DRAFT

Highland Center Well Completion Report

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EXECUTIVE SUMMARY

This Well Completion Report has been prepared for Jacumba Community Services District (JCSD) following the construction and testing of the Highland Center Well. The Highland Center Well is a groundwater production well installed for the purpose of supplying non-potable water to construction projects. The Highland Center Well was drilled, constructed and tested between September 28, 2016 and October 13, 2016.

The executive summary of this Well Completion Report is presented below:

- The Highland Center Well 16-inch diameter pilot borehole was advanced until volcanic bedrock was encountered. Volcanic bedrock was encountered at a depth of 177 feet below ground surface (bgs) and total boring depth was 182 feet bgs.
- The Highland Center Well was completed with mild steel blank casing from 0 feet bgs to 75 feet bgs. Stainless steel wire-wrapped 0.05-slot screen was set from 75 feet bgs to 115 feet bgs. A stainless steel sump was set from 115 feet bgs to 125 feet bgs. The borehole was backfilled with 8 x 16 Cal Silica sand from 125 feet bgs to 182 feet bgs. A sanitary seal consisting of 10.3 sack sand-cement slurry was set from 0 feet bgs to 50 feet bgs. The filter pack surrounding the well screen is 8 x 16 Cal Silica sand.
- A step test and a 24-hour constant rate aquifer test were performed at the Highland Center Well between October 11, 2016 and October 13, 2016. The purpose of the step test was to determine an optimal pumping rate for the 24-hour constant rate aquifer test. The step test consisted of 5 individual steps, or periods of pumping, at increasing production rates beginning at 100 gallons per minute (gpm), followed by 150 gpm, 173 gpm, 210 gpm and 270 gpm. Water level drawdown stabilized at the 100, 150 and 173 gpm steps, however at the 210 and 270 gpm steps, total water level drawdown in addition to the projected water level decline over 24 hours exceeded optimal test design parameters. Based on the drawdown response during the step test, the 24-hour constant rate test was performed at a production rate of 174 gpm. During the constant rate test, maximum water level drawdown of 24.7 feet was recorded at the Highland Center Well.
- During the aquifer testing, water levels at the Park Well and a monitoring well associated with the gas station release site (referred to as Gas Station Well 8D) were monitored to evaluate potential drawdown effects from pumping at the Highland Center Well. The Park Well and the Gas Station Well 8D are located approximately 460 feet west and 960 feet west of the Highland Center Well, respectively. Drawdown due to pumping during the 24-hour constant rate test at the Highland Center Well was 1.9 feet at the Park Well and 0.1 feet at the Gas Station Well 8D.

- A water quality analysis of a groundwater sample collected from the Highland Center Well on October 13, 2016 indicated that the groundwater produced from the Highland Center Well is suitable for non-potable construction use such as dust control application, grading and grubbing. No constituents were detected above primary or secondary U.S. Environmental Protection Agency (EPA) or California maximum contaminant levels (MCLs).

1 WELL LOCATION

The Highland Center Well is located in Jacumba Hot Springs, California south of the intersection of Campo Street and Old Highway 80 on the northeastern corner of Assessor's Parcel Number 660-14-007. (Figure 1). The drilling location for the Highland Center Well was selected based on the results of a surface geophysical survey consisting of seismic refraction and horizontal/vertical spectral ratio (HVSR) measurements, performed by GeoVISION in November 2015. The surface geophysical survey is included in Appendix A.

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2 PILOT BOREHOLE AND LITHOLOGY

The pilot hole for the Highland Center Well was drilled between September 28, 2016 and September 29, 2016 by Fain Drilling and Pump Company, Inc. of Valley Center, California. The pilot hole for the Highlands Center Well was drilled using direct mud rotary with a 15 $^3/_4$-inch diameter tri-cone bit. The pilot hole was drilled to a total depth of 182 feet below ground surface (bgs). The geologist's well log and the driller's well completion report are provided in Appendix B. The geophysical logs and filter pack specification are presented in Appendix C. A graphical log of the formations encountered while drilling the pilot hole is presented in Appendix D.

The lithology encountered while drilling the Highland Center Well pilot hole was characterized using the methods described in ASTM D2488-90, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." During the pilot borehole drilling operations, Dudek staff (Patrick Rentz, a Professional Geologist licensed in the State of California) was on site to continuously log the borehole cuttings that were lifted to the surface. The borehole cuttings were lifted out of the boring via circulating drilling mud and were collected from a shake table, which was used to separate the lithologic material from the drilling mud. The borehole lithology was characterized as: gravels and sand from 0 to 20 feet bgs, coarse to medium sand with small gravels from 20 to 45 feet bgs, well-sorted, clean sand from 45 to 95 feet bgs, coarse to medium sand with small gravels from 95 to 115 feet bgs, clay with sand and gravels from 115 to 177 feet bgs and volcanic rock from 177 to 182 feet bgs (Appendix B and Appendix D).

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3 WELL CONSTRUCTION

Immediately following the completion of the pilot hole to 182 feet bgs, a suite of downhole geophysical logs (including electric log, gamma, deviation, spontaneous potential and guard log) were collected by Richard LaPorte of Victory Well Surveys (Appendix C). Based on the results of the geophysical logging and the lithology encountered when drilling the pilot hole, the Highland Center Well was completed as a production well to a depth of 125 feet. A surface seal consisting of a 16-inch diameter by 0.25-inch thick ASTM A53 Grade B mild steel conductor casing with a 10.3 sack sand/cement seal was placed from land surface to 50 feet bgs. A cleaning pass was performed prior to the installation of the well screen and the borehole was backfilled with 8 x 16 silica sand, using a 2-inch diameter tremie pipe, from 182 feet bgs to 125 feet bgs. After the borehole depth was brought up to 125 feet bgs, 8 $^5/_8$-inch outside diameter (OD) x 0.188-inch thickness mild steel casing was set from 0 to 75 feet bgs. The well screen consisted of 0.050-inch slot wire-wrapped stainless steel Johnson well screen set from 75 to 115 feet bgs (Figure 2 and Appendix D). Below the well screen, a stainless steel sump was installed from 115 to 125 feet bgs. The filter pack, Cal Silica No. 8 x 16 silica sand, was placed in the borehole annulus from land surface to 125 feet.

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4 WELL DEVELOPMENT

Well development was performed on October 6, 2016 from 8:30 to 15:45 (7.25 hours). Development activities included airlifting drilling mud and water from the well using an air compressor and air-jetting/casing swabbing with an isolation tool assembly. This process is used to remove drilling fluid and break-up the mud cake build-up on the borehole wall. The well screen was developed until development water collected in the Imhoff cones was free of drilling mud and the discharge water was visually clear. The well was further developed by installing a submersible pump to remove fine sand and silt. At the end of development, the water produced from the well was observed to be clear (turbidity measured below 40 NTU) with no sand production (Appendix E).

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5 AQUIFER TESTING AND RESULTS

A step test and a 24-hour constant rate aquifer test were performed at the Highland Center Well to estimate the hydraulic properties of the aquifer (Figure 3). The pumping phases of the aquifer tests were conducted between October 11, 2016 and October 13, 2016. A temporary 5-stage submersible pump and a Goulds 15 horsepower (HP) submersible motor were set to a depth of 120 feet btoc in the Highland Center Well for the purpose of aquifer testing. An In-Situ Level Troll 400 pressure transducer was installed at a depth of 118 feet btoc in a 0.75-inch-diameter PVC sounding tube. The pressure transducer was programmed to record groundwater level readings every 15 seconds throughout the duration of the aquifer testing. Additional pressure transducers were installed in the Park Well and Gas Station Well 8D. These wells were equipped with pressure transducers to measure water levels during pump testing and determine if there is drawdown induced by the aquifer testing at the Highland Center Well. Automatic groundwater level readings were recorded every minute by the pressure transducers installed in the observation wells.

A Solinst Barologger was stored in the well vault at Gas Station Well 8D and was used to measure barometric pressure before, during, and after the step test and 24-hour constant rate test. The pressure transducer data collected at the pumping well and observation wells were corrected using barometric data collected from this barologger. At the pumping and observation wells, manual groundwater level measurements were recorded prior to the test and after pumping ceased with an electronic water level sounder. Additionally, manual groundwater level measurements were recorded during the step test and 24-hour constant rate test at the pumping well. Flow and total gallons pumped were measured using an in-line flow meter equipped with a flow totalizer.

5.1 Step Test

A step test was performed at the Highland Center Well from October 11, 2016, at 12:46 through October 11, 2016, at 18:12. The purpose of this step-drawdown test was to establish an optimal pumping rate for the 24-hour constant rate test. The step test consisted of 5 individual steps, or periods of pumping, at increasing production rates beginning at 100 gpm, followed by 150 gpm, 173 gpm, 210 gpm and 270 gpm. The steps were not equal in duration. Each step was run until the rate of drawdown stabilized (achieved a drawdown rate of 0.01 feet/minute). Water level drawdown stabilized at the 100, 150, 173 and 210 gpm steps. The rate of drawdown did not stabilize during the last step at 270 gpm. Total drawdown for each of the five steps were 11.9 feet, 19.5 feet, 22.8 feet, 28.8 feet and 38.6 feet, respectively (Figure 4). Based on the maximum drawdown at each step and the projected drawdown after 24 hours for each step, the optimal flow rate for the 24-hour constant rate test was determined to be 175 gpm. The total volume of water pumped during the step test was 52,710 gallons (0.16 acre-feet).

5.2 24-Hour Constant Rate Test

A 24-hour constant rate test was performed at the Highland Center Well between_October 12, 2016 at 7:00 through October 13, 2016 at 7:00. The static water level in the Highland Center Well measured at the beginning of the 24-hour constant rate test was 54.85 feet btoc. The initial pumping rate was approximately 180 gpm and the average pumping rate was approximately 174 gpm for the duration of the 24-hour test. The flow rate at the beginning of the test is higher than the average flow rate because declining water levels in the well increase the total dynamic head and, therefore, lowers the pumping rate. The average pumping rate is about 3% less than the maximum pumping rate and the data is acceptable for aquifer test analysis (typically up to 20% variance in pumping rate allowed). The total volume of water pumped during the 24-hour constant rate test was 250,980 gallons (0.77 acre-feet). The discharge water from Highland Center Well was conveyed approximately 160 feet away from the well to an adjacent undeveloped field east of the well site via 3-inch diameter lay-flat hose.

After approximately 24-hours of pumping at an average pumping rate of 174 gpm, the total drawdown observed in the Highland Center Well was 24.7 feet. Water level drawdown stabilized at or below 0.01 feet/minute after approximately 110 minutes of pumping (Figure 5). Based on the 24-hour constant rate test results, the Highland Center Well can sustain a pumping rate of 174 gpm. A maximum drawdown of 1.9 feet was observed at the Park Well and a maximum drawdown of 0.1 feet was observed at the Gas Station Well 8D (Figures 6 and 7). Drawdown data collected at the Park Well was used to estimate the aquifer transmissivity and storage.

Specific Capacity

At an average pumping rate of 174 gpm, the maximum drawdown observed in the Highland Center Well during the 24 hour test was 24.7 feet. The specific capacity is 7.04 gpm/ft of drawdown.

Transmissivity

Aquifer transmissivity (the rate at which water flows through a vertical strip of the aquifer 1-foot wide and extending through the full saturated thickness, under a hydraulic gradient of 1 or 100%) was estimated using the Cooper–Jacob approximation to the Theis equation (Cooper and Jacob 1953) as follows:

$$T = \frac{2.303\,Q}{4\,\pi\,\Delta s}$$

Where:

T = transmissivity (feet^2/day)

Q = average pumping rate (feet^3/day) = 174 gpm or 33,534 feet^3/day

π = pi (3.14)

Δs = difference in drawdown over one log cycle (feet) = 0.6 feet

The transmissivity (T) was estimated using the drawdown data collected from the Park Well during the 24-hour constant rate aquifer test at the Highland Center Well. Drawdown at an observation well is typically used to estimate aquifer properties rather than drawdown at the pumping well because there are no effects due to well loss or inefficiency in the observation well (non-pumping well). The drawdown response observed at the pumping well and the observation wells was sufficient for aquifer property calculations, although it is important to note that the drawdown curve indicates that the cone of depression was expanding during the first 400 minutes of the test. After 400 minutes, a source of recharge was encountered which is represented graphically by the slope of the drawdown curve becoming flatter, or horizontal (Figure 5). Aquifer properties must be calculated based on the slope of the drawdown curve before the recharge boundary occurs, or from the early-time data (Driscoll 1986). Transmissivity was estimated at 10,242.8 feet^2/day or 76,616.1 gpd/ft using observation well drawdown data (Figure 6).

Storativity

The aquifer coefficient of storage (also called storativity) is the volume of water released from storage per unit decline in hydraulic head in the aquifer per unit area of the aquifer. Drawdown at an observation well located away from the pumping well is required to calculate the coefficient of storage. A maximum drawdown of 1.9 feet was observed at the Park Well, located 460 feet west of the Highland Center Well, at the end of the 24-hour constant rate aquifer test.

The coefficient of storage is estimated using the Copper-Jacob approximation to the Theis equation (Cooper-Jacob 1946) as follows:

$$\mathbf{S= 2.25Tt_o/r^2}$$

Where:

S = Coefficient of Storage (dimensionless)
T = transmissivity (feet^2/day) = 10,242.8 feet^2/day
t_o = intercept with x-axis, time (days) = 0.00017 days
r = distance to observation well (feet) = 460 feet

The coefficient of storage (S) calculated from data obtained from the Park Well is 0.0000185 (1.8 x10^{-5}) (Figure 6).

The Cooper-Jacob method was verified by validating that dimensionless time (u) is sufficiently small ($u < 0.05$) using the equation as follows:

$$\mathbf{u = r^2S/4Tt}$$

Where:

u = time (dimensionless), assumed 0.05

r = distance to center of pumping (feet) = 460 feet
S = Coefficient of Storage (dimensionless) = 0.0000185
T = transmissivity (feet^2/day) = 10,242.8 feet^2/day (calculated using drawdown from Park Well)
t = time since pumping started = calculated

During a constant rate aquifer test, drawdown data plot on a straight line except at large values of u, or small values of 1/u. At values of u less than about 0.05, the Cooper-Jacob approximation is valid (Driscoll, 1986). For the 24-hour test, a sufficiently small value of u was assumed and used to solve for time since pumping started (t). The calculated value of t was 0.002 minutes, which is less than the data used for the Cooper-Jacob approximation, validating the analysis.

Additionally, the aquifer test data were analyzed using the computer program Aqtesolv Pro, version 4.50 (Aqtesolv). The data input for this modeling software include the water level in the pumping well and observation wells, the rate of pumping and elapsed time of pumping. The range of transmissivity values obtained through the Aqtesolv modeling software was 8,598.9 feet^2/day to 11,060.0 feet^2/day. Table 1 shows the range of aquifer parameters and residual statistics obtained from the Aqtesolv modeling.

Table 1
Range of Calculated Aquifer Properties

Solution Method	**Parameter Estimates**		**Residual Statistics**				
	Transmissivity (feet^2/day)	*Storativity*	*Sum of Squares (feet^2)*	*Variance (feet^2)*	*Std. Deviation (feet)*	*Mean (feet)*	*No. of Residuals*
Theis	8,598.9	7.53E-5	2.093	0.00350	0.0592	-6.5E-4	600
Cooper-Jacob	11,060.0	1.96E-5	0.2048	0.00038	0.0195	-2.135E-8	540

6 WATER QUALITY TEST RESULTS

On October 13, 2016 at 6:45 am, prior to the end of the 24-hour constant rate test, a water quality sample was collected. The Highland Center Well pumped for 23.75 hours at an average pumping rate of 174 gpm prior to collection of the groundwater quality sample. Thus, approximately 247,950 gallons (0.76 acre-feet) were pumped from the well prior to collection of the sample. The water quality sample was placed in laboratory-certified bottles, packed in a cooler with ice, and delivered under chain-of-custody to Babcock Laboratories, Inc. (Babcock) of Riverside, California, on October 13, 2016. Dudek requested a wide range of water quality analyses from Babcock including general minerals, inorganic minerals, general physical analysis and volatile organic compounds (VOCs). General mineral and inorganic mineral laboratory results are provided in Tables 1 and 2.

Table 2
General Mineral Water Quality Results

Constituent	Analytical Method	Units	Highland Center Well Result	California Drinking Water MCLs
Cations				
Total Hardness	EPA 200.7	mg $CaCO_3$/L	120	—
Calcium	EPA 200.7	mg/L	35	—
Magnesium	EPA 200.7	mg/L	8.2	—
Sodium	EPA 200.7	mg/L	98	—
Potassium	EPA 200.7	mg/L	1.8	—
Sodium Adsorption Ratio (SAR)	EPA 200.7	None	6.9	—
Adjusted SAR	EPA 200.7	None	3.9	—
Total Cations	*Calculated*	*me/L*	*6.7*	—
Anions				
Total Alkalinity	SM2320B	mg $CaCO_3$/L	170	—
Hydroxide	SM2320B	mg $CaCO_3$/L	<3.0	—
Carbonate	SM2320B	mg $CaCO_3$/L	<3.0	—
Bicarbonate	SM2320B	mg $CaCO_3$/L	210	—
Chloride	EPA 300.0	mg/L	83	250/500/600[a]
Sulfate	EPA 300.0	mg/L	37	250/500/600[a]
Fluoride	SM4500 F C	mg/L	1.8	2
Nitrate (as N)	EPA 300.0	mg/L	<0.20	10
Nitrate (as NO_3)	EPA 300.0	mg/L	<1.0	45
Total Anions	*Calculated*	*me/L*	*6.60*	—
Aggregate Properties				
pH	SM4500H +B	pH Units	7.8	6.5–8.5[b]
Specific Conductance	SM2510 B	umhos/cm[c]	710	900/1,600/2,200[a] (µS/cm)

Table 2
General Mineral Water Quality Results

Constituent	Analytical Method	Units	Highland Center Well Result	California Drinking Water MCLs
Aggressive Index	Calculated	None	12.0	—
Langlier Index @ 25C	SM2330 B	None	0.20	—
Solids				
Total Dissolved Solids	SM2540 C	mg/L	400	500/1,000/1,500[a]
General Physical				
Color	SM2120 B	Color Units	3.0	15
Odor	SM2150	T.O.N.	<1.0	3
Turbidity	SM2130 B	NTU	0.39	5
Surfactants				
MBAS	SM5540C	mg/L	<0.08	0.5[a]
General Inorganics and Nutrients				
Cyanide	SM4500CN E	mg/L	<0.1	0.15
Perchlorate	EPA314.0	mg/L	<0.004	0.006
Nitrite as N	SM4500N02 B	mg/L	<0.1	1

MBAS = methylene blue active substances; MCL = maximum contaminant level; mg/L = milligrams per liter; me/L = milliequivalents per liter; mg $CaCO_3$/L = milligrams as carbonate; T.O.N. = threshold odor number; NTU = nephelometric units

[a.] Recommended/Upper/Short-Term Secondary MCLs.

[b] Secondary MCLs.

[c.] umhos/cm = micromhos per centimeter which his equivalent to microsiemens per centimeter (µS/cm).

Table 3
Inorganic Minerals Water Quality Results

Constituent	Analytical Method	Units	Highland Center Well Result	California Drinking Water MCLs
Aluminum	EPA 200.7	ug/L	<50	1,000
Antimony	EPA 200.8	ug/L	<6	6
Arsenic	EPA 200.8	ug/L	<2	10
Barium	EPA 200.8	ug/L	170	1,000
Beryllium	EPA 200.8	ug/L	<1	4
Boron	EPA 200.7	ug/L	400	1,000[c]
Cadmium	EPA 200.8	ug/L	<1	5
Chromium (Total)	EPA 200.8	ug/L	<1	50
Copper	EPA 200.8	ug/L	<50	1,300[a]
Iron	EPA 200.7	ug/L	<100	300[b]
Lead	EPA 200.8	ug/L	<5	15[a]
Manganese	EPA 200.8	ug/L	31	50[b]
Mercury	EPA 200.8	ug/L	<1	0.002
Nickel	EPA 200.8	ug/L	<10	0.1

Table 3
Inorganic Minerals Water Quality Results

Constituent	Analytical Method	Units	Highland Center Well Result	California Drinking Water MCLs
Silver	EPA 200.8	ug/L	<10	—
Selenium	EPA 200.8	ug/L	<5	50
Thallium	EPA 200.8	ug/L	<1	2
Zinc	EPA 200.8	ug/L	<50	5,000[a]

EPA = U.S. Environmental Protection Agency; MCL = maximum contaminant level; ug/L = micrograms per liter

[a] Values referred to as MCLs for lead and copper are not actually MCLs; instead, they are called “Action Levels” under the lead and copper rule.

[b] Secondary MCLs.

[c] California Notification Level

In addition to the water quality analysis listed in Tables 1 and 2 above, the Highland Center water quality sample was analyzed for VOCs by EPA Method 524.2. No VOCs were detected. The full laboratory results, including VOCs, are presented in Appendix F.

Dudek measured field water quality parameters of the discharge well water on October 12 and October 13, 2016. Dudek measured the pH, temperature, specific conductance (EC) and total dissolved solids (TDS) using a Hanna HI98129 Combo water quality meter, which was calibrated in the field prior to the analysis of the samples. Dudek also measured turbidity using a calibrated HACH 2100Q turbidity meter. The results of the water quality field analyses are presented in Table 3.

Table 4
Highland Center Well Water Quality Results of Field Analysis

		Specific Conductance	Temperature	TDS	pH	Turbidity
Date	Time	*µS/cm*	*°F*	*mg/L*	*pH units*	*NTU*
10/12/2016	7:30	737	66.9	368	7.62	4.77
10/12/2016	7:40	708	67.6	351	7.53	1.81
10/12/2016	7:45	734	68.0	350	7.58	1.52
10/12/2016	7:57	715	67.8	353	7.53	0.91
10/12/2016	8:21	709	67.8	355	7.57	1.01
10/12/2016	8:40	707	67.8	349	7.65	0.75
10/12/2016	10:50	723	71.2	358	7.54	0.62
10/12/2016	11:30	709	71.2	354	7.58	0.59
10/12/2016	11:50	704	71.8	351	7.59	0.87
10/12/2016	12:45	721	72.1	360	7.62	0.52
10/13/2016	5:49	701	68.0	351	7.62	0.51
10/13/2016	6:13	695	68.0	348	7.59	0.49
10/13/2016	6:27	701	67.8	349	7.58	0.50
10/13/2016	6:58	701	68.0	350	7.59	0.51

Note: µS/cm = microsiemens per centimeter
°F = degrees Fahrenheit
mg/L = milligrams per liter
ppt = parts per thousand
NTU = nephelometric turbidity units

The water quality results indicate that groundwater produced from the Highland Center Well is suitable for construction water supply.

7 REFERENCES

Cooper, H.H., Jr. and C.E. Jacob. 1953. A Generalized Graphical Method of Evaluating Formation Constraints and Summarizing Well Field History. U.S. Department of the Interior, Geological Survey, Water Resources Division, Groundwater Branch. January 1953.

Driscoll, F.G., 1986, Groundwater and wells (Second edition): Johnson Division, St. Paul, Minnesota, 1089 p.

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NOVEMBER 2016

SOURCE: JCSD; SanGIS 2003

FIGURE 1

Well Locations

HIGHLAND CENTER WELL COMPLETION REPORT - JACUMBA COMMUNITY SERVICES DISTRICT

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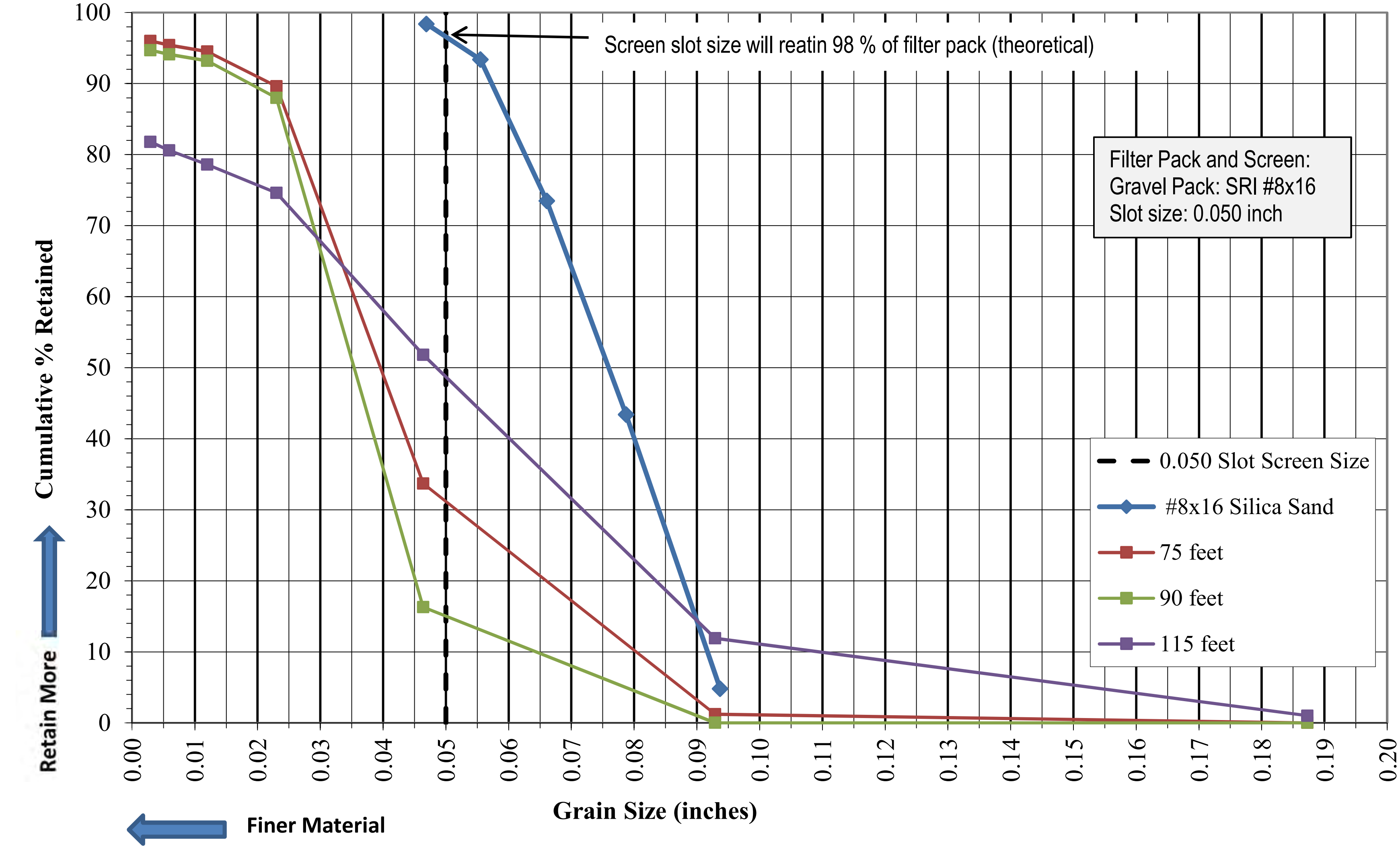
Highland Center Well Completion Report

Figure 2. Highland Center Well Slot Size and Grain Size



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November 2016

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Figure 3. Highland Center Well Testing

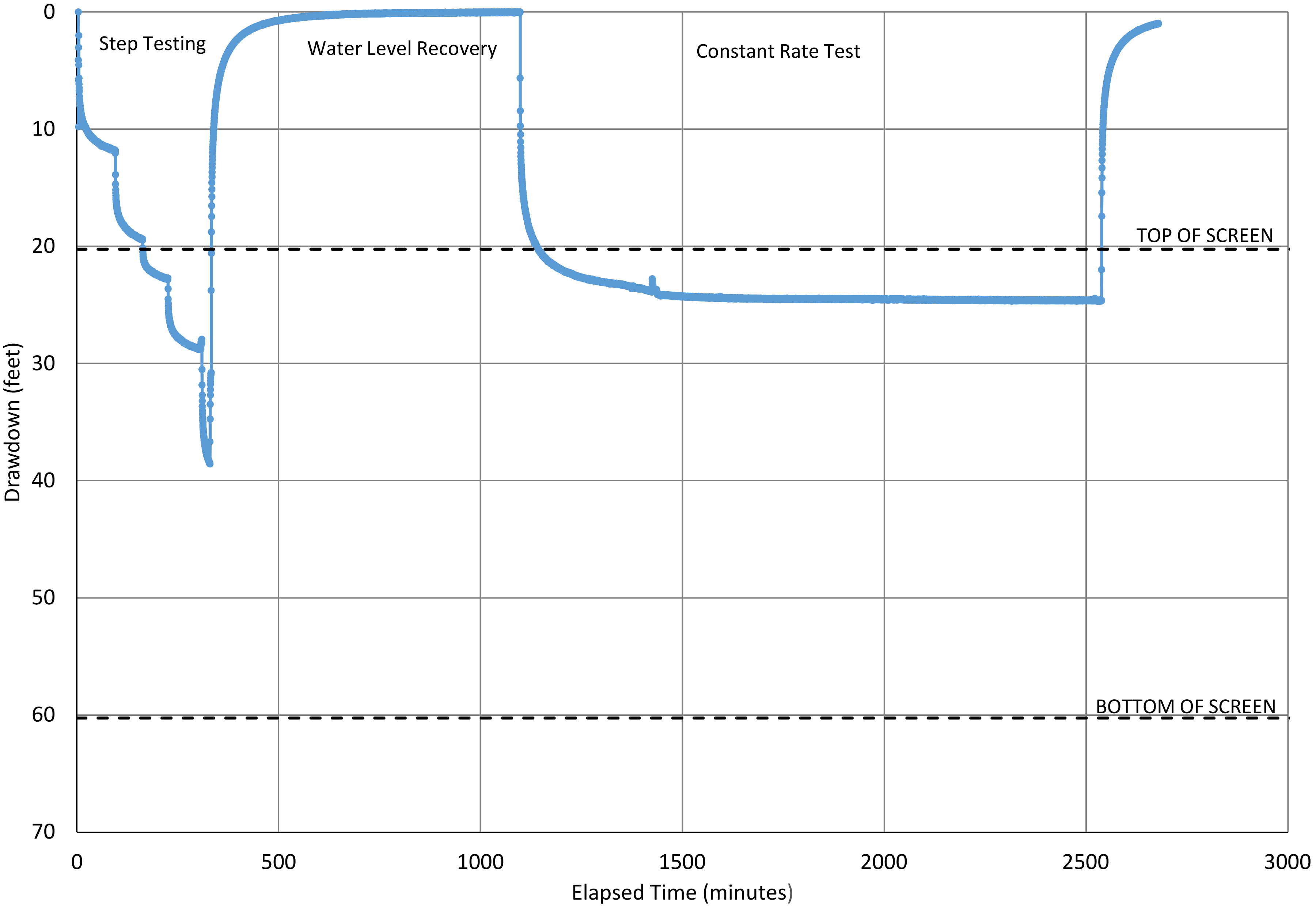

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Figure 4. Highland Center Well Step Test

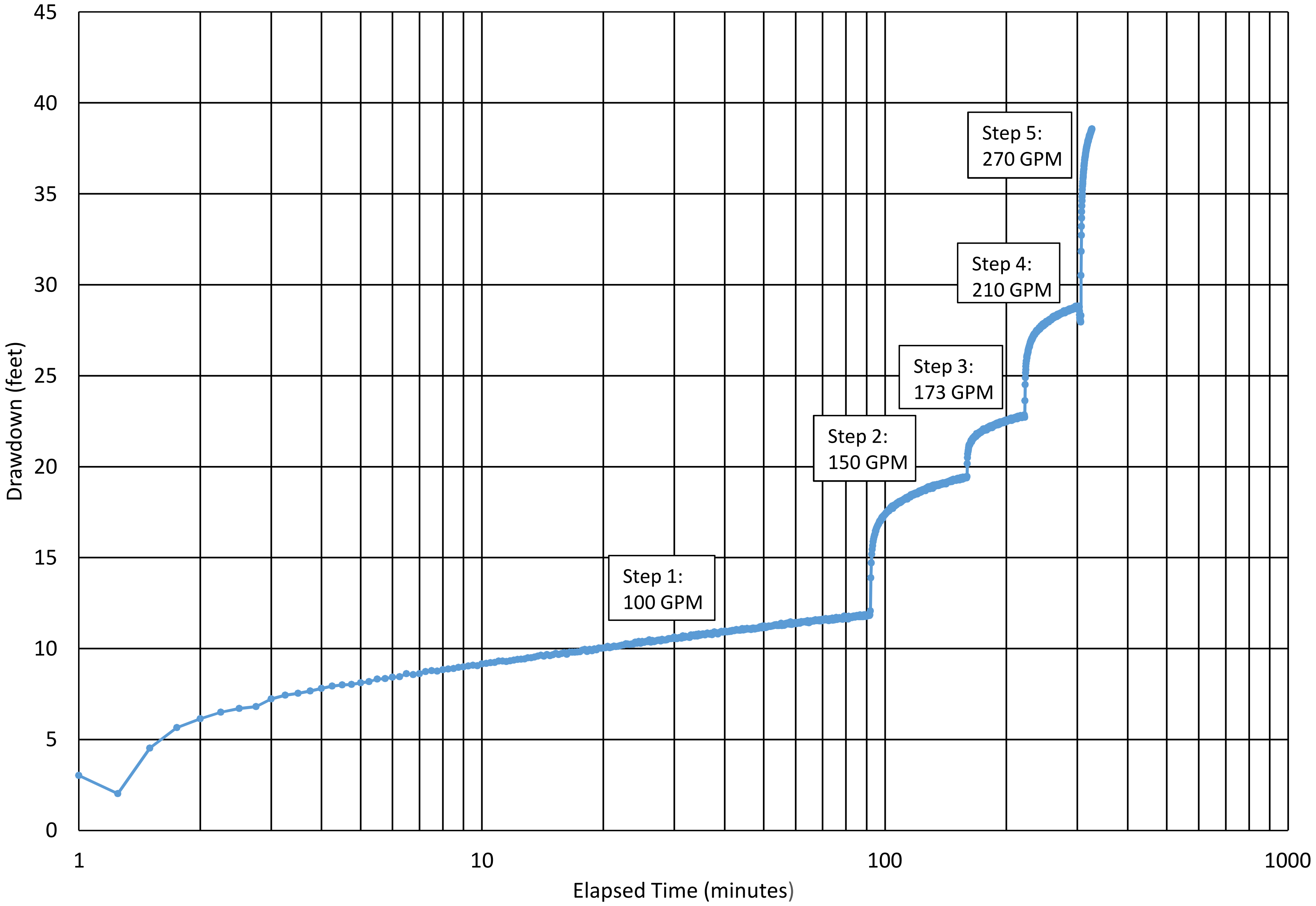

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Figure 5. Highland Center Well Constant Rate 24-Hour Test

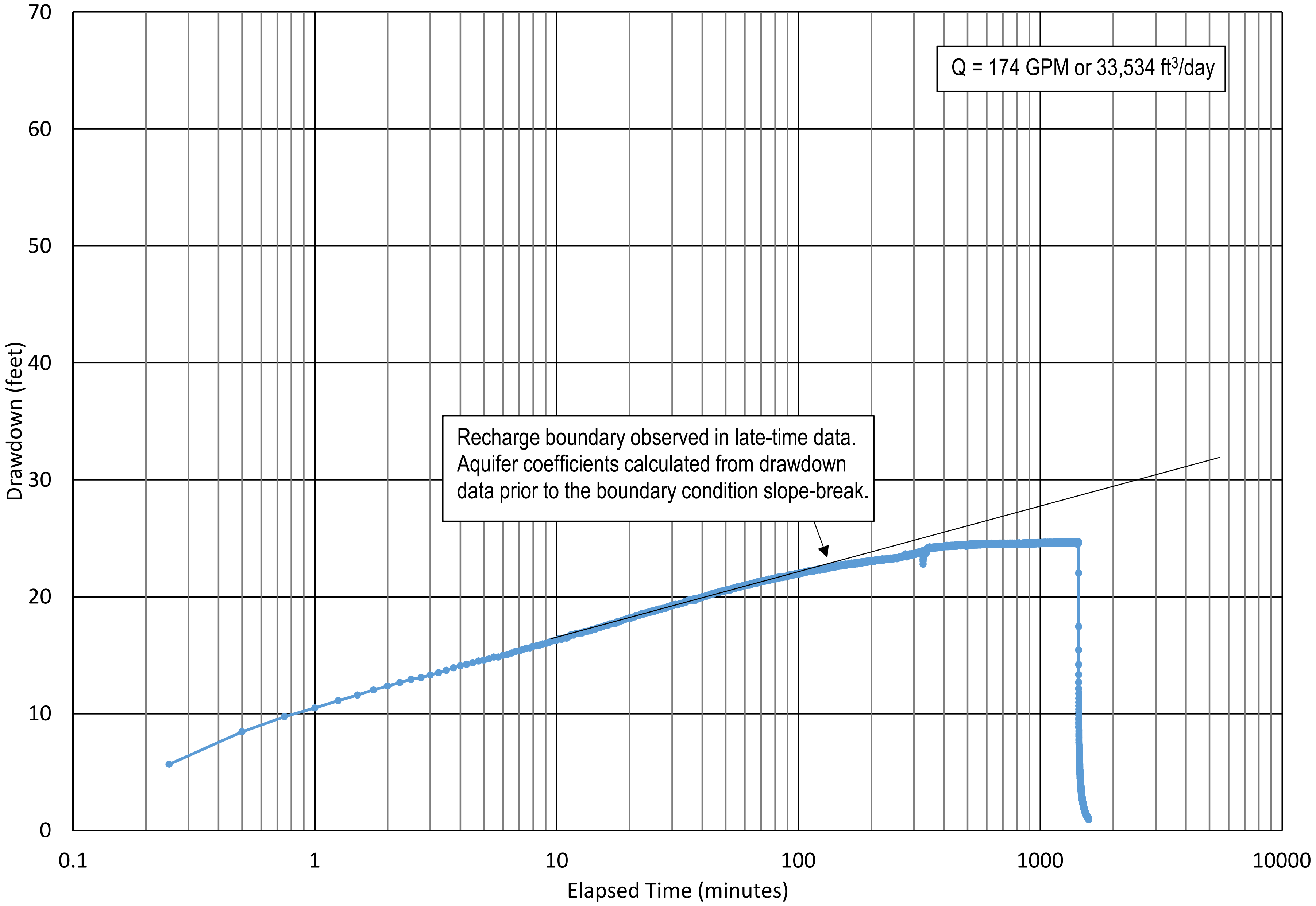

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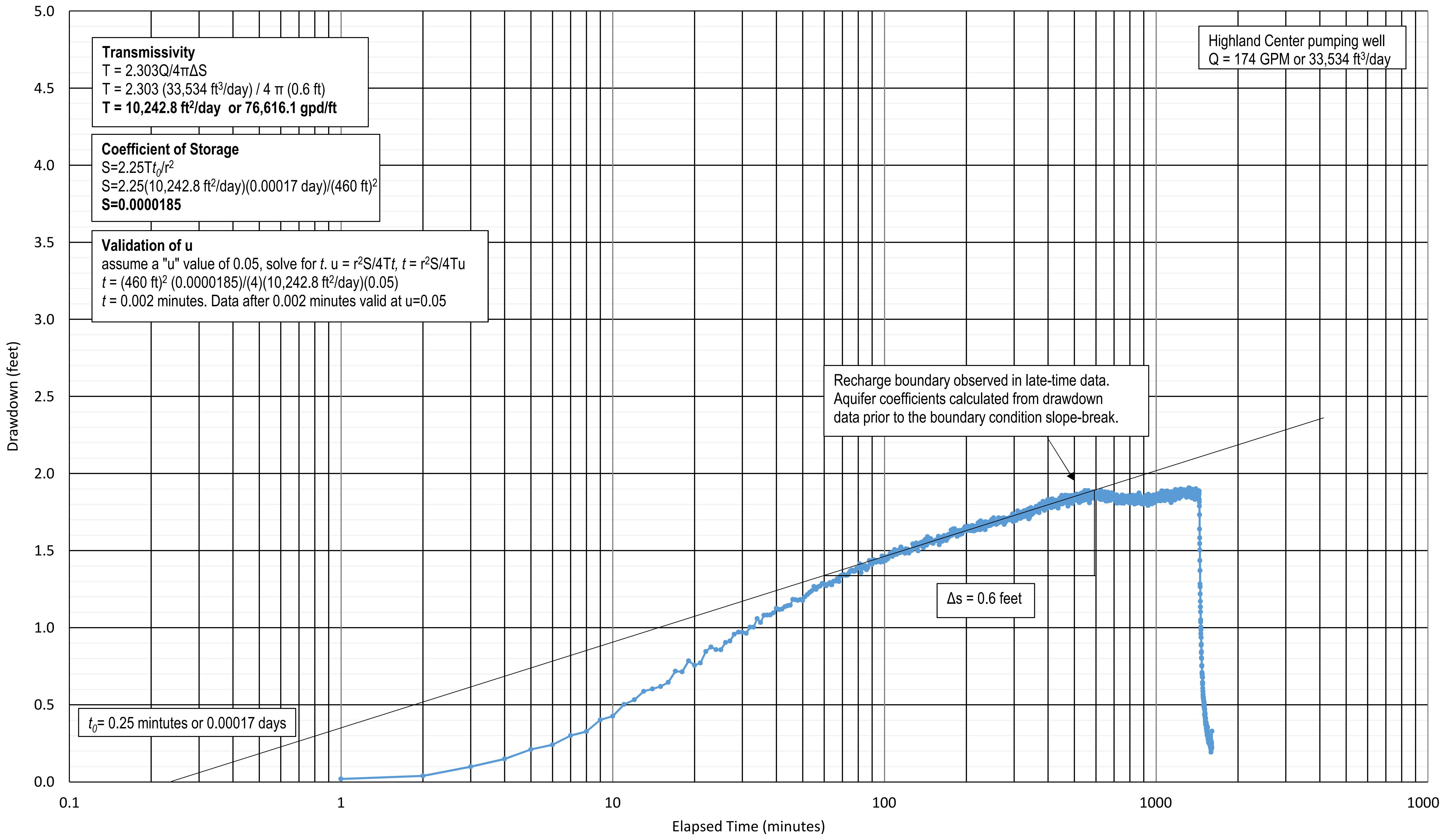
Figure 6. Park Monitoring Well Drawdown During Highland Center Well 24-Hour Test



Transmissivity
$T = 2.303Q/4\pi\Delta S$
$T = 2.303\ (33{,}534\ ft^3/day)\ /\ 4\ \pi\ (0.6\ ft)$
$T = 10{,}242.8\ ft^2/day$ or 76,616.1 gpd/ft

Coefficient of Storage
$S=2.25Tt_0/r^2$
$S=2.25(10{,}242.8\ ft^2/day)(0.00017\ day)/(460\ ft)^2$
S=0.0000185

Validation of u
assume a "u" value of 0.05, solve for t. $u = r^2S/4Tt$, $t = r^2S/4Tu$
$t = (460\ ft)^2\ (0.0000185)/(4)(10{,}242.8\ ft^2/day)(0.05)$
t = 0.002 minutes. Data after 0.002 minutes valid at u=0.05

t_0= 0.25 mintutes or 0.00017 days

Highland Center pumping well
Q = 174 GPM or 33,534 ft^3/day

Recharge boundary observed in late-time data. Aquifer coefficients calculated from drawdown data prior to the boundary condition slope-break.

Δs = 0.6 feet

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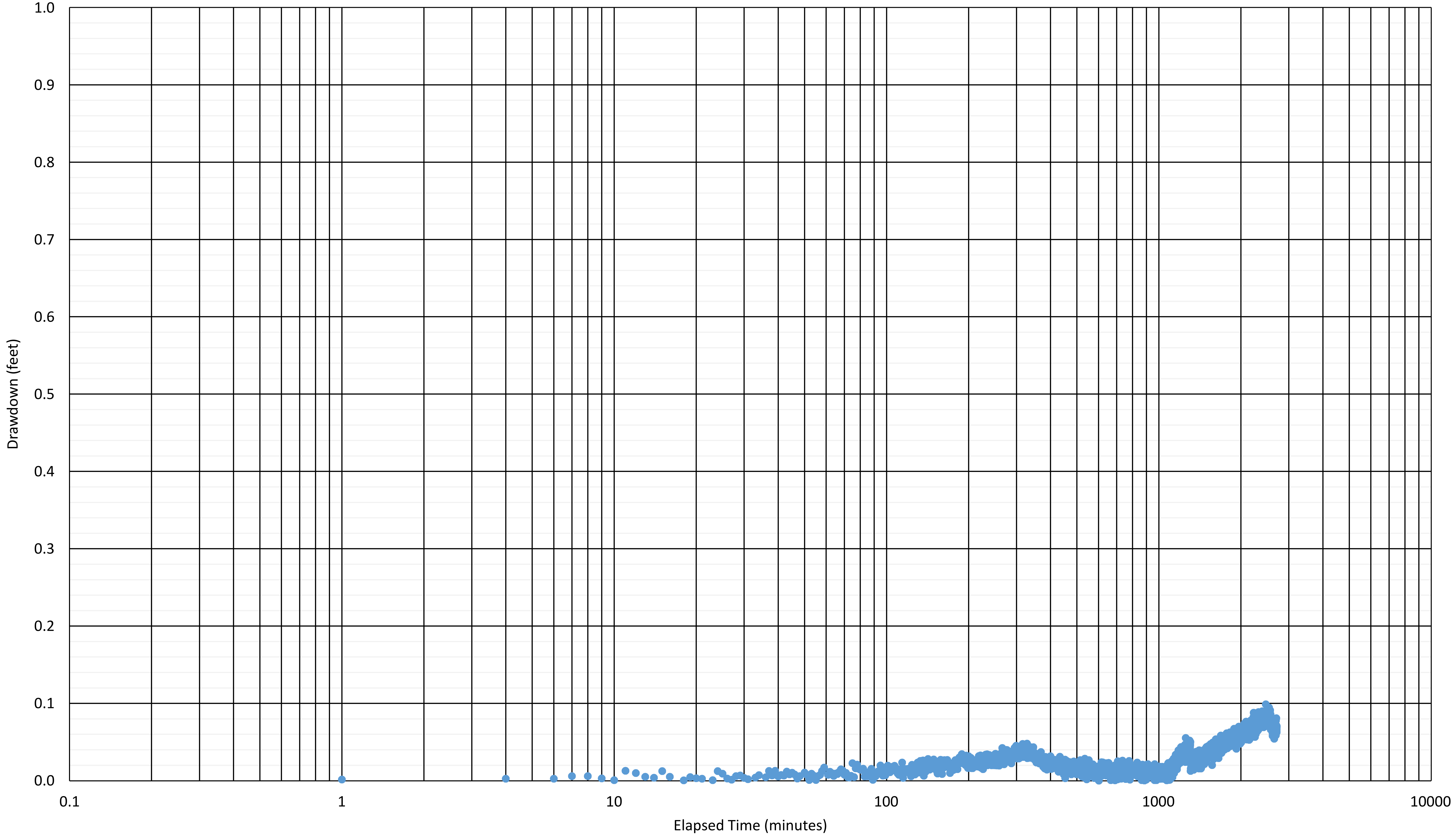
Figure 7. Gas Station Well 8D Drawdown During Highland Center Well 24-Hour Test
Drawdown (feet)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.1
1
10
100
1000
10000
Elapsed Time (minutes)

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APPENDIX A

Surface Geophysical Survey

REPORT

GEOPHYSICAL INVESTIGATION

JACUMBA COMMUNITY SERVICES DISTRICT
JACUMBA HOT SPRINGS, CALIFORNIA

GEO*Vision* Project No. 15425

Prepared for

Dudek Engineering & Environmental
605 Third Street
Encinitas, CA 92024
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Prepared by

GEO*Vision* Geophysical Services
1124 Olympic Drive
Corona, CA 92881
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Report 15425-01

November 23, 2015

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1 INTRODUCTION

A geophysical investigation was conducted on November 5th and 18th, 2015 at the Jacumba Community Services District property in Jacumba Hot Springs, California. The objective of the investigation was to identify the area in the site vicinity with the greatest depth to bedrock. Two geophysical methods were used for this investigation: P-Wave seismic refraction and Horizontal/Vertical Spectral Ratio (HVSR). The P-wave seismic refraction technique was used to determine approximate bedrock depth beneath two profiles at a property located near Old Highway 80 and Campo Street. The HVSR technique was used to determine relative depth to bedrock at several locations along the seismic refraction models to confirm the bedrock topography identified from the seismic lines.

The locations of the two seismic refraction lines and six (6) HVSR measurement locations at the site are shown in Figure 1. The approximate coordinates of the endpoints and center points of the seismic lines are presented in Table 1. HVSR Station A is located about 35 ft south of the west end of seismic line L-1 and next to the Park Monitoring Well. Weathered volcanic rock was identified at a depth of about 127 ft in this well and the water level was about 55 ft below ground surface at the time of the geophysical investigation (Dudek 2015, verbal communication).

The following sections include a discussion of geophysical methodology, equipment and field procedures, data processing, results, and certification.

Legend

● HVSR Station

▬ Seismic Refraction Line with Distances

NOTES:
1. California State Plane Coordinate System, NAD 83 Zone VI (0406), US Survey Feet
2. Image Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

GEOVision geophysical services

Date:	11/19/2015
GV Project:	15425
Developed by:	D Carpenter
Drawn by:	T Rodriguez
Approved by:	A Martin
File Name:	15425_1.MXD

FIGURE 1
SITE MAP

JACUMBA HOT SPRINGS
SAN DIEGO COUNTY, CALIFORNIA

PREPARED FOR
DUDEK ENGINEERING & ENVIRONMENTAL

Table 1 Seismic Survey Locations

Seismic Location	Latitude (Decimal Degrees N)	Longitude (Decimal Degrees W)
L-1 (0')	32.61757	116.18594
L-1 (705')	32.61756	116.18365
L-2 (0')	32.61534	116.18448
L-2 (705')	32.53394	116.18438
HVSR Station A	32.61749	116.18595

Notes:

1. Coordinates taken with a submeter GPS system.
2. Coordinates in Geographic, NAD83 (Conus), US Survey Feet
3. Other HVSR stations referenced to distance along seismic lines.

2 METHODOLOGY

2.1 *Seismic Refraction Technique*

When conducting a seismic survey, acoustic energy is input to the subsurface by an energy source such as a sledgehammer or weight drop impacting a metallic plate, vibratory source, or explosive charge. The acoustic waves propagate into the subsurface at a velocity dependent upon the elastic properties of the material through which they travel. When the waves reach an interface where the density or velocity changes significantly, a portion of the energy is reflected back to the surface, and the remainder is transmitted into the lower layer. Where the velocity of the lower layer is higher than that of the upper layer, a portion of the energy is also critically refracted along the interface. Critically refracted waves travel along the interface at the velocity of the lower layer and continually refract energy back to surface. Receivers (geophones) laid out in linear array on the surface record the incoming refracted and reflected waves. The seismic refraction method involves analysis of the travel times of the first energy to arrive at the geophones. These first arrivals are from either the direct wave (at geophones close to the source), or critically refracted waves (at geophones further from the source).

Analysis of seismic refraction data depends upon the complexity of the subsurface velocity structure. If the subsurface target is planar in nature, then the slope intercept method can be used to model multiple horizontal or dipping planar layers. A minimum of one end shot is required to model horizontal layers and reverse end shots are required to model dipping planar layers. If the subsurface target is undulating (i.e., bedrock valley), then layer-based analysis routines such as the generalized reciprocal method, delay time method, time-term method, plus-minus method, and wavefront method are required to model subsurface velocity structure. These methods generally require a minimum of 5 shot points per spread (end shots, off-end shots, and a center shot). If subsurface velocity structure is complex and cannot be adequately modeled using layer-based modeling techniques (i.e., complex weathering profile in bedrock, numerous lateral velocity variations), then Monte Carlo or tomographic inversion techniques are required to model the seismic refraction data. These techniques require a high shot density (typically every 2 to 4 stations/geophones). Generally these techniques cannot take advantage of off-end shots to extend depth of investigation, so longer profiles are required.

Errors in seismic refraction models can be caused by velocity inversions, hidden layers, or lateral velocity variations. At sites with steeply dipping or highly irregular bedrock surfaces, out of plane refractions (refractions from structures to the side of the line rather than from beneath the line) may severely complicate modeling. A velocity inversion is a geologic layer with a lower seismic velocity than an overlying layer. Critical refraction does not occur along such a layer because velocity has to increase with depth for critical refraction to occur. This type of layer, therefore, cannot be recognized or modeled, and depths to underlying layers would be overestimated. A hidden layer is a layer with a velocity increase, but of sufficiently small thickness relative to the velocities of overlying and underlying layers, that refracted arrivals do not arrive at the geophones before those from the deeper, higher velocity layer. Because the seismic refraction method generally only involves the interpretation of first arrivals, a hidden layer cannot be recognized or modeled, and depths to underlying layers would be underestimated. A subsurface velocity structure that increases as a function of depth rather than as discrete layers will also cause depths to subsurface refractors to be underestimated, in a manner very similar to that of the hidden layer problem. Lateral velocity variations that are not adequately addressed in the seismic models will also lead to depth errors. Tomographic imaging techniques can often resolve the complex velocity structures associated with hidden layers, velocity gradients and lateral velocity variations. However, in the event of an abrupt increase in velocity at a geologic horizon, the velocity model generated using tomographic inversion routines will smooth the horizon with velocity being underestimated at the interface and possibly overestimated at depth.

2.2 *Horizontal/Vertical Spectral Ratio Technique*

The horizontal-to-vertical spectral ratio (HVSR) technique utilizes single-station recordings of ambient vibrations (microtremor or noise) made with a three-component seismometer. In this method, the ratio of the Fourier amplitude spectra of the horizontal and vertical components is calculated to determine the frequency of the maximum HVSR response (HVSR peak frequency), commonly accepted as an approximation of the fundamental frequency (f_0) of the sediment column overlying bedrock. The HVSR peak frequency associated with bedrock is a function of the bedrock depth and S-wave velocity of the sediments overlying bedrock. Assuming uniform velocity structure in the sediments, the lower the HVSR peak frequency the greater the depth to bedrock.

The theoretical HVSR response can be calculated for an S-wave velocity model using modeling schemes based on surface wave ellipticity, vertically propagating body waves, or diffuse wavefields containing body and surface waves. The HVSR frequency peak can also be estimated using the quarter-wavelength approximation:

$$f_0 = \frac{\overline{V}_S}{4z}$$

where f_0 is the site fundamental frequency, $\overline{V}_S$ is the average shear-wave velocity of the soil column overlying bedrock at depth z.

3 EQUIPMENT AND FIELD PROCEDURES

3.1 *Survey Control*

The two seismic refraction lines at the site were established by **GEO***Vision* using the preferred locations provided by Dudek. The locations were adjusted to maximize data coverage in the target area. Geophone locations for the seismic refraction lines were marked using a 300 ft tape measure. The Sokkia C300 auto level was used to measure relative elevations along the line. All elevation data were reduced in a spreadsheet.

The locations of the seismic refraction line and HVSR measurement locations were surveyed using a Magellan Professional MobileMapper™ CX GPS system. The locations of the seismic refraction lines and HVSR measurement locations at the site are presented in Figure 1.

3.2 *Seismic Refraction Survey*

The seismic data acquisition system consisted of two 24-channel Geometrics Geode signal enhancement seismographs combined to form a 48-channel system and a laptop computer running Geometrics Seismodule Controller Software. Other seismic equipment utilized during this investigation consisted of 10 Hz vertical geophones, seismic cable, trigger extension cables, and an accelerated weight drop (AWD).

Each line consisted of 48 geophones spaced 15 feet apart for line lengths of 705 ft. Nineteen (19) shot point locations were occupied: end shots at geophones 1 and 48, multiple off-end shots and interior shots at regular intervals between every fourth geophone.

The AWD was used as the energy source for each shot point. A hammer switch attached to the aluminum strike plate and coupled to a trigger extension cable was used to trigger the seismograph upon impact. The final seismic record at each shot point was the result of stacking 8 to 12 shots to increase the signal to noise ratio. All seismic records were stored on a laptop computer. Data files were named with the sequential line, spread, and shot number and a ".dat" extension. Data acquisition parameters, file names, and leveling data were recorded in a field log, which is retained in project files.

3.3 *Horizontal/Vertical Spectral Ratio Measurements*

The seismic system used to acquire HVSR data was a Micromed Tromino® ENGY (Tromino). The Tromino was coupled to the ground using geophone spikes adapted for the instrument. Microtremor measurements were made for 20 minutes at each measurement location with data recorded at 128 samples per second. Recordings were stored in the instrument's internal memory, downloaded to a laptop computer, viewed in the software package Grilla, provided by Micromed, and reformatted to an ASCII file for further analysis.

4 DATA PROCESSING

4.1 *Seismic Refraction Survey*

Seismic refraction data were modeled using the tomographic analysis technique available in the SeisImager™ Plotrefa software package, developed by Oyo Corporation. Refraction tomography techniques are often able to resolve complex velocity structure (e.g. velocity gradients) that can be observed in bedrock weathering profiles, but are not well suited to accurately resolving layered structures. Conversely, layer-based modeling techniques such as the generalized reciprocal or time term methods can accurately model layered structure, but are not able to accurately model the velocity gradients that can be observed in weathered bedrock. At this site, three geologic units were apparent in the field data: low velocity unsaturated sediments, intermediate velocity saturated sediments, and high velocity bedrock. Because the velocity structure at the site exhibited layered rather than smooth velocity gradient velocity structure the data were modeled using tomographic inversion with a layer based starting model.

The first step in data processing consisted of picking the arrival time of the first energy received at each geophone (first arrival) for each shot point. The first arrivals on each seismic record are either a direct arrival from a P-wave traveling in the uppermost layer or a refracted arrival from a subsurface interface where there is a velocity increase. First arrival times were selected using the automatic and manual picking routines in the software package SeisImager™ (Oyo Corporation) by a **GEO***Vision* geophysicist. First arrival times were picked on all seismic records. First arrival times were saved in an ASCII file containing shot location, geophone locations, and associated first arrival time.

Relative elevations for each geophone location were calculated from the leveling data using a spreadsheet.

The tomographic inversion was conducted as outlined in the following steps. The first arrival and elevation data were loaded into the software package with first arrivals assigned to three layers corresponding to unsaturated sediments, saturated sediments, and bedrock. A time-term inversion routine was then utilized to develop a simple layered velocity model for the seismic line, which was used to develop a 20 layer initial model for tomographic inversion. The velocity model was extended to permit the use of off-end shot points during the inversion with the goal of improving the accuracy of the seismic refraction models near the ends of the lines. A minimum of 20 iterations of non-linear raypath inversion were then implemented to improve the fits of the travel time curves to near-surface sediments/rock. Final tomographic velocity models for each seismic line were exported as ASCII files and imported into the Geosoft Oasis montaj mapping system where the velocity models were gridded, contoured and annotated for presentation.

4.2 *Horizontal/Vertical Spectral Ratio Measurements*

HVSR data were reduced using the Geopsy Version 2.9.1 software package (http://www.geopsy.org) developed by Marc Wathelet for the European SESAME project.

Microtremor data recorded by the Tromino was exported to an ASCII file using the software package Grilla, provided with the instrument. Upon export, a 0.3-Hz low-cut filter was automatically applied. Data files were then loaded into the Geopsy software package, where data file columns containing the vertical and horizontal (north and east) components and 128 Hz sample rate were specified. HVSR was typically calculated over a frequency range dependent upon the observed site response and using a time window length of 30 s. Time windows containing transients (nearby vehicular traffic) or segments yielding poor quality results were not utilized for analysis. Time windows were automatically picked and then manually edited. For every selected time window, Fourier amplitude spectra were calculated and smoothed by the Konno and Ohmachi filter with a smoothing coefficient value of 30. The vertical amplitude spectra were divided by the root-mean-square (RMS) of the horizontal amplitude spectra to calculate the HVSR for each time window and the average HVSR. After calculating the standard deviation of the HVSR amplitudes for all windows, the average response is divided and multiplied by the standard deviation to produce the minimum and maximum HVSR spectra, respectively.

The primary purpose of the HVSR measurements was to determine relative depth to bedrock (i.e. locations with deepest bedrock). Therefore, additional geophysical measurements were not made to estimate S-wave velocity structure needed to model the HVSR data to estimate bedrock depth.

5 RESULTS

The purpose of the P-wave seismic refraction survey was to determine approximate bedrock depth and identify areas on site with the deepest bedrock. The purpose of the HVSR survey was to confirm bedrock depth trends identified in the seismic refraction survey.

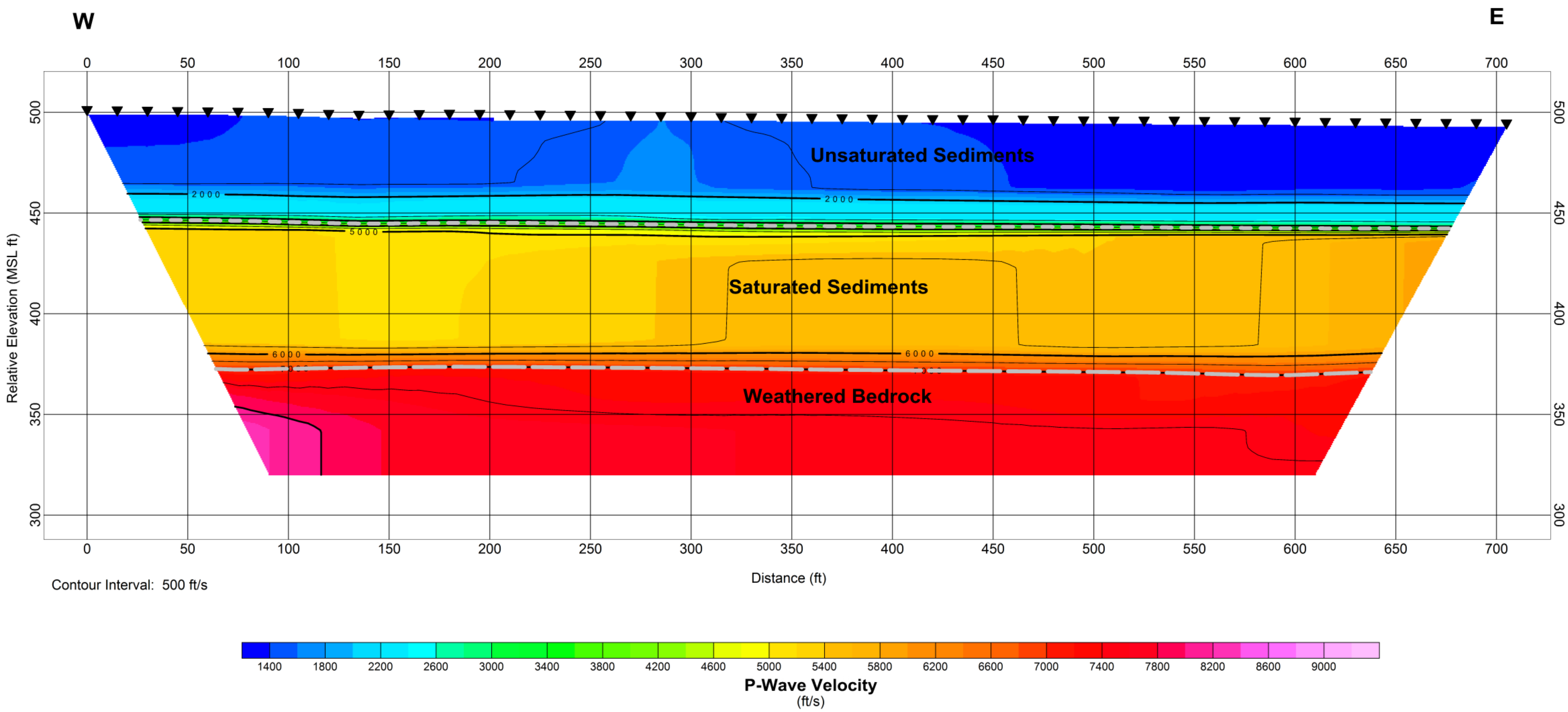
The P-wave seismic refraction model for line L-1, developed using tomographic inversion with a layered starting model, is presented as Figure 2. The color scheme used on the seismic tomography images consist of blue-cyan, yellow-orange, and red-magenta representing low velocity unsaturated sediments, intermediate velocity saturated sediments, and high velocity bedrock, respectively. The top of the saturated zone is interpreted along the 3,500 ft/s velocity contour at a depth of about 52 to 53 ft. Saturated sediments have a P-wave velocity in the 5,000 to 5,500 ft/s range. Depth to bedrock is about 2 to 3 ft shallower than that identified in the Park Monitoring Well, which is considered an acceptable error. The top of weathered bedrock is interpreted along the 7,000 ft/s velocity contour at a depth of about 125 ft. The bedrock surface is subhorizontal beneath the line and may be 5 to 10 feet deeper than that modeled due to the underestimated depth to groundwater. The P-wave velocity of the bedrock unit is most likely in the 7,500 to 8,000 ft/s range near the top of rock, gradually increasing with depth as weathering decreases. The seismic refraction model is not very sensitive to minor variations in bedrock topography because the seismic velocity of the weathered bedrock is not significantly greater than that of saturated sediments. For planning purposes, it can be assumed that bedrock varies from about 125 to 135 ft beneath the seismic line.

HVSR measurements were made at three (3) locations in close proximity to seismic line L-1 and are presented in Figure 4: Station A located adjacent to the Park Monitoring Well and about 35 ft south of a position of 0 ft along L-1; Station B located at a position of 240 ft along L-1 and Station C located at a position of 705 ft along L-1. Assuming that the sediments have relatively uniform S-wave velocity, a reasonable assumption over a small area, then the deepest bedrock would be expected to be associated with the lowest HVSR peak frequency. HVSR stations A and B have broad peaks in the 2 to 2.5 Hz range with the dipping bedrock surface in the site vicinity resulting in a broad rather than sharp peak. HVSR station C has a shaper peak at 2.15 Hz. The edges of the elevated HVSR response associated with bedrock are at frequencies of about 1.4 and 3.5 Hz at all three measurement locations. This observation combined with similar peak frequencies indicates that bedrock is located at relatively uniform depth beneath the line L-1, which is consistent with the seismic refraction model.

The P-wave seismic refraction model for line L-2, developed using tomographic inversion with a layered starting model, is presented as Figure 3. The color scheme used on the seismic tomography images consist of blue-cyan, yellow-orange, and red-magenta representing low velocity unsaturated sediments, intermediate velocity saturated sediments and high velocity bedrock, respectively. The top of saturated sediments is interpreted along the 3,500 ft/s velocity contour at a depth of about 52 to 53 ft, where located above the interpreted top of rock. Saturated sediments have a P-wave velocity in the 5,000 to 6,000 ft/s range. The top of bedrock is interpreted along the 5,000 ft/s velocity contour at a higher elevation than that of saturated sediments, and along the 7,000 ft/s contour where overlain by saturated sediments. There weathered bedrock unit deepens to the north beneath the seismic line from a depth of about 15 ft at the southern end of the line to 125 ft at the northern end of the line. The P-wave velocity of the bedrock unit is expected to be in the 7,500 to 8,000 ft/s range near the top of rock, gradually increasing with depth as weathering decreases. Although not interpreted, it is likely that a thin zone of lower velocity, very intensely weathered rock overlies the interpreted bedrock rock unit at the southernmost end of the line. The contact between bedrock and alluvial aquifers is likely located between a position of 250 and 350 ft beneath the seismic line.

HVSR measurements were made at three (3) locations in close proximity to seismic line L-2 and are presented in Figure 5: Station D located 12 ft east of a position of 705 ft along L-2; Station E located 10 ft east of a position of 510 ft along L-2 and Station F located 10 ft east of a position of 255 ft along L-2. Assuming that the sediments have relatively uniform S-wave velocity, a reasonable assumption over a small area, then the deepest bedrock would be expected to be associated with the lowest HVSR peak frequency. HVSR stations D, E, and F have HVSR peak frequencies at about 2.3, 2.8, and 5 Hz, respectively, indicating that bedrock deepens to the north as indicated by the seismic refraction model. The peak frequency and edges of the elevated HVSR response associated with bedrock at Station D is very similar to that at Station C indicating that bedrock is located at a similar depth at the two measurement locations.

Based on the seismic refraction model and HVSR measurements at Jacumba Community Services District site, the preferred location for a water well is along the northern property boundary.



LEGEND

▼ Geophone Location

- - - - Interpreted Contact between Unsaturated Sediments and Saturated Sediments

— — — Interpreted Contact between Sediments and Weathered Bedrock

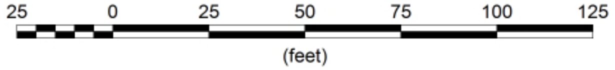


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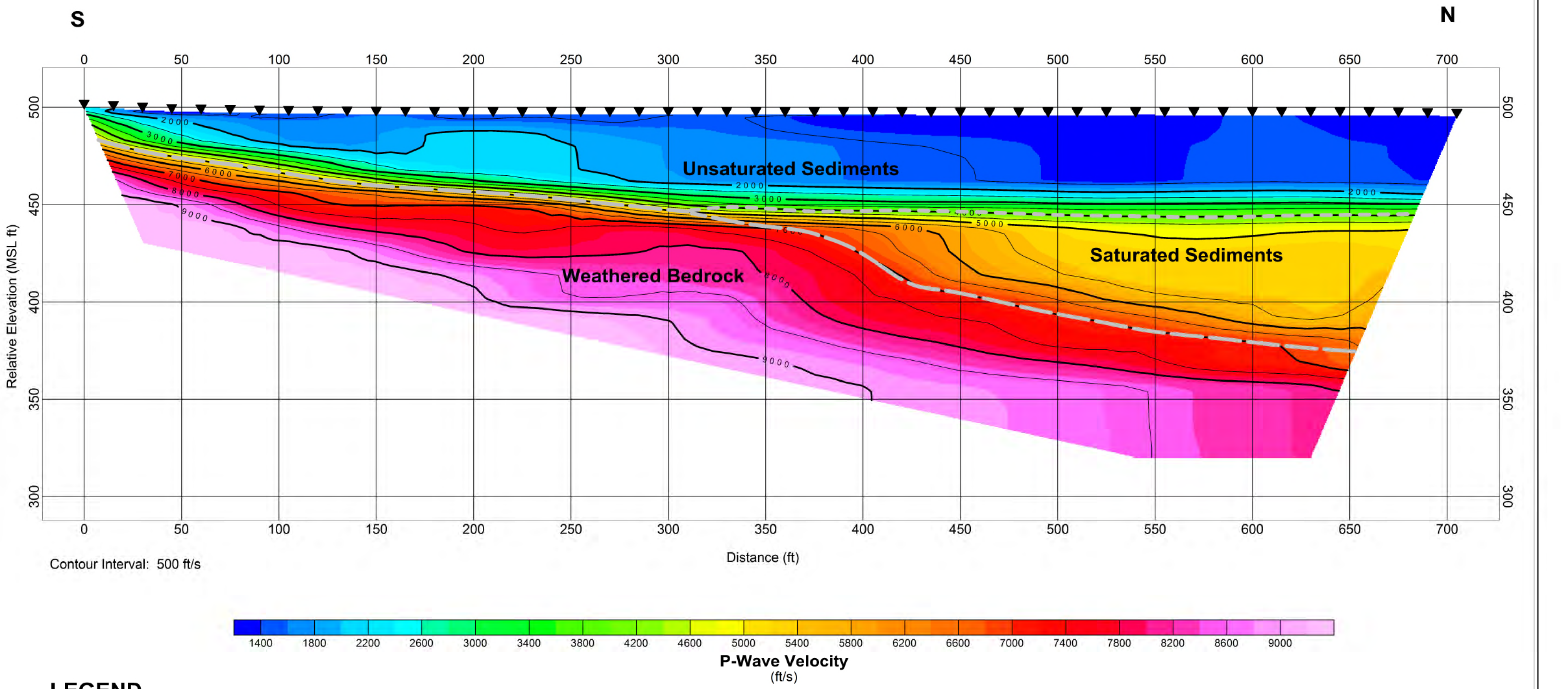
Figure 2

L-1: Layer-Based Tomography Model
GV Project No. 15425

Jacumba Hot Springs
San Diego County, California

Prepared for Dudek Engineering & Environmental



Contour Interval: 500 ft/s

LEGEND

▼ Geophone Location

- - - Interpreted Contact between Unsaturated Sediments and Saturated Sediments

— — Interpreted Contact between Sediments and Weathered Bedrock

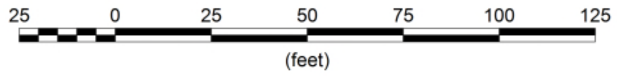
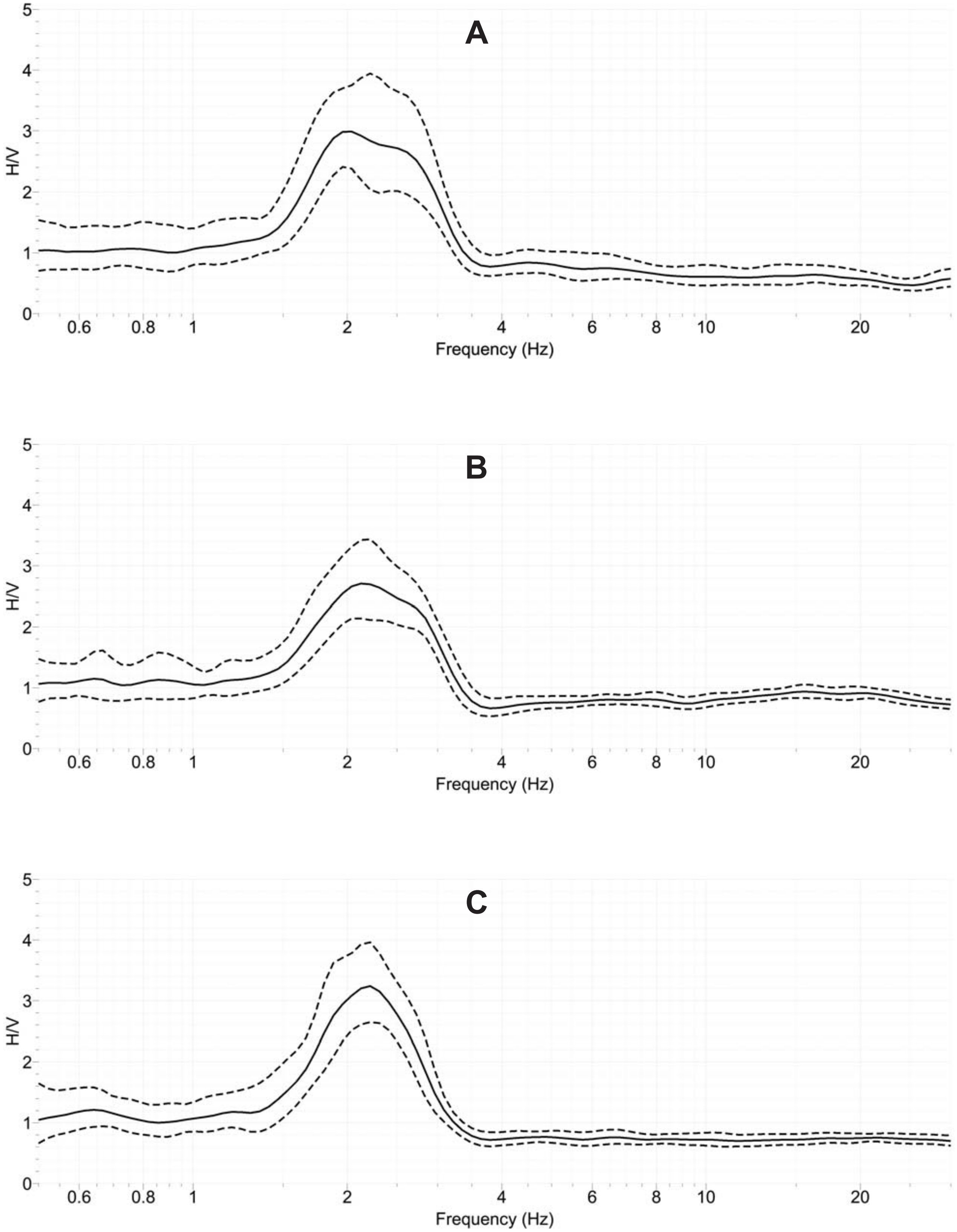


Figure 3

L-2: Layer-Based Tomography Model
GV Project No. 15425

Jacumba Hot Springs
San Diego County, California

Prepared for Dudek Engineering & Environmental



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geophysical services

Project No.: 15425

Date: NOV 20, 2015

Drawn By: D. CARPENTER

Approved By: A. MARTIN

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FIGURE 4
HVSR DATA - STATIONS A, B AND C

JACUMBA HOT SPRINGS
SAN DIEGO COUNTY, CALIFORNIA

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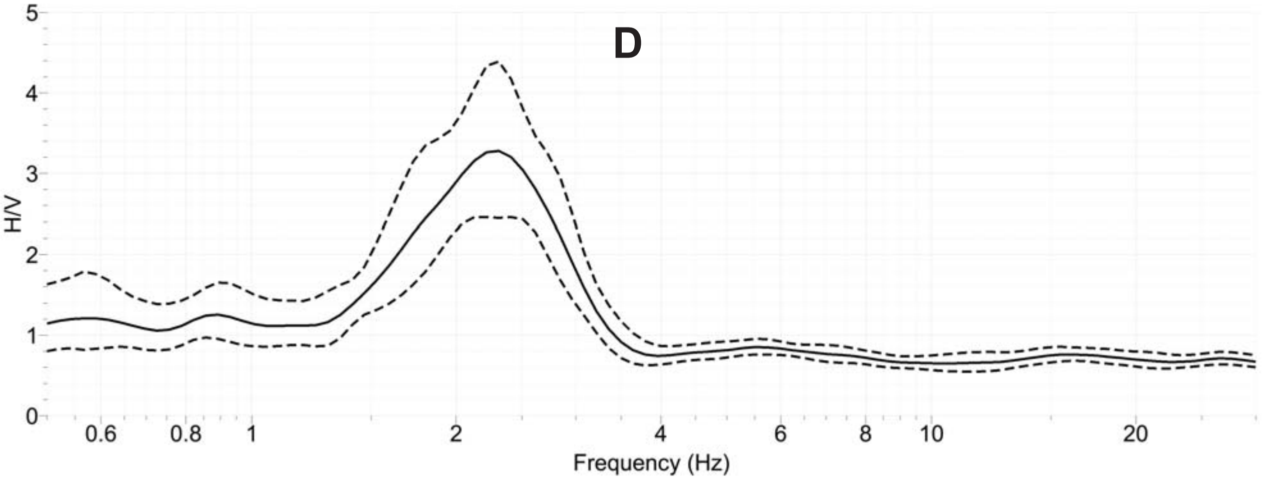

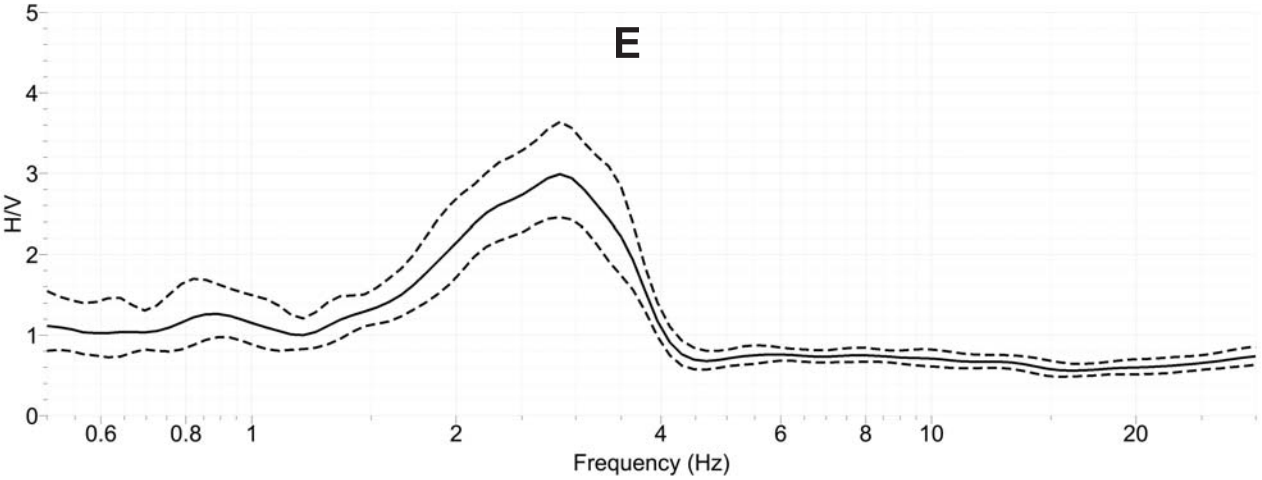

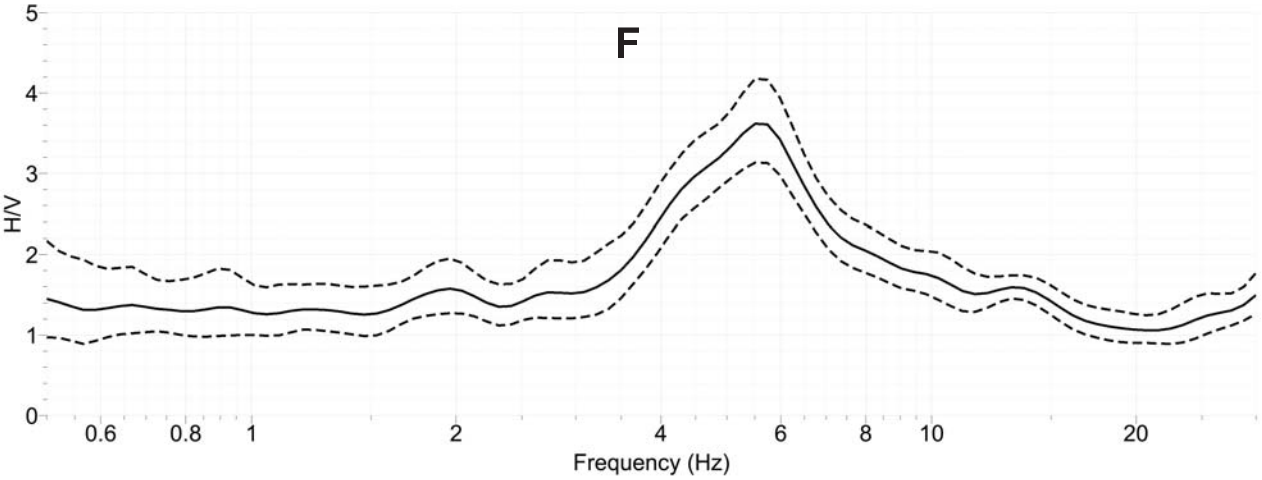

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FIGURE 5
HVSR DATA - STATIONS D, E AND F

Project No.: 15425
Date: NOV 20, 2015
Drawn By: D. CARPENTER
Approved By: A. MARTIN
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JACUMBA HOT SPRINGS
SAN DIEGO COUNTY, CALIFORNIA

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6 CERTIFICATION

All geophysical data, analysis, interpretations, conclusions, and recommendations in this document have been prepared under the supervision of and reviewed by a **GEO***Vision* California Professional Geophysicist.

Reviewed and approved by

Antony J Martin

ANTONY JEFFREY MARTIN
GP 989

11/23/2015

Antony Martin
Date

California Professional Geophysicist, P. GP. 989
GEO*Vision* Geophysical Services

∗ This geophysical investigation was conducted under the supervision of a California Professional Geophysicist using industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing interpretation and reporting. All original field data files, field notes, observations and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

A professional geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations, or ordinances.

APPENDIX B

Geologist's Log, Driller's Log

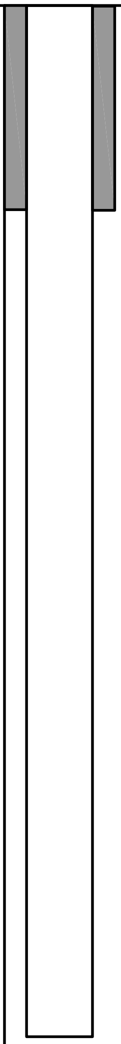
DUDEK

605 Third Street Encinitas, CA 92024

Boring Number

Sheet 1 **of** 4

Project Name Highland Center Well	**Project Number** 9286	**Elevation and Datum**	**Location** Jacumba, CA
Drilling Company Fain	**Driller** Mason	**Date and time started** 9/28/2016 11:05	**Date and time completed** 9/29/2016 12:00
Drilling Equipment Star 50K rig	**Drilling Method** mud rotary	**Completion Depth** 125 feet	**Total number of samples** 27
Size and type of bit tricone 15 3/4-inch	**Hole diameter** 15 3/4-inch	**Weather and temperature** sunny, 85 degrees F	
Drilling fluid drilling mud	**Drilling angle** vertical	**Groundwater Depth** / **First encountered**	**Final** 56.0 feet bgs
Sampler type	**Hammer Driving wt.** / **Drop**	**Geologist onsite/Date** Patrick Rentz	**Checked by/Date**

Lithology	Depth	Samples	Recovery	Blow Count	Description	USCS Symbol	Comments	PID	Sample number (Time)	Boring/Well Completion detail
	0									
					Alluvium					
	10				well graded gravels and sand. light brown.	GW	7.5 YR 3/4		1 (11:20)	
	15				15 3/4-inch bit and collar are 14.5 feet in length.					
	20				gravelly clay with sand. low returns volume indicate high fraction of clay.	CL	7.5 YR 3/4		2 (11:35)	
	30				coarse to medium sized sand with small gravels.	SW	7.5 YR 3/4		3 (11:43)	
	35				coarse to medium sized sand with small gravels.	SW	7.5 YR 3/4		4 (11:51)	
	40				coarse to medium sized sand with small gravels.	SW	7.5 YR 3/4			
	45				coarse to medium sized sand, well sorted. light brown.	SW	7.5 YR 3/4		5 (12:50)	
	55				rig chatter from 45-52 feet. coarse to medium sand. angular, well sorted.	SP	7.5 YR 3/4		6 (13:08)	
	60				well sorted coarse to medium sized sand. light grey.	SP	7.5 YR 5/1			

NOTES:

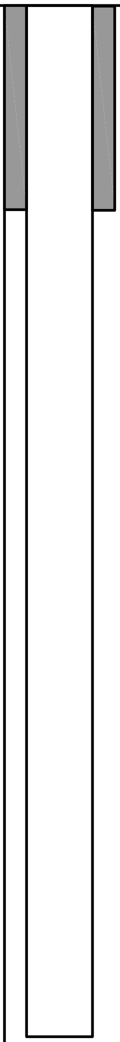
DUDEK

605 Third Street Encinitas, CA 92024

Boring Number

Sheet 2 of 4

Project Name Highland Center Well
Project Number 9286
Elevation and Datum
Location Jacumba, CA
Drilling Company Fain
Driller Mason
Date and time started 9/28/2016 11:05
Date and time completed 9/29/2016 12:00
Drilling Equipment Star 50K rig
Drilling Method mud rotary
Completion Depth 125 feet
Total number of samples 27
Size and type of bit tricone 15 3/4-inch
Hole diameter 15 3/4-inch
Weather and temperature sunny, 85 degrees F
Drilling fluid drilling mud
Drilling angle vertical
Groundwater Depth
First encountered
Final 56.0 feet bgs
Sampler type
Hammer Driving wt.
Drop
Geologist onsite/Date Patrick Rentz
Checked by/Date

Lithology	Depth	Samples	Recovery	Blow Count	Description	USCS Symbol	Comments	PID	Sample number (Time)	Boring/Well Completion detail
					Alluvium					
	65				well sorted coarse to medium sized quartz sand with mica flakes.light grey.	SP	7.5 YR 5/1		7 (13:25)	
	70				well sorted, coarse to medium sized quartz sand. sub-rounded with mica flakes.	SP	7.5 YR 5/1			
	75				clean, well sorted, coarse to medium sand with mica.	SP	7.5 YR 5/1		8 (13:55)	
	80				clean, medium sized sand, increasing fraction of mica.	SP	7.5 YR 5/1		9 (13:50)	
	85				clean, medium sized sand. sub-angular grains with mica flakes.	SP	7.5 YR 5/1		10 (13:58)	
	90				clean, medium sized sand with mica flakes.	SP	7.5 YR 5/1		11 (14:02)	
	95				medium to fine sized sand with mica. sand fining from 90 feet to 95 feet. light grey.	SP	7.5 YR 5/1		12 (14:11)	
	100				higher volume of returns. coarse sized sand and small to medium gravels	SW	7.5 YR 5/1		13 (14:25)	
	105				well graded coarse to fine sand. angular grains with some small gravels.	SW	7.5 YR 5/1		14 (14:31)	

NOTES:

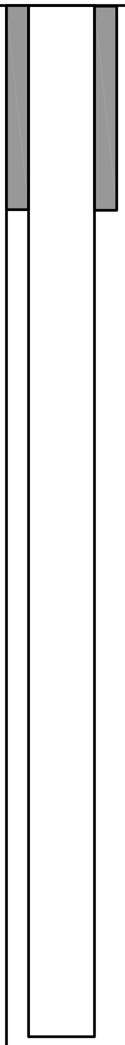
DUDEK
605 Third Street Encinitas, CA 92024

Boring Number

Sheet 3 of 4

Project Name Highland Center Well
Project Number 9286
Elevation and Datum
Location Jacumba, CA
Drilling Company Fain
Driller Mason
Date and time started 9/28/2016 11:05
Date and time completed 9/29/2016 12:00
Drilling Equipment Star 50K rig
Drilling Method mud rotary
Completion Depth 125 feet
Total number of samples 27
Size and type of bit tricone 15 3/4-inch
Hole diameter 15 3/4-inch
Weather and temperature sunny, 85 degrees F
Drilling fluid drilling mud
Drilling angle vertical
Groundwater Depth
First encountered
Final 56.0 feet bgs
Sampler type
Hammer Driving wt.
Drop
Geologist onsite/Date Patrick Rentz
Checked by/Date

Lithology	Depth	Samples	Recovery	Blow Count	Description	USCS Symbol	Comments	PID	Sample number (Time)	Boring/Well Completion detail
					Alluvium					
	110				well graded sand with small, angular gravels.	SW	7.5 YR 5/1		15 (14:35)	
					9/29/2016					
	115				poorly graded coarse to med. sizedsand with large, angular gravels and some clay.	SP SC	7.5 YR 4/4		16 (8:28)	
	120				sandy clay with angular gravel. increasing fraction of clay from 115 - 120 feet.	CL	7.5 YR 4/4		17 (8:49)	
	125				sandy clay with angular gravel. cohesive and compressible.	CL	7.5 YR 4/4		18 (9:01)	
	130				clay with increasing sand content. cohesive and compressible.	CL	7.5 YR 4/4		19 (9:08)	
	135				clay with sand and small gravel. cohesive and compressible.	CL	7.5 YR 4/4		20 (9:25)	
	140				poorly sorted sand with angular gravels and clay. slightly cohesive.	SP SC	7.5 YR 4/4		21 (9:45)	
	155				clay with poorly sorted sand.	CL	7.5 YR 4/4		22 (10:27)	
	160				clay with poorly sorted sand and gravel.	SC CL	7.5 YR 4/4		23 (10:47)	



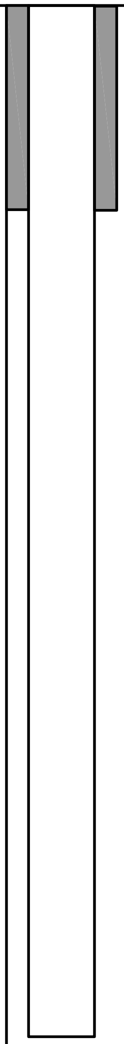
NOTES:

Boring Number

Sheet 4 of 4

Project Name Highland Center Well	**Project Number** 9286	**Elevation and Datum**	**Location** Jacumba, CA
Drilling Company Fain	**Driller** Mason	**Date and time started** 9/28/2016 11:05	**Date and time completed** 9/29/2016 12:00
Drilling Equipment Star 50K rig	**Drilling Method** mud rotary	**Completion Depth** 125 feet	**Total number of samples** 27
Size and type of bit tricone 15 3/4-inch	**Hole diameter** 15 3/4-inch	**Weather and temperature** sunny, 85 degrees F	
Drilling fluid drilling mud	**Drilling angle** vertical	**Groundwater Depth** / **First encountered**	**Final** 56.0 feet bgs
Sampler type	**Hammer** Driving wt. Drop	**Geologist onsite/Date** Patrick Rentz	**Checked by/Date**

Lithology	Depth	Samples	Recovery	Blow Count	Description	USCS Symbol	Comments	PID	Sample number (Time)	Boring/Well Completion detail
					Alluvium					
	165				clay with poorly sorted sand and gravel.	SP CL	7.5 YR 4/4		24 (10:59)	
	170				clay with poorly sorted sand and gravel.	SP CL	7.5 YR 4/4		25 (11:10)	
	175				clay with poorly sorted sand and gravel.	SP CL	7.5 YR 4/4		26 (11:25)	
	180				Volcanics top of weathered volcanic rock. slow drilling on hard rock starts at 177 feet. gravel sized fragments of volcanic rock.				27 (11:30)	
	182				total depth. weathered red and black volcanic rock.					



NOTES:

*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. e0327405

Page One of One

Owner's Well Number Highland Center

Date Work Began 09/28/2016 Date Work Ended 10/7/2016

Local Permit Agency SD DEH

Permit Number LWELL-001506 Permit Date 9/29/16

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N Latitude W Longitude

APN/TRS/Other

Geologic Log

Orientation ● Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	12	Brown Sand
12	37	Brown Clay & Sand
37	63	Brown & White Medium Course Sand
63	96	Medium to Course Sand
96	108	Course Gravel & Sand
108	117	Course Gravel & Clay
117	175	Brown Clay
175	182	Pink & Black Granite

Total Depth of Boring 182 Feet

Total Depth of Completed Well 125 Feet

Well Owner

Name Jacumba Community Services District

Mailing Address P.O.Box 425

City Jacumba Hot Springs State Ca Zip 91934

Well Location

Address Jacumba Community Park / Hwy 80

City Jacumba Hot Springs County San Diego

Latitude ___ Deg. ___ Min. ___ Sec. N Longitude ___ Deg. ___ Min. ___ Sec. W

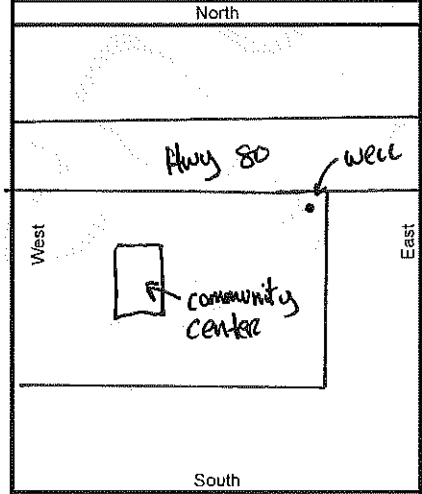
Datum ___ Dec. Lat. 32.6175 Dec. Long. 116.1845

APN Book 660 Page 140 Parcel 07

Township ___ Range ___ Section ___

Location Sketch

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



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 ___ (Feet below surface)

Depth to Static Water Level 59 (Feet) Date Measured 10/12/2016

Estimated Yield * 175 (GPM) Test Type Constant Rate

Test Length 24.0 (Hours) Total Drawdown 20 (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	52	24	Conductor	Low Carbon Steel	.250	16		
0	75	16	Blank	Low Carbon Steel	.188	8 5/8		
75	115	16	Screen	304 Stainless Steel	.188	8 5/8	Wire Wrap	0.050
115	125	16	Sump	304 Stainless Steel	.188	8 5/8		

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	52	Cement	
0	182	Filter Pack	8x12

Attachments

- ☐ Geologic Log
- ☐ Well Construction Diagram
- ☐ Geophysical Log(s)
- ☐ Soil/Water Chemical Analyses
- ☑ Other Site Map

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 Fain Drilling & Pump Co.,Inc.

Person, Firm or Corporation

12029 Old Castle Rd. Valley Center CA 92082

Address City State Zip

Signed ___ C-57 Licensed Water Well Contractor

10/28/2016 Date Signed

328287 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APPENDIX C

Geophysical Logs, Filter Pack Specification

VICTORY WELL SURVEYS

DEVIATION SURVEY

VWS No.
000979

Company FAIN DRILLING AND PUMP
Well Name HIGHLAND CENTER WELL
City JACUMBA
County SAN DIEGO State CA

Location:

OLD HWY 80
@ HIGHLAND CENTER

Sec. Twp. Rge.

Other Services:

E-LOG
GUARD LOG
GAMMA RAY

Permanent Datum G.L.
Log Measured From G.L.
Drilling Measured From G.L.

Elevation N/A
above perm. datum

Elevation
G.L.
D.F.
K.B.

Date	9-29-16		
Run Number	ONE		
Total Depth Driller	183'		
Total Depth Logger	182'		
Bottom Logged Depth	180'		
Top Logged Depth	0		
Casing Driller	N/A		
Casing Logger	N/A		
Bit Size	15.5"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	N/A		
pH / Fluid Loss	N/A		
Source of Sample	PIT		
Rm @ Temp	11.3 @ 75F		
Rmf @ Temp	12.1 @ 75F		
Rmc @ Temp	N/A		
Source of Rmf / Rmc	MEASURED		
Rm @ BHT	N/A		
Time Since Circulation	1 HOUR		
Time Log Started	12:30 PM		
Max. Recorded Temperature	N/A		
Truck Number	ONE		
Location	CA		
Operator	LAPORTE		
Representative	P. RENTZ		

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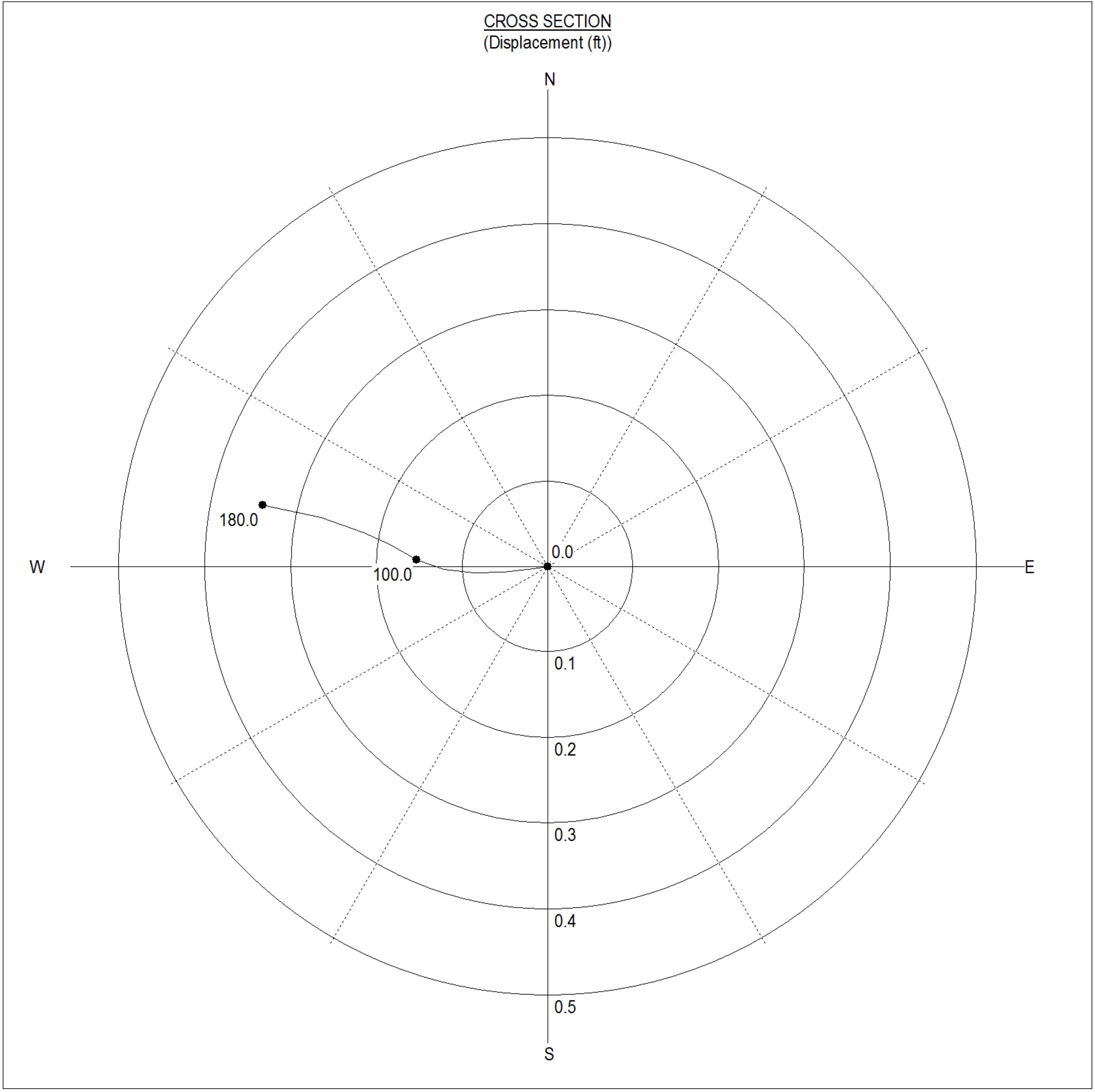
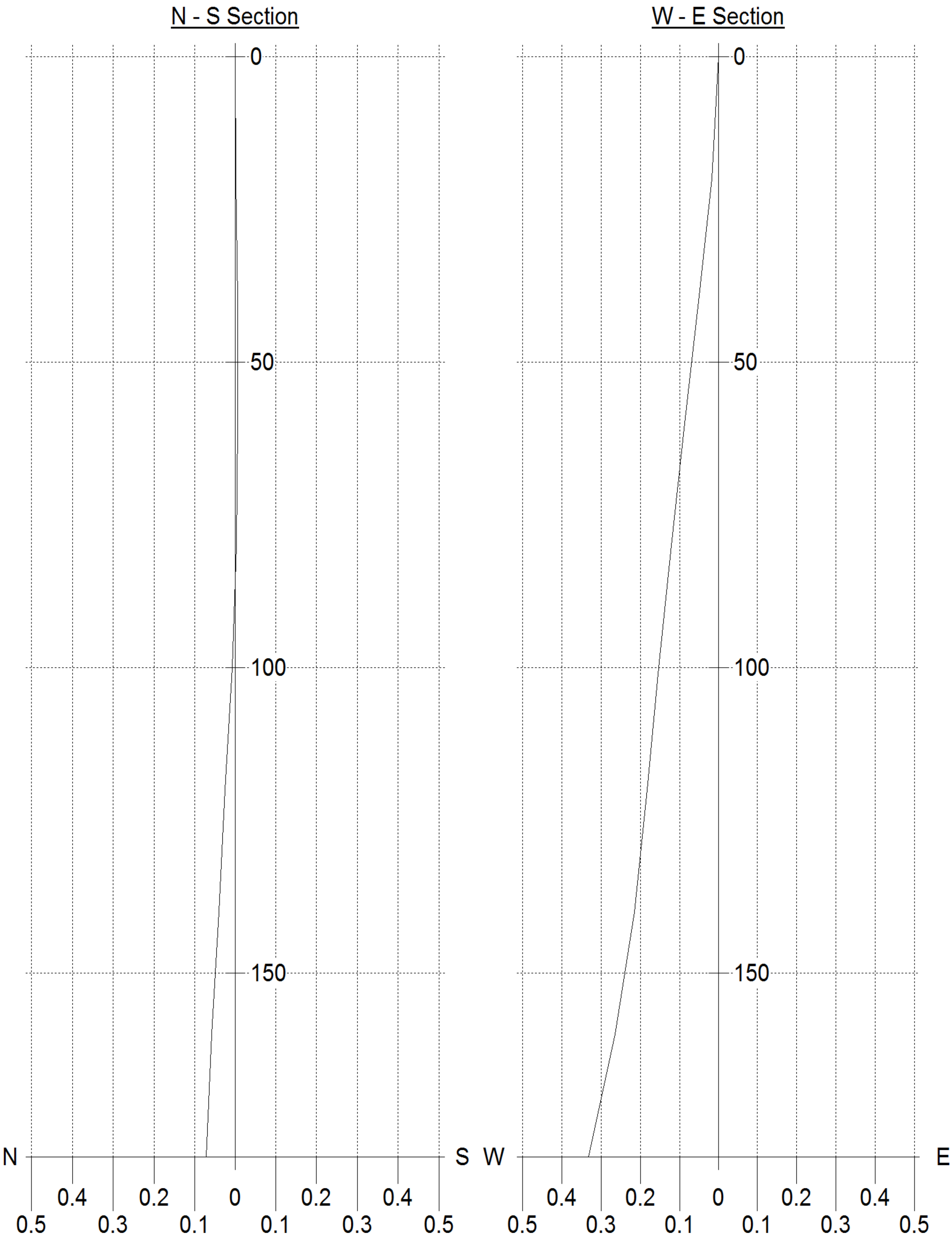
Comments


CROSS SECTION
(Displacement (ft))
N
W
E
S
0.0
100.0
180.0
0.1
0.2
0.3
0.4
0.5

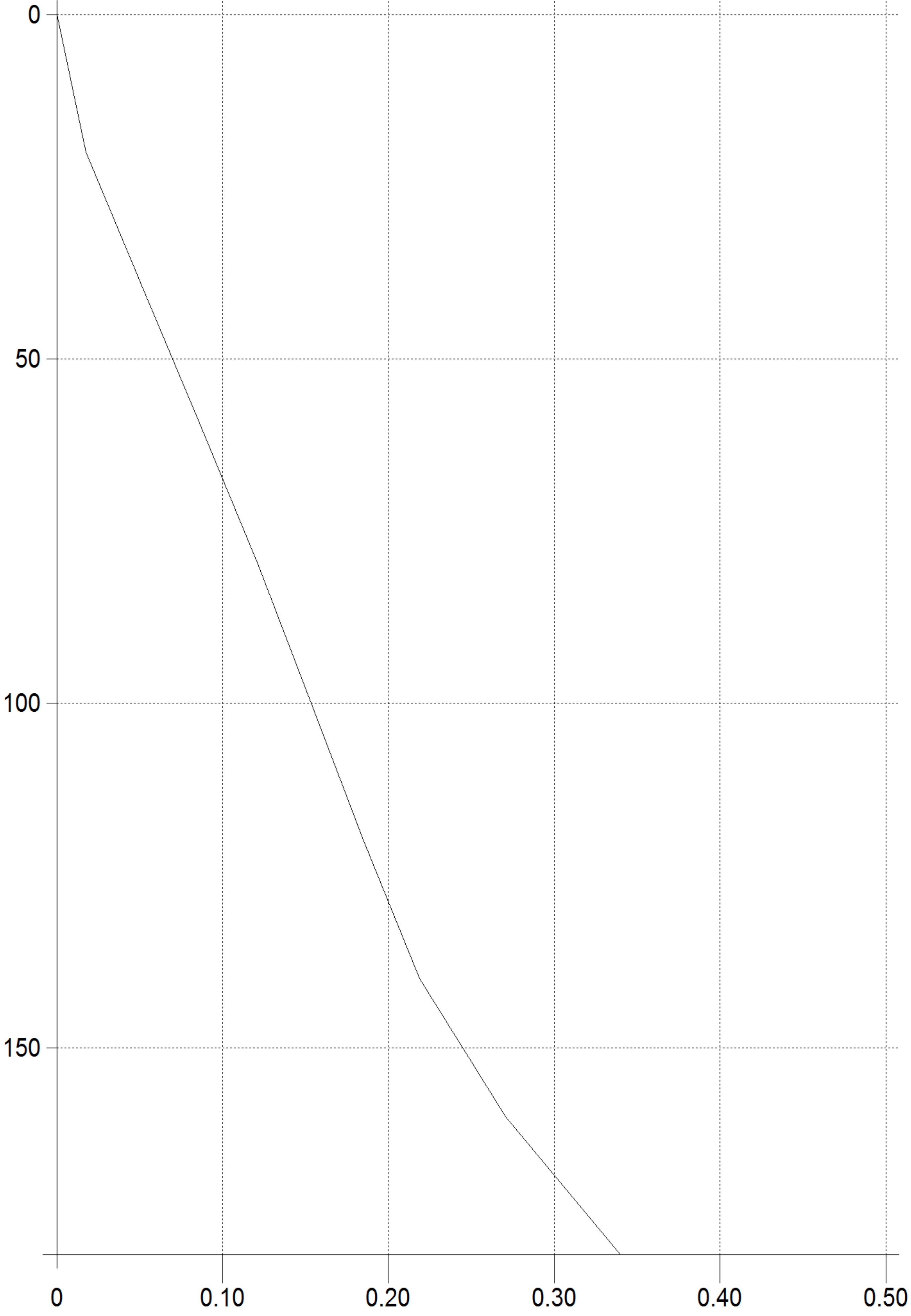
CLOSURE SECTIONS

(True Depth vs Displacement (ft))



IN THE PLANE OF CLOSURE

(True Depth vs Displacement (ft))



TVD Report (Minimum Curvature Method)

Database File	000979.db
Dataset Pathname	./././_tvd_/1
Dataset Creation	Thu Sep 29 13:49:57 2016

Meas. Depth (ft)	Incline	Azimuth	TVD (ft)	North (ft)	East (ft)	Dog Leg	Closure Dis (ft)	Closure Dir	Vert. Sec. (ft)
		Vertical Section Direction 0.00							
0.0	0.00	202.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.0	0.10	262.00	20.00	-0.00	-0.02	0.50	0.02	82.00	-0.00
40.0	0.10	265.00	40.00	-0.01	-0.05	0.03	0.05	83.00	-0.01
60.0	0.10	272.00	60.00	-0.01	-0.09	0.06	0.09	85.20	-0.01
80.0	0.10	279.00	80.00	-0.00	-0.12	0.06	0.12	88.14	-0.00
100.0	0.10	303.00	100.00	0.01	-0.15	0.21	0.15	-86.91	0.01
120.0	0.10	298.00	120.00	0.03	-0.18	0.04	0.19	-81.94	0.03
140.0	0.10	291.00	140.00	0.04	-0.22	0.06	0.22	-79.35	0.04
160.0	0.20	289.00	160.00	0.06	-0.26	0.50	0.27	-77.62	0.06
180.0	0.20	274.00	180.00	0.07	-0.33	0.26	0.34	-77.80	0.07

VICTORY WELL SURVEYS

ELECTRIC LOG
GUARD RESISTIVITY LOG
GAMMA RAY LOG

VWS No.
000979

Company	FAIN DRILLING AND PUMP
Well Name	HIGHLAND CENTER WELL
City	JACUMBA
County	SAN DIEGO
State	CA

Location:

OLD HWY 80
@ HIGHLAND CENTER

Sec. Twp. Rge.

Other Services:

DEVIATION SURVEY

Permanent Datum	G.L.	Elevation above perm. datum	N/A
Log Measured From	G.L.		
Drilling Measured From	G.L.		

Elevation
G.L.
D.F.
K.B.

Date	9-29-16		
Run Number	ONE		
Total Depth Driller	183'		
Total Depth Logger	182'		
Bottom Logged Depth	181'		
Top Logged Depth	30'		
Casing Driller	N/A		
Casing Logger	N/A		
Bit Size	15.5"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	N/A		
pH / Fluid Loss	N/A		
Source of Sample	PIT		
Rm @ Temp	11.3 @ 75F		
Rmf @ Temp	12.1 @ 75F		
Rmc @ Temp	N/A		
Source of Rmf / Rmc	MEASURED		
Rm @ BHT	N/A		
Time Since Circulation	1 HOUR		
Time Log Started	12:30 PM		
Max. Recorded Temperature	N/A		
Truck Number	ONE		
Location	CA		
Operator	LAPORTE		
Representative	P. RENTZ		

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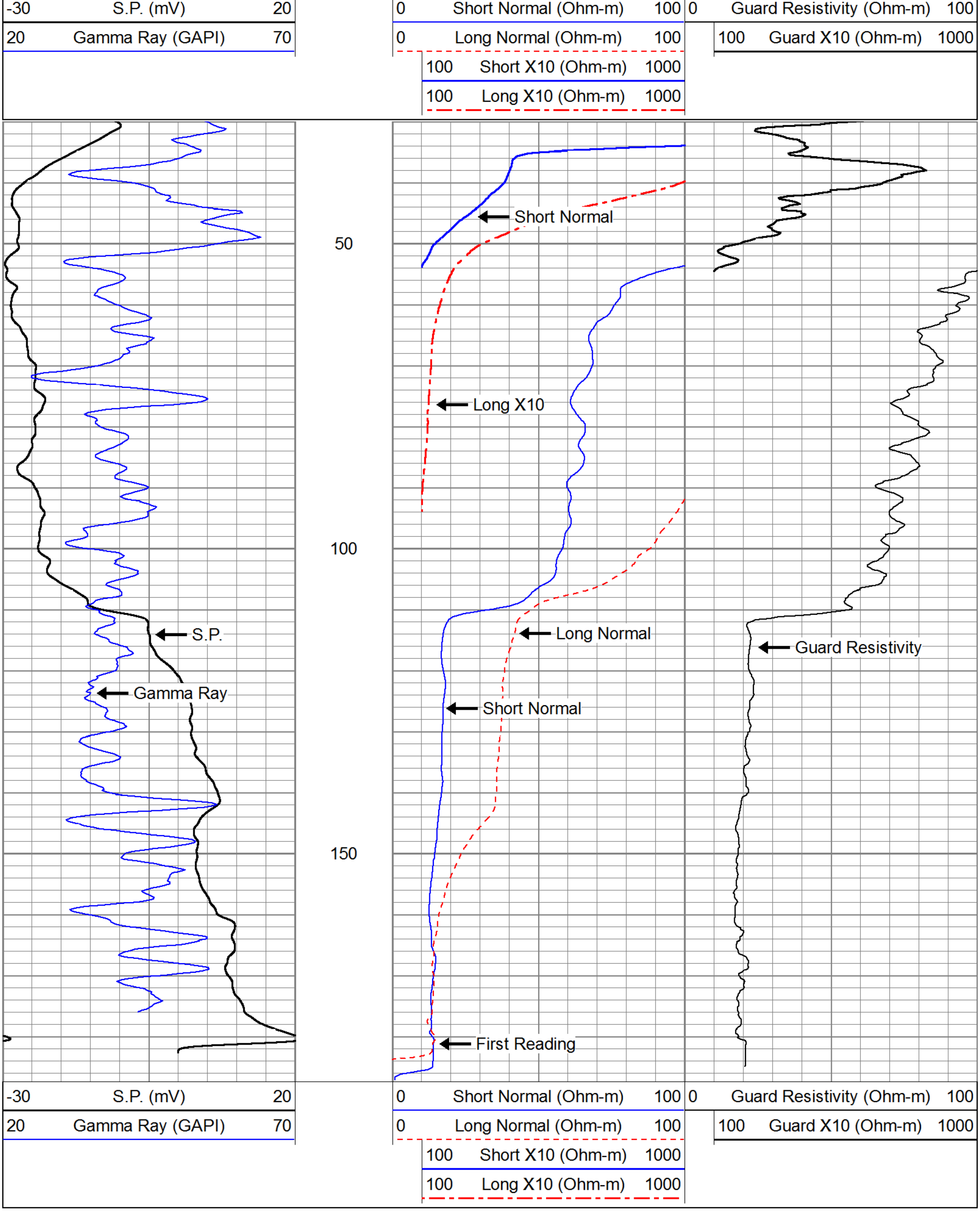
Comments

Database File	000979.db
Dataset Pathname	Fain/Jacumba/Elog/pass1
Presentation Format	elog2
Dataset Creation	Thu Sep 29 12:55:25 2016
Charted by	Depth in Feet scaled 1:240


-30 S.P. (mV) 20
20 Gamma Ray (GAPI) 70
0 Short Normal (Ohm-m) 100
0 Long Normal (Ohm-m) 100
100 Short X10 (Ohm-m) 1000
100 Long X10 (Ohm-m) 1000
0 Guard Resistivity (Ohm-m) 100
100 Guard X10 (Ohm-m) 1000
50
100
150
Short Normal
Long X10
S.P.
Gamma Ray
Long Normal
Short Normal
Guard Resistivity
First Reading
-30 S.P. (mV) 20
20 Gamma Ray (GAPI) 70
0 Short Normal (Ohm-m) 100
0 Long Normal (Ohm-m) 100
100 Short X10 (Ohm-m) 1000
100 Long X10 (Ohm-m) 1000
0 Guard Resistivity (Ohm-m) 100
100 Guard X10 (Ohm-m) 1000

VICTORY WELL SURVEYS

ELECTRIC LOG
GUARD RESISTIVITY LOG
GAMMA RAY LOG

VWS No. 000979

Company FAIN DRILLING AND PUMP
Well Name HIGHLAND CENTER WELL
City JACUMBA
County SAN DIEGO State CA

Location:
OLD HWY 80
@ HIGHLAND CENTER

Other Services:
DEVIATION SURVEY

Sec. Twp. Rge.

Permanent Datum G.L. Elevation N/A
Log Measured From G.L. above perm. datum
Drilling Measured From G.L.

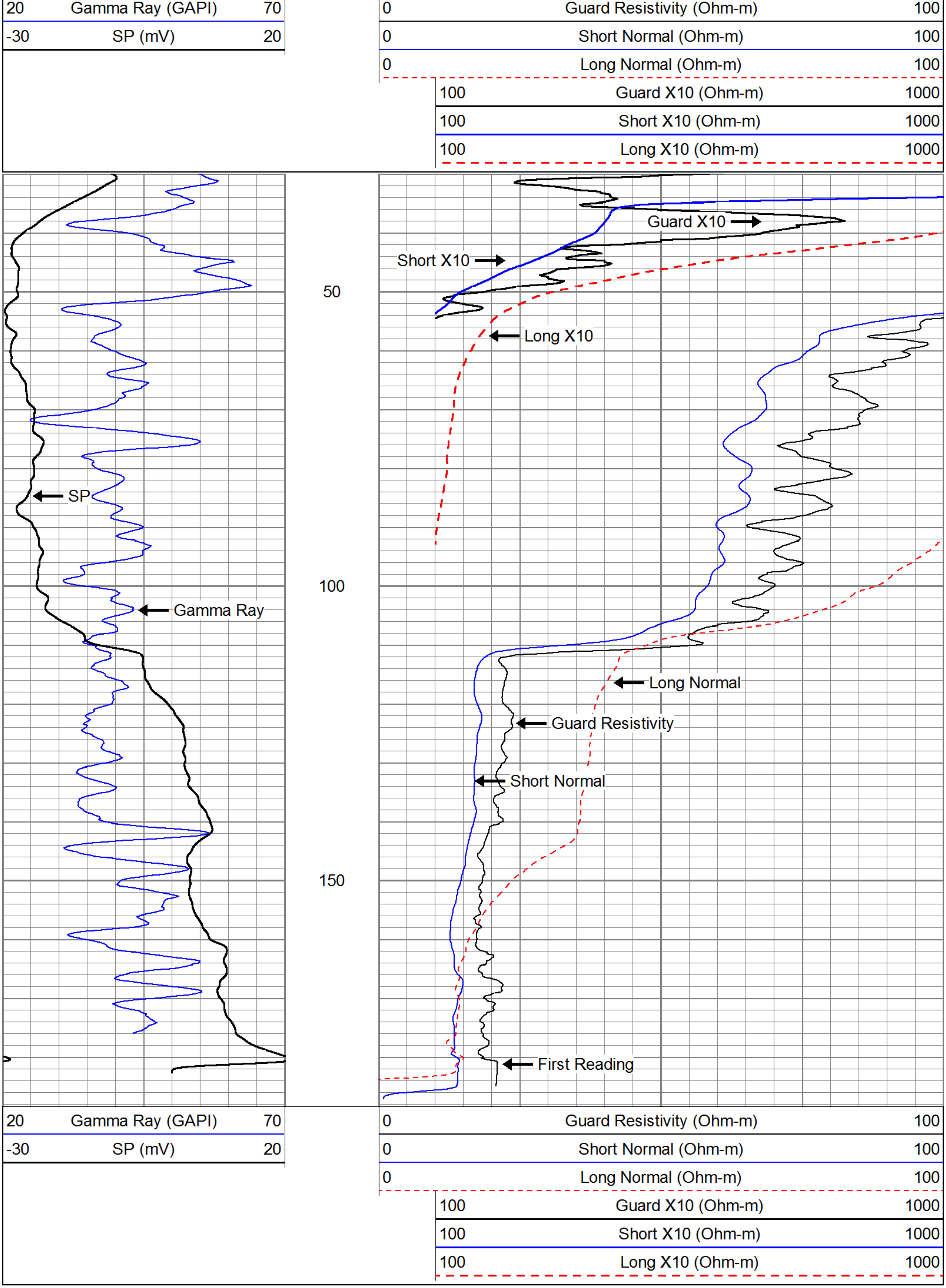
Elevation
G.L.
D.F.
K.B.

Date	9-29-16		
Run Number	ONE		
Total Depth Driller	183'		
Total Depth Logger	182'		
Bottom Logged Depth	181'		
Top Logged Depth	30'		
Casing Driller	N/A		
Casing Logger	N/A		
Bit Size	15.5"		
Type Fluid in Hole	BENTONITE		
Density / Viscosity	N/A		
pH / Fluid Loss	N/A		
Source of Sample	PIT		
Rm @ Temp	11.3 @ 75F		
Rmf @ Temp	12.1 @ 75F		
Rmc @ Temp	N/A		
Source of Rmf / Rmc	MEASURED		
Rm @ BHT	N/A		
Time Since Circulation	1 HOUR		
Time Log Started	12:30 PM		
Max. Recorded Temperature	N/A		
Truck Number	ONE		
Location	CA		
Operator	LAPORTE		
Representative	P. RENTZ		

<<< Fold Here >>>

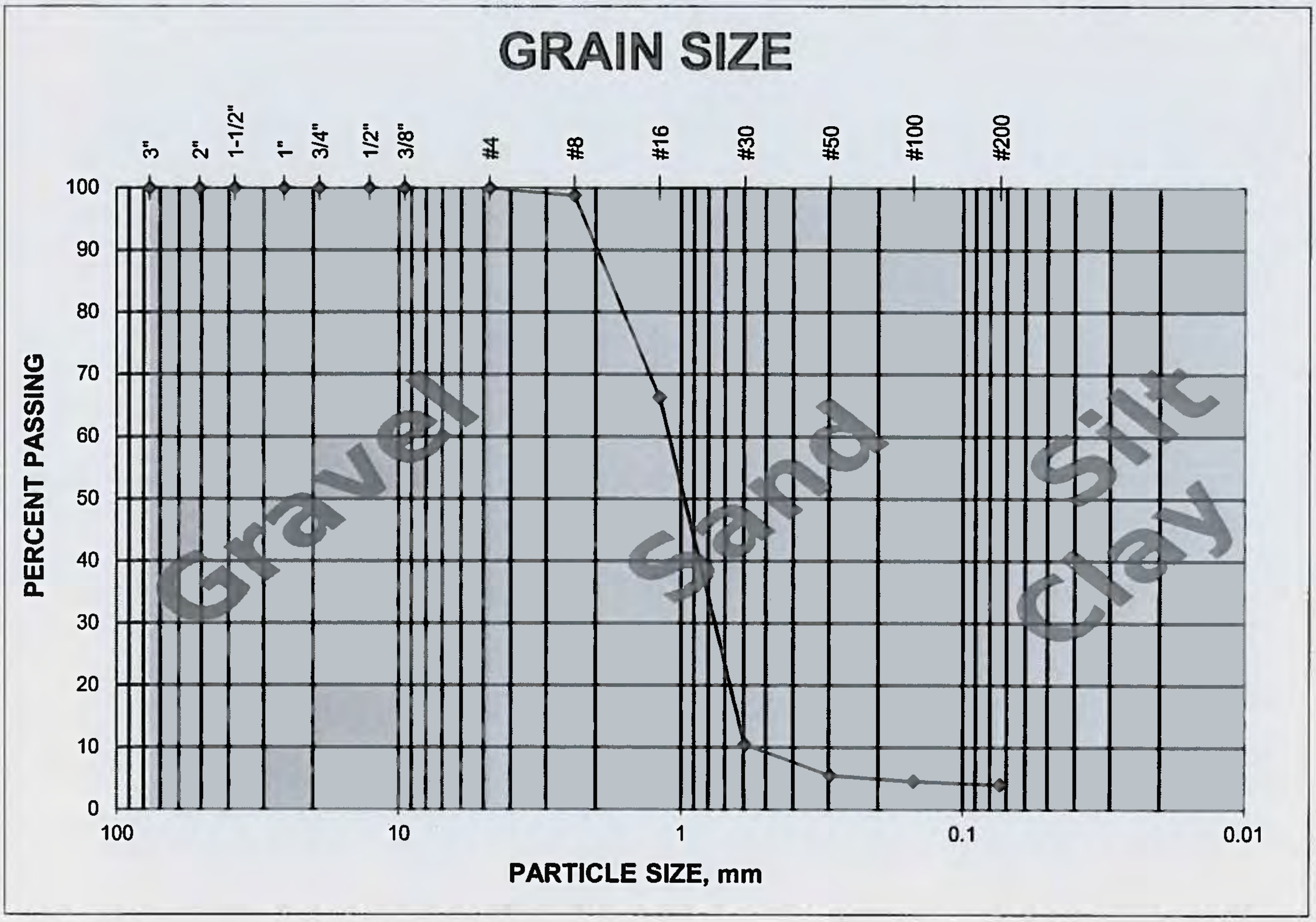
Comments

Database File	000979.db
Dataset Pathname	Fain/Jacumba/GRD/pass1
Presentation Format	guard
Dataset Creation	Thu Sep 29 13:08:40 2016
Charted by	Depth in Feet scaled 1:240


20 Gamma Ray (GAPI) 70
-30 SP (mV) 20
0 Guard Resistivity (Ohm-m) 100
0 Short Normal (Ohm-m) 100
0 Long Normal (Ohm-m) 100
100 Guard X10 (Ohm-m) 1000
100 Short X10 (Ohm-m) 1000
100 Long X10 (Ohm-m) 1000
Guard X10
Short X10
50
Long X10
SP
100
Gamma Ray
Long Normal
Guard Resistivity
Short Normal
150
First Reading
20 Gamma Ray (GAPI) 70
-30 SP (mV) 20
0 Guard Resistivity (Ohm-m) 100
0 Short Normal (Ohm-m) 100
0 Long Normal (Ohm-m) 100
100 Guard X10 (Ohm-m) 1000
100 Short X10 (Ohm-m) 1000
100 Long X10 (Ohm-m) 1000

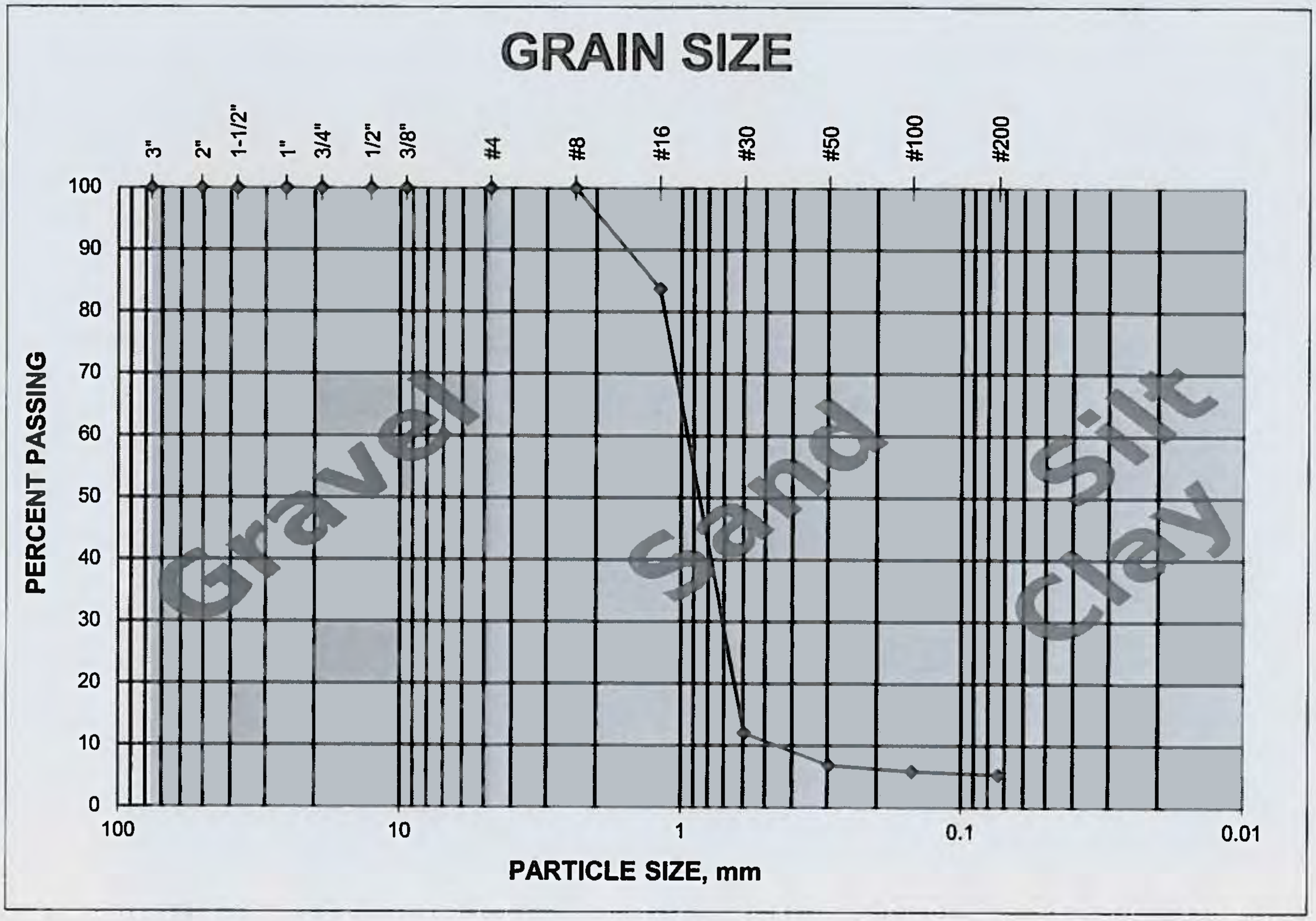
GRAIN SIZE ANALYSIS

PROJECT NAME	DUDEK- HC WELLS
PROJECT NUMBER	5690-22-02
SAMPLE NUMBER	75'
TESTED BY	EG



GRAIN SIZE ANALYSIS

PROJECT NAME	DUDEK- HC WELLS
PROJECT NUMBER	5690-22-02
SAMPLE NUMBER	90'
TESTED BY	EG

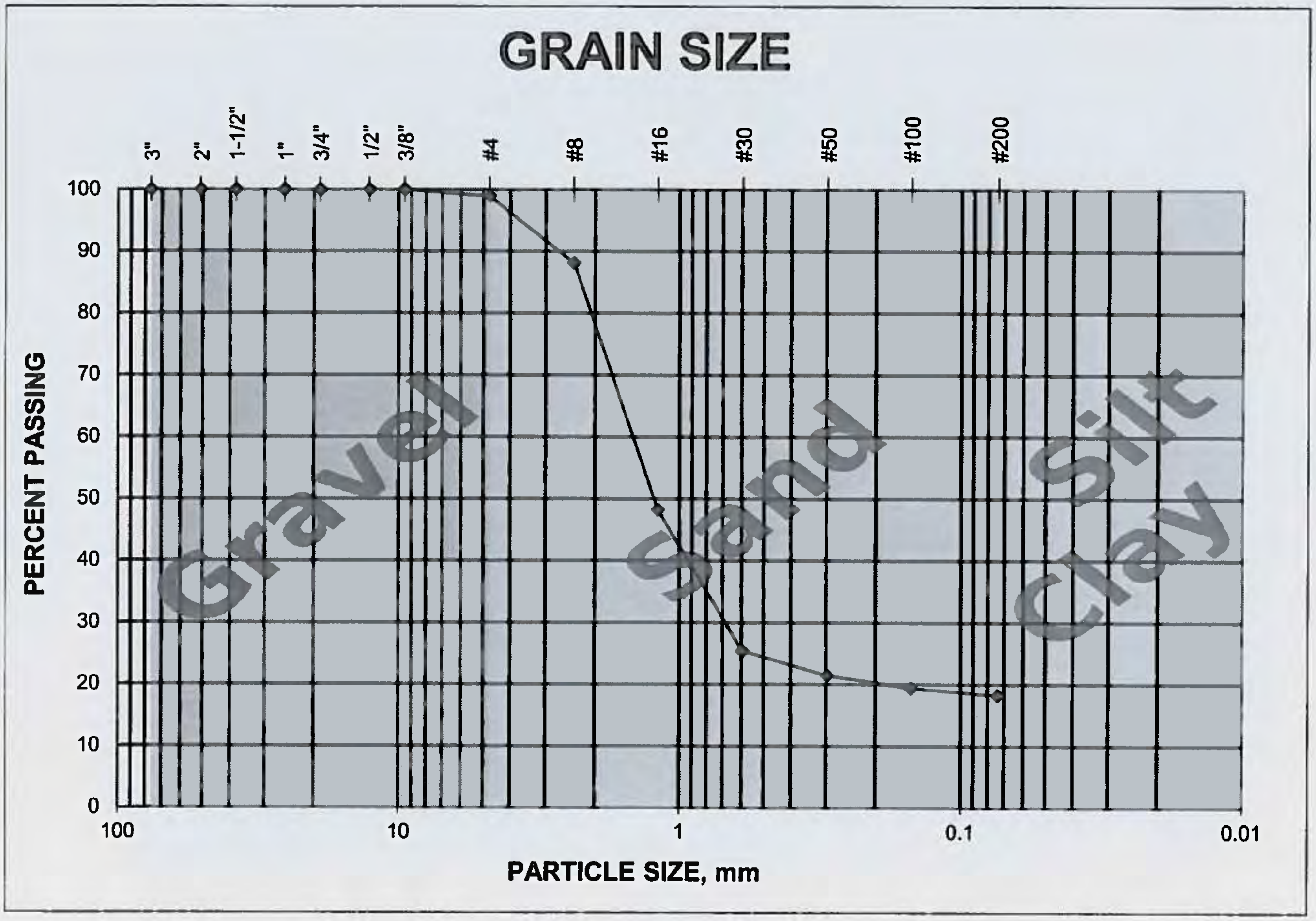


GEOCON

3

GRAIN SIZE ANALYSIS

PROJECT NAME	DUDEK- HC WELLS
PROJECT NUMBER	5690-22-02
SAMPLE NUMBER	115'
TESTED BY	EG



10/3/2016

GEOCON
INCORPORATED

Sieve Summary

Project Name: **DUDEK- HC WELLS**
File# **5690-22-02**
Project Location:
City/ County:
Engr/Geol: **MCE**

Sample #	75'		90'		115'			
Top of Sample Depth (ft.)								
Sample Color	BROWN		GRAYISH BROWN		GRAY			
Sample Description:	SP - Poorly graded SAND		SP-SM - Poorly graded SAND with silt		SM - Silty SAND			
	LL=	PL=	LL=	PL=	LL=	PL=	LL=	PL=
Test Data By: EG	Screen #	% Pass	Screen #	% Pass	Screen #	% Pass	Screen #	% Pass
	6"	100.0	6"	100.0	6"	100.0	6"	
	5"	100.0	5"	100.0	5"	100.0	5"	
	4"	100.0	4"	100.0	4"	100.0	4"	
	3"	100.0	3"	100.0	3"	100.0	3"	
	2"	100.0	2"	100.0	2"	100.0	2"	
	1-1/2"	100.0	1-1/2"	100.0	1-1/2"	100.0	1-1/2"	
	1"	100.0	1"	100.0	1"	100.0	1"	
	3/4"	100.0	3/4"	100.0	3/4"	100.0	3/4"	
	1/2"	100.0	1/2"	100.0	1/2"	100.0	1/2"	
	3/8"	100.0	3/8"	100.0	3/8"	100.0	3/8"	
	#4	100.0	#4	100.0	#4	99.0	#4	
	#8	98.8	#8	100.0	#8	88.1	#8	
	#16	66.3	#16	83.7	#16	48.2	#16	
	#30	10.4	#30	12.0	#30	25.4	#30	
	#50	5.5	#50	6.8	#50	21.4	#50	
	#100	4.6	#100	5.9	#100	19.4	#100	
	#200	4.0	#200	5.3	#200	18.2	#200	

Sample #								
Top of Sample Depth (ft.)								
Sample Color								
Sample Description:								
	LL=	PL=	LL=	PL=	LL=	PL=	LL=	PL=
Test Data By: EG	Screen #	% Pass	Screen #	% Pass	Screen #	% Pass	Screen #	% Pass
	6"		6"		6"		6"	
	5"		5"		5"		5"	
	4"		4"		4"		4"	
	3"		3"		3"		3"	
	2"		2"		2"		2"	
	1-1/2"		1-1/2"		1-1/2"		1-1/2"	
	1"		1"		1"		1"	
	3/4"		3/4"		3/4"		3/4"	
	1/2"		1/2"		1/2"		1/2"	
	3/8"		3/8"		3/8"		3/8"	
	#4		#4		#4		#4	
	#8		#8		#8		#8	
	#16		#16		#16		#16	
	#30		#30		#30		#30	
	#50		#50		#50		#50	
	#100		#100		#100		#100	
	#200		#200		#200		#200	

GEOCON

6900 FLANDERS DR SAN DIEGO CA 92121 (858) 558-6900

SIEVE ANALYSIS
ASTM C136

PROJECT NAME HC Wells

PROJECT NUMBER 5690.22-02

DATE 10-3-16

BY SC

SAMPLE NUMBER 75'

TOTAL WT. 805

SAMPLE DESC. SM Brown Silty (F-C) Sand

LOCATION

	WT.RET	%RET	% PASS	
6"				
5"				
4"				
3"				
2"				
11/2"				
1"				
3/4":				
1/2"				
3/8"				
#4	0	0	100.0	

WT. -#4 350 / 349.4

	WT. RET	% RET.	% PASS	X % PASS
#8	4.3	1.2	98.8	
#16	117.8	33.7	66.3	
#30	312.9	89.6	10.4	
#50	330.1	94.5	5.5	
#100	333.4	95.4	4.6	
#200	335.4	96.0	4.0	

SAMPLE NUMBER 90'

TOTAL WT. 1,094

SAMPLE DESC. SM Grayish Brown Silty (F-C) Sand

LOCATION

	WT.RET	%RET	% PASS	
6"				
5"				
4"				
3"				
2"				
11/2"				
1"				
3/4":				
1/2"				
3/8"				
#4	0	0	100.0	

WT. -#4 350/349.3

	WT. RET	% RET.	% PASS	X % PASS
#8	0.1	0	100.0	
#16	56.9	16.3	83.7	
#30	307.4	88.0	12.0	
#50	325.4	93.2	6.8	
#100	328.8	94.1	5.9	
#200	330.7	94.7	5.3	

SIEVE ANALYSIS
ASTM C136

GEOCON
6900 FLANDERS DR SAN DIEGO CA 92121 (858) 558-6900

PROJECT NAME	HC Wells
PROJECT NUMBER	
DATE	10-3-16
BY	SL

SAMPLE NUMBER	115'	**SAMPLE NUMBER**	
TOTAL WT.	1,145	**TOTAL WT.**	
SAMPLE DESC.	SM Gray Silty (F-C) Sand	**SAMPLE DESC.**	
LOCATION		**LOCATION**	

	WT.RET	%RET	% PASS	
6"				
5"				
4"				
3"				
2"				
11/2"				
1"				
3/4":				
1/2"				
3/8"	0	0	100.0	
#4	12	1.0	99.0	

WT. -#4 350 / 342.4

	WT. RET	% RET.	% PASS	X % PASS
#8	37.7	11.0	89.0	88.1
#16	175.7	51.3	48.7	48.2
#30	254.5	74.3	25.7	25.4
#50	268.3	78.4	21.6	21.4
#100	275.2	80.4	19.6	19.4
#200	279.4	81.6	18.4	18.2

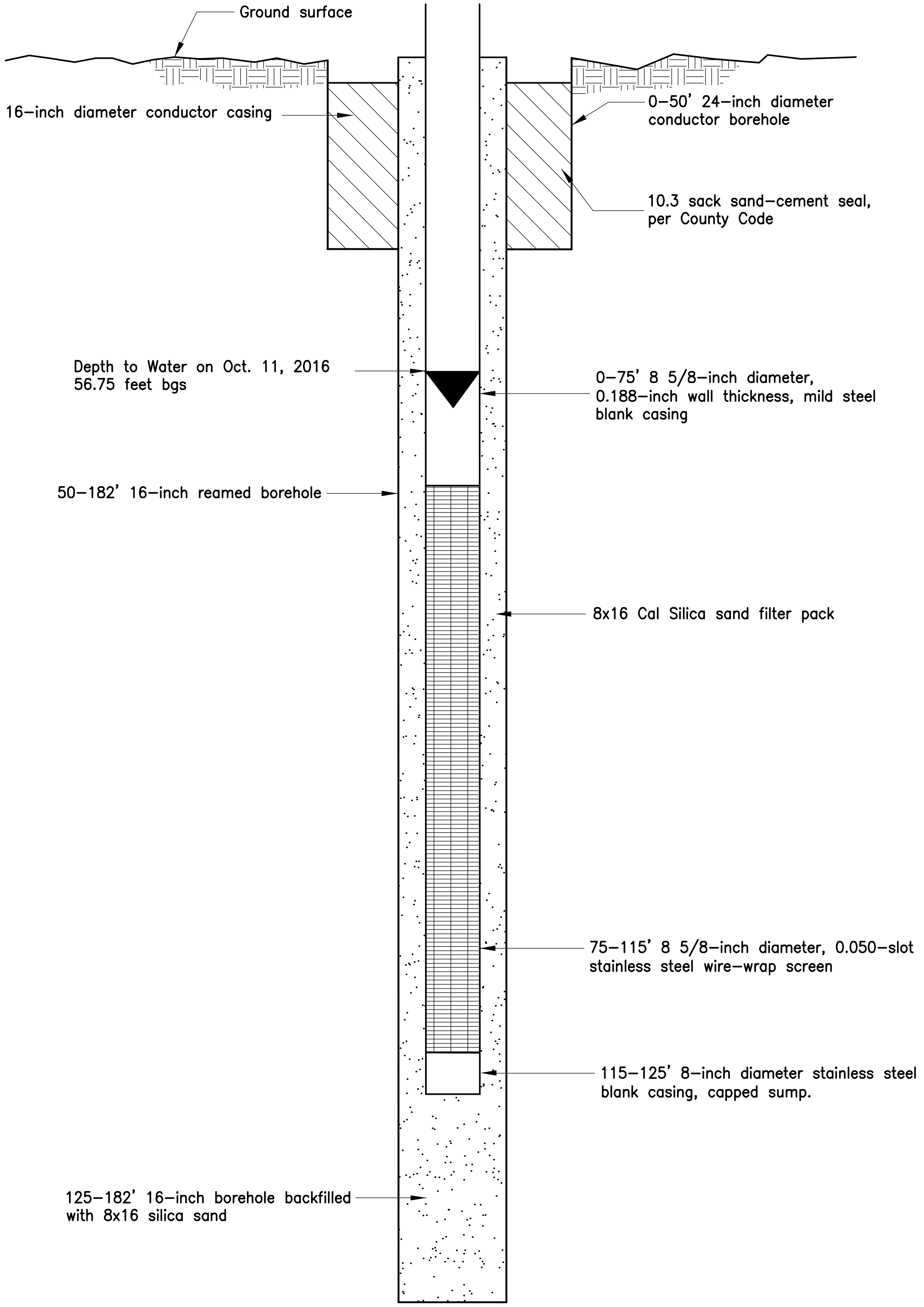
	WT.RET	%RET	% PASS	
6"				
5"				
4"				
3"				
2"				
11/2"				
1"				
3/4":				
1/2"				
3/8"				
#4				

WT. -#4

	WT. RET	% RET.	% PASS	X % PASS
#8				
#16				
#30				
#50				
#100				
#200				

APPENDIX D

As-Built Diagram, Well Completion Log and Photograph Report



NOT TO SCALE

DUDEK

605 Third Street Encinitas, CA 92024
760.942.5147 Fax 760.632.0164

As-Built Highland Center Production Well Construction Diagram

FIGURE
1

Photograph 1. 15 ¾-inch diameter drill bit.

Photograph 2. Victory Survey geophysical logging pilot borehole.

Photograph 3. 16-inch diameter steel conductor casing installation.

Photograph 4. 16-inch diameter steel conductor casing installation.

Photograph 5. Setting 50 foot sanitary cement seal, 10.3-sack cement slurry.

Photograph 6. Johnson 0.05-inch slot, 8 5/8-inch diameter stainless steel wire-wrap screen.

Photograph 7. Mild steel casing and stainless steel screen on flatbed.

Photograph 8. Sample of Cal-Silica 8 x 16 silica sand filter pack

Photograph 9. Fain performing a cleaning pass before casing installation.

Photograph 10. Installing 2-inch diameter tremie pipe.

Photograph 11. Tremie silica sand into borehole.

Photograph 12. Hopper feeding silica sand into tremie pipe.

Photograph 13. Installation of 10 foot stainless steel sump.

Photograph 14. Installation of stainless steel well screen.

Photograph 15. Initial Imhoff cone samples from well development.

Photograph 16. Progress in well development.

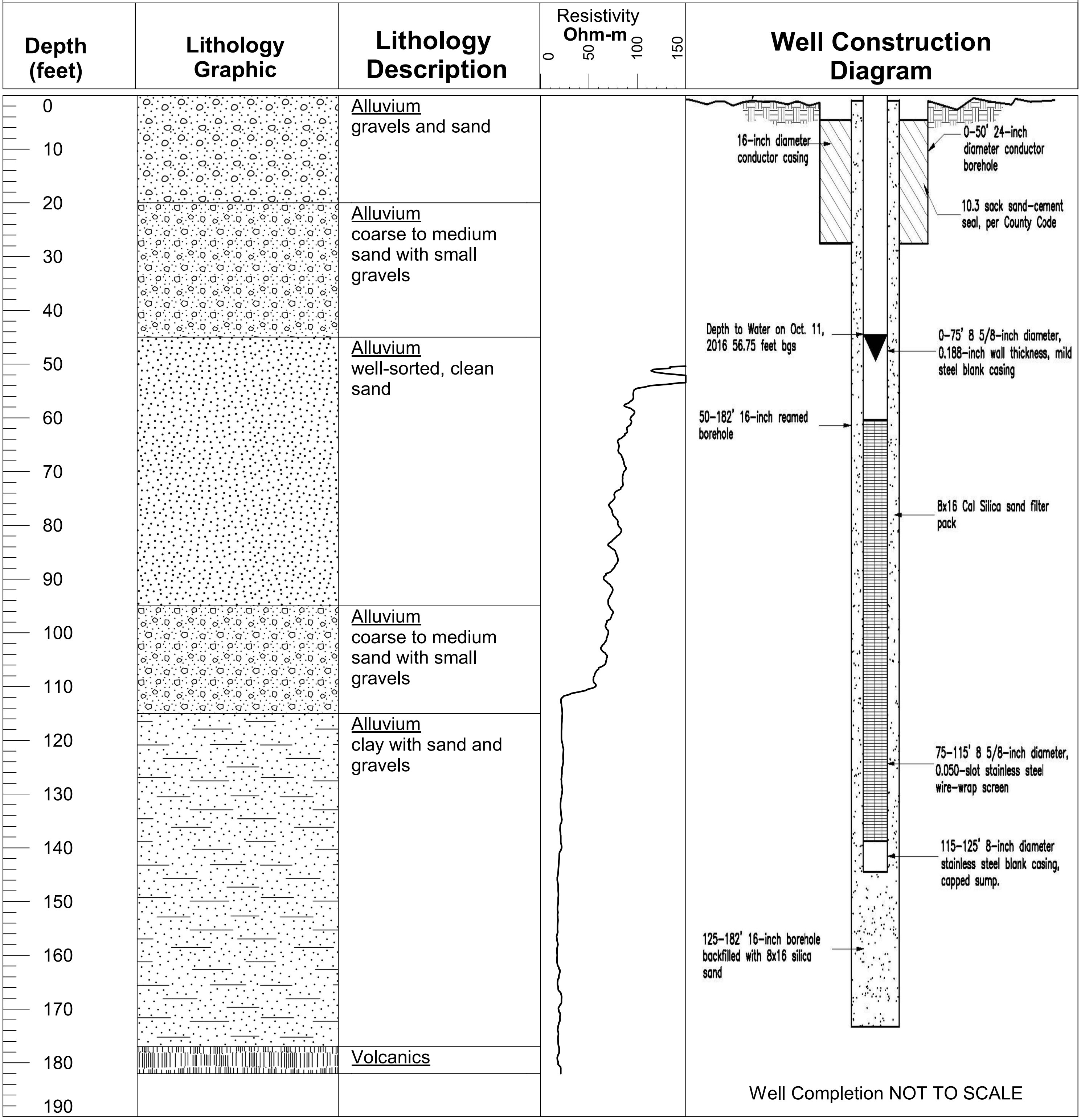
Photograph 17. Well development, Imhoff cone samples.

Photograph 18. Highland Center well pump-testing.

Photograph 19. Equipment setup for well pump-testing.

DUDEK

LOG OF JCSD HIGHLAND CENTER WELL



Project Name: Highland Center Well
Project Number: 9286
Drilling Company: Fain Drilling
and Pump Company
Drilling Method: Mud Rotary
Drilling Start Date: September 28, 2016
Drilling Finish Date: September 29, 2016
Pilot Borehole Diameter: 15.75-inch
Total Borehole Depth: 182 feet

Boring Location: Jacumba Hot Springs, CA

Latitude: 32°37'2.94"N
Longitude: 116°11'4.19"W
Surface Elevation (ft msl): 2,805'

Additional Information:

prepared October 2016

APPENDIX E

Well Development Notes

Well Devlopment of JCSD Highland Center Well

Date: 10/6/2016

Time	Airlifting/Swabbing Depth Interval (ft)	pH	Temp (F)	EC (uS/cm)	TDS (mg/L)	Turbidity (NTU)	Imhoff Cone Measurement; Measured in 1,000 mL Capacity Cone	Comments
8:00								Fain and Dudek onsite. Calibrate HACH 2100Q Turbidity meter and Hanna pH/EC/TDS meter
8:30	75-80						0.5 mL fine sand.	Air-jet/surge block tool downhole. Begin air-jetting.
9:27	75-80	8.98	74.20	803	401	> 800	5 mL gravel pack and fine sand.	150 psi. Airlifted water is brown.
9:31	75-80	9.25	75.00	691	349	> 800	4 mL gravel pack and fine sand.	150 psi
9:35	75-80	8.74	73.50	681	341	> 800	4 mL gravel pack and fine sand.	150 psi. Surge water column.
9:40	75-80	8.41	77.40	653	323	> 800	4 mL fine sand and silt.	150 psi. Airlifted water turns greyish.
9:43	75-80	8.24	75.00	647	323	> 800	3 mL fine sand and silt.	150 psi
9:50	75-80	8.14	74.80	648	324	> 800	4 mL fine sand and silt.	150 psi. Surge water column.
9:55	75-80	8.17	73.10	658	329	> 800	4 mL fine sand and silt.	150 psi.
10:12	80-100	7.78	71.70	629	315	> 800	3 mL gravel pack and fine sand.	150 psi.
10:16	80-100	8.08	72.00	627	313	> 800	4 mL gravel pack and fine sand.	150 psi.
10:21	80-100	8.15	72.10	627	314	> 800	3 mL gravel pack and fine sand.	150 psi. Surge water column.
10:26	80-100	8.15	71.20	634	317	> 800	0.5 mL fine sand and silt.	Airlifted water visually clears up from brown to light greyish.
10:30	80-100	8.17	71.00	631	317	> 800	0.5 mL fine sand and silt.	150 psi.
10:35	80-100	8.09	70.30	634	317	> 800	3 mL fine sand and silt.	150 psi.
10:40	80-100	8.11	71.90	622	310	> 800	4 mL fine sand and silt.	150 psi.
10:43	80-100	8.17	71.60	623	312	> 800	3 mL fine sand and silt.	150 psi. Surge water column.

Well Devlopment of JCSD Highland Center Well

Time	Airlifting/Swabbing Depth Interval (ft)	pH	Temp (F)	EC (uS/cm)	TDS (mg/L)	Turbidity (NTU)	Imhoff Cone Measurement; Measured in 1,000 mL Capacity Cone	Comments
10:48	80-100	8.16	71.40	631	316	> 800	4 mL fine sand and silt.	150 psi.
10:56	80-100	8.20	70.00	641	321	> 800	1 mL fine sand and silt.	150 psi. Airlifted water is greyish.
11:02	80-100	8.15	69.90	642	320	> 800	3 mL fine sand and silt.	Surge water column.
11:20	100-115	8.51	70.50	730	362	> 800	2 mL gravel pack and fine sand.	Airlifted water is brown.
11:25	100-115	8.27	70.70	716	360	> 800	1 mL gravel pack and fine sand.	150 psi.
11:30	100-115	8.28	70.50	715	359	> 800	1 mL gravel pack and fine sand.	150 psi.
11:35	100-115	8.25	69.90	719	359	> 800	1 mL fine sand and silt.	Surge water column.
11:45	100-115	8.20	70.30	721	359	> 800	2 mL fine sand and silt.	Surge water column.
12:00	100-115	8.23	70.50	717	360	> 800	0.5 mL fine sand and silt.	150 psi.
12:15	100-115	8.23	69.80	721	360	> 800	0 mL.	Airlifting from sump at 120 feet.
12:40	80-100	-	-	-	-	-	-	Swab and air-jet.
13:00	75-80	-	-	-	-	-	-	Swab and air-jet.
13:25	100-115	-	-	-	-	-	-	Swab and air-jet.
13:45	75-115	-	-	-	-	-	-	Swab and air-jet.
14:00	110-115	8.25	71.20	721	359	39.60	0 mL.	Airlift.
14:15	110-115	8.30	71.20	717	357	30.50	0 mL.	Airlift.
14:30	110-115	8.28	70.50	713	356	35.20	0 mL.	Airlift.
14:45	110-115	8.26	71.00	715	357	39.30	0 mL.	Airlift.

Time	Airlifting/Swabbing Depth Interval (ft)	pH	Temp (F)	EC (uS/cm)	TDS (mg/L)	Turbidity (NTU)	Imhoff Cone Measurement; Measured in 1,000 mL Capacity Cone	Comments
15:15	110-115	-	-	-	-	-	-	Airlift.
15:30	110-115	-	-	-	-	-	-	Airlift.
15:45	-	-	-	-	-	-	-	Airlifting off.

APPENDIX F

Water Quality Sampling Results

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 1 of 7
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C

Attached is the analytical report for the sample(s) received for your project. Below is a list of the individual sample descriptions with the corresponding laboratory number(s). Also, enclosed is a copy of the Chain of Custody document (if received with your sample(s)). Please note any unused portion of the sample(s) may be responsibly discarded after 30 days from the above report date, unless you have requested otherwise.

Thank you for the opportunity to serve your analytical needs. If you have any questions or concerns regarding this report please contact our client service department.

Sample Identification

Lab Sample #	Client Sample ID	Matrix	Date Sampled	By	Date Submitted	By
B6J1433-01	HC Well	Water	10/13/16 06:45	Patrick Rentz	10/13/16 17:50	Courier (Ray C.)
B6J1433-02	HC Well (Dissolved)	Water	10/13/16 06:45	Patrick Rentz	10/13/16 17:50	Courier (Ray C.)

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 2 of 7
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number

B6J1433-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
HC Well	Water	10/13/16 06:45	10/13/16 17:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Cations							
Total Hardness	120	3.0	mg/L	SM 2340B/EPA 2	10/20/16 19:00	kya	
Calcium	35	1.0	mg/L	EPA 200.7	10/20/16 19:00	kya	
Magnesium	8.2	1.0	mg/L	EPA 200.7	10/20/16 19:00	kya	
Sodium Percentage	63	0.10	%	EPA 200.7	10/20/16 19:00	kya	
Sodium	98	1.0	mg/L	EPA 200.7	10/20/16 19:00	kya	
Potassium	1.8	1.0	mg/L	EPA 200.7	10/20/16 19:00	kya	
Total Cations	6.7	0.05	me/L	Calculation			
Sodium Adsorption Ratio	6.9	0.20	N/A	EPA 200.7	10/20/16 19:00	kya	
Adjusted Sodium Adsorption Ratio	3.9	0.20	N/A	EPA 200.7	10/20/16 19:00	kya	
Anions							
Total Alkalinity	170	3.0	mg/L	SM 2320B	10/19/16 15:25	nc	
Hydroxide	ND	3.0	mg/L	SM 2320B	10/19/16 15:25	nc	
Carbonate	ND	3.0	mg/L	SM 2320B	10/19/16 15:25	nc	
Bicarbonate	210	3.0	mg/L	SM 2320B	10/19/16 15:25	nc	
Chloride	83	1.0	mg/L	EPA 300.0	10/14/16 01:36	dcb	
Sulfate	37	0.50	mg/L	EPA 300.0	10/14/16 01:36	dcb	
Nitrate as N	ND	0.20	mg/L	EPA 300.0	10/14/16 01:36	dcb	
Fluoride	1.8	0.1	mg/L	SM 4500F C	10/21/16 13:10	jdw	
Nitrate	ND	1.0	mg/L	EPA 300.0	10/14/16 01:36	dcb	
Total Anions	6.60	0.05	me/L	Calculation			
Aggregate Properties							
pH	7.8	1.0	pH Units	SM 4500H+ B	10/17/16 15:50	gv	
Specific Conductance	710	1.0	umhos/cm	SM 2510 B	10/17/16 15:50	gv	
Aggressive Index	12.0	1.0	N/A	Calculation			
Langlier Index @ 25 C	0.20		N/A	SM 2330 B	10/14/16 14:35	ljc	

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 3 of 7
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number

B6J1433-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
HC Well	Water	10/13/16 06:45	10/13/16 17:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Solids							
Total Dissolved Solids	400	20	mg/L	SM 2540C	10/20/16 12:35	cmr	
General Physical							
Color	3.0	3.0	Color Units	SM 2120B	10/13/16 20:45	nc	
Odor	ND	1.0	T.O.N.*	SM 2150	10/13/16 20:45	nc	
Turbidity	0.39	0.10	NTU	SM 2130 B	10/13/16 20:45	nc	
Surfactants							
MBAS	ND	0.08	mg/L	SM 5540C	10/13/16 19:40	aza	
General Inorganics							
Cyanide	ND	100	ug/L	SM 4500CN E	10/14/16 18:39	sll	
Perchlorate	ND	4.0	ug/L	EPA 314.0	10/14/16 22:56	dcb	
Nutrients							
Nitrite as N	ND	0.10	mg/L	SM 4500NO2 B	10/13/16 19:40	nc	
Volatile Organic Compounds by EPA 524.2							
1,1,1,2-Tetrachloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,1,1-Trichloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,1,2,2-Tetrachloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,1,2-Trichloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,1-Dichloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,1-Dichloroethene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,1-Dichloropropene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,2,3-Trichlorobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,2,4-Trichlorobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,2,4-Trimethylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,2-Dichlorobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,2-Dichloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,2-Dichloropropane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,3-Dichlorobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,3-Dichloropropane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,3-Dichloropropene (total)	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
1,3,5-Trimethylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	

Client Name:	Dudek & Associates	Analytical Report:	Page 4 of 7
Contact:	Partrick Rentz	Project Name:	Dudek - Lucerne Valley
Address:	605 Third Street Encinitas, CA 92024	Project Number:	Highland Center Well
Report Date:	24-Oct-2016	**Work Order Number:**	**B6J1433**

Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number

B6J1433-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
HC Well	Water	10/13/16 06:45	10/13/16 17:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Volatile Organic Compounds by EPA 524.2							
1,4-Dichlorobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
2,2-Dichloropropane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
2-Butanone(MEK-EPA 8260)	ND	5.0	ug/L	EPA 524.2	10/19/16 07:10	eec	
2-Chlorotoluene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
4-Chlorotoluene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
4-Methyl-2-Pentanone(MIBK)	ND	5.0	ug/L	EPA 524.2	10/19/16 07:10	eec	
Benzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Bis(2-chloroethyl)ether'''	ND	5.0	ug/L	EPA 524.2	10/19/16 07:10	eec	
Bromobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Bromochloromethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Bromodichloromethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Bromoform	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Bromomethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Carbon Tetrachloride	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Chlorobenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Chloroethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Chloroform	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Chloromethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
cis-1,2-Dichloroethene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
cis-1,3-Dichloropropene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Dibromochloromethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Dibromomethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Dichlorodifluoromethane	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Ethylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Hexachlorobutadiene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Isopropylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Methyl tert butyl Ether	ND	3.0	ug/L	EPA 524.2	10/19/16 07:10	eec	
Methylene Chloride	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
n-Butylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
n-Propylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Naphthalene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
p-Isopropyltoluene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
sec-Butylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 5 of 7
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number

B6J1433-01

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
HC Well	Water	10/13/16 06:45	10/13/16 17:50

Analyte(s)	**Result**	**RDL**	**Units**	**Method**	**Analysis Date**	**Analyst**	**Flag**
Volatile Organic Compounds by EPA 524.2							
Styrene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
tert-Butylbenzene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Tetrachloroethene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Toluene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
trans-1,2-Dichloroethene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
trans-1,3-Dichloropropene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Trichloroethene	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Trichlorofluoromethane	ND	5.0	ug/L	EPA 524.2	10/19/16 07:10	eec	
Trichlorotrifluoroethane	ND	10	ug/L	EPA 524.2	10/19/16 07:10	eec	
Vinyl Chloride	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Xylenes (m+p)	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Xylenes (ortho)	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Xylenes (Total)	ND	0.50	ug/L	EPA 524.2	10/19/16 07:10	eec	
Surrogate: 1,2-Dichloroethane-d4	118 %	50-150		EPA 524.2	10/19/16 07:10	eec	
Surrogate: Bromofluorobenzene	98.3 %	50-150		EPA 524.2	10/19/16 07:10	eec	
Surrogate: Toluene-d8	98.3 %	50-150		EPA 524.2	10/19/16 07:10	eec	

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 6 of 7
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number

B6J1433-02

Sample Description	Matrix	Sampled Date/Time	Received Date/Time
HC Well (Dissolved)	Water	10/13/16 06:45	10/13/16 17:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
Metals and Metalloids							
Aluminum	ND	50	ug/L	EPA 200.7	10/20/16 19:02	kya	N_pFilt
Antimony	ND	6.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Arsenic	ND	2.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Barium	170	20	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Beryllium	ND	1.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Boron	400	100	ug/L	EPA 200.7	10/20/16 19:02	kya	N_pFilt
Cadmium	ND	1.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Total Chromium	ND	1.0	ug/L	EPA 200.8	10/19/16 11:58	AP	N_pFilt
Copper	ND	50	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Iron	ND	100	ug/L	EPA 200.7	10/20/16 19:02	kya	N_pFilt
Lead	ND	5.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Manganese	31	20	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Mercury	ND	1.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Nickel	ND	10	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Selenium	ND	5.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Silver	ND	10	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Thallium	ND	1.0	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt
Zinc	ND	50	ug/L	EPA 200.8	10/18/16 13:30	mel	N_pFilt

* NELAP does not offer accreditation for this analyte/method/matrix combination

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 7 of 7
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C

Notes and Definitions

pH:	Regulatory 15 minute holding time exceeded	B6J1433-01
N_pScr:	Cyanide Determination: Sample screened for interference and preserved upon receipt at the lab	B6J1433-01
N_pFilt	Sample filtered and preserved upon receipt to the laboratory.	
ND:	Analyte NOT DETECTED at or above the Method Detection Limit **(if MDL is reported)**, otherwise at or above the Reportable Detection Limit (RDL)	
NR:	Not Reported	
RDL:	Reportable Detection Limit	
MDL:	Method Detection Limit	
* / "' :	NELAP does not offer accreditation for this analyte/method/matrix combination	

Approval

Enclosed are the analytical results for the submitted sample(s). Babcock Laboratories certify the data presented as part of this report meet the minimum quality standards in the referenced analytical methods. Any exceptions have been noted. Babcock Laboratories and its officers and employees assume no responsibility and make no warranty, express or implied, for uses or interpretations made by any recipients, intended or unintended, of this report.

Cindy Waddell

Nancy H. Boulineau For Cindy A. Waddell

cc:

e-Short_No Alias.rpt

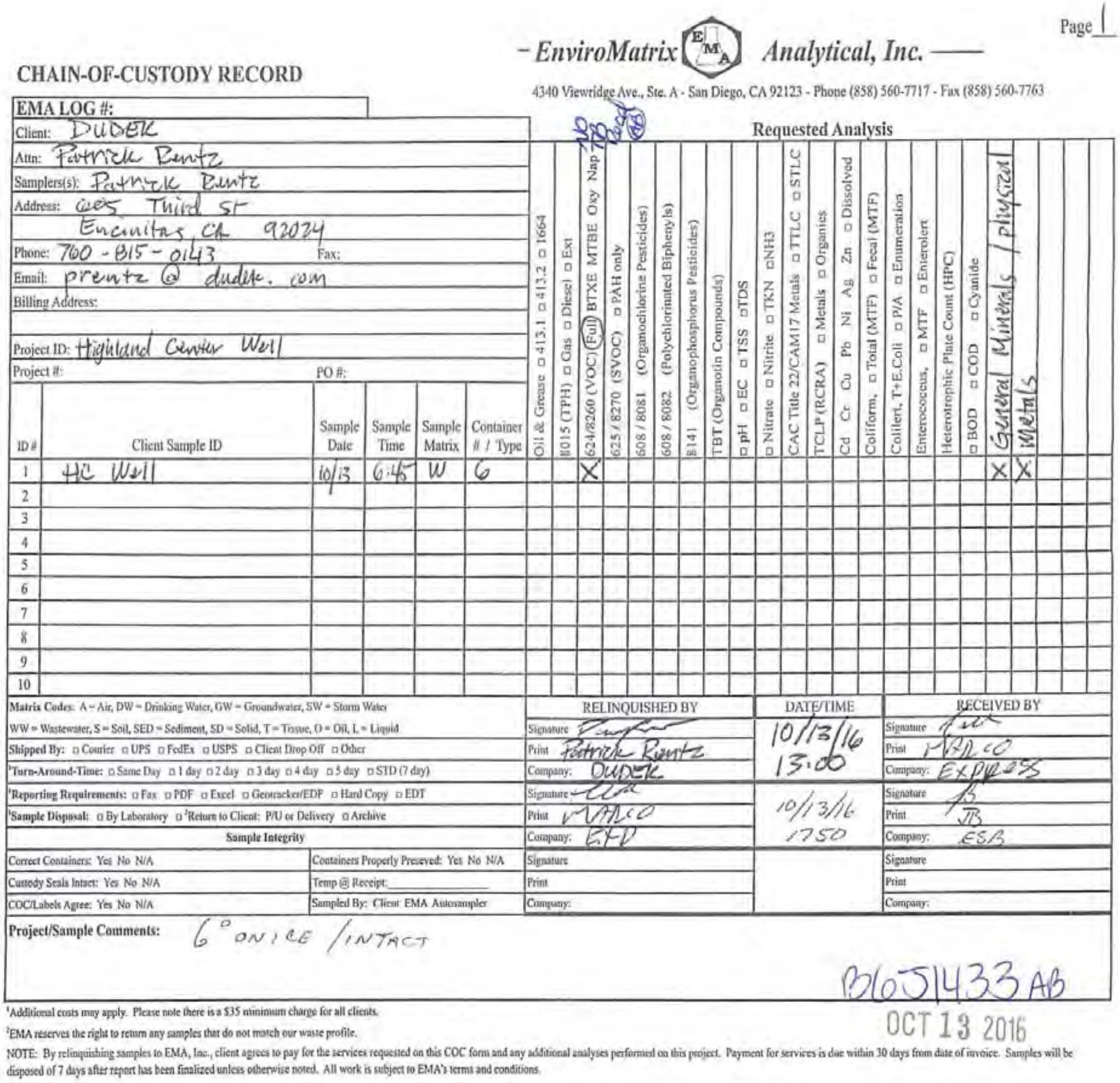
Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 1 of 3
Project Name: Dudek - Lucerne Valley
Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C



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– *EnviroMatrix* *Analytical, Inc.* ——

4340 Viewridge Ave., Ste. A - San Diego, CA 92123 - Phone (858) 560-7717 - Fax (858) 560-7763

CHAIN-OF-CUSTODY RECORD

EMA LOG #:
Client: DUDEK
Attn: Patrick Rentz
Samplers(s): Patrick Rentz
Address: 605 Third st
Encinitas, CA 92024
Phone: 760 - 815 - 0143 Fax:
Email: prentz @ dudek. com
Billing Address:
Project ID: Highland Center Well
Project #: PO #:

Requested Analysis

No TBA Req'd (AB)

ID #	Client Sample ID	Sample Date	Sample Time	Sample Matrix	Container # / Type	Oil & Grease ☐ 413.1 ☐ 413.2 ☐ 1664	8015 (TPH) ☐ Gas ☐ Diesel ☐ Ext	624/8260 (VOC) [✓ Full] BTXE MTBE Oxy Nap	625 / 8270 (SVOC) ☐ PAH only	608 / 8081 (Organochlorine Pesticides)	608 / 8082 (Polychlorinated Biphenyls)	8141 (Organophosphorus Pesticides)	TBT (Organotin Compounds)	☐ pH ☐ EC ☐ TSS ☐TDS	☐ Nitrate ☐ Nitrite ☐ TKN ☐NH3	CAC Title 22/CAM17 Metals ☐ TTLC ☐ STLC	TCLP (RCRA) ☐ Metals ☐ Organics	Cd Cr Cu Pb Ni Ag Zn ☐ Dissolved	Coliform, ☐ Total (MTF) ☐ Fecal (MTF)	Colilert, T+E.Coli ☐ P/A ☐ Enumeration	Enterococcus, ☐ MTF ☐ Enterolert	Heterotrophic Plate Count (HPC)	☐ BOD ☐ COD ☐ Cyanide	General Minerals / physical	Metals				
1	HC Well	10/13	6:45	W	6			X																X	X				
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													

Matrix Codes: A = Air, DW = Drinking Water, GW = Groundwater, SW = Storm Water
WW = Wastewater, S = Soil, SED = Sediment, SD = Solid, T = Tissue, O = Oil, L = Liquid
Shipped By: ☐ Courier ☐ UPS ☐ FedEx ☐ USPS ☐ Client Drop Off ☐ Other
[1]**Turn-Around-Time:** ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day ☐ 4 day ☐ 5 day ☐ STD (7 day)
[1]**Reporting Requirements:** ☐ Fax ☐ PDF ☐ Excel ☐ Geotracker/EDF ☐ Hard Copy ☐ EDT
[1]**Sample Disposal:** ☐ By Laboratory ☐ [2]Return to Client: P/U or Delivery ☐ Archive

Sample Integrity
Correct Containers: Yes No N/A
Containers Properly Preseved: Yes No N/A
Custody Seals Intact: Yes No N/A
Temp @ Receipt: ______________
COC/Labels Agree: Yes No N/A
Sampled By: Client EMA Autosampler

RELINQUISHED BY	DATE/TIME	RECEIVED BY
Signature Print Patrick Rentz Company: DUDEK	10/13/16 13:00	Signature Print MARCO Company: EXPRESS
Signature Print MARCO Company: EXP	10/13/16 1750	Signature Print JB Company: ESB
Signature Print Company:		Signature Print Company:

Project/Sample Comments: 6° ON ICE / INTACT

B6J1433 AB

OCT 13 2016

[1]Additional costs may apply. Please note there is a $35 minimum charge for all clients.
[2]EMA reserves the right to return any samples that do not match our waste profile.
NOTE: By relinquishing samples to EMA, Inc., client agrees to pay for the services requested on this COC form and any additional analyses performed on this project. Payment for services is due within 30 days from date of invoice. Samples will be disposed of 7 days after report has been finalized unless otherwise noted. All work is subject to EMA's terms and conditions.

Client Name: Dudek & Associates
Contact: Partrick Rentz
Address: 605 Third Street
Encinitas, CA 92024

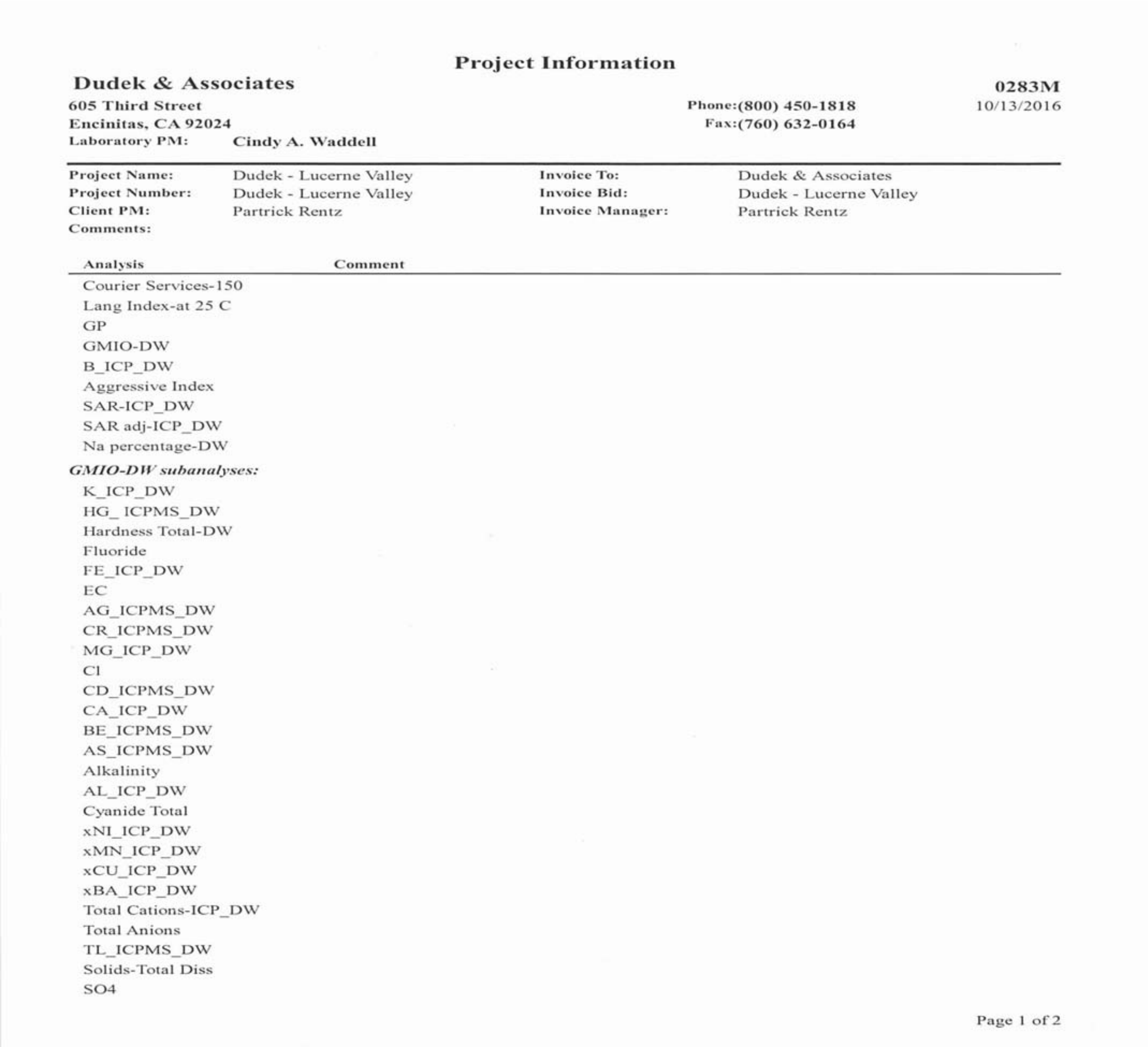
Report Date: 24-Oct-2016

Analytical Report: Page 2 of 3
Project Name: Dudek - Lucerne Valley

Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C



Project Information

Dudek & Associates **0283M**
605 Third Street **Phone:(800) 450-1818** 10/13/2016
Encinitas, CA 92024 **Fax:(760) 632-0164**
Laboratory PM: **Cindy A. Waddell**

Project Name: Dudek - Lucerne Valley **Invoice To:** Dudek & Associates
Project Number: Dudek - Lucerne Valley **Invoice Bid:** Dudek - Lucerne Valley
Client PM: Partrick Rentz **Invoice Manager:** Partrick Rentz
Comments:

Analysis	Comment
Courier Services-150	
Lang Index-at 25 C	
GP	
GMIO-DW	
B_ICP_DW	
Aggressive Index	
SAR-ICP_DW	
SAR adj-ICP_DW	
Na percentage-DW	
GMIO-DW subanalyses:	
K_ICP_DW	
HG_ ICPMS_DW	
Hardness Total-DW	
Fluoride	
FE_ICP_DW	
EC	
AG_ICPMS_DW	
CR_ICPMS_DW	
MG_ICP_DW	
Cl	
CD_ICPMS_DW	
CA_ICP_DW	
BE_ICPMS_DW	
AS_ICPMS_DW	
Alkalinity	
AL_ICP_DW	
Cyanide Total	
xNI_ICP_DW	
xMN_ICP_DW	
xCU_ICP_DW	
xBA_ICP_DW	
Total Cations-ICP_DW	
Total Anions	
TL_ICPMS_DW	
Solids-Total Diss	
SO4	

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Client Name: Dudek & Associates
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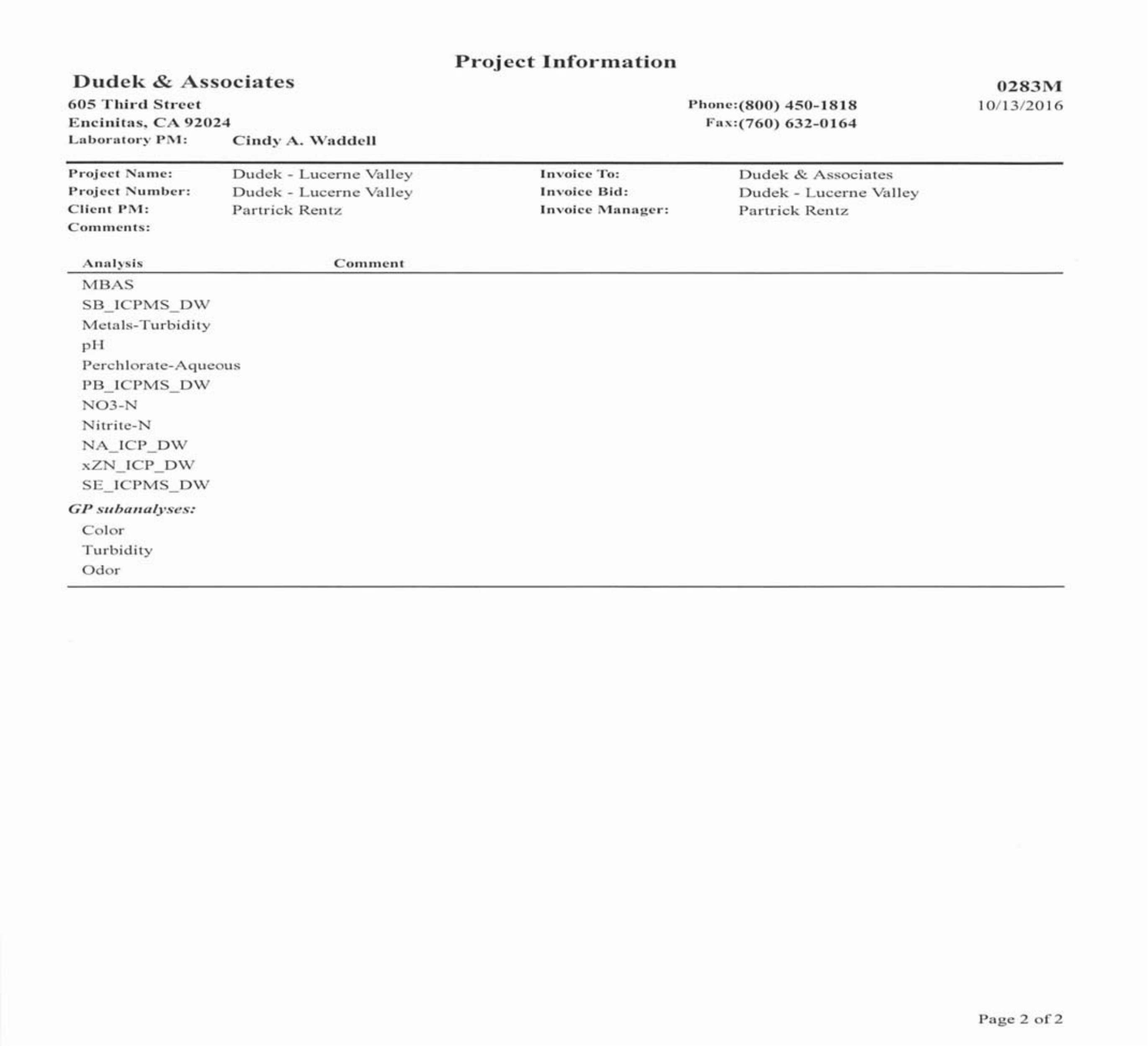
Encinitas, CA 92024

Report Date: 24-Oct-2016

Analytical Report: Page 3 of 3
Project Name: Dudek - Lucerne Valley
Project Number: Highland Center Well

Work Order Number: B6J1433

Received on Ice (Y/N): Yes Temp: 6 °C



Project Information

Dudek & Associates
605 Third Street
Encinitas, CA 92024
Laboratory PM: Cindy A. Waddell

Phone:(800) 450-1818
Fax:(760) 632-0164

0283M
10/13/2016

Project Name: Dudek - Lucerne Valley
Project Number: Dudek - Lucerne Valley
Client PM: Partrick Rentz
Comments:

Invoice To: Dudek & Associates
Invoice Bid: Dudek - Lucerne Valley
Invoice Manager: Partrick Rentz

Analysis	Comment
MBAS	
SB_ICPMS_DW	
Metals-Turbidity	
pH	
Perchlorate-Aqueous	
PB_ICPMS_DW	
NO3-N	
Nitrite-N	
NA_ICP_DW	
xZN_ICP_DW	
SE_ICPMS_DW	
GP subanalyses:	
Color	
Turbidity	
Odor	

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