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SEASIDE GROUNDWATER BASIN WATERMASTER
SEAWATER SENTINEL WELLS PROJECT
Summary of Operations

For
Seaside Groundwater Basin Watermaster

Prepared by

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with assistance from Pueblo Water Resources, Inc.

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Table of Contents

INTRODUCTION

This report documents the installation of four deep monitoring wells in the extreme northern portion of the Seaside Groundwater Basin. The wells are located along the ocean in the coastal portion of the former Fort Ord Military Reservation. The wells were constructed by the Seaside Groundwater Basin Watermaster (Watermaster) as part of court-ordered monitoring program for the Seaside Basin. The wells are designed to provide for detection of seawater intrusion and, as such, are designated as Seawater Sentinel Wells. The report provides a description of construction activities, summarizes hydrogeologic data collected, provides conclusions based on the data collected, and provides recommendation for the on-going monitoring of these wells as they supplement the existing network of monitoring wells.

SCOPE

The scope of work for this project was developed through discussion with Watermaster representatives and documented in the workplan dated January 26, 2007 presented in Appendix E. The work performed included:

- Development of an alternative workplan for the monitoring well program.
- On-going support to Watermaster Technical Advisory Committee (TAC) and Watermaster Board throughout project duration.
- Permitting for the monitoring well construction project. This included: 1) CEQA review and biological assessments as required for Right-of-Entry permit from California State Parks; 2) Acquisition of Coastal Development Permit Waiver from California Coastal Commission; 3) Acquisition of Well Construction Permits from Monterey County Environmental Health.
- Drilling of four exploratory boreholes to 1,500 feet or to the top of the Monterey Formation, whichever was shallower.
- Collection of lithologic and geophysical data from the boreholes.
- Completion of boreholes as deep monitoring wells.
- Air-development of the wells.
- Collection and laboratory analysis of the water quality samples from the four wells.
- Induction logging of the cased wells to establish baseline conductivity signatures to be used to detect future changes in conductivity due to seawater intrusion.
- Preparation of this report documenting construction of the wells and presenting our conclusions developed from the data collected and recommendations for future monitoring of the Sentinel Wells.

BACKGROUND

The Seawater Sentinel Wells are designed to allow detection of seawater intrusion at any depth throughout the entire saturated sediment column. This can be achieved through the use of induction logging which can measure, from within the casing, the conductivity of the fluids within the adjacent formation**.** The use of induction logging as a method to detect seawater relies on the fact that the addition of seawater to ground water changes the native groundwater's physical properties. With the exception of distilled water, all water contains some level of dissolved minerals or salts. Typical drinking water contains less that 1,000 part per million of dissolved salts whereas seawater contains approximately 35,000 parts per million of salts. Unlike organic contaminants which degrade water with concentrations measured in parts per billion; degradation of water by seawater is the result of contamination on the parts per million or even parts per thousand basis. The addition of more salts to the water, as the result of mixing with seawater, changes the physical properties of the water such as the density of the water and, most relevant to the subject project, the electrical properties of the water. As the water within the aquifer becomes more saline due to the intrusion of seawater, the electrical conductivity of the formation containing the water increases relative to the value measured when the aquifer was filled with native groundwater. This change in conductivity can be easily detected with down-hole geophysical tools and, as such, is a cost-effective method of detecting seawater intrusion in locations where the aquifer units are thick and the potential pathways for seawater intrusion are unclear.

PROJECT COMPONENTS

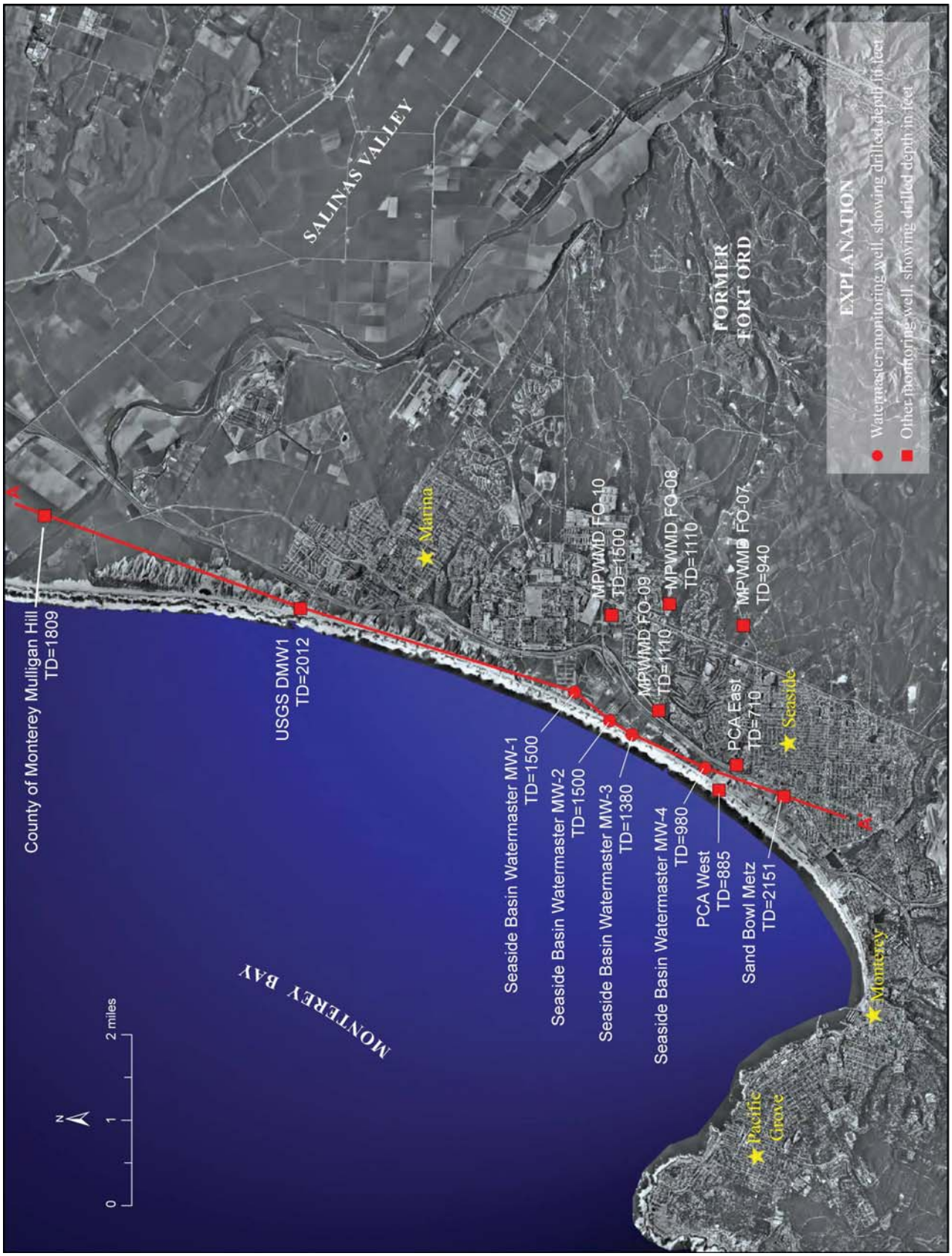
PERMITTING

The wells sites are located in the extreme western portion of the former Fort Ord Military Reservation and are shown on Figure 1. The area west of the freeway is being developed as Fort Ord Dunes State Park and is within the coastal zone. Construction of the wells required a right-of-entry (ROE) permit from California State Parks and approval from the California Coastal Commission. The well locations are also within the Fort Ord Consultation Zone established to protect groundwater use from historical contamination from past land uses on the Reservation. In addition, the wells required construction permits from Monterey County Environmental Health Department. Permitting activities for each of these required approvals are summarized below:

Right of Entry Permit (ROE)/CEQA: The well sites are located on Fort Ord Dunes State Park. In order to issue a ROE permit State Parks required CEQA documentation. Denise Duffy Associates (project subcontractor) prepared CEQA documentation for State Parks and a Notice of Exemption (NOE) was filed on May 30, 2007. The CEQA documentation included project description, biological assessments, and mitigations. After the protest period was over, State Parks issued the Watermaster a ROE for purposes of well construction.

Coastal Commission Compliance: The project is in the Coastal Zone. A Coastal Development Permit (CDP) was applied for and processed by Coastal Commission staff. A *de minimus* waiver was granted on July 11, 2007.

Fort Ord Groundwater Consultation Zone: The well sites are in the groundwater consultation zones of Fort Ord. Mr. David Eisen, PG with BRAC (the Army) was briefed regarding the proposed plan. In subsequent discussions between the Army, the Regional Water Quality Control Board and the EPA, it was concluded that because the wells are for water quality monitoring, they were exempt from the provisions of the consultation zone language.



Orthophoto base from HJW (1999), 1:36,000 scale imagery

FIGURE 1

Well Construction Permits: Upon completion of the above permitting processes, well construction permits from Monterey County Environmental Health Department were applied for and granted. The permits were issued on July 13, 2007

WELL CONSTRUCTION

Bradley and Sons, Inc. (Bradley) of Madera California was the Contractor for the drilling and well construction. Drilling was performed using Ingersoll-Rand Top Head (TH-60) drilling rigs. During some portions of the project, two rigs were in operation concurrently. The wells were drilled by the direct rotary method, with a bentonite based fluid. Fluid was circulated and conditioned in a system equipped with mechanical separators for solids.

Drilling

A fourteen-inch diameter, one-quarter inch thick, steel conductor casing was set to a depth of 50 feet at each of the four sites. The purpose of the conductor casings was to provide stability to the near surface sand deposits. The casings were installed and centered in twenty-inch diameter borings and set with cement grout.

The diameter of each of the pilot borings was 8.75 inches. Drill pipe lengths were twenty feet, and following advancement of each joint of pipe, the fluid was circulated and cleaned to provide representative cutting samples and a balanced column of fluid. Cutting samples were collected throughout the pilot drilling and a lithologic log of the borehole was prepared. Representative cutting samples for each ten-foot depth interval were placed in labeled, compartmentalized sample trays which were then photographed.

Pilot borings were advanced either to the planned maximum depth of 1,500 feet, or to a depth at which the Monterey Formation was positively identified. The pilot boring for SBWM-1 was the only drill hole where the Monterey Formation was not encountered.

Geophysical logging was performed after pilot bore drilling was completed at each site. The geophysical logs include measurements of natural gamma radiation, spontaneous potential, short-and long-normal resistivities, and single point resistance. Welenco, Inc. provided geophysical survey services.

Lithologic logs, photographic documentation of the cutting samples, and geophysical logs for each of the borings are included in Appendix A.

Well Completion

After completion of the pilot bore and geophysical logging the data were reviewed to develop a completion plan for each well. Completion plans (total depth, placement of well screens, and annular seal depth) were developed for each well through consultation between project geologists (Martin Feeney PG, CHg and Mike Burke PG, CHg) and Mr. Joe Oliver PG CHg of the Monterey Peninsula Water Management District. The details of the completion plan are summarized below:

> **SBWM-1 –** This was the first well drilled. The geologic and geophysical data from this well revealed the absence of Santa Margarita Sandstone and the presence of Purisima Formation to total depth of 1,500 feet. The workplan assumed that the well completions would be in the Santa Margarita Sandstone. The absence of this unit required development of a different well design that met the goals and intent of the project. Whereas the Santa Margarita Sandstone is approximately 200 feet thick the Purisima Formation can be over 1,000 feet thick. This

complicated the design of the wells as the project budget and materials were based on the assumption of a thinner aquifer section. Project geologists and Mr. Oliver met and discussed the data and developed a revised well design. The revised design was to perforate the most permeable zones in the lower Purisima Formation – the formation that is hydrostratigraphically adjacent to the Santa Margarita Sandstone to the south. The seal was placed to the top of the lower Purisima Formation. A technical memorandum presenting the data and outlining the justification for the revised design is included in Appendix E.

SBWM-2 – The geologic and geophysical data at this well revealed the conditions to be similar to those found at SBWM-1. The significant difference at this location was that the Monterey Formation was encountered by the pilot boring. The approach to completing this well was based on the approach developed for SBWM-1. SBWM-2 was perforated in the permeable zones between the top of the lower Purisima and the top to the Monterey Formation. The seal was placed to the top of the lower Purisima Formation.

SBWM-3 – Data from this well revealed a shallower sequence of Purisima Formation, and a substantially shallower depth to the top of the Monterey Formation. This well was completed consistent with the approach utilized for SBWM-1 and SBWM-2.

SBWM-4 – Geologic and geophysical data from SBWM-4 were interpreted as Purisima Formation overlying Santa Margarita Sandstone overlying Monterey Formation. The total thickness of the materials between the top of the lower Purisima Formation and the top of the Monterey Formation was less than 230 feet. Given the geologic complexity, perforations were placed from the top of the lower Purisima Formation to the top of the Monterey Formation. Seal was placed to the top of the lower Purisima Formation.

Well Construction

The first step in the well construction process was the reaming of the pilot borehole to a diameter of 12-1/4 inches. Once the ream was complete, a temporary construction tremie pipe was installed in the boring. The casing was then installed, and centered in the boring using plastic centralizers. Centralizers were placed immediately above and below each screen zone, and at intervals of 80 feet within the upper blank section.

Gravel pack and cement grout were placed using the construction tremie. Gravel pack was placed in lifts of approximately 60 feet. After gravel pack was determined to be properly placed to the desired depth, a cement grout annular seal was placed from the top of the gravel pack to ground surface.

Descriptions of the monitoring well construction materials are presented below:

Well Casing: PVC, 3-inch diameter, schedule 80, flush threaded.
Well Screen Perforations: Machine cut slots, 0.032-inch openings.
Gravel Pack: RMC Pacific Materials No. 8 Blend.
Annular Seal: Cement grout, 10-sack mix, with 5 percent bentonite.

Once the annular seal was complete and cured, each monitoring well was provided with a water-tight, flush-mounted, traffic-rated circular well vault set in place with concrete. Reference point elevations were established for each of the wells based on survey data provided by RBF Consulting.

A summary of well construction details for each of the wells is presented in Table 1.

Table 1 – Well Completion Summary

	SBWM-1	SBWM-2	SBWM-3	SBWM-4
Description of Location	Range 8	Bunker 11	Bunker 1	MCWD Lift Station
GPS Coordinates	N 36 39' 07.9" W 121 49' 24.4"	N 36 38' 46.1" W 121 49' 45.3"	N 36 38' 32.0" W 121 49' 55.4"	N 36 37' 47.0" W 121 49' 50.19"
Ground Surface Elev. (ft., msl)	96	73.7	59.5	62.4
Pilot Bore Depth, ft.	1500	1500	1370	980
Casing Depth, ft.	1500	1500	1310	930
Screen Depths, ft.	1130 - 1150 1210 - 1230 1290 - 1310 1380 - 1400 1470 - 1490	990 - 1010 1070 - 1090 1140 - 1160 1230 - 1250 1370 - 1390 1460 - 1480	860 - 880 970 - 990 1060 - 1080 1200 - 1220 1270 - 1290	705 - 800 820 - 920
Annular Seal Depth, ft.	1100	950	820	690

Well Development

Well development was performed immediately following the construction of each well. Initial development was performed by airlifting, with the well casing serving as the eductor pipe. Final development was accomplished by airlifting through a 1-1/2 inch eductor pipe that was lowered to the total completed depth of each well. The purpose of the final development and the use of the eductor pipe was to develop the lower portions of the wells to ensure that the casings were clean and open through total depth in order to provide access to total casing depth for future geophysical monitoring, and to clear and clean all portions of the well screen for water quality sampling.

A depiction of the typical well construction features of the monitoring wells is provided in Figure 2.

TYPICAL WELL CONSTRUCTION

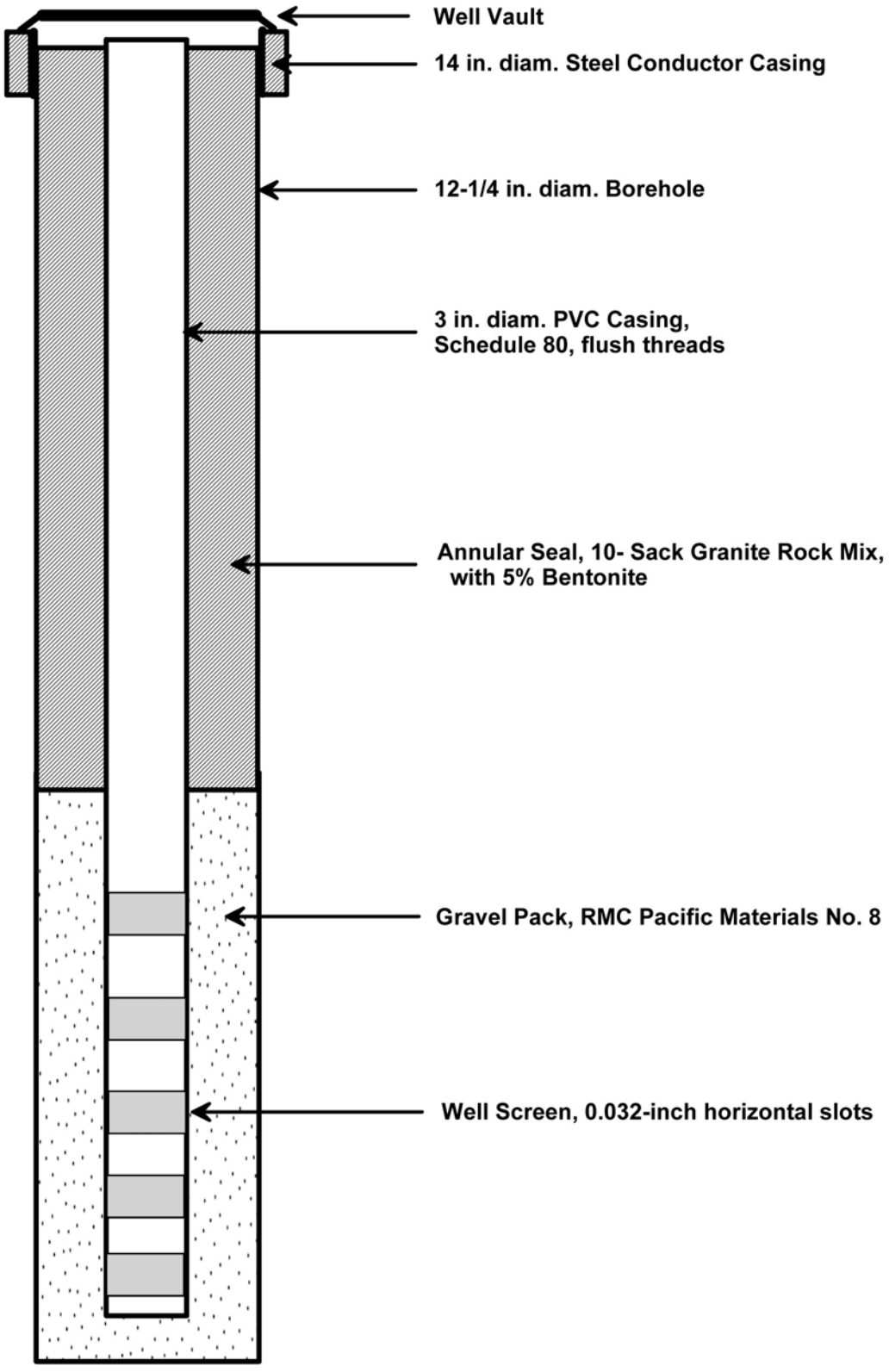


FIGURE 2

Hydrogeologic Interpretations

Although in-depth hydrogeologic analysis of the collected data was not explicitly part of the scope of work for this project, some preliminary interpretations are presented below.

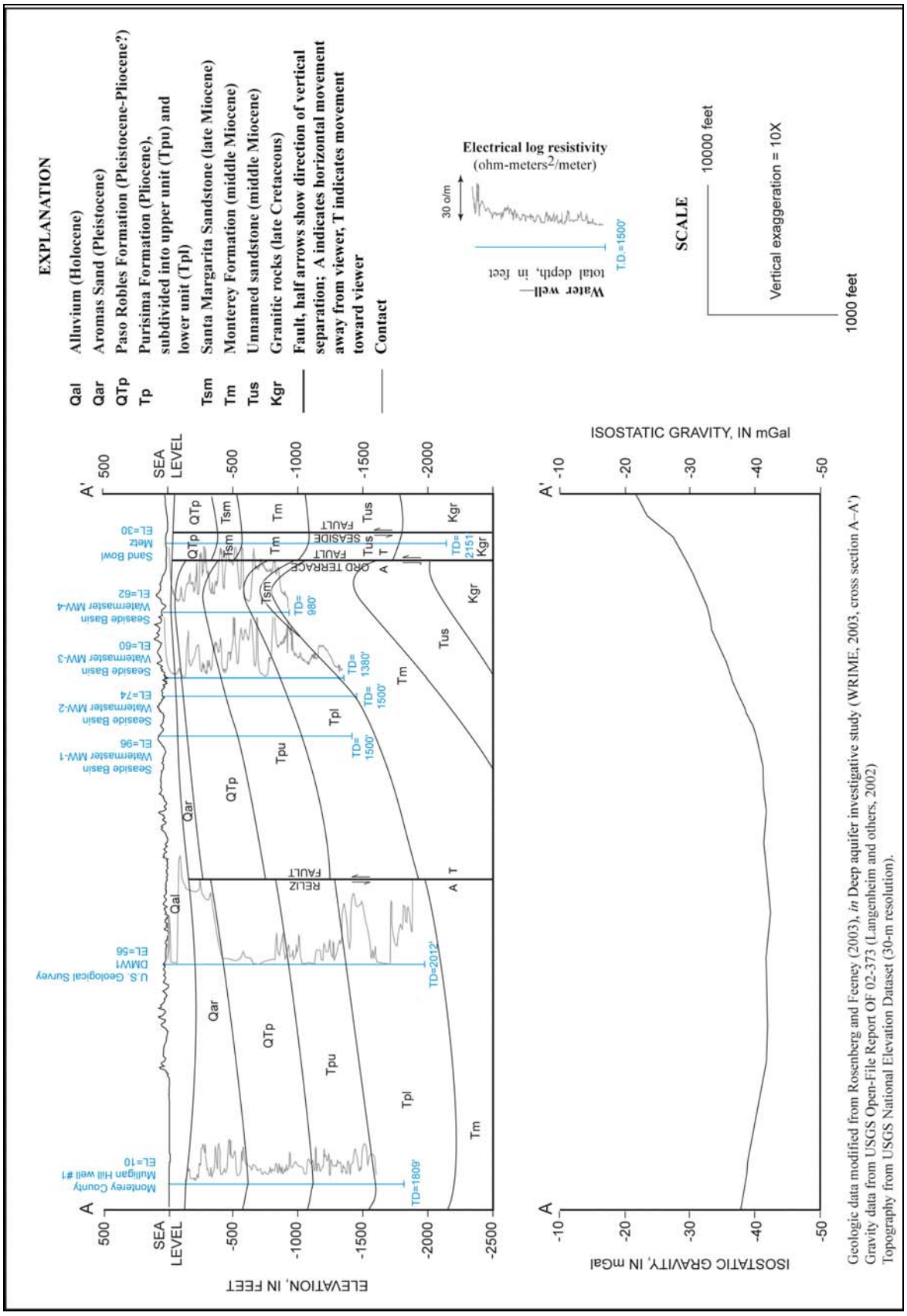
Stratigraphy. Interpretation of the geologic data from the four wells allows advancement of preliminary estimates of the depth to various geologic formations at the four locations. Based on both the borehole data and, as constrained by limits of structural geology, the following table and the accompanying geologic cross-section, Figure 3, are provided. The cross-section line is shown on Figure 1.

Geologic Formation	Depth to Top of Geologic Unit (feet)			
	SBWM-1	**SBWM-2**	**SBWM-3**	**SBWM-4**
Beach Sand/Dunes Sands Deposits	0	0	0	0
Aromas Sand	140	155	75	68
Paso Robles Formation	380	165	132	100
Upper Purisima Formation	600	490	428	332
Lower Purisima Formation	1,115	944	878	691
Santa Margarita Sandstone	NP	NP	NP	860
Monterey Formation	1,650[1]	1,488	1,308	913

[1] – Although the borehole only extended to a depth of 1,500 feet, the depth to the Monterey Formation can be projected from the geophysical log signature. NP denotes unit is not present.

Hydrostratigraphy. Within the Seaside Groundwater Basin, two primary aquifer systems have been delineated, the Paso Robles Formation and the underlying Santa Margarita Sandstone. The Santa Margarita Sandstone overlies the Monterey Formation which is generally regarded as non-water bearing due to low yields and poor water quality. This aquifer system was believed to extend significantly into southern Fort Ord. The data from the Sentinel Wells reveal that the Santa Margarita Sandstone does not extend as far north as previously interpreted and that, at the coast, the Santa Margarita Sandstone is replaced by Purisima Formation within approximately 1.5 miles of Military Avenue.

The absence of the Santa Margarita Sandstone complicates the hydrogeologic understanding of the Seaside Basin, but it may have limited impacts on basin management. The Purisima Formation is water-bearing and is used for municipal supply by Marina Coast Water District. The Purisima Formation is less permeable than the Santa Margarita Sandstone. However, the Purisima is substantially thicker and, as such, may have similar hydraulic transmissivity values. Additional analysis will be required to determine whether the occurrence of the Purisima Formation in place of the Santa Margarita Sandstone has relevance to basin storage volumes, susceptibility to seawater intrusion, opportunities for ASR, and basin management activities.



Geologic data modified from Rosenberg and Feeney (2003), *in* Deep aquifer investigative study (WRIME, 2003, cross section A–A')
Gravity data from USGS Open-File Report OF 02-373 (Langenheim and others, 2002)
Topography from USGS National Elevation Dataset (30-m resolution).

FIGURE 3

INITIAL DATA COLLECTION

Baseline Data Collection

The successful construction of the monitoring wells allowed for the completion of baseline data collection. Lithologic and geophysical data were acquired through the drilling of the pilot borings. The completed monitoring wells provided for the collection of supplemental geophysical data (induction logs), water quality data, and water level data.

Water Level Data

Static water levels were measured at each of the monitoring wells on September 13, 2007, at the time of induction logging. Reference point elevations established by RBF Consulting were used to determine the water surface elevation at each site. Water level data are summarized in Table 2.

Table 2 – Water Level Data Summary

	SBWM-1	SBWM-2	SBWM-3	SBWM-4
Approx. Ground Surface Elevation, ft, (msl)	96	73.7	59.5	62.4
Depth to Water, ft.	115.9	93.0	78.4	82.4
Water Surface Elevation, ft. from MSL	-19.9	-19.3	-18.9	-20

Water surface elevations are significantly below sea level at each well and do not suggest a clear gradient or flow direction.

Water Quality Data

Composite Sampling. Once airlift development was believed to be sufficiently complete, and water produced by airlifting was clear, water quality samples were collected. The samples likely represent a composite of groundwater produced from all sections of the well screen. Samples were delivered to the Monterey Bay Analytical Services laboratory in Monterey, where general mineral analyses were performed. Laboratory reports are included in Appendix B, and the data are summarized in Table 3.

Table 3 – Summary of Water Quality Data, Composite Samples

	SBWM-1	SBWM-2	SBWM-3	SBWM-4
Sample Date	8/14/07	9/4/07	9/6/07	9/5/07
Specific Conductance, µmhos/cm	435	815	620	1150
Total Dissolved Solids, mg/l	305	486	365	671
Calcium, mg/l	16	60	33	84
Magnesium, mg/l	2	10	5	17
Sodium, mg/l	68	94	82	128
Potassium, mg/l	3.2	4.5	4.2	5.9
Bicarbonate, mg/l (as HCO3)	102	218	152	294
Sulfate, mg/l	26	38	27	46
Chloride, mg/l	60	117	93	187

Depth-Specific Sampling. For purposes of determining the appropriateness of utililizing down-hole sampling techniques, depth specific water samples were collected concurrently with induction logging. Welenco collected discreet water quality samples from two depths in each monitoring well on September 13, and September 24, 2007. Samples were collected from the middle of the top and bottom screens on SBWM-1, SBWM-2 and SBWM-3. Samples were collected 10 feet below the top of the screen and 20 feet above the bottom of the screen in SBWM-4. The purpose of the discreet, depth specific, sampling was to provide additional baseline data, evaluate variations in water quality from different depths within each completed well, and allow for comparison of water quality characteristics between the discreet samples and the composite airlift samples. Analytical results for the discreet samples are provided in Table 4.

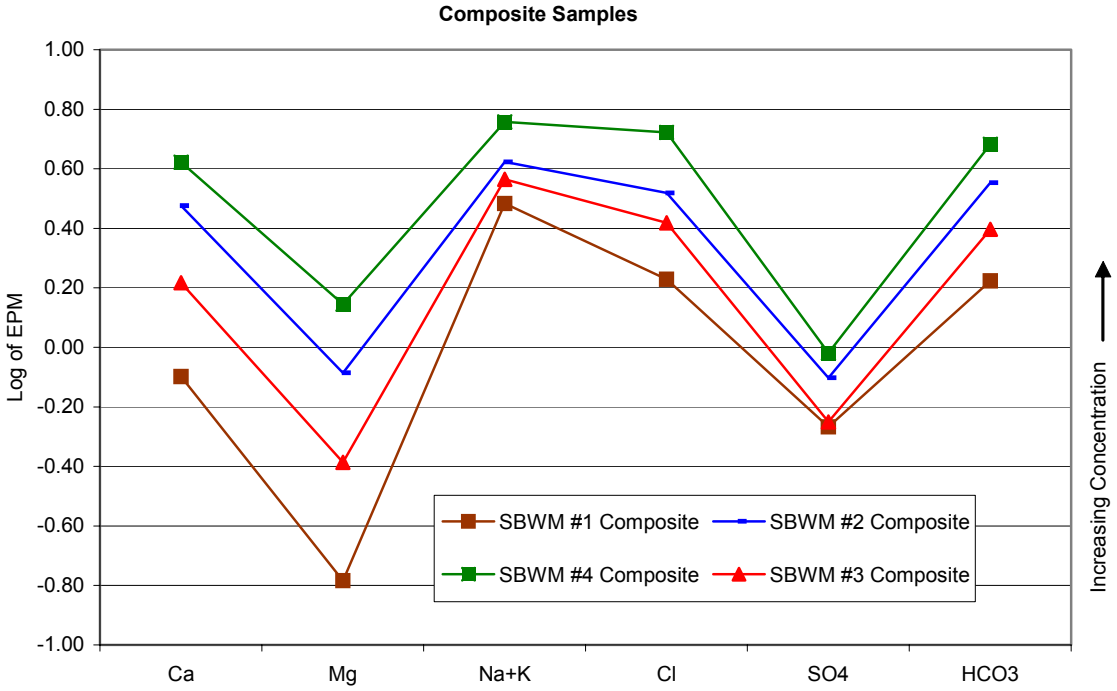
Table 4 – Summary of Water Quality Data, Discreet Samples

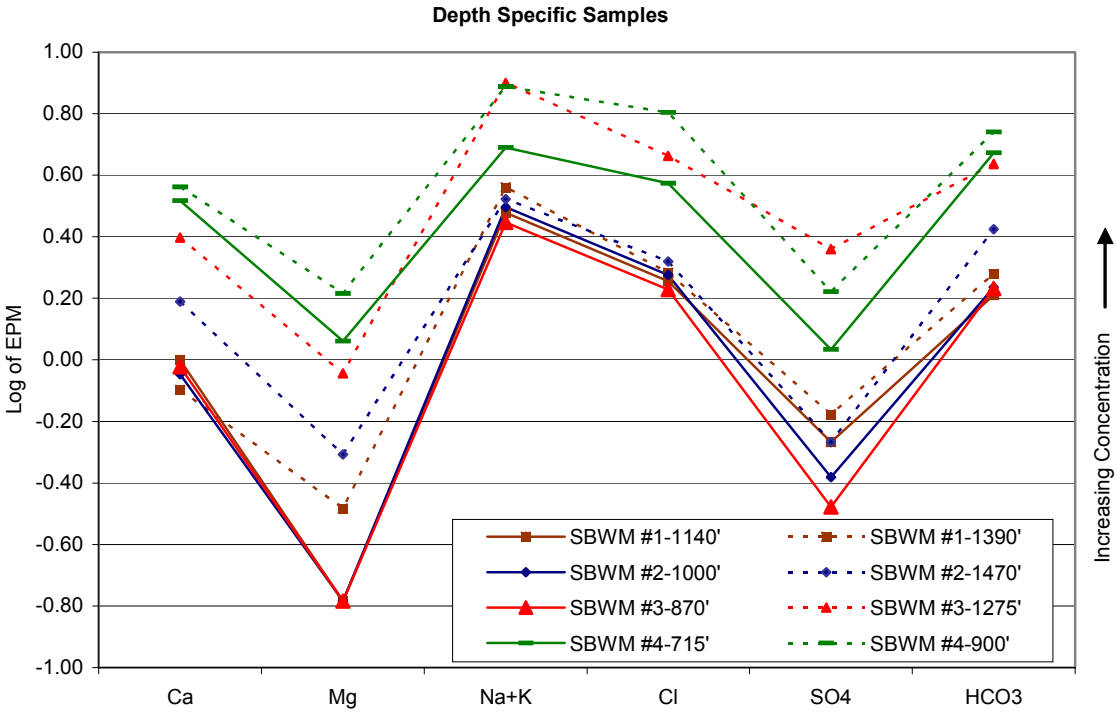
	SBWM-1		**SBWM-2**		**SBWM-3**		**SBWM-4**	
Sample Date	9/13/07		9/24/07		9/13/07		9/24/07	
Sample Depth, ft.	1140	1390	1000	1470	870	1275	715	900
Specific Conductance, µmhos/cm	409	471	451	526	410	1130	977	1375
Total Dissolved Solids, mg/l	256	317	256	308	270	686	586	794
Calcium, mg/l	20	16	18	31	19	50	66	73
Magnesium, mg/l	2	4	2	6	2	11	14	20
Sodium, mg/l	67	81	70	74	62	178	109	172
Potassium, mg/l	3.6	4.5	3.4	4.4	3.9	7.9	6.3	9.7
Bicarbonate, mg/l (as HCO3)	99	116	105	162	104	264	287	336
Sulfate, mg/l	26	32	20	26	16	110	52	80
Chloride, mg/l	64	68	67	74	60	163	133	226

Seaside Groundwater Basin Water Master

Sentinel Wells

Water Quality Samples





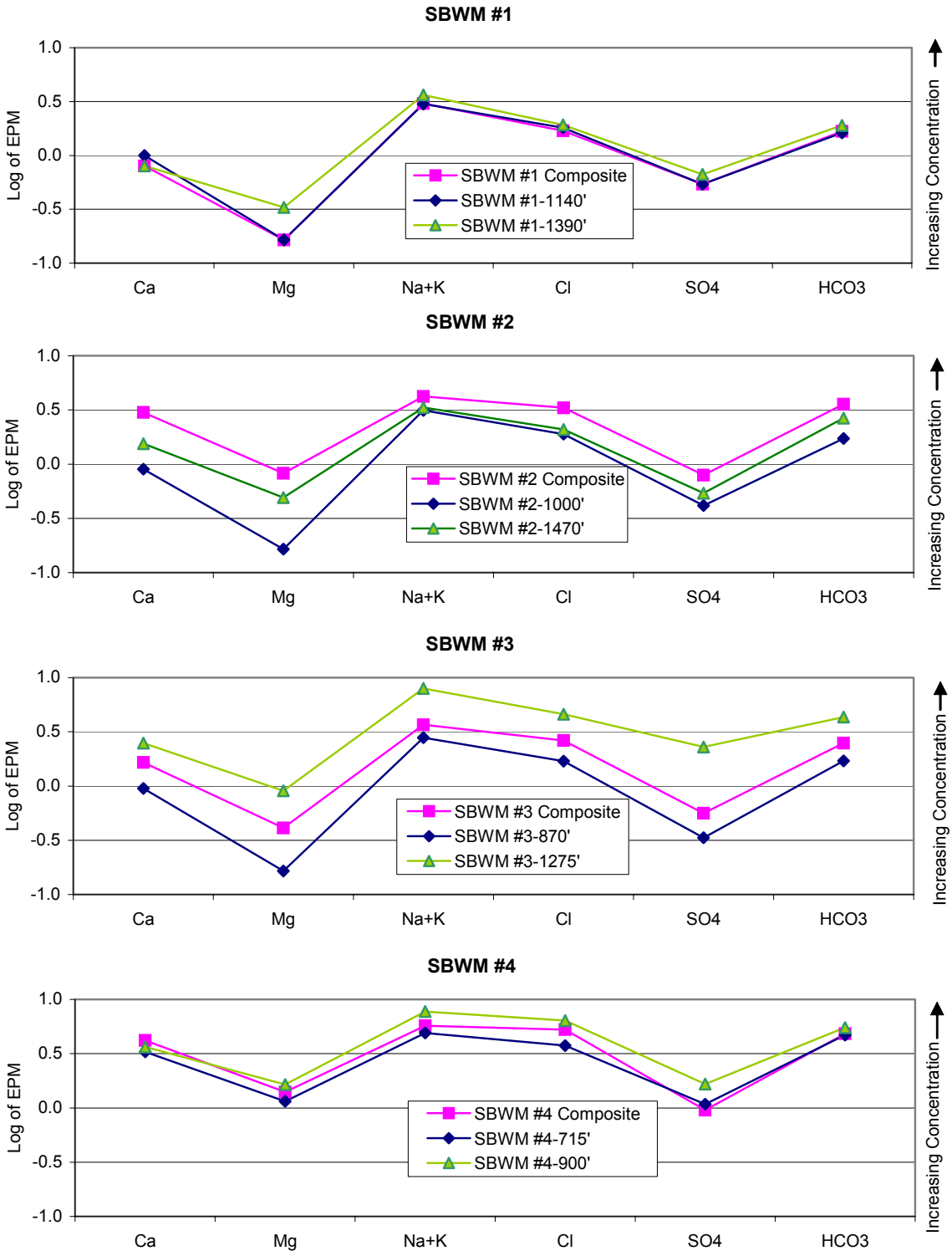
EPM = Equivalents per million = concentration (PPM) x valence/molecular weight

FIGURE 4

Seaside Groundwater Basin Water Master

Sentinel Wells

Water Quality Samples



EPM = Equivalents per million = concentration (PPM) x valence/molecular weight

FIGURE 5

Water Quality Interpretation

Water quality data from the Sentinel Wells supplement and complement the geologic and geophysical data from the boreholes. The water quality data are presented in Figures 4 and 5. The water quality findings are as follows:

- Generally, the water quality of the wells, based on the composite samples, decreases with increasing distance south. SBWM-1 displays a total dissolved solids concentration of 305 milligrams per liter (mg/l) whereas SBWM-4 has a concentration of 671 mg/l. These values are consistent with water quality data for wells completed in the Purisima Formation and the Santa Margarita Sandstone, respectively.
- Based on the composite samples, the water from the three northern wells (SBWM-1, SBWM-2, and SBWM-3) is of a sodium-chloride-bicarbonate chemical character while, the water from SBWM-4 is of a stronger sodium-chloride chemical character.
- Depth specific samples from all wells are presented on bottom panel on Figure 4. As can be seen, the signatures fall into two groups; the lower groups being both samples from SBWM-1 and SBWM-2 and the uppermost sample from SBWM-3. The other group contains the lower sample from SBWM-3 and both samples from SBWM-4. However, careful analysis of the signatures suggests that the lower sample in SBWM-3 is grouped with the SBWM-4 samples primarily due to increased concentration not necessarily due to similar chemical character.
- As can be seen on Figure 5, depth specific sampling provides significant additional insight into the water quality conditions within the aquifer system. The sampling data reveal significant water quality difference with varying depths in the well.
- With the exception of SBWM-2, all of the wells show increased salinity with depth. The more saline composite sample from SBWM-2 suggests contribution to the composite sample from a zone with poorer water quality than the two zones sampled by depth-specific methods.

Induction Logging

Induction logs of the completed wells were performed by Welenco on September 13 and 24, 2007. The first set of logs did not reach the bottom of the wells so additional development was performed by Bradley to clean the wells to the bottom. A second set of induction logs were subsequently performed and the probe successfully reached bottom. Induction logs provide a vertical profile of the conductance of the formation fluids throughout the entire saturated section at each well. These logs will serve as a baseline for the monitoring program through which any future changes in the salinity of groundwater within any zone may be easily identified and tracked during subsequent induction logging. The induction logs for each of the monitoring wells are presented in Figure 6. Induction logs from each of the wells plotted along side with the electric log performed in the open hole at the construction are presented in Appendix C. The induction logging results closely track the electric log signatures from the open hole detailing areas of high conductivity in each of the sediment columns. The induction log for each well is discussed and interpreted below.

Induction Log Interpretation

Induction logs measure the conductivity of the formation at a radial distance of approximately three feet from the casing. The measured conductivity is an aggregate measurement of the electrical conductivity of

the formation fluid and the formation solids and for this reason will not directly correspond with a water sample from the same depth. In clean sand, which has no inherent conductivity, the conductivity measurement more closely approximates the conductivity of the fluid, whereas in clay, which is inherently conductive, the measurement is a composite of the fluid conductivity and the clay conductivity. In mixtures of sediment materials the conductivity increases with increased clay content. Given this relationship, if high conductivities are measured in sediments known to be sand, the water is saline, and in coastal environments, this is strong evidence of seawater intrusion. In clay formations, the formation fluids are commonly naturally saline. Detection of seawater intrusion in clay materials can be most easily detected by increases in conductivity over time.

SBWM-1—The upper 50 feet of the this well shows very high conductivities. This signature is present in all of the wells and is the result of the 50-foot steel conductor casing. However, because the water table is below the conductor casing at all locations, the steel casing does not interfere with data collection within the saturated sediments below. Below the conductor casing in SBWM-1, the sediment materials are dry to a depth of approximately 115 feet. Below this depth, there is approximately 10 feet of sand containing fresh water. Below 125 feet and extending to approximately 350 – 400 feet is sand containing saline water with conductivities measuring as high as 10,000 µmhos/cm. This saline water is contained within the Dune /Beach Sand Deposits and the Aromas Sand. Below this depth, conductivities are relatively low with the exception of the thick marine clay between approximately 600 -700 feet. The other conductive zones also correlate with clay zones.

SBWM-2— As in SBWM-1 there is a thin layer of fresh water overlying a zone of saline water to approximately 130 feet within the Beach/Dune Sands and Aromas Sand. Below this depth, the materials become increasingly clayey, complicating the interpretation. Below this depth, there are no obvious zones of anomalous conductivity; that is, the zones that are more conductive correlate with clay zones.

SBWM-3— In SBWM-3 saline water extends to a depth of approximately 100 feet within the Dune/Beach Sand and Aromas Deposits. Below 100 feet, the materials become clay and conductivities rapidly decline. Again, below the shallow saline water in the sand deposits, all zones of increased conductivity correlate with clay zones.

SBWM-4— As with the other wells, the induction log reveals a thin layer of fresh water overlying saline water with the Dune Sands/Beach Deposits to a depth of approximately 100 feet. Below this depth the materials become clay and there are no additional zones of increased conductivity uncorrelated with clay zones.

Seaside Groundwater Basin Watermaster
Sentinel Wells
Initial Induction Logs
September 2007

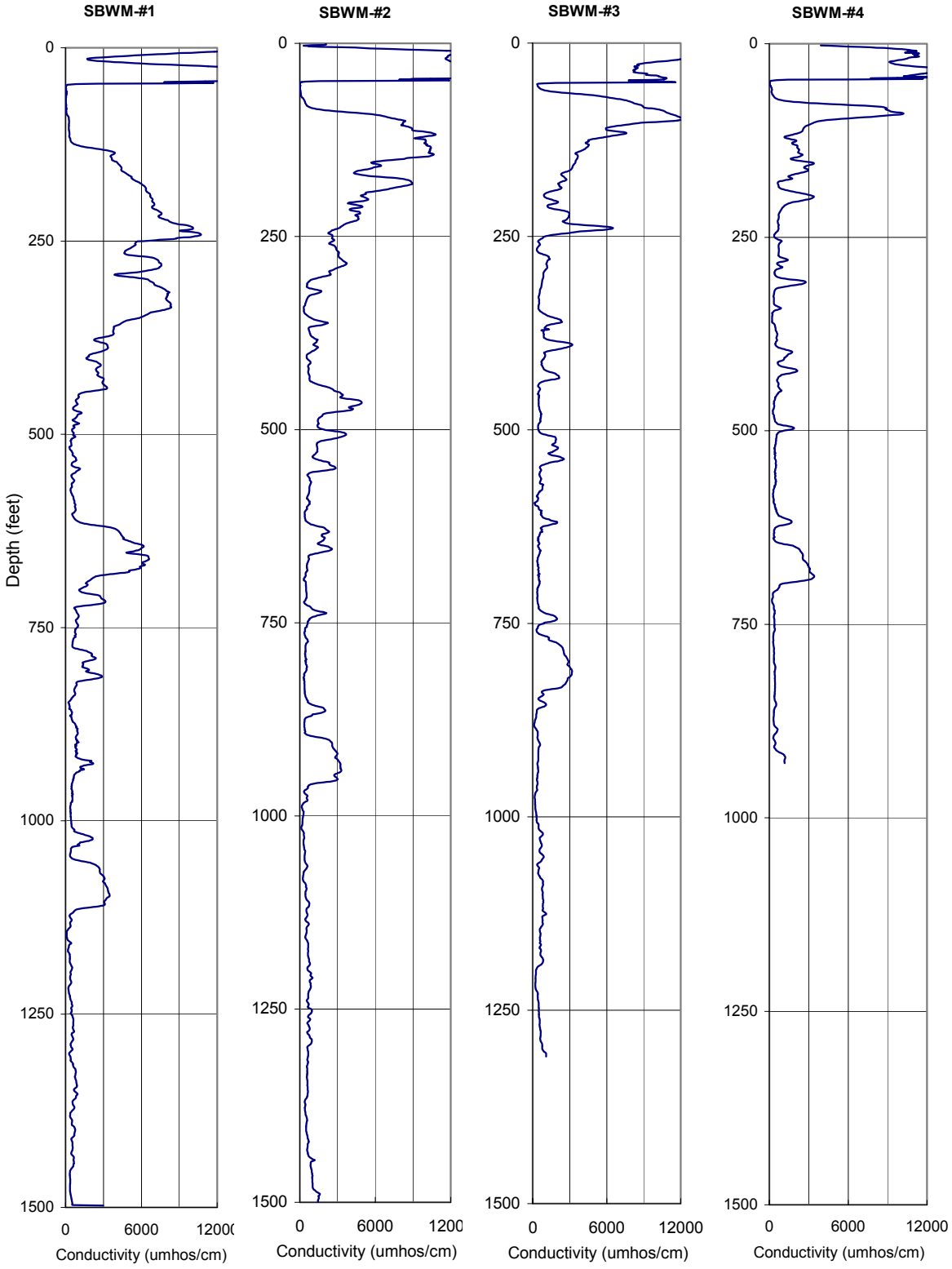


FIGURE 6

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The geologic, geophysical and hydrogeologic data from the Sentinel Wells have provided significant additional understanding of the hydrogeology of the southern Fort Ord area of the Seaside Groundwater Basin.

- The most significant geologic finding was the absence of the Santa Margarita Sandstone at three of the four monitoring wells, and the extremely limited thickness of the Santa Margarita Sandstone at the most southerly site. The most northerly well encountered Miocence/Pliocene-aged Purisima Formation to total depth (1,500 feet). Moving farther south, the monitoring wells encountered Purisima Formation overlying shales of the Monterey Formation. At the most southerly site, the lithologic and water quality data suggest that there is a 30- to 40-foot thick section of Santa Margarita Sandstone underlying the Purisima and overlying the Monterey Formation shales.

- The data reveal that the Purisima Formation extends much farther south into the Seaside Groundwater Basin than had previously been believed. Additionally, the recent data suggest that interpretation of geologic data from some of the previous monitoring wells in southern Fort Ord may have erroneously identified the Purisima Formation as the Santa Margarita Sandstone.
- The absence of the Santa Margarita Sandstone complicates the hydrogeologic understanding of the Seaside Basin, but it may have limited impacts on basin management. The Purisima Formation is water-bearing and is used for municipal supply by Marina Coast Water District, as well as other users at locations in northern Monterey Bay area. The Purisima Formation is less permeable than the Santa Margarita Sandstone, however, the Purisima is substantially thicker and, as such, may have similar transmissivities. Additional analysis will be required to determine whether the occurrence of the Purisima Formation in place of the Santa Margarita Sandstone has relevance to basin storage volumes, susceptibility to seawater intrusion, opportunities for ASR, and basin management.
- Water level data from the Sentinel Wells reveal water levels in the lower aquifer system at the location of the wells to be approximately 20 feet below sea level.

- Water quality data from the Sentinel Wells reveal water quality to vary spatially and with depth. Down-hole sampling techniques have revealed differences in salinity of more than two fold within the same well that was masked when a composite sample was collected. This needs to be considered when designing a sampling program.

- Water from the wells completed in the Purisima Formation is significantly less saline than water from the Santa Margarita Sandstone in the Seaside Basin. This difference will complicate spatial analysis of water quality trends. Comparison of chloride concentrations between waters from Santa Margarita Sandstone and water from the Purisima Formation need to be considered carefully. Naturally occurring chloride concentrations in the Santa Margarita Sandstone are several times higher than the chloride concentrations in the Purisima Formation and therefore intrusion detection “triggers” will need to be specific to the geologic unit.

- No evidence of seawater intrusion was detected in either of the primary aquifer systems of the Seaside Basin: the Paso Robles Formation or the Santa Margarita Sandstone/Purisima Formation.

- Geophysical data reveal significant seawater intrusion in the upper portions of SBWM #1 borehole to depths of approximately 350 feet. The existence of seawater intrusion in the shallow Dune Sands/Aromas Sands units in this area has been known for decades.

- Evidence for seawater intrusion at the other three locations was limited to saline intrusion into the shallow Dune/Beach Sand Deposits.

RECOMMENDATIONS

- The data from the Sentinel Wells, taken together with existing data from previous monitoring wells, raise some hydrogeologic questions and suggest that additional hydrogeologic analysis is required. Some of the hydrogeologic questions are relevant to basin management while others are relatively academic. The hydrogeologic analysis should include, as necessary, the refinement and revision of the overall hydrogeologic structure/stratigraphy of the Basin, but focus on the ramifications, if any, these refinements may have on the management of the basin.

Additional Monitoring Wells:

- While more borehole data are almost always useful, it is not believed at this time to be necessary or cost-effective to install additional monitoring wells in the coastal area near the new Sentinel Wells solely for the purpose of achieving a better understanding of the basin hydrogeology or to manage the basin.

- The need for additional monitoring wells may change over time as data accumulates. If changes in conductivity are detected over several induction logging cycles, monitoring well(s) should be installed as appropriate to allow sampling of the locations and zones of interest. These changes will occur gradually and will need to be confirmed over time before initiating well construction. As such, it is unlikely that Watermaster will need to budget for construction of additional monitoring wells for the coming year. The Watermaster, however, might include in the budget for 2009, a contingency for installing monitoring wells in response to the detection of significant changes in conductivity, as measured by induction logging, in the Sentinel Wells. An appropriate budget for permitting, construction and hydrogeologic oversight of a new monitoring well would be approximately $150,000.

Data Collection:

- The Sentinel Wells represent a significant addition to the monitoring network of the Seaside Groundwater Basin. The Sentinel Wells should be induction logged quarterly. Successive induction logs should be overlaid on previous logs for comparison. Water samples should be collected concurrently for comparison and calibration of induction logs. If possible, water quality samples should be collected from top and bottom of screened intervals. After the first year of data collection, the data should be reviewed with the intent of determining the appropriate sampling frequency.

- The Sentinel Wells are located in the newly-created Fort Ord State Park. This park is soon to be open to the public. Given the park's visitor-serving purposes, there is a motivation to minimize the disruption of park uses that periodic data collection activities will create. As such, it is recommended that data collection methods be utilized that result in minimum disruption. Data collection techniques should have a limited footprint and should be able to be performed quickly.

- Consistent with the recommendation to minimize data collection impacts, it is recommended that periodic water quality sampling be performed utilizing down-hole capture methods. This will avoid well purging activities which would require mobilization of pumping equipment and the containment and disposal of purge water. The use of down-hole sampling capitalizes on the

induction logging program as the down-hole sampling can be performed utilizing the same wire-line equipment on site for induction logging.

- Down-hole, wire-line water-quality sampling also provides the ability to get relatively discrete water-quality samples from differing depths within the perforated interval. Additionally, down-hole sampling, performed concurrently with the induction logging, is much less expensive in terms of labor costs than conventional sampling methods.

- Again, to minimize disruption to Park activities and uses, the Sentinel Wells should be equipped with continuous, water-level data loggers to record water level fluctuations. Continuous water-level data collection will allow characterization of both tidal fluctuations and the pumping stresses imposed by regional extractions. These data will assist in understanding: (1) the nature and degree of connectivity to the ocean; (2) the influence of pumping/injection stresses at these locations; (3) the regional gradients and groundwater flow directions; and (4) long-term trends in groundwater levels along this section of the coastline.

- At the most northerly and southerly sites, there are nearby shallow monitor wells that were installed as part of previous investigations. Consideration should be given to adding these wells to the monitor-well network for regular water-level monitoring as this information could supplement the data from the new Sentinel Wells for future hydrogeologic analyses.

- It is estimated that each induction logging and water quality sample collection event can be performed for approximately $6,500, inclusive of laboratory analysis. This would include four induction logs, the collection of two water samples from each well and laboratory analysis for general-mineral constituents. Technical staff time would be in addition to this cost. It may be possible to acquire the logging and sampling services as part of negotiated annual contract. This could reduce costs significantly.

CLOSURE

This letter-report has been prepared for the exclusive use of the Seaside Groundwater Basin Watermaster for the specific application to the Sentinel Well Project. This report documents the hydrogeologic conditions encountered at the time of construction and initial sampling. The report also documents the physical condition of the wells at the time of construction. Environmental changes, either naturally-occurring or artificially induced, may cause damage to the wells over time. This report expressly does not constitute a guarantee of future performance**.** The findings, conclusions, and recommendations presented were prepared in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the fields of engineering geology and hydrogeology. No other warranty, express or implied, is made.

I appreciate the opportunity to be of service. Please call if you have any questions.

Sincerely,

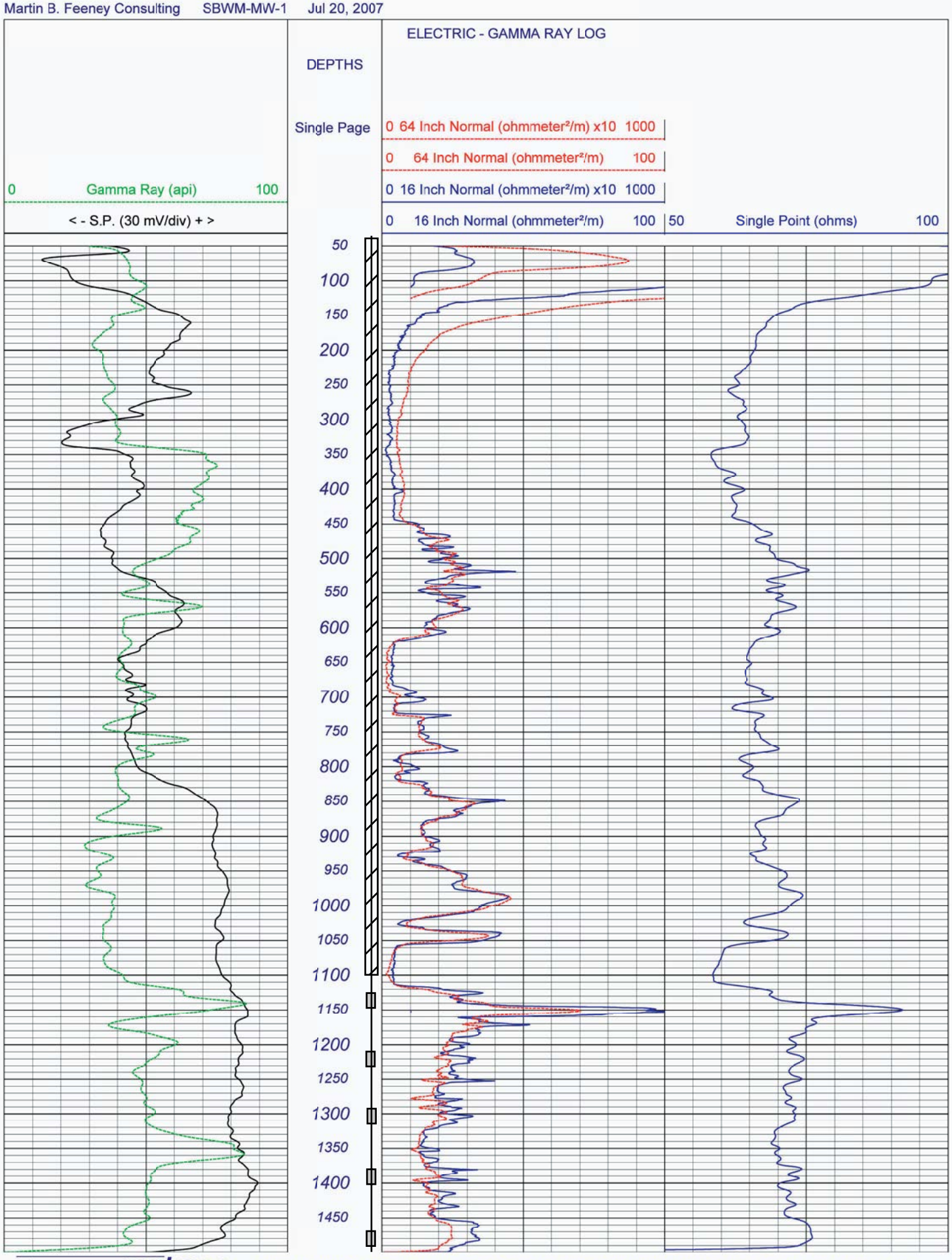
Martin B. Feeney, PG, CEG, CHg

Attachments: Figures 1–6
Appendices A–E

APPENDIX A - LITHOLOGIC AND GEOPHYSICAL LOGS

Contents:

Martin B. Feeney Consulting SBWM-MW-1 Jul 20, 2007



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CA. Contractor's License: 722373
Phone: (800) 445-9914 Fax: (661) 834-2550 Email: welenco@welenco.com Web: www.welenco.com
(Prepared with Log Print, a professional software application developed by welenco, inc.)

Well Name: SBWM MW-1	**Martin B. Feeney** *Consulting Hydrogeologist*
Owner: Seaside Basin Water Master	
Location: Fort Ord Dunes State Park, Range 8; N 36º 39' 07.9", W 121º 49' 24.4"	
Date: July 17 - 20, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersol-Rand TH-60** **Fluid: Bentonite**

Drilling Rate (feet/hour)	Lithology (% Sand Concentration 0 50 100)	Grain Size Distribution % Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
0						
50						SAND: orangish yellow, gray, orange; mostly fine to med. grained; subang. to angular; well sorted.
100						SAND: sl. grayish yellow; frosted; gray in part, orange; predom. very fine-med. grained; granular in part; subang. to angular; sub-rounded; well sorted; black carbonaceous specks; dark gray lith--ic grains.
150					Image 60'-230'	SAND: sl. grayish yellow; frosted orange/white; fine to med. gr.; minor granular. SAND: grayish yellow orange, frosted white; mostly coarse to med. gr.; minor granular; Fe-stained grains.
200						SAND: lt. gray; orange-brown; Fe-stained grains; predom. very fine to med. gr.; abundant black carbonaceous specks; micaceous. SAND: moderate grayish brown, Fe-stained orangish brown grains; abundant black carbon. specks; mostly very fine to fine; grading to silt; grayish in part; micaceous.
250						SILT: moderate grayish brown/orangish brown; black specks' SAND: grayish brown, orange; silty; predom. very fine to med gr.; micromicaceous; black specks; unconsolidated.
300						SILT: brown, orange, minor white; carbon. specks; micaceous; semi-consolidated.
350					Image 240'-410'	SILT: brown, orange; carb. specks; micromicaceous. SILTY SAND: brown/orangish; carb. specks; predom. very fine and silty; micaceous; well sorted.
400						CLAY: med. yellowish orange; interbedded w/ fine sand/gravel; black/dark gray lithic grains.moderately soluble; slightly sticky; soft. Light grayish yellow.
450						CLAYSTONE: moderately greenish gray/olive gray, yellowish orange; firm to moderately hard; sub platy to sub blocky.
500					Image 420'-590'	CLAY: moderately yellowish orange/lt. grayish yellow, white ; soft; m sticky; mod. to poorly soluble; well indurated in part. Abundant porcelaneous chert; yellowish orange, w/ greenish gray claystone.
550						CLAYSTONE: moderately greenish gray/yellowish orange; CLAY: yellowish orange, trace white; interbedded with multicolored gravel and porcel. chert.
600						GRAVEL: white/orange, frosted, trace red; rounded/subrounded; trace porcel. chert, some banded; w/ white and orange silica. CLAY: mod. yellowish orange/white; interbedded w/ orange/white gravel and greenish gray claystone. CLAYSTONE: dark olive gray/greenish gray/light gray; firm to med hard; sub-platy, sub-blocky.
650					7/17 680' @ 17:45 7/18 start drilling @ 10:00	CLAY: lt. grayish yellow, mod. yellowish orange; soft; sl. sticky; cohesive; interbedded w/ white/orange and frosted lithic grains and dark gray/yel.orange claystone.

Well Name: SBWM MW-1	**Martin B. Feeney** *Consulting Hydrogeologist*	PUEBLO water resources
Owner: Seaside Basin Water Master		
Location: Fort Ord Dunes State Park, Range 8; N 36º 39' 07.9", W 121º 49' 24.4"		
Date: July 17 - 20, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**	
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersol-Rand TH-60**	**Fluid: Bentonite**

Drilling Rate (feet/hour)	Lithology (% Sand Concentration 0 50 100)	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
650					Image 600'-770'	CLAYSTONE: mod. greenish gray, orange; platy; crumbly; mod. hard; banded with calcite, in part.
700						CLAYSTONE: blue green to olive; firm; blocky; w/ shell fragments; occasional to abundant pelcypod frags; occasional coarse sand; black, rounded sand grains.
750						
800						CLAYSTONE: dark green; firm; blocky; w/ shell frags. Occasional rounded claystone 'pebbles'; minor gravel as black, rounded clasts; minor red chert.
850					Image 780'-950'	SAND: multi-colored, med to coarse gr.; occasional fine gravel; subrounded gravel; occasionally with clay.
900						SAND: green to white; med. to coarse gr.; poorly sorted; subrnd to round; predom. quartz and olivine(?); abundant shell frags; Becoming finer grained. Interbeds of dark green claystone.
950						SANDY CLAY: grey; sticky; w/ fine to med. gr. sand. CLAYSTONE: dark greenish gray; in part yellowish orange; platy; mod. to very hard.
1000						CLAY: light gray; soft; interbedded w/ claystone; silty.
1050					Image 960'-1130'	CLAYSTONE: mod. to dark greenish gray; in part yellowish; platy, moderately to very hard;
1100						CLAYSTONE: very dark gray to black; platy cuttings; moderately hard; brittle/friable.
1150						CLAYSTONE: very dark gray; platy cuttings; with fine to med. gr. quartz sand; abundant frosted white, small, flat, siliceous cutitngs; abundant kaolinitic white clay; w/ some chert; with brown and gray clay; bulk color of sample pale olive gray.
1200					Image 1140'-1310'	CLAYSTONE/SHALE: predom. dark gray; platy; brittle; with brown sub-platy cuttings of soft brown claystone/mudstone; few roundish small cuttings of white kaolinitic clay; some shells.
1250					Change from drag bit to rock bit at 1240 ft. Cuttings w/ rock bit more ground-up and softer; fewer intact platy cuttings.	CLAY/CLAYSTONE: gray to pale olive gray clay; soft; w/dark gray claystone/shale; minor porc. chert; minor sand; some shells.
1300						

Well Name: SBWM MW-1	**Martin B. Feeney** *Consulting Hydrogeologist*
Owner: Seaside Basin Water Master	
Location: Fort Ord Dunes State Park, Range 8; N 36º 39' 07.9", W 121º 49' 24.4"	
Date: July 17 - 20, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersol-Rand TH-60** **Fluid: Bentonite**

Drilling Rate (feet/hour)	Lithology: % Sand Concentration (0 50 100)	Grain Size Distribution: % Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
	1300					CLAYSTONE/SHALE: very dark gray, gray, dark olive gray, brown; platy cuttings; brittle/friable; w/ soft gray, olive gray clay; minor white clay; shell fragments; w/ quartz sand find to med.; minor porc. chert.
	1350					CLAYSTONE: dark gray to olive gray, yellowish orange in part; platy; brittle; hard w/ lt. gray mod. sticky clay; trace shell frags; with sand, fine to coarse, quartz.
	1400				Image 1320'-1500'	
	1450					CLAYSTONE: medium dark gray; platy; brittle; hard;with fine to coarse grained sand, quartz; with shell fragments.
	1500				TD 1500 ft. @ 13:30, 7/20/07	


Seaside Basin Watermaster
MW-1 60-230'


Seaside Basin Watermaster
MW-1 240-410'


Seaside Basin Watermaster
MW-1
420-590'


Seaside Basin Watermaster
MW-1
600-770'


Seaside Basin Watermaster
MW-1
600-770'

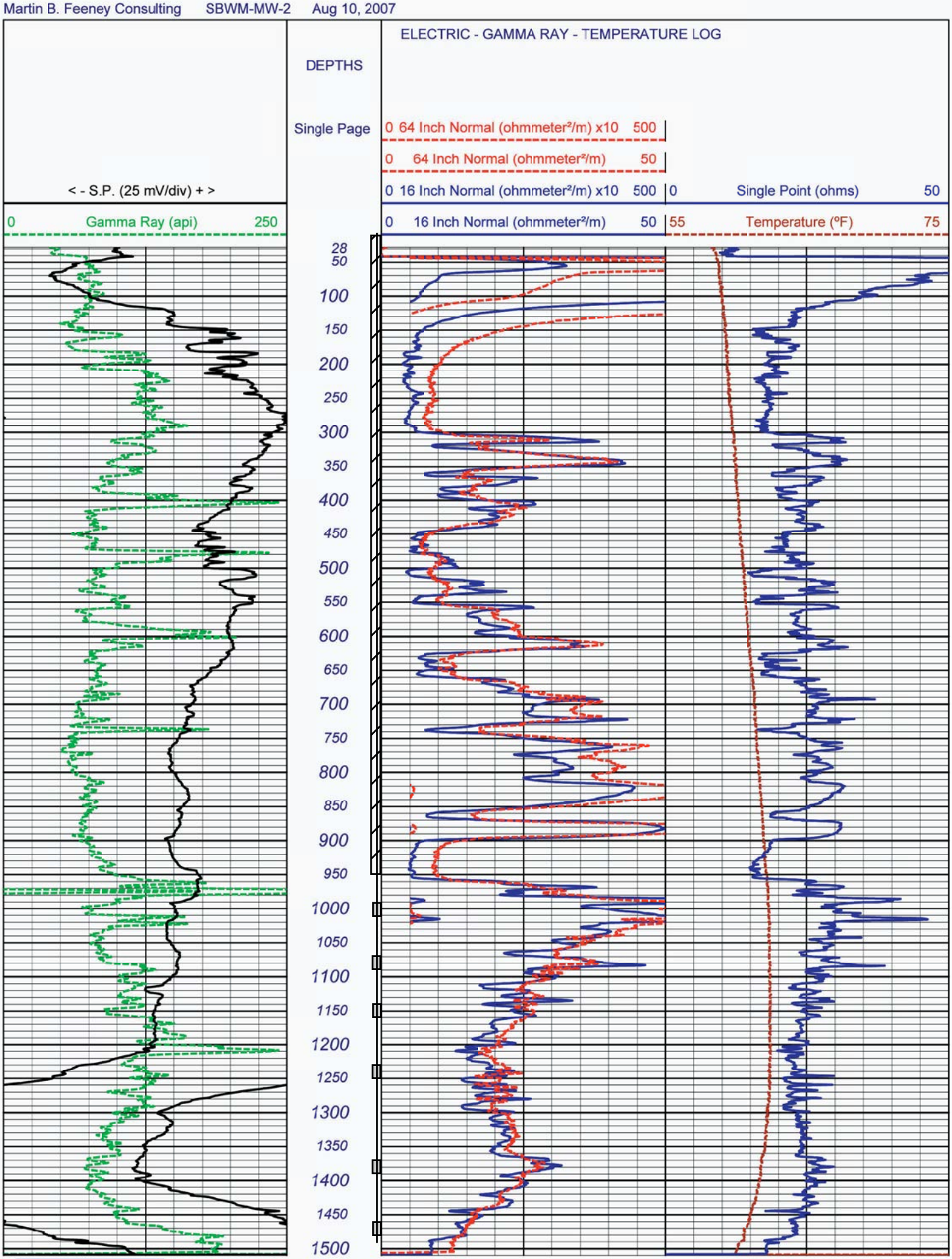

Seaside Basin Watermaster
MW-1
780-950'


Seaside Basin Watermaster
MW-1
960-1130'


Seaside Basin Watermaster
MW-1
1140-1310'


Seaside Basin Watermaster
MW-1 1320-1500

Martin B. Feeney Consulting SBWM-MW-2 Aug 10, 2007



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(Prepared with Log Print, a professional software application developed by welenco, inc.)

Well Name: SBWM MW-2

Owner: Seaside Basin Water Master

Location: Fort Ord Dunes State Park, Bunker 11; 36º 38' 46"N, 121º 49' 46"W

Date: Aug 06 - 07 & Aug 09 - 10, 2007

Loggers: Martin Feeney, Michael Burke, Raju Bhupathi

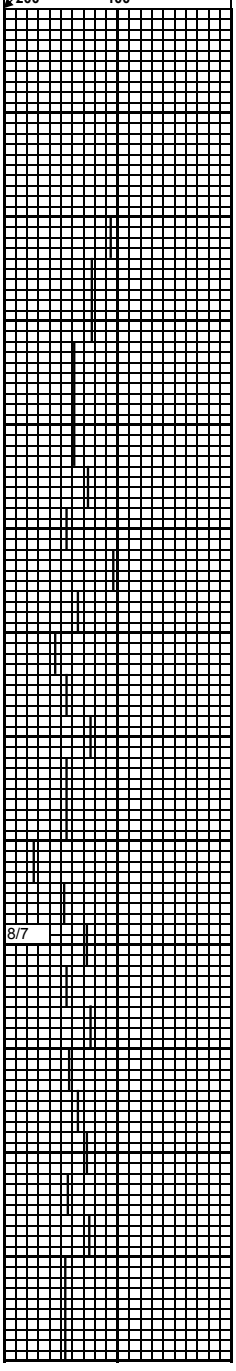
Drilling Co.: Bradley and Sons, Inc.

Rig: Ingersol-Rand TH-60

Fluid: Bentonite

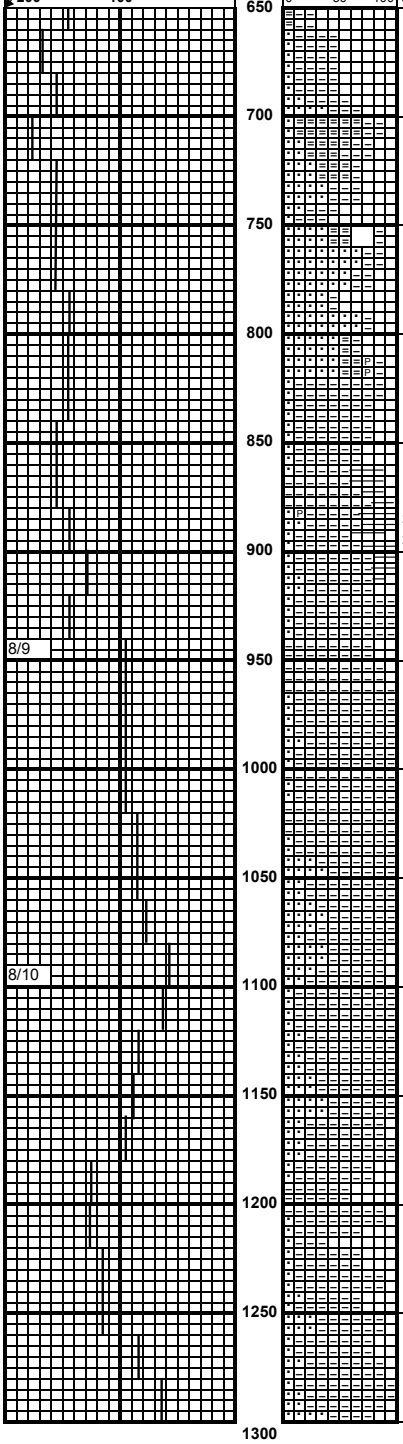
Martin B. Feeney
Consulting Hydrogeologist

PUEBLO water resources



% Gravel	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	
					Commence logging on 8/6/07 @1300 Hrs
	20	50	30		SAND: Clear, white, brown, orange, predom med to fine, unconsol,
	20	50	30		sl sorted, rounded-subrounded, Fe-stained quartz grains, abndt
	20	40	40		black/dark gray lithic grains.
	20	40	40		SAND: Clear, white, brown, orange, predom med to coarse, unco-,
	40	40	20		nsolidated, rndedto sunrnded, abndt lithic grains
	40	30	30		
	40	20	40		SAND: Clear, white, red brown, unconsol, tr porc.
	30	10	60		SILT: Medium gray, mod brown, sl orangish, highly micaceous,
	30	10	60	Image 60'-230'	saturated with black carbonaceous speks, minor lithic grains,
	30	10	60		interbedded with clear-white coarse-vfine qtz grains, tr clay.
	20	20	60		
					SILTY CLAY: Moderate brown silt with light yellowish gray & slight
					orangish clay interbeds, soft mod sticky clay, with abundant
		50	50		black carb speks, micaceous.
		30	70		CLAY: Moderate yellowish orange, sl stiff, mod sticky, cohesive,
		20	80		poorly-sl hydrated, interbedded with med gray silt & vfine-med
	20	30	30	Very sticky clay out of hole(flow line),	white sand, minor carb speks & lithic grns, non calcareous.
	30	30	10	contractor shoveled off the clay	CLAY: Mod yelsh orange, mod to v stiff, very sticky, cohesive,
	60	40			abndt white rnded porc pebbles & white sand grns, tr cherty
		80	20		porc, non calc, grading to indurated clay, w/mnr carb spks & lithic
		80	20		CLAY: Mod yellowish orange, lt yellowish gray, grading to
					light greenish gray claystone, soft, mod sticky.
					Claystone: Mod greenish gray, mnr yelsh orange & sl orngsh
					gray brittle, platy-subplaty, intbdd with yelsh orng sticky clay.
				Image 240'-410'	CLAYSTONE: Mod greenish gray, mnr sl orangsh gray,
	20	30	20	30	tr yelsh orng, mostly subplaty to platy, mnr subblky, mod calc,
	20	30	20	30	fragments is larger size, tr porc.
	30	20	20	30	CLAY: Lt gray, sl yelsh orange, soft, mod sticky, cohesive, with
	30	40	20	10	mod grnsh gray to sl orngsh gray large claystone frag, wht porc &
	30	20	30	20	med-crse clear to wht qtz, tr cherty porcelanite.
	20	20	40	20	PORCELANITE: White, rounded, pebbly, tr brownish gray chert &
	10		70	20	white porcelaneous chert, interbedded with lt gray clay, clear
	10		70	20	to white med - coarse qtz grns and greenish gray claystone.
					SAND: Mostly clear, mnr white, predom medium, subrounded to
	10		70	20	rounded mod well sorted, with porcelanite pebbles & chert,
	10		70	20	greenish gray claystone.
	10		30	60	SILT: Lt gray, abundant carbonaceous speks, intdd with greenish
	10		20	70	gray claystone, porc, tr brnsh gray chert & v-fine to med grnd qtz.
	10		70	20	SAND: Mostly clear, mnr white, predom medium, mostly subrnded
	10		70	20	to mnr rnded, well sorted, with porcelanite pebbles.
	10		60	30	
	10		60	30	SILT: Med gray, highly micaceous, sucrosic.
			50	50	CLAYSTONE: Mod greenish gray, med gray, sl orangish gray,
	10		40	50	Rig Chatter platy to subplaty, intbdd w/lt gray sticky clay.
	10		30	60	CLAYSTONE: Mod greenish gray, sl orangish gray, platy with
	10		30	60	shell fragments, porc pebbles, with sl sticky easily soluble lt gray
	10		10	80	clay, tr white marl.
	10		10	80	CLAYSTONE: Mod grnsh gray, tr orngsh gray, silty, sl micaceous,
				100	w/abndt shell, tr porc pebbles, carb spks, with white calcite/marl.
				100	CHERT: Brownish gray, sl crystalline, sl glassy in part, intbdd
				100	with sl greenish med gray claystone & abndt shell fragments.
	10	20	70		CLAYSTONE: Med gray, mod green in part, platy, brittle.
		10	90		SAND: Mostly clear, tr white, mostly v-fn to med, rnded-sunrnded,
		10	90		sl sorted, tr shell frag, w/easily solubl lt gray clay.
		10	90		CLAYSTONE: Med gray, mnr green, platy, brittle, with lt gray sl sticky
		10	90		well hydrated clay, v-fn sand, sl silty, tr shell fragments.
		30	70	Image 570'-710'	SILTY CLAY: Lt gray silt interbedded with lt gray mostly sl sticky
		30	70		clay, no shell frag, tr porcelanite, sl micaceous, mnr carb speks,
			100		with med to med dark gray brittle claystone.

Well Name: SBWM MW-2	**Martin B. Feeney** *Consulting Hydrogeologist*	PUEBLO water resources
Owner: Seaside Basin Water Master		
Location: Fort Ord Dunes State Park, Bunker 11; 36º 38' 46"N, 121º 49' 46"W		
Date: Aug 06 - 07 & Aug 09 - 10, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**	
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersoll-Rand TH-60**	**Fluid: Bentonite**



Grain Size Distribution				Rig Activity, Bit Sizes, Mud Additives & Properties	
% Gravel	% Coarse	% Medium	% Fine		
			100		CLAY: Med gray, stiff, well indurated, silty in part, intbdd with med gray to mnr yelsh orange firm claystone, tr shell & vfn grned sand.
			100		CLAY: Med gray, lt orangish gray, well indurated, forming chunks renderring its appearance as brittle mudstone, abundant shell fragments & dark gray fine lithic grns @ 700'; w/v-fn sand/silt.
		20	80		
		10	90		SILT/SILTY CLAY: Lt gray, orange, micromicaceous, intbdd with lt gray clay, carb spks/lithic grns, some shell fragments.
	10	30	60		SAND: Clear, orange, tr green, mostly med o fine, rounded, with abndt white marly clay, sl silty, abndt shell frag, tr cherty porc, some carb spks.
	10	70	20		
		10	90		
		10	90		CLAYSTONE: Sl orngish gry, med gry, lt grnsh gry, intbdd w/orng reddish gray & lt gray silt and v-fn sand, platy, abndt carb spks.
		70	30		SAND: Clear, lt gray, orange, reddish gray, dark gray lithic grns, predom med to fine, abundant white marly flakes/clay, intbdd with mod greenish gray brittle claystone.
		70	30		
		40	60	Image 720'-860'	
		30	70		
		20	80		SAND: Lt gray, red clear, orange, dark gray lithics, predom fine to med, intbdd w/mod greenish gray claystone & lt gray clay.
	10	10	80		SILTY SAND: Lt gray, red, clear, orange, mostly fine to mnr med, abndt dark gray lithics & black carb spks, some porc & tr cherty porc, with mod greenish gray & yelsh orange claystone.
		50	50		
		40	60		
	10	40	50		
		40	60		CLAYSTONE: Sl greenish med dark gray, mod yelsh orng, shaly in part, firm to mod hard, platy, sl calc in part.
					SHALY CLAYSTONE: Mostly sl greenish med dark gray, med gray, yellowish orange in part, tr dark gray, platy, shaly in part, mod to v-hard, fissile, some shell & porc.
	20	20	60		
	20	20	60		
	10	30	60		CLAYSTONE: Mostly sl greenish med dark gray, med gray, occ yellowish orange, platy, firm to mod hard, shaly in part, abndt dark gray lithic grns, tr shell fragments.
		50	50		
		70	30		
		70	30		CLAYSTONE: Lt greenish gray, med gray, mnr, yellowish orange, brittle, firm, platy, intbdd w/lt gray clay.
				Image 870'-1010'	
		80	20		CLAYSTONE: Predom med greenish gray, increase in yellowish orange claystone, firm to mod hard, with med clear sand.
		80	20		
		80	20		SAND: Clear, mnr green, predom med to fine, rounded.
		70	30		CLAYSTONE: Sl greenish gray, med dark gray, orangish gray, mnr yellowish orange, brittle to mod hard, abundant marly flakes @ 1000', someshell frag.
		70	30		
		70	30	RIH w/New Bit	
		70	30		CLAYSTONE: Sl greenish med dark gray, orangish gray, increase in yelsh orng frag, tr marl flakes, brittle to mod hard, some shell.
		70	30		SAND: Clear, tr green, pred med -fn, rnded, mod sorted, unconsol.
		70	30		
		60	40		CLAYSTONE: Sl greenish med dark gray, mod yellowish orange, increase in shell frag, brittle to mod hard, platy, intbdd with mostly fine to med clear & tr green qtz grains.
		60	40		
		50	50	Image 1020'-1160'	
		50	50		CLAYSTONE: Predom med grnsh gray, tr yelsh orange & orangish gray, saturated with white shell fragments @ 1110', tr porcelanite.
		60	40		
		60	40		SAND: Clear, predom med to fine, subrnded to rnded, tr porc, intbdd with med greenish gray claystone, some shell frag, mod well sorted, some med size carb fragments.
		60	40		
		80	20		
		80	20		
		80	20		CLAYSTONE: Med grnsh gray, mnr yelsh orng, brittle to mod hard, shaly in part, platy/tabular, tr shell, occ brnsh gray chert.
		80	20		SAND: Clear, pred med to fine, subrnded-rnded, mod well sorted, tr shell fragments.
		80	20		
		80	20		CLAYSTONE: Mostly mod greenish med dark gray, mnr yelsh orang & orngsh gray, platy/tabular, tr shell frag.
		30	70		CLAY: Light gray, soft, poorly sticky, well hydrated, tr marl.
		50	50		CLAYSTONE: Predom med greenish gray, yellowish orange, mnr orangish gray, platy/tabular, brittle to mod hard, intbdd with lt gray clay, tr shell frag.
		50	50		
		40	60	Image 1170'-1310'	
		30	70		SAND: Mostly clr, tr wht, abndt lithics, fine-med, rnded, well srtd.
		40	60		CLAYSTONE: Med grnsh gray, mnr yelsh orng, platy, some marl.
		40	60		SAND: Predom clear, tr green & wht, med to fine, rnded-subrnded, well sorted unconsol, increase in marly flakes & clay, med greenish gray claystone, some shell.
		70	30		
		80	20	Rig Chatter	

Well Name: SBWM MW-2

Owner: Seaside Basin Water Master

Martin B. Feeney
Consulting Hydrogeologist

PUEBLO water resources

Location: Fort Ord Dunes State Park, Bunker 11; 36º 38' 46"N, 121º 49' 46"W

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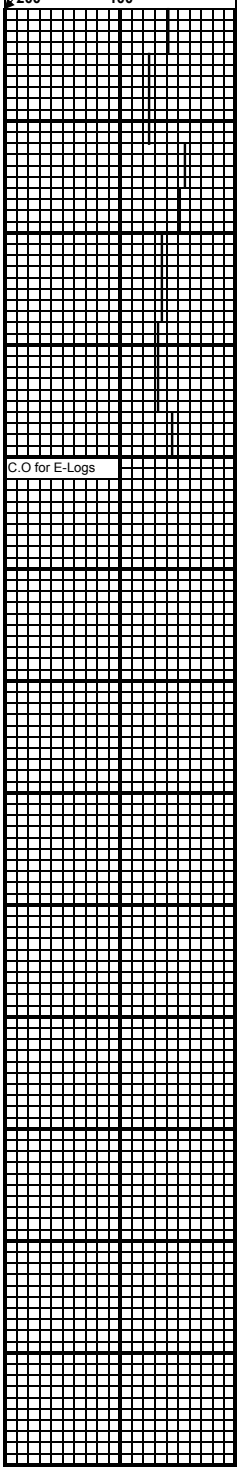
Rig: Ingersoll-Rand TH-60

Fluid: Bentonite



% Gravel	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	
		80	20	Rig Chatter	CLAYSTONE: Predom med greenish gray, tr yellowish orange, abndt white marly flakes & clay, platy, some shell.
		70	30		
		50	50		
		30	70		SAND: Clear, predom v-fine to fine, mnr med, rnded, well sorted, unconsol, intbdd w/med grnsh gray & mnr yelsh orng claystone.
		90	10		CLAY: Lt gray, soft, sticky, mod hydrated, with greenish gray claystone & med grained qtz.
		90	10		
		90	10		
		70	30	Image 1320'-1460'	CLAYSTONE: Med greenish gray, mnr yellowish orange, with med gray silt, carb speks & light gray clay.
		90	10		CLAYSTONE: Med greenish gray, mnr yellowish orange, with lt gray soft clay & med grained sand, mod hard, some shell frag.
		90	10		
		80	20		CLAY: Lt gray, silty in part, soft, mod sticky, mod soluble, non calcareous, w/med greenish gray claystone.
		80	20		
		80	20		CLAYSTONE: Med greenish gray & yellowish orange, non calc, platy, mod hard, some shell.
		80	20		
		70	30	Image 1470'-1500'	CLAYSTONE: Med grnsh gray & yelsh orange, mod hard to brittle, tr porc, some shell frag.
					CLAY: lt grnsh gray, grading to mod grnsh gray, soft, mod sticky.
					Reached TD (1500') @ 1430 Hrs on 8/10/07.


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
60' - 230'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
240' - 410'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
420' - 560'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
570' - 710'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
720' - 860'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
870' - 1010'

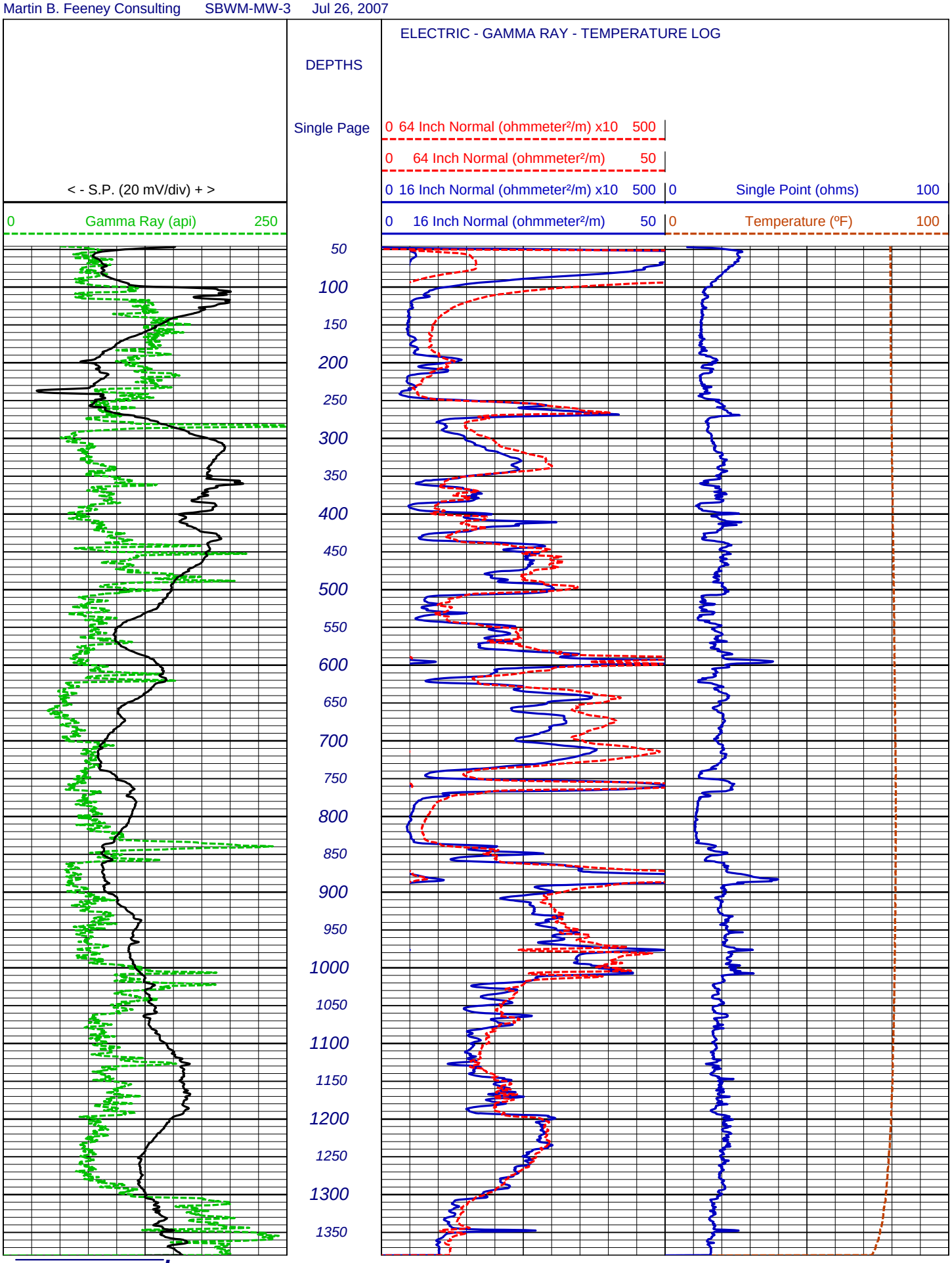

SEASIDE BASIN WATER MASTER
MONITORING WELL 2
1020' - 1160'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
1170' - 1310'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
1320' - 1460'


SEASIDE BASIN WATER MASTER
MONITORING WELL 2
1470' - 1500'

Martin B. Feeney Consulting SBWM-MW-3 Jul 26, 2007



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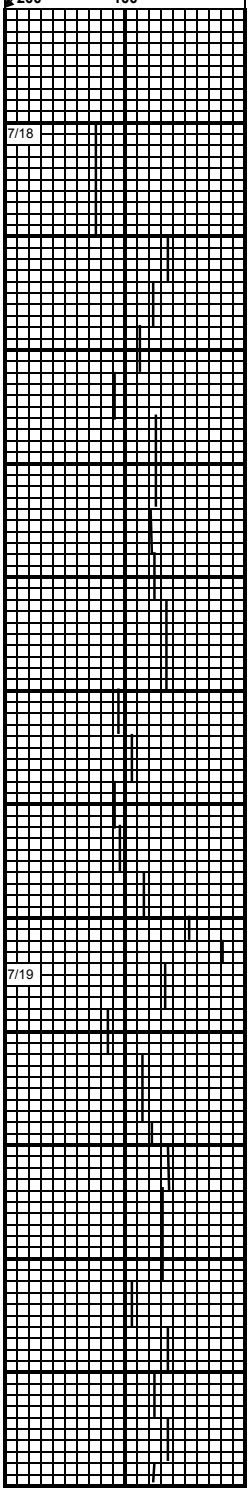
(Prepared with Log Print, a professional software application developed by welenco, inc.)

Well Name: SBWM MW-3	**Martin B. Feeney** *Consulting Hydrogeologist*
Owner: Seaside Basin Water Master	
Location: Fort Ord Dunes State Park, Bunker 1; N 36º 38' 32.0", W 121º 49' 55.4"	
Date: July 18 - 19 & 24 - 27, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersoll-Rand TH-60** / **Fluid: Bentonite**



% Gravel	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
					Commence logging on 7/18/07 @ 0740 Hrs
	20	50	30		SAND: Clear to frosted, orange, lt gray, Fe stained grains, predom med to coarse, abundant dark gray lithic grains, unconsolidated.
	20	80			
	40	60			SAND: Clear, frosted, orange, white, mostly coarse to medium grained, coarse dark gray lithic grains, Fe stained, subrnded to rounded, mnr subang, unconsolidated.
30	20	40	10		
20	30	40	10		
30	30	40			CLAY: Mod yellowish orange, lt grayish yellow, interbedded with coarse sand grains & lithic fragments, soft sticky, non to slightly soluble, poorly hydrated, well indurated in part.
20	60	20			
10	80	10			
20	70	10		Image 60'-230'	CLAY: Mod yellowish orange, lt grayish in part, soft, mod sticky, sl to mod soluble, mod hydrated, mod indurated in part, interbed-
	60	30	10		ded with med- crse orng, frosted & drk gry subrnd-rnded qtz grns.
	40	60			CLAYSTONE: Greenish gray, firm, crumbly, subblocky, mnr subplaty interbedded with mod yellowish orange sticky clay.
	30	70			
		100			CLAY: Lt gray, yellowish orange in part, easily to mod soluble, mod mod hydrated, interbedded with claystone easily crumbly in touch.
	30	70			CLAYSTONE: Greenish gray, tr yellowish orange, subblocky, mnr subplaty, firm to mod hard, interbdd with mod sticky clay.
					CLAY: ILt gray, yellowish orange, mod stiff, mod to v-sticky, mod to poorly soluble, poorly hydrated.
25	35	40			SAND: Mostly frosted, clear, white, orange, mostly crse, subang to ang, subrnded, mnr white porcelanite, tr porc chert, Fe-stained.
25	55	20			
30	50	20			SAND: Mostly clear, mnr orng & white, tr red, Fe-stained, subang to sunrnded, porcelanite in part, tr white to orange porc chert.
10	50	40			
10	50	40			CLAY: Lt gray, soft, easily-mod soluble in part, tr sticky, intbedded with clear sand & greenish gray claystone, tr carb spks.
10	50	40			
10	90				CLAY: Lt gray, mnr greenish gray, soft, slight to mnr mod sticky, easily to mod soluble in part, mnr silty, intbdd with greenish gray claystone & tr white gravel.
10	90			Image 240'-410'	
20	40	40			
	60		40		SILT: Lt gray, micromicaceous, abundant carbonaceous spks.
20	40	40			SAND: Predom frosted, mnr white, orange, predom med to crse, abundant porcelanite, subrounded to subangular.
20	20	40	20		
20	40	30	10		CLAYSTONE: Mod greenish gray, mnr yellowish orange, subblky, firm to mod hard, interbedded with clear to white crse qtz grains.
10	90				
10	90				CLAY: Lt gray, greenish gray, mod to v-sticky, soft, sl soluble, well indurated, tr shell frag @ 400'.
20	80				PEBBLY SAND: Wht, lt orngsh, rnded, intbdd w/grnsh gray-yelsh orng mod hard clystn; tr white clay, abndt shell frag (400' - 420').
30	80				CLAYSTONE: Mod greenish gray, mod yellowish orange, platy, easily crumbly, tr shell fragments.
					CLAY: Lt gray, mod sticky, stiff, well indurated.
	40	60			CLAYSTONE: Mod greenish gray, mod yelsh orange, platy, intbdd with black/drk gray rnded lithic grns & frstd crse sand; abundant shell frag @ 460'; easily crumbly.
				Image 420'-590'	CLAYSTONE: Mod grnsh gray, mod yelsh orng, grysh orng in part, platy-subplaty, subblky in part, large frag in size, intbdd w/lt gray indurated sticky clay in part and tr white pebbly grns; tr shell.
					CLAYSTONE: Mod greenish gray, mod yelsh orange, mnr lt gray, platy-subplaty, mnr subblky, large fragments in size, abndt shell.
					CLAY: mod greenish gray, c-stiff, v-sticky, tr shell fragments.
					CLAY: Lt greenish gray, mod stiff, mod to v-sticky, occ shell frag, intbdd w/mod greenish gray & mnr yelsh orange claystone.
					CLAY: Lt greenish gray, lt gray, mod stiff, mod to v-sticky, increase in shell fragments.
	20	80			SAND: Clear, orange, mostly med-crse, subrnded-rnded, subang, intbdd w/greenish gray claystone, abndt shell fragments.
	30	50	20		
	10	80	10		CLAYSTONE: Lt greenish gray, mnr mod yellowish orange, platy, mod hard, intbdd with med-crse qtz & dark gray lithic grains.
10	10	70	10		
10	10	80			CLAYSTONE: Lt greenish gray, med gray, sl bluish, yelsh orng, mostly platy, mnr subblky, mod hard, intbdd with medium to crse subrnd to sub ang sand grns; abundant shell fragments.
	20	70	10		
	10	90			

Well Name: SBWM MW-3

Owner: Seaside Basin Water Master

Location: Fort Ord Dunes State Park, Bunker 1; N 36º 38' 32.0", W 121º 49' 55.4"

Date: July 18 - 19 & 24 - 27, 2007

Loggers: Martin Feeney, Michael Burke, Raju Bhupathi

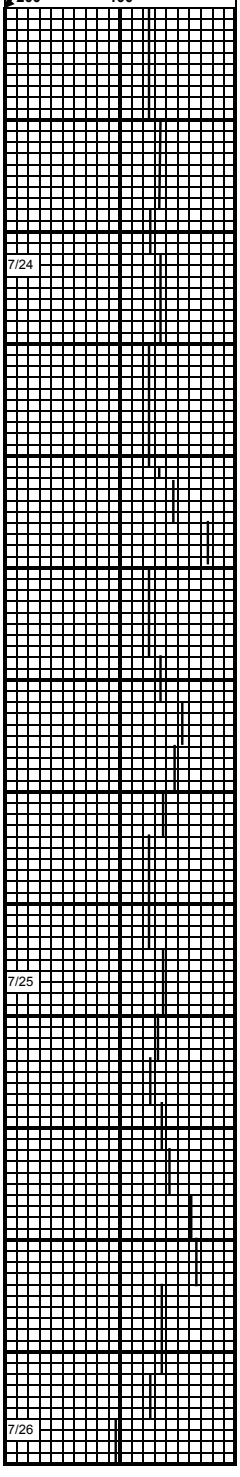
Drilling Co.: Bradley and Sons, Inc.

Rig: Ingersoll-Rand TH-60

Fluid: Bentonite

Martin B. Feeney
Consulting Hydrogeologist

PUEBLO water resources



% Gravel	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
	10	90		Image 600'-770'	CLAYSTONE: Med gray, grading to light greenish gray, yellowish orange, larger fragments in size, platy-subplaty, tr shell fragments.
	10	90			
	10	90			
	10	90			
10	10	80			CLAYSTONE: Lt to med greenish gray, mnr mod yellowish orange fragments, platy, mod to very hard, tr shell fragments.
		100			
		100			
		100			CLAYSTONE: Lt to med greenish gray, med gray, mod yellowish orange, platy, mod to v-hard, intbdd w/lt gray mod sticky clay & med grained sand.
		100			
		100			
	40	50	10		CLAY: Med gray, mnr lt gray, soft, mod to v-sticky, with medium gray to lt greenish gray claystone.
	50	40	10		CLAYSTONE: Med gray, sl greenish, brittle to mod hard, platy, non calc, with clear, orange & brown crse to med qtz possibly
	20	80			from upper hole, med gray sticky well indurated clay.
	20	80			
		100			CLAY: Lt greenish gray, stiff, c-sticky, well indurated, with slight greenish gray claystone & tr yelsh orange claystone; tr shell frag.
		100			
		100			CLAYSTONE: Lt greenish gray, platy, mod to v-hard
		60	40		claystone/shale, with orange & brown med sand grains.
		20	80	Image 780'-950'	SAND: Green, clear, tr orange & brown, med - fine qtz grains,
		30	70		rounded to subrounded; with lt gray soft clay.
		30	70	Rig Chatter	LIMESTONE: White, with sharp edges, slightly-mod hard, tr v-hard,
		40	50	Rig Chatter	fine to med, claystone grading to med dark gray.
10		50	40		SAND: predom clr, tr orng & brn, tr green, predom med to fine, wht
10		60	30		to sl orngsh pebbles in part, with abndt white limeston & marl.
		60	40	Slight Rig Chatter	CLAYSTONE: Mostly med dark gray, mnr mod grayish orange,
		30	70		platy, larger fragments, brittle, mod hard..
		30	70		SAND: Mostly clr, mnr brn, ornge, green & blue, predom fine-med,
		20	80		rnd-sunrnd, w/med dark gry & yelsh orng claystone, tr white marl.
		20	80	Rig Chatter	CLAYSTONE: Med gray, mnr yelsh orng, grading to grnsh gray,
		20	80		platy, firm-mod hard, abndt limestone & clear sand.
		20	80		SAND: Mostly clear, mnr brown, green, blue, lt gray, vfn to med,
		40	60		rounded to subrounded; abundant limestone interbeds.
		40	60		CLAYSTONE: Mod greenish gray, mnr yelsh orng, tr grysh orng,
		40	60	Rig Chatter	mod hard, platy, decrease in limestone.
		40	60		CLAYSTONE: Lt grnsh gray, grading to med dark gray, yelsh orng
		40	60	Rig Chatter	shaly frag, platy, firm-mod hard, with abndt marl, shell frag, tr porc.
10		30	60	Image 960'-1130'	SAND: Mostly clear, mnr orange, brown, white, tr green, mnr black
10		30	60		to dark gray lithics, mostly vfn-med, rnded, with tr wht & orngsh
10		40	50		wht porc chert pebbles, tr brownish gray glassy chert, abndt
10		40	50		limestone & shell fragments.
10		30	60		CLAYSTONE: Mod greenish gray, mnr yelsh orange, shaly frag,
10		60	30		platy, abndt shell fragments, orngsh white porc chert & limestone.
		60	40		SAND: Mostly clear, white, mnr green, brown, mostly vfn-med, wht
			100		to sl orngsh wht porc chert pebbles in part, occ shell.
10			90		CLAY: Lt gray, v-soft, sl-mod sol,uble, well hydrated, sl sticky.
10			90		CLAYSTONE: Sl greenish gray med dark gray, mnr yelsh orange,
10			90		platy, firm to mod hard, brittle, tr shell fragments, occ lt brownish
10			90		white cherty porcelanite pebbles.
10			90		CLAYSTONE: Sl greenish gray, med dark gray, mnr yelsh orange
		30	70		calc frag, platy, non calc; with clear, brown & tr green qtz grains,
		30	70		with shell fragments & black lithic grains.
		40	60		SAND: Mostly clear, mnr brown, orange, tr green, subrnded-rnded,
		30	70		mnr subang, tr brownish wht cherty porcelanite, w/shell frag.
		40	60		CLAYSTONE: Greenish med dark gray, increase in yellowish orng
		50	50	Image 1140'-1310'	calc frag, platy, brittle, mod hard, with cherty porcelanite &
		40	60		porcelanite; mnr white marl.
		40	60		CLAY: Predom white, lt gray, soft, non calc, with clear brown,
		40	60		orange qtz, white porcelanite, tr sl orngsh/brown wht cherty porc.
		60	40		CLAYSTONE: Mod greenish gray, mnr yellowish orange & grayish
		70	30		orange, calc in part, platy, brittle; with cherty porcelanite,
		60	40		decrease in white clay; with lt gray clay & shell fragments.
				New Bit	
		70	30		SAND: Clear, increase in brown, subrnd-subang.

Well Name: SBWM MW-3	**Martin B. Feeney** *Consulting Hydrogeologist*	PUEBLO water resources
Owner: Seaside Basin Water Master		
Location: Fort Ord Dunes State Park, Bunker 1; N 36º 38' 32.0", W 121º 49' 55.4"		
Date: July 18 - 19 & 24 - 27, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**	
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersoll-Rand TH-60**	**Fluid: Bentonite**

Drilling Rate (feet/hour) 200 100	Lithology % Sand Concentration 0 50 100	% Gravel	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
1300				70	30		CLAY: Lt green, mnr lt gray, v-soft, mod soluble.
				70	30		
				70	30		CLAY: Lt - med green, greenish dark dark brown, sl yellowish,
				70	30	Image 1320'-1370'	v-soft, mostly non-cohesive, sticky.
1350				60	40		SAND: Brown, clear, v-fine to med, tr cherty porcelanite.
				70	30		CLAY: Lt-med green, greenish dark brown, sl yelsh, v-soft,
C.O to run E-Logs				70	30		non-cohesive, sticky.
1400							Reached TD (1370') @ 1615 Hrs on 7/26/07.

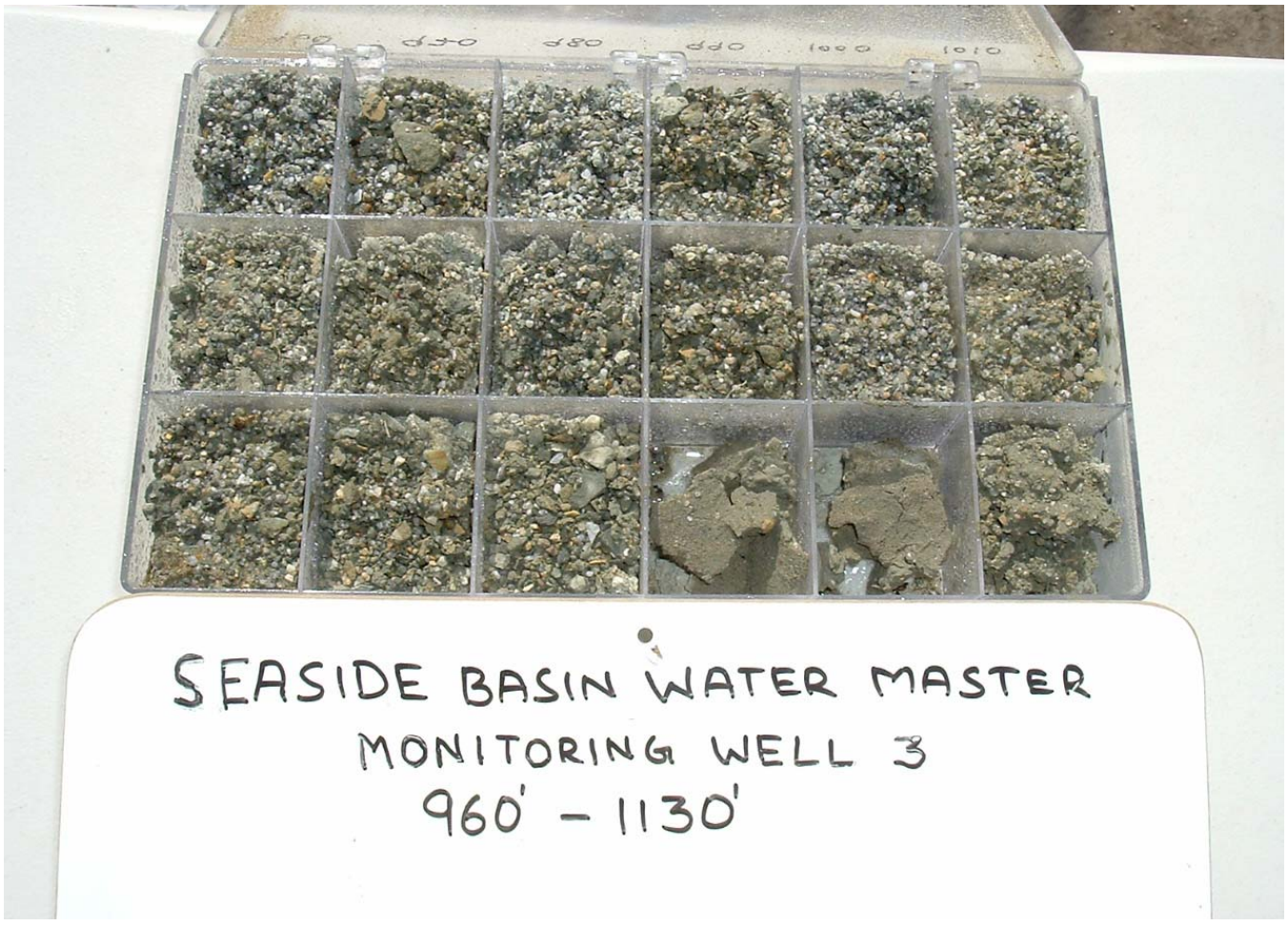

SEASIDE BASIN WATER MASTER
MONITORING WELL 3
60' - 230'


SEASIDE BASIN WATER MASTER
MONITORING WELL 3
240' - 410'

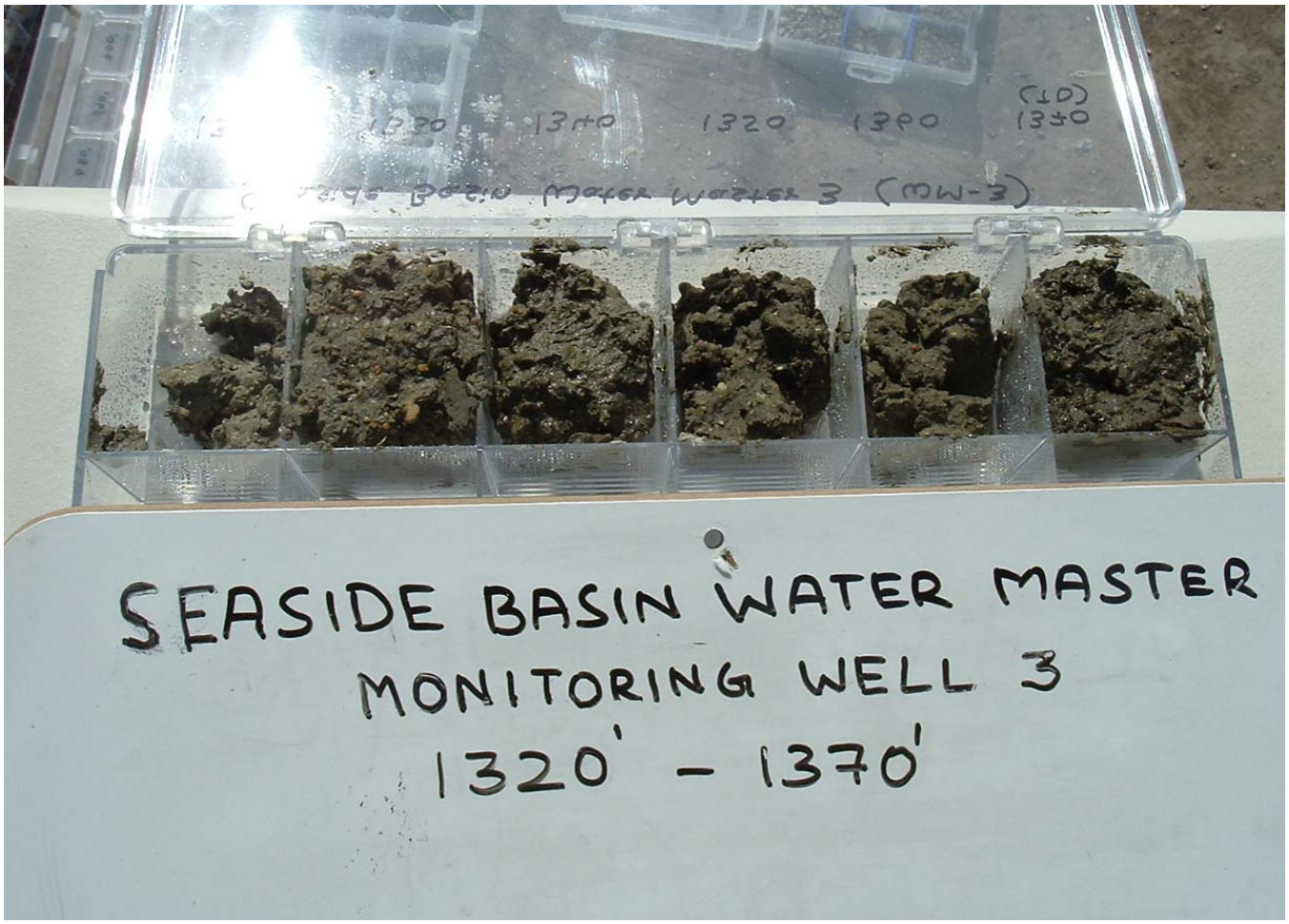

SEASIDE BASIN WATER MASTER
MONITORING WELL 3
420' - 590'


SEASIDE BASIN WATER MASTER
MONITORING WELL 3
600' - 770'

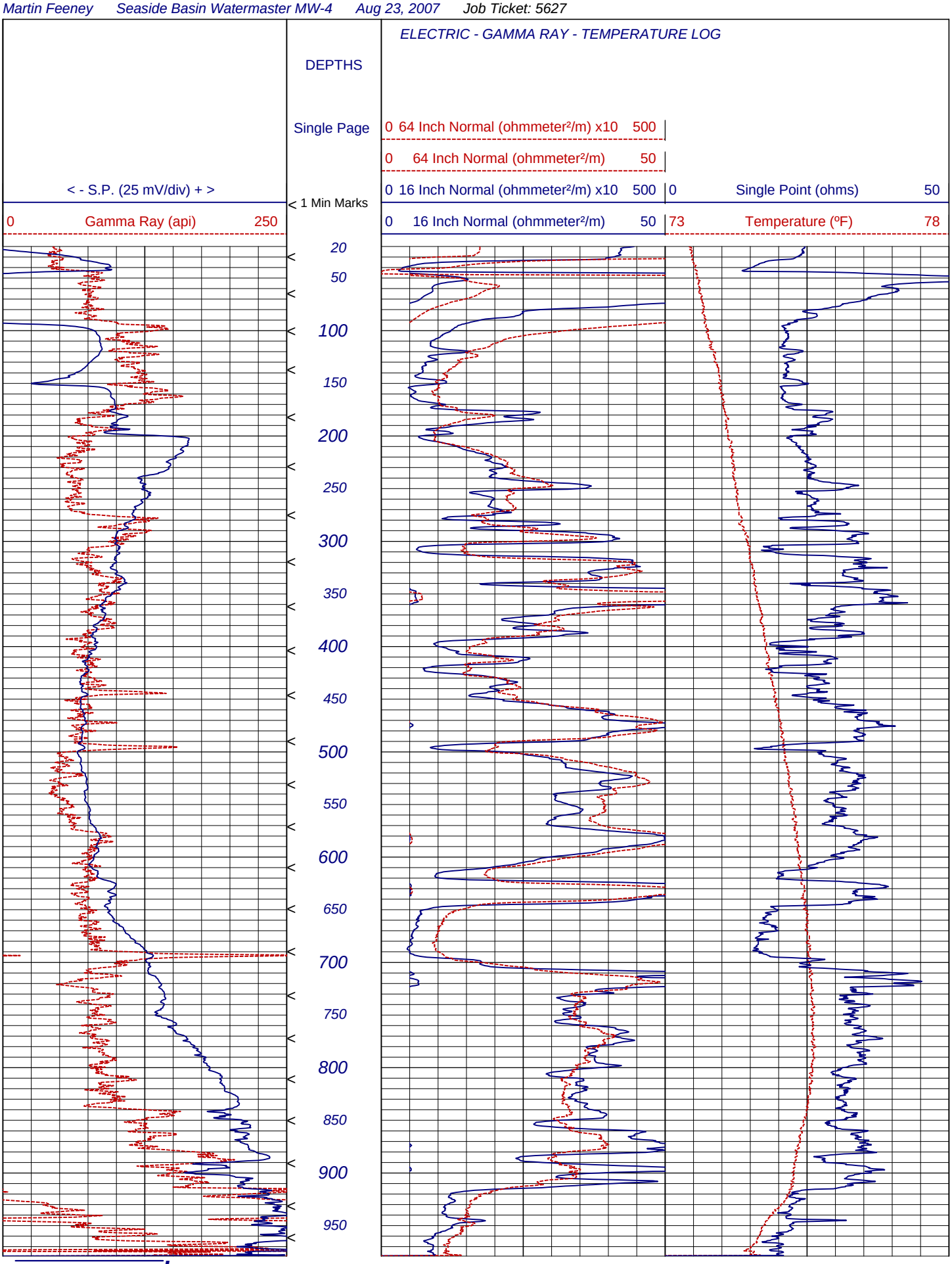

SEASIDE BASIN WATER MASTER
MONITORING WELL 3
780' - 950'


SEASIDE BASIN WATER MASTER
MONITORING WELL 3
960' - 1130'


SEASIDE BASIN WATER MASTER
MONITORING WELL 3
1140' - 1310'


SEASIDE BASIN WATER MASTER
MONITORING WELL 3
1320' - 1370'

Martin Feeney Seaside Basin Watermaster MW-4 Aug 23, 2007 Job Ticket: 5627



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(Prepared with Log Print, a professional software application developed by welenco, inc.)

Well Name: SBWM MW 4

Owner: Seaside Basin Water Master

Location: Fort Ord Dunes State Park, Lift Station; 36º 37' 47" N, 121º 50' 23" W

Date: Aug 20 - 23, 2007

Loggers: Martin Feeney, Michael Burke, Raju Bhupathi

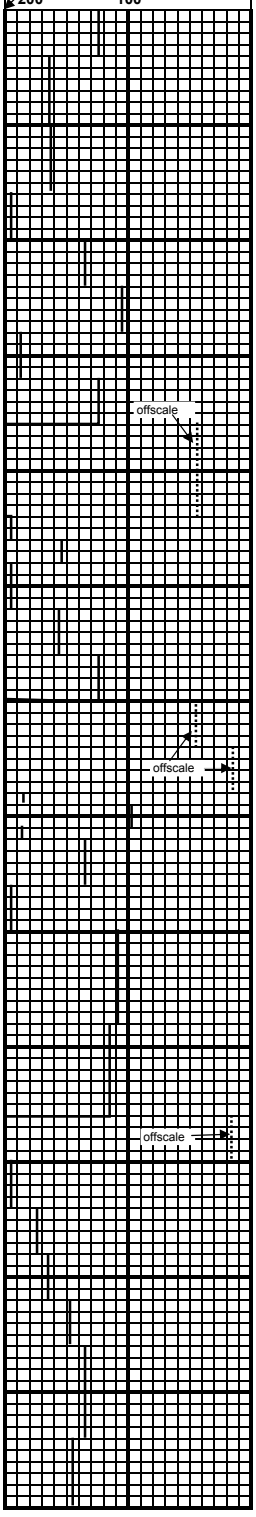
Drilling Co.: Bradley and Sons, Inc.

Rig: Ingersoll-Rand TH-60

Fluid: Bentonite

Martin B. Feeney
Consulting Hydrogeologist

PUEBLO water resources



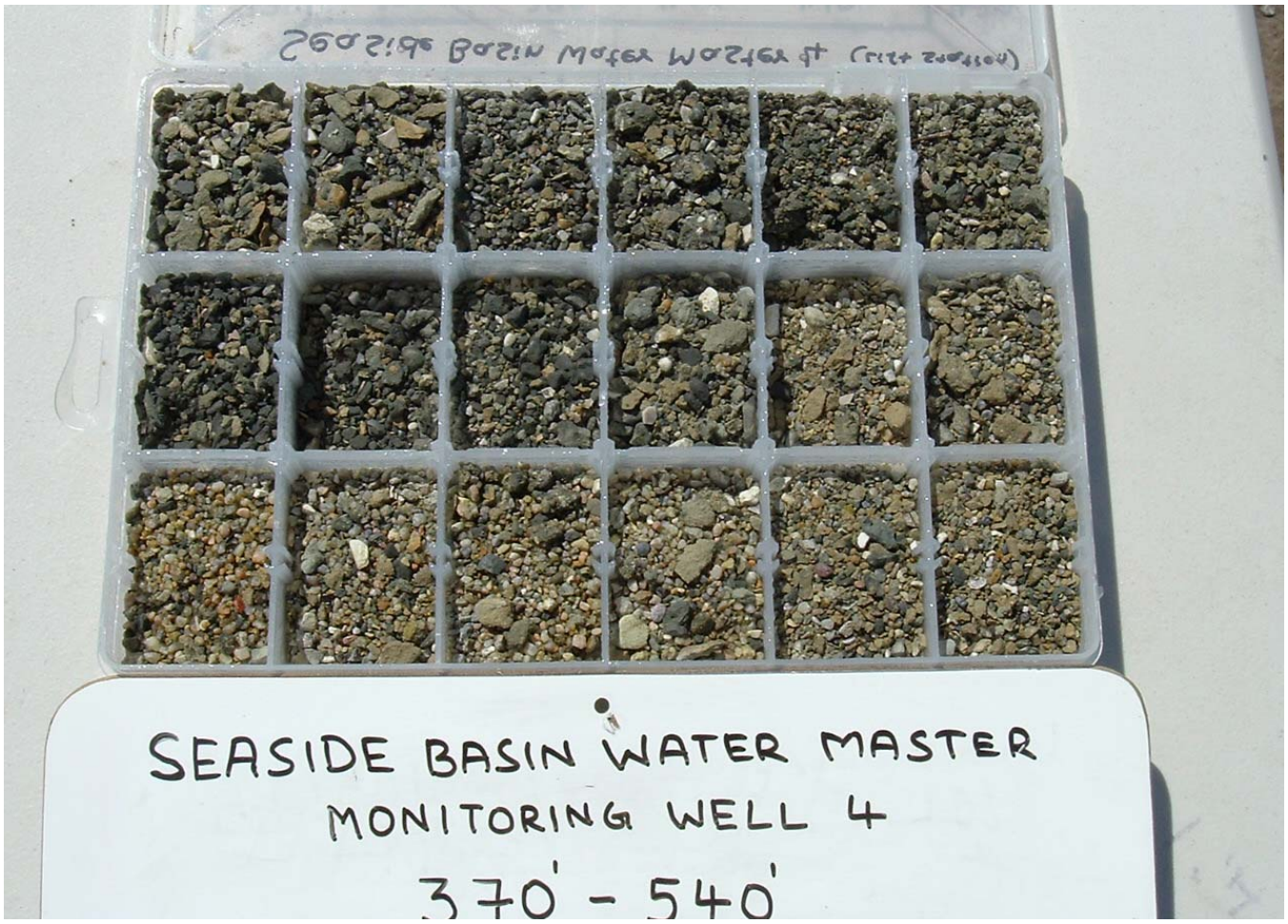
Depth	% Gravel	% Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
0			10	90		Commence Logging @1245 Hrs on 08/20/07
			10	90		SAND: Clear, frosted, orange, brown, predom fine to med, subrnd
			20	80		to rnded, mnr subang, well sorted, unconsol qtz grns, Fe stained.
	5	5	30	60	I	
50			20	80		SAND: Frosted, clear, brown, orange, lt gray, predom fine to med,
			20	80		subrnded to rnded, mod sorted, unconsol, increase in carb
			20	80		specks & dark gray lithic grains.
	20	40	40		Image 0'-180'	SAND: Clear, white, orange, brown, predom med to fine, dark gray
100	30	50	20			lithic grains.
		100				SAND: Clear, brown, orange, predom crse to v-crse, abundant
		100				large shell fragments, @ 100', dark gray & black lithics grains,
		60	40		Mud spill from drill stem during	with light gray indurated clay & mod hard claystone.
	10	70	20		connection. Added Gel & Liqui tro	CLAY: Sl orangish yellow, lt gray, soft, well indurated i.p., sticky,
150		30	70		" " "	w/lt grnsh mod gray claystn & med grayish orng shale, non calc.
			100			CLAYSTONE: Mod grnsh gry, orngsh gry, platy/tabular, mod hard.
		40	60			CLAY: Sl orangish yellow, stiff, v-sticky, poorly hydrated, mod
		40	60			indurated, chunky, w/orngsh gray mod hard claystn & white porc.
		80	20			CLAYSTONE: Med gry, mnr orngsh gry, tabular, mod hard, tr porc.
200		90	10			PORCELANITE: White, med to v-crse, rnded to subang, cherty in
		90	10		Image 190'-360'	part, intbdd /lt orngsh yellow to lt gray clay & crse sand.
		60	10	20		SAND: Clear, white, tr red & green, predom crse, rnded to mnr
	10	60	10	10		subrnded, well sorted, dark gray lithic grains, with abndt white
	20	60	10	10	Rig Chatter	porc and grayish yellow mod sticky clay, tr reddish gray chert.
250		70	20	10		PORCELANITE: White, tr orange, pebbly, rnded, tr cherty porc
		70	20	10	Rig Chatter	& tr reddish gray glassy chert, intbdd with orngsh/graysh yel
		70	20	10	Rig Chatter	mod sticky clay, with mostly clear & tr green crse qtz grains.
			100		Rig Chatter	CLAY: Mod yellowish orng, tr grayish orng, soft, sticky, with
300						predom crse-med qtz claystone & porc carb specks.
						SAND: Clear, wht, tr grn, pred crse-mnr med, rnded, pred unconsol
						i.p compacted w/yelsh orng cly as matrix,abndt carb spks, tr mica.
						CLAYSTONE: Med dark gray, sl greenish in part, firm-mod hard,
					Rig Chatter	platy/tab, porc pebbles in part, tr clr qtz and minute tr greenish qtz.
350						CLAY: Sl orngsh yel, soft, mod to v-sticky i.p., cohesive, chunky.
					Rig Chatter	CLAYSTONE: Sl greenish med dark gray claystone & mudstone,
						firm, brittle-mod hard, v-hard i.p., abundant shell fragments @ 340'.
					Rig Chatter	CLAYSTONE: Sl greenish med dark gray, brittle to v-hard, abndt
400						shell fragments, shaly in part, tr porc chert, some limestone.
						CLAYSTONE: Sl greenish med gray, med gray, yelsh orng, grysh
						orange, brittle to v-hard, platy/tabular, with lt gray to yelsh orng
						clay & some shell frag, tr reddish gray chert, tr porcelanite.
		20	80			SAND: Clear, white, brown, predom med to crse, rnded to subrnd,
						mod sorted, mnr porc grns, tr shell, tr lime stone
450					Image 370'-540'	CLAYSTONE: Predom mod grrenish gray & med gray, mnr yelsh
						orng, & orngsh gray, brittle to mod hard, some shell fragments.
						CLAYSTONE: Greenish gray, med gray, mnr yelsh orng & grysh
						orng, mod hard, platy/tabular.
						CLAYSTONE: Predom grayish orange, & yelsh orange, decrease
						in greenish gray & med gray frag, with sl orangish/grayish yellow
	20	60	20		Slight Rig Chatter	clay, tr white marly clay, some shell.
500		60	30	10		SAND: Predom orange, mnr clear, brown, tr light greenish subrnd
	10	70	10	10		to rnded, sl sorted, tr orangish porcelanite, increase in black &
	10	70	10	10		dark gray crse lithic grns, unconsol.
		80	20			CLAYSTONE: Sl greenish gray, med gray, yelsh orange & grayish
		80	20			orange, platy smaller fragments.
550		10	70	20		CLAYSTONE: Predom grayish orange, & yelsh orange, mnr sl
		10	70	20		greenish gray & med gray, platy, mod hard-brittle, large size
			30	70		frag in part, with med grained sand & lt yelsh gray clay, tr porc.
			30	70		SAND: Clear, reddish gray, orange, tr lt green, rnded, predom v-fine
			40	60		to med, mod sorted, some dark gray lithic grains.
600			40	60		CLAYSTONE: Predom grayish orng & yelsh orng, mnr sl greenish
			40	60		med dark gray, platy/tabular, brittle to sl hard.
			40	60		CLAYSTONE: Mostly medium gray, sl greenish in part, mnr yelsh
					Image 550'-720'	orng, platy to sub-platy, sub-blocky, brittle to sl hard, grading to
						larger frag, tr fine qtz & porc.
650			40	60		CLAYSTONE: Med dark gray, med gray, sl greenish in part, platy.

Well Name: SBWM MW 4	**Martin B. Feeney** *Consulting Hydrogeologist*	PUEBLO water resources
Owner: Seaside Basin Water Master		
Location: Fort Ord Dunes State Park, Lift Station; 36º 37' 47" N, 121º 50' 23" W		
Date: Aug 20 - 23, 2007	**Loggers: Martin Feeney, Michael Burke, Raju Bhupathi**	
Drilling Co.: Bradley and Sons, Inc.	**Rig: Ingersoll-Rand TH-60**	**Fluid: Bentonite**

Drilling Rate (feet/hour) 200 100		Lithology % Sand Concentration 0 50 100	% Gravel	Grain Size Distribution % Coarse	% Medium	% Fine	Rig Activity, Bit Sizes, Mud Additives & Properties	Description of Lithology
offscale	650				40	60		CLAYSTONE: Med gray, yellowish orange, sl greenish in trace, platy, brittle-sl hard, mnr fine-med qtz.
								CLAYSTONE: Mostly med gray, mnr yelsh orng, greenish orng, grading to mod grnsh gray, platy, brittle-sl hard, small frag in size, mostly noncalc med gray frag & mod calc yelsh orng frag.
	700							CLAYSTONE: Mostly mod grnsh gray, mnr yellowish orng, platy, brittle-mod hard, v-hard in part, grading to large fragments.
				70	20	10		LIMESTONE: White, med to crse, frag with sharp edges, with
				60	30	10		med-crse clear qtz, mod hard, tr green qtz and med drk gry clystn.
	750			70	30			SAND: Mostly clear, tr green & brown, predom crse to med,
				80	20			well sorted, unconsol, rnded-subrnded, tr shell fragments.
								CLAYSTONE: Med dark gray, sl greenish in part, mnr yelsh orng,
				80	20		Sl Rig Chatter	brittle-mod hard, with crse-med qtz grns, tr porc chert.
				90	10			SAND: Mostly clear, mnr whitish, tr orange & green, predom crse
	800			90	10			to med, rnded, well sorted, w/porc grns & med dark gray clystn.
				90	10		Image 730'-900'	SAND: Mostly clear, tr green, orange white, predom crse-med,
				90	10			rnded, well sorted, with white & tr orngsh porc grns.
				80	10	10		CLAYSTONE: Mostly med dark gray, med greenish in part, mnr
				80	10	10		yelsh orng, brittle-sl hard, platy, tr porc, tr reddish gray chert.
				70	20	10		CLAY: Lt gray, lt orangish gray, soft, mod sticky, mod cohesive,
	850			70	20	10		sl soluble, tr cherty porc.
				40	50	10		SAND: Mostly clear, mnr green & white, tr orange, predom med to
offscale				40	50	10		crse, mostly rnded, mnr subrnd, ith mostly med dark gray and
				70	30			mnr yelsh orange & graysh orng claystone.
	900			70	30			SAND: Mostly clear, mnr wht, lt & mod green, tr orng, predom crse
				70	30			to med, rnd-subrnd, tr porc chert & lithics, s/sl grnsh gry claystn.
				70	30			SAND: Pred clr, mnr wht, green, tr orng, pred crse-med, unconsol
				70	30			abndt med-crse black carb spks, tr mod grnsh clay, tr lmstn/shell.
				70	30		Rig Chatter	CLAYSTONE: Med-drk grnsh gray, mod calc yelsh orng, brittle-mod ha
				60	40		Image 910'-980'	abundant med-crse carb spks, some shell.
	950			60	40			CLAY: Lt-med grnsh gray, sl brnsh i.p., soft, sticky, tr lithics and
								carb specks, sl petroleum odor from cuttings & sl oil in shaker.
C.O for E-Logs								CLAYSTONE: Mod greenish gray, yelsh orange, grayish orange,
								w/tr crse-med sand, brittle, platy.
	1000							Reached T.D @ 0825 Hrs on 08/23/07


SEASIDE BASIN WATER MASTER
MONITORING WELL 4
0' - 180'


SEASIDE BASIN WATER MASTER
MONITORING WELL 4
190' - 360'


SEASIDE BASIN WATER MASTER
MONITORING WELL 4
370' - 540'


SEASIDE BASIN WATER MASTER
MONITORING WELL 4
550' - 720'


SEASIDE BASIN WATER MASTER
MONITORING WELL 4
730' - 900'


SEASIDE BASIN WATER MASTER
MONITORING WELL 4
910' -980'

APPENDIX B - WATER QUALITY DATA

Laboratory Reports

Contents:

Composite Samples

SBWM #1-4

Depth-Specific Samples

SBWM #1 Depths 1140 and 1390 feet
SBWM #2 Depths 1000 and 1470 feet
SBWM #3 Depths 870 and 1275 feet
SBWM #4 Depths 715 and 900 feet

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Martin Feeney
P.O. Box 23240
Ventura, CA 93002

Wednesday, September 12, 2007

Lab Number: **AA41562**

Collection Date/Time:	9/4/2007	15:30	Sample Collector:	MARKS R
Submittal Date/Time:	9/6/2007	14:00	Sample ID	

Sample Description: MW-2, SGB WM Sentinel

Analyte	Method	Unit	**Result**	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**179**		10	9/10/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**218**		10	9/10/2007
Bromide	EPA300.0	mg/L	**0.43**		0.10	9/6/2007
Calcium	SM3111B	mg/L	**60**		1	9/10/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/10/2007
Chloride	EPA300.0	mg/L	**117**		1	9/6/2007
Fluoride	EPA300.0	mg/L	**0.25**		0.10	9/6/2007
Hardness (as CaCO3)	SM2340B	mg/L	**191**		10	9/10/2007
Iron, Total	SM3111B	ug/L	**430**		100	9/10/2007
Langlier Index (15 deg. C)	SM2330B		**0.70**			9/10/2007
Langlier Index (60 deg. C)	SM2330B		**1.29**			9/10/2007
Magnesium	SM3111B	mg/L	**10**		1	9/10/2007
Manganese, Total	SM3111B	ug/L	**29**		20	9/10/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/6/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/6/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05	9/6/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.2**			9/6/2007
Potassium	SM3111B	mg/L	**4.5**		0.5	9/10/2007
Sodium	SM3111B	mg/L	**94**		1	9/10/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**815**		1	9/10/2007
Sulfate	EPA300.0	mg/L	**38**		1	9/6/2007
Total Diss. Solids	SM2540C	mg/L	**486**		10	9/9/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
J = Result is less than PQL

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Martin Feeney
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Wednesday, September 12, 2007

Lab Number: **AA41564**

Collection Date/Time:	9/6/2007	12:30	Sample Collector:	MARKS R
Submittal Date/Time:	9/6/2007	14:00	Sample ID	

Sample Description: MW-3, SGB Sentinel

Analyte	Method	Unit	**Result**	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**125**		10	9/10/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**152**		10	9/10/2007
Bromide	EPA300.0	mg/L	**0.34**		0.10	9/6/2007
Calcium	SM3111B	mg/L	**33**		1	9/10/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/10/2007
Chloride	EPA300.0	mg/L	**93**		1	9/6/2007
Fluoride	EPA300.0	mg/L	**0.23**		0.10	9/6/2007
Hardness (as CaCO3)	SM2340B	mg/L	**103**		10	9/10/2007
Iron, Total	SM3111B	ug/L	**360**		100	9/10/2007
Langlier Index (15 deg. C)	SM2330B		**0.31**			9/10/2007
Langlier Index (60 deg. C)	SM2330B		**0.90**			9/10/2007
Magnesium	SM3111B	mg/L	**5**		1	9/10/2007
Manganese, Total	SM3111B	ug/L	**32**		20	9/10/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/6/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/6/2007
o-Phosphate-P	EPA300.0	mg/L	**0.08**		0.05	9/6/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.2**			9/6/2007
Potassium	SM3111B	mg/L	**4.2**		0.5	9/10/2007
Sodium	SM3111B	mg/L	**82**		1	9/10/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**620**		1	9/10/2007
Sulfate	EPA300.0	mg/L	**27**		1	9/6/2007
Total Diss. Solids	SM2540C	mg/L	**365**		10	9/9/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
J = Result is less than PQL

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Martin Feeney
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Wednesday, September 12, 2007

Lab Number: **AA41563**

Collection Date/Time:	9/5/2007	16:10	Sample Collector:	MARKS R
Submittal Date/Time:	9/6/2007	14:00	Sample ID	

Sample Description: MW-4, SGB WM Sentinel

Analyte	Method	Unit	**Result**	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**241**		10	9/10/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**294**		10	9/10/2007
Bromide	EPA300.0	mg/L	**0.70**		0.10	9/6/2007
Calcium	SM3111B	mg/L	**84**		1	9/10/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/10/2007
Chloride	EPA300.0	mg/L	**187**		1	9/6/2007
Fluoride	EPA300.0	mg/L	**0.30**		0.10	9/6/2007
Hardness (as CaCO3)	SM2340B	mg/L	**280**		10	9/10/2007
Iron, Total	SM3111B	ug/L	**813**		100	9/10/2007
Langlier Index (15 deg. C)	SM2330B		**0.74**			9/10/2007
Langlier Index (60 deg. C)	SM2330B		**1.33**			9/10/2007
Magnesium	SM3111B	mg/L	**17**		1	9/10/2007
Manganese, Total	SM3111B	ug/L	**90**		20	9/10/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/6/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/6/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05	9/6/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.0**			9/6/2007
Potassium	SM3111B	mg/L	**5.9**		0.5	9/10/2007
Sodium	SM3111B	mg/L	**128**		1	9/10/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**1150**		1	9/10/2007
Sulfate	EPA300.0	mg/L	**46**		1	9/6/2007
Total Diss. Solids	SM2540C	mg/L	**671**		10	9/9/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
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Martin Feeney
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Wednesday, September 26, 2007

Lab Number: AA41774

Collection Date/Time:	9/13/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/14/2007	8:50	Sample ID	

Sample Description: SBWM #1, 1140 feet

Analyte	Method	Unit	Result	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**81**		10	9/18/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**99**		10	9/22/2007
Calcium	SM3111B	mg/L	**20**		1	9/21/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/18/2007
Chloride	EPA300.0	mg/L	**64**		1	9/14/2007
Fluoride	EPA300.0	mg/L	**0.19**		0.10	9/14/2007
Hardness (as CaCO3)	SM2340B	mg/L	**58**		10	9/25/2007
Iron, Total	SM3111B	ug/L	**2570**		100	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.72**			9/24/2007
Langlier Index (60 deg. C)	SM2330B		**1.30**			9/24/2007
Magnesium	SM3111B	mg/L	**2**		1	9/21/2007
Manganese, Total	SM3111B	ug/L	**45**		20	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/14/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**9.0**			9/14/2007
Potassium	SM3111B	mg/L	**3.6**		0.5	9/21/2007
Sodium	SM3111B	mg/L	**67**		1	9/21/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**409**		1	9/14/2007
Sulfate	EPA300.0	mg/L	**26**		1	9/14/2007
Total Diss. Solids	SM2540C	mg/L	**256**		10	9/15/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
J = Result is less than PQL

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Martin Feeney
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Ventura, CA 93002

Wednesday, September 26, 2007

Lab Number: **AA41775**

Collection Date/Time:	9/13/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/14/2007	8:50	Sample ID	

Sample Description: SBWM #1, 1390 feet

Analyte	Method	Unit	**Result**	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**95**		10	9/18/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**116**		10	9/22/2007
Calcium	SM3111B	mg/L	**16**		1	9/21/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/18/2007
Chloride	EPA300.0	mg/L	**68**		1	9/14/2007
Fluoride	EPA300.0	mg/L	**0.18**		0.10	9/14/2007
Hardness (as CaCO3)	SM2340B	mg/L	**56**		10	9/25/2007
Iron, Total	SM3111B	ug/L	**3810**		100	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.18**			9/25/2007
Langlier Index (60 deg. C)	SM2330B		**0.78**			9/25/2007
Magnesium	SM3111B	mg/L	**4**		1	9/21/2007
Manganese, Total	SM3111B	ug/L	**112**		20	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/14/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.5**			9/14/2007
Potassium	SM3111B	mg/L	**4.5**		0.5	9/21/2007
Sodium	SM3111B	mg/L	**81**		1	9/21/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**471**		1	9/14/2007
Sulfate	EPA300.0	mg/L	**32**		1	9/14/2007
Total Diss. Solids	SM2540C	mg/L	**317**		10	9/15/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
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Martin Feeney
P.O. Box 23240
Ventura, CA 93002

Thursday, October 04, 2007

Lab Number: **AA42140**

Collection Date/Time:	9/24/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/25/2007	9:30	Sample ID	

Sample Description: SBWM Monitoring Well #2, 1000 ft

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**86**		10		9/25/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**105**		10		9/26/2007
Calcium	SM3111B	mg/L	**18**		1		9/25/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10		9/25/2007
Chloride	EPA300.0	mg/L	**67**		1	250	9/26/2007
Fluoride	EPA300.0	mg/L	**0.17**		0.10	2.0	9/26/2007
Hardness (as CaCO3)	SM2340B	mg/L	**53**		10		9/26/2007
Iron, Total	SM3111B	ug/L	**206**		100	300	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.11**				10/4/2007
Langlier Index (60 deg. C)	SM2330B		**0.71**				10/4/2007
Magnesium	SM3111B	mg/L	**2**		1		9/25/2007
Manganese, Total	SM3111B	ug/L	**Not detected**		20	50	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	45	9/26/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	1.00	9/26/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05		9/26/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.4**				9/25/2007
Potassium	SM3111B	mg/L	**3.4**		0.5		9/25/2007
Sodium	SM3111B	mg/L	**70**		1		9/25/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**421**		1	900	9/25/2007
Sulfate	EPA300.0	mg/L	**20**		1	250	9/26/2007
Total Diss. Solids	SM2540C	mg/L	**256**		10	500	9/27/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

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Martin Feeney
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Thursday, October 04, 2007

Lab Number: **AA42141**

Collection Date/Time:	9/24/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/25/2007	8:30	Sample ID	

Sample Description: SBWM Monitoring Well #2, 1470 ft

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**133**		10		9/26/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**162**		10		9/26/2007
Calcium	SM3111B	mg/L	**31**		1		9/25/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10		9/25/2007
Chloride	EPA300.0	mg/L	**74**		1	250	9/26/2007
Fluoride	EPA300.0	mg/L	**0.29**		0.10	2.0	9/26/2007
Hardness (as CaCO3)	SM2340B	mg/L	**102**		10		9/26/2007
Iron, Total	SM3111B	ug/L	**691**		100	300	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.32**				10/4/2007
Langlier Index (60 deg. C)	SM2330B		**0.92**				10/4/2007
Magnesium	SM3111B	mg/L	**6**		1		9/25/2007
Manganese, Total	SM3111B	ug/L	**109**		20	50	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	45	9/26/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	1.00	9/26/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05		9/26/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.2**				9/25/2007
Potassium	SM3111B	mg/L	**4.4**		0.5		9/25/2007
Sodium	SM3111B	mg/L	**74**		1		9/25/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**526**		1	900	9/25/2007
Sulfate	EPA300.0	mg/L	**26**		1	250	9/26/2007
Total Diss. Solids	SM2540C	mg/L	**308**		10	500	9/27/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

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Martin Feeney
P.O. Box 23240
Ventura, CA 93002

Wednesday, September 26, 2007

Lab Number: **AA41776**

Collection Date/Time:	9/13/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/14/2007	8:50	Sample ID	

Sample Description: SBWM #3, 870 feet

Analyte	Method	Unit	**Result**	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**85**		10	9/18/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**104**		10	9/22/2007
Calcium	SM3111B	mg/L	**19**		1	9/21/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/18/2007
Chloride	EPA300.0	mg/L	**60**		1	9/14/2007
Fluoride	EPA300.0	mg/L	**0.11**		0.10	9/14/2007
Hardness (as CaCO3)	SM2340B	mg/L	**56**		10	9/25/2007
Iron, Total	SM3111B	ug/L	**1320**		100	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**-0.17**			9/24/2007
Langlier Index (60 deg. C)	SM2330B		**0.42**			9/24/2007
Magnesium	SM3111B	mg/L	**2**		1	9/21/2007
Manganese, Total	SM3111B	ug/L	**21**		20	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/14/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**8.1**			9/14/2007
Potassium	SM3111B	mg/L	**3.9**		0.5	9/21/2007
Sodium	SM3111B	mg/L	**62**		1	9/21/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**410**		1	9/14/2007
Sulfate	EPA300.0	mg/L	**16**		1	9/14/2007
Total Diss. Solids	SM2540C	mg/L	**270**		10	9/15/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
J = Result is less than PQL

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Martin Feeney
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Wednesday, September 26, 2007

Lab Number: **AA41777**

Collection Date/Time:	9/13/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/14/2007	8:50	Sample ID	

Sample Description: SBWM #3, 1275

Analyte	Method	Unit	**Result**	Qual	PQL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**216**		10	9/18/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**264**		10	9/22/2007
Calcium	SM3111B	mg/L	**50**		1	9/21/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10	9/18/2007
Chloride	EPA300.0	mg/L	**163**		1	9/14/2007
Fluoride	EPA300.0	mg/L	**0.21**		0.10	9/14/2007
Hardness (as CaCO3)	SM2340B	mg/L	**170**		10	9/25/2007
Iron, Total	SM3111B	ug/L	**2550**		100	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.07**			9/24/2007
Langlier Index (60 deg. C)	SM2330B		**0.66**			9/24/2007
Magnesium	SM3111B	mg/L	**11**		1	9/21/2007
Manganese, Total	SM3111B	ug/L	**258**		20	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	9/14/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05	9/14/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**7.6**			9/14/2007
Potassium	SM3111B	mg/L	**7.9**		0.5	9/21/2007
Sodium	SM3111B	mg/L	**178**		1	9/21/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**1130**		1	9/14/2007
Sulfate	EPA300.0	mg/L	**110**		1	9/14/2007
Total Diss. Solids	SM2540C	mg/L	**686**		10	9/15/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
J = Result is less than PQL

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Martin Feeney
P.O. Box 23240
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Thursday, October 04, 2007

Lab Number: **AA42142**

Collection Date/Time:	9/24/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/25/2007	8:30	Sample ID	

Sample Description: SBWM Monitoring Well #4, 715 ft

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**235**		10		9/25/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**287**		10		9/26/2007
Calcium	SM3111B	mg/L	**66**		1		9/25/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10		9/25/2007
Chloride	EPA300.0	mg/L	**133**		1	250	9/26/2007
Fluoride	EPA300.0	mg/L	**0.22**		0.10	2.0	9/26/2007
Hardness (as CaCO3)	SM2340B	mg/L	**222**		10		9/26/2007
Iron, Total	SM3111B	ug/L	**241**		100	300	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.14**				10/4/2007
Langlier Index (60 deg. C)	SM2330B		**0.73**				10/4/2007
Magnesium	SM3111B	mg/L	**14**		1		9/25/2007
Manganese, Total	SM3111B	ug/L	**99**		20	50	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	45	9/26/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	1.00	9/26/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05		9/26/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**7.5**				9/25/2007
Potassium	SM3111B	mg/L	**6.3**		0.5		9/25/2007
Sodium	SM3111B	mg/L	**109**		1		9/25/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**977**		1	900	9/25/2007
Sulfate	EPA300.0	mg/L	**52**		1	250	9/26/2007
Total Diss. Solids	SM2540C	mg/L	**586**		10	500	9/27/2007

Sample Comments:

Report Approved by:

Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

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Martin Feeney
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Ventura, CA 93002

Thursday, October 04, 2007

Lab Number: **AA42143**

Collection Date/Time:	9/24/2007	0:00	Sample Collector:	FEENEY M
Submittal Date/Time:	9/25/2007	8:30	Sample ID	

Sample Description: SBWM Monitoring Well #4, 900 ft

Analyte	Method	Unit	**Result**	Qual	PQL	MCL	Date Analyzed
Alkalinity, Total (as CaCO3)	SM2320B	mg/L	**275**		10		9/25/2007
Bicarbonate (as HCO3-)	SM2320B	mg/L	**336**		10		9/26/2007
Calcium	SM3111B	mg/L	**73**		1		9/25/2007
Carbonate as CaCO3	SM2320B	mg/L	**Not detected**		10		9/25/2007
Chloride	EPA300.0	mg/L	**226**		1	250	9/26/2007
Fluoride	EPA300.0	mg/L	**0.25**		0.10	2.0	9/26/2007
Hardness (as CaCO3)	SM2340B	mg/L	**265**		10		9/26/2007
Iron, Total	SM3111B	ug/L	**320**		100	300	9/26/2007
Langlier Index (15 deg. C)	SM2330B		**0.22**				10/4/2007
Langlier Index (60 deg. C)	SM2330B		**0.81**				10/4/2007
Magnesium	SM3111B	mg/L	**20**		1		9/25/2007
Manganese, Total	SM3111B	ug/L	**217**		20	50	9/26/2007
Nitrate as NO3	EPA300.0	mg/L	**Not detected**		1	45	9/26/2007
Nitrite as NO2-N	EPA300.0	mg/L	**Not detected**		0.05	1.00	9/26/2007
o-Phosphate-P	EPA300.0	mg/L	**Not detected**		0.05		9/26/2007
pH (Laboratory)	SM4500-H+B	STD. Units	**7.5**				9/25/2007
Potassium	SM3111B	mg/L	**9.7**		0.5		9/25/2007
Sodium	SM3111B	mg/L	**172**		1		9/25/2007
Specific Conductance (E.C)	SM2510B	umhos/cm	**1375**		1	900	9/25/2007
Sulfate	EPA300.0	mg/L	**80**		1	250	9/26/2007
Total Diss. Solids	SM2540C	mg/L	**794**		10	500	9/27/2007

Sample Comments:

Report Approved by:

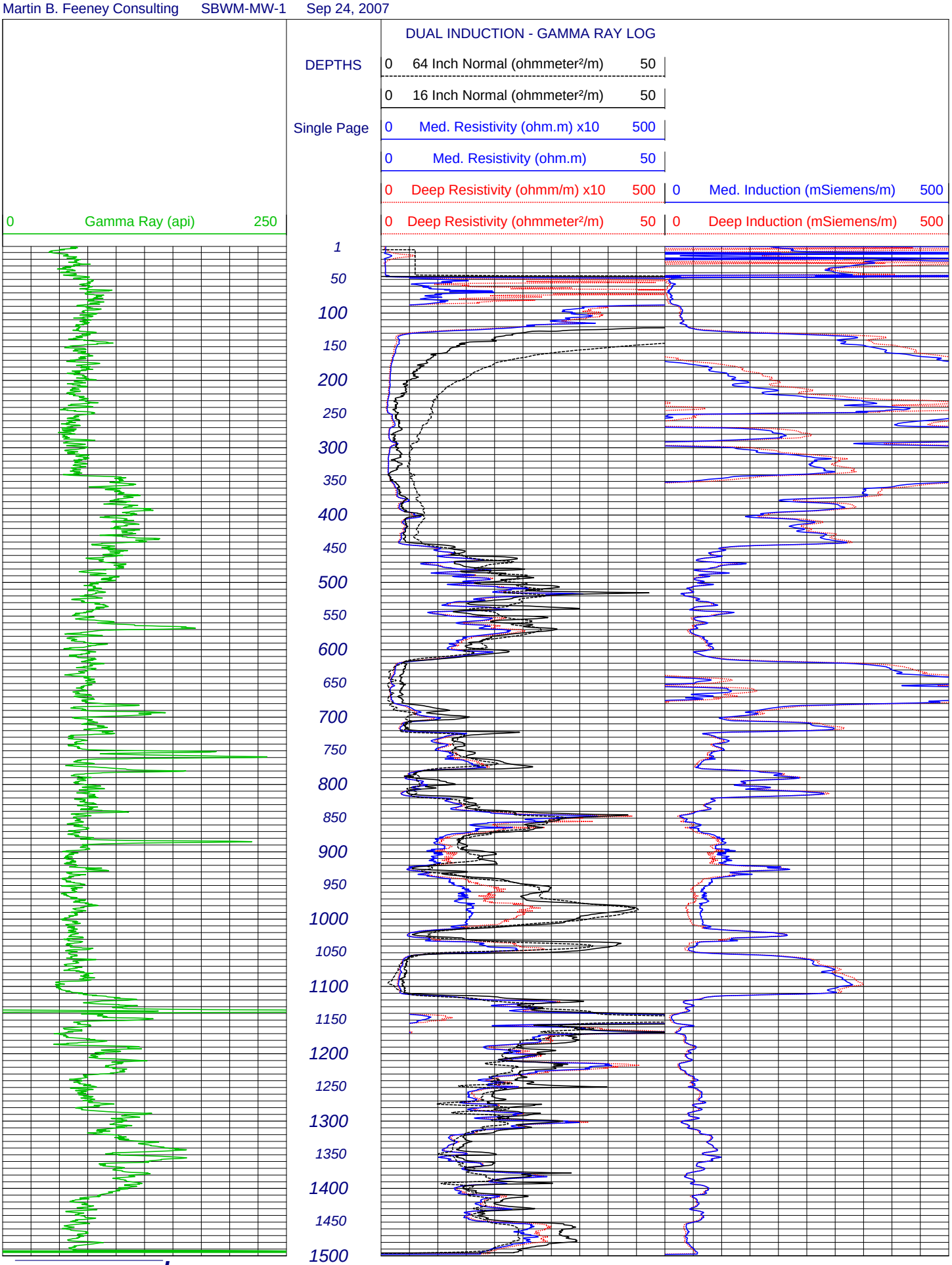
Laboratory Director
Sigrid Weidner-Holland

mg/L: Milligrams per liter (=ppm) ug/L : Micrograms per liter (=ppb) PQL : Practical Quantitation Limit
H = Analyzed ouside of hold time E = Analysis performed by External Laboratory; See External Laboratory Report attachments.
D = Method deviates from standard method due to insufficient sample for MS/MSD

APPENDIX C - INDUCTION LOGS

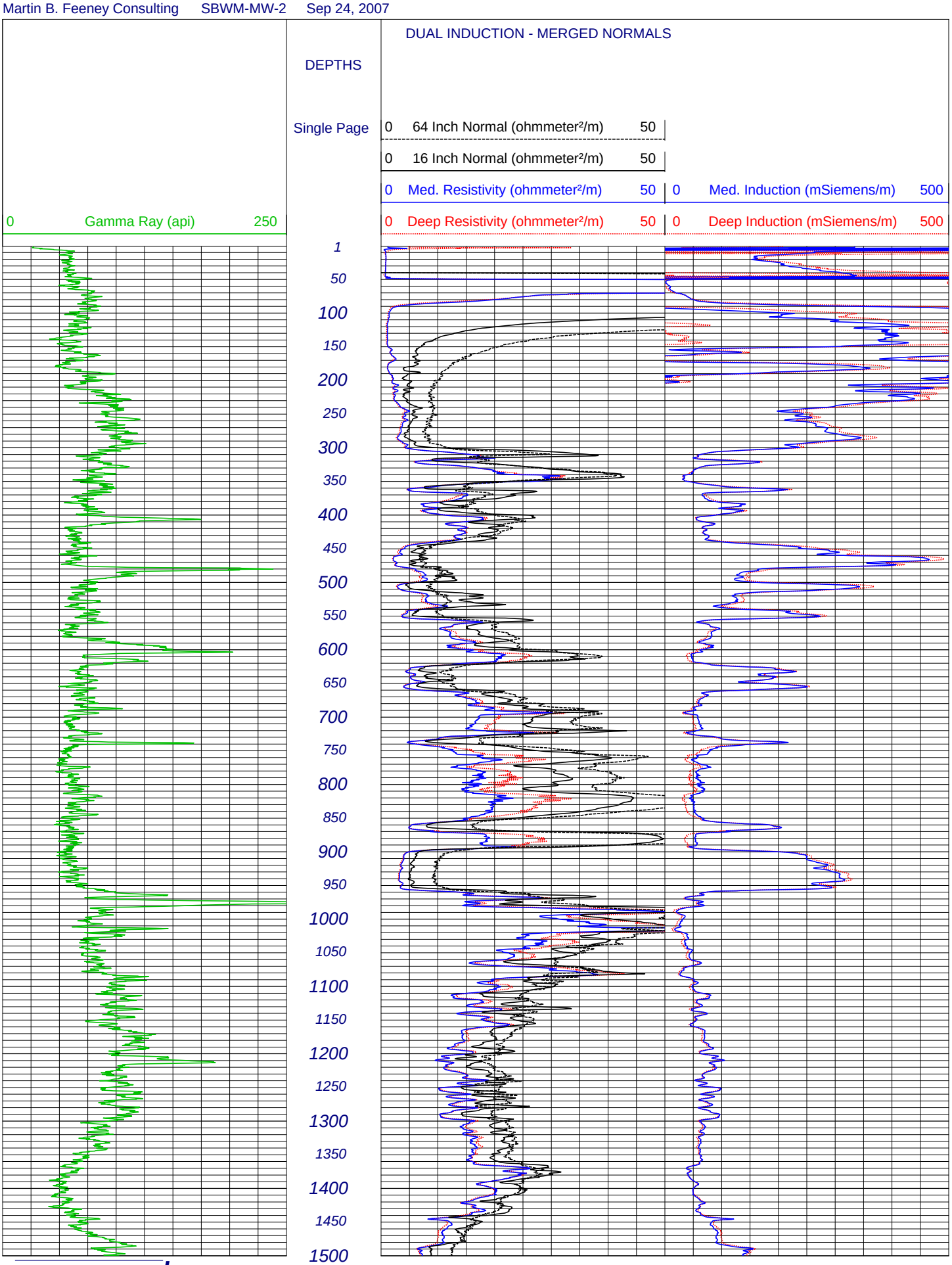
Contents:

Electric/Induction Composite Log



welenco
CA. Contractor's License: 722373
Phone: (800) 445-9914 Fax: (661) 834-2550 Email: welenco@welenco.com Web: www.welenco.com
(Prepared with Log Print, a professional software application developed by welenco, inc.)

Martin B. Feeney Consulting SBWM-MW-2 Sep 24, 2007



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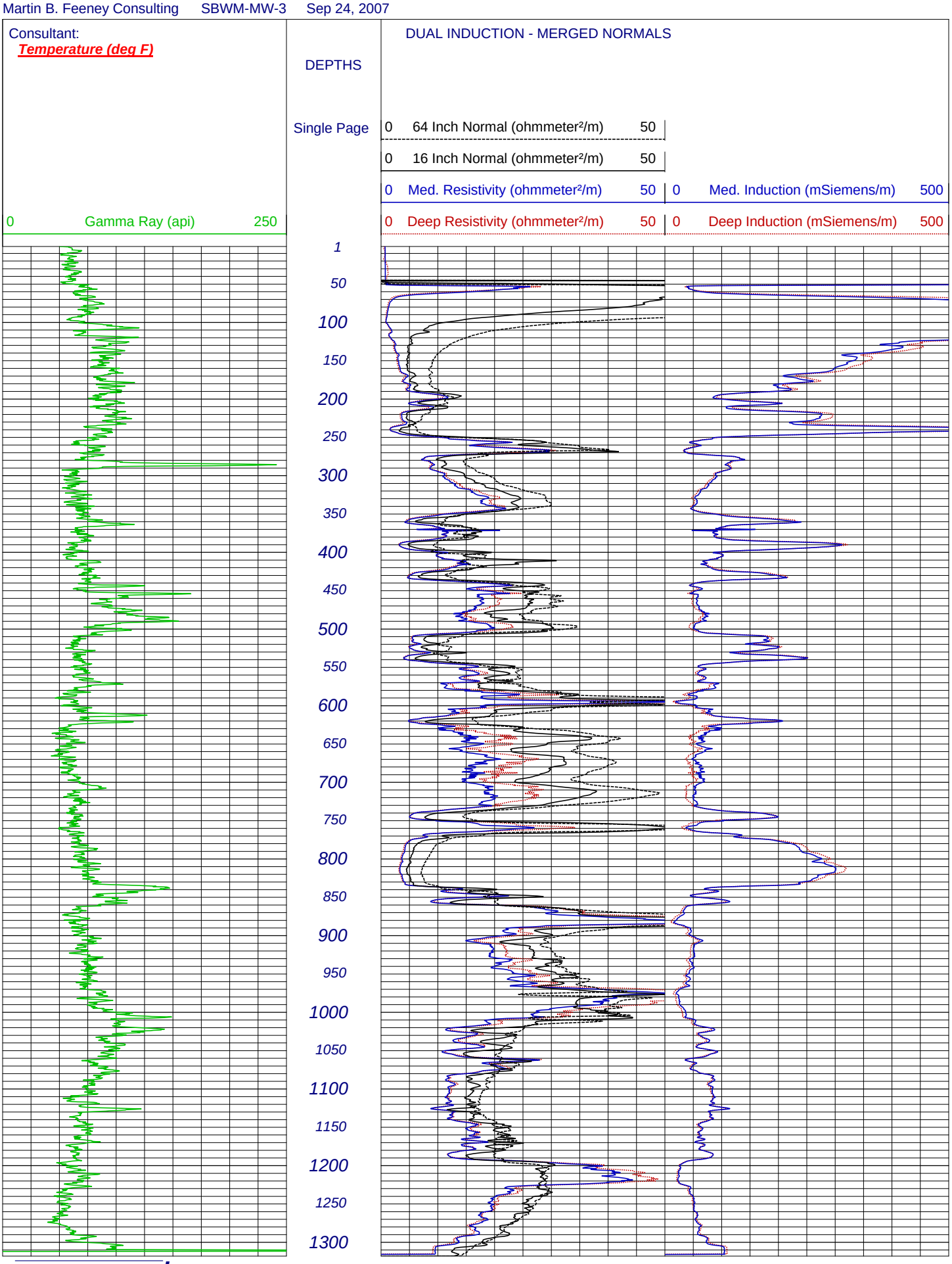
(Prepared with Log Print, a professional software application developed by welenco, inc.)

Martin B. Feeney Consulting SBWM-MW-3 Sep 24, 2007



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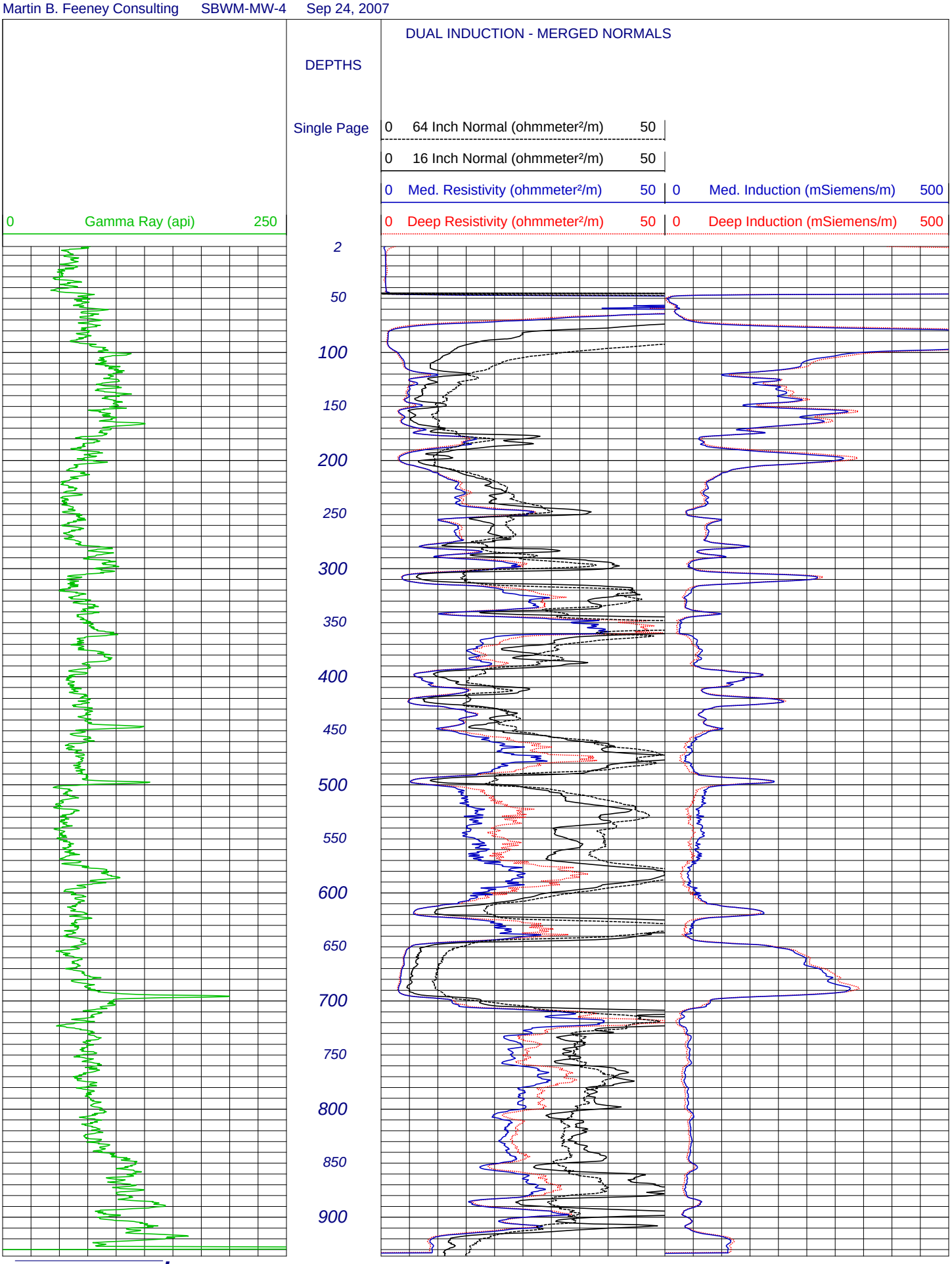
Phone: (800) 445-9914 Fax: (661) 834-2550 Email: welenco@welenco.com Web: www.welenco.com
(Prepared with Log Print, a professional software application developed by welenco, inc.)

Martin B. Feeney Consulting SBWM-MW-4 Sep 24, 2007



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APPENDIX D - PROJECT PHOTOGRAPHS

SEASIDE GROUND WATER BASIN WATERMASTER
SENTINEL WELL PROJECT
Project Photographs

Drilling Operations at SBWM #3

Drilling Operations at SBWM #4

Casing Installation w/ Centralizer

Cementing Operations

Induction Logging Completed Well

Down-hole Water Sample Collection

APPENDIX E - SUPPORTING DOCUMENTS

1) *Seaside Groundwater Basin Watermaster, Seawater Sentinel Monitoring Wells Workplan*, dated January 26, 2007

2) Technical Memorandum to Bob Jaques from: Martin Feeney, PG, CHg; Joe Oliver PG, CHg; Mike Burke, PG, CHg, *SBWM MW#1 - Preliminary Interpretations and Suggested Completion* dated July 24, 2007

SEASIDE GROUNDWATER BASIN WATERMASTER

SEAWATER SENTINEL MONITORING WELLS WORKPLAN
January 26, 2007

INTRODUCTION

As part of the court decree, the Seaside Groundwater Basin Watermaster (Watermaster) is required to install a series of coastal monitoring wells for the purpose of enhancing the existing network of monitoring wells that can detect seawater intrusion into the Seaside Basin. As part of the judge's review of the Watermaster's progress, he imposed a set of deadlines for implementation of this work. The timelines set by the judge are aggressive and will be difficult to achieve without refocusing the scope and goals of this work. This document intends to detail a revised approach to the work, propose preliminary well locations, identify required permits, and suggest an achievable schedule. A preliminary estimate of costs is also provided.

BACKGROUND

The Watermaster has initiated a multi-faceted Basin Monitoring and Management Program (MMP) that includes data collection, management and analysis, ground water modeling, and hydrogeologic analysis. This program also includes the installation of monitoring wells for purposes of refining basin hydrogeology and water quality monitoring. Because of the wells dual purpose of refining basin hydrogeology and water quality monitoring, the magnitude of the monitoring well program was large and expensive. While the insight and data from these wells may be necessary in the long run, achieving the primary goal of detecting seawater intrusion can be achieved with well designs that focus on the water quality monitoring. Hydrogeologic data and understanding that are developed as part of implementation of the coastal monitoring wells will be useful, but not the primary purpose. The decoupling of the dual purposes for installing monitoring wells allows redesign of the coastal monitoring wells, reducing their cost and speeding implementation.

The MMP approved by the judge also includes the construction of several inland monitoring wells to further the understanding of the groundwater basin. The purpose of these wells is to provide better understanding of the structure, hydrostratigraphy, and water level conditions of the inland portions of the basin. These inland wells are not part of this work plan as the purpose of these wells is significantly different than the coastal monitors.

Previous Approach

The previous approach consisted of six monitoring well clusters. Each cluster would have four monitoring wells completed to various depths. One borehole would be drilled to the Monterey Formation and completed toward the lower portion of the aquifer system, one would be completed in the upper Santa Margarita Sandstone, and two would be completed in the overlying Paso Robles Formation. It was assumed that the deeper boring would extend as deep as 1,500 to 2,500 feet. Each well was to be constructed of PVC casing with gravel pack and perforations in the appropriate hydrostratigraphic interval. The deeper well was to be 3-inch diameter while the other wells would be 2-inch diameter. The drilling cost estimate included site preparation, well construction and development, fluid/cuttings disposal and site restoration. Total cost of the drilling program was estimated $3.8 million. The actual well sites were undetermined. The estimated costs did not include site selection, design, permitting, site acquisition, or construction management. These costs were estimated at approximately $550,000 which bring total project cost to $4.35 million.

The proposed approach would have allowed collection of the following data:

- Water levels in the upper and lower Santa Margarita Sandstone
- Water levels in two discrete hydrostratigraphic intervals in the Paso Robles Formation
- Water Quality sampling of the Santa Margarita Sandstone and Paso Robles Formation intervals
- Conductivity/Resistivity (Induction) surveys of entire sediment column providing indirect measurement of water quality and water quality changes.
- Base of water bearing sediments – Depth to Monterey Formation

Revised Approach

With the exception of distilled water, all water contains some level of dissolved minerals or salts. Typical drinking water contains less that 1,000 part per million of dissolved salts whereas seawater contains approximately 35,000 parts per million of salts. Unlike organic contaminants which degrade water with concentrations measured in parts per billion; degradation of water by seawater is the result of contamination on the parts per million or even parts per thousand basis. The addition of more salts to the water, as the result of mixing with seawater, changes the physical properties of the water such as the density of the water and, most relevant to the subject project, the electrical properties of the water.

Distilled water is essentially electrically non-conductive; with increasing amounts of salinity water becomes increasingly more conductive. As such, the electrical conductivity of water can be used to infer the salt concentration. The revised work plan relies on this principal.

The change in electrical properties with increasing salinity makes the detection of seawater contamination into an aquifer relatively easy. As the water within the aquifer becomes more saline due to the intrusion of seawater, the electrical conductivity of the formation containing the water increases relative to the value measured when the aquifer was filled with native ground water.

The revised work plan utilizes single-well monitoring sites (as opposed to the multiple wells at each site described in the existing plan). The wells would extend into and perforate the Santa Margarita Sandstone. The well would be constructed of 3-inch diameter casing to allow the periodic cased-hole conductivity/resistivity (induction) profiling of the aquifer system. This would allow detection of seawater (as measured as an increase in formation conductivity) at any depth from the top of saturation (i.e. the water table) to bottom of the well.

Well Specifics for Each Site:

- One 8 ¾-inch boring to 1,500 feet or Monterey Formation (whichever comes first)
- Geophysical logging (Resistivity, SP and Natural Gamma)
- 3” diameter flush threaded Sch. 80 PVC Casing into Santa Margarita Sandstone
- 100 feet of 0.032-inch horizontally-cut PVC perforations. Continuous or placed in the most productive zones – the zones a production well would be perforated
- Gravel packed in the perforated interval(s)
- Well sealed from the top of Santa Margarita Sandstone
- Well air lifted developed until clean
- Flush-grade surface vault with room for data logging equipment

Data collection from the monitoring well network would include periodic induction logging of the cased borehole and collection of physical water samples from the Santa Margarita Sandstone for calibration purposes. Successive induction logs would be overlaid on previous logs for comparison. If a significant change in conductivity was detected, a depth-specific monitoring well should be drilled at the site to provide improved understanding of the nature of the change. In addition to the indirect measurement of water quality within all portions of the Paso Robles Formation and Santa Margarita Sandstone, the wells would allow monitoring of water level conditions in the Santa Margarita Sandstone.

An example of the type of data that is collected as part of the proposed approach is presented on Figure 1. Figure 1 presents data collected recently from a coastal monitoring well. The data are taken from an induction survey conducted within a three-inch diameter monitoring well similar to the proposed design. This aquifer system has seawater at a depth of 450 feet below ground surface. The presence of seawater is indicated by the rapid increase in conductivity (decrease in resistivity) values below a depth of 450 feet. The presented data represent the baseline value. This well will be surveyed periodically. Data (curves) will be compared to detect the movement of seawater within the aquifer system at this location.

Supplement Network Through Use of Existing Monitoring Wells. In addition to the new wells, and the existing network of monitoring wells owned by MPWMD and California American (see attached map) there are other existing wells in the area of the proposed new wells that can be integrated into the sentinel well network. The proposed well sites are in the coastal bluffs area on the former Fort Ord. As part of the conversion of Fort Ord to civilian use, extensive subsurface exploration has been performed to assess environmental impacts of historical land use. At many locations along the coast, there remain monitoring wells that could be brought into the Watermaster's monitoring program. Many of these wells are quite shallow, but several extend to into the upper aquifer system. These wells would be useful additions to a coastal monitoring network, as many have water quality data extending back to the early 1990's.

In summary, the revised approach will allow collection of the following data:

- Water levels in the Santa Margarita Sandstone
- Collection of water quality samples from the Santa Margarita Sandstone
- Conductivity/Resistivity (Induction) surveys of entire sediment column providing indirect measurement of water quality and water quality changes

Compared to the previous approach the revised approach does not directly collect these data:

- *Base of water bearing sediments – Depth to Monterey Formation.* These data are desirable for increasing understanding of the basin structure. However, these data are very expensive, as drilling to the proposed depths requires a different class of drilling equipment, significantly raising costs. The proposed approach includes drilling into the Santa Margarita Sandstone/Purissima Formation. Within the coastal areas of the Seaside Basin, there are adequate data to project the depth to the Monterey Formation below the bottom of the borehole. In the areas where the Purissima may be encountered, this could be more problematic as there are few, if any, wells that fully penetrate the Purissima into the Monterey.
- *Water Quality sampling of the Paso Robles Formation*. The proposed approach would not allow collection of water quality samples from the Paso Robles Formation. However, the induction surveys will provide water quality data for water within the various units of the Paso Robles Formation.
- *Water levels in two discrete hydrostragraphic intervals in the Paso Robles Formation.* The proposed approach does not provide water level data from any of the various water bearing units of the Paso Robles Formation. However, some of the sites have existing shallow monitoring wells installed as part of Fort Ord clean-up investigations. Water level data from the shallow system may be available from these wells. Additionally, most of the basin's production and artificial recharge is from the confined Santa Margarita Sandstone, and water levels in this aquifer unit at the coast are the primary management tool.

MONITORING PROGRAM

It is assumed that the new monitoring wells would be folded into the existing Seaside Basin monitoring network. It is understood that the judge has specified collection of water data on a quarterly basis from the coastal monitoring well network. This could be accomplished cost-effectively by quarterly induction profiling of the wells supported by periodic (annual) collection of water quality samples. The quarterly induction surveys could be performed by a geophysical contractor who could provide the data to the Watermaster's designated technical personnel for analysis. This approach would reduce quarterly monitoring cost significantly.

WELL SITES

As part of the work associated with the preparation of this work plan, the team (Joe Oliver of the MPWMD and I) met with a representative of the California State Parks (Ken Gray) to identify locations for the coastal monitoring wells. The team visited and received conceptual approval for five sites in the coastal portion of Fort Ord north of Sand City, and I have identified four primary sites and one alternative location. The tentatively approved sites are shown on the attached map and are as follows:

- Range 8 – This site is at the extreme southwestern corner of Range 8. There is an existing shallow monitoring well at this site although actual depth is unknown. The well site would be with the existing paved road.
- Bunker 11 – This site is located immediately in front of the abandoned Ammo Bunker No. 11. The Ammo bunkers are planned to be maintained for public access and historical interest.
- Bunker 1–This site is located immediately in front of the abandoned Ammo Bunker No. 1.
- MCWD Lift Station – This site is located at the site of Marina Coast Water District's existing sewer lift station. There is an existing shallow monitoring well as this site. Again, its actual depth is unknown at the time of the preparation of this plan. Data on the construction of the existing well is likely available from BRAC personnel.

The site below was identified as an alternative site due to its distance from the ocean.

- Along Road – This site will be located along the existing north-south trending road. Several turn-out areas were identified that would support a well site and provide sufficient room for construction.

All of sites are located in existing roads and have sufficient previously-disturbed area for well construction staging. Additionally, each site is in an area where State Parks plans to maintain roads and access. This will allow for continued on-going access to the well sites for the purpose of collecting data.

Alternative Sites: If the well sites on State Park Land become infeasible, a fall back position would be to locate the wells within the TAMC right-of-way. These sites are less favorable for coastal monitoring wells because this right-of-way is significantly farther from the ocean than the above sites.

PERMITTING

Permitting of the well sites will likely be the critical path issue in meeting deadlines imposed by the judge. The discussion below assumes the construction on State Parks property. Construction in the TAMC right-of-way has similar permitting requirements.

The coastal bluffs property of former Fort Ord was formally transferred from the U.S. Army to the Dept. of Interior (Nat'l Parks Service) last fall. Ken Gray's best guess is that the Nat'l Park Service could do a formal transfer to State Parks as early as this March, but based on a field meeting with Mr. Gray on 1/22, the fact that this property has not yet been formally transferred to State Parks does not prevent State Parks from authorizing uses such as monitor wells, because State Parks currently has "operational authority" for the property. Assuming Mr. Gray's assumption is correct the permitting process would likely include:

- State Parks – Based on discussions with Mr. Gray, the Watermaster could submit a project description and an application for permission to install the monitoring wells. The application would need to include assessment of potential impacts for their review prior to granting the permit.
    - The key issue will likely be construction impacts on:
        - Biological resources, including habitat for special-status wildlife species (Smith's blue butterfly, snowy plover, and black legless lizard) and presence of special-status plant species (Monterey Spineflower, Wallflower, and Sand Gilia). If the land has been transferred to State Parks, implementation of the Habitat Management Plan would likely mitigate for these impacts, except for state listed plants. If land has not been transferred and remains federal property, there are existing biological opinions that would likely cover impacts to all these species.
        - Coastal zone analysis/consistencies (aesthetics, impacts on visitor serving uses and coastal access)
        - Other construction impacts (air quality, noise, etc.) - These can be easily mitigated with standard construction practices.

- CEQA - Assuming that the project can be designed and implemented without significant environmental impacts (i.e., possible biological resources impacts discussed below which require more comprehensive mitigation); a Notice of Exemption could be the appropriate document. This assumes that the project will not involve major controversy or objection.

- NEPA - The project would not be subject to NEPA if the US Army has conveyed or will convey ownership of the property to State Parks prior to commencement of construction. Ken Gray has indicated that he believes that State Parks has operational control giving them the permitting authority. If Mr. Gray's assumption is wrong regarding permitting authority, it is believed that there is a categorical exemption for monitor wells under NEPA.
- Coastal Act (California Coastal Commission) - The project would require, at a minimum, an "Amendment to an Existing Coastal Development Permit" which would be considered "Immaterial" (staff level approval). It may be considered "Material" (requiring approval by the Coastal Commission; therefore more coordination and longer time period). If there is no existing permit covering related activities, another process that would be expeditious would be for the project to be considered *de minimus* and receive a waiver from the Coastal Commission staff.

The sites have been selected to avoid impacts to habitat. However, if construction activities are deemed to potentially disturb sensitive habitat, the permits listed below would be necessary. However, the sites likely would be moved to avoid these issues.

- CA Endangered Species Act (ESA) Take permit (California Dept. of Fish and Game) - if the Sand Gilia is located at any sites that may be disturbed and the land has been transferred.
- Federal ESA Take permit (USFWS) - If habitat for snowy plover and/or Smith's blue butterfly is to be disturbed and the land has been transferred.

In addition to the above permits, well construction permits will be required from Monterey County Environmental Health Department. These permits are essentially ministerial and require 2 to 3 weeks to be issued. These permits can only be issued to the drilling contractor.

Timing of permits:

- Timing of State Park Permit: 1 month or less from submission of project definition and supporting documentation
- Well Construction Permits – 2 to 3 weeks.
- CEQA – Assuming a Notice of Exemption: 1 month or less from project definition.
- NEPA – Not Required
- Coastal Commission (if required): minimum 2 months, if Coastal Commission hearing required several months to a year.
- CA / Federal ESA: 6 months to a over a year depending upon resources affected and ownership/designation of land

SCHEDULE

Permitting and site acquisition will control schedule. After permitting is completed, sentinel wells can be installed within 6 weeks. Initial data from the wells would be available within 10 weeks.

COST

Permitting Costs:

Permitting Costs are always difficult to estimate, as the process can be unpredictable. Assuming the permitting process is somewhat similar to that discussed above; permitting costs are estimated at $ 35,000.

Well Construction/Hydrogeologic Data Collection Costs:

Cost for program management, well construction, hydrogeologic supervision and analysis, monitoring network review and initial data collection are estimated at between $850,000.

Annual Monitoring Program Costs:

As proposed the 4 coastal sentinel wells would be induction logged quarterly and water quality samples collected annually. This cost of this limited program is estimated $18,000 per year. This would include approximately $12,000 for induction logging ($3,000 per quarter) and annual collection and analysis of water quality samples of approximately $6,000.

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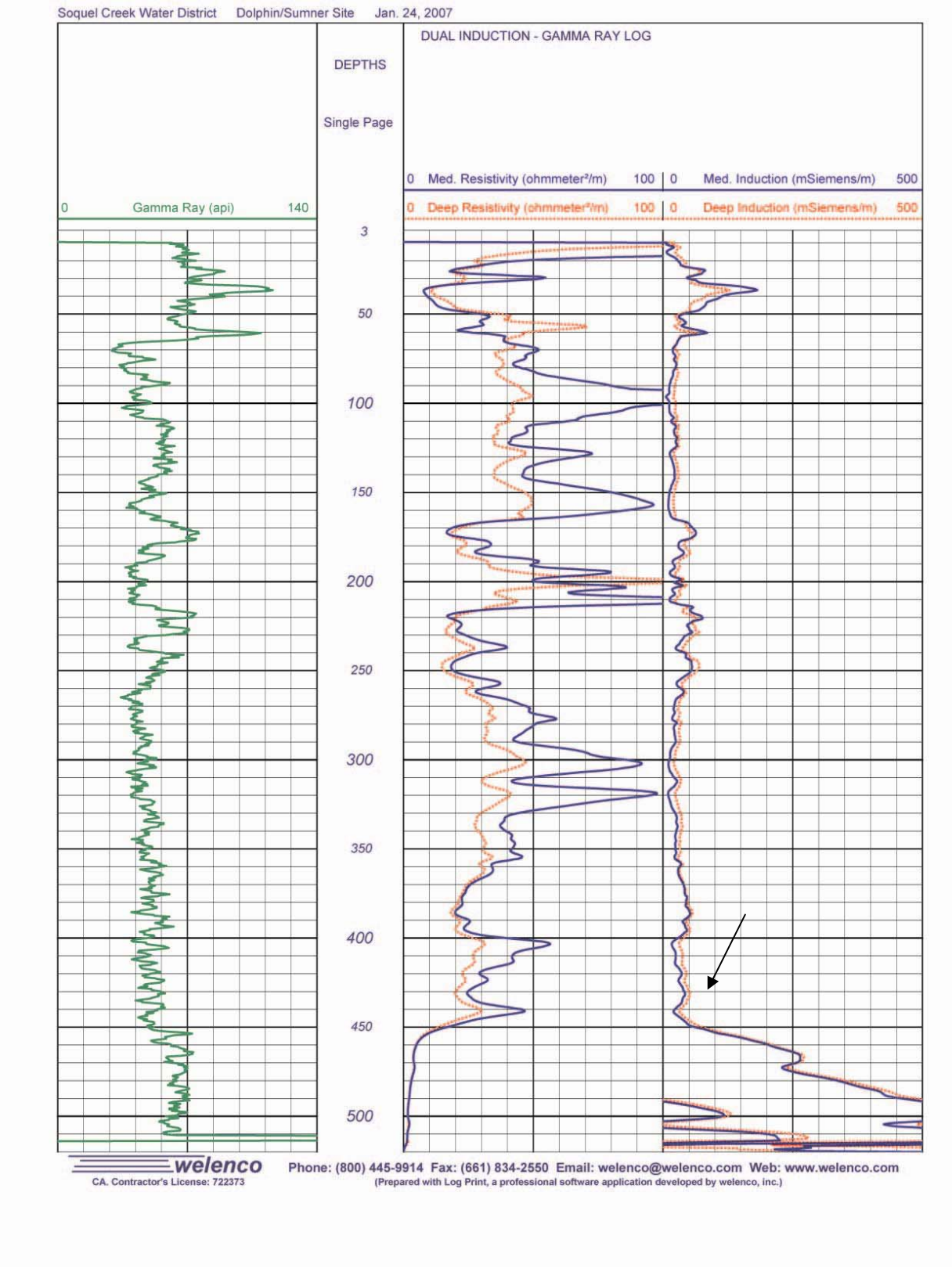
FIGURE 1 – CASED HOLE INDUCTION LOG



Date: July 24, 2007

To: Bob Jaques – Seaside Groundwater Basin Watermaster - Technical Project Manager

From: Martin Feeney, PG, CHg; Joe Oliver PG, CHg; Mike Burke, PG, CHg

Subject: SBWM MW#1 - Preliminary Interpretations and Suggested Completion

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The pilot bore of the subject well reached final depth of 1,500 feet last Friday afternoon, July 20. Lithologic samples were collected at 10-foot intervals from ground surface to final depth. Upon reaching bottom the pilot bore was geophysically logged. Lithologic and geophysical data from the boring reveal the geology at the site to be significantly different than assumed in the original work plan. The differences will require modification of the original well design to balance project goals and budget. This memo presents an interpretation of the data collected and proposes a modified well design that achieves the original project goals within the budget constraints.

DATA AND INTERPRETATION:

Lithologic Data

Drill cuttings were collected at 10-foot intervals and described on-site by logging geologists. Based on the cuttings, preliminary field interpretations were as follows:

0-140’	Dune/Beach Sands
140-380’	Aromas Sand
380- ~600*’	Paso Robles Formation
~600-1,500’	Purisima Formation

* pick between Paso Robles and Purisima was difficult and could be off by as much as 100 feet. The pick is based on a transition from an oxidized and reduced depositional environment concurrent with a change from continental to marine depositional environments.

Geophysical Logs

Upon reaching bottom of the borehole a suite of geophysical logs was performed. These logs included natural gamma, spontaneous potential (SP), and resistivity logs. The interpretations are presented below.

Natural Gamma

Review of the gamma logs delineation of 4 to 5 zones that roughly correlate with the lithologic picks. These are:

0-150’	Average gamma counts of about 45 API units (Beach/Dunes Sands)
150-340’	Average gamma counts of about 38 API units (Aromas)
340-480’	Average gamma counts of about 68 API units (Paso Robles)
480-1,100’	Average gamma counts of about 40 API units (Upper Purisima)
1,200-1,500’	Average gamma counts of about 50 API units (Lower Purisima)

Several gamma peaks occur; prominently at 1,150' and 1,350'. The one at 1,150' corresponds with white clay logged as kaolinite, but it must be a clay with more potassium.

Resistivity Logs

Initial review of the electric logs reveals several zones of low resistivity interpreted as saline water. Saline water exists to at least 380 feet, and possibly as deep as 440 feet. Above these depths the resistivity logs are of little use. Below 440 feet, the resistivity log signatures are typical for the Paso Robles and Purisima. There may be more zones that have saline water but they are masked by the interbedded, variable lithologic nature of the Paso Robles and Purisima Formations.

SP Logs

The SP log delineates several zones of poor water quality. The SP shift is most apparent at the base of the Aromas (340 feet) where it shifts strongly to the left, suggesting saline water. Below this depth, the quantitative use of SP gets difficult as, because of the presence of saline intrusion, it is difficult to determine an accurate "shale line" for reference of left or right shifts.

Resistivity and SP data from the geophysical logs have been utilized to roughly estimate the water quality in various zones and these estimates are attached. It is cautioned that the estimates derived from SP are likely not particularly accurate as the shifts are difficult to estimate.

WATER QUALITY FROM ELECTRIC LOG

Project:	Sentinel Wells
Well Name:	SBWM MW#1

Data from Field and Log

Mud Filtrate Resistivity (R_{mf})	9.3	Ohm-meters	from measurement
Mud Filtrate Temp	75	F°	from measurement
Mud Resistivity (R_m)	11.6	Ohm-meters	from measurement
Mud Temp	65	F°	from measurement
Formation Temp	65	F°	From Temp log or estimate as average annual surface temp
Porosity	0.4	unitless	from lithology

Calculations

Temp. Corrected R_{mf}	9.3	Ohm-meters
Temp. Corrected R_m	10.2	Ohm-meters
Formation Factor	4.4	unitless
Conductivity of Mud @Formation Temp.	862.1	mmhos/cm^2

					FROM SP						*FROM 64-INCH NORMAL*			*FROM 16/64-INCH NORMAL RATIO*		
					Rw Range		EC Range		TDS Range							
Interval	S.P.	$Rt^{16-inch}$	$Rt^{64-inch}$	Rwe	R_w^{NaCl}	R_w^{NaHCO3}	EC^{NaCl}	EC^{NaHCO3}	TDS^{NaCl}	TDS^{NaHCO3}	R_w	TDS^{NaCl}	TDS^{NaHCO3}	R_w	TDS^{NaCl}	TDS^{NaHCO3}
150-300	30	4	7	24.7	42.2	49.7	237	201	126	201	1.6	3366	6351	2.76	1924	3629
300-350	-50	3	6	1.8	1.7	2.0	5794	4925	3071	4925	1.3	3927	7410	2.70	1964	3705
525-625	12	25	40	13.7	20.6	24.2	486	413	258	413	9.0	589	1111	14.40	368	695
720-775	-20	15	18	4.8	5.7	6.7	1747	1485	926	1485	4.0	1309	2470	4.86	1091	2058
950-1000	15	35	35	15.2	23.2	27.3	431	367	229	367	7.9	673	1270	7.87	673	1270
1100-1200	10	40	50	12.9	19.0	22.3	527	448	279	448	11.2	471	889	14.06	377	711
1200-1450	2	18	24	9.9	13.8	16.2	725	616	384	616	5.4	982	1852	7.20	736	1389
1450-1500	4	23	33	10.6	14.9	17.6	670	569	355	569	7.4	714	1347	10.65	498	939

WELL COMPLETION

The initial concept for the Sentinel Wells was to allow seawater intrusion detection throughout the entire sedimentary section at each site and to allow collection of the water level and water quality data from the Santa Margarita Sandstone, the primary aquifer unit of the Seaside Basin. The initial concept assumed that the Sentinel Wells would be encountering the conventional sequence of hydrostratigraphic units for

the Seaside Basin; the Dune Sands/Aromas Sand underlain by the Paso Robles Formation, underlain by the Santa Margarita Sandstone. At this northerly location, this sequence is different. Therefore, the proposed well completion needs to be modified, as constrained by original budget, to meet the needs of the Watermaster to assist in managing the basin. The completed wells should provide the following:

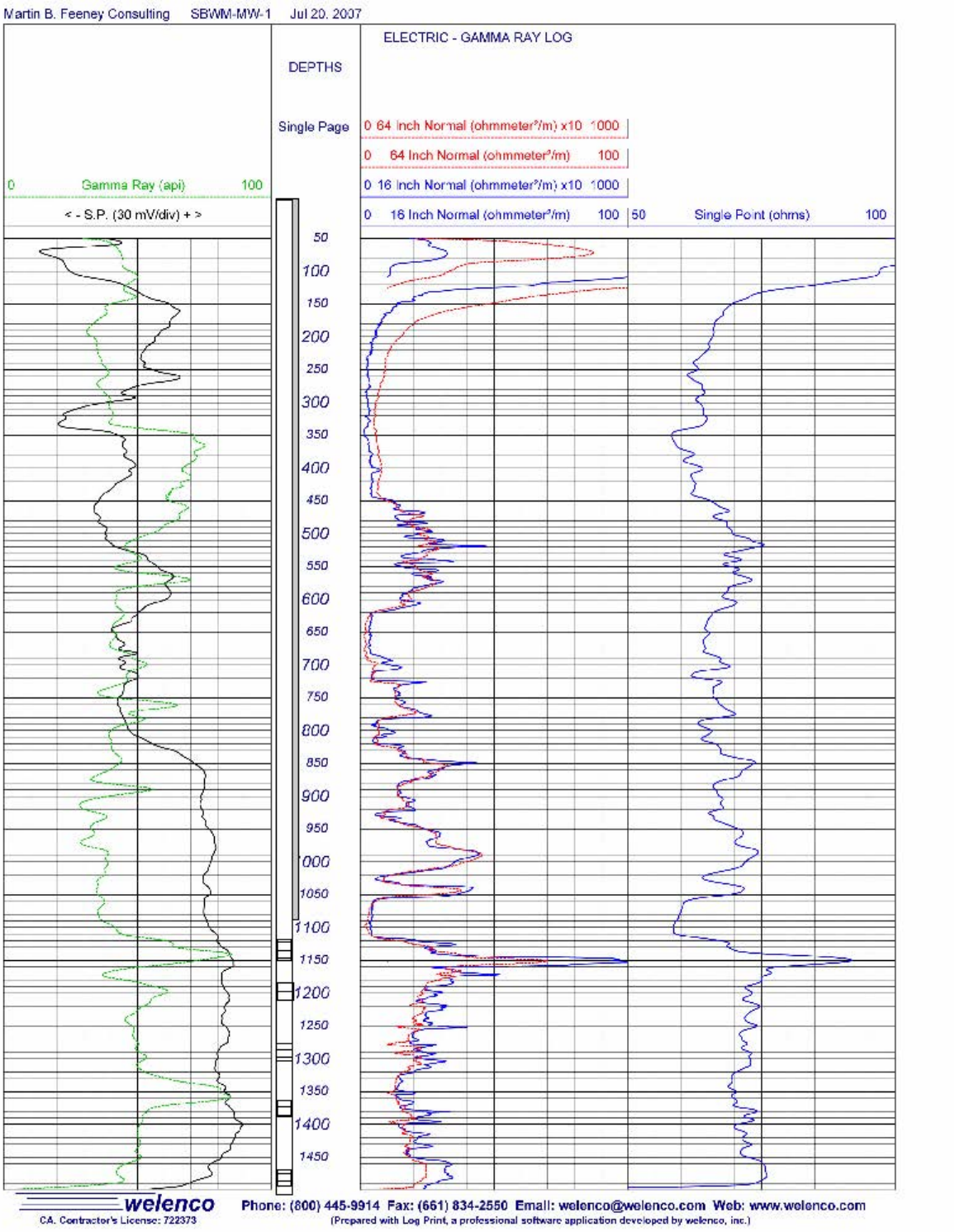
- Ability to assess water quality changes throughout the sedimentary column regardless of the aquifer unit.

- Ability to sample and monitor those aquifer units that may be in hydraulic communication with either the Santa Margarita Sandstone in the Seaside area or the Purisima in the Marina area.

Based on these goals the proposed completion is as follows:

- Well to be cased to 1,500' to allow induction logging of entire section.
- The budgeted 100 feet of perforations will be distributed equally within the Lower Purisima Formation, the interval from 1,120 – 1,500 feet.
- Well will be sealed from 1,100 feet to ground surface.

A diagram of the well and the proposed completion is attached.


Martin B. Feeney Consulting SBWM-MW-1 Jul 20, 2007
ELECTRIC - GAMMA RAY LOG
DEPTHS
Single Page
0 64 Inch Normal (ohmmeter²/m) x10 1000
0 64 Inch Normal (ohmmeter²/m) 100
0 16 Inch Normal (ohmmeter²/m) x10 1000
0 16 Inch Normal (ohmmeter²/m) 100
0 Gamma Ray (api) 100
< - S.P. (30 mV/div) + >
50 Single Point (ohms) 100
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150
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STATE OF CALIFORNIA – THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, *Governor*

CALIFORNIA COASTAL COMMISSION

CENTRAL COAST DISTRICT OFFICE
725 FRONT STREET, SUITE 300
SANTA CRUZ, CA 95060
PHONE: (831) 427-4863
FAX: (831) 427-4877

NOTICE OF COASTAL DEVELOPMENT PERMIT WAIVER

DATE: June 26, 2007

TO: Seaside Basin Watermaster, Attn: Dewey Evans, CEO

FROM: Peter M. Douglas, Executive Director

SUBJECT: Waiver of Coastal Development Permit
Waiver De Minimis Number 3-07-021-W

Based on project plans and information submitted by the applicant(s) named below regarding the development described below, the Executive Director of the Coastal Commission hereby waives the requirement for a Coastal Development Permit, pursuant to Title 14, Section 13238 of the California Code of Regulations.

APPLICANT: Seaside Basin Watermaster, Attn: Dewey Evans, CEO

LOCATION: Fort Ord Dunes State Park (unincorporated area between Seaside & Marina, seaward of Highway 1), Fort Ord (Monterey County) (APNs 031-031-004, 031-041-006, 031-041-007, 031-051-001)

DESCRIPTION: Construction of four monitoring wells and ongoing monitoring for the purpose of detecting seawater intrusion in the Seaside Groundwater Basin.

RATIONALE: The proposed seawater intrusion monitoring wells will not adversely effect coastal resources or public access to the shoreline. The wells would be located in Fort Ord Dunes State Park in existing paved areas that are accessed by existing roadways, and comprehensive construction measures to protect coastal resources are included as part of the proposed project. State Parks has not fully completed its planning for the park but has indicated that they will make use of many of the existing paved areas for future trails and related park infrastructure. The monitoring wells do not require significant access or ongoing attention, and their siting will not prejudice ongoing and more specific planning for the park in that respect. As such, the proposed development is consistent with the policies of Chapter 3 of the Coastal Act.

IMPORTANT: This waiver is not valid unless the site has been posted AND until the waiver has been reported to the Coastal Commission. This waiver is proposed to be reported to the Commission at the meeting of Wednesday, July 11, 2007, in San Luis Obispo. If four Commissioners object to this waiver, a coastal development permit will be required.

Persons wishing to object to or having questions regarding the issuance of a coastal permit waiver for this project should contact the Commission office at the above address.

Sincerely,
PETER M. DOUGLAS
Executive Director

By: STEVE MONOWITZ
District Manager

cc: Carl Holm, Monterey County Planning and Building Inspection Department
Denise Duffy & Associates, Attn: Alison Imamura or Denise Duffy