WELL INSTALLATION AND MONITORING REPORT

Rancho Malibu Project Site
Malibu, California

July 31, 2014

PREPARED FOR

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Project No.1073.01

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Engineering Corporation

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July 31, 2014 Project No. 1073.01

Mr. George Keppler
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P.O. Box 6529
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Well Installation and Monitoring Report
Green Acres LLC
Rancho Malibu Project Site
4000 Malibu Canyon Road
Malibu, California

Dear Mr. Keppler:

This report documents the installation and subsequent monitoring and sampling of five ground water monitoring wells at the property located at 4000 Malibu Canyon Road in Malibu, California. The report has been prepared by Rubicon Engineering Corporation and pursuant to your instructions, will be submitted to the California Regional Water Quality Control Board, Los Angeles Region. If you have any questions, please do not hesitate to call.

Respectfully submitted,

RUBICON ENGINEERING CORPORATION

Mohsen Mehran, Ph.D.
Principal

cc: Mr. Carlyle Hall – Akin Gump Strauss Haur & Feld LLP

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bgs	below ground surface
Cal/OSHA	California Division of Occupational Safety and Health
cm/s	centimeter per second
DO	dissolved oxygen
EC	Electrical Conductivity
EPA	U.S. Environmental protection Agency
gpd	gallons per day
LACDPH	Los Angeles County Department of Public Health
LARWQCB	Regional Water Quality Control Board, Los Angeles Region
MCL	Maximum Contaminant Level
MPD	Malibu Planning Department
MSL	mean sea level
ORP	oxidation reduction potential
OSHA	Occupational Safety and Health Administration
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
USA	Underground Service Alert
USCS	Unified Soil Classification System

1.0 INTRODUCTION

This report documents the installation of five ground water monitoring wells and two ground water monitoring and sampling events conducted at the property located at 4000 Malibu Canyon Road in Malibu, California (the site). The site location map is presented in Figure 1. The site plan, showing the location of each newly installed ground water monitoring well, is presented in Figure 2. The remainder of this section provides a brief project overview and the objectives of this progress report.

1.1 PROJECT OVERVIEW

The project property is bounded by Pacific Coast Highway to the south, Civic Center Way to the northeast, and Malibu Canyon Road to the west (Figure 2). The site is currently vacant but a resort hotel, the Rancho Malibu Resort, is proposed to be constructed at the site. It is our understanding that the facility wastewater will be put through tertiary treatment and the treated water will be utilized for on-site irrigation using a sprinkler system. The treatment system will be designed to generate water that will contain less than 10 milligrams per liter (mg/ℓ) nitrate as nitrogen (nitrate). As long-term application of nitrate-containing water for on-site irrigation may induce limited nitrate leaching losses beyond the root zone, the California Regional water Quality Control Board, Los Angeles Region (LARWQCB) requested an evaluation of the downward transport of nitrogen species from the upper portion of the soil profile in order to assess the potential impact on the underlying water-bearing zones. Utilizing available site-specific, local, and regional data, Rubicon performed ground water flow and nitrate transport modeling to address the agency request and the simulation results were submitted to the LARWQCB (Rubicon, June 25, 2013; Rubicon, September 26, 2013). Rubicon's modeling efforts were based on several assumptions including depth to ground water of 62 feet.

In order to establish the ground water elevation and quality conditions at the site, Rubicon proposed installation of five ground water monitoring wells (RM-1 through RM-5) at the site. In addition to establishing site conditions, the data collected during the field activities will also be beneficial for refining the flow and transport simulation model, if warranted.

1.2 OBJECTIVE AND REPORT ORGANIZATION

The objective of this report is to update Green Acres, LLC and other stakeholders on the well installation and monitoring program conducted at the site from January through July 2014. The activities were performed in accordance with the *Work Plan – Ground Water Monitoring Well Installation* (Rubicon, January 7, 2014) and *Proposal–Test Well Installation* (Rubicon, February 27, 2014).

Section 2.0 of this report provides a summary of completed and projected activities. The activities associated with the installation of the new ground water monitoring wells are summarized in Section 3.0. Ground water monitoring and sampling activities are presented in Section 4.0. Section 5.0 includes a discussion of the findings in relation to the application of the treated water at the site for irrigation purposes. Permits obtained for the field activities are provided in Appendix A and field monitoring records are presented in Appendix B. Appendix C includes boring logs generated for the new wells. Physical properties data for soil samples are provided in Appendix D. Appendix E includes the survey report issued for the new wells. Certificates of analyses for ground water samples are provided in Appendix F.

2.0 SUMMARY OF COMPLETED AND PROJECTED ACTIVITIES

The following sections summarize the site activities completed from January 2014 through July 2014 and the activities planned to be completed between October 2014 and January 2015.

2.1 COMPLETED ACTIVITIES

Date	Activity
January 7, 2014	Rubicon issued *Work Plan – Ground Water Monitoring Well Installation.*
January 29, 2014	Rubicon submitted a well permit application to the Drinking Water Program – Environmental Health Division for installation of the five monitoring wells.
February 18, 2014	The Los Angeles County Department of Public Health (LACDPH) Drinking Water Program – Environmental Health Division issued Permit No. 893164 for installation of the five monitoring wells.
February 19, 2014	Rubicon submitted a proposal package to the City of Malibu Planning Department (MPD) to obtain approval for well installation activities.
February 27, 2014	Rubicon issued *Proposal–Test Well Installation.*
February 28, 2014	The LARWQCB issued comments on the January 7, 2014 work plan.
March 12, 2014	Rubicon submitted a Geologic/Geotechnical Exploratory Excavation Application to the City of Malibu.
March 17, 2014	The City of Malibu issued Permit No. 14-340 for the proposed drilling activities.
March 31 to April 11, 2014	Five ground water monitoring wells (RM-1 through RM-5) were installed at the site.

April 14 and 15, 2014	The five ground water monitoring wells were developed.
April 23 and 24, 2014	Rubicon conducted the first ground water monitoring and sampling event.
May 19, 2014	The monitoring wells were surveyed by McGee Surveying Consulting.
July 15 and 16, 2014	Rubicon conducted the second ground water monitoring and sampling event.

2.2 PROJECTED ACTIVITIES

Date	Activity
October 2014	Rubicon will conduct the third ground water monitoring and sampling event.
January 2015	Rubicon will conduct the fourth ground water monitoring and sampling event.

3.0 GROUND WATER MONITORING WELL INSTALLATION

The ground water monitoring well installation included pre-field activities (January through March 2014); drilling, soil sampling, and well installation activities (March 31 through April 11, 2014); well development (April 14 and 15, 2014); and surveying (May 19, 2014). Well completion details are provided in Table 1 and well locations are shown in Figure 2.

3.1 PRE-FIELD ACTIVITIES

Prior to conducting the field work, Rubicon prepared a site-specific Health and Safety Plan (HASP) for the work to be performed. The HASP, prepared in conformance with applicable U.S. Occupational Safety and Health Administration (OSHA) and California Division of Occupational Safety and Health (Cal/OSHA) requirements, was maintained on site during field activities.

In addition to preparation of the HASP, Rubicon applied for and obtained permits prior to commencement of field work. Permits were obtained from the LACDPH Drinking Water Program (issued February 18, 2014) and from the MPD (issued March 17, 2014). Copies of the permits are provided in Appendix A.

Underground Service Alert (USA) was contacted on March 13, 2014 (USA ticket # A40720954) to locate subsurface utilities. Prior to contacting USA, a site walk was conducted to confirm and mark the proposed drilling locations with white stakes.

3.2 DRILLING AND SOIL SAMPLING

Each boring was hand augered to 5 feet below ground surface (bgs). Drilling was performed by J&H Drilling Co., Inc. (J&H) of Santa Ana, California using a hollow-stem auger drill rig equipped with 8-inch diameter, continuous flight, hollow stem augers. Borehole drilling was supervised by a California Registered Professional Geologist and the soil cores were described in accordance with the Unified Soil Classification System (USCS). For soil profiling purposes, undisturbed soil samples were collected at nominal 10-foot intervals throughout the depths of the borings. The soils were visually classified by the geologist and recorded on field boring logs. Drilling and well installation began on March 31, 2014 and completed on April 11, 2014. Field monitoring records are presented in Appendix B. Boring logs for each of the five wells are provided in Appendix C.

Soil samples were collected using an 18-inch long, modified California split spoon sampler lined with stainless steel sample sleeves. The ends of the soil-filled sample sleeves were trimmed flush and sealed with plastic end-caps lined with Teflon sheets. The sample sleeves were labeled with a unique identification number and placed on ice. Samples were subsequently transported to PTS Laboratories under standard chain-of-custody procedures for soil geotechnical testing. With the exception of boring RM-3, two soil samples were collected from the vadose zone (20 and 50 feet bgs) and one sample was collected from the water-bearing zone (86 to 140 feet bgs) from each boring. In borings RM-4 and RM-5, soil samples were collected continuously from 100 feet bgs and 75 feet bgs, respectively.

3.2.1 Lithologic Conditions

RM-1 was drilled to a total depth of 91 feet bgs. The first 25 feet consisted of silty sand with trace clay. From 25 to 35 feet, a layer of very fine grained silty clay was observed. Fine grained sand with silt was observed from 35 to 73 feet bgs. From 75 feet to 91 feet, fine grained silty sand was observed.

RM-2 was drilled to a total depth of 115 feet bgs. The first 25 feet consisted of sand, silty sand, and clayey sand. A layer of clay was encountered between 25 and 40 feet bgs. Layers of sand, silty sand with fine to medium grained sand lenses, and a mixture of sand, silt, and gravel were observed from 40 to 75 feet bgs. Fine grained silt was encountered between 75 and 98 feet bgs. From 98 to 105 feet bgs, fine to coarse grained clayey sand was observed. Coarse grained sand was observed from 105 feet to the bottom of the borehole.

RM-3 was drilled to a depth of 155 feet bgs. Sand and silty sand were observed from ground surface to approximately 65 feet bgs. Siltstone was observed from 65 to 85 feet bgs. A fine grained silty sand with a trace of clay was observed from 85 to 95 feet bgs. From 95 to 145 feet bgs, silty sand, silt, and siltstone were observed, overlying clay and a fine grained silt.

RM-4 was drilled to a depth of 146 feet bgs. From the surface to approximately 108 feet bgs, the soil was classified as fine grained silty sand, medium grained sand with traces of silt or clay, and fine grained sand with silt and traces of clay. Layers of clay and clayey sand were observed from 108 feet to 117 feet bgs. Silty sand with traces of clay was observed from 117 feet bgs to 124 feet bgs. Medium grained sand with silt and clay, fine grained clayey sand, gravels, silt, and silty sand were observed from 124 feet to the bottom of the boring.

RM-5 was drilled to a depth of 140 feet bgs. Fine grained silty sand and fine to medium grained sand were observed from the surface until a depth of 41 feet bgs. A layer of silt overlying a layer of siltstone was observed from 41 feet to approximately 72 feet bgs. Silt was observed from 72 to 123 feet bgs. Siltstone was observed from 123 feet until the bottom of the boring. Well completion details including total depth and perforated intervals are provided in Table 1.

3.2.2 Soil Geotechnical Results

All samples were tested for total and air-filled porosity, grain size and bulk density, moisture content, and total pore-fluid saturation. In addition, the vadose zone samples were also analyzed for native state permeability to air while the saturated zone samples were analyzed for native-state permeability to water. The results of the soil geotechnical testing are presented in Table 2. The laboratory results are provided in Appendix D.

As shown in Table 2, the moisture content of the samples collected in the upper 50 feet of the soil profile ranged from 5.9 % to 21.3 %. The average moisture content for the upper 50 feet of the vadose zone was approximately 12 %. This moisture content is greater than the moisture content assumed by the previous model by about 3 to 5 %. This difference in the initial moisture content is not expected to affect the long term transport behavior of nitrate in the vadose zone. The hydraulic conductivity of the samples collected from the saturated zone ranged from 1.12×10^{-6} cm/s to 8.88×10^{-6} cm/s. The arithmetic average of the hydraulic conductivity is 5×10^{-6} cm/s. This hydraulic conductivity value is significantly lower than the assumed value for the previous model. The potential effects of the differences between the model input and the measured hydraulic conductivity data is the substantially longer travel time associated with the lower hydraulic conductivity.

3.3 WELL INSTALLATION

The five soil borings were completed as monitoring wells with 2-inch diameter flush threaded, Schedule 40 PVC blank casing and 0.020-inch perforated casing. The screened sections were packed with Monterey No. 3 grade silica sand to 2 feet above the 20 feet long perforated screens. Bentonite chips placed above the sand packs were hydrated in place with potable water and the remaining annular space was filled with bentonite cement grout. The surface of each well was completed with a traffic-rated well box. Well completion details are provided in Table 1.

3.4 WELL DEVELOPMENT AND SURVEYING

The wells were developed on April 14 and 15, 2014 by J&H under Rubicon oversight. Development consisted of repeated cycles of surging and bailing, followed by purging. Initially, fine-grained sediments were bailed from the bottom of each well. The screened intervals were surged using a tight-fitting, vented surge block to agitate the sand pack and to draw fines from the sand pack and surrounding formation into the well casing. The fines that settled to the bottom of each well were then removed by repeated bailing using a heavy, bottom-filling bailer. Purging was accomplished using a bailer and submersible pump. Throughout the well development process, pH, electrical conductivity (EC), temperature, and turbidity were monitored frequently. Purging was continued until the water was visibly free of sand, relatively free of settleable solids, and ground water parameters were stabilized within 10 percent of the preceding parameter readings. Well development logs are provided in Appendix B.

On May 19, 2014, McGee Surveying Consulting surveyed the wells for location and elevation to established benchmarks. Horizontal well locations were surveyed to an accuracy of 1.0 foot. Well head elevations were surveyed to the nearest 0.01 foot at the marked reference point on each well casing. The survey report is provided in Appendix E.

3.5 INVESTIGATION-DERIVED MATERIALS

Investigation-derived materials generated during well installation activities included the soil generated during drilling, sediments from well drilling fluids, and purged ground water generated during well development. In accordance with the work plan, the soil and water generated during the activities were kept on-site and spread on the land.

4.0 GROUND WATER MONITORING

Ground water monitoring and sampling have been conducted at the site on two occasions since the five wells were installed. The first event was conducted on April 23 and 24, 2014 and the second event was completed on July 15 and 16, 2014. The ground water sampling events, analytical results, and data evaluation are discussed below. The field monitoring records are presented in Appendix B.

On April 23 and July 15, 2014, ground water levels were measured in each of the five ground water monitoring wells. The well completion details are presented in Table 1. The water levels were measured, using an electric well sounder, immediately after accessing each well and prior to any artificial water level disturbance. The measurements were recorded to the nearest 0.01 foot relative to the top of the casing in each well. The ground water level data are summarized in Table 3.

4.1 GROUND WATER HYDROLOGY

Depth to water at the site ranged from 35.28 feet bgs to 123.38 feet bgs. Water level elevations ranged from 159.05 feet above mean sea level (MSL) to 49.33 feet MSL. The ground water contours generated using the two sets of data are presented in Figures 3 and 4. The contours show that ground water flow is generally to the southeast. It is noted that the April 2014 data for RM-1 appeared to be anomalous and was not considered for contouring. The general ground water flow direction, however, is consistent with historical data reported for the site vicinity (Earthforensics, August 5, 2013; April 13, 2012). The average hydraulic gradient across the site is approximately 0.04 to 0.15. As shown by the contours, the hydraulic gradient is lower in the upgradient portion of the site than the downgradient areas where steep topography exists. As noted in the boring logs (Appendix C), ground water was encountered at levels deeper than the stabilized water levels indicating that the underlying hydrologic unit is confined.

4.2 GROUND WATER SAMPLING

Prior to sampling, the monitoring wells were purged to remove standing water in the well casings and promote the inflow of representative ground water from the surrounding formation. The monitoring wells were purged using 2-inch diameter Grundfos Redi-Flo2 submersible pumps equipped with polyethylene tubing.

Casing volumes were calculated based on the well diameter and the height of the water column in the well casing. The actual volume of water extracted was measured in containers of known capacity. Typically, well purging continued until three casing volumes had been removed from the well or until the well had been pumped dry. During the first sampling event, RM-3 and RM-4 went dry after 1.5 and 2.5 purge volumes, respectively. During the second sampling event, RM-1, RM-3, RM-4, and RM-5 went dry after approximately 2.3, 1.4, 2.6, and 2.2 purge volumes, respectively.

In accordance with standard sampling procedures, the pH, electrical conductivity (EC), temperature, total dissolved solids (TDS), and turbidity of the ground water were measured initially and after the removal of each successive casing volume. During the second monitoring event, dissolved oxygen (DO) and oxidation reduction potential (ORP) were also measured.

Copies of the field data sheets are included in Appendix B. All field-measured water quality parameters are summarized in Table 4. The pH of ground water ranged from 6.36 to 8.27. The conductivity and TDS data are indicative of high concentrations of general chemical parameters. The DO in the July 2014 sampling event ranged from 2.16 mg/ℓ to 8.56 mg/ℓ. The DO concentrations, however, were generally low except in RM-2. The ORP ranged from 4 mV to 155 mV. The lower ORP data generally corresponded to the low DO. Both the DO and the ORP sets of data are indicative of anaerobic conditions.

4.2.1 Sample Collection

On completion of purging and field measurements for each of the monitoring wells, ground water samples were collected from the tubing using the Redi-Flo2 pumps, which were set to a lower flow rate. For the wells that went dry during purging activities, the wells were allowed to recharge prior to sample collection. The samples were collected in appropriately preserved laboratory supplied glass and/or plastic containers based on requested analyses. All wells were sampled for the following parameters:

- Total Boron (EPA 200.7)
- Total Dissolved Solids (SM 2540 C)
- Chloride and Sulfate (EPA 300.0)
- Total Phosphorus (SM 4500 P B/E)
- Nitrate (as N) and Nitrite (as N) (EPA 300.0)
- Total Kjeldahl Nitrogen (TKN) (SM 4500 N Org B)
- Organic Nitrogen (SM 4500-N(org))
- Ammonia (as N) (SM 4500-NH3 B/C)
- Total Nitrogen (by calculation)
- Enterococcus (SM9230B)
- Total Coliform (SM9221B) and Fecal Coliform (SM9221B/E)

Immediately upon collection, the sample containers were labeled and placed on ice in coolers. All samples were transported from the site to Calscience Environmental Laboratories (Calscience), a state-certified laboratory. Standard chain-of-custody procedures were followed from sample collection to delivery to Calscience. Certificate of Analyses are provided in Appendix F.

Investigation-derived material generated during ground water sampling activities included purged ground water. In accordance with the work plan, the water was kept on-site and spread on the land.

4.2.2 Ground Water Quality

The results of the ground water analyses performed in April and July 2014 are summarized in Table 5 and discussed as follows:

- High chloride, sulfate, and TDS concentrations are indicative of presence of dissolved general chemical constituents. The cations associated with chloride and sulfate are expected to be sodium, potassium, magnesium, and calcium. Wells RM-2 and RM-4 have shown higher than 3,000 mg/ℓ TDS. The other 3 wells have shown TDS concentrations of 1,860 mg/ℓ to 2,620 mg/ℓ. According to the State Water Resources Control Board Resolution 88-63, the ground water that contains greater than 3,000 mg/ℓ TDS is not a suitable water supply system. It should also be noted that the Maximum Contaminant Level (MCL) for TDS is 500 mg/ℓ. Therefore, the water encountered at the site is not a drinking water supply.

- The highest total nitrogen concentrations are detected in RM-3 (31 mg/ℓ and RM-1 (26 mg/ℓ). It is noted the high total nitrogen concentration in RM-3 represents ammonia and organic nitrogen while in RM-1 it represents nitrate and nitrite. Considering that RM-1 is located upgradient of the site and there have not been any discharges on the site from any previous operations, it is likely that the nitrates and nitrites entering the site are transformed as migrating downgradient.

- Nitrate and nitrite concentrations are non-detectable in all wells except in RM-1. The Total Kjeldahl Nitrogen concentration, which is the sum of ammonia and organic nitrogen concentrations, varies from 1.8 mg/ℓ to 31 mg/ℓ with the highest concentration observed in RM-3. The distribution of the various nitrogen species is an indication of anaerobic transformations of nitrate and nitrite to other forms of nitrogen.

- Nitrogen species in the subsurface environment are subject to various transformation mechanisms depending on the oxidative or reductive conditions of the site. Presence of ammonia and organic nitrogen and predominant absence of nitrate combined with moderate to low levels of DO and ORP are indicative of anaerobic conditions. These conditions are conducive to denitrification of nitrogen species which will ultimately produce nitrogen gases. The gases will eventually escape the soil-water environment.

- The bacteriological tests show presence of fecal coliform and total coliform in RM-1, RM-3, and RM-5 with the highest counts observed in RM-1 located upgradient of the site. Enterococcus counts were detected in RM-4 and RM-5 with the highest count (>16,000 MPN/100 mℓ) observed in RM-4 in April 2014. Historical data from the site vicinity also indicate presence of high concentrations of nitrogen and bacteriological contamination in ground water (Stone Environmental, 2004). Future monitoring events may provide additional data for establishing a trend.

5.0 DISCUSSION

The soils encountered during drilling were generally finer than the materials utilized for the nitrate transport model constructed for the site. This change in lithology will have an impact on the hydraulic conductivity of the vadose zone (the zone above the water table). The previous model assumed a hydraulic conductivity of $1x10^{-4}$ cm/s to $1x10^{-3}$ cm/s for the vadose zone. A lower hydraulic conductivity resulting from finer materials encountered at the site, would reduce the vertical flow velocity and increase the travel time of vertical nitrate transport.

The average hydraulic conductivity data collected from the saturated zone (Table 2) is also lower by 2 to 3 orders of magnitude (10^{-6} to 10^{-5} cm/s) than the data assumed by the previous model (10^{-3} cm/s). The effect of such reduction in hydraulic conductivity is the slower water flow velocity and slower transport of any dissolved nitrogen species from the site to downgradient areas.

As mentioned earlier, ground water was encountered during drilling at about 100 feet bgs with the exception of RM-1 which encountered water at about 76 feet bgs. In previous simulations (Rubicon, June 2013), depth to water was assumed to be 62 feet bgs. Comparing the field observations with the previous simulation assumptions, under existing conditions, any nitrate leaving the root zone has to travel approximately 30 to 40 feet more to reach the ground water. This means that the arrival of the nitrate front to ground water will be substantially longer than predicted by the previous model. This transport behavior is expected to result in higher reduction of nitrate as a result of denitrification.

The ground water quality parameters demonstrate that the water-bearing zone is anaerobic as exhibited by the absence of nitrate and presence of ammonia and other forms of nitrogen. As mentioned earlier, presence of nitrate and nitrite in upgradient Well RM-1 indicates transport of these nitrogen species from off-site areas. However, presence of high concentrations of ammonia and organic nitrogen and absence of nitrate and nitrite in the other wells are indicative of denitrification or consumption of oxygen followed by reduction of nitrate (Stumm and Morgan, 1970). The denitrifying bacteria are capable of transforming nitrate and nitrite to nitrogen gases which will escape the subsurface environment (Mehran, et al., 1984). The presence of denitrifying bacteria and a moderate redox potential can lead to denitrification (Edmunds, 1973; Gilham and Cherry, 1978).

Two wells have shown greater than 3,000 mg/ℓ TDS. The other 3 wells also have shown elevated (higher than 1,860 mg/ℓ) TDS. According to the SWRCB Resolution 88-63, all ground waters of the State are considered to be suitable, or potentially suitable, for municipal or domestic water supply with the exception of ground waters where the TDS exceeds 3,000 mg/ℓ and it is not reasonably expected by Regional Boards to supply a public water system. Also, as the state and federal MCL for TDS is 500 mg/ℓ, the greater than 1,890 mg/ℓ TDS detected at the site would not render the water-bearing zone as a drinking water supply source.

Review of the State non-degradation documents including SWRCB Resolution 68-16; *Asociación De Gente Unida Por El Agua v. Central Valley RWQCB* on the interpretation of Resolution No. 68-16 (February 22, 2013); and the Administrative Procedures Update (90-004) demonstrates that the focus of the implementation of the non-degradation policy is on discharge into "high quality water". Presence of high TDS and bacteriological contamination does not qualify the site water-bearing zone as a high quality water source. Application of nitrate-containing tertiary-treated discharge is expected to result in substantially less than 10 mg/ℓ nitrate entering in the leachate under most probable conditions. Considering the anaerobic conditions of the site, the denitrification process that is clearly evident and on-going at the site is expected to overwhelm any new nitrate entering the underlying ground water. The result of this denitrification process would be the production of reduced forms of nitrogen and ultimate production of nitrogen gases that would escape the system. Furthermore, the site conditions indicate that travel time of nitrate from the bottom of the root zone to ground water will be significantly longer than 27 years. Considering the above factors, we believe that application of the tertiary-treated water for irrigation of the site will not result in any significant reduction of ground water quality.

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Tables

TABLE 1

Well Completion Details

Green Acres, LLC
Rancho Malibu Project Site
4000 Malibu Canyon Road, Malibu, CA

Well Name	Installation Date	Easting	Northing	Surface Elevation	Reference Elevation	Boring Depth	Screen Top Depth	Screen Base Depth	Casing Diameter	Screen Slot Size	Well Material
		(feet)	(feet)	(feet MSL)	(feet MSL)	(feet)	(feet)	(feet)	(in.)	(in.)	
RM-1	04/07/14	6,348,764.00	1,836,935.11	225.10	225.06	91	71	91	2	0.020	Sch 40 PVC
RM-2	04/01/14	6,348,817.26	1,835,982.84	217.30	216.63	115	95	115	2	0.020	Sch 40 PVC
RM-3	04/03/14	6,349,221.17	1,836,215.18	226.10	225.48	155	125	155	2	0.020	Sch 40 PVC
RM-4	04/09/14	6,349,495.73	1,836,455.43	223.80	223.62	146	124	144	2	0.020	Sch 40 PVC
RM-5	04/11/14	6,349,750.67	1,836,045.74	173.20	172.71	140	120	140	2	0.020	Sch 40 PVC

Notes:

NAD83(2011) 2010.00 Epoch California State Plane Coordinate Zone 5

North American Vertical Datum of 1988 Orthometric Heights

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TABLE 2

Summary of Soil Geotechnical Analyses

Green Acres, LLC
Rancho Malibu Project Site
4000 Malibu Canyon Road, Malibu, CA

Well	Date	Depth (ft)	Sample Orientation	Moisture Content (% weight)	Density (g/cc)		Porosity (%Vb)		Total Pore Fluid Saturations[3] (%Pv)	25 PSI Confining Stress		
					Dry Bulk	Grain	Total [1]	Air Filled[2]		Effective Permeability to Air[4] (millidarcy)	Effective Permeability to Water[4][5] (millidarcy)	Hydraulic Conductivity[4][5] (cm/s)
RM-1	04/03/14	20	Vertical	21.3	1.51	2.66	43.4	11.2	74.1	69.9	--	--
	04/03/14	50	Vertical	6.2	1.62	2.67	39.5	29.5	25.4	876	--	--
	04/07/14	86	Vertical	12.4	1.66	2.68	37.9	17.2	54.5	--	1.1	1.12E-06
RM-2	03/31/14	20	Vertical	5.7	1.52	2.64	42.3	33.6	20.5	2920	--	--
	03/31/14	50	Vertical	16.3	1.33	2.53	47.3	25.6	45.8	5270		
	03/31/14	110	Vertical	15.9	1.67	2.30	27.6	1.0	96.3	--	6.14	6.28E-06
RM-3	04/01/14	20	Vertical	9.1	1.67	2.65	36.8	21.6	41.3	2030	--	--
	04/01/14	50	Vertical	6.5	1.51	2.66	43.0	33.2	22.8	4580	--	--
RM-4	04/07/14	20	Vertical	5.9	1.52	2.63	42.1	33.1	21.3	1890	--	--
	04/07/14	50	Vertical	10.3	1.64	2.63	37.8	21.0	44.5	793		
	04/08/14	140	Vertical	18.9	1.42	2.73	48.0	21.1	55.9	--	3.26	3.30E-06
RM-5	04/09/14	20	Vertical	8.2	1.56	2.65	41.0	28.2	31.3	792	--	--
	04/09/14	50	Vertical	32.0	1.12	2.34	52.0	16.0	69.3	26.1	--	--
	04/11/14	140	Vertical	35.1	1.08	2.13	49.4	11.5	76.6	--	8.75	8.88E-06

Notes:
Methods used: API RP 40, ASTM D2216, EPA 9100
Vb = Bulk volume, cc
Pv = Pore volume, cc
Air = Nitrogen gas
Water = filtered laboratory fresh (tap) or site water
(1) Total Porosity = all interconnected pore channels
(2) Air Filled = pore channels not occupied by pore fluids
(3) Fluid density used to calculate pore fluid saturations; Water = 0.9996 g/cc
(4) Effective (native) = with as-received pore fluids in place
(5) Permeability to water and hydraulic conductivity measured at saturated conditions

TABLE 3

Ground Water Level Data
April and July 2014

Green Acres, LLC
Rancho Malibu Project Site
4000 Malibu Canyon Road, Malibu, CA

Well	**Date**	**Reference Elevation** (feet MSL)	**Depth to Water** (feet)	**Water Level Elevation** (feet MSL)
RM-1	4/23/14	225.06	75.21	149.85
	7/15/14	--	35.28	189.78
RM-2	4/23/14	216.63	98.86	117.77
	7/15/14	--	99.45	117.18
RM-3	4/23/14	225.48	66.43	159.05
	7/15/14	--	66.25	159.23
RM-4	4/23/14	223.62	95.11	128.51
	7/15/14	--	90.75	132.87
RM-5	4/23/14	172.71	123.38	49.33
	7/15/14	--	123.30	49.41

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TABLE 4

Summary of Field Water Quality Parameters
April and July 2014

Green Acres, LLC
Rancho Malibu Project Site
4000 Malibu Canyon Road, Malibu, CA

Well	Date Collected	pH	Conductivity (µmohs/cm)	Temperature (°F)	TDS (ppm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	ORP (mV)
RM-1	4/23/14	8.27	2,412	69.8	1206	>999	--	--
	7/15/14	8.19	2,390	73.8	1192	480	2.5	4
RM-2	4/23/14	6.28	3,300	74.1	1650	449	--	--
	7/15/14	6.36	3,280	74.1	1640	270	8.56	155
RM-3	4/23/14	7.16	3,100	72.8	1549	>999	--	--
	7/15/14	7.18	3,089	73.3	1545	550	2.93	47
RM-4	4/24/14	7.73	3,177	74.8	1589	>999	--	--
	7/16/14	7.71	3,141	70.4	1571	800	2.16	23
RM-5	4/24/14	6.68	2,059	72.0	1029	>999	--	--
	7/16/14	6.71	1,994	75.1	998	530	6.33	54

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TABLE 5

Summary of Ground Water Analyses
April and July 2014

Green Acres, LLC
Rancho Malibu Project Site
4000 Malibu Canyon Road, Malibu, CA
(All units are mg/L except where noted)

Well	Date	Boron	Chloride	Total Dissolved Solids	Sulfate	Total Phosphorus	Ammonia (as N)	Nitrate (as N)	Nitrite (as N)	Organic Nitrogen	Total Kjeldahl Nitrogen	Total Nitrogen	Enterococcus	Fecal Coliform (MPN/100mL)	Total Coliform (MPN/100mL)
RM-1	04/23/14	1.53	360	1860	380	2.7	1.8	0.94	20	2.5	4.3	26	<18	68	1100
	07/15/14	1.69	300	1900	390	0.75	2.9	9.9	2.0	0.90	3.8	16	<18	<18	<18
RM-2	04/23/14	0.36	650	3640	1500	2.8	0.36	<0.1	<0.1	1.6	2.0	2.0	<18	<18	<18
	07/15/14	0.347	590	3920	1300	0.90	0.28	<0.1	<0.1	1.5	1.8	1.8	<18	<18	<18
RM-3	04/23/14	0.96	880	2440	370	2.1	9.0	<0.1	<0.1	22	31	31	<18	220	220
	07/15/14	1.10	950	2620	320	12	10	<0.1	<0.1	15	25	25	<18	<18	<18
RM-4	04/24/14	2.23	270	3070	1500	2.0	7.2	<0.1	<0.1	0.60	7.8	7.8	>16000	<18	<18
	07/16/14	2.40	280	3020	1500	0.21	7.6	<0.2	<0.2	<0.5	7.7	7.7	170	<18	<18
RM-5	04/24/14	0.45	280	1890	570	8.3	1.3	<0.1	<0.1	11	12	12	45	45	45
	07/16/14	0.358	270	1990	580	1.3	1.0	<0.1	<0.1	2.6	3.6	3.6	<18	<18	<18

NOTES:
"<" denotes less than reporting limits indicated.

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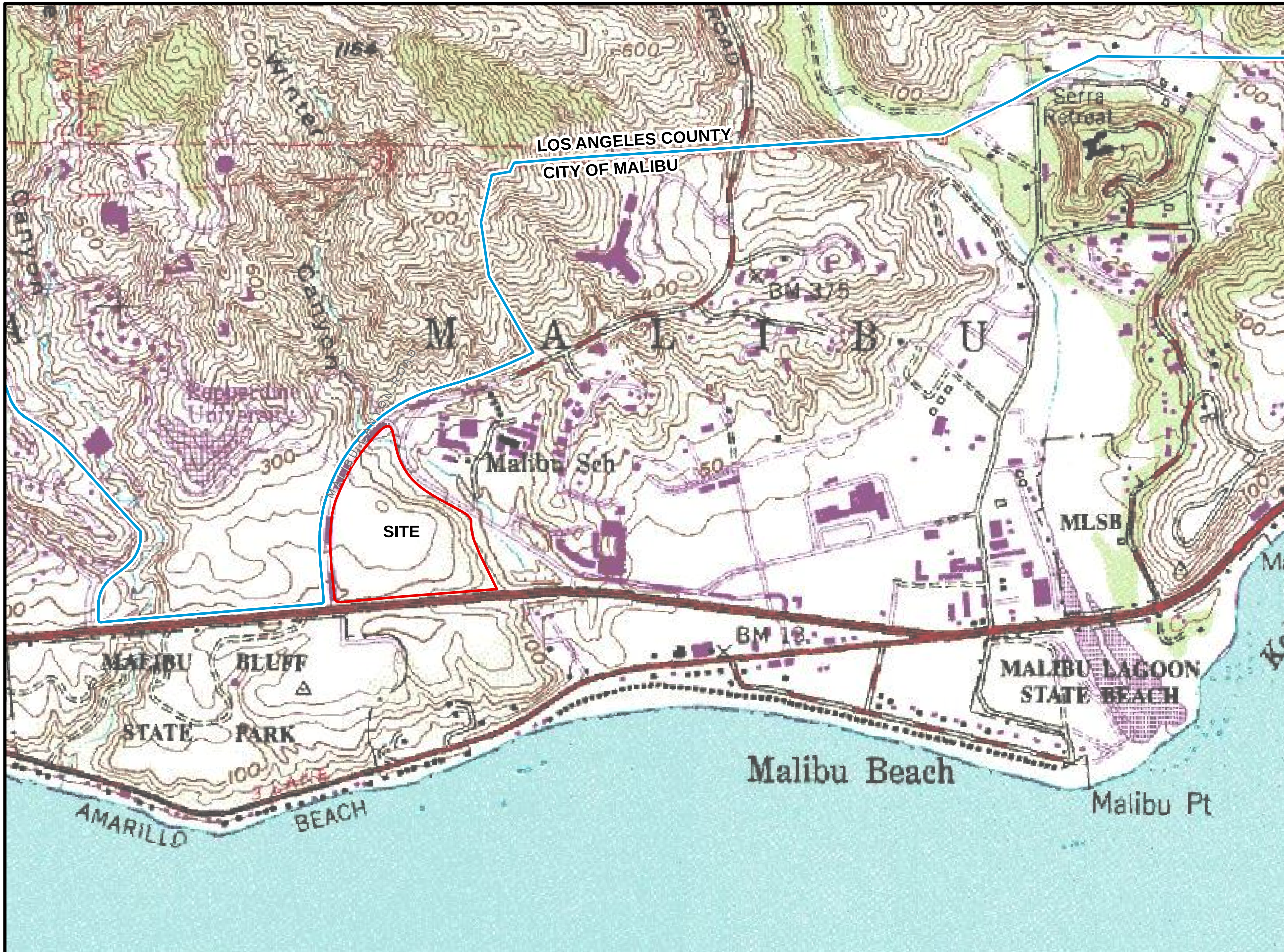
Figures



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REFERENCE:
TOPOGRAPHIC MAP BY USGS 1994

LEGEND

SITE BOUNDARY

LOS ANGELES COUNTY/CITY OF MALIBU BOUNDARY

FIGURE 1

SITE LOCATION MAP

RANCHO MALIBU PROJECT
MALIBU, CALIFORNIA

RUBICON
Engineering Corporation

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FIGURE 2

SITE PLAN

RANCHO MALIBU PROJECT
MALIBU, CALIFORNIA

RUBICON
Engineering Corporation

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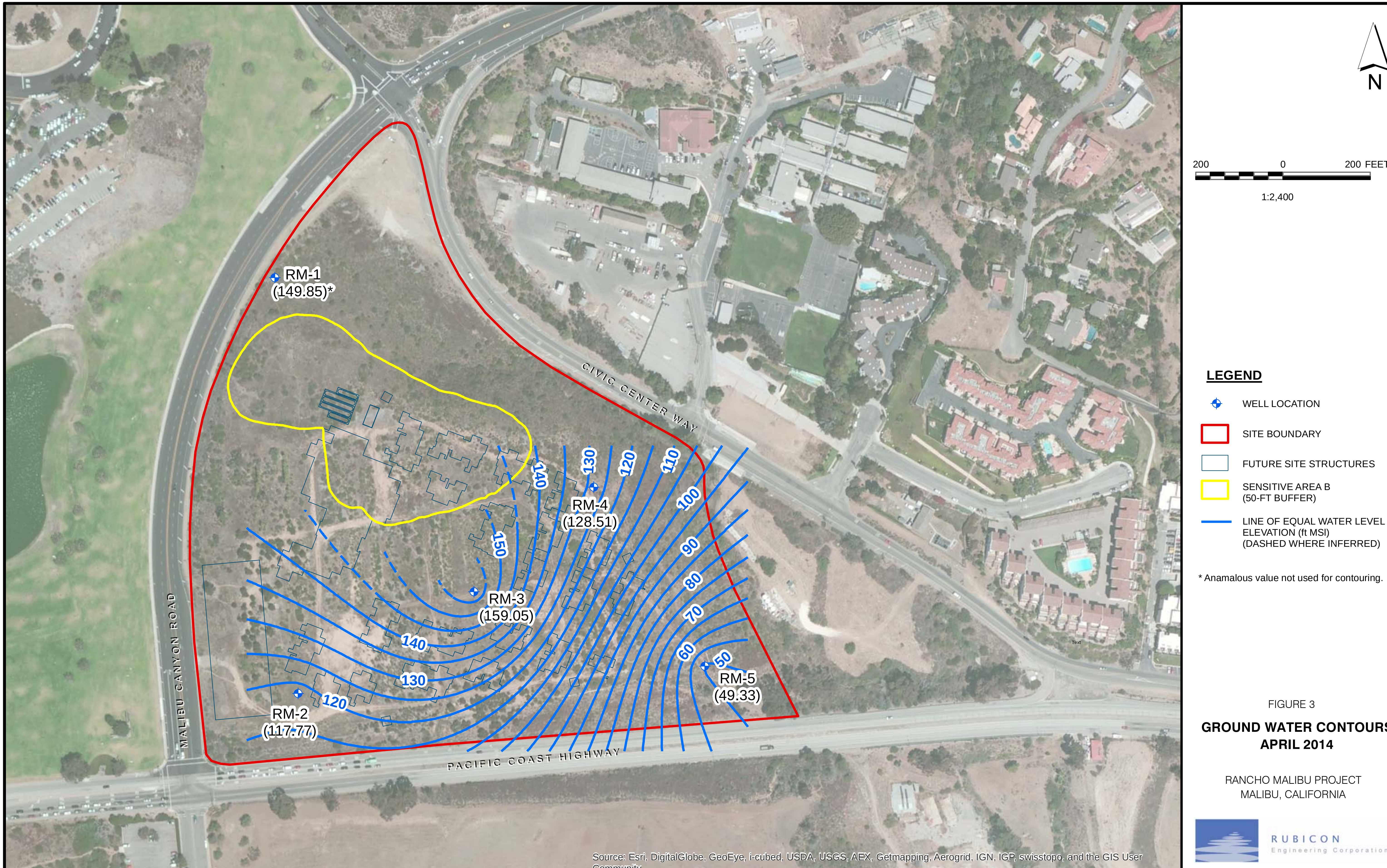

FIGURE 3

GROUND WATER CONTOURS
APRIL 2014

RANCHO MALIBU PROJECT
MALIBU, CALIFORNIA

RUBICON
Engineering Corporation

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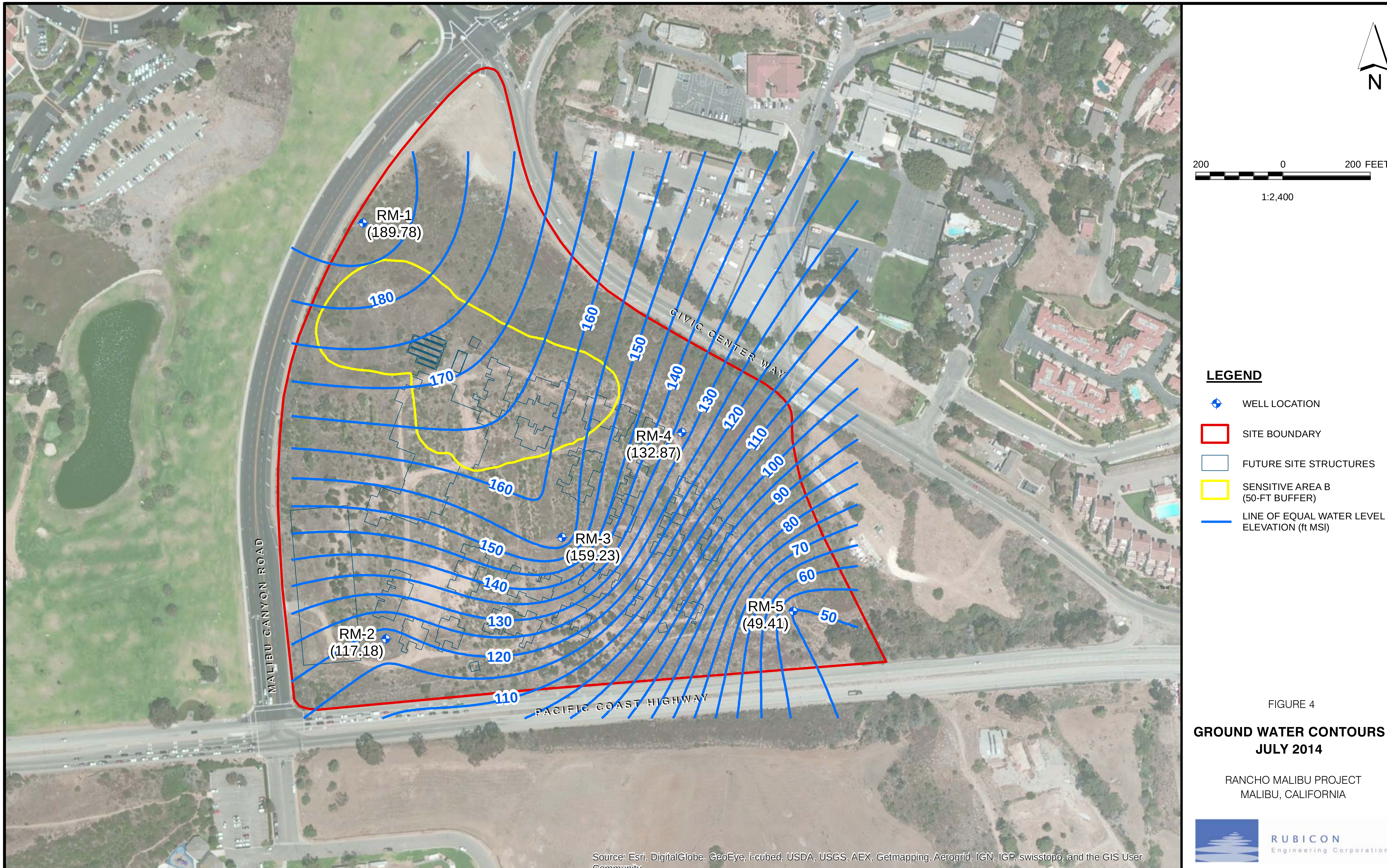

FIGURE 4

GROUND WATER CONTOURS
JULY 2014

RANCHO MALIBU PROJECT
MALIBU, CALIFORNIA

RUBICON
Engineering Corporation

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