Final - Nitrate Mass Balance Study of the 112.6-acre Freedom Ranch Facility located on Buckman Springs Road, San Diego County, California

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Prepared for:
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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

afy – acre-feet per year

APN – Assessor's parcel number

CEQA – California Environmental Quality Act

CIMIS – California Irrigation Management Information System

CRWQCB – California Regional Water Quality Control Board

EP – evapotranspiration

ETo – reference evapotranspiration

GP – general plan

MCL – maximum contaminant level

mg/L – milligram(s) per liter

msl – mean sea level

MUP – Major Use Permit

N – Nitrogen

NO_3 – Nitrate

PET – potential evapotranspiration

EXECUTIVE SUMMARY

AECOM evaluated the potential impacts that increased septic tank effluent from expansion of the Freedom Ranch may have on area groundwater nitrate concentrations. The 112.6-acre facility is located adjacent to Buckman Springs Road in the unincorporated area of Campo, in south central San Diego County, California. Currently, the Freedom Ranch is a 50-bed men's residential alcohol and drug treatment and recovery facility. The project proposes to modify the existing major use permit (MUP) to expand the facility in phases from 50 to 125 beds. Proposed improvements include a multi-purpose building, five dormitories, two parking lots, improved driveways, and new septic systems. Water for the facility is currently and will continue to be supplied by one onsite well (Well-12) regulated by the San Diego County Department of Environmental Health (DEH) as part of a State of California Small Drinking Water System. (Note Well-12 is known as Well-3 in the DEH database.) Wastewater is and will continue to be disposed by existing and new septic systems.

High concentrations of nitrate in drinking water are linked with methemoglobinemia in human infants. The principal sources of nitrate on residential projects are expected to be septic systems. Nitrate from septic systems is the product of properly functioning septic tanks and leach fields/seepage pits. The unsaturated soil beneath the leach field/seepage pit oxidizes the ammonium ions in the effluent into nitrate. Some of the nitrate will be converted to the gaseous nitrous oxide and molecular nitrogen which escape to the atmosphere. This process is called denitrification. Some nitrate is also lost to adsorption onto soil particles and fixation by plants. The remainder may dissolve in groundwater.

The groundwater objective for nitrates in the subject basin is 45 milligrams per liter (mg/L) as NO_3 or 10 mg/L as nitrogen (N). According to the California Regional Water Quality Control Board (CRWQCB) guidelines, in order for a project to be approved, the project proponents must demonstrate that the project is not expected to cause average groundwater nitrate concentrations to rise above the basin plan objective (10 mg/L as N) (CRWQCB 2011). Based on the results of our nitrate mass balance analysis, drinking

water quality is not anticipated to be a significant impact for the project given the calculated septic nitrate loading.

1.0 INDRODUCTION

1.1 Purpose of the Report

The purpose of this report is to determine if modifying the major use permit (MUP) from a 50-bed residential facility to 125 beds will cause average groundwater nitrate concentrations to rise above the basin objective (10 mg/L as nitrogen [N]).

1.2 Project Location and Description

The approximately 112.6-acre property (APNs: 607-110-10, 11, 36 and 52, 607-120-68), is located along Buckman Springs Road, near the intersection of Phelps Road, about 1½ miles northwest of Cameron Corners, in the unincorporated area of Campo, in south central San Diego County, California (Figure 1). The actual footprint of operations, not including the septic systems, is approximately 24 acres. The project proposes increasing the number of licensed recovery home beds from 50 to 125 and providing a dining hall for 150 patrons. There are eight wells on the property; two wells (Well-12 and Well-B) are outfitted with submersible pumps and capable of providing potable water. Well-B, located in a well shed near the southern property boundary, is no longer used for the facility operations. Well-12, located near the northern property boundary, is the primary potable water supply for the facility, pumping about 4 acre-feet per year (afy). Normally, Well-12 cycles on and off based on tank water level. When operating, Well-12 pumps at about 30 gpm. Well-12 is regulated as a County Small Water System well (and is known as Well-3 in their database) and is tested regularly for water quality (as required by California Department of Public Health regulations). The water usage estimate for the project, which includes minimal irrigation and all other potable and non-potable water usage, is about 10 afy; this includes a contingency of roughly 1 afy.

1.3 Applicable Groundwater Regulations

Since the California Environmental Quality Act (CEQA) requires that environmental impacts be assessed for each project, and since increased groundwater usage is a potential impact, this project is subject to analysis by CEQA. This study was performed in accordance with the County scoping letter dated May 22, 2012.

2.0 EXISTING CONDITIONS

2.1 Topographic Setting

The project site is situated on a relatively narrow alluvium-filled north-south-trending valley and surrounded by highlands to the east and west of the site. A watershed boundary map with the project location is presented as Figure 2. Elevations in the watershed range from about 2,780 feet above msl in the south to about 3,840 feet above mean sea level (msl) in the Cameron Mountains in the northeast part of the basin. Surface drainage flows from the north and highlands toward the intermittent creek that parallels Buckman Springs Road in the center of the watershed and exits the basin in the south.

2.2 Climate

Precipitation

According to the County's *Groundwater Limitations Map*, the project site and the surrounding basin are located in the 18 to 21-inch mean annual rainfall belt (Figure 3). Over the past 40 years, annual rainfall totals at the Morena Reservoir rainfall station have ranged from about 3.6 to 41.4 inches. The average annual rainfall for this station is 19.21 inches for that period. The Morena Reservoir Rainfall Station is located less than 4 miles northwest of the project site at an elevation of 3,075 feet above msl and within the same rainfall belt as the project site. Rainfall data for this station were recorded monthly and are complete for the rainfall years (July through June) 1967/1968 through 2007/2008. Data for the Morena Reservoir rainfall station are available in Appendix A of the *Final Groundwater Investigation Report* (AECOM 2013).

The Campo rainfall gauge is located approximately 2 miles southeast of the project site at an elevation of 2,630 feet above msl. The Campo rainfall gauge lies inside the 15 to 18-inch mean annual rainfall belt (adjacent to the 18-21-inch mean annual rainfall belt). The average annual rainfall for this station is about 15.8 inches for the period 1973 – 2002 (Wiedlin and Associates 2006).

Because the project site lies between the Campo rainfall gauge and the Morena Reservoir rainfall station, and the elevation of the Morena Reservoir gauge is approximately the median elevation of the watershed, a distance-and-elevation-based fractionalization factor was applied to the Lake Moreno rainfall data. The corrected annual rainfall average used in the water balance analysis was 18 inches for the 40-year period.

Evapotranspiration

In contrast to evapotranspiration (ET), which is defined as a combined process of evaporation from soil and plant surfaces, and transpiration through plants; potential evapotranspiration (PET) is the amount of water transpired through an irrigated non-specific short green crop. Reference evapotranspiration rates (ETo), obtained from the California Irrigation Management Information System (CIMIS) ET_O map is a measure of PET from a known surface, such as grass or alfalfa. The reference ET_O for this zone (Zone 16) is 62.51 inches.

Evaporation

Since pan evaporation rates were not available for the basin, the reported average annual pan-corrected evaporation rate of 58.3 inches from Lake Morena Reservoir was used along with Zone 16 reference evapotranspiration rates (ETo) [62.51 inches] from CIMIS. PET was calculated as the average of ETo with pan-corrected evaporation data and used in a computer program called *Recharg2*, which solves the soil moisture balance equation. ETo, evaporation rates, and PET are provided on Table 1 and are discussed in the *Final Groundwater Investigation Report* (AECOM 2013).

Table 1. Evaporation and Reference Evapotranspiration Rates

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
ETo (inches)	9.30	8.37	6.30	4.34	2.40	1.55	1.55	2.52	4.03	5.70	7.75	8.70	62.51
Evaporation (inches)	8.58	8.07	6.61	4.97	2.84	1.84	1.95	2.27	3.35	4.62	5.95	7.25	58.30
Average (inches) PET	8.94	8.22	6.46	4.66	2.62	1.70	1.75	2.40	3.69	5.16	6.85	7.98	60.41

2.3 Geology and Soils

A general description of site geology and soil types is given in the *Final Groundwater Investigation* Report (AECOM 2013) currently in review by the San Diego County Groundwater Geologist. Rainfall recharge is an important element of the nitrate mass balance study and it is dependent, along with the precipitation and evaporation, and evapotranspiration information discussed above, on basin geology and soil type.

Geology

The proposed project is located in the east-central portion of the Peninsular Ranges Province, a California geomorphic province with a long and active geologic history. This portion of the province is predominantly composed of rocks of the Southern California Batholith and generally consists of Mesozoic-aged granitic rocks with alluvium-filled valleys.

Soils

Based on the San Diego Area Soil Survey (United States Department of Agriculture 1973), soils that make up the watershed are classified into three general slope types: steeper, mid-slope, and flatter. Based on these three slope types we have assumed representative values for moisture holding capacity and maximum runoff for the site and the entire 1,940-acre watershed. The runoff and holding capacities are inputs to estimate the basin rainfall recharge.

2.4 Water Quality

Well-12, a Transient Non-Community regulated County Small Water System well (and known as Well 3 by the Department of Environmental Health), is tested regularly for total coliform, Escherichia coli (*E. coli)*, and nitrate (reported as N and NO_3). Water samples are collected by the water system operator in laboratory-provided bottles, kept on ice, and sent to EnviroMatrix Analytical (a California-certified laboratory) to be analyzed. Laboratory analytical methods, preservation methods, and results are provided on Table 2. No groundwater samples listed exceeded the MCLs.

Table 2. Well-12 (Small Water System Well 3) Analytical Results

	Nitrate (as N)	**Nitrate (as NO_3)**	**Total Coliform**	**E. Coli**
Analytical Method	SM4500	Calculated	SM9223B	SM9223B
MCL	10 mg/L	45 mg/L	Not Detectable	Not Detectable
Results				
08-Mar-2012	N/A	N/A	Absent	Absent
23-Mar-2012	0.38	1.66	Absent	Absent
04-Dec-2012	N/A	N/A	Absent	Absent

Notes:
E. coli - *Escherichia coli*
mg/L – milligrams per liter
MCL – Maximum Contaminant Level
N/A – Not Analyzed
N - Nitrogen
NO_3 – Nitrate

3.0 NITRATE MASS BALANCE

Nitrate concentrations in the water entering the groundwater system can be estimated by a mass balance equation. This approach is based on conservation of mass and assumes the final concentration of nitrate of the water entering the groundwater will be equal to the total mass of nitrate entering the groundwater system divided by the total quantity of water entering the groundwater system.

The mass balance equation is:

$$C_{resultant} = ((Q_{groundwater} * C_{groundwater}) + (Q_{septic} * C_{septic}))/(Q_{groundwater} + Q_{septic})$$

Where:

Q = quantity of flow (afy)

C = nitrate concentration (mg/L as N)

3.1 Quantity of Flow

The mass balance equation uses the quantity of groundwater flow into the system from groundwater recharge and septic system effluent.

Groundwater Recharge

Infiltration of precipitation can be estimated by calculating the amount of precipitation that percolates through the soil root zone to reach the underlying groundwater system after accounting for losses due to runoff, evapotranspiration, and field capacity (soil moisture capacity). The soil moisture balance equation commonly used to estimate groundwater recharge due to rainfall is:

$$R_i = P_i - RO_i - pET_i - (SMC - SM_i)$$

Where:

R_i	=	Recharge during the i^{th} month (inches)
P_i	=	Precipitation during the i^{th} month (inches)
RO_i	=	Runoff during the i^{th} month (inches)
pET_i	=	Potential evapotranspiration during the i^{th} month (inches)
SMC	=	Soil moisture holding capacity (inches)
SM_i	=	Soil moisture at beginning of the i^{th} month (inches)

Runoff can be estimated as a function of the average monthly moisture content of the soil using the following equation:

$$RO_i = RO_{max} x \frac{\frac{SM_i + SM_{i+1}}{2}}{SMC}$$

where:

RO_i	=	Runoff during the i^{th} month (inches)
RO_{max}	=	Maximum runoff potential (percent)
SM_i	=	Soil moisture at beginning of the i^{th} month (inches)
SM_{i+1}	=	Soil moisture at end of i^{th} month (inches)
SMC	=	Soil moisture holding capacity (inches)

Because the project site lies between the Campo rainfall gauge (15.8 inch annual average from 1973 to 2002) and the Morena Reservoir rainfall station (19.21 inch annual average from 1968 to 2008), and the elevation of the Morena Reservoir gauge is approximately the median elevation of the watershed, a distance-and-elevation-based-fractionalization factor was applied to the Lake Moreno rainfall data. The corrected annual rainfall average used in the water balance analysis was 18.00 inches for the 40-year period. This is a conservative approach.

This information along with an average of evaporation rates and reference evapotranspiration rates (Section 2.2 and Table 1) was used in a computer program called *Recharg2*, which solves the soil moisture balance equation.

Utilizing these data in the *Recharg2* program, we calculated the average rainfall recharge, runoff value, and average annual rainfall recharge volume for the 1,940-acre watershed. The output from the *Recharg2* program is presented in Appendix A.

The groundwater recharge for the project site (as defined by Areas A and B discussed below) is estimated as 23.86 afy (or 21,305 gpd).

Current Septic System Effluent Flow

Current onsite septic system effluent is estimated to be 2,800 gpd and is based on the number of men in active treatment, plus residential and non-residential staff. Average water demand (and corresponding septic system effluent) for each active man in treatment and each resident staff is roughly 50 gpd. Septic system effluent for each non-resident staff member is limited to restroom use during an 8-hour work day and is estimated at 15 gpd (per agreement with the County Groundwater Geologist). Table 3 summarizes the current septic system effluent.

Table 3. Current Project Septic System Effluent

On-Site Water Demand	Quantity	Water Demand	Total Septic Effluent (gpd)
Men in Active Treatment	50	50 gpd	2,500
Residential Staff	5	50 gpd	250
Non-residential Staff	3	15 gpd	45
Total Current Project Septic Effluent			**2,795**

Proposed Project Septic System Effluent Flow

Onsite septic system effluent for the project is expected to increase from about 2,800 gpd to about 7,500 gpd. Actual on-site water usage is expected to be about 6,800 gpd, but an additional 10% is included as contingent water use to cover sporadic periods of peak discharge. This contingency reduces risk of code enforcement or the need for another MUP mod for minor changes in the future. Table 4 summarizes the proposed septic system effluent and is inclusive of all septic system flows on the property (including existing flows to be rerouted from the existing [to be abandoned] system to the new proposed system).

Table 4. Anticipated Project Septic Effluent (including 10% contingency)

On-Site Water Demand	Quantity	Water Demand	Total Septic Effluent (gpd)
Men in Active Treatment	125	50 gpd	6,250
Residential Staff	10	50 gpd	500
Non-residential Staff	6	15 gpd	90
		Subtotal	6,840
10% Contingency for Peak Flow			684
Total Anticipated Project Septic Effluent			**7,524**

Septic System Effluent Flow

There are two currently active leach field areas and six additional proposed septic systems on the Freedom Ranch property as identified on Figure 4. The two existing leach field areas in the western portion of the property will be abandoned and the flows will be rerouted to the new proposed systems. The six proposed septic systems (with primary and secondary lines) will accommodate the entire 7,524 gpd effluent. Two proposed systems are located in a designated Area A and four proposed systems are located in designated Area B, as shown on Figure 4. Figure 4 also shows, in red, the proposed septic system horizontal seepage pits (both primary and secondary), sensitive plant areas, lines of inundation by a 100-year flood, and the distribution of lines throughout the site for areas A and B. Area A is about 68 acres in total and includes part of the northeastern portion of the property. Area B is about 65 acres and encompasses part of the southeastern portion of the property. Both areas also include land outside of the Freedom Ranch. It is anticipated that this land will ultimately be developed as residential property. Based on a December 11, 2012 memo from Freedom Ranch Project Manager, Laurie Price (Appendix B), each area outside of the Freedom Ranch property boundary could potentially develop two additional dwelling units. The associated septic system effluent for each additional offsite residence is assumed to be 0.25 afy (one-half of annual water demand) (or 223 gpd) and is added to the Freedom Ranch septic system effluent.

3.2 Current Nitrate Concentration in Groundwater and Septic System Effluent

Based on sampling results from Well-12, the average concentration of nitrate (as nitrogen [N]) in groundwater is 0.38 mg/L. based on discussions with the County DEH staff the average septic system effluent concentration is assumed to be 30 mg/L (as N).

3.3 Resultant Nitrate in Concentration in Groundwater

The resultant groundwater nitrate concentration for Areas A and B are 8.6 mg/L and 8.9 mg/L, respectively. These concentrations assume that the total effluent from the Freedom Ranch project is equally diverted between the two systems. Tables 5 and 6 enumerate the input and result of the nitrate mass balance equation for the two areas.

Table 5. Resultant Nitrate Concentration in Groundwater – Area A

Average annual recharge in watershed (afy)	348
Watershed size (acres)	1,940
Average recharge per acre in watershed (afy/acre)	0.18
Area A size (acres)	68
Average annual recharge on Area A Freedom Ranch ($Q_{groundwater}$) (afy)	12.20
Average annual recharge on Area A ($Q_{groundwater}$) (gpd)	10,893
Average groundwater recharge nitrate concentration ($C_{groundwater}$) (mg/L as N)	0.38
Quantity of Freedom Ranch septic system effluent at project buildout (Q_{septic}) (gpd)	7,524
Portion of total project effluent diverted to Area A (percent)	50
Quantity of septic system effluent for additional residences in Area A (Q_{septic}) (gpd)	446
Total quantity of septic effluent (Q_{septic}) (gpd)	4,208
Average septic system effluent concentration (C_{septic}) (mg/L as N)	30
Resultant groundwater nitrate concentration ($C_{resultant}$) (mg/L as N)	**8.6**

Table 6. Resultant Nitrate Concentration in Groundwater – Area B

Average annual recharge in watershed (afy)	348
Watershed size (acres)	1,940
Average recharge per acre in watershed (afy/acre)	0.18
Area B size (acres)	65
Average annual recharge on Area B Freedom Ranch ($Q_{groundwater}$) (afy)	11.66
Average annual recharge on Area B ($Q_{groundwater}$) (gpd)	10,412
Average groundwater recharge nitrate concentration ($C_{groundwater}$) (mg/L as N)	0.38
Quantity of Freedom Ranch septic system effluent at project buildout (Q_{septic}) (gpd)	7,524
Portion of total project effluent diverted to Area B (percent)	50
Quantity of septic system effluent for additional residences in Area B (Q_{septic}) (gpd)	446
Total quantity of septic effluent (Q_{septic}) (gpd)	4,208
Average septic system effluent concentration (C_{septic}) (mg/L as N)	30
Resultant groundwater nitrate concentration ($C_{resultant}$) (mg/L as N)	**8.9**

Notes:
No significant irrigation or other sources of recharge.
No other significant sources of nitrogen.
afy - acre-feet per year
gpd - gallons per day
mg/L – milligrams per liter
N - nitrogen

Based on an assumed initial recharge nitrate concentration of 0.38 mg/L (as N) and an average septic system effluent concentration of 30 mg/L as N, the resultant groundwater nitrate concentration in each area is below the MCL of 10 mg/L as N. Should the two septic systems change the assumed 50/50 mix of total effluent, we estimate that Area A could accommodate about 64% of the total project effluent (about 4,815 gpd) without exceeding the MCL. Area B could accommodate about 61% of total project effluent (about 4,590 gpd) without exceeding the MCL.

4.0 SUMMARY OF PROJECT IMPACTS AND MITIGATION

Based upon the results of our study, we provide the following conclusions:

- The Project is expected to produce about 7,500 gpd of septic system effluent for expanded operations (including contingency).

- An additional roughly 450 gpd effluent may be generated in Area A and Area B, if, those portions beyond the property boundary are developed with two residences each per the General Plan.

- If the project effluent is split evenly between the two areas the anticipated average concentration of water recharging the groundwater system will be approximately 8.6 and 8.9 mg/L as N for Areas A and B respectively. Neither exceeds the basin objective of 10 mg/L as N.

- The septic system in Area A can handle up to ca. 4,815 gpd of total effluent (about 64% of the total generated) without exceeding the MCL; and the septic system in Area B can handle up to ca. 4,590 gpd of total effluent (about 61% of the total generated) without exceeding the MCL.

4.1 Recommendations

The following recommendations are based on the layout of the proposed septic system as shown in Figure 4. Changes to the proposed location and increased wastewater flows above those outlined in this report would require a reevaluation of water quality impacts to both onsite wells and nearby offsite wells.

- We recommend that any new onsite production wells be located as far as possible and upgradient of septic systems and other sources of contamination.

5.0 REFERENCES

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FIGURES

1. Regional Location Map

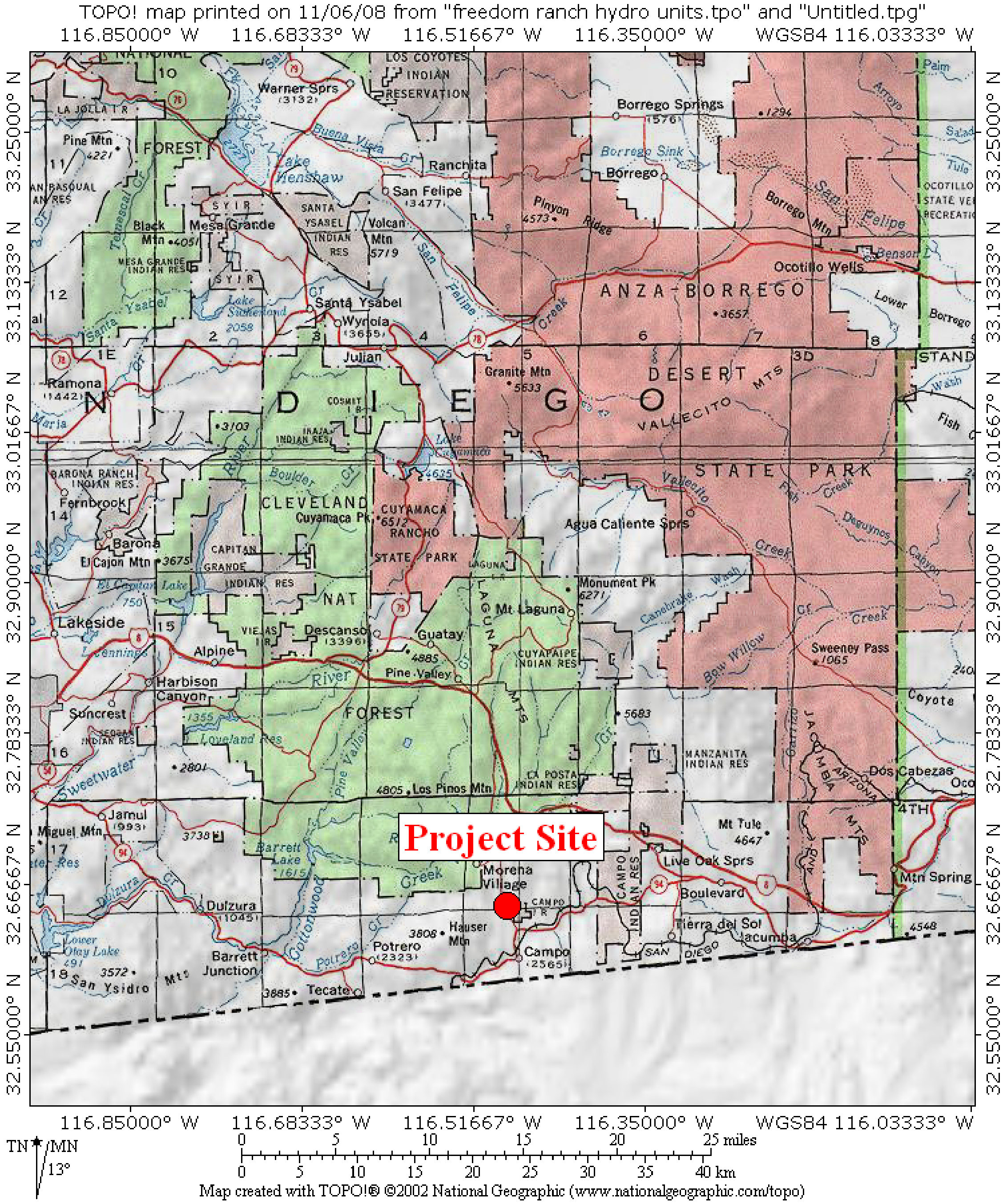


Figure 1
REGIONAL LOCATION MAP
Freedom Ranch
San Diego County, California
June 2013
Project No. 60246607

AECOM

2. Watershed Boundary Map

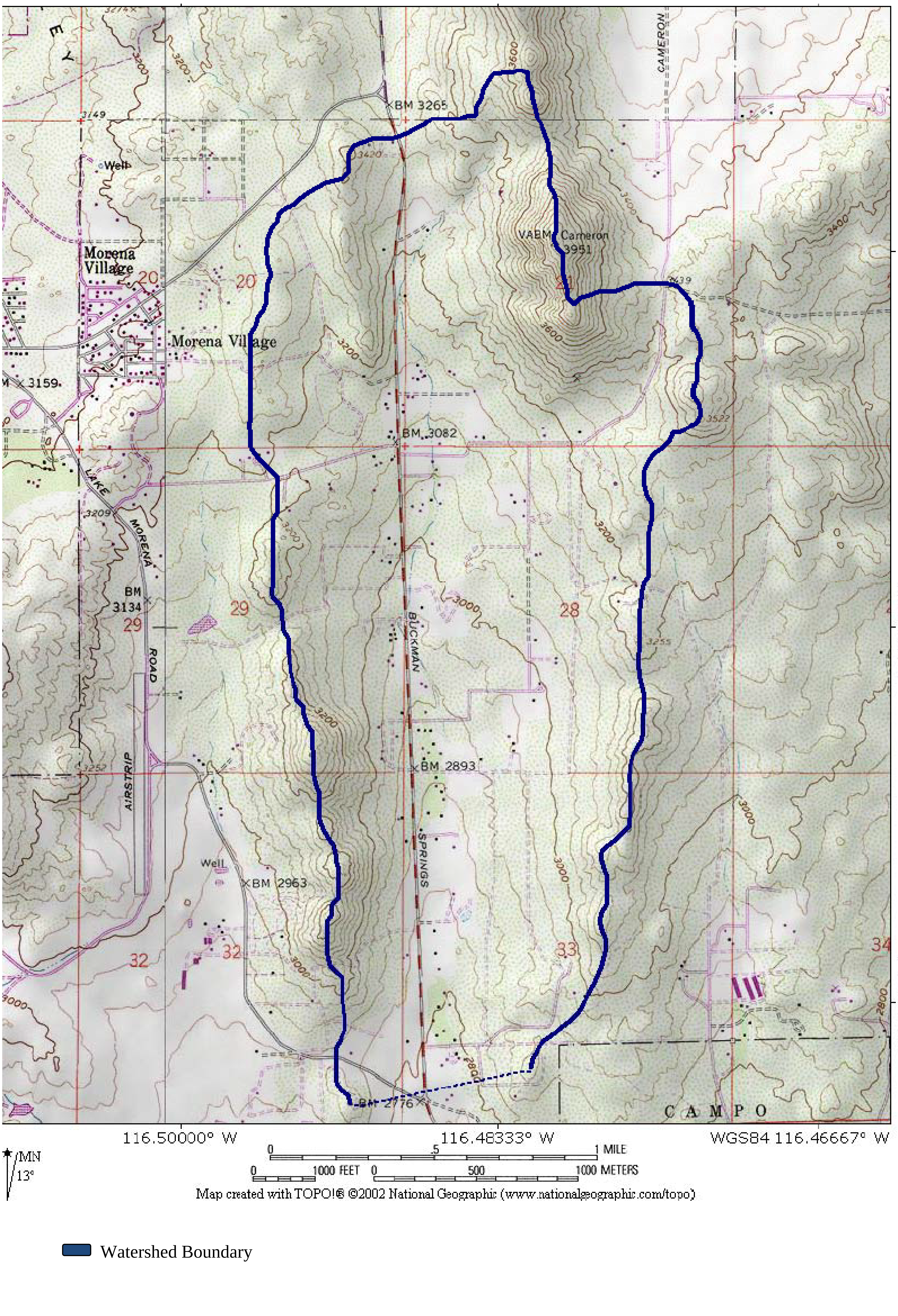


Figure 2
WATERSHED BOUNDARY
Freedom Ranch
San Diego County, California
June 2013
Project No. 60246607

AECOM

Source: TOPO!Map Created from www.nationalgeographic.com/topo

3. Precipitation Map

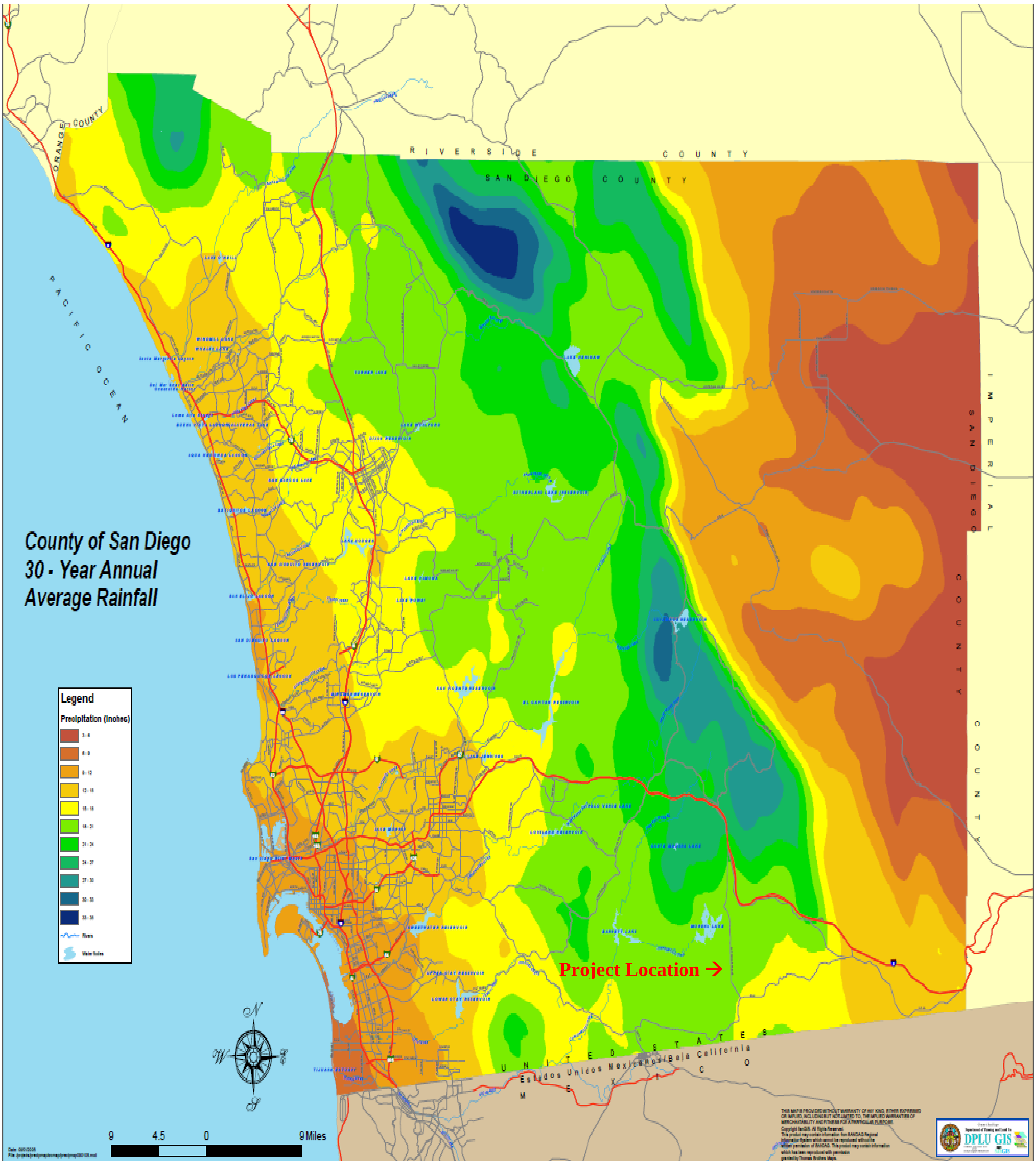


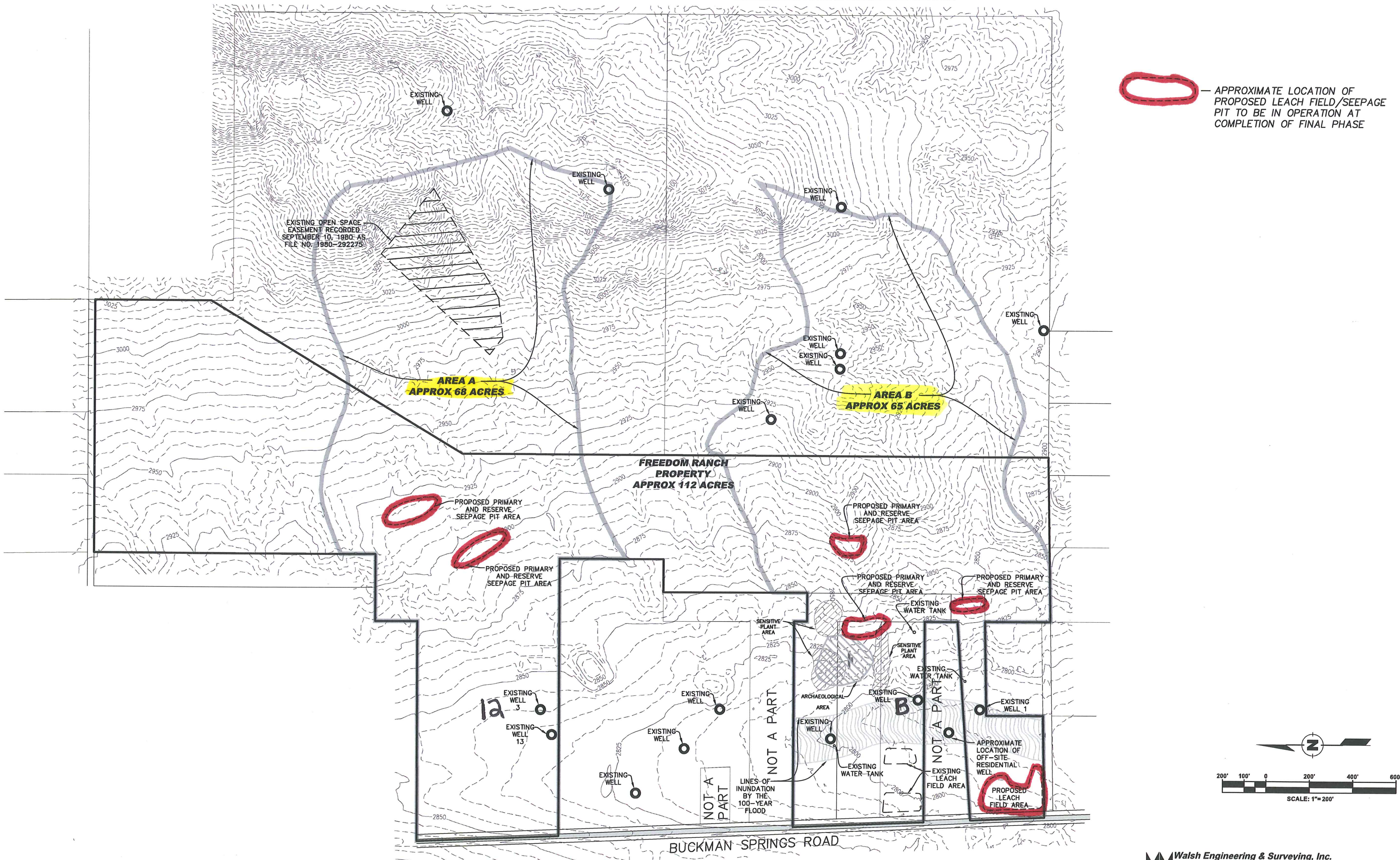
Figure 3
PRECIPITATION MAP
Freedom Ranch
San Diego County, California
June 2013
Project No. 60246607

AECOM

Source: County of San Diego Department of Public Land Use (DPLU) San GIS

4. Septic System and Onsite Wells

FREEDOM RANCH
SEPTIC SYSTEM NITRATE STUDY



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APPENDICES

A. Recharg2 Output

Recharg2 Output
Flatter Areas

Soil Moisture Capacity = 5.10
Calculated Average Recharge = 1.77
Assumed maximum runoff = 20.00 Percent.
Calculated average runoff = 6.09 Percent.

Year	Total Rainfall	Calculated Runoff	Calculated Recharge
1967	15.17	0.80	0.00
1968	19.64	2.03	2.20
1969	10.05	0.00	0.00
1970	13.95	0.51	0.00
1971	9.26	0.20	0.00
1972	22.48	1.86	0.12
1973	10.71	0.58	0.00
1974	17.45	0.26	0.00
1975	21.91	1.12	0.00
1976	15.55	0.12	0.00
1977	35.21	5.25	10.33
1978	26.49	4.02	4.37
1979	39.31	5.11	15.40
1980	14.03	0.65	0.00
1981	21.35	2.55	1.46
1982	35.22	4.91	6.94
1983	7.30	0.00	0.00
1984	15.47	0.49	0.00
1985	19.46	1.96	0.00
1986	14.22	0.16	0.00
1987	21.18	0.71	0.00
1988	9.47	0.13	0.00
1989	9.47	0.44	0.00
1990	20.40	1.93	2.76
1991	11.95	0.89	0.00
1992	26.38	2.84	7.40
1993	17.41	1.01	0.00
1994	3.42	0.00	0.00
1995	11.34	0.30	0.00
1996	18.19	1.47	0.87
1997	37.36	4.70	8.05
1998	16.87	0.12	0.00
1999	10.21	0.58	0.00
2000	15.32	1.06	0.00
2001	7.21	0.00	0.00
2002	17.24	0.74	0.00
2003	15.26	0.78	0.00
2004	32.38	4.78	6.77
2005	17.73	0.40	0.00
2006	10.47	0.34	0.00
2007	23.93	2.39	5.75

Recharg2 Output
Mid Slope Areas

Soil Moisture Capacity = 2.00
Calculated Average Recharge = 2.56
Assumed maximum runoff = 25.00 Percent.
Calculated average runoff = 9.39 Percent.

Year	Total Rainfall	Calculated Runoff	Calculated Recharge
1967	15.17	1.22	1.18
1968	19.64	2.45	4.87
1969	10.05	0.00	0.00
1970	13.95	0.98	0.00
1971	9.26	0.39	0.00
1972	22.48	3.23	1.85
1973	10.71	0.70	0.82
1974	17.45	0.63	0.00
1975	21.91	1.26	2.49
1976	15.55	0.34	0.00
1977	35.21	7.19	11.52
1978	26.49	5.41	6.08
1979	39.31	6.15	17.47
1980	14.03	1.34	0.00
1981	21.35	3.52	3.59
1982	35.22	6.82	8.17
1983	7.30	0.00	0.00
1984	15.47	0.96	0.00
1985	19.46	3.29	0.51
1986	14.22	0.43	0.00
1987	21.18	1.52	0.00
1988	9.47	0.33	0.00
1989	9.47	0.84	0.00
1990	20.40	3.23	4.57
1991	11.95	1.80	0.26
1992	26.38	3.61	9.74
1993	17.41	1.72	0.47
1994	3.42	0.00	0.00
1995	11.34	0.79	0.00
1996	18.19	2.16	3.27
1997	37.36	6.61	9.14
1998	16.87	0.36	0.00
1999	10.21	0.87	0.22
2000	15.32	1.86	0.96
2001	7.21	0.00	0.00
2002	17.24	1.46	0.00
2003	15.26	1.21	0.64
2004	32.38	5.67	8.95
2005	17.73	0.87	0.00
2006	10.47	0.75	0.00
2007	23.93	3.20	8.06

Recharg2 Output
Steeper Areas

Soil Moisture Capacity = 1.70
Calculated Average Recharge = 2.40
Assumed maximum runoff = 30.00 Percent.
Calculated average runoff = 11.27 Percent.

Year	Total Rainfall	Calculated Runoff	Calculated Recharge
1967	15.17	1.50	1.21
1968	19.64	2.93	4.73
1969	10.05	0.00	0.00
1970	13.95	1.19	0.00
1971	9.26	0.52	0.00
1972	22.48	3.92	1.48
1973	10.71	0.84	0.99
1974	17.45	0.77	0.00
1975	21.91	1.51	2.60
1976	15.55	0.47	0.00
1977	35.21	8.63	10.43
1978	26.49	6.46	5.33
1979	39.31	7.26	16.73
1980	14.03	1.65	0.00
1981	21.35	4.17	3.26
1982	35.22	8.19	7.18
1983	7.30	0.00	0.00
1984	15.47	1.13	0.00
1985	19.46	3.70	0.53
1986	14.22	0.56	0.00
1987	21.18	1.76	0.10
1988	9.47	0.45	0.00
1989	9.47	1.00	0.02
1990	20.40	4.01	4.09
1991	11.95	2.05	0.42
1992	26.38	4.36	9.34
1993	17.41	1.95	0.61
1994	3.42	0.00	0.00
1995	11.34	0.97	0.00
1996	18.19	2.60	3.17
1997	37.36	7.92	8.21
1998	16.87	0.43	0.00
1999	10.21	1.04	0.39
2000	15.32	2.29	0.87
2001	7.21	0.00	0.00
2002	17.24	1.76	0.07
2003	15.26	1.46	0.76
2004	32.38	6.68	8.28
2005	17.73	1.02	0.00
2006	10.47	0.92	0.00
2007	23.93	3.88	7.70

B. December 11, 2012 Memo from Laurie Price

Date: December 11, 2012

To: Doug Roff

From: Laurie Price

RE: Freedom Ranch Nitrate Study

This memo is in response to your inquiry regarding how many homes can be realistically be built, (given all the constraints) in those portions of area A and area B east of Freedom Ranch's Major Use property line.

The answer to this question is a little tricky since I do not know the existing constraints within the areas. I'm using the maximum number of dwelling units permitted by San Diego County General Plan for determining the number of units permitted. When, and if the land is developed, this number will be adjusted downward based upon existing constraints. Although I have not factored in any constraints when determining how many dwellings could be build, it is safe to assume that there are groundwater and slope constraints which probable would reduce the total number of home that could be built.

Today the property is two legal parcels. Area A is located within a 84-acre parcel and area B is located within a 80-acre parcel. The land use designated is Rural Lands with a maximum density of 1 dwelling unit per 20 acres. Per the General Plan each parcel could theoretically be divided into 4 lots, thus the maximum number of dwelling units would be 8.

Areas A and B are 32 and 25 acres respectively. Per the General Plan there could be 1 dwelling unit in each area, or a maximum of two units. However, when and if the property is subdivided probable there will be lots created outside of areas A and B, and lots that will include portions of areas A and B. I believe it is safe to conclude that portions of area A would be within two lots and the same is likely to occur with area B. The table below summarizes the maximum permitted dwelling unit from the various alternatives:

DU from the total acreage	8
DU from areas A & B acreage	2
DU from acreage within and outside the areas A & B	4

It is my opinion that if the property were to be subdivided, there would be no more than 2, and probably less than 2 septic systems located in each of the areas.