FINAL
Groundwater Monitoring and Mitigation Plan
Tierra del Sol Solar Farm Project
Major Use Permit 3300-12-010; Rezone 3600-12-005
Tierra del Sol, San Diego County, California

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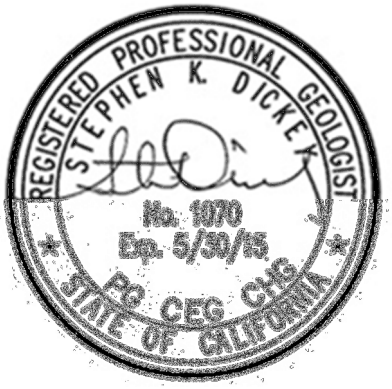

Stephen K. Dickey, PG, CHG, CEG

NOVEMBER 2013

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1.0 INTRODUCTION

The proposed Tierra del Sol Solar Farm Project (Project) consists of a 420-acre solar energy system in the unincorporated community of Tierra del Sol in southeast San Diego County. Residents in this area rely on groundwater as their sole source of water supply. The Project will pump groundwater from one on-site production well (Well B) to help meet its construction and operational water demand. This Groundwater Monitoring and Management Plan (GMMP) has been prepared on behalf of Tierra del Sol Solar Farm LLC by Dudek in order to provide protection of nearby groundwater dependent habitat and ensure adequate groundwater supply for other groundwater users in the area.

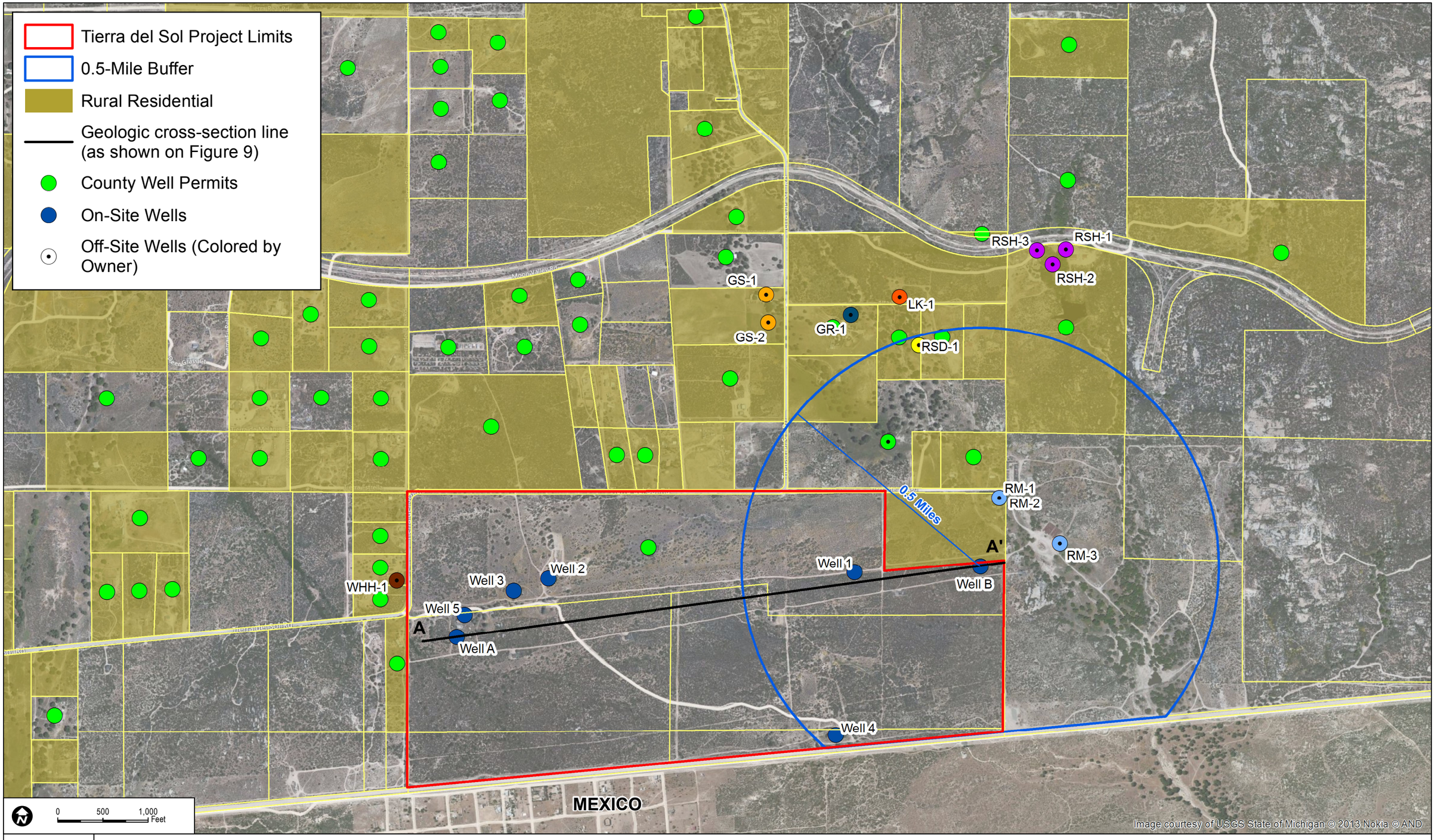
As described in the Groundwater Resources Investigation Report for the proposed Tierra del Sol Solar Farm Project (Dudek, 2013), the Project will require an estimated 50 acre-feet of water during the 1 year construction period and 6 acre-feet per year (afy) thereafter to meet operational demand. Since Well B cannot meet the short-term construction water demand, an estimated 18 acre-feet of construction water will be pumped from on-site Well B (Figure 1), and up to 32 acre-feet of water will be supplied by off-site groundwater and/or municipal sources. Peak construction demand will occur over approximately 50 working days while site clearing, grubbing and grading take place. At the conclusion of these activities, a soil tackifier will be applied to stabilize soils. Following this application, construction water demand will be limited to dust control for the remainder of the approximately 1 year Project construction period. Operational water demand will be driven primarily by washing of the concentrating photovoltaic (CPV) panels and landscape irrigation. Other sources of operational water demand include sanitary and drinking water for the operation and maintenance (O&M) building and annual application of soil binding stabilization agent. It is anticipated that the estimated 6 acre-feet of average annual operational water demand will be entirely met using groundwater from on-site production Well B. The operational demand is relatively low, with an annual average pumping rate of 11.2 gallons per minute (gpm) if Well B is operated an average of 8 hours per day. The demand is equivalent to the use associated with 12 single family residences located on the 420 acre property and less than would be expected for residential buildout.

Results of the Groundwater Resources Investigation indicate that the short-term production of construction water from Well B would result in a less than significant impact to groundwater storage and groundwater levels at off-site wells and groundwater-dependent habitat. Long-term operational water demands are relatively low, well within the sustainable yield of the aquifer system, and have minimal impact.

Because actual conditions during groundwater extraction for the Project may vary from conditions assumed in the Groundwater Resources Investigation (Dudek 2103) this GMMP has been prepared for the Tierra del Sol Solar Farm Project. This GMMP establishes protective groundwater drawdown thresholds for off-site well interference and groundwater-dependent habitat and provides the technical basis for the application of water level (drawdown) thresholds.

Six existing on-site wells and eleven off-site groundwater wells will be used for the groundwater monitoring program (Figure 1).

This GMMP also describes the monitoring, mitigation and reporting procedures by which the County of San Diego Planning and Development Services (PDS) can ensure that the conditions and criteria for the Project's groundwater extraction activities are continually being upheld. A 5 year monitoring period is proposed to assess the impact of the short-term construction water demand, as operational demands are minimal.



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SOURCE: Bing Maps, SanGIS 2010, SANDAG 2009

FIGURE 1
On-site and Off-site Well Locations

GROUNDWATER MONITORING AND MITIGATION PLAN - TIERRA DEL SOL SOLAR FARM

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2.0 ESTABLISHMENT OF GROUNDWATER THRESHOLDS

According to the County of San Diego Guidelines for Determining Significance and Report Format Content Requirements (County of San Diego, 2007), this Project-related groundwater extraction would incur a significant well interference impact if it results in a decrease in saturated thickness of 5% (20 feet or greater off-site groundwater drawdown in a fractured rock aquifer assuming 400 feet saturated thickness and a 5 foot or greater off-site groundwater drawdown in an alluvial aquifer assuming 100 feet of saturated thickness). Additionally, The County's Guidelines for Determining Significance for Biological Resources (County of San Diego, 2010) defines a project-related drawdown of 3 feet below historical low groundwater levels as causing a significant impact to riparian habitat of a groundwater sensitive natural community. The thresholds established below incorporate these guidelines and represent a conservative basis for monitoring and mitigating potential groundwater impacts related to the Project.

2.1 Potential Off-Site Well Interference

As described in the Groundwater Resources Investigation Report (Dudek, 2013), the closest wells to the pumping well (Well B) are off-site private wells RM-1, RM-2, RM-3 and RSD-1 (Figure 1). RM-1 and RM-2 are residential wells located approximately 784 feet north of Well B and are completed to a total depth of 147 feet below ground surface (bgs) and 200 feet bgs, respectively. RM-3 is an irrigation well located approximately 917 feet northeast of Well B and is completed to a total depth of 155 feet bgs. RSD-1 is located approximately 2,539 feet north of Well B and is completed to a total depth of 299 feet bgs. An additional 4 wells were identified from confidential well logs and a site reconnaissance. These wells are located within a 0.5 mile radius of Well B and are presented in Table 1.

Table 1
Well Users within 0.5 Mile Radius of Well B

Well Number	APN	Use	Distance from Well B
RM-1 and RM-2	658-090-30	Domestic	784
RM-3	659-130-01	Agriculture	917
RSD-1	658-090-51	Domestic	2,539
Off-site Confidential Wells[d]			
645		Domestic	861[a]
CW-1[c]		Agriculture	1,713
4133		Domestic	2,617[b]
18495		Domestic	2,707[b]

a Reported distance is to property line as the exact well location is unknown.
b Approximate well location observed in the field.
c Property owner choose not to participate in water level monitoring.
d Assessor parcel numbers (APN) are redacted for confidential well logs.

The exact locations of the off-site confidential wells have not been verified in the field. Well 645 is a residential well (property line is located 861 feet from Well B) and is completed to a depth of 177 feet bgs. Well CW-1 is an irrigation well located approximately 1,713 feet northwest of Well B and is reported to be completed to a depth of 400 feet bgs (pers. comm. CW-1 property owner). Well 4133 is located approximately 2,617 feet north of Well B and is completed to a depth of 620 feet bgs. Well 18495 is located approximately 2,707 feet north of Well B and is completed to a depth of 700 feet bgs. For comparison, Well B is completed to a total depth of 1,311 feet bgs.

Off-site Wells RM-1, RM-3 and RSD-1 located within 0.5 mile radius of Well B have been fitted with 1-inch sounding tubes and pressure transducers to record water levels. Manual water level measurements will be recorded with a sounder to confirm transducer accuracy. Baseline water level conditions in RM-1, RM-3 and RSD-1 have been established through water level measurements recorded by the pressure transducers since October 2012. During pumping at Well B, a maximum drawdown of 10 feet below the previously established water level baseline will be allowed.

2.2 Groundwater Dependent Habitat

The Groundwater Resources Investigation Report identifies two groundwater-dependent vegetation communities mapped on or near the Project site and in the Project vicinity that may depend on groundwater: coast live oak (*Quercus agrifolia*) and mixed oak woodland. The majority of coast live oak or mixed woodland is mapped northwest of Well B on a parcel adjacent to the Project (Figure 2). Results of the Groundwater Resources Investigation Report indicate that there is likely limited hydraulic connection between primary producing fractures of the pumping well (Well B) at greater than 1,000 feet bgs and the shallow aquifer system. As the coast live oak or mixed woodland appears to be approximately coincident with the alluvial soils (Dudek, 2013), Project-related groundwater production is not anticipated to result in drawdown of the groundwater table to the detriment of this groundwater-dependent habitat. Water level monitoring will be conducted within the oak woodland to protect the health of the oak trees.

Tierra del Sol Solar Farm Boundary
Potential Groundwater-Dependent Habitat

Vegetation

OW, Open Water
DL, Disturbed Land
dBSC, disturbed Flat-topped Buckwheat
CC/BSC, Granitic Chamise Chaparral/Flat-topped Buckwheat
GMX/BSC, Granitic Mixed Chaparral/Flat-topped Buckwheat
BSC, Flat-topped Buckwheat
BSC/RSC, Flat-topped Buckwheat/Red Shank Chaparral
CLOW, Coast Live Oak Woodland
BSS, Big Sagebrush Scrub
CC, Granitic Chamise Chaparral
RSC, Red Shank Chaparral
SOC, Scrub Oak Chaparral
GMX, Granitic Mixed Chaparral

Well B
0.5-Mile Buffer
Groundwater-Dependent Habitat Monitoring Wells

RSD-1
RM-1
RM-2
RM-3
Potential Groundwater-Dependent Habitat
MEXICO
Tierra del Sol Rd
Moon Valley Rd
Alta Vega Rd
Tierra del Melanie
Melinda de Oro
Tierra Estrella

0 250 500 Feet

Image courtesy of USGS State of Michigan © 2013 Nokia © AND

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SOURCE: Bing Maps, SanGIS, Dudek 2012

FIGURE 2
Potential Groundwater-Dependent Vegetation

GROUNDWATER MONITORING AND MITIGATION PLAN - TIERRA DEL SOL SOLAR FARM

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Existing off-site monitoring wells RM-1, RM-2 and RM-3 are located within the coast live oak and mixed oak woodland and the wells are reported to be partially completed within the alluvial aquifer. The historical low groundwater level in the vicinity of the oak woodland is not known over the period corresponding to the lifespan of mature oaks. This lack of historical water level data precludes determination of a water level threshold 3 feet below the historical low. Therefore, routine biological monitoring of the oak woodland for the duration of the 1 year Project construction period will serve as a means to continually assess oak health. Biological monitoring procedures are described below in section 3.2. If an International Society of Arboriculture (ISA) Certified Arborist or Registered Profession Forester observes that no impact to the oak woodland has occurred over the construction period, biological monitoring of the oak woodland will cease, since groundwater demands will decrease thereafter. In addition to biological monitoring a water level threshold of 10 feet of drawdown below baseline at RM-1 and RM-3 will be established to protect the oaks' ability to continually access groundwater from the alluvial aquifer. The 10 feet limit at Wells RM-1 and RM-3 is a hybrid of the 20 feet or greater off-site groundwater drawdown in a fractured rock aquifer and the 5 feet or greater off-site groundwater drawdown in an alluvial aquifer developed in consultation with the County Groundwater Geologist as both alluvial and fractured rock aquifers are present in the vicinity of Wells RM-1 and RM-3.

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3.0 MONITORING PROCEDURES AND MITIGATION CRITERIA

The groundwater and biological monitoring procedures and mitigation criteria outlined below will be followed during the 1 year construction period and throughout the operational duration of the Project. The groundwater monitoring program defined herein will be carried out under the direction of a Certified Hydrogeologist registered in the State of California.

3.1 Groundwater Production and Water Level Monitoring

Pressure transducers will be maintained in a network of the 6 on-site monitoring wells (Well 1, Well 2, Well 3, Well 4, Well 5 and Well A, Figure 1) and 11 off-site monitoring wells (GR-1, GS-1, GS-2, LK-1, RM-1, RM-3, RSD-1, RSH-1, RSH-2, RSH-3, and WHH-1, Figure 1) as well as in the on-site production well (Well B). Signed letters will be requested from private property owners to allow for continued monitoring of the off-site wells. The pressure transducers will be programed to record the water level every 15 minutes. In addition, ambient barometric pressure and temperature will be recorded at 15 minute intervals with a barometric logger.

Transducer data will be downloaded on a monthly basis during Project construction and quarterly basis during Project operation. During the approximately 60 day period of peak construction water demand transducer data will be downloaded weekly at Well B, select on-site monitoring wells and the nearest off-site monitoring wells RM-1 and RM-3. An instantaneous flow meter will be installed on Well B to monitor cumulative groundwater usage. Flow rate and volume measurements will be recorded daily during Project construction and monthly during Project operation.

3.2 Groundwater Dependent Habitat Monitoring

The following monitoring program will establish the current status and health of the existing oak woodland and document oak conditions up to a 5 year post-construction timeframe. If water levels in Wells RM-1, RM-3 and RSD-1 do not drop more than 3 feet below baseline during the 1 year construction period, monitoring will cease at that time. The goal is to determine if the project's use of groundwater is impacting area oak trees/woodlands.

3.2.1 Baseline Data Collection

Baseline data will be collected over the course of approximately 1 year prior to Project-related groundwater extraction. Potentially affected native trees within the study area will be evaluated for overall physical condition and attributes. The trees shall be inventoried by an ISA Certified Arborist or Registered Professional Forester with specific experience evaluating native oak species, in particular coast live oaks. The baseline monitoring evaluations will include the following:

- Establishment of 72 pseudo-randomized 0.1 acre plots around oak groupings and scattered individual trees (Figure 3). Sample plots would include the range of

existing habitat conditions, including elevation, slope and aspect, proximity to roads and other land uses.

- Tagging of trees and recording species, tag number, trunk diameter at breast height (dbh) (in.), height (ft.) and dominance (i.e., whether the tree is under the canopy of another tree or forms the uppermost canopy). Slope, aspect, and elevation of each tree location, existing understory species (including proportion of natives to exotics), presence of debris and litter, and soil type, depth, and parent material will be noted for each tree or plot.
- Placement of tensiometers (or similar) to measure soil moisture levels
    - Soil moisture levels will be recorded quarterly at depths up to 48-inches
- Assessment of tree status, including documentation of:
    - Dbh measured at 4.5 feet above ground (according to standard practices)
    - Number of stems
    - Overall tree height (based on ocular estimates)
    - Tree crown spread (measurement in each cardinal direction, based on ocular estimate)
    - Overall tree health condition (Good, Fair, Poor, Dead)
    - Overall tree structural condition (Good, Fair, Poor, Dead)
    - Pest presence (Type, Extent – minimal, moderate, high)
    - Disease presence (Type, Extent – minimal, moderate, high)
    - Other specific comments
- Assessment of acorn production, seedling establishment and sapling tree densities and conditions
- The data collection procedure will include full data collection at each plot so that consistency is maintained among sampling plots.
- Creation of oak tree database using GIS or similar application

Monitoring Site	Habitat Type	Habitat Description	Acres	Number of 1/10 acre monitoirng plots
Offsite	CLOW	Open Coast Live Oak Woodland	79.90	71
Onsite	CLOW	Open Coast Live Oak Woodland	0.87	1

Legend

- Sampling Plots
- 0.5 Mile Radius Around Well
- Potential Groundwater Dependent Oak Woodland
- Tierra del Sol Project Limits

RSD-1
CLOW
RM-1
RM-2
RM-3
CLOW
MEXICO
Tierra del Sol Rd
Moon Valley Rd
Alta Vega Rd
Tierra del Melanie
Melanie de Oro
Tierra Estrella

0 250 500 Feet

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SOURCE: Bing Maps, SanGIS, Dudek 2012

FIGURE 3
Oak Woodland Monitoring Locations

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3.2.2 Ongoing Monitoring

Ongoing monitoring will be carried out quarterly during the 1 year Project construction period. If the Certified Arborist or Registered Professional Forester observes an impact to the oak woodland after this period, monitoring will continue in years 2 through 5 following initiation of Project-related groundwater extraction. Monitoring will include the following components:

- Monitoring inspections will include re-evaluation of the baseline data as well as collection of soil moisture data from pre-placed tensiometers.
- Monitoring will include re-evaluating the trees to determine if changes are occurring that may indicate ground water drawdown is having a deleterious effect on oak woodlands or individual trees. The following information will be recorded during each monitoring visit and the data will be compared to previous monitoring results:
  - Dbh, measured at 4.5 feet above ground (according to standard practices)
  - Number of stems
  - Overall tree height (based on ocular estimates)
  - Tree crown spread (measurement in each cardinal direction, based on ocular estimate)
  - Overall tree health condition (Good, Fair, Poor, Dead)
  - Overall tree structural condition (Good, Fair, Poor, Dead)
  - Pest presence (Type, Extent – minimal, moderate, high)
  - Disease presence (Type, Extent – minimal, moderate, high)
  - Other specific comments

In particular, monitoring evaluations will focus on examining crowns for discoloration, loss of vigor, foliage curling, and/or pest presence; and trunks and root crowns for beetle/borer symptoms, bleeding cankers, or seeping areas (indicative of fungal infections). These and similar signs may indicate that a tree or a grouping of trees is experiencing stress, which can be corroborated by tensiometer readings. Trees under stress are more susceptible to disease and insect attacks.

3.3 Groundwater Mitigation Criteria

The following mitigation criteria will be established to protect groundwater resources and groundwater-dependent habitat in the Project area:

- If the groundwater levels at off-site wells located within 0.5 mile of Well B (RM-1, RM-3 or RSD-1) drops 10 feet below the baseline water levels, groundwater pumping at Well B will cease until the water level at the well that experienced the threshold exceedance

has increased above the threshold and remained there for at least 30 continuous days. Additionally, written permission from the County PDS must be obtained before production may be resumed.

- If the groundwater levels in the vicinity of the groundwater dependent habitat (RM-1 or RM-3) drops below 10 feet of the pre-pumping static water level and there is evidence of deteriorating oak tree health by the Arborist or Forester, there may be a temporary or permanent cessation of pumping at Well B. If evidence of deterioration persists after the 5 year period, mitigation will consist of offsite wetland/oak woodland credits at a 3:1 ratio.
- If an impact to the oak woodland habitat is observed by the monitoring Certified Arborist or Registered Professional Forester over the duration of the Project construction period, routine monitoring of the oak woodland will continue for a maximum up to 5 years following initiation of Project-related groundwater extraction. The monitoring Certified Arborist or Registered Professional Forester will base mitigation recommendations on the type and extent of tree issues observed. If groundwater drawdown is determined to be the cause of tree stress, resulting in the presence of secondary pests (insects and/or disease), halting groundwater extraction may be recommended.
- If less than 3 feet of drawdown is observed at monitoring wells RM-1 and RM-3 at the end of Project construction and no deleterious health effects are observed in the oak woodland habitat, monitoring can cease at the end of the first year of project operation as long as the wells operate only as intended under the Project's conditions of approval.
- For the 1 year construction period, 18 acre-feet of water is proposed to be pumped from on-site supply Well B. For subsequent years, 6 afy will be pumped from Well B for O&M of the Project. The groundwater storage within 0.5-mile radius study area surrounding Well B is estimated at 387 acre-feet. The average annual recharge for the study area within 0.5-mile radius of Well B is estimated at 27 afy. Thus, average annual recharge within the 0.5-mile radius study area is sufficient to meet Project construction and operational water demands.

4.0 REPORTING REQUIREMENTS

A groundwater monitoring report will be completed by a Certified Hydrogeologist registered in the State of California and submitted to the County PDS each month, no later than 28 days following the end of the monitoring month. The report will include the following information:

- Water level hydrographs and tabulated water level data for each monitoring well.
- Tabulated groundwater production volumes from each production well.
- Documentation of groundwater drawdown at off-site monitoring wells RM-1 and RM-3.

- Documentation of any threshold-included curtailment of groundwater production.
- Appendix documenting groundwater dependent habitat monitoring as described above.

If the baseline water levels at the off-site monitoring wells RM-1, RM-3 and RSD-1 are exceeded by 5 feet, the County PDS will be notified via letter and electronic mail within five working days of the exceedance. Additionally, if water level thresholds at the off-site wells are exceeded by 10 feet, pumping of Well B shall cease and the County PDS notified via letter and electronic mail within five working days.

In addition to the monthly groundwater monitoring reports, annual reports will also be submitted to the County PDS summarizing groundwater-dependent habitat monitoring efforts and any mitigation recommendations implemented in the field during the monitoring year. The monitoring year will coincide with the calendar year. The annual reports will document tree health and mortality, tensiometer readings, water level readings, well production and success of mitigation efforts (if any were necessary). Annual reports will be completed prior to the end of January in the next calendar year.

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6.0 LIST OF PREPARERS

This GMMP was prepared by Dudek Hydrogeologists, Trey Driscoll, PG, CHG and Lydia Roach, PhD. Dudek arborist, Michael S. Huff prepared the monitoring program for the groundwater dependent habitat. Dudek Hydrogeologist Stephen K. Dickey, PG, CHG, CEG, provided review assistance and coordination with the County as the County-approved hydrogeologist. Peter Quinlan, RG and principal-in-charge; and Jill Weinberger, PhD, PG, provided peer review of this GMMP.

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