Appendix M

Surface/Groundwater Quality
Supporting Information
Preliminary Hydrology Report

For

EAST CAT CANYON FIELD
REDEVELOPMENT PROJECT

Prepared for:

Aera Energy LLC
10000 Ming Avenue
Bakersfield, CA 93311-1302
661-665-5000

Project Address:
Sections 19, 20, 29, 30 T9N R32W
East Cat Canyon Field, Santa Barbara County, California

Prepared by:

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September 17, 2014
Project Description

The East Cat Canyon Field Redevelopment project comprises approximately 2,100 acres of which 290 acres is proposed for disturbance and is located within the Solomon Hills northeast of the Gato Ridge mountain ranges within East Cat Canyon, approximately 10 miles southeast of the communities of Santa Maria and Orcutt located in northern Santa Barbara County, California. The property is owned and developed by Aera Energy LLC. The property consists of eight leases located within Sections 19, 20, 28, 29, 31 and 32 of Township 9N/Range 32W, SBBM and is outline on the attached location map. (See Attached Drawing 072-13-026A).

The proposed development will re-establish oil production in an existing oil field. Prior wells have been abandoned and prior facilities have been removed. There is no active production in the proposed project area. The proposed project will use steam injection to develop an ultra-heavy bituminous resource. Project plans include construction and restoration of approximately 73 well pads, construction and restoration of over nine miles of field access roads and drilling of up to 315 wells. Planned wells include oil/gas production wells, steam injection wells, observation wells, water injection wells, and fresh water wells. The project’s well pads and roadways have been designed to use existing well pads and roadways when possible.

New process facilities and field systems will be constructed. Process facilities will include: 1) a production group station for bulk separation of produced gas and liquids, 2) a central processing plant for cleaning and sales of produced oil, for cleaning and softening of produced water and for treatment of produced gas, and 3) a steam generation site (six once through steam generators rated at 85 million BTU/hour each) for production of saturated steam to be used for thermal enhanced oil recovery (TEOR). All project steam will be generated by the recycle of produced water. Field systems will include 1) a production gathering network, 2) a steam distribution network and 3) electrical power distribution and SCADA networks. Project infrastructure will also include an office building, a multipurpose building, a warehouse and maintenance building and a facility control building. A water system with a 3,000 barrel tank and fire water distribution is also planned.

Main access to the project site will be from Cat Canyon Road. Secondary access will be provided from Long Canyon Road. The proposed project will disturb approximately 290 acres. Earthwork volumes are expected to be balanced onsite by project completion. Legacy fill material and excess material will be managed at a new Soil Reclamation Site.

Project construction and well drilling will be phased. Phase I activities will include the development of approximately 25% of the project. In addition to field systems to support well production and injection, Phase I construction will include the initial capacities at a new Group Station, new Central Processing Facility and new Steam Generation Site. The project’s water system, primary offices, main roadways and the Soil Reclamation Site will also be part of Phase I. Activities for Phase I are expected to last approximately four years. Phase II will develop the remaining resource and expand capacities at the Group Station, Central Processing Facility and Steam Generation Site. Phase II construction and well drilling will start about three years after Phase I completion. Phase II capacity
additions to processing facilities are expected to take up to two years. Phase II well drilling and construction of field systems are planned to take place over a period of up to ten years. Production from the project is expected to continue for more than 30 years.

**Project Site**

The topography of the area consists of a series of north-south aligned subdued hills with elevations ranging from about +500 to +1,000 feet above mean sea level (MSL). The project is contained within 6 watersheds which ultimately discharge into the Sisquoc River to the north. (See attached watershed map). The watersheds consist of Cat Canyon (7000 acres), Long Canyon (893 acres), Olivera Canyon (1414 acres), and 3 unnamed blue lines (Unnamed 1&2 800 acres Unnamed #3 218 acres). Cat Canyon is the principal stream in the area. All watersheds are intermittent and flow to the north toward the community of Sisquoc. All 6 creeks are well entrenched along most of their courses. (See Attached drawing 072-13-022A). Watersheds were defined using the available topographical contours from Topo Depot. Each watershed was further divided into both pre and post construction sub-watersheds. (See Attached Drawing 072-13-023A thru 023E for Pre Construction and 072-13-024A thru 024C for Post Construction).

The Hydrological Soils Groups for areas within the project site were obtained from the United States Department of Agriculture, National Resource Conservation Services, Web Soil Survey site. The Hydrological Soils Group appears to be predominantly Group C with some Group A and D dispersed within the watersheds. Group C Soils have a slow infiltration rate when thoroughly wet. These soils also have a slow rate of water transmission. Group A soils have a high infiltration rate and low runoff potential when thoroughly wet. They also have a high rate of water transmission. Group D soils have a very slow infiltration rate and high potential for water runoff. These soils have a very slow rate of water transmission.

Unnamed Blue line #1 is predominantly Group C with Group A located within the channel. A small patch of Group D is located along the southern edge of the watershed. (See Appendix A). Unnamed Blue line #2 is predominantly Group C with Group A located within the channels and along the southern edge of the watershed. A small patch of Group D is located along the southern edge of the watershed. (See Appendix A). Unnamed Blue line #3 is predominantly Group C. A small patch of Group D is located along the eastern edge of the watershed. (See Appendix A). Long Canyon is predominantly Group C with Group A located within the channels and along the southern end of the watershed. A small patch of Group D is located along the northeastern edge of the watershed. (See Appendix A). Olivera Canyon is predominantly Group C with Group A located within the channels. A patch of Group D is dispersed throughout the northern portion of the watershed. (See Appendix A). Cat Canyon is predominantly Group C to the southeast and predominantly Group D to the northwest with Group A located within the northwest portion of the channels. (See Appendix A). These soils groups will be used in determining weighted CN values needed for the final hydrology when design phase plans have been developed.
Methodology

Runoff shall be conveyed safely, to prevent erosion from slopes and channels. Basins have been provided where practical, but have been kept outside of the 6 defined blue line channels. Disturbed slopes shall be revegetated with appropriate native or drought tolerant vegetation. Permanent Channel crossings will be stabilized and energy dissipaters such as rip rap will be used at the outlet of storm drains, culverts or channels that enter unlined channels to minimize erosion potential. There are 2 structures being proposed for creek crossing for this project. Both culverts are sufficiently sized to handle the 100 year post construction flow. (See Figure 1). One is at the entrance of the project site off of Cat Canyon Road crossing over Cat Canyon, which is a proposed 20’ x 12’ high U-shaped structure with a natural bottom. (See Attached Drawing 072-13-016D). The other structure is on Long Canyon where the new tie-in road is proposed. The box culvert will be a 4’ x 4’ Concrete Box Culvert. (See Attached Drawing 072-13-016A).

The hydrology was calculated for each watershed using the rational method Q=CIA as required by the Santa Barbara Flood Control District. The runoff coefficients were calculated from the Santa Barbara County Flood Control District Rainfall Intensity/Runoff Coefficient equations Dated August 2003. (See Appendix A) The Pre construction Runoff Coefficients were calculated using the equation for Curve #4 - North County Agriculture, since most of the watershed is in a natural state and the current and proposed zoning is agriculture. For the post construction runoff coefficients an interpolation between Curve #3 and Curve #4 was used for the disturbed area. For facilities a higher C value was used and for the Central Processing Plant the equation for commercial was used, since most of the area will be paved. As reaches were added to the discharge, the runoff coefficients were weighted based on area.

Intensities were calculated using Rainfall Intensity equations from the Santa Barbara County Flood Control District Curve Construction for Sisquoc dated August 2003. Times of Concentration Values were obtained from the nomograph provided by the Santa Barbara County Flood Control District. (See Appendix B).

The flows for the 100, 50, 25, and 10 year pre and post construction events were calculated and provided in Tables 1 - 5 below for each junction of the watershed. Complete spreadsheets for each model run can be found in Appendix C. Where practical and as shown on the field redevelopment plans detention basins will be provided to reduce the peak flows. These basins will be sized to handle the incremental flows. Currently the basins are sized at a minimum of 0.1 acre feet per acre as required by Santa Barbara County Flood Control and Water Conservation District – Standard Conditions of Project Plan Approval. The Santa Barbara Urban Hydrograph will be utilized in designing the final basin sizes based on the flows provided below and the project design documents.
Findings and Conclusions

For Unnamed Blue Line #1 & #2 the project will increase the 100 year property boundary discharge by 88.10 cubic feet/sec. For Unnamed Blue Line #3 and Olivera Canyon there will be no increase, since no development is planned within either watershed. For Long Canyon the 100 year property boundary discharge will increase by 84.6 cubic feet per second and for Cat Canyon the 100 year property boundary discharge will increase by 150.8 cubic feet per second. See Tables 1 through 5 below for pre and post flows for the 100 year, 50 year, 25 year and 10 year at various junction points throughout the project area. A complete copy of the Rational Method calculations can be found in Appendix D and pre and post watershed maps can be found on attached drawings 072-13-022A thru 072-13-024C.

Based on the hydrologic soils group information the project area is predominantly group C and will have a slow infiltration rate and moderate runoff potential. They will also have a slow rate of water transmission. Areas within the existing natural drainage channels are shown as Group A and will have a high infiltration rate and low runoff potential. These soils also have a high rate of water transmission. See Appendix A for Hydrological Soils Maps for each watershed.

Detention Basins have been strategically placed outside of existing blue line channels to reduce the increase in peak flow discharge caused by the development of the project site. Specific design and outflow discharge for post construction have not been determined, however the proposed detention basins are currently sized for a minimum 0.1 acre feet per acre and gravity bleeder lines will be designed for the 100 year 24 hour storm event developed condition to 0.07 cubic feet per second per acre as required by the Santa Barbara County Flood Control and Water Conservation District. The terrain, proximity to existing blue lines and the preservation of existing oak trees had significantly limited size and location of detention basins. Sixteen detention basins are proposed for the project area. Basins typically vary in size from 2100 cubic yards to 7500 cubic yards averaging 3750 cubic yards, except for 3 basins. Two basins exceed this range they are Basin A which is 18250 cubic yards and Basin G which is 14250 cubic yards. The smallest basin is Basin D and it has 725 cubic yard capacity. These basins will be more than sufficiently sized at the time of project development. See drawing 072-13-024A thru C for proposed basin locations.

There are 2 major creek crossings proposed for the project. The main entrance off of Cat Canyon Road will cross Cat Canyon Creek. A 20’ x 12’ U-shaped culvert is proposed for this entrance. The second crossing is proposed where the main road through the project site ties into Long Canyon Road crossing Long Canyon Creek. A 4’ x 4’ box culvert is proposed for this crossing. Both crossings were sized for over a 100 year storm event for the developed condition. Calculations can be found in Figure 1 below and on the attached drawings 072-13-016D and 072-13-016A.
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FIGURE 1

Creek Crossing Calculations

Using Manning’s Equation

\[ Q = \frac{1.486}{n} \times A \times R^{2/3} \times S^{1/2} \]

\( Q \) = Discharge  
\( n \) = Manning’s roughness coefficient  
\( A \) = Cross Sectional Area  
\( R \) = Hydraulic Radius  
\( S \) = Slope of Culvert

For Cat Canyon Creek Crossing at Junction 20

Using a 20 x 12 U-Shape Concrete Culvert  
\( Q_{100} = 3138.3 \) cubic feet per second per Post Construction 100 year Rational method  
\( n = 0.02075 \)  
\( A = 240 \)  
\( R = 3.75 \)  
\( S = 0.0147 \)

Solve for \( Q \)

\[ Q = \frac{5.029.9 \text{ cubic feet per second}}{\text{calc}} \]

Culvert is sufficiently sized for 100 year post construction flow.

For Long Canyon Creek Crossing at Junction 3

Using a 4 x 4 Concrete Box Culvert  
\( Q_{100} = 276.7 \) cubic feet per second per Post Construction 100 year Rational method  
\( n = 0.012 \)  
\( A = 15.65 \)  
\( R = 1.04 \)  
\( S = 0.0259 \)

Solve for \( Q \)

\[ Q = 320.2 \text{ cubic feet per second} \text{ (calc)} \]

Culvert is sufficiently sized for 100 year post construction flow.
Appendix A

Hydrologic Soils Groups
MAP LEGEND

Area of Interest (AOI)  

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Northern Santa Barbara Area, California
Survey Area Data: Version 8, Dec 7, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 7, 2010—Jun 10, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
# Hydrologic Soil Group

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArF</td>
<td>Arnold sand, 15 to 45 percent slopes</td>
<td>A</td>
<td>0.7</td>
<td>0.6%</td>
</tr>
<tr>
<td>ChF</td>
<td>Chamise shaly loam, 15 to 45 percent slopes</td>
<td>C</td>
<td>50.8</td>
<td>45.2%</td>
</tr>
<tr>
<td>ChG</td>
<td>Chamise shaly loam, 45 to 75 percent slopes</td>
<td>C</td>
<td>0.4</td>
<td>0.3%</td>
</tr>
<tr>
<td>EdD2</td>
<td>Elder sandy loam, 9 to 15 percent slopes, eroded</td>
<td>A</td>
<td>21.9</td>
<td>19.4%</td>
</tr>
<tr>
<td>RuG</td>
<td>Rough broken land</td>
<td>D</td>
<td>1.4</td>
<td>1.2%</td>
</tr>
<tr>
<td>SfG</td>
<td>San Andreas-Tierra complex, 30 to 75 percent slopes</td>
<td>C</td>
<td>37.4</td>
<td>33.2%</td>
</tr>
<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td></td>
<td><strong>112.5</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher
MAP LEGEND

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.
Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Coordinate System: Web Mercator (EPSG:3857)

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Survey Area Data: Version 8, Dec 7, 2013

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## Hydrologic Soil Group

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArF</td>
<td>Arnold sand, 15 to 45 percent slopes</td>
<td>A</td>
<td>61.6</td>
<td>8.9%</td>
</tr>
<tr>
<td>Cfd</td>
<td>Chamise shaly sandy loam, 9 to 15 percent slopes</td>
<td>C</td>
<td>24.1</td>
<td>3.5%</td>
</tr>
<tr>
<td>Chf</td>
<td>Chamise shaly loam, 15 to 45 percent slopes</td>
<td>C</td>
<td>166.1</td>
<td>24.1%</td>
</tr>
<tr>
<td>Chg</td>
<td>Chamise shaly loam, 45 to 75 percent slopes</td>
<td>C</td>
<td>144.8</td>
<td>21.0%</td>
</tr>
<tr>
<td>CuA</td>
<td>Corralitos loamy sand, 0 to 2 percent slopes</td>
<td>A</td>
<td>2.3</td>
<td>0.3%</td>
</tr>
<tr>
<td>EdC2</td>
<td>Elder sandy loam, 2 to 9 percent slopes, eroded</td>
<td>A</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>EdD2</td>
<td>Elder sandy loam, 9 to 15 percent slopes, eroded</td>
<td>A</td>
<td>84.0</td>
<td>12.2%</td>
</tr>
<tr>
<td>PtC</td>
<td>Positas fine sandy loam, 2 to 9 percent slopes</td>
<td>D</td>
<td>2.2</td>
<td>0.3%</td>
</tr>
<tr>
<td>PtD</td>
<td>Positas fine sandy loam, 9 to 15 percent slopes</td>
<td>D</td>
<td>9.7</td>
<td>1.4%</td>
</tr>
<tr>
<td>Rs</td>
<td>Riverwash</td>
<td>D</td>
<td>0.2</td>
<td>0.0%</td>
</tr>
<tr>
<td>RuG</td>
<td>Rough broken land</td>
<td>D</td>
<td>13.6</td>
<td>2.0%</td>
</tr>
<tr>
<td>SfE</td>
<td>San Andreas-Tierra complex, 15 to 30 percent slopes</td>
<td>C</td>
<td>10.4</td>
<td>1.5%</td>
</tr>
<tr>
<td>SfG</td>
<td>San Andreas-Tierra complex, 30 to 75 percent slopes</td>
<td>C</td>
<td>169.6</td>
<td>24.6%</td>
</tr>
</tbody>
</table>

**Totals for Area of Interest**: 688.6 100.0%
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

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If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method:  Dominant Condition

Component Percent Cutoff:  None Specified

Tie-break Rule:  Higher
The soil surveys that comprise your AOI were mapped at 1:20,000. Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Coordinate System: Web Mercator (EPSG:3857)

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Hydrologic Soil Group

Description

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Rating Options

Aggregation Method: Dominant Condition
Component Percent Cutoff: None Specified
Tie-break Rule: Higher
Hydrologic Soil Group—Northern Santa Barbara Area, California
(Long Canyon)

MAP LEGEND

Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArF</td>
<td>Arnold sand, 15 to 45 percent slopes</td>
<td>A</td>
<td>223.7</td>
<td>25.1%</td>
</tr>
<tr>
<td>CeE2</td>
<td>Chamise sandy loam, 5 to 30 percent slopes, eroded</td>
<td>C</td>
<td>19.8</td>
<td>2.2%</td>
</tr>
<tr>
<td>ChD</td>
<td>Chamise shaly loam, 9 to 15 percent slopes</td>
<td>C</td>
<td>25.5</td>
<td>2.9%</td>
</tr>
<tr>
<td>ChF</td>
<td>Chamise shaly loam, 15 to 45 percent slopes</td>
<td>C</td>
<td>109.5</td>
<td>12.3%</td>
</tr>
<tr>
<td>ChG</td>
<td>Chamise shaly loam, 45 to 75 percent slopes</td>
<td>C</td>
<td>165.2</td>
<td>18.5%</td>
</tr>
<tr>
<td>CtD2</td>
<td>Corralitos sand, 2 to 15 percent slopes, eroded</td>
<td>A</td>
<td>24.5</td>
<td>2.7%</td>
</tr>
<tr>
<td>CuC</td>
<td>Corralitos loamy sand, 2 to 9 percent slopes</td>
<td>A</td>
<td>61.8</td>
<td>6.9%</td>
</tr>
<tr>
<td>EdC2</td>
<td>Elder sandy loam, 2 to 9 percent slopes, eroded</td>
<td>A</td>
<td>30.6</td>
<td>3.4%</td>
</tr>
<tr>
<td>PtD</td>
<td>Positas fine sandy loam, 9 to 15 percent slopes</td>
<td>D</td>
<td>63.9</td>
<td>7.2%</td>
</tr>
<tr>
<td>RuG</td>
<td>Rough broken land</td>
<td>D</td>
<td>5.7</td>
<td>0.6%</td>
</tr>
<tr>
<td>SfE</td>
<td>San Andreas-Tierra complex, 15 to 30 percent slopes</td>
<td>C</td>
<td>9.5</td>
<td>1.1%</td>
</tr>
<tr>
<td>SfG</td>
<td>San Andreas-Tierra complex, 30 to 75 percent slopes</td>
<td>C</td>
<td>152.9</td>
<td>17.1%</td>
</tr>
<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td></td>
<td><strong>892.6</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

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Rating Options

Aggregation Method: Dominant Condition
Component Percent Cutoff: None Specified
Tie-break Rule: Higher
Hydrologic Soil Group—Northern Santa Barbara Area, California
( Olivera Canyon)

MAP LEGEND

Area of Interest (AOI)  
Soils

Soil Rating Polygons
- A
- B
- C
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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<tr>
<th>Map unit symbol</th>
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<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArF</td>
<td>Arnold sand, 15 to 45 percent slopes</td>
<td>A</td>
<td>16.9</td>
<td>1.2%</td>
</tr>
<tr>
<td>BnD2</td>
<td>Betteravia loamy sand, dark variant, 5 to 15 percent slopes, eroded</td>
<td>C</td>
<td>10.3</td>
<td>0.7%</td>
</tr>
<tr>
<td>CeE2</td>
<td>Chamise sandy loam, 5 to 30 percent slopes, eroded</td>
<td>C</td>
<td>62.9</td>
<td>4.4%</td>
</tr>
<tr>
<td>ChD</td>
<td>Chamise shaly loam, 9 to 15 percent slopes</td>
<td>C</td>
<td>139.4</td>
<td>9.9%</td>
</tr>
<tr>
<td>ChF</td>
<td>Chamise shaly loam, 15 to 45 percent slopes</td>
<td>C</td>
<td>96.8</td>
<td>6.8%</td>
</tr>
<tr>
<td>ChG</td>
<td>Chamise shaly loam, 45 to 75 percent slopes</td>
<td>C</td>
<td>174.4</td>
<td>12.3%</td>
</tr>
<tr>
<td>ChG2</td>
<td>Chamise shaly loam, 30 to 75 percent slopes, eroded</td>
<td>C</td>
<td>257.1</td>
<td>18.2%</td>
</tr>
<tr>
<td>CuA</td>
<td>Corralitos loamy sand, 0 to 2 percent slopes</td>
<td>A</td>
<td>3.1</td>
<td>0.2%</td>
</tr>
<tr>
<td>CuC</td>
<td>Corralitos loamy sand, 2 to 9 percent slopes</td>
<td>A</td>
<td>41.1</td>
<td>2.9%</td>
</tr>
<tr>
<td>CuD</td>
<td>Corralitos loamy sand, 9 to 15 percent slopes</td>
<td>A</td>
<td>69.7</td>
<td>4.9%</td>
</tr>
<tr>
<td>EdD2</td>
<td>Elder sandy loam, 9 to 15 percent slopes, eroded</td>
<td>A</td>
<td>10.5</td>
<td>0.7%</td>
</tr>
<tr>
<td>GmG</td>
<td>Gaviota sandy loam, 30 to 75 percent slopes, MLRA 15</td>
<td>D</td>
<td>2.6</td>
<td>0.2%</td>
</tr>
<tr>
<td>PtC</td>
<td>Positas fine sandy loam, 2 to 9 percent slopes</td>
<td>D</td>
<td>19.3</td>
<td>1.4%</td>
</tr>
<tr>
<td>PtD</td>
<td>Positas fine sandy loam, 9 to 15 percent slopes</td>
<td>D</td>
<td>137.3</td>
<td>9.7%</td>
</tr>
<tr>
<td>PtD3</td>
<td>Positas fine sandy loam, 9 to 15 percent slopes, severely eroded</td>
<td>D</td>
<td>11.4</td>
<td>0.8%</td>
</tr>
<tr>
<td>SfE</td>
<td>San Andreas-Tierra complex, 15 to 30 percent slopes</td>
<td>C</td>
<td>40.5</td>
<td>2.9%</td>
</tr>
<tr>
<td>SfG</td>
<td>San Andreas-Tierra complex, 30 to 75 percent slopes</td>
<td>C</td>
<td>320.9</td>
<td>22.7%</td>
</tr>
<tr>
<td>Totals for Area of Interest</td>
<td></td>
<td></td>
<td>1,414.2</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition
Component Percent Cutoff: None Specified
Tie-break Rule: Higher
MAP LEGEND

Area of Interest (AOI)  

Soils

Soil Rating Polygons

A  
A/D  
B  
B/D  
C  
C/D  
D  
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Northern Santa Barbara Area, California
Survey Area Data: Version 8, Dec 7, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 7, 2010—Jun 10, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group—Northern Santa Barbara Area, California
(Cat Canyon)
## Hydrologic Soil Group

### Hydrologic Soil Group—Summary by Map Unit—Northern Santa Barbara Area, California (CA672)

<table>
<thead>
<tr>
<th>Map unit symbol</th>
<th>Map unit name</th>
<th>Rating</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArD</td>
<td>Arnold sand, 5 to 15 percent slopes</td>
<td>A</td>
<td>113.8</td>
<td>1.6%</td>
</tr>
<tr>
<td>ArF</td>
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<td>BnD2</td>
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<td>C</td>
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<td>1.4%</td>
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<tr>
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<td>CwG</td>
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<td>2.3%</td>
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<td>DaF3</td>
<td>Diablo silty clay, 15 to 45 percent slopes, severely eroded</td>
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<td>0.0%</td>
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<td>Map unit name</td>
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<td>EdC2</td>
<td>Elder sandy loam, 2 to 9 percent slopes, eroded</td>
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<td>EmC</td>
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<td>GmG</td>
<td>Gaviota sandy loam, 30 to 75 percent slopes, MLRA 15</td>
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<td>GsE</td>
<td>Gazos clay loam, 15 to 30 percent slopes</td>
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<td>50.3</td>
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<td>6.2%</td>
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<tr>
<td>GsG</td>
<td>Gazos clay loam, 45 to 75 percent slopes</td>
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<td>17.9</td>
<td>0.3%</td>
</tr>
<tr>
<td>LmG</td>
<td>Lopez shaly clay loam, 15 to 75 percent slopes</td>
<td>D</td>
<td>142.6</td>
<td>2.0%</td>
</tr>
<tr>
<td>RuG</td>
<td>Rough broken land</td>
<td>D</td>
<td>690.2</td>
<td>9.9%</td>
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<tr>
<td>SfD</td>
<td>San Andreas-Tierra complex, 5 to 15 percent slopes</td>
<td>C</td>
<td>83.0</td>
<td>1.2%</td>
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<td>SfE</td>
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<td>426.6</td>
<td>6.1%</td>
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<tr>
<td>SfF3</td>
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<td>C</td>
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<td>SfG</td>
<td>San Andreas-Tierra complex, 30 to 75 percent slopes</td>
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<td>5.0%</td>
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<td>Sh</td>
<td>Sandy alluvial land</td>
<td>B</td>
<td>76.7</td>
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<td>SpG</td>
<td>Sedimentary rock land</td>
<td>D</td>
<td>69.6</td>
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<tr>
<td>SrG</td>
<td>Shedd silty clay loam, 45 to 75 percent slopes</td>
<td>C</td>
<td>2.3</td>
<td>0.0%</td>
</tr>
<tr>
<td>TdF</td>
<td>Terrace escarpments, loamy</td>
<td></td>
<td>26.0</td>
<td>0.4%</td>
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<tr>
<td>TnE2</td>
<td>Tierra sandy loam, 15 to 30 percent slopes, eroded</td>
<td>D</td>
<td>89.8</td>
<td>1.3%</td>
</tr>
</tbody>
</table>
### Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

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### Rating Options

**Aggregation Method:** Dominant Condition

**Component Percent Cutoff:** None Specified
Tie-break Rule: Higher
Appendix B

Runoff Coefficient Equations and Curves
Rainfall Intensity/Runoff Coefficient Equations
SBCFCD         August, 2003

Curve #1 - Commercial
Equation: \( C = 0.60 \times (RI)^{0.21} \)

<table>
<thead>
<tr>
<th>Rainfall Intensity (in/hr)</th>
<th>Runoff Coefficient</th>
<th>Synthetic Value</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.6</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td>1.5</td>
<td>0.66</td>
<td>0.653326711</td>
<td>0.006673289</td>
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<tr>
<td>2</td>
<td>0.7</td>
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<td>0.00598709</td>
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<tr>
<td>2.5</td>
<td>0.73</td>
<td>0.727308482</td>
<td>0.002691518</td>
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<tr>
<td>3</td>
<td>0.76</td>
<td>0.755695287</td>
<td>0.004304713</td>
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<tr>
<td>3.5</td>
<td>0.78</td>
<td>0.780558648</td>
<td>-0.00558648</td>
</tr>
<tr>
<td>4</td>
<td>0.8</td>
<td>0.802756533</td>
<td>-0.002756533</td>
</tr>
</tbody>
</table>

Curve #2 - South Coast Single Family
Equation: \( C = -0.01643 + 0.6228(RI) - 0.225(RI)^2 + 0.04115(RI)^3 - 0.002848(RI)^4 \)

<table>
<thead>
<tr>
<th>Rainfall Intensity (in/hr)</th>
<th>Runoff Coefficient</th>
<th>Synthetic Value</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.42</td>
<td>0.419672</td>
<td>0.000328</td>
</tr>
<tr>
<td>1.5</td>
<td>0.535</td>
<td>0.53598325</td>
<td>-0.00098325</td>
</tr>
<tr>
<td>2</td>
<td>0.615</td>
<td>0.612802</td>
<td>0.002198</td>
</tr>
<tr>
<td>2.5</td>
<td>0.665</td>
<td>0.66603875</td>
<td>-0.00103875</td>
</tr>
<tr>
<td>3</td>
<td>0.708</td>
<td>0.707332</td>
<td>0.000668</td>
</tr>
<tr>
<td>3.5</td>
<td>0.745</td>
<td>0.74404825</td>
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</tr>
<tr>
<td>4</td>
<td>0.78</td>
<td>0.779282</td>
<td>0.000718</td>
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</table>

Curve #3 - North County Single Family, South Coast Agriculture
Equation: \( C = 0.004071 + 0.3989(RI) - 0.07952(RI)^2 + 0.006444(RI)^3 \)

<table>
<thead>
<tr>
<th>Rainfall Intensity (in/hr)</th>
<th>Runoff Coefficient</th>
<th>Synthetic Value</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.33</td>
<td>0.329895</td>
<td>0.000105</td>
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<td>1.5</td>
<td>0.445</td>
<td>0.4452495</td>
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<tr>
<td>2</td>
<td>0.535</td>
<td>0.535343</td>
<td>-0.000343</td>
</tr>
<tr>
<td>2.5</td>
<td>0.605</td>
<td>0.6050085</td>
<td>-8.5E-06</td>
</tr>
<tr>
<td>3</td>
<td>0.66</td>
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<td>0.000921</td>
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<td>3.5</td>
<td>0.701</td>
<td>0.7023875</td>
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<tr>
<td>4</td>
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<td>0.739767</td>
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</table>

Curve #4 - North County Agriculture
Equation: \( C = 1.01 \times (RI)^{0.29 - 0.837} \)

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<th>Rainfall Intensity (in/hr)</th>
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<th>Variation</th>
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<td>0.007</td>
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</tbody>
</table>
Rainfall Intensity vs. Runoff Coefficients

Rainfall Intensity (in/hr)

Runoff Coefficient

- Curve 1
- Curve 1 - Equation
- Curve 2
- Curve 2 - Equation
- Curve 3
- Curve 3 - Equation
- Curve 4
- Curve 4 - Equation
Appendix C

Rainfall intensity Equations and Curves

For Siquoc
Curve Construction for Sisquoc
SBCFCD August, 2003

Area: Sisquoc
Gage #: 256
Elevation: 420
Years of Record: 33

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<th>15</th>
<th>30</th>
<th>45</th>
<th>60</th>
<th>75</th>
<th>90</th>
<th>105</th>
<th>120</th>
<th>135</th>
<th>150</th>
<th>165</th>
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<table>
<thead>
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<th>Frequency (yrs):</th>
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Note: "Actual" Curves taken from Santa Barbara County Flood Control District Recording Data. Data available for 15, 30, 60, 120 and 180 minutes. Intermediate values were determined visually and by using Excel "Series" extrapolation.
Appendix D

Rational Method Calculations
### 100 Year Flow - PRE CONSTRUCTION

<table>
<thead>
<tr>
<th>Point of Concentration</th>
<th>Area Description</th>
<th>Delta H (ft)</th>
<th>L (ft)</th>
<th>S (%)</th>
<th>V (fps)</th>
<th>TOC (min)</th>
<th>Area</th>
<th>Q (cfs)</th>
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<th>Hydraulic Radius R</th>
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<td>Point of Concentration</td>
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<td>Delta H (ft)</td>
<td>L (ft)</td>
<td>S (%)</td>
<td>V (fps)</td>
<td>Δ</td>
<td>Total</td>
<td>I</td>
<td>C</td>
<td>Area</td>
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<tr>
<td>NNBL2-20 J8,J9</td>
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<td>3207</td>
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<td>36.5</td>
<td>1.67</td>
<td>0.53</td>
<td>55.98</td>
</tr>
</tbody>
</table>

| **Unnamed Blueline #3** | | | | | | | | | | | | | |
| NNBL3-1 J3A, J10 | Initial Area | 110 | 1349 | 8.2% | 5.5 | 5.5 | 4.13 | 0.69 | 12.58 | 12.58 | 35.7 |
| NNBL3-2 J3B, J10 | Initial Area | 70 | 677 | 10.3% | 3.0 | 3.0 | 5.52 | 0.82 | 6.13 | 6.13 | 27.8 |
| Junction 10 | | | | | | | | | | | | |
| NNBL3-3 J10,J11 | J10-J11 | 45 | 2263 | 2.0% | 4.96 | 7.6 | 13.1 | 2.73 | 0.61 | 25.07 | 43.78 | 72.4 | 0.04 | 0.91 |
| NNBL3-4 J3C,J11 | Initial Area | 55 | 609 | 9.1% | 3.0 | 3.0 | 5.52 | 0.82 | 6.78 | 6.78 | 30.7 |
| Junction 11 | J11 | | | | | | | | | | | | |
| NNBL3-5 J11,J12 | J11-J12 | 84 | 1933 | 4.4% | 7.82 | 4.1 | 17.2 | 2.39 | 0.56 | 42.5 | 93.06 | 124.0 | 0.04 | 1.01 |
| NNBL3-6 J3D,J12 | Initial Area | 199 | 2019 | 9.9% | 3.0 | 3.0 | 5.52 | 0.82 | 12.04 | 12.04 | 54.6 |
| Junction 12 | J12 | | | | | | | | | | | | |
| NNBL3-7 J12,J13 | J12-J13 | 66 | 1164 | 5.6% | 10.37 | 1.9 | 19.1 | 2.28 | 0.57 | 16.97 | 122.07 | 157.7 | 0.04 | 1.27 |
| NNBL3-8 J3E,J13 | Initial Area | 196 | 2019 | 9.7% | 7.1 | 7.1 | 3.66 | 0.63 | 23.35 | 23.35 | 54.1 |
| Junction 13 | J13 | | | | | | | | | | | | |
| NNBL3-9 J13,J14 | J13-J14 | 15 | 611 | 2.4% | 8.06 | 1.3 | 20.4 | 2.21 | 0.57 | 8.43 | 153.85 | 193.7 | 0.04 | 1.64 |
| NNBL3-10 J3F,J14 | Initial Area | 199 | 1666 | 12.0% | 5.5 | 5.5 | 4.13 | 0.69 | 16.27 | 16.27 | 46.2 |
| Junction 14 | J14 | | | | | | | | | | | | |
| NNBL3-11 J14,J15 | J14-J15 | 36 | 812 | 4.4% | 9.31 | 1.5 | 21.8 | 2.14 | 0.57 | 15.07 | 185.19 | 224.9 | 0.04 | 1.30 |
| NNBL3-12 J3G,J15 | Initial Area | 184 | 1808 | 10.2% | 6.5 | 6.5 | 3.81 | 0.65 | 18.70 | 18.70 | 46.5 |
| Junction 15 | J15 | | | | | | | | | | | | |
| NNBL3-13 J15, end | J15 - end | 37 | 800 | 4.6% | 8.84 | 1.5 | 23.3 | 2.07 | 0.57 | 14.11 | 218.00 | 255.0 | 0.04 | 1.16 |
### Rational Method
#### Pre Construction

**Q = 100 YEAR FLOW**

<table>
<thead>
<tr>
<th>Point of Concentration</th>
<th>Area Description</th>
<th>Delta H (ft)</th>
<th>L (ft)</th>
<th>S (%)</th>
<th>V (fps)</th>
<th>TOC (min)</th>
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<td>4.0</td>
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**Note:**
- Mannings n
- Hydraulic Radius R

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R:\2013 Projects\ABRA\13186-ECC CBQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-114 100 Yr Flows (PRE)
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### Cat Canyon (cont’d)

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### Rational Method
#### Pre Construction

**Q = 50 YEAR FLOW**

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## Rational Method

**Q = 50 YEAR FLOW**

### Pre Construction

**DS-13186-114**

**Edited By: RSD**

**T.J. Cross Engineers**

**08/18/14**

**Checked By: JAC**

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R:\2013 Projects\ARRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls

DS-114 50 Yr Flows (PRE)
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### Rational Method

#### Pre Construction

**Q = 50 YEAR FLOW**

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R:\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls

DS-114 50 Yr Flows (PRE)
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### Rational Method

#### Pre Construction

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### Rational Method
#### Pre Construction

**Q = 25 YEAR FLOW**

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### Rational Method

Pre Construction

**Q= 25 YEAR FLOW**

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### Rational Method

#### Pre Construction

**Q= 10 YEAR FLOW**

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R:\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
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Rational Method
Pre Construction
Q= 10 YEAR FLOW

Rational Method
Pre Construction
Q= 10 YEAR FLOW

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R:\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-114 10 Yr Flows (PRE)
### 100 Year Flow - POST CONSTRUCTION

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<th>L (ft)</th>
<th>S (%)</th>
<th>V (fps)</th>
<th>TOC (min)</th>
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R:\\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-115 100 Yr Flows (POST)
### Rational Method

Post Construction

Q = 50 YEAR FLOW

#### 50 Year Flow - POST CONSTRUCTION

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<th>L (ft)</th>
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<th>V (fps)</th>
<th>TOC (min)</th>
<th>Area</th>
<th>Q (cfs)</th>
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R:\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls

DS-115 50 Yr Flows (POST)
### Rational Method

**Post Construction**

**Q**: 50 YEAR FLOW

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<th>Area Description</th>
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<th>V (fps)</th>
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### Rational Method

**Post Construction**

\( Q = 50 \text{ YEAR FLOW} \)

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R:\2013 Projects\ABRA\13186-ECC CBQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-115 50 Yr Flows (POST)
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R:\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 8-16-14.xls DS-115 50 Yr Flows (POST)
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### Rational Method

Post Construction

Q = 25 YEAR FLOW

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R:\2013 Projects\ARRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-115 25 Yr Flows (POST)
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### Rational Method Post Construction

**Q = 10 YEAR FLOW**

**Rational Method**

**Post Construction**

**Q = 10 YEAR FLOW**

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## Rational Method

### Post Construction

**Q = 10 YEAR FLOW**

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R:\2013 Projects\ARRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls

DS-115 10 Yr Flows (POST)
## Rational Method

### Post Construction

| Q= 10 YEAR FLOW |

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### T.J. Cross Engineers

08/8/14

### Checked By: JAC

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### Rational Method

#### Point of Concentration

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<th>L (ft)</th>
<th>S (%)</th>
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<th>TOC (min)</th>
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R:\2013 Projects\ARRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-115 10 Yr Flows (POST)
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<td>77</td>
<td>1919</td>
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<td>10.0</td>
<td>2.08</td>
<td>1.0</td>
<td>23.74</td>
<td>23.74</td>
<td>37.6</td>
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<td>BH-J21</td>
<td>59</td>
<td>713</td>
<td>8.3%</td>
<td>7.25</td>
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<td>11.6</td>
<td>7.16</td>
<td>26.90</td>
<td>38.8</td>
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<td>107.3</td>
<td>67</td>
<td>0.67</td>
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<td>6180.98</td>
<td>1383.2</td>
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<td>CAT CYN 45A AE, BE</td>
<td>Initial Area</td>
<td>298</td>
<td>1467</td>
<td>20.3%</td>
<td>4.3</td>
<td>4.3</td>
<td>3.12</td>
<td>0.80</td>
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<td>3026</td>
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<td>8.2</td>
<td>2.29</td>
<td>0.45</td>
<td>47.36</td>
<td>47.36</td>
<td>48.4</td>
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<td>CAT CYN 46 J21,J22</td>
<td>J21-J22</td>
<td>10</td>
<td>1413</td>
<td>0.7%</td>
<td>7.84</td>
<td>3.0</td>
<td>110.3</td>
<td>6303.68</td>
<td>1369.6</td>
<td>395</td>
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<td>Junction 22 J22</td>
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<td>110.3</td>
<td>66</td>
<td>0.66</td>
<td>0.33</td>
<td>6369.89</td>
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<td>CAT CYN 49B1 AK, J29</td>
<td>Initial Area</td>
<td>200</td>
<td>1003</td>
<td>19.9%</td>
<td>3.1</td>
<td>3.1</td>
<td>3.65</td>
<td>2.68</td>
<td>15.32</td>
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<td>J29</td>
<td>35</td>
<td>417</td>
<td>8.4%</td>
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<td>0.7</td>
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<td>6.1</td>
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<td>9.50</td>
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<td>J22-J23</td>
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<td>4302</td>
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<td>0.32</td>
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R:\2013 Projects\ABRA\13186-ECC CEQA Permit Assistance\Civil\Hydrology\DS-13186 - 115 pre construction runoff Rev 0 8-16-14.xls
DS-115 10 Yr Flows (POST)
WELL CAPACITY AND AQUIFER TEST, McCROSKEY WS-12 WATER WELL, EAST CAT CANYON DEVELOPMENT, SANTA BARBARA, CALIFORNIA

Prepared for: AERA ENERGY, LLC

October 2012
Fugro Job No. 04.62120157
October 19, 2012  
Project No. 04.62120157

Aera Energy, LLC  
10000 Ming Avenue, 3B51  
Bakersfield, California 93311

Attention: Mr. Eric Paulsen, P.E., Sr. Staff Facilities Engineer

Subject: Well Capacity and Aquifer Test, McCrosky WS-12 Water Well, East Cat Canyon Development, Santa Barbara, California

Dear Mr. Paulsen:

In accordance with the general scope of work outlined in our proposal to Mr. Dean Taormina with Sturgeon Services International (Sturgeon), dated August 16, 2012 (Attachment A), Fugro has completed a well capacity, aquifer test, and related assessment of the so-called McCrosky WS-12 water well located along Long Canyon Road on the western boundary of the Aera Fee of the East Cat Canyon Development in Santa Barbara County. The location of the subject water well is shown on an air photo of the "Aera Fee," which is included with this letter report as Attachment B. Pursuant to certain recommendations contained in our report to Aera LLC on groundwater supply sources in the East Cat Canyon Field (March 28, 2012\(^1\)), the purpose of the well capacity testing was to determine the current condition of the McCrosky WS-12 water well (depth, water level, well depth, location, and condition of perforations, etc.) and based on the condition assessment, perform pump testing of the well to assess yield, water quality, and the groundwater production potential of the Paso Robles formation aquifer in the "Aera Fee" area of the East Cat Canyon field. We understand that groundwater is one source of water supply being considered by Aera LLC for the generation of steam to develop the oil and gas resources of the East Cat Canyon Oilfield.

With this report we include documentation of health and safety measures that were followed during the field work (Attachment C), the results of a downhole video-log of the water well (Attachment D), various photographs that document the field work (Attachment E), daily field memoranda, which document preparation for and conduct of the well testing procedures (Attachment F), various graphs of the aquifer test results (Attachment G), and the results of a water quality analysis performed on the produced groundwater (Attachment H). As you are aware, the McCrosky WS-12 well was reportedly drilled in the late 1970s for use as a groundwater supply source. Certain hand-written tabulations of use from that period (1977) indicate that it was pumped at 4,000 barrels per day (about 110 gpm pumped continuously over a 24-hour period) and that the well was originally 700 feet in depth and produced groundwater

\(^1\) Fugro (2012), Groundwater Source Supply Study East Cat Canyon Field, Santa Barbara County, Prepared for Aera Energy, LLC, Fugro Job No. 04.62120024, dated March 28.
from the "Paso Robles gravels." A water quality analysis of groundwater produced dating from 1975 indicates the groundwater was of good quality (i.e., fresh water) with a calcium sulfate mineral character and total dissolved solid concentration of about 1,000 milligrams per litre (mg/l). Design of the well is unknown (other than reported depth). Records indicate it apparently was provided with a 40 hp submersible pump capable of producing 130 gpm from an unknown pump setting and total lift.

The McCroskey WS-12 well is currently being used by two ranchers in the area (Mr. Joe Jorge and Mr. Marvin Teixeira) under an agreement with Aera. We are informed and as documented in this study, the well is used intermittently to fill a 10,000 gallon water tank for cattle watering. Mr. Jorge informed us that the well had at sometime in the last 10 years been provided with a small submersible pump and is pumped at a rate of about 10 gpm. Mr. Jorge had no information relative to past use and pumpage of the well, water level data, water quality data, or well service records. Based on geologic information we provided in our report dated March 28, 2012 to Aera LLC, we concluded that as much as 300 feet of potentially saturated Paso Robles Formation is present in the northerly half of the Aera Fee area and, pending further study of the McCroskey WS 12 well (described below), it is possible that properly designed and constructed wells in the northerly boundary of the "Aera Fee" could produce significant amounts of groundwater.

Subject to the completion of various health, safety, and environment (HSE) meetings and documentation which were coordinated by staff of Sturgeon and discussions with the operators of the well (Mr. Joe Jorge and Marvin Teixeira), Fugro initiated field work on October 1, 2012 by having Fisher Pump of Santa Maria remove the existing submersible pump from the well and perform a downhole video-log of the well. As documented in the daily reports of field observations by Fugro (Attachment E), the existing pump in the well was used to initially fill a portable 1,000 gallon tank (existing pump flow rate of 17 gallons per minute (gpm)) and the existing pump which was installed to a depth of 461 feet was removed. The 1,000 gallons of stored water was then released back into the well at a rate of about 2 gpm to help settle solids and clear the water for the video-log. The video-log was performed on October 2, 2012 and indicated the static water level in the well was at a depth of 247 feet below top of casing and that the well was of a depth of 491 feet. As indicated in the video-log (Attachment D), water clarity was fairly good and indicated the well was heavily incrusted with a carbonate precipitate, with randomly visible vertical slot (likely mills knife or gun perforated installed) present at depths below a depth of 350 feet. Discussions were then held with Mr. Eric Paulsen at Aera LLC and concurrence received that the condition of the well was acceptable relative to proceeding with the intended well capacity test. Fisher Pump then installed a sounding tube to a depth of 473 feet for purposes of providing a water level pressure transducer in the well, followed by the installation of a 25 hp submersible pump to a depth of 479 feet. Background water level data were then collected and the pump was turned on at about 2 pm on October 3, 2012 to perform an initial specific capacity or variable discharge test at rates ranging from 42 to 125 gpm for a period of 400 minutes. Discharge water for the duration of the 400 minutes of specific capacity testing remained cloudy with a slight orange-brown color (refer to Attachment F).

Following an overnight period of water level recovery (refer to Attachment D) on October 4, 2012 a constant discharge test was started at 11 a.m. at a discharge rate of approximately
125 gpm. The test continued for a period of 12 hours with a maximum drawdown (water level below the static water level) of about 146 feet feet, indicating a specific capacity for the well of about 0.85 gpm per foot of drawdown. During the last 4 hours of the constant discharge test the pumping water level remained stable. At the end of the 12 hour constant discharge test a sample of the produced groundwater was collected for analysis of general mineral constituents. The analytical results are contained in Attachment H. Upon cessation of pumping, recovery water levels were monitored for a period of 500 minutes and indicate essentially full recovery to the pre-test static water level within the first 60 minutes after cessation of pumping. The temporary test pump was then removed by Fisher Pump, and the existing submersible pump reinstalled to the same depth, and start-up of the well was then performed. Demobilization from the site was completed by Fisher Pump on Friday, October 5, 1012.

Analysis of the groundwater produced (refer to Attachment H) indicates it to be of a calcium sulfate chemical character with total dissolved solids (TDS) concentration of 900 milligrams per litre (mg/l). The groundwater is considered somewhat hard and, based on this analysis, contains a dissolved iron concentration of 1.3 mg/l. The analytical results appear to be grossly similar to groundwater quality analysis form this well performed in the late 1970s. The groundwater is considered to be a freshwater source that would be generally suitable for the intended industrial uses by Aera LLC, subject to review by a chemical engineer relative to use for steam production.

Based on the results of the capacity testing of the Mc Crosky WS-12 well presented above, it is apparent that the Paso Robles formation which underlies the northerly portion of the "Aera Fee" is saturated, and that properly designed and constructed wells at the locations recommended in our report of March 2012 should be able to produce fresh groundwater at rates in the range of 250 gpm each. The existing McCrosky WS-12 well is considered to be in fairly poor condition, and, given its age and relatively inefficient and unknown design, affected by significant incrustation of the perforated openings. Detailed analysis of the aquifer properties (i.e., transmissivity) is not considered appropriate given the poor condition of the well. Nonetheless, the well capacity testing and analysis provides guidance on a suggested preliminary depth and design of additional freshwater source wells on the "Aera Fee" lease. Such wells should be drilled to approximate depths of 750 feet, geophysically electrically logged, mud logged, and as appropriate, completed with 12-inch diameter mild steel casing with perforations placed from depths of about 300 to 700 feet. The wells should be gravel packed, provided with surface seal, and generally follow construction standards that would be contained in well construction permits to be obtained from the County of Santa Barbara. Pending the decisions of Aera LLC on the use of groundwater as a supply source for the proposed project (subject to a variety of engineering, conveyance, environmental, and cost issues) we would be pleased to continue to assist Aera LLC on the next steps in this process.

Anticipating that some form of environmental review will be associated with the permits for the project and that use of groundwater as a source will be subject to environmental review, we suggest that the McCrosky WS-12 well be instrumented with a downhole pressure transducer to collect water level readings on an hourly basis. Such data could then be downloaded on a quarterly basis to assess current use, seasonal water level variations, and potential recharge to the aquifer associated with precipitation and streamflow in the northerly
Santa Maria River. The well should also be provided with a small totalizer meter to document production.

It has been our pleasure to assist Aera LLC on this project and we remain available to continue our work at your direction.

Sincerely,
FUGRO CONSULTANTS, INC.

[Signature]
Timothy Nicely, P.G., C.H.g.
Senior Project Hydrogeologist

[Signature]
David Gardner, P.G., C.H.g.
Principal Hydrogeologist

Copies: (4) Addressee and Pdf
Attachments:
Attachment A - Proposal Sturgeon Services International, Dated August 16, 2012
Attachment B - Air Photo of The "Aera Fee"
Attachment C - Documentation of Health and Safety Measures
Attachment D - Results of a Downhole Video-Log of the Mccrosky WS-12 Water Well
Attachment E - Various Photographs that Document the Field Work
Attachment F - Report of Field Operations
Attachment G - Various Graphs of the Aquifer Test Results
Attachment H - Constant Discharge Test Results General Mineral Constituents Analysis
ATTACHMENT A
PROPOSAL STURGEON SERVICES INTERNATIONAL
DATED AUGUST 16, 2012
August 16, 2012
Proposal No. 04.62120024

Sturgeon Services International
3511 Gilmore Avenue
Bakersfield, California 93308-6205

Attention: Mr. E. Dean Taormina, Central Coast Division Manager

Subject: Proposal to Conduct Well Capacity and Aquifer Test, McCrosky WS-12 Water Well

Dear Mr. Taormina:

As requested, Fugro Consultants, Inc. is pleased to submit this proposal to Sturgeon Services International to assist Aera Energy LLC (Aera) in an evaluation of the condition and production capacity of the existing McCrosky WS-12 water well located in the East Cat Canyon Development, Aera Fee property east of Long Canyon Road near the town of Sisqoc in Santa Barbara County. As discussed in a recently prepared groundwater source study (March 28, 2012) for Aera, this water supply well was reported in the late 1970s to have pumped groundwater in the range of about 130 gallons per minute (gpm) from aquifers contained in the Paso Robles formation. The well is reported to have been drilled to a depth of 700 feet and over the years has been retrofitted with a series of successively smaller pumps. The well is currently being used by a Mr. Joe Jorge and several other ranchers under a use agreement with Aera. Actual pumpage from the well is believed to be somewhat intermittent and in the range of 10 gpm.

The purpose of performance testing this well is to determine the well’s current condition (depth, water level, and depth of perforated casing, etc.) and to perform a 24 to 48 hour constant discharge test to better understand the production potential of aquifers of the Paso Robles formation in this area of the lease. The well was inspected in March 2012 and found to be operable with a power drop to the well from a nearby power pole. To test the well in the range of the historic reported yield (i.e., in the range of 125 gpm) the existing pump in the well will need to be removed (pump setting depth unknown) and a temporary submersible pump of suitable capacity and lift installed. At that time, the well would be video logged to determine depth, water levels, condition of the casing, and perforations. The well would initially be pumped to assess specific capacity (range in well yields and drawdown) followed by a 24 to 48 hour constant discharge test at an appropriate production rate. A water sample would be collected for analysis of general mineral constituents. The well would be equipped with a downhole pressure transducer to record water-level variations at regular intervals (on the order of every minute). A recovery test would be conducted for a duration of 12 hours following the pump test. The temporary pump would then be removed and the existing small pump reinstalled. Fugro would provide oversight of the entire task and prepare a summary report of the findings. The report would comment on the results relative to the groundwater resources of the Paso Robles formation in the lease area relative to the needs of Aera.

To perform the above work, Fugro would work directly for Sturgeon who would coordinate the overall field services consistent with their current contracts with Aera. Fugro in
turn would retain the services of a qualified well-pump contractor (Scott Fisher Pumps located in Santa Maria) to assist in the pump removal and installation of a temporary test pump, coordinate the electrical connections, and surface discharge of the produced water. Fugro would retain Welenco to perform the well video log, and use Capco Analytical to perform the water quality analysis. To coordinate the work we would need to meet at the site with Mr. Jorge to understand his well use requirements and the approximate 3 day interruption of use of the well during the performance testing. Based on a meeting with Scott Fisher at the well site in early August 2012, the electricity at the site can be used for the pump test (i.e., a generator will not be required) and that discharge of the produced water will be directed to an appropriate drainage swale along Long Canyon Road. We assume that Sturgeon will provide details to Fugro and the other subcontractors relative to HSE requirements associated with the proposed work.

The work outlined above is estimated to cost $22,000, to be performed in accordance with the hourly rates by labor category shown on the attached Fee Schedule. The quote by Fisher Pumps to perform their work is attached to this proposal. The work should require about 3 days in the field to complete, and another 2 weeks to analyze the acquired data, obtain the results of the water quality analysis, and prepare the report documenting the findings.

We appreciate the opportunity to continue to assist Aera on this project. Please call should you have any questions.

Sincerely,

FUGRO CONSULTANTS, INC.

David Gardner, P.G., C.H.g.
Principal Hydrogeologist

Copies: (Pdf) Addressee
(Pdf) Eric Paulson, Aera Energy LLC

Attachments: Fisher Pump Quote
ATTACHMENT B
AIR PHOTO OF THE "AERA FEE"
ATTACHMENT C
DOCUMENTATION OF HEALTH AND SAFETY MEASURES
1. General Information

Project Title: East Cat Canyon Hydrogeologic Well Source Study; McCrosky Well WS12
Project Manager: 805-289-3826

Project No.: 04.6212 0024
Activity Center Mgr: 62

Site Name: East Cat Canyon, Cat Canyon Oil Field
Site HSE Officer: Timothy Nicely

Site Address: 6516 East Cat Canyon Road, Santa Maria, California
Facility HSE Officer (if applicable):

FCL HSE Officer: Cathy Morris
Office (713) 346-4016; Cell (805) 432-3115
Fugro 24-Hr Emergency # 888-333-4577

Client: Sturgeon Services
Site Thomas Bro. Nos. 345 H11

Client Contact: Dean Taormina
Client Phone No: 661-343-6580

Subcontractor: Fisher Pump, Scott Fisher
Subcontractor Phone No.: 805-310-2576

USA Ticket #: None needed
Exp. Date: N/A

(Attach Electronic USA Ticket to this Plan) USA Ticket Number: 
Current on FCL Approved Subcontractor List? Yes ☒ No ☐

If answered No, Business Unit Manager Approval Necessary:

2. Emergency Information

Fire: 911 or Local:
Police: 911 or Local:
Ambulance: 911 or Local:

Nearest Medical Facility: Marian Medical Center
Address: 1400 East Church Street, Santa Maria, CA
Phone: 805-739-3000

This form may be used for those site activities that do not pose a significant threat of exposure to site contaminants or hazards. It is the responsibility of the Project Manager to ensure that this plan is complete and sign the Health Safety and Environmental Plan (HSEP). All project personnel must receive a copy of this form, familiarize themselves with its contents and sign the signature page before work begins.

Approved by GHSE Manager, Fugro Consultants, Inc., May 2012
Note: If this is a printed or downloaded copy, please check the online OHSE-MS to ensure that it is the latest version.
Directions: From well site: Drive north on Long Canyon Road; 
    Turn left onto Foxen Canyon Road; 
    Turn right onto Philbric Road; 
    Continue onto E Main Street; 
    Turn Left onto Palisade Drive; 
    Take 1st Right onto E Church Street; Hospital is on the right 

From site office: Drive NW on Cat Canyon Road; 
    Turn Left onto Palmer Road; 
    Take 1st Right onto Dominion Road; 
    Turn Left onto E Clark Ave.; 
    Merge onto US 101 North; 
    Take exit 171 toward CA-166 W/Main Street/Guadalupe; 
    Turn right onto Cypress Street/Nicholson Ave; 
    Turn left onto Stratford Ave; 
    This becomes Church Street; Hospital is on the right 

3. Planned Site Activities 
   a. Pull existing pump (Fisher Pump) 
   b. Perform video log, install pump, electrical and plumbing 
   c. Perform pumping test 

4. Restricted, Exclusion and/or Protected Habitat Areas 
   None 

5. Local and/or Physical Hazards 
   (Address physical, environmental or health hazards such as high traffic areas, rough terrain, severe weather conditions, excessive dust or pollutants. Note: If there is a significant threat of exposure to site contaminants use the ES-F60 Environmental Site Health and Safety Plan) 

   Lockout/Tagout procedures apply (HS-R49 is appended) 
   Heat illness prevention may apply in the canyon (HS-R35 is appended) 
   Fire prevention associated with vehicular exhaust and/or electrical work for well pump may apply (HS-R36 is appended) 

6. Project Specific Training Requirements 
   ☑ First Aid / CPR
7. Attached JSAs and/or Procedures
   - GEO 101 Hand Sampling
   - GEO 102 Drilling / Sampling
   - GEO 103 Downhole Logging
   - GEO 104 Exploration Pits
   - GEO 105 Seismic Refraction Survey

8. Health Safety and Environmental Procedures Required by the Facility
   (Such as On-Site Safety Orientation, Site Access Procedures, etc.)

   On site safety training is required at Aera’s East Cat Canyon site office prior to any site work.

9. Project Safety Equipment List
   (List all applicable PPE from JSA’s, add any project specific requirements such as barricades, 2-way radios, etc.)

   - Hard Hat
   - Safety Shoes
   - Hearing Protection
   - Cotton Gloves
   - Leather Gloves
   - Rubber Gloves
   - Safety Glasses w/Side Shields
   - Safety Vest
   - Goggles
   - Face Shield
   - Safety Harness
   - Sun Screen
   - Insect Repellent
   - Drinking Water
   - First Aid Kit
   - Fire Extinguisher

Approved by OHSE Manager, Fugro Consultants, Inc., May 2012
Note: If this is a printed or downloaded copy, please check the online OHSE-MS to ensure that it is the latest version.
(For PPE Requirements of Level C* or above use the GeoEnvironmental Site HSE Plan Template)

*See Onshore Guidebook Page 37 for a description of PPE Levels of Protection
By my signature below, I hereby indicate that I have reviewed and understand this HSEP and I agree to follow the guidelines therein.

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<th>Name (Signature)</th>
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<td></td>
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<tr>
<td>David S. Fisher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peter Hernandez</td>
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TO THE SUBCONTRACTOR: This plan has been prepared solely for the use of Fugro Consultants, Inc. personnel. It is supplied to you for informational purposes only. You are responsible for your own health safety and environmental program.

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<th>Timothy Nicely</th>
<th>10/1/2012</th>
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<tr>
<td>Project Manager</td>
<td>Date</td>
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Directions to Marian Medical Center
1400 East Church Street, Santa Maria, CA 93454
15.6 mi – about 27 mins
1. Head west on Cat Canyon Rd toward Long Canyon Rd
   About 5 mins
   go 2.2 mi
total 2.2 mi

2. Turn left onto Palmer Rd
   About 1 min
   go 0.5 mi
total 2.6 mi

3. Take the 1st right onto Dominion Rd
   About 6 mins
   go 3.5 mi
total 6.1 mi

4. Turn left onto E Clark Ave
   About 6 mins
   go 2.7 mi
total 8.8 mi

5. Slight right to merge onto US-101 N
   About 7 mins
   go 6.2 mi
total 15.0 mi

6. Take exit 171 toward CA-166 W/Main St/Guadalupe
   go 0.2 mi
total 15.2 mi

7. Turn right onto Cypress St/Nicholson Ave
   go 0.1 mi
total 15.4 mi

8. Turn left onto Stratford Ave
   go 358 ft
total 15.4 mi

9. Stratford Ave turns slightly right and becomes E Church St
   Destination will be on the right
   go 0.1 mi
total 15.6 mi

Marian Medical Center
1400 East Church Street, Santa Maria, CA 93454
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<td>About 2 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Slight left onto Foxen Canyon Rd</td>
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<td>total 2.1 mi</td>
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<td></td>
<td>About 3 mins</td>
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<td></td>
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<td>3.</td>
<td>Turn right to stay on Foxen Canyon Rd</td>
<td>go 7.4 mi</td>
<td>total 9.4 mi</td>
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<tr>
<td></td>
<td>About 13 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Turn right onto Philbric Rd</td>
<td>go 1.5 mi</td>
<td>total 11.0 mi</td>
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Marian Medical Center
1400 East Church Street, Santa Maria, CA 93454

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Map data ©2012 Google
Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.
ENERGY ISOLATION (LOCKOUT TAGOUT)
HS-R49

1.0 PURPOSE

The purpose of this procedure is to establish to help maintain the safety of all employees and to comply with the OSHA regulation 29 CFR 1910.147. It establishes the minimum safety requirements for work being performed where energy sources can be a hazard.

2.0 APPLICATION

This procedure establishes minimum requirements for the lockout of energy isolating devices when maintenance or servicing is done on machines or equipment. It is essential that the machine or equipment is stopped and isolated from all potentially hazardous energy sources and locked out before employees perform any service or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could cause injury.

This program and its procedures shall apply to all activities under the direct control of the Company.

3.0 DEFINITIONS

Affected Employee - An employee whose job requires him/her to operate to use a machine or equipment on which services or maintenance is being performed under lockout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized Employee - An employee, by department designation, which locks or implements a system procedure on machines or equipment for the purpose of performing the service or maintenance on that machine or equipment.

Cord and Plug-connected Equipment - Equipment that is powered by an electrical energy source that can be shut down by removing the cord and plug from the energy source.

Energized - Connected to an energy source or containing residual or stored energy.

Energy Isolation Device - A mechanical device that is part of a piece of equipment, machinery or system that physically prevents the transmission or release of energy. Some examples include manually operated electrical circuit breakers; disconnect switches, slide gates, line valves, and blocks. This term does not include a push button; selector switch, and other control circuit type devices.

Energy Source - Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.
Locks - An individually keyed padlock personally assigned to an Authorized Person or Affected Person that is used with a lock out device to control and isolate energy sources.

Lockout - The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout Device - A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energization of a machine or equipment.

Tag Out - Posting a prominent warning tag with durable string onto the energy isolation device and/or lock out device of the piece of equipment, machinery or system being controlled. The tag must state "DO NOT OPERATE" and document the Authorized Person taking the equipment out of operation, as well as the date. It is a warning to others that the equipment cannot be put back into operation until the tag and/or lock have been removed by the Authorized Person.

4.0 RESPONSIBILITIES

4.1 MANAGEMENT

Management is responsible for making sure that all hazardous energy sources are identified and that all applicable employees receive training consistent with their level of lock-out/tag-out responsibility.

4.2 ON SITE SUPERVISOR

The on-site supervisor must ensure that all employees follow the requirements or guidelines making up these procedures.

4.3 EMPLOYEE

The employee is required to comply with the restrictions and limitations during the use of lockout. Only authorized employees are to perform the lockout in accordance with this procedure. Upon observing a machine or piece of equipment that is locked out to perform servicing or maintenance, employees must not attempt to start, energize, or use that machine or equipment.

5.0 TRAINING

All authorized, affected, and incidental personnel shall receive training consistent with their level of lockout/tag-out responsibility.

An authorized employee is one who has been designated to perform service or maintenance. Training for authorized employees will include:
• Recognition of applicable hazardous energy sources (i.e., electrical, mechanical, hydraulic, pneumatic, chemical, thermal, gravitational, magnetic, tension, kinetic, etc.)

• Type and magnitude of the energy available in the workplace

• Methods and means necessary for energy isolation and control.

An affected employee is one who operates or uses a machine on which servicing is being performed, or one who is required to work in an area in which such servicing is being performed. Affected individuals will be instructed in the purpose and use of the energy control procedure.

Incidental employees are those who may work in an area where energy control procedures are used. These individuals will be instructed about the procedure and the prohibition against restarting or reenergizing machines or equipment which are locked out or tagged out.

Retraining will be provided for all authorized and affected individuals whenever there is a change in their job assignments; a change in machines, equipment, or processes that present a new hazard; or when there is a change in the energy control procedures. Additional retraining will be conducted whenever a periodic inspection or other evidence reveals that there are inadequacies in the individual's knowledge or use of the energy control procedures.

Awareness training will be documented and retained within the Clarity Training by using course LOTOEFV Lockout/Tagout for affected employees.

Outside training shall be conducted for authorized employees.

6.0 JOB PLANNING

Prior to permitting and commencing the work, survey equipment to locate and identify all isolating devices to be certain which switch(es), valve(s), or other energy isolating devices apply to the equipment to be locked out. More than one energy source (electrical, mechanical, stored, or other) may be involved.

7.0 LOCKOUT PROCEDURES

Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.

The authorized employee shall identify the type and magnitude of the energy that the machine or equipment utilizes. The employee shall understand the hazards of the energy, and shall know the methods to control the energy.

If the machine or equipment is operating, shut it down by normal stopping procedure, i.e., depress stop button, open switch, close valve, etc.
De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).

Lock out the energy isolating device(s) with assigned individual lock or tag (if using the tagout system, fasten a "DO NOT OPERATE" tag) that is available from the on site supervisor or the HSE department.

- Lockout and/or tagout device shall include the name of the individual applying the device.
- Lockout devices, where used shall be affixed in a manner that will hold the energy isolating devices in a safe or off position.
- Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the safe or off positions.
- Where tagout devices are used with energy isolation devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached.
- Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device in a position that will be immediately obvious to anyone attempting to operate the device.

Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, air, gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.

Ensure that equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the switch or other normal operating control(s) or by testing to make certain the equipment will not operate.

Return operating control(s) to neutral or "OFF" position after verifying the isolation of the equipment.

Prior to starting work on machines or equipment that have been locked or tagged out; the authorized employee shall verify that isolation and de-energization of the machine or equipment have been accomplished.

8.0 PROCEDURES FOR TESTING

When temporarily removing lockout devices for the purpose of performing a test on machinery or equipment, the following steps should be taken:
- Check the machine or equipment, as well as the immediate area around the machine or equipment, to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.

- Check the work area to ensure that employees have been safely positioned or removed from the area.

- The employee that will be performing the test shall remove the lockout/tagout device(s) in conjunction with the individual that initially attached the lockout/tagout device(s)

- Procedure with testing machine or equipment.

- De-energize machine or equipment and reapply lockout/tagout device(s)

- Ensure that equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the switch or other normal operating control(s) or by testing to make certain the equipment will not operate.

- Return operating control(s) to neutral or "OFF" position after verifying the isolation of the equipment.

- Prior to starting work on machines or equipment that have been locked or tagged out; the authorized employee shall verify that isolation and de-energization of the machine or equipment have been accomplished.

- The test has been performed and the machine or equipment is now locked out again.

9.0 RESTORING TO SERVICE

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps should be taken:

- Check the machine or equipment, as well as the immediate area around the machine or equipment, to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.

- Check the work area to ensure that employees have been safely positioned or removed from the area.

- Verify that controls are in "OFF" or neutral position.

- Remove the lockout devices and re-energize the machine or equipment.

- Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

Note: This procedure does not apply to cord or plug connected equipment when the equipment is in exclusive control of the employee who is performing the service or maintenance of the equipment.
10.0 PROCEDURES INVOLVING MULTIPLE PERSONS (GROUP LOCKOUT)

If more than one authorized employee is required to lockout the same equipment, each shall place his/her own personal lockout device on the energy isolating device(s). When an energy isolating device cannot accept multiple locks, a multiple lockout device (hasp) may be used.

The authorized employee who has the primary responsibility for the work being performed under the protection of a group lockout/tagout device shall ascertain the exposure status of individual group members.

11.0 REFERENCES

29 CFR 1910.333 SUBPART S - ELECTRICAL
HEAT ILLNESS PREVENTION PLAN

HS-R35

Prepared for:
EMPLOYEES OF FUGRO CONSULTANTS, INC.
HEAT ILLNESS PREVENTION PLAN

APPROVED BY: Cathy Morris DATE: May 2012

Cathy Morris, Fugro Consultants, Inc.
HSE Manager

Approved by OHS Manager, Fugro Consultants, Inc., May 2012
Note: If this is a printed or downloaded copy, please check the online OHS-MS to ensure that it is the latest version.
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1.0 PURPOSE

The purpose of the Heat Illness Prevention Plan (HIPP) is to meet the requirements set forth in California Code of Regulations, Title 8, Section 3395 as well as address Heat Illness concerns relating to employee’s safety throughout Fugro Consultants, Inc., and also to serve as a supplement to the Fugro Consultants Injury and Illness Prevention Program (IIPP). The information is intended to be used in conjunction with the IIPP. The HIPP establishes procedures and provides information necessary to ensure that employees of Fugro Consultants, Inc. (Fugro), are knowledgeable in the prevention and recognition of heat stress, in order to ensure their own safety and the safety of others.

2.0 SCOPE

This HIPP provides information regarding safe work practices for Fugro employees working in conditions where heat-related illness can be a serious to life-threatening occurrence.

3.0 HEAT ILLNESS PREVENTION

Heat-related illnesses are avoidable if training is in place and the right actions are taken before, during, and after working in hot conditions. High temperatures and humidity can stress the body’s ability to cool itself, making heat illness a concern during hot weather months. Working outdoors, especially during summer months, exposes personnel to elevated heat conditions, creating the potential for heat illness. The three primary forms of heat illness are heat cramps, heat exhaustion, and heat stroke. Heat stroke can be a life-threatening condition.

3.1 RECOGNIZE THE HAZARD

Learn the signs and symptoms of heat-induced illness and how to respond. All Fugro Consultants employees will receive supervisory and non-supervisory training, as outlined in CCR Title 8, Section 3395 (Heat Illness Prevention). Cal/OSHA and OSHA Heat Illness Prevention and Heat Equation Guidelines are provided in Appendix A of this HIPP.

Employee training topics will include:

- The environmental and personal risk factors for heat illness
- Review of this HIPP and procedures
- The importance of staying hydrated, drinking water frequently throughout the day, up to 4 cups per hour
- Importance of acclimatization (allowing the body to adjust gradually to the work in high heat)
- Types of heat illness and the signs and symptoms
- Necessity of immediately reporting to Fugro, directly or through the employee’s supervisor any signs or symptoms of heat illness

1

Approved by OHSE Manager, Fugro Consultants, Inc., May 2012
Note: If this is a printed or downloaded copy, please check the online OHSE-MS to ensure that it is the latest version.
Heat Illness Prevention Plan
HS-R35
Revision 0

➢ Fugro's procedures for responding to symptoms of possible heat illness, including how emergency medical services will be provided if they become necessary

➢ Fugro's procedures for emergency communications. This includes the emergency response procedures such as locating local medical services and communication alternatives

➢ Fugro's procedures for ensuring that, in the event of an emergency, clear and precise directions to the work site can and will be provided, as needed, to emergency responders

**Supervisory Training.** Prior to assignment to supervision of employees working in the heat, training on the following topics shall be provided:

➢ The information required for employee training listed above

➢ The importance of preventing heat illness and how to recognize the symptoms

➢ The procedures the supervisor is to follow when an employee exhibits symptoms consistent with possible heat illness, including emergency response procedures

➢ Procedures for acclimatization

➢ Modifying working hours where necessary/possible to work during cooler hours of the day

➢ Providing a "buddy system" to allow employees to watch each other closely for signs of heat illness

3.2 WATER

There will be an adequate supply of clean cool potable water available at all job sites. The Fugro Site Safety Representative or designated person will ensure that an adequate supply of drinking water is available at each location and that employees are encouraged consume an adequate amount of water.

It is recommended that each employee drink 4 8-ounce glasses of water per hour, including at the start of shift.

3.3 SHADE

Fugro will provide shade for recovery periods when employees need relief from the heat. The direct heat of the sun can add as much as 15 degrees to the heat index. Rest breaks are important to provide time for cooling and provide an opportunity to drink water. Breaks should be taken in cooler, shaded areas. The Fugro site safety representative or designate will be responsible for ensuring that adequate shade is available at work sites where the temperature is expected to exceed 85 degrees. The location of shade areas and the need to rest and get into
the shade if any heat illness symptoms are present will be discussed daily at the tailgate meeting.

3.4 ACCLIMATIZATION

People need time for their bodies to adjust to work in the heat. Acclimatization is particularly important for employees returning to work after a prolonged absence or recent illness, recently moving from a cool climate to a hot climate, or working during the beginning stages of a heat wave.

For heavy work under extremely hot conditions, at least the first 2 or 3 days of work in the heat should be limited to 2 to 4 hours.

Monitor employees closely for signs and symptoms of heat illness, particularly when they have not been working in the heat for the last few days or when a heat wave occurs.

3.5 PROMPT MEDICAL ATTENTION

Recognizing the symptoms of heat illness and providing an effective response requires promptly acting on early warning signs. These signs are covered in the information provided in Appendix A and in Section 4 of this HIPP. Any of these symptoms require immediate attention.

All Fugro field personnel are first-aid/CPR trained. However, if workers show any abnormal response to the heat and first-aid trained personnel are not immediately available onsite, call 911 immediately. A site-specific safety plan is written for all Fugro field projects. These plans include an emergency action plan that details the site location and alternative communication methods if cell phone coverage is not available at the work site. How to contact emergency services and guide them to the work location will be discussed daily at the tailgate meeting.

3.6 OTHER INFORMATION

➢ Dress for the heat. Wear lightweight, loose fitting, light colored clothing.

➢ Eat small meals and eat more often. Avoid foods that are high in protein, as they tend to increase metabolic heat.

4.0 GENERAL SIGNS AND CARE FOR HEAT EMERGENCIES

4.1 HEAT CRAMPS

Description: Heat cramps are a common type of heat-related injury that most people have experienced at one time or another. Heat cramps are muscle spasms that usually affect the arms, legs, or stomach. Frequently, they do not occur at the time of exposure, but later at night or when relaxing. Heat cramps are caused by heavy sweating, especially when water is not replaced quickly enough. Although heat cramps can be painful, they are not considered serious.
Prevention/First Aid: Drink electrolyte solutions such as Gatorade and plenty of water during the day, and try eating more fruits, like bananas, to help keep your body hydrated during hot weather. Contact your supervisor, Fugro safety personnel, or call 911 if you or a coworker becomes ill.

4.2 HEAT EXHAUSTION

Description: Heat exhaustion is a more serious condition than heat cramps. It occurs when the body’s internal temperature-regulating system is overworked, but has not completely shut down. In heat exhaustion, the surface blood vessels and capillaries, which enlarge to cool the blood, collapse from loss of body fluids and necessary minerals. This happens when you do not drink enough fluids to replace what you are sweating away.

Symptoms Include: Headaches, dizziness or lightheadedness, weakness, mood changes such as irritability, confusion, or the inability to think straight, upset stomach, vomiting, decreased or dark colored urine, fainting or passing out, and pale, clammy skin.

Prevention/First Aid: Act immediately. If not treated, heat exhaustion may advance to heat stroke or death. Move the victim to a cool, shaded area to rest, and don’t leave the person alone. If symptoms include dizziness or lightheadedness, lay the victim on his or her back and raise the legs 6 to 8 inches. If symptoms include nausea or upset stomach, lay the victim on his or her side. Loosen and remove any heavy clothing. Have the victim drink cool water (about a cup every 15 minutes) unless sick to the stomach. Cool the person’s body by fanning and spraying with a cool mist of water or applying a wet cloth to the person’s skin. Call 911 for emergency help if the person doesn’t feel better within a few minutes.

4.3 HEAT STROKE

Description: Heat stroke is a life-threatening illness with a high death rate. It occurs when the body has depleted its supply of water and salt and the victims’ core body temperature rises to deadly levels. A heat stroke victim may suffer heat cramps and/or heat exhaustion before progressing into the heat stroke stage, but this is not always the case. It should be noted that heat stroke is sometimes mistaken for a heart attack. It is therefore very important to be able to recognize the signs and symptoms of heat stroke and to check for them anytime an employee collapses while working in a hot environment.

Symptoms Include: A high body temperature (103 degrees F); a distinct absence of sweating (usually), hot red or flushed dry skin, rapid pulse, difficulty breathing, constricted pupils, any or all of the signs or symptoms of heat exhaustion including dizziness, headache, nausea, vomiting or confusion, and possibly more severe symptoms including bizarre behavior and high blood pressure. Advanced symptoms can be seizure or convulsions, collapse, loss of consciousness, and a body temperature of over 108 degrees F.

Prevention/First Aid: Call 911 for emergency help immediately. Move the victim to a cool, shaded area, and don’t leave the person alone. Lay the victim on his or her back. Move any nearby objects away from victim if symptoms include seizures or fits. If symptoms include
nausea or upset stomach, lay the victim on their side. Loosen and remove any heavy clothing. Have the person drink cool water (about a cup every 15 minutes) if alert enough to drink something, unless person is sick to their stomach. Cool the person’s body by fanning and spraying with a cool mist of water or wiping with a wet cloth or covering him or her with a wet sheet. Place ice packs under the armpits and groin area.

For additional information on Heat Illness Prevention, please contact your supervisor or the Fugro HSE Department.
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**The Heat Equation**

**HIGH TEMPERATURE + HIGH HUMIDITY + PHYSICAL WORK = HEAT ILLNESS**

When the body is unable to cool itself through sweating, serious heat illnesses may occur. The most severe heat-induced illnesses are heat exhaustion and heat stroke. If left untreated, heat exhaustion could progress to heat stroke and possible death.

**Heat Exhaustion**

**What are the symptoms?**

HEADACHES; DIZZINESS OR LIghtHeAdEness; WEAKNESS; MOOD CHANGES SUCH AS IRITABILTY, CONFUSION, OR THE INABILITY TO THINK STRAIGHT; UPSET STOMACH; VOMITING; DECREASED OR DARK-COLORED URINE; FAINTING OR PASSING OUT; AND PALE, CLAMMY SKIN

**What should you do?**

- Act immediately. If not treated, heat exhaustion may advance to heat stroke or death.
- Move the victim to a cool, shaded area to rest. Don’t leave the person alone. If symptoms include dizziness or light-headedness, lay the victim on his or her back and raise the legs 6 to 8 inches. If symptoms include nausea or upset stomach, lay the victim on his or her side.
- Loosen and remove any heavy clothing.
- Have the person drink cool water (about a cup every 15 minutes) unless sick to the stomach.
- Cool the person’s body by fanning and spraying with a cool mist of water or wrapping the victim with a wet cloth or covering him or her with a wet sheet.
- Call 911 for emergency help if the person does not feel better in a few minutes.

**Heat Stroke—A Medical Emergency**

**What are the symptoms?**

DRY, PALE SKIN WITH NO SWEATING; HOT, RED SKIN THAT LOOKS SUNBURNED; MOOD CHANGES SUCH AS IRRITABILITY, CONFUSION, OR THE INABILITY TO THINK STRAIGHT; SEIZURES OR FITS; AND UNCONSCIOUSNESS WITH NO RESPONSE

**What should you do?**

- Call 911 for emergency help immediately.
- Move the victim to a cool, shaded area. Don’t leave the person alone. Lay the victim on his or her back. Move any nearby objects away from the person if symptoms include seizures or fits. If symptoms include nausea or upset stomach, lay the victim on his or her side.
- Loosen and remove any heavy clothing.
- Have the person drink cool water (about a cup every 15 minutes) if alert enough to drink something, unless sick to the stomach.
- Cool the person’s body by fanning and spraying with a cool mist of water or wrapping the victim with a wet cloth or covering him or her with a wet sheet.
- Place ice packs under the armpits and groin area.

**How can you protect yourself and your coworkers?**

- Learn the signs and symptoms of heat-induced illnesses and how to respond.
- Train your workforce about heat-induced illnesses.
- Perform the heaviest work during the coolest part of the day.
- Build up tolerance to the heat and the work activity slowly. This usually takes about 2 weeks.
- Use the buddy system, with people working in pairs.
- Drink plenty of cool water about a cup every 15 to 20 minutes.
- Wear light, loose-fitting, breathable clothing, such as cotton.
- Take frequent, short breaks in cool, shaded areas to allow the body to cool down.
- Avoid eating large meals before working in hot environments.
- Avoid alcohol or beverages with caffeine. These make the body lose water and increase the risk for heat illnesses.

**What factors put you at increased risk?**

- Taking certain medications. Check with your health-care provider or pharmacist to see if any medicines you are taking affect you when working in hot environments.
- Having a previous heat-induced illness.
- Wearing personal protective equipment such as a respirator or protective suit.
FIRE PREVENTION
HS-R36

1.0 PURPOSE

The purpose of the fire prevention and protection plan is to eliminate the causes of fire and prevent loss of life and property by fire. It provides employees and contractors with information and guidelines which will assist them recognizing, reporting and controlling fire hazards. This plan is in compliance with OSHA 29 CFR 1910.39.

2.0 SCOPE

Company-wide.

3.0 BASICS OF FIRE

3.1 THE FIRE TETRAHEDRON

In order to understand fire safety, you must first understand fire chemistry. These four basic elements are needed to produce a fire:

1. Fuel - Paper, wood, rags, oil, or grease.
2. Oxygen - Air, ventilation, stored oxygen.
3. Heat - Ignition sources, hot surfaces, sparks, open flames, electrical arcs.
4. Chemical Reaction - A sustained chemical reaction

To eliminate the potential for a fire or to extinguish a fire, you must remove 1 or more of the 4 components of the Fire Tetrahedron.

3.2 FOUR GENERAL CLASSES OF FIRE

The four general classes of fire are as follows:

1. Class A fires are those that have paper, wood, trash, and other solid material for fuel.
2. Class B has a flammable liquid or gas as a fuel; an example of a Class B fire would be gasoline that has ignited (In a Class B fire vapor suppression is of primary importance).
3. Class C fires are electrical in nature.
4. Class D fires result from a combustible metal such as magnesium.
3.3 TYPES OF FIRE EXTINGUISHERS

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<tr>
<td>BC</td>
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<tr>
<td>ABC</td>
<td>Dry Chemical or Halon</td>
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4.0 POTENTIAL FIRE HAZARDS: IDENTIFICATION AND CONTROL

4.1 COMMON CAUSES OF FIRES

- Overloaded electrical circuits, unsafe wiring and defective extension cords
- Appliances such as coffee pots/makers, hot plates and other heating devices left on not in use.
- Unattended cooking
- Overheated motors and other equipment not maintained properly
- Improper use of non-electrical heating systems (space heaters)
- Improper disposal of smoking material such as emptying ash trays in trash cans and/or coming in contact with other combustible material.
- Not using an ash tray - leaving a lighted cigarette on combustible material such as furniture
- Improper use, handling and storage of flammable material (gasoline, solvents, paints)
- Improper use of candles, Christmas tree lights and associated electrical cords
- Poor housekeeping which results in accumulation of combustibles such as paper, boxes, oil-soaked rags, and flammable liquids
- Improper use of welding torches and equipment

4.2 CHEMICAL HANDLING AND STORAGE

- Leaks, spills, and overflows must be avoided. Storage of flammable and combustible liquids in open containers is not permitted
- Chemicals, specifically, flammable and combustible liquids, should be stored in appropriate cabinets.
- Incompatible materials in storage areas must be segregated. Specifically, separate ignitable material from oxidizers or sources of ignition. In general, do not store different types of Incompatibles in the same container.

5.0 FIRE PREVENTION GUIDELINES

The following fire prevention guidelines should be adhered to in an effort to mitigate the hazards of fire, explosions, and the dangers associated with flammable materials.
Work locations, vehicles, and the inside and outside of buildings shall be kept clean and orderly at all times.

- Discarded packing material or scrap should not be accumulated.
- Portable electric heaters must be used with caution, away from ignition sources, furniture and other flammable materials.
- Portable electric heaters must be equipped with an auto shut-off timer and be of the type that shut off automatically if tipped over.
- Combustible materials, such as oil-soaked rags, waste, and shavings shall be kept in approved metal containers with metal lids. Containers should be emptied as soon as possible.
- Flammable liquids such as gasoline, benzene, naphtha, lacquer thinner, and other solvents of this class shall not be used for general cleaning purposes.
- In any building, except one provided for their storage, flammable liquids such as gasoline, benzene, naphtha, lacquer thinner, and other solvents of this class shall be limited to five gallons, in an approved properly labeled container.
- When pouring or pumping gasoline or other flammable liquids from one container to another, metallic contact shall be maintained between the pouring and receiving containers.
- Strict adherence shall be paid to the "No Smoking" and "Stop Your Motor" signs at fuel dispensing locations.
- Change oil-soaked or contaminated clothing. It may cause skin irritation and is a fire hazard. Do NOT place in a dryer!
- Smoking or open flame shall not be permitted in areas where dangerous gases might be present, for example, oil rooms, hydrogen areas, acetylene storage, or similar areas. Neither shall smoking be permitted in storerooms, battery rooms, flammable liquid storage and use locations, or in other areas where quantities of combustible materials are kept. Absence of "No Smoking" signs shall not excuse smoking in dangerous places.
- All containers shall be labeled as to their contents. The Material Safety Data Sheet for each hazard will be readily available.
- A fire escape plan shall be posted in each building. Personnel should be familiar with their plan. Employees assigned to field locations, vessels, rigs, barges, etc., shall review the station bill for information pertaining to muster locations and other emergency responsibilities.

6.0 FIRE SAFETY AND LIFE SAVING EQUIPMENT

Fugro shall provide adequate and appropriate fire, safety, and life-saving equipment. This equipment shall be properly located at all times and only used during emergencies or drills.
It shall only be used for the purpose for which it is intended. All employees shall be required to report any deficiencies in equipment immediately to their supervisor.

Fire, safety and lifesaving equipment shall not be removed from designated locations for any purpose other than its authorized use, maintenance, or testing. When fire extinguishers have been used they shall not be put back into service until they have been refilled.

6.1 TYPES OF FIRE PROTECTION EQUIPMENT

The basic types of fire protection equipment and systems used within Fugro to control or extinguish fires are:

- Portable fire extinguishers
- Sprinkler systems
- Chemical types extinguishing systems, including carbon dioxide, dry chemical and HFC-227ea systems

6.2 INSPECTIONS AND MAINTENANCE

All extinguishers shall be regularly inspected, refilled, weighed, etc., in accordance with the manufacturers' recommendations. The date of such inspections, refills, etc., shall be recorded on a tag permanently attached to the extinguishers.

As required by state fire marshal law, below are the frequencies that each type of fire protection equipment must be inspected by a licensed vendor.

- Fire Extinguishers - Annually
- Fire Alarm Panel - Annually
- Fire Sprinkler System - Quarterly
- Fire Suppression System - Bi-Annually

As required by federal law, OSHA 29 CFR 1910.157, fire extinguishers are to be visually inspected monthly. Documentation of the visual inspection shall be kept and available upon request.

7.0 EMERGENCY DRILLS

Office fire drills shall be held annually and shall be taken seriously by all concerned. For action plans to be effective all staff must be familiar with the safety and emergency procedures appropriate to their location. A log of all emergency drills shall be maintained.

8.0 FIRE PREVENTION TRAINING

Fugro shall provide basic training, upon initial assignment, in the use of fire fighting techniques and equipment to an appropriate number of office and field based personnel. Additional fire fighting training shall be provided annually thereafter.
Where Fugro has provided portable fire extinguishers for employees use in the workplace, Fugro will provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved in fighting fires that are in the incipient stage.

Employee’s assigned fire fighting responsibilities shall be familiar with both the location and the operation of all fire protection equipment in the area of their work.

9.0 APPLICABLE REGULATIONS, CODES AND RECOMMENDED PRACTICES

Emergency Action Plan

Fugro Emergency Contact List

<table>
<thead>
<tr>
<th>Rev. #</th>
<th>Date</th>
<th>DCR #</th>
<th>Approved By:</th>
<th>Description of Change:</th>
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<td>---</td>
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Approved by OHSE Manager, Fugro Consultants, Inc., May 2012
Note: If this is a printed or downloaded copy, please check the online OHSE-MS to ensure that it is the latest version.
ATTACHMENT D
RESULTS OF A DOWNHOLE VIDEO-LOG OF THE
McCROSKY WS-12 WATER WELL
**Wellbore Video Report**

**Company:** Fugro, Consultants, Inc  
**Address:** 4820 McGrath Street, Suite 100  
**City:** Ventura  
**State:** CA  
**Zip:** 93003-7778  
**Reason For Survey:** General Inspection  
**Camera:** CCV Color Flip Camera - Short L.H.  
**Location:** AREA Lease off Long Canyon road  
**sec:** 18  
**Twp:** 9N  
**Rge:** 32W  
**Reason For Survey:** General Inspection  
**Latitude:** 34° 50' 58.4"  
**Longitude:** 120° 16' 34.9"  
**Casing Buildup:** Very Heavy, Increasing W/Depth  
**Operator:** L. Hock  
**Depth:** ____ Van: 5  
**Run No.:** 1  
**Survey Date:** Oct 2, 2012  
**Invoce No.:** 1571  
**Run No.:** 1  
**Zero Datum:** Top of casing  
**Measurrd Casing Buildup:** Very Heavy, Increasing W/Depth  
**Casing I.D. @ Surface:** 11.5"  
**I.D. Ref. Measured:** Casing Buildup: Very Heavy, Increasing W/Depth  
**Notes:** (Note: Latitude and Longitude values determined using a recreational GPS accurate to about +/- 45’. EC, TWP and RGE then determined using the TRS conversion program; accuracy not guaranteed.)

### SELECTED WELLBORE SNAPSHOTS

<table>
<thead>
<tr>
<th>True Depths (Sidewith - Feet)</th>
<th>Wellbore/Casing Information</th>
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<tbody>
<tr>
<td>0’</td>
<td>Zeroed at top of casing with sideview lens</td>
</tr>
<tr>
<td>247’</td>
<td>Static water level @ 248’</td>
</tr>
<tr>
<td>254’</td>
<td>No visibility @ 255’</td>
</tr>
<tr>
<td>278’</td>
<td>Sideview, no visible perforations</td>
</tr>
<tr>
<td>304’</td>
<td>Sideview, no visible perforations</td>
</tr>
<tr>
<td>350’</td>
<td>Visible vertical slots</td>
</tr>
<tr>
<td>460’</td>
<td>Probable gun perforation</td>
</tr>
<tr>
<td>491’</td>
<td>Fill, end of down run survey @ 492’</td>
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<tr>
<td>492’</td>
<td>Sidescan up</td>
</tr>
<tr>
<td>170’</td>
<td>End of survey and recording</td>
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</tbody>
</table>

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**Page No. 1**
ATTACHMENT E

VARIOUS PHOTOGRAPHS THAT DOCUMENT THE FIELD WORK
SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California
SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California
SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California

PLATE E-5
SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California

PLATE E-6
10/3/2012 4:38:05 PM

10/3/2012 4:38:22 PM

SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California
SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California
SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California

PLATE E-11
10/4/2012 7:15:59 PM

10/4/2012 7:16:08 PM

SITE PHOTOGRAPHS
McCroskey WS-12 Pumping Tests
East Cat Canyon, Sisquoc, California
ATTACHMENT F
REPORT OF FIELD OPERATIONS
7 am Site orientation / safety meeting with Dean Thormin (Sturgeon) and Scott Fisher (Fisher Pump).

8 Met at McCrory WS-12 site. Fisher to pull pump today and slowly install 500 gallons of water to clear for video log, schedule for Tuesday. Pump to be installed Tuesday. Dean on site all time.

(Marvin Teixeira and Joe Jorge notified of plan. 10,000 gal tank is currently full to ~ 2 ft from top.) Forecast: Hot.

Marvin Teixeira would like to hire the pump re-installed by Friday.

9 Scott Fisher at yard mobilizing crew.

115 Fisher crew (Enrico?) on site w/ 10,000 gal tank. Fill next pump

17 gpm until 12:35 pm. Vol: 8.24, 10°C pH: 7.5, EC: 1160 mS/cm

12:05 Deactivated electrical panel. 15' started pulling pump on 1/4" PVC drop pipe (20'-6"th).

15'10 Pulled 461' of drop pipe (4/20'1821').

24'788 ft btdc dw. Top a casing ~ 1.50 ft shorgs. Shl: 212.38 bgs

16'30 All off site. To return c 10 am for video log. Water running to

vic 110 ~ 2 gpm. Well head re-installed. Tank c 9000 gallons.
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only 200 gallons of water was introduced into well overnight. Dan on site.</td>
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<tr>
<td>10:05</td>
<td>Video log to be here @ 10:05.</td>
</tr>
<tr>
<td>SWL: 24'3&quot; ft deep. Some silt is @ 350 ft.</td>
<td></td>
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<tr>
<td>Fill @ 991 ft. ~ 210 ft of fill. Non clear primitive. Heavily crushed.</td>
<td></td>
</tr>
<tr>
<td>No part ~ 260 opened. Well is in poor condition.</td>
<td></td>
</tr>
<tr>
<td>12:30</td>
<td>Per cell of Eric Peterson &amp; Dan Thornton, plan is to continue @ ply.</td>
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<tr>
<td></td>
<td>For stop host. Prep to be installed today.</td>
</tr>
<tr>
<td></td>
<td>Due to remove on site until 4pm. Fisher can to return @ 7am tomorrow.</td>
</tr>
<tr>
<td>12:45</td>
<td>Off site.</td>
</tr>
</tbody>
</table>

Mileage: ____________________ miles

Copy Sent To Client: Y N

Continued On Next Page

4820 McGrath Street, Suite 100 • Ventura, California 93003-7779 • 805/650-7000, Fax 805/650-7010
**REPORT OF FIELD OBSERVATIONS**

<table>
<thead>
<tr>
<th>Job No.:</th>
<th>04.62120024</th>
<th>Date:</th>
<th>October 3, 2012</th>
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<tbody>
<tr>
<td>Location:</td>
<td>East Cty Canyon, McCusky WS-12</td>
<td>Weather:</td>
<td>Clear</td>
</tr>
<tr>
<td>Observer:</td>
<td>Timothy Nish (Fugro)</td>
<td>Observation Period:</td>
<td>Start:</td>
</tr>
</tbody>
</table>

**Description:**

Pump installation underway by Fish. Pump crew, observed by Dean Taramina.
- Pump intake installed to 479 feet. Tubing for transducer installed to 473 feet.
- Static water level 1.251 feet below top of tube (3 feet above casing).
- Transducer (300 psi range) installed to 473 feet. Therefore, 226 feet above transducer.

1:47 pm Started transducer at 1 minute intervals.
1:55 pm Pump on to check rotation. See Pumping Test Field Data Form for details. Switched off.

2:01:30 pm Switched on. No discharge. Switched off.

2:07 pm Meter: 58,477,084 ft³ Switched on for Step Test.
- Pumped for 100 minutes at 42 gpm (after initial high rate).
- 100 minutes at 75 gpm
- 100 minutes at 100 gpm
- 100 minutes at 125 gpm (until 8:37 pm)

Meter not accurate enough so flow was calculated with bucket stopwatch. Flow divided to top of slope at several locations. Flow reached road, crossed to west side, then down (North) along shoulder of Long Cyn. Rd, at times crossing back to east side. No pooling evident.

**Mileage:** __________ miles

**Copy Sent To Client:** Y N

Continued On Next Page

Page 1 Of
## WR-F45 Pumping Test Field Data Form (Cont.)

**Project Name:** Aerom Feet

**Well No.:** McCraky #5-12

**Date:** October 3, 2012

**Project No.:** 04.2120024

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<th>Drawdown (Feet)</th>
<th>Discharge (Gallons)</th>
<th>Discharge (gpm)</th>
<th>Comments (e.g., specific capacity, valve adjustments)</th>
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<td>2:30 pm</td>
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<td>42 gpm</td>
<td>42</td>
<td>80 psi</td>
<td>70 psi Turbid</td>
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</tbody>
</table>

Approved by David Gardner, AC 71 Manager, Fugro West, Inc. 11/5/09

Note: If this is a printed copy, please check the online QMS to ensure that it is the latest version.
WR-F45 Pumping Test Field Data Form (Cont.)

Project Name: Akers
Well No.: McCosky 85-12
Date: 02.3.2012
Project No.: 04.62120024

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<th>Elapsed Time (Minutes)</th>
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<th>Drawdown (Feet)</th>
<th>Discharge (Gallons)</th>
<th>Comments (e.g., specific capacity, valve adjustments)</th>
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<td>75 gpm</td>
<td>-12.5 psi, Capped</td>
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<td>7:50</td>
<td>7:36 35</td>
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<td>69 gpm</td>
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<td>7:36 35</td>
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<td>8:25</td>
<td>9:05</td>
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<td></td>
<td>125</td>
<td>125 psi, Still rusty</td>
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<td>8:35</td>
<td>9:30</td>
<td></td>
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<td>125</td>
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<tr>
<td>8:37</td>
<td>9:32</td>
<td></td>
<td></td>
<td>125</td>
<td>Stepped up Step</td>
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</tbody>
</table>

Approved by David Gardner, AC 71 Manager, Fugro West, Inc. 11/5/09
Note: If this is a printed copy, please check the online QMS to ensure that it is the latest version.
Compiled equipment and lighting for constant rate test (lighting, generator...)

11:00 am Started pumping of well for test at 125 gpm. See Pumping Test Field Data Form for details.

125 gpm rate study after initially higher rate.

After several hours, flow rate and pumping level study.

After 2 hours (13:00) water became rusty in color, clearing after several hours there.

Minor erosion on to shoulder and road noted.

19:00 Tank fed by this well (10,000 gal) is 1/2 full: 4.5 ft from top of 9 ft high tank.

23:00 Test steady. To leave pump on all night. Collected water samples.

When leaving site, noticed small slump at onto road.

23:16 Stopped water flow from pump. Test terminated. Data sufficient for analysis due to study Phil & Q. Mud cone in front of slump.

Called Des. Sent pictures of slump.

00:00 (midnight) Cleaned up dirt on shoulder & Des mud (lights, traffic control)

No tire marks were present on this very recent slump. Photographed site. Slump is small and superficial < 2 ft deep.

00:30 Des and I leave site. Road sufficiently delineated. To get and clean

1/2 hour tomorrow morning.

Mileage: __________ miles

Copy Sent To Client: Y  N  Continued On Next Page  Page  Of
## WR-F45 Pumping Test Field Data Form (Cont.)

<table>
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<th>Acme East Cit Canyon</th>
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<tr>
<td>Well No.</td>
<td>McComb, WS-12</td>
<td>Project No.:</td>
<td>04.G2120.024</td>
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Approved by David Gardner, AC 71 Manager, Fugro West, Inc. 11/5/09
Note: If this is a printed copy, please check the online QMS to ensure that it is the latest version.
<table>
<thead>
<tr>
<th>Clock Time</th>
<th>Elapsed Time (Minutes)</th>
<th>Water Level (Feet BTOC)</th>
<th>Drawdown (Feet)</th>
<th>Discharge (Gallons)</th>
<th>Discharge (gpm)</th>
<th>Comments (e.g., specific capacity, valve adjustments)</th>
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<td>22:00</td>
<td>660</td>
<td>Filled bucket</td>
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<td>125</td>
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<td>1213.5/s cm 19.3 7.45</td>
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<td>23:00</td>
<td>720</td>
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<td></td>
<td>125</td>
<td></td>
<td>1213.5/s cm 19.3 7.43 Small hillside slide onto</td>
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<td></td>
<td>Long Cyn Rd. 4% of AB h m</td>
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<td>23:16</td>
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<td>Stopped test. Canal slide, filled Dana</td>
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<td>Small 1 small debris</td>
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<td>Down on site Cleaned up</td>
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</tbody>
</table>

Note: If this is a printed copy, please check the online QMS to ensure that it is the latest version.
Description:

7:30 Fischer Pump on site to remove test pump then re-install 1.5HP existing pump.

Removal nearly done. Downloaded all data. Complete recovery to 9 AM.

Down read button to cleanup Long Canyon Rd.

10:30 Cleanup largely complete. Pump removal underway. Fischer plus to complete re-installation today, if not tomorrow.
ATTACHMENT G
VARIOUS GRAPHS OF THE AQUIFER TEST RESULTS
McCroskey WS-12 Constant Rate Test Hydrograph: October 4, 2012

- Static water level: 246.6 feet
- Average pumping rate: 125 gpm
- Final pumping water level: 392.9 feet
- Drawdown: 146.3 feet
- Specific Capacity: 0.85 gpm/ft
- Pump Intake: 479 feet
- Well depth (to fill): 431 feet
- Well depth (total): 700 feet

Depth to Water, feet

Time since step began, minutes

Valve adjustment
McCroskey WS-12 Constant Rate Test Recovery Hydrograph

Pre-test Static water level: 246.6 feet
Pump Intake: 479 feet
Well depth (to fill): 491 feet
Well depth (total): 700 feet

Depth to Water, feet

Time since pumping ended, minutes

PLATE G-4
McCroskey WS-12 Step Test Hydrograph

- **Step 1**: Pumping rate: 42 gpm, Pumping water level: 280 feet, Specific Capacity: 1.25 gpm/ft
- **Step 2**: Pumping rate: 75 gpm, Pumping water level: 317 feet, Specific Capacity: 1.06 gpm/ft
- **Step 3**: Pumping rate: 100 gpm, Pumping water level: 356 feet, Specific Capacity: 0.91 gpm/ft
- **Step 4**: Pumping rate: 125 gpm, Pumping water level: 393 feet, Specific Capacity: 0.85 gpm/ft

Static water level: 246.3 feet

Time since step began, minutes
ATTACHMENT H
CONSTANT DISCHARGE TEST RESULTS
GENERAL MINERAL CONSTITUENTS ANALYSIS
Prepared for: Fugro West, Inc.  
4820 McGrath St. Suite 100  
Ventura, CA 93003  
Attn: Tim Nicely

Report Date: October 15, 2012  
Laboratory Number: 122977  
Project Name: McCroskey WS-12  
Project No: 04.62120024  
Sampled by: Client

On October 5, 2012, Capco Analytical Services, Inc. (CAS), received one (1) sample to be analyzed. The sample was identified and assigned the laboratory ID number listed below:

<table>
<thead>
<tr>
<th>SAMPLE DESCRIPTION</th>
<th>CAS LAB NUMBER ID</th>
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</thead>
<tbody>
<tr>
<td>McCROSKEY WS-12</td>
<td>122977-01</td>
</tr>
</tbody>
</table>

By my signature below, I certify that the results contained in this laboratory report comply with applicable standards for certification by the California Department of Public Health’s Environmental Laboratories Accreditation Program (ELAP), both technically and for completeness, and that, based on my inquiry of the person or persons directly responsible for performing the analyses, the information submitted is, to the best of my knowledge and belief true, accurate, and complete.

Alin E. Repede, MS  
Director - Analytical Operations

If you have any further questions or concerns, please contact me at your convenience. This report consists of 6 pages excluding the cover letter and the Chain of Custody.

This report shall not be reproduced except in full without the written approval of CAS. The test results reported represent only the item being tested and may not represent the entire material from which the sample was taken.
# CERTIFICATE OF ANALYSIS

Client: Fugro Consultants  
Sample ID: McCroskey WS-12  
CAS LAB NO: 122977-01  
Analyst: AN/ABE/GM/LL

## GENERAL MINERAL SUMMARY

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<th>PQL</th>
<th>METHOD</th>
<th>DATE ANALYZED</th>
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T.D.S.: Total Dissolved Solids  
mg/L: Milligrams/Liter (ppm)
QUALITY CONTROL SECTION
# QUALITY CONTROL SECTION

**Client:** Fugro Consultants  
**Sample ID:** Method Blank  
**CAS LAB NO:** 122977-MB  
**Analyst:** AN/ABE/GM/LL

## GENERAL MINERAL SUMMARY

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T.D.S.: Total Dissolved Solids  
mg/L: Milligrams/Liter (ppm)
# Quality Control Report

**Client:** FUGRO  
**Sample ID:** McCroskey WS-12  
**CAS LAB NO:** 122977  
**Sample Matrix:** WATER  
**Date Sampled:** 10/04/12  
**Date Received:** 10/05/12  
**Date Analyzed:** 10/05/12  
**Analyst:** GP

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*mg/L: Milligrams/Liter (ppm)*  
*%Rec: Percent Recovered*  
*BQL: Below Practical Quantitation Limit*
## Quality Control Report

**Client:** FUGRO  
**Sample ID:** McCroskey WS-12  
**CAS LAB NO:** 122977-01  
**Sample Matrix:** WATER  
**Date Sampled:** 10/04/12  
**Date Received:** 10/05/12  
**Date Analyzed:** 10/05/12  
**Analyst:** GP

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mg/L: Milligrams/Liter (ppm)  
%REC: Percent Recovered  
BQL: Below Practical Quantitation Limit
Certificate of Analysis

Notes:
The Chain of Custody document is part of the analytical report. Any remaining sample(s) for testing will be disposed of one month from the final report date unless other arrangements are made in advance. All results are expressed on wet weight basis unless otherwise specified.

[Signature]
Authorized Signature
Keith Chang, Ph.D. (QA/QC Supervisor)

The results in this report apply to the samples analyzed in accordance with the chain of custody document. Capco Analytical certifies that the test results meet all requirements of ELAP unless noted in the Case Narrative. This analytical report must be reproduced in its entirety.

Legend for Abbreviations:
PQL  Practical Quantitation Limit
BQL  Below Practical Quantitation Limit
ND   NOT DETECTED at or above the Reporting Limit. If J-value reported, then NOT DETECTED at or above the Method Detection Limit (MDL).
MDL  Method Detection Limit
MRL  Method Reporting Limit
MDA  Minimum Detectable Activity
MCL  Maximum Contamination Level
**Chain of Custody Record**

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**Turn Around Time**

- STANDARD: 24 HOURS
- OTHER: 48 HOURS
- 72 HOURS

**Check One Box:**
- DISPOSE SAMPLES
- RETURN SAMPLES

---

The undersigned hereby acknowledges having received a copy of the Fee Schedule/General Information and Conditions, the provisions of which are a part of this agreement.
Hi Kathryn:

Regarding your (Email) Information Request on November 14, 2016: Please provide a copy of the report "Groundwater Source Supply Study East Cat Canyon Field, prepared for Aera Energy LLC, Fugro Job No 04.62120024", Dated March 28th 2012.”

This report was referenced in Aera’s application Appendix G, Well Capacity and Aquifer Test. It was an internal study commissioned early in our project design process. It is outdated and contains business and other information not relevant to groundwater or environmental study.

The document predates Aera’s studies and subsequent decision to use water in the Sisquoc oil-bearing reservoirs for makeup water, instead of freshwater, so the report (now incorrectly) states that Aera anticipates needing fresh water to initial steam make up water. To be clear, the Project will not use freshwater for steam.

In addition, since this this report was meant for internal planning purposes only, it included, in the attachments, some business-specific, non-technical items such as meeting minutes, internal project correspondence, equipment quotes, and cost proposals. These non-technical attachment items have been removed from the report. The report and its relevant attachments are included here.

Best,

Susan

Susan Perrell
Environmental Advisor
Aera Energy LLC
3030 Saturn Avenue Suite 101
Brea, CA 92821
714 743 4396 (mobile)
smperrell@aeraenergy.com
www.AeraEastCatCanyon.com
GROUNDWATER SOURCE SUPPLY STUDY
EAST CAT CANYON FIELD
SANTA BARBARA COUNTY

Prepared for:
AERA ENERGY, LLC

March 2012
Fugro Job No. 04.62120024
March 28, 2012
Project No. 04.62120024

Aera Energy, LLC
10000 Ming Avenue, 3B51
Bakersfield, California, 93311

Attention: Mr. Eric Paulson, Project Manager

Subject: Groundwater Source Supply Study, East Cat Canyon Development, Santa Barbara County

Dear Mr. Paulson:

In accordance with our proposal dated January 25, 2012 (Aera Energy, LLC Purchase Order No. P-021412-00-NDA), we have completed a desktop hydrogeologic assessment of the groundwater resources of the East Cat Canyon area of Santa Barbara County. We understand that groundwater is one source of potential water supply being considered to generate steam for to develop the oil and gas resources of certain lease areas owned by Aera Energy, LLC (Aera) in the East Cat Canyon area of the Cat Canyon oil field. Once the steam injection process is underway, produced water associated with the oil will likely be recycled and substituted for the initial use of groundwater. Aera estimates that an initial supply of groundwater (or some other suitable source water) of up to 10,000 barrels per day (bpd), or about 1.3 acre-feet per day, or about 300 gallons per minute (gpm) will be required. For reliability and system redundancy, it is envisioned that two water wells, each supplying about 300 gpm would be required. It is preferred to have the location for the groundwater source wells be in the southern part of the East Cat Canyon field.

The scope of work for this desktop hydrogeologic study included a preliminary meeting with you that was held prior to our proposal submittal to better understand the requirements of the proposed project, the study area, data sources, and the level of effort to analyze the groundwater resources of the area. A telephone conference call was conducted with you on February 17, 2012 to kick-off the study (refer to Attachment 1) which served to further clarify and define the study objectives, data sources, communication plans, schedule a site visit, and deliverables. Background information provided by Aera included an informal groundwater source water study prepared by Aera (date unknown but assumed to be from late 2011) that provides a conceptualization of the hydrogeology of the East Cat Canyon Field (Field Fee, R&G Fee, Victory, McNee, Fleisher, Bonetti, and Aera Fee areas), various structural contour maps, cross sections, and somewhat limited historic information on water source wells that have been developed in the field (refer to Attachment 2 - Aera Water Supply Study and Related Data).

Much of the hydrogeologic conceptualization of the area is derived from four exploratory oil wells drilled by Aera in late-2011 and early-2012 and from public domain data source such as the California Division of Conservation, Division of Oil and Gas (DOG) (http://owr.conservation.ca.gov/WellSearch/WellSearch.aspx), the County of Santa Barbara, and the United States Geological Survey (USGS). For purposes of this desktop hydrogeological study we describe the available background information related to the groundwater resources of the
East Cat Canyon field and immediately surrounding area, a discussion of the general geology and groundwater resource potential of each of the fee or lease areas planned to be developed by Aera, and provide a tentative initial exploration program and associated costs to further define and develop the groundwater resources. Relevant correspondence related to the conduct of the study are proved in Attachment 3 - Relevant Correspondence.

GENERAL GEOLOGIC SETTING

Surface maps (low altitude air photos dating from within the last 5 years provided by Aera) indicate the proposed development consists of eight lease areas located within Sections 19, 20, 28, 29, 31, and 32 of Township 9N/Range 32W, SBBM. The lease areas are shown on Plate 1 - Surface Map-East Cat Canyon Area with the approximate size of each lease area. This map also shows the extent of development in the area (roads, oilwell access roads and pads, the location of residential homes, industrial developments, very limited agricultural development, and drainage catchments.

The topography of the area consists of a series of north-south aligned subdued hills with elevations ranging from about +500 to +1,000 feet above mean sea level (MSL). Cat Canyon Creek is the principal stream of the area, which is intermittent and flows to the north toward the community of Sisquoc. This creek, as well as those in Long Canyon and Olivera Canyon are well entrenched along most of its course. Evidence of rising water in the creek system is not apparent. Precipitation in the area as measured at the Sisquoc Fire Station No. 23 (elevation of +420 feet MSL) averages about 15 inches per year. Almost 95 percent of the rainfall occurs between the months of November through April. Soils in the area are relatively thin, heavily developed with clay residuals, and of poor permeability. As such, the area is not considered a groundwater recharge area. Very limited agricultural development occurs in Cat Canyon with the valley floors locally being used for the dry farming of hay and grain.

The geology of the overall area is well described and presented in the "Geologic Map of the Sisquoc Quadrangle" (Dibblee, 1994), in the Geology and Paleontology of the Santa Maria District ((Woodring and Bramlette, USGS Professional Paper 222, 1950), in a somewhat more regional report of the Cat Canyon Oilfield prepared by the California Department of Conservation, Division of Oil and Gas, and by Muir (1964, USGS Water Supply Paper 1664) for the adjacent and southerly San Antonio Creek Valley. More detailed descriptions of the geology of the East Cat Canyon field are provided by Aera in their initial groundwater source study. This latter study provides a very useful overview of the Plio-Pleistocene stratigraphy, the signatures and depths of various marker beds, structural contour maps, and cross sections illustrating the regional structure.

As indicated on Plate 2 - Regional Geologic Map, the project area is dominated by a flat lying to slightly northeasterly inclined sequence of Pliocene and Pleistocene series formations, unconformably underlain by structurally deformed and folded Miocene and older formations. These formations and stratigraphic relationships are shown on Plate 2 in a south to north structural cross section (C-D) that accompanies the Dibblee geologic map of the area. This cross section extends in its northerly half from Cat Canyon Road northeasterly through Long Canyon (Section 30 to Section 21), thence to the mouth of Olivera Canyon and the floodplain of the Santa Maria River. For the purposes of groundwater development and potential aquifer units, only the Plio-Pleistocene units are of interest and these include, from oldest to youngest
the Careaga sandstone and the Paso Robles Formation. The underlying formations as shown by Dibblee and described by Woodring and Bramlette (1950) are important oil reservoirs in the area (Sisquoc and Monterey Formations) but do not contain appreciable quantities of fresh (i.e., potable) groundwater since they are consolidated rocks that do not store or transmit water and are, therefore, poor aquifers.

The Careaga sandstone constitutes the oldest (Pliocene age) potential aquifer in the project area and crops out as a linear band along the southerly edge of Field Fee and R & G lease area (refer to Plate 2). The Careaga sandstone in this area is divided into two members. The Cebada fine-grained lower member consists chiefly or entirely of very uniform fine-grained to very fine grained massive sandstone, light gray to yellow in color. Small stringers of shale pebbles and fossils are abundant. As reflected in numerous oil-well electric logs in the project area (refer to Plate 3 - Well Location Map) this member attains a maximum thickness about 250 feet, and thins to the north in the subsurface. The upper member of the Careaga sandstone is referred to the Graciosa member and in the project area consists of coarse-grained sandstone with thin stringers of gravel. This member attains a maximum thickness of about 100 feet in the southerly part of the project area and thins out to zero thickness to the northeast. As will be described further below, the upper member of the Careaga sandstone yields small quantities of water to properly designed and constructed wells (i.e., in the range of a few gallons per minute). The lower Cebada member of the Careaga sandstone is typically not perforated in wells due to its very fine-grained nature and very limited groundwater production potential.

The Paso Robles Formation crops out in a large part of the project area and conformably overlies the Careaga sandstone (refer to Plate 2). This formation dips gently (less than 5 degrees) to the northeast and is present in thicknesses of over 500 feet under the project area. The Paso Robles Formation is non-marine and consists of poorly consolidated stream-deposited lenticular beds of gravel, sand, silt, and clay. The formation is exposed at ground surface at numerous locations in Cat Canyon, Long Canyon, and Olivera Canyon and consists of very poorly sorted and heterogeneous (i.e., a wide range of grain size materials) mixtures of cobbles, gravel, and sand in a clay matrix. The base of the Paso Robles Formation can be identified on geophysical logs of oil wells in the project area as an abrupt reduction in resistivity. This resistivity signature was used to prepare a contour map of equal elevation of the base of the Paso Robles Formation in the project area (refer to Plate 4 - Hydrogeologic Map). As indicated, the formation thickens gradually in a north to northwest direction across the project area to about 500 feet (depending on surface topography), with the base of the formation ranging from an elevation of about +1,000 feet MSL in the Field Fee area to about -100 feet MSL in the Aera Fee area. As will be discussed further below, a large part of the Paso Robles Formation in the project area occurs above the inferred effective base of fresh water (EBFW), and is not saturated (i.e., the base of the formation is above the regional water table). The Paso Robles Formation is the aquifer of choice in the area and where the formation occurs below the water table and is of sufficient thickness (i.e., more than 200 feet thick) it can yield modest quantities of water to wells. Variations in well yields can however be considerable due to the previously mentioned poorly sorted nature of the sediments. These limitations will be described further below.

As indicated on Plate 2, terrace deposits (map symbol Qoa and referred to as older alluvium by Dibblee) are exposed on the ridgelines and hills between Cat Canyon Road, Long Canyon Road, and Olivera Canyon Road. These deposits are of late Pleistocene age and
consist of mixtures of gravel, sand, and silt. The terrace deposits, although somewhat permeable, are above the zone of saturation and are not a source of water supply to wells.

Streambed alluvium of Recent age also occurs in the project area in the valley floors and tributary canyons. The alluvium deposits are of very limited thickness and lateral extent in Long Canyon and Olivera Canyon (Victory and McNee lease areas, respectively) and consist of poorly sorted mixtures of sand in gravel in a silty clay matrix. The very limited thickness (likely less than 25 feet) and very low hydraulic conductivity (permeability) of these deposits eliminate them as a source of water for wells. In Cat Canyon, the alluvial deposits and associated floodplain area are locally developed to agriculture for the dry farming of hay and grain. A shallow alluvial well (now abandoned) reported as formerly operated by Conoco exists north of the intersection of Cat Canyon Road and Palmer Road. We are informed that this well was on the order of 50 feet deep and produced less than 5 gpm.

GENERAL HYDROGEOLOGY

Within the above described geologic framework the groundwater resources of the project area were evaluated in terms of the location, depths, aerial extent, hydraulic properties, and sustainable yield of potential aquifers. In addition to the well log and related data provided by Aera, we considered a number of additional data source. There is no published hydrogeologic report for the area of interest nor has the County of Santa Barbara Flood Control District or the USGS established any groundwater monitoring wells in the area for purposes of obtaining water level or water quality data. The Department of Conservation, DOG website cited above provided considerable supplemental well log data (lithologic logs, electric logs, and well abandonment data) for literally hundreds of production and injection oil wells located in the project area and in the surrounding lease areas. The DOG database can be queried for wells for which data exist in a specific township, range, and section. By doing so all operators of wells in a particular section are provided, from which data for each well, by operator can be obtained. For the majority of the wells, there is no data. Records related to DOG oversight on the abandonment of about 200 wells (mostly in the 1980s) were reviewed. The abandonment records typically contain a narrative of how the well was abandoned and in some cases information on the assumed base of fresh water for purposes of placing well seals. Lithologic and geophysical logs of the formations encountered during drilling are sometimes present. They are often of very limited value since they do not focus on the upper water bearing section of the well or the well casing (referred to as a casing shoe) has been placed in the potential water bearing zone and accordingly, the geophysical electric log is absent in the upper part of the well.

Using the DOG well database, a spreadsheet was developed (refer to Attachment 4) that tabulated information for a number of wells (on the order of 75) relative to location, lease name, well name, operator, section, township, range, elevation, elevation of the assumed base of the Paso Robles Formation, elevation of an inter-Careaga marker bed, assumed elevation of the effective base of fresh water (EBFW), elevation of the inferred water table, thickness of the Paso Robles Formation, and other information on the well. A summary of these data are provided in Table 1 - Summary of Well Data. For many wells, the base of the Paso Robles Formation was not difficult to identify on the geophysical electric logs and was used to define the EBFW. In many wells however, the elevation of the base of the Paso Robles Formation could only be inferred due to the presence of casing in the upper portion of the well. Similarly,
with a general lack of detailed lithologic logs for the wells and a virtual lack of water level information for the area, an inferred water surface elevation in the project area was prepared. Many of the geophysical electric logs allowed identification of the "base of high resistivity layers" which Aera has referred to as the "base of air sands" in their groundwater source study report. Table 1 - Summary of Well Log Data, provides information for each DOG well record reviewed on the assumed EBFW and inferred water surface elevation in the project area.

From the data contained in Table 1 and from other sources (Dibblee map of the area, etc.), several maps of the project area were developed to show the spatial extent of the Paso Robles Formation (structural contour map of the EFBW), the inferred groundwater surface elevation, and where the Paso Robles Formation occurs at elevation below the inferred water surface elevation (i.e., where the Paso Robles Formation would be expected to be saturated and contain groundwater). It should be stressed that while the general interpretation of the extent of saturated Paso Robles Formation is considered correct, given the uncertainties associated with the data contained in the well logs, inaccuracies may exist at specific spatial locations. Plate 4 - Hydrogeologic Map, shows that the base of the Paso Roles Formation ranges from an elevation of approximately +1,000 feet MSL in the southeast part of the project area and is inclined to the northwest at about 0.1 percent where it occurs at a depth of about -100 feet MSL at the northwest corner of the Fleisher lease area. The general orientation of the contours of the EBFW is consistent with structural contours developed by Aera for the inter-Careaga marker bed and the top of the Sisquoc Formation. Plate 4 shows the pinch-out line of the Paso Robles Formation north of Cat Canyon Road (R & G and Field Fee areas) and that the Paso Robles Formation thickens to the northwest, reaching a maximum thickness of about 600 feet at the northern end of the Aera Fee near Foxen Canyon Road. Also shown on Plate 4, based on very limited data and interpretations of the elevation of the base of air sands (high resistivity signatures on geophysical logs) is the inferred elevation of the groundwater surface in the project area. The inferred groundwater surface suggests the potentiometric surface flows, at least conceptually, from northeast to southwest across the project site at a gradient of about 0.01 feet/feet. In most of the southerly half of the project site (McNee, Fleisher, Victory, R & G, Field Fee) groundwater in the Paso Robles Formation is absent. The inferred groundwater surface contours would suggest that the very limited source of groundwater recharge to the project area is from the northeast and as transient inflows (if any) from the Santa Maria River alluvial system.

Plate 5 - Area of Potentially Saturated Paso Robles Formation presents the above described limits of the saturated Paso Robles Formation. The area of potential saturated Paso Robles Formation is consistent with other anecdotal information on the current and historic development and use of groundwater in and adjacent the project area. There is an abandoned water well on the Bonetti lease area that was reportedly used as part of the historic oilfield operations. The former well is located at the northern midpoint of the Bonetti lease area. There is no well log or historic data on the use of this well. The structural contour map would suggest that the Paso Robles Formation in this area is about 600 feet thick and that the lower 200 feet of the formation would be saturated. While the yield of this well is unknown, it is inferred that it would have been on the order of perhaps 5 gpm. Further north in Section 20 in the Aera Fee area, three water wells referred to as the McCrosky wells were drilled in the 1960s related to the oilfield activities. Very limited information is available for these wells (refer to Attachment 2). Limited data suggest the wells encountered about 700 feet of Paso Robles Formation with
limited sustained groundwater production potential. McCrosky Wells 10 and 11 have been abandoned. However, McCrosky Well No. 12 is currently being used by a Mr. Joe Jorge under a use agreement with Aera.

Additional anecdotal and verbal information on other privately owned domestic water wells located in Long Canyon and in Olivera Canyon was obtained from the Santa Barbara County Environmental Health Services (EHS), several water well drillers (i.e., F & T Drilling) who have drilled wells in the area, and from a hydrogeologic consultant, Mr. Rick Hoffman who has done work in the area. Mr. Norman Fijimoto with the County of Santa Barbara EHS is the responsible individual at the County who reviews and issues well permit applications for the drilling of water wells (small domestic and shared water system wells). His agency also maintains records of well logs, pump tests, and water quality for such wells. These data are generally not available to the public in that they are confidential under the California Water code. Mr. Fujimoto did share with me information for several water wells located in Olivera Canyon (southwest part of the northeast quarter of Section 20 immediately east of the Aera Fee). Several residences in that area are served by a "shared water system" supplied by a well that reportedly produces about 6 gpm. Apparently this shared water system well (indicated as such on Plate 6 - Potential Test Well Location Map) resulted from a lack of or limited amount of groundwater on one of the parcels (APN 101-050-32). Mr. Fujimoto believed that the well being used is about 500 feet deep and produces groundwater from the Paso Robles Formation. To issue a permit for groundwater use for domestic (i.e., residential) water supply the well needs to be tested by a qualified individual for a period of not less than 72 hours and demonstrate a sustained yield of not less than 3 gpm. Mr. Fujimoto was also aware of a well located about 1,000 feet to the northeast that serves a residence that produces 3 gpm. This well is referred to as the "Neilson" well and is shown as such on Plate 5. Mr. Hoffman provided limited information to me for a well in Olivera Canyon (located at the northwest corner of Section 28) drilled for a proposed single family residence (Whitman). The well reportedly produces from the base of the Paso Robles Formation and the upper member of the Careaga sandstone (the well is reportedly about 400 feet deep). Test pumping of this well resulted in a yield of less than 1 gpm and the proposed residence was not constructed. Attempts were made to obtain well driller reports and related information for wells in the study area drilled by F & T Drilling and Layne Christensen (formerly Floyd V. Wells of Santa Maria). Both drilling companies have a long history of drilling water wells in the area. Neither company was able to provide any reliable information for wells in the area, which is consistent with the limited past exploration and development efforts to obtain groundwater in the area.

CONCLUSIONS AND RECOMMENDATIONS

Based on the above it is apparent that groundwater resources of the project area are extremely limited. The aquifer of choice in the project area is the Paso Robles Formation. This formation contains potential aquifers consisting of thin lenses (a few feet thick) of lenticular and discontinuous sand and gravel beds that contain groundwater where below the water table. However, these sand and gravel beds display relatively low hydraulic conductivity values due their poorly sorted grain size and the presence of silt and clay. This lithologic character is evident on the fairly detailed logs of cuttings for the recently drilled exploratory oil wells drilled by Aera (Victory G1, Victory G-7, etc.). As shown on Plate 5, much of the project area leases (McNee, Fleisher, West, R & R, Victory, and Field Fee) contain significant thicknesses of the
Paso Robles Formation, but the available data indicate these deposits occur above the regional water table and would be dry. Hence, groundwater resources do not exist in these areas.

Further north in the Bonetti lease area and the Aera Fee, the Paso Robles Formation becomes at least in part saturated and there is a limited history of well development and groundwater use in these areas. The so-called "Bonetti WS" well located along the north midpoint boundary of this area was drilled to a depth of 505 feet in 1966 and may have been used as a water supply source for oilfield activities. Unfortunately, no records of use appear to exist. Based on the hydrogeologic conditions described above it is likely the well, if in fact used, produced several gallons per minute. Based on a field inspection conducted on March 8, 2012, the well appears to have been abandoned for many decades. In the Area Fee area (also known in the past as the McCroskey lease), three groundwater source wells were drilled (referred to as the McCroskey WS 10, WS 11, and WS 12 as shown on Plate 3). There are no data (depth, lithologic log, etc) available for WS 10 and DOG records indicate the well was destroyed in 1990. Similarly, no data exist for WS 11 and DOG records indicated it was destroyed in 1975. Records for McCroskey WS 12 date from the late 1970s indicating that it was pumped at 4,000 barrels per day (about 110 gpm pumped continuously over a 24-hour period) and that it was 700 feet deep and produced groundwater from the "Paso Robles gravels". A water quality analysis of groundwater produced dating from 1975 indicates the groundwater is of good quality (i.e., fresh water considered to a potable standard with treatment by disinfection) of a calcium sulfate mineral character with total dissolved solid concentrations of about 1,000 milligrams per litre (mg/l). Design of the well is unknown (other than depth) and records indicate it apparently was provided with a 40 hp submersible pump capable of producing 130 gpm from an unknown pump setting and total lift. These records are contained in Attachment 2. The reported yield and daily quantity of water pumped from this well are remarkable and certainly different from the apparent lack of appreciable groundwater in the McCroskey WS 10 and WS 11, and for more recently drilled domestic wells immediately east of the Aera Fee drilled and completed in the same Paso Robles Formation. Nonetheless, the historic data cannot be ignored.

The McCroskey WS 12 well is currently being used by a rancher in the area (a Mr. Joe Jorge) under an agreement with Aera. In an attempt to obtain more information about the current use of the McCroskey WS 12 Well, Aera staff contacted Mr. Jorge and was told that the well is used intermittently to fill a 10,000 gallon water tank. Mr. Jorge believed that the well had at sometime in the last 10 years been provided with a small submersible pump (depth setting unknown) and pumped at a rate of about 10 gpm. Mr. Jorge had no information relative to past use and pumpage of the well, water level data, water quality data, or well service records. The lack of historic (i.e., post 1980) and current information regarding this well is unfortunate.

Based on the above, we conclude that as much as 300 feet of potentially saturated Paso Robles Formation is present in the northerly half of the Aera Fee area and, pending further study of the McCroskey WS 12 well (described below), it is possible that properly designed and constructed wells located along the northerly edge of the Aera Fee area may be capable of producing in the range of 100 gpm. The inferred recharge mechanism to wells located along the northerly boundary of the Aera Fee area is underflow from the alluvial deposits of the Santa Maria River basin, which overlie the Paso Robles Formation. To validate this, the McCroskey WS 12 well should be pump tested. The existing submersible pump from the well should be removed, the well video logged, a submersible pump capable of pumping up to 150 gpm installed in the well, and a step drawdown and constant rate discharge test performed. The
constant rate discharge test should be at a rate based on the results of the specific capacity test and be conducted for a duration of not less than 48-hours. During the pump test, the well would be provided with a pressure transducer to collect water level data (drawdown and recovery). Water quality samples would be collected from the well for general mineral analysis. Upon completion, the existing submersible pump would be reinstalled. Testing of the well as described above would require about one week to perform. Costs to perform the test are estimated to be about $10,000 and would include costs for a pump contractor, electrical modifications at the well head or use of a portable generator, surface discharge piping and control valves, water level monitoring, water quality analysis, and oversight by Fugro of the pump test and preparation of a report documenting the results. Performance of this testing is considered a high priority.

Depending on the outcome of this testing, two potential well sites should be considered by Aera; one at the northeast corner of the Aera Fee area (first choice) and an alternative site roughly at a midpoint along the northern boundary in the topographic drainage swale along the unimproved access road. Both of these locations are shown on Plate 6. A well or “test well” at these locations would extend to depths of about 600 feet, cuttings logged by a geologist, a geophysical electric log performed, and completed with 6-inch diameter SDR 21 F-480 PVC casing with perforations placed in the lower half of the well (depending on review of the lithologic and geophysical log data). The well would be gravel packed, developed by pumping, and pump tests conducted to determine aquifer parameters, sustainable yield, and groundwater quality. The McCroskey WS 12 would be used as a monitoring well to further define aquifer properties in the area and the location and spacing of additional wells to achieve the desired groundwater production for the proposed project of up to about 300 gpm. F & T Drilling has provided a quote for the cost of constructing the proposed test well, which is included in Attachment 6. The overall test-well drilling program and oversight by Fugro should be budgeted by Aera in the range of about $60,000. Test-well drilling should take about 1 month to complete.

Finally, some limited comments can be provided relative to possible groundwater interference effects associated with the use of groundwater from wells in the recommended areas (Aera Fee), groundwater in storage, and safe yield considerations. Based on very limited data, distance drawdown relationships can be developed using the Theis equation (Theis, 1935) for wells pumping at an assumed rate for certain durations of time. Aquifer properties for the Paso Robles Formation (transmissivity and storage) can be inferred given the general lithologic properties of the formation. A graph showing the theoretical distance drawdown effects after 1 year of continuous pumping at rates of 25 and 50 gpm are shown on Plate 7 - Theoretical Distance Drawdown Projections. As indicated at distances of 500 feet from a given well location, the steady state drawdown would be on the order of about 5 feet for a pumping rate of 25 gpm and 9 feet for a pumping rate of 50 gpm. As shown on Plate 6, a residence with an assumed well, which pumps groundwater from the Paso Robles Formation is located about 500 feet from the northeast corner of the Aera Fee.

Groundwater in storage in the area of the saturated Paso Robles Formation as shown on Plate 5 (sections 19 and 20, which cover an area of about 1,500 acres) is estimated to be about 22,500 acre-feet. This assumes about 300 feet of average saturated thickness and a specific yield (amount of groundwater that can be released from storage) of 5 percent. Relative to safe yield or the amount of groundwater that can be developed or pumped annually in the...
project area on a sustainable basis, the amount would be equal to the annual groundwater recharge from the sum of infiltration of rainfall and stream seepage. The amount can only be estimated in a very general sense since there is no data on stream seepage losses (Cat Canyon, Long Canyon, and Olivera Canyon), and it is known that the aerial infiltration of rainfall on the Paso Robles and Careaga Formations is likely negligible. The most likely source of recharge to wells located at the northern boundary of the Aera Fee is from subsurface underflow from the alluvial deposits associated with the Santa Maria River. These alluvial deposits are inferred to be in hydraulic connection with the underlying Paso Robles Formation and would provide a more or less constant head source of water to wells in this area. Further assessment of the magnitude of this underflow should be performed after the McCroskey WS 12 well is tested and, if favorable, a test well is constructed and tested at one of the two recommended test well sites.

Sincerely,

FUGRO CONSULTANTS, INC.

David Gardner, P.G., C.H.g.
Principal Hydrogeologist

Enclosures:  Table 1 - Summary of Well Data
Plate 1 - Surface Map, East Cat Canyon Area
Plate 2 - Regional Geologic Map
Plate 3 - Well Location Map
Plate 4 - Hydrogeologic Map
Plate 5 - Area of Potentially Saturated Paso Robles Formation
Plate 6 - Potential Test Well Location Map
Plate 7 - Theoretical Distance Drawdown Projections

Attachment 2 - Aera Water Supply Study and Related Data
Attachment 3 - Relevant Correspondence
Attachment 4 - Exploratory Oil Well Database
Attachment 5 - Test Well Construction Cost Estimate
REFERENCES

Department of Natural Resources (1954), Summary of Operations, California Oil Fields, Fortieth Annual Report of the State Oil and Gas Supervisor, Vol. 40 San Francisco, Cal., January through June No. 1.

Dibblee, Thomas Jr. (1994), Geologic Map of the Sisquoc Quadrangle, Santa Barbara County, California, Prepared in cooperation with the California Department of Conservation, Division of Mines and Geology and the U.S. Geological Survey.


TABLE 1 - SUMMARY OF WELL DATA
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<thead>
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<th>LeaseName</th>
<th>WellNo</th>
<th>Section</th>
<th>Township</th>
<th>Range</th>
<th>Elevation</th>
<th>Elev_Base PR</th>
<th>Elev Careaga Marker</th>
<th>Elev EBFW</th>
<th>Thickness</th>
<th>Inferred Surface Groundwater Elevation</th>
<th>Lithologic Log</th>
<th>Electric_Log</th>
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<td>450</td>
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<td>-90</td>
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<td>716</td>
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<td>20</td>
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<td>436</td>
<td>580</td>
<td>Below 600</td>
<td>No</td>
<td>Yes</td>
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<tr>
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<td>Victory-G1</td>
<td>30</td>
<td>9N</td>
<td>32W</td>
<td>1000</td>
<td>850</td>
<td>500</td>
<td>850</td>
<td>150</td>
<td>Below 600</td>
<td>Yes</td>
<td>Yes</td>
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<td>Victory-G2</td>
<td>30</td>
<td>9N</td>
<td>32W</td>
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<td>610</td>
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<td>200</td>
<td>Below 600</td>
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<td>Yes</td>
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<td>850 est</td>
<td>Unknown</td>
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<td>Below 600</td>
<td>Yes</td>
<td>Yes</td>
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<td>31</td>
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<td>0</td>
<td>Water sand at depth</td>
<td>760-780 Foxen</td>
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<td>Yes, below 704 feet</td>
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<td>No</td>
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<td>1</td>
<td>31</td>
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<td>32W</td>
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<td>660</td>
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<td>160</td>
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<td>Yes, below 704 feet</td>
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<td>31</td>
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<td>Yes, below 600 feet</td>
<td>Yes, casing shoe at 710 feet</td>
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<td>945</td>
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<td>610</td>
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<td>80</td>
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<tr>
<td>Field Fee</td>
<td>32</td>
<td>9N</td>
<td>32W</td>
<td>0</td>
<td>0</td>
<td>Absent</td>
<td>Absent</td>
<td>Yes, below 600 ft depth Yes, below 600 ft depth</td>
<td>No</td>
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<td>Husky Electro Petr</td>
<td>4B-32</td>
<td>32</td>
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<td>32W</td>
<td>916</td>
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<td>750</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent No</td>
<td>Yes, casing shoe at 70 feet</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Summary of Well Data
PLATES
SURFACE MAP - EAST CAT CANYON AREA
East Cat Canyon Hydrogeologic Study
Sisquoc, California

PLATE 1
Geologic Map of the Sisquoc Quadrangle, Santa Barbara County, California, (Dibblee, 1994).

**BASE MAP SOURCE:** Geologic Map of the Sisquoc Quadrangle, Santa Barbara County, California, (Dibblee, 1994).

**SOURCE:** Section from Geologic Map of the Sisquoc Quadrangle, Santa Barbara County, California, (Dibblee, 1994).

**LEGEND**

- **Qa** Alluvium
- **Qsg** Stream channel deposits
- **Qds** Landslide debris
- **QtM** Older Alluvium
- **Qtp** Paso Robles Formation
- **Tcog** Careaga Sandstone (Graciosa Member) - massive gray-white to tan sandstone
- **Tcog** Careaga Sandstone (Cebada Member) - massive tan to yellow, soft, fine grained sandstone

**SiOquc Formation**
- Monterey Shale
- Formation Contact - dashed where inferred or indefinite
- Fault - dashed where indefinite or inferred, dotted where concealed, relative vertical movement shown by U/D (U = upthrown side, D = downthrown side), short arrow indicates dip of fault plane, sawteeth are on upper plate of low angle thrust fault
- Anticline - dashed where inferred or indefinite
- Syncline - dashed where inferred or indefinite

**Strike and dip of beds:**
- 0° Inclined
- 90° Vertical

**Deep Wells shown:**
- 3. Stone & Goodwin
- 4. R & G Oil Co., #11
- 5. R & G Oil Co., #5
- 6. R & G Oil Co., #6
- 7. Palmer-Stendel Oil Co., #9
- 8. Palmer-Stendel Oil Co., #10
- 9. Palmer-Stendel Oil Co., #20

**REGIONAL GEOLOGIC MAP**

East Cat Canyon Hydrogeologic Study

Sisquoc, California

PLATE 2
AREA WHERE PASO ROBLES FORMATION IS SATURATED

AREA WHERE PASO ROBLES FORMATION IS ABOVE THE INFERRED WATER SURFACE ELEVATION

Legend
- Water Well Location
- Oil Well Location
- Potential Test Well Location
- Pinch Out (Zero Thickness)
- Line of Paso Robles Formation

Aera Lease Boundaries
- Aera Fee
- Bonetti
- Field Fee
- Fleisher
- McNee
- R&G
- Stendel
- Victory
- West
- WestCo

Imagery Source: This map presents land cover imagery for the world and detailed topographic maps for the United States. The map includes the National Park Service (NPS) National Earth (physical) map at 1 mile per pixel for the world at small scales, National Geographic Topo! 1:24,000 and 1:63,000 scale maps for the United States at medium scales, and National Geographic Topo! 1:100,000 and 1:240,000 scale maps for the United States at large scales. The Topo! maps are seamless, scanned images of United States Geospatial Sciences (USGS) paper topographic maps. For more information on this map, visit us online at http://goto.arcgisonline.com/maps/NGS_Topo_US_2D

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Grid: NAD83 State Plane, California Zone V, Feet

AREA OF POTENTIALLY SATURATED PASO ROBLES FORMATION
East Cat Canyon
Santa Barbara County, California

PLATE 5
Aera Energy LLC  
Project No. 04-62120024

Legend
- Water Well Location
- Oil Well Location
- Potential Test Well Location

Aera Lease Boundaries

Imagery Source: This map presents land cover imagery for the world and detailed topographic information for the United States. The map includes the National Park Service (NPS) Natural Earth physical map at 1.24 meter per pixel for the world at small scales, i-cubed eTOPO 1:250,000-scale maps for the contiguous United States at medium scales, and National Geographic TOPO! 1:100,000 and 1:24,000-scale maps (1:250,000 and 1:63,000 in Alaska) for the United States at large scales. The TOPO! maps are seamless, scanned images of United States Geological Survey (USGS) paper topographic maps. For more information on this map, visit us online at http://.goto.arcgisonline.com/maps/NGS_Topo_US_2D

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Grid: NAD83 State Plane, California Zone V, Feet
Theoretical Distance Drawdown Projections

Pumping Rate = 25 and 50 gpm
T = 1000 gpd/ft, S = 0.10, Time = 1 year

THEORETICAL DISTANCE DRAWDOWN PROJECTIONS
East Cat Canyon Hydrogeologic Study
Sisquoc, California
ATTACHMENT 2
AERA WATER SUPPLY STUDY AND RELATED DATA
## INDEX OF WELL RECORDS

**Operator:** AP"A" ENERGY LLC  
**Field:** Cat Canyon  
**County:** Santa Barbara  
**Sec.:** 20  
**T.:** 9N  
**R.:** 32W  
**S.B.:** B & M.

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<tr>
<td>&quot;McCROSKEY&quot;</td>
<td>WS11</td>
<td>20746</td>
<td>4-14-75</td>
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<td>Final. let. 6.3-76</td>
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<td></td>
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<td>ELEC.</td>
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<tr>
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<td>HIST.</td>
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<td></td>
<td>ABAN.</td>
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<tr>
<td>&quot;McCROSKEY&quot;</td>
<td>WS12</td>
<td>20747</td>
<td>4-15-75</td>
<td></td>
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</table>

"McCROSKEY"  
Well No. 10  
A.P.I. No. --  
Notices (DATE REQ'D) No Records  
Records 6-4-90 Abandon  
Status 1990  
Remarks Final Letter 7-29-91

- Depth 395  
- Sand gravel yellow  
- Blue green chalk clay
DIVISION OF OIL AND GAS
CHECK RECORDS RECEIVED AND WELL "MCCROSKEY" WSL2

Company: Continental Oil Co.  Well No: "McGroskey" WSL2
API No.: 083-20747  Sec. 20, T. 9N, R. 32W, S.B. 6M.
County: Santa Barbara  Field: Cat Canyon

RECORDS RECEIVED

<table>
<thead>
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<th>RECORDS RECEIVED</th>
<th>DATE</th>
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<tr>
<td>Well Summary (Form OGI00)</td>
<td>6-1-26</td>
</tr>
<tr>
<td>History (Form OGI03)</td>
<td>6-1-26</td>
</tr>
<tr>
<td>Core Record (Form OGI01)</td>
<td></td>
</tr>
<tr>
<td>Directional Survey</td>
<td></td>
</tr>
<tr>
<td>Sidewall Samples</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Date final records received</td>
<td></td>
</tr>
<tr>
<td>Electric logs:</td>
<td></td>
</tr>
</tbody>
</table>

STATUS

Producing - Oil  Water Disposal
Idle - Oil      Water Flood
Abandoned - Oil  Steam Flood
Drilling - Idle  Fire Flood
Abandoned - Dry Hole  Air Injection
Producing - Gas  CO2 Injection
Idle - Gas      Gas Injection
Abandoned - Gas  LPG Injection
Gas-Open to Oil Zone  Observation
Water Flood Source

DATE

RECOMPLETED

REMARKS

ENGINEER'S CHECK LIST

1. Summary, History, & Core record (dupl.)
2. Electric Log
3. Operator's Name
4. Signature
5. Well Designation
6. Location
7. Elevation
8. Notices
9. "TH" Reports
10. Casing Record
11. Plugs
12. Surface Inspection
13. Production

CLERICAL CHECK LIST

1. Location change (F-OGD165)
2. Elevation change (F-OGD165)
3. Form OGD121
4. Form OGI59 (Final Letter)
5. Form OGD150b (Release of Bond)
6. Duplicate logs to archives
7. Notice of Records due (F-OGD170)

Water well records for "McGroskey" WSL10 are in water wells file (water well reports)

RECORDS NOT APPROVED

Reason:

RECORDS APPROVED 4/4/66 AB

RELEASE BOND

Date Eligible
(Use date last needed records were received.)

MAP AND MAP BOOK 5

OGD2 (2-75-GSRL-4M)

LONG BEACH OFFICE - USE REVERSE SIDE
History of Oil or Gas Well

Operator: CONTINENTAL OIL COMPANY
Field: Olivera Canyon

Well No.: McCroskey 4-12, Sec. 20, T. 9N, R. 32W, S.R.B. & M.

Date: May 25, 1976
Signed: [Signature]

290 Maple Court, Suite 128 Ventura, California 93003
(805) 642-8154
Title: Division Manager of Production

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Objective: To drill water source well

T.D.: 700'

Casing: 11-3/4", 60#, Natl "D" 0-700'

Work Done: August 1975 M.I.R.U. Drilled to 700' and ran 11-3/4", 60#
Natl. "D" casing 0-700'. Installed rods, pump and tubing and put well on production.

D.O.G. Santa Maria (2)
D.O.P. Santa Maria (1)
Well File (1)
Explo. (1)

[Map No. and Map Letter]
[Map No. and Map Letter]
[Map No.]
[Map No.]

OG 103
Mr. H.D. Haley, Agent
Continental Oil Company
180 E. Ashwood Avenue
Ventura, CA 93003

Santa Maria, Calif.
April 17, 1975

(083-20747)

Dear Sir:

Your proposal to drill Well No. "McCrockey" No.12, Section 20, T. 34N, R. 42W, S.B.B. & M., Cat Canyon Field, Santa Barbara County, dated undated, received 4-15-75, has been examined in conjunction with records filed in this office.

DECISION: THE PROPOSAL IS APPROVED.

Blanket Bond

JLZ: kc

THOMAS E. GAY, JR., Acting Chief
DEPARTMENT OF CONSERVATION

By

Deputy
DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be cancelled.

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well No. "McCroesky Water Source 12", API No. (083-20747), Sec. 20, T. 9N, R. 32W, S.B. B. & M., Olivera Canyon Field, Santa Barbara County.

Legal description of mineral-right lease, consisting of 240 acres, is as follows:

(Attach map or plat to scale)

Producing lease

Do mineral and surface leases coincide? Yes. X No. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 76 feet South along section line and 211 feet East at right angles to said line from the Northwest corner of section 20 or

If well is to be directionally drilled, show proposed coordinates at total depth.

Elevation of ground above sea level 607 feet.

All depth measurements taken from top of KB (Derrick Floor, Rotary Table or Kelly Bushing) which is 10 feet above ground.

PROPOSED CASING PROGRAM

<table>
<thead>
<tr>
<th>SIZE OF CASING</th>
<th>WEIGHT</th>
<th>GRADE AND TYPE</th>
<th>TOP</th>
<th>BOTTOM</th>
<th>CEMENTING DEPTHS</th>
<th>CALCULATED FILL BEHIND CASING</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 3/4&quot;</td>
<td>60#</td>
<td>National &quot;D&quot;</td>
<td>0</td>
<td>700'</td>
<td></td>
<td></td>
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</table>

(A complete drilling program is preferred and may be submitted in lieu of the above program)

Intended zone(s) of completion: Paso Robles Gravels (200-700')

Estimated total depth 700'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address: 180 N. Ashwood Ave.

Continental Oil Company

By Division (Name) Manager of Prod. (Date)

Type of Organization Corporation

(Corporation, Partnership, Individual, etc.)

OG105 (12-73-GSR1-15M)
WELL RECORD
COMBINED FILE
0408320747
SHELL
MC CROSEY
12-20
CAT CANYON
30 009N 032W 20
SANTA BARBARA
CA
UNITED STATES
CALIFORNIA
Casing Plat

Location: 76°S. + 211°E. from NE corner of Sec. 20.

Casing Detail:
Surf - 700'  11 3/4" 60# National "B"

Miscellaneous:
Water Source Well.

Hole Size:
17" - 700'

Well name #: McCroskey WS12
API #: 040832074700
Sec. Twp. + Range: Sec. 20, T9N, R32W
Date: 8-11-09
DIVISION OF OIL AND GAS

Notice of Intention to Drill New Well

This notice and indemnity or cash bond shall be filed, and approval given, before drilling begins. If operations have not commenced within one year of receipt of the notice, this notice will be considered cancelled.

DIVISION OF OIL AND GAS

In compliance with Section 3203, Division 3, Public Resources Code, notice is hereby given that it is our intention to commence drilling well No. McCroskey Water Source 12, API No. (Assigned by Division).

Sec. 20, T9N, R32W, S.B., B. & M., Olivera Canyon Field, Santa Barbara County.

Legal description of mineral-right lease, consisting of 240 acres, is as follows: (Attach map or plat to scale)

Producing lease

Do mineral and surface leases coincide? Yes. No. If answer is no, attach legal description of both surface and mineral leases, and map or plat to scale.

Location of well 76 feet South along section line and 211 feet East (Direction) at right angles to said line from the Northwest corner of section 20 or

If well is to be directionally drilled, show proposed coordinates at total depth.

Elevation of ground above sea level 607 feet.

All depth measurements taken from top of KB (Derrick Floor, Rotary Table or Kelly Bushing) which is 10 feet above ground.

PROPOSED CASING PROGRAM

<table>
<thead>
<tr>
<th>SIZE OF CASING</th>
<th>WEIGHT</th>
<th>GRADE AND TYPE</th>
<th>TOP</th>
<th>BOTTOM</th>
<th>CEMENTING DEPTHS</th>
<th>CALCULATED FILL BEHIND CASING</th>
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</thead>
<tbody>
<tr>
<td>11 3/4&quot;</td>
<td>60#</td>
<td>National &quot;D&quot;</td>
<td>0</td>
<td>700#</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(A complete drilling program is preferred and may be submitted in lieu of the above program)

Intended zone(s) of completion: Paso Robles Gravel (200-700')

Estimated total depth 700'

It is understood that if changes in this plan become necessary we are to notify you immediately.

Address: 180 N. Ashwood Ave.

CONTINENTAL OIL COMPANY

Original Signed By: H. D. HALEY

By: Division Manager of Prod.

Type of Organization Corporation

(Original, Partnership, Individual, etc.)

OG105 (12-73-G5R1-15M)
SUBMIT IN DUPLICATE
RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF CONSERVATION
DIVISION OF OIL AND GAS

History of Oil or Gas Well

Operator: CONTINENTAL OIL COMPANY  Field: Olivera Canyon

Well No.: McCroskey No. 12  Sec.: 20  T.: 9N  R.: 32W  S.R.B. & M.

Date: May 25, 1976  Signed: [Signature]

Address: 290 Maple Court, Suite 128  (805) 642-8154  Title: Division Manager of Production

Ventura, California  93003  (President, Secretary or Agent)

History must be complete in all detail. Use this form to report all operations during drilling and testing of the well or during redrilling or altering the casing, plugging, or abandonment with the dates thereof. Include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests and initial production data.

Objective:  To drill water source well

T.D.:  700'

Casing:  11-3/4", 60#, Natl "D"  0-700'


D.O.G. Santa Maria (2)  
D.O.P. Santa Maria (1)  
Well File (1)  
Explo. (1)
Fruit Growers Laboratory, Inc.
P.O. BOX 272 - 853 CORPORATION STREET - PHONE (805) 525-2146
Santa Paula, California 93060
May 22, 1975
Lab. No. 31059

Phone conversation with Floyd Wells: This is the McCrosky
lease sample, and was mis-named by the well loggers.

RE: PURCHASE ORDER NO. 12028 - CONTINENTAL
OIL COMPANY - ELLIOTT LEASE WATER SAMPLE

Submitting Lab. No. 31059, a water sample received May 15, 1975,
with Purchase Order No. 12028, sample described as "Continental Oil
Company, Elliott Lease Sample".

Since laboratory personnel did not take this sample, we will
assume no responsibility as to the accuracy of sampling, but must consider
it as representative of the source from which it was collected.

The analysis is submitted on the attached sheet and values reported
in conventional terms. Also attached are sheets which discuss chemical
quality standards for domestic water supplies, another which interprets some
of the terms, and a third which permits evaluation of the water as an
irrigation source.

CONCLUSIONS

1). Lab. No. 31059 "Continental Oil Company, Elliott Lease Sample" contained
a total dissolved solids concentration of 982 mg./liter and a total
solids residue on evaporation of 933 mg./liter.

2). Iron and Manganese are present at concentrations which should not prove
troublesome in domestic use.

3). The mineral composition of this water is such that it meets the present
chemical quality standards for domestic water supplies as adopted by
the State Department of Public Health.

4). Total hardness is 30.7 GPG.

5). The water is considered to be a Class 2 irrigation source usable with a
reasonable degree of safety in a wide range of crops, including the
more sensitive ones, citrus and Avocados.

Please call if there are questions.

Very truly yours,

Fruit Growers Laboratory, Inc.

Edward J. Garrett, Jr.
**WATER ANALYSIS REPORT**

**OWNER** - Floyd V. Wells, Inc.

**LAB. NO.** - 31059

**DATE SUBMITTED** - Received May 15, 1975

**ANALYSIS REPORTED** - May 21, 1975

**MATERIAL** - Continental Oil Co., Groskey Lease.

<table>
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<th></th>
<th>MILLIGRAM EQUIVALENTS PER LITER</th>
<th>MILLIGRAMS PER LITER</th>
<th>LBS. PER ACRE FOOT</th>
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<td>45.0</td>
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<td>Magnesium (Mg)</td>
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<td>51</td>
<td>139</td>
<td>30.0</td>
</tr>
<tr>
<td>Sodium (Na)</td>
<td>3.5</td>
<td>80</td>
<td>218</td>
<td>25.0</td>
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<tr>
<td>Potassium (K)</td>
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<td>Carbonate (CO₂)</td>
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<td>Bicarbonate (HCO₃⁻)</td>
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<td>Chloride (Cl)</td>
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<td>Sulphate (SO₄²⁻)</td>
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<td>928</td>
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<td>Nitrate (NO₃⁻)</td>
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<td>24</td>
<td>0.7</td>
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<td>2672</td>
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**TOTAL SOLIDS (residue)..........................mg/liter @ 103°C**

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<tr>
<td>Boron</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Fluoride</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>less than 0.1</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>less than 0.05</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.7</td>
<td>7.6</td>
</tr>
<tr>
<td>EC X 10⁻⁶ at 25°C</td>
<td>1252</td>
<td></td>
</tr>
</tbody>
</table>

**HARDNESS**

Grains Per Gallon (as Ca CO₃)

<table>
<thead>
<tr>
<th>Component</th>
<th>Grains</th>
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<tr>
<td>Calcium</td>
<td>18.4</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>12.3</td>
<td></td>
</tr>
<tr>
<td>Total Hardness</td>
<td>30.7</td>
<td></td>
</tr>
<tr>
<td>Temporary Hardness</td>
<td>14.3</td>
<td></td>
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<tr>
<td>Permanent Hardness</td>
<td>16.4</td>
<td></td>
</tr>
</tbody>
</table>

These results were obtained by following standard laboratory procedures; the liability of the corporation shall not exceed the amount paid for this report.

**CHEMIST**

Ming Y. Wang
Conductance (EC $10^2$ at 25° C)—A measure of capacity of water to conduct an electric current. Provides a rough measure of the mineral content of the water but does not give any indication of the relative quantities of the constituents in solution.

Total Dissolved Solids—A total amount of soluble inorganic constituents dissolved in water and expressed as parts per million and lbs. per acre foot.

Boron—Characteristic element of such compounds as borax and boric acid. Needed in small quantity by all plants but injurious in higher concentrations.

Chlorides—Found in all natural waters but at greater concentrations in drainage waters, sewage effluents and ocean water. Chlorides affect the agricultural and domestic use of waters. Suggest 200 ppm as upper tolerance limit for citrus and walnuts—prefer less than 100 ppm for avocados.

Sodium Percent—The quantity of sodium in milligram equivalents is divided by the sum of calcium, magnesium, sodium and potassium and results expressed as a percentage. Waters of high sodium percentage so react with the soil that it becomes difficult to till and to "take water".

### Relative Tolerance of Crop Plants to Boron

<table>
<thead>
<tr>
<th>Sensitive</th>
<th>Semitolerant</th>
<th>Tolerant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lemon</td>
<td>Lima Bean</td>
<td>Carrot</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>Sweetpotato</td>
<td>Lettuce</td>
</tr>
<tr>
<td>Avocado</td>
<td>Bell Pepper</td>
<td>Cabbage</td>
</tr>
<tr>
<td>Orange</td>
<td>Tomato</td>
<td>Turnip</td>
</tr>
<tr>
<td>Blackberry</td>
<td>Pumpkin</td>
<td>Onion</td>
</tr>
<tr>
<td>Persian (English) walnut</td>
<td>Corn</td>
<td>Alfalfa</td>
</tr>
<tr>
<td>Black walnut</td>
<td>Wheat</td>
<td>Garden Beet</td>
</tr>
</tbody>
</table>

### Tolerance of Crop Plants to Salt

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Palm</td>
<td>Olive</td>
<td>Pear</td>
</tr>
<tr>
<td>Sugar Beet</td>
<td>Grape</td>
<td>Apple</td>
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<tr>
<td>Asparagus</td>
<td>Cantaloupe</td>
<td>Orange</td>
</tr>
<tr>
<td>Spinach</td>
<td>Tomato</td>
<td>Grapefruit</td>
</tr>
<tr>
<td>Barley (grain)</td>
<td>Cabbage</td>
<td>Peach</td>
</tr>
<tr>
<td>Cotton</td>
<td>Bell Pepper</td>
<td>Strawberry</td>
</tr>
<tr>
<td>Saltgrass</td>
<td>Lettuce</td>
<td>Lemon</td>
</tr>
<tr>
<td>Bermuda grass</td>
<td>Carrot</td>
<td>Avocado</td>
</tr>
<tr>
<td></td>
<td>Onion</td>
<td>Walnut</td>
</tr>
<tr>
<td></td>
<td>Cucumber</td>
<td>Green Beans</td>
</tr>
<tr>
<td></td>
<td>Alfalfa</td>
<td>Lodine Clover</td>
</tr>
<tr>
<td></td>
<td>Wheat</td>
<td>Field Beans</td>
</tr>
</tbody>
</table>

Importance of Good Drainage to Prevent Salt Accumulation

In order to prevent accumulation of the salts added by irrigation water it is absolutely necessary to apply more water, if the rainfall is light, than is required by crops. In such case, rigid conservation of irrigation water is incompatible with soil conservation. A substantial amount of irrigation water must be wasted by liberal application as a necessary means of preventing increased salinity in the soil. This increases the need for drainage; but unless adequate, serious injury will result eventually from the salts originating in the water itself.

The more saline the irrigation water, the greater amount that should be applied per irrigation.
WATER CLASSIFICATION SCHEMES IN GENERAL USE THROUGHOUT THE UNITED STATES

a). F. M. Eaton
Ref. - Qualitative Classification of irrigation Waters Page 229 April 1948, Citrograph

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percent Sodium</th>
<th>Percent Sensitive Plants</th>
<th>Percent Tolerant Plants</th>
<th>Chlorides M.E. Per Liter</th>
<th>Sulphates M.E. Per Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, Excellent to Good</td>
<td>0.40</td>
<td>Under 0.40</td>
<td>Under 1.00</td>
<td>Under 2</td>
<td>Under 4</td>
</tr>
<tr>
<td>Class 2, Good to Injurious</td>
<td>40-70</td>
<td>0.40-1.00</td>
<td>1.00-2.00</td>
<td>2-6</td>
<td>4-12</td>
</tr>
<tr>
<td>Class 3, Injurious to Unsatisfactory</td>
<td>70-100</td>
<td>1.00 Plus</td>
<td>2.00 Plus</td>
<td>6 Plus</td>
<td>12 Plus</td>
</tr>
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</table>

LAB NO.

b). Dr. L. D. Doneen—Division Irrigation—University of California, Davis

<table>
<thead>
<tr>
<th>Conductance</th>
<th>Class 1 Excellent to Good</th>
<th>Class 2 Good to Injurious</th>
<th>Class 3 Injurious to Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC $\times 10^4$ at 25°C</td>
<td>Less than 1,000</td>
<td>1,000-3,000</td>
<td>More than 3,000</td>
</tr>
<tr>
<td>Boron, PPM</td>
<td>Less than 0.5</td>
<td>0.5-2.0</td>
<td>More than 2.0</td>
</tr>
<tr>
<td>Sodium Percentage</td>
<td>Less than 60</td>
<td>60-75</td>
<td>More than 75</td>
</tr>
<tr>
<td>Chlorides, M.E. Per Liter</td>
<td>Less than 5</td>
<td>5-10</td>
<td>More than 10</td>
</tr>
</tbody>
</table>

Values used as a guide only, since permissible limits vary widely with different crops, soils and climatic conditions.

c). Permissible Limits for Boron in Irrigation Water

<table>
<thead>
<tr>
<th>Crop Groups</th>
<th>Sensitive</th>
<th>Semitolerant</th>
<th>Tolerant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classes of Water</td>
<td>PPM</td>
<td>PPM</td>
<td>PPM</td>
</tr>
<tr>
<td>Excellent</td>
<td>0.33</td>
<td>0.67</td>
<td>1.00</td>
</tr>
<tr>
<td>Good</td>
<td>0.33 to 0.67</td>
<td>0.67 to 1.33</td>
<td>1.00 to 2.00</td>
</tr>
<tr>
<td>Permissible</td>
<td>0.67 to 1.00</td>
<td>1.33 to 2.00</td>
<td>2.00 to 3.00</td>
</tr>
<tr>
<td>Doubtful</td>
<td>1.00 to 1.25</td>
<td>2.00 to 2.50</td>
<td>3.00 to 3.75</td>
</tr>
<tr>
<td>Unsuitable</td>
<td>1.25</td>
<td>2.50</td>
<td>3.75</td>
</tr>
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</table>


<table>
<thead>
<tr>
<th>Alkali Coefficient</th>
<th>Class</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 18</td>
<td>Good</td>
<td>Have been used successfully for many years without special care to prevent alkali accumulation.</td>
</tr>
<tr>
<td>18 to 6</td>
<td>Fair</td>
<td>Special care to prevent gradual alkali accumulation has generally been found necessary except on loose soils with free drainage.</td>
</tr>
<tr>
<td>5.9 to 1.2</td>
<td>Poor</td>
<td>Care in selection of soils has been found to be imperative and artificial drainage has frequently been found necessary.</td>
</tr>
<tr>
<td>Less than 1.2</td>
<td>Bad</td>
<td>Practically valueless for irrigation.</td>
</tr>
<tr>
<td>Chemical Substance</td>
<td>PHS Drinking Water Standards</td>
<td>State Bd. Pub. Health Standards</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td></td>
<td>Rec. Max. (mg./l)</td>
<td>Mandatory Max. (mg./l)</td>
</tr>
<tr>
<td>ABS Detergent</td>
<td>0.5</td>
<td>-</td>
</tr>
<tr>
<td>Aluminum</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
<td>Barium</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Cadmium</td>
<td>-</td>
<td>0.01</td>
</tr>
<tr>
<td>Carbon Chloroform Extract</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Chloride</td>
<td>250</td>
<td>-</td>
</tr>
<tr>
<td>Chromium, Hexavalent</td>
<td>-</td>
<td>0.05</td>
</tr>
<tr>
<td>Copper</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Cyanide</td>
<td>0.01</td>
<td>0.2</td>
</tr>
<tr>
<td>Fluoride (See PHS Standards)</td>
<td>-</td>
<td>(See Standard)</td>
</tr>
<tr>
<td>Hardness</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Iron</td>
<td>0.3</td>
<td>-</td>
</tr>
<tr>
<td>Lead</td>
<td>-</td>
<td>0.05</td>
</tr>
<tr>
<td>Magnesium</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.05</td>
<td>-</td>
</tr>
<tr>
<td>Mercury</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nitrate-N + Nitrite-N</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Phenols</td>
<td>0.001</td>
<td>-</td>
</tr>
<tr>
<td>Selenium</td>
<td>-</td>
<td>0.01</td>
</tr>
<tr>
<td>Silver</td>
<td>-</td>
<td>0.05</td>
</tr>
<tr>
<td>Sulfate</td>
<td>250</td>
<td>-</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>500</td>
<td>-</td>
</tr>
<tr>
<td>Zinc</td>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>

(1) These chemical substances should not be present in a water supply in excess of the listed concentrations where other more suitable supplies are or can be made available.

(2) The presence of these substances in excess of the concentrations listed constitutes grounds for rejection of the supply.

(3) Constituent concentrations up to the Short-Term Limit are acceptable only for existing systems and on a temporary basis pending construction of treatment facilities or development of acceptable new water sources. New systems serving water which carries constituent concentrations up to the Short-Term Limit will be allowed only if adequate progress is being demonstrated toward providing water of improved mineral quality.

WATER WELL LOCATION

for

CONTINENTAL OIL CO.

PORTION NW 1/4, SEC. 20, T.34 N., R.22 W., S.B.M.
COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA

LIEBER SURVEYS, INC.

307 E. WILSHIRE AVE.
SANTA BARBARA, CALIF. 93101
L.S.I. #75068
REF. 35 B.R.O. 4/8/75
REvised 4/9/75
COUNTY OF SANTA BARBARA
DEPARTMENT OF PETROLEUM

P.O. BOX 1068
1862 South Broadway, Room 200
SANTA MARIA, CALIFORNIA 93454
Telephone (805) 922-1749

APPLICATION FOR PERMIT TO DRILL

I WELL DATA

In compliance with County Ordinance No. 1927, we hereby request permission to drill the following:

Well Name & No. Mccroskey Water Source No. 12

Type Well Oil Well
Gas Well X
Water Well
Injection Well
Core Hole Wildcat

Location Township 9N
Range 32W
Section 20
Field Olivia Canyon

Elevation GL 607

Onshore Coordinates North 76 ft.
South 211 ft.

Offshore Coordinates Zone No.

From the Northwest corner of the

Proposed Completion Zone Paso Robles Gravels

GEOSTRICAL FORMATION

Note: Attach map or plat to scale and indicate distance from section corner, nearest completed or abandoned well, Domestic water well, and other distances listed in Section 25-6 Ordinance No. 1927 if applicable.

Land Owner(s): Continental Oil Company
NAME AND ADDRESS
No. of Acres: 240

II PROPOSED CASING AND CEMENTING PROGRAM

<table>
<thead>
<tr>
<th>CONDUCTOR</th>
<th>SURFACE STRING</th>
<th>WATER STRING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole Size</td>
<td>17&quot;</td>
<td>Cement</td>
</tr>
<tr>
<td>Length</td>
<td>700'</td>
<td>Sks-fr³</td>
</tr>
<tr>
<td>Size</td>
<td>11 3/4&quot;</td>
<td>Water</td>
</tr>
<tr>
<td>Weight</td>
<td>60#</td>
<td>Gal/Sk-fr³</td>
</tr>
<tr>
<td>Grade</td>
<td>&quot;D&quot;</td>
<td>Additive #1</td>
</tr>
<tr>
<td>Type Coupling</td>
<td>Welded</td>
<td>Sks-fr³-% mix</td>
</tr>
<tr>
<td>New or Used</td>
<td>Used</td>
<td>Additive #2</td>
</tr>
</tbody>
</table>

Note: If pipe utilized for the water string is used pipe, specify when tested and method used.

Date tested: __________________________
Method Used: __________________________
Casing accessories to be used: __________________________

III PROPOSED PRODUCING METHOD AND ENCLOSURES

Natural Primary Steam Injection Fire Flood
Other, Specify Gas Injection Water Flood

ENCLOSURES: a. $200.00 Permit Fee X b. Faithful Performance Bond $5,000.00 Single Bond

® c. Faithful Performance Bond $5,000.00 Blanket Bond

d. Rider to Blanket Bond On File.

Name of Company: Continental Oil Company
Telephone No. 642-8154

Address: 180 N. Ashwood Ave.

By: Division Manager of Production

Title: __________________________

EXHIBIT NO. 1
Mr. H.D. Haley, Agent
Continental Oil Company
180 N. Ashwood Avenue
Ventura, CA 93003

Santa Maria, Calif.
April 17, 1975

Dear Sir:

Your proposal to drill Well No. "Bakroskey" NN12, Section 20, T. 29 N., R. 32 W., S.B.B. & M., Cat. Canyon Field, Santa Barbara County, dated undated, received 4-15-75, has been examined in conjunction with records filed in this office.

DECISION: THE PROPOSAL IS APPROVED.

THOMAS E. GAY, JR., Acting Chief
JOHN E. MATTHEWS, Jr., State Oil and Gas Supervisor

By:

Deputy
JURISDICTIONAL DETERMINATION REPORT

EAST CAT CANYON OIL FIELD REDEVELOPMENT PROJECT
SANTA BARBARA COUNTY, CALIFORNIA

Project No. 1002-0455

Prepared for:
Aera Energy LLC
10000 Ming Avenue
Bakersfield, California 93311

Prepared By:
Padre Associates, Inc.
369 Pacific Street
San Luis Obispo, California 93401

July 2016
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D Data Sheets
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   Vegetation Rapid Assessment Form - Pool A
## LIST OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDFW</td>
<td>California Department of Fish and Wildlife</td>
<td></td>
</tr>
<tr>
<td>CNPS</td>
<td>California Native Plant Society</td>
<td></td>
</tr>
<tr>
<td>CRLF</td>
<td>California Red-Legged Frog</td>
<td></td>
</tr>
<tr>
<td>CTS</td>
<td>California Tiger Salamander</td>
<td></td>
</tr>
<tr>
<td>CWA</td>
<td>Clean Water Act</td>
<td></td>
</tr>
<tr>
<td>DPS</td>
<td>Distinct Population Segment</td>
<td></td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>ESU</td>
<td>Evolutionary Significant Unit</td>
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<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
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<td>FESA</td>
<td>Federal Endangered Species Act</td>
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<tr>
<td>FWCA</td>
<td>Federal Wildlife Coordination Act</td>
<td></td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>HDD</td>
<td>Horizontal Directional Drilling</td>
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<td>NMFS</td>
<td>National Marine Fisheries Service</td>
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<td>NRCS</td>
<td>Natural Resources Conservation Service</td>
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</tr>
<tr>
<td>NWI</td>
<td>National Wetland Inventory</td>
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<tr>
<td>OHWM</td>
<td>Ordinary High Water Mark</td>
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<tr>
<td>RWQCB</td>
<td>Regional Water Quality Control Board</td>
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</tr>
<tr>
<td>TNW</td>
<td>Traditionally Navigable Waters</td>
<td></td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
<td></td>
</tr>
<tr>
<td>USFWS</td>
<td>United States Fish and Wildlife Service</td>
<td></td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geologic Survey</td>
<td></td>
</tr>
</tbody>
</table>
Padre Associates, Inc. hereby certifies that all statements furnished in the following Jurisdictional Determination Report and all supporting information are true and correct to the best of our knowledge and belief. Further, we certify that all field surveys associated with this report were performed by Padre Associates, Inc. using standards accepted by Federal, State, and local survey guidelines and accurately represent all information retained from field visits to the East Cat Canyon Project Site in Santa Barbara County, California.

Christine Santala
Project Manager/Biologist

Eric K. Snelling
Principal
1.0 INTRODUCTION

The following Jurisdictional Determination Report (Report) was prepared for Aera Energy LLC (Aera) by Padre Associates, Inc. (Padre) documenting the results of a desktop and field survey investigation of water resources within the proposed East Cat Canyon Oil Field Redevelopment Project Site (Project Site), located within northern Santa Barbara County, California. This Report provides discussions regarding water resources provided protection by the United States Clean Water Act (CWA) and regulated by the United States Army Corps of Engineers (Corps). Other water resources regulated by the State of California or Santa Barbara County, but not federally regulated, are not discussed in this Report and permitting for these water resources may also be required. This Report was prepared following a preliminary meeting with Crystal Huerta (Corps – Los Angeles District), Susan Perrell (Aera Energy LLC), Sarah Spann (Padre), and Eric Snelling (Padre) on June 30, 2014 discussing the Project and federally regulated water resources that may potentially be impacted by Project activities.

The intent of this Report is to provide sufficient documentation of water resources within the Project Site to assist Federal regulatory agencies in determining the extent of Federal jurisdiction (“regulated activities”) and addresses specific Project activities requiring a Corps permit (refer to Appendix A – Preliminary Jurisdictional Determination Form). This Report also provides information regarding federally listed Threatened and Endangered species that occur in the Project Site and surrounding region. This information has been provided with the intent to assist the Federal review process between the Corps and other regulatory entities, such as the United States Fish and Wildlife Service (USFWS).

The information obtained during Federal review may warrant the Corps to assert “control and responsibility” for portions of the Project located beyond the limits of Corps regulated waters, per 33 Code of Federal Regulation 325 Appendix B (33 CFR 325), which states the following:

“Typical factors to be considered in determining whether sufficient ‘control and responsibility’ exists include:

(i) Whether or not the regulated activity comprises ‘merely a link’ in a corridor type project (e.g., a transportation or utility transmission project).

(ii) Whether there are aspects of the upland facility in the immediate vicinity of the regulated activity which affect the location and configuration of the regulated activity.

(iii) The extent to which the entire project will be within Corps jurisdiction.

(iv) The extent of cumulative Federal control and responsibility.

Federal control and responsibility will include the portions of the project beyond the limits of Corps jurisdiction where the cumulative Federal involvement of the Corps and other Federal agencies is sufficient to grant legal control over such additional portions of the project. (33 CFR 325)”
2.0 PROJECT OVERVIEW

2.1 SITE LOCATION

The Project Site is located within the Solomon Hills northeast of the Gato Ridge mountain ranges within Cat Canyon, approximately 10 miles southeast of the City of Santa Maria and the community of Orcutt located in northern Santa Barbara County, California (5th Supervisorial District) (Figure 1 – Project Location and Overview). The main property entrance is located at 6516 Cat Canyon Road, south of the community of Sisquoc, California.

2.2 PROJECT DESCRIPTION

The Project will reestablish oil production within the Brooks sand (reservoir) underlying the Project site. The purpose of the Project is to safely and economically produce crude oil while protecting the environment and providing jobs and other benefits to Santa Barbara County. Project plans include construction and restoration of approximately 72 well pads, construction and restoration of over nine miles of field access roads, and drilling of up to 296 wells (Figure 2 – Project Site Footprint). Planned wells include oil/gas production wells, steam injection wells, observation wells, non-potable water production wells, water injection wells, and fresh groundwater wells. No hydraulic fracturing (“fracking”) will be used for this Project.

New processing facilities and field systems will be constructed. Processing facilities will include: 1) a production group station for bulk separation of produced gas and liquids, 2) a central processing facility for oil cleaning, water cleaning, water softening, oil storage, and oil sales, and 3) a steam generation site (up to six once-through steam generators rated at 85 million British thermal units/hour each) for production of saturated steam to be used for thermal enhanced oil recovery. An additional 62.5 million British thermal units/hour steam generator will be used to generate steam from the project’s produced gas. No fresh water will be used to generate steam; only non-potable water will be used.

Field systems will include: 1) a production gathering network, 2) a steam distribution network and 3) electrical power distribution and supervisory control and data acquisition (SCADA) networks. Project infrastructure will also include an office building, a multipurpose building, a warehouse and maintenance building, and a facility control building. A fresh water system with a 3,000 barrel tank and water distribution pipelines is planned for drinking water and ancillary purposes, including fire protection, lavatories, showers, equipment cleaning, dust control, and minor landscape irrigation.

Utility connections for the Project include a 14 mile, eight inch natural gas pipeline and associated facilities, capable of providing 13 million cubic feet per day of natural gas to the Project at a delivery pressure of 300 pounds per square inch gage. The new pipeline will originate at the existing Southern California Gas Company Line Divide Station, located along Graciosa Road, and will terminate at Aera’s proposed central processing facility. The pipeline will be primarily installed in the existing public utility corridor within the public right of way, under existing road pavement. Project electrical power will be provided by transmission-level service from Pacific Gas and Electric Company’s Sisquoc-Santa Ynez 115 kilovolt power line to a new Aera-owned substation located at the central processing facility.
In summary, the Project components include the following:

1. Project Site
   a. Aera-owned portions of the East Cat Canyon Oil Field (Aera property), and
   b. Portions of the Project footprint located on parcels adjacent to the Aera property

2. Natural Gas Pipeline
   a. Proposed Southern California Gas Company gas pipeline route

3. Electrical Transmission Line
   a. Proposed Pacific Gas and Electric electrical transmission line route

Aera will operate the field under its well-established and proven management system that incorporates many processes, plans and programs to ensure public and worker health and safety, environmental protection, regulatory compliance, and community involvement. These programs include Spill Prevention, Incident Response, Site Safety, Site Security, Pollution Prevention, Species Protection, Environmental Compliance, Environmental Training, Safety Training, and Community Involvement.

Production from the Project is expected to continue for more than 30 years after initial production unless or until it is deemed uneconomic or undesirable to continue operation. At that point in time, any wells not yet previously abandoned will be permanently plugged and abandoned (including the removal of surface wellheads); equipment, facilities and infrastructure will be removed; and restoration of the property will be completed in accordance with applicable laws and regulations.
LEGEND:

- Aera Energy LLC Property
- Project Site Footprint

Source: County of Santa Barbara, TJCross 8-20-2014, DPSI 2013 Land Survey
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet

Notes: This map was created for informational and display purposes only.

EAST CAT CANYON OIL FIELD REDEVELOPMENT PROJECT

PROJECT NUMBER: 1002-0455
DATE: May 2015

PROJECT SITE FOOTPRINT

FIGURE 2
3.0 REGULATORY OVERVIEW

3.1 FEDERAL CLEAN WATER ACT

The primary regulatory legislation that governs the Federal protection of water resources is the CWA of 1977. In its current form, the CWA is a comprehensive legislation that generally includes reference to the United States Water Pollution Control Act of 1972, and its substantial supplementation by the CWA. Both acts were amended in 1981, 1987, and 1993. Overall, the CWA seeks to maintain and restore the physical, chemical, and biological integrity of the Nation’s waters by setting water quality standards for surface water and by regulating activities that may result in the discharge of pollutants into water resources. CWA water quality and other standards are jointly enforced by the Environmental Protection Agency (EPA) and the Corps in cooperation with the States and Tribal Nations. Together, the EPA and Corps share the responsibility for the issuance of permits for the placement of dredged or fill material into Waters of the United States (“waters”) and adjacent wetlands, pursuant to Section 404 of the CWA enforced within the Title 33 in the Code of Federal Regulations (33 CFR).

Per the CWA, waters are defined as follows:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters including interstate wetlands;
3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
   i. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
   ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
   iii. Which are used or could be used for industrial purpose by industries in interstate commerce.
4. All impoundments of waters otherwise defined as waters of the United States under the definition;
5. Tributaries of waters identified in paragraphs (a) (1) through (4) of this section;
6. The territorial seas;
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) (1) through (6) of this section; and
8. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area’s status as prior converted cropland by any other Federal
agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA (33 CFR 328).”

Recent decisions in the United States Supreme Court (i.e., Solid Waste Agency of Northern Cook County [SWANCC] v. Corps, 531 U.S. 159 [2001]; John A. Rapanos, et al., v. United States, 547 U.S. 715 [2006]) have led to the development of Federal guidance that requires careful examination and documentation of the (1) physical locations and hydrologic connections among waters/wetlands and traditional navigable waters (e.g., large rivers, oceans), (2) “adjacency” of a wetland to traditionally navigable waters, and (3) demonstration of a “significant nexus” to maintenance of the physical, chemical and biological integrity of traditional navigable waters.

Further, to determine the extent of the boundaries in non-tidal waters, the lateral extent of Corps jurisdiction is often determined by the ordinary high water mark (OHWM), which is defined as:

“...[the] line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas” (33 CFR 328[e]).

Additionally, the Corps asserts jurisdiction over adjacent wetlands, defined as follows (33 CFR 328.3 [b]):

“Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.”

On May 23, 2015, the EPA and ACOE jointly announced a final rule defining the scope of waters protected under the CWA, and was put into effect on August 28, 2015. The new rule revises the existing administrative definition of “waters of the United States”, in conjunction with providing clarification to make jurisdictional determinations more predictable. However, challenges to the new ruling were filed by stakeholders, and on October 9, 2015, the U.S. Court of Appeals for the Sixth Circuit stayed the Clean Water Rule nationwide pending further action of the court. As of June 2016 (the time in which this report was written), the stay has not been lifted, and as such, prior CWA regulations (1993) remain in effect.

For the purposes of identification and delineation of wetlands, the Corps uses the Environmental Laboratory Corps of Engineers Wetland Delineation Manual (Environmental Laboratory, 1987), and the Arid West regional supplement (Environmental Laboratory, 2008). The Corps defines a wetland using a three parameter test in which all parameters must all occur to be classified as a Federal wetland. These parameters include: hydrology, hydric soil, and hydrophytic vegetation.

Figure 3 provides a representational drawing of the Corps jurisdictional limits for general reference.
In addition, waters and wetlands are further regulated by authorities within the State of California. As such, pursuant to Section 401 of the CWA, the Corps cannot issue a Federal permit until the State of California first issues a water quality certification to ensure that a project will comply with State water quality standards. Other regulatory guidance from the California Department of Fish and Wildlife (CDFW) that regulates the bed, bank, and adjacent riparian vegetation of a channel must also be considered. This Report, however, provides information with specific focus only on federally regulated waters and wetlands.

3.1.1 Tributaries

Federal waters include tributaries that contribute flow (directly, or indirectly, by means of other tributaries) to larger federally protected waterbodies. Tributaries can provide this connection of flow if the stream is ephemeral (flows only during and immediately following rainfall), intermittent (seasonal flows), or permanent. This connection is considered a “significant nexus” per decisions by the Supreme Court (531 U.S. 159; 547 U.S. 715). United States Geological Survey (USGS) blue-line streams (“blue-lines”) can provide an initial starting point in determining locations of tributaries; however, field surveys must be performed to determine defining characteristics of an OHWM, stream function, and a significant nexus to jurisdictional waters. Stream channels are formed, maintained, and altered by the water and sediment they carry, and the forms they take can vary greatly, year to year; therefore, field surveys are important in determining current stream function and jurisdictional limits for any tributary.

A tributary can be a natural, man-altered, or man-made water body. A tributary is physically characterized by the presence of a channel with defined bed and bank. Certain ephemeral waters in the arid west are distinguishable from geographic features which have a
significant nexus to downstream waters, but do not have visible surface water year round. In some cases these ephemeral tributaries may serve as a transitional area between the upland environment and the downstream waters. During and following precipitation events, ephemeral tributaries collect and transport water and sometimes sediment from the upper reaches of the landscape downstream to other waters. These ephemeral tributaries may provide habitat for wildlife and aquatic organisms in downstream reaches. These biological and physical processes may further support nutrient cycling, sediment retention and transport, pollutant trapping and filtration, and improvement of water quality; functions that may significantly affect the chemical, physical, and biological integrity of downstream waters.

A natural or manmade break (e.g., rock outcrop, underground flow, dam, weir, diversion, or similar break) in the presence of a bed and bank or OHWM does not establish the upstream limit of a tributary in cases where a bed and bank and an OHWM can be identified upstream and downstream of the break.
Summary of Key Points
(Corps and EPA, 2008)

The agencies will assert jurisdiction over the following waters:

- Traditional navigable waters
- Wetlands adjacent to traditional navigable waters
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months)
- Wetlands that directly abut such tributaries

The agencies will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent
- Wetlands adjacent to but that do not directly abut a relatively permanent non-navigable tributary

The agencies generally will not assert jurisdiction over the following features:

- Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow)
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water

The agencies will apply the significant nexus standard as follows:

- A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters
- Significant nexus includes consideration of hydrological and ecological factors

Significant nexus includes consideration of hydrological factors including the following:

- Volume, duration, and frequency of flow, including consideration of certain physical characteristics of the tributary
- Proximity to the traditional navigable water
- Size of the watershed
- Average annual rainfall
- Average annual winter snow pack

Significant nexus also includes ecological factors including the following:

- Potential of tributaries to carry pollutants and flood waters to traditional navigable waters
- Provision of aquatic habitat that supports a traditional navigable water
- Potential of wetlands to trap and filter pollutants or store flood waters
- Maintenance of water quality in traditional navigable waters
3.2 FEDERAL ENDANGERED SPECIES ACT

The USFWS has responsibility under the Fish and Wildlife Coordination Act (FWCA), the Federal Endangered Species Act (FESA), and other similar wildlife legislation. As discussed above, the CWA water quality and other standards are jointly enforced by the EPA, as such, the USFWS has authority in evaluating impacts to fish and wildlife from proposed projects that include impacts to water resources regulated under the CWA. The FWCA requires that Federal agencies, such as the Corps, that construct, license, or permit projects that impact water resources must first consult with the USFWS, the National Marine Fisheries Service (NMFS) in some instances, and the State fish and wildlife agency, such as the CDFW, regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. The FESA requires Federal agencies enter formal consultation with the USFWS if a proposed Federal action may affect a federally listed species.

The FESA, administered by the USFWS and the NMFS, provides protection to species listed as Threatened or Endangered, and Critical Habitat designated for the protection of such species. The FESA prohibits take of Threatened and Endangered species except under certain circumstances and only with authorization from the USFWS through a permit under sections 4(d), 7, or 10(a) of the FESA. Under the FESA, take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Critical Habitat is defined in Section 3(5)(A) of the FESA as: (1) specific areas within the geographical area occupied by the species at the time of listing, on which are found those physical or biological features that are essential to the conservation of the listed species and that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time of listing that are essential for the conservation of a listed species.
4.0 METHODOLOGY

The information provided in this Report includes a desktop review of the Project region and information gathered from field surveys.

4.1 DESKTOP REVIEW

Prior to conducting the field survey, a desktop review was performed. The desktop review included the preparation and/or investigation of the following resources:

- Corps Jurisdictional Determination Form Instructional Guidebook. 2007;
- A Field Guide to the Identification of the OHWM in the Arid West Region of the Western United States. 2008. (Lichvar et al., 2008);
- Regional Supplement to the Corps Wetland Delineation Manual: Arid west Region (Version 2.0). 2008. (Environmental Laboratory, 2008);
- USGS. 7.5 Minute Quadrangles. Twitchell Dam, Tepusquet Canyon, Sisquoc, Orcutt, Lompoc, Los Alamos, Zaca Creek, Foxen Canyon, and Santa Maria.
- USFWS California Tiger Salamander (Ambystoma californiense) (CTS) Pond Habitats - Northern Area. 2010;
- Federal Emergency Management Agency (FEMA) 100 Year Floodplain Map;
- Biological Resources Survey Report for the East Cat Oil Field, Santa Barbara County, California. 2015. Prepared by Padre Associates Inc.;
- Biological Resources Survey Report for the Natural Gas Import Pipeline, Santa Barbara County, California. 2015. Prepared by Padre Associates Inc.; and


4.2 FIELD VISITS

The information obtained during the desktop review was used to conduct a field survey on March 18, 2015, focused on the water resources within the proposed Project Site, the Natural Gas Pipeline route, and the Electrical Transmission Line route. This survey included an investigation of the OHWM of Cat Canyon Creek and Long Canyon Creek, and a pool located within the Project Site that has been documented holding water throughout the growing season. The field survey was completed during the typical growing season for the area, in which plants can be most easily identifiable. Vegetation within the survey area was recorded and the indicator status of each species was determined using the National Wetland Plant List (Lichvar et al., 2014). The indicator status refers to the relative frequency with which a plant species occurs in areas that support wetland hydrology and/or soils, as summarized in Table 1.

Table 1. National Wetland Plant List Definitions of Indicator Categories

<table>
<thead>
<tr>
<th>Indicator Status</th>
<th>Definition (Lichvar et al., 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obligate Wetland (OBL)</td>
<td>Always occur in wetlands</td>
</tr>
<tr>
<td>Facultative Wetland (FACW)</td>
<td>Usually occur in wetlands, but may occur in non-wetlands</td>
</tr>
<tr>
<td>Facultative (FAC)</td>
<td>Occur in wetlands and non-wetlands</td>
</tr>
<tr>
<td>Facultative Upland (FACU)</td>
<td>Usually occur in non-wetlands, but may occur in wetlands</td>
</tr>
<tr>
<td>Upland (UPL)</td>
<td>Almost never occur in wetlands</td>
</tr>
<tr>
<td>To be Determined (TBD)</td>
<td>Status not yet determined</td>
</tr>
</tbody>
</table>
5.0 FINDINGS

The following discussion of water resources includes those documented within the Project region based on a desktop review and information retained from field surveys. The following section separately discusses the Project Site, Natural Gas Pipeline, and Electrical Transmission Line. Section 6.0 provides further information regarding functions and services of water resources and federally listed Threatened and Endangered species that may be impacted by Project activities.

5.1 PROJECT SITE

The Project Site is located within the Solomon Hills and the Gato Ridge mountain ranges in East Cat Canyon where the topography generally consists of dense oak woodland and shrub habitats comprised of steeply to moderately incised canyons and drainages, moderate to steep hills, and valleys that provide water drainage. Long Canyon and Olivera Canyon are two predominant valleys occurring within the Project Site. The USFWS NWI (2015) indicates that there are no wetland features within the Project Site (Figure 4 – NWI Wetland Map). TJ Cross Engineers (2014) completed a hydrology study for the Project Site and designated six distinct watershed boundaries associated with the USGS blue-lines contained within the Project Site. The watersheds are identified as the following: Unnamed Blueline #1, Unnamed Blueline #2, Unnamed Blueline #3, Olivera Canyon Creek, Long Canyon Creek, and Cat Canyon Creek (Appendix B – Watershed Map). Cat Canyon Creek and several of the unnamed blue-lines are located within FEMA 100 year floodplains (Figure 5 – FEMA 100 Year Floodplain Map).

A watershed is an area of land that drains water from the hillsides into a common low elevation area, including stream channels, rivers, or lakes. A watershed boundary is the divide that separates one drainage area from another, typically defined by topography, such as a ridge top. The hydrological and ecological functions of a watershed include rainwater collection, water storage, and it provides habitat for plants and animals. The six watersheds contained in the Project Site and the immediate surrounding region are generally defined by the ridgelines above the moderate to steeply incised canyons surrounding the blue-line, and consist of habitats including oak woodland, grasslands, coastal scrub, rocky outcrops, and areas that have been disturbed by past and on-going oil production and agricultural activities.

The blue-lines within the Project Site are ephemeral and remain dry for the majority of the year except during and immediately following rainfall. They do not provide a perennial water supply for aquatic wildlife, such as fish, that rely on a continual water source for survival and/or breeding; however they do provide migration corridors for wildlife and supply water to wetlands that provide habitat for wildlife, including special-status species. The USGS topographic maps illustrate that these blue-lines connect to the adjacent Sisquoc River, and associated floodplain, located to the north of the Project Site (refer to Appendix B). This river is subject to moderate to heavy seasonal flows and provides suitable habitat for a variety of wildlife, including several special-status plants and animals.

The Project footprint will include direct impacts Long Canyon Creek and Cat Canyon Creek. The following sections provide further information specific to these two drainages.
5.1.1 Cat Canyon Creek

Cat Canyon Creek is a blue-line drainage illustrated on USGS imagery. While this drainage is ephemeral, its incisive morphology and channel sand deposits indicate potential to carry high energy, high volume flow from the Project site northward to the Sisquoc River. The Sisquoc River integrates into the Santa Maria River, which provides water storage and drainage for the larger Santa Maria Valley. This riverine system meets with the Pacific Ocean approximately 3,700 feet (0.7 miles) from the Project Site.

Cat Canyon Creek occurs along the western boundary of the Project Site and intersects under the main entrance into the Project Site (Photo 1) through one large culvert (Photo 2).

As proposed, the Project will utilize the existing crossing during the initial Project construction, while concurrently constructing a new Project site entrance located approximately 300 feet northwest (downstream) of the existing entrance. The new site entrance is being developed to safely enable two-way traffic into and out of the Project Site. This existing site entrance will remain in place following construction of the new site entrance across Cat Canyon Creek. A preliminary drawing of the proposed crossing is provided as Figure 6 - Cat Canyon Creek Crossing.
LEGEND:
- Aera Energy LLC Property BSA
- Natural Gas Import Pipeline Route BSA
- Ephemeral Wetland Depression on Aera Energy LLC Property
- 115kV Service Line BSA
- USGS Blue Line Stream
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Other
- Riverine

Source: NAIP 2012 Image, Santa Barbara County, USFWS NWI, TJ Cross 8/20/14, DPSI 2013, Spec Services
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Notes: BSA = Biological Survey Area
This map was created for informational and display purposes only.
LEGEND:
- Aera Energy LLC Property
- USGS Blue Line Drainage
- 100 Year Flood Zone
- Project Site Footprint
- Field Collected OHWM Boundary

Source: County of Santa Barbara, TJCross 8-20-14, DPSI 2013 Land Survey, USGS, Esri Online Imagery Basemap, FEMA
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Notes: This map was created for informational and display purposes only.

EAST CAT CANYON
OIL FIELD REDEVELOPMENT PROJECT

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CAT CANYON CREEK CROSSING

FIGURE 6
During the March 18, 2915 field visit, the location for the proposed Cat Canyon Creek crossing was investigated. The channel of the drainage is primarily bare sand. Indicators of an OHWM were apparent and included identification of a well-defined sandy stream bottom, drift deposits (organic debris collection), narrow berms created by sediment deposits, plant germination, thickening vegetation above the OHWM due to lack of disturbance from moderate events, and transitions in vegetation (Photographs 3 and 4). Within the channel, were occurrences of germination of annual yellow sweet clover (*Melilotus indicus*) and ripgut brome (*Bromus diandrus*) seedlings. The immediate banks were scattered with arroyo willow (*Salix lasiolepis*), mulefat (*Baccharis salicifolia*), blue elderberry (*Sambucus mexicana*), poison oak (*Toxicodendron densilobum*), and sandbar willow (*Salix exigua*). The drainage and its immediate banks are bounded in the upland areas by coast live oak (*Quercus agrifolia*) woodland and California coastal scrub, consisting of black sage (*Salvia mellifera*), coyote brush (*Baccharis pilularis*), and California sagebrush (*Artemisia californica*).
5.1.2 Long Canyon Creek

Long Canyon Creek is a blue-line illustrated on USGS imagery and is topographically lower in elevation than the immediate surroundings, providing a point of water accumulation during periods of rainfall. This drainage is ephemeral and does not provide regular surface water flow. When water is present within the drainage, it flows to the north, through numerous private properties. It is significantly channelized when the drainage meets up with Foxen Canyon Road, and runs along the road, adjacent to rotational agricultural fields, then through the Hansen Aggregates sand and gravel quarry located immediately adjacent to the Sisquoc River. A review of historical aerial images (1938 and 1967) shows that Long Canyon Creek has a historical connection to the Sisquoc River at the location of the quarry (refer to Figure 7 – Historical Aerial Images). More recent aerial images (2014) and a review of Google Earth imagery (2015) indicate that a connection to the Sisquoc River through the quarry may still be present; however, due to access constraints, no field surveys were conducted at the quarry site.

The Project footprint includes three road improvements crossing Long Canyon Creek. The road improvements include one culvert installation and two Arizona crossings. Preliminary drawings of the proposed crossings are provided as Figure 8. Figure 8 also provides the USGS blue-line for Long Canyon.

During the March 18, 2015 field visit, the length of Long Canyon Creek was walked and indicators of an OHWM were intermittent and only observed in some locations. An OWHM was observed and documented (GPS) near the southern-most Project crossing. The Project proposes to improve this existing crossing and install a culvert in the drainage (Photo 5). The OHWM averaged approximately 9 feet wide, and indicators observed included defined sandy channel, erosional rilling, vegetation transitions, and germination of seedlings (Photo 6).

![Photo 5](image1.png) Existing Long Canyon Creek crossing proposed for improvements with a culvert installation (aspect: west).

![Photo 6](image2.png) Immediately downstream of the existing crossing where indicators of an OHWM were observed (aspect: north).
LEGEND:
- Aera Energy LLC Property
- USGS Blue Line Drainage
- 100 Year Flood Zone

Source: FEMA, DPSI 2013 Survey, UCSB MIL, County of Santa Barbara
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Notes: This map was created for informational and display purposes only.
LEGEND:

- Blue: Area Energy LLC Property
- Dashed Blue: USGS Blue Line Stream
- Gray: Project Site Footprint
- Green: Field Collected OHWM Boundary

Source: County of Santa Barbara, TJCross 8-20-14, DPSI 2013 Land Survey, NAIP 2012 Image
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Notes: OHWM = Ordinary High Water Mark
This map was created for informational and display purposes only.

EAST CAT CANYON OIL FIELD REDEVELOPMENT PROJECT
PROJECT NUMBER: 1002-0455
DATE: May 2015
PROJECT NAME: LONG CANYON CREEK CROSSINGS

FIGURE 8
The remaining two Project road improvements within Long Canyon Creek occur at existing road crossings (Photographs 7 and 8). Observations of OHWM indicators were not readily visible at these locations; however, the crossings occur along the lower elevations where water would likely accumulate from the surrounding hillsides. The vegetation at these locations consisted of upland grassland species.

Review of historical aerial imagery illustrates disturbance within the Long Canyon Valley, including tilling of soil for crop production and stock pond creation in the upper reaches of the drainages, upstream from the Project Site. These disturbances may have altered the drainage; however, the valley remains as the low-lying elevation that collects water from the eastern and western facing slopes and provides drainages for the Long Canyon watershed. During the March 2015 field survey, no observations of flow inhibitors, such as earthen dam impoundments, were observed within the Project Site, and road crossings were provided with culverts or were low-lying dirt roads that would not impede flow, when flow is present.

The Long Canyon watershed encompasses 893 acres and ultimately discharges into the Sisquoc River to the north. The soils along the Long Canyon creek corridor are categorized as Hydrological Soils Group C (high runoff potential) and Group A (low runoff potential) located within the channels and along the southern end of the watershed (TJ Cross, 2014). The soil is described as Corralitos Loamy Sand, 2 to 9 percent slopes, and is found in alluvial fan settings (NRCS, 2014). The term alluvial refers to a deposition of sand, silt, or other sediments carried by flowing water.
5.1.3 Wetlands

The Project Site was also investigated for isolated and/or adjacent wetlands that may be afforded Federal protection. The results of a web soil survey (NRCS, 2015), provided as Appendix C – NRCS Custom Soil Resource Report, described the Project Site consisting of steep hillside of well drained, sand and fine sandy loam from soft weathered sandstone/alluvium bedrock (San Andreas-Terra complex and Arnold sand) that drain water into the low-lying valleys that consist of sandy alluvial fans (Corralitos loamy sand) where water infiltrates soon after rainfall. The soil survey indicated that no soils occurring within the Project Site were hydric.

Field visits on January 15 and 16, 2013 (Padre, 2015a), documented pooled water within the Project Site following recorded rainfall of 0.13 inch on January 10, 2013. Several depressional pools were identified along abandoned well pads or containment basins that were previously graded and cleared of vegetation and some with a road base. The majority of the pools did not support vegetation and no endemic vernal pool species were observed during field visits. Few (under twelve) of the pools contained sparse vegetation on the perimeter, consisting primarily of non-native species including brass buttons (Cotula coropifolia), annual rabbitsfoot grass (Polypogon monspeliensis), rattail sixweeks grass (Festuca myuros), and yellow sweet clover (Melilotus indicus). Hydrophytic vegetation was not predominant and hydrology indicators were only present following rainfall and not during the region’s growing season. In addition, all pools were located on disturbed/compacted soils that do not meet hydric soil specifications.

The Project site was visited again on February 13, 2013 (Padre, 2015a), and the pools were all dry except for two that were once used as containment basins during past oil field operations (Pool A and Pool B). Pool B is fenced off from cattle, and during the February 2013 survey, had an impervious concrete/asphalt base with no emergent vegetation. Pool A was open to cattle and other wildlife to use and was underlain by a claypan, which was capable of holding water for longer hydroperiods. Pool A contained non-native brass button patches with component species consisting of parish’s spikerush (Eleocharis parishii), toad rush (Juncus bufonius), yellow sweet clover, rattail sixweeks grass, and annual rabbitsfoot grass.

Follow up spring botanical surveys were completed throughout the month of April 2013 (Padre, 2015), and the only remaining water identified within the Project Site was observed at Pool A where water persisted and a small patch of brass buttons patches was identified and further surveyed using the California Native Plant Society (CNPS) and CDFW Protocol for Combined Vegetation Rapid Assessment and Relevé Sampling (California Native Plant Society, 2011). Data sheets for these surveys are provided within Appendix D – Data Sheets. None of the remaining pools contained sufficient hydrophytic vegetation or hydroperiod consistent with Federal wetland definitions and were not further examined.

During the recent March 18, 2015 field survey, Pool A was surveyed to document wetland characteristics (Photographs 9 and 10). Pool A is a shallow depression with pooled water located on an abandoned well pad, adjacent to an unpaved access road. It is surrounded on one side by a steep cut in the hillside, indicating past land use disturbance. Due to the general site characteristics of Pool A, the pool was characterized as an “atypical situation”, as outlined in Section F of the Corps 1987 Manual. Specifically, Pool A is considered to be man-induced wetland
which is defined as a wetland that has been purposefully or incidentally created by human activities.


During the March 2015 field survey, Padre conducted a routine wetland determination utilizing the Corps 1987 Manual and Corps Arid West Regional Supplement (2008), to further determine if the pool may be provided Federal protection. The Corps defines a wetland using a three parameter test in which all parameters must all occur to be classified as a Federal wetland. These parameters include: hydrology, soil, and vegetation. The vegetation observed included brass buttons (*Cotula coronopifolia*) (obligate wetland always occurring in wetlands), toad rush (*Juncus bufonius*) (facultative wetland usually occurring in wetlands), creeping spike rush (*Eleocharis macrostachya*) (obligate-facultative wetland), and ripgut brome (*Bromus diandrus*) (upland) as dominate plant composition, indicating the presence of hydrophytic vegetation. Hydrology indicators observed include: surface water, high water table, saturation, water marks, aquatic invertebrates, and presence of a shallow aquitard; indicating the presence of wetland hydrology. A soil pit was examined for presence or absence of hydric soil indicators. The soil was identified as a sandy loam with no hydric soil indicators (i.e., redoximorphic features, depleted soils, etc.) observed. Refer to Appendix D for the wetland delineation data sheet. In summary, the wetland delineation concluded that Pool A is not a Federal wetland because positive indicators for at least one of the three parameters is absent, as per paragraph 72, Section F- Atypical Situations of the Corps 1987 Manual.
5.2 NATURAL GAS PIPELINE

The Natural Gas Pipeline route is located under existing paved roads with established culverts that maintain water flow. The Natural Gas Pipeline route is situated along side rotational row-crop agriculture and vineyards, city development, large residential lots grazed by livestock, and open space. During a reconnaissance-level field survey, USGS blue-lines that transect throughout the proposed Natural Gas Pipeline route were observed to be ephemeral and consist of dry, loose sand and rock with moderate to dense scrub and scattered oak woodland habitat. There are also a number or agricultural drainages that are regularly cleared of vegetation and the presence of water is irregular and dependent on crop irrigation cycles.

There are 11 blue-line crossings within the Natural Gas Pipeline route including Cat Canyon Creek, Orcutt Creek, Graciosa Canyon Creek, and eight unnamed drainages (Figure 9 – Natural Gas Pipeline Blue-Line Crossings). The blue-lines located in the western portion of the pipeline route flow northwest into Orcutt Creek, which continues northwest to the Santa Maria River and into the Pacific Ocean. The blue-lines that transect the eastern portion of the Natural Gas Pipeline route generally flow northeast into the Sisquoc/Santa Maria River. As proposed, the Project will incorporate horizontal directional drilling (HDD) techniques to install the pipeline under the blue-line crossings, as necessary.

The blue-line drainages were not surveyed by Padre Biologists due to limited access; however, the drainages were examined from the road right-of-ways and indicators for OHWM were present at each blue-line crossing.

5.3 ELECTRICAL TRANSMISSION LINE

The Electrical Transmission Line is proposed to extend from the western portion of the Project Site to an adjacent parcel to the west. The transmission line transects Cat Canyon Creek and the adjacent Cat Canyon Road; however, proposed Project activities will not result in impacts to the bed or bank of Cat Canyon Creek. The habitat occurring along this route consists primarily of grazed non-native grassland, disturbed scrub, and sparse oak tree canopy. Riparian habitats do not occur in this section of Cat Canyon Creek.
6.0 FEDERALLY PROTECTED PLANT AND WILDLIFE SPECIES

The watersheds and drainages occurring within the Project Site and along the Natural Gas Pipeline route provide a significant nexus for water resource to the Sisquoc River region. During periods of flow in these drainages, they perform numerous beneficial functions for the region, including groundwater recharge, stream recharge, pollution filtration, flood control, and habitat for terrestrial and aquatic wildlife. Although these drainages are ephemeral and do not contain water year round, they continue to perform numerous beneficial functions for wildlife habitat by providing nesting habitat, cover, food, and migratory corridors.

The Project is located within a region known to support several federally listed species, including La Graciosa thistle (*Cirsium scariosum var. loncholepis*), Lompoc yerba santa (*Eriodictyon capitatum*), southern steelhead (*Oncorhynchus mykiss*), California tiger salamander (*Ambystoma californiense*) (CTS), and California red-legged frog (*Rana draytonii*) (CRLF). These species have been documented throughout the region by CDFW’s California Natural Diversity Database (CNDDB) (CDFW, 2015) and/or designated as USFWS Critical Habitat (USFWS, 2015). The table below provides a summary of federally listed species documented in the Project region (USGS quadrangles: Sisquoc, Foxen Canyon, Lompoc, Los Alamos, Orcutt, Santa Maria, Tepusquet Canyon, Twitchell Dam, and Zaca Creek) and a summary of the species’ potential to occur within the Project Site/Natural Gas Pipeline route/Electrical Transmission Line route, their current status, habitat description, and nearest documented occurrence.

**Table 2. Federally Listed Species of the Project Region**

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Regulatory Status ¹</th>
<th>General Habitat Description</th>
<th>Nearest Documented Occurrence</th>
<th>Project Site, Natural Gas Pipeline, Electrical Transmission Line</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Habitat Present</td>
</tr>
<tr>
<td>Plants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Gambel’s water cress</td>
<td><em>Nasturtium gambelii</em></td>
<td>FE, ST, Rank 1B.1</td>
<td>Marshes and swamps (freshwater or brackish).</td>
<td>Barka Slough, San Antonio Valley, approximately four miles from the Natural Gas Pipeline (CDFW, 2015).</td>
<td>X</td>
</tr>
<tr>
<td>Gaviota tarplant</td>
<td><em>Deinandra increscens</em> ssp. <em>villosa</em></td>
<td>FE, SE Rank 1B.1</td>
<td>Coastal scrub, valley and foothill grassland, coastal bluff scrub.</td>
<td>3.5 miles west of Orcutt on Highway 1; approximately 13 miles from the Project site (CDFW, 2015). Potential for occurrence along the Natural Gas Pipeline.</td>
<td>X</td>
</tr>
<tr>
<td>La Graciosa thistle</td>
<td><em>Cirsium scariosum var. loncholepis</em></td>
<td>FE, ST Rank 1B.1</td>
<td>Mesic and sandy cismontane woodland, coastal dunes, riparian scrub, brackish marshes, valley and foothill grassland.</td>
<td>Canada de Las Flores; 2.5 miles north of Los Alamos Valley; approximately 4.0 miles from the Project site (CDFW, 2015). Potential for occurrence along the Natural Gas Pipeline.</td>
<td>X</td>
</tr>
<tr>
<td>Lompoc yerba santa</td>
<td><em>Eriodictyon capitatum</em></td>
<td>FE, SR, Rank 1B.2</td>
<td>Closed-cone coniferous forest, maritime chaparral.</td>
<td>Orcutt Oil Field; Graciosa Ridge; Solomon Hills; 6.7 miles west of the Project site (CDFW, 2015).</td>
<td>X</td>
</tr>
</tbody>
</table>

¹ Regulatory Status: FE = Federal Endangered; ST = State Threatened; SR = State Rare; Rank 1B.1 = Species of greatest concern; Rank 1B.2 = Species of special concern.
## Table 2. Federally Listed Species of the Project Region

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Regulatory Status</th>
<th>General Habitat Description</th>
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<th>Project Site, Natural Gas Pipeline, Electrical Transmission Line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common Name</strong></td>
<td></td>
<td></td>
<td></td>
<td>Habitat Present Occurrence ≤ Five Miles Potential for Occurrence</td>
</tr>
<tr>
<td><strong>Scientific Name</strong> (Arranged alphabetically by scientific name)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Regulatory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Common Name</strong></td>
<td><strong>Scientific Name</strong></td>
<td><strong>General Habitat Description</strong></td>
<td><strong>Nearest Documented Occurrence</strong></td>
<td><strong>Project Site, Natural Gas Pipeline, Electrical Transmission Line</strong></td>
</tr>
<tr>
<td><strong>Vandenberg monkeyflower</strong></td>
<td>Mimulus fremontii var. vandenbergensis</td>
<td>Chaparral (Burton Mesa), cismontane woodland. Sandy, often disturbed areas.</td>
<td>La Purisima Mission State Historic Park; approximately 11.8 miles from the Project site (CDFW, 2015).</td>
<td>X</td>
</tr>
<tr>
<td><strong>Invertebrates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vernal pool fairy shrimp</strong></td>
<td>Branchinecta lynchii</td>
<td>Vernal pools.</td>
<td>Wet season protocol-level surveys within the Project site resulted in negative findings (Padre, 2015). Nearest occurrence in Sargent Fee (Padre, 2010), within one mile from the proposed Natural Gas Pipeline.</td>
<td>X X</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Southern steelhead</strong></td>
<td>Oncorhynchus mykiss irideus</td>
<td>Warmer waters and more variable conditions from Santa Maria river into San Diego County.</td>
<td>USFWS critical habitat occurs along the Sisquoc River, within one mile of the Project Site.</td>
<td>X</td>
</tr>
<tr>
<td><strong>Unarmored threespine stickleback</strong></td>
<td>Gasterosteus aculeatus williamsoni</td>
<td>Weedy pools, backwaters and emergent vegetation at the stream edge in small southern California streams.</td>
<td>Nearest known location: San Antonio Creek, greater than five miles from the Project Site (CDFW, 2015).</td>
<td>X</td>
</tr>
<tr>
<td><strong>Amphibians</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Arroyo toad</strong></td>
<td>Anaxyrus californicus</td>
<td>Rivers with sandy banks, willows, cottonwoods, and sycamores; loose, gravelly areas of streams in drier parts of range.</td>
<td>Nearest known location: Sisquoc River, approximately 3.8 miles north-northwest of the Project Site (CDFW, 2015).</td>
<td>X</td>
</tr>
<tr>
<td><strong>California red-legged frog</strong></td>
<td>Rana draytonii</td>
<td>Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation.</td>
<td>Nearest known location: along the Sisquoc River, approximately 2.5 miles north and northeast of the Project Site (CDFW, 2015).</td>
<td>X X</td>
</tr>
<tr>
<td><strong>California tiger salamander</strong></td>
<td>Ambystoma californiense</td>
<td>Need underground refuges, especially ground squirrel burrows and vernal pools or other seasonal water sources for breeding.</td>
<td>Nearest known location: east round pond located east of Highway 101, approximately 4.2 miles southwest of the Project Site (CDFW, 2015).</td>
<td>X X X</td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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<tr>
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<th>Project Site, Natural Gas Pipeline, Electrical Transmission Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Bell's vireo</td>
<td>Vireo bellii pusillus</td>
<td>FE, SE, M</td>
<td>Low riparian in vicinity of water or in dry river bottoms, below 2000 feet.</td>
<td>Nearest known location: Sisquoc River in Foxen Canyon, approximately three miles east-northeast of Project Site. (CDFW, 2014). Protocol level surveys were completed by Padre in 2014 and no least Bell's vireo were detected at the Project Site (Padre, 2015).</td>
<td>X</td>
</tr>
</tbody>
</table>

**Notes:**

Status Codes:

- **FT** Federal Threatened (USFWS/NMFS)
- **ST** State Threatened (CDFW)
- **FE** Federal Endangered (USFWS/NMFS)
- **SE** State Endangered (CDFW)
- **SR** State Rare (CDFW)

G1/S1 Global/State Rank, less than 6 viable element occurrences (Eos) OR less than 1,000 individuals OR less than 2,000 acres. Critically Imperiled – At very high risk of extinction or elimination due to extreme rarity, very steep declines, or other factors.

G2/S2 Global/State Rank, 6-20 Eos OR 1,000-3,000 individuals OR 2,000-10,000 acres. Imperiled – At high risk of extinction or elimination due to very restricted range, very few populations or occurrences, steep declines, or other factors.

G3/S3 Global/State Rank, 21-80 Eos or 3,000-10,000 individuals OR 10,000-50,000. Vulnerable – At moderate risk of extinction or elimination due to a restricted range, relatively few populations or occurrences, recent and widespread declines, or other factors.

G4/S4 Global/State Rank. Apparently secure – this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat

G5/S5 Global/State Rank. Common, widespread, and abundant. Population or stand demonstrably secure to ineradicable due to being commonly found in the world

SH/GH Global/State Rank. Possibly Extinct – Known from only historical occurrences but still some hope of rediscovery.
Table 3 provides a summary of Critical Habitats occurring within ten miles of the Project Site. Figure 10 – Federally Protected Biological Resources within Project Vicinity provides illustration of federally listed species and designated Critical Habitat within ten miles of the Project Site.

Table 3. Critical Habitat Occurring Within Ten Miles of the Project Site

<table>
<thead>
<tr>
<th>Critical Habitat</th>
<th>Distance from Project Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arroyo Toad Critical Habitat</td>
<td>2.5 miles east</td>
</tr>
<tr>
<td>California Red-Legged Frog Critical Habitat</td>
<td>5.5 miles northeast</td>
</tr>
<tr>
<td>California Tiger Salamander Critical Habitat</td>
<td>3.3 miles southwest</td>
</tr>
<tr>
<td>La Graciosa Thistle Critical Habitat</td>
<td>3.0 miles southwest</td>
</tr>
<tr>
<td>Lompoc Yerba Santa Critical Habitat</td>
<td>5.4 miles west</td>
</tr>
<tr>
<td>Southern Steelhead Critical Habitat</td>
<td>0.7 miles north-northeast</td>
</tr>
<tr>
<td>Vandenberg Monkeyflower Critical Habitat</td>
<td>5.8 miles south</td>
</tr>
</tbody>
</table>
Further discussion below is provided for the species that have a potential to occur in the Project Site, along the proposed utility corridors, and/or the Project occurs within ten miles from designated Critical Habitat (Figure 10).

**Arroyo Toad Critical Habitat.** No federally designated Critical Habitat for arroyo toad (*Bufo californicus*) occurs within the Project Site, Natural Gas Pipeline, or Electrical Transmission Line; however, it does occur to the east within 2.5 miles of the Project site in the upstream reaches of the Sisquoc River.

**California red-legged frog.** Critical Habitat for the CRLF does not occur within the Project Site, Natural Gas Pipeline, or Electrical Transmission Line; however, it does occur within a five mile radius of the Project Site and immediately adjacent to the proposed Natural Gas Pipeline route along Graciosa Road, near the western terminus of the proposed pipeline corridor. The CNDDB query resulted in the identification of several documented occurrences of CRLF within five miles of the Project Site (CDFW, 2015). These occurrences are primarily located within pools/ponds along the Sisquoc River to the north of the Project Site. No CRLF have been documented within the Project Site. CRLF have been documented to the south of Project Site by Sage Institute, Inc. (2012) in a small stock pond (pond “E”) during a CRLF eye-shine survey in June of 2011. Suitable breeding habitat does not occur within the Project site or within the Project utility corridors; however, CRLF may utilize portions of the Project Site for migratory routes to suitable breeding ponds. Following discussions with the USFWS, protocol-level CRLF surveys were deemed not warranted due to lack of suitable habitat within the Project Site.

**California tiger salamander.** The Project is located within the Santa Barbara County Distinct Population Segment (DPS) for federally Endangered CTS, and is located between three distinct DPS Critical Habitat Units provided protection by the USFWS: Unit 1 – Western Santa Maria/Orcutt, Unit 2 – Eastern Santa Maria, and Unit 3 – Western Los Alamos/Careaga. The Project Site is located within five miles from Critical Habitat for this species (USFWS, 2005) and documented breeding pools (Storrer, 2013). The Natural Gas Pipeline route is located along the southern border of the Critical Habitat and occurs within one mile from a known breeding pond (TWDA-12), located near East Clark Avenue and Dominion Road. The USFWS has also identified several pools with aerial imagery that have not necessarily been surveyed and may or may not contain suitable breeding or upland habitat; however, the USFWS is interested in their protection (USFWS, 2010). Two of these ponds are referred to as: Olivera Canyon Pond (SISQ-20), located within the Project Site (not within the Project footprint), and Long Canyon Pond (SISQ-19), located on a parcel adjacent to the Project Site. Olivera Canyon Pond does not hold water for long durations, did not hold water following any given rain event in the winter months of 2013, 2014, or 2015, and therefore has not been subject to aquatic sampling. Long Canyon Pond is located on private property and there is limited access and information available. However, based on historical aerial photo review, this feature appears to hold water for a significant period of time following rainfall. No aquatic surveys have been performed at Long Canyon Pond. Although not identified as a potential breeding pond by USFWS, aquatic sampling was conducted at Pool A (referenced above) in March and May of 2015. Results of the sampling were negative for CTS.
A CTS habitat assessment completed by Mr. Vince Semenson in 2007 and a second completed by Storrer Environmental in 2011 determined that upland habitat within the Project Site was not suitable for CTS. Surveys completed by Sage Institute, Inc. (2012) identified several small stock ponds within the adjacent ERG Operating Company, LLC property to the immediate west of the Project Site that may also provide suitable habitat for CTS. Aquatic surveys of these ponds were carried out by ERG Resources LLC consultant, Paul Collins, and concluded that no CTS were found (Collins, 2014). Despite these conclusions, discussions with the USFWS and CDFW indicated that protocol-level surveys were necessary to determine presence or absence of the species occurring within the Project Site. Based on these agency discussions, an upland drift net array was designed to capture the most plausible salamander movements through the Project Site. This ‘most plausible pathways’ driftnet survey approach was chosen over the standard USFWS protocol, due to the infeasibility of covering 95 percent of the property boundary. These surveys were approved by the USFWS and CDFW and initiated in October of 2014. The drift nets were removed in May and resulted in no observations of CTS or any other federally listed species.

Within the Project footprint, and within the proposed routes for the Natural Gas Pipeline and Electrical Transmission Line, Project activities are not expected to include any activities in or adjacent to any known pools with the potential to support California tiger salamander.

**Gambel’s watercress.** No Gambel’s watercress was observed within the Project Site, Natural Gas Pipeline, or Electrical Transmission Line; however, suitable habitat may occur in wetland and grassland communities adjacent to the Natural Gas Pipeline. Additionally, a common species of watercress (*Nasturtium officinale*) was observed within a small drainage feature along Graciosa Road near the Natural Gas Pipeline route, and as such, indicates that there is potential for Gambel’s watercress to occur. The Natural Gas Pipeline route is proposed in the existing roadway; therefore, Project activities are not expected to include any vegetation or topsoil removal that may contain a potential seed bank for this species.

**Gaviota tarplant.** No Critical Habitat for federally Endangered Gaviota tarplant occurs in the Project Site, Natural Gas Pipeline, or Electrical Transmission Line. The CNNDB query resulted in the nearest documented occurrence approximately 13 miles northwest of the Project Site (CDFW, 2015). Additionally, the closest critical habitat unit, the Gaviota Tarplant Sudden Peak Unit, occurs more than 20 miles to the southwest of the Project Site and the Electrical Transmission Line route and approximately 16 miles southwest of the western terminus of the Natural Gas Pipeline route. No Gaviota tarplant was observed during appropriately timed botanical surveys within the Project Site completed in 2014 (Padre, 2015).

**La Graciosa thistle.** No Critical Habitat for federally Endangered La Graciosa thistle occurs in the Project Site or Electrical Transmission Line; however, the Santa Maria River-Orcutt Creek Critical Habitat Unit (No. 2) occurs along Graciosa Road in the western portion of the proposed Natural Gas Pipeline. Additionally, the Cañada de Las Flores Critical Habitat Unit (No. 3) occurs within five miles to the south of the Natural Gas Pipeline. The Natural Gas Pipeline route is proposed in the existing roadway; therefore, Project activities are not expected to result in impacts to Critical Habitat. No La Graciosa thistle was observed during appropriately timed botanical surveys within the Project Site completed in 2014 (Padre, 2015).
Lompoc Yerba Santa Critical Habitat. No federally designated Critical Habitat for Lompoc yerba santa (*Eriodictyon capitatum*) occurs within the Project Site, Natural Gas Pipeline, or Electrical Transmission Line; however, the Lompoc Yerba Santa - Solomon Hills Unit is located approximately 5.4 miles west of the Project Site, five miles west of portions of the Electrical Transmission Line, and approximately 0.8 mile east of the western terminus of the Natural Gas Pipeline near Graciosa Road.

Southern steelhead. The Sisquoc River is designated as an evolutionary significant unit (ESU) for federally Endangered southern steelhead and designated Critical Habitat regulated by the NMFS. This river does not intersect the Project Site, Natural Gas Pipeline, or Electrical Transmission Line; however, Cat Canyon Creek and Orcutt Creek are tributaries within this system.

Vandenberg monkeyflower. No Critical Habitat for federally Endangered Vandenberg monkeyflower occurs in the Project Site, Natural Gas Pipeline, or Electrical Transmission Line. The CNDDB query resulted in the nearest documented occurrence approximately 11.8 miles southwest of the Project Site (CDFW, 2015). Designated Critical Habitat including the following Critical Habitat Units, the Vandenberg Unit (No. 1), Santa Lucia Unit (No. 2), the Encina Unit (No. 3), and the La Purisima Unit (No. 4), occur more than 10 miles to the southwest of the Project site and Electrical Transmission Line route; however, are approximately six miles from the western terminus of the Natural Gas Pipeline route. No Vandenberg monkeyflower was observed during appropriately timed botanical surveys within the Project Site completed in 2014 (Padre, 2015).
7.0 SUMMARY AND DISCUSSION

USGS blue-lines identified within the Project Site include Cat Canyon Creek, Long Canyon Creek, and Olivera Canyon Creek, as well as three additional unnamed drainages. Construction of Project entrances will impact Cat Canyon Creek and Long Canyon Creek. The proposed Natural Gas Pipeline route will intersect 11 USGS blue-lines by methods of HDD. The Electrical Transmission Line will transect Cat Canyon Creek; however, the proposed activities associated with these utilities will not result in impacts to the bed or bank of the drainage.

On March 18, 2015, Padre Biologists completed a field visit to the Project Site to identify the extent of jurisdictional waters within the limits of the Project footprint, and any isolated wetlands that may be impacted by Project activities. The information obtained from this field visit and during the desktop review was used to analyze the extent of water resources within the Project footprint. In addition, a desktop review and previous surveys conducted in 2013 and 2014 along the proposed Natural Gas Pipeline route were used to analyze the extent of water resources that intersect the route.

The extent of Federal jurisdiction is often determined by the OHWM. A clearly defined OHWM was evident during field surveys within Cat Canyon Creek, within the proposed Project footprint. This area is likely afforded protection by the CWA. The OHWM along Long Canyon Road has been disturbed, and is intermittently visible, or absent, at many locations. Drought, agriculture, and ranching activities have likely contributed to these conditions. The most problematic OHWM delineations are associated with the commonly occurring ephemeral/intermittent channel forms that dominate the Arid West landscape. The climate of the region drastically influences the hydrology, channel-forming processes, and distribution of OHWM indicators such that delineations can be inconsistent (over space and time) and problematic (Lichvar, 2008). Despite the lack of a continuous and distinct OHWM, it is evident that the location of Long Canyon Creek provides the main drainage for the watershed in this area, which is further supported by the occurrence of alluvial soils. In addition, historical aerial photographs and current Google Earth imagery shows a connection to the Sisquoc River.

The agencies will decide jurisdiction over the following types of waters when they have a significant nexus with a traditional navigable water: (1) non-navigable tributaries that are not relatively permanent, (2) wetlands adjacent to non-navigable tributaries that are not relatively permanent, and (3) wetlands adjacent to, but not directly abutting, a relatively permanent tributary (e. a., separated from it by uplands, a berm, dike or similar feature) (EPA, 2008). Based on figures and information provided in this report, Long Canyon Creek may be considered a non-navigable tributary that is not relatively permanent that has a significant nexus to a TNW (via the Sisquoc River) and is likely afforded protection by the CWA.

The 11 blue-lines intersecting the proposed Natural Gas Pipeline displayed identifying features of an OHWM. However, due to the use of HDD methods, no impacts are expected as a result of pipeline installation activities, and as such no protection is necessary under the CWA, and likely will not be regulated by the Corps. The March 2015 field survey, and previous field surveys, did not result in the identification in isolated wetlands within the Project Site or along the proposed utility lines.
Federally listed Threatened and Endangered species may occur in the Project Site and surrounding region, including within the Natural Gas Pipeline route. These species include La Graciosa thistle, Gaviota tarplant, Vandenberg monkeyflower, southern steelhead, CTS, and CRLF. None of these species were identified during field surveys of the Project area; however protocol surveys were not conducted. The Corps has jurisdiction over the water resources located within the Project Site that are subject to the CWA. The Corps may also elect to assert “control and responsibility” for portions of the Project located outside of (upland from) Corps-regulated waters due to the potential presence of Threatened and Endangered species that are protected under the FESA and therefore contribute to the cumulative Federal control and responsibility of the entire Project Site.
8.0 LITERATURE CITED


California Department of Fish and Wildlife (CDFW). 2015. California Natural Diversity Database (CNDDB) Rare Find. Twitchell Dam, Tepusquet Canyon, Sisquoc, Orcutt, Lompoc, Los Alamos, Zaca Creek, Foxen Canyon, and Santa Maria Quadrangles.

Collins, Paul W. and Peter Gaede. 2014. California Tiger Salamanders (Ambystoma californiense) Upland and Aquatic Survey Results 2013/2014 ERG West Cat Canyon Lease in Northern Santa Barbara County, California. Prepared for ERG Operating Company LLC, Santa Maria, CA.


Natural Resources Conservation Service (NRCS). 2006. Field Indicators of Hydric Soils in the United States, Version 6.0. G.W. Hurt, L.M. Vasilas, editors. United States Department of Agriculture (USDA), NRCS, in cooperation with the National Technical Committee for Hydric Soils, Fort Worth, TX.


This preliminary JD finds that there “may be” waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

### Preliminary Jurisdictional Determination Form

<table>
<thead>
<tr>
<th>District Office</th>
<th>Los Angeles District</th>
<th>File/ORM #</th>
<th>PJD Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>CA</td>
<td>City/County</td>
<td>Santa Barbara County</td>
</tr>
<tr>
<td>Nearest Waterbody:</td>
<td>Cat Canyon Creek/Sisquoc River/Pacific Ocean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location: TRS, Lat.Long or UTM:</td>
<td>Lat. 34.826790° Long. -120.285275°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name/ Address of Person Requesting PJD</td>
<td>Aera Energy LLC PO Box 11164 Bakersfield, CA 93389-1164</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Identify (Estimate) Amount of Waters in the Review Area:

<table>
<thead>
<tr>
<th>Non-Wetland Waters:</th>
<th>Stream Flow:</th>
<th>Wetlands:</th>
</tr>
</thead>
<tbody>
<tr>
<td>linear ft width</td>
<td>Ephemeral</td>
<td>acre(s) Cowardin Class: N/A</td>
</tr>
</tbody>
</table>

#### Name of Any Water Bodies on the Site Identified as:

- Section 10 Waters: [ ]
- Tidal: [ ]
- Non-Tidal: [ ]

- 7.5 Sisquoc / Orcutt Quadrangles
- Custom Soil Report Prepared January 2015
- National wetlands inventory map(s). Cite name: [Sisquoc/Orcutt quads: Prepared January 2015]
- USDA Natural Resources Conservation Service Soil Survey. Citation: [ ]
- USGS HND data. [ ]
- USGS 8 and 12 digit HUC maps. [ ]
- U.S. Geological Survey map(s). Cite quad name: [ ]
- FEMA/FIRM maps: [USGS topo quad FEMA]
- 100-year Floodplain Elevation is: [ ]
- Photographs: [ ]
- Aerial (Name & Date): NAIP 2012
- Other (Name & Date): [ ]

#### Other information (please specify): [ ]

#### Important Note: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

---

**EXPLANATION OF PRELIMINARY AND APPROVED JURISDICTIONAL DETERMINATIONS:**

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.  
2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring “preconstruction notification” (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant’s acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and in that any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.
This preliminary JD finds that there "may be" waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

Appendix A - Sites

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Cowardin Class</th>
<th>Est. Amount of Aquatic Resource in Review Area</th>
<th>Class of Aquatic Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>34.820321°</td>
<td>-120.287369°</td>
<td>Riverine</td>
<td>0.01 acre</td>
<td>Non-Section 10 non-wetland</td>
</tr>
<tr>
<td>2</td>
<td>34.824039°</td>
<td>-120.266616°</td>
<td>Riverine</td>
<td>0.03</td>
<td>Non-Section 10 non-wetland</td>
</tr>
<tr>
<td>3</td>
<td>34.833291°</td>
<td>-120.271361°</td>
<td>Riverine</td>
<td>0.01</td>
<td>Non-Section 10 wetland</td>
</tr>
<tr>
<td>4</td>
<td>34.835228°</td>
<td>-120.273718°</td>
<td>Riverine</td>
<td>&lt;0.001</td>
<td>Non-Section 10 non-wetland</td>
</tr>
</tbody>
</table>

Notes:

Site 1. Cat Canyon Creek proposed impact area (bridge)
Site 2. Long Canyon Creek proposed impact area (culvert; south)
Site 3. Long Canyon creek proposed impact area (Arizona crossing; mid)
Site 4. Long Canyon creek proposed impact area (Arizona crossing; north). As proposed, the Arizona crossing is located slightly north of the existing culvert that directs flow under Long Canyon Road. As such, impacts may be limited to associated grading of the area during construction.

For maps, plans, and photographs, please refer to the following document:

APPENDIX B

Watershed Map
APPENDIX C

Soil Report Summary Map
NRCS Custom Soil Resource Report
Custom Soil Resource Report for
Northern Santa Barbara Area, California

Aera Energy LLC East Cat Canyon
Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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    ChG—Chamise shaly loam, 45 to 75 percent slopes ............................. 18
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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the
individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.
The soil surveys that comprise your AOI were mapped at 1:20,000. Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Northern Santa Barbara Area, California
Survey Area Data: Version 9, Sep 25, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 7, 2010—Jun 10, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
## Map Unit Legend

<table>
<thead>
<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArD</td>
<td>Arnold sand, 5 to 15 percent slopes</td>
<td>6.3</td>
<td>0.3%</td>
</tr>
<tr>
<td>ArF</td>
<td>Arnold sand, 15 to 45 percent slopes</td>
<td>467.1</td>
<td>21.7%</td>
</tr>
<tr>
<td>CeE2</td>
<td>Chamise sandy loam, 5 to 30 percent slopes, eroded</td>
<td>19.7</td>
<td>0.9%</td>
</tr>
<tr>
<td>ChD</td>
<td>Chamise shaly loam, 9 to 15 percent slopes</td>
<td>134.1</td>
<td>6.2%</td>
</tr>
<tr>
<td>ChF</td>
<td>Chamise shaly loam, 15 to 45 percent slopes</td>
<td>317.6</td>
<td>14.7%</td>
</tr>
<tr>
<td>ChG</td>
<td>Chamise shaly loam, 45 to 75 percent slopes</td>
<td>320.3</td>
<td>14.9%</td>
</tr>
<tr>
<td>ChG2</td>
<td>Chamise shaly loam, 30 to 75 percent slopes, eroded</td>
<td>12.3</td>
<td>0.6%</td>
</tr>
<tr>
<td>CtD</td>
<td>Corralitos sand, 2 to 15 percent slopes</td>
<td>32.8</td>
<td>1.5%</td>
</tr>
<tr>
<td>CtD2</td>
<td>Corralitos sand, 2 to 15 percent slopes, eroded</td>
<td>12.0</td>
<td>0.6%</td>
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<td>CuC</td>
<td>Corralitos loamy sand, 2 to 9 percent slopes</td>
<td>87.1</td>
<td>4.0%</td>
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<tr>
<td>CuD</td>
<td>Corralitos loamy sand, 9 to 15 percent slopes</td>
<td>21.6</td>
<td>1.0%</td>
</tr>
<tr>
<td>EdC2</td>
<td>Elder sandy loam, 2 to 9 percent slopes, eroded</td>
<td>13.9</td>
<td>0.6%</td>
</tr>
<tr>
<td>EdD2</td>
<td>Elder sandy loam, 9 to 15 percent slopes, eroded</td>
<td>72.3</td>
<td>3.4%</td>
</tr>
<tr>
<td>PtD</td>
<td>Positas fine sandy loam, 9 to 15 percent slopes</td>
<td>57.9</td>
<td>2.7%</td>
</tr>
<tr>
<td>RuG</td>
<td>Rough broken land</td>
<td>153.9</td>
<td>7.1%</td>
</tr>
<tr>
<td>SfD</td>
<td>San Andreas-Tierra complex, 5 to 15 percent slopes</td>
<td>12.1</td>
<td>0.6%</td>
</tr>
<tr>
<td>SfE</td>
<td>San Andreas-Tierra complex, 15 to 30 percent slopes</td>
<td>21.1</td>
<td>1.0%</td>
</tr>
<tr>
<td>SfG</td>
<td>San Andreas-Tierra complex, 30 to 75 percent slopes</td>
<td>386.6</td>
<td>17.9%</td>
</tr>
<tr>
<td>Sh</td>
<td>Sandy alluvial land</td>
<td>6.1</td>
<td>0.3%</td>
</tr>
<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td><strong>2,154.9</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a soil series. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into soil phases. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly
indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A complex consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An association is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An undifferentiated group is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include miscellaneous areas. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.
Northern Santa Barbara Area, California

ArD—Arnold sand, 5 to 15 percent slopes

Map Unit Setting

- National map unit symbol: hbwb
- Elevation: 200 to 1,500 feet
- Mean annual precipitation: 14 to 18 inches
- Mean annual air temperature: 57 degrees F
- Frost-free period: 260 to 300 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Arnold and similar soils: 85 percent
- Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arnold

Setting

- Landform: Hills, ridges
- Landform position (two-dimensional): Backslope
- Landform position (three-dimensional): Side slope
- Down-slope shape: Convex
- Across-slope shape: Convex
- Parent material: Residuum weathered from sandstone

Typical profile

- H1 - 0 to 23 inches: sand
- H2 - 23 to 55 inches: sand
- H3 - 55 to 59 inches: weathered bedrock

Properties and qualities

- Slope: 5 to 15 percent
- Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
- Natural drainage class: Somewhat excessively drained
- Runoff class: Very low
- Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

- Land capability classification (irrigated): 4e
- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: A
- Ecological site: Sandy (R015XD055CA)

Minor Components

San andreas

- Percent of map unit: 5 percent
Santa lucia
Percent of map unit: 3 percent

Crow hill
Percent of map unit: 3 percent

Chamise
Percent of map unit: 2 percent

Linne
Percent of map unit: 2 percent

ArF—Arnold sand, 15 to 45 percent slopes

Map Unit Setting
National map unit symbol: hbwc
Elevation: 200 to 1,500 feet
Mean annual precipitation: 12 to 23 inches
Mean annual air temperature: 57 to 59 degrees F
Frost-free period: 260 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition
Arnold and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the map unit.

Description of Arnold
Setting
Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone

Typical profile
H1 - 0 to 23 inches: sand
H2 - 23 to 55 inches: sand
H3 - 55 to 59 inches: weathered bedrock

Properties and qualities
Slope: 15 to 45 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None  
Available water storage in profile: Low (about 3.6 inches)

**Interpretive groups**
- Land capability classification (irrigated): 6e
- Land capability classification (nonirrigated): 6e
- Hydrologic Soil Group: A
- Ecological site: Sandy (R015XD055CA)

**Minor Components**
- **San andreas**
  - Percent of map unit: 5 percent
- **Crow hill**
  - Percent of map unit: 3 percent
- **Santa lucia**
  - Percent of map unit: 3 percent
- **Chamise**
  - Percent of map unit: 2 percent
- **Linne**
  - Percent of map unit: 2 percent

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**CeE2—Chamise sandy loam, 5 to 30 percent slopes, eroded**

**Map Unit Setting**
- National map unit symbol: hbxh
- Elevation: 200 to 1,500 feet
- Mean annual precipitation: 12 to 20 inches
- Mean annual air temperature: 57 degrees F
- Frost-free period: 240 to 300 days
- Farmland classification: Not prime farmland

**Map Unit Composition**
- Chamise and similar soils: 85 percent
- Minor components: 10 percent
- Estimates are based on observations, descriptions, and transects of the map unit.

**Description of Chamise**

**Setting**
- Landform: Terraces
- Landform position (two-dimensional): Toeslope
- Landform position (three-dimensional): Tread
- Down-slope shape: Linear
- Across-slope shape: Linear
- Parent material: Alluvium

**Typical profile**
- H1 - 0 to 16 inches: sandy loam
H2 - 16 to 22 inches: shaly clay
H3 - 22 to 35 inches: very shaly clay
H4 - 35 to 60 inches: very shaly clay loam

Properties and qualities
- **Slope:** 5 to 30 percent
- **Depth to restrictive feature:** 16 to 40 inches to strongly contrasting textural stratification
- **Natural drainage class:** Well drained
- **Runoff class:** Very high
- **Capacity of the most limiting layer to transmit water (Ksat):** Moderately low to moderately high (0.06 to 0.20 in/hr)
- **Depth to water table:** More than 80 inches
- **Frequency of flooding:** None
- **Frequency of ponding:** None
- **Available water storage in profile:** Very low (about 1.8 inches)

Interpretive groups
- **Land capability classification (irrigated):** 4e
- **Land capability classification (nonirrigated):** 4e
- **Hydrologic Soil Group:** C
- **Other vegetative classification:** LOAMY (015XD047CA_1)

Minor Components
- **Unnamed**
  - **Percent of map unit:** 10 percent
- **Chamise, sh-l**
  - **Percent of map unit:**

ChD—Chamise shaly loam, 9 to 15 percent slopes

Map Unit Setting
- **National map unit symbol:** hbxl
- **Elevation:** 200 to 1,500 feet
- **Mean annual precipitation:** 12 to 20 inches
- **Mean annual air temperature:** 57 degrees F
- **Frost-free period:** 240 to 300 days
- **Farmland classification:** Not prime farmland

Map Unit Composition
- **Chamise and similar soils:** 85 percent
- **Minor components:** 15 percent
  - Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chamise

Setting
- **Landform:** Terraces
- **Landform position (two-dimensional):** Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 18 inches: shaly loam
H2 - 18 to 24 inches: shaly clay
H3 - 24 to 37 inches: very shaly clay
H4 - 37 to 60 inches: very shaly clay loam

Properties and qualities
Slope: 9 to 15 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups
Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: LOAMY (015XD047CA_1)

Minor Components
Unnamed
Percent of map unit: 10 percent

Chamise, loam
Percent of map unit: 5 percent

ChF—Chamise shaly loam, 15 to 45 percent slopes

Map Unit Setting
National map unit symbol: hbxm
Elevation: 200 to 1,500 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition
Chamise and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chamise

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 18 inches: shaly loam
H2 - 18 to 24 inches: shaly clay
H3 - 24 to 37 inches: very shaly clay
H4 - 37 to 60 inches: very shaly clay loam

Properties and qualities

Slope: 15 to 45 percent
Depth to restrictive feature: 18 to 40 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: LOAMY (015XD047CA_1)

Minor Components

Tierra
Percent of map unit: 5 percent

Unnamed
Percent of map unit: 5 percent

Chamise, sandy loam
Percent of map unit: 5 percent

ChG—Chamise shaly loam, 45 to 75 percent slopes

Map Unit Setting

National map unit symbol: hbxn
Elevation: 200 to 1,500 feet
Mean annual precipitation: 12 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition
Chamise and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chamise

Setting
Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 18 inches: shaly loam
H2 - 18 to 24 inches: shaly clay
H3 - 24 to 37 inches: very shaly clay
H4 - 37 to 60 inches: very shaly clay loam

Properties and qualities
Slope: 45 to 75 percent
Depth to restrictive feature: 18 to 30 inches to strongly contrasting textural stratification
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups
Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Steep loamy (R015XD116CA)

Minor Components

Unnamed
Percent of map unit: 10 percent

Chamise, sh-l
Percent of map unit: 5 percent
ChG2—Chamise shaly loam, 30 to 75 percent slopes, eroded

Map Unit Setting
  National map unit symbol: hbxp
  Elevation: 200 to 1,500 feet
  Mean annual precipitation: 12 to 20 inches
  Mean annual air temperature: 57 degrees F
  Frost-free period: 240 to 300 days
  Farmland classification: Not prime farmland

Map Unit Composition
  Chamise and similar soils: 85 percent
  Minor components: 15 percent
  Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chamise

Setting
  Landform: Terraces
  Landform position (two-dimensional): Toeslope
  Landform position (three-dimensional): Tread
  Down-slope shape: Linear
  Across-slope shape: Linear
  Parent material: Alluvium

Typical profile
  H1 - 0 to 10 inches: shaly loam
  H2 - 10 to 16 inches: shaly clay
  H3 - 16 to 29 inches: very shaly clay
  H4 - 29 to 60 inches: very shaly clay loam

Properties and qualities
  Slope: 30 to 75 percent
  Depth to restrictive feature: 10 to 20 inches to strongly contrasting textural stratification
  Natural drainage class: Well drained
  Runoff class: Very high
  Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
  Depth to water table: More than 80 inches
  Frequency of flooding: None
  Frequency of ponding: None
  Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups
  Land capability classification (irrigated): 7e
  Land capability classification (nonirrigated): 7e
  Hydrologic Soil Group: C
  Ecological site: Shallow loamy (R015XD093CA)
Minor Components

Unnamed

Percent of map unit: 15 percent

CtD—Corralitos sand, 2 to 15 percent slopes

Map Unit Setting

National map unit symbol: hby0
Elevation: 100 to 800 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 250 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Corralitos and similar soils: 85 percent
Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the map unit.

Description of Corralitos

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

H1 - 0 to 20 inches: sand
H2 - 20 to 60 inches: sand

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy (R015XD055CA)

Minor Components

Elder
  Percent of map unit: 5 percent

Arnold
  Percent of map unit: 5 percent

Gullied land
  Percent of map unit: 4 percent

Riverwash
  Percent of map unit: 1 percent
  Landform: Drainageways

CtD2—Corralitos sand, 2 to 15 percent slopes, eroded

Map Unit Setting
  National map unit symbol: hby1
  Elevation: 100 to 800 feet
  Mean annual precipitation: 14 to 18 inches
  Mean annual air temperature: 59 to 61 degrees F
  Frost-free period: 250 to 310 days
  Farmland classification: Not prime farmland

Map Unit Composition
  Corralitos and similar soils: 85 percent
  Minor components: 15 percent
  Estimates are based on observations, descriptions, and transects of the map unit.

Description of Corralitos

Setting
  Landform: Alluvial fans
  Landform position (two-dimensional): Footslope
  Landform position (three-dimensional): Tread
  Down-slope shape: Linear
  Across-slope shape: Linear
  Parent material: Sandy alluvium

Typical profile
  H1 - 0 to 20 inches: sand
  H2 - 20 to 60 inches: sand

Properties and qualities
  Slope: 2 to 15 percent
  Depth to restrictive feature: More than 80 inches
  Natural drainage class: Somewhat excessively drained
  Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Sandy (R015XD055CA)

Minor Components
Arnold
Percent of map unit: 10 percent
Riverwash
Percent of map unit: 5 percent
Landform: Drainageways

CuC—Corralitos loamy sand, 2 to 9 percent slopes

Map Unit Setting
National map unit symbol: hby3
Elevation: 100 to 800 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 250 to 310 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Corralitos and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Corralitos
Setting
Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
H1 - 0 to 32 inches: loamy sand
H2 - 32 to 60 inches: stratified sand to loamy sand
Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: Sandy (R015XD055CA)

Minor Components

Arnold
Percent of map unit: 5 percent

Unnamed
Percent of map unit: 5 percent

Corralitos, sand
Percent of map unit: 5 percent

CuD—Corralitos loamy sand, 9 to 15 percent slopes

Map Unit Setting
National map unit symbol: hby4
Elevation: 100 to 800 feet
Mean annual precipitation: 14 to 18 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 250 to 310 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Corralitos and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Corralitos

Setting
Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
- H1 - 0 to 32 inches: loamy sand
- H2 - 32 to 60 inches: stratified sand to loamy sand

Properties and qualities
- Slope: 9 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Somewhat excessively drained
- Runoff class: Very low
- Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Low (about 4.8 inches)

Interpretive groups
- Land capability classification (irrigated): 3s
- Land capability classification (nonirrigated): 4e
- Hydrologic Soil Group: A
- Ecological site: Sandy (R015XD055CA)

Minor Components

Corralitos, sand
- Percent of map unit: 8 percent

Arnold
- Percent of map unit: 7 percent

EdC2—Elder sandy loam, 2 to 9 percent slopes, eroded

Map Unit Setting
- National map unit symbol: hbyl
- Elevation: 100 to 1,500 feet
- Mean annual precipitation: 12 to 18 inches
- Mean annual air temperature: 57 degrees F
- Frost-free period: 240 to 300 days
- Farmland classification: Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition
- Elder and similar soils: 85 percent
- Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the map unit.
Description of Elder

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from acid sandstone and shale

Typical profile

H1 - 0 to 23 inches: sandy loam
H2 - 23 to 35 inches: sandy loam
H3 - 35 to 72 inches: fine sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A
Other vegetative classification: LOAMY (015XD047CA_1)

Minor Components

Corralitos
Percent of map unit: 5 percent

Botella
Percent of map unit: 5 percent

Elder, sh-I
Percent of map unit: 5 percent

EdD2—Elder sandy loam, 9 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hbym
Elevation: 100 to 1,500 feet
Mean annual precipitation: 12 to 18 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 240 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition
- Elder and similar soils: 85 percent
- Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the map unit.

Description of Elder

Setting
- Landform: Alluvial fans
- Landform position (two-dimensional): Footslope
- Landform position (three-dimensional): Tread
- Down-slope shape: Linear
- Across-slope shape: Linear
- Parent material: Alluvium derived from acid sandstone and shale

Typical profile
- H1 - 0 to 23 inches: sandy loam
- H2 - 23 to 35 inches: sandy loam
- H3 - 35 to 72 inches: fine sandy loam

Properties and qualities
- Slope: 9 to 15 percent
- Depth to restrictive feature: More than 80 inches
- Natural drainage class: Well drained
- Runoff class: Very low
- Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: Occasional
- Frequency of ponding: None
- Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups
- Land capability classification (irrigated): 3w
- Land capability classification (nonirrigated): 3w
- Hydrologic Soil Group: A
- Other vegetative classification: LOAMY (015XD047CA_1)

Minor Components

Botella
- Percent of map unit: 5 percent

Corralitos
- Percent of map unit: 5 percent

Elder, sh-l
- Percent of map unit: 5 percent
PtD—Positas fine sandy loam, 9 to 15 percent slopes

Map Unit Setting

- National map unit symbol: hc15
- Elevation: 400 to 900 feet
- Mean annual precipitation: 15 to 20 inches
- Mean annual air temperature: 61 degrees F
- Frost-free period: 300 to 320 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Positas and similar soils: 85 percent
- Minor components: 15 percent
- Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Positas

Setting

- Landform: Terraces
- Landform position (two-dimensional): Toeslope
- Landform position (three-dimensional): Tread
- Down-slope shape: Linear
- Across-slope shape: Linear
- Parent material: Alluvium

Typical profile

- H1 - 0 to 21 inches: fine sandy loam
- H2 - 21 to 48 inches: clay
- H3 - 48 to 60 inches: very gravelly clay

Properties and qualities

- Slope: 9 to 15 percent
- Depth to restrictive feature: 12 to 21 inches to abrupt textural change
- Natural drainage class: Well drained
- Runoff class: High
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

- Land capability classification (irrigated): 3e
- Land capability classification (nonirrigated): 3e
- Hydrologic Soil Group: D
- Ecological site: Claypan (R015XD115CA)
Minor Components

Unnamed

Percent of map unit: 15 percent

RuG—Rough broken land

Map Unit Composition

Lithic xerorthents and similar soils: 40 percent
Rough broken land: 40 percent
Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the map unit.

Description of Rough Broken Land

Setting

Landform: Mountains
Parent material: Residuum weathered from sandstone or semiconsolidated gravelly sediments

Typical profile

H1 - 0 to 59 inches: weathered bedrock

Properties and qualities

Slope: 30 to 90 percent
Depth to restrictive feature: 0 to 10 inches to paralithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): 8e
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: D

Description of Lithic Xerorthents

Properties and qualities

Slope: 30 to 90 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Minor Components

Unnamed

Percent of map unit: 10 percent

SfD—San Andreas-Tierra complex, 5 to 15 percent slopes

Map Unit Setting

National map unit symbol: hc1k
Elevation: 150 to 2,500 feet
Mean annual precipitation: 13 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 240 to 320 days
Farmland classification: Not prime farmland

Map Unit Composition

San andreas and similar soils: 50 percent
Tierra and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of San Andreas

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from soft sandstone

Typical profile

H1 - 0 to 15 inches: fine sandy loam
H2 - 15 to 28 inches: very fine sandy loam
H3 - 28 to 59 inches: weathered bedrock

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: 24 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Other vegetative classification: LOAMY (015XD047CA_1)

Description of Tierra

Setting
Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 11 inches: sandy loam
H2 - 11 to 43 inches: clay
H3 - 43 to 62 inches: clay loam

Properties and qualities
Slope: 5 to 15 percent
Depth to restrictive feature: 11 to 40 inches to abrupt textural change
Natural drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: Claypan (R015XD115CA)

Minor Components
Crow hill
Percent of map unit: 5 percent
Gaviota
Percent of map unit: 5 percent

SfE—San Andreas-Tierra complex, 15 to 30 percent slopes

Map Unit Setting
National map unit symbol: hc1l
Elevation: 150 to 2,500 feet
Mean annual precipitation: 13 to 20 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 240 to 320 days
Farmland classification: Not prime farmland

Map Unit Composition
San andreas and similar soils: 60 percent
Tierra and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of San Andreas
Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from soft sandstone

Typical profile
H1 - 0 to 15 inches: fine sandy loam
H2 - 15 to 28 inches: very fine sandy loam
H3 - 28 to 59 inches: weathered bedrock

Properties and qualities
Slope: 15 to 30 percent
Depth to restrictive feature: 22 to 30 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: LOAMY (015XD047CA_1)

Description of Tierra
Setting
Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 11 inches: sandy loam
H2 - 11 to 43 inches: clay
**Properties and qualities**

- **Slope**: 15 to 30 percent
- **Depth to restrictive feature**: 8 to 24 inches to abrupt textural change
- **Natural drainage class**: Moderately well drained
- **Runoff class**: Very high
- **Capacity of the most limiting layer to transmit water (Ksat)**: Very low to moderately low (0.00 to 0.06 in/hr)
- **Depth to water table**: More than 80 inches
- **Frequency of flooding**: None
- **Frequency of ponding**: None
- **Salinity, maximum in profile**: Nonsaline (0.0 to 2.0 mmhos/cm)
- **Available water storage in profile**: Very low (about 1.3 inches)

**Interpretive groups**

- **Land capability classification (irrigated)**: 4e
- **Land capability classification (nonirrigated)**: 4e
- **Hydrologic Soil Group**: D
- **Ecological site**: Claypan (R015XD115CA)

**Minor Components**

- **Crow hill**
  - Percent of map unit: 5 percent
- **Gaviota**
  - Percent of map unit: 5 percent
- **Unnamed**
  - Percent of map unit: 5 percent

**SfG—San Andreas-Tierra complex, 30 to 75 percent slopes**

**Map Unit Setting**

- **National map unit symbol**: hc1n
- **Elevation**: 150 to 2,500 feet
- **Mean annual precipitation**: 13 to 20 inches
- **Mean annual air temperature**: 57 degrees F
- **Frost-free period**: 240 to 320 days
- **Farmland classification**: Not prime farmland

**Map Unit Composition**

- **San andreas and similar soils**: 60 percent
- **Tierra and similar soils**: 25 percent
- **Minor components**: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.
Description of San Andreas

Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from soft sandstone

Typical profile
H1 - 0 to 15 inches: fine sandy loam
H2 - 15 to 28 inches: very fine sandy loam
H3 - 28 to 59 inches: weathered bedrock

Properties and qualities
Slope: 30 to 75 percent
Depth to restrictive feature: 20 to 28 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups
Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Steep loamy (R015XD116CA)

Description of Tierra

Setting
Landform: Terraces
Landform position (two-dimensional): Toe slope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 11 inches: sandy loam
H2 - 11 to 43 inches: clay
H3 - 43 to 62 inches: clay loam

Properties and qualities
Slope: 30 to 50 percent
Depth to restrictive feature: 11 to 26 inches to abrupt textural change
Natural drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Claypan (R015XD115CA)

Minor Components

Crow hill
Percent of map unit: 5 percent

Unnamed
Percent of map unit: 5 percent

Gaviota
Percent of map unit: 5 percent

Sh—Sandy alluvial land

Map Unit Setting
National map unit symbol: hc1r
Mean annual precipitation: 14 inches
Mean annual air temperature: 61 degrees F
Farmland classification: Not prime farmland

Map Unit Composition
Sandy alluvial land and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the map unit.

Description of Sandy Alluvial Land

Setting
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Yy

Typical profile
H1 - 0 to 10 inches: sand
H2 - 10 to 30 inches: stratified sand to loam
H3 - 30 to 60 inches: stratified gravelly sand to gravelly loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups
Land capability classification (irrigated): 7s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Ecological site: Sandy alluvial (R014XD098CA)

Minor Components
Unnamed
Percent of map unit: 10 percent

Unnamed
Percent of map unit: 5 percent
Landform: Drainageways
References


APPENDIX D

Data Sheets
Wetland Delineation Form; Arid West Region - Pool A
Vegetation Rapid Assessment Form - Pool A
WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: AEPA ECC / Pool A  
City/County: SB County  
Sampling Date: 3/18/15

Applicant/Owner: AEPA  
State:  
Investigator(s): C. Santana, A. Tribb, T. Benson  
Section, Township, Range:  
Landform (hillslope, terrace, etc.): depression  
Local relief (concave, convex, none):  
Slope (%):  
Subregion (LRR):  
Lat: 34.831610°  
Long: -120.188341°  
Datum:  
Soil Map Unit Name:  
NWI classification:  

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ❌ No ✗ (If no, explain in Remarks.)

Are Vegetation Yes ❌ No ✗ or Hydrology Yes ❌ No ✗ significantly disturbed? Are "Normal Circumstances" present? Yes ❌ No ✗

Are Vegetation Yes ❌ No ✗ or Hydrology Yes ❌ No ✗ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ❌ No ✗  
Hydric Soil Present? Yes ❌ No ✗  
Wetland Hydrology Present? Yes ❌ No ✗  

Is the Sampled Area Yes ❌ No ✗ within a Wetland?

Remarks: Problematic soil > man-induced wetlands. W/ no hydric soil present = NO WETLAND. Corp Nat Man 82 "MAN-MADE" ≠ 74. no hydric soil

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: )  
1.  
2.  
3.  
4.  
5.  

Absolute % Cover  
Dominant Species?  
Status  

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata:  

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:
Total % Cover of: Multiply by:
OBL species x 1 =  
FACW species x 2 =  
FAC species x 3 =  
FACU species x 4 =  
UPL species x 5 =  

Column Totals: (A) (B)

Prevalence Index = B/A =  

Hydrophytic Vegetation Indicators:
Dominance Test is > 50%
Prevalence Index is ≤ 3.0
Morphological Adaptations1 (Provide supporting data in Remarks or on a separate sheet)
Problematic Hydrophytic Vegetation1 (Explain)

1Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ❌ No ✗

Hern Stratum (Plot size: )

1. Cohulia coromelana  
2. Unidentified herb  
3. Flammia parviflora  
4. Unidentified herb  
5. Unidentified herb  
6. Unidentified herb  
7.  
8.  

Total Cover  

107 = Total Cover

Woody Vine Stratum (Plot size: )

1.  
2.  

Total Cover  

655 = Total Cover

% Bare Ground in Herb Stratum  
% Cover of Biotic Crust  

Remarks:  

US Army Corps of Engineers  
Arid West – Version 2.0
### Soil

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<tr>
<th>Depth (inches)</th>
<th>Matrix</th>
<th>Color (moist)</th>
<th>%</th>
<th>Redox Features</th>
<th>Color (moist)</th>
<th>%</th>
<th>Type</th>
<th>Loc</th>
<th>Texture</th>
<th>Remarks</th>
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<td>15%</td>
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<td>SANDY LOAM</td>
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1Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. 2Location: PL=Pure Lining, M=Matrix.

**Hydric Soil Indicators:** (Applicable to all LRRs, unless otherwise noted.)
- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR C)
- 1 cm Muck (A9) (LRR D)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)

**Indicators for Problematic Hydric Soils:**
- 1 cm Muck (A9) (LRR C)
- 2 cm Muck (A10) (LRR B)
- Reduced Vertic (F15)
- Red Parent Material (TF2)
- Other (Explain in Remarks)

**Restrictive Layer (if present):**
- Type: GIPAVEL
- Depth (inches): 2 INCHES

**Hydric Soil Present?** Yes No (X)

### Hydrology

**Wetland Hydrology Indicators:**
- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1) (Nonriverine)
- Sediment Deposits (B2) (Nonriverine)
- Drift Deposits (B3) (Nonriverine)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- Salt Crust (B11)
- Biotic Crust (B12)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

**Secondary Indicators (2 or more required):**
- Water Marks (B1) (Riverine)
- Sediment Deposits (B2) (Riverine)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- FAC-Neutral Test (D5)

**Field Observations:**
- Surface Water Present? Yes No Depth (inches): 2 INCHES
- Water Table Present? Yes No Depth (inches): 2 INCHES
- Saturation Present? Yes No Depth (inches): 2 INCHES

**Wetland Hydrology Present?** Yes No

**Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:**

Remarks:
CNPS and CDFG Combined Vegetation Rapid Assessment and Relevé Field Form

Relevé of Rapid Assessment (circle one)  
(Revised May 13, 2011)

<table>
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<tr>
<th>For Office Use:</th>
<th>Final database #:</th>
<th>Final vegetation type name:</th>
<th>Alliance Association:</th>
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I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

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<th>Polygon/Stand #:</th>
<th>Air photo:</th>
<th>Date:</th>
<th>Name(s) of surveyors (circle recorder):</th>
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<tr>
<td>F00008</td>
<td>Aerial</td>
<td>4/15/13</td>
<td>(Chris Santana), (Teresa Adami), (Kenny Iwane)</td>
</tr>
</tbody>
</table>

GPS wypt #: 8  GPS name: _______ Datum: _______ or NAD83. Bearing, left axis at SW pt ______ (degrees) of Long / Short side

| UTME  | 120° 1' 59.4 89 | UTMN  | 24° 49' 55.2 66 | Zone 10 H1 (circle one) | Error: ± 1/8 ft / m / pdop |

GPS within stand? Yes / No If No, cite from waypoint to stand, distance _______ meters & bearing _______ (degrees)

Elevation: 924 ft Camera Name/Photograph #: Nikon Coolpix M400 1, 2, 3, 4

Stand Size (acres): <1 / 1-5 / >5 | Plot Size (m²): 10 / 100 / 400 / 1000 | Plot Shape ______ x ______ ft / m or Circle Radius ______ ft / m

Exposure, Actual: ______ NE NW SE SW Flat Variable All | Steepness, Actual: ______ 0°-15° \ 15°-25° \ >25

Topography: Macro: top upper mid lower bottom Micro: convex flat concave undulating

Geology code: SETUV Soil Texture code: MESA | Upland or Wetland Riparian (circle one)

% Surface cover: ______ (Incl. outcrops) (50cm diam) (25-60cm) (7.5-25cm) (2-7.5cm) (Incl. sand, mud)


% Current year bioturbation ______ Past bioturbation present? Yes / No | % Hoof punch ______

Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.

Site history, stand age, comments: Former abandoned well pad, depression w/ ranter (HW) used by wildlife or water source, historically used oil field and access roads.

Disturbance code / Intensity (L,M,H): 01 / M 02 / M 03 / M 04 / M 05 / M 06 / M 07 / M 08 / M 09 / M 10 / M "Other" ____________ 1 ______

II. HABITAT AND VEGETATION DESCRIPTION

Tree DBH: T1 (<1" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (24-48" dbh), T6 multi-layered (T3 or T4 layer under T5. >60% cover)

Shrub: S1 seedling (<3 yr. old), S2 young (<1% dead), S3 mature (1-25% dead), S4 decadent (>25% dead)

Herbaceous: H1 (=2" plant ht.), H2 (>2" ht.) Desert Riparian/Shrub: J1 (<2ft. stem ht.), J2 (2-10ft. ht.), J3 (10-20ft. ht.), J4 (>20ft. ht.)

Desert Palm/Joshua Tree: J1 (<1" base diameter), J2 (1.5-6" diam.), J3 (6" diam.) | % NonVase cover: ______ % Vase Veg cover: ______

% Cover - Conifer tree / Hardwood tree: ______ % Regenerating Tree: ______ % Shrub: 1% Herbaceous: 20%

Height Class - Conifer tree / Hardwood tree: ______ % Regenerating Tree: ______ % Shrub: 03 Herbaceous: 01

Height classes: 01 = 0-1m 02 = 1-2m 03 = 2-5m 04 = 5-10m 06 = 15-20m 07 = 20-35m 09 = 35-50m 10 = >50m

Species, Stratum, and % cover. Stratum categories: T=Tree, S=Shrub, H=Herb, E=SEedling, A=SAlping, N=Non-vascular.

% cover intervals for reference: <1% 1-5% >5-15% >15-25% >25-50% >50-75% 75%

<table>
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<tr>
<th>Stratum</th>
<th>Species</th>
<th>% cover</th>
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<tbody>
<tr>
<td>H</td>
<td>Eleocharis paniculata</td>
<td>4</td>
</tr>
<tr>
<td>H</td>
<td>Corolla crocina</td>
<td>5</td>
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<tr>
<td>H</td>
<td>Doryanthes humbroum</td>
<td>2</td>
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<tr>
<td>H</td>
<td>Pseudotropaeolum spinosum</td>
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<tr>
<td>H</td>
<td>Lythrum salicaria</td>
<td>2</td>
</tr>
<tr>
<td>H</td>
<td>Polygonum monspelicum</td>
<td>3</td>
</tr>
<tr>
<td>T</td>
<td>Echinocystis lutescens</td>
<td>2</td>
</tr>
<tr>
<td>H</td>
<td>Sparganium erectum</td>
<td>2</td>
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</tbody>
</table>

Unusual species:

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name: _______ (Pond community)

Field-assessed association name (optional): _______

Adjacent alliances/direction: _______ _______ _______ _______

Confidence in alliance identification: L M H Explain: _______

Phenology (E,P,I): Herb ______ Shrub ______ Tree ______ Other identification or mapping information: _______

Is poly >1 type: Yes / No If yes, explain:
CNPS and CDFG Combined Vegetation Rapid Assessment and Relevé Field Form
RELEVE SPECIES SHEET (Revised 5/13/2011)

Stratum categories: T = Tree, S = Shrub, H = Herb, E = SEedling, A = SApling, and N=Non-vascular
% Cover Intervals for reference: r = trace, + = <1%, 1-5%, >15-15%, >15-25%, >25-50%, >50-75%, >75%

<table>
<thead>
<tr>
<th>Strata</th>
<th>Vascular plant name or lichen/bryophyte</th>
<th>% Cover</th>
<th>Collection</th>
<th>Final species determination (or DBH)</th>
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</table>
Polygon/Stand No. ECC0008 – Brass Buttons Patch

NORTH

EAST

SOUTH

WEST
SOIL BENEFICIAL RE-USE PLAN

AERA ENERGY LLC
EAST CAT CANYON OIL FIELD REDEVELOPMENT
PROJECT
6516 CAT CANYON ROAD
SANTA BARBARA COUNTY, CALIFORNIA

Prepared for:
Aera Energy LLC

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1.0 GENERAL OVERVIEW

On behalf of Aera Energy LLC (Aera), Padre Associates, Inc. (Padre) has prepared this Soil Beneficial Re-Use Plan for submittal to the California Regional Water Quality Control Board – Central Coast Region (RWQCB). Aera is planning to relocate and operate an existing soil beneficial re-use facility in compliance with the RWQCB’s General Conditional Waiver of Waste Discharge Requirements for the Re-Use of Non-Hazardous Crude Oil Impacted Soil and Non-Hazardous Spent Sandblasting Aggregate on Active Oil Lease and Fee Properties in the Central Coast, Order No. R3-2010-0037 (Beneficial Re-use Waiver) for the on-site and off-site re-use of petroleum hydrocarbon-containing soil at Aera’s East Cat Canyon Oil Field property, located in Santa Barbara County, California (Project Site). Attached are two plates: Plate 1 is a Site Location Map, and Plate 2 showing the location of the proposed stockpiling and mixing area. As part of the Waiver enrollment requirements, a Compliance Plan and a Management Practices Plan have been prepared, which are included as Attachments A and B, respectively.

The Project Site is located approximately six miles east of the Town of Orcutt (refer to Plate 1- Site Location Map) and encompasses approximately 2,100 acres. The Project Site is further located within the Solomon Hills, and includes portions of the Olivera Canyon Area and the East Area of the Cat Canyon Oil Field (refer to Plate 2 – Site Map). Access to the Project Site is via Cat Canyon Road.

The Project Site was historically used for crude oil exploration and production, and portions of the Project Site are still currently active. Aera is intending to redevelop the Project Site using existing and new roads and well pads, new oil production and steam injection wells, steam generators, a central processing facility, and pipelines. As part of the Project, Aera proposes to utilize areas that are known to contain pre-existing petroleum hydrocarbon-containing soils. Construction activities will disturb the petroleum hydrocarbon-containing soils; therefore Aera plans to excavate the petroleum hydrocarbon-containing soils for beneficial re-use either on-site or at other Aera locations.

Implementation of the Project would result in the excavation of petroleum hydrocarbon-containing soil (the Re-Use Material), processing the Re-Use Material, and placement of processed Re-Use Material throughout the Project Site as road sub-base, road base, and/or final road surfaces associated with the planned oil field re-development activities. The source of the Re-Use Material originates from multiple on-site petroleum hydrocarbon-containing soil sites and oily sand produced during petroleum production activities.
2.0 PROJECT SITE PERMIT HISTORY

Aera is currently enrolled with the RWQCB for the stockpiling of petroleum-containing soil at the Project Site, per the requirements of the General Conditional Waiver of Waste Discharge Requirements for the Management of Petroleum-Impacted Soils at Authorized Waste Pile Management Facilities at Active Oil Leases and Fee Properties in the Central Coast Region, (Waste Pile Order) (Order No. R3-2010-0036); however, no active soil waste piles currently exist at the Project Site.

3.0 SUMMARY OF RE-USE FEATURES

At each Re-Use Source Site, soil with total petroleum hydrocarbon (TPH) concentrations in excess of concentrations specified by the Santa Barbara County Environmental Health Services (SBCEHS) Lease Restoration Program, will be either transported and processed on-site at the Re-Use Site for preparation for use as on-site road material, transported to Aera’s Belridge road-mix facility for re-use, or disposed off-site at the Santa Maria Regional Landfill under the Non-Hazardous Impacted Soil program.

Aera proposes to use the following procedures during the course of the excavation and processing of Re-Use Material:

- Erosion control measures would be installed and maintained throughout the course of the excavation and material processing activities.
- Existing vegetation would be cleared from the proposed excavation areas and disposed off-site or shredded and used for erosion control.
- Dust control and air monitoring would be conducted during all excavation activities in accordance with the Santa Barbara County Grading Ordinance and Santa Barbara County Air Pollution Control District (APCD) regulations.
- Soil samples from the bottom, and any exposed excavation sidewalls would be collected and chemically analyzed for petroleum constituents to document the remaining petroleum hydrocarbon-containing soil located outside of the planned disturbance area. Analytical results would be submitted to SBCEHS to document the remaining TPH-containing soil adjacent to and under the Re-Use Source Area.

4.0 RE-USE MATERIAL PROCESSING AND PLACEMENT AS ROAD MATERIAL

Based on the results of previous soil testing conducted for geotechnical properties, the dense asphaltic material typically found at and near the surface can be processed and used as reclaimed asphalt pavement; sandy oily-containing material can be processed and used in asphalt concrete; and other on-site TPH-containing soils can be processed to be used as either road sub-base or base material (Tetra Tech, 2001).

The various TPH-containing soils can be excavated using conventional excavation equipment and segregated for further processing depending on the final use. Processing of these
soils may include the addition of asphalt, aggregate material, clean sand, soil binders, and water (for proper compaction during placement). The material will be transferred to the proposed soil management area shown on Plate 2. There it will be stockpiled on-site for either re-use on-site for road base material or transported off-site to another Aera facility for beneficial re-use. The material will be monitored for compliance with the Waste Pile Order and the Beneficial Re-Use Order, as shown in Attachment A. The material will be handled in accordance with Attachment B – Management Practices Plan.

5.0 SCHEDULE

The proposed Project activities will be completed over an approximate 10-year period following receipt of all necessary permits and approvals. Project activities would occur throughout the year; unless restricted by the requirements of permits issued to the Project.

6.0 PERMIT REQUIREMENT SUMMARY

Other permits that would be required for the proposed soil beneficial re-use project include, but not limited to, the following:

- Storm Water Pollution Prevention Plan and Notice of Intent – State Water Resources Control Board General Permit for Storm Water Discharges Associated with Construction or Land Disturbance Activities.
- Land Use and Grading Permits issued by the Santa Barbara County Planning and Development Department.
- An Authority to Construct/Permit to Operate will be required by the Santa Barbara APCD for contaminated soil excavation projects. As part of the APCD permit, Aera will be required to prepare and implement an Air Quality Monitoring Plan that includes air monitoring requirements during soil excavation activities for volatile organic compounds and dust emissions. The Air Quality Monitoring Plan will include reporting requirements in the event of non-compliance and contingency measures to ensure that the action levels are not exceeded.
PLATES
Beneficial Re-Use Areas

Palmer Rd
Olivera Canyon Rd
Long Canyon Rd
Cat Canyon Rd

PROPOSED BENEFICIAL RE-USE AREAS LOCATION

Z:\Kristin\GIS Maps\Map Project\East Cat Canyon\Permit Doc Figures\Beneficial Reuse\Proposed Beneficial Re-use Areas Location.mxd

Aera Energy LLC Property
Well or Other Facility Pad
Laydown Area
Road
Cut / Fill Slope
Storm Water Basin
Pipeline Corridor
Slope Benching

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1002-0455
PLATE 2

EAST CAT CANYON
SANTA BARBARA COUNTY, CA

PROPOSED BENEFICIAL RE-USE AREAS LOCATION

Source: County of Santa Barbara, TJCross 8-20-14, DPSI 2013
Land Survey
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Notes: This map was created for informational and display purposes only.
ATTACHMENT A

COMPLIANCE PLAN
COMPLIANCE PLAN

A. Site Inspections and Observations – Aera shall inspect all re-use project areas according to the following schedule, recording the following Standard Observations.
   a. Site Inspection Schedule:
      i. Aera shall perform one inspection prior to, during, and after the rainy season (October 1 through April 1), or at any time a failed management measure and/or discharge is reported or observed.
         1. Standard Observations – standard observations shall be performed along the perimeter of all authorized re-use projects to inspect for evidence of erosion or washout after severe rain events, and integrity during wet seasons. Aera shall select a sufficient number and location for each “observation point” as necessary to achieve compliance with the conditions of the waiver.

B. Data Logging and Reporting
   a. Logbooks – Aera shall maintain logbooks for recording all visual and water analysis data.
   b. If at any time offsite erosion or washout is observed, Aera shall determine and identify the failed management measures and source of discharge. Management measure failure is defined as:
      i. Whenever an implemented management measure creates a condition of pollution, contamination, or condition of nuisance
      ii. When lack of implementation of a necessary management measure creates a condition of pollution, contamination, or condition of nuisance
   c. If management measures fail, Aera shall photo document them and shall implement management practices immediately to prevent discharge and impacts to water quality.
   d. Annual Report – Aera shall submit an annual report to the Water Board by October 1st summarizing all preparedness measures performed to ensure discharges to surface and groundwater do not occur during the impending rainy season. The annual report shall include the following:
      i. Status of re-use projects including:
         1. The source of all materials
         2. Approximate volume of materials used
         3. Results of all soil chemical characterization performed
      ii. Summary of all Management Practices implemented in preparation of the upcoming rainy season.
      iv. Visual storm water observations and their observation dates
      v. Stabilization and erosion control measures implemented
vi. Summary of violations
vii. Summary of standard observations performed
viii. Summary of actions implemented for the protection of water quality
ix. Documentation of rainfall measurement procedures and locations
x. A summary of water quality monitoring performed during the previous year (if any)
ox. Recommendations for improving the monitoring and reporting program
xi. Maps
   1. Map or aerial photo that show the locations of physical features and monitoring locations if applicable
   2. Map showing areas in which re-use materials have been placed and locations of re-use material projects completed during the previous year.

xiii. Lab Results
   1. All monitoring and analytical data obtained during the previous year
   2. The evaluation and interpretation of all available data
xiv. Electronic Submittals – the annual report will be submitted electronically

xv. Aera shall maintain records of all monitoring information and results for a minimum of 3 years

xvi. Photo-point monitoring points – All photo-point monitoring points will be documented in logbooks and photos will be of sufficient quality to record the effectiveness of the management practice

e. Aera shall notify the Executive Officer within 48 hours by telephone or email and within 14 days in writing of:
   i. Any noncompliance potentially or actually endangering health or the environment
   ii. Any flooding equipment failure, or other change in site conditions which could impair the integrity of the site
   iii. Any time Aera observes a discharge from the re-use areas
   iv. Any violations of the waiver conditions
ATTACHMENT B

MANAGEMENT PRACTICES PLAN
Aera Energy LLC East Cat Canyon Oil Field
Beneficial Re-Use Plan

MANAGEMENT PRACTICES PLAN

A. Non-structural Management Practices
   a. **Good housekeeping** – Aera will operate the re-use project area in accordance with good housekeeping principals which are summarized by the following:
      i. Keep work site clean
      ii. Keep work site orderly
      iii. Handling materials and wastes in a manner that minimizes risk and potential runoff
   b. **Preventative Maintenance** – all equipment used in and around the re-use project area will be routinely inspected for wear and repaired if necessary.
   c. **Oil Spill Response** – an emergency contact list (located in Aera’s Oil Spill Contingency Plan) includes contact information for Aera personnel, spill contractors, emergency numbers, and government agencies that must be notified in case of a release. The responsibilities of the response personnel include identifying the size, position, and content of the spill, and also the direction and speed and the likelihood of a spill entering a vulnerable area. No member of the response party shall do anything that would put anyone at risk. It is important that the spilled material be contained as soon as possible to prevent damage to health or to the environment.
   d. **Material handling and storage** – all materials will be handled in accordance with the waiver conditions.
   e. **Employee training** – all Aera field personnel are given annual training on the Management Practices Plan. The major emphasis of the training is in spill preventions and response, good housekeeping, and material management practices and an understanding of applicable pollution control laws and discharge procedure protocols.
   f. **Record keeping** – all plan related activities will be recorded and available for inspection.
   g. **Inspections** – site inspections will occur regularly according to the Site Inspection Schedule in the compliance plan.

B. **Structural Management Practices** – The main structural management practice that will be utilized will be earthen berms constructed around the re-use project location.