

DOCKETED

Docket Number:	99-AFC-01C
Project Title:	Elk Hills Power Project - Compliance
TN #:	266444
Document Title:	Appendix K Geohazards Assessment
Description:	Appendix K Geohazards Assessment for CalCapture Project
Filer:	Daniel I. Padilla
Organization:	California Resources Corporation
Submitter Role:	Applicant
Submission Date:	10/10/2025 12:13:58 PM
Docketed Date:	10/10/2025

CalCapture CCS Project

Geohazards Assessment



Prepared for:
Carbon TerraVault Holdings, LLC, a carbon
management subsidiary of California Resources
Corporation

October 2025

Project/File:
185806775

Prepared by:
Stantec Consulting Services Inc.
2646 Santa Maria Way, Suite 107
Santa Maria, CA 93455

Revision Schedule

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date

Disclaimer

The conclusions in the Report titled CalCapture CCS Project Geohazards Assessment are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from Carbon TerraVault Holdings, LLC, a carbon management subsidiary of California Resources Corporation (the "Client") and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

Prepared by:



Signature

Zoe Dascalos

Reviewed by:



Signature

Jaret Fischer, P.E.

Approved by:



Signature

Eric Snelling, Senior Principal

Table of Contents

Acronyms / Abbreviations.....	iii
1 Introduction	1
1.1 Project Description	1
1.2 CTV I Background Information.....	6
1.3 Project Location	7
1.4 Purpose and Scope of Work	7
1.4.1 Purpose	7
1.4.2 Methodology.....	8
2 Results	9
2.1 Regional Geology.....	9
2.2 Regional Groundwater	11
2.3 Regional Seismicity.....	11
2.3.1 Fault Rupture (Ground Rupture) Hazard	11
2.3.2 Strong Ground Shaking	14
2.3.3 Liquefaction.....	14
2.3.4 Lateral Spreading.....	15
2.3.5 Settlement	15
2.4 Local Faults and Fractures	15
2.5 Subsidence	15
2.6 Site Conditions	16
2.6.1 Expansive Soil Potential	16
2.6.2 Corrosive Soil Potential.....	16
2.6.3 Near Surface Obstructions or Restrictive Soil Layers.....	20
2.6.4 Frost Depth	20
2.6.5 Slopes	20
2.6.6 Erosion	20
2.6.7 Landforms that Could Develop Sinkholes or Other Hazards	21
2.7 Review of Aerial Photographs.....	22
3 Environmental Analysis	23
3.1 Significance Criteria	23
3.2 Impact Analysis	24
3.2.1 GEO-1 Impact Analysis.....	24
3.2.2 GEO-2 Impact Analysis.....	24
3.2.3 MINERAL-1 Impact Analysis.....	25
3.2.4 MINERAL-2 Impact Analysis.....	25
4 Cumulative Impacts	26
5 Mitigation Measures.....	27
6 Conclusions.....	28
7 Limitations and Assumptions.....	29
8 References	30



CalCapture CCS Project – Geohazards Assessment
Table of Contents

List of Tables

Table 1 Project Parcel Data	7
Table 2 Corrosive Potential of Soils Mapped on the Project Site	17
Table 3 Erosive Potential for Soils Mapped on the Project Site	21

List of Figures

Figure 1 Regional Location	3
Figure 2 Project Location	4
Figure 3 Geology.....	10
Figure 4 Faults	13
Figure 5 Soils	18



Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
BMP	best management practice
CalGEM	California Geologic Energy Management Division
CARB	California Air Resources Board
CCR	California Code of Regulations
CCS	Carbon Capture and Sequestration
CCU	Carbon Capture Unit
CEC	California Energy Commission
CFR	Code of Federal Regulations
CGS	California Geological Survey
Cl	chloride
CO ₂	carbon dioxide
CRC	California Resources Corporation
CTV	Carbon TerraVault Holdings, LLC
CTV I	Carbon TerraVault I
CUP	Conditional Use Permit
the CUP	Collectively, CUP No. 13, Map 118; CUP No. 14, Map 118; CUP No. 5, Map 119; CUP No. 3, Map 120; CUP No. 2, Map 138; and CUP No. 6, Map 119
EFG+	Econamine FG Plus
EHOF	Elk Hills Oilfield
EHPP	Elk Hills Power Plant
EI	Expansion Index
EIR	Environmental Impact Report
GT	gas turbine
HDD	horizontal directional drilling
HRSG	heat recovery steam generator
K	soil-erodibility factor
Kern County	Kern County Planning and Natural Resources Department
kV	kilovolt
M	magnitude
MDB&M	Mount Diablo Base and Meridian
MM	mitigation measure
MMTPY	million metric tons per year
MTPD	metric tons per day
MWe	megawatt equivalent
NOD	Notice of Determination
NRCS	Natural Resources Conservation Service
PGA	Peak Ground Acceleration
ppm	parts per million
Project	CalCapture Carbon Capture and Sequestration Project
RO	reverse osmosis
SEI	Soils Engineering Inc.



CalCapture CCS Project – Geohazards Assessment

Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
SO ₄	sulfate
ST	steam turbine
Stantec	Stantec Consulting Services Inc.
UIC	Underground Injection Control
U.S. EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey



1 Introduction

Stantec Consulting Services Inc. (Stantec) has prepared this desktop Geohazards Assessment on behalf of Carbon TerraVault Holdings, LLC (CTV), a carbon management subsidiary of California Resources Corporation (CRC) for the CalCapture Carbon Capture and Sequestration (CCS) Project (Project), located in the Elk Hills Oilfield (EHOF) near Tupman, Kern County, California (Project site). CRC is seeking approval of a Modification to the Elk Hills Power Plant Application for Certification from the California Energy Commission (CEC) as the lead agency. The Regional Location and Project Location are shown in Figures 1 and 2.

1.1 Project Description

The proposed Project would capture carbon dioxide (CO₂) generated as a by-product by CRC's 550-megawatt-equivalent (MWe) Elk Hills Power Plant (EHPP), located in the EHOF near Tupman, Kern County, California. The EHPP was commissioned in 2003 and is powered by two General Electric 7FA gas turbines (GTs), with two heat recovery steam generators (HRSGs) providing steam to a General Electric D11 steam turbine (ST). The Carbon Capture Unit (CCU), not including pipelines or temporary staging and parking areas, would be located immediately south of the EHPP in a 7.64-acre existing disturbed area.

Implementation of the Project will require approval of a Petition for Modification Application from the California Energy Commission (CEC), who has the exclusive authority for licensing thermal power plants of 50 MW or larger, as well as related transmission lines, fuel supply lines, and other facilities.

The CCU would utilize Fluor's Econamine FG PlusSM (EFG+) process to capture and concentrate the CO₂. The EFG+ process is designed to capture 95 percent of the CO₂ from the total flue gas feed to the unit. The EFG+ CCU can be divided into seven primary subsystems or sections: Flue Gas Cooling, CO₂ Absorption, Solvent Regeneration, Solvent Maintenance, Chemical Storage and Supply, CO₂ Compression, and Utility Support Systems. The treated flue gas is vented to the atmosphere directly from the EFG+ CCU plant absorber. The concentrated CO₂ would then be compressed, dehydrated, and stripped of oxygen prior to conveyance to the permitted manifold pad, permitted as part of the approved Carbon TerraVault I (CTV I) project (State Clearinghouse No. 2022030180), which will direct the CO₂ to the U.S. Environmental Protection Agency (U.S. EPA) approved Class VI Underground Injection Control (UIC) wells to be injected into a depleted oil and gas reservoir located on the CRC property and approved as part of the CTV I project. The previously approved CTV I manifold pad, injection wells, depleted oil and gas reservoir and related facilities further discussed in Section 1.2 below are not part of the CalCapture CCS Project analyzed in this report.

A new, approximately 0.5-mile, 8- to 10-inch pipeline, installed primarily below ground utilizing either trenching or horizontal directional drilling (HDD) techniques, would transport the CO₂ from the CCU to the tie-in with the Carbon TerraVault I (CTV I) permitted 35R manifold facility (pad). It is anticipated that the



CalCapture CCS Project – Geohazards Assessment

1 Introduction

proposed Project would capture approximately 4,400 metric tons of CO₂ per day (MTPD) (1.6 million metric tons of CO₂ per year [MMTPY]). The proposed Project is estimated to be in operation for up to 26 years.¹

Water use during operation of the CalCapture CCU would be minimized by the inclusion of a hybrid cooling system (Wet Surface Air Coolers [WSAC], air coolers, secondary glycol cooling, and water cooling). Additionally, the CCU would be equipped with a water treatment system, consisting of a reverse osmosis (RO) Unit that is designed to recover and reuse water from the Cooling Tower blowdown. The recovered water is utilized as make-up to the CO₂ absorption system and the Wash Water WSAC Basin. A wastewater stream (less than 10 gallons per minute) would be collected at the CalCapture CCU and transferred by a new surface pipeline to the EHPP for disposal via an existing UIC Class I injection well.

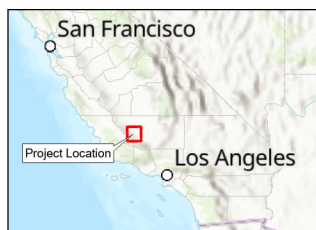
The proposed Project includes a single connection to the CRC Power System and would include a connection of a new 115-kilovolt (kV) transmission line to a new CRC electrical substation. The proposed Project would require a new transmission tie line to connect the Project switching station to the existing CRC substation. Electrical power would be supplied to the CalCapture Substation with a new dedicated electrical transformer. The new 115-kV transmission tie line is expected to be built using pre-engineered steel poles with anchor bolt foundation designs.

During construction, temporary offices and existing parking areas would be used by construction personnel. Temporary office and parking areas have been designated on previously disturbed areas to the south and northeast of the Project site. Two additional areas are located approximately 5.5 miles southeast of the Project site. There are no permanent new buildings proposed for the Project, and no grading would occur within the temporary office and parking areas. Total temporary staging and parking area would be approximately 30.74 acres.

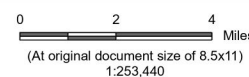
¹The life of the project is dependent on the sources permitted for injection into the CTV I approved storage reservoir, the ability of the project year by year to obtain CO₂ and inject at the maximum 2,210,000 million tons per year, and the total estimated storage capacity of up to 48 million tons of CO₂.



V:\185806775_CRC_CalCapture03_data\gis_cad\gispro\Geohazards\Geohazards_Figures_20250625.aprx Revised: 2025-07-03 By: mdeseo



 Project Location



Project Location Prepared by MMD on 2025-07-03
Kern County, CA TR by CT on 2025-07-03
Client/Project IR by ES on 2025-07-03
185806775

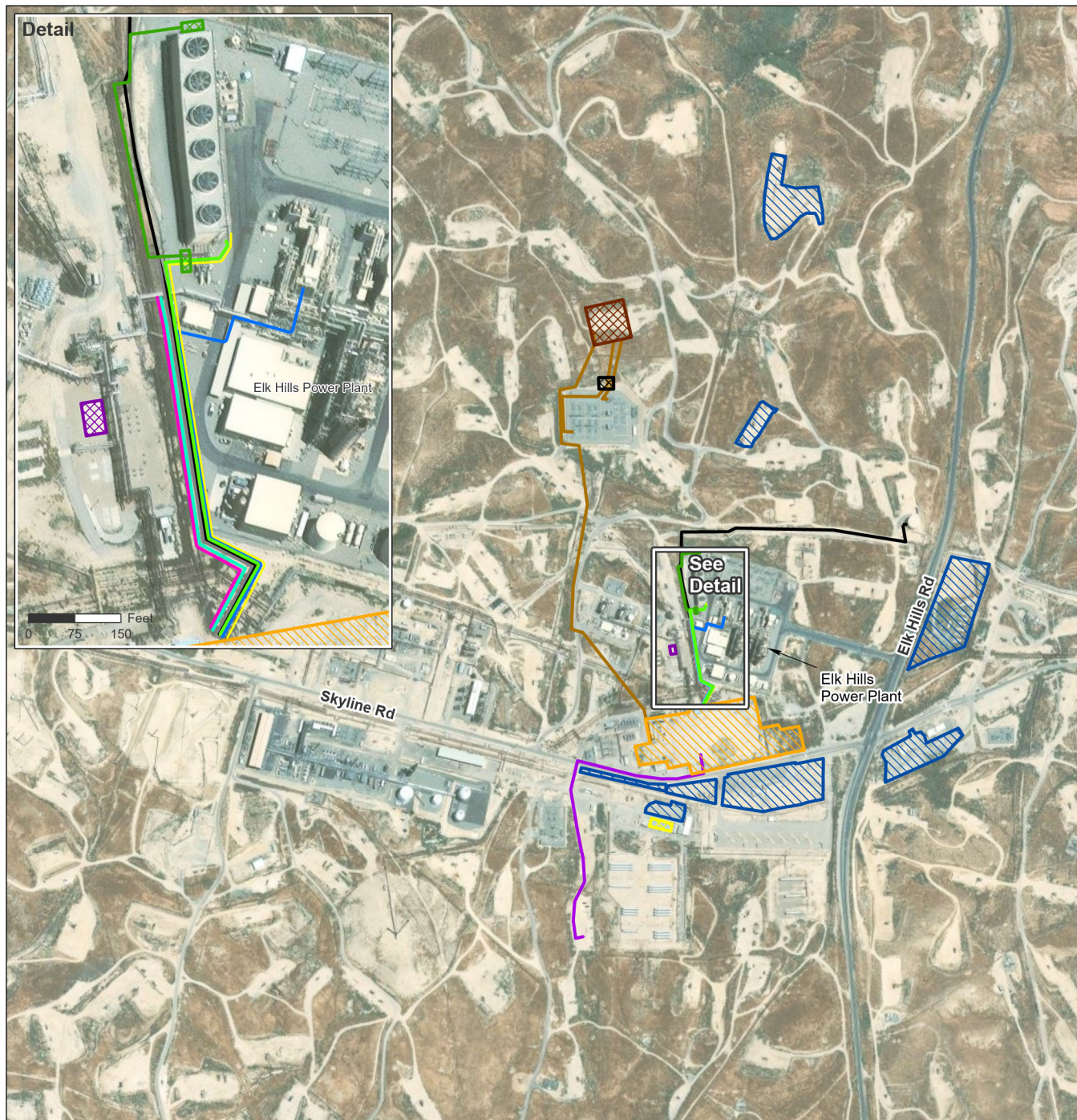
California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Figure No.

1
Title
Project Vicinity

Notes
1. Coordinate System: NAD 1983 StatePlane
California V FIPS 0405 Feet
2. Data Sources: Stantec, 2025.
3. Background: Esri, GEBCO, NOAA, National
Geographic, Garmin, HERE, Geonames.org
Copyright:©2013 National Geographic Society, i-
cubed

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

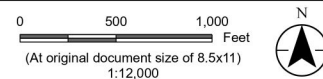
V:\185806775_Active\185806775_CRC_CalCapture03_data\gis_cad\gispro\Geohazards\Geohazards_Figures_20250625.aprx Revised: 2025-08-04 By: mdeseeo



Notes
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec, 2025.
3. Background: Esri, GEBCO, NOAA, National Geographic, Garin, HERE, Geonames.org
Copyright:©2013 National Geographic Society, i-cubed

- Capture Facility
- Temporary Parking, Office, and Staging Areas
- Proposed Sub Location (250 x 250)
- Substation Extension Proposal
- New BPSTG & Transformer
- Warehouse
- Cooling Water Sump

- Electrical Lines
- CO2 Line
- CWR Line
- CWS Line
- Condensate Line
- HP Steam Line
- LP Steam Line
- Raw Water Line
- RO Permeate Stream Pipeline
- CWS Line Alternative

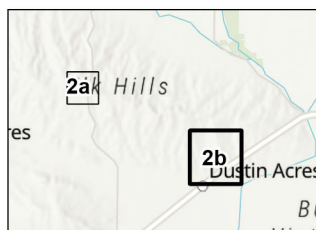


Project Location Prepared by MMD on 2025-08-04
Kern County, CA TR by CT on 2025-08-04
Client/Project IR by ES on 2025-08-04
185806775

California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Figure No. 2a
Title
Project Location

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

V:\185806775_CRC_CalCapture\03_data\gis_cad\gispro\Geohazards\Geohazards_Figures_20250625.aprx Revised: 2025-08-04 By: mdeseo



 Temporary Parking, Office, and Staging Areas

0 800 1,600 Feet
(At original document size of 8.5x11)
1:19,200



Project Location Prepared by MMD on 2025-08-04
Kern County, CA TR by CT on 2025-08-04
Client/Project IR by ES on 2025-08-04
185806775

California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Figure No.
2b

Title
Project Location

Notes
1. Coordinate System: NAD 1983 StatePlane
California V FIPS 0405 Feet
2. Data Sources: Stantec, 2025.
3. Background: Esri, GEBCO, NOAA, National
Geographic, Garin, HERE, Geonames.org
Copyright:©2013 National Geographic Society, i-
cubed

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

1.2 CTV I Background Information

On December 31, 2024, the U.S. EPA issued four UIC Class VI well permits to CTV, a carbon management subsidiary of CRC.

The specific U.S. EPA permits issued for the four wells are as follows:

- R9UIC-CA6-FY22 1.1 for well 373-35R
- R9UIC-CA6-FY22 1.2 for well 345C-36R
- R9UIC-CA6-FY22 1.3 for well 353XC-35R
- R9UIC-CA6-FY22 1.4 for well 363C-27R

These four wells would be utilized to inject the CO₂ captured from the proposed Project into the Monterey Formation 26R storage reservoir located approximately 6,000 feet below the ground surface. The CTV I project area is located within the EHO, which is a suitable area for long-term CO₂ storage and sequestration. The CTV I project was designed to implement sustainable CCS in support of California's initiative to combat climate change by reducing CO₂ levels in the atmosphere.

In addition to the Class VI Permit, CTV obtained a land use permit from the Kern County Planning and Natural Resources Department (Kern County) in 2024. Specifically, the CTV I project was approved by the Kern County Board of Supervisors on October 21, 2024, based on a final Environmental Impact Report (EIR, State Clearinghouse #2022030180) prepared by Kern County and certified by it on the same date. A Notice of Determination was filed with the Kern County Clerk on October 22, 2024. The CTV I project is subject to the terms, conditions and restrictions set forth in the Conditional Use Permits (CUP) issued by Kern County and identified as CUP No. 13, Map 118; CUP No. 14, Map 118; CUP No. 5, Map 119; CUP No. 3, Map 120; CUP No. 2, Map 138; and CUP No. 6, Map 119 (collectively, "the CUP"). Implementation of the CUP authorizes the construction and operation of underground CO₂ facility pipelines to support the CTV I CCS facility and related infrastructure (e.g., injection/monitoring wells, CO₂ manifold piping and metering facilities) within the 9,104-acre project site, located within the EHO.

Four monitoring wells permitted by the California Geologic Energy Management Division (CalGEM), as part of the CUP issued by Kern County for the CTV I project would be used for CO₂ monitoring. In addition, six CTV I permitted wells would be used to monitor for seismic activity. The seismic monitoring wells will be used to detect seismic events at or above magnitude (M) 1.0 in real time as required by the California Air Resources Board (CARB) CCS Protocol under the Low Carbon Fuel Standard (LCFS) (C.4.3.2.3). Additionally, the California Integrated Seismic Network will be monitored continuously for indication of a 2.7 M or greater earthquake or greater occurring within a 1-mile radius of injection operations from commencement of injection activity to its completion.

Monitoring activities would extend beyond the injection phase of the Project pursuant to Code of Federal Regulation (CFR) Title 40 Section 146.93 until site closure is granted. Monitoring requirements during post-injection are similar to those during injection, with activities such as sampling occurring quarterly and monitoring well integrity testing at frequency per U.S. EPA requirement.



As noted above, the facilities approved as part of the CTV I project, including but not limited to the manifold, pad, injection wells, monitoring wells and related transmission lines, pipelines and other related facilities that have already been approved by applicable agencies with jurisdiction over those facilities, including the U.S. EPA, CalGEM and Kern County, are not included as part of the proposed Project. Accordingly, such facilities are not analyzed in this report.

1.3 Project Location

The Project is located within the EHOF in the southwestern edge of the San Joaquin Valley near Tupman in Kern County, California.

The Project comprises portions of six parcels owned by CRC. The Project is contained within the following sections of EHOF: sections 26, 34, and 35 of Township 30 South Range 23 East and sections 10 and 11 of Township 31 South Range 24 East, Mount Diablo Base and Meridian (MDB&M), Kern County, State of California (Table 1). The proposed Project would be located on approximately 52 acres within the identified parcels.

Table 1 Project Parcel Data

Assessor's Parcel Number	Section/ Township/ Range	Acreage*
158-090-19	Section 35/ Township 30S/ Range 23E	590.61
158-090-16	Section 35/ Township 30S/ Range 23E	14.78
158-090-02	Section 26/ Township 30S/ Range 23E	640
158-090-04	Section 34/ Township 30S/ Range 23E	682.86
298-070-05	Section 11/Township 31S/Range 24E	640
298-070-06	Section 10/Township 31S/Range 24E	640

Notes:

Assessor's parcel acreages from Kern County Web Map ([Kern County GIS](#), 2025).

1.4 Purpose and Scope of Work

1.4.1 Purpose

The purpose of this Desktop Geohazards Assessment is to evaluate relevant publicly available information and data provided by CRC for the Project site and provide an overview of geologic conditions that represent potential geotechnical hazards associated with the Project. This report has been prepared in accordance with accepted geotechnical engineering principles and in general conformance with the approved scope of services.



1.4.2 Methodology

Stantec performed a desktop-level evaluation of the geologic and soil hazards that may affect future development of the Project site. The Scope of Work for this Desktop Geohazards Assessment included:

- Review of relevant published geologic information consisting of the following: U.S. Geological Survey (USGS) published maps and reports, State of California-issued geologic and hazard maps, and Kern County Safety Element.
- Review and summarize regional and local geology and identify potential geotechnical and geologic hazards.
- Research and identify relevant geologic hazards, such as fault rupture, seismic shaking, lateral spreading, liquefaction, landslide, subsidence, erosion, slope stability, shallow groundwater, expansive and collapsible soils, based on readily available information and a thorough understanding of the Project site's geologic and soil conditions.

The geohazards assessment presented here was authored by Environmental Planner Zoe Dascalos, B.S., and reviewed by Principal Engineer, Jaret Fischer, P.E. This report also incorporates geotechnical and geologic information prepared by CRC for the CTV I project, as appropriate, as presented within the following technical reports:

- Soils Engineering Inc. (SEI). (2025). Geotechnical Investigation Report for the Terra Vault 1 Carbon Capture Project 4026 Skyline Road Tupman, Kern County, CA.
- SEI. (2023). Geotechnical Investigation Report for the Elk Hills GEHA & Truck Unloading Station 4026 Skyline Road Tupman, Kern County, CA.
- SEI. (2020). Geologic Hazards Study for the CO₂ Capture Project from Elk Hills Power Plant.



2 Results

The following sections detail the findings of this Desktop Geohazards Assessment.

2.1 Regional Geology

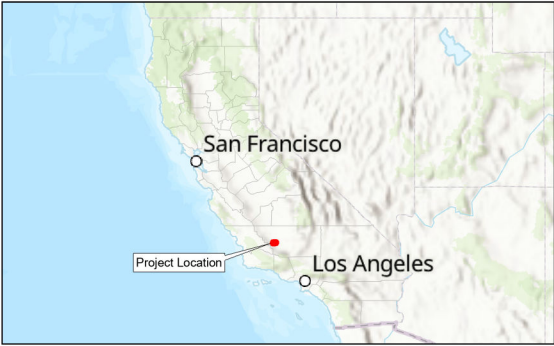
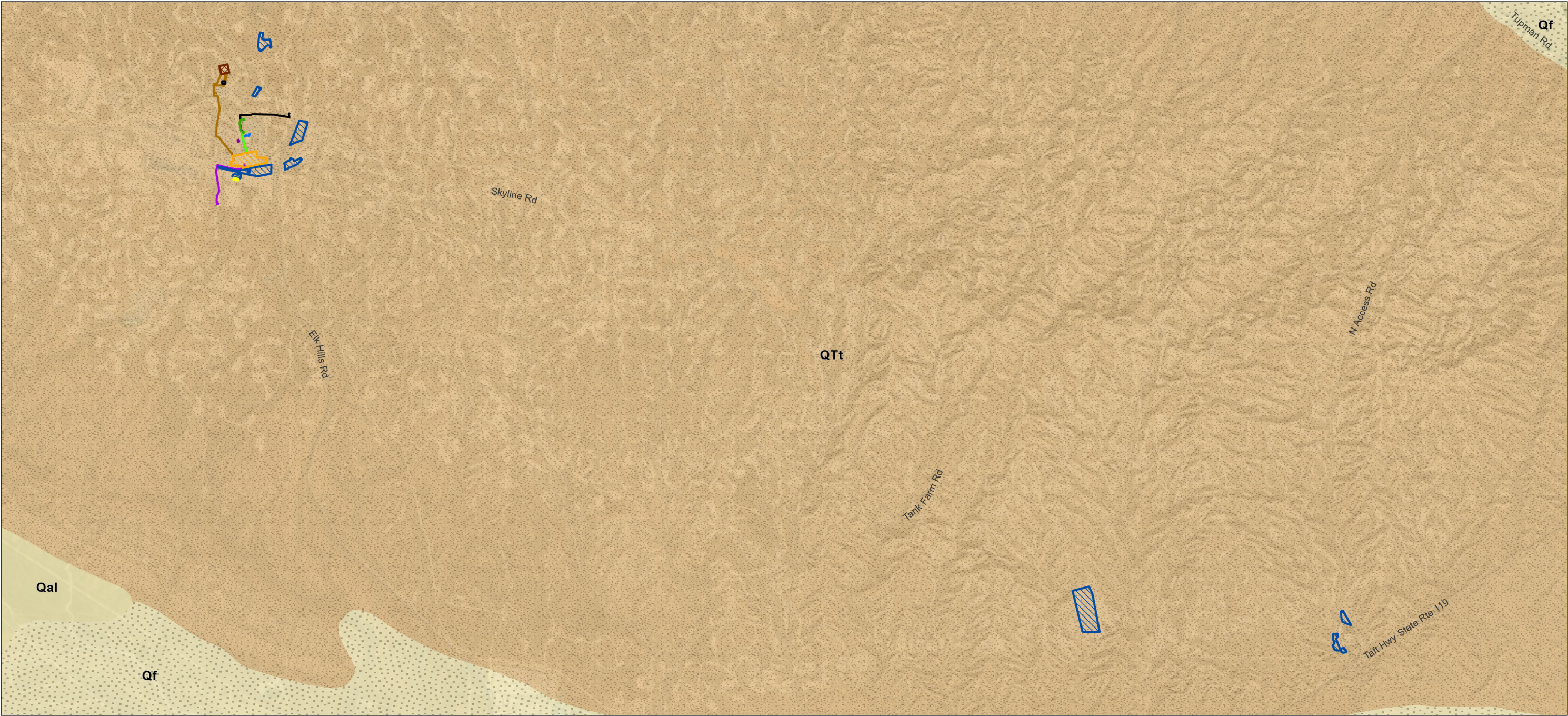
The Project is located within the EHOFF in the Southwest edge of the San Joaquin Valley near Tupman in Kern County, California. The CCU and the CO₂ pipeline would be situated within Section 35 of Township 30 South and Range 23 East MDB&M, in the East Elk Hills, California USGS 7.5-minute topographic quadrangle. The Project area is underlain by Quaternary Pliocene-Pleistocene non-marine sedimentary rocks consisting of sandstone, shale, and gravel deposits (SEI 2020).

The San Joaquin Valley is approximately 200 miles long and up to 70 miles wide. The northern portion of the San Joaquin Valley is drained by the San Joaquin River, which flows from east-central California to the San Francisco Bay before reaching the Pacific Ocean. The southern portion of the San Joaquin Valley drains into two terminal lake beds, Tulare Lake and Buena Vista Lake. Geologically, the San Joaquin Valley structural trough is characterized by marine and continental sedimentary deposits reaching thicknesses of up to 32,000 feet.

The Project is located within Quaternary Pliocene-Pleistocene non-marine sedimentary rocks consisting of sandstone, shale, and gravel deposits. The Project is within the CRC primary production zone of the EHOFF. The EHOFF is an anticline that is composed of uplifted, stratified alluvial soils. The Tulare formation lies at the surface of Elk Hills (SEI 2020). The Tulare Formation is underlain by the San Joaquin formation, the Etchegoin formation, and the Monterey formation. The San Joaquin formation is characterized as a Pliocene aged sandstone, silty sand, and siltstone containing mostly marine fossils. The Etchegoin formation is a marine sandstone. The upper units of the Tulare formation are mostly unsaturated; however, the lower units are sometimes saturated with water and oil (SEI 2020). The geologic map of the Project site is provided in Figure 3.



V:\1858\Active\185806775_CRC_CalCapture\03_data\gis_cad\gis\pro\Geohazards\Geohazards_Figures_20250625.aprx Revised: 2025-08-04 By: mdeseeo



Notes
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec 2025, USGS Geologic map of California : Bakersfield sheet, Smith, A.R. 1964.
3. Background: Esri, GEBCO, NOAA, National Geographic, Garin, HERE, Geonames.org
Copyright:©2013 National Geographic Society, i-cubed

- | | | | |
|--|--|--|-----------------------------|
| | Capture Facility | | Electrical Lines |
| | Temporary Parking, Office, and Staging Areas | | CO2 Line |
| | Proposed Sub Location (250 x 250) | | CWR Line |
| | Substation Extension Proposal | | CWS Line |
| | New BPSTG & Transformer | | Condensate Line |
| | Warehouse | | HP Steam Line |
| | Cooling Water Sump | | LP Steam Line |
| | | | Raw Water Line |
| | | | RO Permeate Stream Pipeline |
| | | | CWS Line Alternative |

- Geologic Map Unit**
- QTt - Tulare Formation (Pliocene to Pleistocene)
 - Qal
 - Qf

0 1,500 3,000 Feet
(At original document size of 11x17)
1:36,000



Project Location	Prepared by MMD on 2025-08-04
Kern County, CA	TR by CT 2025-08-04
Client/Project	IR by ES on 2025-08-04
	185806775

California Resources Corporation
CalCapture Carbon Capture and Sequestration Project

Figure No.

3

Title

Geology

2.2 Regional Groundwater

The Project site is located within the San Joaquin Valley Basin (DWR 2019). In 1987 a groundwater assessment was conducted by the Mark Group at 27R, which is located approximately 1 mile northwest of the Project site, during which no groundwater was encountered to a depth of 420 feet. In addition, no water was encountered in 1991 when a 1,000-foot soil boring was drilled at 27R. Groundwater was not encountered at a depth of 100 feet in soil borings, and there is no shallow groundwater beneath the Project site (SEI 2020). Groundwater was not encountered during the 2024 and 2023 field explorations completed by SEI. However, depth to an unconfined aquifer according to Department of Water Resources was 165 feet in spring 2023 (SEI 2025).

There are no records of any water supply wells at the Project site or of groundwater being used as drinking water. Therefore, the risk of exposure to contaminated groundwater is insubstantial (CARB 2023).

2.3 Regional Seismicity

2.3.1 Fault Rupture (Ground Rupture) Hazard

The USGS has mapped Quaternary active faults within 35-miles of the Project site. The nearest Quaternary active fault mapped by the USGS is an unnamed undifferentiated Quaternary fault located approximately 2.6 miles east of the Project site. Another unnamed undifferentiated Quaternary fault is located approximately 3.9 miles northwest of the Project site. Other named and unnamed Quaternary active faults have also been mapped within a 35-mile radius of the Project site though none occur at the Project site (USGS 2025b) (refer to Figure 4). Nearby active earthquake faults within 35-miles include the following:

- San Andreas (1857 Rupture M-2a and other segments – 14.8 miles
- San Andreas (Cholame M-1c-1) – 22.3 miles
- Kern Front – 22.7 miles
- White Wolf – 25.0 miles
- Pleito Thrust – 25.2 miles
- San Juan – 28.9 miles

According to geotechnical investigations performed by SEI using the program EQFault (version 3.0), the largest estimated maximum site acceleration is 0.2517g from an 8.0 M earthquake on the San Andreas Fault located approximately 14.8 miles away.



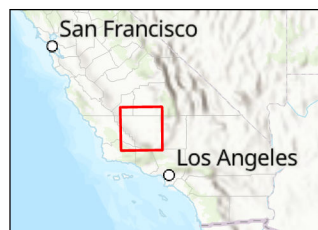
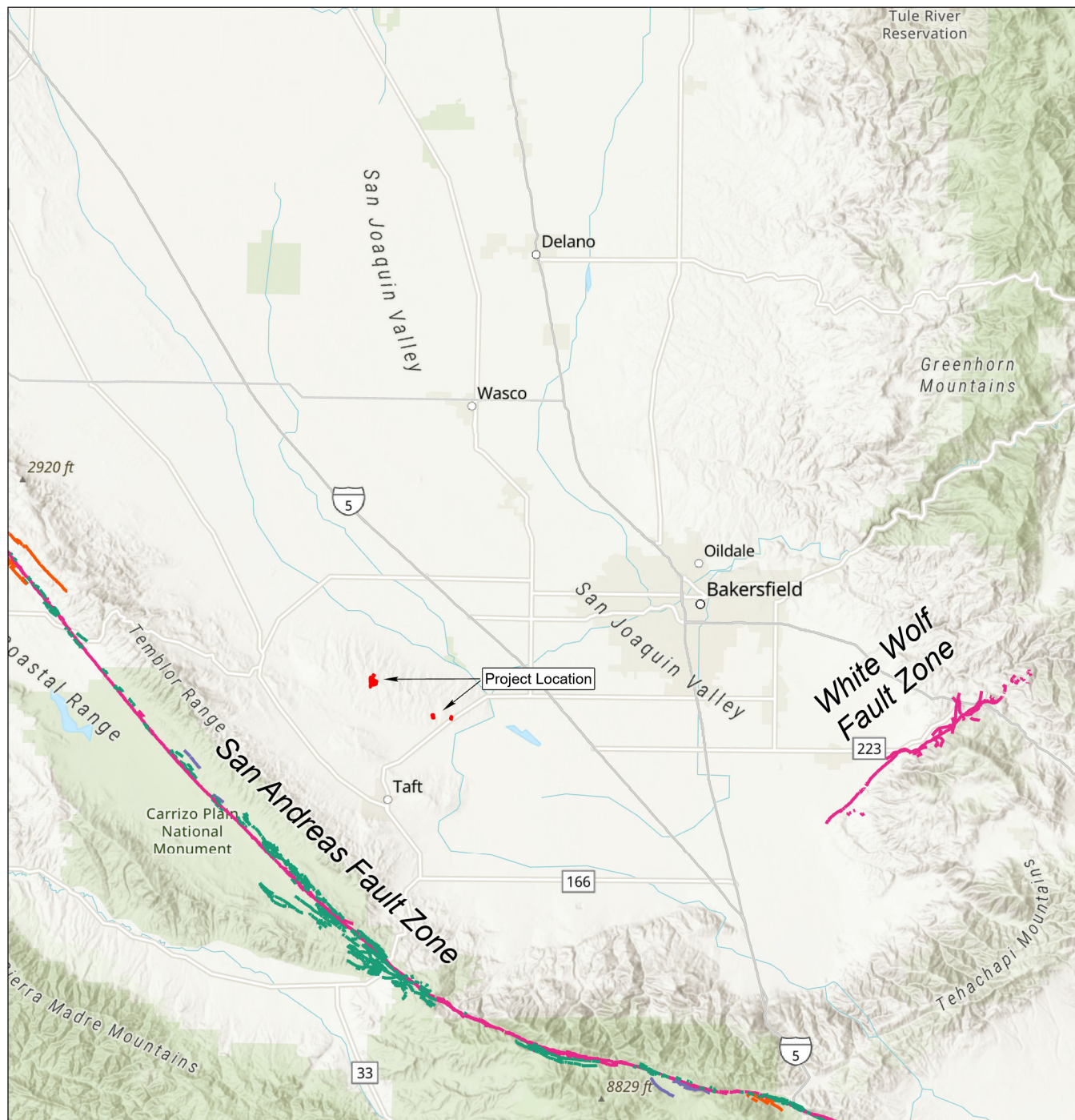
CalCapture CCS Project – Geohazards Assessment

2 Results

The occurrence of low magnitude seismic events on the existing active faults in the vicinity of the Project site suggests that the near-surface stresses are being accommodated on these existing geologic structures. Therefore, surface rupture at the Project site is unlikely to occur.



V:\18580\Active\185806775_CRC_CalCapture03_data\gis_cad\gispro\Geohazards\Geohazards_Figures_20250625.aprx Revised: 2025-07-03 By: mdeseo



- Project Location**
- Quaternary Faults**
- Age**
- Latest Quaternary
 - Undifferentiated Quaternary
 - Late Quaternary
 - Historic

0 6 12 Miles
(At original document size of 8.5x11)
1:760,320



Project Location Prepared by MMD on 2025-07-03
Kern County, CA TR by CT on 2025-07-03
Client/Project IR by ES on 2025-07-03
185806775

California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Figure No.

4
Title
Faults

Notes

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
2. Data Sources: Stantec 2025, Faults from USGS, 2024, Township/Section/ data from BLM 2018, Quadrangle data from USGS 2017.
3. Background: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org
Copyright:©2013 National Geographic Society, i-cubed

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

2.3.2 Strong Ground Shaking

The Project site is located within an area where earthquakes have occurred in historic time. In 2015, a 1.1 M earthquake was recorded approximately at the Project site (35.279°N 119.469°W) (USGS 2025a).

In addition to the earthquake at the Project site, numerous earthquakes have occurred in Kern County. The largest recorded earthquake in Kern County was the Kern County Earthquake in 1952, which is estimated to have had a 7.7 M. Prior to that, in 1857, the Fort Tejon Earthquake occurred along the San Andreas Fault. This was prior to the Richter scale, so it was estimated to be 7.9 M. A majority of Kern County earthquakes are less than 5.0 M on the Richter scale (SEI 2020).

Information published by the USGS indicates that the peak ground acceleration (PGA) with a 2 percent probability of being exceeded at the Project site in 50 years is 40 to 80 percent gravity, where percent gravity is the percent acceleration due to gravity determined in accordance with the U.S. Seismic Hazard Maps web site (USGS 2014). Mitigation of strong ground shaking, when needed, is typically provided by designing structures in accordance with the latest edition of the California Building Code and industry standards for pipelines. Based on the proximity to active faults and magnitude of documented earthquakes within the region, strong ground shaking may occur at the Project site; however, ground failure is highly unlikely.

2.3.3 Liquefaction

Liquefaction of saturated sandy soils is generally caused by the sudden decrease in soil shear strength due to vibration. During cyclic shaking, typically caused by an earthquake, the soil mass is distorted, and inter-particle stresses are transferred from the soil particles to the pore water, resulting in an increase in pore pressure. As pore pressure increases, the bearing capacity of the soil decreases, and the soil may behave temporarily as a viscous fluid (liquefaction) and consequently loses its capacity to support the structures founded thereon.

Engineering research of soil liquefaction potential (Seed, et al. 1985; Seed and Idris 1982) indicates that, generally, the following three basic factors must exist concurrently for liquefaction to occur:

- A source of ground shaking such as an earthquake capable of generating soil mass distortions.
- A relatively loose sandy soil fabric exhibiting a potential for volume reduction.
- A relatively shallow groundwater table (within approximately 50 feet below ground surface) or completely saturated soil conditions that would allow positive pore pressure generation.

The Project site is not within any currently mapped Liquefaction Zones established by the California Geological Survey (CGS) as the area has not been evaluated for liquefaction or landslide hazards and is not located within an Alquist-Priolo Fault Zone (CGS 2024).

Based on the near surface soil conditions, anticipated subsurface soil conditions, depth to groundwater, and proximity to seismically active faults, the potential for liquefaction induced settlement is low. A design



level geotechnical investigation, prepared as part of detailed engineering design, will quantify the anticipated seismically induced settlement and provide recommendations for mitigation, as necessary.

2.3.4 Lateral Spreading

Lateral spreading typically occurs as a form of horizontal displacement of relatively flat-lying alluvial material toward an open or “free” face such as an open body of water, channel, or excavation. This movement is generally due to failure along a weak plane and is often associated with liquefaction. As cracks develop within the weakened material, blocks of soil displace laterally toward the open face. Cracking and lateral movement may gradually propagate away from the face as blocks continue to break free.

The Project site has a low liquefaction potential as discussed above and is located at least one-half to one mile from a free face (abrupt changes in surface topography). Given the relatively flat topography of the Project site, soil conditions, depth to groundwater, depth to bedrock, and the low potential for liquefaction in the area, the potential for lateral spreading is considered low.

2.3.5 Settlement

The Geologic Hazard Study for the CO₂ Capture Project from Elk Hills Power Plant prepared by SEI (located at the Project site) estimated that the amount of dynamic settlement that would occur at the Project site during a major earthquake is approximately 0.33 inches to 0.55 inches based on the lithology encountered as well as the blow counts recorded using soil sampling and the data analysis of the soil borings using the program LiquefyPro. The estimated amount of differential settlement was 0.185 inches to 0.281 inches (SEI 2020).

2.4 Local Faults and Fractures

The Project site is not located within an Alquist-Priolo Fault Zone (CGS 2024). The USGS has mapped Quaternary active faults within 35 miles of the Project site. The nearest Quaternary active fault mapped by the USGS is an unnamed undifferentiated Quaternary fault located approximately 2.6 miles east of the Project site. Another unnamed undifferentiated Quaternary fault is located approximately 3.9 miles northwest of the Project site. Other named and unnamed Quaternary active faults have also been mapped within a 35-mile radius of the Project site though none occur at the Project site (USGS 2025b).

2.5 Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface due to several factors. Underground mining operations and groundwater pumping can lead to surface subsidence as subsurface material settles where fluids and/or material have been removed from below. Soil types also play a role in land subsidence since some types of soil expand when wet and contract when dry.



The USGS maps areas of recorded historical and current subsidence across California. The map shows areas of subsidence caused by groundwater pumping, peat loss, and oil extraction. The Project is not located within any mapped area of subsidence (SEI 2020).

In addition, the City of Bakersfield Safety Element Maps subsidence in nearby areas including the Project. These main causes of subsidence are tectonic subsidence, oil and gas fluid extraction, groundwater withdrawal and hydrocompaction of moisture deficient alluvial deposits. The Project is located in an area where no historic land subsidence has occurred and is located outside the area of hydrocompaction (SEI 2020).

Although unconsolidated alluvial soils are present over portions of the Project site, these soils are largely unsaturated and are not used as a source of groundwater. Therefore, the risk of subsidence in these soils is low. In addition, the Project does not involve removal of oil and gas production or groundwater pumping, eliminating the possibility for subsidence caused by the Project.

2.6 Site Conditions

2.6.1 Expansive Soil Potential

Soil volume changes can occur when expansive soils undergo alternating cycles of wetting (swelling) and drying (shrinking). Soils mapped on the Project site are primarily alluvial and include Elkhills sandy loam, with 9 to 50 percent slopes, eroded, Elkhills-Torriorthents stratified complex, with 9 to 15 percent slopes, Elkhills-Torriorthents stratified, eroded complex, with 15 to 50 percent slopes, Kimberlina sandy loam, with 5 to 9 percent slopes (refer to Figure 5). These soils are not considered hydric soils (NRCS 2025).

Soil borings collected at the Project site in 2020 showed low to moderately expansive surface soils. In addition, multiple consolidation tests were conducted on the top 6-inches of samples. The results indicated that there was a low to moderate consolidation potential, ranging from -0.1 to -2.9 percent (SEI 2020).

Five soil borings advanced at the Project site in November 2023 were laboratory tested to determine Expansion Index (EI). Per the ASTM International D4829 standard for Expansion Index of Soils, soils are considered to be expansive when the EI result is greater than 20. The soil borings had EI values of 5, 11, and 10, which indicates a very low expansion potential (SEI 2023).

2.6.2 Corrosive Soil Potential

Sand in direct contact with concrete typically has a lower corrosion potential than clay soils in direct contact with concrete. Corrosive soils can typically be mitigated with corrosion resistant concrete. Natural Resources Conservation Service (NRCS) mapped soils on the Project site have the following risks of corrosion:



CalCapture CCS Project – Geohazards Assessment
2 Results

Table 2 Corrosive Potential of Soils Mapped on the Project Site

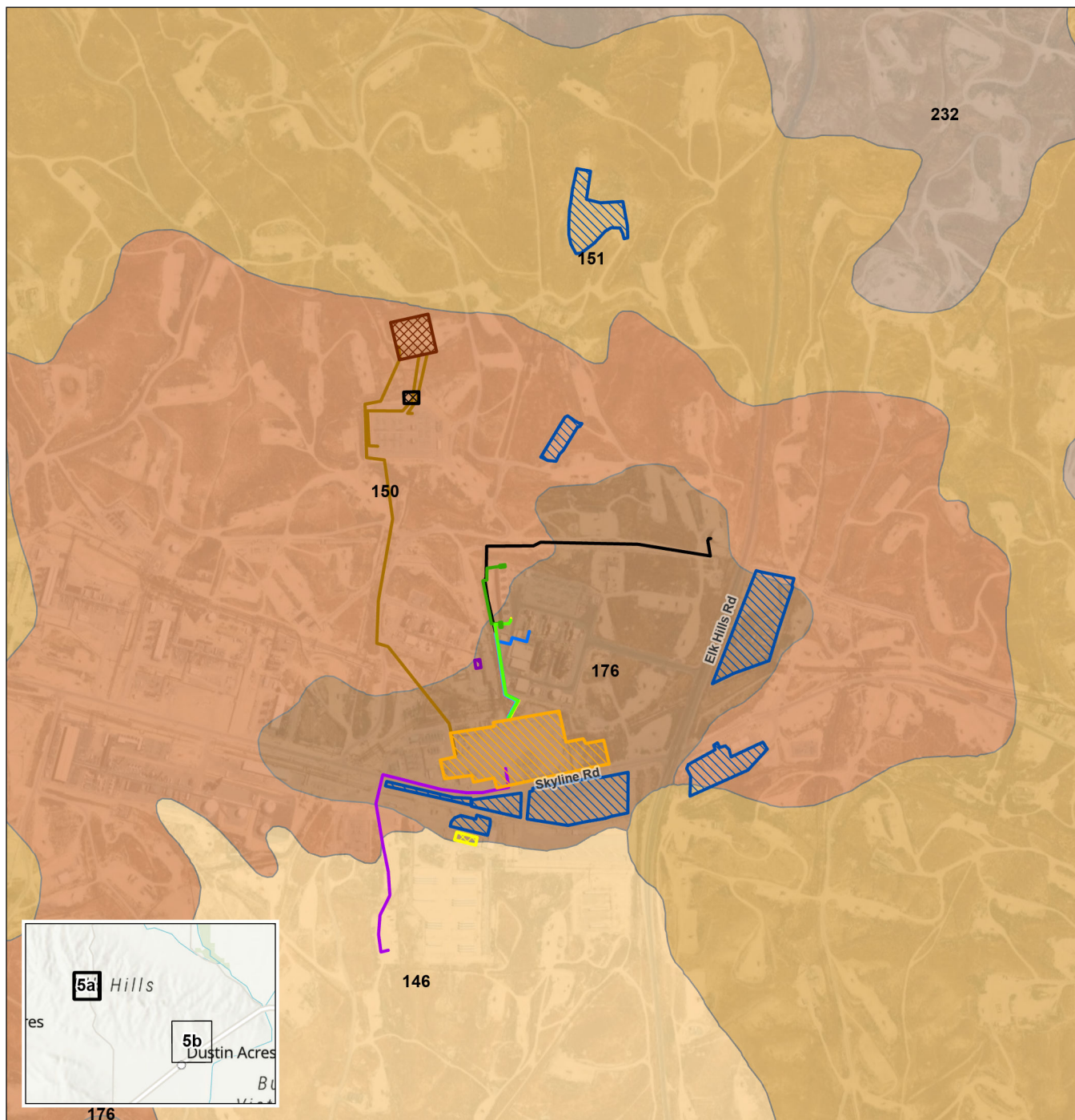
Soil Type	Potential of Corrosion of Concrete	Potential Corrosion of Steel
146—Elkhills sandy loam, 9 to 50 percent slopes, eroded	Moderate	High
150—Elkhills-Torriorthents stratified complex, 9 to 15 percent slopes	Moderate	High
176—Kimberlina sandy loam, 5 to 9 percent slopes	Moderate	High
217— Kimberlina-Urban land complex, 0 to 5 percent slopes	Moderate	Moderate
729—Sodic Haplocambids, thick-Torriorthents, thin-Torriorthents, very thin, eroded, complex, 30 to 60 percent slopes	High	High
733—Sodic Haplocambids, thick-Torriorthents, thin, complex, 15 to 30 percent slopes	High	High
735—Sodic Haplocambids, thick-Elkhills-Torriorthents, thin, complex, 30 to 60 percent slopes	High	High

Source: NRCS 2025

Preliminary test results by SEI indicate that existing surface soils are corrosive. The highest sulfate (SO₄) concentration measured was 5,500 parts per million (ppm), the highest chloride (Cl) measured was 530 ppm, and the soil pH tests results indicated pH values of between 7.82 and 8.05 (SEI 2025).



V:\185806775_CRC_CalCapture03_data\gis\pro\Geohazards\Geohazards_Figures_20250625.aprx Revised: 2025-08-04 By: mdeseeo



Project Features

- Capture Facility
- Temporary Parking, Office, and Staging Areas
- Proposed Sub Location (250 x 250)
- Substation Extension Proposal
- New BPSTG & Transformer
- Warehouse
- Cooling Water Sump

- Electrical Lines
- CO2 Line
- CWR Line
- CWS Line
- Condensate Line
- HP Steam Line
- LP Steam Line
- Raw Water Line
- RO Permeate Stream Pipeline
- CWS Line Alternative

Soils

- 146: Elkhills sandy loam, 9 to 50 percent slopes, eroded
- 150: Elkhills-Torriorthents stratified complex, 9 to 15 percent slopes
- 151: Elkhills-Torriorthents stratified, eroded complex, 15 to 50 percent slopes
- 176: Kimberlina sandy loam, 5 to 9 percent slopes
- 232: Torriorthents stratified, eroded-Elkhills complex, 9 to 50 percent slopes

0 500 1,000 Feet
(At original document size of 8.5x11)
1:12,000



Project Location Prepared by MMD on 2025-08-04
Kern County, CA TR by CT on 2025-08-04
Client/Project IR by ES on 2025-08-04
185806775

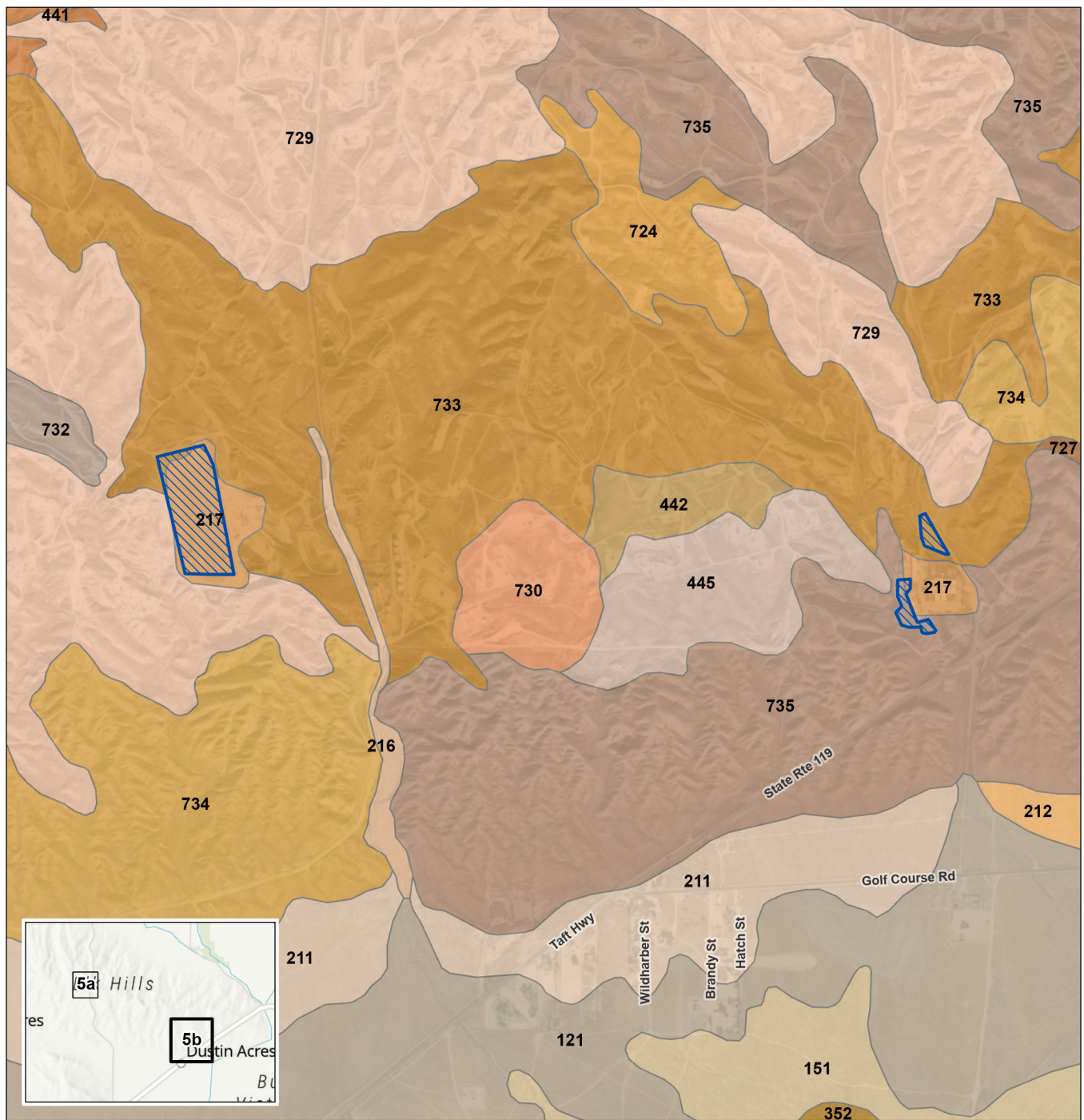
California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Figure No.
5a

Title
Soils

Notes

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet; 2. Data Sources: Stantec, 2025. Soils from NRCS, 2025. 3. Background: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, Copyright:©2013 National Geographic Society, i-cubed

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Project Features

- Temporary Parking, Office, and Staging Areas

Soils

- 121: Granoso loamy sand, 2 to 5 percent slopes
- 151: Excelsior fine sandy loam, saline-sodic, 0 to 1 percent slopes
- 211: Kimberlina fine sandy loam, 2 to 5 percent slopes
- 212: Kimberlina fine sandy loam, saline-sodic, 0 to 2 percent slopes
- 216: Kimberlina-Granoso complex, 0 to 5 percent slopes, occasionally flooded
- 217: Kimberlina-Urban land complex, 0 to 5 percent slopes

Notes

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet; 2. Data Sources: Stantec, 2025. Soils from NRCS, 2025. 3. Background: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, Copyright:©2013 National Geographic Society, i-cubed

- 352: Posochanet-Posochanet, partially reclaimed, association, 0 to 1 percent slopes
- 441: Sodic Haplocambids, thick, 9 to 30 percent slopes, MLRA 17
- 442: Elkhills sandy loam, 5 to 15 percent slopes
- 445: Sodic Haplocambids, thick-Elkhills complex, 30 to 50 percent slopes
- 724: Elkhills sandy loam, 30 to 60 percent slopes
- 727: Sodic Haplocambids, thick, 30 to 50 percent slopes

- 729: Sodic Haplocambids, thick-Torriorthents, thin-Torriorthents, very thin, eroded, complex, 30 to 60 percent slopes
- 730: Haplocambids, thick-Elkhills complex, 9 to 15 percent slopes
- 732: Elkhills-Haplocambids, thick, complex, 30 to 50 percent slopes
- 733: Sodic Haplocambids, thick-Torriorthents, thin, complex, 15 to 30 percent slopes
- 734: Sodic Haplocambids, thick-Torriorthents, very thin, eroded-Elkhills complex, 15 to 50 percent slopes
- 735: Sodic Haplocambids, thick-Elkhills-Torriorthents, thin, complex, 30 to 60 percent slopes

0 500 1,000 Feet
(At original document size of 8.5x11)
1:19,200



Project Location Prepared by MMD on 2025-08-04
Kern County, CA TR by CT on 2025-08-04
Client/Project IR by ES on 2025-08-04
185806775

California Resources Corporation
CalCapture Carbon Capture and Sequestration Project
Figure No.
5b
Title
Soils

2.6.3 Near Surface Obstructions or Restrictive Soil Layers

SEI encountered subsurface soils during two investigations, November 2023 and July 2024. During November 2023 soils investigation activities, soils were encountered in the future amine treatment facility, which consisted predominantly of stiff medium plasticity clays and medium to very dense sands in the upper 14 feet and hard medium plasticity clays below 14 feet. During the July 2024 investigation, soils were encountered in the area of the future manifold and injection wells. These soils consisted predominately of very stiff to hard low to high plasticity clays, very stiff to hard silts, and loose to dense sands in the upper 10 feet, while the soils below 10 feet were medium dense to very dense sands (SEI 2025).

If surface organics are identified, they will be removed prior to grading the Project site. The approximate depth of subsurface organic material and soils will be characterized in the design level geotechnical investigation completed during detailed engineering design. Near-surface obstructions or restrictive soil layers will be assessed by the design-level geotechnical investigation.

2.6.4 Frost Depth

California Extreme Frost Line Penetration at the Project site is an average of 5 inches per the US Department of Commerce (2025). Proposed minimum foundation depths below the frost depth will be included in the design-level geotechnical investigation report completed during detailed engineering design.

2.6.5 Slopes

The Project site was previously graded for an oil and gas production facility and is relatively flat and is located in an area with minimal slope to the west. No historical landslides or creep has been observed in the area where the Project site is located (SEI 2025). Permanent slopes steeper than 5:1 (horizontal to vertical) or higher than 5 feet are not anticipated to be constructed or built upon for the Project. Due to the existing topography and the proposed grading, landslides are not considered a potential hazard for the Project site. The stability of slopes, if any, would be verified when design-level grading information becomes available.

2.6.6 Erosion

The predominantly fine-grained soils underlying the Project site are potentially susceptible to erosion or the loss of topsoil due to surface water flows and wind-driven movement. Runoff potential is the relative measurement of the potential for water to runoff into drainage channels versus infiltrate directly into the soil. The on-site soils have a low to medium runoff potential and the soils within the staging/laydown area have a runoff potential ranging from low to very high. The erosion potential for each on-site soil was also determined using the K-Factor. The soil-erodibility factor (K) represents: (1) the susceptibility of soil or surface material to erosion, (2) the transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high



in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff, although these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high runoff rates and large runoff volumes (SWRCB 2017). Refer to Table 3.

Table 3 Erosive Potential for Soils Mapped on the Project Site

Soil Type	Runoff Class	Erosion Potential (K-Factor)
146—Elkhills sandy loam, 9 to 50 percent slopes, eroded	Medium	0.17
150—Elkhills-Torriorthents stratified complex, 9 to 15 percent slopes	Low	0.17
176—Kimberlina sandy loam, 5 to 9 percent slopes	Low	0.24
217— Kimberlina-Urban land complex, 0 to 5 percent slopes	Low	0.24
729—Sodic Haplocambids, thick-Torriorthents, thin-Torriorthents, very thin, eroded, complex, 30 to 60 percent slopes	Very high	0.43
733—Sodic Haplocambids, thick-Torriorthents, thin, complex, 15 to 30 percent slopes	Very high	0.43
735—Sodic Haplocambids, thick-Elkhills-Torriorthents, thin, complex, 30 to 60 percent slopes	Very high	0.43

Source: NRCS 2025

The erosion potential for soils increases when the soils are disturbed, the existing vegetation removed, and the soil is exposed to wind and rain drop impact. Additionally, steeper slopes tend to erode faster if not protected with erosion and sediment control best management practices (BMPs). Mitigation of soil erosion may include selective grading, placement of vegetation-free xeriscaping, design of runoff control features such as drainage ditches, and construction of erosion control features such as pavements and surface mats. Site drainage features will be addressed in the final engineering plans for the Project.

2.6.7 Landforms that Could Develop Sinkholes or Other Hazards

Sinkholes and karst topography (limestone formations susceptible to formation of underground caverns) are known to exist in California (USGS 2018). The Project site is covered by Quaternary alluvial material and underlain by loosely consolidated bedrock of the Tulare Formation. Therefore, the potential for sinkhole development at the Project site is considered relatively low. Existing landforms are not consistent



with landforms that could develop into sinkholes or other geologic hazards but should be addressed in the design level geotechnical investigation when site specific conditions are understood.

2.7 Review of Aerial Photographs

Historical aerial imagery from 1937, 1942, 1952, 1956, 1967, 1968, 1973, 1976, 1978, 1984, 1994, 2005, 2009, 2012, 2016, and 2020 reveals that the Project site and adjacent properties were developed for oil and production since prior to 1937 (EDR 2025).



3 Environmental Analysis

The following sections present the potential effects from the construction and operation of the Project on geologic resources and risks to life and property from geologic hazards.

3.1 Significance Criteria

In accordance with the CEQA Guidelines Appendix G Environmental Checklist,² the following questions are to be analyzed and evaluated to determine whether geology impacts are significant (as they pertain to the Geohazards Assessment). Would the proposed project:

- a. Directly or indirectly cause potential adverse effects, including the risk of loss, injury, or death involving the following:
 - i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.
 - ii. Strong seismic ground shaking?
 - iii. Seismic-related ground failure, including liquefaction?
 - iv. Landslides?
- b. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or offsite landslide, subsidence, liquefaction, or collapse.

In accordance with the CEQA Guidelines Appendix G Environmental Checklist, the following questions are to be analyzed and evaluated to determine whether mineral impacts are significant (as they pertain to the Geohazards Assessment). Would the proposed project:

- a. Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.
- b. Result in the loss of availability of a locally important mineral resource recovery site delineated on a local plan, specific plan, or other land use plan.

²Appendix G Environmental Checklist Form, Guidelines for the Implementation of the California Environmental Quality Act, 2023



3.2 Impact Analysis

3.2.1 GEO-1 Impact Analysis

Impact GEO-1 Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving: Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. Strong seismic ground shaking? Seismic-related ground failure, including liquefaction? Landslides?

Less than significant with mitigation. The Project does not directly or indirectly cause potential substantial adverse effect related to ground rupture. The Project site has a low likelihood of surface fault rupture due to the distance from active faults. Based on the proximity to active faults and magnitude of documented earthquakes within the region, strong ground shaking may occur at the Project site; however, ground failure is highly unlikely.

The Project site is not within any currently mapped Liquefaction Zones established by the California Geological Survey (CGS) as the area has not been evaluated for liquefaction or landslide hazards and is not located within an Alquist-Priolo Fault Zone (CGS 2024). Based on the near surface soil conditions, anticipated subsurface soil conditions, depth to groundwater, and proximity to seismically active faults, the potential for liquefaction induced settlement is low. A design level geotechnical investigation will quantify the anticipated seismically induced settlement and provide recommendations for mitigation, as necessary, to protect structures and pipelines in accordance with the Uniform Building Code and industry design standards.

Due to the existing topography and the proposed grading, landslides are not considered a potential hazard for the Project site. The stability of slopes, if any, should be verified when design-level grading information becomes available.

Seismic shaking, liquefaction, and mass wasting related impacts can be mitigated to less than significant with mitigation measures GEO-1 through 4.

3.2.2 GEO-2 Impact Analysis

Impact GEO-2 Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or offsite landslide, subsidence, liquefaction, or collapse.

Less than significant with mitigation. Liquefaction, mass wasting, and subsidence related impacts can be mitigated to less than significant.

The Project site is not within any currently mapped Liquefaction Zones established by the California Geological Survey (CGS) as the area has not been evaluated for liquefaction or landslide hazards and is



not located within an Alquist-Priolo Fault Zone (CGS 2024). Based on the near surface soil conditions, anticipated subsurface soil conditions, depth to groundwater, and proximity to seismically active faults, the potential for liquefaction induced settlement is low. A geotechnical investigation will be prepared during the detailed engineering design phase to quantify the anticipated seismically induced settlement and provide recommendations for mitigation, as necessary.

Due to the existing topography and the proposed grading, landslides are not considered a potential hazard for the Project site. The stability of slopes, if any, should be verified when design-level grading information becomes available.

Project is located in an area where no historic land subsidence has occurred and is located outside the area of hydrocompaction (SEI 2020). Although unconsolidated alluvial soils are present over portions of the Project site, these soils are largely unsaturated and are not used as a source of groundwater. Therefore, the risk of subsidence in these soils is low. In addition, the Project does not involve removal of oil and gas production or groundwater pumping, eliminating the possibility for subsidence caused by the Project.

3.2.3 MINERAL-1 Impact Analysis

Impact MINERAL-1 Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.

Less than significant impact. Project activities could result in the temporary or permanent loss of availability of mineral resources if project development those resources could not be extracted, or if activities prevented access to mineral resources. As described above, the project site is located on lands designated as MRZ-3, where known or inferred mineral occurrences of undetermined mineral resource significance are present (CGS 2009). No mines were determined to be active within the project area. Oil and gas in the Elk Hills oilfield reservoir is considered a mineral resource of value to the state and as identified in the Kern County General Plan. The CTV I Project, previously approved by Kern County, dedicated a CO2 storage reservoir that would preclude further oil and gas production within that zone. The CalCapture project would not result in additional loss of oil and gas resource production; therefore, the proposed Project would result in a less than significant impact to mineral resources.

3.2.4 MINERAL-2 Impact Analysis

Impact MINERAL-2 Result in the loss of availability of a locally important mineral resource recovery site delineated on a local plan, specific plan, or other land use plan.

No impact. The Project will not result in the loss of availability of a locally important mineral resource recovery site delineated on a local plan, specific plan, or other land use plan. Therefore, resulting in no impact.



4 Cumulative Impacts

Development of the Project in addition to projected future development in the area will alter the landforms in the region and expose additional workers to geologic hazards of the region. Site-specific geologic and construction issues will be addressed and potential impacts mitigated through implementation of recommendations contained within site-specific geotechnical investigations as the projects move through the permitting processes. Furthermore, any geological and soil impacts are localized in the specific project areas and therefore, will not create significant cumulative impacts. Mitigation measures presented below in Section 5 would reduce Project-specific impacts to less than significant levels. Additionally, the CTV I project, currently under construction, would also comply with County requirements to address potential geologic and soils impacts. Mitigation measures imposed on the CTV I project by Kern County will reduce potential geologic and soil impacts from that Project to less than significant levels. Finally, Kern County has prepared an EIR evaluating the potential impacts (including contributions to cumulative impacts) of oil and gas development in connection with previously proposed amendments to the Kern County Zoning Ordinance: Final Environmental Impact Report - Revisions to the Kern County Zoning Ordinance - 2015(C) Focused on Oil and Gas Local Permitting, certified on November 9, 2015, supplemented by a Supplemental EIR certified on December 11, 2018; an SREIR certified on March 8, 2021; and an Addendum adopted on August 23, 2022. The Oil and Gas EIR is referenced herein as a source of information regarding cumulative impacts from oil and gas development (Kern County 2024). The consideration of geologic and soil impacts and mitigation measures of each project in the area will result in cumulative impacts that are less than significant.



5 Mitigation Measures

The following mitigation measures (MMs) are proposed for the Project to reduce geohazard impacts to less than significant levels.

MM GEO-1: The Owner/operator shall operate in compliance with the existing CTV I seismic activity monitoring plan that includes, but is not limited to, connection to the Statewide seismic monitoring program of California Seismic Network (CISN). All requirements for seismic monitoring adopted by the CARB – “Carbon Capture, Removal, Utilization and Storage Program” shall be implemented.

MM GEO-2: Operators shall not locate facilities on slopes greater than 30 percent.

MM GEO-3: The Owner/operator shall prepare a final site-specific design-level geotechnical report that complies with all applicable federal, state, and local code requirements and is prepared by a qualified geotechnical engineer and certified engineering geologist, prior to commencement of any construction of the project including Class VI injection wells. The geotechnical report will determine and identify the expansive potential of the underlying soil at the project site and be used in determining final siting of project components to ensure that project components are not located on unstable or potentially unstable geologic units or soils. The geotechnical report shall be reviewed and approved by the CEC and Kern County Public Works Department for compliance with all applicable state and local code requirements.

MM GEO-4: The Owner/operators shall avoid building infrastructure on expansive soil unless a site-specific Professional Engineering certification is submitted concluding that the new equipment will not cause substantial risks to life or property. The site-specific professional engineering certification must be submitted and reviewed by CEC and the Kern County Public Works Department and a memo provided that agrees that construction and operation of new equipment will not cause substantial risks to life or property as determined through established engineering standards. All recommendations required by the approved engineering certification from the CEC and Kern County Public Works Department shall be implemented.



6 Conclusions

Based on the currently planned development, it is Stantec's opinion that the Project site has a low likelihood of surface fault rupture due to the distance from active faults. The Project site may be subject to strong ground shaking due to seismic events. Groundwater has not been encountered during previous site investigations. Based on the near surface soil conditions, anticipated subsurface soil conditions, and the low to moderate PGA, the potential for liquefaction-related ground failure, including liquefaction, is moderate. The potential for lateral spreading is low, and the likelihood of surface subsidence is low on the Project site. Soils at the Project site have a very low expansion potential.

The design-level geotechnical investigation will establish the types and depths of soils at the Project site and recommend corrosion mitigation.

Due to the relatively flat topography of the Project site, landslides are not considered a potential hazard. The development of sinkholes is unlikely but will be further assessed during the design-level geotechnical investigation.



7 Limitations and Assumptions

Analyses performed at the desktop level rely on available, pre-existing data. The intent of the desktop approach is to provide practical results that guide our client as an exploratory, cost-saving measure before field work is considered and conducted. No field investigation was performed as part of this geohazards assessment. Limitations and assumptions relevant to this geohazards assessment include the following:

- The data analyzed herein are correct and adequate for this analysis.
- Data provided by the Client, including reports and maps, are correct and up to date.
- The activity state (e.g., active, inactive) of faults identified in this geohazards assessment is not addressed herein.
- Slope stability within the Project area and surroundings is not addressed herein.



8 References

- California Air Resources Board (CARB). 2023. CARB LCFS Report #1 Site Based Risk Assessment CTV Elk Hills Oilfield (EHOF).
- California Geological Survey (CGS). 2024. Earthquake Zones of Required Investigation. Accessed February 2025. Available at: <https://maps.conservation.ca.gov/cgs/informationwarehouse/eqzapp/>
- Department of Water Resources (DWR). 2019. Groundwater Basin Boundary Assessment Tool. Accessed February 2025. Available at: <https://gis.water.ca.gov/app/bbat/>
- Dibblee, T. W., and J. A. Minch. 2006. Geologic map of the Shale Point and Blackwells Corner quadrangles, Kern County, California, 1:24,000 scale. 1. Dibblee Geological Foundation. Accessed February 2025. Available at: https://ngmdb.usgs.gov/Prodesc/proddesc_80783.htm
- Environmental Data Resources, Inc. (EDR). 2025. The EDR Aerial Photo Decade Package. LightBox Holdings, L.P.
- Kern County Planning and Natural Resources Department. 2021. *Oil and Gas Ordinance Supplemental Recirculated Environmental Impact Report* (2020/2021). Accessed November 2023. <https://kernplanning.com/SREIR2020-oil-gas-zoning-revisions/>
- Kern County Planning and Natural Resources Department. 2024. Recirculated Draft Environmental Impact Report, Volume I. June.
- Natural Resources Conservation Service (NRCS). 2025. Web Soil Survey. Accessed April 2025. Available at: <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>.
- Seed, H. B., K. Tokimatsu, L. F. Harder, and R. M. Chung, (1985). "The influence of SPT procedures in soil liquefaction resistance evaluations." J. Geotech. Engr., ASCE, 111(12), 1425–1445.
- Seed, H. B., and I. M. Idriss. 1982. "Ground motions and soil liquefaction during earthquakes." Earthquake Engineering Research Institute Monograph, Oakland, Calif.
- Soils Engineering Inc. (SEI). 2020. Geologic Hazards Study for the CO₂ Capture Project from Elk Hills Power Plant.
- . 2023. Geotechnical Investigation Report for the Elk Hills GEHA & Truck Unloading Station 4026 Skyline Road Tupman, Kern County, CA.
- . 2025. Geotechnical Investigation Report for the Terra Vault 1 Carbon Capture Project 4026 Skyline Road Tupman, Kern County, CA.



CalCapture CCS Project – Geohazards Assessment

8 References

- State Water Resources Control Board (SWRCB). 2017. K Factor Map. Accessed February 2025.
Retrieved from:
https://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/guidance/k_factor_map.pdf
- U.S. Department of Commerce. 2025. Climate Data Online. Accessed February 2025. Available at:
<https://www.ncei.noaa.gov/cdo-web>.
- U.S. Geological Survey (USGS). 2014. Seismic Hazard Map of California. Accessed February 2025.
Available at: <https://www.usgs.gov/media/images/2014-seismic-hazard-map-california>
- . 2018. Sinkholes. Accessed February 2025. Available at: <https://www.usgs.gov/special-topics/water-science-school/science/sinkholes>
- . 2025a. Search Earthquake Catalog. Accessed February 2025. Available at:
<https://earthquake.usgs.gov/earthquakes/search/>
- . 2025b. U.S. Quaternary Faults. Accessed February 2025. Available at:
<https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=5a6038b3a1684561a9b0aadf88412fcf>





Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

Stantec Consulting Services Inc.
2646 Santa Maria Way, Suite 107
Santa Maria CA 93455-1776
stantec.com

