DUFFEL 13 DIXON PROPERTY
DIXON, CALIFORNIA

PRELIMINARY GEOTECHNICAL REPORT

SUBMITTED TO
Mr. Jeb Elmore
VP Acquisitions
Lewis Management Corporation
9216 Kiefer Boulevard, Suite 4
Sacramento, CA 95826

PREPARED BY
ENGEO Incorporated

July 24, 2019

PROJECT NO.
16329.000.000

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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
16329.000.000

July 24, 2019

Mr. Jeb Elmore
VP Acquisitions
Lewis Management Corporation
9216 Kiefer Boulevard, Suite 4
Sacramento, CA 95826

Subject: Duffel 13 Dixon Property
Vaughn Road and Hwy. 113
Dixon, California

PRELIMINARY GEOTECHNICAL REPORT

Dear Mr. Elmore:

ENGEO prepared this preliminary geotechnical report for Lewis Management Corporation as outlined in our agreement dated June 28, 2019. We characterized the subsurface conditions at the site to provide the enclosed preliminary geotechnical recommendations for earthwork, expansive soil mitigation measures, and foundation recommendations.

From a geotechnical standpoint, the site is suitable for the planned development provided the conclusions and preliminary recommendations presented in this report are incorporated into the preliminary design. We recommend a design-level study be performed to sufficiently assess site undocumented fill and expansive soils, and to provide design-level site improvement recommendations.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Stephen Blakely
sb/jb/jf

Jonathan Boland, GE

REGISTERED PROFESSIONAL ENGINEER
JONATHAN BOLAND
No. 2763
GEOTECHNICAL
STATE OF CALIFORNIA

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

We prepared this preliminary geotechnical report for design of Duffel 13 Dixon Property in Dixon, California, as outlined in our agreement dated June 28, 2019. Mr. Rob White authorized us to conduct the following scope of services:

- Service plan development
- Subsurface field exploration
- Soil laboratory testing
- Data analysis and conclusions
- Preliminary report preparation

For our use, we received a site plan prepared by Wood Rodgers, dated June 26, 2019, delivered electronically via email. We also received a Preliminary Title Report – Update "C," prepared by Chicago Title Company, dated March 16, 2019, also delivered electronically via email.

This report was prepared for the exclusive use of our client and their consultants for preliminary design of this project. In the event that any changes are made in the character, design, or layout of the development, we must be contacted to review the conclusions and recommendations contained in this report to evaluate whether modifications are recommended. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.2 PROJECT LOCATION AND DESCRIPTION

As shown on Figure 1, the approximately 13-acre site is located south of Vaughn Road / North Lincoln Street and west of North 1st Street / State Route 113 in Dixon, California. Access to the site is provided from a paved parking area at the southern boundary of the site. The site boundaries and our exploratory locations are shown in Figure 2. The site is bound by Vaughn Road / North Lincoln Street to the north, North 1st Street / State Route 113 to the east, a commercial development to the south, and a residential development to the west.

Based on our discussions with you, we understand site development will include both residential and commercial/retail improvements. The commercial/retail component will be located on the northeastern portion of the site and will be approximately 2 acres in size. We understand the residential development will occupy a majority of the remaining 11 acres, and may include 88 single-family houses with associated paved roadways. An access easement and a ½-acre water quality basin will be located in the southeastern portion of the site.

While no specific development details are available, we understand that the commercial/retail component will likely consist of one- or two-story retail buildings with associated parking lots, drive aisles, utilities, and landscaping. The residential component will likely consist of one- to two-story single-family, wood-frame houses with associated streets, underground utilities, and landscaping.

2.0 FINDINGS

2.1 SITE BACKGROUND

We reviewed topographic maps of the site dating back to 1908 and aerial photographs dating back to 1968. Based on our review of select maps and photos, the site appears to have been mostly undeveloped agricultural land as far back as 1908. In a 1968 aerial photograph, an area of apparent ground disturbance was located near the northeastern corner of the site. No additional information was provided regarding previous grading or improvements onsite.

Below, we summarize our observations based on the historic topographic maps and aerial photographs we reviewed.

Topographic Maps (USGS)

- 1908 through 1981 Maps – The property appears to be undeveloped land. An east-west aligned road is mapped at the northern site boundary, and a north-south aligned road is mapped at the eastern site boundary. An unnamed watercourse to the south and southwest of the property is mapped in a roughly northwesterly orientation.

- 2012 through 2015 Maps – The unnamed watercourse is no longer mapped south or southwest of the property. Local streets indicative of residential development are mapped west of the property.

Aerial Photographs

- 1968 Photograph – The property appears to be undeveloped land. Trees line the streets on the northern and eastern boundaries of the property. An area of ground disturbance is present on the northeast corner of the property.

- 1993 Photograph – The trees lining the streets and the disturbed area in the northeast are no longer present. It appears the property is in use for agriculture.

- 2005 through 2014 Photographs – The streets north and east of the site appear to have been improved. A residential development is located to the west of the property. Commercial / retail developments appear north, south, and east of the site. The site itself appears disced.

2.2 FIELD EXPLORATION

We observed excavation of seven test pits at the locations shown on the Site Plan, Figure 2, on July 3, 2019. An ENGEO representative observed the test pit excavations and logged the subsurface conditions at each location. We retained a tractor-mounted Case 850N EP backhoe and operator to excavate the test pits using a 2-foot-wide bucket and logged the type, location, and uniformity of the underlying soil. The maximum depth penetrated by the test pits was 12½ feet. We backfilled the test pits loosely with site soils. The location and elevations of our explorations are approximate and were estimated using handheld GPS; they should be considered accurate only to the degree implied by the method used.

We obtained bulk soil samples from the test pits using hand-sampling techniques. The test pit logs present descriptions and graphically depict the subsurface conditions encountered.

We used the field logs to develop the report logs in Appendix A. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time.

2.3 GEOLOGY AND SEISMICITY

2.3.1 Geology

The site is located in the Great Valley Geomorphic Province. The Great Valley is an elongate, northwest-trending structural trough bound by the Coast Ranges on the west and the Sierra Nevada on the east. The Great Valley has been and is presently being filled with sediments primarily derived from surrounding mountain ranges.

As shown in Figure 3, the site is underlain by Quaternary alluvium. Graymer et al. (2002) mapped the site as either Holocene alluvial fan deposits (Qhf) or natural levee deposits (Qhl). The detailed surficial mapping of Helley and Harwood (1985) indicates the entire site is underlain by Quaternary alluvium, with lower Modesto Formation (Qml) occurring to the west, and Quaternary basin deposits (Qb) to the east of the site. Holocene-age alluvium typically consists of unweathered gravel, sand, and silt. The Pleistocene-age lower Modesto Formation, which could be encountered in deeper excavations, typically consists of slightly weathered gravel, sand, silt, and clay.

2.3.2 Seismicity

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist within the site. The site does lie within a seismically active region and there are numerous faults in the area that are considered active. The following table summarizes the distances to mapped, active regional faults and estimated magnitudes with approximately 50 miles. We used the USGS Spatial Query tool that is based on USGS 2008 National Seismic Hazard Maps used to develop the 2016 California Building Code (CBC) seismic parameters. Refer to Figure 4 for a Regional Faulting and Seismicity map that shows known USGS faults and former earthquake epicenters and magnitudes.

TABLE 2.3.2-1: Active Faults Capable of Producing Significant Ground Shaking at the Site

FAULT NAME	APPROXIMATE DISTANCE FROM SITE (MILES)	MAXIMUM MOMENT MAGNITUDE
Great Valley 4a, Trout Creek	10½	6.5
Great Valley 4b, Gordon Valley	11	6.7
Great Valley 5, Pittsburg Kirby Hills	15	6.6
Great Valley 3, Mysterious Ridge	20	7.0
Green Valley Connected	20	6.7
Hunting Creek, Berryessa	20½	7.0
West Napa	29	6.6
Greenville Connected	40	6.9
Hayward-Rodgers Creek; RC+HN	42	7.1
Hayward-Rodgers Creek; RC+HN+HS	42	7.3
Hayward-Rodgers Creek; RC	42	7.0
Mount Diablo Thrust	42½	6.6

FAULT NAME	APPROXIMATE DISTANCE FROM SITE (MILES)	MAXIMUM MOMENT MAGNITUDE
Hayward-Rodgers Creek; HN+HS	42½	6.9
Hayward-Rodgers Creek; HN	42½	6.5
Calaveras; CN+CC	46	6.9
Calaveras; CN	46	6.8
Calaveras; CN+CC+CS	46	6.9
Maacama-Garberville	48	7.4
Hayward-Rodgers Creek; HS	49	6.7
Bartlett Springs	49	7.3
Great Valley 2	50	6.4

* Average of Ellsworth and Hanks maximum magnitudes.

2.4 SURFACE CONDITIONS

At the time of our field exploration, the Duffel 13 site was relatively level, and appeared to have been recently disced. A moderate to heavy growth of dry grasses and weeds was present at a tree line at the western property boundary. While no topographic information was provided, the surface elevations from Google Earth indicate the area slopes gently to the east, with site grades ranging from approximately Elevation 63 to 69 feet (Datum WGS84). Sidewalks with adjacent streetlights and utility access boxes and manholes were present at Vaughn Road / North Lincoln Street at the northern property boundary and North 1st Street / State Route 113 at the eastern property boundary. Several utility risers / stubs were observed behind the sidewalks to the north and east.

PHOTO 2.4-1:
Site conditions, looking south.

PHOTO 2.4-2:
Site conditions, looking northeast.

2.5 SUBSURFACE CONDITIONS

The soil encountered in our explorations generally consisted of very stiff to hard, medium plasticity, lean clay with varying sand content. Surficial lean clay with gravel and sandy clay with gravel, identified as fill, was encountered within Test Pits TP2, TP3, and TP7. Cemented sandy clay was encountered at a depth of approximately 9 feet within TP1.

Consult the Site Plan, Figure 2, and exploration logs for specific subsurface conditions at each location. We include our exploration logs in Appendix A. The test pit logs contain the soil type, color, consistency, and visual classification in general accordance with the Unified Soil Classification System. The logs graphically depict the subsurface conditions encountered at the time of the exploration.

2.6 GROUNDWATER CONDITIONS

We did not observe static or perched groundwater in any of our subsurface explorations. However, State Well No. 07N01E12N002M, located less than 1/10 mile from the eastern site boundary, shows historical groundwater less than 10 feet below ground surface. The most recent measurement from this well recorded groundwater at a depth of 13.9 feet in 2006.

Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, and other factors not evident at the time measurements were made.

2.7 LABORATORY TESTING

We performed laboratory tests on select soil samples to evaluate some of their engineering properties. For this project, we performed moisture content, plasticity index, and sieve analysis. Laboratory results are recorded on the test pit logs in Appendix A, and additional laboratory data is included in Appendix B.

3.0 PRELIMINARY CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development, provided the preliminary geotechnical recommendations in this report are properly incorporated into the design plans and specifications.

The primary geotechnical concerns that could affect development on the site are existing fill and expansive soil. We summarize our conclusions below.

3.1 EXISTING FILL

Our test pits indicate that portions of the site are underlain by non-engineered fill. We encountered fill up to 3½ feet deep in Test Pits TP2, TP3, and TP7. Refer to our test pit logs in Appendix A for more detailed information.

Non-engineered fills can undergo excessive settlement, especially under new fill or building loads. Without proper documentation of existing fill located on the site, we recommend complete removal and recompaction of the existing fill. Any backfill associated with test pit excavations should also be removed and backfilled with engineered fill.

We present preliminary fill removal recommendations in Section 4.1.1.

3.2 EXPANSIVE SOIL

Our test pits encountered variable soil materials near the ground surface that predominantly consisted of medium plasticity clays. Laboratory test data, and our experience with similar soils in the vicinity of the site, indicate that these soils are potentially expansive.

Expansive soils change in volume with changes in moisture. They can shrink or swell and cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to volume changes associated with expansive soil can be reduced by:

- Selective grading to exclude potentially expansive soil from the upper 2 feet of building pads.
- Constructing the upper 2 feet of building pads with select import fill with low expansion potential.
- Lime treating building pads to reduce expansive soil behavior.
- Supporting structures on properly designed post-tensioned concrete mat foundations design to accommodate the site-specific soil conditions.

Based on the conditions encountered, and our experience with similar developments in the area, it is our opinion that post-tensioned mat foundations may be the preferred foundation system for the proposed structures to mitigate expansive soil conditions. Preliminary design criteria for this foundation type are presented in Section 4.2.

We also provide specific grading recommendations for compaction of clay soil at the site. The purpose of these recommendations is to reduce the swell potential of the clay by compacting the soil at a high moisture content and controlling the amount of compaction.

The design-level geotechnical report should investigate other expansive soil mitigation alternatives based on the final development details and layout.

3.3 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, and ground lurching. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift, soil liquefaction, lateral spreading, landslides, tsunamis, flooding or seiches is considered low to negligible at the site.

3.3.1 Ground Rupture

Since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the subject property.

3.3.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the Northern California region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, structures should be designed using sound engineering judgement and the applicable California Building code (CBC) requirements, as a minimum.

3.3.3 Liquefaction

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sands. While the Association of Bay Area Governments Resilience Program's online Liquefaction Susceptibility Map shows the site mapped as moderate liquefaction susceptibility, clean sands were not encountered in our test pits. Our experience with similar sites in the area indicates that clean sands are unlikely to be encountered at depth. For these reasons and based upon engineering judgment, it is our opinion that the potential for liquefaction at the site is low during seismic shaking. Future design-level explorations should further evaluate liquefaction potential onsite.

3.3.4 Flooding

We reviewed the Federal Emergency Management Agency (FEMA) Flood Insurance Maps for the City of Dixon (Map 06095C0200E) dated May 4, 2009. The site is mapped as Zone X, an area of minimal flood hazard. The Civil Engineer should review pertinent information relating to possible flood levels for the subject site based on final pad elevations and provide appropriate design measures for development of the project, as needed.

3.4 SOIL CORROSION POTENTIAL

Determination of soil corrosion potential was beyond the scope of this preliminary geotechnical report. Our experience with similar sites in the vicinity of this project indicate that site soils may be moderately to severely corrosive. We recommend that soil corrosion potential be addressed during a design-level geotechnical exploration report. At that time and as part of a design-level study, we recommend representative soil samples be collected and submitted to a qualified analytical lab for determination of pH, resistivity, sulfate, and chloride.

3.5 GROUNDWATER

As discussed in Section 2.6, groundwater was not encountered in our explorations extending to a depth of approximately 12½ feet below grade. Historic groundwater levels in the vicinity of the site have been reported at a depth of less than 10 feet below ground surface (well 07N01E12N002M). Based on the proposed improvements, excavations for deep underground utilities may encounter groundwater. Future design-level geotechnical explorations should extend well below the depth of the deepest proposed underground improvements to further evaluate groundwater conditions and provide appropriate recommendations.

Perched water can occur above the static water table due to shallow cemented soils following periods of wet weather or landscape watering. Perched water can:

1. Impede grading activities.

2. Cause moisture damage to sensitive floor coverings.

3. Transmit moisture vapor through slabs causing excessive mold/mildew build-up, fogging of windows, and damage to computers and other sensitive equipment.

4. Cause premature pavement failure if hydrostatic pressures build up beneath the section.

3.6 2016 CBC SEISMIC DESIGN PARAMETERS

The 2016 CBC utilizes design criteria set forth in the 2010 ASCE 7 Standard. Based on the subsurface conditions encountered, we characterized the site as Site Class D in accordance with the 2016 CBC. We provide the 2016 CBC seismic design parameters in Table 3.6-1 below, which include design spectral response acceleration parameters based on the mapped Risk-Targeted Maximum Considered Earthquake (MCER) spectral response acceleration parameters.

TABLE 3.6-1: 2016 CBC Seismic Design Parameters, Latitude: 38.465401 Longitude: -121.823267

PARAMETER	VALUE
Site Class	D
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	1.18
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.43
Site Coefficient, F_A	1.03
Site Coefficient, F_V	1.57
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	1.22
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.67
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	0.81
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.45
Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration, PGA (g)	0.42
Site Coefficient, F_{PGA}	1.08
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	0.46

4.0 PRELIMINARY RECOMMENDATIONS

The preliminary recommendations included in this report should be utilized for project planning purposes and are intended for the areas of the site that will be developed with structural improvements. These areas include, but are not limited to building pads, sidewalks, pavement areas, retaining walls, and/or soundwalls. Prior to development, we should be retained to prepare a design-level geotechnical report.

4.1 EARTHWORK

4.1.1 Existing Fill Removal

Remove existing fill to competent native soil, as evaluated by ENGEO. Figure 2 displays the approximate lateral extent of existing fill based on our explorations. The lateral extent and depth of fill is expected to vary and additional exploration during a design-level geotechnical investigation should further delineate fill onsite.

4.1.2 Fill Compaction

We recommend removal of existing fills, stripping of organics, scarification, moisture conditioning, and compaction of the soil prior to fill placement, following cutting operations, and in areas left at grade. For low-expansion potential native or import soil (Expansion Index less than 50), we recommend compaction of fill and trench backfill to at least 90 percent relative compaction (ASTM D-1557) and compaction of the upper 6 inches of finish pavement subgrade to at least 95 percent relative compaction prior to aggregate base placement. Soil should be compacted at a minimum of 1 percentage point over optimum moisture content. For expansive native soil, we recommend that fill be compacted within a range of 87 to 92 percent relative compaction at a moisture content at least 4 percentage points above optimum. Landscape fills can generally be compacted to a minimum of 85 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material.

4.1.3 Acceptable Fill

In general, we anticipate the onsite soil should be suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 6 inches in maximum dimension. Imported fill should also meet the above requirements and have an Expansion Index less than 50.

4.1.4 Organic Content

We recommend material placed as engineered fill contain no more than 3 percent organic content by weight. We recommend soil samples be collected for laboratory testing to determine organic content during the design-level report. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Remove strippings from the site or, if considered suitable by the landscape architect and owner, use them in landscape fill.

4.1.5 Slope Gradients

For cut and fill slopes up to 8 feet tall, construct final slope gradients to 2:1 (horizontal:vertical) or flatter. The contractor is responsible to construct temporary construction slopes in accordance with CALOSHA requirements. Final slopes should be protected from surface erosion by installation of appropriate best management practices (BMPs) or finish landscaping.

4.2 FOUNDATIONS

We recommend that one- and two-story structures be supported on post-tensioned (PT) mat foundations bearing on competent native soil or compacted fill. On a preliminary basis, we recommend PT mats be approximately 10 inches thick, or greater, and have a thickened edge at least 2 inches greater than the mat thickness. The thickened edge should be at least 12 inches wide. Design PT mats for a maximum average allowable bearing pressure of 1,000 pounds per square foot (psf) for dead plus live loads, with maximum localized bearing pressures of 1,500 psf at column or wall loads.

Final post-tensioned foundation design should be performed by a structural engineer based on the procedure presented by the Post-Tensioning Institute "Design of Post-Tensioned Slabs-on-Ground" Third Edition, including appropriate addenda (2004).

4.3 FLEXIBLE PAVEMENTS

Based on our preliminary exploration and laboratory testing, we judged an R-value of 5 to be appropriate for preliminary pavement design. Using a preliminary design R-value of 5 and Procedure 633 of the Caltrans Highway Design Manual (including the asphalt factor of safety), we developed the preliminary pavement sections in Table 4.3-1.

TABLE 4.3-1: Preliminary Pavement Sections

Traffic Index	Hot Mix Asphalt (inches)	Class 2 Aggregate Base (inches)
6	3½	13
7	4	15½

The City of Dixon 2014 Design Standards specify minimum traffic indices and pavement section thicknesses for various public street classifications. The minimum values are a TI = 6 with 3½ inches of asphalt concrete over 10 inches of aggregate base over engineering fabric. The design-level geotechnical report should include R-value testing to confirm final design-level pavement recommendations.

5.0 DESIGN-LEVEL GEOTECHNICAL REPORT

This report presents findings, conclusions, and preliminary geotechnical recommendations intended for planning purposes only. Future design-level geotechnical explorations should be performed when development plans are finalized. We anticipate the design-level geotechnical report will include:

- Additional subsurface exploration based on the actual development layout.
- Further delineation of undocumented fills.
- Additional laboratory testing to determine moisture density, soil corrosion potential, soil expansion potential, and verify the design R-value for flexible pavements.
- Specific recommendations for site grading, foundations, sound and/or retaining walls (if applicable), and utility trench backfill.

6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents preliminary geotechnical recommendations for design of the improvements discussed in Section 1.2 for the Duffel 13 project in Dixon, California. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and preliminary recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data is representative of the actual subsurface conditions across the site. Considering possible underground variability of soil, rock, stockpiled material, and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, ENGEO must be notified immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

SELECTED REFERENCES

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California Building Code, 2016.

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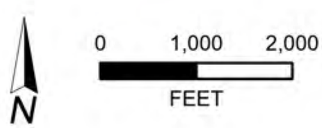
Helley, E.J., and Harwood, D.S., 1985, Geologic map of the late Cenozoic deposits of the Sacramento Valley and Northern Sierran Foothills, California [map], U.S. Geological Survey, Miscellaneous Field Studies Map MF-1790, scale 1:62,500.

Post-Tensioning Institute (PTI), 2007, Design of Post-Tensioned Slabs-on-Ground, 3rd Edition.

FIGURES



BASEMAP SOURCE: ESRI MAPPING SERVICE

ENGEO Expect Excellence	VICINITY MAP DUFFEL 13 DIXON DIXON, CALIFORNIA	PROJECT NO. : 16329.000.000 SCALE: AS SHOWN DRAWN BY: QRL	CHECKED BY: JCB	FIGURE NO. 1

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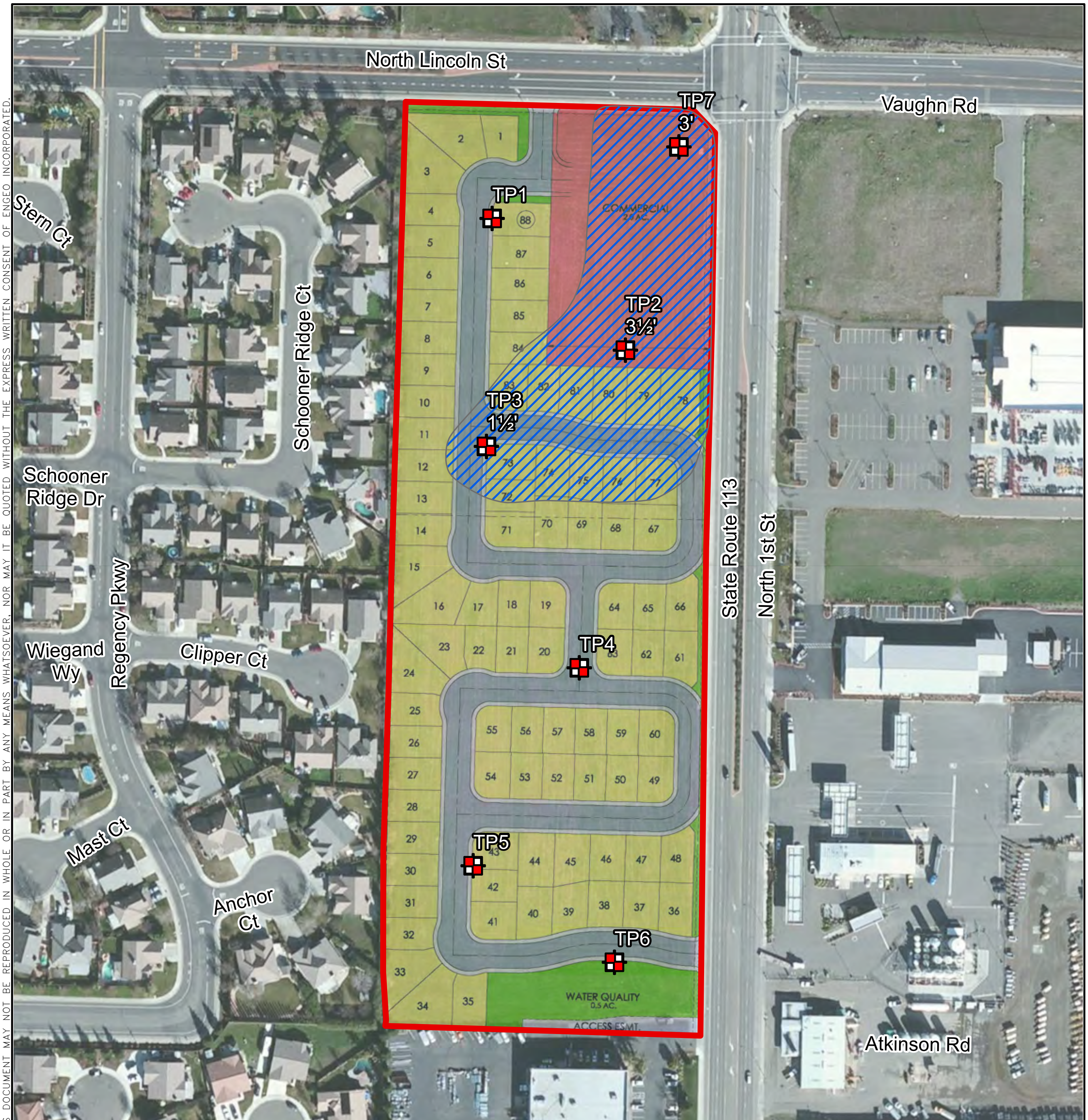
USER: QLIANG

ORIGINAL FIGURE PRINTED IN COLOR



N

0 100 200

FEET

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

- PROJECT SITE
- APPROXIMATE LATERAL EXTENT OF FILL
- TP7 TEST PIT LOCATION (ENGEO, 2019)
- (3½') APPROXIMATE FILL DEPTH

BASEMAP SOURCE: ESRI MAPPING SERVICE, WOOD RODGERS

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SITE PLAN DUFFEL 13 DIXON DIXON, CALIFORNIA	PROJECT NO.: 16329.000.000		FIGURE NO. 2
	SCALE: AS SHOWN		
	DRAWN BY: QRL	CHECKED BY: JCB	

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USER: QLIANG

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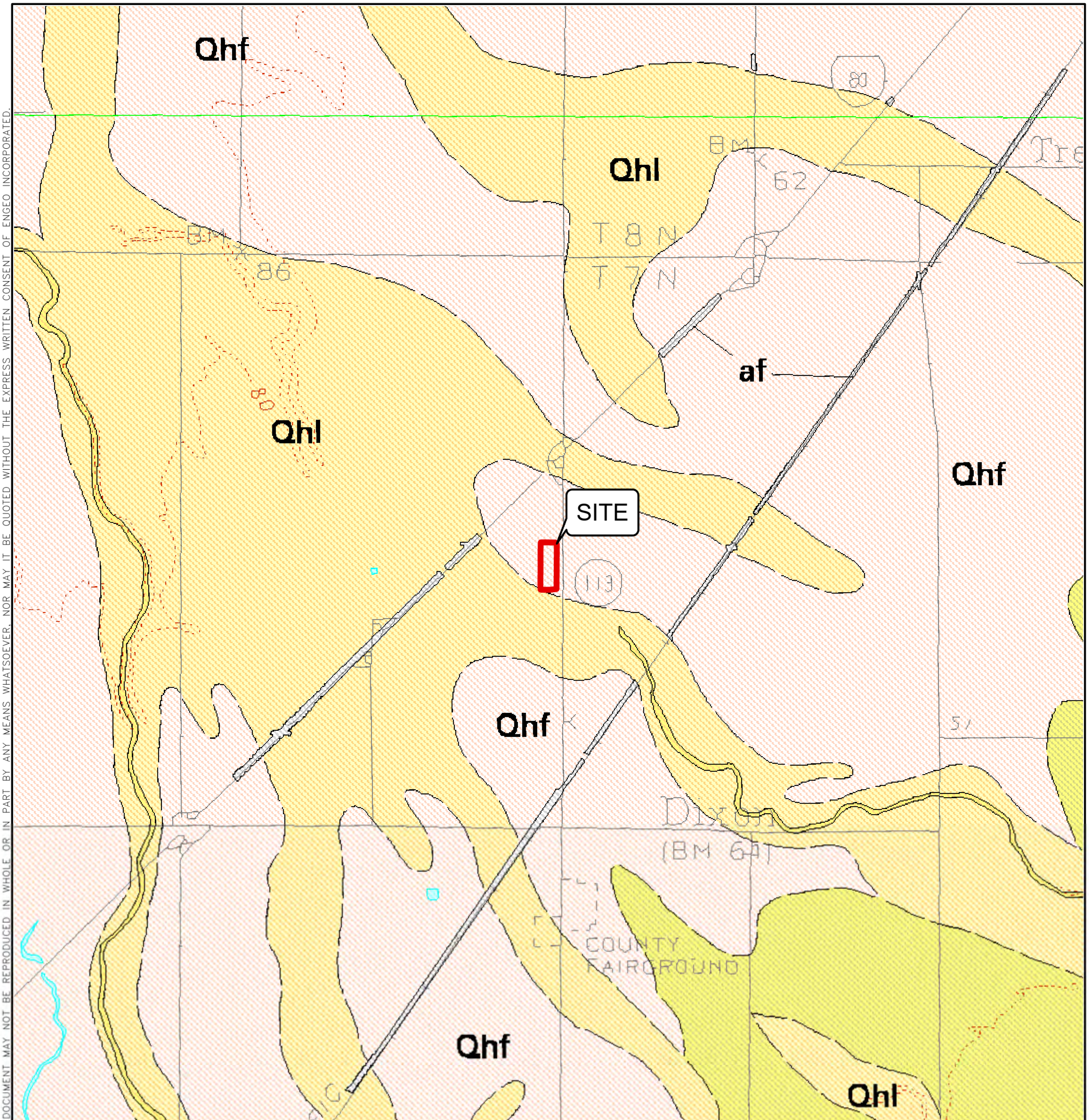

N

0 2,500 5,000

FEET

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

af	ARTIFICIAL FILL
Qhf	ALLUVIAL FAN DEPOSITS (HOLOCENE)
Qhl	NATURAL LEVEE DEPOSITS (HOLOCENE)

BASEMAP SOURCE: GRAYMER ET AL. 2002

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REGIONAL GEOLOGIC MAP

DUFFEL 13 DIXON

DIXON, CALIFORNIA

PROJECT NO.: 16329.000.000		FIGURE NO. 3
SCALE: AS SHOWN		
DRAWN BY: QRL	CHECKED BY: JCB	

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USER: QLIANG

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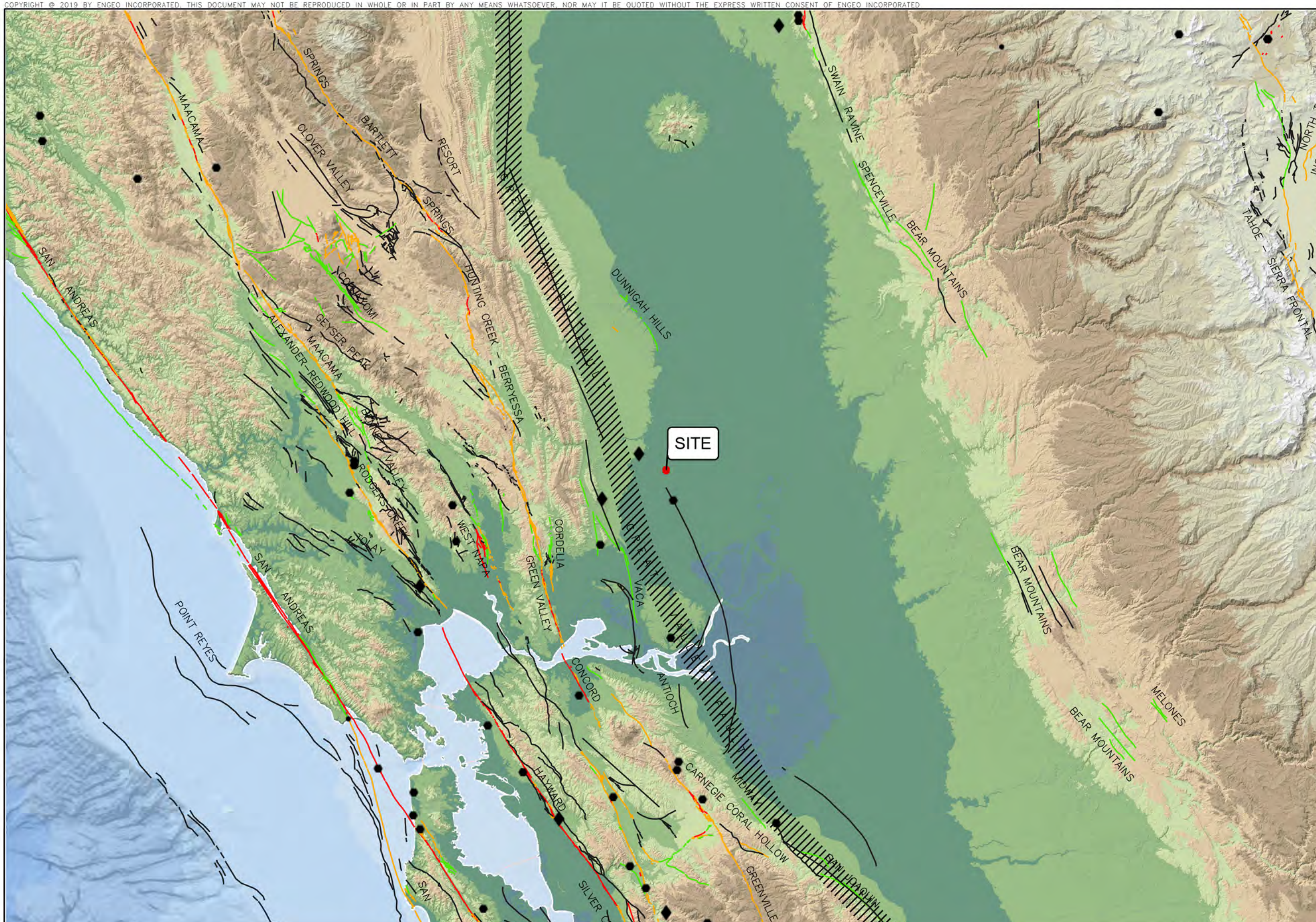

N

0 7.5 15
Miles

EXPLANATION
ALL LOCATIONS ARE APPROXIMATE

EARTHQUAKE
- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6

USGS QUATERNARY FAULTS
- HISTORICAL
- LATEST QUATERNARY
- LATE QUATERNARY
- UNDIFFERENTIATED QUATERNARY

- HISTORIC BLIND THRUST FAULT ZONE

BASE MAP SOURCE
ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2018
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-PRESENT)

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REGIONAL FAULTING AND SEISMICITY
DUFFEL 13 DIXON
DIXON, CALIFORNIA

PROJECT NO.: 16329.000.000	FIGURE NO. 4
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: JCB

APPENDIX A

EXPLORATION LOGS

Test Pit Logs

TEST PIT LOG TP1

Duffel 13 Dixon, California 16329.000.000	Logged By: S. Blakely Logged Date: July 3, 2019 Equipment: Case 850N EP Backhoe

Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0 - 9	LEAN CLAY (CL), dark brown, very stiff, moist, medium plasticity, medium toughness, approximately 5-10% fine-grained sand.	1½	30	47		
2	grades to brown					
4½	grades to dark yellowish brown, 11% fine-grained sand	5				89.2
9 - 10½	SANDY LEAN CLAY (CL), dark yellowish brown, hard, moist, low plasticity, low toughness, approximately 30% fine- to medium-grained sand, cemented, no HCl reaction, cemented nodules and ichnofossils.					
10½	Bottom of test pit at 10½ feet. No groundwater encountered.					

TEST PIT LOG TP2

Duffel 13 Dixon, California 16329.000.000	Logged By: S. Blakely Logged Date: July 3, 2019 Equipment: Case 850N EP Backhoe

Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0-1½	LEAN CLAY WITH GRAVEL (CL), dark brown, very stiff, moist, low to medium plasticity, low to medium toughness, approximately 20% angular to subrounded fine to coarse gravel, approximately 5-10% fine-grained sand [Fill].					
1½-3½	LEAN CLAY (CL), dark brown, very stiff, moist, medium plasticity, medium toughness, 10% fine-grained sand, trace coarse-grained sand and subangular fine gravel [Fill].	1½			19.8	90.4
3½-10½	LEAN CLAY (CL), dark yellowish brown, very stiff, moist, medium plasticity, medium toughness, 6% fine-grained sand. [Native]	4			20.4	93.5
10	few cemented clay nodules					
10½	Bottom of test pit at 10½ feet. No groundwater encountered.					

TEST PIT LOG TP3

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Duffel 13 Dixon, California 16329.000.000	Logged By: S. Blakely Logged Date: July 3, 2019 Equipment: Case 850N EP Backhoe

Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0-1½	SANDY LEAN CLAY WITH GRAVEL (CL), brown, very strong, slightly moist, low plasticity, low toughness, approximately 25% fine- to coarse-grained sand, approximately 15% angular to subrounded fine to coarse gravel [Fill].					
1½-10½	LEAN CLAY (CL), dark brown, hard, moist, medium plasticity, medium toughness, approximately 5-10% fine-grained sand. [Native]					
2	grades to brown, very stiff					
4½	grades to dark yellowish brown	5			19.9	
10	few cemented clay nodules					
10½	Bottom of test pit at 10½ feet. No groundwater encountered.					

TEST PIT LOG TP4

Duffel 13
Dixon, California
16329.000.000

Logged By: S. Blakely
Logged Date: July 3, 2019
Equipment: Case 850N EP Backhoe

Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0-11½	LEAN CLAY (CL), dark brown, hard, moist, medium plasticity, medium toughness, 8% fine-grained sand.	1½	28	45		92.4
2½	grades to brown, very stiff, medium to high plasticity, medium to high toughness					
8½	grades to dark yellowish brown					
10½	grades to yellowish brown, a few cemented clay nodules					
11½	Bottom of test pit at 11½ feet. No groundwater encountered.					

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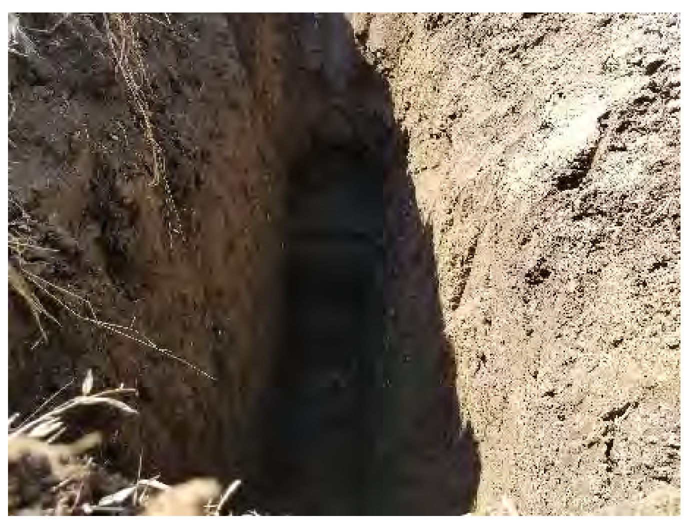
TEST PIT LOG TP5

Duffel 13
Dixon, California
16329.000.000

Logged By: S. Blakely
Logged Date: July 3, 2019
Equipment: Case 850N EP Backhoe

Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0-12½	LEAN CLAY (CL), dark brown, hard, moist, medium plasticity, medium toughness, approximately 5-10% fine-grained sand.					
2½	grades to brown, very stiff					
10½	grades to yellowish brown					
		10			19.5	
11½	grades to dark yellowish brown, medium to high plasticity, medium to high toughness					
		12			19.2	
12½	Bottom of test pit at 12½ feet. No groundwater encountered.					



TEST PIT LOG TP6

Duffel 13
Dixon, California
16329.000.000

Logged By: S. Blakely
Logged Date: July 3, 2019
Equipment: Case 850N EP Backhoe

Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0-10½	LEAN CLAY (CL), brown, hard, moist, medium plasticity, medium toughness, 14% fine- to coarse-grained sand.	1			15.4	86.1
1½	grades to medium to high plasticity, medium to high toughness, approximately 5-10% fine-grained sand					
2½	grades to very stiff					
4	grades to yellowish brown, medium plasticity, low to medium toughness					
10½	Bottom of test pit at 10½ feet. No groundwater encountered.					

TEST PIT LOG TP7

Duffel 13 Dixon, California 16329.000.000	Logged By: S. Blakely Logged Date: July 3, 2019 Equipment: Case 850N EP Backhoe

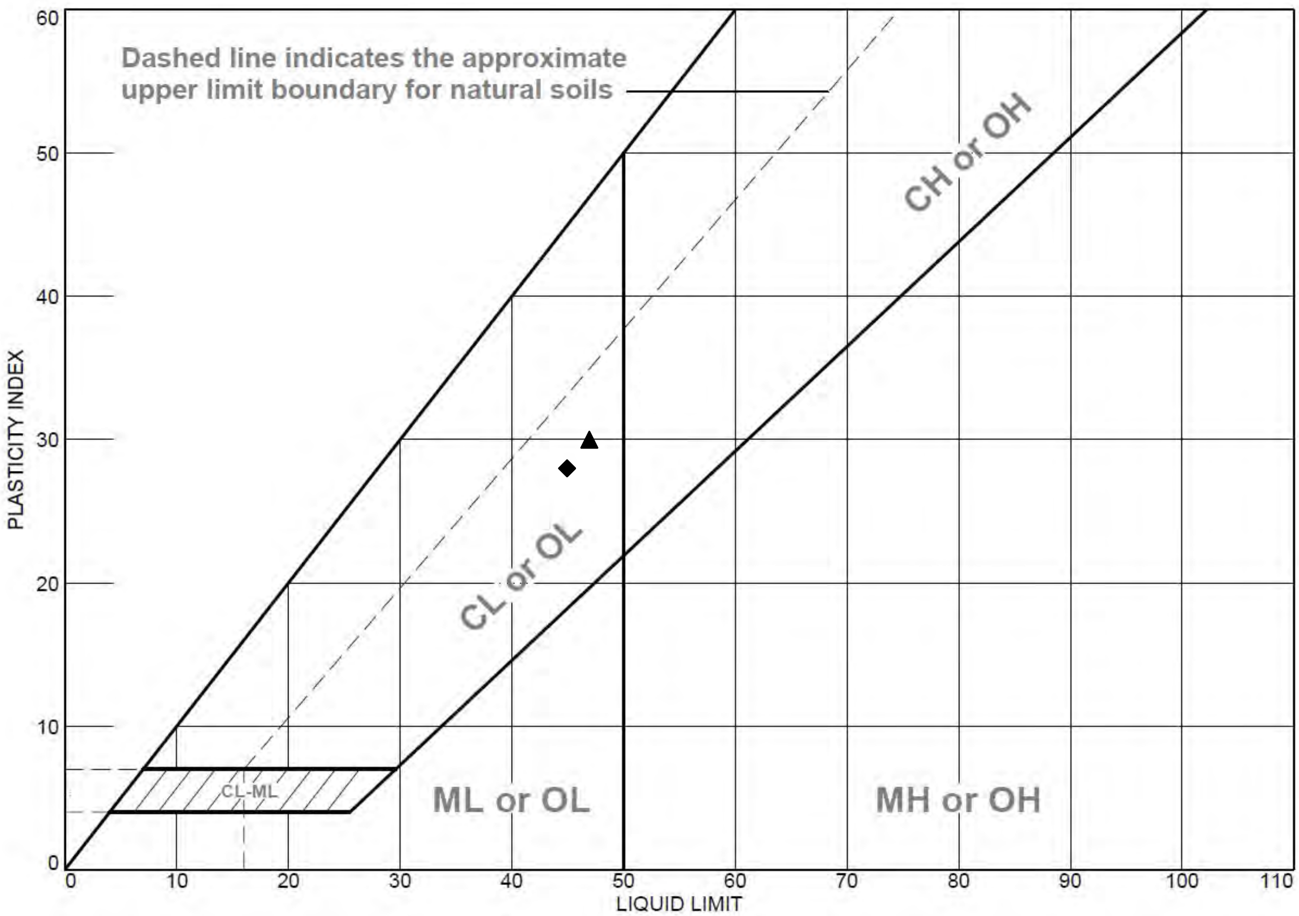
Depth (Feet)	Description	Depth of Sample/ Lab Test (Feet)	Plasticity Index	Liquid Limit	Laboratory Moisture Content%	Fines Content (% passing #200 sieve)
0-3	SANDY LEAN CLAY WITH GRAVEL (CL), dark brown, very stiff, slightly moist, medium plasticity, medium toughness, approximately 30% fine- to coarse-grained sand, approximately 10% angular to subrounded fine gravel [Fill].	2-3			12.8	
3-4	LEAN CLAY (CL), dark brown, hard, moist, medium to high plasticity, medium toughness, approximately 5-10% fine-grained sand. [Native]	3-4			22.5	
4	Bottom of test pit at 4 feet. No groundwater encountered.					

APPENDIX B

LABORATORY TEST DATA

Liquid and Plastic Limits Test Report
Particle Size Distribution Reports (5 pages)
Moisture Content Determination

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
▲	See exploration logs	47	17	30			
◆	See exploration logs	45	17	28		92.4	CL

Project No.: 16329.000.000 PH001 **Date:** 7/12/2019
Project Name: Duffel 13 Dixon Property
Project location: Dixon, CA
Client: Lewis Management Corporation
▲ **Sample Number:** TP1 **Depth:** 1.5
◆ **Sample Number:** TP4 **Depth:** 1.5

Remarks:
▲ PI: ASTM D4318, Wet Method
◆ PI: ASTM D4318, Wet Method, GS: ASTM D1140, Method B, USCS: ASTM D2487

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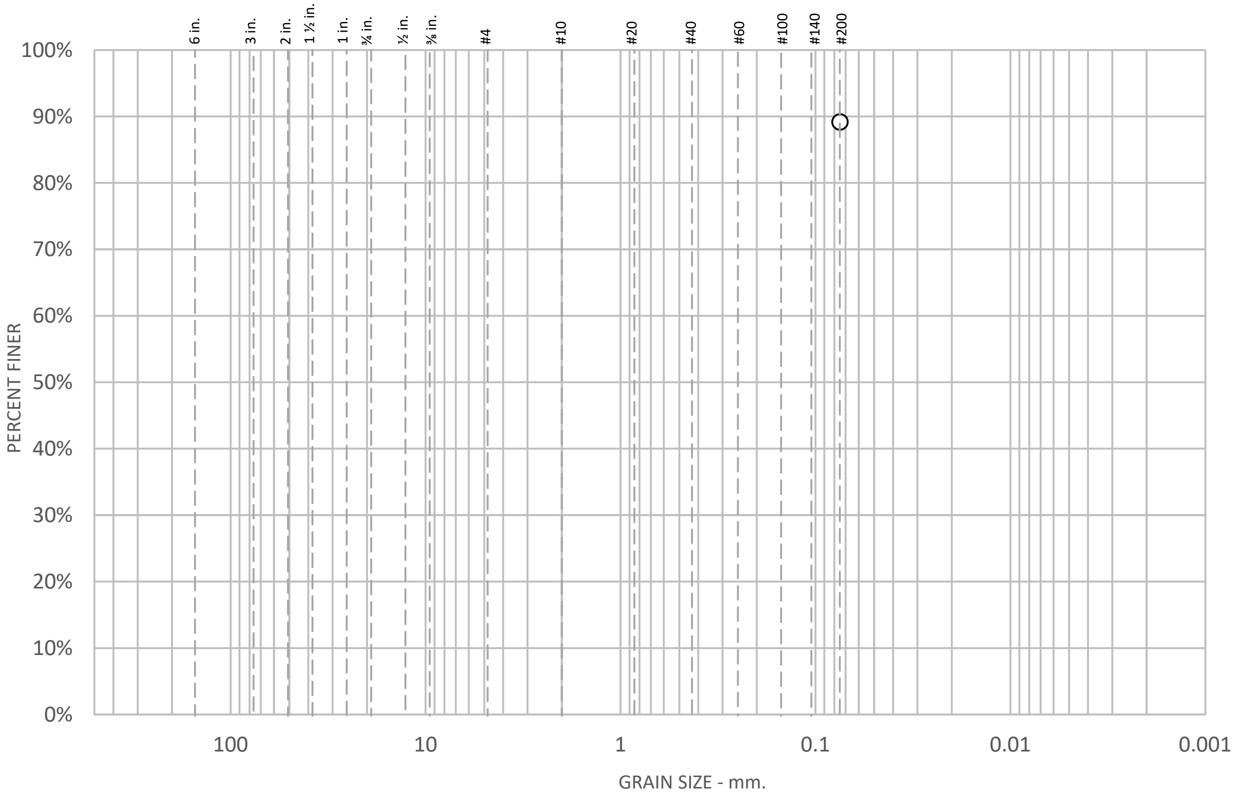
Tested By: R. Montalvo Checked By: M. Gilbert
Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						89.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	89.2		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D1140, Method B
Soak time = 120 min
Dry sample weight = 203.2 g

Sample Number: TP1 @ 5

Client: Lewis Management Corporation
Project Number: 16329.000.000 PH001
Project: Duffel 13 Dixon Property
Date: 7/12/2019
Project location: Dixon, CA

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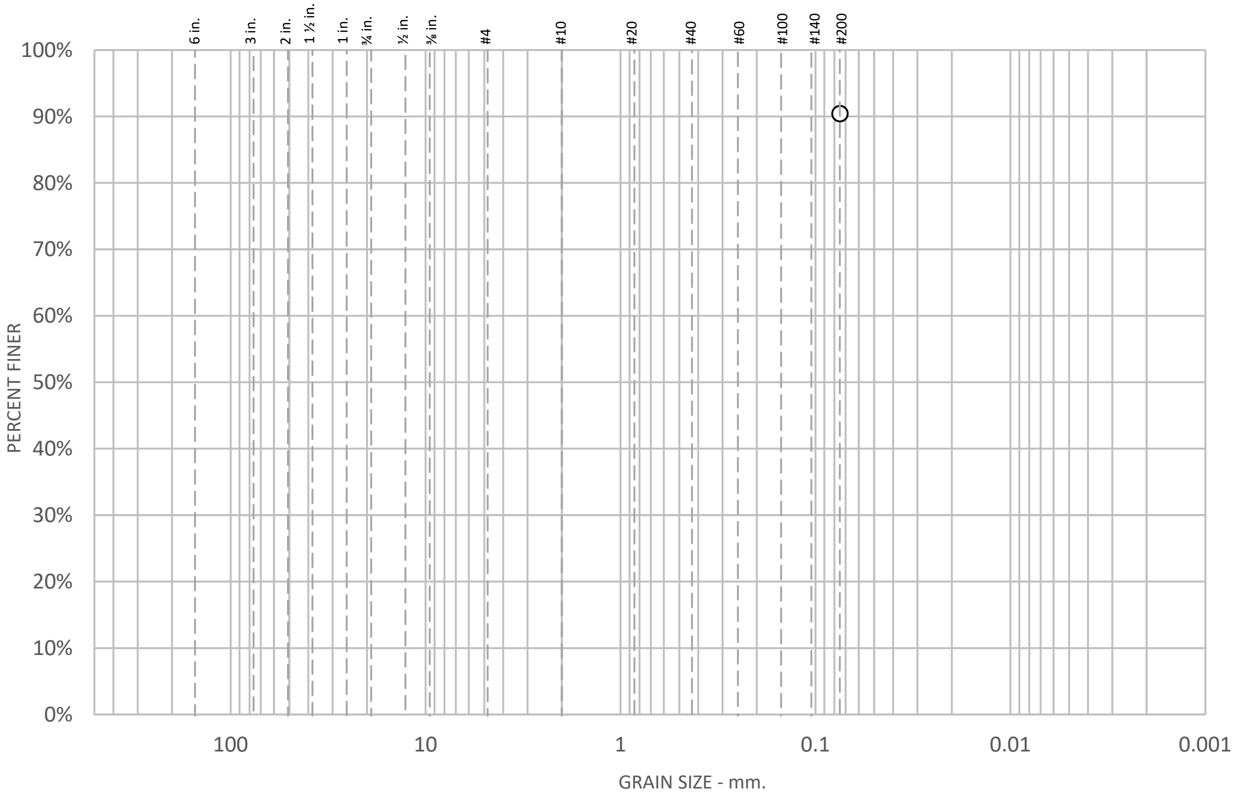
Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						90.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	90.4		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D1140, Method B
Soak time = 120 min
Dry sample weight = 175.4 g

Sample Number: TP2 @ 1.5

Client: Lewis Management Corporation **Project Number:** 16329.000.000 PH001
Project: Duffel 13 Dixon Property **Date:** 7/12/2019
Project location: Dixon, CA

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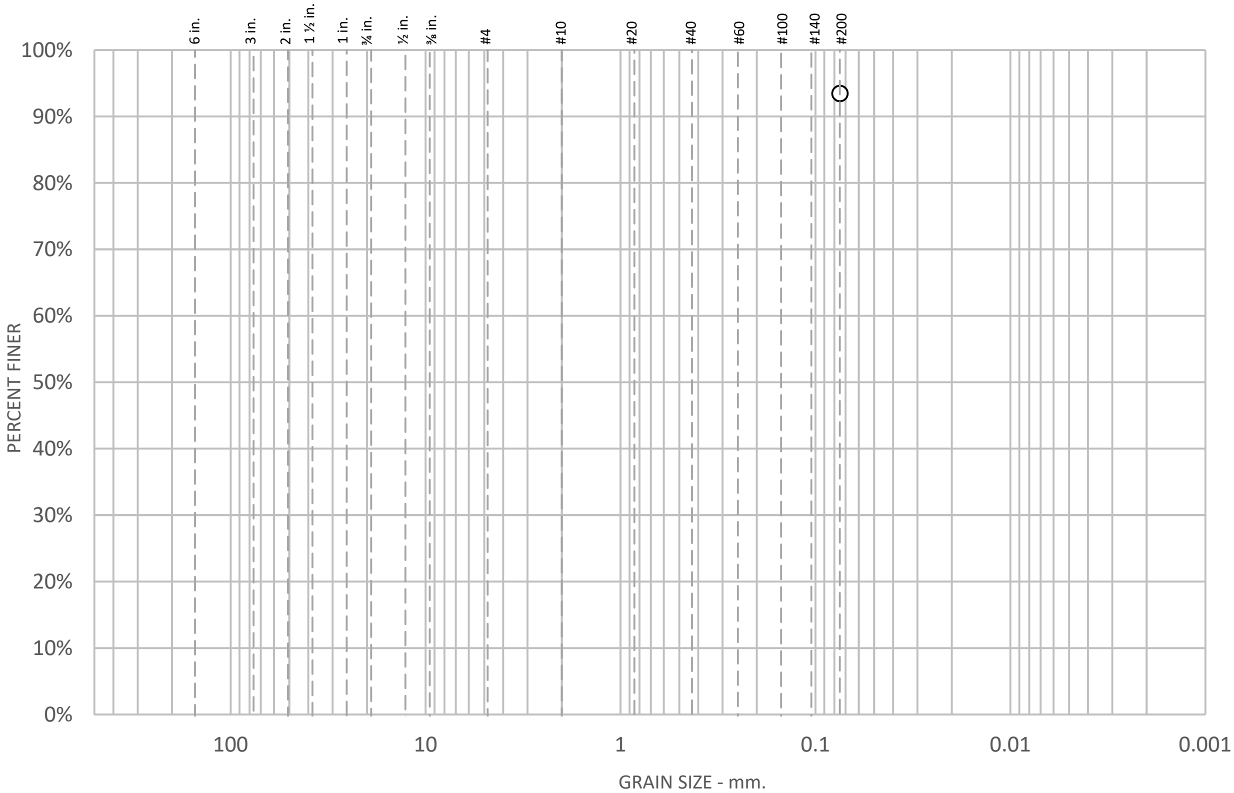
Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						93.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	93.5		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = D_{85} = D_{60} =
D_{50} = D_{30} = D_{15} =
D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D1140, Method B
Soak time = 120 min
Dry sample weight = 163.6 g

Sample Number: TP2 @ 4

Client: Lewis Management Corporation
Project: Duffel 13 Dixon Property
Project location: Dixon, CA
Project Number: 16329.000.000 PH001
Date: 7/12/2019

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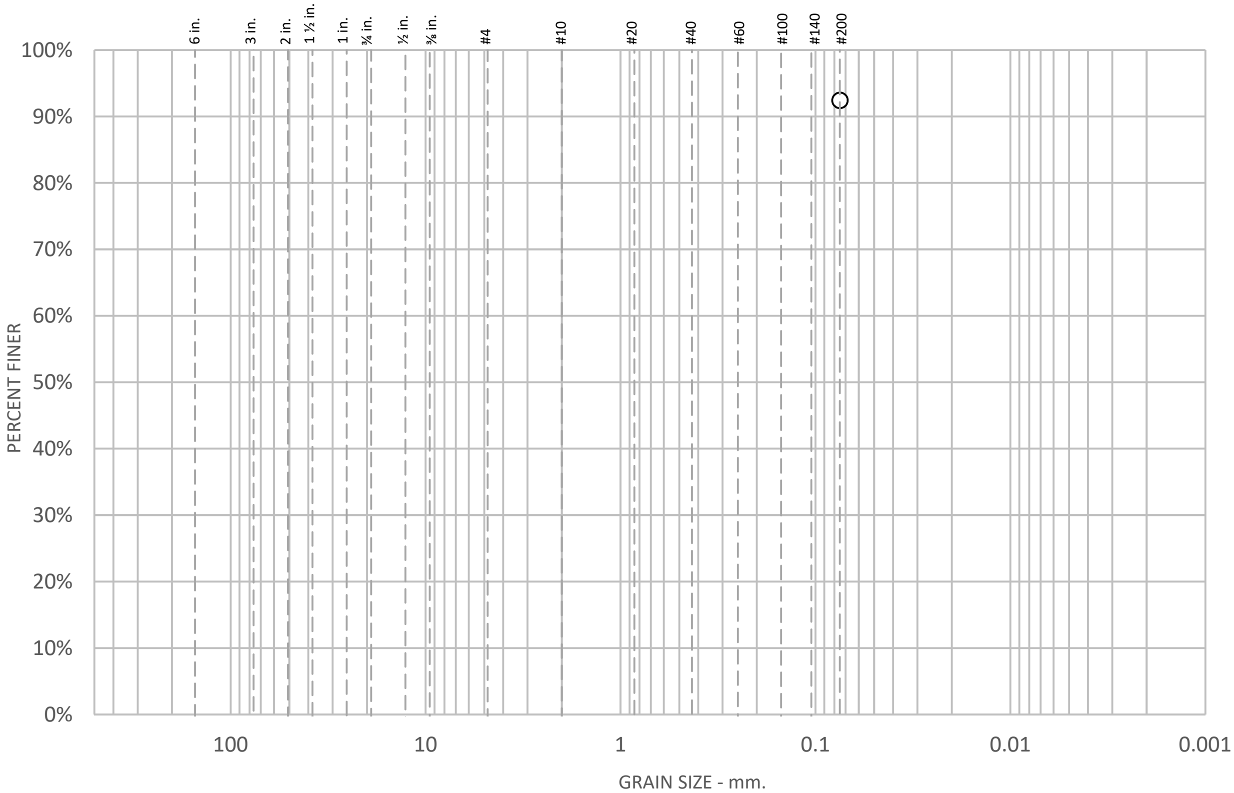
Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						92.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	92.4		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = 17 LL = 45 PI = 28

Coefficients

D_{90} =	D_{85} =	D_{60} =
D_{50} =	D_{30} =	D_{15} =
D_{10} =	C_u =	C_c =

Classification

USCS = CL

Remarks

PI: ASTM D4318, Wet Method

ASTM D1140, Method B
Soak time = 120 min
Dry sample weight = 203.1 g

Sample Number: TP4 @ 1.5

Client: Lewis Management Corporation
Project Number: 16329.000.000 PH001
Project: Duffel 13 Dixon Property
Date: 7/12/2019
Project location: Dixon, CA

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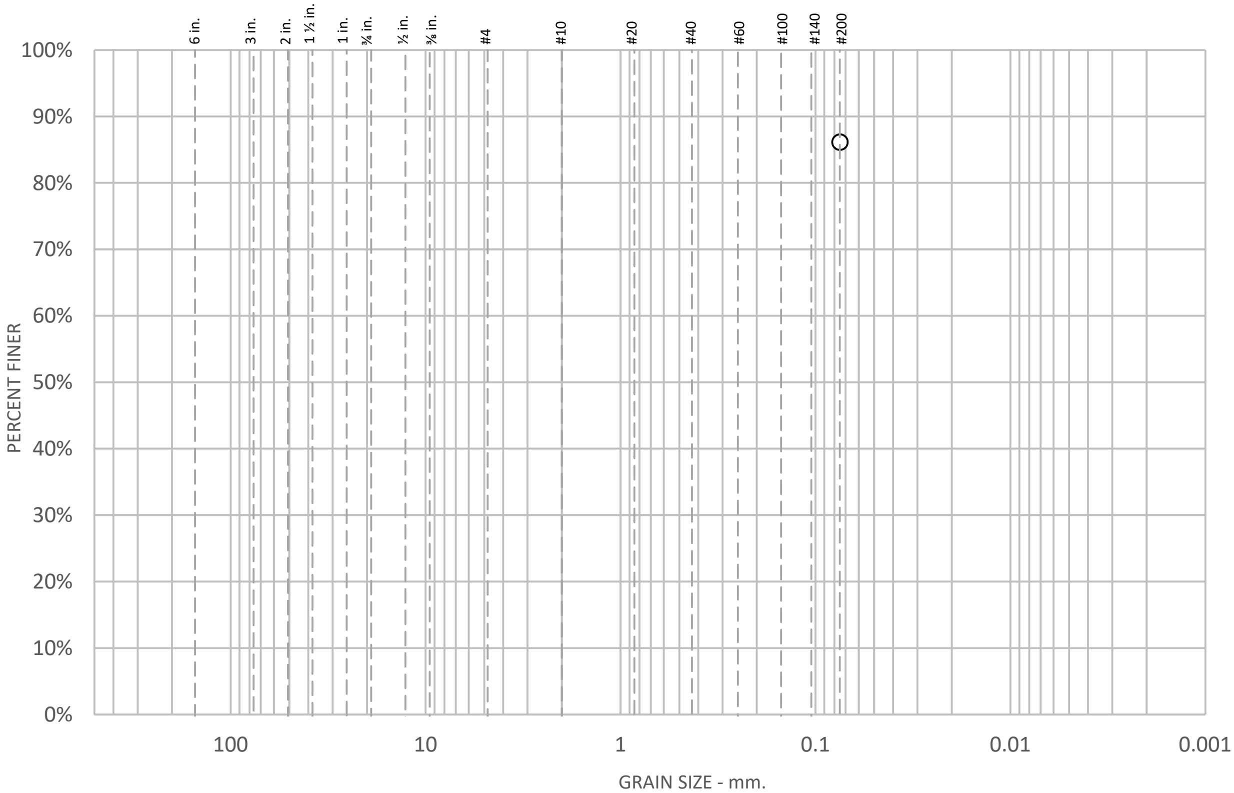
Tested By: R. Montalvo **Checked By:** M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						86.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	86.1		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL = LL = PI =

Coefficients

D_{90} = D_{85} = D_{60} =

D_{50} = D_{30} = D_{15} =

D_{10} = C_u = C_c =

Classification

USCS =

Remarks

ASTM D1140, Method B
Soak time = 120 min
Dry sample weight = 200.4 g

Sample Number: TP6 @ 1

Client: Lewis Management Corporation
Project Number: 16329.000.000 PH001
Project: Duffel 13 Dixon Property
Date: 7/12/2019
Project location: Dixon, CA

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Tested By: R. Montalvo
Checked By: M. Gilbert

Test Location: 2213 Plaza Drive, Rocklin, CA 95765

MOISTURE CONTENT DETERMINATION

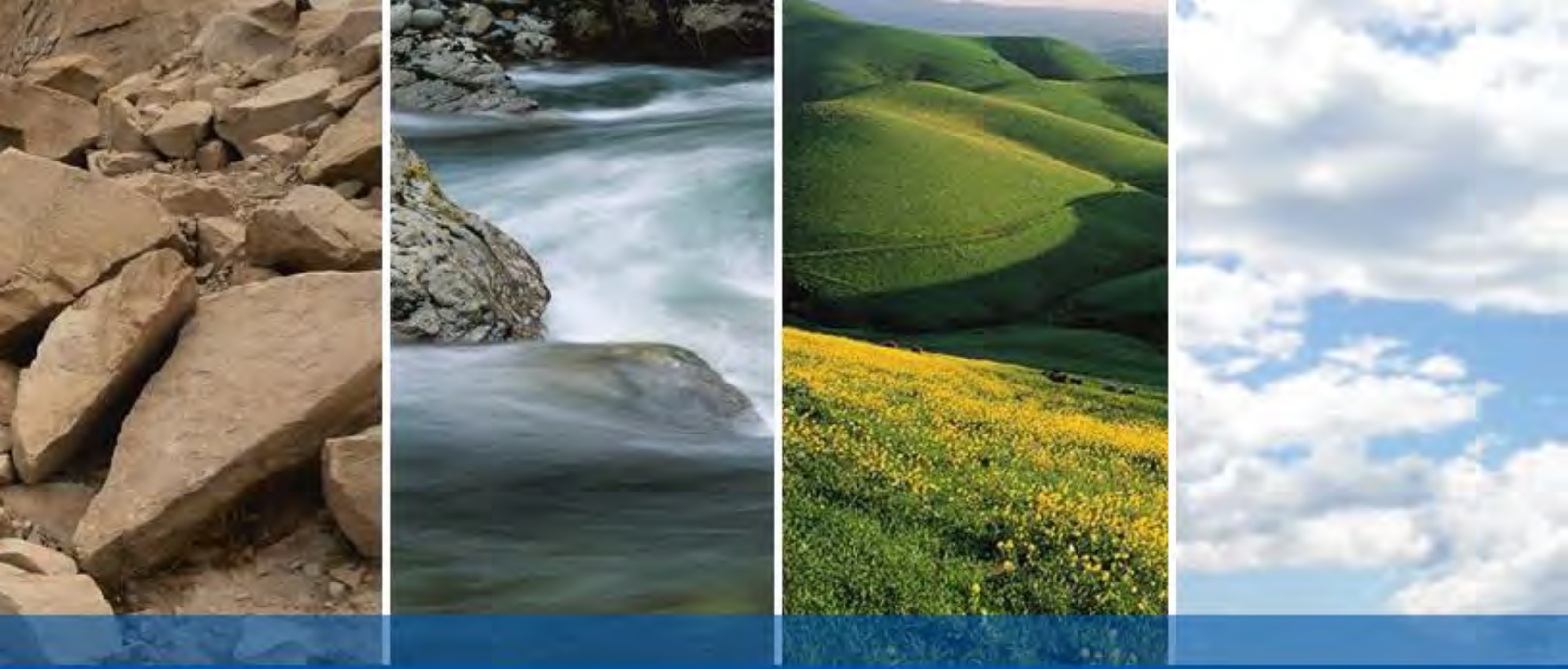
ASTM D2216

BORING/SAMPLE ID	TP2@1.5	TP2@4	TP3@5	TP5@10	TP5@12	TP6@1	TP7@0-3	TP7@3-4
DEPTH (ft)	**1.5**	**4**	**5**	**10**	**12**	**1**	**0-3**	**3-4**
Method A or B	B	B	B	B	B	B	B	B
%MOISTURE	**19.8**	**20.4**	**19.9**	**19.5**	**19.2**	**15.4**	**12.8**	**22.5**

PROJECT NAME: **Duffel 13 Dixon Property**
DATE: **07/12/19**
PROJECT NUMBER: **16329.000.000**
CLIENT: **Lewis Management Corporation**
PHASE NUMBER: **001**

ENGEO Expect Excellence

Tested by: R. Montalvo Reviewed by: M. Gilbert



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