APPENDIX L SLOPE STABILITY INVESTIGATION

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June 21, 2018

El Monte Nature Preserve, LLC
1335 San Lucas Court
Solana Beach, California 92075
Attention: Mr. Bill Adams

Job No. 15383-8

Dear Mr. Adams:

This letter transmits two copies of our slope stability investigation report, prepared for the proposed El Monte Sand Mining project, located at 13964 El Monte Road in Lakeside, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact us at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

Jay J. Martin, E.G.
Vice President

JJM:lb

Distribution: El Monte Nature Preserve, LLC (2 and electronic)

SLOPE STABILITY INVESTIGATION
PROPOSED EL MONTE SAND MINING PROJECT
LAKESIDE, CALIFORNIA
PREPARED FOR
EL MONTE NATURE PRESERVE, LLC
JOB NO. 15383-8

June 21, 2018

El Monte Nature Preserve, LLC Job No. 15383-8
1335 San Lucas Court
Solana Beach, California 92075
Attention: Mr. Bill Adams

Dear Mr. Adams:

Attached herewith is the report of slope stability investigation prepared for the proposed El Monte Sand Mining project, located at 13964 El Monte Road in Lakeside, California.

This report was based upon a scope of services generally outlined in our proposal dated June 24, 2015, and other written and verbal communications.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact us at your convenience.

Respectfully submitted,
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PROPOSED EL MONTE SAND MINING PROJECT
LAKESIDE, CALIFORNIA
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INTRODUCTION

During August and September of 2015, this firm conducted exploratory drilling, laboratory testing and slope stability analysis for the proposed El Monte Sand Mining project that includes sand mining operations. A revised reclamation plan was evaluated during January 2016. The purposes of this investigation were to explore and evaluate the engineering geologic conditions at the subject site and to provide slope stability analysis for the mining and reclamation plan.

To orient our investigation, several documents and maps were provided for our use. These include the following:

- Project description for the El Monte Sand Mining and Nature Preserve project by EnviroMINE revised January 2016
- Reclaimed Bench Configuration Diagram dated January 20, 2016
- Reclamation Plan Set (6 sheets), dated January 24, 2016
- Preliminary Geotechnical Evaluation, El Monte Mining, Reclamation and Groundwater Recharge Project, by Ninyo & Moore, dated July 18, 2011
- Compendium Report of Geotechnical Investigations, El Capital Golf Course, Lakeside, California, by Shepardson Engineering Associates, Inc., dated July 28, 2003
- Attachment 1 of the Scope for Geotechnical Investigation document dated June 18, 2015

The approximate location of the site excavation area is shown on the attached Location Map (Enclosure A-1).

The results of our investigation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this investigation included the following:

- Review of published and unpublished literature and maps including geologic mapping by Todd (2004) and Tan (2002)
- Examination of aerial imagery dated 1953, 1964, 1966, 1968, 1971, 1980, 1981, 1989, 1994, 1996, 2002, 2004, 2005, 2006, 2010, 2011, 2012 and 2015
- Review of studies by prior consultants
- Geologic mapping of the site and adjacent area
- Marking of the exploration locations and notification of Underground Service Alert
- Coordination with County of San Diego Department of Environmental Health to obtain a waiver for grouting of the geotechnical borings
- Drilling and sampling four hollow-stem auger borings in the excavation area
- Laboratory testing of selected samples retrieved from the borings
- Slope stability calculations (limit equilibrium and surficial) for the proposed slopes under static and seismic conditions
- Evaluation of potential geologic hazards to the project including seismic shaking hazard

PROJECT CONSIDERATIONS

The project description indicates that the site will produce approximately 12.5 million tons of construction aggregate/sand material over a 12-year production period, followed by four years of reclamation. The project will include disturbance and reclamation of approximately 262 acres of a 479.5-acre site. Total reclaimed slope heights will be approximately 36 feet. A prior study considered deeper pit elevations; therefore, geotechnical borings up to 100 feet deep are available for the project. The purpose of the slope stability investigation is to provide reclaimed slope configurations consistent with the requirements of the Surface Mining and Reclamation Act, County of San Diego, and the Office of Mine Reclamation. This report addresses the items included in the County's "Scope for Geotechnical Investigation" dated June 18, 2015. That document includes requirements to address future groundwater levels as a result of an upstream dam breach, the stability of temporary slopes, and compaction of fill.

According to the Reclamation Plan (EnviroMINE, 2016), the project will be developed in four phases working from east to west. A drop structure to mitigate erosion by surface flows entering the pit along the upstream portion is planned at the east end. Wash fines will be used in backfilling excavations from water features (ponds) associated with a former golf course project. Wash fines will also be distributed on disturbed site areas. Excavations are not planned below the groundwater table. Reclamation of each phase area is planned to commence at the start of the subsequent phase.

A maximum pit depth of approximately 36 to 41 feet is anticipated based on proposed bottom elevations that range from 399 feet to 434 feet above mean sea level (amsl) and existing surfaces ranging from 438 feet amsl to 450 feet amsl at the west and east ends of the excavation area, respectively. Slopes are planned at 3 horizontal (h) to 1 vertical (v) inclination with an intervening bench. Excavation is not proposed beneath the groundwater table.

Our slope stability calculations for the proposed reclaimed slopes are based on configurations consistent with the Reclamation Plan. We modeled and evaluated a typical slope proposed for development of the excavation area. Slopes flatter than 2(h) to 1(v) in alluvial materials situated above the groundwater table are typically considered stable. For completeness, we include engineering calculations of the gross stability of the proposed slope configuration under static and seismic conditions.

SITE DESCRIPTION

The site consists of an elongate area of undeveloped land within the margins of the San Diego River floodplain bounded by unpaved Willow Road to the north and paved El Monte Road to the south. The vegetated channel of the San Diego River trends roughly east to west as it bisects the site. A mine pit with surface water is adjacent to the site on the west, and residences are located near the southeast boundary. Land marginal to the floodplain is elevated above the active river channel forming terrace risers or benches north and south of the channel area. These benches were generally undeveloped at the time of our investigation. Site elevations range from approximately 450 feet amsl at the northeast limit of the proposed excavation area to 430 feet amsl at the western limit. Vegetation on the benches generally consists of a low growth of dried annual grasses and weeds with few large trees. The river channel includes a dense growth of trees. Bedrock slopes are locally bouldery north and south of the river floodplain. The eastern portion of the site includes areas formerly graded for an uncompleted golf course project that produced undulatory terrain and areas of fill.

Examination of aerial imagery indicates that the bench areas have previously been utilized for borrow material, material processing and equipment storage. Small structures were located in the northwest corner and southwest portion of the site as early as 1989. A covered open-sided structure remains in the northwest corner. No structures remain in the southwest portion of the site. Equipment and/or materials were stored in cleared areas adjacent to Willow Road and north of El Monte Road in the western portion of the site between 2005 and 2006. Materials processing areas were located in the western and northeastern portions of the site between 2005 and 2006 and included use of heavy equipment and sorting/stacking equipment. Grading for the golf course project in the eastern portion of the site is visible in imagery dated May 2005. Changes to the site do not appear in aerial imagery since 2012 when equipment/materials were removed from an extensive fenced area in the southwest portion of the site.

Evidence of geologic hazards including landsliding or surface faulting was not observed in the aerial imagery examined.

The proposed reclamation configuration including the excavation area boundary and slope geometries is depicted on Enclosure A-2. Geologic cross sections are presented on Enclosures A-4.2 and A-4.4.

PREVIOUS INVESTIGATIONS

Several reports documenting geologic mapping, subsurface explorations and sampling, and groundwater monitoring for projects at and adjacent to the site were examined (Shepardson, 2003; Ninyo & Moore, 2011). Subsurface information and groundwater data from these investigations were utilized in our evaluation. Findings include:

- Alluvial soils up to 106 feet thick overlie granitic and metavolcanic bedrock along the floodplain axis.
- Groundwater occurs at elevations ranging from approximately 420 feet amsl on the east to 391 feet amsl on the west (Ninyo & Moore, 2011).
- Cut slopes at 2(h) to 1(v) should be grossly stable against deep-seated failure.
- Materials should be excavatable with standard heavy equipment; well drilling (depending on depth) may encounter hard bedrock formation below the alluvium.
- The site is subject to liquefaction.
- Faulting is not anticipated within the project area.
- Unprotected site soils are susceptible to erosion.

FIELD INVESTIGATION

Four hollow-stem auger borings were drilled to depths up to 100 feet below the existing ground surface (bgs) in the excavation area during August 2015 to supplement prior exploration by others. Existing roads were utilized and no access improvements were required. Drilling was performed using a CME 75 truck-mounted drilling rig equipped for soil sampling. The eastern portion of the project was added to the proposed excavation area after our field program was completed; therefore, we utilized prior explorations by others to characterize the subsurface conditions in the eastern portion of the project. The approximate locations of our exploratory borings are indicated on the attached Site Plan (Enclosure A-2).

Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a modified California ring sampler (3-inch outer diameter and 2.42-inch inner diameter) were utilized in our investigation. The penetration resistance was recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The sampler was driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blowcounts at each sampling interval. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. standard penetration test sampler). Both relatively undisturbed and bulk samples of typical soil types obtained were returned to the laboratory in sealed containers for testing and evaluation.

Exploratory boring logs, together with the uncorrected blowcount data and in-place density data, are presented in Appendix B. The stratification lines presented on the boring logs represent approximate boundaries between soil types, which may include gradual transitions.

At the completion of drilling, all borings were backfilled to the initial grade of the boring with soil drill cuttings and tamped using the drilling equipment augers. This backfilling operation is expected to compact the boring to a density approximating that of the existing soils. It is possible that some settlement of the backfilled material may occur. Our firm will not monitor boring locations for any settlement. This is deemed to be, and is accepted to be, the responsibility of our client.

Exploratory borings reported for prior investigations are included in Appendix B for reference.

A Site Plan indicating current and prior exploration locations, proposed slopes and the limits of proposed excavation is provided as Enclosure A-2.

LABORATORY ANALYSIS

Included in our laboratory testing program were field moisture content tests on all samples returned to the laboratory and field dry density tests on all relatively undisturbed samples. The results are included on the boring logs. Direct shear testing was performed on selected relatively undisturbed samples and one remolded sample in order to provide shear strength parameters for slope stability evaluations. Sieve analyses were performed on selected samples as an aid to classification.

Laboratory test results are presented in Appendix C. Soil classifications provided are in accordance with the Unified Soil Classification System (USCS).

SITE GEOLOGY

The site is located near the community of Lakeside in unincorporated San Diego County, east of Highway 67 and north of Interstate Highway 8. The site is situated in a broad river valley formed in bedrock terrain of the Peninsular Ranges geomorphic province. The Peninsular Ranges include plutonic and metamorphic crystalline rocks of Cretaceous and older age. The crystalline basement rocks are locally mantled by residual soils and capped by isolated alluvial/sedimentary remnants.

Valley bottoms are typically alluviated. Geologic units in the area include metavolcanic rocks likely coeval with the plutonic rocks of the Peninsular Ranges batholith, intrusive granitics and alluvial sediments deposited in the San Diego River floodplain.

GEOLOGIC UNITS:

The site was mapped on a topographic base using the geologic nomenclature of Todd (2004) for bedrock units, and alluvial nomenclature established for this investigation based on relative landscape position above the river channel. A Site Plan and Geologic Map is presented as Enclosure A-4.1. Cross sections are presented as Enclosures A-4.2 through A-4.4. The units designated for this investigation are described below. Structural examination of bedrock units was not included in the field investigation as excavations are not proposed within the bedrock materials and planned slope angles are very flat relative to the strength and ability of bedrock units to stand at steep angles.

Fill (f)

Fill associated with prior site use as a borrow area, dirt roads/tracks and pond/river channel embankments are derived from local materials including sand, silt and gravel from alluvium and soil. The eastern portion of the proposed excavation area includes fill and disturbed native soils associated with an uncompleted golf course project. Based on examination of aerial imagery, the entire bench area above the active river channel has previously been disturbed by ploughing or disking. The entire site should be considered disturbed ground based on its history of ploughing/disking and use for materials storage, borrow and processing. Larger areas of fill are shown on the Site Plan and Geologic Map (Enclosure A-4.1). Minor areas of fill occur within the Qya unit, primarily within the northeastern area of the future excavation area that was graded for the golf course project. All fill materials are considered undocumented and unsuitable for support of engineered improvements.

Recent Wash Deposits (Qw)

Wash deposits consisting of sand, silt and gravel are present in the active San Diego River channel. These sediments are unconsolidated, include clasts of the more durable bedrock types in the larger size fraction and incise the Qya unit. A dense growth of trees is present within these sediments.

Young Alluvium (Qya)

Alluvium consisting of unconsolidated sand and silt with gravel forms the elevated bench area adjacent to the river channel. The upper surface of these sediments is commonly a gray-brown, fine-grained sand and micaceous silt that is compressible and soft. This surface is heavily disturbed by burrowing and plant growth. This unit was mapped as young alluvium (Qya) by Todd (2004). These sediments are derived from weathering and erosion of adjacent bedrock hillsides that include granitic and metavolcanic rock types and reflect the color and mineral composition of the parent materials. Over bank deposits of fine-grained sand and silt deposited during river flooding are also present locally.

Older Alluvium (Qoa)

An isolated remnant of older alluvium may occur northwest of the excavation area; however field relations suggest that a portion of these materials is either disturbed or imported. These materials consist of strong reddish-brown silty sands that form a bench elevated relative to the Qya surfaces. Geomorphic relations and soil color suggest that these are older than Qya and represent an old land surface preserved above the active modern floodplain; however, the southern margin of the bench includes abundant concrete and metavolcanic debris/clasts that are inconsistent with granitic outcrops nearby. Concrete debris was observed to be buried within/beneath the reddish materials along the margin of the bench, and pedogenic soil development (clay coating, prismatic structure) was lacking in soils exposed at the margin. Aerial imagery indicates that this area was ploughed/furrowed in 1994, fallow in 2002 and cleared/graded in 2005 with equipment stored on a flattened surface. Several large trees visible since imagery dated 1953 remain near the margin of the deposit and are rooted in the Qya surface. The reddish-brown materials terminate near the trees as if placed to avoid burying the trunks. For purposes of this investigation, we interpret the Qoa unit to consist of a natural terrace deposit (reddish-brown sediments) that was partially altered by clearing and placement of a fill derived from the Qoa surface along the unit margin that incorporates imported debris and rock fragments. The alternative interpretation is that these materials were imported from an offsite area, end-dumped and spread/flattened with equipment. Explorations are not available to make a more definitive conclusion as to the source of the unit designated Qoa. This unit is not within the proposed excavations area.

Granitic Bedrock (Kgr)

As described by Todd (2004), these rocks consist of undivided tonalite and granodiorite of early Cretaceous age, most lithologically similar to tonalite of Alpine (Ka), Japatul Valley Tonalite (Kjv), and Corte Madera Monzogranite (Kcm). Includes lesser gabbro and metavolcanic rocks. This unit forms bouldery hillsides along the northwest margin of the proposed excavation area and is interpreted to underlie the site at depth. Clasts of this unit were observed as rounded cobbles in the Qya unit.

Metavolcanic Rocks (Kmv)

As described by Todd (2004), these rocks consist of amphibolite-facies tuff, tuffbreccia and volcanic flow rock of andesitic, dacitic and basaltic composition of early Cretaceous age. Also includes rare feldspathic metaquartzite, pelitic schist and granitoid-cobble metaconglomerate. Typically forms screens between and within plutons in the western part of the El Cajon quadrangle. These rocks form a more subdued topography along the southern boundary of the proposed excavation area, are exposed in rock cuts along El Monte Road and stand at very steep to vertical angles where cut. Clasts of this unit were observed as sub-rounded to angular clasts in the Qya unit and include boulder of angular breccia in a finer groundmass.

Chiquito Peak Monzogranite (Kcp)

As described by Todd (2004), these rocks consist of hornblende-biotite monzogranite and granodiorite and lesser tonalite, leucogranite, alaskite and pegmatite of early Cretaceous age. Forms lenticular plutons and narrow, sheet-like bodies. Medium grained; moderately to strongly foliated. Variable from one body to another; partly dependent on lithology of nearby units. These rocks are exposed in road cuts along El Monte Road at the southeastern portion of the proposed excavation area.

Consolidated Sediment

As encountered in geotechnical explorations, cemented sediments occur within the alluvial column at elevations below approximately 360 feet amsl. These materials are gray to dark gray, coarse-grained sand and silty sand with clay and gravel. The density of and clay content in these materials suggest possible weathered bedrock.

GEOLOGIC STRUCTURE:

The alluvial sediments of the San Diego River valley are anticipated to be crudely bedded and stratified due to deposition by alluvial processes. As encountered in subsurface explorations, alluvial units include thickly bedded silty sand and sand beds with gravel, and gravel lenses. Sands are locally coarse-grained where gravel content is higher. Few silt layers where encountered at intermediate and deeper depths in the borings. Individual units are anticipated to be discontinuous due to depositional processes that include channel meander, braided stream flow and variable transport energy. For slope stability, the alluvial units are anticipated to act as homogenous, relatively flat-lying layers that are not prone to slide on steep contacts or bedding planes.

FAULTING AND SEISMICITY

Regional seismic sources and historic earthquakes were assessed to determine ground motion conditions for evaluation of potential seismic effects on stability of proposed finished slopes. We calculated deterministic peak ground accelerations for the regional seismic sources. These data are presented in the following sections.

REGIONAL FAULTS:

The tectonics of Southern California are dominated by the interaction of the North American and Pacific tectonic plates, which slide past each other in transform motion. Although some motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone is the major surface expression of the tectonic boundary and accommodates most transform slip between the Pacific and North American Plates. The Rose Canyon – Newport-Inglewood, Elsinore and other offshore transform faults also accommodate strain between the Pacific and North American plates. Recent seismic activity in the greater San Diego region includes the magnitude 7.2 El Mayor – Cucapah earthquake of April 2010. This event occurred on the Laguna Salada fault zone at an epicentral distance of 165 kilometers (102 miles) from the site and was felt over a wide region.

Rose Canyon Fault Zone

The coastal San Diego region is traversed by a broad zone of faulting associated with the Rose Canyon fault zone (RCFZ), a system of faults that accommodates motion between the Pacific and North American tectonic plates. The RCFZ is considered a southern extension of the offshore Newport-Inglewood fault zone. North of downtown San Diego, the RCFZ diverges southward into three named strands—the Coronado, Silver Strand and Spanish Bight faults. The RCFZ is located approximately 30 kilometers (19 miles) southwest of the site.

Elsinore Fault Zone

The Julian segment of the Elsinore fault zone is located about 37 kilometers (23 miles) northeast of the site. The Elsinore fault zone is typified by multiple en echelon and diverging faults. To the north, the Elsinore zone splays into the Whittier and Chino faults. The Elsinore is primarily a strike-slip fault zone; however, transtentional features such as the graben of the Elsinore and Temecula Valleys also occur. Most Elsinore fault traces are demonstrably active (Holocene) as documented by Saul (1978), Rockwell and others (1986) and Wills (1988).

Coronado Bank Fault Zone

The Coronado Bank fault is located approximately 55 kilometers (35 miles) southwest of the site in the offshore region of San Diego. The Coronado Bank fault zone is a system of strike-slip and normal fault that trends north-northwest in the offshore region. The fault trend is reflected in alignment of bathymetric features including the Coronado Escarpment, Lasuen Knoll, and connection with the Palos Verdes fault zone is postulated.

San Jacinto Fault Zone

The Borrego segment of the San Jacinto fault zone (SJFZ) is located approximately 70 kilometers (43 miles) northeast of the site. The SJFZ is a system of northwest-trending, right-lateral, strike-slip faults that roughly parallels the trend of the southern San Andrea fault zone. More large historic earthquakes have occurred on the San Jacinto fault than any other fault in Southern California (Working Group on California Earthquake Probabilities, 1988).

REGIONAL SEISMICITY:

A map of recorded earthquake epicenters is included as Enclosure A-5 (Epi Software, 2000). The epicenters and magnitudes are based on data from the California Institute of Technology - Southern California Earthquake Data Center catalog. This enclosure presents circles as epicenters of earthquakes with magnitude equal to or greater than magnitude 4.0 recorded from 1932 through 2012.

The most significant fault with regard to generation of ground shaking is the Rose Canyon zone, about 30 kilometers (19 miles) to the southwest.

GROUND-SHAKING HAZARD

The ground-shaking hazard at the site was evaluated from a deterministic standpoint for use as a guide to formulate an appropriate seismic coefficient for use in slope stability analyses.

A deterministic evaluation of seismic hazard was performed for the Rose Canyon fault and other regional faults using the attenuation relations of Boore and Atkinson (2008), Campbell and Bozorgnia (2008) and Chiou and Youngs (2008). The deterministic evaluation considers the magnitude, distance and attenuation characteristics of the site based on soil conditions. These data are summarized in the following table.

Table 1: Summary of Seismic Sources

Fault Name	Distance (kilometers)	Direction	Magnitude	PGA (g)
Rose Canyon	30	SW	6.9	0.14
Elsinore (Julian)	37	NE	7.6	0.16
Coronado Bank	53	SW	7.4	0.11
San Jacinto (Borrego)	72	NE	7.4	0.09

We utilized K_h = 0.12 to model the psuedostatic condition for slope stability calculations, consistent with conservative application of methods described by Seed (1979). Seed (1979) considered the size of a sliding mass and earthquake magnitude in selection of K_h. For large slopes, Seed suggested K_h = 0.15 for sites near faults capable of generating magnitude 8.5 earthquakes. The closest fault to the site, the Rose Canyon fault, is assigned a characteristic magnitude of 6.9. Based on the method of Seed (1979), selection of $K_h = 0.12$ is conservative based on the seismic setting of the site.

GROUNDWATER

The site is located in the San Diego River Valley groundwater basin and is underlain by an alluvial aquifer with variable recharge based on seasonal climatic conditions. Groundwater data compiled by State of California Department of Water Resources (2015) for Helix Water District observation well HWD-2 are summarized in the following table. This well is located in the north-central portion of the future excavation area.

Table 2.1: Summary of Water Level Data – HWD-2

Date of Measurement	Reference Point Elevation (feet amsl)	Water Surface Elevation (feet amsl)	Depth to Water at Well (feet bgs)
4/27/2012	447.24	414.61	32.63
10/9/2012		414.81	32.43
4/24/2013		414.62	33.62
6/6/2014		410.98	36.26
10/17/2014		409.74	34.50

Groundwater data from exploratory borings and monitoring wells that encountered groundwater utilized for site investigations is summarized in the following table.

Table 2.2: Summary of Groundwater Data from Explorations and Monitoring Wells			
Data ID	**Reference Point Elevation (feet amsl)**	**Water Surface Elevation (feet amsl)**	**Depth to Water at Well (feet bgs)**
CHJ (2015)			
B-1	435	394.9	40.1
B-2	440	397.7	42.3
B-3	448	405.7	42.3
B-4	443	406.3	36.7
Ninyo & Moore (2011)			
B-2	438	397	41
B-3	440	401	39
B-4	442	407	35
B-5	450	407	43
B-6	455	420	35
B-7	453	423	30
B-8	456	416	40
B-9	460	425	35
B-10	475	431	44
B-15	436	391	45
B-19	444	409	35
B-23	455	420	35
B-24	453	413	40
B-26	469	424	45
Shepardson (2003)			
B-7	465	444	21
B-8	455	440	15
B-9	457	434	23
B-10	455	436	19
B-11	453	434.4	18.6
B-12	449	432.2	16.8
B-14	447	428.2	18.8
B-16	447	418.8	28.2
EarthTech (1998)			
MW-1	450	435	15
MW-2	465	446	19
MW-5	458	445	13
MW-6	450	440	10

The water surface elevation (WSE) encountered in Boring No. 1 (current investigation) is consistent with the WSE (depicted on the topographic contour map dated April 21, 2013) in the existing pit adjacent to the western boundary of the site. The quarry bottom is planned at elevations between 394 and 434 feet amsl at the west and east ends, respectively. Surface water is not anticipated to occur in the final pit except during times of high flow in the San Diego River. Water elevation in the subsurface mimics the surface topography so that depth to water is relatively consistent along the river axis through the excavation area. For evaluation of liquefaction effects and slope stability, we have utilized a water surface elevation at 420 feet amsl based on an anticipated high groundwater surface and in consideration of potential flooding events.

SLOPE STABILITY

The term "landslide", as used in this report, refers to deep-seated slope failures that involve mine pit-scale features that have the potential to reduce the long-term stability of finished quarry reclamation slopes. Surficial failures refer to shallow failures within approximately 4 feet of the surface that may result in localized raveling of soil material.

The susceptibility of a geologic unit to landsliding is dependent upon various factors, primarily: 1) the presence and orientation of weak structures, such as fractures, faults or clay beds and degree of cementation of the material; 2) the height and steepness of the natural or cut slope; 3) the presence and quantity of groundwater and 4) the occurrence of strong seismic shaking. The primary influences on the stability of mine and reclaimed slopes are anticipated to be slope geometry and material strengths of native alluvial and planned fill units.

SLOPE STABILITY EVALUATION

We evaluated the global slope and surficial stability of the proposed slopes for representative material types. Material strength properties for stability calculations were modeled using Mohr-Coulomb criteria and the ultimate mining depth (tallest slopes) anticipated for the mine pit and reclaimed geometries. We analyzed the reclamation configuration. Discussion and summary of these analyses are presented below. Slope stability data and calculations are presented in Appendix D.

GLOBAL STABILITY CALCULATIONS:

The global stability of future reclamation slopes, as depicted on the Mining and Reclamation Plan, was analyzed using Spencer's method under both static and seismic conditions for rotational and composite failure surfaces using the SLIDE computer program, version 6.038 (Rocscience, Inc., 2016). The materials strengths of the fill and native sedimentary units were determined by laboratory tests using samples from the current borings.

A representative slope, derived from the Mining and Reclamation Plan, was modeled as follows:

- 30-foot-high benched mine slope, cut into alluvium consisting of a 10-foot upper section and 20-foot lower section separated by a 20-foot-wide bench.

The seismic stability calculations were performed using a lateral pseudostatic coefficient "K_h" of 0.12, based on a very conservative interpretation of regional seismic conditions. Groundwater was not considered in the global stability evaluation as excavations will remain above the groundwater table.

Laboratory tests of samples collected from borings included sieve analysis and direct shear of relatively undisturbed samples and one remolded sample. The results of direct shear tests are summarized below and are based on saturated conditions.

Table 3: El Monte Sand Project—Shear Test Summary				
Sample	Cohesion (psf)		ϕ (degrees)	
	Peak	Residual	Peak	Residual
B-1 at 20 Feet (SP-SM)	134.0	57.5	36.8	33.6
B-1 at 90 Feet (SM)	362.2	229.9	40.7	36.2
B-2 at 45 Feet (SP-SM)	198.7	144.4	32.9	30.2
B-2 at 60 Feet (SM)	245.1	107.4	31.7	29.9
B-3 at 40 Feet (silt remolded to 80%)	214.2	250.0	29.8	28.1
B-4 at 15 Feet (SM)	117.0	108.6	30.0	30.1

The strength of sand and silty sand units in the Qya was taken as the average of the five results from Boring Nos. 1, 2 and 4 (residual cohesion = 129; residual ϕ = 32°). The silt sub-unit of Qya, represented by the sample from Boring No. 3, was modeled with cohesion = 220 pounds per square foot (psf); residual ϕ = 28°. Laboratory test results are included in Appendix C.

Bedrock units were not included in the model as mining is anticipated to terminate above the bedrock surface. Bedrock units under global stability conditions would exhibit infinite strength relative to alluvial and fill units.

The results of the global slope stability analyses are summarized below in Table 4. Details of stability calculations including material type boundaries, strength parameters and the minimum factor of safety and critical slip surface are included in Enclosures D-1.1 through D-1.3.

Table 4: Summary of Slope Stability Results—El Monte Sand Project			
Slope Configuration	**Static F.S.**	**Seismic F.S. (K_h=0.12)**	**Enclosure**
30-foot-High Cut Slope with 20-Foot-Wide Bench Separating Upper 3(h) to 1(v) and Lower 3(h):1(v) Sections	2.43	--	D-1.1
	--	1.73	D-1.2
Flooded Condition at 420 Feet Elevation	--	1.44	D-1.3

SURFICIAL STABILITY CALCULATIONS:
Surficial stability of reclamation slopes was modeled using the infinite slope model method as presented in Enclosure D-2. This model uses a saturated zone 4 feet thick extending downward from the slope surface. The factor of safety estimated by this model is 1.63.

SLOPE STABILITY CONCLUSIONS:
As indicated by calculation for global stability, a static factor of safety in excess of 1.5 and seismic factor of safety in excess of 1.1 were indicated for the modeled reclaimed slope configuration and satisfy Office of Mine Reclamation and County of San Diego criteria. The global slope configurations appear suitably stable for mining and reclamation of the proposed slopes according to regulatory requirements.

The surficial stability model indicates a suitably stable configuration for the proposed end use of the reclaimed mine slopes as open space. The proposed pit configuration and lack of structures within the future reclaimed pit preclude the potential for erosion or raveling to affect adjacent property or on-site improvements.

LIQUEFACTION POTENTIAL AND SEISMIC SETTLEMENT

Based on the groundwater, soil and seismic conditions of the site, the potential for liquefaction was evaluated. Liquefaction is a process in which strong ground shaking causes saturated soils to lose their strength and behave as a fluid (Matti and Carson, 1991). Ground failure associated with liquefaction can result in severe damage to structures. Soil types susceptible to liquefaction include sand, silty sand, sandy silt and silt, as well as soils having a plasticity index (PI) less than 7 (Boulanger and Idriss, 2006). Loose soils with a PI less than 12 and moisture content greater than 85 percent of the liquid limit are also susceptible to liquefaction (Bray and Sancio, 2006). For sandy soils, the geologic conditions for increased susceptibility to liquefaction are: 1) shallow groundwater (generally less than 50 feet in depth), 2) the presence of unconsolidated sandy alluvium, typically Holocene in age, and 3) strong ground shaking of sufficient duration. All three of these conditions must be present for liquefaction to occur.

Due to the potential for the presence of shallow groundwater beneath the site (34 feet), the liquefaction potential of site soils has been evaluated based on the SPT data obtained and using the simplified procedure described by Seed and Idriss (1982), Seed and others (1985), modified in the 1996 National Center for Earthquake Engineering Research (NCEER) and 1998 NCEER/National Science Foundation (NSF) workshops (Youd and Idriss, 2001) and recently summarized by Idriss and Boulanger (2008). The method of evaluating liquefaction potential consists of comparing the cyclic stress ratio (CSR) developed in the soil by the earthquake motion to cyclic resistance ratio (CRR), which will cause liquefaction of the soil for a given number of cycles. In the simplified procedure, the CSR developed in the soil is calculated from a formula that incorporates ground surface acceleration, total and effective stresses in the soil at different depths (which in turn are related to the location of the groundwater table), non-rigidity of the soil column and a number of simplifying assumptions.

For sandy soils, the CRR that will cause liquefaction is related to the relative density of the soil, expressed in terms of SPT blowcounts $(N_1)_{60}$ (Seed and Idriss, 1982; Seed and others, 1985; Youd and Idriss, 2001; Idriss and Boulanger, 2008), cone penetration resistance (q_{c1N}) (Robertson and Wride, 1998; Youd and Idriss, 2001; Idriss and Boulanger, 2008) or shear wave velocity (V_{s1}) (Andrus and Stokoe, 2000; Youd and Idriss, 2001; Andrus and others, 2004), all normalized for an effective overburden pressure of 1 ton per square foot and corrected to equivalent clean sand resistance. For clayey soils, the CRR is related to cyclic undrained shear strength ratio, s_u/σ_{vc}' (Idriss and Boulanger, 2008). For this investigation, SPT blowcounts were obtained and utilized in the analysis. A projected future depth to groundwater of 34 feet below the existing ground surface (bgs) was utilized to calculate the liquefaction potential in the area. A peak ground acceleration of 0.35g (geomean MCE level consistent with 2013 CBC) and a deaggregated earthquake magnitude of 6.2 were utilized as input into the liquefaction analysis program GeoSuite©, version 2.4 (Yi, 2015).

The procedures and corrections summarized by Idriss and Boulanger (2008) were utilized to evaluate the liquefaction potential of saturated sandy soils for SPT data. These methods were incorporated into a liquefaction and seismic settlement program, GeoSuite©, version 2.4 (Yi, 2015).

Liquefaction potential was evaluated for the soil profile encountered in Boring No. 3 with the SPT sampler. The results of liquefaction potential evaluations are shown in Enclosure E-1. Our calculation indicates that liquefaction could occur in layers at depths ranging from approximately 40 to 45 feet bgs and from approximately 70 to 75 feet bgs based on SPT data.

Ishihara (1985) published a paper containing observations on the protective effect that an upper layer of non-liquefied material had against the manifestation of liquefaction at the ground surface. The paper contained graphs that plotted thickness of the upper non-liquefied layer (H_1) and the thickness of underlying liquefied material (H_2). The maximum acceleration is 400 to 500 gal in Ishihara's graph. The term "surface manifestation" is utilized to describe liquefaction-induced surface damage.

A quantitative method using an index called the liquefaction potential index (LPI) was developed and presented by Iwasaki (1978, 1982). The LPI is defined as:

$$LPI = \int_0^{20} F_1 W(z) dz$$

where $W(z) = 10 - 0.5z$, $F_1 = 1 - FS$ for $FS < 1.0$, $F_1 = 0$ for $FS > 1.0$ and z is the depth below the ground surface in meters. The LPI presents the risk of liquefaction damage as a single value with the following indicators of liquefaction-induced damage:

Table 5: LPI Range and Damage

LPI Range	**Damage**
LPI = 0	Liquefaction risk is very low.
0 < LPI ≤ 5	Liquefaction risk is low.
5 < LPI ≤ 15	Liquefaction risk is high.
LPI > 15	Liquefaction risk is very high.

The most recent development for quantitative descriptions of liquefaction-induced surface damage, called "liquefaction vulnerability", was made by Tonlin & Taylor (2013) after the Christchurch, New Zealand earthquakes occurred between 2010 and 2011 and is based on field observations and analyses of approximately 7,500 cone penetrometer test (CPT) investigations. A new index, the liquefaction severity number (LSN), was proposed and defined as:

$$LSN = \int \frac{\varepsilon_v}{z} dz$$

where ε_v is the calculated volumetric densification strain in the subject layer from Zhang et al. (2002) and z is the depth to the layer of interest in meters below the ground surface. The typical behaviors of sites with a given LSN are summarized in following table.

Table 6: LSN Ranges and Observed Land Effects

LSN Range	Predominant Performance
0 – 10	Little to no expression of liquefaction, minor effects
10 – 20	Minor expression of liquefaction, some sand boils
20 – 30	Moderate expression of liquefaction, with sand boils and some structural damage
30 – 40	Moderate to severe expression of liquefaction, settlement can cause structural damage
40 – 50	Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures
>50	Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlements affecting structures, damage to services

Both LPI and LSN indices were calculated. The results indicate that the liquefaction risk of the site is low as per the LPI index. The site exhibits little to minor expression of liquefaction as per the LSN index. A minor expression of liquefaction means that some sand boils may occur during or after earthquake shaking per Tonlin & Taylor (2013).

CONCLUSIONS

On the basis of our field investigation and slope stability analyses, it is the opinion of this firm that the proposed slope excavations and reclamation of the proposed mine slopes are feasible from geotechnical engineering and engineering geologic standpoints, provided the recommendations contained in this report are implemented during mining.

In general, it appears that the strength of the alluvial resource is sufficient to accommodate the proposed overall slope angles under static and seismic conditions. Transient flooding of the working pit is not anticipated to destabilize slopes cut to 3(h) to 1(v) or flatter.

Based on our analyses, the proposed overall reclamation slope configuration is suitably stable against gross failure for the anticipated long-term conditions, including the effects of seismic shaking and a flooded pit.

Adherence to an approved slope excavation plan and consideration/mitigation of newly exposed potentially adverse geologic features (if present) during mining can result in stable slopes after completion of reclamation.

Evidence of active faulting was not observed on the site during this investigation. The results of liquefaction analysis indicate that the risk of liquefaction effects to the proposed site end use/improvements is low.

Moderate seismic shaking of the site can be expected to occur during the lifetime of the proposed mining and reclamation. This potential has been considered in our analyses and evaluation of slope stability.

With time, natural processes during and after quarry operation will result in deposition of soil on benches and shallow slopes. This material can facilitate revegetation and lend a more natural appearance to the reclaimed slopes.

RECOMMENDATIONS

Overall final cut slopes in soil/alluvial materials should be no steeper than approximately 18-1/2 degrees [3(h) to 1(v)] up to the maximum proposed height (approximately 30 feet). The benching plan appears to be suitable for mining and reclamation.

Geotechnical evaluation and design, management of mine slope and bench geometry based on encountered conditions, or use of mechanical support systems can enhance the safety of or mitigate hazards in mining; however, monitoring of slope conditions for failure warning signs is the most important means for protecting mine workers (Girard and McHugh, 2000) as it can prevent exposure of personnel to potentially hazardous conditions. As is typical for any surface mining operation, we recommend periodic observation of mine benches above working areas for indications of potential instability during mine operations.

COMPACTED FILLS:

If engineered fills are needed, the on-site soils and sand production by products should provide adequate quality fill material provided they are free from organic matter and other deleterious materials. Fill should be inorganic, non-expansive granular soils.

Fill should be spread in near-horizontal layers, approximately 8 inches thick. Thicker lifts may be approved by the geotechnical engineer if testing indicates that the grading procedures are adequate to achieve the required compaction. Each lift should be spread evenly, thoroughly mixed during spreading to attain uniformity of the material and moisture in each layer, brought to near optimum moisture content and compacted to a minimum relative compaction of 90 percent in accordance with ASTM D1557.

FILL SLOPE CONSTRUCTION:

Fill slopes should be constructed no steeper than 2(h):1(v). Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction and then roll the final slopes to provide dense, erosion-resistant surfaces.

SLOPE PROTECTION:

Inasmuch as the native materials are susceptible to erosion by wind and running water, it is our recommendation that project slopes be protected from erosion by establishment of vegetation as soon as possible.

Slopes should be protected with drainage improvements such as berms and/or levees as necessary to prevent slope erosion.

LIMITATIONS

CHJ Consultants has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, express or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing conducted on the site as the site existed during the study, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested at the time of the subject study, and the findings of this report may be invalidated fully or partially by changes outside of the control of CHJ Consultants. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions that appear different than those described herein be encountered in the field by the client, any firm performing services for the client or the client's assign, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this study are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
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AERIAL PHOTOGRAPHS EXAMINED

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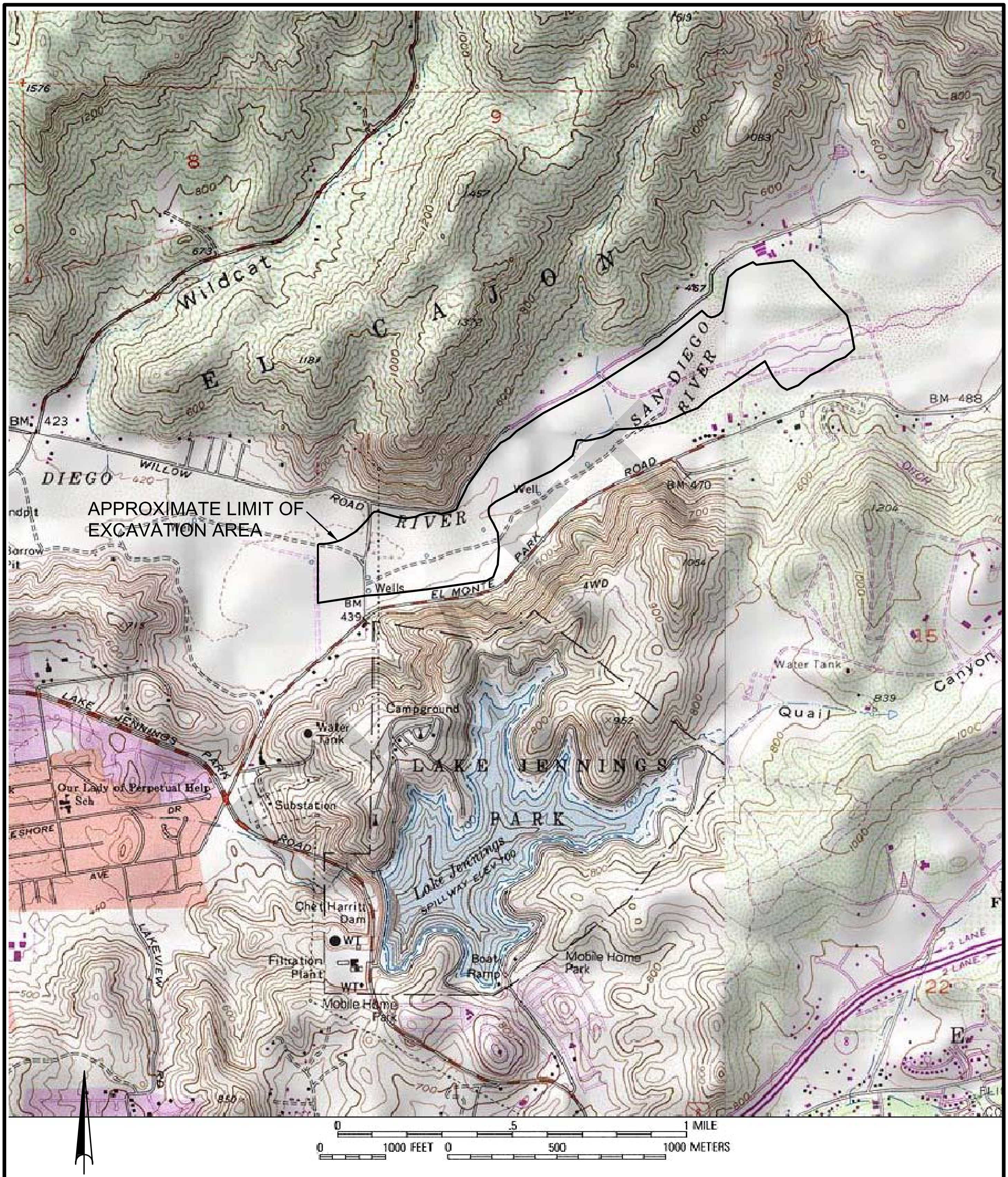
APPENDIX A

MAPS AND CROSS SECTIONS



N

SCALE: 1" = 2000'

LOCATION MAP

FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE PROJECT LAKESIDE, CALIFORNIA	ENCLOSURE "A-1"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants

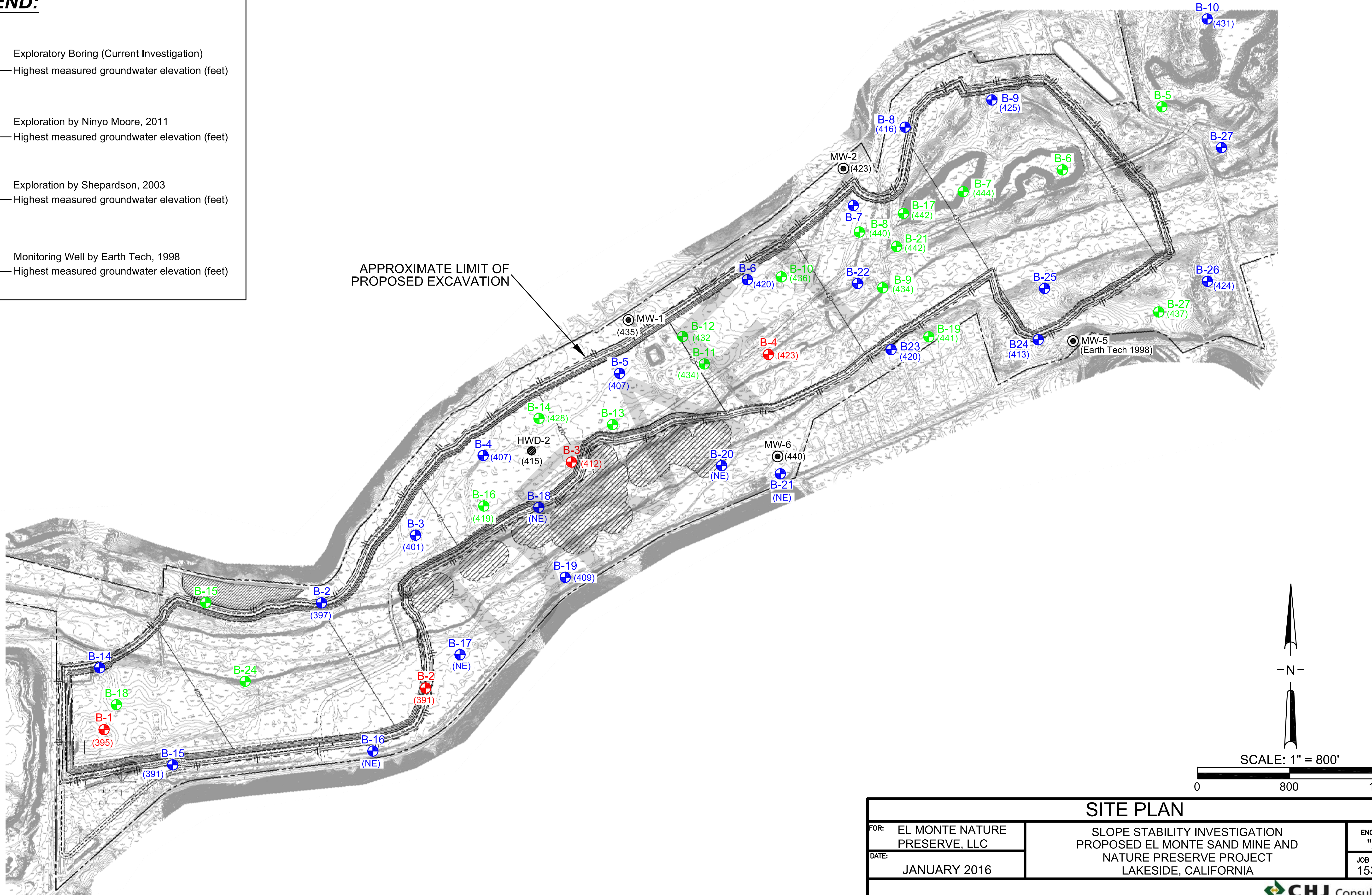
LEGEND:

B-4 — Exploratory Boring (Current Investigation)
(407) — Highest measured groundwater elevation (feet)

B-21 — Exploration by Ninyo Moore, 2011
(407) — Highest measured groundwater elevation (feet)

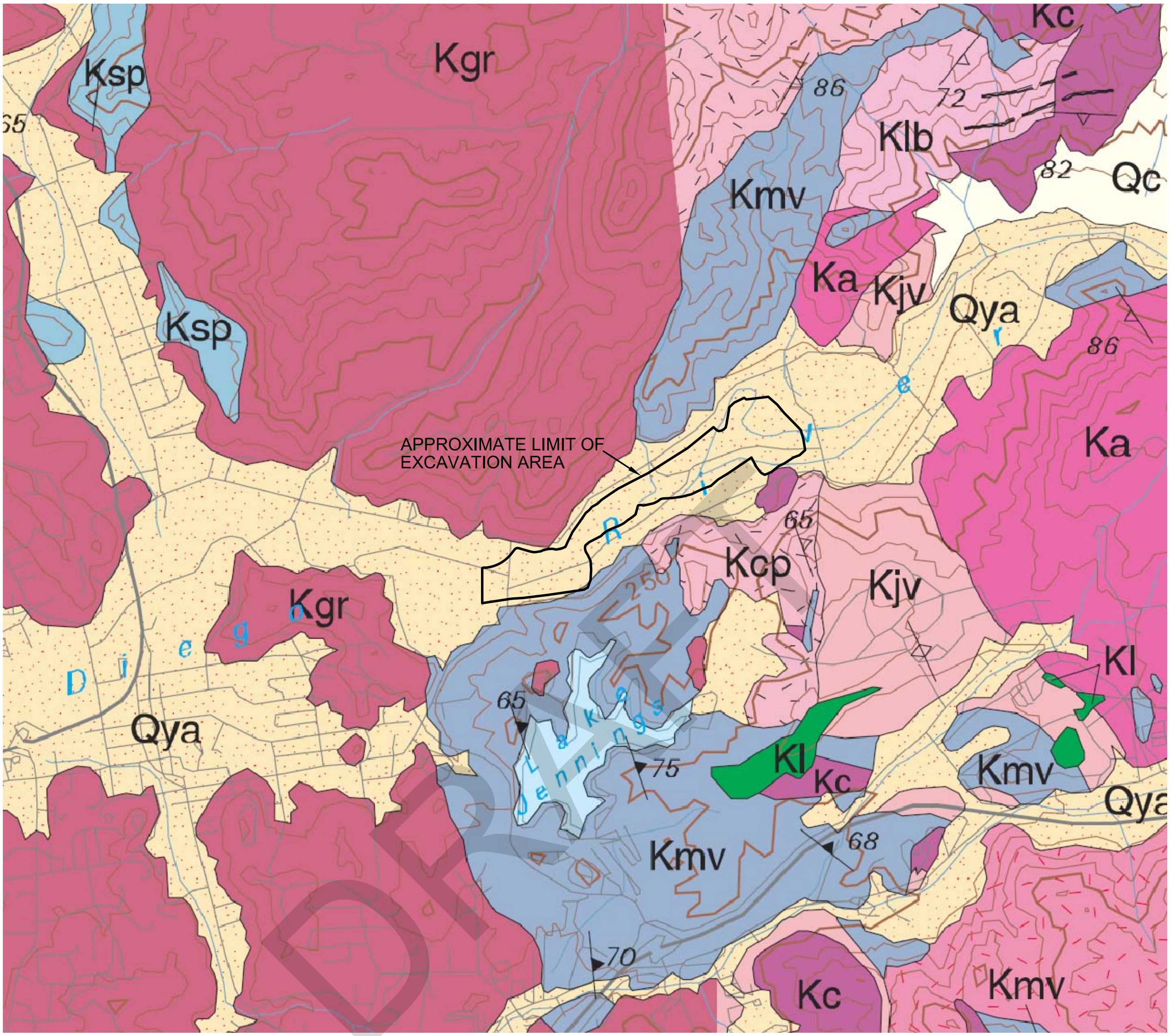
B-24 — Exploration by Shepardson, 2003
(407) — Highest measured groundwater elevation (feet)

MW-6 — Monitoring Well by Earth Tech, 1998
(407) — Highest measured groundwater elevation (feet)



SITE PLAN		
FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE PROJECT LAKESIDE, CALIFORNIA	ENCLOSURE "A-2"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants



(Base Map: Todd, 2004)

GEOLOGIC UNITS:

Qya - young alluvium
Kcp - Chiquito Peak monzogranite
Kjv - Japatul Valley tonalite
Ka - Tonalite of Alpine
Kgr - granitoid rocks
Kmv - metavolcanic rocks

geologic contact

N

SCALE: 1" = 4000'

GEOLOGIC INDEX MAP

FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE PROJECT LAKESIDE, CALIFORNIA	ENCLOSURE "A-3"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants

GEOLOGIC UNITS:

f - fill - Fill associated with prior site use as a borrow area, dirt roads/ tracks, pond/river channel embankments, and golf course development derived from local materials including sand, silt and gravel from young alluvium and topsoil.

Qw - active wash deposits of San Diego River Channel. Primarily medium-to coarse-grained sand with fine-grained sand, silt and gravel. Poorly consolidated.

Qya - young alluvium of San Diego River Valley. Includes sand, silt and gravel derived from granitic and metavolcanic sources of adjacent highlands. Surface locally mantled with brownish-gray micaceous sandy silt. Forms geomorphic bench elevated relative to river channel sediments.

Qoa - older alluvium of isolated terrace. Reddish-brown silty sand with gravel and cobbles forming terrace remnant elevated above Qya surface. Locally with fill and debris along southern margin.

Kmv - metavolcanic bedrock

Kgr - granitic bedrock

Kcp - Chiquito Peak monzogranite

LEGEND:

B-4 Exploratory Boring (Current Investigation)

B-21 Exploration by Ninyo Moore, 2011

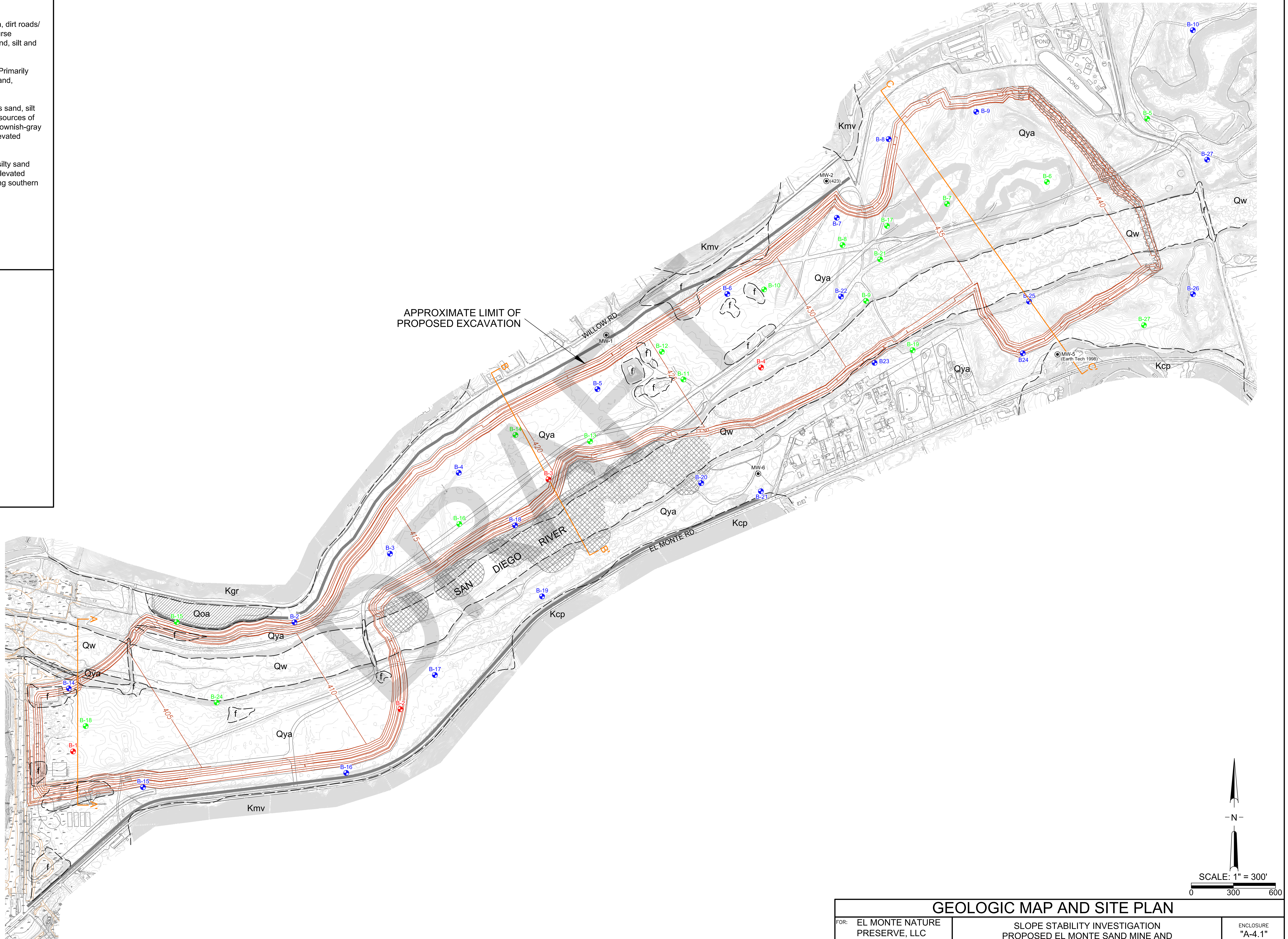
B-24 Exploration by Shepardson, 2003

MW-6 Monitoring Well by Earth Tech, 1998

Geologic Contact

C C' Geologic Cross Section

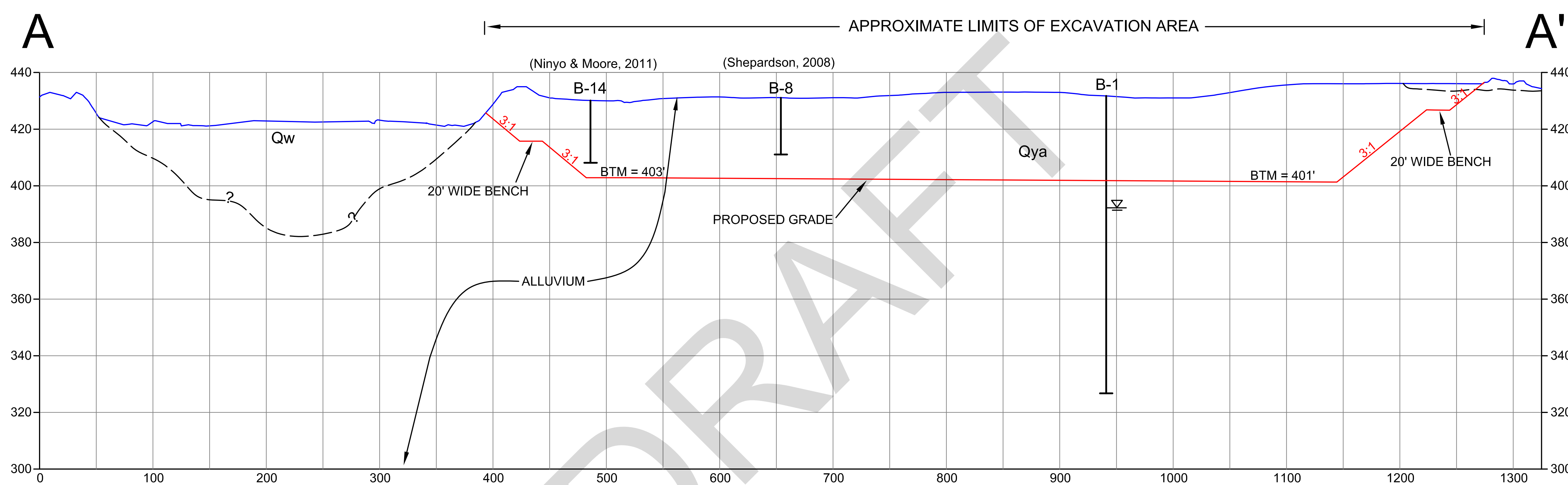
Excavation Area Boundary



GEOLOGIC MAP AND SITE PLAN

FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE PROJECT LAKESIDE, CALIFORNIA	ENCLOSURE "A-4.1"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants



ELEVATION OF GROUNDWATER IN BORING

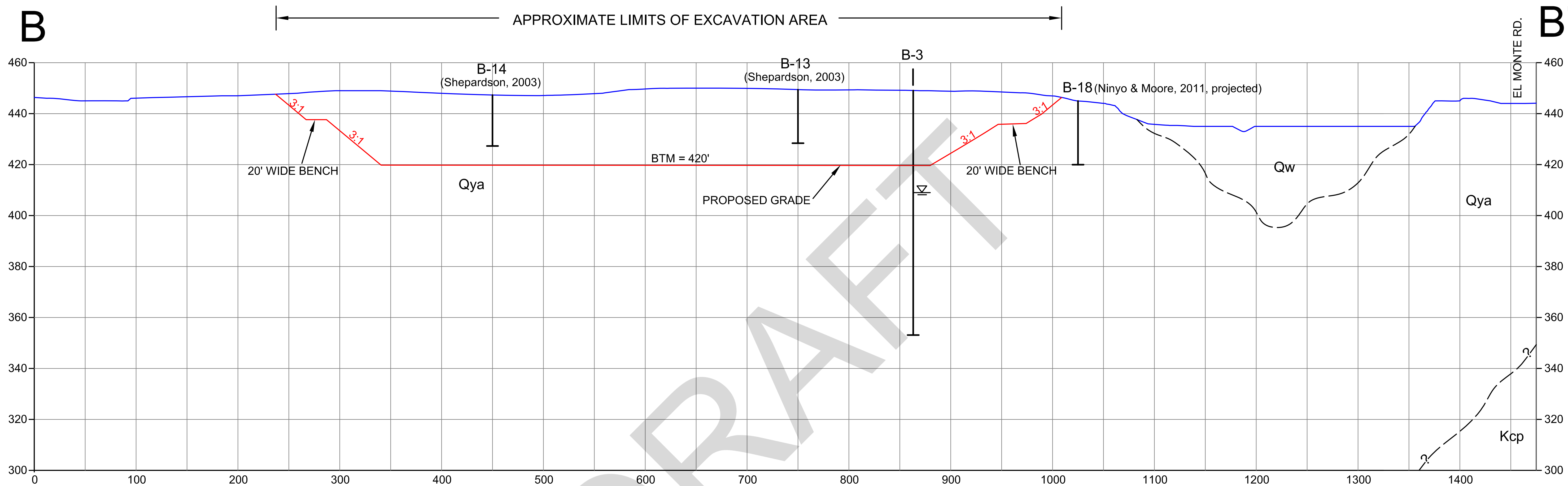
NOTE: SECTION USES VERTICAL EXAGGERATION AT 2.5X

SCALE: V = 40'
H = 100'

GEOLOGIC CROSS SECTION A-A'

FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE 13964 EL MONTE ROAD LAKESIDE, CALIFORNIA	ENCLOSURE "A-4.2"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants



ELEVATION OF GROUNDWATER IN BORING

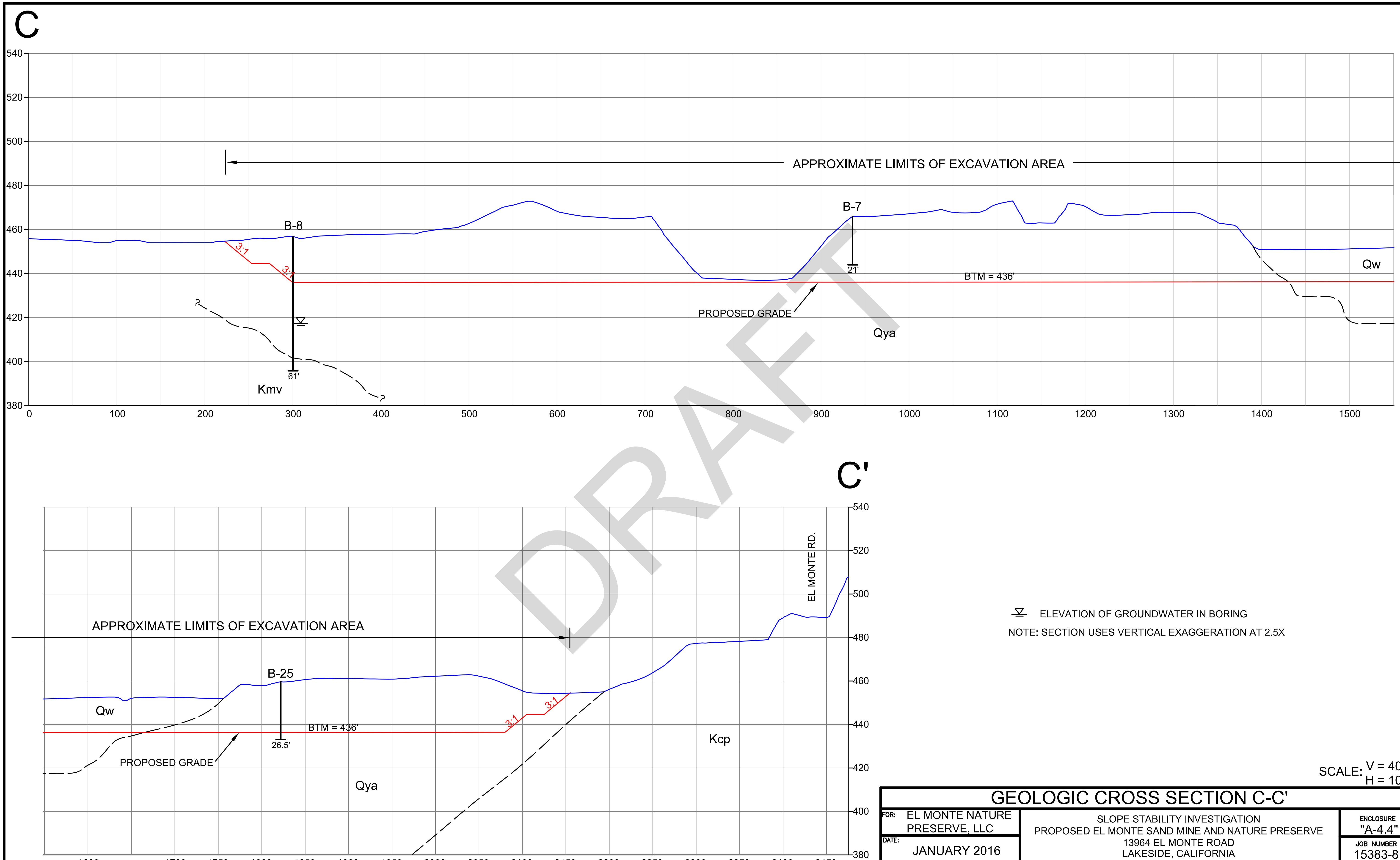
NOTE: SECTION USES VERTICAL EXAGGERATION AT 2.5X

GEOLOGIC CROSS SECTION B-B'

FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE 13964 EL MONTE ROAD LAKESIDE, CALIFORNIA	ENCLOSURE "A-4.3"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants

SCALE: V = 40'
H = 100'



GEOLOGIC CROSS SECTION C-C'

FOR: EL MONTE NATURE PRESERVE, LLC

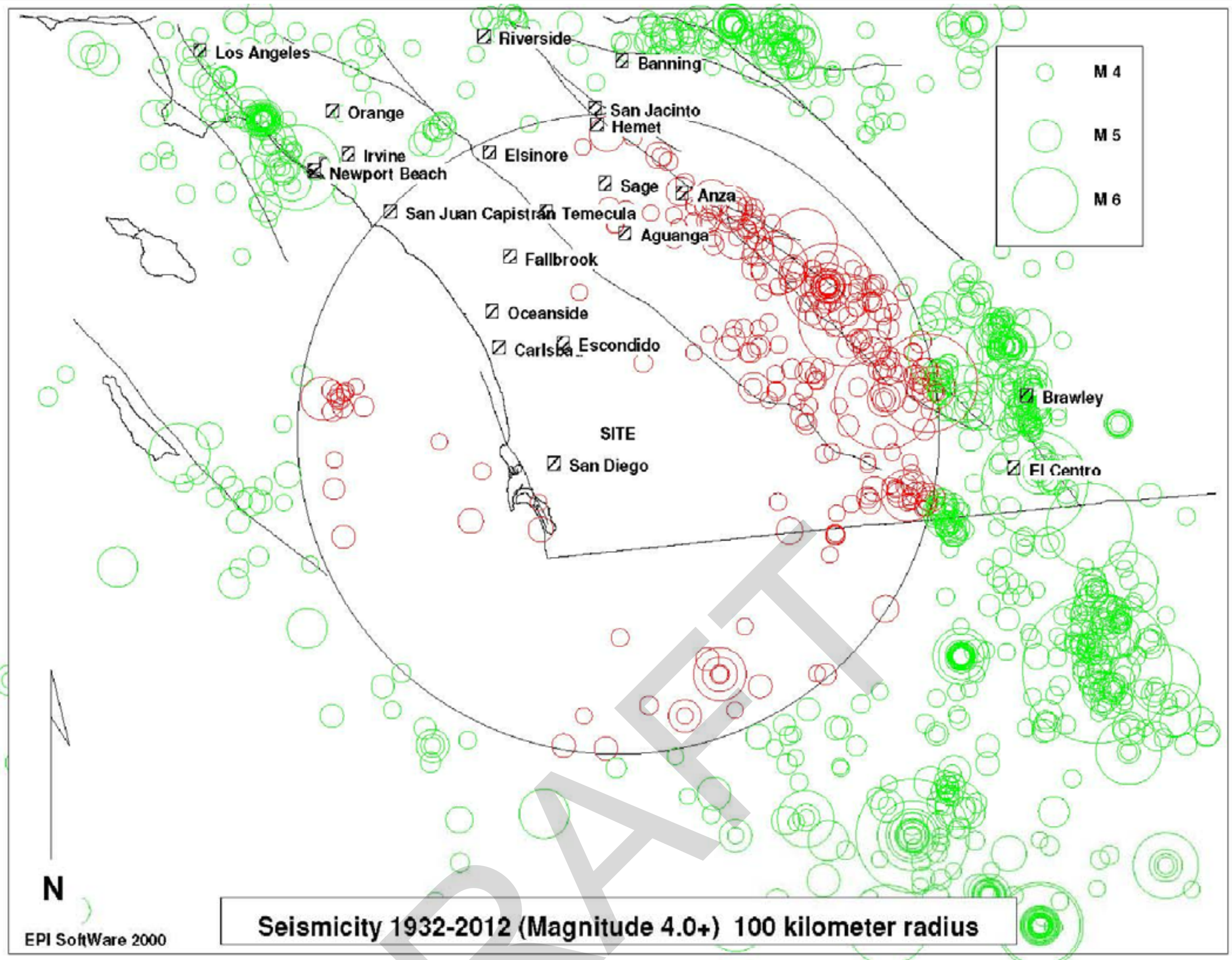
DATE: JANUARY 2016

SLOPE STABILITY INVESTIGATION
PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE
13964 EL MONTE ROAD
LAKESIDE, CALIFORNIA

ENCLOSURE "A-4.4"

JOB NUMBER 15383-8

CHJ Consultants



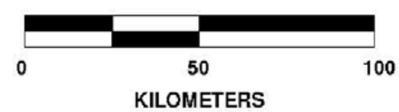
SITE LOCATION: 32.8723 LAT. -116.8863 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 1373

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 310

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:



4.0- 4.9 : 283
5.0- 5.9 : 22
6.0- 6.9 : 5
7.0- 7.9 : 0
8.0- 8.9 : 0

CLOSEST EVENT: 4.2 ON WEDNESDAY, DECEMBER 04, 1991 LOCATED APPROX. 23 KILOMETERS NORTH OF THE SITE

LARGEST 5 EVENTS:

6.6 ON TUESDAY, NOVEMBER 24, 1987 LOCATED APPROX. 97 KILOMETERS EAST OF THE SITE
6.6 ON WEDNESDAY, OCTOBER 21, 1942 LOCATED APPROX. 83 KILOMETERS EAST OF THE SITE
6.5 ON TUESDAY, APRIL 09, 1968 LOCATED APPROX. 78 KILOMETERS NORTHEAST OF THE SITE
6.4 ON FRIDAY, MARCH 19, 1954 LOCATED APPROX. 79 KILOMETERS NORTHEAST OF THE SITE
6.0 ON THURSDAY, MARCH 25, 1937 LOCATED APPROX. 83 KILOMETERS NORTHEAST OF THE SITE

EARTHQUAKE EPICENTER MAP

FOR: EL MONTE NATURE PRESERVE, LLC	SLOPE STABILITY INVESTIGATION PROPOSED EL MONTE SAND MINE AND NATURE PRESERVE PROJECT LAKESIDE, CALIFORNIA	ENCLOSURE "A-5"
DATE: JANUARY 2016		JOB NUMBER 15383-8

CHJ Consultants