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April 16, 2019
Kleinfelder Project No. 20193578.001A

Mr. Jorge Goytortua
Otay-TJ LLC
c/o The Harrison Company
P.O. Box 230283
Encinitas, California 92023

SUBJECT: Geotechnical Investigation Report
Proposed OTN Parking Lot
South of Siempre Viva Road
East of Cross Border Xpress
San Diego, California

Dear Mr. Goytortua:

This report presents the results of our geotechnical investigation for the proposed OTN Parking Lot on an undeveloped parcel located just east of the existing Cross Border Xpress development in San Diego, California.

We appreciate the opportunity to be of service on this project during and look forward to future endeavors. If you have any questions about this report, please contact us at 619.831.4600.

Respectfully submitted,

KLEINFELDER

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GEOTECHNICAL INVESTIGATION REPORT
PROPOSED OTN PARKING LOT
SOUTH OF SIEMPRE VIVA ROAD
EAST OF CROSS BORDER XPRESS
SAN DIEGO, CALIFORNIA
KLEINFELDER PROJECT NO. 20193578.001A

APRIL 16, 2019

A Report Prepared for:

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Otay-TJ LLC
c/o The Harrison Company
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Encinitas, California 92023

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PROPOSED OTN PARKING LOT
SOUTH OF SIEMPRE VIVA ROAD
EAST OF CROSS BORDER XPRESS
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1 INTRODUCTION

This report presents the results of our geotechnical study for the proposed Cross Border Xpress OTN Parking Lot located in San Diego, California. The site is bounded on the north by Siempre Viva Road, on the west by the existing Cross Border Xpress development, on the east by unimproved Inbound Street and a mostly vacant parcel, and on the south by a drainage channel. The 150-foot wide Border Patrol Corridor along the USA-Mexico border is located further to the south.

The approximate latitude and longitude coordinates of the proposed parking lot are:

Latitude: 32.55205°N

Longitude: -116.96984°W

The site location is shown on the Vicinity Map, Figure 1. A site plan showing our approximate field exploration locations for boreholes and test pits is presented as Exploration Site Plan, Figure 2. This report is based on data contained in several Kleinfelder investigations over the past 12 years for the adjacent Cross Border Xpress (CBX) development, and current geologic reconnaissance and field exploration.

1.1 SITE AND PROJECT DESCRIPTION

The existing CBX provides access to the Tijuana International Airport (TIA), which connects to major international destinations including Asia and South America. The proposed OTN Parking Lot will provide overflow parking during peak demand and be situated on the approximate 15-acre portion of a 21-acre parcel immediately adjacent to the existing CBX temporary parking lots.

The site is currently undeveloped and is sparsely to moderately vegetated with seasonal low grasses and scrub. Unlined drainage channels enter the parcel from both the east and west sides, and eventually merge and flow south across the international border. The western channel is concrete lined on the CBX property and empties into a desilting basin prior to entering the subject parcel. Site elevations north of the channels range from about 458 to 478 feet MSL datum from southwest to northeast. The area south of the channels is not part of the project and is not addressed in this report. Fill slopes approximately 4 to 6 feet high ascend along the western site perimeter, with higher slopes at the northwest corner associated with a temporary stockpile.

Numerous small stockpiles of soil and debris are concentrated within the central portion of the site in an area approximately 200 by 450 feet in size. Rows of scattered stockpiles of a very light-colored material are also present in the western portion of the site.

Based on our review of the May 16, 2018 conceptual plans prepared by Latitude 33 Engineering and Planning, the proposed parking lot will have approximately 2,113 stalls, two bioretention basins and a perimeter sidewalk. Changes in site use will result in some level of site regrading for drainage. Although grading details are not known at this time, we anticipate this may result in cuts and fills on the order of 1 to 2 feet. A box culvert will be constructed in the general location of the existing western drainage channel in the southwestern portion of the site and discharge into a new bioretention basin. The project will also include widening of Siempre Viva Drive and creating site access. A conservation area with a buffer from wetlands and environmental resources will be protected in the southeastern portion of the site.

1.2 PURPOSE AND SCOPE OF SERVICES

The purpose of our study is to evaluate the geotechnical conditions at the site to assist Otay – TJ Partners LLC with the proposed project. Our scope of services for this geotechnical report consisted of reviewing available reports and information relevant to the site, conducting a field exploration and laboratory testing program, performing geotechnical engineering and geologic analyses, and developing recommendations for design and construction of the proposed project. Our review included geologic maps, aerial photographs and the following reports for the adjacent CBX site to the east:

- MTGL, Inc., 1999. Geotechnical Investigation, Otay Mesa Business Center, Lots 3 and 6 of Section 3, San Diego, California, dated April 26, 1999.
- Geocon, 2001. Geotechnical Investigation, Las Californias Center, San Diego, California, dated June 8, 2001.

- Geocon, 2004. Geotechnical Investigation Update, Las Californias Center, San Diego, California, dated February 4, 2004.
- Kleinfelder, 2009. Preliminary Geotechnical Report, Proposed San Diego - Tijuana Airport Cross Border Facility, San Diego, California, dated April 1, 2009.
- Kleinfelder, 2011. Geotechnical Report San Diego - Tijuana Airport Cross Border Facility - Phase I San Diego, California, dated May 20, 2011.
- Kleinfelder, 2015. Compaction Test Summary and Observations - Otay Pacific Place Widening, San Diego -Tijuana Airport Cross Border Facility Project, San Diego, California, dated September 18, 2015.
- Kleinfelder, 2017. Addendum No. 4 to Geotechnical Report, Infiltration Study for the Six Additional Parking Lots San Diego - Tijuana Airport Cross Border Xpress, San Diego, California, dated May 18, 2017.

2 METHODS OF STUDY

2.1 GEOTECHNICAL FIELD INVESTIGATION

Our field investigation consisted of advancing two soil borings and excavating ten test pits within the proposed project footprint. In addition, we conducted four shallow borings to estimate infiltration rates as part of the site BMPS. The approximate locations of the borings and tests pits are shown on Figure 2. Boring B-1 was advanced utilizing a truck mounted all terrain Marl-5 drill rig operated by Pacific Drilling. Boring B-2 and the percolation borings were advanced utilizing a limited access 319E DEERE equipment with hollow stem augers operated by Scotts Drilling. The test pits were excavated by using a backhoe that was operated by Cut N Core. The depth of borings ranged from approximately 6 ½ to 16 ½ and test pits depth ranged from 5 ¼ to 7 ¼ feet below ground surface (bgs). A staff engineer from our office supervised the field operations and logged the borings and test pits. Selected bulk, disturbed, and intact samples were retrieved from the borings and test pits, and transported to our laboratory for further evaluation. Drive samples were typically collected at nominal 5-foot intervals to the termination depth of the boring. We recorded the number of blows necessary to drive either a Standard Penetration Test (SPT) sampler or a California sampler at each sampling location. A summary of the geotechnical boring and test pit logs is presented in Appendix A.

2.2 LABORATORY TESTING

Geotechnical laboratory testing was performed on selected bulk and driven samples to correlate field classifications and to provide engineering parameters for geotechnical design. The laboratory testing program consisted of moisture determination, sieve analyses, Atterberg Limits, maximum dry density with lime treatment (Modified Proctor test), R-Value, unconfined compressive strength and pH to estimate the soil-lime proportion for lime treatment. The test results are presented in Appendix B, with some test results presented on the boring logs in Appendix A.

2.3 REVIEW OF EXISTING INFORMATION

Our review of existing information consisted of researching previous geotechnical reports, geologic maps and aerial photographs available to our office. Our review of the referenced reports for the adjacent CBX development provides a summary of initial site conditions and site grading. This is presented herein since the subsurface conditions and geotechnical issues on the current site are similar to the pre-grading conditions of the CBX site as discussed below.

2.3.1 Aerial Photographs

Our review included review of numerous aerial images contained within Google Earth between May 1994 and November 2017. The 1994 image indicate the presence of numerous temporary facilities such as storage containers or greenhouses; however, these had all been removed prior to the second image in September 1996. Stockpiles in the north central area were added between the September 2003 and July 2004 images, with the northern ones were subsequently spread. The August 2005 image shows that approximately 30 low stockpiles of a whitish material (possibly diatomaceous earth or vermiculite) were widely spread in the western portion of the site. Most of these stockpiles remain on site, although the southwestern ones were apparently removed or spread during grading of the drainage channel in 2008.

2.3.2 Geotechnical Reports

A preliminary geotechnical investigation was performed for the CBX site to the east in 1999 by MTGL, Inc. for R.C. Properties. The CBX site was then referred to as Lots 3 and 6 of Section 3. Five borings were advanced to depths of 4 to 10 feet and seven test pits were advanced to depths of 7 to 10 feet. Limited laboratory testing included one expansion index test with a result of 149, which classifies as very high. The results of four Atterberg limits tests for plasticity index (PI) were 34 and 39 in the upper 5 feet and 7 and 22 between depths of 7 and 9 feet.

A geotechnical investigation was performed for the CBX site to the east of the project site in 2001 by Geocon, Inc. for PEMA Properties LLC. Four borings were advanced to depths of 4 to 10 feet and twelve test pits were advanced to depths of 7 to 10 feet. Laboratory testing included seven expansion index tests with three results of 99, 136 and 202 which classify as very high. Recommendations were provided for three remedial options to address mitigation of the highly expansive soil. The selected option consisted of importing approximately 520,000 cubic yards (cy) of soil to raise site grades of the previously undeveloped site for both drainage purposes and to provide a minimum 4-foot cap of low expansive soil over the underlying highly expansive native soils. Soil import and stockpiling occurred from April 2004 and April 2005. Site grading was performed between 2005 and 2008 and generally consisted of spreading and compacting the imported low expansive soil to provide a minimum 4-feet cap over the native highly expansive soil.

Kleinfelder's 2009 preliminary investigation for the CBX site included 14 test pits to depths between 4 ½ and 10 feet. Kleinfelder's 2011 investigation included 12 hollow stem auger borings and one large diameter bucket auger to depths between 6 ½ and 40 feet. The site was subsequently regraded for the CBX development with minor changes in finish grade.

Kleinfelder's May 18, 2017 Addendum 4 for the CBX site included 10 borings and 8 borehole infiltration tests to support design of storm water basins throughout the CBX temporary parking lots. Due to the presence of clayey soils, the results of the testing indicted unfactored infiltration rates of 0.00 inches per hour (in/hr) for 4 tests, rates between 0.01 and 0.02 in/hr for 3 tests and 0.11 in/hr for one test.

3 GEOLOGY AND SUBSURFACE CONDITIONS

3.1 REGIONAL GEOLOGY

The project area is situated in the coastal region of the Peninsular Ranges Geomorphic Province. This geomorphic province encompasses an area that extends approximately 900 miles from the Transverse Ranges and the Los Angeles Basin south to the southern tip of Baja California and varies in width from approximately 30 to 100 miles (Norris and Webb, 1990). The province is characterized by mountainous terrain on the east (eastern mountainous region) composed mostly of Mesozoic igneous and metamorphic rocks, and relatively low-lying coastal terraces to the west (coastal region) underlain by late Cretaceous, Tertiary, and Quaternary age sedimentary rocks. Most of the coastal region of the County of San Diego, including the site, occur within this coastal region and are underlain by sedimentary rock. Specifically, the subject site is underlain at depth by Quaternary age Very Old Paralic Deposits which are in turn underlain by Pliocene age Otay Formation. The Otay Formation was encountered at a depth of approximately 40 feet in previous investigations to the southwest and is well below the depths of site grading for the parking lots.

3.2 SITE GEOLOGY AND SUBSURFACE CONDITIONS

The project site is underlain by three general soil types, stockpiles of imported fill, topsoil, Pleistocene-age Very Old Paralic Deposits (previously known as Lindavista Formation) and Pliocene-age Otay Formation. Generalized descriptions are provided in the subsequent sections below:

3.2.1 Fill (Q_{af})

The fill includes imported stockpiles of soil that were apparently dumped between 2003 and 2005 based on our review of aerial images in Google Earth. In addition, demolition of previous site development has likely disturbed the upper 1 to 2 feet in portions of the site. This activity was previously described in Section 2.3.1 of this report.

3.2.2 Very Old Paralic Deposits (Qvop)

Lindavista Formation is a specific early- to middle-Pleistocene age marine terrace deposit. More recent geologic maps for other portions of San Diego County now refer to this unit as Very Old Paralic Deposits. For purposes of this report, we have utilized the more recent geologic term Very Old Paralic Deposits.

In general, this unit consists of an approximate 2 to 6-foot thick clay layer over a sandy layer. The upper approximate 1 to 2 feet consists of topsoil or material that has been disturbed by previous site activities. The upper layer consists of moist, olive brown to dark brown, sandy clays. The lower unit consists of dense to very dense, moist, reddish brown, weakly cemented, clayey to cohesionless clean sands with sub-rounded gravel and cobbles.

3.2.3 Otay Formation (To)

This unit was not directly observed within our field explorations, however it was encountered at a depth of approximately 40 feet for the pedestrian bridge foundations in the southwest corner of the CBX. The material was difficult to sample and observe due to the excessive abundant cobble within the cemented conglomerate. Review of the geologic map describes the Pliocene-age Otay Formation as poorly indurated massive light-colored sandstone, siltstone, and claystone, interbedded with bentonite lenses.

3.2.4 Groundwater

Groundwater was not encountered in the explorations by Kleinfelder or previous consultants. Although the static groundwater is located at considerable depth, perched layers may exist or develop on top of impervious clay soil layers, particularly in close proximity to the drainage channels.

4 DISCUSSIONS, ANALYSIS, AND RECOMMENDATIONS

4.1 POTENTIAL GEOLOGIC HAZARDS

Potential geologic hazards considered in our study include; surface rupture, seismic shaking, landslides, liquefaction, seismically induced settlement, flooding and expansive soils. Although these hazards should not impact development of the proposed parking lot, the following sections discuss these hazards and their potential impact to this site:

4.1.1 Faulting and Seismicity

The geologic map of the Otay Quadrangle (Todd, 2004) indicates the site is not underlain by active or potentially active faults (i.e., faults that exhibit evidence of ground displacement in the last 11,000 years and 1,600,000 years, respectively), nor does the site lie within an Alquist-Priolo Earthquake Fault Zone. The Silver Strand fault which is part of the southern extent of the Rose Canyon Fault Zone in the Coronado area is the closest mapped active fault and is located approximately 14 miles (12.9 km) northwest of the site. The Rose Canyon fault is postulated as having the potential to generate a maximum earthquake of magnitude 6.9.

4.1.2 Surface Rupture

The subject site is not underlain by a known active or potentially active fault. The closest active fault to the site is an offshore segment of the northern Rose Canyon fault located approximately 14 miles to the northwest. The closest mapped potentially active fault to the site is located approximately 1 mile to the east and is probably a conjugate structure off the south end of the La Nacion fault which is also presently designated as potentially active. Based on this information, the potential for ground rupture due to faulting at the site is considered low.

4.1.3 Landslides

Landslides are deep-seated ground failures (several tens to hundreds of feet deep) in which a large arcuate shaped section of a slope detaches and slides downhill. Landslides are not to be confused with minor slope failures (slumps), which are usually limited to the topsoil zone and can occur on slopes composed of almost any geologic material. Landslides can cause damage to structures both above and below the slide mass. Structures above the slide area are typically damaged by undermining of foundations. Areas below a slide mass can be damaged by being overridden and crushed by the failed slope material.

Several formations within San Diego County are particularly prone to landsliding. These formations generally have high clay content and mobilize when they become saturated with water. Other factors, such as steeply dipping bedding that project out of the face of the slope and/or the presence of fracture planes, will also increase the potential for landsliding.

The site is located in Geologic Hazard Category 53 on the San Diego Seismic Safety Maps. Category 53 is described as level or sloping terrain, unfavorable geologic structure, and variable slope stability. However, due to the relatively flat-lying topography on and nearby the subject site, the potential for landsliding is considered low.

4.1.4 Liquefaction and Seismic Settlement

The term liquefaction describes a phenomenon in which saturated, cohesionless soils temporarily lose shear strength (liquefy) due to increased pore water pressures induced by strong, cyclic ground motions during an earthquake. Structures founded on or above potentially liquefiable soils may experience bearing capacity failures due to the temporary loss of foundation support, vertical settlements (both total and differential), and undergo lateral spreading. The factors known to influence liquefaction potential include soil type, relative density, grain size, confining pressure, depth to groundwater, and the intensity and duration of the seismic ground shaking. The cohesionless soils most susceptible to liquefaction are loose, saturated sands and some silts.

Due to the relatively high in-situ density of the underlying soils and the lack of permanent near-surface groundwater, the potential for liquefaction occurring at the site is considered low.

Seismic Settlement occurs in response to seismic shaking during which low density soils undergo densification/consolidation resulting in an overall reduction in volume and settlement. Low density unconsolidated sands are most prone to settlement. Due to the presence of shallow compacted fill over native dense soils with high clay content, seismic settlement would be considered low.

4.1.5 Flood Hazard

According to a Federal Emergency Management Agency (FEMA) flood insurance map overlay 06073C2200G on the Federal Emergency Management Administration database, the site is outside of a 100-year and 500-year floodplains and does not appear to be subject to flooding.

4.1.6 Expansive Soils

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, stormwater basin infiltration, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of pavement, structures or concrete slabs supported on grade.

The 2004 Geocon investigation of the adjacent CBX site encountered clayey topsoils and clayey soils within the Very Old Paralic deposits that were classified as highly to very highly expansive. Three of the highest test results indicated Expansion Index (EI) results of 99, 136 and 202. Due to the presence of these near-surface expansive soils, soil import and site grading of the adjacent CBX site was performed in 2005 to 2007 to provide a cap of low to medium expansive fill (EI less than 50) within the upper 4 feet of finish grade.

Highly expansive soils were also observed within the borings and test pits performed for this investigation. The presence of expansive soils is potentially high and mitigation measures consisting of lime treatment are discussed in the following sections of the report.

4.2 GRADING RECOMMENDATIONS

4.2.1 General

Based on the results of our site reconnaissance, subsurface exploration and laboratory testing, it is our opinion that the proposed development is feasible from a geotechnical standpoint. It is anticipated that the soils within the existing soil stockpiles, minus any over-sized particles, organic matter, debris or other unsuitable materials, will be suitable to spread and blended with the native soil.

Based on our understanding of the project and the results of our review, we anticipate that earthwork will be minor and will generally consist of cuts and fills on the order of 1 to 2 feet for surface drainage. Proposed pavements and associated improvements should be located directly on approved low expansive compacted fill soils (if any) or clay soils that are stabilized with lime treatment. General guidelines to stabilize the on-site clay soils with lime treatment are presented in Appendix C, Lime Stabilization Guidelines.

All site preparation and earthwork operations should be performed in accordance with applicable codes. All reference to maximum dry density is established in accordance with American Society for Testing and Materials (ASTM) ASTM D 1557 or D558 for lime stabilization.

4.2.2 Excavation Characteristics

Our subsurface exploration indicated the subsurface materials consisted of 1 to 2 feet of disturbed soil over stiff to hard clay and dense to very dense sands of the Very Old Paralic Deposits. Excavation into the on-site materials can likely be achieved with medium to heavy-duty excavation equipment. Note that our field investigation was performed during a season with unusually high rainfall and the truck mounted drill rig became stuck in soft and wet clay subgrade.

4.2.3 Site Preparation

The actual locations of any underground utilities such as electrical ducts, sanitary sewers, storm drains, and water mains should be verified in the field at the time of construction. Abandoned utilities (if any) should be completely removed, and the loose backfill removed and replaced. Any trench created by relocating the existing utilities should be backfilled with properly compacted fill.

Based on the May 16, 2018 conceptual plans prepared by Latitude 33 Engineering and Planning, the project is anticipated to consist of regrading for drainage considerations. The subgrade exposed at the bottom of each excavation should be observed by a representative of Kleinfelder prior to the placement of any fill to observe and document depth of excavation and condition of the subgrade.

4.2.4 Engineered Fill

Due to the presence of expansive clay with low R-value, the onsite soils are not suitable for use within the upper 18 inches of pavement or hardscape areas without lime stabilization. Onsite fill soils can be reused as compacted fill below this depth or in non-paved areas, provided they are free of oversized rock, clay clods, organic materials, and deleterious debris. Rocks greater than 3 inches in diameter should not be placed within 2 feet of finished grade. Oversize material in excess of 6 inches in diameter should not be used in structural fill.

In areas to receive more than 6 inches of fill, we recommend that the upper 12-inches of existing soil be scarified and recompacted to address the potential for previously disturbed soil below the lime stabilization. Potential areas of deeper soft and yielding subgrade identified at this time would require a deeper removal and recompaction. Fill should be moisture conditioned to about 1 to 3 percent above optimum moisture and be compacted to 90 percent or more relative compaction in accordance with ASTM D 1557. For lime-treated soils, compaction to 95% of ASTM D558 is recommended. Although the optimum lift thickness for fill soils will be dependent on the type of compaction equipment used, fill should generally be placed in uniform lifts not exceeding approximately 8 inches in loose thickness. Oversized material, rocks, or hard lumps greater than 6 inches and less than 12 inches in dimension should not be used in compacted fills within 8 feet of finished grade.

4.2.5 Import Materials

We recommend that import fill materials (if any) consist of granular, very low to low expansive material (expansion index of 50 or less) as evaluated by ASTM D 4829 and with low corrosivity characteristics. Low corrosivity material is defined as having a minimum resistivity of more than 2,000 ohm-cm when tested in accordance with California Test 643, unless defined otherwise by the corrosion consultant. Import material should be evaluated by Kleinfelder at the borrow site for its suitability as fill prior to importation to the project site.

4.3 UTILITY TRENCH EXCAVATIONS

4.3.1 Temporary Trench Excavations

We recommend trenches and excavations be designed and constructed in accordance with OSHA regulations. These regulations provide trench sloping and shoring design parameters for trenches up to 20 feet deep based on a description of the soil types encountered. For planning purposes, we recommend the OSHA soil Type B be used for the Very Old Paralic Deposits.

Temporary excavations should be constructed in accordance with OSHA recommendations. Excavations deeper than 5 feet should be shored or laid back on a slope no steeper than 1H:1V (horizontal:vertical). In the case of trench excavations, OSHA requirements regarding personnel safety should be met using appropriate shoring (including trench boxes), or by laying back the slopes in accordance with OSHA requirements. Temporary excavations that encounter seepage may require shoring or may be stabilized by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. On-site safety of personnel is the responsibility of the contractor, and their designated “competent person” should perform regular inspections of all temporary excavations.

Heavy construction loads, such as those resulting from stockpiles and equipment, should be kept a sufficient distance away from the top of the excavation or shoring to prevent unanticipated surcharge loading. All surface water should be diverted away from excavations.

4.3.2 Pipe Bedding and Trench Backfill

Pipe bedding should consist of sand or similar granular material having a sand equivalent value of 30 or more. The sand should be placed in a zone that extends a minimum of 6 inches below and 12 inches above the pipe for the full trench width. The bedding material should be compacted to a minimum of 90 percent of the maximum dry density. Trench backfill above pipe bedding may consist of approved onsite or import soils placed in lifts no greater than 8 inches loose thickness and compacted to 90 percent of the maximum dry density.

4.4 EXTERIOR FLATWORK

To reduce the potential manifestation of distress to exterior concrete flatwork (ie, sidewalks, driveways, etc) due to movement of the underlying soil, we recommend that such flatwork be constructed on at least 2 feet of low expansive fill or 18 inches of soil improved with lime treatment following the guidelines in Appendix C.

4.5 PAVEMENT RECOMMENDATIONS

We understand the project will include both asphalt concrete (AC) roadways and parking areas and concrete access drives. Based on the presence of clayey expansive soil with low R-Value, we recommend pavement subgrade soils be stabilized by lime treatment which would result in much higher R-Value and reduced pavement sections. In addition, this process will eliminate the need for aggregate base below the AC. General guidelines to stabilize the on-site clay soils with lime treatment are discussed in Section 4.2 and presented in Appendix C, Lime Stabilization Guidelines.

Based on an R-value of 70 for the upper 18 inches of site soils treated with at least 7% lime by dry weight, the pavement sections in Table 2 below have been evaluated in general accordance with Caltrans methods for pavement design. We evaluated pavements for traffic indices of 5 and 6 for automobile and shuttle bus traffic, respectively. Recommended flexible pavement sections for these conditions are given in Table 2.

Table 1

Recommended Flexible Pavement Sections

Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5	4	0
6	5	0

4.6 SURFACE DRAINAGE

Final elevations at the site should be planned so that paved areas are sloped, and drainage gradients maintained to carry all surface water off the site. Ponding should not occur on the site.

Planters should be built so that water exiting from them will not seep beneath slabs and pavement. In any event, the maintenance personnel should be instructed to limit irrigation to the minimum necessary to properly sustain the landscaping plants. Should excessive irrigation, waterline breaks, or unusually high rainfall occur, saturated zones and perched groundwater may develop. Consequently, the site should be graded so that water drains away readily without saturating landscaped areas.

4.7 CORROSIVITY CHARACTERISTICS

Our review of previous testing of the very old paralic deposits at the adjacent CBX site indicates a high corrosion potential due to low resistivity. This is typical of clay soils and our experience in the site vicinity. Therefore, we recommend that project design be based on the assumption of highly corrosive clay with resistivity's below 1,000 ohn-cm. If needed, soil samples can be collected during site grading to perform laboratory testing on representative soil samples that will potentially be in contact with subsurface utilities and foundations. Laboratory testing should include pH, minimum electrical resistivity, and soluble chloride and sulfate content.

4.8 STORMWATER INFILTRATION FEASIBILITY

We have evaluated the site in conformance with the 2018 City of San Diego Storm Water Standards. Infiltration rate is defined as the measured velocity that water progresses downward (vertically) into the soil and percolation is defined as the flow of water through the subsurface soil layers. Infiltration may be controlled primarily by factors such as the type and porosity of the surface filtering media, maintenance of these media, surface slope, surface vegetation, and intensity, duration, and type of precipitation. Percolation may be controlled primarily by the soil types and properties such as grain size and density, soil layering, porosity, hydraulic head, and the proximity to the groundwater. Surface drainage and maintenance will largely determine the site's infiltration rate and the amount of water that will infiltrate for any given storm. The percolation rate will depend locally on the soil layering and will be controlled by the finer grained soil layers.

Borehole percolation testing was the selected method for field infiltration testing at the site and was performed at four different locations for two general areas. One area is on the northern side of the site while the second area is located south near a drainage channel. The percolation tests were performed in general accordance with methods outlined in California Test 750, "Method for Determining the Percolation Rate of Soils Using a 6-Inch-Diameter-Test Hole". Tests were performed in drilled holes advanced to a depth of 6 ½ feet below the existing ground surface. The measured percolation rates have been converted to an adjusted short-term infiltration rate based on borehole geometry using the Porchet Method (Ritzema, 1994) and are presented in Table 1. These values are the raw (unfactored) infiltration rates and does not include the safety factors determined from Storm Water Standards; therefore, these unfactored values are considered the "observed" infiltration rate. The observed infiltration rate can be converted to a "reliable" infiltration rate, per the Storm Water Standards, by using a safety factor of 2.

Table2

Summary of Field-Measured Infiltration Rate

Boring	Test Hole Diameter (in)	Test Depth Below Ground Surface (feet)	Short-Term ("Observed") Infiltration Rate (inch/hour)	Soil Description
PERC-1	8	6 ½	0.05	Sandy Lean Clay/ Clayey Sand
PERC-2	8	6 ½	0.02	Sandy Lean Clay/ Clayey Sand
PERC-3	8	6 ½	0.13	Sandy Lean Clay/ Clayey Sand
PERC-4	8	6 ½	0.10	Sandy Lean Clay/ Clayey Sand/ Poorly Graded Sand with Clay and Gravel

Note that relatively clean water was used to perform the test above. However, surface runoff water from the site would likely contain silt, clay, sand, and/or other materials that would further decrease infiltration at the site. The field infiltration rate in Table 1 does not include the reliability safety factor for feasibility screening.

Based on visual soil classifications and laboratory testing of soil samples collected during our field exploration at the infiltration test locations, the shallow artificial fill and very old paralic deposits both consist of clayey sand with variable amounts of gravel within the depth interval of the test. The boring logs and laboratory results are presented in Appendix A and Appendix B, respectively.

4.8.1 Site Conditions and Potential Mitigation Measures

In implementing infiltration systems at the project site, one has to consider the site conditions. The typical considerations when implementing infiltration systems at the site are the; bearing capacity of foundations, seismic settlement, heaving from expansive soils, and slope stability that may be affected by the presence of water. The site is relatively level and underlain by highly expansive clay which would mound water and heave upon increases in moisture content. To mitigate potential problems, we recommend the infiltration systems be located away from the proposed improvements. Due to the shallow depth of the formational clay soils, the water would perch on top of this layer, restricting the downward flow and resulting in unpredictable lateral migration. Water often travels through the network of existing and future utility trenches.

4.8.2 Recommendations and Conclusions

Based on the 2018 Storm Water Standards a site is considered “No infiltration” if the reliable infiltration rate is below the partial infiltration rate standard of 0.05 inches per hour. Based on our observed infiltration rates presented in Table 1 the values range from 0.02 to 0.13 inches per hour and by implementing a Factor of 2 for reliable infiltration rates these values are considered “no infiltration” and at the extreme lower end of “partial infiltration” rate criteria (.05 and .065 in/hr). Due to the potential for mounding and heaving of highly expansive soils, we recommend both areas be considered “no infiltration”. The completed I-8 forms for the City of San Diego Storm Water Standards BMPs are presented in Appendix D for each percolation test.

5 ADDITIONAL STUDIES

The review of plans and specifications, and the observation and testing by Kleinfelder of earthwork related construction activities, are an integral part of the conclusions and recommendations made in this report. Accordingly, Kleinfelder should be retained to review the final plans and specifications to confirm the intent of our design recommendations is incorporated into the construction documents. In addition, a Kleinfelder representative should be on-site during construction to evaluate the exposed grading conditions, verify the required moisture treatment and compaction are being achieved, and to verify lime treatment is being completed in accordance with our recommendations

6 LIMITATIONS

This report has been prepared for the exclusive use of Otay-TJ LLC and their consultants for specific application to the subject project. The findings, conclusions and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

Recommendations contained in this report are based on our field observations and subsurface explorations, laboratory tests, and our understanding of the proposed construction. It should be recognized that definition and evaluation of subsurface conditions are difficult and it is possible that soil or groundwater conditions could vary between or beyond the points explored. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. The conclusions presented herein are based on field explorations, laboratory testing, engineering analyses, and professional judgement.

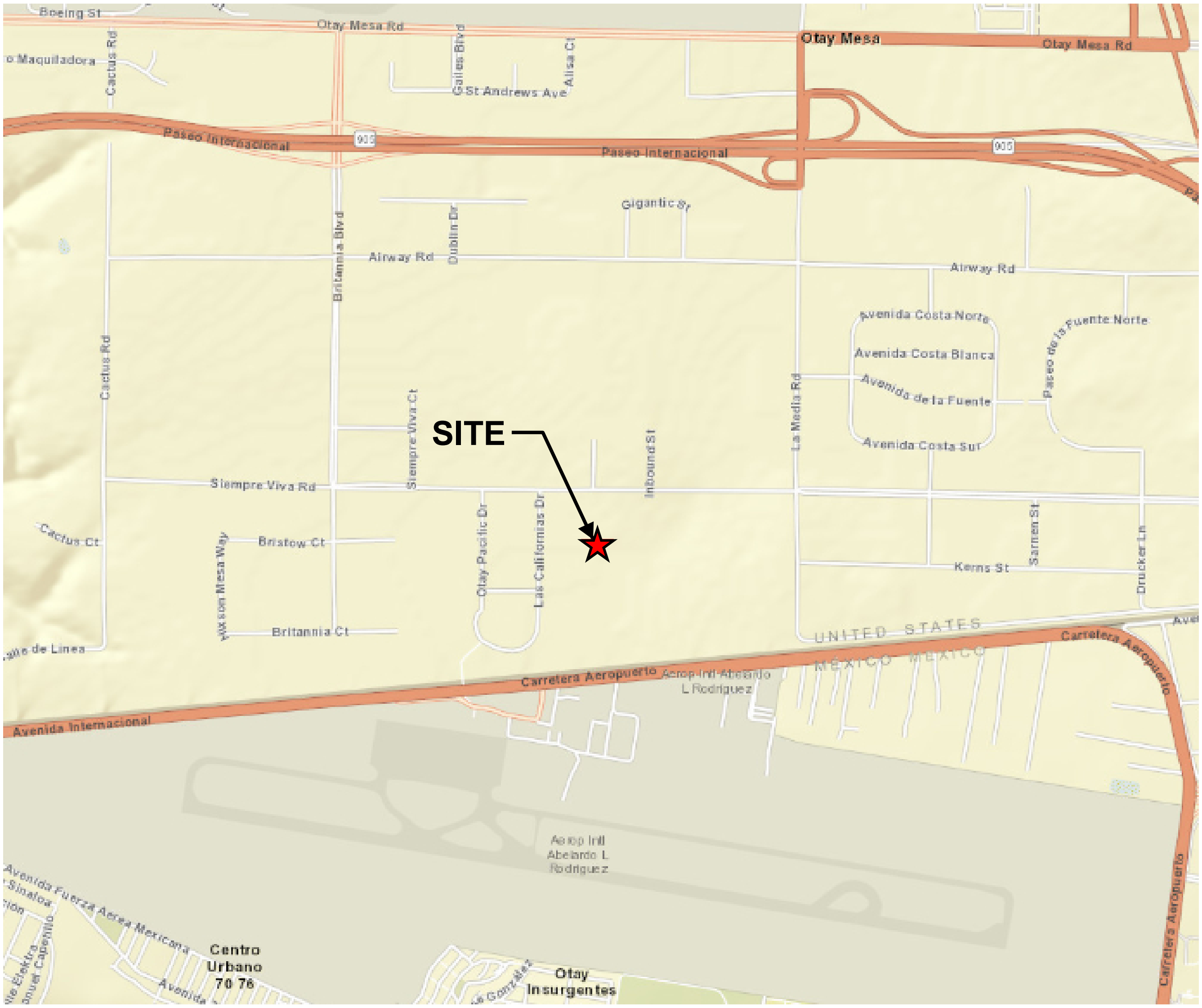
Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service, which provide information for their purposes at acceptable levels of risk. The client and key members of the design team should discuss the issues addressed in this report with Kleinfelder, so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for future performance and maintenance.

Kleinfelder cannot be responsible for interpretation by others of this report or the conditions encountered in the field. Kleinfelder should be retained so that all geotechnical aspects of construction can be monitored on a full-time basis by a representative from Kleinfelder, including site preparation, preparation of foundations, and placement of engineered fill and trench backfill. These services provide Kleinfelder the opportunity to observe the actual soil and groundwater conditions encountered during construction and to evaluate the applicability of the recommendations presented in this report to the site conditions. If changed site conditions affect the recommendations presented herein, Kleinfelder must also be retained to perform a supplemental evaluation and to issue a revision to our original report.

This report, and any future addenda or reports regarding this site, may be made available to bidders to supply them with the data contained in the report regarding subsurface conditions and laboratory test results at the point and time noted. Bidders may rely on interpretations, opinion, recommendations, or conclusions contained in the report at their sole risk. Because of the limited nature of any subsurface study, the contractor may encounter conditions during construction which differ from those presented in this report. In such event, the contractor should promptly notify the owner so that Kleinfelder's geotechnical engineer can be contacted to confirm those conditions.

This report may be used only within a reasonable time from its issuance but in no event later than one year from the date of the report. Land use, site conditions (both on site and off site), or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

FIGURES



N

0 1,000 2,000 4,000 Feet

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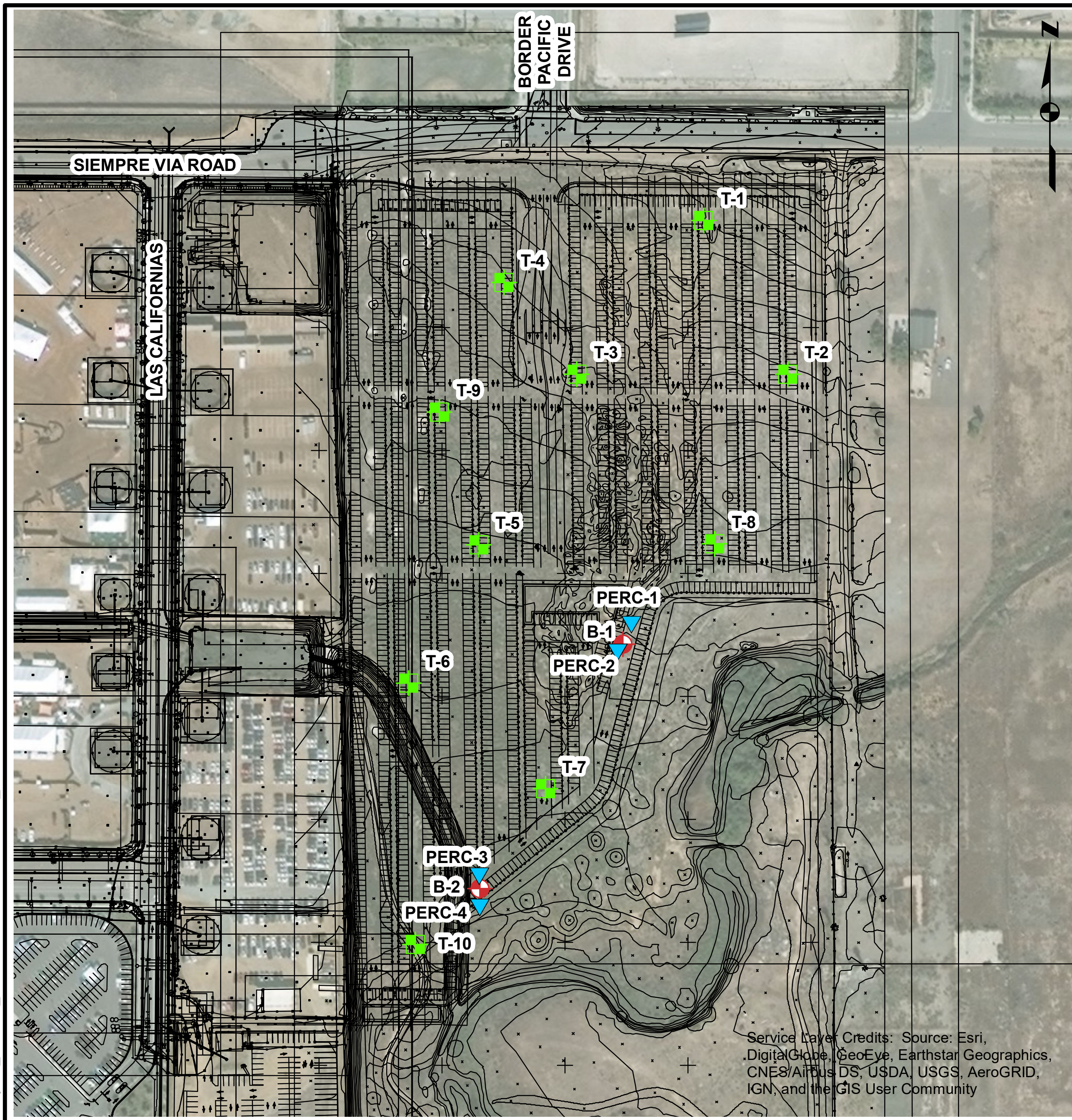
PROJECT NO.	20193578
DRAWN:	4/10/2019
DRAWN BY:	JP
CHECKED BY:	ST
FILE NAME:	20193578_vic.mxd

VICINITY MAP

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE
1

\\sandiego\sandiego-data\GRAPHICS_clients\Otay-TJ_Venture_LLC\20193578\mxd\20193578_vic.mxd



0 125 250 500 Feet

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LEGEND

- APPROXIMATE LOCATION OF BORING
- APPROXIMATE LOCATION OF PERCOLATION TEST
- APPROXIMATE LOCATION OF TEST PIT

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PROJECT NO. 20193578	**EXPLORATION SITE PLAN**		FIGURE
DRAWN: 4/16/2019			
DRAWN BY: JP			**2**
CHECKED BY: ST	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA		
FILE NAME: 20193578_SITE.mxd			

\\SanDiego\SANDIEGO-DATA\GRAPHICS_clients\Otay-TJ_Venture_LLC\20193578\mxd\20193578_SITE.mxd

APPENDIX A

Boring and Test Pit Logs

SAMPLER AND DRILLING METHOD GRAPHICS

- BULK / GRAB / BAG SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 or 2-1/2 in. (50.8 or 63.5 mm.) outer diameter)
- CALIFORNIA SAMPLER (3 in. (76.2 mm.) outer diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)
- HQ CORE SAMPLE (2.500 in. (63.5 mm.) core diameter)
- SHELBY TUBE SAMPLER
- HOLLOW STEM AUGER
- SOLID STEM AUGER
- WASH BORING
- SONIC CONTINUOUS SAMPLER

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS
WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	$Cu \geq 4$ and $1 \leq Cc \leq 3$	**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			$Cu < 4$ and/ or $1 > Cc > 3$	**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	$Cu \geq 4$ and $1 \leq Cc \leq 3$	**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			$Cu < 4$ and/ or $1 > Cc > 3$	**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES		**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
				GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (Half or more of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	$Cu \geq 6$ and $1 \leq Cc \leq 3$	**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			$Cu < 6$ and/ or $1 > Cc > 3$	**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	$Cu \geq 6$ and $1 \leq Cc \leq 3$	**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			$Cu < 6$ and/ or $1 > Cc > 3$	**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES		**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
				SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (Half or more of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit 50 or greater)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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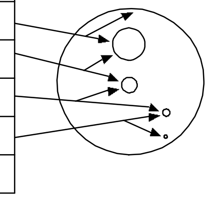
PROJECT NO.: 20193578	GRAPHICS KEY	FIGURE
DRAWN BY: SM		
CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	A-1
DATE: 3/13/2019		
REVISED: 4/16/2019		

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

Term of Use	AMOUNT	
	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N_{60} (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

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PROJECT NO.: 20193578	SOIL DESCRIPTION KEY	FIGURE
DRAWN BY: SM		
CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	A-2
DATE: 3/13/2019		
REVISED: 4/16/2019		

BORING LOG B-1

Date Begin - End:	2/28/2019	**Drilling Company:**	Pacific Drilling
Logged By:	SM	**Drill Crew:**	Toby & Brian
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	M5
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger
Weather:	Sunny	**Exploration Diameter:**	6 in. O.D.

Hammer Type - Drop: 140 lb. Auto - 30 in.

Approximate Ground Surface Elevation (ft.): 463.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Blow Counts(BC)= Uncorr. Blows/6 in. / Push Tube(PT)= psi / Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
	0	**ARTIFICIAL FILL (af)** **Sandy Lean CLAY (CL)**: low plasticity, dark olive brown, moist	S1										
	1	**VERY OLD PARALIC DEPOSITS (Qvop)** **Sandy Lean CLAY (CL)**: fine to medium-grained, low plasticity, dark olive brown, moist											
460	3												
	4		S2	BC=7 16 24	18"								
	4.5	**Clayey SAND (SC)**: fine to medium-grained, low plasticity, reddish brown, moist, dense, fine gravel											
	6												Hard drilling at 6 feet.
455	8												
	10	very dense	S3	BC=28 34 38	16"								
450	13	**Poorly Graded SAND with Clay (SP-SC)**: fine to coarse-grained, non-plastic, light yellowish brown, moist, dense, fine gravel											
	15		S4	BC=10 16 18	18"								
445	18												

The boring was terminated at approximately 16.5 ft. below ground surface. The boring was backfilled with auger cuttings on February 28, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578	BORING LOG B-1	FIGURE
DRAWN BY:	SM		
CHECKED BY:	SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	A-3
DATE:	3/13/2019		
REVISED:	4/16/2019		PAGE: 1 of 1

Date Begin - End:	3/19/2019	**Drilling Company:**	Scott's Drilling			**BORING LOG B-2**
Logged By:	SM	**Drill Crew:**	Joshua & John			
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	319E DEER w/Worksite Pro_PA 30	**Hammer Type - Drop:**	140 lb. Cathead - 30 in.	
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger			
Weather:	Sunny	**Exploration Diameter:**	8 in. O.D.			

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION: Approximate Ground Surface Elevation (ft.): 460.00 Surface Condition: Bare Earth and Weeds — Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Push Tube(PT)= psi Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: low to medium plasticity, dark brown, moist, trace of gravel												
			VERY OLD PARALIC DEPOSITS (Qvop) **Clayey SAND (SC)**: fine to medium-grained, low plasticity, reddish brown, moist, trace of gravel	S1		BC=9 17 32	18"								
455	5		**Clayey SAND with Gravel (SC)**: fine to medium-grained, low plasticity, reddish brown, moist, trace of gravel	S2			13"								
450	10														
445	15														

The boring was terminated at approximately 6.5 ft. below ground surface. The boring was backfilled with auger cuttings on March 19, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

Date Begin - End:	3/19/2019	**Drilling Company:**	Scott's Drilling
Logged By:	SM	**Drill Crew:**	Joshua & John
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	319E DEER w/Worksite Pro_PA 30
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger
Weather:	Sunny	**Exploration Diameter:**	8 in. O.D.

Hammer Type - Drop: 140 lb. Cathead - 30 in.

BORING LOG PERC-1

FIELD EXPLORATION / LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 463.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Push Tube(PT)= psi Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist												
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: low to medium plasticity, dark olive brown, moist												
460				S1		BC=10 15 32	16"								
			Clayey SAND (SC): fine to medium-grained, low plasticity, dark brown, moist, very dense												Hard drilling at 4 feet.
	5			S2		BC=12 28 50/5"	16"								
			light brown												
455															
	10														
450															
	15														
445															

The boring was terminated at approximately 6.5 ft. below ground surface. The boring was backfilled with auger cuttings on March 19, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578
DRAWN BY:	SM
CHECKED BY:	SHR
DATE:	3/13/2019
REVISED:	4/16/2019

BORING LOG PERC-1

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE

A-5

Date Begin - End:	3/19/2019	**Drilling Company:**	Scott's Drilling
Logged By:	SM	**Drill Crew:**	Joshua & John
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	319E DEER w/Worksite Pro_PA 30
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger
Weather:	Sunny	**Exploration Diameter:**	8 in. O.D.

Hammer Type - Drop: 140 lb. Cathead - 30 in.

BORING LOG PERC-2

Approximate Ground Surface Elevation (ft.): 463.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Push Tube(PT)= psi Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist												
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: low to medium plasticity, dark olive brown, moist												
460				S1		BC=17 21 26	18"								
	5			S2		BC=50/5"	5"								
			Clayey SAND (SC): fine to medium-grained, low plasticity, brown to light brown, moist, some gravel (3")												
455															
	10														
450															
	15														
445															

The boring was terminated at approximately 5.4 ft. below ground surface. The boring was backfilled with auger cuttings on March 19, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578
DRAWN BY:	SM
CHECKED BY:	SHR
DATE:	3/13/2019
REVISED:	4/16/2019

BORING LOG PERC-2

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE

A-6

PLOTTED: 04/16/2019 04:27 PM BY: STena
OFFICE FILTER: SAN DIEGO
PROJECT NUMBER: 20193578.001A
gINT FILE: Klf_gint_master_2019
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2019.GLB [_KLF_BORING/TEST PIT SOIL LOG]

Date Begin - End:	3/19/2019	**Drilling Company:**	Scott's Drilling		**BORING LOG PERC-3**
Logged By:	SM	**Drill Crew:**	Joshua & John		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	319E DEER w/Worksite Pro_PA 30	**Hammer Type - Drop:**	140 lb. Cathead - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Sunny	**Exploration Diameter:**	8 in. O.D.		

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description (Approximate Ground Surface Elevation (ft.): 460.00; Surface Condition: Bare Earth and Weeds)	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Push Tube(PT)= psi Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist												
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: low to medium plasticity, dark brown, moist, trace of fine gravel	S1		BC=10 18 25	16"								
			Clayey SAND (SC): fine to medium-grained, low plasticity, dark brown, moist, dense												Hard drilling at 4 feet.
455	5		brown, trace of mica, trace of gravel	S2		BC=8 16 50	11"								
450	10														
445	15														

FIELD EXPLORATION / LABORATORY RESULTS

The boring was terminated at approximately 6.5 ft. below ground surface. The boring was backfilled with auger cuttings on March 19, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20193578	BORING LOG PERC-3	FIGURE
	DRAWN BY: SM		A-7
	CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	
	DATE: 3/13/2019		
	REVISED: 4/16/2019		PAGE: 1 of 1

BORING LOG PERC-4

Date Begin - End:	3/19/2019	**Drilling Company:**	Scott's Drilling
Logged By:	SM	**Drill Crew:**	Joshua & John
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	319E DEER w/Worksite Pro_PA 30
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger
Weather:	Sunny	**Exploration Diameter:**	8 in. O.D.

Hammer Type - Drop: 140 lb. Cathead - 30 in.

FIELD EXPLORATION / LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 460.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Push Tube(PT)= psi Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist	S1			24"								
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: low to medium plasticity, dark olive brown, moist, trace of gravel												
			Clayey SAND (SC): fine to medium-grained, low plasticity, brown, moist, trace of gravel, trace of mica	S2			12"								Hard drilling at 4 feet.
455	5		**Poorly Graded SAND with Clay and Gravel (SP-SC)**: fine to medium-grained, low plasticity, brown, moist, trace of mica, little gravel	S3		BC=6 27 50/3"	13"								
450	10														
445	15														

The boring was terminated at approximately 6.3 ft. below ground surface. The boring was backfilled with auger cuttings on March 19, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.: 20193578	BORING LOG PERC-4	FIGURE
DRAWN BY: SM		
CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	A-8
DATE: 3/13/2019		
REVISED: 4/16/2019		PAGE: 1 of 1

PLOTTED: 04/16/2019 04:27 PM BY: STena

Date Begin - End:	3/05/2019	Excavation Company:	Cut 'N Core
Logged By:	SM	Excavation Crew:	Kyle
Hor.-Vert. Datum:	Not Available	Excavation Equip.:	CAT Backhoe
Plunge:	N/A degrees	Excav. Dimensions:	2.6 x 5.6 x 5.9 ft
Weather:	Sunny		

TEST PIT LOG TP-1

Approximate Ground Surface Elevation (ft.): 474.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION: Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, brown, moist, trace grass, trace bricks, trace cobbles up to 6 inches in size	S1									
470	5		**VERY OLD PARALIC DEPOSITS (Qvop)** **Clayey SAND (SC)**: fine to medium-grained, low plasticity, resddish brown, moist, fine to medium coarse, trace gravels, weakly cemented	S2		SC				28	32	13	
465													

The test pit was terminated at approximately 5.9 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

gINT FILE: Klf_gint_master_2019 PROJECT NUMBER: 20193578.001A OFFICE FILTER: SAN DIEGO
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2019.GLB [_KLF_BORING/TEST PIT SOIL LOG]

Date Begin - End:	3/05/2019	Excavation Company:	Cut 'N Core
Logged By:	SM	Excavation Crew:	Kyle
Hor.-Vert. Datum:	Not Available	Excavation Equip.:	CAT Backhoe
Plunge:	N/A degrees	Excav. Dimensions:	2.6 x 5.7 x 5.5 ft
Weather:	Sunny		

TEST PIT LOG TP-2

FIELD EXPLORATION / LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 470.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark brown, moist	S1									
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, brown, moist, trace fine gravel										
			Clayey SAND (SC): fine to medium-grained, low plasticity, reddish brown, moist, weakly cemented	S2									
465	5												

The test pit was terminated at approximately 5.5 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20193578	TEST PIT LOG TP-2	FIGURE
	DRAWN BY: SM		A-10
	CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	
	DATE: 3/13/2019		
	REVISED: 4/16/2019		PAGE: 1 of 1

TEST PIT LOG TP-3

Date Begin - End:	3/05/2019	**Excavation Company:**	Cut 'N Core
Logged By:	SM	**Excavation Crew:**	Kyle
Hor.-Vert. Datum:	Not Available	**Excavation Equip.:**	CAT Backhoe
Plunge:	N/A degrees	**Excav. Dimensions:**	2.3 x 5.5 x 7.1 ft
Weather:	Sunny		

FIELD EXPLORATION / LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 468.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark brown, moist	S1									
465			**VERY OLD PARALIC DEPOSITS (Qvop)** **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, dark brown, moist										
	5		**Clayey SAND (SC)**: fine to medium-grained, low plasticity, brown, moist	S2									
460													

The test pit was terminated at approximately 7.1 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.: 20193578	TEST PIT LOG TP-3	FIGURE	
DRAWN BY: SM			
CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	A-11	
DATE: 3/13/2019			
REVISED: 4/16/2019		PAGE: 1 of 1	

Date Begin - End:	3/05/2019	Excavation Company:	Cut 'N Core
Logged By:	SM	Excavation Crew:	Kyle
Hor.-Vert. Datum:	Not Available	Excavation Equip.:	CAT Backhoe
Plunge:	N/A degrees	Excav. Dimensions:	2.4 x 5.2 x 5.3 ft
Weather:	Sunny		

TEST PIT LOG TP-4

FIELD EXPLORATION / LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 469.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark brown, moist	S1									
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, dark brown, moist, trace gravels										
465													
	5		**Clayey SAND (SC)**: fine to medium-grained, low plasticity, brown, moist										
460													

The test pit was terminated at approximately 5.3 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578
DRAWN BY:	SM
CHECKED BY:	SHR
DATE:	3/13/2019
REVISED:	4/16/2019

TEST PIT LOG TP-4

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE
A-12

Date Begin - End:	3/05/2019	Excavation Company:	Cut 'N Core
Logged By:	SM	Excavation Crew:	Kyle
Hor.-Vert. Datum:	Not Available	Excavation Equip.:	CAT Backhoe
Plunge:	N/A degrees	Excav. Dimensions:	2.4 x 5.3 x 5.5 ft
Weather:	Sunny		

TEST PIT LOG TP-5

Approximate Ground Surface Elevation (ft.): 464.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist	S1		CL	21.3		100	70	41	23	**R Value(Lime treated)=76 Unconfined Compressive Strength(Lime treated) Proctor ASTM D558 A**
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, brown, moist, trace gravel										
460													
	5		**Clayey SAND (SC)**: fine to medium-grained, low plasticity, brown, moist										
455													

The test pit was terminated at approximately 5.5 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578
DRAWN BY:	SM
CHECKED BY:	SHR
DATE:	3/13/2019
REVISED:	4/16/2019

TEST PIT LOG TP-5

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE
A-13

Date Begin - End:	3/05/2019	**Excavation Company:**	Cut 'N Core
Logged By:	SM	**Excavation Crew:**	Kyle
Hor.-Vert. Datum:	Not Available	**Excavation Equip.:**	CAT Backhoe
Plunge:	N/A degrees	**Excav. Dimensions:**	2.8 x 5.5 x 5.5 ft
Weather:	Sunny		

TEST PIT LOG TP-6

Approximate Ground Surface Elevation (ft.): 462.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description (FIELD EXPLORATION)	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark brown, moist	S1									
460			**VERY OLD PARALIC DEPOSITS (Qvop)** **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, brown, moist, trace fine gravel										
	5		**Clayey SAND (SC)**: fine to medium-grained, low plasticity, brown, moist										
455													

The test pit was terminated at approximately 5.5 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

Date Begin - End:	3/05/2019	Excavation Company:	Cut 'N Core	TEST PIT LOG TP-7
Logged By:	SM	Excavation Crew:	Kyle	
Hor.-Vert. Datum:	Not Available	Excavation Equip.:	CAT Backhoe	
Plunge:	N/A degrees	Excav. Dimensions:	2.5 x 5.8 x 7.2 ft	
Weather:	Sunny			

Approximate Ground Surface Elevation (ft.): 460.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description (FIELD EXPLORATION)	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist	S1									
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, brown, moist										
			Silty SAND (SM): fine to medium-grained, non-plastic, reddish brown, moist, trace mica, weakly cemented	S2									
455	5												

LABORATORY RESULTS

The test pit was terminated at approximately 7.2 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578	TEST PIT LOG TP-7	FIGURE
DRAWN BY:	SM		A-15
CHECKED BY:	SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	
DATE:	3/13/2019		
REVISED:	4/16/2019		PAGE: 1 of 1

Date Begin - End:	3/05/2019	**Excavation Company:**	Cut 'N Core
Logged By:	SM	**Excavation Crew:**	Kyle
Hor.-Vert. Datum:	Not Available	**Excavation Equip.:**	CAT Backhoe
Plunge:	N/A degrees	**Excav. Dimensions:**	2.3 x 6 x 5.2 ft
Weather:	Sunny		

TEST PIT LOG TP-8

Approximate Ground Surface Elevation (ft.): 465.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description (FIELD EXPLORATION)	Sample Number	Sample Type	USCS Symbol (LABORATORY RESULTS)	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: brown, moist	S1		CH	18.6		100	75	56	36	**R Value(Lime treated)=74 Unconfined Compressive Strength(Lime treated) Proctor ASTM D558 A**
			VERY OLD PARALIC DEPOSITS (Qvop) **Fat CLAY with Sand (CH)**: fine to medium-grained, low to medium plasticity, brown, moist, trace gravel										
			Silty SAND (SM): fine to medium-grained, non-plastic, yellowish brown, moist, trace fine gravel, trace mica, trace clay	S2									
460	5												

The test pit was terminated at approximately 5.2 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20193578	TEST PIT LOG TP-8	FIGURE
	DRAWN BY: SM		A-16
	CHECKED BY: SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	
	DATE: 3/13/2019		
	REVISED: 4/16/2019		PAGE: 1 of 1

Date Begin - End:	3/05/2019	**Excavation Company:**	Cut 'N Core
Logged By:	SM	**Excavation Crew:**	Kyle
Hor.-Vert. Datum:	Not Available	**Excavation Equip.:**	CAT Backhoe
Plunge:	N/A degrees	**Excav. Dimensions:**	2.5 x 7 x 7.1 ft
Weather:	Sunny		

TEST PIT LOG TP-9

Approximate Ground Surface Elevation (ft.): 465.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
			ARTIFICIAL FILL (af) **Sandy Lean CLAY (CL)**: dark olive brown, moist	S1									
			VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, brown, moist, trace fine gravel										
460	5												
			Clayey SAND (SC): fine to medium-grained, low plasticity, yellowish brown, moist, weakly cemented	S2									

FIELD EXPLORATION / LABORATORY RESULTS

The test pit was terminated at approximately 7.1 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

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PROJECT NO.:	20193578	TEST PIT LOG TP-9	FIGURE
DRAWN BY:	SM		A-17
CHECKED BY:	SHR	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	
DATE:	3/13/2019		
REVISED:	4/16/2019		PAGE: 1 of 1

Date Begin - End:	3/05/2019	**Excavation Company:**	Cut 'N Core
Logged By:	SM	**Excavation Crew:**	Kyle
Hor.-Vert. Datum:	Not Available	**Excavation Equip.:**	CAT Backhoe
Plunge:	N/A degrees	**Excav. Dimensions:**	2.6 x 5.8 x 5.5 ft
Weather:	Sunny		

TEST PIT LOG TP-10

FIELD EXPLORATION / LABORATORY RESULTS

Approximate Ground Surface Elevation (ft.): 465.00
Surface Condition: Bare Earth and Weeds

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		ARTIFICAL FILL (af) **Sandy Lean CLAY (CL)**: dark brown, moist	S1									
		VERY OLD PARALIC DEPOSITS (Qvop) **Sandy Lean CLAY (CL)**: fine to medium-grained, low to medium plasticity, dark brown, moist										
		Clayey SAND (SC): fine to medium-grained, low plasticity, brown, moist, trace subrounded gravels	S2									
460	5	**Poorly Graded GRAVEL with Sand and Clay (GP-GC)**: fine to medium-grained, low plasticity, reddish brown, moist, fine to medium coarse, gravels up to 7 inches in size										

The test pit was terminated at approximately 5.5 ft. below ground surface. The test pit was backfilled with excavated material on March 05, 2019.

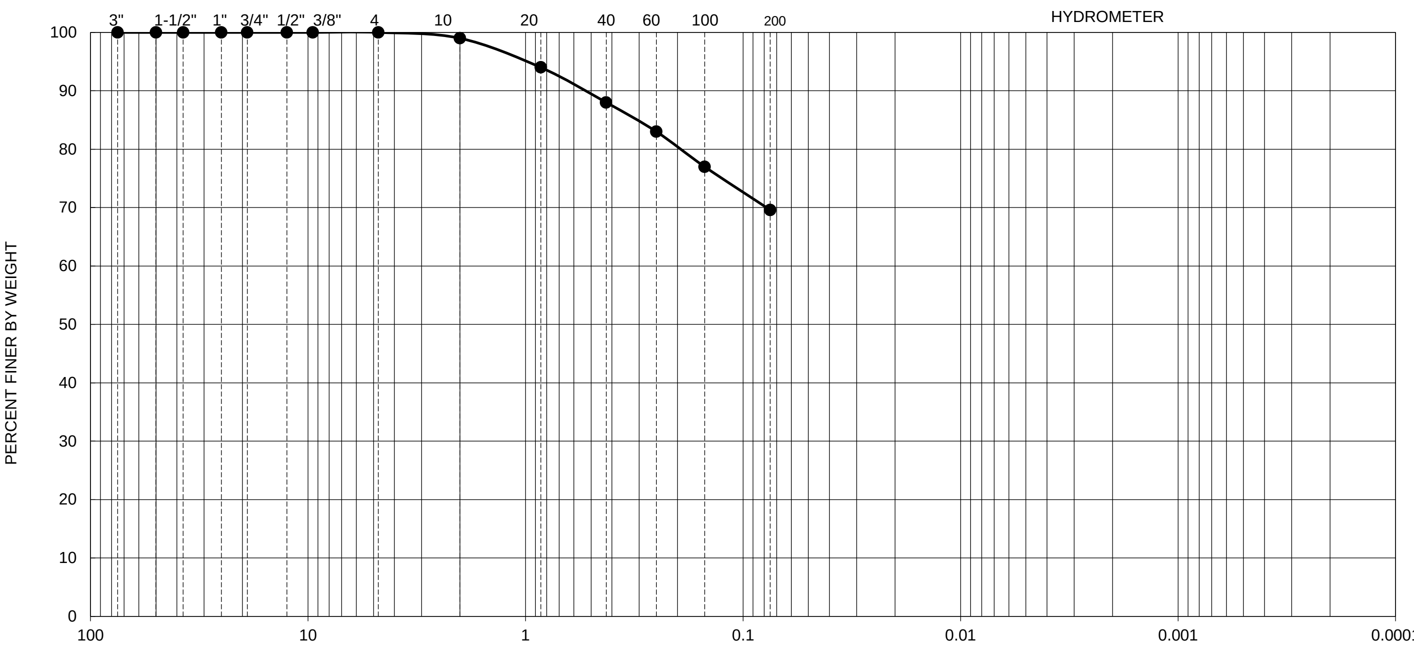
GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during excavation or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Google Earth.

APPENDIX B

Laboratory Test Results

Date Tested: **4/3/2019**

USCS	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Boring No.	Sample No.	Depth (ft)	Passing 200 (%)	USCS Classification
TP-5	1	0.5-1.5	69.6	CL

Sample Description	Sandy lean clay

	Sieve Size		% Passing
Sieve Analysis	3"	75 mm	100
	2"	50 mm	100
	1.5"	37.5 mm	100
	1"	25 mm	100
	3/4"	19 mm	100
	1/2"	12.5 mm	100
	3/8"	9.5 mm	100
	No. 4	4.75 mm	100
	No. 10	2.0 mm	99
	No. 20	0.85 mm	94
	No. 40	0.425 mm	88
	No. 60	0.25 mm	83
	No 100	0.15 mm	77
	No 200	.075 mm	69.6

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913

KLEINFELDER
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Checked by:	S.Tena	Tech:	Uly
Project No.	20193578.001A	Date:	10-Apr-19

GRADATION TEST RESULTS

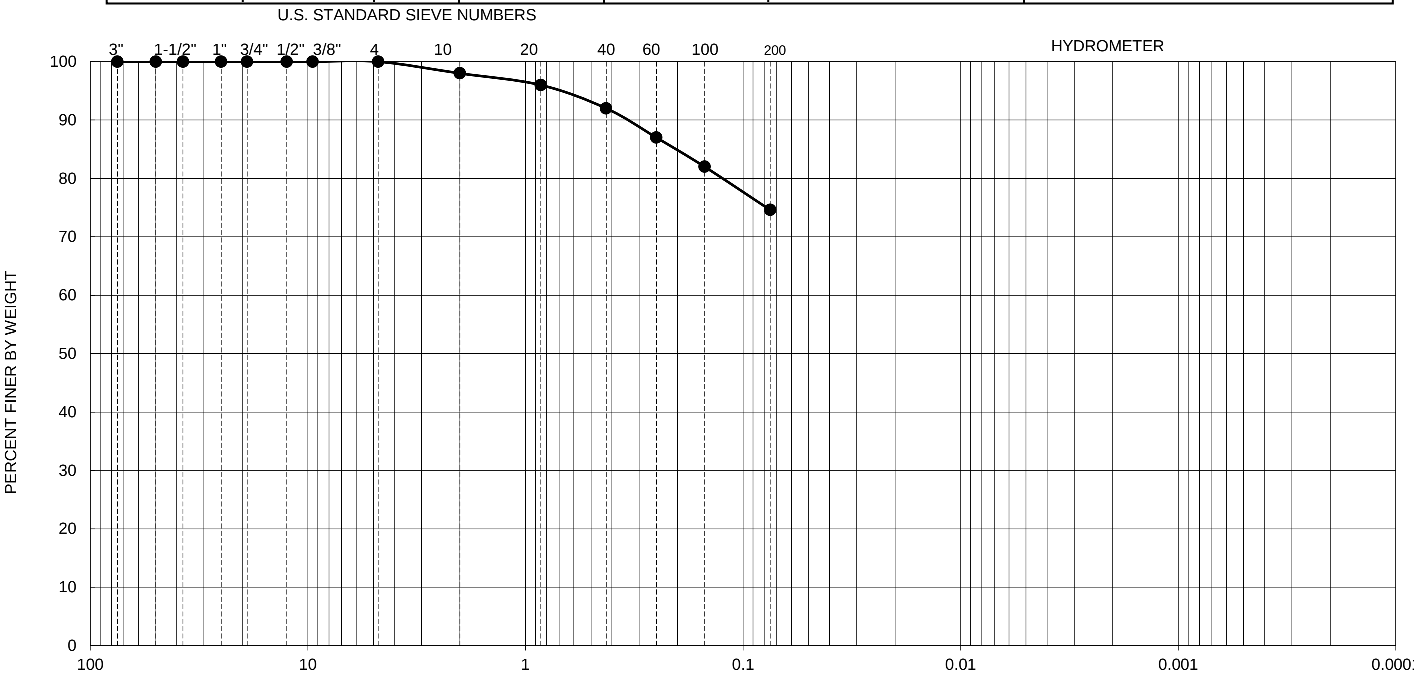
OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE

B-1

Date Tested: 4/3/2019

USCS	GRAVEL		SAND			FINES	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



Boring No.	Sample No.	Depth (ft)	Passing 200 (%)	USCS Classification
TP-8	1	0.5-1.5	74.6	CH

Sample Description	Fat clay with sand

	Sieve Size		% Passing
Sieve Analysis	3"	75 mm	100
	2"	50 mm	100
	1.5"	37.5 mm	100
	1"	25 mm	100
	3/4"	19 mm	100
	1/2"	12.5 mm	100
	3/8"	9.5 mm	100
	No. 4	4.75 mm	100
	No. 10	2.0 mm	98
	No. 20	0.85 mm	96
	No. 40	0.425 mm	92
	No. 60	0.25 mm	87
	No 100	0.15 mm	82
	No 200	.075 mm	74.6

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 6913

KLEINFELDER
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Checked by:	S.Tena	Tech:	Uly
Project No.	20193578.001A	Date:	16-Apr-19

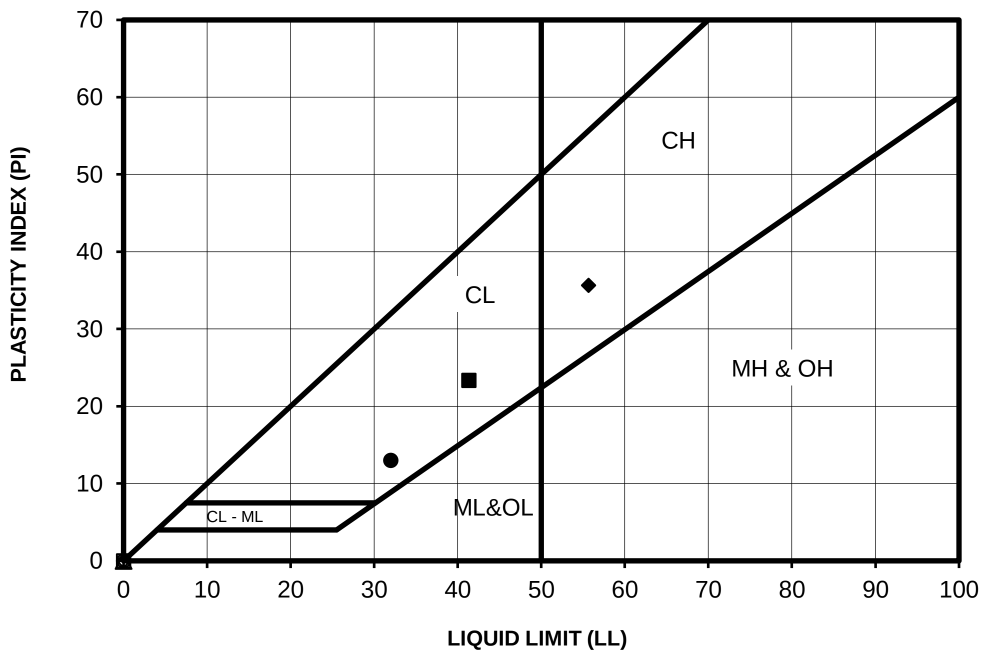
GRADATION TEST RESULTS

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE
B-2

Date Tested : 4/2-8/2019

SYMBOL	SAMPLE NAME	DEPTH (ft)	LL	PL	PI	USCS CLASSIFICATION (Minus No. 40 Sieve Fraction)	USCS (Entire Sample)
●	TP-1/2	3-6	32	19	13	CL	SC
■	TP-5/1	0.5-1.5	41	18	23	CL	CL
◆	TP-8/1	0.5-1.5	56	20	36	CH	CH



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

Limitations: Pursuant to applicable codes, the results presented in this report are for the exclusive use of the client and the registered design professional in responsible charge. The results apply only to the samples tested. If changes to the specification were made and not communicated to Kleinfelder, Kleinfelder assumes no responsibility for pass/fail statements (meets/did not meet), if provided. This report may not be reproduced, except in full, without written approval of Kleinfelder.

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Checked by	S.Tena	TECH	Uly P.
PROJECT NO: 20193578.001A		10-Apr-19	

ATTERBERG LIMITS TEST RESULTS

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE

B-3

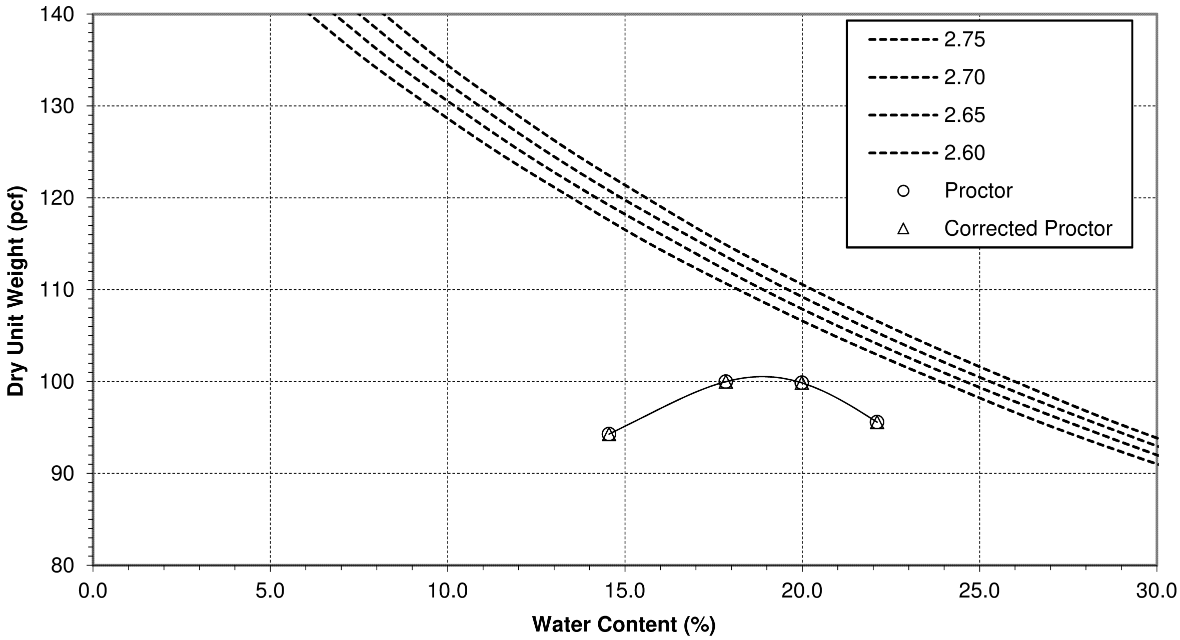
Laboratory Test Report

Client:	**Otay Tijuana Venture, L.L.C.**	Report No.:	**19-SAN-00277 Rev. 0**	Issued:	**4/10/2019**
Project:	**20193578.001A**			Field ID:	**various bore holes**
	CBX OTN Parking Lot Geotechnical	Sampled by:	**Bob Frazer**	Date:	**3/25/2019**
	02-000L - Lab Testing	Submitted by:	**K. Crennan**	Date:	**3/25/2019**

Tested on **4/4/2019** by **U. Panuncialman**

Material Description: **Brown sandy clay treated with 7% lime by dry weight of soil**

Location: **TP-5/1 0.5'-1.5'**



Test Method: ASTM D558 A	Uncorrected	Corrected
Maximum Dry Unit Weight (pcf)	**100.5**	**na**
Optimum Water Content (%)	**18.9**	**na**
Oversize Fraction, retained on (%)		**<5**
Bulk Specific Gravity of Oversize Fraction		**na**

Rammer Type: Manual

Specimen Preparation: Moist

Reviewed on 4/10/2019 by Ulysses Panuncialman,
Lab Supervisor

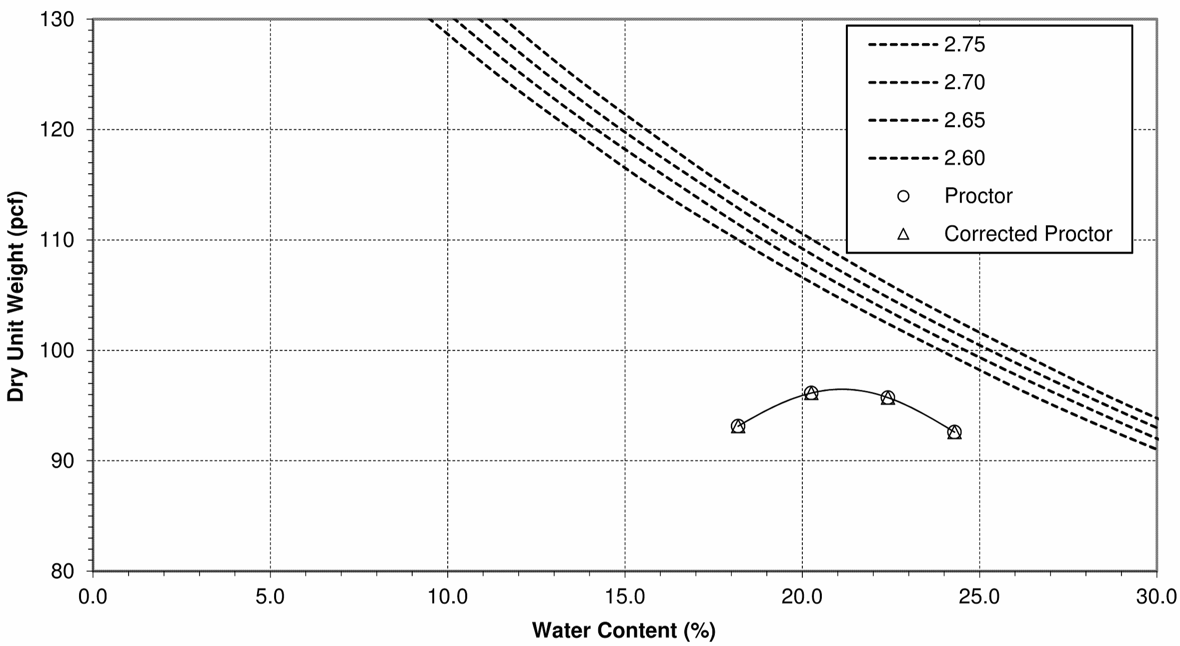
Laboratory Test Report

Client:	**Otay Tijuana Venture, L.L.C.**	Report No.:	**19-SAN-00277 Rev. 0**	Issued:	**4/10/2019**
Project:	**20193578.001A**			Field ID:	**various bore holes**
	CBX OTN Parking Lot Geotechnical	Sampled by:	**Bob Frazer**	Date:	**3/25/2019**
	02-000L - Lab Testing	Submitted by:	**K. Crennan**	Date:	**3/25/2019**

Tested on **4/8/2019** by **U.Panuncialman**

Material Description: **Dark brown sandy clay treated with 7% lime by dry weight soil**

Location: **TP-8** / **1 0.5'-1.5'**



Test Method: ASTM D558 A	Uncorrected	Corrected
Maximum Dry Unit Weight (pcf)	**96.5**	**na**
Optimum Water Content (%)	**21.1**	**na**
Oversize Fraction, retained on (%)		**<5**
Bulk Specific Gravity of Oversize Fraction		**na**

Rammer Type: Manual

Specimen Preparation: Moist

Reviewed on 4/10/2019 by Ulysses Panuncialman,
Lab Supervisor

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5761 Copley Dr, Suite 100
San Diego, CA
92111
858.223.8500

Compressive Strength of Lime Stabilized Soil (ASTM D1633)

Date: **4/16/2019**

Project:	**OTN Parking Lot at Otay CBX, San Diego CA**		
Project No.	20193578.001A		
Sample No.	TP-5 / 1 depth 0.5-1.5'		
Description	Brown sandy lean clay		
Date Sampled	3/25/2019	Date Molded	4/5/2019
Lime Type	Type S Hydrated Lime		
Lime Content	7% by dry weight of soil		
Method	A	Tested by:	Uly P.
Curing	moist room		

Sample No	A	B	C
Date Tested	4/8/2019	4/12/2019	4/12/2019
Age, days	**3**	**7**	**7**
Diameter, inches	3.99	3.97	3.97
Height, inches	4.58	4.60	4.59
Area, sq. in.	12.50	12.38	12.38
L/D	1.15	1.16	1.16
Ultimate Load, lbs.	1127	1529	1482
Compressive Strength, psi	90	124	120
Correction Factor (L/D)	0.905	0.905	0.905
Corr. Compressive Strength, psi	80	110	110
Avg. Corr. Compressive Strength, psi	**80**	**110**	

Remarks Compressive strength rounded to nearest 5 psi

FIGURE B-6

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5761 Copley Dr, Suite 100
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92111
858.223.8500

Compressive Strength of Lime Stabilized Soil (ASTM D1633)

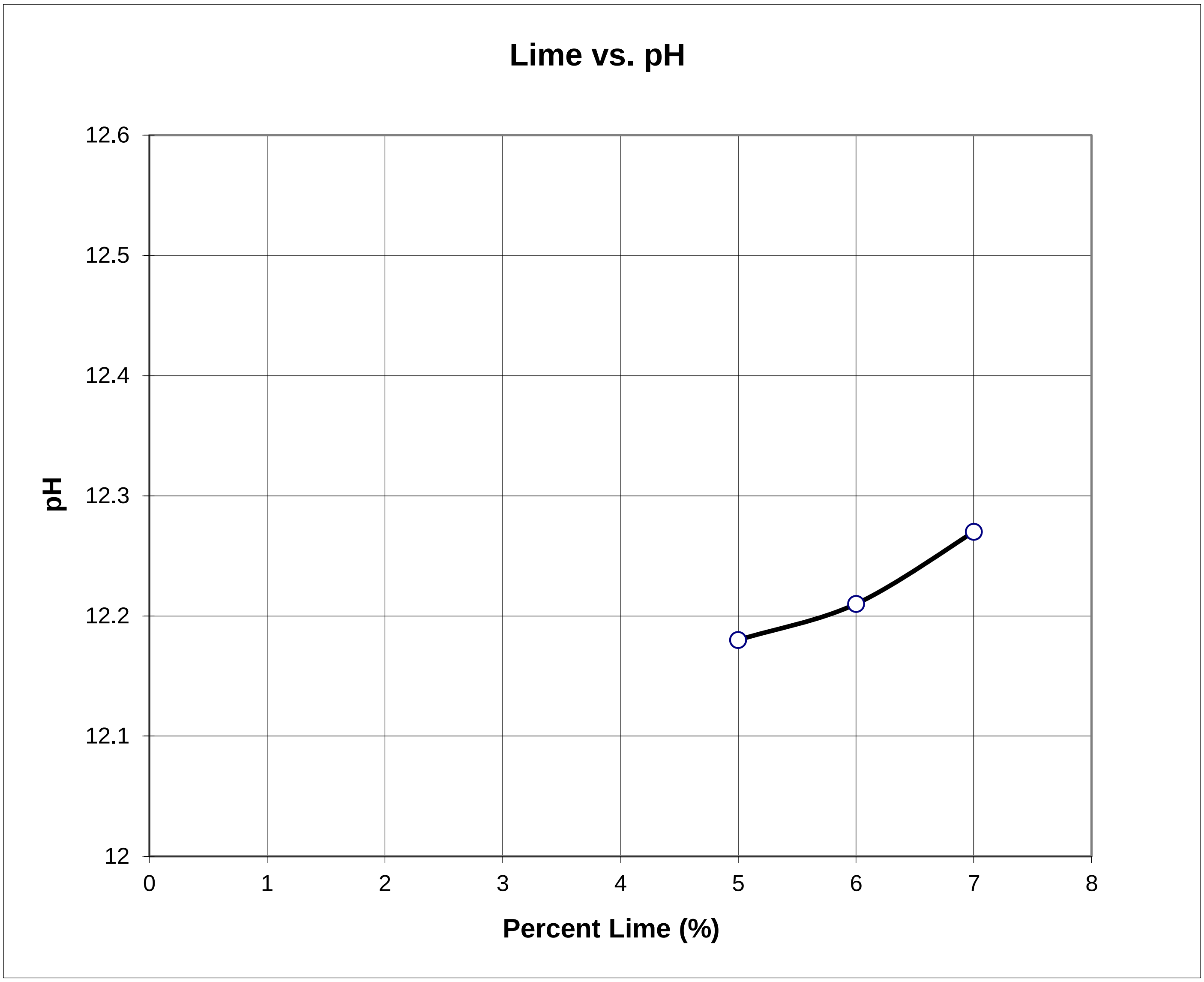
Date: **4/16/2019**

Project:	**OTN Parking Lot at Otay CBX, San Diego CA**		
Project No.	20193578.001A		
Sample No.	TP-8 / 1 depth 0.5-1.5'		
Description	Dark brown fat clay with sand		
Date Sampled	3/25/2019	Date Molded:	4/9/2019
Lime Type	Type S Hydrated Lime		
Lme Content	7% by dry weight of soil		
Method	A	Tested by:	Uly P.
Curing	moist room		

Sample No	A	B	C
Date Tested	4/12/2019	4/16/2019	4/16/2019
Age, days	**3**	**7**	**7**
Diameter, inches	3.98	3.99	3.97
Height, inches	4.58	4.61	4.58
Area, sq. in.	12.44	12.50	12.38
L/D	1.15	1.16	1.15
Ultimate Load, lbs.	1695	1762	1739
Compressive Strength, psi	136	141	140
Correction Factor (L/D)	0.905	0.905	0.905
Corr. Compressive Strength, psi	125	130	125
Avg. Corr. Compressive Strength, psi	**125**	**130**	

Remarks Compressive strength rounded to nearest 5 psi

FIGURE B-7



Lime Type	Type S Hydrated Lime

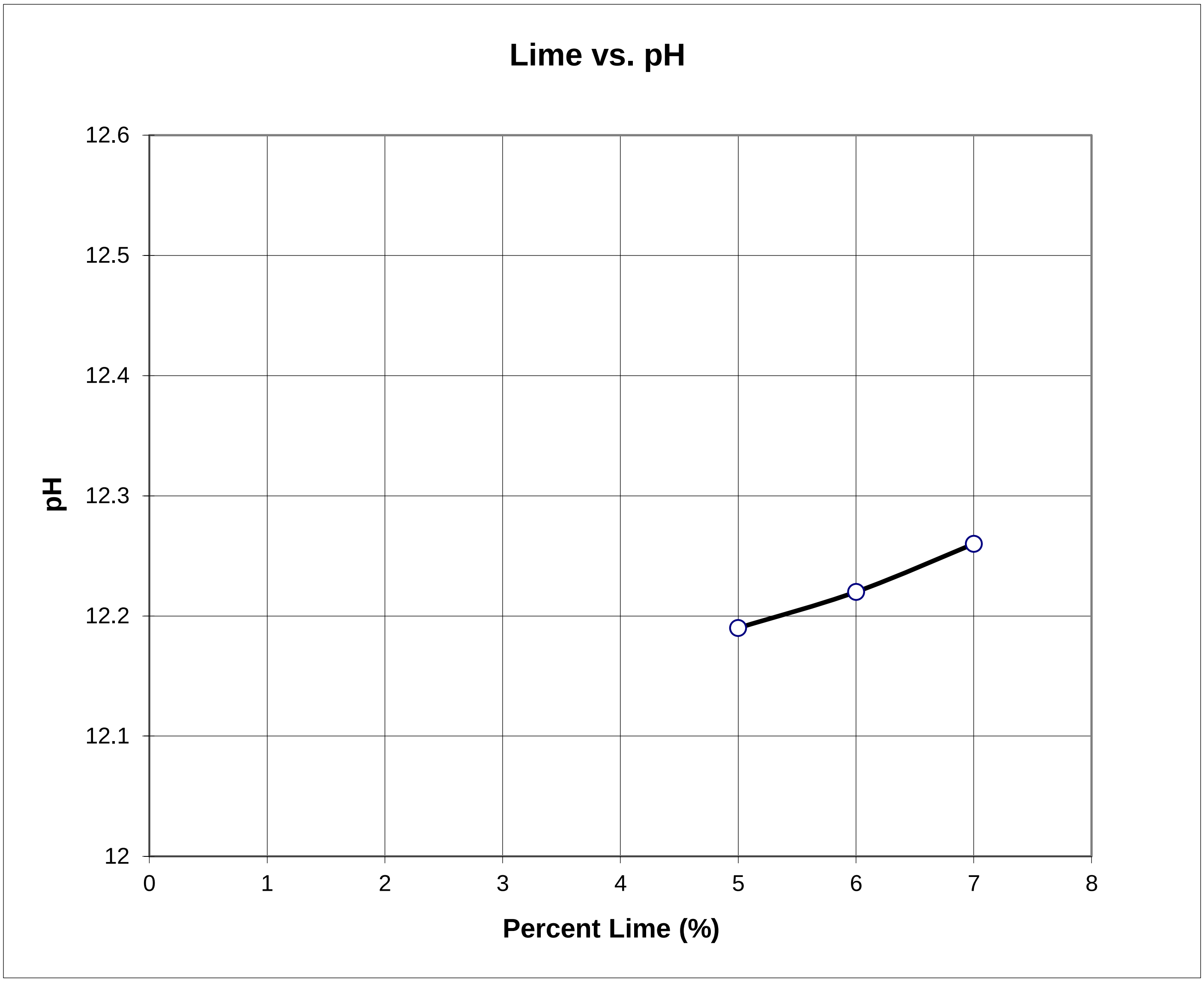
Boring No.	Sample No.	Depth (ft)	USCS
TP 5	1	0.5-1.5	CL

Sample Description	sandy lean clay

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D6276-19

KLEINFELDER Bright People. Right Solutions.			Using pH to Estimate the Soil-Lime Proportion for Soil Stabilization	FIGURE
CHECKED BY:	S.Tena	TECH: Uly P.	OTN PARKING LOT EAST OF OTAY CBX SAN DIEGO, CALIFORNIA	B-8
PROJECT NO	20193578.001A	DATE: 4/10/2019		

Date Tested 4/2/2019



% Lime by Dry Weight of Soil

Lime Type	Type S Hydrated Lime

Boring No.	Sample No.	Depth (ft)	USCS
TP 8	1	0.5-1.5	CL

Sample Description	sandy lean clay

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D6276-19

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CHECKED BY:	S.Tena	TECH: Uly P.	
PROJECT NO	20193578.001A	DATE: 4/16/2019	

Using pH to Estimate the Soil-Lime Proportion for Soil Stabilization

OTN PARKING LOT
EAST OF OTAY CBX
SAN DIEGO, CALIFORNIA

FIGURE
B-9

APPENDIX C

Lime Stabilization Guidelines

APPENDIX C
LIME STABILIZATION GUIDELINES

1.0 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

Content of Soil AASHTO T102 Spot Test of Asphaltic Materials

ASTM C25 Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime

ASTM C51 Standard Terminology Relating to lime and limestone (as used by the Industry)

ASTM C977 Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization

ASTM D516 Standard Test Method for Sulfate Ion in Water

ASTM D558 Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures

ASTM D977 Standard Specification for Emulsified Asphalt

ASTM D2397 Standard Specification for Cationic Emulsified Asphalt

ASTM D3551 Standard Practice for Laboratory Preparation of Soil-lime Mixtures Using a Mechanical Mixer

ASTM D4972 Standard Test Method for pH of Soils (Method A)

ASTM D6938 Standard Test Methods for In-Place Density and Water and Soil-Aggregate by Nuclear Methods

1.2 SUBMITTALS

Submit the following in accordance with the Section on "Submittals."

1.2.1 Design Data

a. Job-mix formula in conformance with the specification requirements.

b. Mixing procedures in conformance with the specification requirements.

c. Analysis of equipment.

1.2.2 Required Data

Before the commencement of the work, the contractor shall submit a job-mix formula showing the amount of lime and water required per cubic yard, and the proposed procedures for blending the lime and soil to the design requirements. Process type and number of lime applications, stages of mixing, lime slurry mixing depths, and depths of compaction lifts shall be included. Also, a list of equipment to be used and their relation to the method of lime slurry proportioning, mixing, spreading, pulverizing and compacting subgrade and other related work shall be included. The formula shall also contain the amount of lime (as both quicklime and hydrated lime slurry), in sacks and pounds per cubic yard of soil, and the amount of water to be used.

1.2.3 Statements

Submit a list of all construction equipment to be used on the project fifteen days before bringing equipment to the job site.

1.2.4 Field Test Reports

a. Site Preparation - Summary of site clearing and grubbing, initial site grading, and remedial grading operations, including optimum moisture, maximum density and field compaction tests results of untreated soils.

b. Final Compaction Report - Summary of lime stabilization operations, including optimum moisture, maximum density, and compaction test results of lime stabilized soils.

c. Field Application Rate - Daily summary of total weight of lime applied, square footage treated and depth of treatment.

d. Phenolphthalein - Daily summary of phenolphthalein tests and observations.

e. pH Test - Daily summary of pH test results.

1.2.5 Certificates

Upon each delivery of lime, a "Manufacturer's Certificate of Compliance with the Project Specifications" is to be submitted to the Owner's Representative with a certified copy of the delivery weight.

1.2.6 Samples

a. Lime - A sample of the lime to be used shall be submitted to the Owner's Representative at least seven days before the commencement of the work. Samples are to be submitted in moisture-proof, airtight containers.

b. Cured lime Treated Material - A typical cured sample of on-site material with the required percent of lime shall be submitted to the Owner's Representative at least five days before the commencement of the work.

1.3 DELIVERIES AND STORAGE

Deliver lime in containers showing or including designated trade name, product identification, specification number, manufacturer's name, and source. Store materials in a manner that will prevent moisture damage, overexposure and contamination.

1.4 WEATHER LIMITATIONS

Do not treat or compact subgrade when weather conditions detrimentally affect the quality of the materials. Do not apply lime unless the air temperature is at least 40 degrees Fahrenheit (5 degrees Centigrade) in the shade and rising. Do not apply lime to soils that are frozen or contain frost. If the air temperature falls below 35 degrees Fahrenheit (2 degrees Centigrade) in the shade, protect completed lime stabilized areas by approved methods against the detrimental effects of freezing. Remove and replace any damaged portion of the stabilized areas with new lime stabilized material in accordance with this specification. Do not apply lime during rain or when rain is predicted during the scheduled treatment period. Cover any compacted lime treated subgrade with asphalt emulsion, plastic, or other impervious surface to prevent infiltration of rainwater. Slope compacted subgrade surfaces to drain.

2.0 PRODUCTS

2.1 LIME STABILIZATION REQUIREMENTS

Perform lime treatment of subgrade. Scarify subgrade soil and mix uniformly with lime and water, spread, shape, compact and cure in accordance with these specifications and the following requirements.

2.1.1 Lime Requirement:

Quicklime is to be added to the soil in one application at a minimum rate of 7.0 percent quicklime by dry weight of the in-place soil (an average dry unit weight of soil of 100 pcf may be assumed for estimation purposes). Confirm lime content before starting operations by performing pH tests on the on-site soils using ASTM test method D4972. A minimum pH of 12.4 shall be obtained in the treated soil after 24 hours.

2.1.2 Depth Requirement:

The depth of stabilization shall be a minimum of 18 inches.

2.2 LIME

Only lime conforming to the following specifications shall be used for this project:

2.2.1 High Calcium Quicklime

High calcium quicklime shall be in compliance with the chemical composition requirements of ASTM C977. The quicklime shall have an available lime index (ASTM C25) of at least 90 percent available CaO (Calcium Oxide). Quicklime shall be fresh product manufactured from high calcium limestone as defined in ASTM C51. Fresh product is defined as quicklime that has been properly stored in enclosed conditions to prevent air slaking and carbonation. Fresh product shall not be stored longer than three months from the time of manufacture. A Certificate of Compliance and a certified shipping weight shall be submitted to the Owner's Representative with each delivery. Dry hydrated, air slaked, bi-product or waste lime shall not be used. Dry quicklime shall not be used in field application.

2.3 WATER

The water used for mixing shall be potable and shall not contain more than 650 parts per million of chlorides as Cl, nor more than 500 parts per million of sulfates as SO4. The water for mixing is subject to approval by the Owner's Representative.

2.4 SOIL

Unless approved by the Owner's Representative, the material to be stabilized consists of the on-site, inorganic, native soil unless imported material, relocated material, or preliminary earthwork is required. Remove stones retained on a 3-inch sieve, and deleterious substances such as sticks, debris, and vegetable matter.

2.5 BITUMINOUS CURING SEAL

The curing seal is to be emulsified asphalt conforming to ASTM D977 (Type SS-1 or Type SS-1h) or ASTM D2397 (Type CSS-1 or Type CSS-1h). The base asphalt used to manufacture the emulsion shall show a negative spot when tested in accordance with AASHTO T102 using standard naphtha.

3.0 EXECUTION

3.1 SITE PREPARATION

Clean debris from the area to be stabilized. Perform clearing and grubbing to a minimum depth of 12 inches. Rough grade and shape the areas to be stabilized to conform to the lines, grades, and cross sections indicated on the approved grading plans. Comply with the earthwork requirements in the governing geotechnical report. After the required line and grade has been achieved, but prior to the application of lime slurry, scarify and partially pulverize the subgrade to a depth equal to the proposed depth of treatment, or to the maximum depth of equipment reach, whichever is less. Remove rocks larger than 3 inches, and organic materials such as stumps and roots.

Inspect the exposed subgrade for adequacy for the forthcoming compactive effort during lime treatment. The prepared subgrade is to be firm and able to support typical construction equipment without yielding. Soft or yielding (pumping) subgrade is to be stabilized before the application of lime. The Owner's Representative should observe the subgrade prior to the application of lime to determine if unstable areas are present and to observe that corrective measures taken, if necessary.

3.1.1 Grade Control

When the lime stabilized subgrade is to be constructed to meet a fixed grade, provide adequate line and grade stakes for control. Finished and completed stabilized areas shall conform to the lines, grades, cross section, and dimensions indicated. Locate grade stakes in lanes parallel to centerline of areas under construction, and suitably placed for string lining. Maintain line and grade. The Grading Contractor should be aware that lime stabilization generally lowers the soil density and increases the soil thickness, and that this bulking effect needs to be considered when specifying grade.

3.2 LIME TREATMENT AND SEQUENCE OF CONSTRUCTION OPERATIONS

Comply with this sequence of construction operations, unless specified otherwise.

3.2.1 Application Requirements

After site preparation, scarify subgrade and spread lime. Blend lime into subgrade to required depth as indicated. Apply lime and water only to those areas where mixing operations can be completed during the same working day. Accomplish application and mixing of lime by the slurry method. Use the same method during any single day's operation.

3.2.2 Quick Lime Application

Apply a mixture of lime and water onto the existing soil in one application. Maintain the water content at 4 to 6 percent above optimum, as determined by ASTM D558 test method performed on the lime-soil mixture during the application process. The lime shall be distributed using equipment and procedures capable of uniformly spreading the lime. Lime shall be distributed using a non-pressurized mechanical vane-feed spreader with on-board scales and controls capable of spreading the lime at a prescribed weight per unit area. The amount of lime spread shall be the amount required for mixing to the specified depth, which will result in the specified rate of lime application.

Lime shall be spread only on that area where initial mixing operations can be completed during the same working day. Spread lime evenly to yield uniform distribution throughout soil. Distribute lime in successive passes over subgrade materials until the specified amount of lime has been uniformly applied. Continually agitate lime to keep mixture uniform. Keep pumps, distribution spray bars, spreading equipment, and other equipment clean of excessive lime. The approved laboratory shall verify the specified amount and rate of application of lime for the various materials encountered.

3.2.3 Mixing and Watering

Distribute the lime by successive passes over the scarified subgrade until the specified amount of lime has been uniformly applied. Mix the lime into the subgrade with single or multiple passes of all wheel drive rotary mixers capable of down and up cutting the soil (CMI RS 500 or equivalent). During the mixing process, add water to provide a moisture content of 4 to 6 percent above the optimum moisture content in order to facilitate the chemical reaction of the lime with the subgrade materials. This moisture content shall be maintained for at least 48 hours after the lime application.

The mixer shall continue making passes until it has produced a homogeneous, uniform mixture of soil, lime and water. Continue mixing or remixing operations until 100 percent of the stabilized soil passes the 1-inch sieve and at least 60 percent passing the No. 4 sieve. The material shall be free of streaks or pockets of lime. The presence of streaks or pockets of lime, or non-uniformity of color reaction when tested with standard phenolphthalein indicator, will be considered evidence of inadequate mixing. Lime shall not be left exposed for more than 6 hours prior to mixing. Lime left exposed shall be removed and replaced with new lime. The mixing operation in any given area should be completed within 24 hours of lime application. After initial mixing, shape and roll subgrade lightly to seal surface in order to reduce evaporation of moisture and lime carbonation.

The full depth of stabilization for the lime application may be performed in a single layer, provided the contractor can demonstrate that the equipment and methods of operation will provide uniform distribution of the lime throughout the layer. If the contractor is unable to achieve uniformity throughout the layer (as determined by the Owner's Representative) the area should be stabilized and mixed using thinner lifts until uniformity is achieved. Lime application and mixing operations may be achieved simultaneously (with a single piece of equipment), provided the Contractor can demonstrate that the equipment will provide uniform distribution and mixing.

3.2.4 Curing

Moisture cure the lime-soil mixture for 48 hours. During the curing process, maintain the moisture content at 4 to 6 percent above the optimum moisture content in order to facilitate the chemical reaction of the lime with the subgrade materials. If necessary during the curing process, add water and remix to provide a moisture content of 4 to 6 percent above the optimum moisture content throughout the full treated soil depth.

3.2.5 Pulverization and Mixing

After the lime is uniformly applied to soil, the mixture is pulverized and has been preliminary cured for at least 48 hours, re-pulverize the lime treated material and continue mixing until 100 percent of soil particles pass a 1-inch sieve and 60 percent pass the No. 4 sieve. If resultant mixture contains clods, reduce their size by scarifying, remixing, or pulverization to meet the specified gradation. Continue mixing until material is uniform. During the mixing processes, add water to provide moisture contents of 4 to 6 percent above the optimum moisture throughout the treated depth.

3.2.6 Compaction

Compact lime stabilized material immediately after final mixing. Compaction shall begin as soon as possible after the 48 hour mellowing period. Aerate or sprinkle as necessary to maintain moisture content of 4 to 6 percent above the optimum moisture content during compaction. Compact lime stabilized material in specified lifts to 95 percent of the maximum dry density at a moisture content of at least 4 percent over optimum in accordance with ASTM D558. In no case should the wet density of the compacted lime stabilized material be less than 95 percent of the wet density calculated as the maximum dry density times one plus the optimum moisture content in hundredths. Base the density value on a representative soil sample obtained from site, treated with required proportion of lime, and cured as specified herein.

As compaction progresses, maintain the shape of the lifts by blading. Surface upon completion shall be smooth and conform to indicated section and established lines and grades. Perform initial compaction with sheepsfoot roller or segmented-type roller. The selected roller shall be of sufficient weight and shall impose sufficient compactive force so that the specified minimum density requirements are achieved throughout the entire compacted lift thickness. Perform final rolling by means of sheepsfoot, steel-tired, or pneumatic rollers. Areas inaccessible to large compaction equipment shall be compacted to meet the minimum compaction requirements by other means satisfactory to the Owner's Representative. The surface of the compacted, bladed subgrade is to be kept moist until finish rolling.

The full depth of stabilized soil may be compacted in a single layer, provided the Contractor can demonstrate to the Owner's Representative that the equipment and methods of operation will provide the required compacted density throughout the layer. If the contractor is unable to achieve the required density throughout the layer, the area shall be recompacted using thinner lifts until the density requirements are achieved throughout the entire lift thickness.

3.2.7 Finishing

Within two hours of compaction and finish blading, finish roll the subgrade with a pneumatic or suitable roller sufficiently light to prevent hairline cracking. Vibratory rollers shall not be used. No loose material shall be left on the subgrade after finish rolling. The surface of the stabilized material after finish rolling shall be the established graded plane. At any point, the surface shall not vary more than ⅜-inch above or below the established grade. After finish rolling, the subgrade surface shall be "dimpled" to a depth of ¼-inch using a sheepsfoot or tamping foot roller. Under no circumstances will it be permissible to add new or trimmed lime stabilized material to fill low areas or to raise the grade after the surface is finish rolled. Keep the surface of each compacted layer moist until covered by a subsequent layer of lime stabilized material or curing seal.

3.2.8 Limit of Daily Operations (Temporary Joints)

The entire mixing operation in any given area should be completed within 24 hours of the lime application. At the end of each working day, prepare a temporary joint in fully compacted material normal to paved surface centerline. Construct a longitudinal temporary joint for partial width sections against which future material is to be placed. Remove temporary joints during next work period by trimming 3 inches into treated material for continuity. Trimmed material may be incorporated in subsequent work. Temporary joints shall not coincide with any longitudinal or transverse temporary joint location of previous or any subsequent construction. Remixing 6 inches into the previous day's work may be substituted for joints, providing the method and equipment is acceptable to the Owner's Representative.

3.2.9 Final Curing

Within 4 hours of finish rolling, seal the surface with a curing seal consisting of SS or CSS grade asphaltic emulsion. The curing seal is to be applied uniformly to top (final) layer of the compacted lime stabilized material at a rate of at least 0.35 gallons per square yard of surface.

No water shall be added in the field to the certified emulsion mixture. Apply curing seal before temperature falls below 40 degrees Fahrenheit. Cure compacted lime stabilized material for at least three days. Maintain the moisture content of mixture at 4 to 6 percent above optimum during curing. Lime that has been overexposed to open air shall be removed and disposed of off-site.

3.3 TRAFFIC CONTROL, CURING AND DRAINAGE PROTECTION

No equipment or heavy construction traffic is to be permitted on the freshly treated, asphalt emulsion cure sealed surface for at least five days after the curing seal has been applied. Provide warning signs and barricades so that traffic will not travel over freshly treated surfaces. Do not permit equipment or traffic on lime treated material until subgrade stability is assured. Asphalt concrete, asphalt surface treatment, or cement treated base is not to be placed within five calendar days following application of the curing seal unless approved by the Owner's Representative. The surface of the cured subgrade should be swept clean before the placement of asphalt concrete, asphalt surface treatment, or aggregate base. Maintain finished surface until work has been completed. Provide drainage and surface protection during entire period of construction to prevent water from collecting or standing on areas to be stabilized or on the stabilized subgrade surface.

3.4 EQUIPMENT LIMITATIONS

3.4.1 General

The equipment to be used for each category of work shall conform to requirements set forth in this specification. Maintain equipment in satisfactory and safe operating condition.

3.4.2 Spreading Equipment

Lime shall be distributed using a non-pressurized mechanical vane-feed spreader with on-board scales and controls capable of spreading the lime at a prescribed weight per unit area. Spreading lime by aggregate spreaders, dump trucks, or agricultural spreaders is not allowed.

Spreading by end dumping, or tailgate control methods are not allowed. Change or alter equipment in the event of non-uniform spreading.

3.4.3 Additional Mixing Equipment Limitations

Deep-lift rotary mixers may facilitate changes in specified depths of operation, providing equipment and methods of operation sustain uniform distribution of lime with required gradation throughout the deeper layer. The use of any proposed mixing equipment requires the approval of the Owner's Representative.

3.4.4 Additional Compaction Equipment Limitations

Unauthorized equipment, hauling or transportation vehicles will not be allowed for compaction purposes.

3.5 TESTS

3.5.1 General

Perform sampling and testing using a laboratory that has been inspected by the Cement and Concrete Reference Laboratory (CCRL) within the past 3 years, or by a Government approved independent commercial testing laboratory. Frequency of sampling and testing of materials for conformance and quality control shall be as specified herein and shall be performed at such other times as necessary to document contract compliance. Test reports and results shall be certified by the laboratory and submitted together with Contractor's daily certification.

3.5.2 Optimum Moisture, Maximum Density

Perform laboratory optimum moisture determinations and maximum dry density tests on lime treated material sampled after final mixing and before initial compaction. The soil samples are to be kept in air tight containers until the laboratory compaction curve or moisture determination is performed. Soil mixture shall be laboratory compacted within three hours of sampling for optimum moisture and maximum density determination. Optimum moisture and maximum dry density are to be determined using ASTM D558 and the Job Mix Formula.

3.5.3 Uniformity Tests

Phenolphthalein Test - After placement and mixing of each lift, perform a series of uniformity tests. Excavate a hole for the full depth of treatment and impregnate the sides of hole with a standard phenolphthalein alcohol indicator. Non-conformity of color reaction when material is treated as above will be considered evidence of inadequate mixing.

a. pH Test - The pH of the uncured soil and lime mixture shall be tested in accordance with ASTM D4972 to determine that the required percent of lime was added to stabilize the soils. A pH of at least 12.4 shall be obtained.

3.5.4 Compaction

Perform in-place density tests to determine degree of compaction after final compaction. Test in accordance with ASTM D6938.

3.5.5 Thickness and Smoothness

Thickness of final lime treated subgrade shall not be less than thickness shown on plans.

3.5.6 Field Application Rate Test

Tests for checking initial lime spreading rate shall be by measurement of the total weight of lime placed and the area and depth of soil treated with the measured weight of lime. Spot checks of the field application rate shall be made by the placement of a pan of measured area over the surface of the ground to be treated and weighing the amount of lime deposited in the pan after the passage of the distribution truck.

3.5.7 Frequency of Tests

Optimum moisture and maximum density: One test for each material type or change of material that has in-place density requirements.

Thickness, smoothness and uniformity: Two tests for each work shift or for every 9,000 square feet of lime treated soil (whichever is more frequent).

Field density: One set of 3 tests for every 3,000 square feet placed or for each lift per work shift (whichever is more frequent).

Field application rate test: One test for each lime-spreading vehicle to be used on site, and after each load is applied.

Phenolphthalein Tests: Perform test at a minimum of one location for every 3,000 square feet of lime treated soil, or once for each lift per work shift (whichever is more frequent).

pH Test: Perform test at a minimum of one location for each lift of 3,000 square feet of lime treated soil, or once for each lift per work shift (whichever is more frequent). At each test location, one test from each 4-inch depth interval) shall be tested.

APPENDIX D

BMPS Worksheets

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions[1]		Worksheet C.4-1: Form I-8A[2]
Part 1 - Full Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		Project Phase:
		Preliminary Phase
Criteria 1: Infiltration Rate Screening		
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[3]? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ○ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ⦿ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ○ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).	
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ○ Yes; Continue to Step 1C. ○ No; Skip to Step 1D.	
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ○ No; full infiltration is not required. Answer "No" to Criteria 1 Result.	
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ○ Yes; continue to Step 1E. ○ No; select an appropriate infiltration testing method.	

[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[3] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ◯ Yes; continue to Step 1F. ◯ No; conduct appropriate number of tests.	
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ◯ Yes; continue to Step 1G. ◯ No; select appropriate factor of safety.	
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ◯ Yes; answer "Yes" to Criteria 1 Result. ◯ No; answer "No" to Criteria 1 Result.	
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ◯ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ◉ No; full infiltration is not required. Skip to Part 1 Result.	
Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report. Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.025 inches per hour.		

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered "Yes," continue to Step 2B. For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	○Yes	○No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	○Yes	○No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	○Yes	○No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	○Yes	○No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○Yes	○No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]		
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	○Yes	○ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○Yes	○ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○Yes	○ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	○Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	○ Yes	○ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	○ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening [4]	Result
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	○ Full infiltration Condition ◉ Complete Part 2

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
	Preliminary Phase
Criteria 3 : Infiltration Rate Screening	

3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ○ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ○ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ◉ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ○ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ◉ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ○ Yes; Continue to Criteria 4. ◉ No: Skip to Part 2 Result.

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

Borehole percolation test method was selected to evaluate the infiltration rate. The reliable infiltration rate was 0.025 inches per hour.

PERC-1

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	Yes	No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	Yes	No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	Yes	No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	Yes	No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	Yes	No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	Yes	No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○Yes	○No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○Yes	○No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	○Yes	○No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	○Yes	○No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○Yes	○No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Summarize findings and basis; provide references to related reports or exhibits.	

Part 2 – Partial Infiltration Geotechnical Screening Result[5]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	○ Partial Infiltration Condition ◉ No Infiltration Condition

[5] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions[1]		Worksheet C.4-1: Form I-8A[2]
Part 1 - Full Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		Project Phase:
		Preliminary Phase
Criteria 1: Infiltration Rate Screening		
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[3]? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ○ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ◉ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ○ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).	
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ○ Yes; Continue to Step 1C. ○ No; Skip to Step 1D.	
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ○ No; full infiltration is not required. Answer "No" to Criteria 1 Result.	
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ○ Yes; continue to Step 1E. ○ No; select an appropriate infiltration testing method.	

[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[3] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ○ Yes; continue to Step 1F. ○ No; conduct appropriate number of tests.	
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ○ Yes; continue to Step 1G. ○ No; select appropriate factor of safety.	
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ○ Yes; answer "Yes" to Criteria 1 Result. ○ No; answer "No" to Criteria 1 Result.	
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ○ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ◉ No; full infiltration is not required. Skip to Part 1 Result.	
Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report. Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.01 inches per hour.		

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered "Yes," continue to Step 2B. For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	○ Yes	○ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	○ Yes	○ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	○ Yes	○ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	○ Yes	○ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	○Yes	○ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○Yes	○ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○Yes	○ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	○Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	○ Yes	○ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	○ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening [4]	Result
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	○ Full infiltration Condition ◉ Complete Part 2

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

<table>
<tr><th>Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions</th><th colspan="2">Worksheet C.4-1: Form I-8A[2]</th></tr>
<tr><td colspan="3">Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria</td></tr>
<tr><td colspan="2">DMA(s) Being Analyzed:</td><td>Project Phase:</td></tr>
<tr><td colspan="2"></td><td>Preliminary Phase</td></tr>
<tr><td colspan="3">Criteria 3 : Infiltration Rate Screening</td></tr>
<tr><td>3A</td><td colspan="2">NRCS Type C, D, or “urban/unclassified”: Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or “urban/unclassified” and corroborated by available site soil data?
○ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result.
○ Yes; the site is mapped as D soils or “urban/unclassified” and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result.
⦿ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.</td></tr>
<tr><td>3B</td><td colspan="2">Infiltration Testing Result: Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr?
○ Yes; the site may support partial infiltration. Answer “Yes” to Criteria 3 Result.
⦿ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer “No” to Criteria 3 Result.</td></tr>
<tr><td>Criteria 3 Result</td><td colspan="2">Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP?
○ Yes; Continue to Criteria 4.
⦿ No: Skip to Part 2 Result.</td></tr>
<tr><td colspan="3">Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).
Borehole percolation test method was selected to evaluate the infiltration rate. The reliable infiltration rate was 0.01 inches per hour.</td></tr>
</table>

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	○ Yes	○ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	○ Yes	○ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	○ Yes	○ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	○ Yes	○ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	○ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○ Yes	○ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○ Yes	○ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	○ Yes	○ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	○ Yes	○ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Summarize findings and basis; provide references to related reports or exhibits.	

Part 2 – Partial Infiltration Geotechnical Screening Result[5]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	○ Partial Infiltration Condition ◉ No Infiltration Condition

[5] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions[1]		Worksheet C.4-1: Form I-8A[2]
Part 1 - Full Infiltration Feasibility Screening Criteria		
DMA(s) Being Analyzed:		Project Phase:
		Preliminary Phase
Criteria 1: Infiltration Rate Screening		
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[3]? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ○ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ⦿ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ○ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).	
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ○ Yes; Continue to Step 1C. ○ No; Skip to Step 1D.	
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ○ No; full infiltration is not required. Answer "No" to Criteria 1 Result.	
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ○ Yes; continue to Step 1E. ○ No; select an appropriate infiltration testing method.	

[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[3] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ◯ Yes; continue to Step 1F. ◯ No; conduct appropriate number of tests.	
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ◯ Yes; continue to Step 1G. ◯ No; select appropriate factor of safety.	
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ◯ Yes; answer "Yes" to Criteria 1 Result. ◯ No; answer "No" to Criteria 1 Result.	
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ◯ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ◉ No; full infiltration is not required. Skip to Part 1 Result.	

Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report.

Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.065 inches per hour.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered "Yes," continue to Step 2B. For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	○ Yes	○ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	○ Yes	○ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	○ Yes	○ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	○ Yes	○ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	○Yes	○ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○Yes	○ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○Yes	○ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	○Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	○ Yes	○ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	○ No
Summarize findings and basis; provide references to related reports or exhibits.			

Part 1 Result – Full Infiltration Geotechnical Screening[4]	Result
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.	○ Full infiltration Condition ◉ Complete Part 2

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
	Preliminary Phase

Criteria 3 : Infiltration Rate Screening	
3A	**NRCS Type C, D, or “urban/unclassified”:** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or “urban/unclassified” and corroborated by available site soil data? ○ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result. ⊙ Yes; the site is mapped as D soils or “urban/unclassified” and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer “Yes” to Criteria 3 Result. ○ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ○ Yes; the site may support partial infiltration. Answer “Yes” to Criteria 3 Result. ○ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer “No” to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ⊙ Yes; Continue to Criteria 4. ○ No: Skip to Part 2 Result.

Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate).

Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.065 inches per hour.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	◉ Yes	○ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	◉ Yes	○ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	◉ Yes	○ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	◉ Yes	○ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	◉ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	◉ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	◉ Yes	○ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	◉ Yes	○ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	◉ Yes	○ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	○ Yes	◉ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	◉ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]

Summarize findings and basis; provide references to related reports or exhibits.

Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.065 inches per hour. The site has a high expansion potential and with a increase in moisture due to infiltration it could heave proposed improvements. Therefore, no infiltration is recommended for this site.

Part 2 – Partial Infiltration Geotechnical Screening Result[5]	Result
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	○ Partial Infiltration Condition ◉ No Infiltration Condition

[5] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

PERC-4

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions[1]	Worksheet C.4-1: Form I-8A[2]
Part 1 - Full Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	**Project Phase:**
	Preliminary Phase
Criteria 1: Infiltration Rate Screening	
1A	Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper Type A or B and corroborated by available site soil data[3]? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result or continue to Step 1B if the applicant elects to perform infiltration testing. ○ No; the mapped soil types are A or B but is not corroborated by available site soil data (continue to Step 1B). ⊙ No; the mapped soil types are C, D, or "urban/unclassified" and is corroborated by available site soil data. Answer "No" to Criteria 1 Result. ○ No; the mapped soil types are C, D, or "urban/unclassified" but is not corroborated by available site soil data (continue to Step 1B).
1B	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1? ○ Yes; Continue to Step 1C. ○ No; Skip to Step 1D.
1C	Is the reliable infiltration rate calculated using planning phase methods from Table D.3-1 greater than 0.5 inches per hour? ○ Yes; the DMA may feasibly support full infiltration. Answer "Yes" to Criteria 1 Result. ○ No; full infiltration is not required. Answer "No" to Criteria 1 Result.
1D	**Infiltration Testing Method.** Is the selected infiltration testing method suitable during the design phase (see Appendix D.3)? Note: Alternative testing standards may be allowed with appropriate rationales and documentation. ○ Yes; continue to Step 1E. ○ No; select an appropriate infiltration testing method.

[1] Note that it is not required to investigate each and every criterion in the worksheet, a single "no" answer in Part 1, Part 2, Part 3, or Part 4 determines a full, partial, or no infiltration condition.

[2] This form must be completed each time there is a change to the site layout that would affect the infiltration feasibility condition. Previously completed forms shall be retained to document the evolution of the site storm water design.

[3] Available data includes site-specific sampling or observation of soil types or texture classes, such as obtained from borings or test pits necessary to support other design elements.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
1E	**Number of Percolation/Infiltration Tests.** Does the infiltration testing method performed satisfy the minimum number of tests specified in Table D.3-2? ○ Yes; continue to Step 1F. ○ No; conduct appropriate number of tests.
IF	**Factor of Safety.** Is the suitable Factor of Safety selected for full infiltration design? See guidance in D.5; Tables D.5-1 and D.5-2; and Worksheet D.5-1 (Form I-9). ○ Yes; continue to Step 1G. ○ No; select appropriate factor of safety.
1G	**Full Infiltration Feasibility.** Is the average measured infiltration rate divided by the Factor of Safety greater than 0.5 inches per hour? ○ Yes; answer "Yes" to Criteria 1 Result. ○ No; answer "No" to Criteria 1 Result.
Criteria 1 Result	Is the estimated reliable infiltration rate greater than 0.5 inches per hour within the DMA where runoff can reasonably be routed to a BMP? ○ Yes; the DMA may feasibly support full infiltration. Continue to Criteria 2. ◉ No; full infiltration is not required. Skip to Part 1 Result.
Summarize infiltration testing methods, testing locations, replicates, and results and summarize estimates of reliable infiltration rates according to procedures outlined in D.5. Documentation should be included in project geotechnical report. Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.05 inches per hour.	

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
Criteria 2: Geologic/Geotechnical Screening			
2A	If all questions in Step 2A are answered "Yes," continue to Step 2B. For any "No" answer in Step 2A answer "No" to Criteria 2, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
2A-1	Can the proposed full infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick below the infiltrating surface?	○ Yes	○ No
2A-2	Can the proposed full infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	○ Yes	○ No
2A-3	Can the proposed full infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	○ Yes	○ No
2B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 2B are answered "Yes," then answer "Yes" to Criteria 2 Result. If there are "No" answers continue to Step 2C.		
2B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can full infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	○ Yes	○ No
2B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can full infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011 or most recent edition). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can full infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	○Yes	○ No
2B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can full infiltration BMPs be proposed within the DMA without increasing slope stability risks?	○Yes	○ No
2B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can full infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	○Yes	○ No
2B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can full infiltration BMPs be proposed within the DMA using established setbacks from underground utilities, structures, and/or retaining walls?	○Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
2C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 2B. Provide a discussion of geologic/geotechnical hazards that would prevent full infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for full infiltration BMPs? If the question in Step 2 is answered "Yes," then answer "Yes" to Criteria 2 Result. If the question in Step 2C is answered "No," then answer "No" to Criteria 2 Result.	○ Yes	○ No
Criteria 2 Result	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	○ No
Summarize findings and basis; provide references to related reports or exhibits.			
Part 1 Result – Full Infiltration Geotechnical Screening [4]		**Result**	
If answers to both Criteria 1 and Criteria 2 are "Yes", a full infiltration design is potentially feasible based on Geotechnical conditions only. If either answer to Criteria 1 or Criteria 2 is "No", a full infiltration design is not required.		○ Full infiltration Condition ◉ Complete Part 2	

[4] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Part 2 – Partial vs. No Infiltration Feasibility Screening Criteria	
DMA(s) Being Analyzed:	Project Phase:
	Preliminary Phase
Criteria 3 : Infiltration Rate Screening	
3A	**NRCS Type C, D, or "urban/unclassified":** Is the mapped hydrologic soil group according to the NRCS Web Soil Survey or UC Davis Soil Web Mapper is Type C, D, or "urban/unclassified" and corroborated by available site soil data? ○ Yes; the site is mapped as C soils and a reliable infiltration rate of 0.15 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ⦿ Yes; the site is mapped as D soils or "urban/unclassified" and a reliable infiltration rate of 0.05 in/hr. is used to size partial infiltration BMPS. Answer "Yes" to Criteria 3 Result. ○ No; infiltration testing is conducted (refer to Table D.3-1), continue to Step 3B.
3B	**Infiltration Testing Result:** Is the reliable infiltration rate (i.e. average measured infiltration rate/2) greater than 0.05 in/hr. and less than or equal to 0.5 in/hr? ○ Yes; the site may support partial infiltration. Answer "Yes" to Criteria 3 Result. ○ No; the reliable infiltration rate (i.e. average measured rate/2) is less than 0.05 in/hr., partial infiltration is not required. Answer "No" to Criteria 3 Result.
Criteria 3 Result	Is the estimated reliable infiltration rate (i.e., average measured infiltration rate/2) greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour at any location within each DMA where runoff can reasonably be routed to a BMP? ⦿ Yes; Continue to Criteria 4. ○ No: Skip to Part 2 Result.
Summarize infiltration testing and/or mapping results (i.e. soil maps and series description used for infiltration rate). Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.05 inches per hour.	

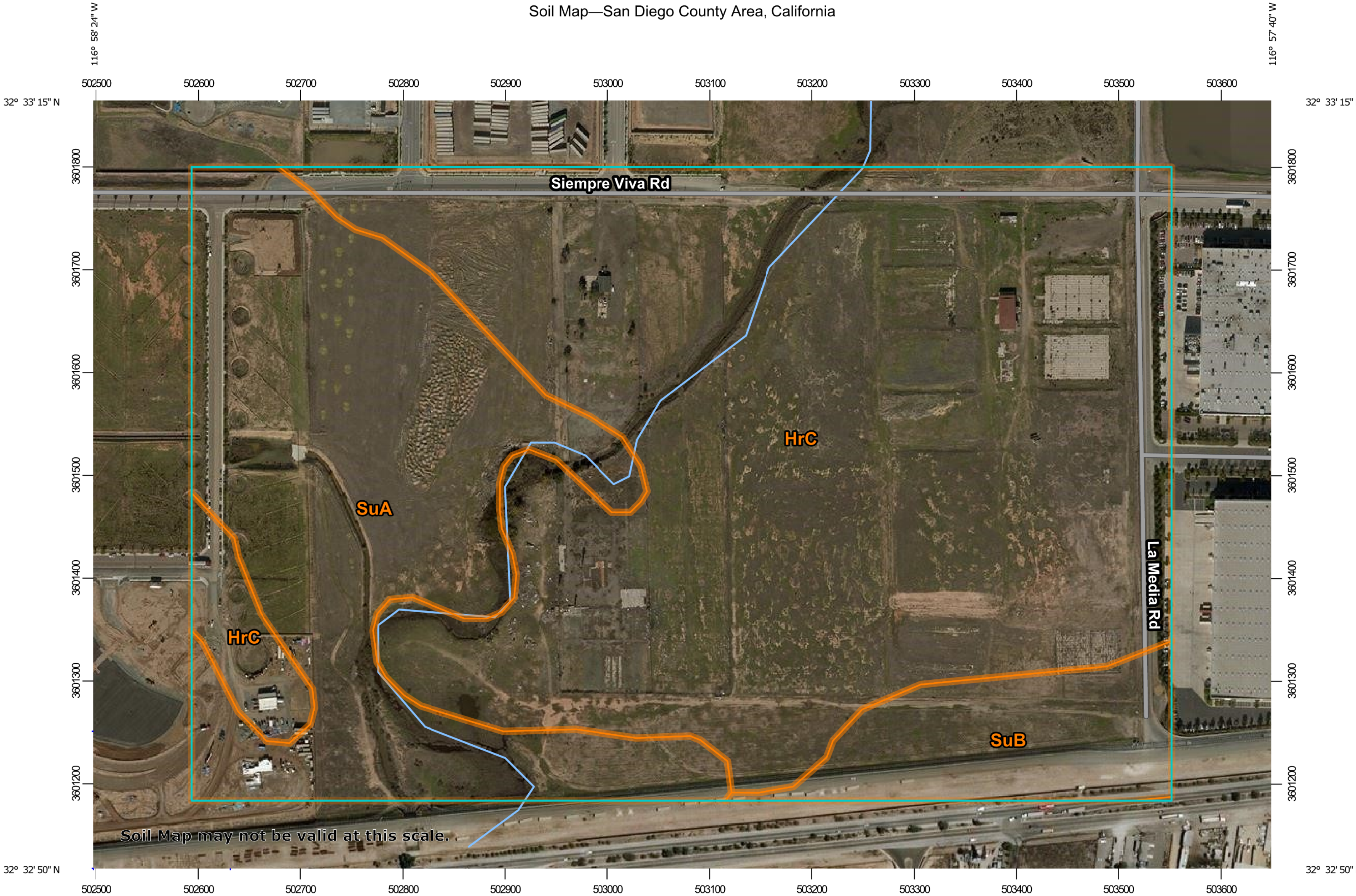
Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions			Worksheet C.4-1: Form I-8A[2]
Criteria 4: Geologic/Geotechnical Screening			
4A	If all questions in Step 4A are answered "Yes," continue to Step 2B. For any "No" answer in Step 4A answer "No" to Criteria 4 Result, and submit an "Infiltration Feasibility Condition Letter" that meets the requirements in Appendix C.1.1. The geologic/geotechnical analyses listed in Appendix C.2.1 do not apply to the DMA because one of the following setbacks cannot be avoided and therefore result in the DMA being in a no infiltration condition. The setbacks must be the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP.		
4A-1	Can the proposed partial infiltration BMP(s) avoid areas with existing fill materials greater than 5 feet thick?	◉ Yes	○ No
4A-2	Can the proposed partial infiltration BMP(s) avoid placement within 10 feet of existing underground utilities, structures, or retaining walls?	◉ Yes	○ No
4A-3	Can the proposed partial infiltration BMP(s) avoid placement within 50 feet of a natural slope (>25%) or within a distance of 1.5H from fill slopes where H is the height of the fill slope?	◉ Yes	○ No
4B	When full infiltration is determined to be feasible, a geotechnical investigation report must be prepared that considers the relevant factors identified in Appendix C.2.1. If all questions in Step 4B are answered "Yes," then answer "Yes" to Criteria 4 Result. If there are any "No" answers continue to Step 4C.		
4B-1	**Hydroconsolidation.** Analyze hydroconsolidation potential per approved ASTM standard due to a proposed full infiltration BMP. Can partial infiltration BMPs be proposed within the DMA without increasing hydroconsolidation risks?	◉ Yes	○ No
4B-2	**Expansive Soils.** Identify expansive soils (soils with an expansion index greater than 20) and the extent of such soils due to proposed full infiltration BMPs. Can partial infiltration BMPs be proposed within the DMA without increasing expansive soil risks?	○ Yes	◉ No
4B-3	**Liquefaction**. If applicable, identify mapped liquefaction areas. Evaluate liquefaction hazards in accordance with Section 6.4.2 of the City of San Diego's Guidelines for Geotechnical Reports (2011). Liquefaction hazard assessment shall take into account any increase in groundwater elevation or groundwater mounding that could occur as a result of proposed infiltration or percolation facilities. Can partial infiltration BMPs be proposed within the DMA without increasing liquefaction risks?	◉ Yes	○ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions		Worksheet C.4-1: Form I-8A[2]	
4B-4	**Slope Stability**. If applicable, perform a slope stability analysis in accordance with the ASCE and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California to determine minimum slope setbacks for full infiltration BMPs. See the City of San Diego's Guidelines for Geotechnical Reports (2011) to determine which type of slope stability analysis is required. Can partial infiltration BMPs be proposed within the DMA without increasing slope stability risks?	◉ Yes	○ No
4B-5	**Other Geotechnical Hazards.** Identify site-specific geotechnical hazards not already mentioned (refer to Appendix C.2.1). Can partial infiltration BMPs be proposed within the DMA without increasing risk of geologic or geotechnical hazards not already mentioned?	◉ Yes	○ No
4B-6	**Setbacks.** Establish setbacks from underground utilities, structures, and/or retaining walls. Reference applicable ASTM or other recognized standard in the geotechnical report. Can partial infiltration BMPs be proposed within the DMA using recommended setbacks from underground utilities, structures, and/or retaining walls?	◉ Yes	○ No
4C	**Mitigation Measures.** Propose mitigation measures for each geologic/geotechnical hazard identified in Step 4B. Provide a discussion on geologic/geotechnical hazards that would prevent partial infiltration BMPs that cannot be reasonably mitigated in the geotechnical report. See Appendix C.2.1.8 for a list of typically reasonable and typically unreasonable mitigation measures. Can mitigation measures be proposed to allow for partial infiltration BMPs? If the question in Step 4C is answered "Yes," then answer "Yes" to Criteria 4 Result. If the question in Step 4C is answered "No," then answer "No" to Criteria 4 Result.	○ Yes	◉ No
Criteria 4 Result	Can infiltration of greater than or equal to 0.05 inches/hour and less than or equal to 0.5 inches/hour be allowed without increasing the risk of geologic or geotechnical hazards that cannot be reasonably mitigated to an acceptable level?	○ Yes	◉ No

Categorization of Infiltration Feasibility Condition based on Geotechnical Conditions	Worksheet C.4-1: Form I-8A[2]
Summarize findings and basis; provide references to related reports or exhibits. Borehole percolation testing was performed to evaluate the infiltration rate at the site. The reliable infiltration rate was 0.05 inches per hour. The site has a high expansion potential and with a increase in moisture due to infiltration it could heave proposed improvements. Therefore, no infiltration is recommended for this site.	
Part 2 – Partial Infiltration Geotechnical Screening Result[5]	**Result**
If answers to both Criteria 3 and Criteria 4 are "Yes", a partial infiltration design is potentially feasible based on geotechnical conditions only. If answers to either Criteria 3 or Criteria 4 is "No", then infiltration of any volume is considered to be infeasible within the site.	○ Partial Infiltration Condition ◉ No Infiltration Condition

[5] To be completed using gathered site information and best professional judgement considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Soil Map—San Diego County Area, California



Map Scale: 1:5,270 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1000, 1500

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 13, Sep 12, 2018

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

Date(s) aerial images were photographed: May 2, 2010—Jan 4, 2015

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HrC	Huerhuero loam, 2 to 9 percent slopes	94.7	64.6%
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes	41.7	28.4%
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes	10.1	6.9%
Totals for Area of Interest		**146.6**	**100.0%**

Hydrologic Soil Group and Surface Runoff

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

Report—Hydrologic Soil Group and Surface Runoff

Absence of an entry indicates that the data were not estimated. The dash indicates no documented presence.

Hydrologic Soil Group and Surface Runoff–San Diego County Area, California			
Map symbol and soil name	**Pct. of map unit**	**Surface Runoff**	**Hydrologic Soil Group**
HrC—Huerhuero loam, 2 to 9 percent slopes			
Huerhuero	85	Very high	D

Hydrologic Soil Group and Surface Runoff–San Diego County Area, California			
Map symbol and soil name	**Pct. of map unit**	**Surface Runoff**	**Hydrologic Soil Group**
SuA—Stockpen gravelly clay loam, 0 to 2 percent slopes			
Stockpen	85	Very high	D
SuB—Stockpen gravelly clay loam, 2 to 5 percent slopes			
Stockpen	85	Very high	D

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 13, Sep 12, 2018

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

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

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

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

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

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–San Diego County Area, California

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
HrC—Huerhuero loam, 2 to 9 percent slopes														
Huerhuero	85	D	0-12	Loam	ML, CL-ML	A-4	0- 0- 0	0- 0- 0	95-98-100	90-95-100	80-88-95	50-63-75	25-30-35	5-8 -10
			12-55	Clay loam, clay	CL, CH	A-7	0- 0- 0	0- 0- 0	95-98-100	90-95-100	90-95-100	70-83-95	40-50-60	20-25-30
			55-72	Stratified sand to sandy loam	SC-SM	A-2	0- 0- 0	0- 0- 0	90-95-100	90-95-100	50-63-75	25-30-35	15-20-25	5-8 -10
SuA—Stockpen gravelly clay loam, 0 to 2 percent slopes														
Stockpen	85	D	0-3	Gravelly clay loam	CL	A-6	0- 0- 0	0- 0- 0	75-80-85	70-73-75	60-65-70	50-55-60	30-35-40	10-15-20
			3-21	Gravelly clay	CH	A-7	0- 0- 0	0- 0- 0	75-80-85	70-73-75	60-68-75	50-58-65	50-58-65	25-30-35
			21-60	Clay	CH	A-7	0- 0- 0	0- 0- 0	80-90-100	75-85-95	70-83-95	60-75-90	50-55-60	25-30-35

Engineering Properties–San Diego County Area, California														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
SuB—Stockpen gravelly clay loam, 2 to 5 percent slopes														
Stockpen	85	D	0-3	Gravelly clay loam	CL	A-6	0- 0- 0	0- 0- 0	75-80-85	70-73-75	60-65-70	50-55-60	30-35-40	10-15-20
			3-21	Gravelly clay	CH	A-7	0- 0- 0	0- 0- 0	75-80-85	70-73-75	60-68-75	50-58-65	50-58-65	25-30-35
			21-60	Clay	CH	A-7	0- 0- 0	0- 0- 0	80-90-100	75-85-95	70-83-95	60-75-90	50-55-60	25-30-35

Data Source Information

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 13, Sep 12, 2018

Percolation Test Data Sheet

Project: Otay Cross Border Xpress

Tested By: Selene Murdock

Date: 3/20/2019

Project No: 20193578.001A

Checked By:

Borehole ID: **PERC-1**

Depth of Borehole:	5	feet
Diameter of Borehole:	8	inches
USCS Soil Classification:	SC	
PVC Pipe Hieght above Surface	0	ft

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to water (feet)	Final Depth to Water (feet)	Change in Water Level (feet)	Percolation Rate (min./in.)
1	8:39	9:09	30	3.45	3.48	0.03	83.33
2	9:09	9:39	30	3.48	3.50	0.02	125.00
3	9:39	10:09	30	3.50	3.53	0.03	83.33
4	10:10	10:40	30	3.19	3.21	0.02	125.00
5	10:40	11:10	30	3.21	3.25	0.04	62.50
6	11:10	11:40	30	3.25	3.28	0.03	83.33
7	11:40	12:10	30	3.28	3.31	0.03	83.33
8	12:10	12:40	30	3.31	3.33	0.02	125.00
9	12:40	1:10	30	3.33	3.37	0.04	62.50
10	1:10	1:40	30	3.37	3.40	0.03	83.33
11	1:40	2:10	30	3.40	3.42	0.02	125.00
12	2:10	2:40	30	3.42	3.44	0.02	**125.00**

Porchet Method Conversion - to convert percolation rate to tested infiltration rate

Reference:

H.P. Ritzema, 1994, "Drainage Principles and Applications", International Institute for Land Reclamation and Improvement, Publication 16, 2nd revised edition, Wageningen, The Netherlands

$$I_t = \frac{\Delta H \; 60 \; r}{\Delta t \; (r + 2Havg)}$$

Ho = Original height of water column in hole (inches)
Hf = Final height of water column in hole (inches)
ΔH = Change in head over the time interval (inches)
Havg = Average head over the time interval (inches)
Δt = Time interval (minutes)
r = Effective radius of test hole (inches)
It = Tested infiltration rate (inch/hour)

Conversion Parameters (for 8 inch hole)		
Ho	18.96	inches
Hf	18.72	inches
ΔH	0.24	inches
Havg	18.84	inches
Δt	30.00	minutes
r	4.00	inches
It	**0.05**	in/hr

Percolation Test Data Sheet

Project:	Otay Cross Border Xpress	Tested By:	Selene Murdock
		Date:	3/20/2019
Project No:	20193578.001A	Checked By:	

Borehole ID:	**PERC-2**	
Depth of Borehole:	5	feet
Diameter of Borehole:	8	inches
USCS Soil Classification:	SC	
PVC Pipe Hieght above Surface	0	ft

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to water (feet)	Final Depth to Water (feet)	Change in Water Level (feet)	Percolation Rate (min./in.)
1	8:41	9:11	30	2.59	2.59	0	NA
2	9:11	9:41	30	2.59	2.60	0.01	250.00
3	9:41	10:11	30	2.60	2.60	0	NA
4	10:11	10:41	30	2.60	2.61	0.01	250.00
5	10:41	11:11	30	2.61	2.61	0	NA
6	11:11	11:41	30	2.61	2.62	0.01	250.00
7	11:41	12:11	30	2.62	2.62	0	NA
8	12:11	12:41	30	2.62	2.63	0.01	250.00
9	12:41	13:11	30	2.63	2.64	0.01	250.00
10	13:11	13:41	30	2.64	2.65	0.01	250.00
11	13:41	14:11	30	2.65	2.66	0.01	250.00
12	14:11	14:41	30	2.66	2.67	0.01	**250.00**

Porchet Method Conversion - to convert percolation rate to tested infiltration rate

Reference:
H.P. Ritzema, 1994, "Drainage Principles and Applications", International Institute for Land Reclamation and Improvement, Publication 16, 2nd revised edition, Wageningen, The Netherlands

$$I_t = \frac{\Delta H\ 60\ r}{\Delta t\ (r + 2Havg)}$$

Ho = Original height of water column in hole (inches)
Hf = Final height of water column in hole (inches)
ΔH = Change in head over the time interval (inches)
Havg = Average head over the time interval (inches)
Δt = Time interval (minutes)
r = Effective radius of test hole (inches)
It = Tested infiltration rate (inch/hour)

Conversion Parameters (for 8 inch hole)		
Ho	28.08	inches
Hf	27.96	inches
ΔH	0.12	inches
Havg	28.02	inches
Δt	30.00	minutes
r	4.00	inches
It	**0.02**	in/hr

Percolation Test Data Sheet

Project:	Otay Cross Border Xpress	Tested By:	Selene Murdock
		Date:	3/20/2019
Project No:	20193578.001A	Checked By:	

Borehole ID:	**PERC-3**	
Depth of Borehole:	5	feet
Diameter of Borehole:	8	inches
USCS Soil Classification:	SC	
PVC Pipe Hieght above Surface	0	ft

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to water (feet)	Final Depth to Water (feet)	Change in Water Level (feet)	Percolation Rate (min./in.)
1	8:50	9:20	30	3.65	3.77	0.12	20.83
2	9:20	9:50	30	3.77	3.80	0.03	83.33
3	9:52	10:22	30	3.57	3.65	0.08	31.25
4	10:22	10:52	30	3.65	3.72	0.07	35.71
5	10:52	11:22	30	3.72	3.79	0.07	35.71
6	11:22	11:52	30	3.56	3.60	0.04	62.50
7	11:52	12:22	30	3.60	3.71	0.11	22.73
8	12:22	12:52	30	3.71	3.76	0.05	50.00
9	12:53	13:23	30	3.55	3.59	0.04	62.50
10	13:23	13:53	30	3.59	3.68	0.09	27.78
11	13:53	14:23	30	3.68	3.77	0.09	27.78
12	14:23	14:53	30	3.55	3.60	0.05	**50.00**

Porchet Method Conversion - to convert percolation rate to tested infiltration rate

Reference:
H.P. Ritzema, 1994, "Drainage Principles and Applications", International Institute for Land Reclamation and Improvement, Publication 16, 2nd revised edition, Wageningen, The Netherlands

$$I_t = \frac{\Delta H\ 60\ r}{\Delta t\ (r + 2Havg)}$$

Ho = Original height of water column in hole (inches)
Hf = Final height of water column in hole (inches)
ΔH = Change in head over the time interval (inches)
Havg = Average head over the time interval (inches)
Δt = Time interval (minutes)
r = Effective radius of test hole (inches)
It = Tested infiltration rate (inch/hour)

Conversion Parameters (for 8 inch hole)		
Ho	17.40	inches
Hf	16.80	inches
ΔH	0.60	inches
Havg	17.10	inches
Δt	30.00	minutes
r	4.00	inches
It	**0.13**	in/hr

Percolation Test Data Sheet

Project:	Otay Cross Border Xpress	Tested By:	Selene Murdock
		Date:	3/20/2019
Project No:	20193578.001A	Checked By:	

Borehole ID:	**PERC-4**	
Depth of Borehole:	5	feet
Diameter of Borehole:	8	inches
USCS Soil Classification:	SC	
PVC Pipe Hieght above Surface	0	ft

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to water (feet)	Final Depth to Water (feet)	Change in Water Level (feet)	Percolation Rate (min./in.)
1	8:53	9:23	30	3.25	3.30	0.05	50.00
2	9:23	9:53	30	3.30	3.38	0.08	31.25
3	9:53	10:23	30	3.38	3.45	0.07	35.71
4	10:23	10:53	30	3.45	3.50	0.05	50.00
5	10:53	11:23	30	3.50	3.55	0.05	50.00
6	11:23	11:53	30	3.55	3.60	0.05	50.00
7	11:53	12:23	30	3.60	3.62	0.02	125.00
8	12:23	12:53	30	3.62	3.68	0.06	41.67
9	12:54	13:24	30	3.40	3.43	0.03	83.33
10	13:24	13:54	30	3.43	3.44	0.01	250.00
11	13:54	14:24	30	3.44	3.51	0.07	35.71
12	14:24	14:54	30	3.51	3.55	0.04	**62.50**

Porchet Method Conversion - to convert percolation rate to tested infiltration rate

Reference:
H.P. Ritzema, 1994, "Drainage Principles and Applications", International Institute for Land Reclamation and Improvement, Publication 16, 2nd revised edition, Wageningen, The Netherlands

$$I_t = \frac{\Delta H\ 60\ r}{\Delta t\ (r + 2Havg)}$$

Ho = Original height of water column in hole (inches)
Hf = Final height of water column in hole (inches)
ΔH = Change in head over the time interval (inches)
Havg = Average head over the time interval (inches)
Δt = Time interval (minutes)
r = Effective radius of test hole (inches)
It = Tested infiltration rate (inch/hour)

Conversion Parameters (for 8 inch hole)		
Ho	17.88	inches
Hf	17.40	inches
ΔH	0.48	inches
Havg	17.64	inches
Δt	30.00	minutes
r	4.00	inches
It	**0.10**	in/hr