REPORT OF PRELIMINARY
GEOTECHNICAL INVESTIGATION
Coppel Residence
8194 Prestwick Drive
La Jolla, California

JOB NO. 14-10569
18 August 2015

Prepared for:

Rodolfo and Maria Coppel

Geotechnical Exploration, Inc.
SOIL AND FOUNDATION ENGINEERING ● GROUNDWATER ● ENGINEERING GEOLOGY

18 August 2015

Rodolfo and Maria Coppel
8194 Prestwick Drive
La Jolla, CA 92037

Job No. 14-10569

Subject: **Report of Preliminary Geotechnical Investigation**
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Dear Mr. and Mrs. Coppel:

At the request of Island Architects and in accordance with our proposal of December 4, 2014, ***Geotechnical Exploration, Inc.*** has prepared this report per current City of San Diego guidelines of the geotechnical and general geologic conditions at the location of the existing residential lot. The original field work, including three exploratory borings, was performed on June 20, 2014, although a report was never prepared. As part of the report preparation, we reviewed the field and laboratory data, as well as the current plans prepared by Island Architects, dated July 10, 2015.

In our opinion, if the conclusions and recommendations presented in this report are implemented during site preparation and construction, the site will be suited for the proposed residential structure and improvements.

This opportunity to be of service is sincerely appreciated. Should you have any questions concerning the following report, please do not hesitate to contact us. Reference to our **Job No. 14-10569** will expedite a response to your inquiries.

Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

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The following report presents the findings and recommendations of ***Geotechnical Exploration, Inc.*** for the subject project.

I. PROJECT SUMMARY

It is our understanding, based on communications with your architect and review of preliminary plans prepared by Island Architects dated July 10, 2015, that the existing structure will be removed and the lot is being developed to receive a new single-family residence with a basement, attached garage and associated improvements. The new structure is to be constructed of standard-type building materials utilizing a caisson and grade beam foundation system with structurally designed slab-on-grade floors.

Final construction plans have not been provided to us during the preparation of this report, however, when completed they should be made available for our review.

II. SCOPE OF WORK

The scope of work performed for the preparation of this report included review of available published information pertaining to the site geology, incorporation of the 2014 site reconnaissance, subsurface exploration program and laboratory testing, and geotechnical engineering analysis of the research, field and laboratory data obtained in 2014. Information from the previous exploratory borings and laboratory testing have been utilized in the preparation of this current report.

III. SUMMARY OF GEOTECHNICAL & GEOLOGIC FINDINGS

Our 2014 subsurface investigation revealed the lot to be underlain by stiff to very stiff, sandy clay formational materials with 5½ to approximately 31 feet of stiff to very stiff, damp to moist, sandy clay fill soils. Due to the significant differential thickness, these fill soils will have some potential for differential settlement of the proposed structure and associated improvements. We recommend that the proposed structure be founded on a caisson and grade beam foundation system with structurally designed slabs The underlying formational soils, have good bearing strength characteristics, and are suitable for support of the proposed structural loads.

All foundations for the proposed new structure and improvements should be founded into the underlying stiff to very stiff formational materials or properly compacted fill soils. In proposed improvement areas, the existing fill soils will require removal and recompaction to a depth of 3 feet prior to placement of new fill or improvements. Excavation for the basement will result in the removal of the upper 10 feet of fill soil, reducing the total depth of the caissons in the basement area.

In our opinion, the site is suited for the proposed residential construction provided the recommendations provided in this report are implemented during site development. A combination of conventional construction techniques and materials with caissons and grade beams can be utilized. Detailed final construction plans should be made available for our review when available.

The proposed work will not, in our opinion, destabilize or result in settlement of adjacent property if the recommendations presented in this report are implemented. In addition, temporary cuts for proposed retaining walls will not, in our opinion, destabilize existing slopes. Further, there are no geologic hazards on or near the site that would prohibit the construction of the new residential improvements.

IV. SITE DESCRIPTION

The lot is known as: Assessor's Parcel No. 346-333-03-00, Lot 69, according to Recorded Map No. 4392, in the City and County of San Diego, State of California. Refer to Figure No. I, the Vicinity Map, for the site location.

The rectangular-shaped lot is located at 8194 Prestwick Drive in the La Jolla area of the City of San Diego. The lot consists of approximately 12,125 square feet and a single-story, single-family residence currently exists on the property. The lot is bordered on the north and south by similar residential properties at the approximate same elevations; on the west by similar residential properties along the east side of Calle Del Oro; and on the east by Prestwick Drive. The western portion of the lot consists of an approximately 60-foot-high, westerly descending fill over natural slope (see Figure No. II, the Plot Plan). Vegetation consists of ornamental landscaping with shrubbery and a few trees.

The property consists of a relatively level building pad at an approximate elevation of 315 feet above Mean Sea Level (MSL). Elevations across the property range from approximately 325 feet (MSL) along the east side of the property adjacent to Prestwick Drive to 237 feet above MSL at the southwest property corner. Survey

information concerning approximate elevations across the site was obtained from a site plan with topographic data prepared by Island Architects, dated July 14, 2015.

V. FIELD INVESTIGATION

A. Exploratory Excavations

Three exploratory borings were placed on the site on June 20, 2014. The borings were placed in order to retrieve representative soil samples and to define the soil profile across the property. The boring logs are included as Figure Nos. IIIa-c in this report. For the exploratory boring locations, refer to the Site Plan and Site-specific Geologic Map, Figure No. II.

The borings were excavated to depths ranging from approximately 7½ feet to 33 feet. The data obtained from the prior borings was utilized in the preparation of this report.

Our field representatives logged the soils encountered in the borings. Both bulk and in situ samples were taken of the encountered predominant soil types. The excavation logs were prepared on the basis of our observations and laboratory testing. The results of the 2014 laboratory testing are presented in Figure No. IV of this report. The predominant soils have been classified per applicable portions of the Unified Soil Classification System (see Appendix A).

B. Slope Observations

The stability of the existing westerly descending slope on the western half of the property should not be affected by the planned residential development if proper

drainage and irrigation practices are implemented. The descending fill over natural slope is at an approximate gradient of 1.5:1.0 and was observed to be in good condition with no evidence of instability or prior slope failure.

VI. LABORATORY TESTS & SOIL INFORMATION

Laboratory tests were performed in 2014 on retrieved soil samples in order to evaluate their physical and mechanical properties. The 2014 test results are presented on Figure Nos. III and IV. The following tests were conducted on representative soil samples:

1. *Moisture Content (ASTM D2216)*
2. *Density Measurements (ASTM D2937)*
3. *Laboratory Compaction Characteristics (ASTM D1557)*
4. *Determination of Percentage of Particles Smaller than #200 Sieve (ASTM D1140)*
5. *Standard Test Method for Particle Size Analysis of Soils (ASTM D422)*
6. *Standard Test Method for Expansion Index of Soils (ASTM D4829)*
7. *Standard Test Method for Direct Shear Test of Soils under Consolidated Drained Conditions (ASTM D3080)*

The moisture content of a soil sample (ASTM D2216) is a measure of the water content, expressed as a percentage of the dry weight of the sample. Moisture content and density measurements (ASTM D2937) were performed to establish the in situ moisture and density of samples retrieved from the exploratory excavations. The dry soil weights were compared to the laboratory maximum dry density of the same soil to determine relative compaction.

Laboratory compaction values (ASTM D1557) establish the optimum moisture content and the laboratory maximum dry density of the tested soils. The relationship between the moisture and density of remolded soil samples helps to establish the relative compaction of the existing fill soils and soil compaction conditions to be anticipated during any future grading operation.

The passing -200 sieve size analysis (ASTM D1140) and particle size analysis (ASTM D422) aid in classification of the tested soils based on their fine material content and provide qualitative information related to engineering characteristics such as expansion potential, permeability, and shear strength.

The expansion potential of soils is determined, when necessary, utilizing the Standard Test Method for Expansion Index of Soils (ASTM D4829). In accordance with the Standard (Table 5.3), potentially expansive soils are classified as follows:

EXPANSION INDEX	***POTENTIAL EXPANSION***
0 to 20	Very low
21 to 50	Low
51 to 90	Medium
91 to 130	High
Above 130	Very high

Based on the 2014 test results, the sampled and tested soils on the site have a medium expansion potential, with a maximum measured expansion index of 74. It is our opinion that the on-site soils in general possess a low to medium expansion potential.

Direct shear tests (ASTM D3080) were performed in 2014 on soil samples obtained from our borings in order to evaluate strength characteristics of the soils comprising the descending slope. The shear tests were performed with a constant strain rate direct shear machine. The specimens tested were saturated and then sheared under various normal loads.

Based on the field and laboratory test data, our observations of the primary soil types on the project, and our previous experience with laboratory testing of similar soils, our Geotechnical Engineer has assigned values for friction angle, coefficient of friction, and cohesion for those soils that will have significant lateral support or load bearing functions on the project. These values have been utilized in assigning the recommended bearing value as well as active and passive earth pressure design criteria for foundations, retaining walls, slope stability analyses, etc.

VII. REGIONAL GEOLOGIC DESCRIPTION

San Diego County has been divided into three major geomorphic provinces: the Coastal Plain, the Peninsular Ranges and the Salton Trough. The Coastal Plain exists west of the Peninsular Ranges. The Salton Trough is east of the Peninsular Ranges. These divisions are the result of the basic geologic distinctions between the areas. Mesozoic metavolcanic, metasedimentary and plutonic rocks predominate in the Peninsular Ranges with primarily Cenozoic sedimentary rocks to the west and east of this central mountain range (Demere, 1997).

In the Coastal Plain region, where the subject property is located, the "basement" consists of Mesozoic crystalline rocks. Basement rocks are also exposed as high relief areas (e.g., Black Mountain northeast of the subject property and Cowles Mountain near the San Carlos area of San Diego). Younger Cretaceous and Tertiary

sediments lap up against these older features. These sediments form a "*layer cake*" sequence of marine and non-marine sedimentary rock units, with some formations up to 140 million years old. Faulting related to the La Nacion and Rose Canyon Fault zones has broken up this sequence into a number of distinct fault blocks in the southwestern part of the county. Northwestern portions of the county are relatively undeformed by faulting (Demere, 1997).

The Peninsular Ranges form the granitic spine of San Diego County. These rocks are primarily plutonic, forming at depth beneath the earth's crust 140 to 90 million years ago as the result of the subduction of an oceanic crustal plate beneath the North American continent. These rocks formed the much larger Southern California batholith. Metamorphism associated with the intrusion of these great granitic masses affected the much older sediments that existed near the surface over that period of time. These metasedimentary rocks remain as roof pendants of marble, schist, slate, quartzite and gneiss throughout the Peninsular Ranges. Locally, Miocene-age volcanic rocks and flows have also accumulated within these mountains (e.g., Jacumba Valley). Regional tectonic forces and erosion over time have uplifted and unroofed these granitic rocks to expose them at the surface (Demere, 1997).

The Salton Trough is the northerly extension of the Gulf of California. This zone is undergoing active deformation related to faulting along the Elsinore and San Jacinto Fault Zones, which are part of the major regional tectonic feature in the southwestern portion of California, the San Andreas Fault Zone. Translational movement along these fault zones has resulted in crustal rifting and subsidence. The Salton Trough, also referred to as the Colorado Desert, has been filled with sediments to depth of approximately 5 miles since the movement began in the early Miocene, 24 million years ago. The source of these sediments has been the

local mountains as well as the ancestral and modern Colorado River (Demere, 1997).

As indicated previously, the San Diego area is part of a seismically active region of California. It is on the eastern boundary of the Southern California Continental Borderland, part of the Peninsular Ranges Geomorphic Province. This region is part of a broad tectonic boundary between the North American and Pacific Plates. The actual plate boundary is characterized by a complex system of active, major, right-lateral strike-slip faults, trending northwest/southeast. This fault system extends eastward to the San Andreas Fault (approximately 70 miles from San Diego) and westward to the San Clemente Fault (approximately 50 miles off-shore from San Diego) (Berger and Schug, 1991).

In California, major earthquakes can generally be correlated with movement on active faults. As defined by the California Division of Mines and Geology (Hart, E.W., 1980), an "active" fault is one that has had ground surface displacement within Holocene time (about the last 11,000 years). Additionally, faults along which major historical earthquakes have occurred (about the last 210 years in California) are also considered to be active (Association of Engineering Geologist, 1973). The California Division of Mines and Geology (now the California Geological Survey) defines a *"potentially active"* fault as one that has had ground surface displacement during Quaternary time, that is, between 11,000 and 1.6 million years (Hart, E.W., 1980).

During recent history, prior to April 2010, the San Diego County area has been relatively quiet seismically. No fault ruptures or major earthquakes had been experienced in historic time within the greater San Diego area. Since earthquakes have been recorded by instruments (since the 1930s), the San Diego area has

experienced scattered seismic events with Richter magnitudes generally less than M4.0. During June 1985, a series of small earthquakes occurred beneath San Diego Bay, three of which were recorded at M4.0 to M4.2. In addition, the Oceanside earthquake of July 13, 1986, located approximately 26 miles offshore of the City of Oceanside, had a magnitude of M5.3 (Hauksson and Jones, 1988).

On June 15, 2004, a M5.3 earthquake occurred approximately 45 miles southwest of downtown San Diego (26 miles west of Rosarito, Mexico). Although this earthquake was widely felt, no significant damage was reported. Another widely felt earthquake on a distant southern California fault was a M5.4 event that took place on July 29, 2008, west-southwest of the Chino Hills area of Riverside County.

Several earthquakes ranging from M5.0 to M6.0 occurred in northern Baja California, centered in the Gulf of California on August 3, 2009. These were felt in San Diego but no injuries or damage was reported. A M5.8 earthquake followed by a M4.9 aftershock occurred on December 30, 2009, centered about 20 miles south of the Mexican border city of Mexicali. These were also felt in San Diego, swaying high-rise buildings, but again no significant damage or injuries were reported.

On Easter Sunday April 4, 2010, a large earthquake occurred in Baja California, Mexico. It was widely felt throughout the southwest including Phoenix, Arizona and San Diego in California. This M7.2 event, the Sierra El Mayor earthquake, occurred in northern Baja California, approximately 40 miles south of the Mexico-USA border at shallow depth along the principal plate boundary between the North American and Pacific plates. According to the U. S. Geological Survey this is an area with a high level of historical seismicity, and it has recently also been seismically active, though this is the largest event to strike in this area since 1892. The April 4, 2010, earthquake appears to have been larger than the M6.9 earthquake in 1940 or any

of the early 20th century events (e.g., 1915 and 1934) in this region of northern Baja California. The event caused widespread damage to structures, closure of businesses, government offices and schools, power outages, displacement of people from their homes and injuries in the nearby major metropolitan areas of Mexicali in Mexico and Calexico in Southern California.

This event's aftershock zone extends significantly to the northwest, overlapping with the portion of the fault system that is thought to have ruptured in 1892. Some structures in the San Diego area experienced minor damage and there were some injuries. Ground motions for the April 4, 2010, main event, recorded at stations in San Diego and reported by the California Strong Motion Instrumentation Program (CSMIP), ranged up to 0.058g. Aftershocks from this event continue to the date of this report along the trend northwest and south of the original event, including within San Diego County, closer to the San Diego metropolitan area. There have been hundreds of these earthquakes including events up to M5.7.

On July 7, 2010, a M5.4 earthquake occurred in Southern California at 4:53 pm (Pacific Time) about 30 miles south of Palm Springs, 25 miles southwest of Indio, and 13 miles north-northwest of Borrego Springs. The earthquake occurred near the Coyote Creek segment of the San Jacinto Fault. The earthquake exhibited right lateral slip to the northwest, consistent with the direction of movement on the San Jacinto Fault. The earthquake was felt throughout Southern California, with strong shaking near the epicenter. It was followed by more than 60 aftershocks of M1.3 and greater during the first hour. Seismologists expect continued aftershock activity.

In the last 50 years, there have been four other earthquakes in the magnitude M5.0 range within 20 kilometers of the Coyote Creek segment: M5.8 in 1968, M5.3 on 2/25/1980, M5.0 on 10/31/2001, and M5.2 on 6/12/2005. The biggest earthquake near this location was the M6.0 Buck Ridge earthquake on 3/25/1937.

VIII. SITE-SPECIFIC SOIL & GEOLOGIC DESCRIPTION

A. Stratigraphy

Our field work, reconnaissance and review of the *"Geologic Map of the La Jolla Quadrangle"* contained within California Division of Mines and Geology (now the California Geological Survey) Bulletin 200 *"Geology of the San Diego Metropolitan Area, California"* (Michael P. Kennedy, 1975) and the updated geologic maps by Kennedy and Tan, 2005 and 2008, *"Geologic Map of San Diego, 30'x60' Quadrangle, CA,"* indicate that the site is underlain by Eocene-age Ardath Shale (Ta) formational materials. The formational soils are overlain by less than 5½ feet to approximately 31 feet of fill soil. Figure No. VI presents a plan view geologic map (Kennedy and Tan, 2008) of the general area of the site, and Figure No. VII displays the geologic hazards of the area.

Fill Soils (Qaf): The proposed building pad area is overlain by approximately 5.5 to 31 feet of fill soil as encountered at the locations of exploratory borings B-1 through B-3. The encountered fill soils consist of stiff to very stiff, yellow and gray-brown, sandy clay. These fill soils are generally damp to moist, of medium expansion potential and due to the significant differential thickness, have some differential settlement potential.

Ardath Shale Formation (Ta): The encountered formational materials consist of hard, moist, orange and gray-brown, sandy clay. The formational soils were encountered at depths ranging from less than 5½ feet to approximately 31 feet. The formational soils have a medium expansion potential and good bearing strength characteristics. Refer to Figure Nos. III and IV.

B. Structure

Observations of nearby bedrock exposures and review of the referenced geologic map indicate that the layered formational materials of the Ardath Shale Formation (Ta) strike generally N20°W to N65°W and dip northeast at angles of 3 to 5 degrees. The direction of dip is approximately parallel to the hillside and not out of slope.

The site is underlain by relatively stable formational materials of the Ardath Shale Formation (Ta) and no adverse geologic conditions are expected. The measured dips parallel to the hillside are considered to be a relatively stable geologic condition.

A review of the City of San Diego Geologic Hazards Map indicates that no faults are mapped on the site. The active Rose Canyon Fault Zone (RCFZ) is mapped approximately ½-mile west of the property. Aerial photograph review indicates that the site is not underlain by landslides or unstable natural slopes.

IX. GEOLOGIC HAZARDS

A review of the City of San Diego Seismic Safety Study, Geologic Hazards Map Sheet No. 29, indicates that the site is located in a low to moderate risk geologic

hazard area designated as Category 26. Category 26 is identified as being underlain by *"slide-prone formations"* specifically the Ardath Formation with *"unfavorable geologic structure."* In our opinion, the geologic risk is considered low due to the favorable dips within the formational materials. An excerpted portion of the Geologic Hazards Map Sheet 29 and the legend are presented as Figure No. VII.

The following is a discussion of the geologic conditions and hazards common to this area of the City of San Diego, as well as project-specific geologic information relating to development of the subject property.

A. Local and Regional Faults

Reference to the geologic map of the area, Figure No. VI (Kennedy and Tan, 2008), and the City of San Diego Seismic Safety Study, Geologic Hazards Map No. 29, Figure No. VII, indicates that no faults are shown to cross the site. In our explicit professional opinion, neither an active fault nor a potentially active fault underlies the site.

Rose Canyon Fault: The Rose Canyon Fault Zone (Mount Soledad and Rose Canyon Faults) is located approximately ½-mile west of the subject site. The Rose Canyon Fault is mapped trending north-south from Oceanside to downtown San Diego, from where it appears to head southward into San Diego Bay, through Coronado and offshore. The Rose Canyon Fault Zone is considered to be a complex zone of onshore and offshore, en echelon strike slip, oblique reverse, and oblique normal faults. The Rose Canyon Fault is considered to be capable of generating an M7.2 earthquake and is considered microseismically active, although no significant recent earthquakes are known to have occurred on the fault.

Investigative work on faults that are part of the Rose Canyon Fault Zone at the Police Administration and Technical Center in downtown San Diego, at the SDG&E facility in Rose Canyon, and within San Diego Bay and elsewhere within downtown San Diego, has encountered offsets in Holocene (geologically recent) sediments. These findings confirm Holocene displacement on the Rose Canyon Fault, which was designated an *"active"* fault in November 1991 (Hart E.W. and W. A. Bryant, 2007, Fault-Rupture Hazard Zones in California, California Geological Survey Special Publication 42).

Coronado Bank Fault: The Coronado Bank Fault is located approximately 13 miles southwest of the site. Evidence for this fault is based upon geophysical data (acoustic profiles) and the general alignment of epicenters of recorded seismic activity (Greene, 1979). The Oceanside earthquake of M5.3 recorded July 13, 1986, is known to have been centered on the fault or within the Coronado Bank Fault Zone. Although this fault is considered active, due to the seismicity within the fault zone, it is significantly less active seismically than the Elsinore Fault (Hileman, 1973). It is postulated that the Coronado Bank Fault is capable of generating a M7.6 earthquake and is of great interest due to its close proximity to the greater San Diego metropolitan area.

Newport-Inglewood Fault: The Newport-Inglewood Fault Zone is located approximately 23 miles northwest of the site. A significant earthquake (M6.4) occurred along this fault on March 10, 1933. Since then no additional significant events have occurred. The fault is believed to have a slip rate of approximately 0.6 mm/yr with an unknown recurrence interval. This fault is believed capable of producing an earthquake of M6.0 to M7.4 (SCEC, 2004).

Elsinore Fault: The Elsinore Fault is located approximately 37 to 54 miles east and northeast of the site. The fault extends approximately 200 kilometers (125 miles) from the Mexican border to the northern end of the Santa Ana Mountains. The Elsinore Fault zone is a 1- to 4-mile-wide, northwest-southeast-trending zone of discontinuous and en echelon faults extending through portions of Orange, Riverside, San Diego, and Imperial Counties. Individual faults within the Elsinore Fault Zone range from less than 1 mile to 16 miles in length. The trend, length and geomorphic expression of the Elsinore Fault Zone identify it as being a part of the highly active San Andreas Fault system.

Like the other faults in the San Andreas system, the Elsinore Fault is a transverse fault showing predominantly right-lateral movement. According to Hart, et al. (1979), this movement averages less than 1 centimeter per year. Along most of its length, the Elsinore Fault Zone is marked by a bold topographic expression consisting of linearly aligned ridges, swales and hallows. Faulted Holocene alluvial deposits (believed to be less than 11,000 years old) found along several segments of the fault zone suggest that at least part of the zone is currently active.

Although the Elsinore Fault Zone belongs to the San Andreas set of active, northwest-trending, right-slip faults in the southern California area (Crowell, 1962), it has not been the site of a major earthquake in historic time, other than a M6.0 earthquake near the town of Elsinore in 1910 (Richter, 1958; Toppozada and Parke, 1982). However, based on length and evidence of late-Pleistocene or Holocene displacement, Greensfelder (1974) has estimated that the Elsinore Fault Zone is reasonably capable of generating an earthquake ranging from M6.8 to M7.1. Faulting evidence exposed in trenches placed in Glen Ivy Marsh across the Glen Ivy North Fault (a strand of the Elsinore Fault Zone between Corona and Lake Elsinore), suggest a maximum earthquake recurrence interval of 300 years, and when

combined with previous estimates of the long-term horizontal slip rate of 0.8 to 7.0 mm/year, suggest typical earthquakes of M6.0 to M7.0 (Rockwell, 1985).

San Jacinto Fault: The San Jacinto Fault is located 59 to 80 miles to the northeast of the site. The San Jacinto Fault Zone consists of a series of closely spaced faults, including the Coyote Creek Fault, that form the western margin of the San Jacinto Mountains. The fault zone extends from its junction with the San Andreas Fault in San Bernardino, southeasterly toward the Brawley area, where it continues south of the international border as the Imperial Transform Fault (Earth Consultants International [ECI], 2009).

The San Jacinto Fault zone has a high level of historical seismic activity, with at least 10 damaging earthquakes (M6.0 to M7.0) having occurred on this fault zone between 1890 and 1986. Earthquakes on the San Jacinto Fault in 1899 and 1918 caused fatalities in the Riverside County area. Offset across this fault is predominantly right-lateral, similar to the San Andreas Fault, although some investigators have suggested that dip-slip motion contributes up to 10% of the net slip (ECI, 2009).

The segments of the San Jacinto Fault that are of most concern to major metropolitan areas are the San Bernardino, San Jacinto Valley and Anza segments. Fault slip rates on the various segments of the San Jacinto are less well constrained than for the San Andreas Fault, but the available data suggest slip rates of 12 ±6 mm/yr for the northern segments of the fault, and slip rates of 4 ±2 mm/yr for the southern segments. For large ground-rupturing earthquakes on the San Jacinto fault, various investigators have suggested a recurrence interval of 150 to 300 years. The Working Group on California Earthquake Probabilities (WGCEP, 2008) has estimated that there is a 31 percent probability that an earthquake of M6.7 or

greater will occur within 30 years on this fault. Maximum credible earthquakes of M6.7, M6.9, and M7.2 are expected on the San Bernardino, San Jacinto Valley and Anza segments, respectively, capable of generating peak horizontal ground accelerations of 0.48g to 0.53g in the County of Riverside, (ECI, 2009). A M5.4 earthquake occurred on the San Jacinto Fault on July 7, 2010.

The United States Geological Survey has issued the following statements with respect to the recent seismic activity on southern California faults:

> The San Jacinto fault, along with the Elsinore, San Andreas, and other faults, is part of the plate boundary that accommodates about 2 inches/year of motion as the Pacific plate moves northwest relative to the North American plate. The largest recent earthquake on the San Jacinto fault, near this location, the M6.5 1968 Borrego Mountain earthquake April 8, 1968, occurred about 25 miles southeast of the July 7, 2010, M5.4 earthquake.
>
> This M5.4 earthquake follows the 4th of April 2010, Easter Sunday, M7.2 earthquake, located about 125 miles to the south, well south of the US Mexico international border. A M4.9 earthquake occurred in the same area on June 12th at 8:08 pm (Pacific Time). Thus this section of the San Jacinto fault remains active.
>
> Seismologists are watching two major earthquake faults in southern California. The San Jacinto fault, the most active earthquake fault in southern California, extends for more than 100 miles from the international border into San Bernardino and Riverside, a major metropolitan area often called the Inland Empire. The Elsinore fault is more than 110 miles long, and extends into the Orange County and Los Angeles area as the Whittier fault. The Elsinore fault is capable of a major earthquake that would significantly affect the large metropolitan areas of southern California. The Elsinore fault has not hosted a major earthquake in more than 100 years. The occurrence of these earthquakes along the San Jacinto fault and continued aftershocks demonstrates that the earthquake activity in the region remains at an elevated level. The San Jacinto fault is known as the most active earthquake fault in southern California. Caltech and USGS seismologist continue to monitor the ongoing earthquake activity using

the Caltech/USGS Southern California Seismic Network and a GPS network of more than 100 stations.

B. Other Geologic Hazards

Ground Rupture: Ground rupture is characterized by bedrock slippage along an established fault and may result in displacement of the ground surface. For ground rupture to occur along a fault, an earthquake usually exceeds M5.0. If a M5.0 earthquake were to take place on a local fault, an estimated surface-rupture length 1 mile long could be expected (Greensfelder, 1974). Our investigation indicates that the subject site is not directly on a known active fault trace and, therefore, the risk of ground rupture is remote.

Ground Shaking: Structural damage caused by seismically induced ground shaking is a detrimental effect directly related to faulting and earthquake activity. Ground shaking is considered to be the greatest seismic hazard in San Diego County. The intensity of ground shaking is dependent on the magnitude of the earthquake, the distance from the earthquake, and the seismic response characteristics of underlying soils and geologic units. Earthquakes of M5.0 or greater are generally associated with significant damage. It is our opinion that the most serious damage to the site would be caused by a large earthquake originating on a nearby strand of the Rose Canyon Fault Zone. Although the chance of such an event is remote, it could occur within the useful life of the structure. The Modified Mercalli Index was developed to quantify the intensity of ground shaking and is included here as Appendix B.

Landslides: Based upon our geotechnical investigation, review of the geologic map (Kennedy and Tan, 2005, 2008), review of the referenced City of San Diego Seismic Safety Study -- Geologic Hazards Map Sheet 29 and stereo-pair aerial photographs (3-29-53, AXN-8M-1 and 2), there are no known or suspected ancient landslides located on the site.

Slope Stability: Based on our analyses performed along cross section A-A', the existing slope is stable. New and temporary slopes are anticipated to have good stability if they constructed in accordance with our recommendations. Refer to Section X and Appendix D. The location of the cross section is presented on the Plot Plan and Geologic Map, Figure No. II. Slope stability calculations indicate that the proposed residence and improvements will not affect the gross or shallow stability of the site. Gross and shallow slope stability calculations yielded factors of safety higher than 1.5.

Liquefaction: The liquefaction of saturated sands during earthquakes can be a major cause of damage to buildings. Liquefaction is the process by which soils are transformed into a viscous fluid that will flow as a liquid when unconfined. It occurs primarily in loose, saturated sands and silts when they are sufficiently shaken by an earthquake.

On this site, the risk of liquefaction of foundation materials due to seismic shaking is considered to be very low due to the fine-grained (non-porous) nature of the natural-ground material and the lack of a shallow, static groundwater surface under the site. The groundwater surface is at a minimum of over 50 feet below the ground surface. The site does not have a potential for soil strength loss to occur due to a seismic event.

Tsunami and Seiches: A tsunami is a series of long waves generated in the ocean by a sudden displacement of a large volume of water. Underwater earthquakes, landslides, volcanic eruptions, meteoric impacts, or onshore slope failures can cause this displacement. Tsunami waves can travel at speeds averaging 450 to 600 miles per hour. As a tsunami nears the coastline, its speed diminishes, its wave length decreases, and its height increases greatly. After a major earthquake or other near-shore tsunami-inducing activity occurs, a tsunami could reach the shore within a few minutes. One coastal community may experience no damaging waves while another may experience very destructive waves. Some low-lying areas could experience severe inland inundation of water and deposition of debris.

Wave heights and run-up elevations from tsunami along the San Diego Coast have historically fallen within the normal range of the tides (Joy 1968). The largest tsunami effect recorded in San Diego since 1950 was May 22, 1960, which had a maximum wave height of 2.1 feet (NOAA, 1993). In this event, 80 meters of dock were destroyed and a barge sunk in Quivera Basin. Other tsunamis felt in San Diego County occurred on November 5, 1952, with a wave height of 2.3 feet caused by an earthquake in Kamchatka; March 9, 1957, with a wave height of 1.5 feet; May 22, 1960, at 2.1 feet; March 27, 1964, with a wave height of 3.7 feet and September 29, 2009, with a wave height of 0.5 feet. It should be noted that damage does not necessarily occur in direct relationship to wave height, illustrated by the fact that the damage caused by the 2.1-foot wave height in 1960 was worse than damage caused by several other tsunamis with higher wave heights.

Historical wave heights and run-up elevations from tsunamis that have impacted the San Diego Coast have historically fallen within the normal range of the tides (Joy, 1968). The site is located at over 300 feet above mean sea level and approximately 2 miles from an exposed beach. It is unlikely that a tsunami would

affect the lot. The site is not mapped within a possible inundation zone on the California Geological Survey's 2009 *"Tsunami Inundation Map for Emergency Planning, La Jolla Quadrangle, San Diego County."*

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. The site is not located in the vicinity of or downstream from this type of water body. The risk of a seiche affecting the site is very low.

Geologic Hazards Summary: It is our opinion, based upon a review of the available maps, our research and our site investigation, that the site is underlain by relatively stable formational materials and is suited for the for the proposed residential structure and associated improvements provided the recommendations herein are implemented.

No significant geologic hazards are known to exist on the site that would prevent the proposed construction. Ground shaking from earthquakes on active southern California faults and active faults in northwestern Mexico is the greatest geologic hazard at the property.

In our explicit professional opinion, no *"active"* or *"potentially active"* faults underlie the project site.

X. SLOPE STABILITY ANALYSES

We have performed slope stability analysis based on information obtained in our exploratory excavations, the laboratory test results from retrieved soil samples collected during the drilling, our field review of site conditions, our review of aerial

photos, review of pertinent documents and geologic maps of the area, and our experience with similar formational units in the La Jolla area of the City of San Diego. The slope stability analyses were performed along cross sections (A-A') oriented perpendicular to the sloping lot from east to west. The location of the cross sections are presented on the Plot Plan and Geologic Map, Figure No. II.

We performed the gross slope stability calculations by using the *SLIDE 6* program (see Appendix D). The program utilizes, among others, the Bishop Simplified method of limit equilibrium slope stability conditions. The program calculates the factor of safety against shear soil failure on potential circular slide and sliding block surfaces. The sliding surfaces start on points chosen on the left side of the slope, and exit on a plane on the right side of the cross section, or slide as blocks on a slide failure plane. The factor of safety against shear soil failure is calculated for each sliding block or each circular surface exiting between the two points. The program output figure shows the printout of chosen slide surfaces and safety factors for calculated surfaces and the block of color corresponding to different factors of safety for possible slide surfaces. Soil strength values, geometry, and water conditions, have been input in the program calculations based on geological observations and laboratory soil tests of representative soil samples from the area.

Shallow slope failure analysis on representative existing slopes at the site yielded a factor of safety higher than 1.5. It is our opinion the site slopes should remain stable if proper drainage and irrigation practices are maintained. Refer to our Slope Stability results in Appendix D.

XI. GROUNDWATER

No groundwater was encountered during the course of our field investigation and we do not anticipate significant groundwater problems to develop in the future, *if the property is developed as proposed and proper drainage is implemented and maintained*. The true groundwater surface is assumed to be at a depth of over 100 feet below the existing and planned building pads. Based on exploratory drilling throughout San Diego County, we would expect minor seeps between the ground surface and true water table due to transient *"perching"* of vadose water on exceptionally dense, low permeability beds within the formational materials.

It should be kept in mind that any required construction operations will change surface drainage patterns and/or reduce permeabilities due to the densification of compacted soils. Such changes of surface and subsurface hydrologic conditions, plus irrigation of landscaping or significant increases in rainfall, may result in the appearance of surface or near-surface water at locations where none existed previously. The damage from such water is expected to be localized and cosmetic in nature, if good positive drainage is implemented, as recommended in this report, during and at the completion of construction.

On properties such as the subject site where dense, low permeability soils exist at shallow depths, even normal landscape irrigation practices on the property or neighboring properties, or periods of extended rainfall, can result in shallow "perched" water conditions. The perching (shallow depth) accumulation of water on a low permeability surface can result in areas of persistent wetting and drowning of lawns, plants and trees. Resolution of such conditions, should they occur, may require site-specific design and construction of subdrain and shallow "wick" drain dewatering systems.

Subsurface drainage with a properly designed and constructed subdrain system will be required along with continuous back drainage behind any proposed lower-level basement walls, property line retaining walls, or any perimeter stem walls for raised-wood floors where the outside grades are higher than the crawl space grades. Furthermore, crawl spaces, if used, should be provided with the proper cross-ventilation to help reduce the potential for moisture-related problems. Additional recommendations may be required at the time of construction.

It must be understood that unless discovered during site exploration or encountered during site construction operations, it is extremely difficult to predict if or where perched or true groundwater conditions may appear in the future. When site fill or formational soils are fine-grained and of low permeability, water problems may not become apparent for extended periods of time.

Water conditions, where suspected or encountered during construction, should be evaluated and remedied by the project civil and geotechnical consultants. The project developer and property owner, however, must realize that post-construction appearances of groundwater may have to be dealt with on a site-specific basis. Proper functional surface drainage should be implemented and maintained at the property.

XII. RECOMMENDATIONS

The following recommendations are based upon the practical field investigation conducted by our firm in 2014, and resulting laboratory tests, in conjunction with our knowledge and experience with similar soils in the La Jolla area. The opinions, conclusions, and recommendations presented in this report are contingent upon ***Geotechnical Exploration, Inc.*** being retained to review the final plans and

specifications as they are developed and to observe the site earthwork and installation of foundations.

A. Seismic Design Criteria

1. *Seismic Data Bases:* An estimation of the peak ground acceleration and the repeatable high ground acceleration (RHGA) likely to occur at the project site is based on the known significant local and regional faults within 100 miles of the site. While an earthquake has only one magnitude, it can have many intensities, which decrease with distance from the epicenter. The Modified Mercalli Intensity Scale is used to measure the intensity of an earthquake's effects and is provided as Appendix B.

2. *Seismic Design Criteria:* The proposed structure should be designed in accordance with the 2013 California Building Code (CBC), which incorporates by reference the ASCE 7-10 for seismic design. We recommend the following parameters be utilized. We have determined the mapped spectral acceleration values for the site based on latitude 32.8551 degrees and longitude 117.2476 degrees, utilizing a program titled "*U.S. Seismic Design Maps and Tools*" provided by the USGS, which provides a solution for ASCE 7-10 utilizing digitized files for the Spectral Acceleration maps.

3. *Structure and Foundation Design*: The design of the new addition structures and foundations shall be based on Seismic Design Category D.

4. *Spectral Acceleration and Design Values*: The structural seismic design, when applicable, shall be based on the following values that are based on the site location, soil characteristics, and seismic maps by USGS, as required by

the 2013 CBC and ASCE 7-10. The USGS Design Maps and Tools Summary for the site is included as Appendix D. The Site D values for this property are:

TABLE I
Mapped Spectral Acceleration Values and Design Parameters

S_s	S_1	F_a	F_v	S_{ms}	S_{m1}	S_{ds}	S_{d1}
1.302	0.506	1.00	1.500	1.302	0.759	0.868	0.506

B. Preparation of Soils for Site Development

5. *Clearing and Stripping:* The existing structure and vegetation on the lot should be removed prior to the preparation of the building pad and areas to receive associated improvements. This includes any roots from existing trees and shrubbery. Holes resulting from the removal of root systems or other buried obstructions that extend below the planned grades should be cleared and backfilled with properly compacted fill.

6. *Building Pad Surface and Subgrade Preparation:* After the building pad has been cleared, stripped, and the required excavations made to remove the existing disturbed surface fill, the upper 3 feet of pad fill soils should be removed and recompacted. The bottom of the excavation should be scarified to a depth of 6 inches, moisture conditioned, and compacted to the requirements for structural fill. The near-surface moisture content of clayey soils should be maintained by periodic sprinkling until within 48 hours prior to concrete placement.

7. *Material for Fill:* Existing on-site soils with an organic content of less than 3 percent by volume are, in general, suitable for use as fill. Imported fill

material, where required, should have a low-expansion potential (Expansion Index of 50 or less per ASTM D4829-11). In addition, both imported and existing on-site materials for use as fill should not contain rocks or lumps more than 6 inches in greatest dimension if the fill soils are compacted with heavy compaction equipment (or 3 inches in greatest dimension if compacted with lightweight equipment). All materials for use as fill should be approved by our representative prior to importing to the site.

8. *Expansive Soil Conditions:* We anticipate that medium to highly expansive sandy clay will be encountered during grading. Should such soils be used as fill, they should be moisture conditioned to at least 5 percent above optimum moisture content, compacted to 88 to 92 percent. Soils of medium or greater expansion potential should not be used as retaining wall backfill soils. If basement slabs are placed directly on medium expansive formational materials, the moisture content of the soil should be verified to be at least 3 percent above optimum, or scarification and moisture conditioning will be required. This recommendation is applicable even though caisson foundations are used to help reduce slab uplift soil pressure.

9. *Fill Compaction:* All structural fill should be compacted to a minimum degree of compaction of 90 percent based upon ASTM D1557-12. Fill material should be spread and compacted in uniform horizontal lifts not exceeding 8 inches in uncompacted thickness. Before compaction begins, the fill should be brought to a water content that will permit proper compaction by either: (1) aerating and drying the fill if it is too wet, or (2) moistening the fill with water if it is too dry. Each lift should be thoroughly mixed before compaction to ensure a uniform distribution of moisture. For low expansive soils, the moisture content should be within 2 percent of optimum. For medium to

highly expansive soils, the moisture content should be at least 5 percent over optimum. Once placed, soil moisture content of the fill soils should be maintained by sprinkling daily. Medium to highly expansive soils should be compacted to between 88 and 92 percent of Maximum Dry Density.

The areal extent required to remove the surficial soils should be confirmed by our representatives during the excavation work based on their examination of the soils being exposed. The lateral extent of the excavation and recompaction should be at least 5 feet beyond the edge of the perimeter ground level foundations of the new residential additions and any areas to receive exterior improvements where feasible.

If heavy compaction equipment is utilized, oversize material more than 6 inches in diameter should be removed from the fill. If lightweight compaction equipment is used, oversize material more than 3 inches in diameter should be removed.

Any rigid improvements founded on the existing surface soils can be expected to undergo movement and possible damage. ***Geotechnical Exploration, Inc.*** takes no responsibility for the performance of any improvements built on loose natural soils or inadequately compacted fills. Subgrade soils in any exterior area receiving concrete improvements should be verified for compaction and moisture within 48 hours prior to concrete placement.

No uncontrolled fill soils should remain after completion of the site work. In the event that temporary ramps or pads are constructed of uncontrolled fill

soils, the loose fill soils should be removed and/or recompacted prior to completion of the grading operation.

10. *Trench and Retaining Wall Backfill:* New utility trenches and basement walls should be backfilled with imported low-expansive compacted fill; gravel is also a suitable backfill material but should be used only if space constraints will not allow the use of compaction equipment. Gravel can also be used as backfill around perforated subdrains. All backfill material should be placed in lift thicknesses appropriate to the type of compaction equipment utilized and compacted to a minimum degree of compaction of 90 percent by mechanical means.

Our experience has shown that even shallow, narrow trenches (such as for irrigation and electrical lines) that are not properly compacted can result in problems, particularly with respect to shallow groundwater accumulation and migration.

Backfill soils placed behind retaining walls should be installed as early as the retaining walls are capable of supporting lateral loads. Backfill soils behind retaining walls should be low expansive (Expansion Index less than 50). The exposed face of temporary cuts made in highly expansive soils should be kept moist to prevent desiccation cracking and reduce swelling potential.

C. Design Parameters for Shallow Foundations

11. Footings: We recommend that the proposed secondary structures (such as sidewalks, patios, garden walls, etc.) be supported on conventional, individual-spread and/or continuous footing foundations bearing on

undisturbed formational materials or on at least 3 feet of properly compacted fill soils. The footings should be founded at least 18 inches below the lowest adjacent finished grade when founded into properly compacted fill (or 12 inches into formational material). Footings located adjacent to utility trenches should have their bearing surfaces situated below an imaginary 1.0:1.0 plane projected upward from the bottom edge of the adjacent utility trench. Foundations paralleling slope elevation contour lines should be deepened as indicated on Figure No. VIII.

D. Caisson Recommendations

The following recommendations are provided for use by the Structural Engineer in design of the foundations.

12. *Deepened Continuous Footings:* If deepened continuous footings are utilized in areas of relatively shallow fill, they may be deepened to penetrate at least 2 feet into dense formational soils measured on the downhill side of the formational soils slope. The allowable soil end bearing capacity of shallow footings bearing into firm or dense formational soils is 6,000 psf.

13. *Caisson-supported Grade Beam Footings:* Grade beam footings should be founded at least 18 inches below the lowest adjacent finished grade and should have a minimum width of 18 inches. The grade beam footings should contain top and bottom reinforcement to provide structural continuity and to permit spanning of local irregularities. The final dimensions and reinforcing should be specified by the structural engineer based on the spacing of the caissons as well as load per caissons. A minimum clearance of 3 inches

should be maintained between steel reinforcement and the bottom or sides of the footing.

NOTE: The project Civil/Structural Engineer should review all reinforcing schedules. The reinforcing minimums recommended herein are not to be construed as structural designs, but merely as minimum reinforcement to reduce the potential for cracking and separations.

14. *Caisson Design*: Where caissons are utilized, they should be designed by the project Civil/Structural Engineer to support all vertical and lateral loads of the proposed structures and/or exterior primary rigid improvements (e.g., proposed retaining walls, swimming pool and spa, carport structures, etc.) where applicable.

15. *End-bearing Caissons*: For vertical loading, all end-bearing caissons should be embedded at least 10 feet into dense (very stiff) formational materials (through the existing fill soils and any top soil/or slopewash if encountered).

When drilling excavations for caissons utilizing end-bearing strength, it is important to limit the amount of loose material at the bottom of the excavation. Therefore, we recommend that caissons be designed with a minimum diameter of 2 feet in order to facilitate observation of the excavations and allow ease of material removal at the bottom. No slough over 1 inch in thickness should remain at the bottom of the excavation before concrete placement. The drilling contractor should provide an appropriate cleaning tool to satisfy this requirement. Otherwise, shoring installation and hand-tool cleaning (or another acceptable option) will be required. The maximum depth of end-bearing caissons is estimated to be

about 40 feet, beneath proposed basement level. The caisson spacing will depend upon the structural designer's choice for grade-beam and slab dimensions as well as design loads.

16. *Vertical Caisson Bearing Capacity*: The recommended allowable end bearing capacity is 20,000 psf for caissons penetrating at least 10 feet into dense (very stiff) formational soils and at least 15 feet below the soil surface. This end-bearing capacity has already deducted the downdrag force produced by existing fills. The caisson weight to be considered is only one-third the actual weight of the buried caisson. For any exposed portion of caisson, the weight to be considered is 150 pcf. The actual required caisson length and embedment into formational soils should be established by the structural engineer based on the length required to adequately support the total vertical and lateral loads included in the design. An average allowable increase of 550 psf of shaft frictional capacity can be used for caissons embedded at least 10 feet into formational soils (and at least 15 feet below the ground surface and at least 10 feet into formation).

    The recommended allowable end-bearing vertical capacity already includes the effect of negative friction produced by the existing fills. Any caisson weight (150 pcf) above the soil surface should be considered as dead load and should be deducted from the net end-bearing capacity. Caisson depth for the lower-level basement or shallow footings into formation should not be shorter than 10 feet. Due to fill thickness, actual total length may vary at other locations.

17. *Minimum Caisson Spacing*: The minimum center-to-center spacing of caissons in a perpendicular direction to the temporary seismic or wind lateral

load should be 3 caisson diameters. For caissons paralleling seismic or wind lateral loads, the shadow effect produces a reducing effect in combined individual lateral load capacity. Therefore, the group reduction factor for caisson diameters of 3B, 4B, 5B, 6B and 7B (where B is in feet) is 0.6, 0.75, 0.9, 1.0, 1.0, respectively, for leading row caissons; and 0.4, 0.6, 0.75, 0.9, and 1.0 for trailing row caissons.

18. *Lateral Resistance*: For lateral earthquake or wind load resistance, the structural engineer may use any method that considers the equilibrium of forces and moments. For caissons near the slope top, the effective depth for seismic or wind loading resistance should be vertically measured from the horizontal plane providing a setback of 10 feet to daylight. For static loading, we also recommend that caissons closer than 10 feet to the slope top or slope face be designed to support a lateral soil load directed to the slope face. This soil lateral load will be zero for caissons located at distance of 10 feet from slope top, and the maximum soil lateral load will be for caissons located within 10 feet of the slope top. The load should be calculated as active soil pressure (triangular distribution) ranging from zero for caissons at least 10 feet behind the slope top, to the maximum soil pressure for caissons on the slope face or at the top of the slope, with an equivalent fluid weight of 55 pcf acting on twice the caisson diameter and the varying depth, depending on the caisson's distance from the top of the slope. The maximum depth to apply this active pressure is 10 feet.

Soil passive resistance for caissons should be considered starting 10 feet below the ground surface at the top of the slope and 3 feet below the surface for caissons behind 10 feet away from the slope top. Caissons located within

6 feet of an existing or proposed sewer line should be designed to transmit lateral loads starting 3 feet below the sewer pipe.

If a balance of forces is calculated based on the applied lateral forces and reaction soil forces, the following allowable passive (equivalent fluid) forces are recommended: 150 pcf for existing fill and 300 pcf for formational soils. The passive resistance should be measured from where the depth of caissons is at least 10 feet to the slope face. The passive resistance of the caissons may be considered applicable on a projected surface equal to 2½ times the diameter of the caisson multiplied by the vertical length being considered. For caissons near slope faces, passive resistance against seismic or wind loading may start to be measured from a horizontal plane providing a setback distance of 10 feet to the slope face.

19. *Caisson Drilling Observations*: Caisson drilling or excavation operations should be performed under the continued observations of a representative of our firm to confirm the penetration into formational soils.

20. *Caisson Design Standards:* The design and construction of the caissons should be in accordance with the recommendations presented above, the current CBC requirements accepted by the City of San Diego, and also in accordance with ACI 336, 4R-93 Design and Construction of Drilled Piers, of the American Concrete Institute. The contractor shall follow all the safety procedures required by Cal OSHA.

21. *Bearing Values*: At the recommended depths, shallow footings on native, medium dense formational soil or properly compacted fill soil may be designed for allowable bearing pressures of 2,500 psf for combined dead and

live loads, and increased one-third for all loads, including wind or seismic. The footings should be a minimum of 12 inches in width and at least 18 inches in depth into properly compacted fill or dense natural soils.

22. *Footing Reinforcement*: All continuous footings should contain top and bottom reinforcement to provide structural continuity and to permit spanning of local irregularities. We recommend that a minimum of two No. 5 top and two No. 5 bottom reinforcing bars be provided in the footings. A minimum clearance of 3 inches should be maintained between steel reinforcement and the bottom or sides of the footing. Isolated square footings should contain, as a minimum, a grid of three No. 4 steel bars on 12-inch centers, both ways. In order for us to offer an opinion as to whether the footings are founded on soils of sufficient load bearing capacity, it is essential that our representative inspect the footing excavations prior to the placement of reinforcing steel or concrete, and within 48 hours prior to concrete placement.

NOTE: The project Civil/Structural Engineer should review all reinforcing schedules. The reinforcing minimums recommended herein are not to be construed as structural designs, but merely as minimum reinforcement to reduce the potential for cracking and separations.

23. *Lateral Loads:* Lateral load resistance for structure foundations may be developed in friction between the foundation bottoms and the supporting subgrade. An allowable friction coefficient of 0.35 is considered applicable. An additional allowable passive resistance equal to an equivalent fluid weight of 300 pounds per cubic foot acting against the foundations may be used in design provided the footings are poured neat against the adjacent

undisturbed formational materials and/or properly compacted fill materials. These lateral resistance values assume a level surface in front of the footing for a minimum distance of three times the embedment depth of the footing.

24. *Settlement:* Settlements under structural design loads are expected to be within tolerable limits for the proposed structures. For footings designed in accordance with the recommendations presented in the preceding paragraphs, we anticipate that total settlements should not exceed 1 inch and that post-construction differential angular rotation should be less than 1/240.

E. Concrete Slab On-Grade Criteria

Slabs on-grade may only be used on new, properly compacted fill or when bearing on dense natural soils.

25. *Minimum Floor Slab Reinforcement:* Based on our experience, we have found that, for various reasons, floor slabs occasionally crack. Therefore, we recommend that all slabs on-grade contain at least a minimum amount of reinforcing steel to reduce the separation of cracks, should they occur. Slab subgrade soil should be verified by a ***Geotechnical Exploration, Inc.*** representative to have the proper moisture content within 48 hours prior to placement of the vapor barrier and pouring of concrete.

New interior floor slabs should be a minimum of 5 inches actual thickness and be reinforced with No. 4 bars on 18-inch centers, both ways, placed at midheight in the slab. ***The slabs should be underlain by a moisture retardant membrane such as StegoWrap 15-mil, on a properly compacted subgrade or a 4-inch-thick base layer (or as indicated by***

the membrane manufacturer). Soil moisture content should be kept above the optimum prior to moisture barrier or waterproofing placement under the new concrete slab.

Slab subgrade soil should be verified by a ***Geotechnical Exploration, Inc.*** representative to have the proper moisture content within 48 hours prior to placement of the vapor barrier and pouring of concrete.

26. *Slab Moisture Emission:* Although it is not the responsibility of geotechnical engineering firms to provide moisture protection recommendations, as a service to our clients we provide the following discussion and suggested minimum protection criteria. Actual recommendations should be provided by the Project Architect and waterproofing consultants or product manufacturer.

Soil moisture vapor can result in damage to moisture-sensitive floors, some floor sealers, or sensitive equipment in direct contact with the floor, in addition to mold and staining on slabs, walls and carpets. The common practice in Southern California is to place vapor retarders made of PVC, or of polyethylene. PVC retarders are made in thickness ranging from 10- to 60-mil. Polyethylene retarders, called visqueen, range from 5- to 10-mil in thickness. These products are no longer considered adequate for moisture protection and can actually deteriorate over time.

Specialty vapor retarding and barrier products possess higher tensile strength and are more specifically designed for and intended to retard moisture transmission into and through concrete slabs. The use of such products is highly recommended for reduction of floor slab moisture emission.

The following American Society for Testing and Materials (ASTM) and American Concrete Institute (ACI) sections address the issue of moisture transmission into and through concrete slabs: ASTM E1745-97 (2009) Standard Specification for Plastic Water Vapor Retarders Used in Contact Concrete Slabs; ASTM E154-88 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth; ASTM E96-95 Standard Test Methods for Water Vapor Transmission of Materials; ASTM E1643-98 (2009) Standard Practice for Installation of Water Vapor Retarders Used in Contact Under Concrete Slabs; and ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

26.1 Based on the above, we recommend that the vapor barrier consist of a minimum 15-mil extruded polyolefin plastic (no recycled content or woven materials permitted). Permeance as tested before and after mandatory conditioning (ASTM E1745 Section 7.1 and subparagraphs 7.1.1-7.1.5) should be less than 0.01 perms (grains/square foot/hour in Hg) and comply with the ASTM E1745 Class A requirements. Installation of vapor barriers should be in accordance with ASTM E1643. The basis of design is 15-mil StegoWrap vapor barrier placed per the manufacturer's guidelines. Reef Industries Vapor Guard membrane has also been shown to achieve a permeance of less than 0.01 perms. We recommend that the slab be poured directly on the vapor barrier, which is placed directly on the prepared subgrade soil.

26.2 Common to all acceptable products, vapor retarder/barrier joints must be lapped and sealed with mastic or the manufacturer's recommended tape or sealing products. In actual practice, stakes are often driven through the retarder material, equipment is dragged or rolled across

the retarder, overlapping or jointing is not properly implemented, etc. All these construction deficiencies reduce the retarder's effectiveness. In no case should retarder/barrier products be punctured or gaps be allowed to form prior to or during concrete placement.

26.3 Vapor retarders/barriers do not provide full waterproofing for structures constructed below free water surfaces. They are intended to help reduce or prevent vapor transmission and/or capillary migration through the soil and through the concrete slabs. Waterproofing systems must be designed and properly constructed if full waterproofing is desired. The owner and project designers should be consulted to determine the specific level of protection required.

26.4 Following placement of any concrete floor slabs, sufficient drying time must be allowed prior to placement of floor coverings. Premature placement of floor coverings may result in degradation of adhesive materials and loosening of the finish floor materials.

27. *Concrete Isolation Joints:* We recommend the project Civil/Structural Engineer incorporate isolation joints and sawcuts to at least one-fourth the thickness of the slab in any floor designs. The joints and cuts, if properly placed, should reduce the potential for and help control floor slab cracking. We recommend that concrete shrinkage joints be spaced no farther than approximately 20 feet apart, and also at re-entrant corners. However, due to a number of reasons (such as base preparation, construction techniques, curing procedures, and normal shrinkage of concrete), some cracking of slabs can be expected. Structural slabs should not be provided with control joints.

28. Exterior Slab Reinforcement: Exterior concrete slabs should be at least 4 inches thick. As a minimum for protection of on-site improvements, we recommend that all nonstructural concrete slabs (such as patios, sidewalks, etc.), be founded on properly compacted and tested fill or dense native formation and be underlain by 2 inches and no more than 3 inches of clean leveling sand, with No. 3 bars at 18-inch centers, both ways, at the center of the slab. Exterior slabs should contain adequate isolation and control joints.

    The performance of on-site improvements can be greatly affected by soil base preparation and the quality of construction. It is therefore important that all improvements are properly designed and constructed for the existing soil conditions. The improvements should not be built on loose soils or fills placed without our observation and testing. The subgrade of exterior improvements should be verified as properly prepared within 48 hours prior to concrete placement. A minimum thickness of 3 feet of properly recompacted soils should underlie the exterior slabs on-grade or they should be constructed on dense formational soils.

For exterior slabs with the minimum shrinkage reinforcement, control joints should be placed at spaces no farther than 15 feet apart or the width of the slab, whichever is less, and also at re-entrant corners. Control and isolation joints in exterior slabs should be sealed with elastomeric joint sealant. The sealant should be inspected every 6 months and be properly maintained.

29. *Concrete Pavement:* Driveway pavement, consisting of Portland cement concrete at least 5½ inches in thickness, may be placed on properly compacted and moisture-conditioned subgrade soils or stiff to hard/dense formational soils. The concrete should be at least 3,500 psi compressive

strength, with control joints no farther than 15 feet apart and at re-entrant corners. Pavement joints should be properly sealed with permanent joint sealant, as required in sections 201.3.6 through 201.3.8 of the Standard Specifications for Public Work Construction, 2012 Edition. Subgrade soil for the driveway should be compacted to at least 90 percent of Maximum Dry Density.

Control joints should be placed within 12 hours after concrete placement or as soon as the concrete allows sawcutting without aggregate raveling. The sawcuts should penetrate at least one-quarter the thickness of the slab. A minimum 8-inch thickened edge into properly compacted soil is recommended for the perimeter of the pavement slabs.

*F. **Retaining Wall Design Criteria***

30. *Design Parameters – Unrestrained:* The active earth pressure (to be utilized in the design of any cantilever retaining walls or pool walls, utilizing on-site soils as backfill) should be based on an *Equivalent Fluid Weight* of 65 pcf (for level backfill only). For low-expansive level backfill placed within a wedge behind the new retaining wall at a 60-degree angle, the active pressure is 38 pcf. In the event that a new retaining wall is surcharged by low expansive sloping backfill, the design active earth pressure should be based on the appropriate Equivalent Fluid Weight presented in the following table.

Slope Ratio	Height of Slope/Height of Wall* 0.25	0.50	0.75	1.00(+)
1.5:1.0 (existing slope)	40	45	50	52

*To determine design active earth pressures for ratios intermediate to those presented, interpolate between the stated values.

31. *Design Parameters – Restrained:* Retaining walls designed to support the existing clayey fill and/or formational materials should be designed using an equivalent fluid weight of 55 pcf for unrestrained walls and 80 pcf for restrained walls with level, medium expansive backfill or on-site soils. Retaining walls designed for a restrained condition may utilize a triangular pressure equal to 56 pcf (times the total height of retained, imported, low expansive soil, considered in pounds per square foot) considered as acting everywhere on the back of the wall. The soil pressure produced by any footings, improvements, or any other surcharge placed within a horizontal distance equal to the height of the retaining portion of the wall should be included in the wall design pressure. The recommended lateral soil pressures are based on the assumption that no loose soils or soil wedges will be retained by the retaining wall. The structural engineer should specify on the plans the type of soil assumed in the calculations (i.e., low expansive or highly expansive).

32. *Surcharge Loads:* Any loads placed on the active wedge behind a cantilever wall retaining low expansive soils should be included in the design by multiplying the load weight by a factor of 0.31. For a restrained wall, the lateral factor should be 0.47. If retaining walls are backfilled using on-site clayey soils, a surcharge factor of 0.46 for unrestrained conditions should be used (or 0.66 for restrained conditions). These surcharge factors may also

be used for shoring walls. Retaining walls over 6 feet in exposed height will require seismic loading design. A soil seismic increment of 16 pcf may be used for cantilever unrestrained walls. Restrained walls do not require an additional seismic increment.

Backfill placed behind the walls should be compacted to a minimum degree of compaction of 90 percent using light compaction equipment. If heavy equipment is used, the walls should be appropriately temporarily braced.

33. *Retaining Wall Seismic Earth Pressures*: If seismic loading is to be considered for retaining walls more than 6 feet in height, they should be designed for seismic earth pressures in addition to the normal static pressures. For the retaining wall (unrestrained) with level backfill, we recommend that the seismic pressure increment be taken as an additional fluid pressure distribution (zero pressure at the ground surface and maximum pressure at the base) utilizing an equivalent fluid weight of 16 pounds pcf. A Kh value of 0.18 may be used is a computer program such as "*Retaining Wall Pro*" or a similar program is used for wall design. The soil pressure described above may be used for the design of shoring structures.

34. *Retaining Wall Drainage:* The preceding design pressures assume that the walls are backfilled with low-expansive on-site or imported soils, and that there is sufficient drainage behind the walls to prevent the build-up of hydrostatic pressures from surface water infiltration. We recommend that drainage be provided by a composite drainage material such as Miradrain 6000/6200 or equivalent. The drain material should terminate 3 inches below the finish surface where the surface is covered by pavements or slabs or 6 inches below the finish surface in landscape areas (see Figure No. IX for

Retaining Wall Drainage schematic). Waterproofing should extend from the bottom to the top of the wall.

Proper subdrains and free-draining backwall material or board drains (such as J-drain or Miradrain) should be installed behind all retaining walls (in addition to proper waterproofing) on the subject project ***Geotechnical Exploration, Inc.*** will assume no liability for damage to structures or improvements that is attributable to poor drainage. The architectural plans should clearly indicate that subdrains for any lower-level walls be placed at an elevation at least 1 foot below the bottom of the lower-level slabs. At least 0.5-percent gradient should be provided to the subdrain. The subdrain should be placed in an envelope of crushed rock gravel up to 1 inch in maximum diameter, and be wrapped with Mirafi 140N geofabric or equivalent. The subdrain should consist of Amerdrain or QuickDrain (rectangular section boards).

If the slab is to be supported on top of basement wall footings, the subdrain should be placed on the outer face of the footing (where feasible), not on top of the footing. Refer to Figure No. IX, Retaining Wall Drainage Schematic. A sump pump may be needed if the subdrain does not outlet via gravity. The collected water should be taken to an approved drainage facility.

35. *Drainage Quality Control*: It must be understood that it is not within the scope of our services to provide quality control oversight for surface or subsurface drainage construction or retaining wall sealing and base of wall drain construction. It is the responsibility of the contractor to verify proper wall sealing, geofabric installation, protection board (if needed), drain depth below interior floor or yard surface, pipe percent slope to the outlet, etc.

G. Slopes

It is our understanding that no new, large permanent slopes are proposed. Temporary slopes may be required during site preparation and construction.

36. *Slope Observations:* A representative of ***Geotechnical Exploration, Inc.*** must observe any steep temporary slopes *during construction*. In the event that soils and formational material comprising a slope are not as anticipated, any required slope design changes would be presented at that time.

37. *Cal-OSHA*: Where not superseded by specific recommendations presented in this report, trenches, excavations, and temporary slopes at the subject site should be constructed in accordance with Title 8, Construction Safety Orders, issued by Cal-OSHA.

38. *Permanent Slopes*: Any new cut or fill slopes up to 10 feet in height should be constructed at an inclination of 2.0:1.0 (horizontal to vertical). Permanent slopes at a 2.0:1.0 slope should possess a factor of safety of 1.5 against deep and shallow failure.

39. *Temporary Slopes*: Based on our subsurface investigation work, laboratory test results, and engineering analysis, temporary slopes should be stable for a maximum slope height of up to 12 feet and may be cut at a slope ratio of 0.5:1.0 in properly compacted fill soils, and vertical in the lower 6 feet and 0.5:1.0 in the upper 6 feet in stiff natural soils. Some localized sloughing or raveling of the soils exposed on the slopes, however, may occur.

Since the stability of temporary construction slopes will depend largely on the contractor's activities and safety precautions (storage and equipment loadings near the tops of cut slopes, surface drainage provisions, etc.), it should be the contractor's responsibility to establish and maintain all temporary construction slopes at a safe inclination appropriate to his methods of operation. No soil stockpiles or surcharge may be placed within a horizontal distance of 10 feet from the excavation.

If these recommendations are not feasible due to space constraints, temporary shoring may be required for safety and to protect adjacent property improvements. Similarly, footings near temporary cuts should be underpinned or protected with shoring.

No soil stockpiles or surcharge may be placed within a horizontal distance of 10 feet from the excavation. If these recommendations are not feasible, off-site stockpiling may be required.

40. *Slope Top/Face Performance:* The soils that occur in close proximity to the top or face of even properly compacted fill or dense/stiff natural ground cut slopes often possess poor lateral stability. The degree of lateral and vertical deformation depends on the inherent expansion and strength characteristics of the soil types comprising the slope, slope steepness and height, loosening of slope face soils by burrowing rodents, and irrigation and vegetation maintenance practices, as well as the quality of compaction of fill soils. Structures and other improvements could suffer damage due to these soil movement factors if not properly designed to accommodate or withstand such movement. New fill or cut slopes should be constructed at a 2.0:1.0 slope gradient.

41. *Slope Top Structure Performance:* Rigid improvements such as top-of-slope walls, columns, decorative planters, concrete flatwork, swimming pools and other similar types of improvements can be expected to display varying degrees of separation typical of improvements constructed at the top of a slope. The separations result primarily from slope top lateral and vertical soil deformation processes. These separations often occur regardless of being underlain by cut or fill slope material. Proximity to a slope top is often the primary factor affecting the degree of separations occurring.

Shallow foundations close to slopes should be provided with a setback of 8 feet measured from the top of the foundation. Foundations within this setback distance should be deepened as shown on Figure No. VIII, Foundation Requirements Near Slopes. Typical and to-be-expected separations can range from minimal to up to 1 inch or greater in width. In order to minimize the effect of slope-top lateral soil deformation, we recommend that the top-of-slope improvements be designed with flexible connections and joints in rigid structures so that the separations do not result in visually apparent cracking damage and/or can be cosmetically dressed as part of the ongoing property maintenance. These flexible connections may include "slip joints" in wrought iron fencing, evenly spaced vertical joints in block walls or fences, control joints with flexible caulking in exterior flatwork improvements, etc.

In addition, use of planters to provide separation between top-of-slope hardscape such as patio slabs and pool decking from top-of-slope walls can aid greatly in reducing cosmetic cracking and separations in exterior improvements. Actual materials and techniques would need to be determined by the project architect or the landscape architect for individual

properties. Steel dowels placed in flatwork may prevent noticeable vertical differentials, but if provided with a slip-end they may still allow some lateral displacement.

H. Site Drainage Considerations

42. *Erosion Control*: Appropriate erosion control measures should be taken at all times during and after construction to prevent surface runoff waters from entering footing excavations or ponding on finished building pad areas.

43. *Surface Drainage:* Adequate measures should be taken to properly finish-grade the lot after the structures and other improvements are in place. Drainage waters from this site and adjacent properties should be directed away from the footings, floor slabs, and slopes, onto the natural drainage direction for this area or into properly designed and approved drainage facilities provided by the project civil engineer. Roof gutters and downspouts should be installed on the residence, with the runoff directed away from the foundations via closed drainage lines. Proper subsurface and surface drainage will help minimize the potential for waters to seek the level of the bearing soils under the footings and floor slabs.

Failure to observe this recommendation could result in undermining and possible differential settlement of the structure or other improvements on the site or cause other moisture-related problems. Currently, the CBC requires a minimum 1-percent surface gradient for proper drainage of building pads unless waived by the building official. Concrete pavement may have a minimum gradient of 0.5-percent.

44. *Planter Drainage:* Planter areas, flower beds and planter boxes should be sloped to drain away from the footings and floor slabs at a gradient of at least 5 percent within 5 feet from the perimeter walls. Any planter areas adjacent to the residence or surrounded by concrete improvements should be provided with sufficient area drains to help with rapid runoff disposal. No water should be allowed to pond adjacent to the residence or other improvements or anywhere on the site.

I. General Recommendations

45. *Project Start Up Notification:* In order to reduce work delays during site development, this firm should be contacted 48 hours prior to any need for observation of footing excavations or field density testing of compacted fill soils. If possible, placement of formwork and steel reinforcement in footing excavations should not occur prior to observing the excavations; in the event that our observations reveal the need for deepening or redesigning foundation structures at any locations, any formwork or steel reinforcement in the affected footing excavation areas would have to be removed prior to correction of the observed problem (i.e., deepening the footing excavation, recompacting soil in the bottom of the excavation, etc.).

46. *Construction Best Management Practices (BMPs):* Construction BMPs must be implemented in accordance with the requirements of the controlling jurisdiction. Sufficient BMPs must be installed to prevent silt, mud or other construction debris from being tracked into the adjacent street(s) or storm water conveyance systems due to construction vehicles or any other construction activity. The contractor is responsible for cleaning any such

debris that may be in the street at the end of each work day or after a storm event that causes breach in the installed construction BMPs.

All stockpiles of uncompacted soil and/or building materials that are intended to be left unprotected for a period greater than 7 days are to be provided with erosion and sediment controls. Such soil must be protected each day when the probability of rain is 40% or greater. A concrete washout should be provided on all projects that propose the construction of any concrete improvements that are to be poured in place. All erosion/sediment control devices should be maintained in working order at all times. All slopes that are created or disturbed by construction activity must be protected against erosion and sediment transport at all times. The storage of all construction materials and equipment must be protected against any potential release of pollutants into the environment.

XIII. GRADING NOTES

Geotechnical Exploration, Inc. recommends that we be retained to verify the actual soil conditions revealed during site grading work and footing excavation to be as anticipated in this "*Report of Preliminary Geotechnical Investigation*" for the project. In addition, the placement and compaction of any fill or backfill soils during site grading work must be observed and tested by the soil engineer.

It is the responsibility of the grading contractor to comply with the requirements on the grading plans as well as the local grading ordinance. All retaining wall and trench backfill should be properly compacted. ***Geotechnical Exploration, Inc.*** will assume no liability for damage occurring due to improperly or uncompacted backfill placed without our observations and testing.

XIV. LIMITATIONS

Our conclusions and recommendations have been based on available data obtained from our field investigation and laboratory analysis, as well as our experience with similar soils and formational materials located in this area of San Diego. Of necessity, we must assume a certain degree of continuity between exploratory excavations and/or natural exposures. It is, therefore, necessary that all observations, conclusions, and recommendations be verified at the time grading operations begin or when footing excavations are placed. In the event discrepancies are noted, additional recommendations may be issued, if required.

The work performed and recommendations presented herein are the result of an investigation and analysis that meet the contemporary standard of care in our profession within the County of San Diego. No warranty is provided.

As stated previously, it is not within the scope of our services to provide quality control oversight for surface or subsurface drainage construction or retaining wall sealing and base of wall drain construction. It is the responsibility of the contractor to verify proper wall sealing, geofabric installation, protection board installation (if needed), drain depth below interior floor or yard surfaces, pipe percent slope to the outlet, etc.

This report should be considered valid for a period of two (2) years, and is subject to review by our firm following that time. If significant modifications are made to the building plans, especially with respect to the height and location of any proposed structures, this report must be presented to us for immediate review and possible revision.

If the geotechnical consultant of record is changed, work shall be stopped until the replacement has agreed in writing to accept the responsibility within their area of technical competence upon completion of the work. It shall be the responsibility of the permittee to notify the governing agency in writing of such change prior to the commencement or recommencement of grading and/or foundation installation work.

It is the responsibility of the owner and/or developer to ensure that the recommendations summarized in this report are carried out in the field operations and that our recommendations for design of this project are incorporated in the structural plans. We should be retained to review the project plans once they are available, to verify that our recommendations are adequately incorporated in the plans. Additional or modified recommendations may be issued if warranted after plan review.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for the safety of personnel other than our own on the site; the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considered any of the recommended actions presented herein to be unsafe.

The firm of ***Geotechnical Exploration, Inc.*** shall not be held responsible for changes to the physical condition of the property, such as addition of fill soils or changing drainage patterns, which occur subsequent to issuance of this report and the changes are made without our observations, testing, and approval.

Once again, should any questions arise concerning this report, please feel free to contact the undersigned. Reference to our **Job No. 14-10569** will expedite a reply to your inquiries.

Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

Jay K. Heiser
Senior Project Geologist

Jaime A. Cerros, P.E.
R.C.E. 34422/G.E. 2007
Senior Geotechnical Engineer

Leslie D. Reed, President
C.E.G. 999/P.G. 3391

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JOB NO. 14-10569
August 2015

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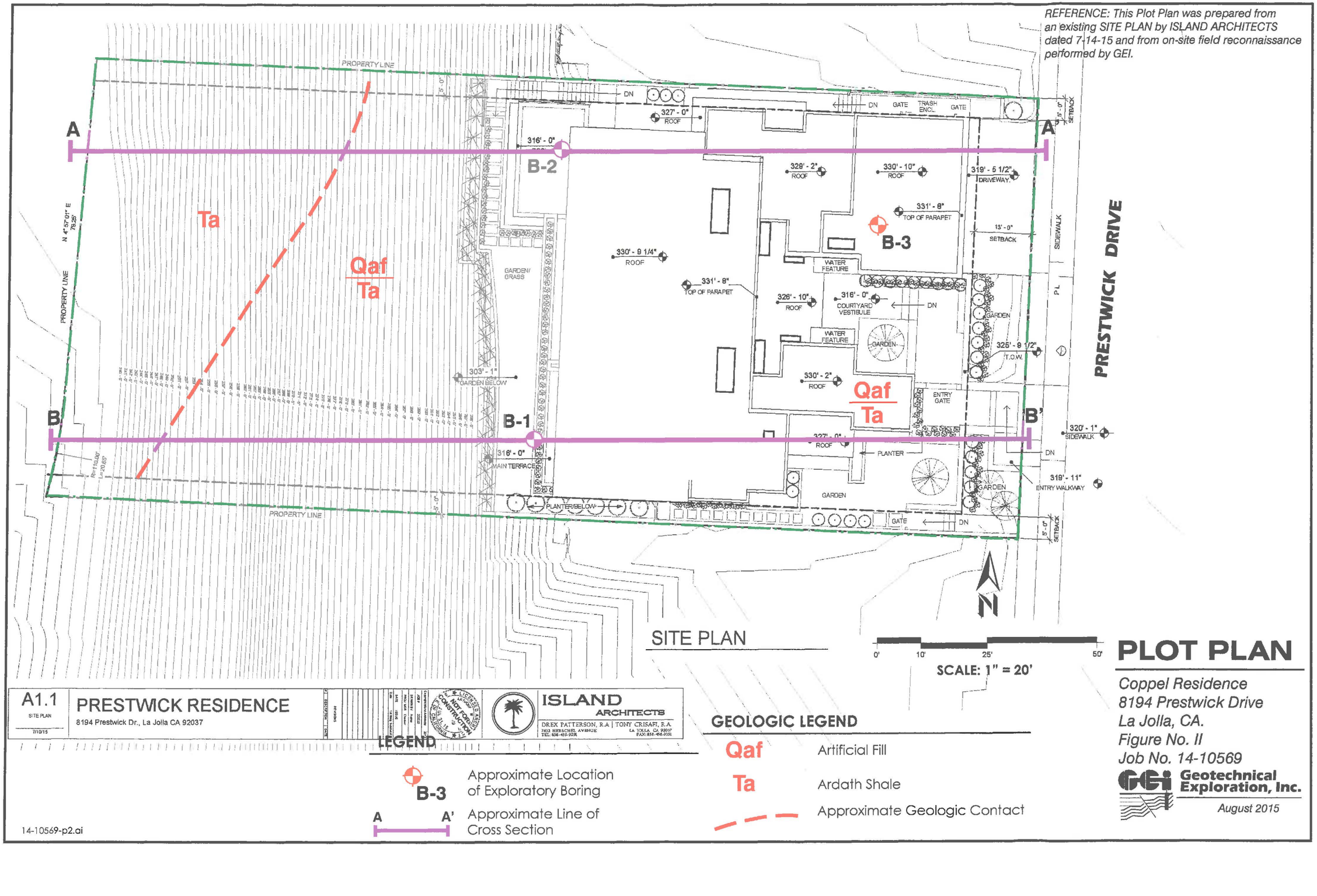
VICINITY MAP

Thomas Bros. Guide San Diego County, pg 1227

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.

Figure No. I
Job No. 14-10569

REFERENCE: This Plot Plan was prepared from an existing SITE PLAN by ISLAND ARCHITECTS dated 7-14-15 and from on-site field reconnaissance performed by GEI.



SITE PLAN

0' 10' 25' 50'

SCALE: 1" = 20'

PLOT PLAN

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.
Figure No. II
Job No. 14-10569

Geotechnical Exploration, Inc.

August 2015

A1.1
SITE PLAN
7/10/15

PRESTWICK RESIDENCE
8194 Prestwick Dr., La Jolla CA 92037

ISLAND ARCHITECTS
DREX PATTERSON, R.A. | TONY CRISAFI, R.A.
7663 HERSCHEL AVENUE LA JOLLA, CA 92037
TEL: 858-459-9291 FAX: 858-456-0151

NOT FOR CONSTRUCTION

LEGEND

B-3 — Approximate Location of Exploratory Boring

A — A' — Approximate Line of Cross Section

GEOLOGIC LEGEND

Qaf — Artificial Fill

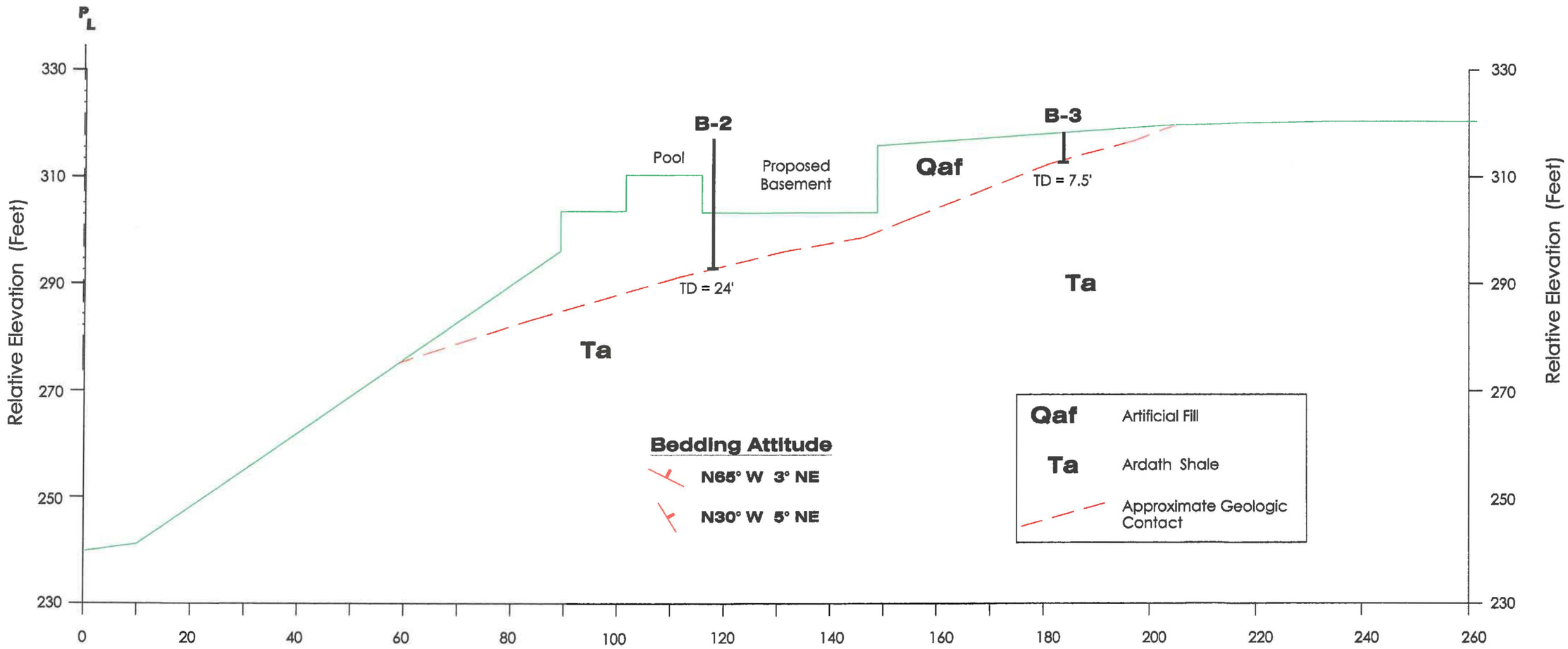
Ta — Ardath Shale

Approximate Geologic Contact

14-10569-p2.ai

GEOLOGIC CROSS SECTION

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.



NOTE: This Cross Section is not to be used for legal purposes. Locations and dimensions are approximate. Actual property dimensions and locations of utilities may be obtained from the Approved Building Plans or the "As-Built" Grading Plans.

Figure No. Va
Job No. 14-10569

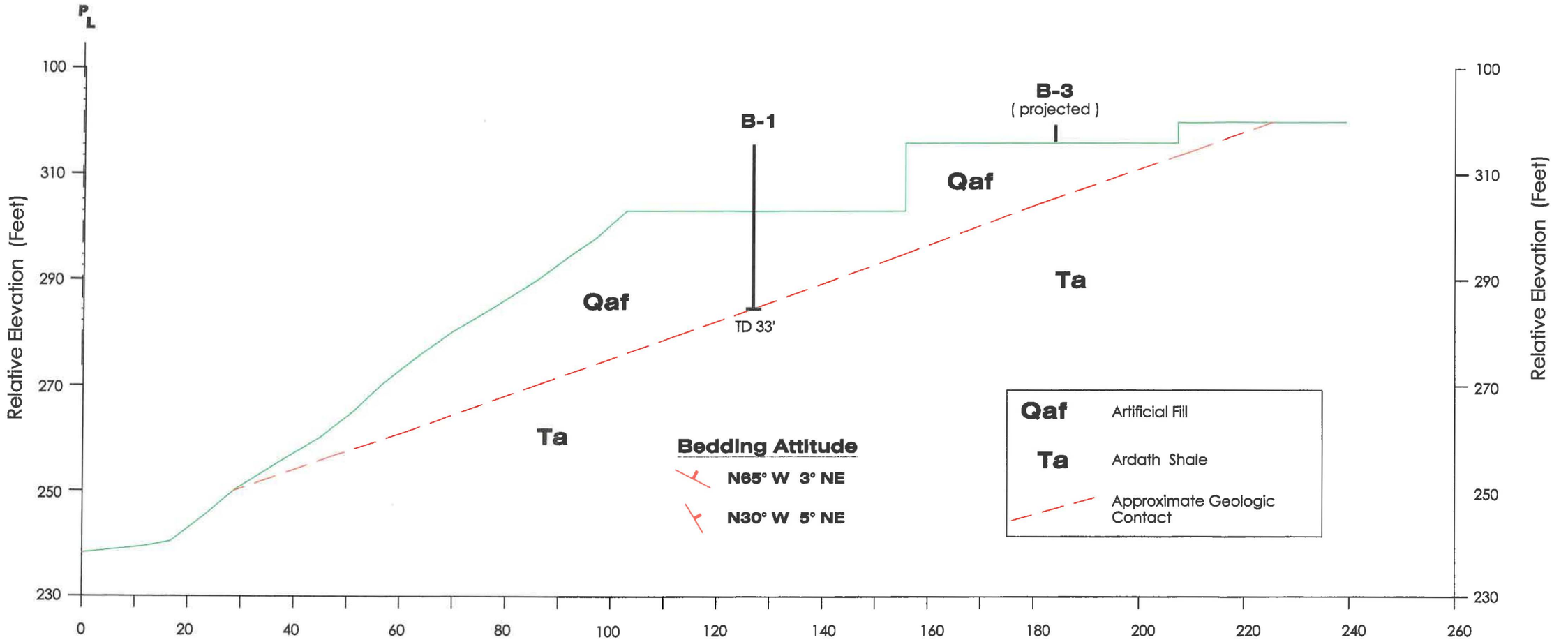
Geotechnical Exploration, Inc.

August 2015

14-10569-AA

CROSS SECTION B-B'

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.



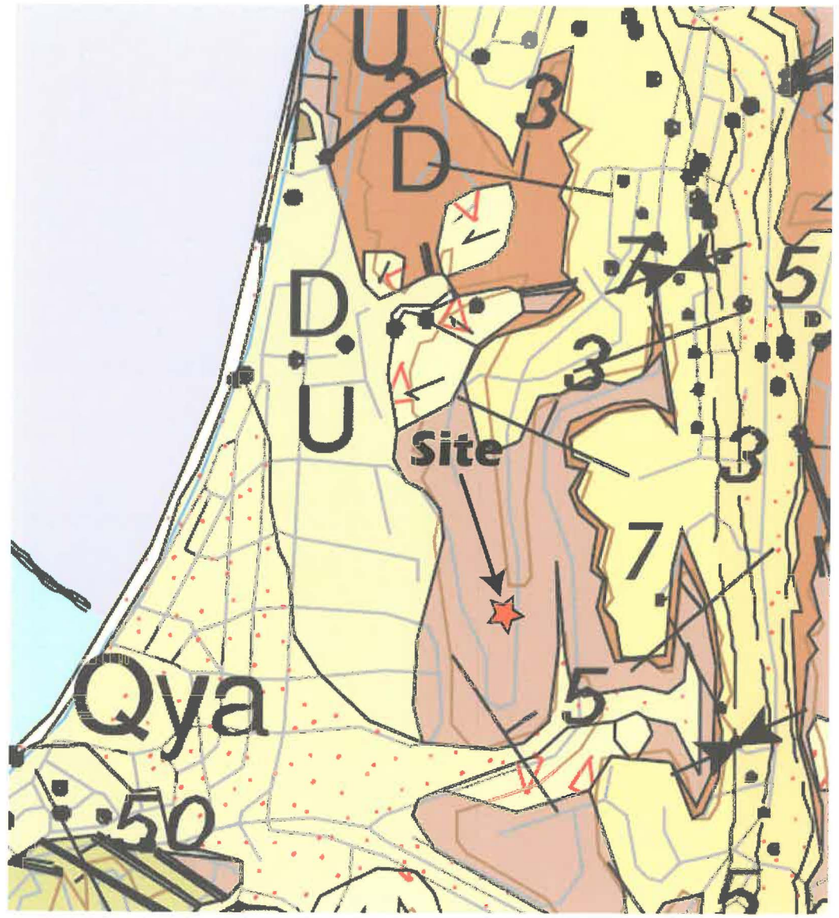
NOTE: This Cross Section is not to be used for legal purposes. Locations and dimensions are approximate. Actual property dimensions and locations of utilities may be obtained from the Approved Building Plans or the "As-Built" Grading Plans.

14-10569-BB

Figure No. Vb
Job No. 14-10569

Geotechnical Exploration, Inc.

August 2015



Coppel Residence
8194 Prestwick Drive
La Jolla, CA.

SCALE 1:100,000

2 0 2 4 6 Miles

2 0 2 4 0 Kilometers

Contour Interval: 50 meters (approximately 164 feet)
Bathymetric Contour Interval: 50 meters (approximately 164 feet)

EXCERPT FROM GEOLOGIC MAP OF THE SAN DIEGO 30' x 60' QUADRANGLE, CALIFORNIA

By
Michael P. Kennedy[1] and Siang S. Tan[1]
2008
Digital preparation by
Kelly R. Bovard[2], Anne G. Garcia[2], Diane Burns[2], and Carlos I. Gutierrez[1]

1. Department of Conservation, California Geological Survey
2. U.S. Geological Survey, Department of Earth Sciences, University of California, Riverside

ONSHORE MAP SYMBOLS

Contact - Contact between geologic units; dotted where concealed.

Fault - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.

Anticline - Solid where accurately located; dashed where approximately located; dotted where concealed. Arrow indicates direction of axial plunge.

Syncline - Solid where accurately located; dotted where concealed. Arrow indicates direction of axial plunge.

Landslide - Arrows indicate principal direction of movement. Queried where existence is questionable.

Strike and dip of beds

Inclined

Strike and dip of igneous joints

Inclined

Vertical

Strike and dip of metamorphic foliation

Inclined

DESCRIPTION OF MAP UNITS

Ardath Shale (middle Eocene)—Mostly uniform, weakly fissile olive-gray silty shale. The upper part contains thin beds of medium-grained sandstone, similar to thicker ones in the overlying Scripps Formation, and concretionary beds with molluscan fossils. The type section of the Ardath Shale is on the east side of Rose Canyon, 800 m south of the Ardath Road intersection with Interstate 5 (Kennedy and Moore, 1971)

Base Map

Onshore base (hypsography, hydrography, and transportation) from U.S.G.S. digital line graph (DLG) data, San Diego 30' x 60' metric quadrangle. Shaded topographic base from U.S.G.S. digital elevation models (DEMs). Offshore bathymetric contours and shaded bathymetry from N.O.A.A. single and multibeam data. Projection is UTM, zone 11, North American Datum 1927.

This map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, STATEMAP Award no. 98HQAG2049

Prepared in cooperation with the U.S. Geological Survey, Southern California Areal Mapping Project

Figure No. VI
Job No. 14-10569

Geotechnical Exploration, Inc.

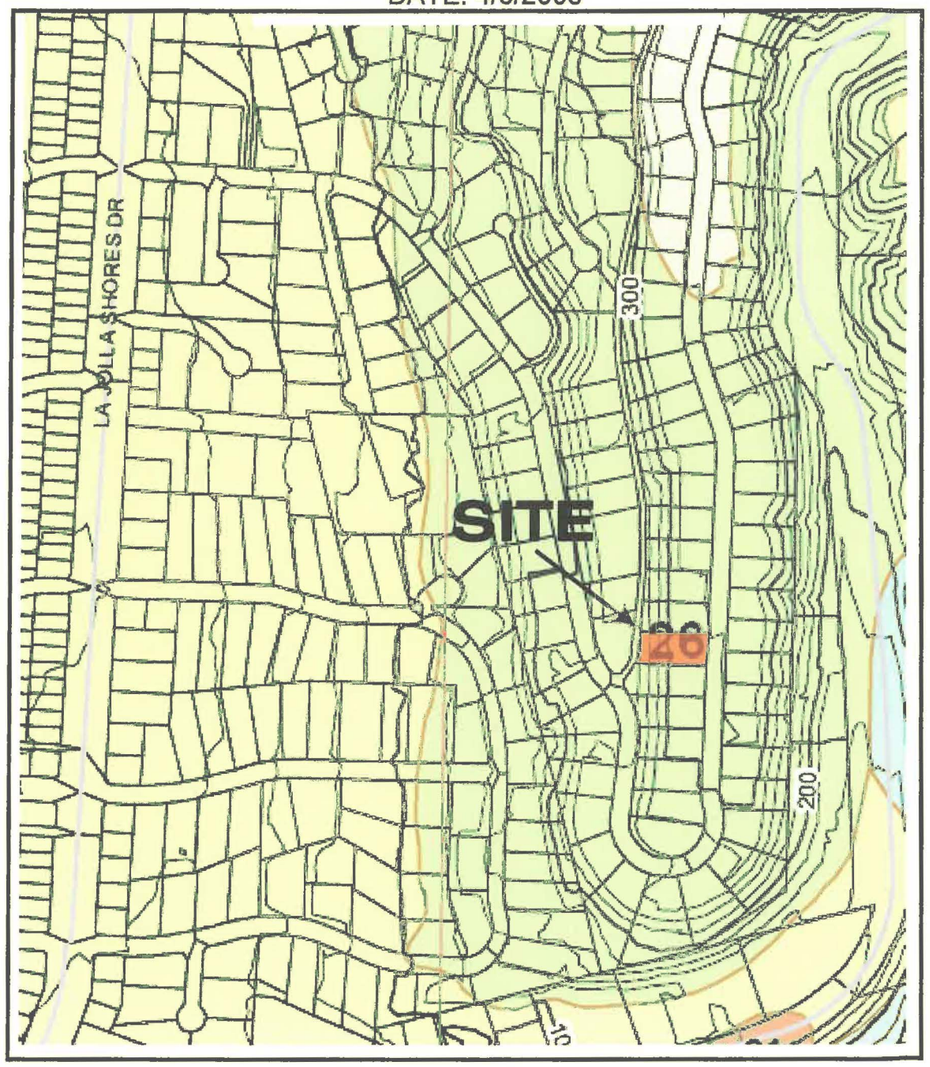
August 2015

coppel-prest-2008-geo.ai

Geologic Hazards Map Excerpt
from City of San Diego
Geologic Hazards and Fault Map
Sheet 29

Development Services Department

DATE: 4/3/2008



Coppel Residence
194 Prestwick Drive
La Jolla, CA.

LEGEND

Geologic Hazard Categories

FAULT ZONES

- 11 Active, Alquist-Priolo Earthquake Fault Zone
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
- 13 Downtown special fault zone

LANDSLIDES

- 21 Confirmed, known, or highly suspected
- 22 Possible or conjectured

SLIDE-PRONE FORMATIONS

- 23 Friars: neutral or favorable geologic structure
- 24 Friars: unfavorable geologic structure
- 25 Ardath: neutral or favorable geologic structure
- 26 Ardath: unfavorable geologic structure
- 27 Otay, Sweetwater, and others

LIQUEFACTION

- 31 High Potential -- shallow groundwater major drainages, hydraulic fills
- 32 Low Potential -- fluctuating groundwater minor drainages

COASTAL BLUFFS

- 41 Generally unstable Numerous landslides, high steep bluffs, severe erosion, unfavorable geologic structure
- 42 Generally unstable Unfavorable bedding plains, high erosion
- 43 Generally unstable Unfavorable jointing, local high erosion
- 44 Moderately stable Mostly stable formations, local high erosion
- 45 Moderately stable Some minor landslides, minor erosion
- 46 Moderately stable Some unfavorable geologic structure, minor or no erosion
- 47 Generally stable Favorable geologic structure, minor or no erosion, no landslides
- 48 Generally stable Broad beach areas, developed harbor

OTHER TERRAIN

- 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk
- 54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk
- 55 Modified terrain (graded sites) Nominal risk

Water (Bays and Lakes)

FAULTS

- Fault
- Inferred Fault
- Concealed Fault
- Shear Zone

Figure No. VII
Job No. 14-10569

Geotechnical Exploration, Inc.

August 2015

coppel-prest-seis-combo.ai

EQUIPMENT	DIMENSION & TYPE OF EXCAVATION	DATE LOGGED
Limited Access Auger Drill Rig	**6-inch diameter Boring**	**6-20-15**
SURFACE ELEVATION	GROUNDWATER/ SEEPAGE DEPTH	LOGGED BY
± 315' Mean Sea Level	**Not Encountered**	**SO**

DEPTH (feet)	SYMBOL	SAMPLE	FIELD DESCRIPTION AND CLASSIFICATION DESCRIPTION AND REMARKS (Grain size, Density, Moisture, Color)	U.S.C.S.	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	DENSITY (% of M.D.D.)	EXPAN. + (%) CONSOL. -	EXPANSION INDEX	BLOW COUNTS/FT.	SAMPLE O.D. (INCHES)
			SANDY CLAY. Stiff to very stiff. Damp to moist. Yellow- and gray-brown.	CL									
			FILL (Qaf)		10.5	112.9			97			43	3"
4												42	2"
			-- formational fragments. Bulk bag from 2'- 7'.				12.0	116.5			74		
					14.3	109.9			94			75	3"
8													
					16.0	113.8			98			60	3"
12			-- becomes more gray-brown.									27	2"
			Bulk bag from 15'- 20'.										
16					18.4	112.9			97	see fig IVc		49	3"
												29	2"
20													
24					17.4	107.0			92			50/ 4"	3"
			-- rock in sampler tip, refusal.										
28													
					17.4	109.4			94			60	3"
32			**SANDY CLAY.** Hard. Moist. Orange- and gray-brown.	CL								85/ 11"	3"
			ARDATH SHALE FORMATION (Ta)										
36			Bottom @ 33'										

EXPLORATION LOG 10569 COPPEL.GPJ GEO_EXPL.GDT 8/3/15

- PERCHED WATER TABLE
- BULK BAG SAMPLE
- IN-PLACE SAMPLE
- MODIFIED CALIFORNIA SAMPLE
- NUCLEAR FIELD DENSITY TEST
- STANDARD PENETRATION TEST

JOB NAME
Coppel Residential Project

SITE LOCATION
8194 Prestwick Drive, La Jolla, CA

JOB NUMBER
14-10569

REVIEWED BY
LDR/JAC

LOG No.
B-1

FIGURE NUMBER
IIIa

Geotechnical Exploration, Inc.

EQUIPMENT	DIMENSION & TYPE OF EXCAVATION	DATE LOGGED
Limited Access Auger Drill Rig	**6-inch diameter Boring**	**6-20-15**
SURFACE ELEVATION	GROUNDWATER/ SEEPAGE DEPTH	LOGGED BY
± 315' Mean Sea Level	**Not Encountered**	**SO**

DEPTH (feet)	SYMBOL	SAMPLE	FIELD DESCRIPTION AND CLASSIFICATION DESCRIPTION AND REMARKS (Grain size, Density, Moisture, Color)	U.S.C.S.	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	DENSITY (% of M.D.D.)	EXPAN. + (%) CONSOL. -	BLOW COUNTS/FT.	SAMPLE O.D. (INCHES)
0			**SANDY CLAY**. Very stiff. Damp to moist. Yellow- and gray-brown.	CL								
2			**FILL (Qaf)**									
4												
6			-- formational fragments.		13.7	116.3			99		65	3"
8											33	2"
10												
12					15.0	113.8			98		65	3"
14			-- no sample retrieval, 2" rock encountered.								50/ 3"	2"
16												
18			-- becomes firm to stiff, very moist, dark gray-brown with organic odor.		23.2	104.6			90	see fig IVc	19	3"
20											14	2"
22			**SANDY CLAY**. Hard. Moist. Orange- and gray-brown.	CL	19.1	110.4			95		90/ 11"	3"
24			**ARDATH SHALE FORMATION (Ta)**								77	2"
26			Bottom @ 24'									

EXPLORATION LOG 10569 COPPEL.GPJ GEO_EXPL.GDT 8/3/15

- PERCHED WATER TABLE
- BULK BAG SAMPLE
- IN-PLACE SAMPLE
- MODIFIED CALIFORNIA SAMPLE
- NUCLEAR FIELD DENSITY TEST
- STANDARD PENETRATION TEST

JOB NAME	**Coppel Residential Project**
SITE LOCATION	**8194 Prestwick Drive, La Jolla, CA**
JOB NUMBER	**14-10569**
REVIEWED BY	**LDR/JAC**
FIGURE NUMBER	**IIIb**
LOG No.	**B-2**

Geotechnical Exploration, Inc.

EQUIPMENT	DIMENSION & TYPE OF EXCAVATION	DATE LOGGED
Limited Access Auger Drill Rig	**6-inch diameter Boring**	**6-20-15**
SURFACE ELEVATION	GROUNDWATER/ SEEPAGE DEPTH	LOGGED BY
± 315' Mean Sea Level	**Not Encountered**	**SO**

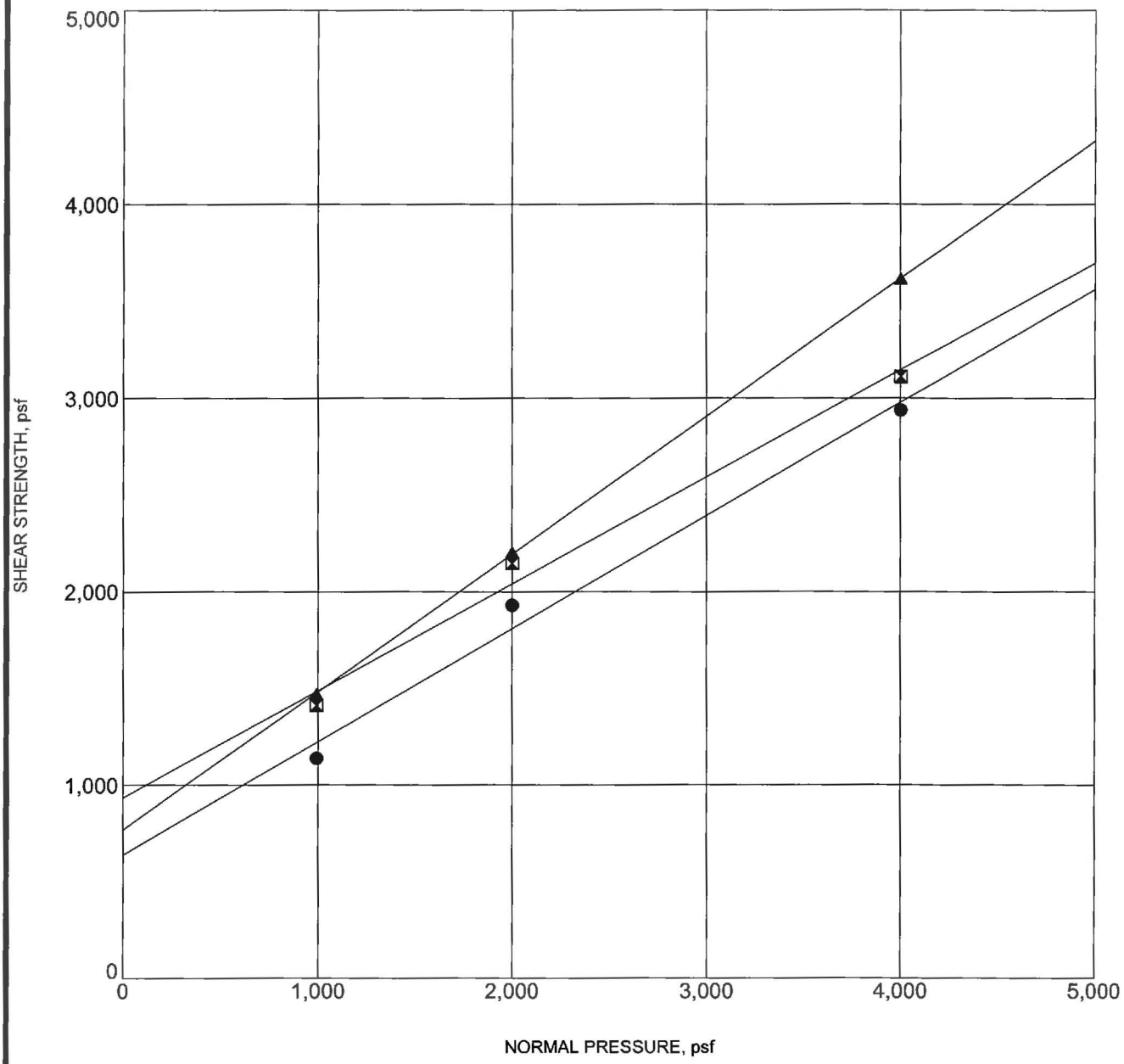
DEPTH (feet)	SYMBOL	SAMPLE	FIELD DESCRIPTION AND CLASSIFICATION DESCRIPTION AND REMARKS (Grain size, Density, Moisture, Color)	U.S.C.S.	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	DENSITY (% of M.D.D.)	EXPAN. + (%) CONSOL. -	BLOW COUNTS/FT.	SAMPLE O.D. (INCHES)
0			**SANDY CLAY.** Stiff to very stiff. Damp to moist. Yellow-brown.	CL								
			FILL (Qaf)									
2			-- formational fragments.									
4												
			SANDY CLAY. Hard. Moist. Orange- and gray-brown.	CL							82	3"
6			**ARDATH SHALE FORMATION (Ta)**								82	2"
8			Bottom @ 7.5'									
10												
12												
14												

EXPLORATION LOG 10569 COPPEL.GPJ GEO_EXPL.GDT 8/3/15

- PERCHED WATER TABLE
- BULK BAG SAMPLE
- IN-PLACE SAMPLE
- MODIFIED CALIFORNIA SAMPLE
- NUCLEAR FIELD DENSITY TEST
- STANDARD PENETRATION TEST

JOB NAME	**Coppel Residential Project**
SITE LOCATION	**8194 Prestwick Drive, La Jolla, CA**
JOB NUMBER	**14-10569**
REVIEWED BY	**LDR/JAC**
FIGURE NUMBER	**IIIc**
LOG No.	**B-3**

Geotechnical Exploration, Inc.



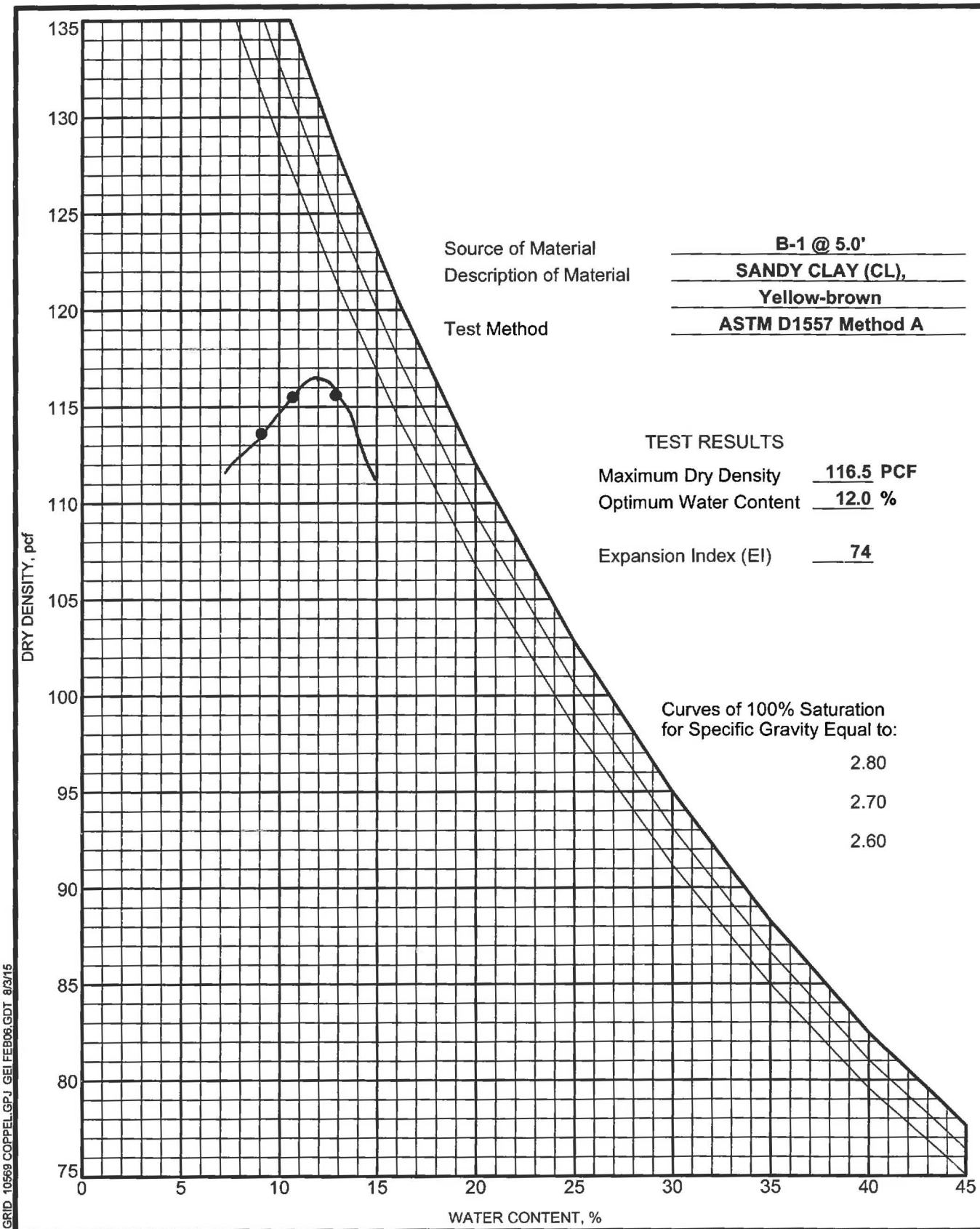
Specimen Identification		Classification	γ_d	MC%	c	ϕ
●	B-1 @ 7.5'	SANDY CLAY (CL), Yellow-brown			638	30
⊠	B-1 @ 31.0'	SANDY CLAY (CL), Orange-gray-brown			933	29
▲	B-2 @ 13.0'	SANDY CLAY (CL), Orange-gray-brown			768	35

Geotechnical Exploration, Inc.

DIRECT SHEAR TEST

Figure Number: IVb
Job Name: Coppel Residential Project
Site Location: 8194 Prestwick Drive, La Jolla, CA
Job Number: 14-10569

US_DIRECT_SHEAR_10569 COPPEL.GPJ GEO_EXPL.GDT 8/3/15



Source of Material: B-1 @ 5.0'

Description of Material: SANDY CLAY (CL), Yellow-brown

Test Method: ASTM D1557 Method A

TEST RESULTS

Maximum Dry Density: 116.5 PCF

Optimum Water Content: 12.0 %

Expansion Index (EI): 74

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

COMPACTION + EI DARK GRID 10569 COPPEL.GPJ GEI FEB06.GDT 8/3/15

Geotechnical Exploration, Inc.

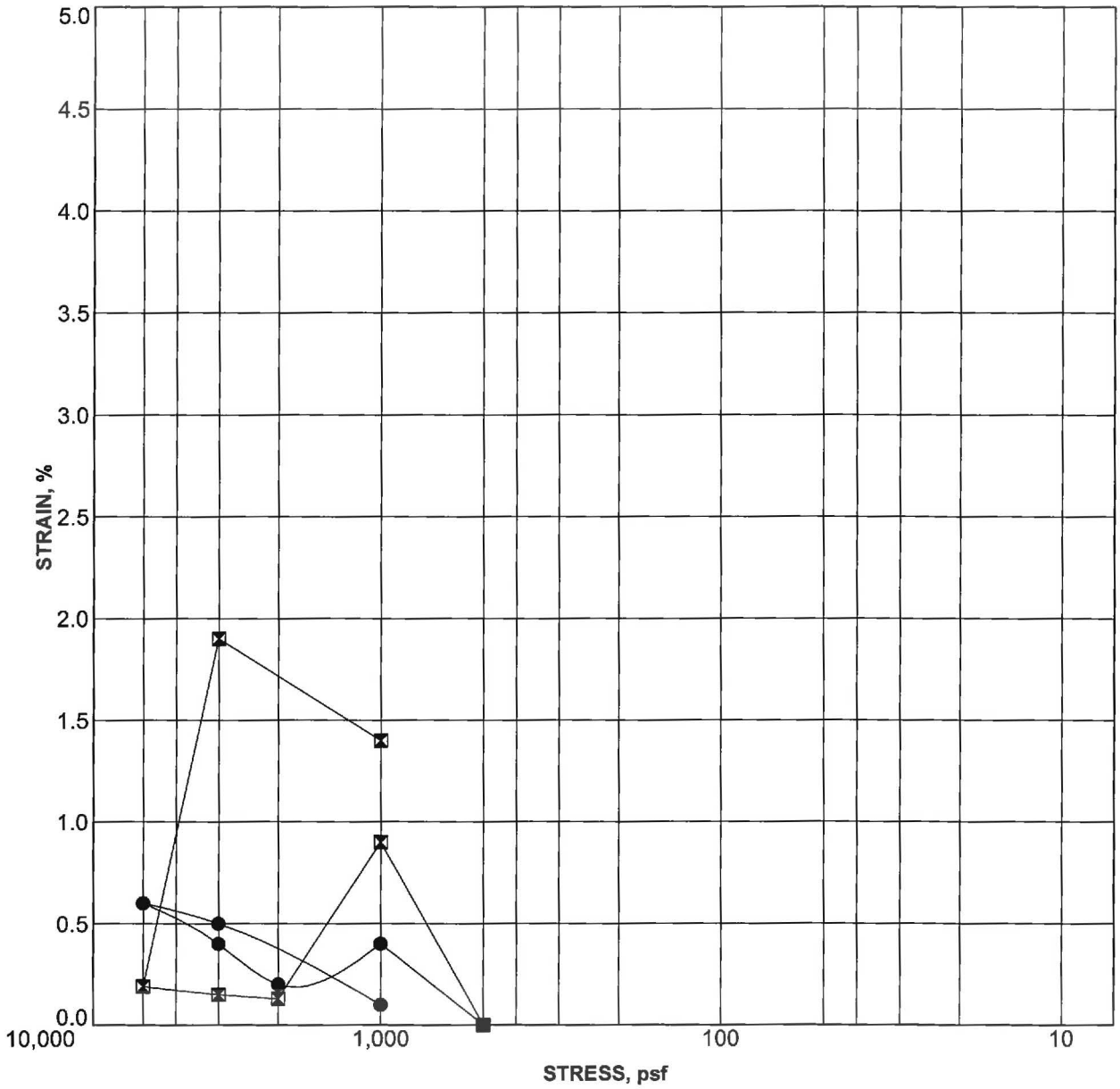
MOISTURE-DENSITY RELATIONSHIP

Figure Number: IVa

Job Name: Coppel Residential Project

Site Location: 8194 Prestwick Drive, La Jolla, CA

Job Number: 14-10569



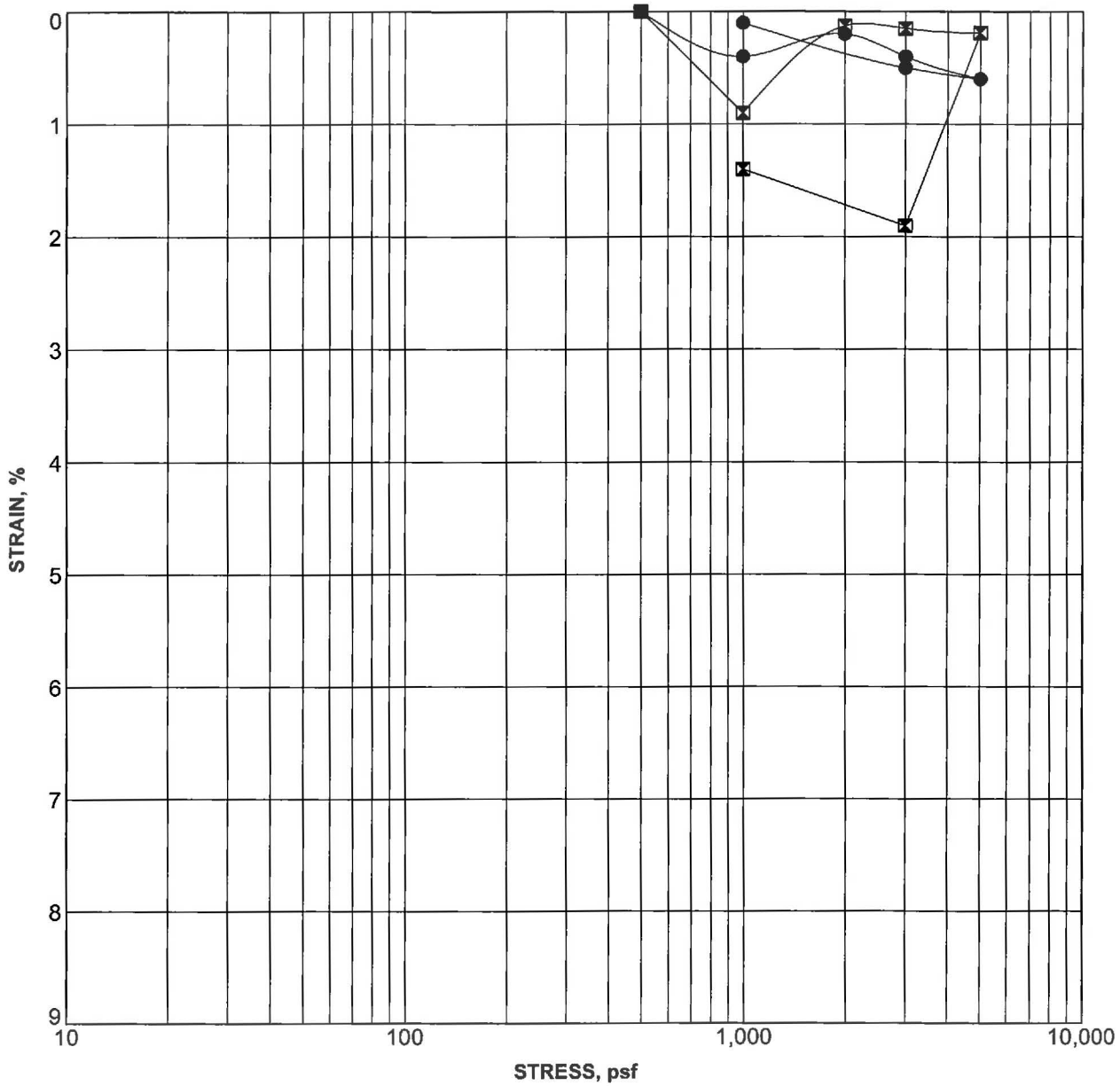
Specimen Identification		Classification	γ_d, pcf	MC, %	Notes
●	B-1 @ 18.0	SANDY CLAY (CL), Yellow-brown			
▲	B-2 @ 18.0	SANDY CLAY (CL), Orange-gray-brown			

Geotechnical Exploration, Inc.

CONSOLIDATION TEST

Figure Number: IVc
Job Name: Coppel Residential Project
Site Location: 8194 Prestwick Drive, La Jolla, CA
Job Number: 14-10569

US_CONSOL_STRAIN-REV SEPT2010 10569 COPPEL.GPJ GEI FEB06.GDT 8/3/15



Specimen Identification	Classification	γ_d, pcf	MC, %	Notes
B-1 @ 18.0	SANDY CLAY (CL), Yellow-brown			
B-2 @ 18.0	SANDY CLAY (CL), Orange-gray-brown			

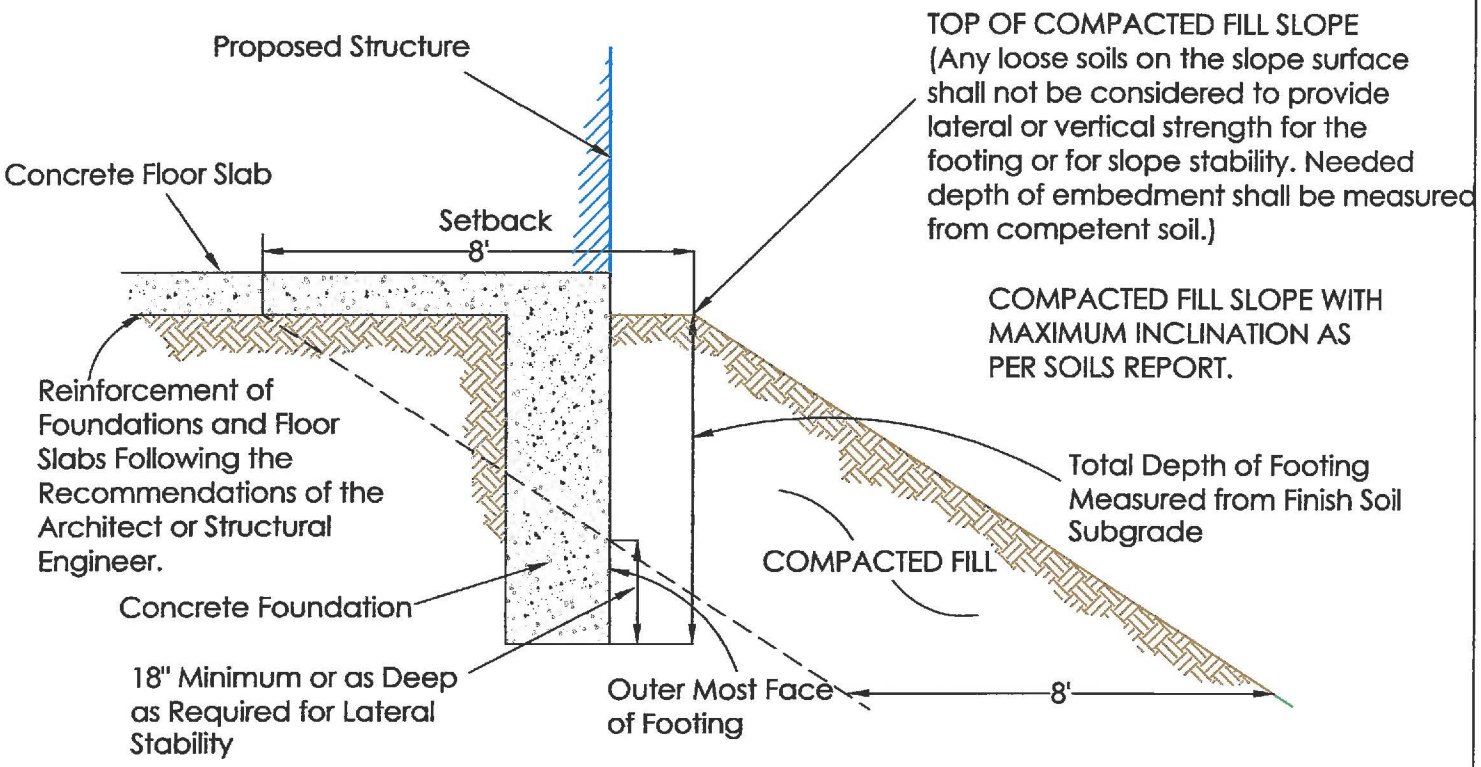
Geotechnical Exploration, Inc.

CONSOLIDATION TEST

Figure Number: IVc
Job Name: Coppel Residential Project
Site Location: 8194 Prestwick Drive, La Jolla, CA
Job Number: 14-10569

US_CONSOL_STRAIN-REV FEB06 10569 COPPEL.GPJ GEI FEB06.GDT 8/3/15

FOUNDATION REQUIREMENTS NEAR SLOPES



TYPICAL SECTION

(Showing Proposed Foundation Located Within 8 Feet of Top of Slope)

18" FOOTING / 8' SETBACK

Total Depth of Footing

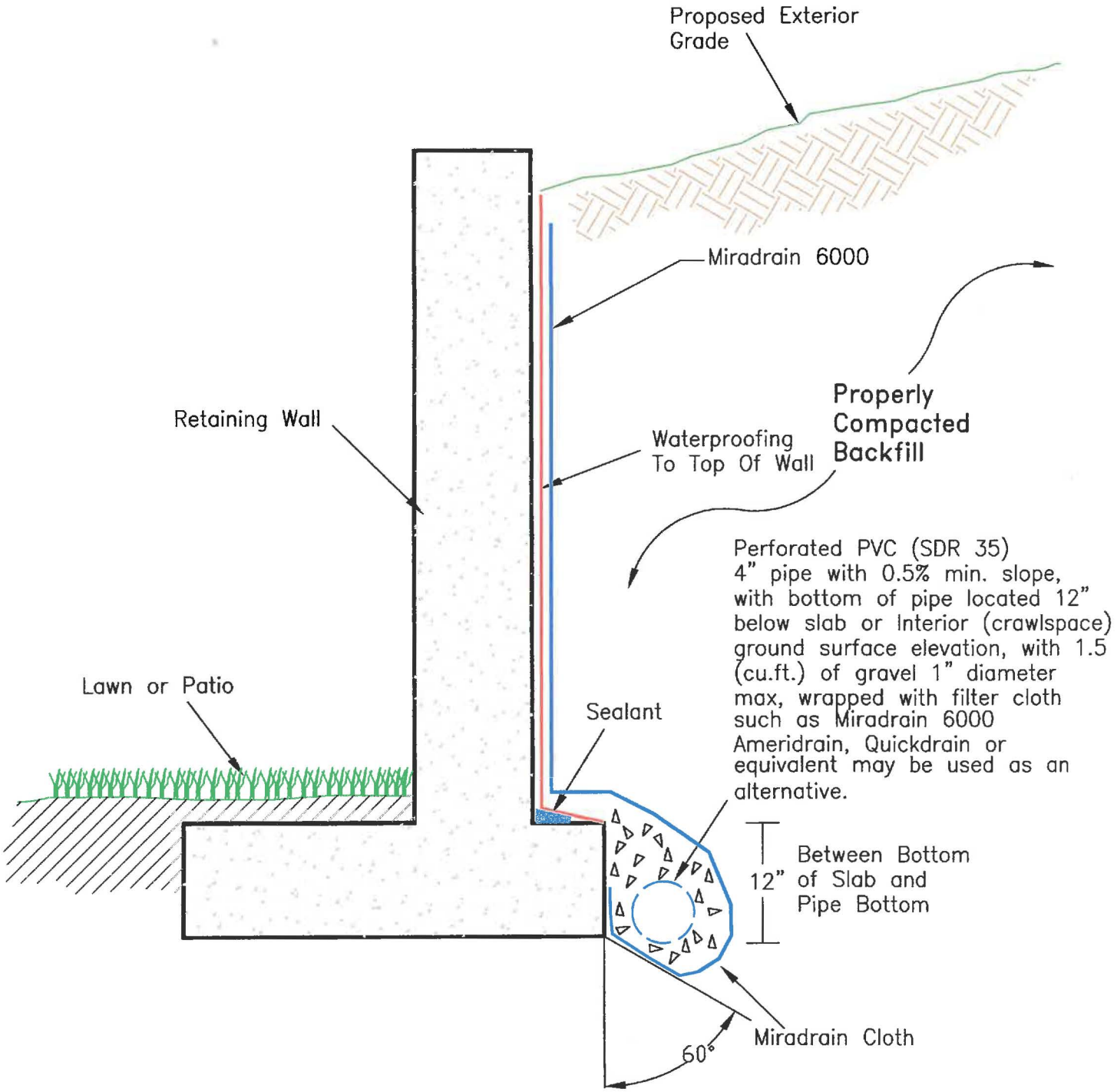
Distance From Top of Slope	1.5:1.0 SLOPE *	2.0:1.0 SLOPE
0	82"	66"
2'	66"	54"
4'	51"	42"
6'	34"	30"
8'	18"	18"

* when applicable

Figure No. VIII
Job No. 14-10569

Geotechnical Exploration, Inc.

SCHEMATIC RETAINING WALL SUBDRAIN RECOMMENDATIONS



NOT TO SCALE

Figure No. IX
Job No. 14–10569

NOTE: As an option to Miradrain 6000, Gravel or Crushed rock 3/4" maximum diameter may be used with a minimum 12" thickness along the interior face of the wall and 2.0 cu.ft./ft. of pipe gravel envelope.

Geotechnical Exploration, Inc.

APPENDIX A
UNIFIED SOIL CLASSIFICATION CHART
SOIL DESCRIPTION

Coarse-grained (More than half of material is larger than a No. 200 sieve)

GRAVELS, CLEAN GRAVELS (More than half of coarse fraction is larger than No. 4 sieve size, but smaller than 3")	GW	Well-graded gravels, gravel and sand mixtures, little or no fines.
	GP	Poorly graded gravels, gravel and sand mixtures, little or no fines.
GRAVELS WITH FINES (Appreciable amount)	GC	Clay gravels, poorly graded gravel-sand-silt mixtures
SANDS, CLEAN SANDS (More than half of coarse fraction is smaller than a No. 4 sieve)	SW	Well-graded sand, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines.
SANDS WITH FINES (Appreciable amount)	SM	Silty sands, poorly graded sand and silty mixtures.
	SC	Clayey sands, poorly graded sand and clay mixtures.

Fine-grained (More than half of material is smaller than a No. 200 sieve)

SILTS AND CLAYS

Liquid Limit Less than 50	ML	Inorganic silts and very fine sands, rock flour, sandy silt and clayey-silt sand mixtures with a slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, clean clays.
	OL	Organic silts and organic silty clays of low plasticity.
Liquid Limit Greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	CH	Inorganic clays of high plasticity, fat clays.
	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

(rev. 6/05)

APPENDIX B
MODIFIED MERCALLI INTENSITY SCALE OF 1931
(Excerpted from the California Division of Conservation Division of Mines and Geology DMG Note 32)

The first scale to reflect earthquake intensities was developed by deRossi of Italy, and Forel of Switzerland, in the 1880s, and is known as the Rossi-Forel Scale. This scale, with values from I to X, was used for about two decades. A need for a more refined scale increased with the advancement of the science of seismology, and in 1902, the Italian seismologist Mercalli devised a new scale on a I to XII range. The Mercalli Scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neumann to take into account modern structural features.

The Modified Mercalli Intensity Scale measures the intensity of an earthquake's effects in a given locality, and is perhaps much more meaningful to the layman because it is based on actual observations of earthquake effects at specific places. It should be noted that because the damage used for assigning intensities can be obtained only from direct firsthand reports, considerable time -- weeks or months -- is sometimes needed before an intensity map can be assembled for a particular earthquake.

On the Modified Mercalli Intensity Scale, values range from I to XII. The most commonly used adaptation covers the range of intensity from the conditions of *"I -- not felt except by very few, favorably situated,"* to *"XII -- damage total, lines of sight disturbed, objects thrown into the air."* While an earthquake has only one magnitude, it can have many intensities, which decrease with distance from the epicenter.

It is difficult to compare magnitude and intensity because intensity is linked with the particular ground and structural conditions of a given area, as well as distance from the earthquake epicenter, while magnitude depends on the energy released at the focus of the earthquake.

I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects thrown upward into the air.

APPENDIX C

USGS DESIGN MAPS SUMMARY REPORT

USGS Design Maps Summary Report

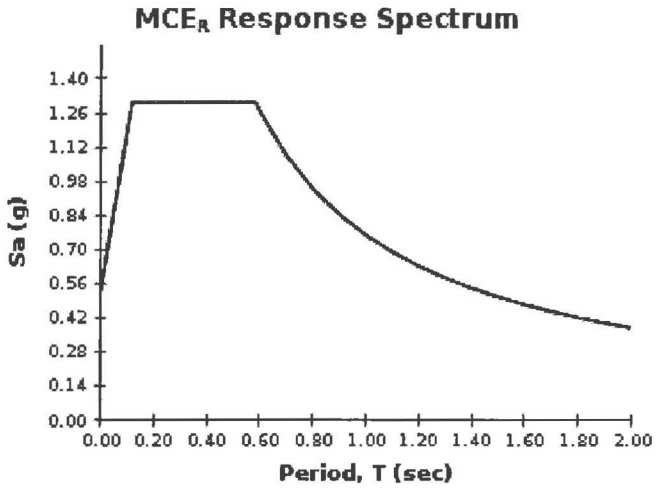
User-Specified Input

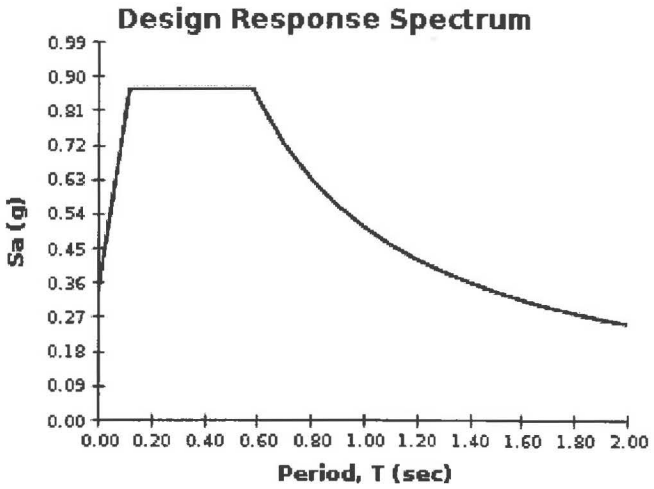
Report Title	8194 Prestwick Drive, La Jolla,CA Mon August 17, 2015 17:37:33 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	32.8551°N, 117.2476°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS-Provided Output

S_S =	1.302 g	S_{MS} =	1.302 g	S_{DS} =	0.868 g
S_1 =	0.506 g	S_{M1} =	0.759 g	S_{D1} =	0.506 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

APPENDIX D

SLOPE STABILITY ANALYSES

Shallow Failure Analysis Slope Stability Calculations
Coppel Residence
8194 Prestwick Drive
La Jolla, California

Job No. 14-10569

Soil Design Parameters:

Soil Unit Weight: 120 pcf, Saturated Unit Weight = 130 pcf
Friction Angle: 30 degrees
Cohesion: 350 psf (for remolded compacted fill)
Slope Angle, β,: 33.69 degrees (existing 1.5 to 1.0 slope)

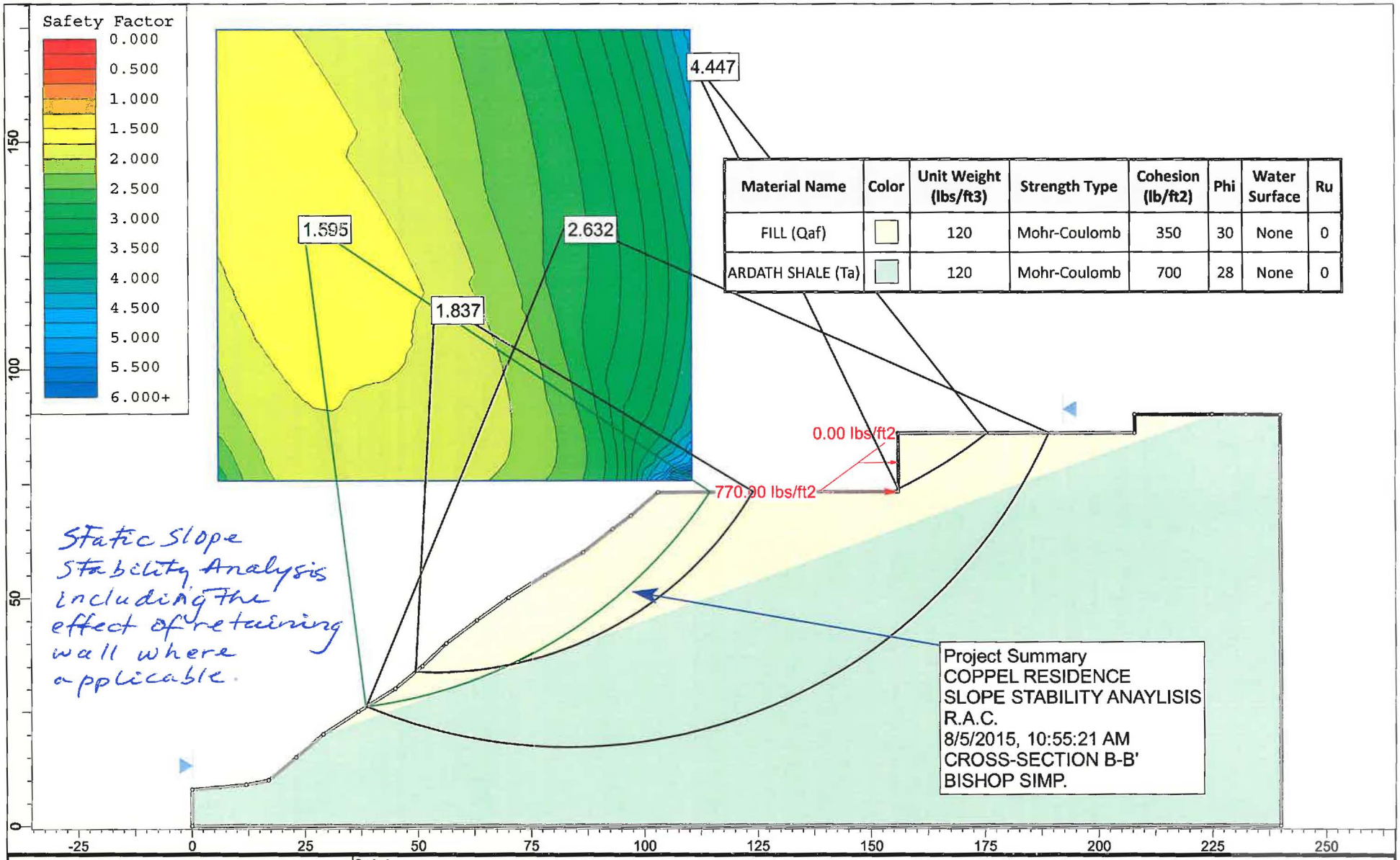
Shallow Failure Stability Analysis:

$Fs = C/(\gamma \text{ sat} \times H \times \cos\wedge 2\ (\beta) \times \text{Tan } \beta) \quad + \quad (\gamma'/\gamma \text{ sat})(\tan \phi/\tan\beta)$

$= 350/(130 \times 3.0 \times 0.692 \times 0.667) \quad + \quad (62.4/130)\ (0.577/0.667)$

$= 1.94 + 0.415$

$= 2.35 > 1.50$ **O.K**



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE			
Analysis Description	SLOPE STABILITY ANAYLISIS			
Drawn By	R.A.C.	Scale	1:350	Company
Date	8/5/2015, 10:55:21 AM			File Name JOB NO.14-10569B02.slim

SLIDEINTERPRET 6.005

SHALLOW FAILURE

Υ	Υ_{sat}	Υ'	H
pcf	pcf	pcf	ft
120	130	67.6	3

FILL	
$C_{(Qaf)}$	$\Phi_{(Qaf)}$
psf	°
350	30

ARDATH FORMATION	
$C_{(Ka)}$	$\Phi_{(Ka)}$
psf	°
700	28

$$F.S.=\frac{C}{\gamma_{sat}Hcos^2(\beta)tan(\beta)}+\frac{\gamma'tan(\varphi)}{\gamma_{sat}tan(\beta)} \qquad \text{(eq.1)}$$

Shallow Slope Stability Analysis is based on the above equation (1) for the calculated values.

CROSS-SECTION A-A'		
SOIL TYPE	β(°)	F.S.
Qaf	4	17.190
Qaf	1	68.629
Qaf	27	2.808
Qaf	36	2.300
Qaf	33	2.427
Qaf	32	2.477
Qaf	38	2.234
Ka	38	4.054
Ka	36	4.155
Ka	39	4.011
Ka	36	4.155
Ka	34	4.282
Ka	35	4.215
Ka	37	4.101
Ka	34	4.282
Ka	6	19.896

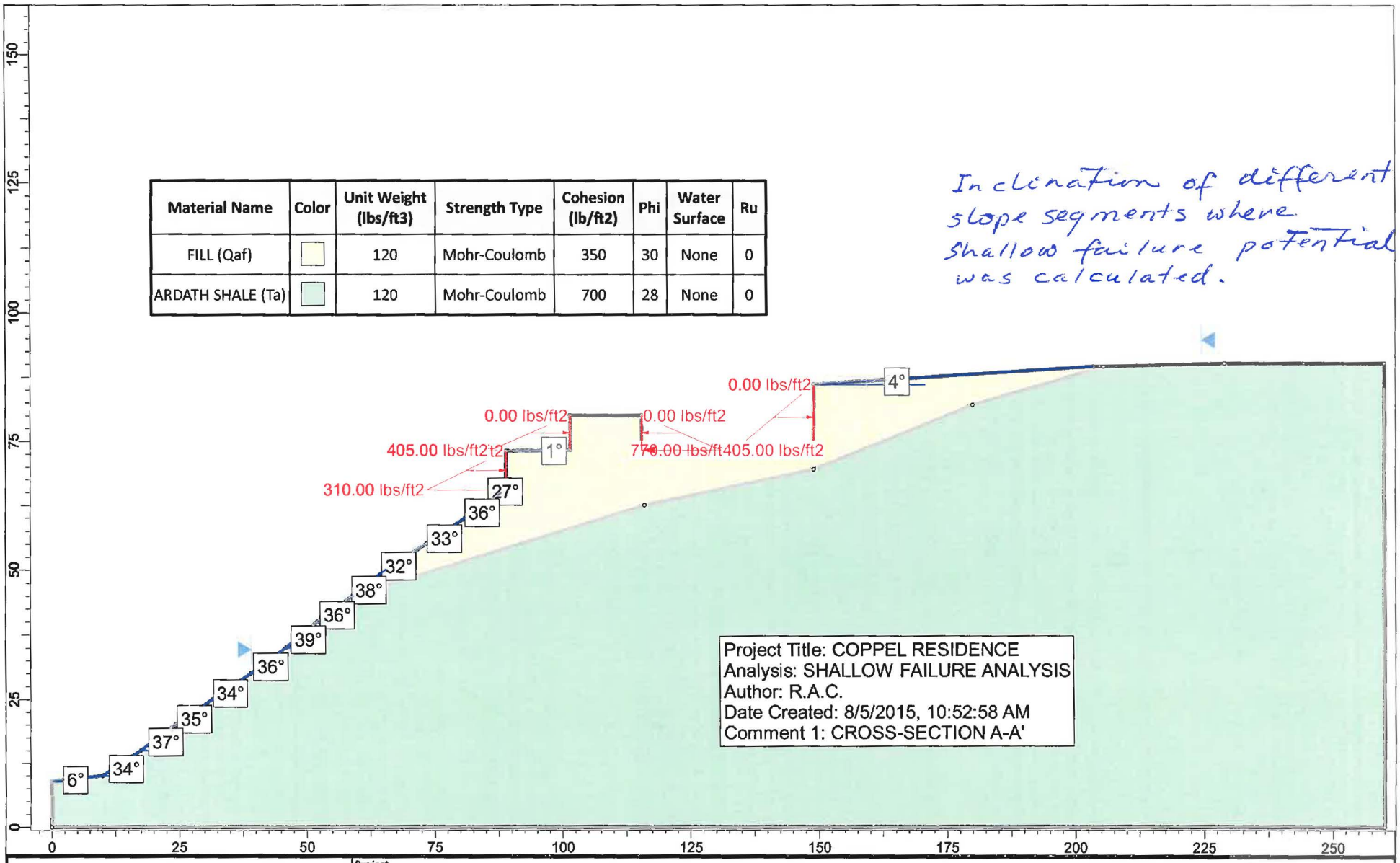
CROSS-SECTION B-B'		
SOIL TYPE	β(°)	F.S.
Qaf	1	68.629
Qaf	40	2.180
Qaf	37	2.266
Qaf	38	2.234
Qaf	30	2.593
Qaf	32	2.477
Qaf	36	2.300
Qaf	37	2.266
Qaf	44	2.107
Qaf	40	2.180
Qaf	31	2.532
Qaf	33	2.427
Ka	33	4.355
Ka	40	3.975
Ka	40	3.975
Ka	11	11.005

β° = slope angle of a specific segment of slope face.

F.S. = The calculated factor of safety against shear failure for that specific segment of the slope.

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Inclination of different slope segments where shallow failure potential was calculated.



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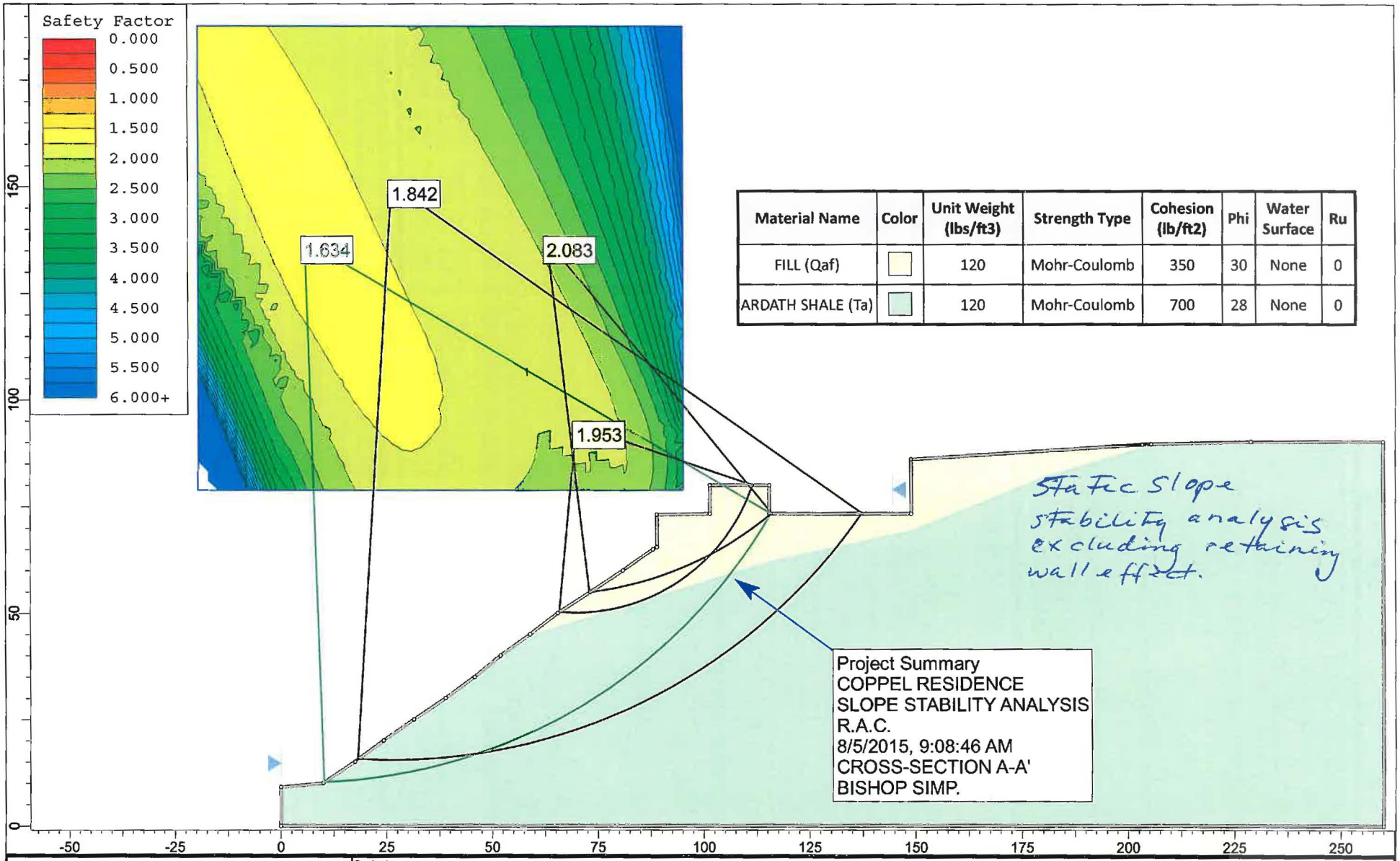
Analysis Description	SHALLOW FAILURE ANALYSIS		
Drawn By: R.A.C.	Scale: 1:310	Company:	
Date: 8/5/2015, 10:52:58 AM		File Name: JOB NO. 14-10569A(SHALLOW_FAILURE).slim	

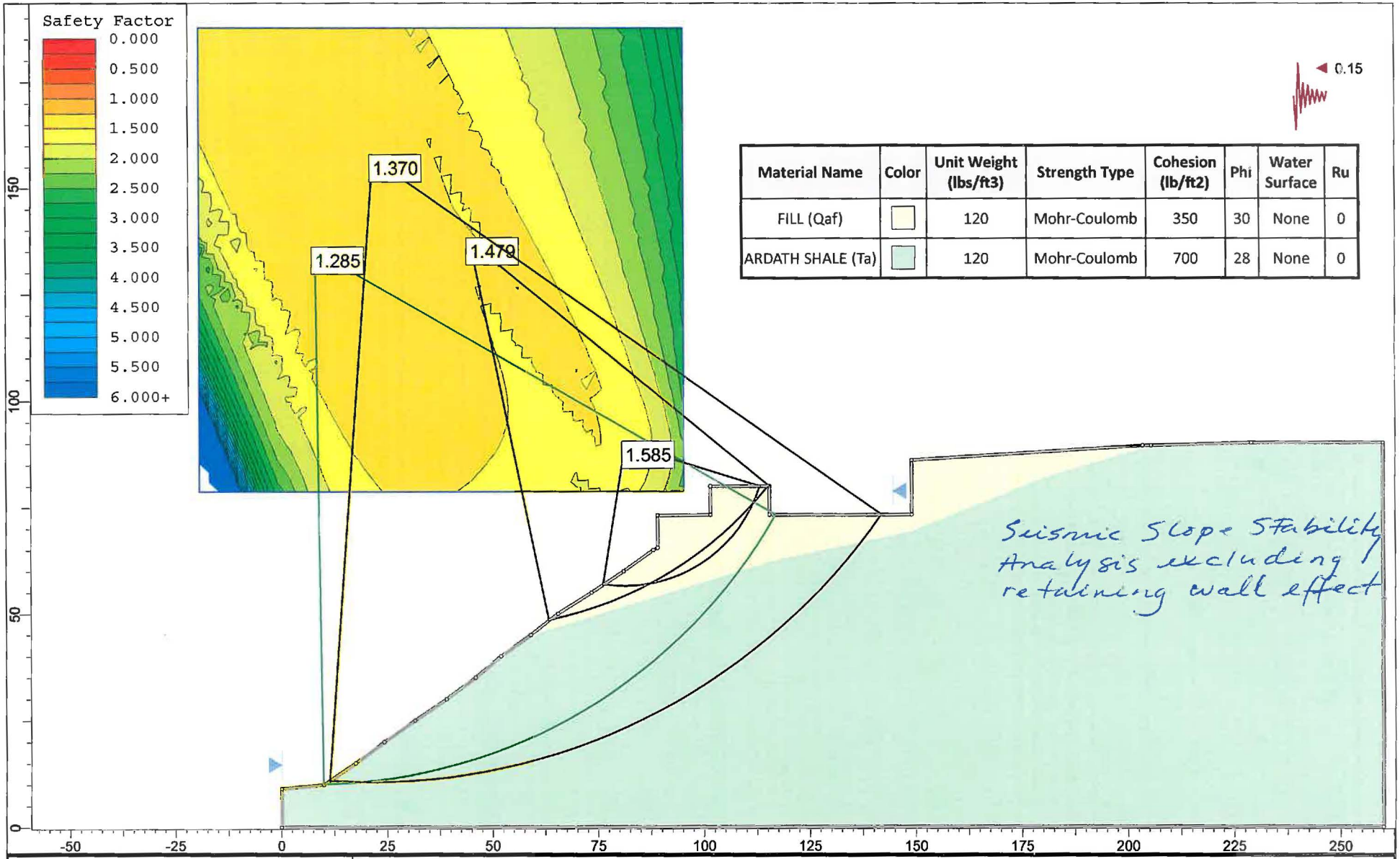
SLIDE 6.005



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE			
Analysis Description	SLOPE STABILITY ANALYSIS			
Drawn By	R.A.C.	Scale	1:375	Company
Date	8/5/2015, 9:08:46 AM			File Name JOB NO. 14-10569A01.slim

SLIDEINTERPRET 6.005



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

rocscience	Project	COPPEL RESIDENCE		
	Analysis Description	SLOPE STABILITY ANALYSIS		
	Drawn By	R.A.C.	Scale 1:375	Company
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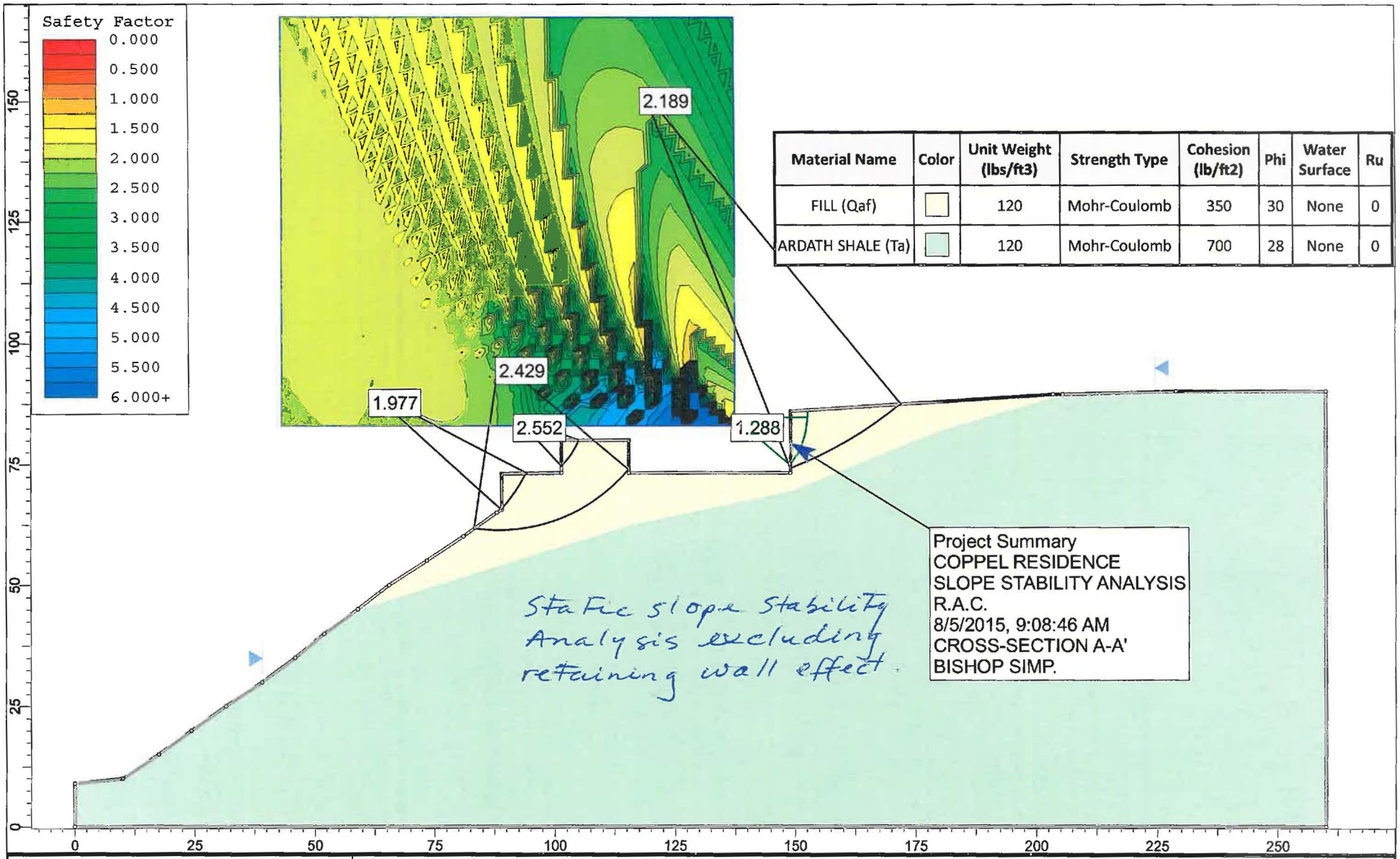
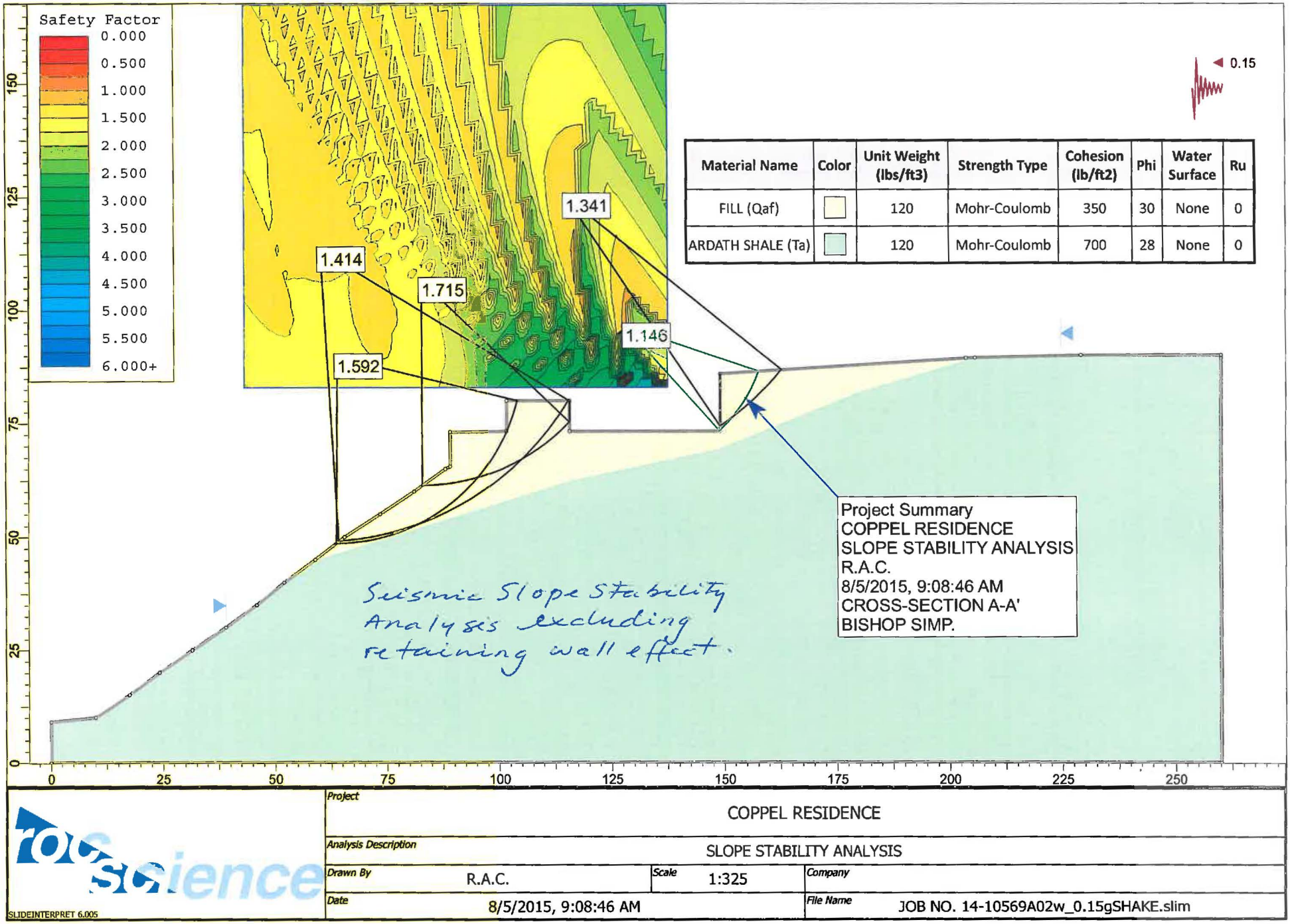
SLIDEINTERPRET 6.005

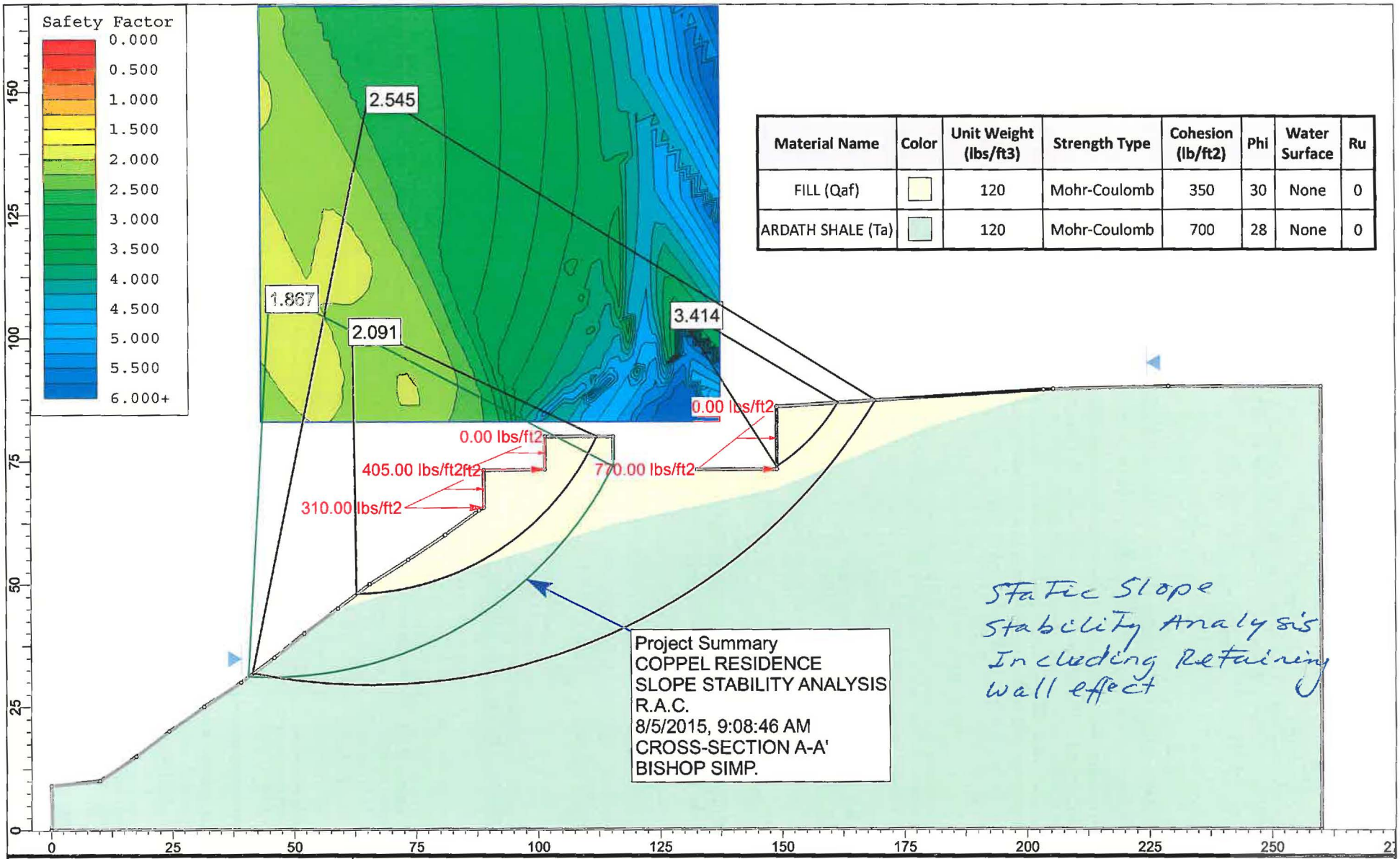


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

rocscience	Project	COPPEL RESIDENCE		
	Analysis Description	SLOPE STABILITY ANALYSIS		
	Drawn By	R.A.C.	Scale 1:330	Company
	Date	8/5/2015, 9:08:46 AM		File Name JOB NO. 14-10569A02.slim

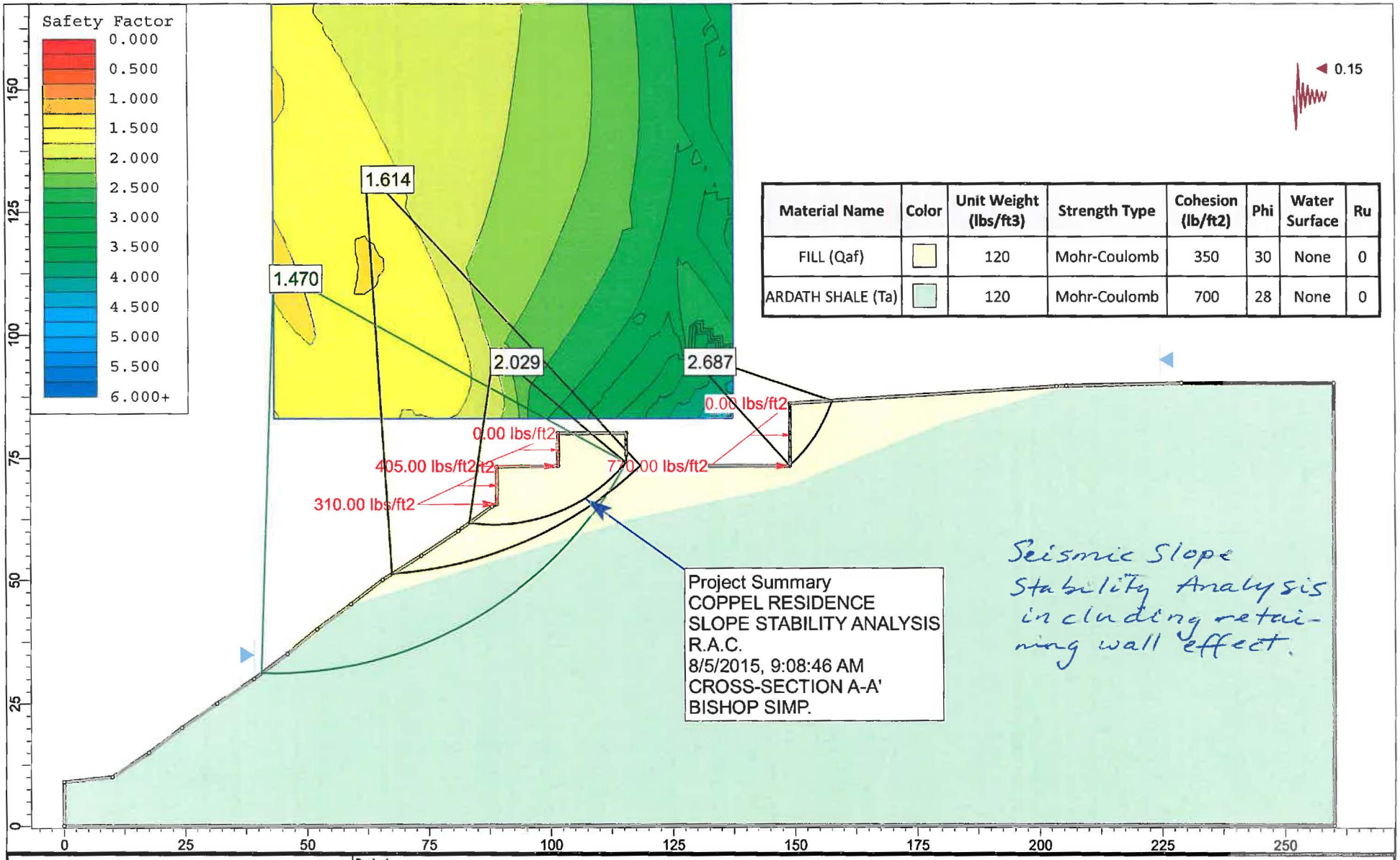
SLIDEINTERPRET 6.005

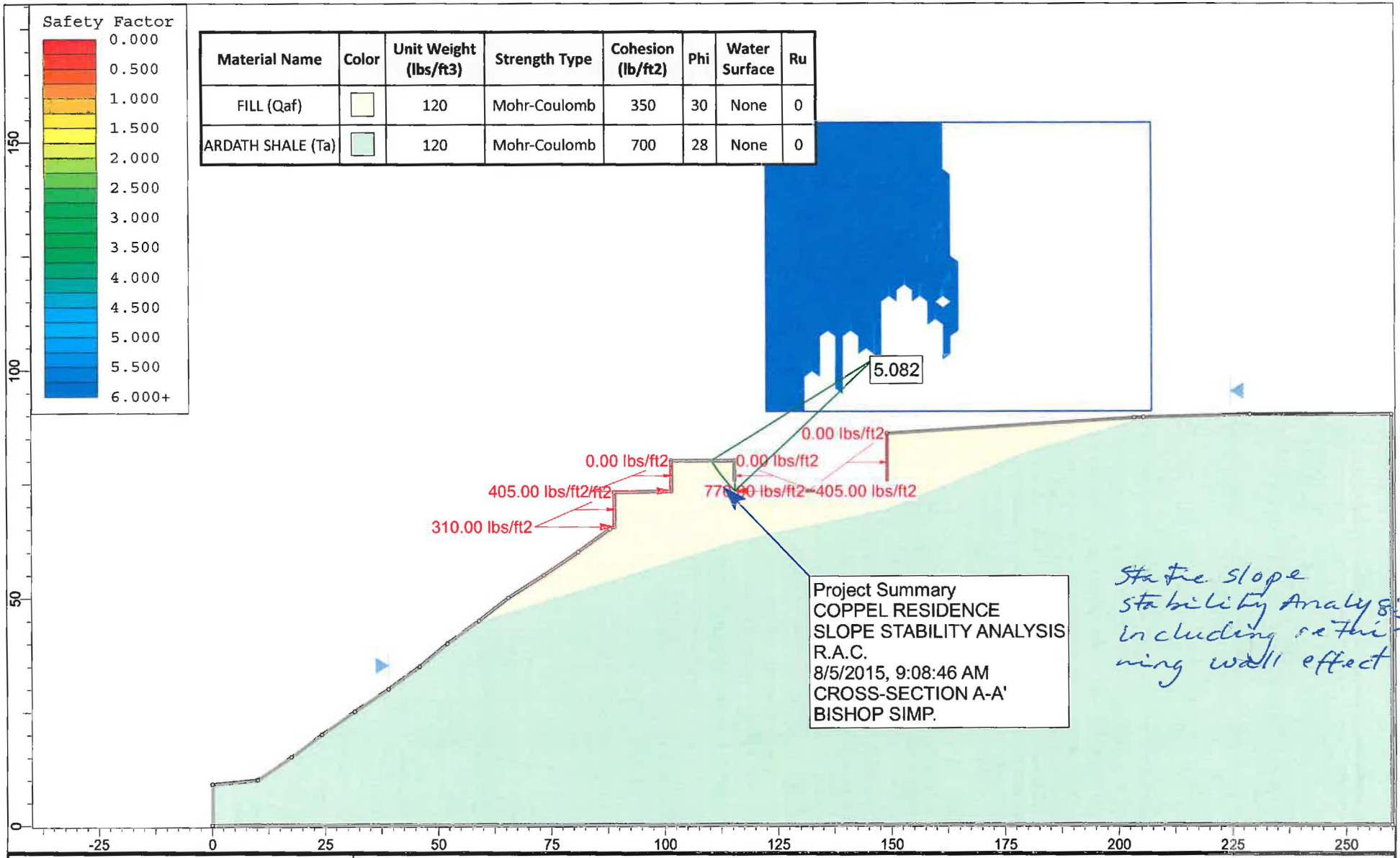




Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

SLIDEINTERPRET 6.005	Project	COPPEL RESIDENCE		
	Analysis Description	SLOPE STABILITY ANALYSIS		
	Drawn By	R.A.C.	Scale 1:325	Company
	Date	8/5/2015, 9:08:46 AM		File Name JOB NO. 14-10569A03.slim

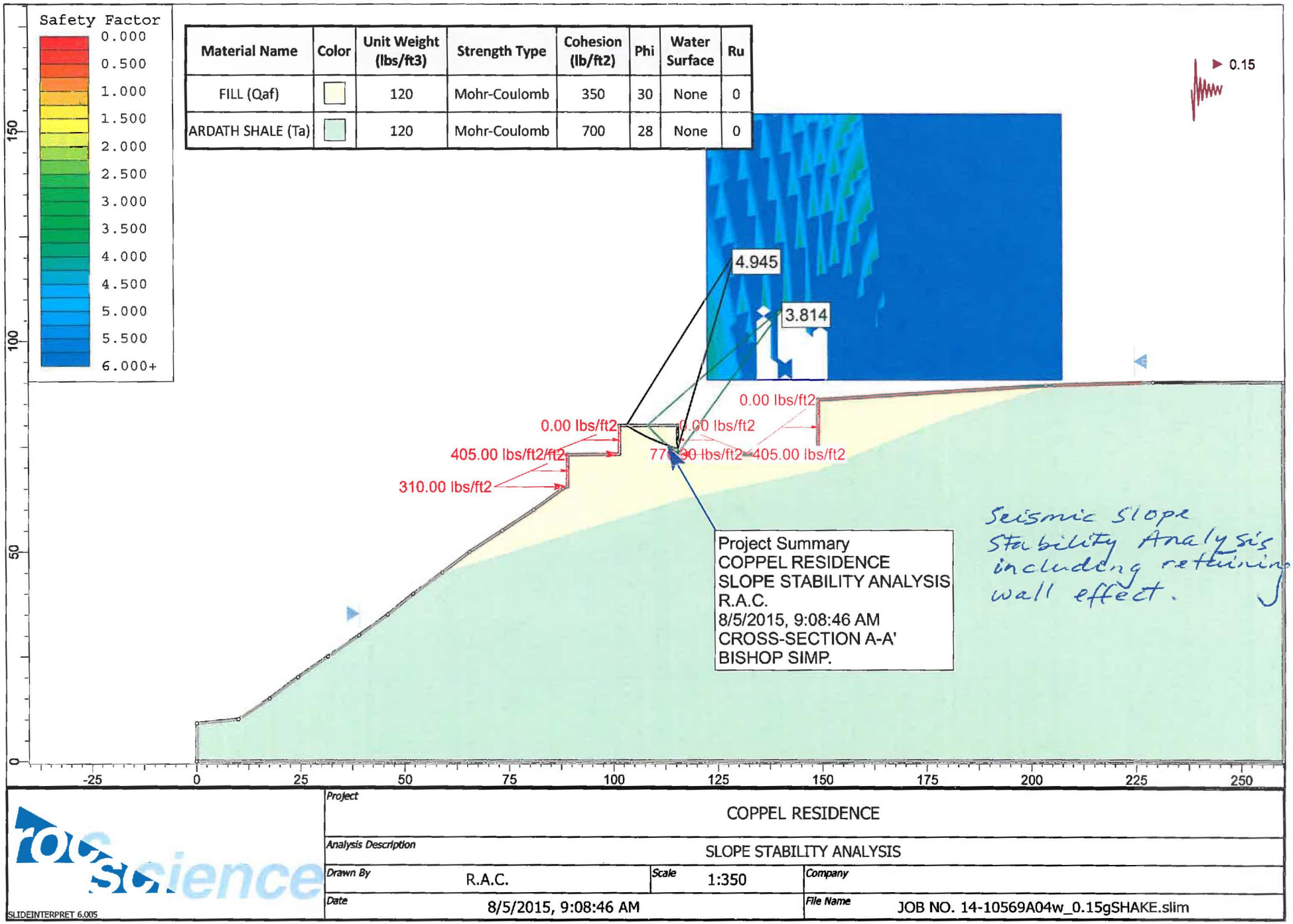




Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE		
Analysis Description	SLOPE STABILITY ANALYSIS		
Drawn By	R.A.C.	Scale 1:350	Company
Date	8/5/2015, 9:08:46 AM		File Name JOB NO. 14-10569A04.slim

SLIDEINTERPRET 6.005



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Analysis Description	SLOPE STABILITY ANALYSIS		
Drawn By: R.A.C.	Scale: 1:350	Company:	
Date: 8/5/2015, 9:08:46 AM		File Name: JOB NO. 14-10569A04w_0.15gSHAKE.slim	

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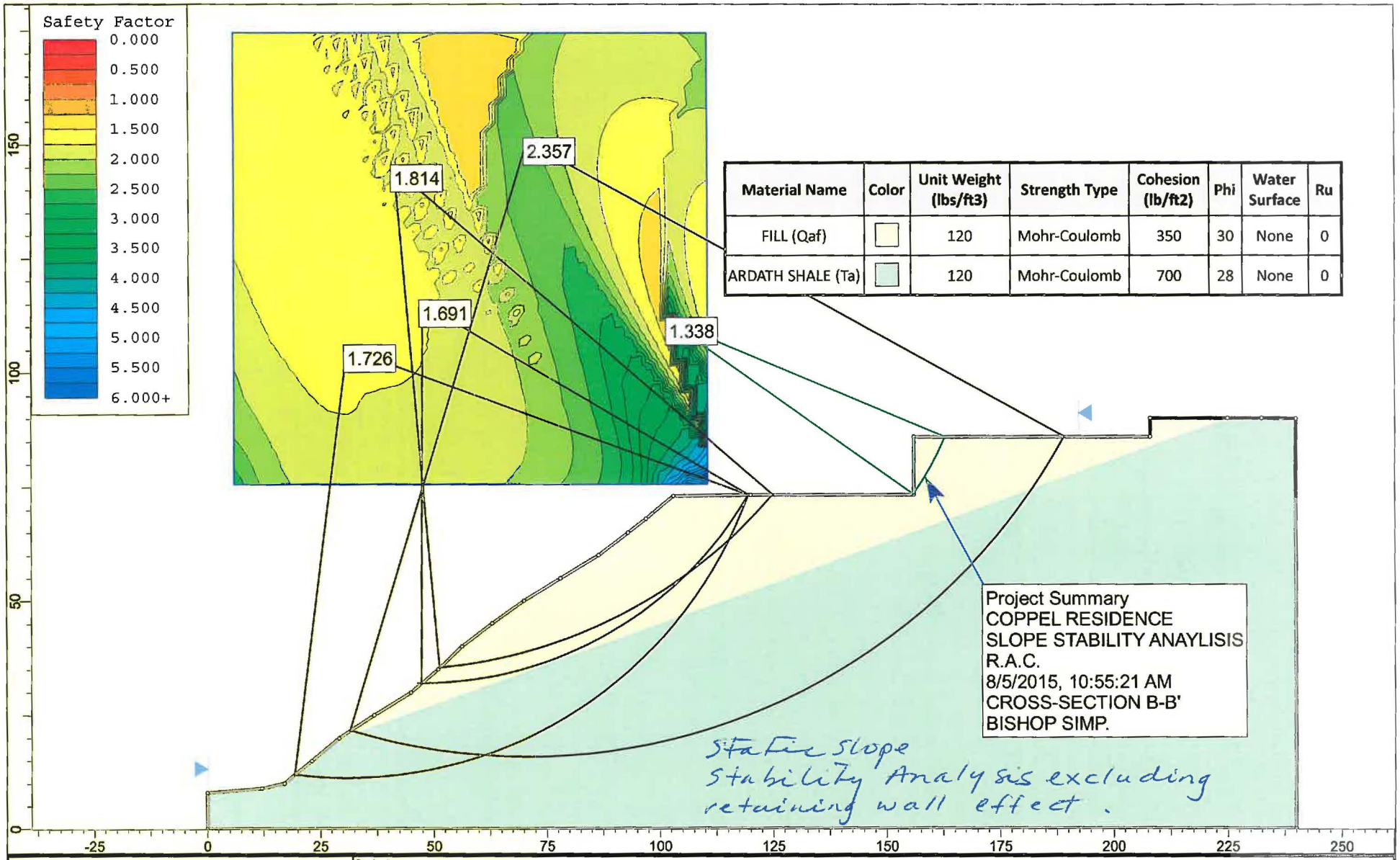

rocscience	Project	COPPEL RESIDENCE		
	Analysis Description	SLOPE STABILITY ANAYLISIS		
	Drawn By	R.A.C.	Scale 1:350	Company
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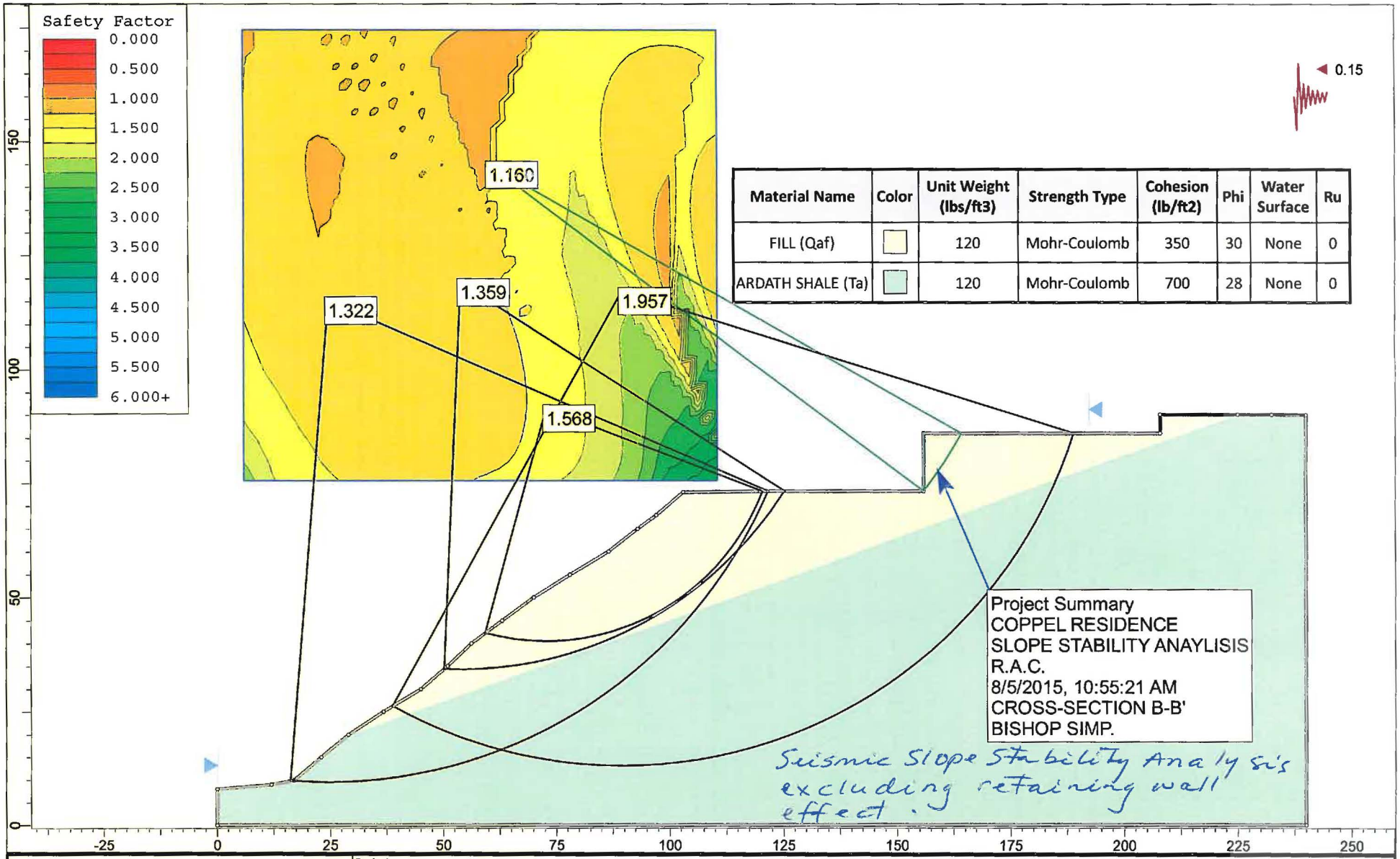
SLIDEINTERPRET 6.005



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	Analysis Description	SLOPE STABILITY ANAYLISIS		
	Drawn By	R.A.C.	Scale 1:350	Company
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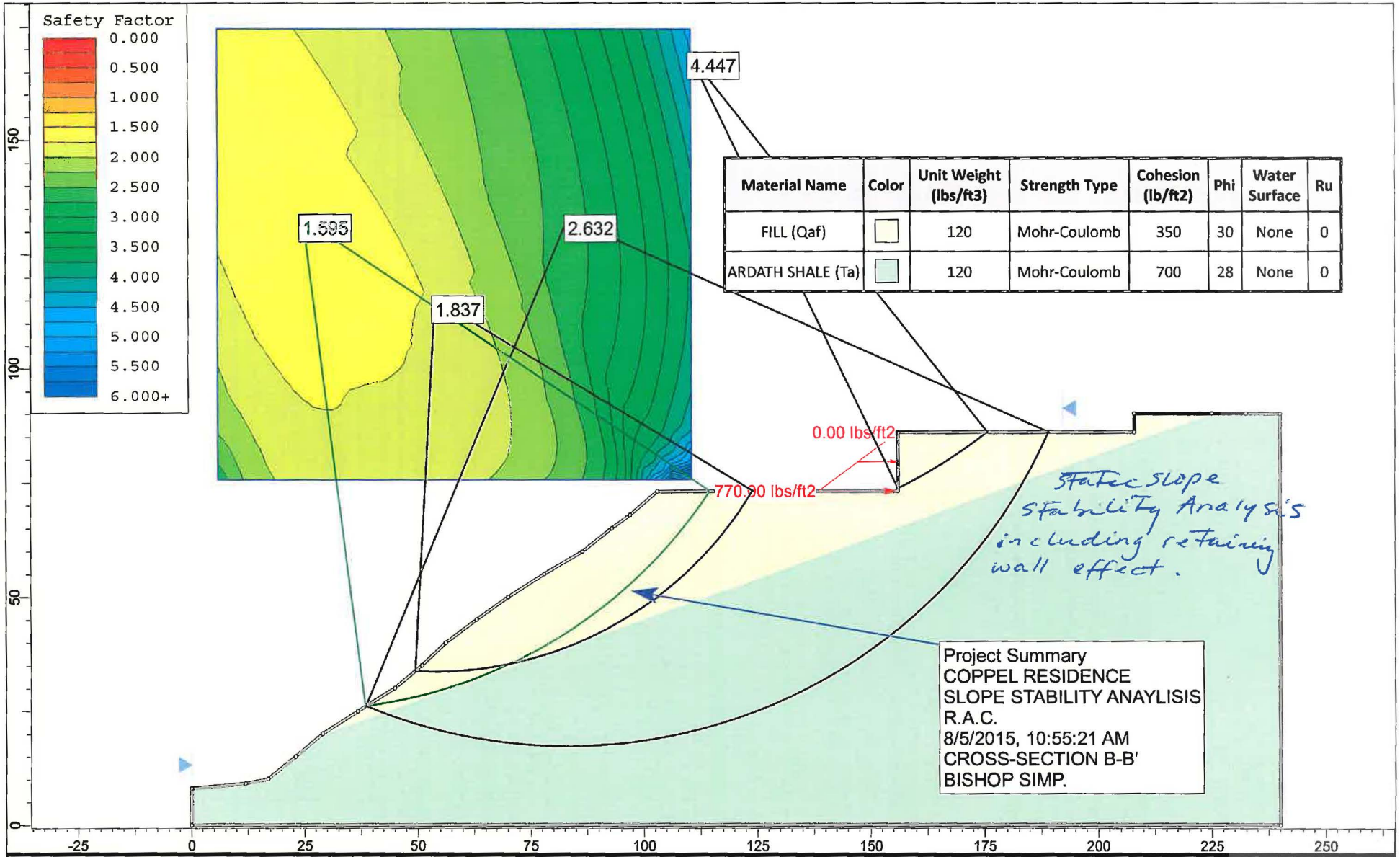

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE			
Analysis Description	SLOPE STABILITY ANAYLISIS			
Drawn By	R.A.C.	Scale	1:350	Company
Date	8/5/2015, 10:55:21 AM			File Name JOB NO.14-10569B02.slim

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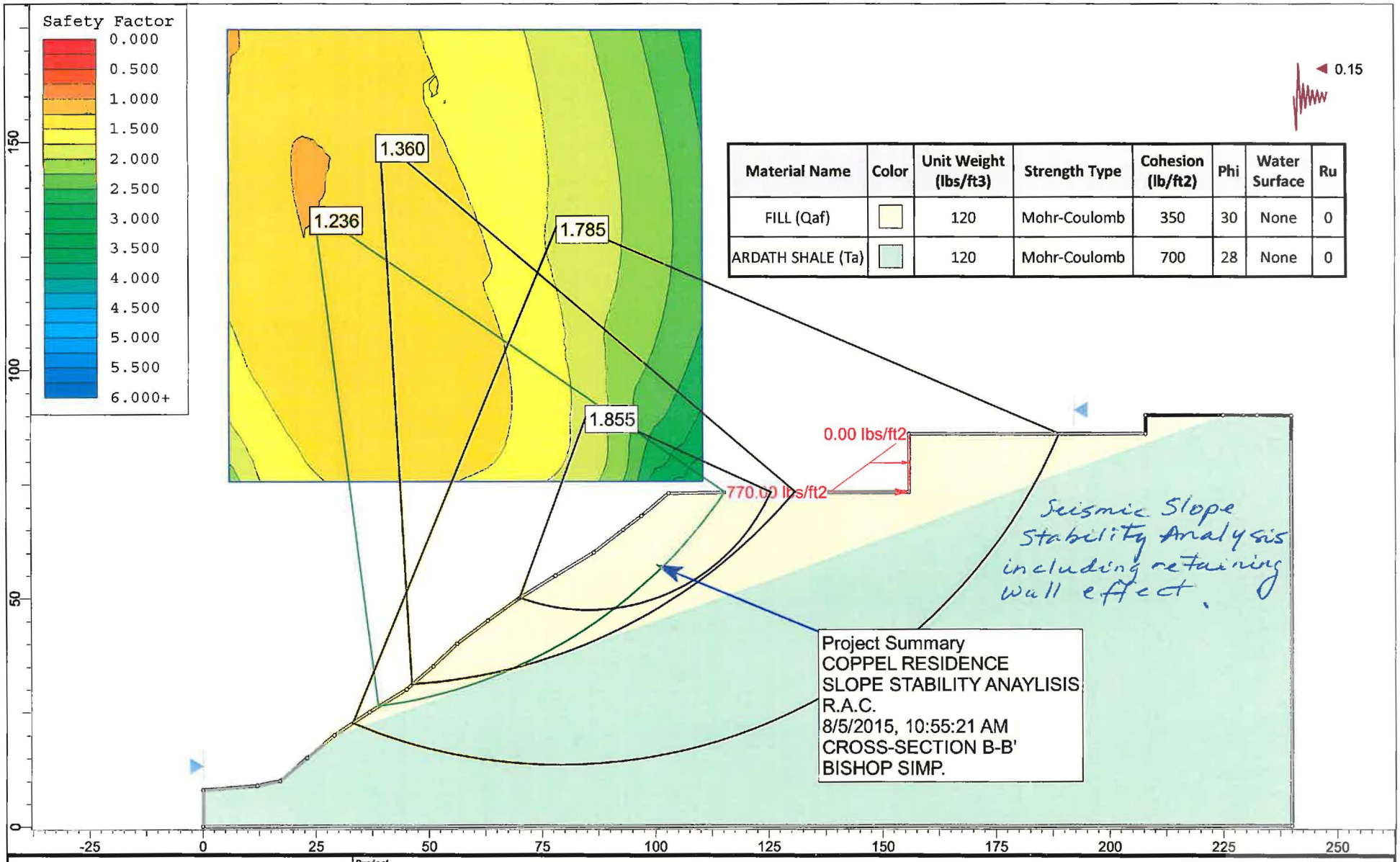

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE			
Analysis Description	SLOPE STABILITY ANAYLISIS			
Drawn By	R.A.C.	Scale	1:350	Company
Date	8/5/2015, 10:55:21 AM			File Name JOB NO.14-10569B02w_0.15gSHAKE.slim

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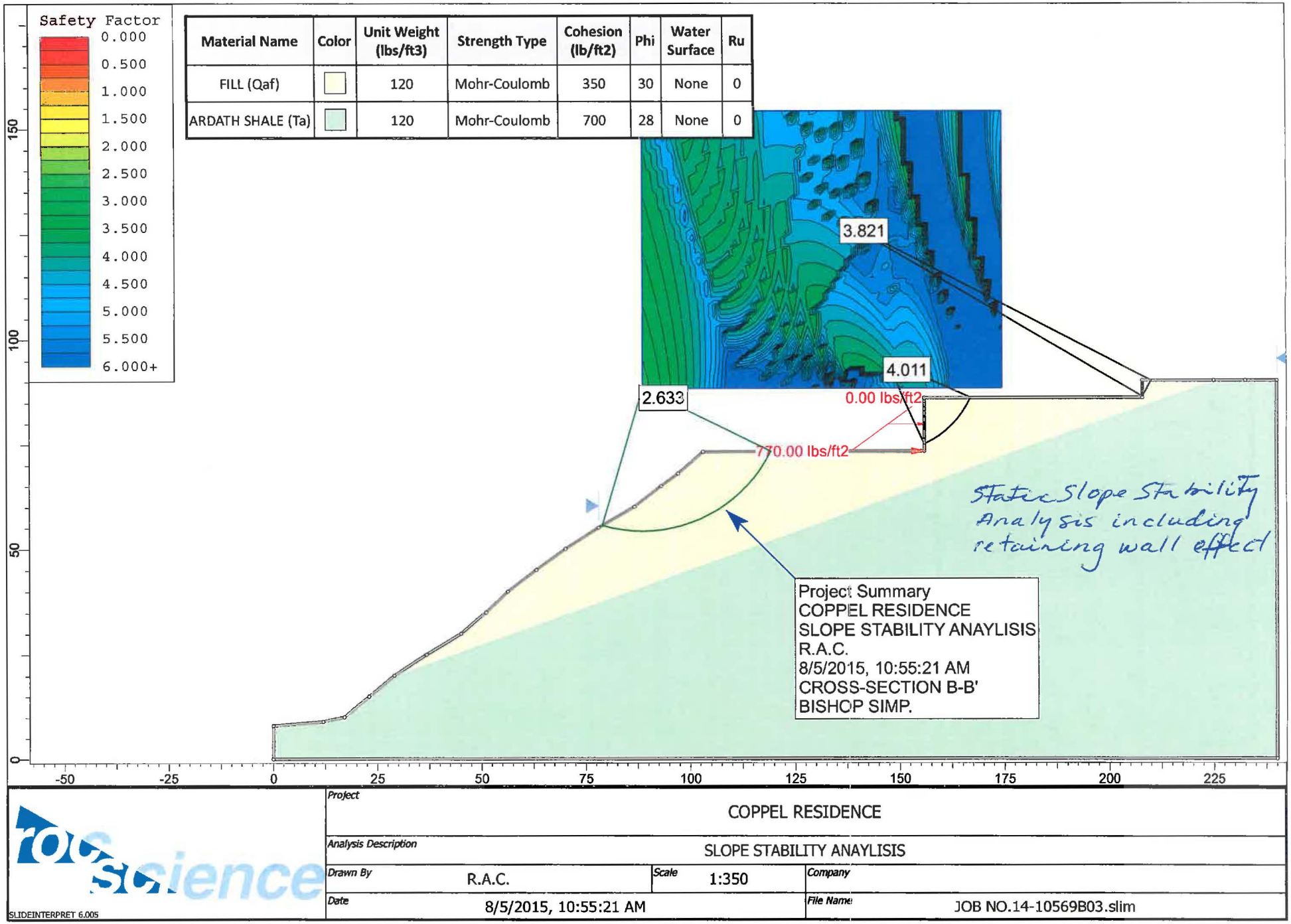

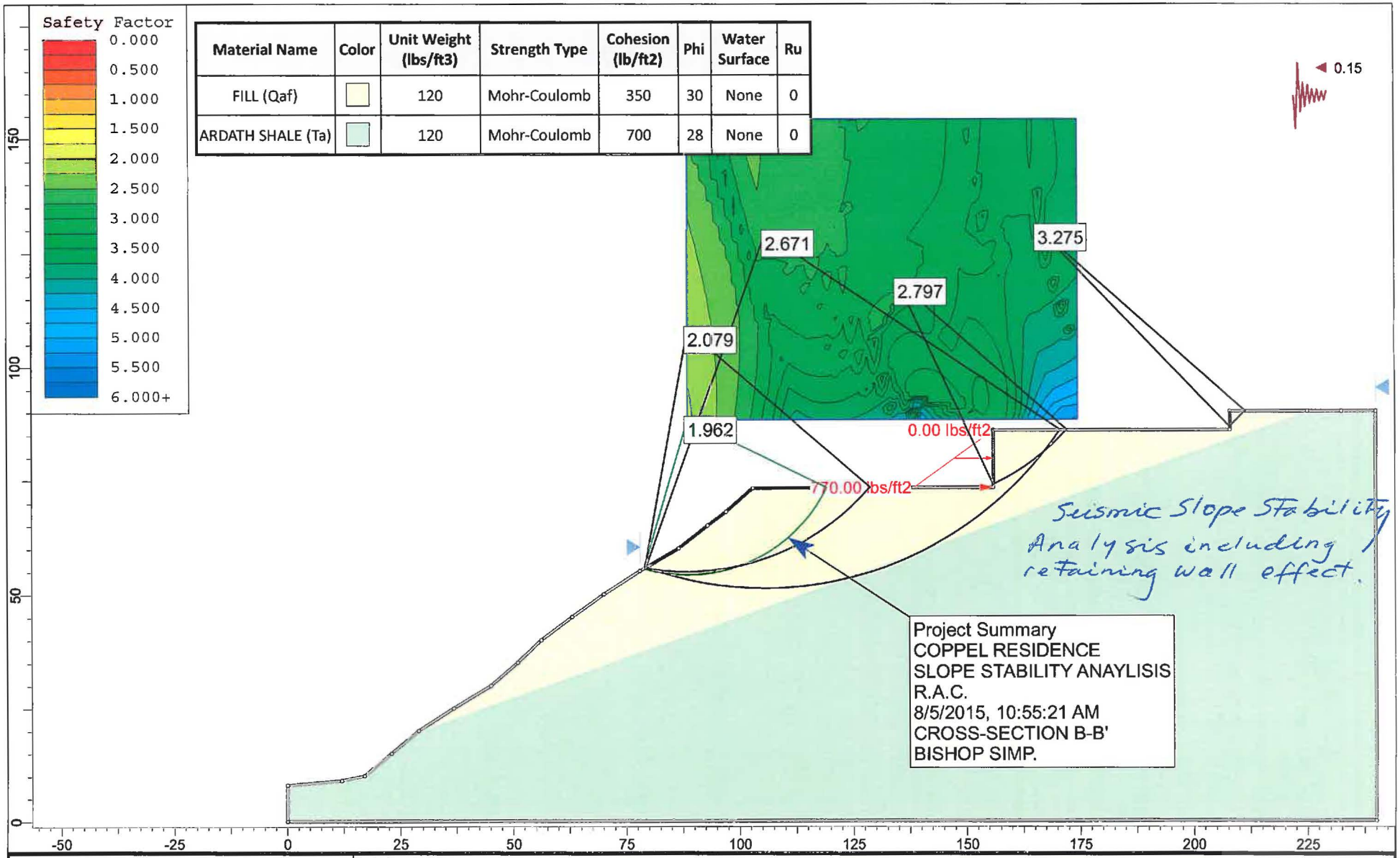

rocscience	Project	COPPEL RESIDENCE		
	Analysis Description	SLOPE STABILITY ANAYLISIS		
	Drawn By	R.A.C.	Scale 1:350	Company
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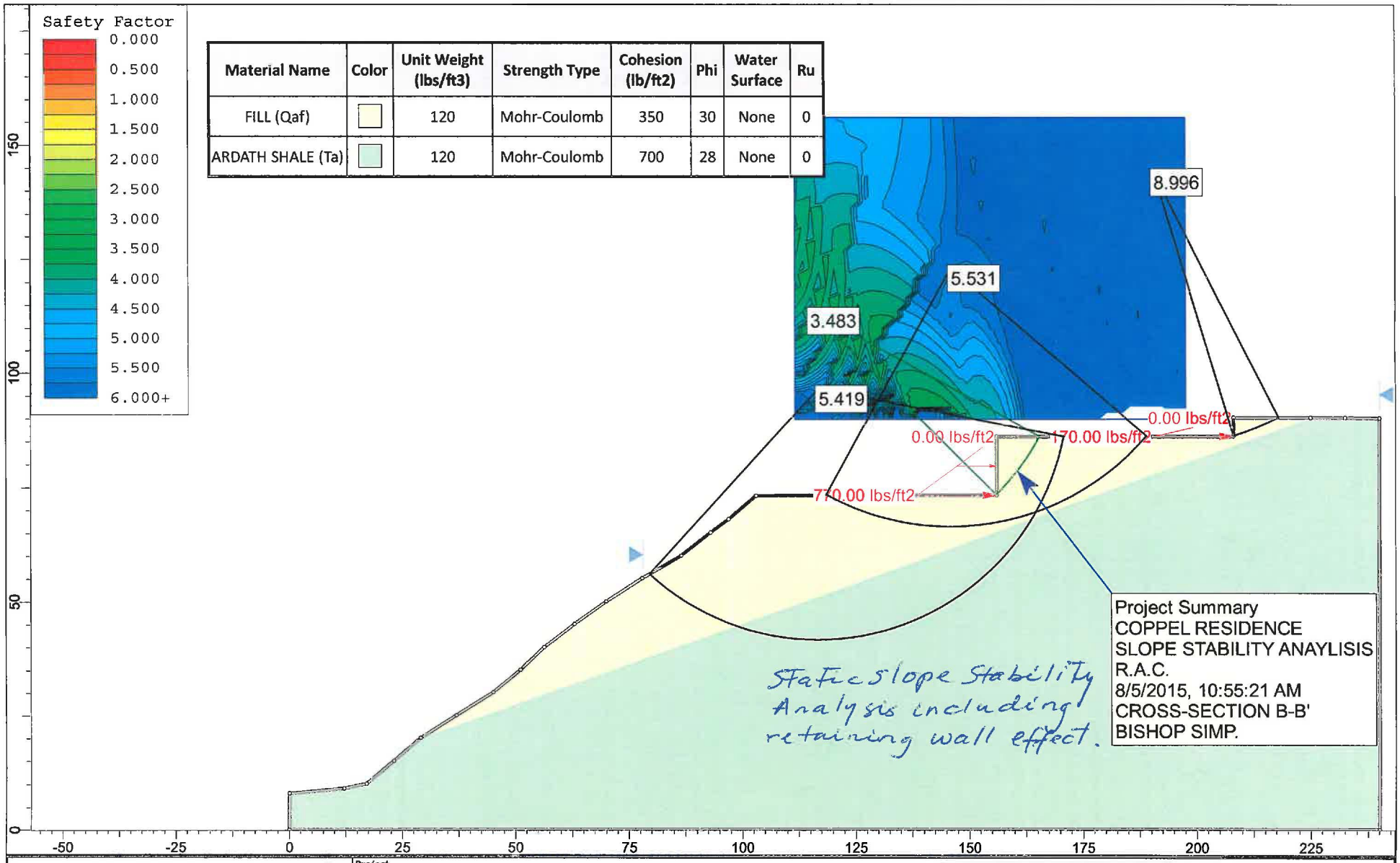
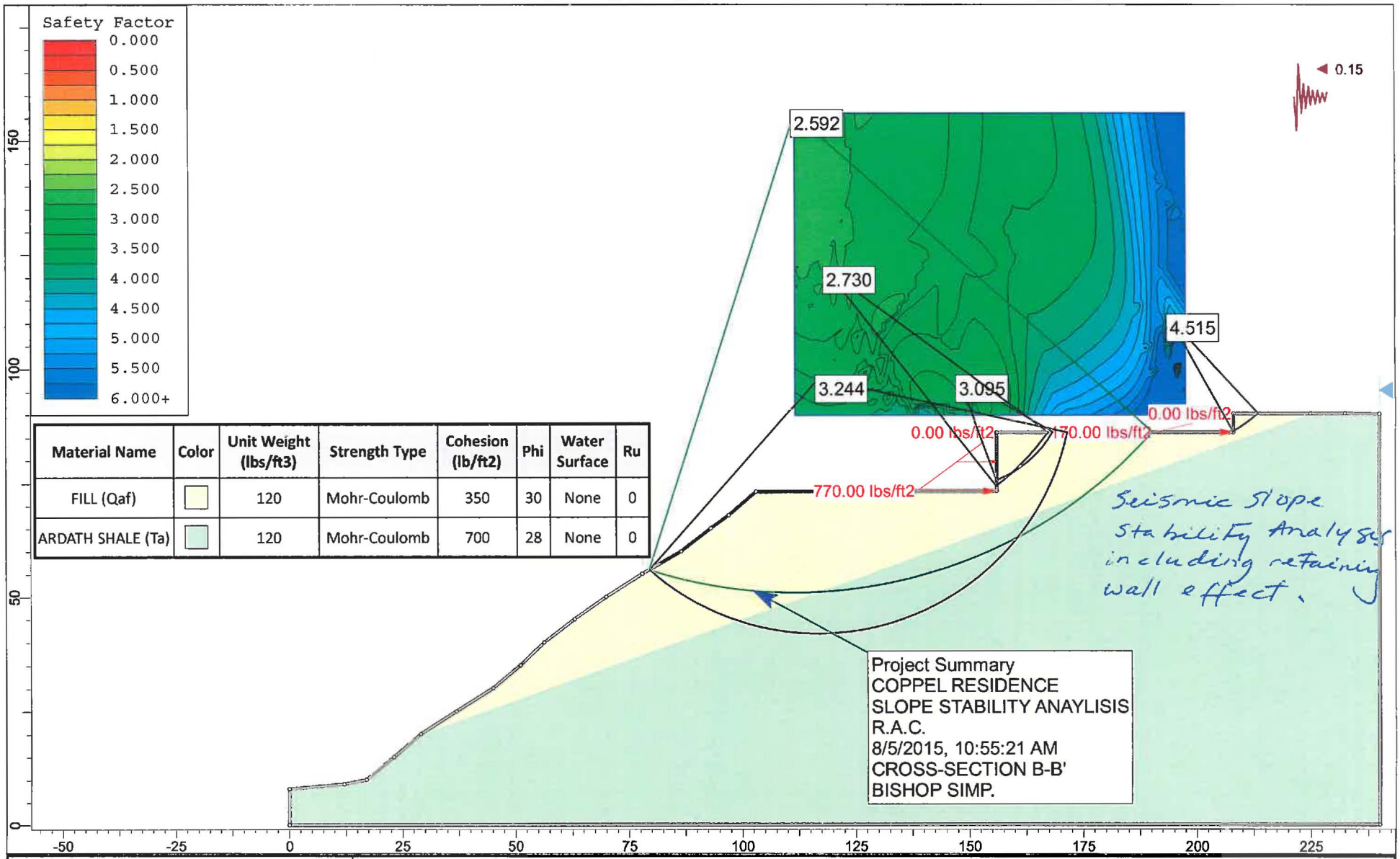


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE		
Analysis Description	SLOPE STABILITY ANAYLISIS		
Drawn By	R.A.C.	Scale 1:350	Company
Date	8/5/2015, 10:55:21 AM		File Name JOB NO.14-10569B04.slim

SLIDEINTERPRET 6.005

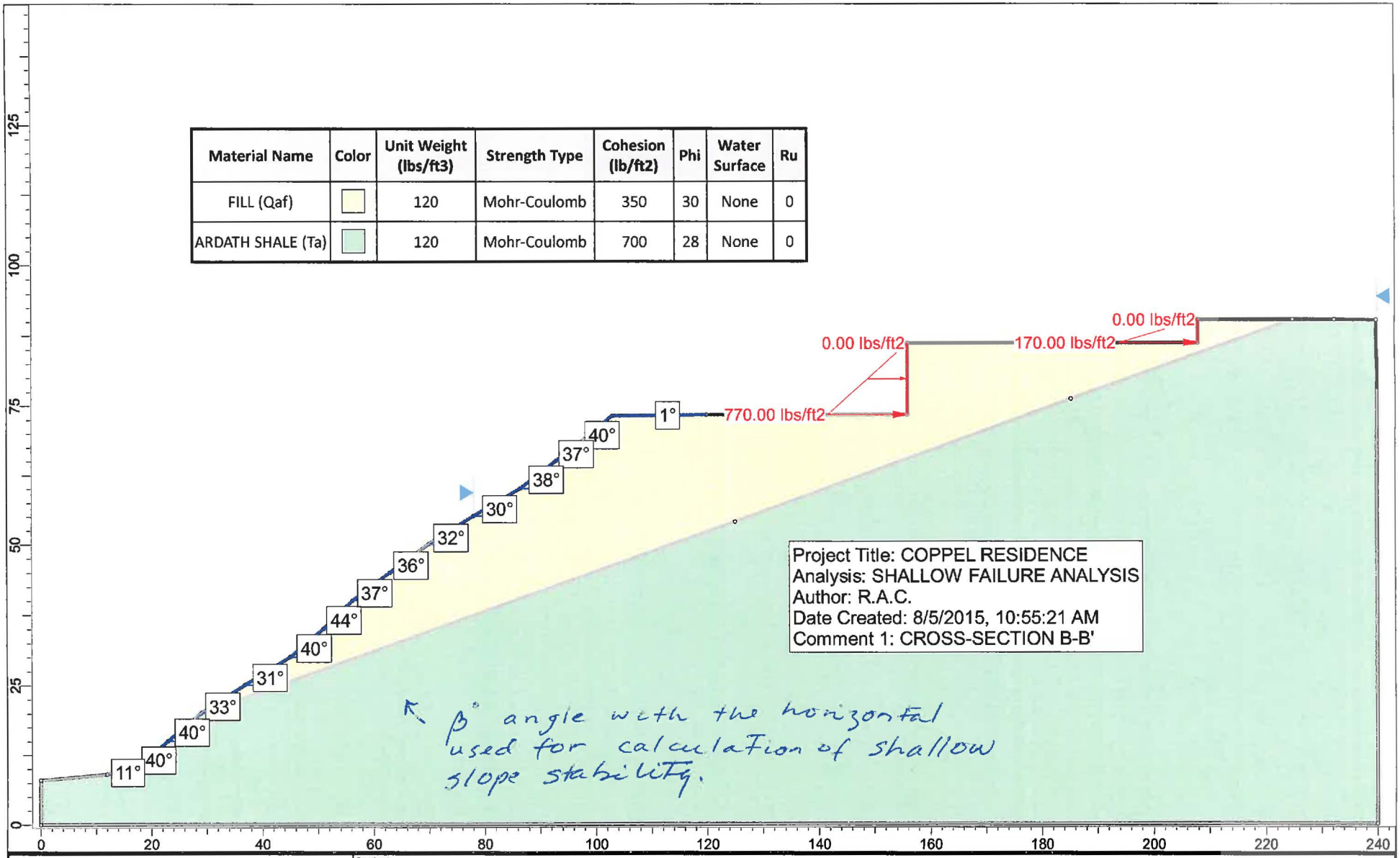


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0

Project	COPPEL RESIDENCE		
Analysis Description	SLOPE STABILITY ANAYLISIS		
Drawn By	R.A.C.	Scale 1:350	Company
Date	8/5/2015, 10:55:21 AM		File Name JOB NO.14-10569B04w_0.15gSHAKE.slim

SLIDEINTERPRET 6.005

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (lb/ft2)	Phi	Water Surface	Ru
FILL (Qaf)		120	Mohr-Coulomb	350	30	None	0
ARDATH SHALE (Ta)		120	Mohr-Coulomb	700	28	None	0



rocscience	Project	COPPEL RESIDENCE		
	Analysis Description	SHALLOW FAILURE ANALYSIS		
	Drawn By	R.A.C.	Scale 1:285	Company
	Date	8/5/2015, 10:55:21 AM		File Name JOB NO.14-10569B04(SHALLOW_FAILURE).slim

SLIDE 6.005

Geotechnical Exploration, Inc.

SOIL AND FOUNDATION ENGINEERING ● GROUNDWATER ● ENGINEERING GEOLOGY

01 February 2016

Ms. Cori del Castillo
Island Architects
7626 Herschel Avenue
La Jolla, CA 92037

Job No. 15-10569

Subject: **Preliminary Grading Plan Review**
Coppel Residence
8194 Prestwick Drive
La Jolla, California

Dear Ms. Del Castillo:

As requested and as required by the City of San Diego reviewer, we have reviewed the preliminary grading and WPCP plan for the subject project. The reviewed plans included sheets C1 through C3 and sheet WPCP, dated August 4, 2015, prepared by Pasco Laret Suiter and Associates. The plans were reviewed from a geotechnical engineering viewpoint to verify compliance with our recommendations.

After suggested corrections were made (encapsulation of the bio-retention areas), we found the plans to be in general accordance with the recommendations as presented in our "Report of Geotechnical Investigation," dated August 18, 2015. A copy of the soil report and this letter should be provided to pertinent contractors involved with soil preparation and foundation construction. Any soil compaction should be as required by the City of San Diego.

If you have any questions regarding this letter, please contact our office. Reference to our **Job No. 15-10569** will help expedite a response to your inquiry.

Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

Jaime A. Cerros, P.E.
R.C.E. 34422/G.E. 2007
Senior Geotechnical Engineer

7420 TRADE STREET ● SAN DIEGO, CA. 92121 ● (858) 549-7222 ● FAX: (858) 549-1604 ● EMAIL: geotech@gei-sd.com

Geotechnical Exploration, Inc.
SOIL AND FOUNDATION ENGINEERING • GROUNDWATER • ENGINEERING GEOLOGY

08 February 2016

Mr. Rodolfo and Maria Coppel
c/o Island Architects
7626 Herschel Avenue
La Jolla, CA 92037
Attn: Ms. Cori del Castillo

Job No. 14-10569

Subject: **Addendum Geotechnical Report Response to City Reviewer**
Coppel Residence
8194 Prestwick Drive
La Jolla, California

Dear Mr. and Mrs. Coppel:

As requested by Ms. Cori del Castillo with Island Architects, and as required by LDR Geology Reviewer, we are replying to comments in a memo with a completion date of December 4, 2015. The LDR Reviewer has reviewed our Preliminary Geotechnical Investigation report dated August 18, 2015, as well as Preliminary Grading Plans by Pasco Laret Suiter and Associates dated August 4, 2015.

Issue No. 3: *"Submit an addendum geotechnical report that includes the logs of the subsurface exploration at the site that provides the detailed direct observation and mapping of the bedding attitudes conducted by an engineering geologist. Indicate if the geologic structure is unfavorable. (New Issue).*

GEI Response: In our geotechnical report dated August 18, 2015, we provided boring logs of subsurface exploration at the site. The borings were performed with small diameter augers and obtained 3-inch-diameter soil samples. No large diameter borings were excavated since they were not considered necessary. We observed nearby bedrock exposures and reviewed the geological map by Kennedy and Tan (2008) that indicated bedding attitudes in this area were not unfavorable, with strikes generally N20°W to N65°W and dips northeast at angles of 3 to 5 degrees, with direction parallel to the hillside and not out of slope.

Issue No. 4: *"The geotechnical consultant should confirm that the setback between the descending slope and outer edge of the proposed building foundations is adequate to provide protection from slope drainage, erosion and shallow failures over the expected life of the structures. (New Issue).*

GEI Response: The building foundations are anticipated to be a sufficient distance from the slope face to comply with the 8-foot minimum setback. Other improvements such as retaining walls close to or on the slope face will need to have the foundations sufficiently embedded on the slope side to comply with the minimum required setback. Adequate embedment will be confirmed by the geotechnical consultant during foundation excavation inspection. Proper foundation embedment will provide adequate protection against erosion, drainage, and shallow failures on the slope face over the expected life of the structures.

Issue No. 5: *"Submit original quality prints and digital copies (on CD/DVD/or USB data storage device) of the referenced and requested geotechnical reports. (New Issue)".*

GEI Response: We are providing a quality copy of this report and a copy on CD.

If you have further questions regarding this letter, please contact our office. Reference to our **Job No. 14-10569** will help expedite a response to your inquiry.

Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

Jaime A. Cerros, P.E.
R.C.E. 34422/G.E. 2007
Senior Geotechnical Engineer

Leslie D. Reed, President
C.E.G. 999/P.G. 3391

cc: Laret Suiter and Associates

Geotechnical Exploration, Inc.
SOIL AND FOUNDATION ENGINEERING • GROUNDWATER • ENGINEERING GEOLOGY

11 April 2016

Rodolfo and Maria Coppel
8194 Prestwick Drive
La Jolla, CA 92037

Job No. 14-10569

Subject: **Addendum Geotechnical Report Response to City Reviewer**
Coppel Residence
8194 Prestwick Drive
La Jolla, California

Dear Mr. and Mrs. Coppel:

In accordance with your request, ***Geotechnical Exploration, Inc***. herein responds to City of San Diego LDR-Geology review comments in Memo with completion date March 10, 2016, with respect to the planned residential project at the subject property in La Jolla, California. The LDR Reviewer has reviewed our Preliminary Geotechnical Investigation report dated August 18, 2015, as well as Preliminary Grading/Drainage Plans by Pasco Lauret Suiter & Associates, dated August 4, 2015.

Issue No. 7: "Submit an addendum geotechnical report that includes the site specific geologic mapping of the bedding attitudes. Include a geologic map that provides the bedding attitudes measured by the geotechnical consultant at nearby rock exposures." (New Issue)

GEI Response: Our subsurface exploratory drilling program for the project site utilized a solid stem auger limited access drill rig. Due to the disturbing nature of the soils when using augers, no bedding attitudes of the formational soils underlying the project site were achievable. However, our firm has conducted a large-diameter boring at 8440 Whale Watch Way, in close proximity of the project site. Based on the bedding attitudes observed in our large-diameter boring and review of the geological map by Kennedy and Tan (2008), bedding attitudes in this area were not unfavorable, with strikes generally N30°W to N65°W and dip 3 to 5 degrees to the northeast. These dips are into the hillside (or parallel to the hillside) and, therefore, are considered to be a relatively stable geologic condition. Figure No. VI (Geologic Map and Legend) of our Preliminary Geotechnical Investigation report dated August 18, 2015, includes these bedding attitudes as mapped by Kennedy and Tan (2008). In addition, the bedding attitudes as indicated by Kennedy and Tan (2008), have also been depicted on our geologic cross sections

(A-A') and B-B'), Figure Nos. Va and Vb of our Preliminary Geotechnical Investigation report dated August 18, 2015.

Issue No. 8: "Revise Section A-A and the Typical Bio Retention Area Detail on the Preliminary Grading Plan (Sheet C.2) to indicate the 30 MIL HDPE liner surrounding the sides and bottom of these facilities." (New Issue)

GEI Response: The civil engineer will revise the preliminary grading plan accordingly.

Issue No. 9: "Submit original quality prints and digital copies (on CD/DVD/or USB data storage device) of the referenced geotechnical reports and requested addendum for our records." (New Issue)

GEI Response: We are providing a quality copy print of this report and a copy on CD.

In addition, we have been asked to address the feasibility of on-site storm water disposal/infiltration systems and potential impacts regarding slope stability, fill settlement, piping of soil, and premature failure of pavement (Engineering Comments Issues 19 and 20). The geotechnical consultant must comment whether or not the proposed on-site storm water disposal/infiltration systems will have adverse impacts on adjacent properties located hydrologically downstream.

Based on our discussion with Pasco Laret Suiter & Associates, the grading plans will be revised and it is our understanding that the proposed bio-retention basins will have an impermeable liner and no infiltration is proposed.

If you have further questions regarding this letter, please contact our office. Reference to our **Job No. 14-10569** will help expedite a response to your inquiry.

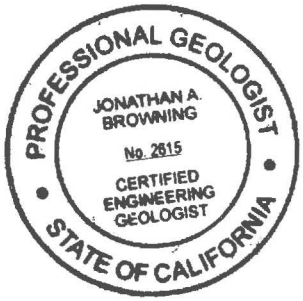
Respectfully submitted,

GEOTECHNICAL EXPLORATION, INC.

Jonathan A. Browning
C.E.G. 2615/P.G. 9012
Senior Project Geologist

Jaime A. Cerros, P.E.
R.C.E. 34422/G.E. 2007
Senior Geotechnical Engineer

cc: Island Architects



Attachments: 1 copy of each requested report

Geotechnical Exploration, Inc.
SOIL AND FOUNDATION ENGINEERING ● GROUNDWATER ● ENGINEERING GEOLOGY

22 June 2016

Rodolfo and Maria Coppel
8194 Prestwick Drive
La Jolla, CA 92037

Job No. 14-10569

Subject: **Addendum Geotechnical Report Response to City Reviewer (Cycle 5)**
Coppel Residence
8194 Prestwick Drive
La Jolla, California

Dear Mr. and Mrs. Coppel:

In accordance with your request, ***Geotechnical Exploration, Inc.*** herein responds to City of San Diego LDR-Geology review comments in a memo with completion date May 31, 2016, with respect to the planned residential project at the subject property. The LDR Reviewer has reviewed our Preliminary Geotechnical Investigation report dated August 18, 2015, our Addendum Geotechnical Report Response to City Reviewer dated April 11, 2016, as well as Preliminary Grading/Drainage Plans by Pasco Lauret Suiter & Associates, dated August 4, 2015.

Issue No. 11: *"Submit an addendum geotechnical report." (New Issue)*

GEI Response: We submit this letter as our "Addendum Geotechnical Report Response to City Reviewer (Cycle 5)" comments.

Issue No. 12: *"Revise the geologic map and cross sections to include the location of the large diameter boring conducted at 8440 Whale Watch Way. Include the log of the large diameter boring." (New Issue)*

GEI Response: Attached with this addendum geotechnical report are the revised geologic map and cross sections with the location of the supplemental exploratory test pit excavated on the lower portion of the west slope where the Ardath Shale was exposed for evaluation of the geologic structure. The measured bedding attitudes dip into the hillside and, therefore, are considered to be a relatively stable geologic condition.

Issue No. 13: "Show the apparent dip on the cross section."*Submit original quality prints and digital copies (on CD/DVD/or USB data storage device) of the referenced geotechnical reports and requested addendum for our records." (New Issue)*

GEI Response: We have included the apparent dip on the attached cross sections.

Issue No. 14: *"Submit original quality prints and digital copies (on CD/DVD/or USB data storage device) of the referenced geotechnical reports and requested addendum for our records." (New Issue)*

GEI Response: We are providing a quality print of this report and a digital copy on CD.

If you have further questions regarding this letter, please contact our office. Reference to our **Job No. 14-10569** will help expedite a response to your inquiry.

Respectfully submitted,

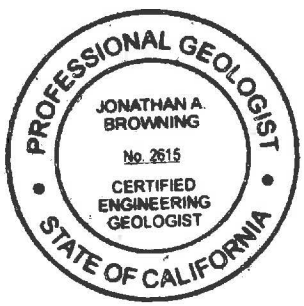
GEOTECHNICAL EXPLORATION, INC.

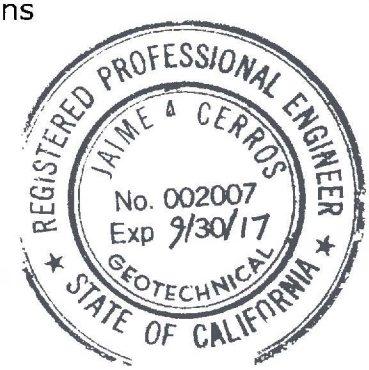
Jonathan A. Browning
C.E.G. 2615/P.G. 9012
Senior Project Geologist

Jaime A. Cerros, P.E.
R.C.E. 34422/G.E. 2007
Senior Geotechnical Engineer

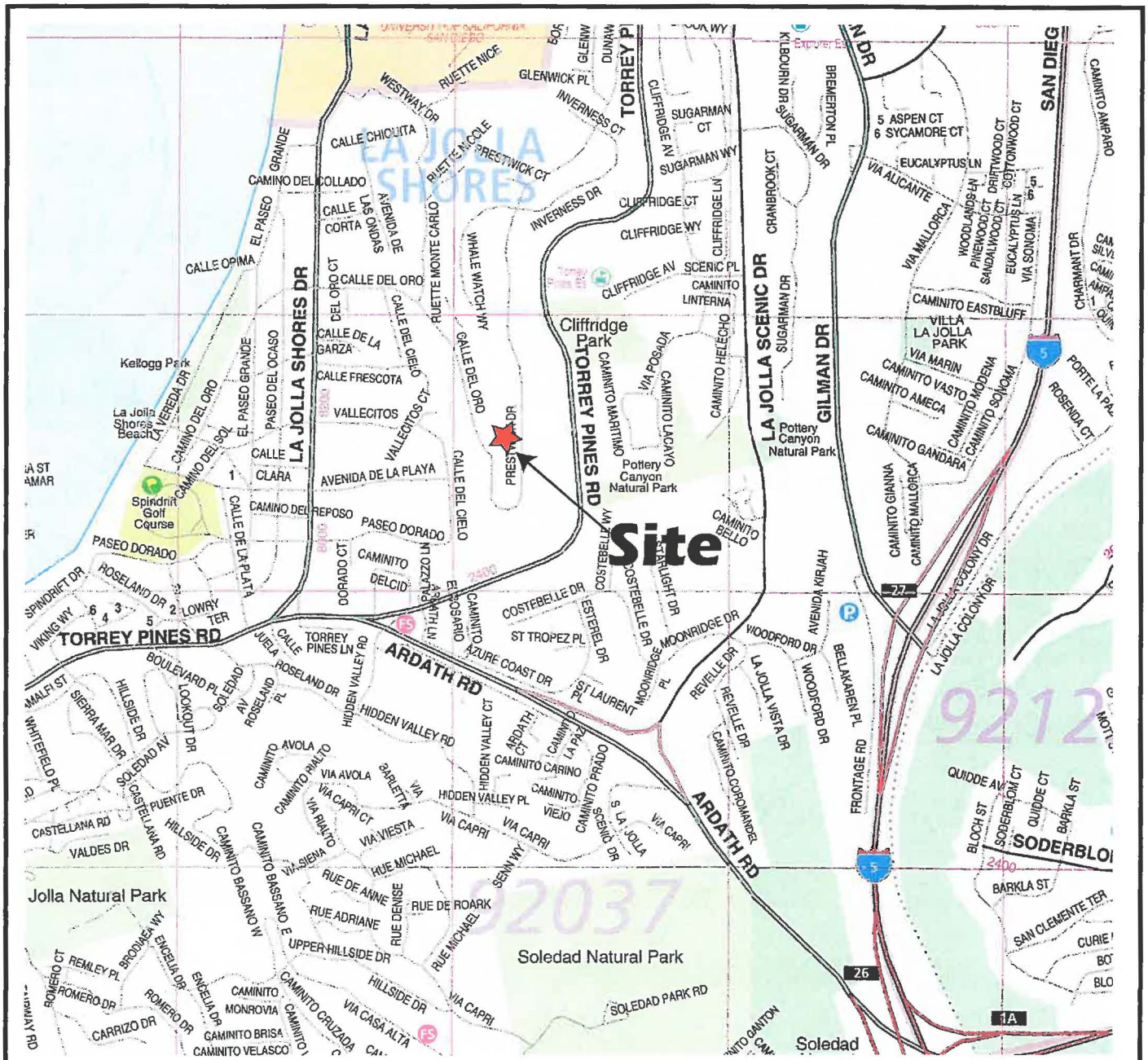
cc: Island Architects

Attachments: 1 copy of revised geologic map and cross sections





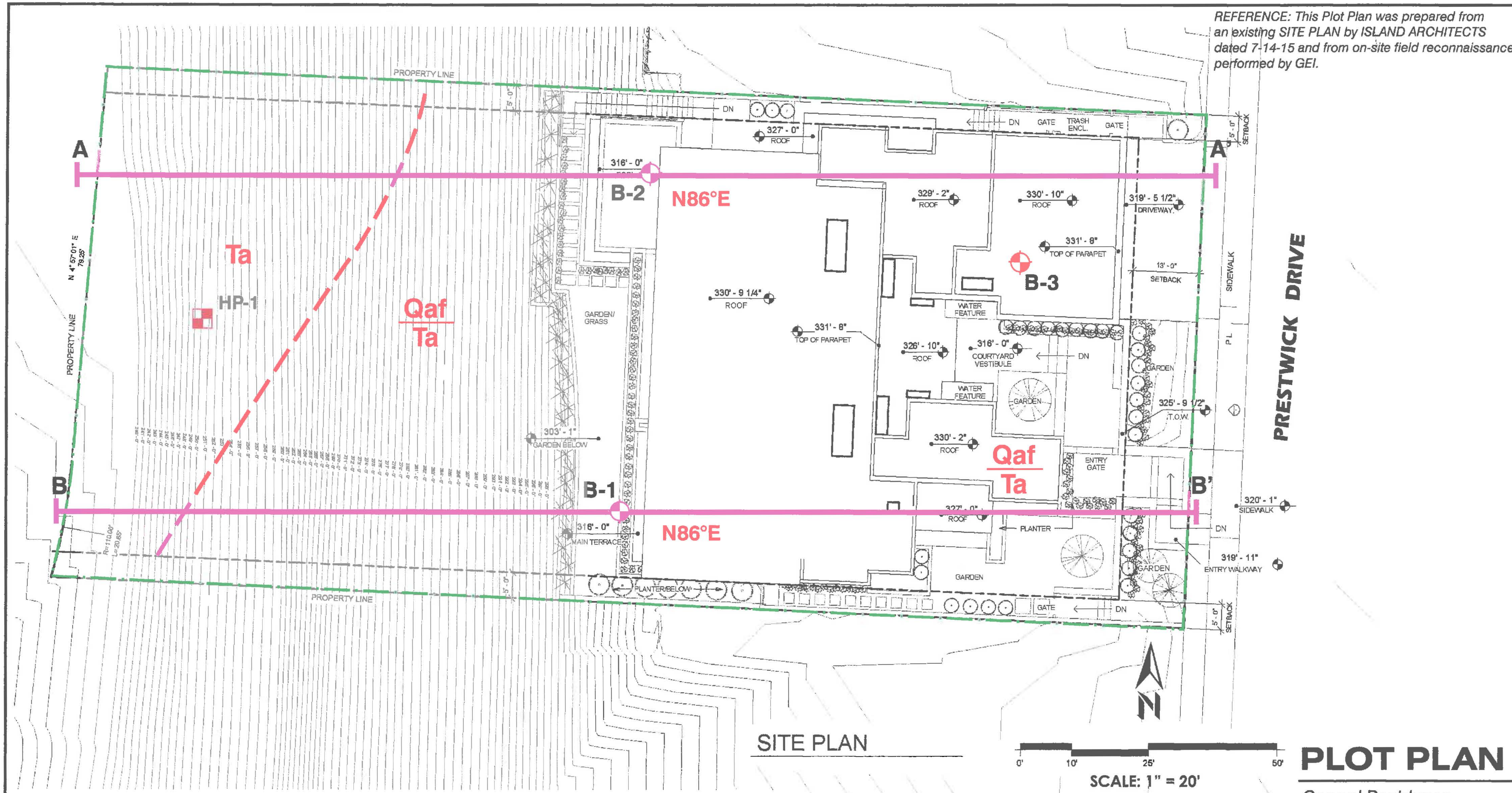
VICINITY MAP



Thomas Bros. Guide San Diego County, pg 1227

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.

Figure No. I
Job No. 14-10569



A1.1 SITE PLAN 7/10/15	PRESTWICK RESIDENCE 8194 Prestwick Dr., La Jolla CA 92037	ISLAND ARCHITECTS DREX PATTERSON, R.A. | TONY CRISAFI, R.A.

LEGEND

- HP-1 — Approximate Location of Exploratory Handpit
- B-3 — Approximate Location of Exploratory Boring
- A — A' — Approximate Line of Cross Section

GEOLOGIC LEGEND

- Qaf — Artificial Fill
- Ta — Ardath Shale
- Approximate Geologic Contact

PLOT PLAN

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.
Figure No. II
Job No. 14-10569

Geotechnical Exploration, Inc.

June 2016

14-10569-p2.ai

EQUIPMENT	DIMENSION & TYPE OF EXCAVATION	DATE LOGGED
Hand Tools	**3' X 3' X 4' Handpit**	**6-24-16**
SURFACE ELEVATION	GROUNDWATER/ SEEPAGE DEPTH	LOGGED BY
± 250' Mean Sea Level	**Not Encountered**	**JKH**

DEPTH (feet)	SYMBOL	SAMPLE	FIELD DESCRIPTION AND CLASSIFICATION DESCRIPTION AND REMARKS (Grain size, Density, Moisture, Color)	U.S.C.S.	IN-PLACE MOISTURE (%)	IN-PLACE DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (pcf)	DENSITY (% of M.D.D.)	EXPAN. + (%) CONSOL. -	BLOW COUNTS/FT.	SAMPLE O.D. (INCHES)
1			**SILTY CLAYSTONE**, highly fractured, with abundant roots. Firm. Dry to damp. Light gray and orange. **WEATHERED ARDATH SHALE FORMATION (Ta)**	CL								
2			Bedding attitude: N40°W, 6°NE. **SILTY CLAYSTONE**, moderately fractured. Very stiff to hard. Damp. Light gray and orange. **ARDATH SHALE FORMATION (Ta)**	CL								
3			Bedding attitude: N50°W, 4°NE.									
4			Bottom @ 4'									
5												

- PERCHED WATER TABLE
- BULK BAG SAMPLE
- 1 IN-PLACE SAMPLE
- MODIFIED CALIFORNIA SAMPLE
- S NUCLEAR FIELD DENSITY TEST
- STANDARD PENETRATION TEST

JOB NAME
Coppel Residential Project

SITE LOCATION
8194 Prestwick Drive, La Jolla, CA

JOB NUMBER
14-10569

REVIEWED BY
LDR/JAC

FIGURE NUMBER
IIId

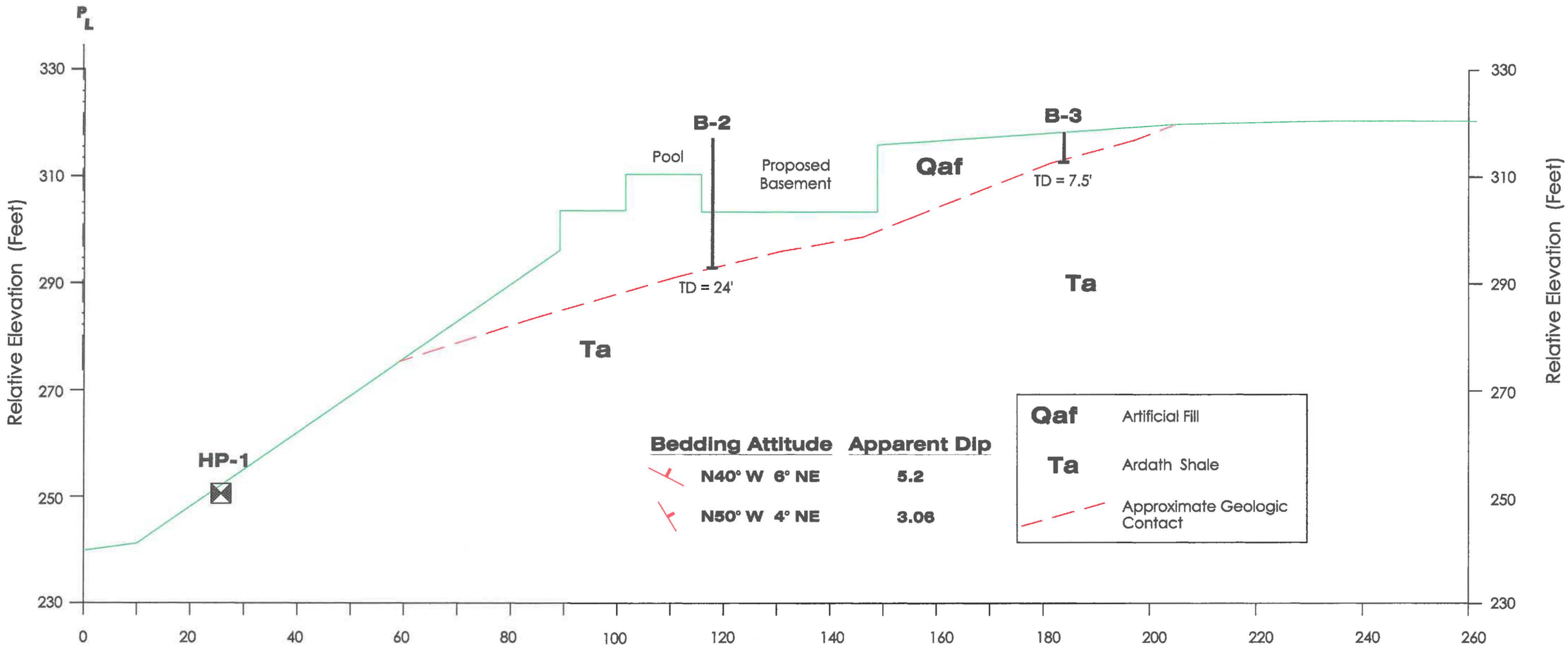
Geotechnical Exploration, Inc.

LOG No.
HP-1

EXPLORATION LOG 10569 COPPEL.GPJ GEO_EXPL.GDT 6/29/16

GEOLOGIC CROSS SECTION

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.



NOTE: This Cross Section is not to be used for legal purposes. Locations and dimensions are approximate. Actual property dimensions and locations of utilities may be obtained from the Approved Building Plans or the "As-Built" Grading Plans.

14-10569-AA-6-2016

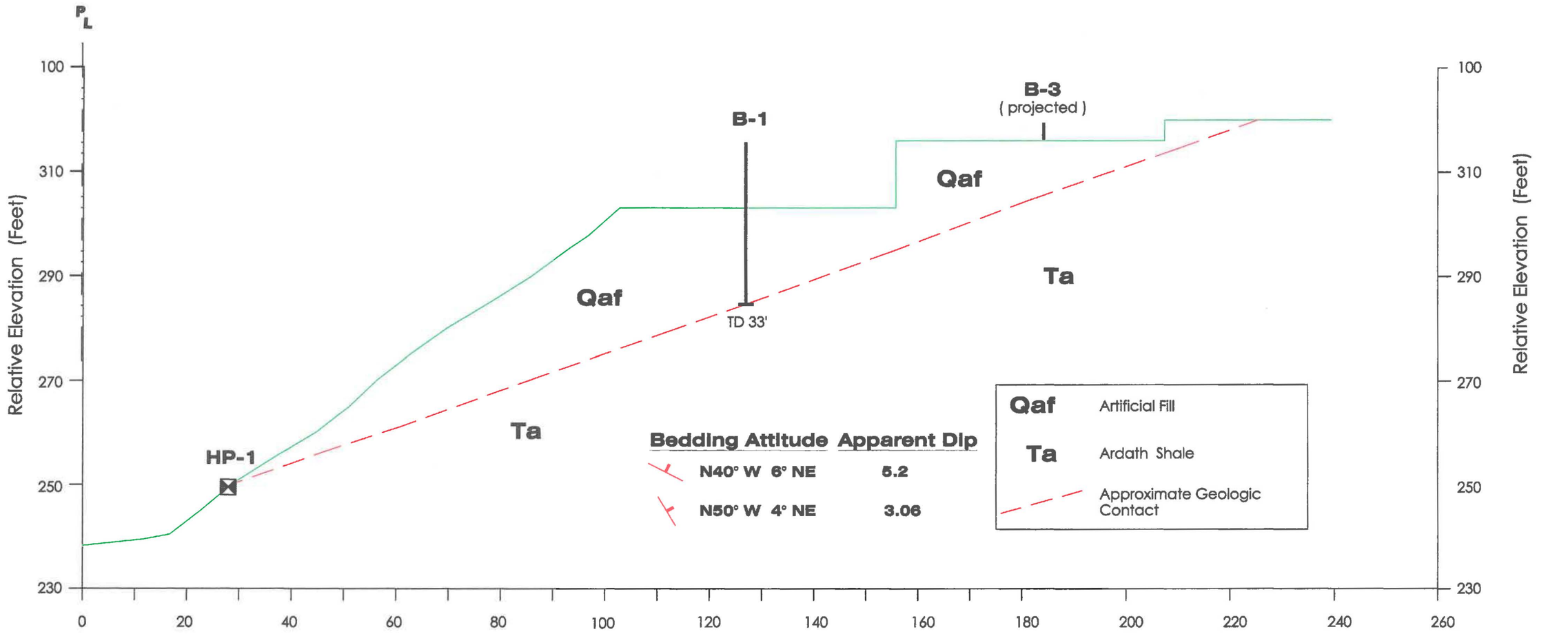
Figure No. Va
Job No. 14-10569

Geotechnical Exploration, Inc.

June 2016

CROSS SECTION B-B'

Coppel Residence
8194 Prestwick Drive
La Jolla, CA.



NOTE: This Cross Section is not to be used for legal purposes. Locations and dimensions are approximate. Actual property dimensions and locations of utilities may be obtained from the Approved Building Plans or the "As-Built" Grading Plans.

Figure No. Vb
Job No. 14-10569

Geotechnical Exploration, Inc.

June 2016

14-10569-BB-6-2016

WATER QUALITY STUDY
STANDARD PROJECT

For:

PRESTWICK RESIDENCE

APN: 346-333-03-00
8194 PRESTWICK DRIVE
LA JOLLA, CALIFORNIA

Prepared For:

CORI DEL CASTILLO
7626 HERSCHEL AVENUE
LA JOLLA, CALIFORNIA

Date:
August 4, 2015

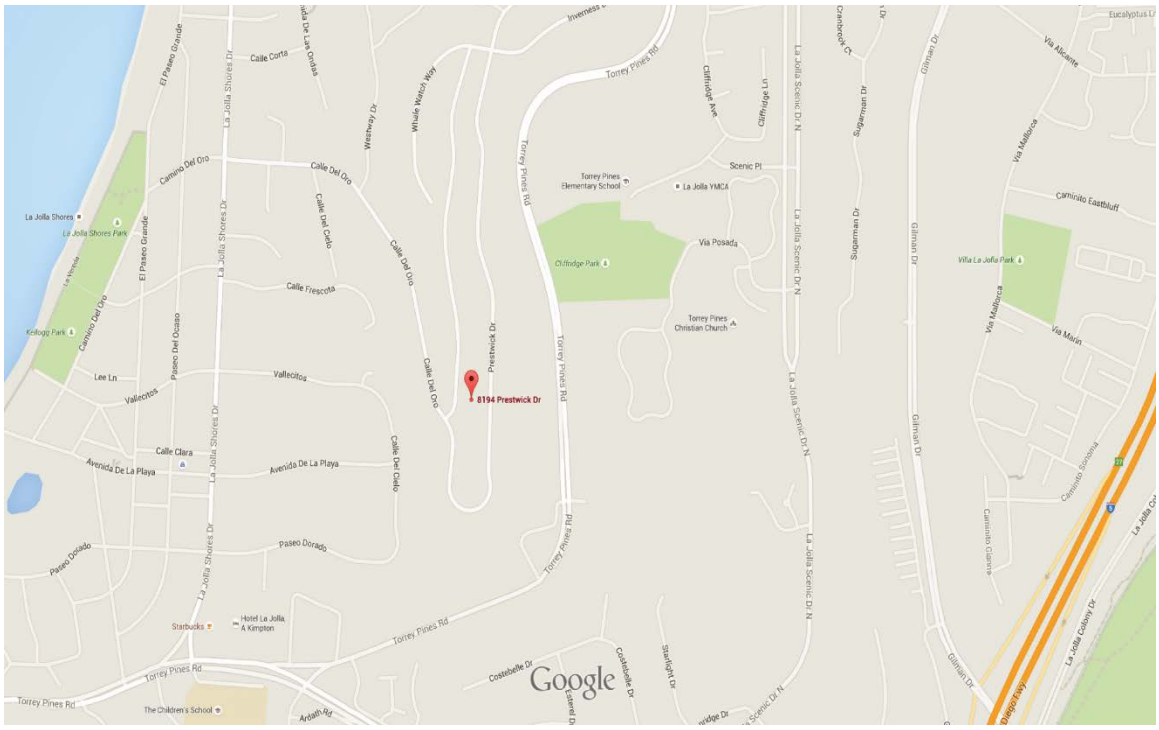
Revised:
December 30, 2015

Prepared By:
Pasco Laret Suiter & Associates
535 North Coast Highway 101, Suite A
Solana Beach, CA 92075

Brian M. Ardolino, RCE 71651 — 1-5-16 DATE

TABLE OF CONTENTS

WATER QUALITY STUDY



Vicinity Map

Not to Scale

1. INTRODUCTION

The purpose of this report is to address the potential water quality impacts that could result from the proposed home and site construction at the above identified property.

Source Control Best Management Practices (BMPs) will be utilized to provide a long-term solution to water quality in accordance with City of San Diego Storm Water Standards. This Standard Project Storm Water Quality Study is intended to identify and propose mitigation for pollutants of concern originating from the project site.

1.1 Project Description

The scope of the proposed project includes the demolition of the existing home along with the driveway, patio areas, and surrounding landscape. Subsequently, there will be construction of a new single family home, retaining walls, stairs, a pool, and new landscape areas with its associated drainage to manage site run-on and run-off. The landscape areas will closely match natural vegetation with native species incorporated throughout, and provide fire resistant ornamental landscaping with city approved species that require little to no irrigation.

The total area disturbed by the project scope is 12,588.56 square feet (+/-0.29 acres).

The project proposes to install PVC drain pipes and area drains in landscape planters throughout the site that will route site drainage to the existing driveway and ultimately to the rear alley at the west property line.

1.2 Pollutants and Conditions of Concern

The project is located in the La Jolla Watershed Management Area. More specifically it is located in the Scripps Hydrologic Area (906.3). Runoff from the proposed project site flows southwest and discharges to Prestwick Drive and subsequently to the municipal stormwater system and the ultimate receiving water, the Pacific Ocean. This run-off does not discharge directly into any natural water body. The project site is not located within or within 200 feet of a Water Quality Sensitive Area as defined by the current City of San Diego Storm Water Standards Manual. The impaired water bodies downstream of the project and their impairments are summarized below:

Impaired Water Body	**Impairment**
Pacific Ocean Shoreline	Indicator bacteria, nutrients, trace metals and toxics

Anticipated post-construction pollutants are illustrated in the table below (highlighted row applicable to this project):

General Pollutant Categories									
Priority Project Categories	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Housing Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development	P(1)	P(1)	X	P(2)	X	P(5)	X	P(3)	P(5)
Industrial Development	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	P(1)
Steep Hillside Developments	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X	X	P(1)
Retail Gas Outlets			X	X	X	X	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

Nutrients – Nutrients are nutritive substances that foster growth, especially compounds that contain nitrogen, phosphorous and potassium. Their proliferation is typically caused by the transport of fertilizers, green waste, detergents from car washing, dumping of janitorial wastewater or failing septic/sewer systems from the watershed. Water containing excessive nutrients can alter the aquatic habitat and create a harmful environment for humans and aquatic life.

Bacteria and viruses – Bacteria and viruses are ubiquitous microorganisms that thrive under certain environmental conditions. Their proliferation is typically caused by the transport of animal or human fecal wastes from the watershed. Water containing excessive bacteria and viruses can alter the aquatic habitat and create a harmful environment for humans and aquatic life. Also, the decomposition of excess organic waste causes increased growth of undesirable organisms in the water.

2. REQUIRED PERMANENT BMP'S FOR PRIORITY DEVELOPMENT PROJECTS

2.1 Source Control BMP's

The proposed project design encourages source control measures to limit the exposure of pollutants to storm water runoff. The following methods and designs have been incorporated into the project design as source control BMPs:

- No source control for maintenance bays is required because maintenance bays are not proposed for the site.
- No source control for vehicle and equipment wash areas is required because no vehicle or equipment wash area is proposed.
- No source control for outdoor processing areas is required because no outdoor processing areas are proposed.
- No outdoor processing areas are proposed, therefore a source control BMP is not required for these areas.
- No fueling areas are proposed, therefore a source control BMP is not required for these areas.
- The area above the proposed retaining wall east of the project site is a steep slope. The proposed landscaping above the retaining wall is to be disturbed as minimally as possible and new landscaping designed to both restore the destroyed natural fauna and provide fire resistant, low irrigation species vegetation for surface soils stabilization. Deep rooted, drought tolerant native species will be utilized in accordance with the Landscape Technical Manual.
- Efficient irrigation systems and landscape design are proposed. Irrigation runoff will be minimized by providing an irrigation system designed for each landscape areas specific requirement. Additionally, rain shutoff devices and shutoff valves will be used. Soil saturation sensitive irrigation systems (drip) will be used in conjunction with soil moisture sensors to mitigate potential overwater which would have a detrimental effect on the stability of the soil.
- Trash storage areas on the site will be paved and all trash containers will have lids to prevent rainfall intrusion.
- Outdoor material storage areas are not proposed on the site, therefore a source control BMP is not required for this item.
- No loading docks are proposed on the site, therefore a source control BMP is not required for this item.
- Pest management will be employed by the modification of the site and landscaping design on the site. Use of resistant plant varieties will be used to the extent practicable.
- No public stormdrain inlets or catch basins are located onsite or along the property frontage, thus no signs prohibiting illegal dumping are necessary for this project.
- No fire sprinkler systems are proposed, therefore a source control BMP is not required for this item.
- Air conditioning condensate will be designed to runoff to site landscape areas.

- New roofing materials will be installed on the project with the use of galvanized steel or copper minimized or eliminated from the design. If used, these materials should receive a coating or patina to reduce the exposure of these metals.

2.2 Standard LID BMP's

The following standard LID BMP's were incorporated into the project design:

1. The site grading will be minimized to the extent feasible with approximately 350 cubic yards of total earthwork proposed on the site. Where possible, existing grades will be left largely undisturbed for the new construction.
2. The change in the project impervious footprint compared to the existing site will be minimal as new, impervious patio areas will be integrated with landscape areas and permeable pavements to limit the overall coverage of paving and roofs.
3. The site design will disperse runoff to adjacent landscape areas and mimic the existing runoff patterns, therefore not altering the drainage pattern of the site.
4. Soil compaction beyond building footing and retaining wall footing and backfill is not proposed. All landscaping and irrigation necessary to implement the proposed design will include necessary top soil and amendments to provide the best mix of plant support, soil stability, and subsurface drainage.
5. The site will be stabilized through the use of minimal impervious areas, treatment areas, and vegetation of disturbed soils and slopes with drought tolerant vegetation. Runoff will be conveyed safely away from the tops of slopes by way of drainage swales and storm drain piping. The existing drainage pattern of the site run-on and runoff will not be changed.
6. Energy dissipaters will placed at all drainage discharge locations to reduce the potential for erosion and minimize impacts to receiving waters.

2.3 Buffer Measures

No buffer measures are proposed for the project site. The site is located outside of the 100-year floodplain.

2.4 BMP Maintenance

The onsite landscape BMP areas are to be maintained as necessary by the property owner. The property owner is to preserve existing vegetation and maintain stabilizing and planter vegetation in order to reduce the potential for onsite erosion. Stabilizing vegetation must be installed, irrigated and established prior to October 1. If stabilizing vegetation is not established by October 1, physical stabilization in the form of silt fences, gravel bags, or fiber rolls must be implemented to prevent erosion until stabilizing vegetation is established. Onsite BMP's are not to be modified without permission from the City of San Diego.

MAINTENANCE TASKS

Task	Frequency	Maintenance Notes
Watering	Minimal, soil saturation sensitive irrigation per the landscape and irrigation plans.	Moisture sensing devices must be maintained in good working order. Irrigation settings must be checked periodically to ensure plant health.
Fertilization	2 time / year	
Remove and Replace Dead Plants	2 time / year	
Miscellaneous Upkeep	12 times / year	

APPENDIX A

STORMWATER APPLICABILITY CHECKLIST

Project Name: Prestwick Residence

THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Storm Water Requirements Applicability Checklist**	FORM **DS-560** December 2015

Project Address:	Project Number *(for the City Use Only)*:
8194 Prestwick Drive, La Jolla, CA 92037	Click here to enter project number

SECTION 1. Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the Storm Water Standards Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP)[1], which is administrated by the State Water Resources Control Board.

For all projects complete PART A: If project is required to submit a SWPPP or WPCP, continue to PART B.

PART A: Determine Construction Phase Storm Water Requirements.

1. Is the project subject to California's statewide General NPDES permit for Storm Water Discharges Associated with construction activities, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

   ○ Yes; SWPPP required, skip questions 2-4 ◉ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity that results in ground disturbance and contact with storm water runoff?

   ◉ Yes; WPCP required, skip questions 3-4 ○ No; next question

3. Does the project propose routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (projects such as pipeline/utility replacement)

   ○ Yes; WPCP required, skip questions 4 ◉ No; next question

4. Does the project only include the following Permit types listed below?
   - Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
   - Individual Right of Way Permits that exclusively include one of the following activities and associated curb/ sidewalk repair: water services, sewer lateral, storm drain lateral, or dry utility service.
   - Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, pot holing, geotechnical borings, curb and gutter replacement, and retaining wall encroachments.

   ☐ Yes; no document required

Check one of the boxes to the right, and continue to PART B:

☐ If you checked "Yes" for question 1,
a SWPPP is REQUIRED. Continue to PART B

☒ If you checked "No" for question 1, and checked "Yes" for question 2 or 3,
a WPCP is REQUIRED. If the project processes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to PART B.**

☐ If you checked "No" for all question 1-3, and checked "Yes" for question 4
PART B **does not apply and no document is required. Continue to Section 2.**

More information on the City's construction BMP requirements as well as CGP requirements can be found at:
www.sandiego.gov/stormwater/regulations/swguide/constructing.shtml

Project Name: Prestwick Residence

PART B: Determine Construction Site Priority.

This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a "high threat to water quality." The City has aligned the local definition of "high threat to water quality" to the risk. Determination approach of the Stat e Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **NOTE:** The construction priority does **NOT** change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by city staff.

Complete PART B and continued to Section 2

1. ☐ ASBS

a. Projects located in the ASBS watershed. A map of the ASBS watershed can he found here *<placeholder for ASBS map link>*

2. ☐ High Priority

a. Projects 1 acre or more determined to be Risk Level 2 or Risk Level 3 per the Construction General Permit and not located in the ASBS watershed.

b. Projects 1 acre or more determined to be LUP Type 2 or LUP Type 3 per the Construction General Permit and not located in the ASBS watershed.

3. ☐ Medium Priority

a. Projects 1 acre or more but not subject to an ASBS or high priority designation.

b. Projects determined to be Risk Level 1 or LUP Type 1 per the Construction General Permit and not located in the ASBS watershed.

4. ☒ Low Priority

a. Projects not subject to ASBS, high or medium priority designation.

SECTION 2. Permanent Storm Water BMP Requirements.

Additional information for determining the requirements is found in the Storm Water Standards Manual.

PART C: Determine if Not Subject to Permanent Storm Water Requirements.

Projects that are considered maintenance, or otherwise not categorized as "new development projects" or "redevelopment projects" according to the Storm Water Standards Manual are not subject to Permanent Storm Water BMPs.

If "yes" is checked for any number in Part C, proceed to Part F and check "Not Subject to Permanent Storm Water BMP Requirements".

If "no" is checked for all of the numbers in Part C continue to Part D.

1.	Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact storm water?	○ Yes ◉ No
2.	Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?	○ Yes ◉ No
3.	Does the project fall under routine maintenance? Examples include, but are not limited to: roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay, and pothole repair).	○ Yes ◉ No

Project Name: Prestwick Residence

PART D: PDP Exempt Requirements.

PDP Exempt projects are required to implement site design and source control BMPs.

If "yes" was checked for any questions in Part D, continue to Part F and check the box labeled "PDP Exempt."
If "no" was checked for all questions in Part D, continue to Part E.

1. Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:

   • Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   • Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;
   • Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Storm Water Standards manual?

   ○ Yes; PDP exempt requirements apply ◉ No; next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Storm Water Standards Manual?

   ○ Yes; PDP exempt requirements apply ◉ No; PDP not exempt. PDP requirements apply.

PART E: Determine if Project is a Priority Development Project (PDP). Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

If "yes" is checked for any number in PART E, continue to PART F and check the box labeled "Priority Development Project".
If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Project".

1.	**New Development that creates 10,000 square feet or more of impervious surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	○ Yes ◉ No
2.	**Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	○ Yes ◉ No
3.	**New development or redevelopment of a restaurant.** Facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC 5812), and where the land development creates and/or replace 5,000 square feet or more of impervious surface.	○ Yes ◉ No
4.	**New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater.	○ Yes ◉ No

Project Name: Prestwick Residence

5. **New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).**	○ Yes ◉ No
6. **New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).	○ Yes ◉ No
7. **New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging- directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).	○ Yes ◉ No
8. **New development or redevelopment projects of a retail gasoline outlet that creates and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic of 100 or more vehicles per day.	○ Yes ◉ No
9. **New development or redevelopment projects of an automotive repair shops that creates and/or replaces 5,000 square feet or more of impervious surfaces.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.	○ Yes ◉ No
10. **Other Pollutant Generating Project.** The project is not covered in the categories above, results in the disturbance of one or more acres of land and is expected to generate pollutants post construction, such as fertilizers and pesticides. This does not include projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces of if they sheet flow to surrounding pervious surfaces.	○ Yes ◉ No

PART F: Select the appropriate category based on the outcomes of PART C through PART E.

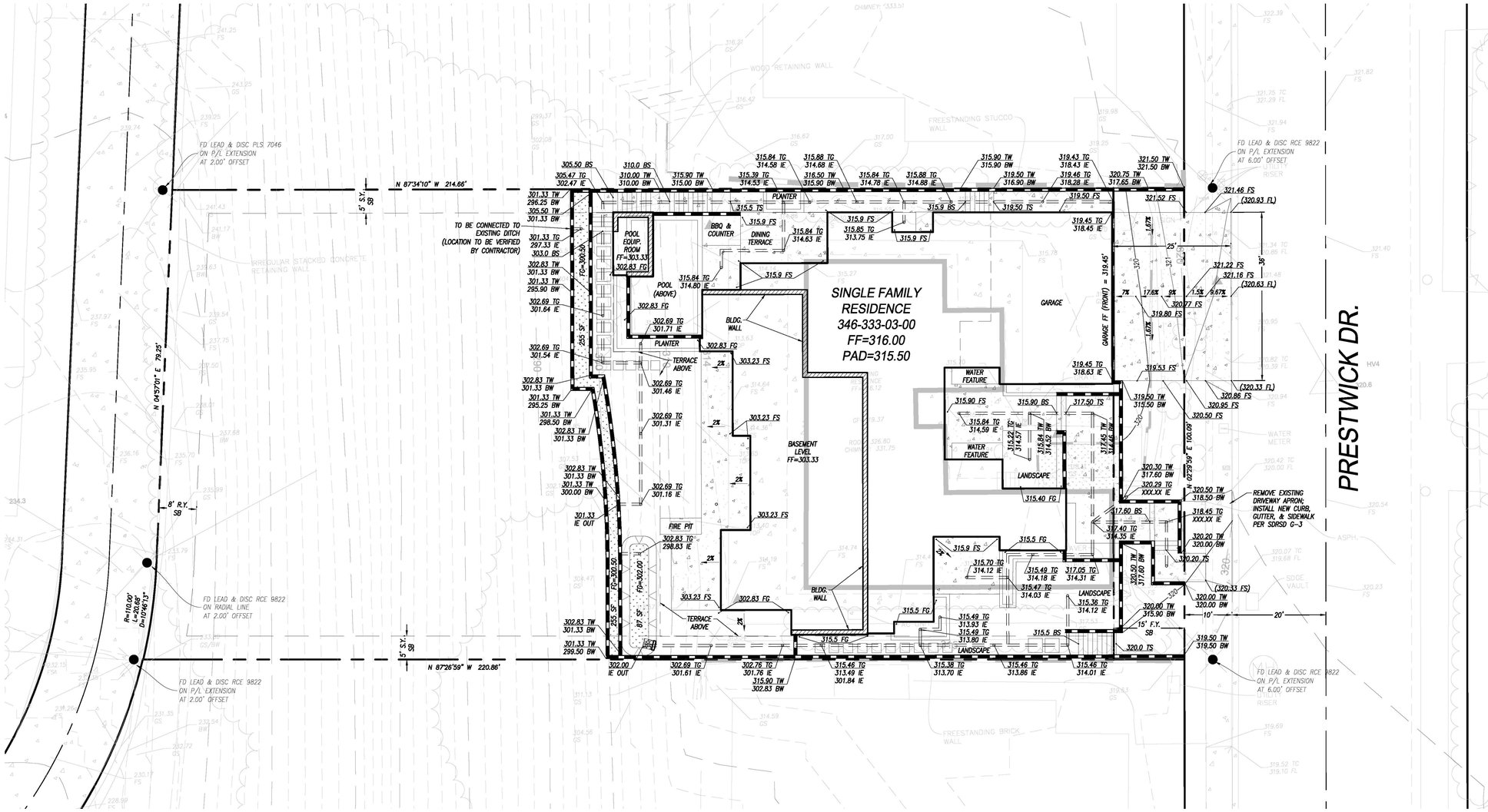
1. The project is **NOT SUBJECT TO STORM WATER REQUIREMENTS**.	☐
2. The project is a **STANDARD PROJECT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance.	☐
3. The project is **PDP EXEMPT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance.	☐
4. The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control, and structural pollutant control BMP requirements apply. See the Storm Water Standards Manual for guidance on determining if project requires hydromodification management.	☐

Name of Owner or Agent *(Please Print)*: Brian M. Ardolino, P.E.	Title: Associate Principal
Signature:	Date: January 28, 2016

APPENDIX B

ENGINEERED CIVIL SITE PLAN

PRELIMINARY GRADING PLAN
8194 PRESTWICK DRIVE
LA JOLLA, CA 92037

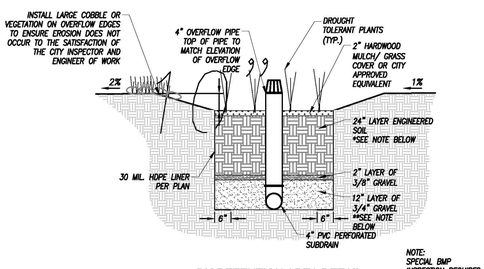


PRELIMINARY GRADING PLAN

SCALE: 1" = 10'

10 5 0 10 20 30

GRAPHIC SCALE IN FEET



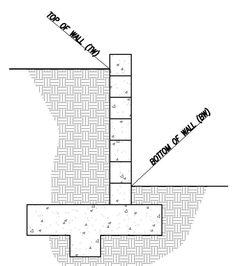
NOTE: SPECIAL BMP INSPECTION REQUIRED

BIORETENTION AREA DETAIL

NOT TO SCALE

* BIORETENTION "ENGINEERED SOIL" LAYER SHALL BE MINIMUM 24" DEEP "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOORD MULCH, AND 20-30% TOPSOIL, FREE OF STONES, STUMPS, ROOTS, OR SIMILAR OBJECTS, AND ALSO FREE OF NOXIOUS WEEDS.

** 3/4" CRUSHED ROCK LAYER SHALL BE A MINIMUM OF 12" BUT MAY BE DEEPENED TO INCREASE THE INFILTRATION AND STORAGE ABILITY OF THE DETAIL THE EFFECTIVE AREA OF THE BASIN SHALL BE LEVEL AND SHALL BE SIZED BASED ON CALCULATION. TYPICALLY, THE SURFACE AREA OF THE BIORETENTION BASIN IS 4% OF THE IMPERVIOUS AREA DRAINING TO IT. ALL BIORETENTION PLANTERS TO BE DEPRESSED AT LEAST 6" BELOW ADJACENT FINISHED SURFACE



TYPICAL WALL ELEVATION LOCATIONS SHOWN ON PLAN

NOT TO SCALE

SITE INFORMATION

OWNER:
ADDRESS: 8194 PRESTWICK DRIVE
APN: 346-333-03-00
AREA: 21,681 SF (0.50 AC)

GRADING TABULATIONS

TOTAL AREA TO BE GRADED:	12589 SF
AMOUNT OF CUT:	1460 CUBIC YARDS
MAXIMUM DEPTH OF CUT OUTSIDE OF THE BUILDING:	13 FEET
AMOUNT OF FILL:	70 CUBIC YARDS
MAXIMUM DEPTH OF FILL OUTSIDE OF THE BUILDING:	3 FEET
AMOUNT OF EXPORT SOIL:	1390 CUBIC YARDS

EARTHWORK QUANTITIES INCLUDE EXCAVATION FOR BUILDING AND SITE GRADING AS SHOWN ON THIS PLAN. QUANTITIES DO NOT INCLUDE REMEDIAL GRADING.

LEGAL DESCRIPTION

LOT 69 OF PRESTWICK ESTATES UNIT NO.1, IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP THEREOF NO.4392, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, NOVEMBER 13, 1959.

(AS DESCRIBED IN QUITCLAIM DEED RECORDED IN THE OFFICE OF THE SAN DIEGO COUNTY RECORDER AS DOCUMENT 2014-0523088)

TOPOGRAPHY

PASCO LARET SUITER & ASSOCIATES
535 N. COAST HWY 101, SUITE A
SOLANA BEACH, CA 92075
858-259-8212
DATE: JANUARY 22, 2013

BENCHMARK

THE PROJECT BENCHMARK IS THE EAST BRASS PLUG AT THE INTERSECTION OF MURLANDS VISTA WAY AND NAUTILUS STREET, PER THE CITY OF SAN DIEGO VERTICAL CONTROL BOOK, ELEVATION = 313.991.

LEGEND

- PROPOSED SITE RETAINING WALL
- PROPOSED SITE SCREEN WALL
- BUILDING RETAINING WALL
- EXISTING RETAINING WALL
- RECESSED LANDSCAPE PLANTER FOR STORMWATER TREATMENT
- AREA DRAIN INLET AND GRATE
- CLEANOUT
- PVC DRAIN PIPE (SIZE AND SLOPE PER PLAN)
- LIMIT OF WORK

ABBREVIATIONS

BW	BOTTOM OF WALL ELEVATION
BS	BOTTOM OF STAIR ELEVATION
EX	EXISTING
FF	FINISH FLOOR ELEVATION
FG	FINISH GRADE ELEVATION
FS	FINISH SURFACE ELEVATION
IE	INVERT ELEVATION
TG	TOP OF GRATE ELEVATION
TS	TOP OF STAIR ELEVATION
TW	TOP OF WALL ELEVATION
WL	WATER LEVEL ELEVATION

REGISTERED PROFESSIONAL ENGINEER BRIAN MICHAEL ARDOLINO No. 71651 Exp. 12/31/15 CIVIL STATE OF CALIFORNIA

Know what's below. Call before you dig.

PASCO LARET SUITER & ASSOCIATES
CIVIL ENGINEERING + LAND PLANNING + LAND SURVEYING
535 North Highway 101, Ste A, Solana Beach, CA 92075
ph 858.259.8212 | fx 858.259.4812 | plsengineering.com

PLANS PREPARED UNDER THE SUPERVISION OF

BRIAN M. ARDOLINO

DATE: 08-04-15
R.C.E. NO. 71651
EXP. 12-31-15

PREPARED BY:
Name: PASCO LARET SUITER & ASSOC.
525 N. HWY 101, SUITE A
SOLANA BEACH, CA 92075
Phone: (858) 259-8212

Project Address:
8194 PRESTWICK DRIVE
LA JOLLA, CA 92037

Project Name:
PRESTWICK RESIDENCE

Sheet Title:
PRELIMINARY GRADING PLAN

Revision 14:
Revision 13:
Revision 12:
Revision 11:
Revision 10:
Revision 9:
Revision 8:
Revision 7:
Revision 6:
Revision 5:
Revision 4:
Revision 3:
Revision 2:
Revision 1:

Original Date: AUGUST 4, 2015
Sheet: 2 of: 3
DEP#:

C.2

APPENDIX C

PRELIMINARY HYDROLOGY STUDY

PRELIMINARY HYDROLOGY CALCULATIONS

For

PRESTWICK RESIDENCE

APN: 346-333-03-00
8194 PRESTWICK DRIVE
LA JOLLA, CALIFORNIA

Prepared For

CORI DEL CASTILLO
7626 HERSCHEL AVENUE
LA JOLLA, CALIFORNIA

PREPARED BY:

PASCO LARET SUITER & ASSOCIATES, INC.
535 N. HIGHWAY 101, SUITE A
SOLANA BEACH, CA 92075
(858)259-8212

DATE: 8-3-15

8-4-15

BRIAN M. ARDOLINO RCE 71651 DATE

PLSA 2326
August 3, 2015

TABLE OF CONTENTS

A. INTRODUCTION

The purpose of this report is to analyze the storm water runoff produced from the 100 year storm event of the pre-developed and post-developed condition of the site located at 8295 Prestwick Drive, La Jolla, California.

Pre-development Conditions

The existing condition of the project site is residential developed land. There is an existing building with concrete patios at the rear of the property. The front of the property (east side) slopes eastward towards Prestwick Drive. The rear of the property (west side) slopes westward towards the alley in the rear. The property has an existing total gross area of 21,661 sf or 0.50 acre. The total impervious area is estimated to be 5,803 sf. Using the Rational Method the weighted runoff coefficient for the existing site condition has been calculated to be 0.647 (see attached calculations). The total peak flowrate for the 100 year 6 hour storm event has been calculated to be 1.70 for the existing site condition (see attached calculations).

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The proposed grading for this project will be for the construction of a single family residence with an attached garage. The driveway will run along the northeast corner of the site. Also, a pool will be constructed at the rear of the property. Using the Rational Method the weighted runoff coefficient for the proposed site condition has been calculated to be 0.494 (see attached calculations). The peak flowrate for the 100 year 6 hour storm event has been calculated to be 1.59 cfs (see attached calculations).

The total proposed impervious area within the drainage basin, including roofs and hardscape, has been estimated to be 8,504 sf. Runoff from the site has been designed to drain in east to west direction, towards the rear alley similar to that of the existing condition. The bioretention basin has been proposed at the rear (west side) of the property. The bioretention basin has been designed to intercept and treat runoff from the proposed roof runoff and hardscape areas prior to leaving the site. The required biorention area is sized per the proposed impervious area - 340 sf is needed and 342 sf, split into two basins, is provided.

B. CONCLUSION

Based on the calculations in this report, the proposed development will result in an increase in peak flow rate of 0.35 cfs. The bioretention basin proposed is adequately sized to treat the runoff from the increase of impervious material. The proposed project meets the minimum stormwater treatment requirements as defined by the County of San Diego Hydrology Manual. It is the opinion of Pasco Laret Suiter & Associates that the proposed improvements associated with this project will not result in any additional drainage impacts to the adjacent downstream properties.

Please call if you have any questions.

Sincerely,

Brian M. Ardolino, PE
RCE 71651

METHODOLOGY

Introduction

The hydrologic model used to perform the hydrologic analysis presented in this report utilizes the Ration Method (RM) equation, Q=CIA. The RM formula estimates the peak rate of runoff based on the variables of area, runoff coefficient, and rainfall intensity. The rainfall intensity (I) is equal to:

$$I = 7.44 \times P_6 \times D^{-0.645}$$

Where:

I = Intensity (in/hr)
P_6 = 6-hour precipitation (inches)
D = duration (minutes – use Tc)

Using the Time of Concentration (Tc), which is the time required for a given element of water that originates at the most remote point of the basin being analyzed to reach the point at which the runoff from the basin is being analyzed. The RM equation determines the storm water runoff rate (Q) for a given basin in terms of flow (typically in cubic feet per second (cfs) but sometimes as gallons per minute (gpm)). The RM equation is as follows:

$$Q = CIA$$

Where:

Q= flow (in cfs)
C = runoff coefficient, ratio of rainfall that produces storm water runoff (runoff vs. infiltration/evaporation/absorption/etc)
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The RM equation assumes that the storm event being analyzed delivers precipitation to the entire basin uniformly, and therefore the peak discharge rate will occur when a raindrop that falls at the most remote portion of the basin arrives at the point of analysis. The RM also assumes that the fraction of rainfall that becomes runoff or the runoff coefficient C is not affected by the storm intensity, I, or the precipitation zone number.

The pre & post-development runoff coefficient used was determined by using a weighted "C" average.

C= [0.90 x Impervious Area) + Cp x (Subarea – Impervious Area)] / Subarea

Where: Cp = pervious surface runoff coefficient

For the proposed development the runoff coefficient utilized for the hydrologic analysis of the project site varied based on the area of impervious surfaces. Weighted runoff coefficient calculations can be seen Sections D and E of this report.

D. HYDROLOGY CALCULATIONS PRE DEVELOPMENT

Rational Method Parameters

Runoff Coefficient C=0.9* for Impervious Area
Runoff Coefficient C=0.35* for Natural Area, Soil Type "C" per County Soils Map

100 Year 6 Hour Storm Precipitation (P_6)=2.0 in (see rainfall isopluvial*)
$T_c=(11.9L^3/\Delta E)^{0.385}$ per Figure 3-4 of the County of San Diego Hydrology Manual (L= miles)*
$T_t=T_i + Tc$
I= Intensity in/hr, $I=7.44xP_6xD^{-0.645}$*
Duration (D)= Time of Concentration, Tc
Q=Peak Runoff, Q=C*I*A (cfs)
C= [(IMP area x 0.9) + [(Subarea – IMP area) x 0.35]] / Subarea

*From San Diego County Hydrology Manual, June 2003 Revision

$T_i=(11.9(162/5280)^3/6)^{0.385}$
T_i=0.02 hours = 1.4 min
1.4 min < 5 min therefore use 5 min

$I=7.44(2.0)(5)^{-0.645}$
I=5.27 in/hr

A=21,661 sf = 0.50 ac
C= (0.27*0.9) + [(0.50-0.27)*0.35] / 0.5
C=0.647

Q_{100}= 0.647 * 5.27 in/hr * 0.50 acres
Q_{100}=1.70 cfs

E. HYDROLOGY CALCULATIONS POST DEVELOPMENT

Rational Method Parameters

Runoff Coefficient C=0.9* for Impervious Area
Runoff Coefficient C=0.35* for Natural Area, Soil Type "D" per County Soils Map

100 Year 6 Hour Storm Precipitation (P_6)=2.0 in (see rainfall isopluvial*)
$T_c=(11.9L^3/\Delta E)^{0.385}$ per Figure 3-4 of the County of San Diego Hydrology Manual (L= miles)*
$T_t=T_i + Tc$
I= Intensity in/hr, $I=7.44xP_6xD^{-0.645}$*
Duration (D)= Time of Concentration, Tc
Q=Peak Runoff, Q=C*I*A (cfs)
C= [(IMP area x 0.9) + [(Subarea – IMP area) x 0.35]] / Subarea

*From San Diego County Hydrology Manual, June 2003 Revision

$T_i=(11.9(162/5280)^3/17)^{0.385}$
T_i=0.016 hours = 0.93 min
0.93 min < 5 min therefore use 5 min

$I=7.44(2.0)(5)^{-0.645}$
I=5.27 in/hr

A=21,661 sf = 0.50 ac
C= (0.39*0.9) + [(0.50-0.39)0.35] / 0.50
C=0.779

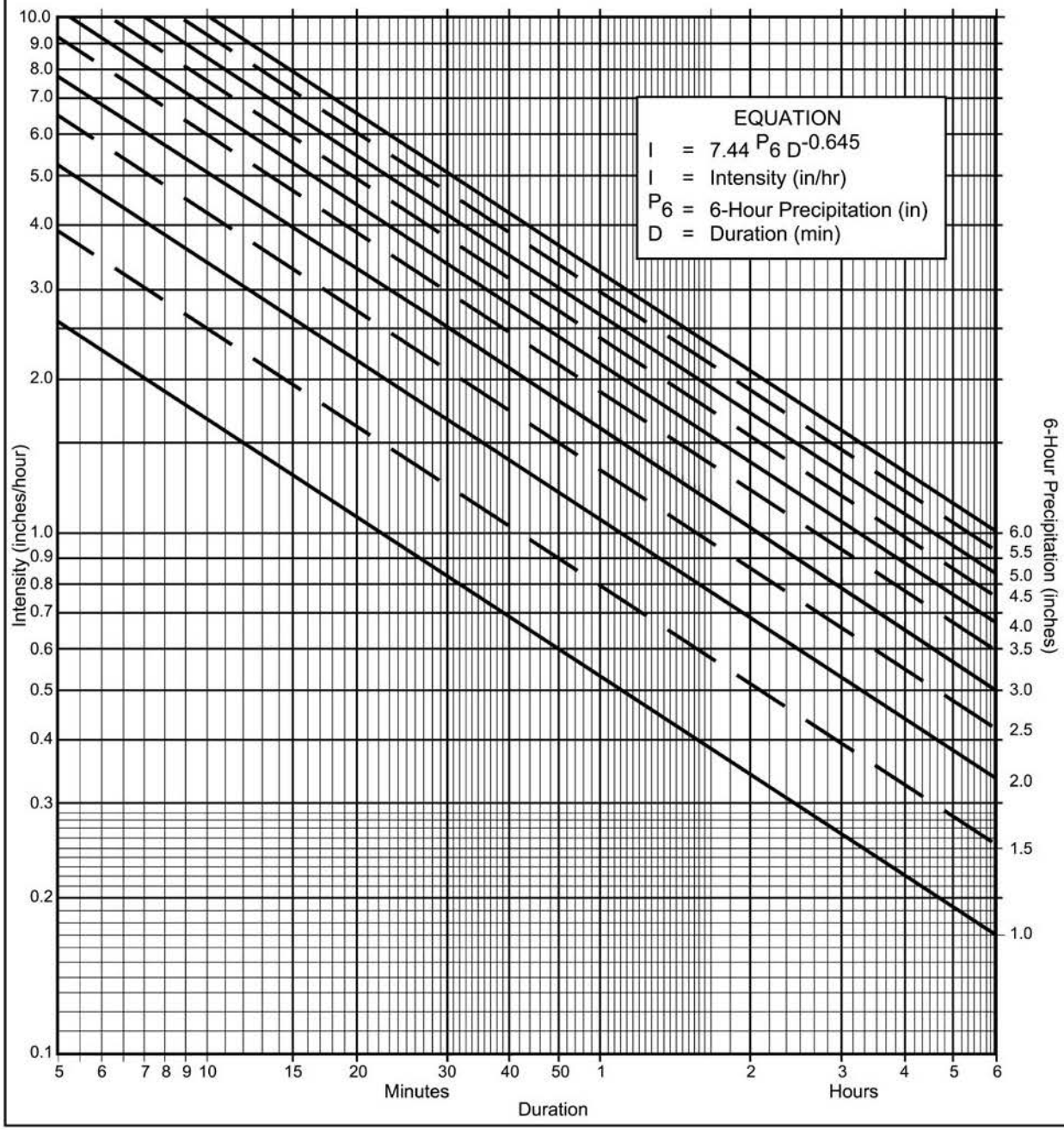
Q_{100}= 0.779 * 5.27 in/hr * 0.50 acres
Q_{100}=2.05 cfs

F. APPENDIX

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

PRELIMINARY HYDROLOGY CALCULATIONS

For

PRESTWICK RESIDENCE

APN: 346-333-03-00
8194 PRESTWICK DRIVE
LA JOLLA, CALIFORNIA

Prepared For

CORI DEL CASTILLO
7626 HERSCHEL AVENUE
LA JOLLA, CALIFORNIA

PREPARED BY:

PASCO LARET SUITER & ASSOCIATES, INC.
535 N. HIGHWAY 101, SUITE A
SOLANA BEACH, CA 92075
(858)259-8212

DATE: 8-3-15

8-4-15

BRIAN M. ARDOLINO RCE 71651 DATE

PLSA 2326
August 3, 2015

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C=0.647

Q_{100}= 0.647 * 5.27 in/hr * 0.50 acres
Q_{100}=1.70 cfs

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C= (0.39*0.9) + [(0.50-0.39)0.35] / 0.50
C=0.779

Q_{100}= 0.779 * 5.27 in/hr * 0.50 acres
Q_{100}=2.05 cfs

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Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
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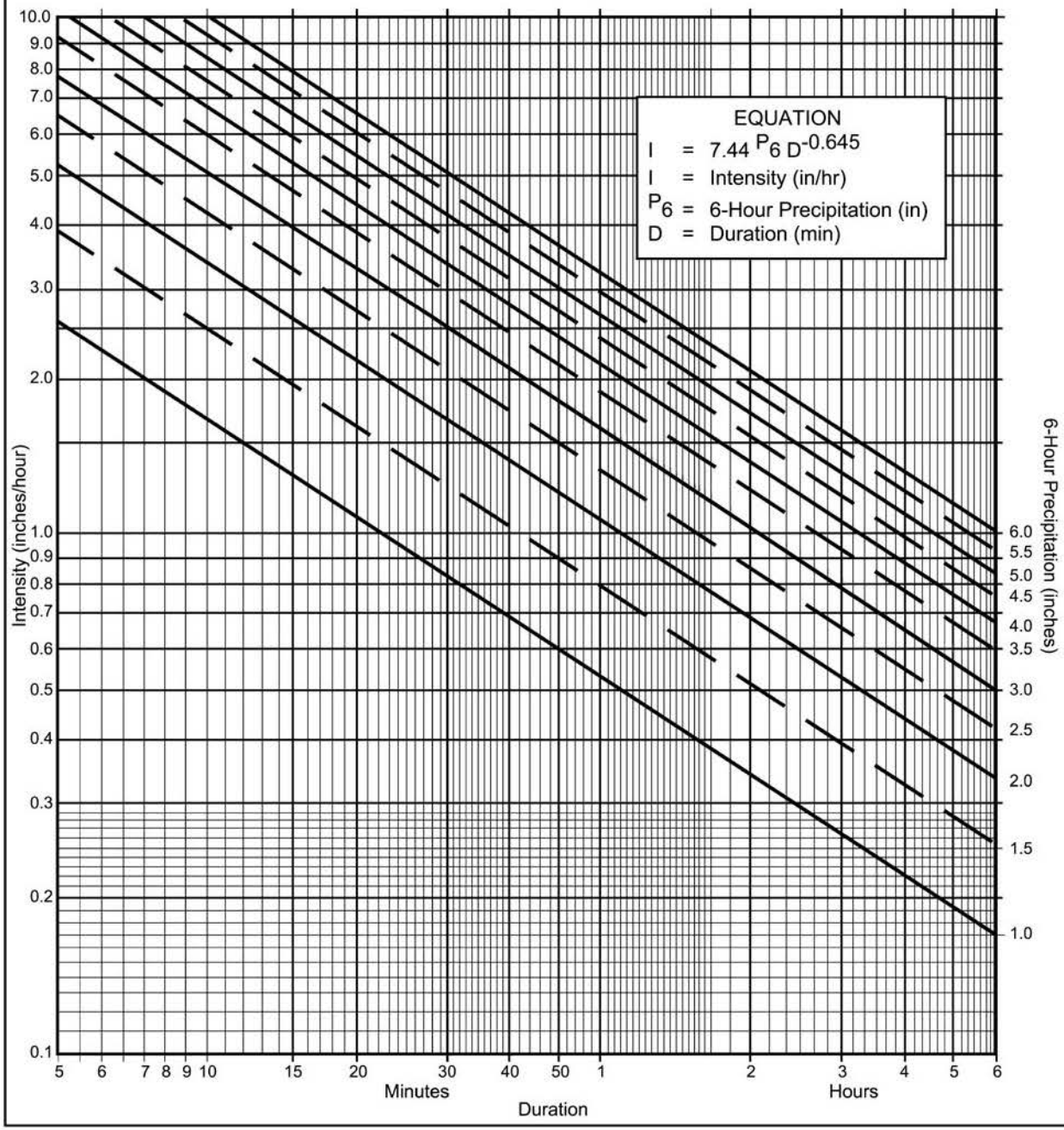
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

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Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

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(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1

PASCO LARET SUITER
& ASSOCIATES
CIVIL ENGINEERING + LAND PLANNING + LAND SURVEYING

WATER POLLUTION CONTROL PLAN
FOR:

8194 PRESTWICK DRIVE
LA JOLLA, CALIFORNIA

APN: 346-333-03-00

PREPARED FOR:

CORI DEL CASTILLO
7626 HERSCHEL AVENUE
LA JOLLA, CALIFORNIA

PREPARED BY:
PASCO LARET SUITER & ASSOCIATES
535 N. HIGHWAY 101, SUITE A
SOLANA BEACH, CA 92075

DATE:
August 3, 2015

REVISED:
December 30, 2015

REGISTERED PROFESSIONAL ENGINEER
BRIAN MICHAEL ARDOLINO
No. 71651
Exp. 12-31-17
CIVIL
STATE OF CALIFORNIA

1-5-16

BRIAN ARDOLINO, RCE 71651 DATE

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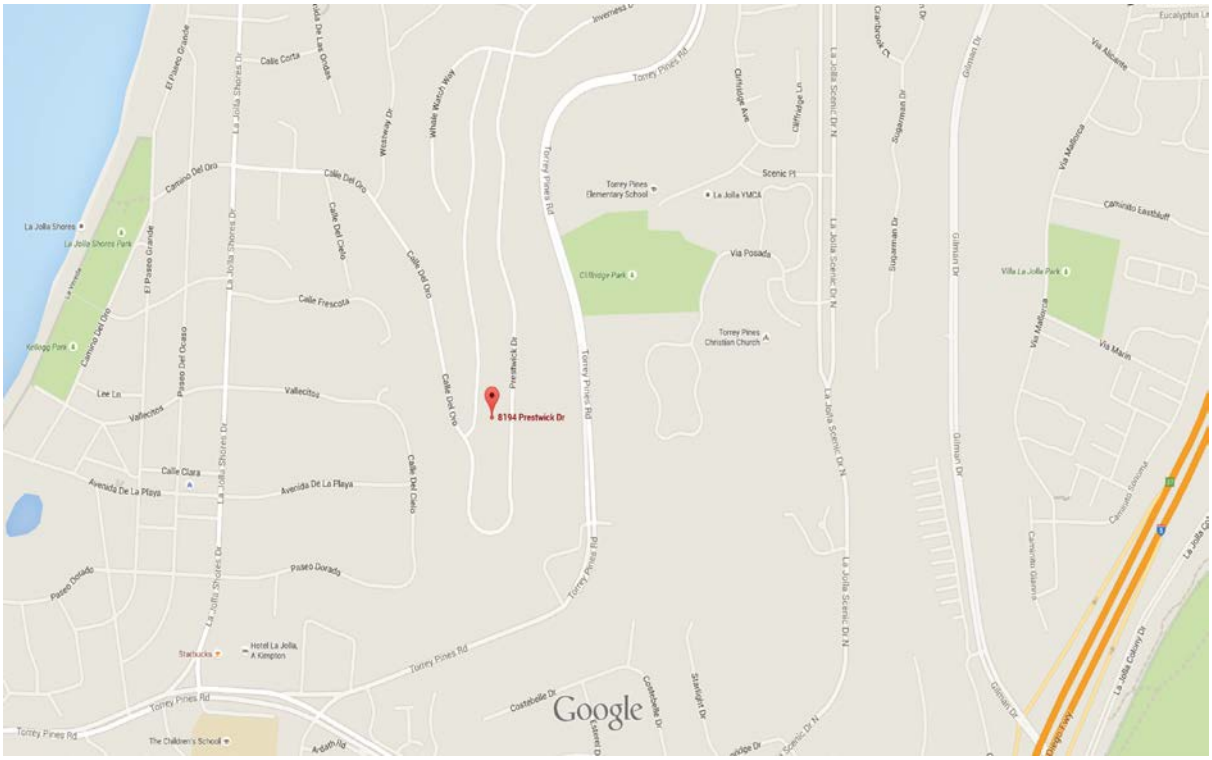
1.0 PROJECT LOCATION

The project site is located on 8194 Prestwick Drive, in La Jolla California in the City of San Diego.



VICINITY MAP

2.0 PROJECT DESCRIPTION

The scope of the proposed project includes the demolition of the existing home along with the driveway, patio areas, and surrounding landscape. Subsequently, there will be construction of a new single family home, retaining walls, stairs, a pool, and new landscape areas. The site is bordered by other existing homes to the north and south, Prestwick Drive to the east, and an alley to the west. In the existing condition, stormwater runoff from the building pads drains away from the buildings. The lot flows in an east to west direction eventually discharging into the alley to the west. The post development drainage paths will mimic the existing conditions by maintaining the existing site drainage patterns and runoff points.

3.0 RESPONSIBLE PARTIES

The owner is responsible for retaining qualified personnel to install, inspect, and maintain all BMP's for the duration of construction. In this case, the General Contractor listed below will be assuming the responsibilities of the Storm Water Pollution Prevention Manager (SWPPM). A Construction BMP Inspection Checklist for use by the SWPPM is included in Appendix "C" of this report.

SMPPM
Contractor's Name:

Telephone Number:

Company Address:

The SWPPM shall have primary responsibility and significant authority for the implementation, maintenance, inspection of construction BMP's required by the approved WPCP. The SWPPM will be available at all times throughout the duration of the project. Duties of the SWPPM include but are not limited to:

- Ensuring full compliance with the WPCP
- Implementing all elements of the WPCP, including but not limited to:
    - Implementation of prompt and effective erosion and sediment control measures
    - Implementing all non-storm water management, and materials and waste management activities such as: monitoring discharges (dewatering, diversion devices); general site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.
- Pre-storm inspections
- Storm event inspections

- Post-storm inspections
- Routine inspections as specified in the project's specifications or described in the WPCP
- Ensuring elimination of all unauthorized discharges
- The SWPPM shall be assigned authority by the Contractor to mobilize crews in order to make immediate repairs to the control measures
- Coordinate with the Contractor to assure all of the necessary corrections/repairs are made immediately, and that the project complies with the WPCP.

4.0 POTENTIAL POLLUTANT SOURCES

Inventory of Materials and Activities that May Pollute Storm Water

The following is a list of construction materials that will be used and activities that will be performed that will have the potential to contribute pollutants, other than sediment, to storm water runoff (control practices for each activity are identified in the Water Pollution Control Drawings (WPCDs) and/or in Sections 500.3.4 through 500.3.9:

- Adhesives, Glues
- Resins, Epoxy Synthetics
- Calks, Sealers, Putty, Sealing Agents
- Cleaners, Ammonia, Lye, Caustic Sodas
- Bleaching Agents
- Etching Agents
- Cleaners, Ammonia, Lye, Caustic Sodas
- Bleaching Agents
- Solder (Lead, Tin), Flux (Zinc, Chloride)
- Pipe Fitting (Cut Shavings)
- Galvanized Metals (Nails, Fences)
- Electric Wiring
- Paint Thinner, Acetone, MEK, Stripper
- Paints, Lacquers, Varnish, Enamels
- Turpentine, Gum Spirit, Solvents
- Sanding, Stripping
- Paints (Pigments), Dyes
- Sawdust
- Particle Board Dusts (Formaldehyde)
- Treated Woods
- Dusts (Brick, Cement)

- Concrete Curing Compounds
- Glazing Compounds
- Cleaning Surfaces
- Flashing
- Drywall
- Tile Cutting (Ceramic Dusts)
- Insulation
- Venting Systems
- Dusts (Brick, Cement, Saw, Drywall)
- Insulating
- Coolant Reservoirs
- Vehicle and Machinery Maintenance
- Gasoline, Oils, Additives
- Marking Paints (Sprays)
- Grading, Earth Moving
- Portable Toilets
- Fire Hazard Control (Herbicides)
- Health and Safety
- Wash Waters* (Herbicides, Concrete, Oils, Greases)
- Planting, Plant Maintenance
- Excavation, Tilling
- Masonry & Concrete*
- Solid Wastes (Trees, Shrubs)
- Exposing Natural Lime or Other Mineral Deposits
- Soils Additives
- Revegetation of Graded Areas
- Waste Storage (Used Oils, Solvents, Etc.)
- Hazardous Waste Containment
- Raw Material Piles

Construction activities that have the potential to contribute sediment to storm water discharges include:

- Grading Operations
- Utility Excavation Operations
- Landscaping Operations

Section 5.0 lists all Best Management Practices (BMPs) that have been selected for implementation in this project. Implementation and location of BMPs are shown on the Water Pollution Control Plan Site Map in Appendix "A". Appendix "B" includes copies of the fact sheets of all the BMPs selected for this project.

5.0 BEST MANAGEMENT PRACTICES

Below is a table listing the construction BMP's that have been chosen for this project. The location of the construction BMP's listed below are shown on the Water Pollution Control Site Map located in Appendix "A".

EROSION CONTROL METHOD	**CASQA DETAIL**
HYDROSEEDING	SS-4
SEDIMENT CONTROL METHOD	
FIBER ROLLS (STRAW WATTLES)	SC-5
GRAVEL BAGS	SC-6,SC-8
STORMDRAIN INLET PROTECTION	SC-10
SILT FENCE	SE-1
OFFSITE SEDIMENT TRACKING PREVENTION	
STABILIZED CONSTRUCTION ENTRANCE	TC-1
GENERAL SITE MANAGEMENT BMP'S	
MATERIAL DELIVERY AND STORAGE	WM-1
CONCRETE WASTE MANAGEMENT	WM-8
SOLID WASTE MANAGEMENT	WM-5
SANITARY WASTE MANAGEMENT	WM-9

6.0 SOURCE CONTROL MEASURES

The proposed project design encourages source control measures to limit the exposure of pollutants to storm water runoff. The following methods and designs have been incorporated into the project design as source control BMPs:

- No source control for maintenance bays is required because maintenance bays are not proposed for the site.
- No source control for vehicle and equipment wash areas is required because no vehicle or equipment wash area is proposed.
- No source control for outdoor processing areas is required because no outdoor processing areas are proposed.
- No fueling areas are proposed.
- The existing site does not contain steep hillsides; therefore no source control for steep hillside landscaping is required.
- Efficient irrigation systems and landscape design are proposed. Irrigation runoff will be minimized by providing an irrigation system designed for each landscape

areas specific requirement. Additionally, rain shutoff devices and shutoff valves will be used.

- The trash storage area for the site will also be located underneath the roof line to eliminate direct precipitation to the trash storage area.
- Outdoor material storage areas are not proposed on the site.
- No loading docks are proposed on the site.
- In the future, integrated pest management educational materials will be distributed to residents and tenants. These materials will discuss methods of keeping pests out of buildings and landscaping, and how to eliminate existing pests without the use of pesticides. The need for pesticide will be reduced by planting pest resistant plants, and by modifying the landscape design to discourage pests.
- Public stormdrain inlets or catch basins are located along the property frontage, thus signs prohibiting illegal dumping are necessary for this project.
- A fire sprinkler system is proposed on the site; therefore discharges from the sprinkler system's operational maintenance and testing will be conveyed to the sanitary sewer system.
- Air condition condensate will be directed into landscaping areas before exiting the site.
- Non-toxic roofing materials are proposed for the building.

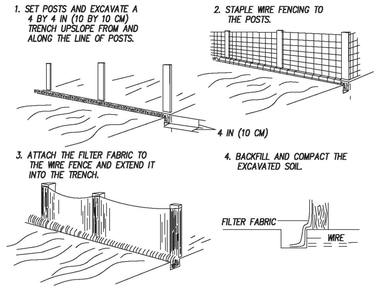
7.0 ADVANCED TREATMENT

The project site is relatively small in area (approximately 0.61 acre), located in a residential area, and there is no offsite stormwater run-on entering the site, no advanced treatment measures are necessary for the project.

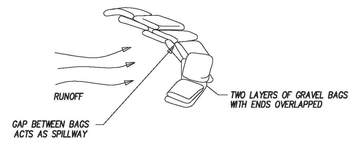
APPENDIX “A”

LEGEND

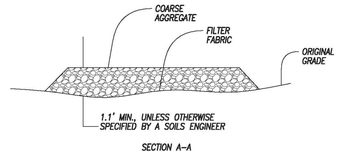
FLOW ARROWS	→
STREET SWEEPING AND VACUUMING PER SC-7	SSV
SILT FENCE PER SC-1	SF
STABILIZED CONSTRUCTION ENTRANCE PER TC-1	
PRESERVATION OF EXISTING VEGETATION PER EC-2	PEV
GRAVEL BAG CHEVRONS PER SC-6	
STORM DRAIN INLET PROTECTION PER SC-10	
MATERIAL DELIVERY AND STORAGE PER WM-1	
STOCKPILE MANAGEMENT PER WM-3	STOCKPILE MANAGEMENT
SPILL PREVENTION AND CONTROL PER WM-4	
SCHEDULING PER SS-1	SCH
WATER CONSERVATION PRACTICES PER NS-1	
VEHICLE AND EQUIPMENT CLEANING PER NS-8	VEC
VEHICLE AND EQUIPMENT FUELING PER NS-9	VEF
VEHICLE AND EQUIPMENT MAINTENANCE PER NS-10	VEM
PROPERTY BOUNDARY	
SOLID WASTE MANAGEMENT PER WM-5	
HAZARDOUS WASTE MANAGEMENT PER WM-6	
CONCRETE WASTE MANAGEMENT PER WM-8	CWM
SANITARY/SEPTIC WASTE MANAGEMENT PER WM-9	SA
LIQUID WASTE MANAGEMENT PER WM-10	LWM
CONCRETE CURING PER NS-12	CC
CONCRETE FINISHING PER NS-13	CF



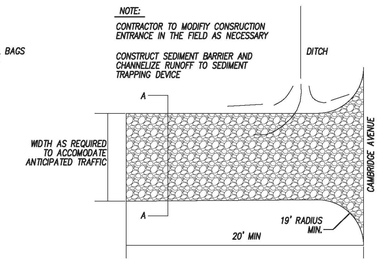
SILT FENCE DETAIL
NOT TO SCALE



GRAVEL BAG DETAIL
NOT TO SCALE



SECTION A-A



CONSTRUCTION ENTRANCE DETAIL
NOT TO SCALE

BMPS TO BE IMPLEMENTED

SS-1	SCHEDULING
SS-2	PRESERVATION OF EXISTING VEGETATION
SS-4	HYDROSEEDING
SC-6	GRAVEL BAG BERMS
SC-7	STREET SWEEPING
SC-10	STORM DRAIN INLET PROTECTION
TC-1	STABILIZED CONSTRUCTION ENTRANCE
WM-1	MATERIAL DELIVERY AND STORAGE MANAGEMENT
WM-2	MATERIAL USE MANAGEMENT
WM-3	STOCKPILE MANAGEMENT
WM-4	SPILL PREVENTION AND CONTROL
WM-5	SOLID WASTE
WM-9	SANITARY WASTE
WM-10	LIQUID WASTE
NS-1	WATER CONSERVATION PRACTICES
NS-2	DEWATERING OPERATIONS
NS-3	PAVING AND GRINDING
NS-7	POTABLE WATER/IRRIGATION FLUSHING
NS-8	VEHICLE AND EQUIPMENT CLEANING
NS-9	VEHICLE AND EQUIPMENT FUELING
NS-10	VEHICLE AND EQUIPMENT MAINTENANCE
NS-12	CONCRETE CURING
NS-13	CONCRETE FINISHING

NOTE: BMP NUMBERS REFERENCE LATEST CALTRANS BMP FACT SHEETS

EROSION AND SEDIMENT CONTROL NOTES:

TEMPORARY EROSION/SEDIMENT CONTROL, PRIOR TO COMPLETION OF FINAL IMPROVEMENTS, SHALL BE PERFORMED BY THE CONTRACTOR OR QUALIFIED PERSON AS INDICATED BELOW:

1. ALL REQUIREMENTS OF THE CITY OF SAN DIEGO "LAND DEVELOPMENT MANUAL, STORM WATER STANDARDS" MUST BE INCORPORATED INTO THE DESIGN AND CONSTRUCTION OF THE PROPOSED GRADING/IMPROVEMENTS CONSISTENT WITH THE APPROVED WATER QUALITY TECHNICAL REPORT (WQTR) AND WATER POLLUTION CONTROL PLAN (WPCP).
2. FOR STORM DRAIN INLETS, PROVIDE A GRAVEL BAG SILT BASIN IMMEDIATELY UPSTREAM OF INLET AS INDICATED ON DETAILS THIS SHEET.
3. FOR INLETS LOCATED AT SUMPS ADJACENT TO TOP OF SLOPES, THE CONTRACTOR SHALL ENSURE THAT WATER DRAINING TO THE SUMP IS DIRECTED INTO THE INLET AND THAT A MINIMUM OF 1 FOOT OF FREEBOARD EXISTS AND IS MAINTAINED ABOVE THE TOP OF THE INLET. IF FREEBOARD IS NOT PROVIDED BY THE GRADING SHOWN ON THESE PLANS, THE CONTRACTOR SHALL PROVIDE IT VIA TEMPORARY MEASURES, I.E. GRAVEL BAGS OR DIKES.
4. THE GRADING CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANUP OF SILT AND MUD ON ADJACENT STREET(S) DUE TO CONSTRUCTION ACTIVITY.
5. THE CONTRACTOR SHALL CHECK AND MAINTAIN ALL LINED AND UNLINED DITCHES AFTER EACH RAINFALL.
6. THE CONTRACTOR SHALL REMOVE SILT AND DEBRIS AFTER EACH MAJOR RAINFALL OR WHEN SILT REACHES AN ELEVATION OF 0.5' BELOW WEIR OPENING FOR GRAVEL BAG BASINS.
7. EQUIPMENT AND WORKERS FOR EMERGENCY WORK SHALL BE MADE AVAILABLE AT ALL TIMES DURING THE RAINY SEASON. ALL NECESSARY MATERIALS SHALL BE STOCKPILED ON SITE AT CONVENIENT LOCATIONS TO FACILITATE RAPID CONSTRUCTION OF TEMPORARY DEVICES WHEN RAIN IS IMMINENT.
8. PERMANENT BMP DEVICES SHOWN ON PLAN SHALL NOT BE MOVED OR MODIFIED WITHOUT THE APPROVAL OF THE CITY ENGINEER OR RESIDENT ENGINEER AND THE ENGINEER OF WORK.
9. THE CONTRACTOR SHALL RESTORE ALL EROSION/SEDIMENT CONTROL DEVICES TO WORKING ORDER TO THE SATISFACTION OF THE CITY ENGINEER OR RESIDENT ENGINEER AFTER EACH RUNOFF PRODUCING RAINFALL.
10. THE CONTRACTOR SHALL INSTALL ADDITIONAL EROSION/SEDIMENT CONTROL MEASURES AS MAY BE REQUIRED BY THE RESIDENT ENGINEER AND THE ENGINEER OF WORK DUE TO UNCOMPLETED GRADING OPERATION OR UNFORESEEN CIRCUMSTANCES WHICH MAY ARISE.
11. THE CONTRACTOR SHALL BE RESPONSIBLE AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT PUBLIC TRESPASS ONTO AREAS WHERE IMPOUNDED WATERS CREATE A HAZARDOUS CONDITION.
12. ALL EROSION/SEDIMENT CONTROL MEASURES PROVIDED PER THE APPROVED GRADING PLAN SHALL BE INCORPORATED HEREON. ALL EROSION/SEDIMENT CONTROL FOR INTERIM GRADING CONDITIONS SHALL BE DONE TO THE SATISFACTION OF THE RESIDENT ENGINEER.
13. GRADED AREAS AROUND THE PROJECT PERIMETER MUST DRAIN AWAY FROM THE FACE OF THE SLOPE AT THE CONCLUSION OF EACH WORKING DAY.
14. ALL REMOVABLE PROTECTIVE DEVICES SHOWN SHALL BE IN PLACE AT THE END OF EACH WORKING DAY WHEN THE FIVE DAY RAIN PROBABILITY FORECAST EXCEEDS 40%. THE CONTRACTOR SHALL ONLY GRADE, INCLUDING CLEARING AND GRUBBING FOR THE AREAS FOR WHICH THE CONTRACTOR CAN PROVIDE EROSION/SEDIMENT CONTROL MEASURES.
15. THE CONTRACTOR SHALL ARRANGE FOR WEEKLY MEETINGS FROM OCTOBER 30TH TO MARCH 30TH FOR PROJECT TEAM (GENERAL CONTRACTOR, QUALIFIED PERSON, EROSION CONTROL SUBCONTRACTOR IF ANY, ENGINEER OF WORK, OWNER/DEVELOPER AND THE RESIDENT ENGINEER) TO EVALUATE THE ADEQUACY OF THE EROSION CONTROL MEASURES ANN OTHER RELATED CONSTRUCTION ACTIVITIES.

HYDROSEED NOTE:
GRADED PAD AREAS SHALL BE HYDROSEEDED TO PREVENT EROSION, IN THE EVENT THAT CONSTRUCTION OF BUILDING(S) DOES NOT OCCUR WITHIN 30 DAYS OF GRADING. HYDROSEED SHALL BE IRRIGATED AND REAPPLIED AS NECESSARY TO ESTABLISH GROWTH.

HYDROSEED MIX FOR TEMPORARY EROSION CONTROL:
PURE LIVE SEED

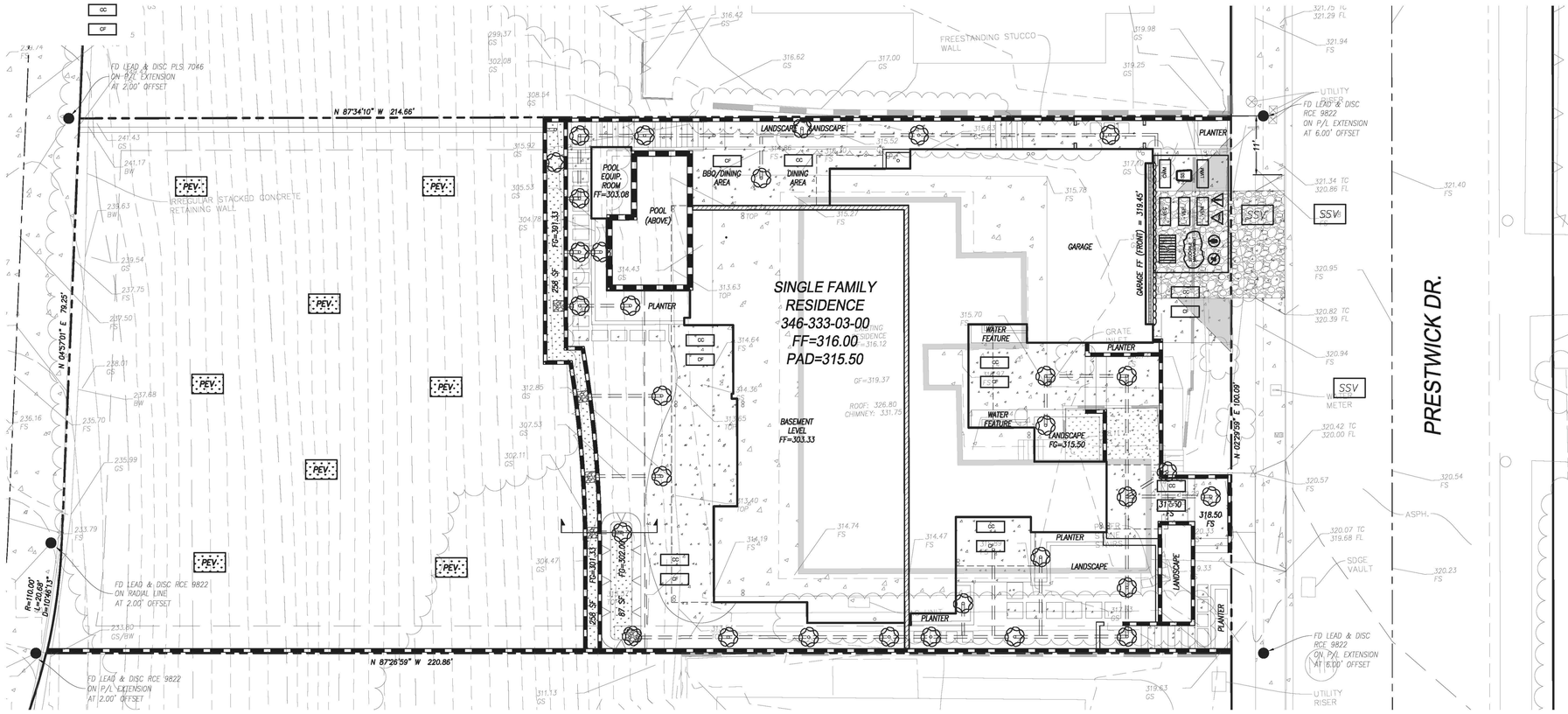
LBS/ACRE	SPECIES
6.0	VULPIA MICROSTACHYS
4.0	MUHLENBERGIA MICROSPERMA
3.0	HORDEUM INTERCEDENS
2.0	ESCHSCHOLZIA CALIFORNICA
5.0	HORDEUM CALIFORNICUM PROSTRATE
20.0	

STORM WATER QUALITY NOTES: (CONSTRUCTION BMPS)

1. SUFFICIENT BMPS MUST BE INSTALLED TO PREVENT SILT, MUD OR OTHER CONSTRUCTION DEBRIS FROM BEING TRACKED IN TO THE ADJACENT STREET(S) OR STORM WATER CONVEYANCE SYSTEMS DUE TO CONSTRUCTION VEHICLES OR ANY OTHER CONSTRUCTION ACTIVITY, THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING ANY SUCH DEBRIS THAT MAY BE IN THE STREET AT THE END OF EACH WORK DAY AFTER A STORM EVENT THAT CAUSES A BREECH IN THE INSTALLED CONSTRUCTION BMPS.
2. ALL STOCK PILES OF UNCOMPACTED SOIL AND/OR BUILDING MATERIALS THAT ARE INTENDED TO BE LEFT UNPROTECTED FOR A PERIOD GREATER THAN SEVEN CALENDAR DAYS ARE TO BE PROVIDED WITH EROSION AND SEDIMENT CONTROLS. SUCH SOIL MUST BE PROTECTED EACH DAY WHEN THE PROBABILITY OF RAIN IS 40% OR GREATER.
3. A CONCRETE WASHOUT SHALL BE PROVIDED ON ALL PROJECTS WHICH PROPOSE THE CONSTRUCTION OF ANY CONCRETE IMPROVEMENTS THAT ARE TO BE POURED IN PLACE ON THE SITE.
4. ALL EROSION/SEDIMENT CONTROL DEVICES SHALL BE MAINTAINED IN WORKING ORDER AT ALL TIMES.
5. ALL SLOPES THAT ARE GRADED OR DISTURBED BY CONSTRUCTION ACTIVITY MUST BE PROTECTED AGAINST EROSION AND SEDIMENT TRANSPORT AT ALL TIMES.
6. THE STORAGE OF ALL CONSTRUCTION MATERIALS AND EQUIPMENT MUST BE PROTECTED AGAINST ANY POTENTIAL RELEASE OR POLLUTANTS INTO THE ENVIRONMENT.

SPECIAL BMP NOTES:

1. SEE ARCHITECTURAL PLANS FOR DOWNSPOUT LOCATIONS. TYPICAL DOWNSPOUT TO DISCHARGE INTO LANDSCAPING.
2. DOWNSPOUT RUNOFF THAT DISCHARGES ONTO HARDSCAPE SHALL FLOW TO LANDSCAPE AREAS PRIOR TO BEING COLLECTED BY AN AREA DRAIN OR DISCHARGED TO STREET.



WATER POLLUTION CONTROL PLAN
SCALE: 1" = 10'

10 5 0 10 20 30
GRAPHIC SCALE IN FEET

811 Know what's below. Call before you dig.

PASCO LARET SUITER & ASSOCIATES
CIVIL ENGINEERING + LAND PLANNING + LAND SURVEYING
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ph 858.259.8212 | fx 858.259.4812 | plsaengineering.com

PLANS PREPARED UNDER THE SUPERVISION OF
BRIAN M. ARDOLINO
DATE: 08-04-15
R.C.E. NO. 71651
EXP. 12-31-15

PREPARED BY:
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Phone: (858) 259-8212

Project Address:
8194 PRESTWICK DRIVE
LA JOLLA, CA 92037

Project Name:
PRESTWICK RESIDENCE

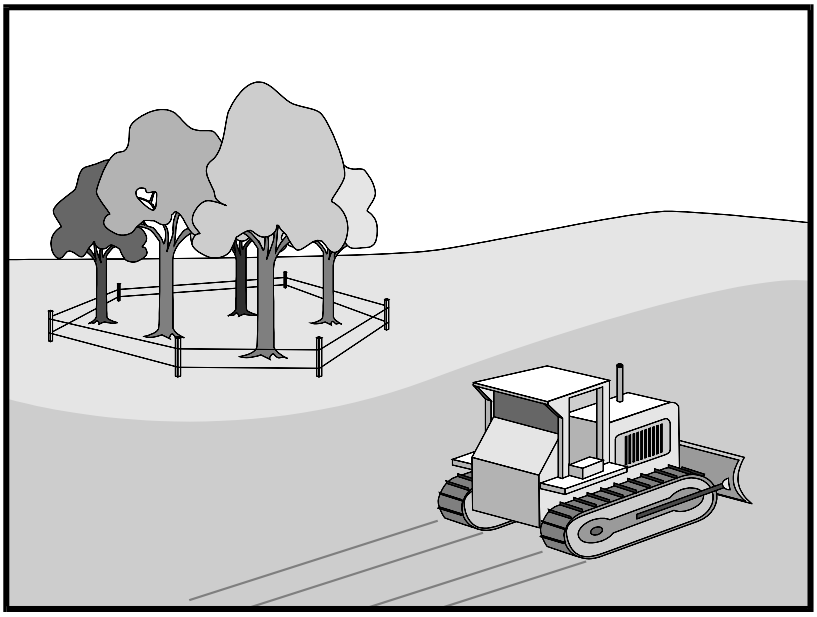
Sheet Title:
WATER POLLUTION CONTROL PLAN

Revision 14:
Revision 13:
Revision 12:
Revision 11:
Revision 10:
Revision 9:
Revision 8:
Revision 7:
Revision 6:
Revision 5:
Revision 4:
Revision 3:
Revision 2:
Revision 1:
Original Date: AUGUST 4, 2015
Sheet: 1 of: 1
DEP#:

WPCP

APPENDIX “B”

Preservation Of Existing Vegetation EC-2



Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Preservation Of Existing Vegetation EC-2

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

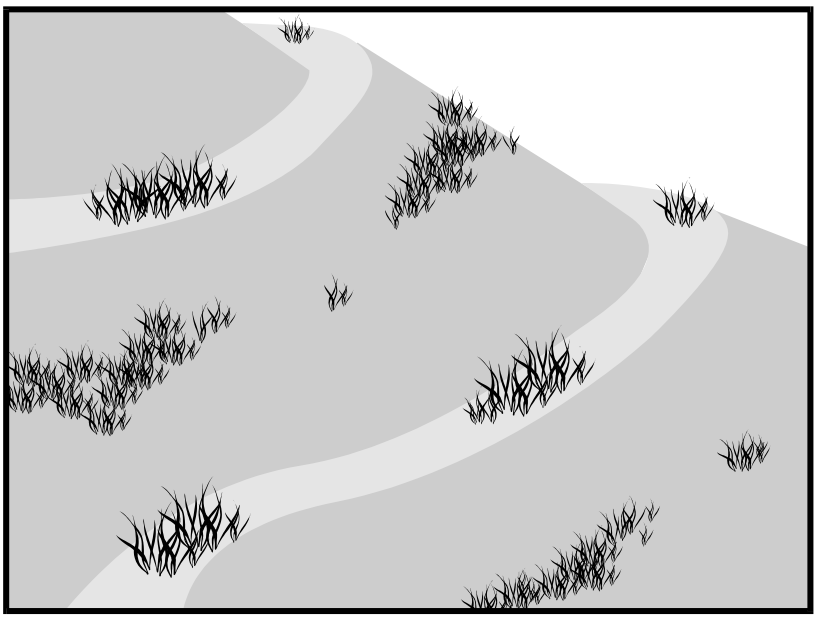
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding EC-4



Description and Purpose

Hydroseeding typically consists of applying a mixture of a hydraulic mulch, seed, fertilizer, and stabilizing emulsion with a hydraulic mulcher, to temporarily protect exposed soils from erosion by water and wind. Hydraulic seeding, or hydroseeding, is simply the method by which temporary or permanent seed is applied to the soil surface.

Suitable Applications

Hydroseeding is suitable for disturbed areas requiring temporary protection until permanent stabilization is established, for disturbed areas that will be re-disturbed following an extended period of inactivity, or to apply permanent stabilization measures. Hydroseeding without mulch or other cover (e.g. EC-7, Erosion Control Blanket) is not a stand-alone erosion control BMP and should be combined with additional measures until vegetation establishment.

Typical applications for hydroseeding include:

- Disturbed soil/graded areas where permanent stabilization or continued earthwork is not anticipated prior to seed germination.
- Cleared and graded areas exposed to seasonal rains or temporary irrigation.
- Areas not subject to heavy wear by construction equipment or high traffic.

Categories

EC	Erosion Control	☑
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching
EC-14 Compost Blanket
EC-16 Non-Vegetative Stabilization

Limitations

- Availability of hydroseeding equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Hydraulic seed should be applied with hydraulic mulch or a stand-alone hydroseed application should be followed by one of the following:
    - Straw mulch (see Straw Mulch EC-6)
    - Rolled erosion control products (see Geotextiles and Mats EC-7)
    - Application of Compost Blanket (see Compost Blanket EC-14)

  Hydraulic seed may be used alone only on small flat surfaces when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control.
- Hydraulic seed without mulch does not provide immediate erosion control.
- Temporary seeding may not be appropriate for steep slopes (i.e., slopes readily prone to rill erosion or without sufficient topsoil).
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation may not be appropriate for short term inactivity (i.e. less than 3-6 months).
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown and some may have water quality impacts due to their chemical makeup. Additionally these constituents may require non-visible pollutant monitoring. Refer to specific chemical properties identified in the product Material Safety Data Sheet; products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.

Implementation

In order to select appropriate hydraulic seed mixtures, an evaluation of site conditions should be performed with respect to:

- Soil conditions
- Site topography and exposure (sun/wind)
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS), Resource Conservation Districts and Agricultural Extension Service can provide information on appropriate seed mixes.

The following steps should be followed for implementation:

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying (See EC-15, Soil Preparation) the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.
- Avoid use of hydraulic seed in areas where the BMP would be incompatible with future earthwork activities.
- Hydraulic seed can be applied using a multiple step or one step process.
  - In a multiple step process, hydraulic seed is applied first, followed by mulch or a Rolled Erosion Control Product (RECP).
  - In the one step process, hydraulic seed is applied with hydraulic mulch in a hydraulic matrix. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.
- All hydraulically seeded areas should have mulch, or alternate erosion control cover to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds should be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag should be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container should be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed should be pellet inoculated. Inoculant sources should be species specific and should be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer should conform to the requirements of the California Food and Agricultural Code, which can be found at http://www.leginfo.ca.gov/.html/fac_table_of_contents.html. Fertilizer should be pelleted or granular form.
- Follow up applications should be made as needed to cover areas of poor coverage or germination/vegetation establishment and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Costs

Average cost for installation and maintenance may vary from as low as $1,900 per acre for flat slopes and stable soils, to $4,000 per acre for moderate to steep slopes and/or erosive soils. Cost of seed mixtures vary based on types of required vegetation.

BMP	Installed Cost per Acre
Hydraulic Seed	$1,900-$4,000

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems should be inspected for complete coverage and adjusted as needed to maintain complete coverage.

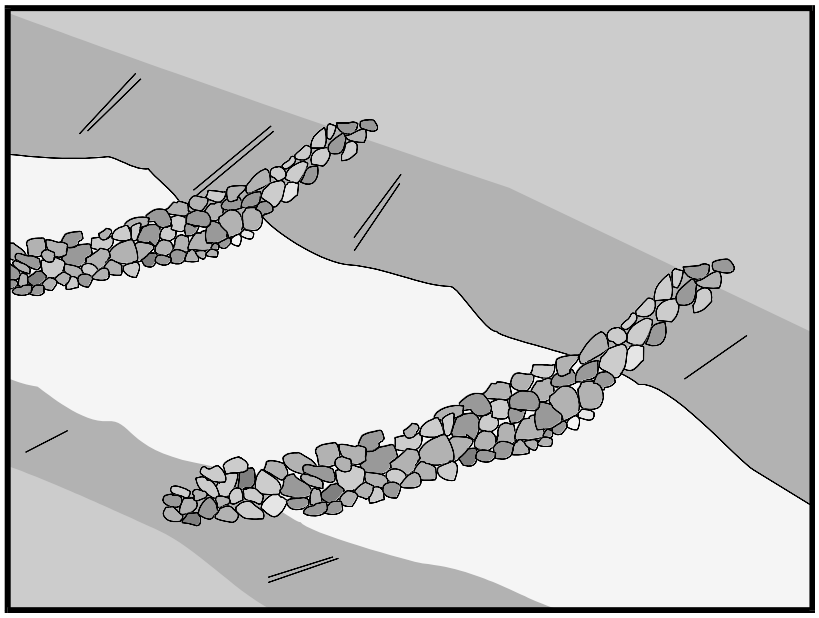
References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Check Dams SE-4



Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 ft/s.
- During the establishment of grass linings in drainage ditches or channels.
- In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.
- To act as a grade control structure.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

Limitations

- Not to be used in live streams or in channels with extended base flows.
- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion potential or sediment-laden flow is expected, as installation may damage vegetation.
- Require extensive maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.
- Do not construct check dams with straw bales or silt fence.
- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as as sediment controls. Note that use of 1-2 isolated check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity should be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, either:

- Don't use check dams. Consider alternative BMPs, or.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam (see "Spacing Between Check Dams" detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of

the ditch or swale (see "Typical Rock Check Dam" detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet (see "Gravel Bag Check Dam" detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer's instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- For multiple check dam installation, backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap should be cleaned following each storm event.

- High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.

Materials

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.
- Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms.
- Sandbags used for check dams should conform to SE-8, Sandbag Barrier.
- Fiber rolls used for check dams should conform to SE-5, Fiber Rolls.
- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Upper rows or gravel and sand bags shall overlap joints in lower rows.
- Fiber rolls should be trenched in, backfilled, and firmly staked in place.
- Install along a level contour.
- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

Costs

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

References

Draft – Sedimentation and Erosion Control, and Inventory of Current Practices, USEPA, April 1990.

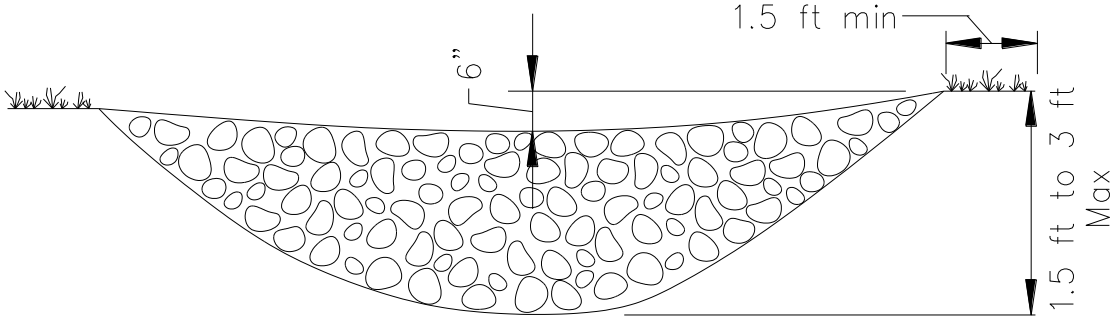
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

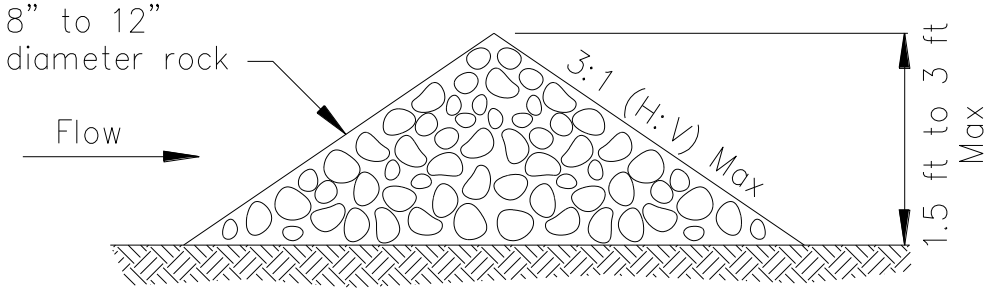
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

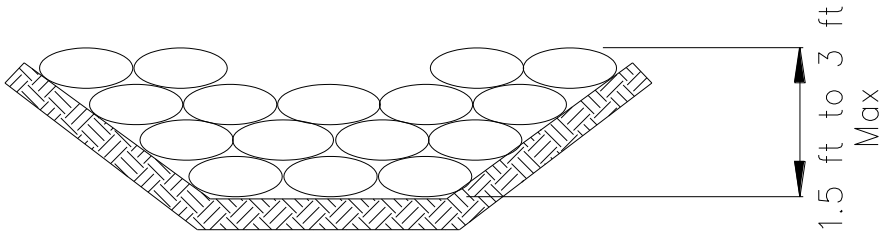


ELEVATION

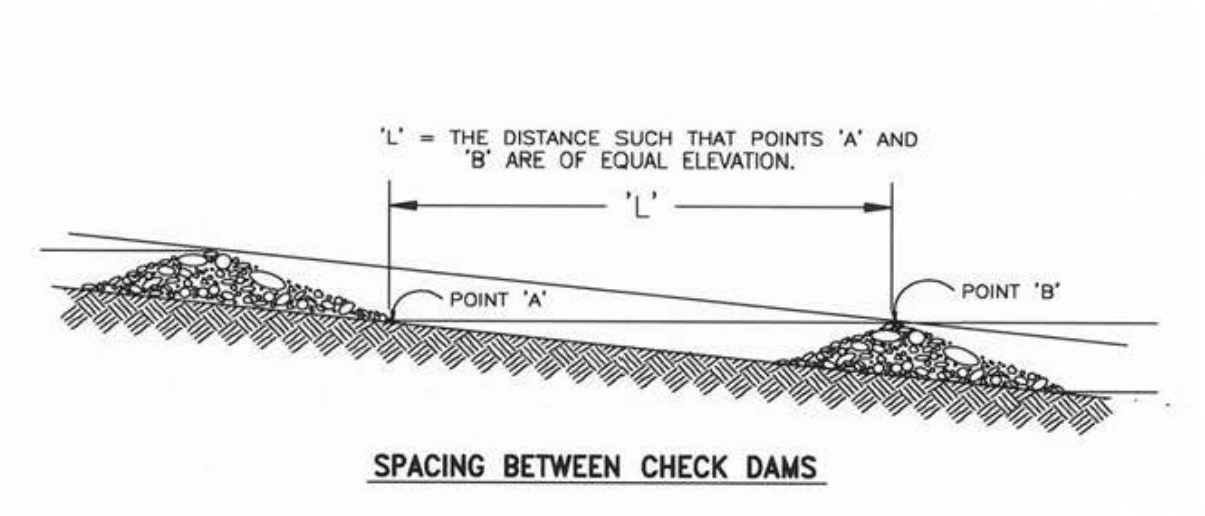


TYPICAL ROCK CHECK DAM SECTION

ROCK CHECK DAM
NOT TO SCALE

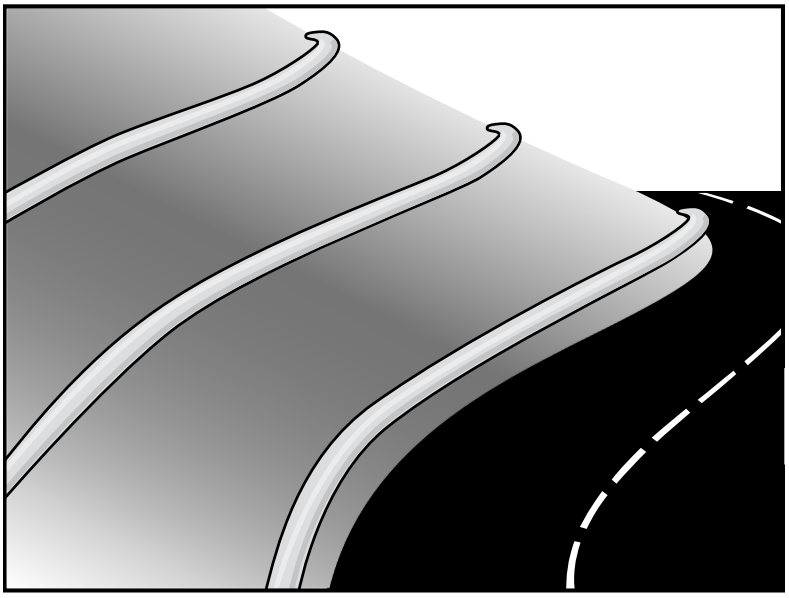


GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE



SPACING BETWEEN CHECK DAMS

Fiber Rolls SE-5



Description and Purpose

A fiber roll consists of straw, coir, or other biodegradable materials bound into a tight tubular roll wrapped by netting, which can be photodegradable or natural. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- At the end of a downward slope where it transitions to a steeper slope.
- Along the perimeter of a project.
- As check dams in unlined ditches with minimal grade.
- Down-slope of exposed soil areas.
- At operational storm drains as a form of inlet protection.

Categories

EC	Erosion Control	☒
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

- Around temporary stockpiles.

Limitations

- Fiber rolls are not effective unless trenched in and staked.
- Not intended for use in high flow situations.
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.
- Rolls typically function for 12-24 months depending upon local conditions.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.
- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.
- Fiber rolls are made from weed free rice straw, flax, or a similar agricultural material bound into a tight tubular roll by netting.
- Typical fiber rolls vary in diameter from 9 in. to 20 in. Larger diameter rolls are available as well.

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Prepare the slope before beginning installation.
- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.
- Start building trenches and installing rolls from the bottom of the slope and work up.
- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into the trench.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.
- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Typically, fiber rolls encased with plastic netting are used for a temporary application because the netting does not biodegrade. Fiber rolls used in a permanent application are typically encased with a biodegradeable material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance.
- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But, they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for regular fiber rolls range from $20 - $30 per 25 ft roll.

Material costs for PAM impregnated fiber rolls range between 7.00-$9.00 per linear foot, based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP should be periodically removed

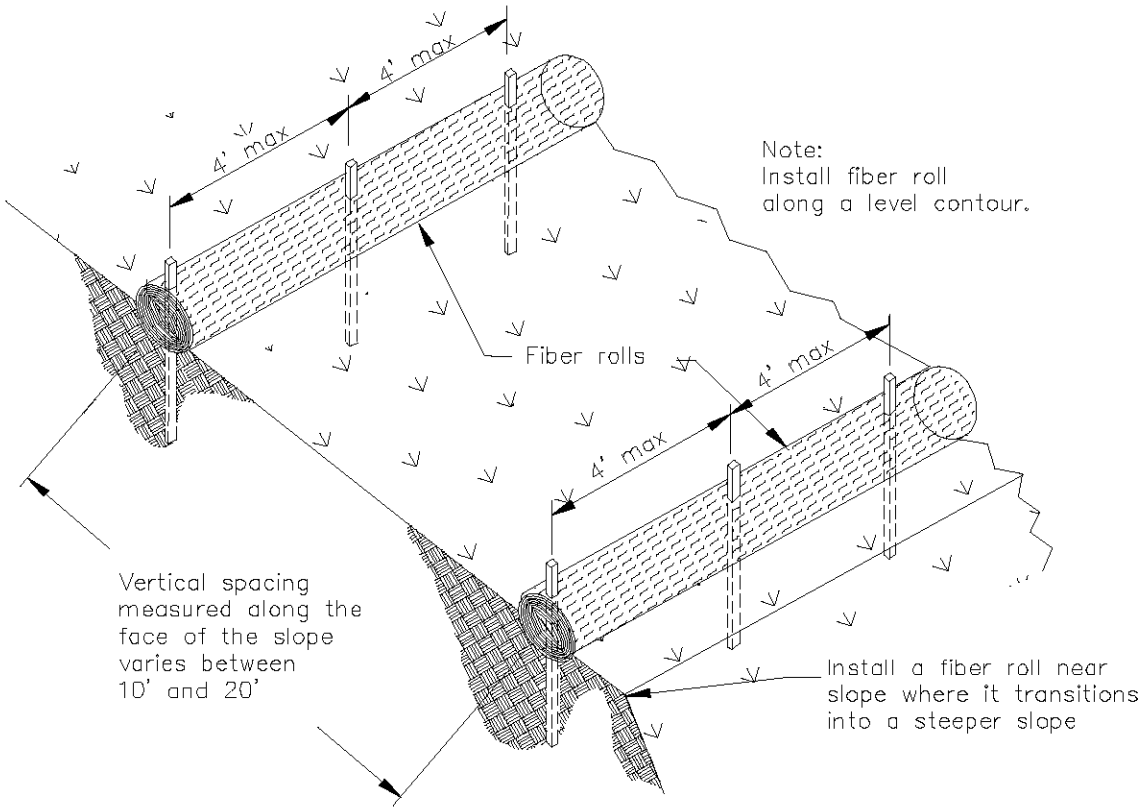
in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.
- Repair any rills or gullies promptly.

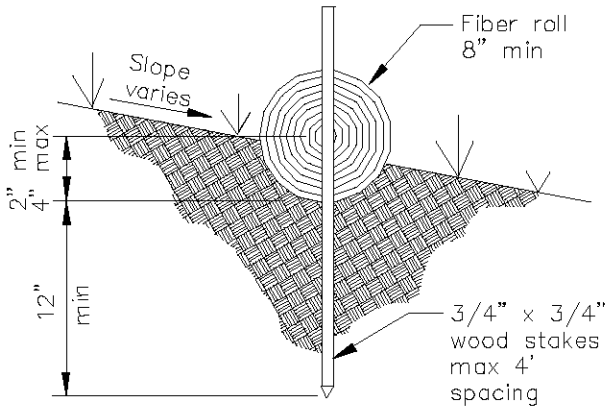
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Street Sweeping and Vacuuming SE-7

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

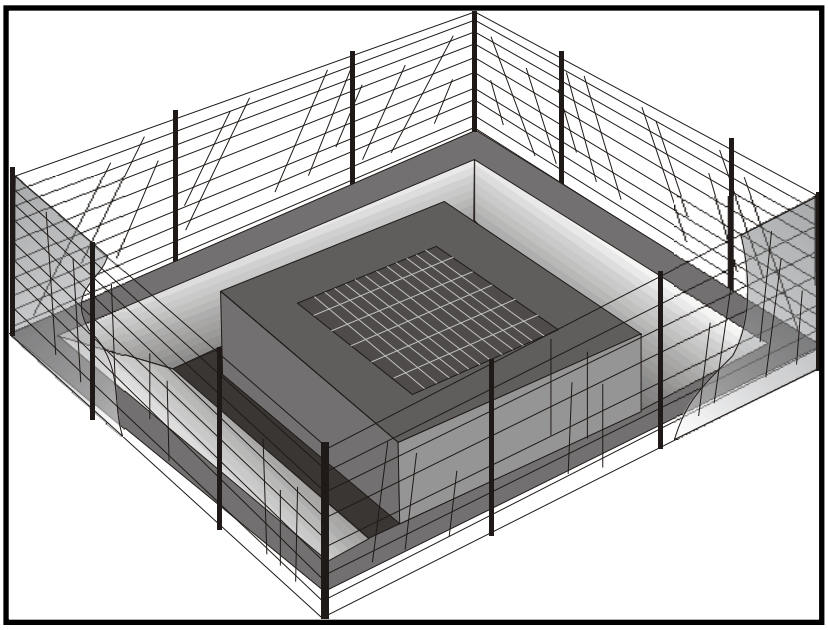
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence
SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-14 Biofilter Bags
SE-13 Compost Socks and Berms

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

- Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use

other onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.
- Seven types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.

- Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.

- Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).

- Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.

- Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.

- Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.

- Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.

- Compost Socks: Allow filtered run-off to pass through the compost while retaining sediment and potentially other pollutants (SE-13). Appropriate for flows under 1.0 cfs.

- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.

- Provide area around the inlet for water to pond without flooding structures and property.

- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.

- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence -*** Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.

  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.

  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.

  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.

  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap -*** Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag -*** Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.

  2. Leave room upstream of barrier for water to pond and sediment to settle.

  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.

  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter -*** Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.

  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.

  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.

  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary) –*** Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.
    2. Biofilter bags should be placed around inlets to intercept runoff flows.
    3. All bag joints should overlap by 6 in.
    4. Leave room upstream for water to pond and for sediment to settle out.
    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

- ***DI Protection Type 7 – Compost Socks*** – A compost sock can be assembled on site by filling a mesh sock (e.g., with a pneumatic blower). Compost socks do not require special trenching compared to other sediment control methods (e.g., silt fence). Compost socks should conform to specification detailed in SE-13, Compost Socks and Berms.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.
- See SE-13 for Compost Sock cost information.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

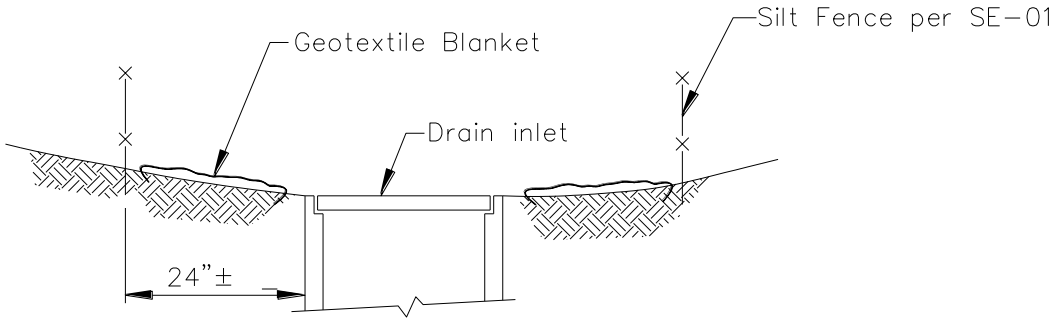
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.
    - Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

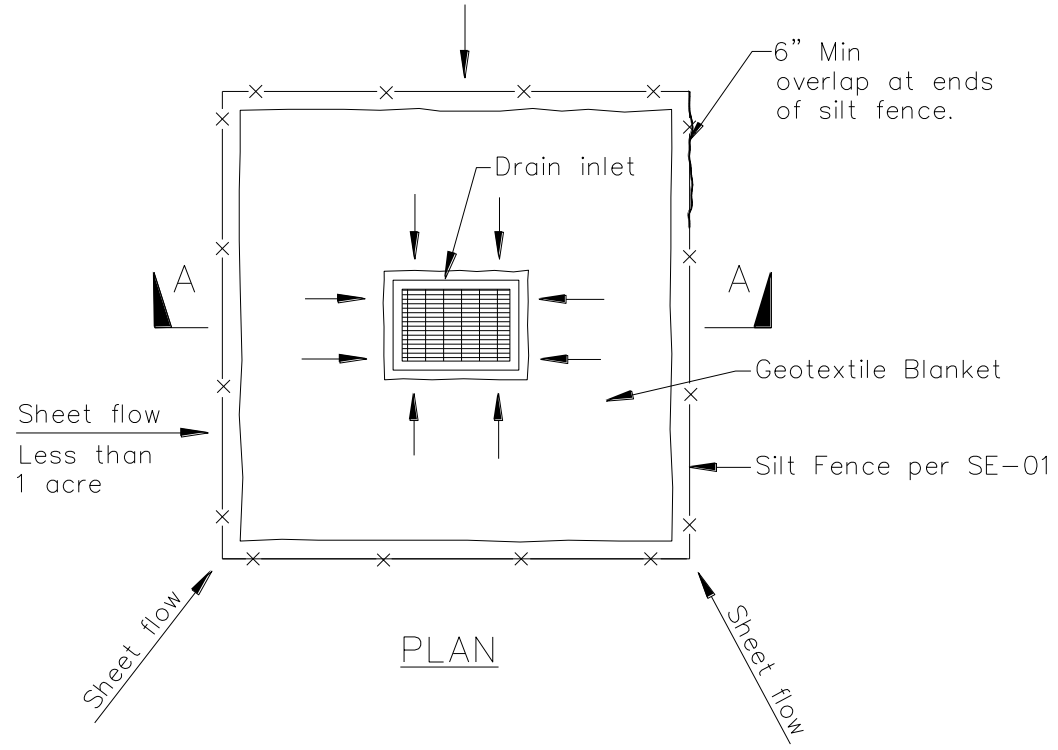
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A–A

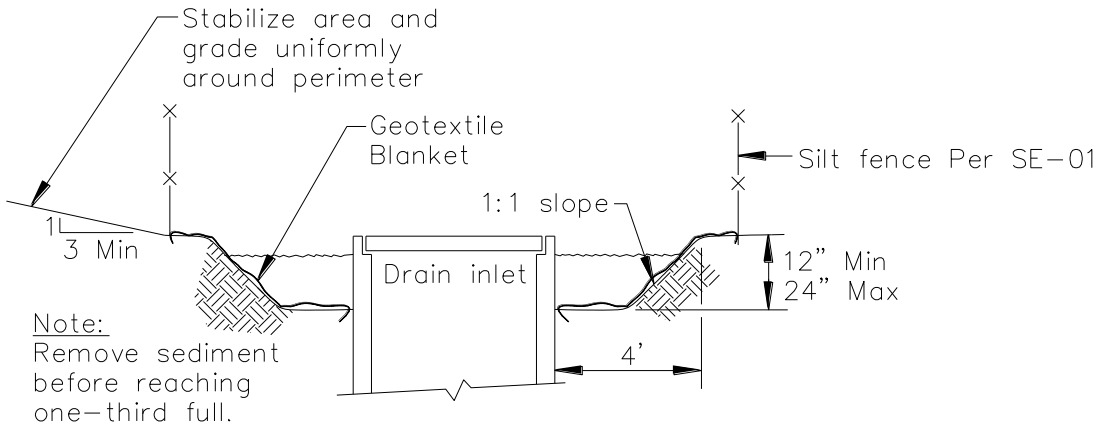


PLAN

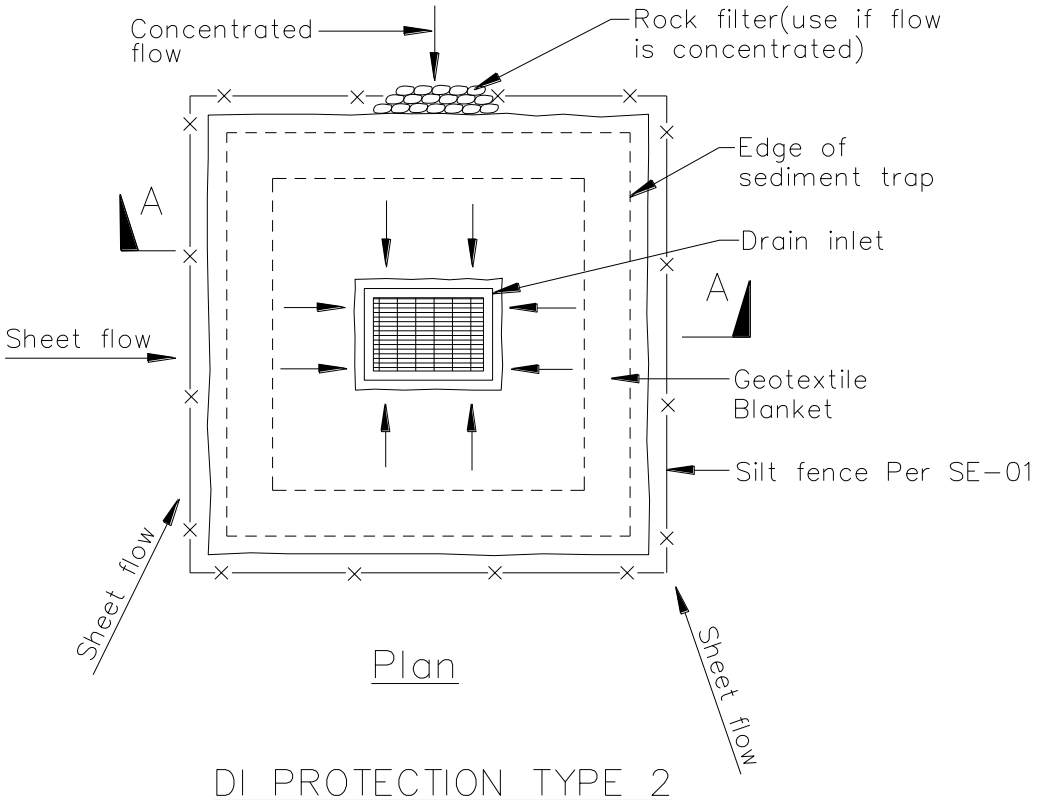
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



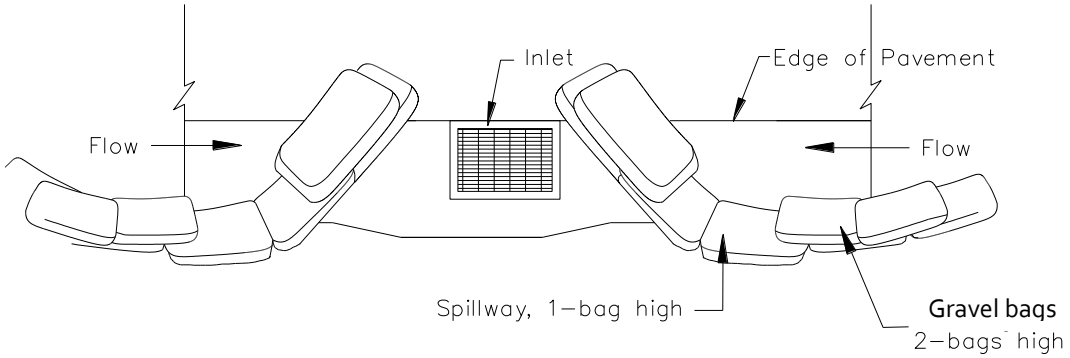
Section A–A



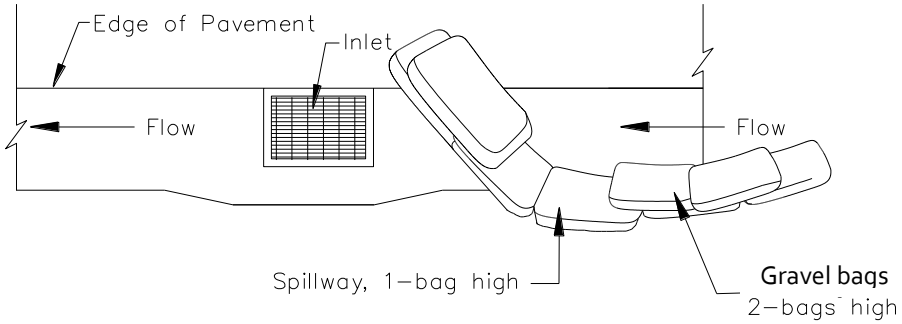
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

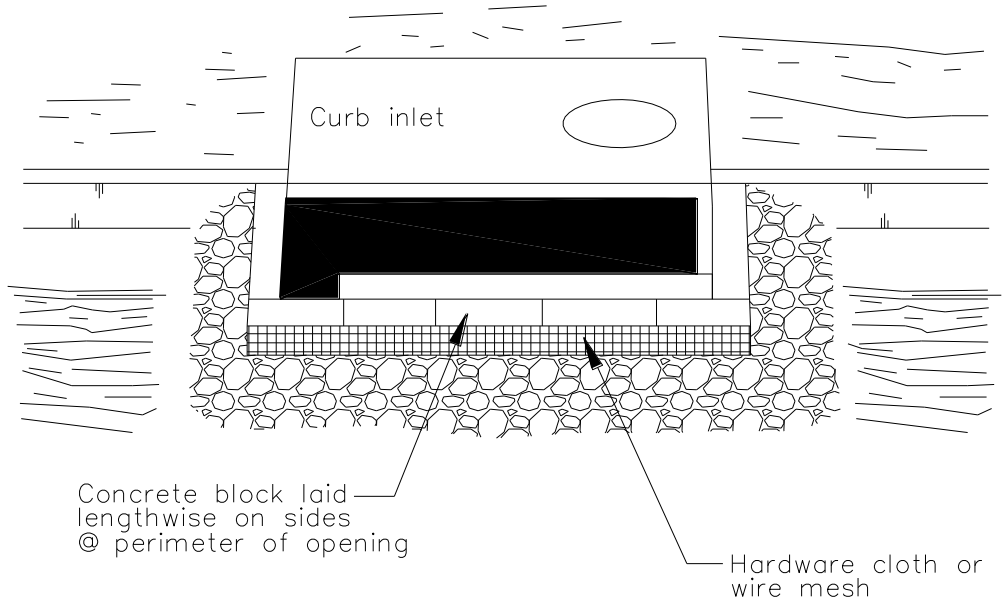


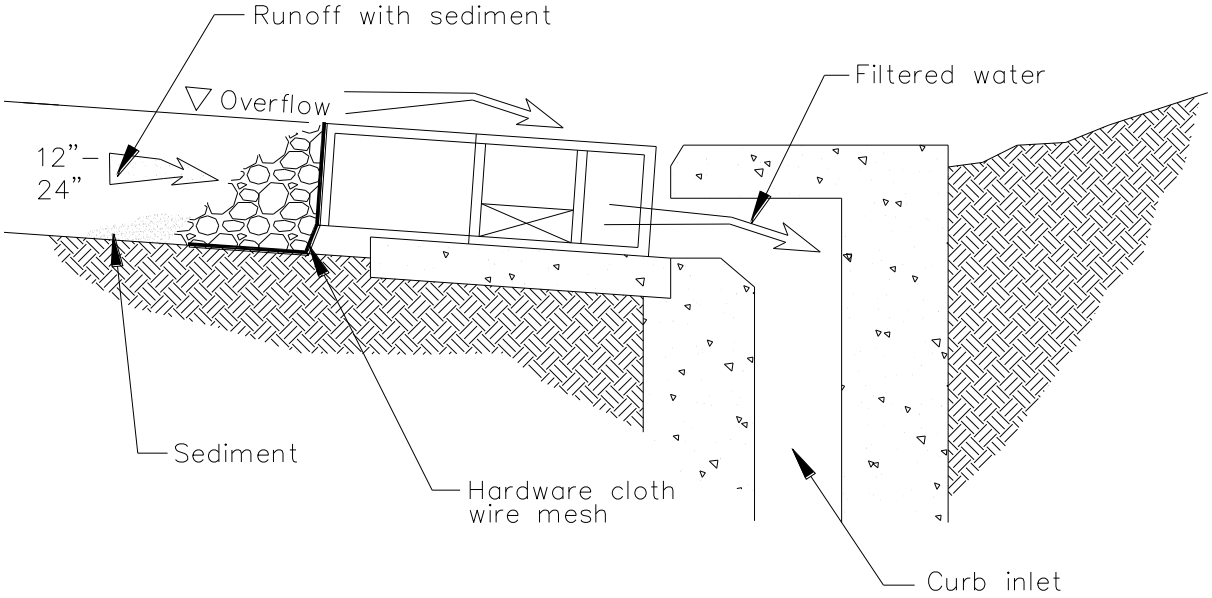
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.
6. Protection can be effective even if it is not immediately adjacent to the inlet provided that the inlet is protected from potential sources of pollution.

DI PROTECTION TYPE 3
NOT TO SCALE

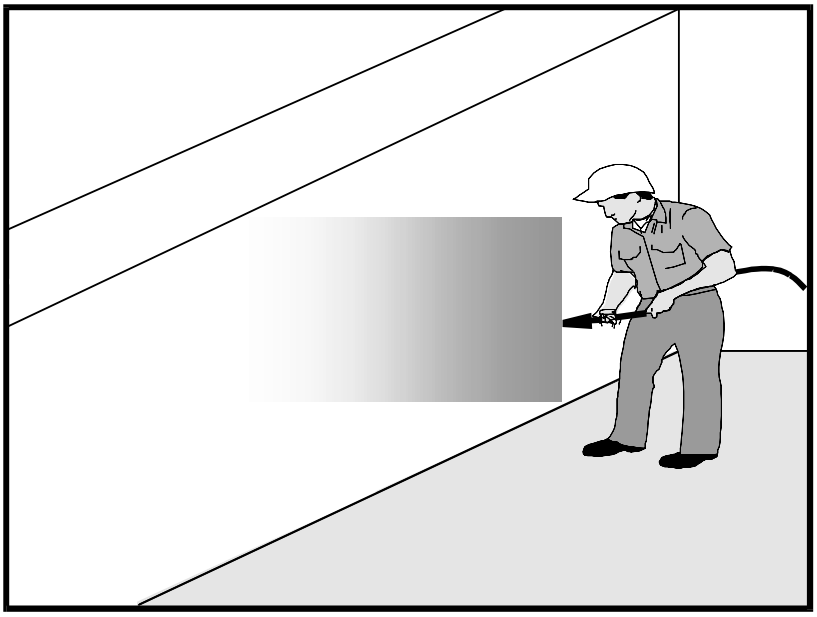




DI PROTECTION – TYPE 4

NOT TO SCALE

Concrete Curing NS-12



Categories		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

Suitable Applications

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.
- Minimize the drift by applying the curing compound close to the concrete surface. Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.
- Use proper storage and handling techniques for concrete curing compounds. Refer to WM-1, Material Delivery and Storage.
- Protect drain inlets prior to the application of curing compounds.
- Refer to WM-4, Spill Prevention and Control.

Water Curing for Bridge Decks, Retaining Walls, and other Structures

- Direct cure water away from inlets and watercourses to collection areas for evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.
- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

Education

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

Costs

All of the above measures are generally low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.
- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect cure containers and spraying equipment for leaks.

References

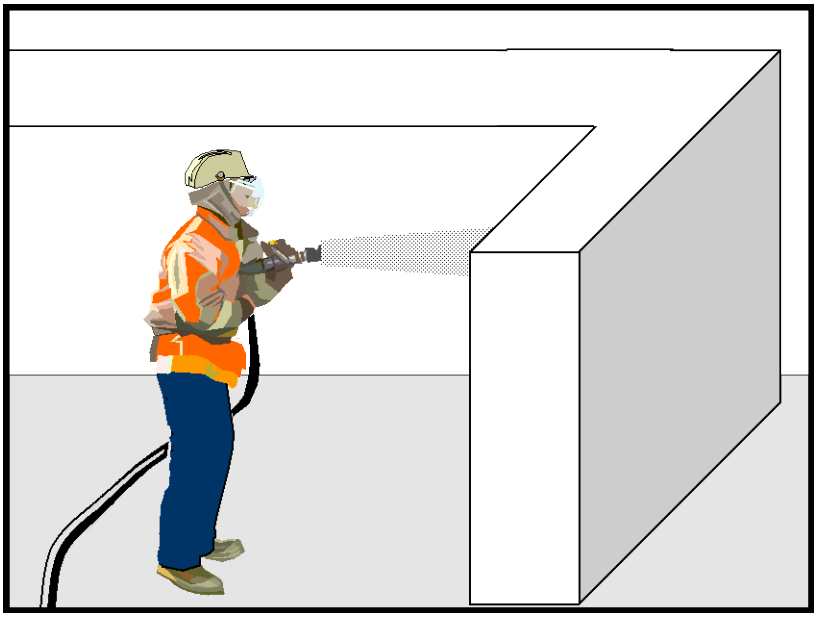
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Concrete Finishing NS-13



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Legend:

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☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Methods include sand blasting, shot blasting, grinding, or high pressure water blasting. Stormwater and non-stormwater exposed to concrete finishing by-products may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate BMPs can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Concrete and its associated curing materials have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

Suitable Applications

These procedures apply to all construction locations where concrete finishing operations are performed.

Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

- Collect and properly dispose of water from high-pressure water blasting operations.
- Collect contaminated water from blasting operations at the top of slopes. Transport or dispose of contaminated water while using BMPs such as those for erosion control. Refer to EC-9, Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering). Refer to NS-2 Dewatering Operations.
- Protect inlets during sandblasting operations. Refer to SE-10, Storm Drain Inlet Protection.
- Refer to WM-8, Concrete Waste Management for disposal of concrete debris.
- Minimize the drift of dust and blast material as much as possible by keeping the blasting nozzle close to the surface.
- When blast residue contains a potentially hazardous waste, refer to WM-6, Hazardous Waste Management.

Education

- Educate employees, subcontractors, and suppliers on proper concrete finishing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete finishing procedures.

Costs

These measures are generally of low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts concrete dust and debris as required by the General Permit.

- Sweep or vacuum up debris from sandblasting at the end of each shift.
- At the end of each work shift, remove and contain liquid and solid waste from containment structures, if any, and from the general work area.
- Inspect containment structures for damage prior to use and prior to onset of forecasted rain.

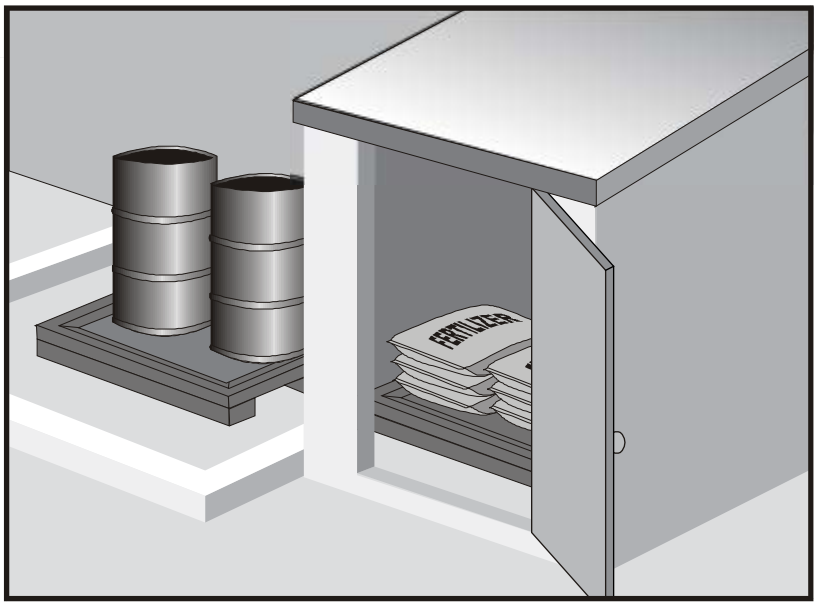
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Material Delivery and Storage WM-1



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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
    - Avoid transport near drainage paths or waterways.
    - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
    - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.
- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Keep storage areas clean and well organized, including a current list of all materials onsite.
- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

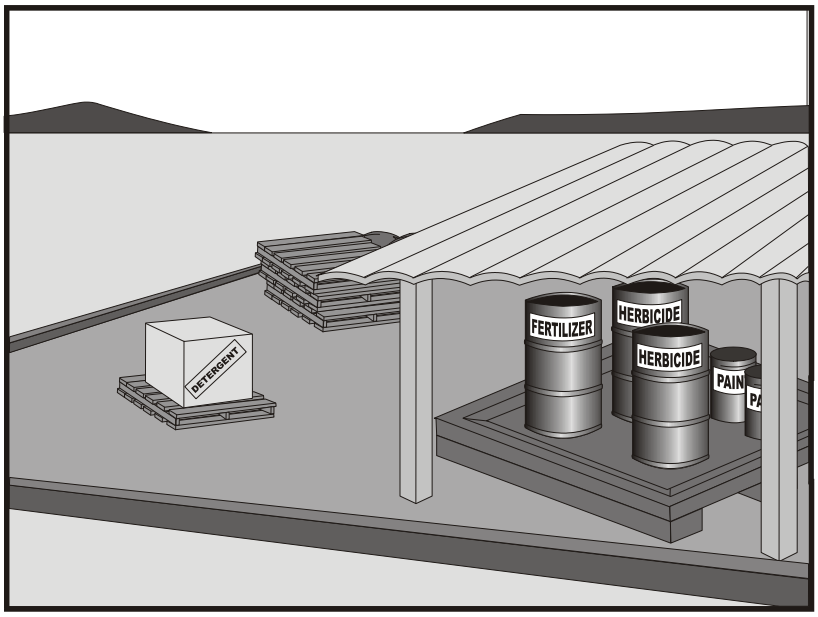
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use WM-2



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

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Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or contain for proper disposal off site. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.
- Document the location, time, chemicals applied, and applicator's name and qualifications.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

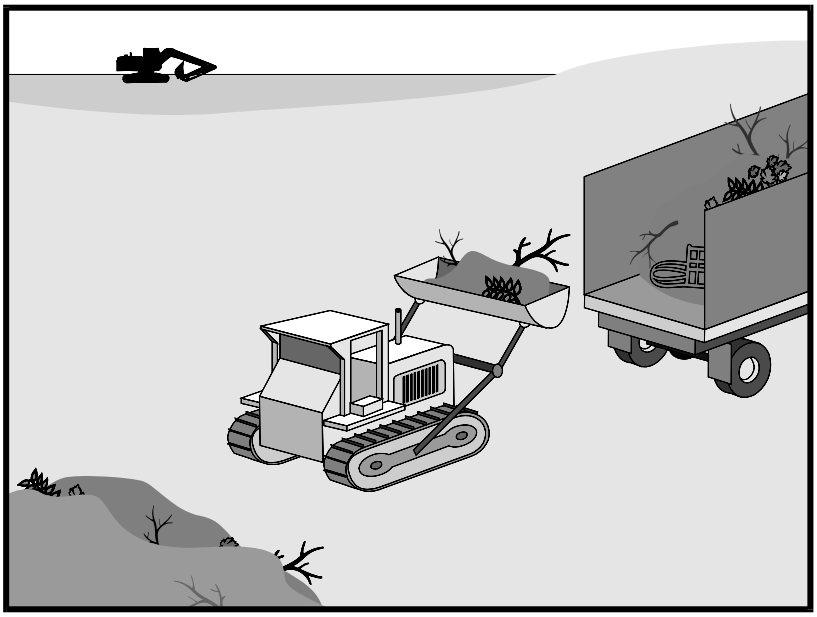
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials

- Highway planting wastes, including vegetative material, plant containers, and packaging materials

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Cover waste containers at the end of each work day and when it is raining.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.

- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.

- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur

- Inspect construction waste area regularly.

- Arrange for regular waste collection.

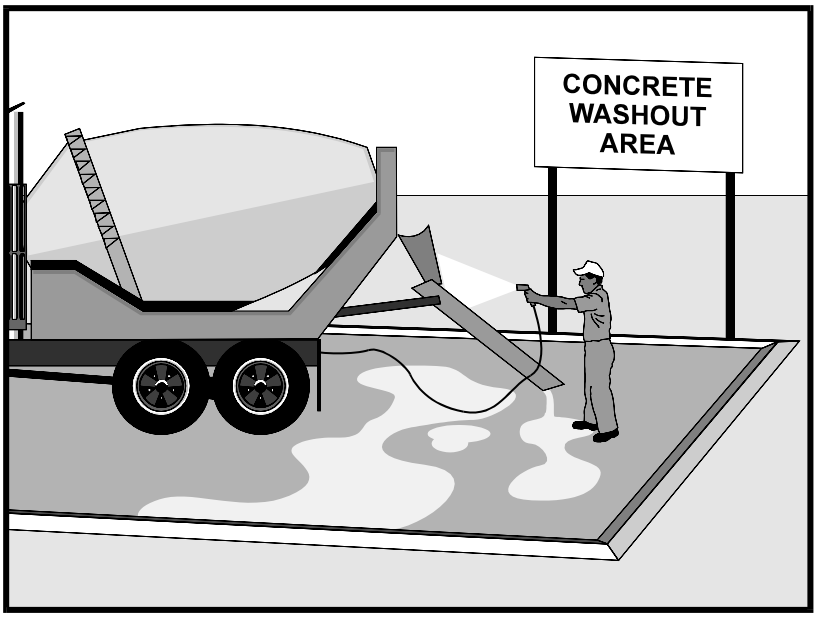
References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ **Primary Category**
☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Prevent the discharge of pollutants to stormwater from concrete waste by conducting washout onsite or offsite in a designated area, and by employee and subcontractor training.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

Suitable Applications

Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result from demolition activities.
- Slurries containing portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.
- Concrete trucks and other concrete-coated equipment are washed onsite.

- Mortar-mixing stations exist.
- Stucco mixing and spraying.
- See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washouts shall be implemented in a manner that prevents leaching to underlying soils. Washout containers must be water tight and washouts on or in the ground must be lined with a suitable impervious liner, typically a plastic type material.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.
- See typical concrete washout installation details at the end of this fact sheet.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.

- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.
- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.

Concrete Demolition Wastes

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.
- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

Concrete Slurry Wastes

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut concrete slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine or by sweeping. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Concrete slurry residue should be disposed in a temporary washout facility (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of or recycled offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of or recycle hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
  - Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag Barrier).
  - Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
  - Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a “roll-off”; this concrete washout facility should be properly sealed to prevent leakage, and should be removed from the site and replaced when the container reaches 75% capacity.
- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations..

- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures. Roll-0ff concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Temporary concrete washout facilities should be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and properly disposed or recycled in accordance with federal, state or local regulations.

- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000, Updated March 2003.

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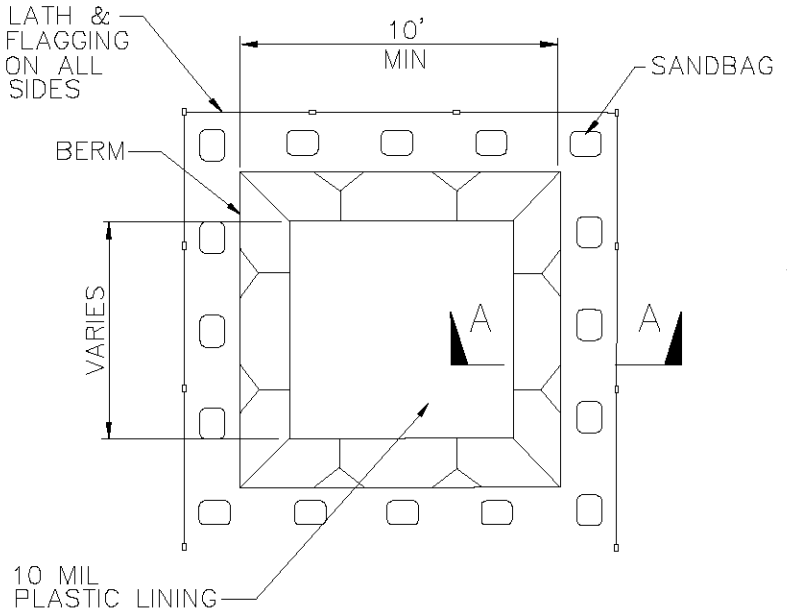

PLAN
NOT TO SCALE
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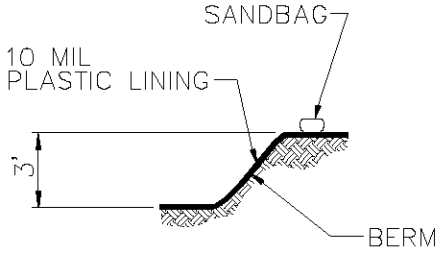
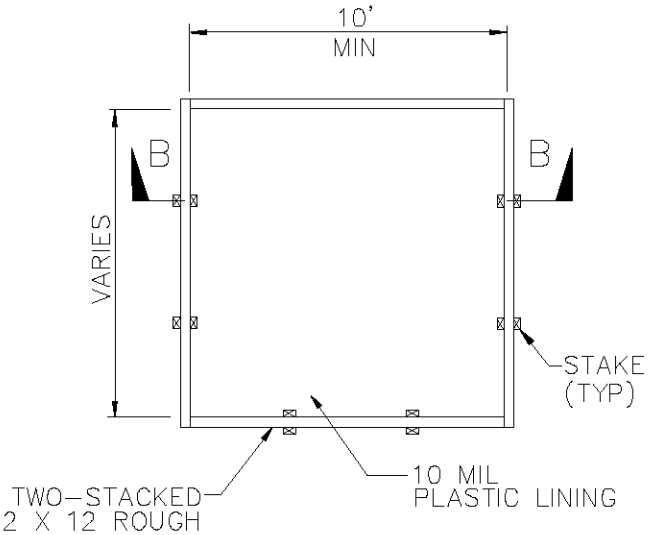
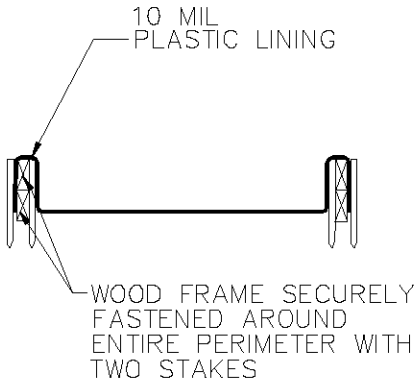


SECTION A–A
NOT TO SCALE



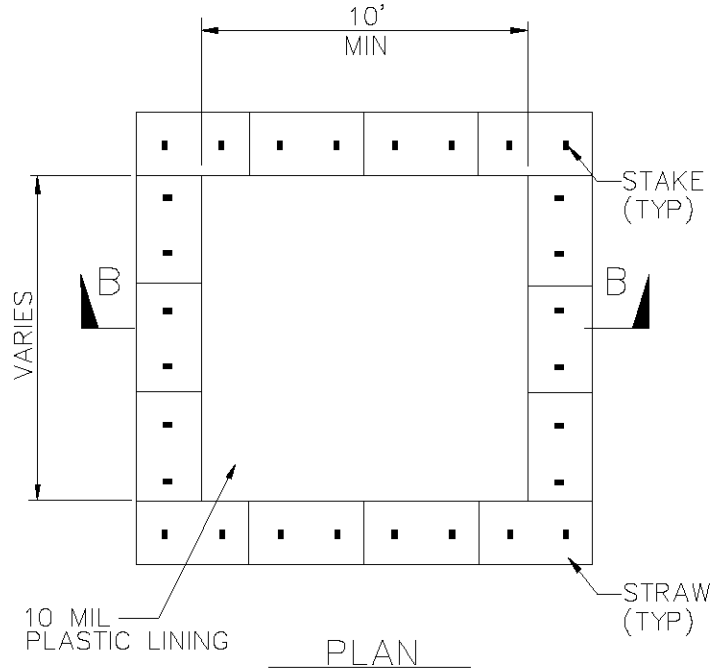
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"



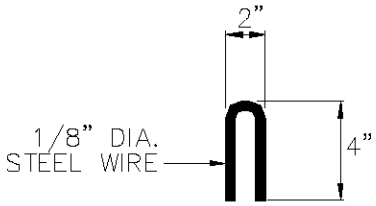
SECTION B–B
NOT TO SCALE

NOTES

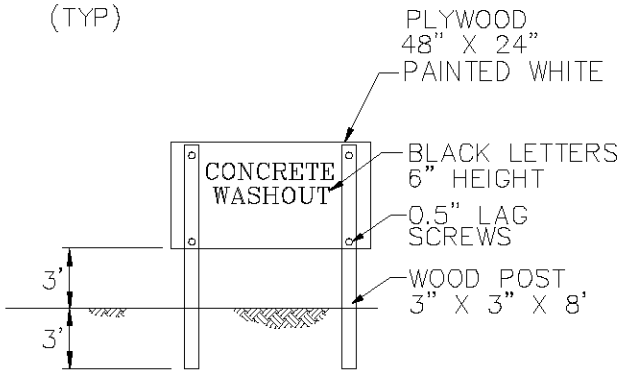
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



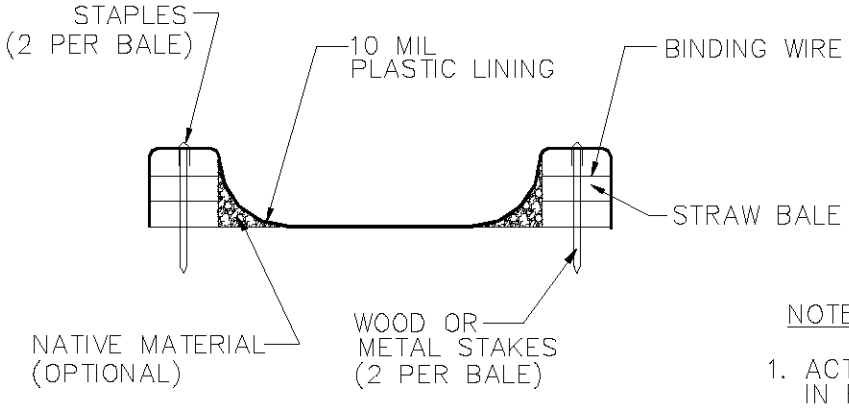
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

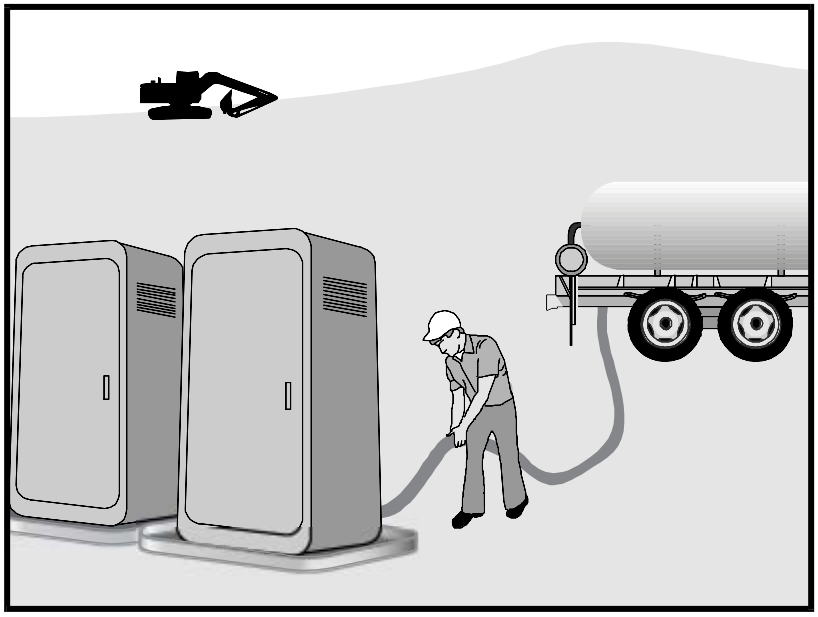


SECTION B–B
NOT TO SCALE

NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Sanitary/Septic Waste Management WM-9



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

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Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

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- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- Wastewater should not be discharged or buried within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce the use of sanitary facilities (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

APPENDIX “C”

Storm Water Quality Construction Site Inspection Checklist

GENERAL INFORMATION				
Project Name				
Project Nº				
Contractor				
Inspector's Name				
Inspector's Title				
Signature				
Date of Inspection				
Inspection Type (Check Applicable)	❒ Prior to forecast rain ❒ 24-hr intervals during extended rain		❒ After a rain event ❒ Other _____	
Season (Check Applicable)	❒ Rainy		❒ Non-Rainy	
Storm Data	Storm Start Date & Time:		Storm Duration (hrs):	
	Time elapsed since last storm (Circle Applicable Units)	Min. Hr. Days	Approximate Rainfall Amount (inches)	

INSPECTION OF BMPs				
BMP	**Yes**	**No**	**N/A**	**Corrective Action**
Preservation of Existing Vegetation				
Is temporary fencing provided to preserve vegetation in areas where no construction activity is planned?				
Location:				
Location:				
Location:				
Location:				
Erosion Control				
Does the applied temporary erosion control provide 100% coverage for the affected areas?				
Are any non-vegetated areas that may require temporary erosion control?				
Is the area where erosion controls are used required free from visible erosion?				

INSPECTION OF BMPs				
BMP	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Location:				
Location:				
Location:				
Temporary Linear Sediment Barriers (Silt Fence, Fiber Rolls, Sandbag Barriers, etc.)				
Are temporary linear sediment barriers properly installed, functional and maintained?				
Are temporary linear sediment barriers free of accumulated litter?				
Is the built-up sediment less than 1/3 the height of the barrier?				
Are cross barriers installed where necessary and properly spaced?				
Location:				
Location:				
Location:				
Location:				
Location:				
Storm Drain Inlet Protection				
Are storm drain inlets internal to the project properly protected?				
Are storm drain inlet protection devices in working order and being properly maintained?				
Location:				
Location:				
Location:				
Location:				
Location:				
Sediment Basins				
Are basins designed in accordance with the requirements of the General Permit?				
Are basins maintained to provide the required retention/detention?				
Are basin controls (inlets, outlets, diversions, weirs, spillways, and racks) in working order?				
Location:				
Location:				
Location:				
Location:				
Stockpiles				
Are all locations of temporary stockpiles, including soil, hazardous waste, and construction materials in approved areas?				
Are stockpiles protected from run-on, run-off from adjacent areas and from winds?				

INSPECTION OF BMPs				
BMP	**Yes**	**No**	**N/A**	**Corrective Action**
Are stockpiles located at least 15 m from concentrated flows, downstream drainage courses and storm drain inlets?				
Are required covers and/or perimeter controls in place?				
Location:				
Location:				
Location:				
Location:				
Concentrated Flows				
Are concentrated flow paths free of visible erosion?				
Location:				
Location:				
Location:				
Location:				
Tracking Control				
Is the entrance stabilized to prevent tracking				
Is the stabilized entrance inspected daily to ensure that it is working properly				
Are points of ingress/egress to public/private roads inspected and swept and vacuumed as needed?				
Are all paved areas free of visible sediment tracking or other particulate matter?				
Location:				
Location:				
Location:				
Location:				
Wind Erosion Control				
Is dust control implemented?				
Location:				
Location:				
Location:				
Location:				
Dewatering Operations				
Are all one-time dewatering operations covered by the General Permit inspected before and as they occur and BMPs implemented as necessary during discharge?				
Is ground water dewatering handled in conformance with the dewatering permit issued by the RWQCB?				
Is required treatment provided for dewatering effluent?				
Location:				
Location:				

INSPECTION OF BMPs				
BMP	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Location:				
Vehicle & Equipment Fueling, Cleaning, and Maintenance				
Are vehicle and equipment fueling, cleaning and maintenance areas reasonably clean and free of spills, leaks, or any other deleterious material?				
Are vehicle and equipment fueling, cleaning and maintenance activities performed on an impermeable surface in dedicated areas?				
If no, are drip pans used?				
Are dedicated fueling, cleaning, and maintenance areas located at least 15 m away from downstream drainage facilities and watercourses and protected from run-on and runoff?				
Is wash water contained for infiltration/ evaporation and disposed of appropriately?				
Is on-site cleaning limited to washing with water (no soap, soaps substitutes, solvents, or steam)?				
On each day of use, are vehicles and equipment inspected for leaks and if necessary, repaired?				
Location:				
Location:				
Location:				
Location:				
Waste Management & Materials Pollution Control				
Are material storage areas and washout areas protected from run-on and runoff, and located at least 15 m from concentrated flows and downstream drainage facilities?				
Are all material handling and storage areas clean; organized; free of spills, leaks, or any other deleterious material; and stocked with appropriate clean-up supplies?				
Are liquid materials, hazardous materials, and hazardous wastes stored in temporary containment facilities?				
Are bagged and boxed materials stored on pallets?				
Are hazardous materials and wastes stored in appropriate, labeled containers?				
Are proper storage, clean-up, and spill-reporting procedures for hazardous materials and wastes posted in open, conspicuous and accessible locations adjacent to storage areas?				
Are temporary containment facilities free of spills and rainwater?				
Are temporary containment facilities and bagged/boxed materials covered?				
Are temporary concrete washout facilities designated and being used?				
Are temporary concrete washout facilities functional for receiving and containing concrete waste and are concrete residues prevented from entering the drainage system?				
Do temporary concrete washout facilities provide sufficient volume and freeboard for planned concrete operations?				
Are concrete wastes, including residues from cutting and grinding, contained and disposed of off-site or in concrete washout facilities?				
Are spills from mobile equipment fueling and maintenance properly contained and cleaned up?				
Is the site free of litter?				

INSPECTION OF BMPs				
BMP	**Yes**	**No**	**N/A**	**Corrective Action**
Are trash receptacles provided in the yard, field trailer areas, and at locations where workers congregate for lunch and break periods?				
Is litter from work areas collected and placed in watertight dumpsters?				
Are waste management receptacles free of leaks?				
Are the contents of waste management receptacles properly protected from contact with storm water or from being dislodged by winds?				
Are waste management receptacles filled at or beyond capacity?				
Location:				
Location:				
Location:				
Location:				
Temporary Water Body Crossing or Encroachment				
Are temporary water body crossings and encroachments constructed appropriately?				
Does the project conform to the requirements of the 404 permit and/or 1601agreement?				
Location:				
Location:				
Location:				
Location:				
Illicit Connection/ Discharge				
Is there any evidence of illicit discharges or illegal dumping on the project site?				
If yes, has the Owner/Operator been notified?				
Location:				
Location:				
Location:				
Location:				
Discharge Points				
Are discharge points and discharge flows free from visible pollutants?				
Are discharge points free of any significant sediment transport?				
Location:				
Location:				
Location:				
Location:				
SWPPP Update				
Does the SWPPP and Project Schedule adequately reflect the current site conditions and contractor operations?				
Are all BMPs shown on the water pollution control drawings installed in the proper location(s) and according to the details in the SWPPP?				

INSPECTION OF BMPs				
BMP	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Location:				
Location:				
Location:				
General				
Are there any other potential concerns at the site?				
Location:				
Location:				
Location:				
Location:				
Storm Water Monitoring				
Does storm water discharge directly to a water body listed in the General Permit as impaired for sediment/sedimentation or turbidity?				
If yes, were samples for sediment/sedimentation or turbidity collected pursuant to the sampling and analysis plan in the SWPPP?				
Did the sampling results indicate that the discharges are causing or contributing to further impairment?				
If yes, were the erosion/sediment control BMPs improved or maintained to reduce the discharge of sediment to the water body?				
Were there any BMPs not properly implemented or breaches, malfunctions, leakages or spills observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water?				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				
If sampling indicated pollution of the storm water, were the leaks, breaches, spills, etc. cleaned up and the contaminated soil properly disposed of?				
Were the BMPs maintained or replaced?				
Were soil amendments (e.g., gypsum, lime) used on the project?				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan in the SWPPP?				
If sampling indicated pollution of the storm water by the use of the soil amendments, is there a contingency plan for retention onsite of the polluted storm water?				
Did storm water contact stored materials or waste and run off the construction site? (Materials not in watertight containers, etc.)				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan in the SWPPP?				