CONSTRUCTION HOURS AND MITIGATIONS

The Santa Cruz County Municipal Code prohibits offensive noise (including construction) between the hours of 10:00 PM and 8:00 AM. The City of Santa Cruz prohibits offensive noise between the hours of 10:00 PM and 8:00 AM, but exempts certain construction projects from these time limits.

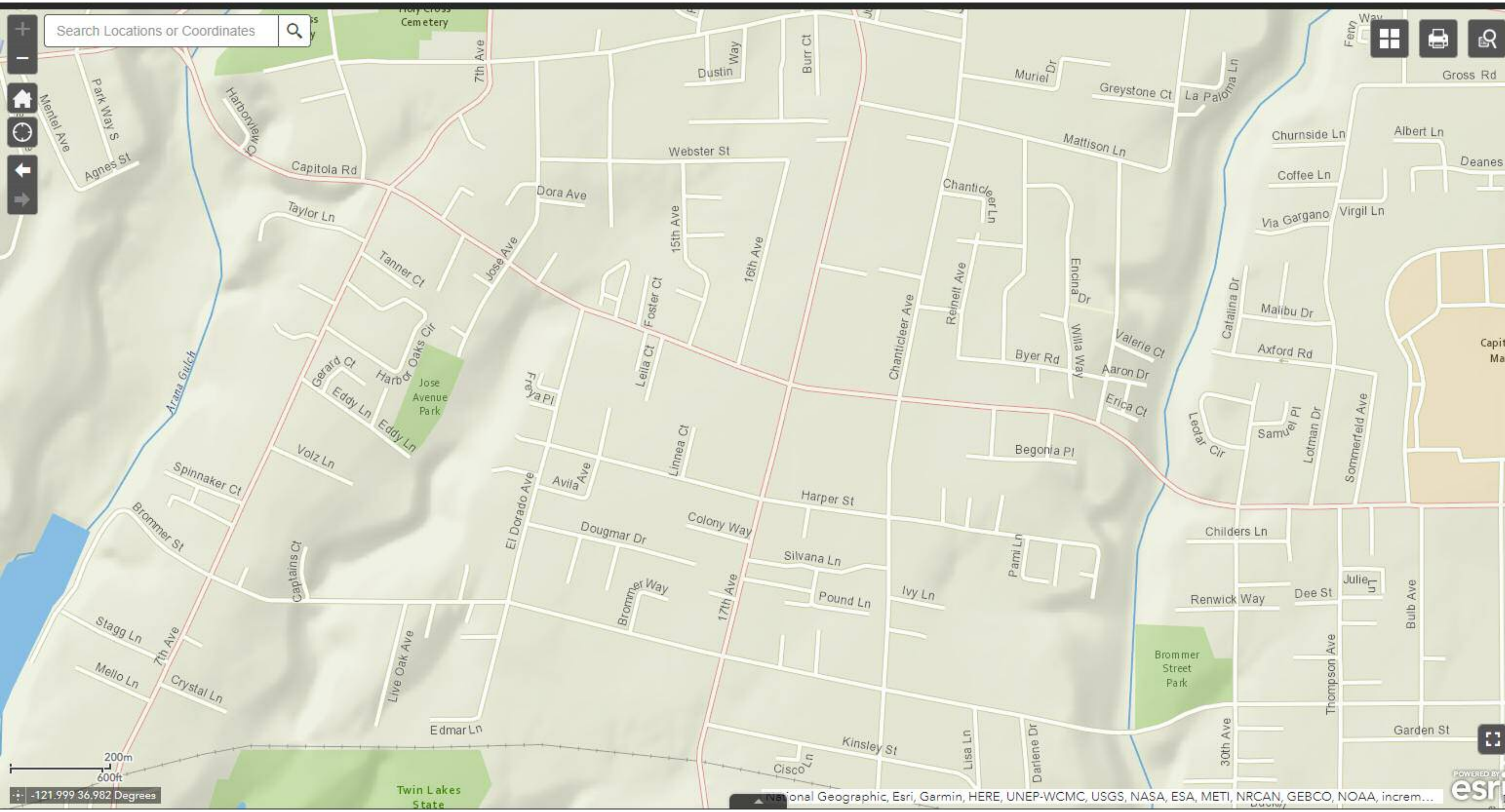
The prohibition of offensive noise during nighttime hours would limit the effects of nighttime construction noise, thereby reducing impacts to residential land uses during the hours people are typically in their homes or normally sleep. However, construction activities may be exempt from these noise ordinance restrictions in some instances, such that construction may take place at night. In addition, daytime noise would still exceed the established threshold of 60 dB Ldn (or CNEL) at other noise-sensitive receptors (including institutional and office uses); therefore the following mitigations are required.

Mitigation Measures. The following mitigation measures are required to reduce construction-related noise impacts:

Construction Hours. Hours of construction for the project shall be limited to the hours between 8:00 AM and 7:00 PM on weekdays and 9:00 AM to 4:00 PM on Saturdays.

Acoustical Shelters. Air compressors and generators used for construction shall be surrounded by temporary acoustical shelters if within 1,500 feet of a sensitive receptor (including residential, institutional, and office land uses).

Construction Equipment. Stationary construction equipment that generates noise that exceeds 60 dBA at the boundaries of adjacent sensitive receptors shall be baffled to reduce noise and vibration levels. All construction equipment powered by internal combustion engines shall be properly muffled and maintained. Unnecessary idling of internal combustion engines shall be prohibited. Whenever feasible, electrical power shall be used to run air compressors and similar power tools.



Search Locations or Coordinates
Holy Cross Cemetery
7th Ave
Dustin Way
Burr Ct
Muriel Dr
Greystone Ct
La Paloma Ln
Fern Way
Gross Rd
Mentel Ave
Park Way S
Agnes St
Harborview Ct
Capitola Rd
Webster St
Mattison Ln
Churnside Ln
Albert Ln
Deanes Ln
Coffee Ln
Via Gargano
Virgil Ln
Chanticleer Ln
Dora Ave
Taylor Ln
Tanner Ct
Jose Ave
15th Ave
16th Ave
Encina Dr
Reinelt Ave
Chanticleer Ave
Catalina Dr
Malibu Dr
Capitola Mall
Foster Ct
Leila Ct
Harbor Oaks Cir
Gerard Ct
Eddy Ln
Jose Avenue Park
Arana Gulch
Freya Pl
Willa Way
Valerie Ct
Byer Rd
Aaron Dr
Axford Rd
Erica Ct
Ledyard Cir
Samuel Pl
Lotman Dr
Sommerfeld Ave
Begonia Pl
Volz Ln
Spinnaker Ct
Linnea Ct
Avila Ave
El Dorado Ave
Harper St
Brommer St
Dougmar Dr
Colony Way
Silvana Ln
Parni Ln
Childers Ln
Captains Ct
Brommer Way
17th Ave
Pound Ln
Ivy Ln
Julie Ln
Dee St
Renwick Way
Bulb Ave
Stagg Ln
Mello Ln
7th Ave
Crystal Ln
Live Oak Ave
Brommer Street Park
Thompson Ave
Edmar Ln
Kinsley St
Lisa Ln
Darlene Dr
30th Ave
Garden St
Cisco Ln
200m
600ft
Twin Lakes State
-121.999 36.982 Degrees
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increm...
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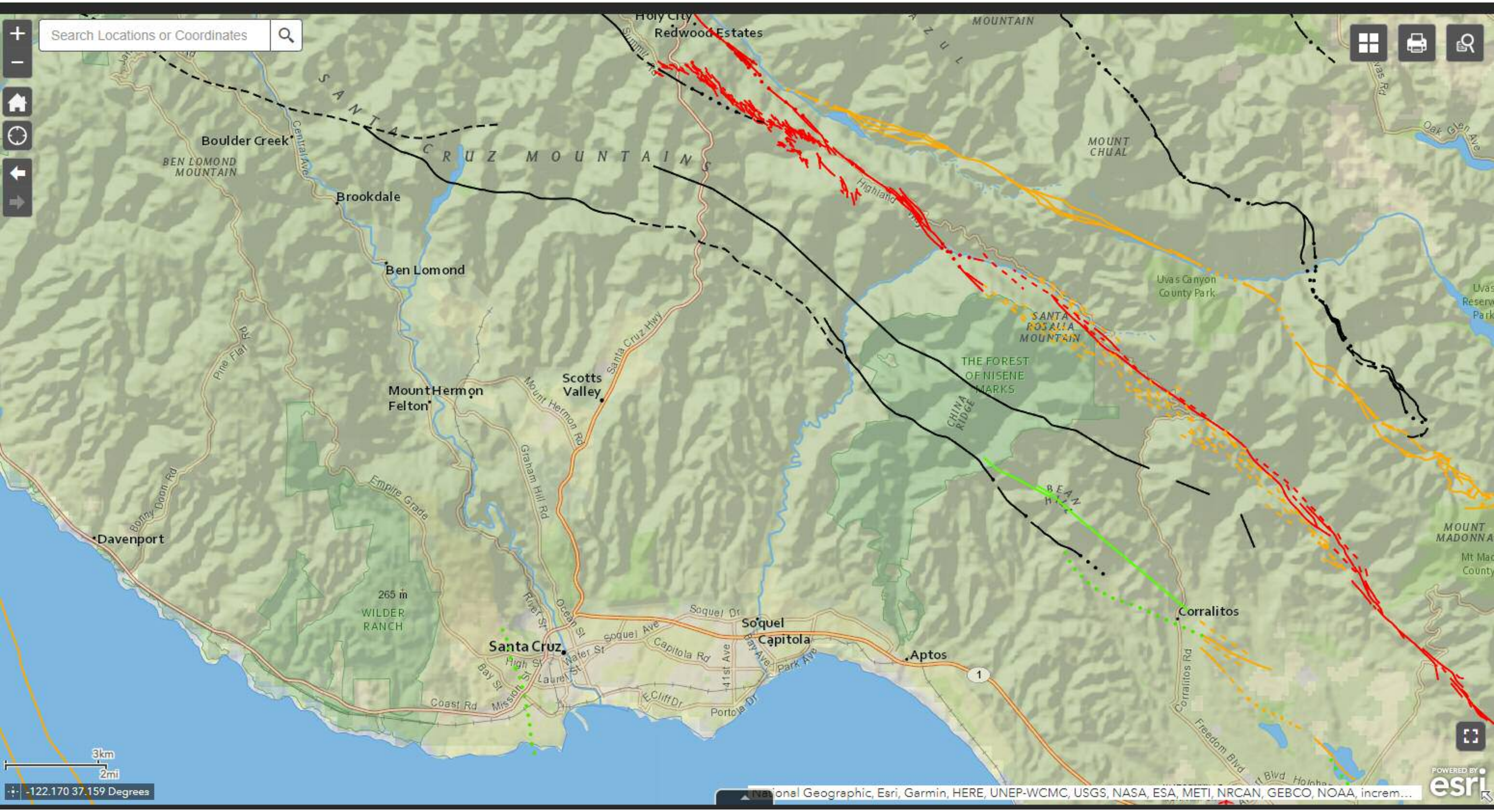

Search Locations or Coordinates
Holy City
Redwood Estates
MOUNTAIN
SANTA CRUZ MOUNTAINS
Boulder Creek
BEN LOMOND MOUNTAIN
Brookdale
Ben Lomond
MOUNT CHUAL
Oak Glen Ave
Uvas Canyon County Park
SANTA ROSALIA MOUNTAIN
THE FOREST OF NISENE MARKS
CHINA RIDGE
Mount Hermon
Felton
Scotts Valley
Santa Cruz Hwy
Mount Hermon Rd
Graham Hill Rd
Empire Grade
Pine Flat Rd
Bonny Doon Rd
Davenport
265 m
WILDER RANCH
BEAN HILL
Corralitos
Soquel Dr
Soquel
Capitola
Aptos
Santa Cruz
Soquel Ave
Capitola Rd
41st Ave
Bay Ave
Park Ave
Water St
Ocean St
River St
High St
Bay St
Laurel St
Mission St
Coast Rd
E Cliff Dr
Portola Dr
Corralitos Rd
Freedom Blvd
MOUNT MADONNA
3km
2mi
-122.170 37.159 Degrees
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increm...
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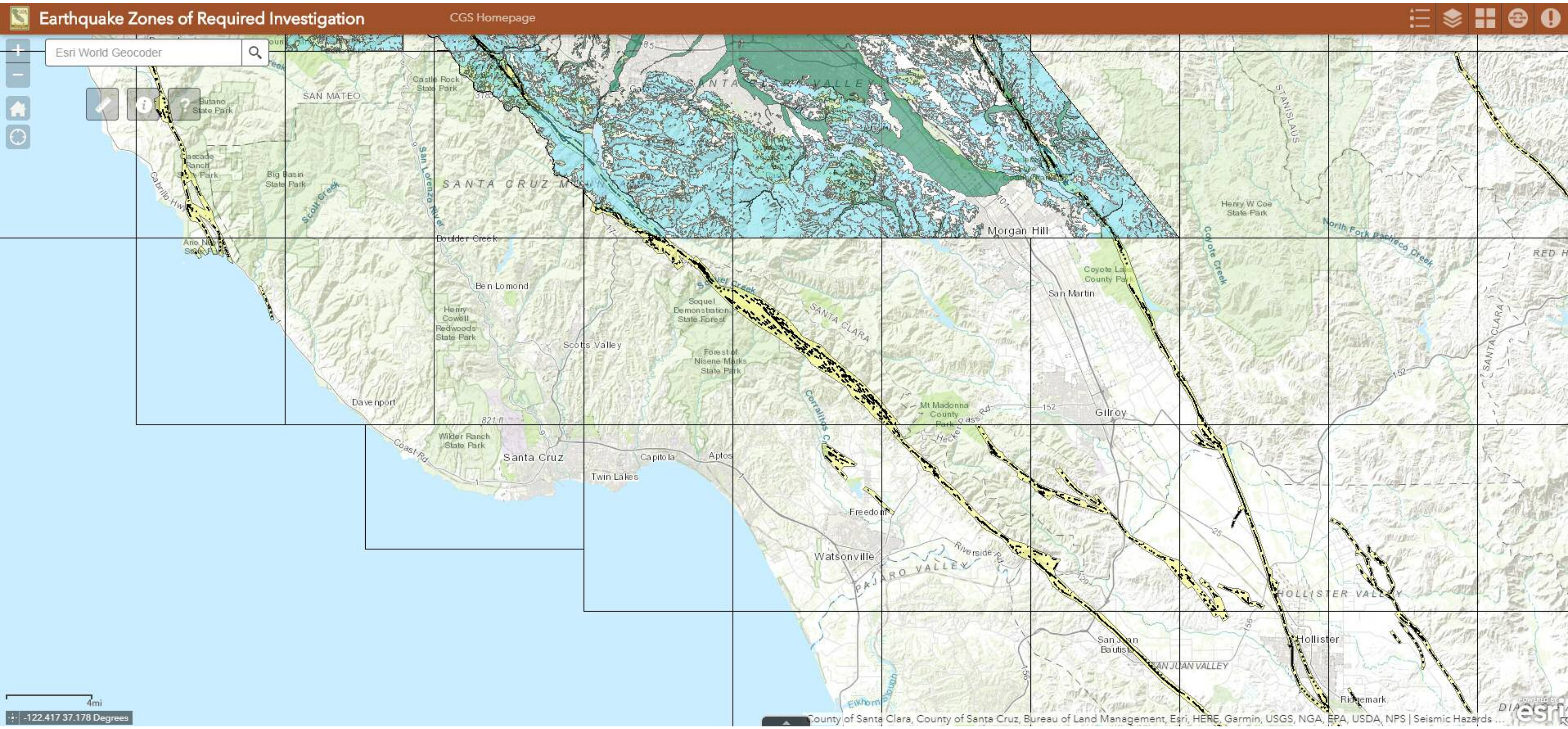

Earthquake Zones of Required Investigation
CGS Homepage
Esri World Geocoder
SAN MATEO
Castle Rock State Park
Butano State Park
Cascade Ranch State Park
Big Basin State Park
Scott Creek
San Lorenzo River
SANTA CRUZ MTNS
SANTA CLARA VALLEY
Año Nuevo SR
Boulder Creek
Ben Lomond
Henry Cowell Redwoods State Park
Scotts Valley
Soquel Demonstration State Forest
Forest of Nisene Marks State Park
Davenport
821 ft
Wilder Ranch State Park
Coast Rd
Santa Cruz
Capitola
Twin Lakes
Aptos
Corralitos Creek
Freedom
Watsonville
PAJARO VALLEY
Riverside Rd
Mt Madonna County Park
Hecker Pass Rd
Morgan Hill
San Martin
Coyote Lake County Park
Gilroy
Coyote Creek
Henry W Coe State Park
North Fork Pacheco Creek
STANISLAUS
RED HILLS
SANTA CLARA
HOLLISTER VALLEY
Hollister
San Juan Bautista
SAN JUAN VALLEY
Ridgemark
Elkhorn Slough
4mi
-122.417 37.178 Degrees
County of Santa Clara, County of Santa Cruz, Bureau of Land Management, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS | Seismic Hazards ...
esri

FAULT ZONES and COASTAL ZONE

SANTA CRUZ COUNTY, CALIFORNIA

On October 17, 1989, the magnitude 7.1 Loma Prieta earthquake struck the San Andreas Fault, causing 64 deaths and more than $6 billion in property damages in central California. Parallel to the San Andreas, the Zayante-Vergeles, Butano, Corralitos and San Gregorio faults also run through the County.

The San Andreas Fault Zone and parts of the Zayante Fault Zone, shown in red, represent the most serious shaking threats; homes proposed in these areas automatically require a Geological Report. The General Plan requires homes to be built at least 50 feet from any fault trace.

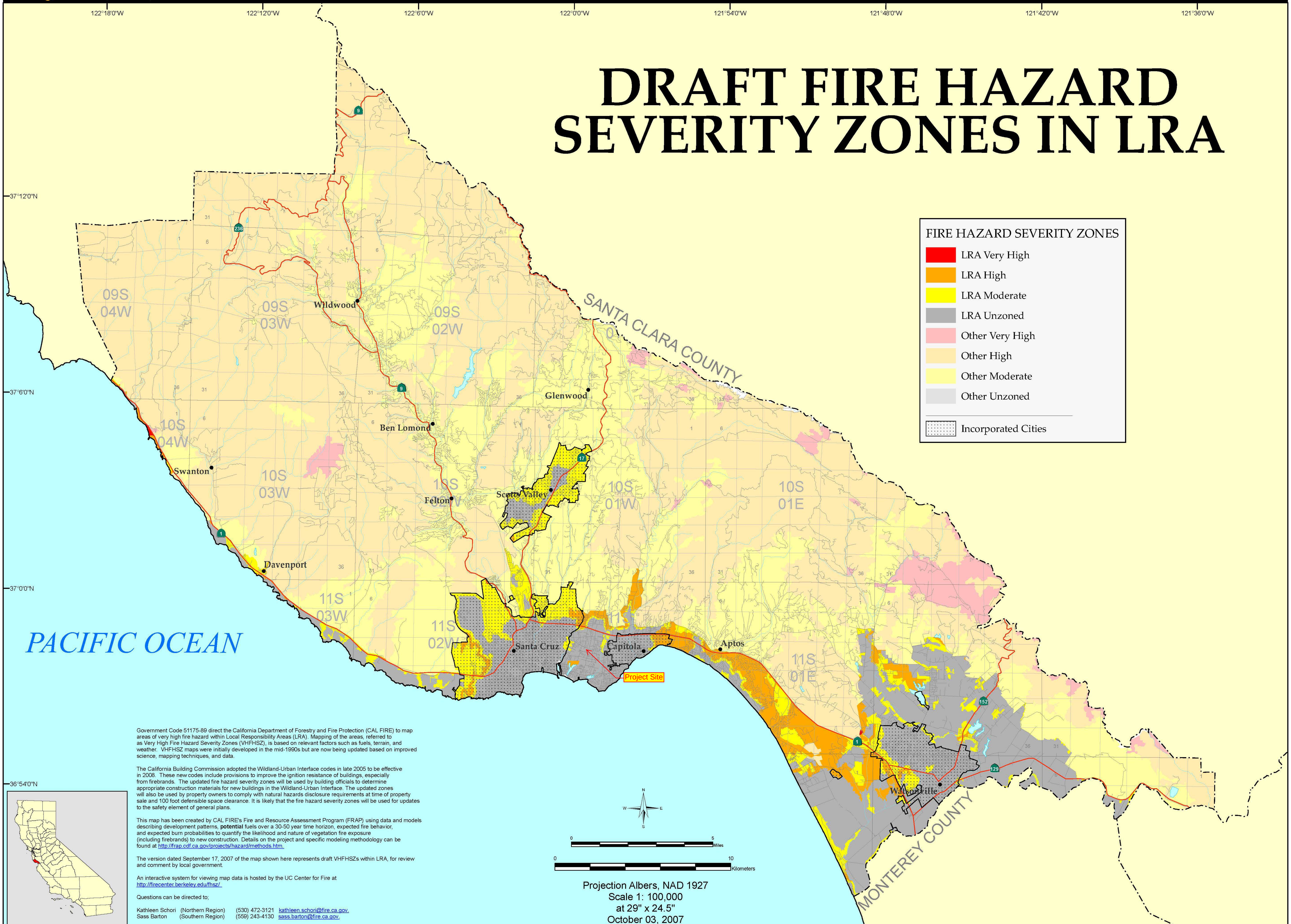
The Coastal Zone was established in 1972 by a voter initiative, Proposition 22. In 1976, the California Legislature expanded the Coastal Zone to its present area, shown in blue. The Coastal Act protects beaches, scenic areas, coastal bluffs, wetlands, agricultural lands and other sensitive resources, and supports low-income housing. The County's Local Coastal Program, approved by the Coastal Commission, requires Coastal Permits for many projects in the Coastal Zone.

038-05_FAULTSandCOASTAL
PREPARED BY SANTA CRUZ COUNTY GEOGRAPHIC INFORMATION SYSTEM STAFF
FEBRUARY 2005

SANTA CRUZ COUNTY

Fire and Resource Assessment Program
California Department of Forestry and Fire Protection

DRAFT FIRE HAZARD SEVERITY ZONES IN LRA



Government Code 51175-89 direct the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of very high fire hazard within Local Responsibility Areas (LRA). Mapping of the areas, referred to as Very High Fire Hazard Severity Zones (VHFHSZ), is based on relevant factors such as fuels, terrain, and weather. VHFHSZ maps were initially developed in the mid-1990s but are now being updated based on improved science, mapping techniques, and data.

The California Building Commission adopted the Wildland-Urban Interface codes in late 2005 to be effective in 2008. These new codes include provisions to improve the ignition resistance of buildings, especially from firebrands. The updated fire hazard severity zones will be used by building officials to determine appropriate construction materials for new buildings in the Wildland-Urban Interface. The updated zones will also be used by property owners to comply with natural hazards disclosure requirements at time of property sale and 100 foot defensible space clearance. It is likely that the fire hazard severity zones will be used for updates to the safety element of general plans.

This map has been created by CAL FIRE's Fire and Resource Assessment Program (FRAP) using data and models describing development patterns, **potential** fuels over a 30-50 year time horizon, expected fire behavior, and expected burn probabilities to quantify the likelihood and nature of vegetation fire exposure (including firebrands) to new construction. Details on the project and specific modeling methodology can be found at http://frap.cdf.ca.gov/projects/hazard/methods.htm.

The version dated September 17, 2007 of the map shown here represents draft VHFHSZs within LRA, for review and comment by local government.

An interactive system for viewing map data is hosted by the UC Center for Fire at http://firecenter.berkeley.edu/fhsz/

Questions can be directed to;

Kathleen Schori (Northern Region) (530) 472-3121 kathleen.schori@fire.ca.gov.
Sass Barton (Southern Region) (559) 243-4130 sass.barton@fire.ca.gov.

Projection Albers, NAD 1927
Scale 1: 100,000
at 29" x 24.5"
October 03, 2007

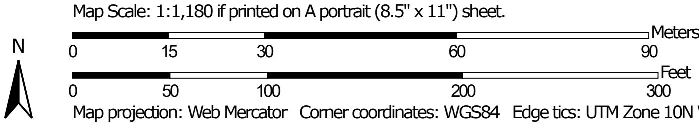
Obtain FRAP maps, data, metadata and publications on the Internet at http://frap.cdf.ca.gov
For more information, contact CAL FIRE-FRAP, PO Box 944246, Sacramento, CA 94244-2460, (916) 327-3939.

Arnold Schwarzenegger, Governor,
State of California
Mike Chrisman, Secretary for Resources,
The Resources Agency
Ruben Grijalva, Director,
Department of Forestry and Fire Protection

MAP ID: FHSZL06_1_MAP
DATA SOURCES
CAL FIRE Fire Hazard Severity Zones (FHSZL06_1)
CAL FIRE State Responsibility Areas (SRA05_4)
CAL FIRE Incorporated Cities (Incorp07_2)
PLSS (1:100,000 USGS, Land Grants with CAL FIRE grid)

Representative Slope—Santa Cruz County, California
(1500 Capitola Road, Live Oak, CA)

Map Scale: 1:1,180 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

0 - 5

5 - 15

15 - 45

45 - 60

60 - 100

Not rated or not available

Soil Rating Lines

0 - 5

5 - 15

15 - 45

45 - 60

60 - 100

Not rated or not available

Soil Rating Points

0 - 5

5 - 15

15 - 45

45 - 60

60 - 100

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Santa Cruz County, California
Survey Area Data: Version 13, Sep 16, 2019

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

Date(s) aerial images were photographed: Mar 16, 2019—Apr 7, 2019

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

Representative Slope

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
178	Watsonville loam, thick surface, 0 to 2 percent slopes	1.0	3.8	100.0%
Totals for Area of Interest			**3.8**	**100.0%**

Description

Slope gradient is the difference in elevation between two points, expressed as a percentage of the distance between those points.

The slope gradient is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Earth Systems
500 Park Center Drive, Suite 1 | Hollister, CA 95023 | Ph: 831.637.2133 | www.earthsystems.com

October 24, 2018 File No.: 302482-001
(Revised November 6, 2018)

Mr. Carlos Jurado
MidPen Housing
275 Main Street, Suite 204
Watsonville, CA 95076

PROJECT: MIDPEN HOUSING LIVE OAK TOWN CENTER MIXED-USE DEVELOPMENT
1412, 1438, 1500 AND 1514 CAPITOLA ROAD
SANTA CRUZ, CALIFORNIA

SUBJECT: *Revised* Geotechnical Engineering Report

REF.: Revised Proposal for a Geotechnical Engineering Investigation, Soil Percolation Rate Testing, Plan Reviews, and Geotechnical Consultation, MidPen Housing Santa Cruz Site, 1514 Capitola Road, Santa Cruz, California, by Earth Systems Pacific, dated June 29, 2018

Dear Mr. Jurado:

In accordance with your authorization of the above-referenced proposal, this revised geotechnical engineering report was prepared for use in development of plans and specifications for the planned development of the 3.7-acre site at 1412, 1438, 1500, and 1514 Capitola Road in Santa Cruz. As shown on the Landscape Site Plan by Wald Ruhnke & Dost, the project will consist of two 2-story commercial medical buildings fronting Capitola Road, and a group of 3-story residential apartment buildings surrounding a common area on the southeast-central portion of the site. Plans for the buildings were not provided for our review, but we assumed that they will be conventional light-frame structures that will be supported by post-tensioned slab-on-grade foundations. Other planned site improvements include paved driveways, parking spaces, and landscape. Stormwater runoff will be directed to bio-swales or similar management/treatment facilities. Based on the site topography, we anticipate that grading will entail cuts and fills on the order of 3 feet, and some site retaining walls may be constructed. The development will be served by municipal utilities.

Scope of Services

The scope of work for the geotechnical engineering investigation included a general site reconnaissance, subsurface exploration, laboratory testing of soil samples, engineering evaluation of the data collected, and preparation of this report. To assess the potential infiltration rates of the soil, relatively shallow percolation rate tests were conducted at the expected site of the stormwater management/treatment facilities. The analysis and subsequent recommendations were based on the Landscape Site Plan by Wald Ruhnke & Dost, Sheet L1.00, dated 10/30/2018, and other information provided by the client on May 22, 2018.

The report and recommendations are intended to comply with the considerations of Sections 1803.1 through 1803.6, 1803.7 (portions of), and J104.3 and J104.4 of the 2016 California Building Code (CBC), and common geotechnical engineering practice in this area at this time under similar conditions. The tests were performed in general conformance with the standards noted, as modified by common geotechnical practice in this area at this time under similar conditions.

Preliminary geotechnical recommendations for site preparation and grading, post-tensioned slab foundations, exterior flatwork, retaining walls, asphalt concrete pavement sections, utility trenches, site drainage and finish improvements, and geotechnical observation and testing are presented to guide the development of project plans and specifications. Soil percolation rate test results are also provided. It is our intent that this report be used by the client to form the geotechnical basis of the design of the project as described herein, and in the preparation of plans and specifications.

Evaluation of the site geology, assessment of the soil percolation rate test results, and analyses of the soil for mold or other microbial content, lead, asbestos, corrosion potential, radioisotopes, hydrocarbons, or other chemical properties are beyond the scope of this report. This report does not address issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, shoring, temporary slope angles, and construction means and methods. Ancillary features such as temporary access roads, fences, swimming pools, light poles, signage, and nonstructural fills are not within our scope and are also not addressed.

To verify that pertinent issues have been addressed and to aid in conformance with the intent of this report, it is requested that grading and foundation plans be submitted to the geotechnical engineer for review as they near completion. In the event that there are any changes in the nature, design, or locations of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained herein shall not be considered valid unless the changes are reviewed and the conclusions of this report are verified or modified in writing by the geotechnical engineer. The criteria presented in this report are considered preliminary until such time as they are verified or modified in writing by the geotechnical engineer in the field during construction.

Site Setting

The site consists of four parcels (APNs 026-74-112, -113, -114 and -115) totaling approximately 3.7 acres and is located at 1412, 1438, 1500 and 1514 Capitola Road in Santa Cruz, California. The properties are bounded by commercial buildings to the east and residential developments to the west and south. At the time of the investigation, single family residences and associated sheds were present at 1438 and 1500 Capitola Road. The remainder of the site was undeveloped except for paved driveways, parking spaces, and storage pads. A review of historic Google Earth images indicated that residences or other structures were previously present at 1412 and 1514 Capitola Road. The site is currently vegetated with several trees amid grass, weeds, and landscape plantings. Topographically, the site slopes very gently toward the south and west. A storm drain line with a few surface inlets is present along the western and portion of the southern property boundaries.

Subsurface Investigation and Laboratory Testing

The subsurface exploration consisted of nine borings drilled at the site on September 7, 2018. The borings were drilled using a truck-mounted Mobil Drill rig, Model B-24, equipped with a 4-inch diameter, continuous flight, solid-stem auger. Three sets of two infiltration test borings was drilled on the same day. The approximate boring and infiltration test locations are shown on the attached Boring and Infiltration Test Location Map.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System (ASTM D 2488-17). Soil samples were obtained from the borings using an internally-lined barrel sampler (ASTM D 3550-17, with shoe similar to D 2937-17), Standard Penetration Tests (SPT - ASTM D 1586-11) were conducted at selected depths, and bulk soil samples were obtained from the auger cuttings. Copies of the boring logs are attached.

Selected liner samples were tested for unit weight and moisture (ASTM D 2937-17, modified for internal liners). Two liner samples and one SPT sample were tested for particle size distribution (ASTM D 422-63/07 and D 1140-17). Two liner samples were tested for plasticity index (ASTM D 4318-17), and one liner sample was tested for unconfined compressive strength (ASTM D 2166/D

2166M-16). One bulk sample was tested for R-value (ASTM D 2844/D 2844M-13). Copies of the laboratory test results are attached.

General Subsurface Profile

In general, the soils encountered in the exploratory borings were mixtures of sands, silts, and clays. At the location of Boring 1, the upper 2-½ feet of soil was likely previously-placed undocumented fill. Previously-placed fill with some buried debris were also encountered in three of the infiltration test borings drilled near the northwest corner of the site. The predominantly fine-grained native soils had medium stiff to very stiff consistencies, although occasional hard layers were encountered. Except for the upper 3 feet of loose material in Borings 4 and 6 and a 1-foot thick loose zone below 2 feet in Boring 8, the predominantly coarse-grained materials were medium dense to dense. The soils were generally moist at the time of drilling. Free subsurface water was not encountered within the maximum 15-foot depth of exploration.

Conclusions

<u>Site Suitability</u>:

Based on the results of the subsurface investigation and laboratory testing program, in our opinion, the site is geotechnically suitable for the proposed development provided that the recommendations contained herein are implemented in the design and construction. The primary geotechnical considerations are the expansion potential of the soil, the nonuniformity of the upper soils, the presence of previously-placed undocumented fill, and the potential for soil disturbance resulting from removal of the existing trees, structures, and other improvements at the site. Removal (overexcavation) and recompaction of the upper soil are recommended to provide more uniform support of the proposed structures and to help reduce the effects of soil expansion and contraction on the proposed improvements. The existing undocumented fill should also be removed during the overexcavation operations.

<u>Soil Expansion Potential:</u>

Plasticity index tests of samples of the upper soils from the site indicated that the samples tested have low expansion potentials, with a maximum liquid limit of 17 and a maximum plasticity index of 4. However, based on the Web Soil Survey for Santa Cruz County, California, the soils mapped at the site (Watsonville loam), can exhibit liquid limits of up to 60 and plasticity indices as high as 35. These values indicate that highly expansive soils are potentially present at the site. Expansive soils tend to swell with increases in soil moisture and shrink as the soil moisture decreases. The volume changes that the soils undergo in this cyclical pattern can stress and damage foundations, exterior flatwork, and other improvements if precautionary measures are not incorporated into the design and construction procedures. To help reduce the effects of the expansive soils, the post-tensioned slabs should be designed to withstand forces related to soil expansion and contraction. The soils in areas to receive foundations and other improvements should be moisture conditioned prior to construction of the improvements. Exterior concrete flatwork should be constructed over a layer of nonexpansive imported material.

Seismic Setting:

The site is located within a seismically active area, but outside of Alquist-Priolo Earthquake Fault Zones. According to the *Geologic and Seismologic Discussion, City of Santa Cruz General Plan Update* (Nolan Associates, 2009), no potentially active faults cross the City of Santa Cruz, and the risk for surface ground rupture is therefore low. However, strong ground shaking should be expected during the design life of the planned structures. At a minimum, the planned improvements should be designed to resist seismic shaking in accordance with current California Building Code (CBC) requirements. Seismic design parameters based on the 2016 Edition of the CBC are presented later in the report.

The Landslide and Liquefaction Hazard Maps included in the Nolan report show the site as being in an area having low landslide and liquefaction hazards, and potentially unstable or liquefiable soils were not encountered in our exploratory borings. Thus, measures to mitigate potential landslides and soil liquefaction are not considered necessary for the project.

Recommendations

Site Preparation and Grading

1. The site should be prepared for grading by removing existing structures, pavement, debris, trees and other vegetation, large roots, and other potentially deleterious materials from areas to receive improvements. The site preparation operations should be observed by the geotechnical engineer prior to continuing grading.

2. Existing utility lines that will not remain in service should be either removed or abandoned. The appropriate method of utility abandonment will depend upon the type, depth, and location of the utility. Recommendations for abandonment can be made as necessary.

3. The soil in the building areas and in areas to receive exterior flatwork and other improvements should be removed (overexcavated) to minimum depths of 2 feet below existing grade or below the planned building pad elevations, whichever is deeper. The overexcavated areas should extend a minimum of 5 feet beyond the planned building foundation perimeters, and 2 feet beyond the edges of exterior flatwork and other improvements associated with the structures.

4. Existing undocumented fill, extending to an estimated depth of 2-½ feet, was present at the location of Boring 1, but undocumented fill may be present to greater depths and at other locations on the site. It was also noted that undocumented fill and buried debris were encountered in the borings drilled for infiltration testing along the northwestern edge of the site. The undocumented fill and any buried debris in areas to receive improvements should be entirely removed during the overexcavation operations. The overexcavation and removal of undocumented fill and buried debris should be observed by the geotechnical engineer prior to continuing grading.

5. The overexcavated surfaces should be cross-scarified to an approximate depth of 8 inches. The soil should then be moisture conditioned to a level slightly above optimum moisture content and recompacted to a minimum of 90 percent of maximum dry density.

6. The previously overexcavated material can be re-used as fill provided that it is cleared of excessive quantities of debris, organics, or other potentially deleterious materials. Fill should be placed in moisture conditioned lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent of maximum dry density. Large roots, rock, debris, and irreducible material larger than 4 inches in diameter should be removed from the soil prior to compaction.

7. If fill is to be imported for general use at the site (other than nonexpansive imported material), the fill should be coarse grained (ASTM D 2487-17) with a plasticity index (ASTM D 4318-17) of 15 or less. Nonexpansive imported material should be placed in areas to receive exterior concrete (refer to Exterior Concrete Flatwork below). Proposed imported soils should be evaluated by the geotechnical engineer before being transported to the site, and on an intermittent basis during placement and compaction on the site.

8. Due to the fine-grained nature of the site soils, and depending on moisture conditions at the time of construction, there is a potential for the soils to become unstable during grading. Unstable soils hinder compactive effort and are inappropriate for placement of additional fill. Alternatives to correct instability include aeration to dry the soils, lime treatment, and the use of gravel or geotextiles as stabilizing measures. Recommendations for stabilization should be provided by a representative of this firm as needed during construction.

9. Cut and fill slopes should not be steeper than 2:1, measured horizontally to vertically.

Foundations

1. The structures should be supported by post-tensioned slab foundations designed to resist soil expansion and contraction. The post-tensioned slabs should be designed in accordance with the provisions of the current edition of the California Building Code and the recommendations of the Post-Tensioning Institute. The following design criteria were developed for the post construction case in general accordance with the recommendations contained in the document "Design and Construction of Post-Tensioned Slabs-on-Ground", 3rd Edition published by the Post-Tensioning Institute. The criteria were based on Thornthwaite Moisture Indices ranging from -20 for dry conditions to +10 for irrigated conditions.

Edge Moisture Variation Distance (e_m)	
Center Lift Condition	9.0 feet
Edge Lift Condition	4.4 feet
Estimated Differential Swell (y_m)	
Center Lift Condition	0.72 inches
Edge Lift Condition	2.0 inches
Allowable Bearing Capacity (dead loads)	1,500 psf
Allowable Bearing Capacity (dead + live loads)	2,000 psf
Allowable Bearing Capacity (DL+LL+ wind or seismic)	2,500 psf
Subgrade Friction Factor (slab against subgrade)	0.25
Total settlement	1 inch
Differential settlement (within 25 feet)	½ inch

2. The seismic design parameters for the site per Chapter 16 of the California Building Code (2016 Edition) are as follows. The values were determined utilizing the USGS U.S. Seismic Design Maps web-based tool and the 2015 International Building Code (2016 CBC) provisions. The site coordinates were determined using the Google Earth web site.

   Site Class = D

   Short Term Spectral Acceleration Parameter, $S_s = 1.500$ g
   1 Second Spectral Acceleration Parameter, $S_1 = 0.600$ g

   Site Coefficient, $F_a = 1.00$
   Site Coefficient, $F_v = 1.50$

   Adjusted Spectral Acceleration Parameter, $S_{MS} = 1.500$ g
   Adjusted Spectral Acceleration Parameter, $S_{M1} = 0.900$ g

   Design Spectral Acceleration Parameter, $S_{DS} = 1.000$ g
   Design Spectral Acceleration Parameter, $S_{D1} = 0.600$ g

3. The building pads should be periodically moisture conditioned as necessary to maintain the soil moisture content at a minimum of 3 percent above optimum to a minimum depth of 12 inches at the time of placement of concrete or vapor retarding membranes. The moisture content of the soil should be tested by the geotechnical engineer prior to placement of the concrete or vapor retarding membranes.

4. In areas where moisture transmitted from the subgrade would be undesirable, a vapor retarder should be utilized beneath the post-tensioned slab foundation. The vapor retarder should comply with ASTM Standard Specification E 1745-17 and the latest recommendations of ACI Committee 302. The vapor retarder should be installed in accordance with ASTM Standard Practice E 1643-18a. Care should be taken to properly lap and seal the vapor retarder, particularly around utilities, and to protect it from damage during construction.

5. If sand, gravel or other permeable material is to be placed over the vapor retarder, the material over the vapor retarder should be only lightly moistened and not saturated prior to casting the slab concrete. Recent studies, including those by ACI Committee 302, have concluded that excess water above the vapor retarder would increase the potential for

moisture damage to floor coverings and could increase the potential for mold growth or other microbial contamination. The studies also concluded that it is preferable to eliminate the sand layer and place the slab concrete in direct contact with the vapor retarder, particularly during wet weather construction. However, placing the concrete directly on the vapor retarder would require special attention to using the proper vapor retarder, concrete mix design, and finishing and curing techniques.

6. When concrete slabs are in direct contact with vapor retarders, the concrete water to cement (w/c) ratio should be correctly specified to control bleed water and plastic shrinkage cracking. Also, the concrete could be proportioned to reduce its porosity (and its corresponding potential for transmitting moisture) by limiting the w/c ratio. Concrete materials, placement and curing methods should be specified by the design professional.

7. To further protect moisture-sensitive floor coverings, the perimeters of the post-tensioned slabs should be deepened to penetrate a minimum of 6 inches into the subgrade soil.

8. The post-tensioned slabs should be constructed and maintained in accordance with the publication *Construction and Maintenance Manual for Post-tensioned Slab-on-Ground Foundations* by the Post-Tensioning Institute. Particular attention should be paid to the “Property Owner Maintenance” and “Landscaping” sections of the Manual.

<u>Exterior Concrete Flatwork</u>

1. Exterior concrete flatwork should have a minimum thickness of 4 full inches and should be reinforced as directed by the architect/engineer. Due to the soil expansion potential, exterior flatwork should be cast on a minimum 6-inch layer of compacted, nonexpansive material such as clean sand or aggregate base. However, a greater thickness of nonexpansive material would enhance flatwork performance. Prior to placement of the nonexpansive material, the soil surface in the flatwork area should be at or above optimum moisture content, and no desiccation cracks should be present.

2. Exterior flatwork adjacent to the structures should be designed to be independent of the post-tensioned slab foundations. The flatwork should not be doweled to foundations, and a separator should be placed between the two.

3. Prior to placement of the concrete, the soil surface in the flatwork area should be at or above optimum moisture content, and no desiccation cracks should be present.

4. To reduce shrinkage cracks in concrete, the concrete aggregates should be of appropriate size and proportion, the water/cement ratio should be low, the concrete should be properly placed and finished, contraction joints should be installed, and the concrete should be properly cured.

Retaining Walls

1. Retaining walls should be supported by conventional spread footings. The footings should have minimum depths of 24 inches below lowest adjacent grade and should bear in firm native or compacted soil. The footing reinforcement should be as required by the design engineer. The footing excavations should be observed by the geotechnical engineer to prior to placement of formwork or reinforcing steel, and should be moisture conditioned to close any desiccation cracks prior to concrete placement.

2. Footings should be designed using a maximum allowable bearing capacity of 2,500 psf dead plus live load. This value may be increased by one-third when transient loads such as wind or seismicity are included. Using these criteria, long term total and differential foundation settlements are expected to be on the order of ½ inch.

3. Resistance to lateral loads should be calculated based on a passive equivalent fluid pressure of 250 pcf and a friction factor of 0.25. Passive and frictional resistance can be combined in the calculations without reductions. These values are based on the assumption that backfill adjacent to foundations is adequately compacted.

4. Lateral earth pressures for wall design should be based on the following parameters.

   Active equivalent fluid pressure (horizontal retained surface) ....45 pcf
   At-rest equivalent fluid pressure (horizontal retained surface) ....60 pcf
   Active equivalent fluid pressure (2:1 sloping surface above wall).........70 pcf
   At-rest equivalent fluid pressure (2:1 sloping surface above wall) ....95 pcf

5. If seismic forces are to be considered in the retaining wall design, the seismic increment of earth pressure should be 8H pounds per square foot, where H is the height of the retained soil. The seismic pressure should be applied uniformly on the back of the wall along the height of the retained material.

6. No surcharges are taken into consideration in the above values. The equivalent fluid pressures are ultimate values and will require application of appropriate factors of safety by the architect/engineer.

7. Retaining wall backfill should be fully drained utilizing either a free draining gravel blanket, permeable material, or a manufactured synthetic drainage system. Water from the drainage medium should be collected and discharged via either a rigid perforated pipe or weep holes. Collection pipes should be placed perforations downward near the bottom of the drainage medium and should discharge in a nonerosive manner away from foundations, slopes, and other improvements. Drainage medium consisting of a gravel blanket or permeable material should have a width of approximately 1 foot and should extend upward to within 1 foot of the top of the wall backfill. The upper foot of backfill over the drainage medium should consist of native soil to reduce the flow of surface drainage into the wall drain system. Gravel blankets should be separated from the backfill soil using a permeable synthetic fabric conforming to Caltrans Standard Specifications, Section 88-1.02B, Class A. Permeable material should conform to Section 68-2.02F(3), Class 2, of the Caltrans Standard Specifications. Manufactured synthetic drains such as Miradrain or Enkadrain should be installed in accordance with the recommendations of the manufacturer.

8. Water from the drainage medium can be drained using weep holes, provided that seepage at the base of the wall is acceptable. The weep holes should consist of minimum 1-½ inch diameter holes at 10-foot maximum spacings. The weep holes should be placed as low as possible on the wall. Corrosion-resistant screens or filter fabric should be placed behind the weep holes to reduce the chance of the drainage medium from washing out from behind the wall.

9. Retaining wall backfill should be placed in thin, moisture conditioned, lifts, compacted to a minimum 90 percent of maximum dry density, as tested by the geotechnical engineer.

10. The architect/engineer should bear in mind that retaining walls by their nature are flexible structures, and this flexibility can result in cracking of surface coatings. Where walls are to be plastered or will otherwise have a finish surface applied, this flexibility should be considered in determining the suitability of the surfacing material, spacing of horizontal and vertical joints, connections to structures, etc.

11. Long-term settlement of properly compacted sand or gravel retaining wall backfill should be assumed to be about ¼ percent of the depth of the backfill. Long-term settlement of properly compacted clayey retaining wall backfill should be assumed to be about ½ to 1 percent of the depth of the backfill. Improvements constructed near the tops of retaining walls should be designed to accommodate the estimated settlement.

<u>Pavement Sections</u>

1. The following asphalt concrete (AC) pavement sections were based on an R-value of 12, resulting from a test of the upper sandy silty clay from the site. The pavement sections were designed in accordance with the Caltrans Highway Design Method for Traffic Indices (TIs) of 4.0 through 7.0. Determination of the appropriate TI for each area to be paved is the province of the design engineer and the jurisdiction. The aggregate base should conform to Caltrans Class 2.

R-value	Traffic Index	AC Thickness	Class 2 Base Thickness
12	4.0	2.5”	7”
12	4.5	2.5”	8”
12	5.0	3.0”	9”
12	5.5	3.0”	10”
12	6.0	3.5”	11”
12	6.5	4.0”	12”
12	7.0	4.0”	14”

2. The upper 12 inches of subgrade soil and the aggregate base courses should be compacted to a minimum 95 percent of maximum dry density. The subgrade and base should be firm and unyielding when proofrolled with heavy, rubber-tired equipment prior to paving. The pavement subgrade soils should be periodically moistened as necessary prior to placement of the aggregate base to maintain the soil moisture content near optimum.

3. To provide stability for curbs, they should be set back a minimum of 3 feet from the tops of slopes. Foundations may be provided to increase curb stability, particularly atop slopes.

4. Pavement longevity will be enhanced if the surface grade drains away from the edges of the pavement. Finished AC surfaces should slope toward drainage facilities at 2 percent where practicable, but in no case should water be allowed to pond.

5. Cutoff walls below curbs and around landscape islands may be used to extend the life of the pavement by reducing irrigation water and runoff that seeps into the aggregate base. Where utilized, cutoff walls should extend through the aggregate base to penetrate a minimum of 3 inches into the subgrade soils.

6. To reduce migration of surface drainage into the subgrade, maintenance of the paved areas is critical. Any cracks that develop in the AC should be promptly sealed.

<u>Utility Trenches</u>

1. A select, noncorrosive, granular, easily compacted material should be used as bedding and shading immediately around utility pipes. The site soils may be used for trench backfill above the select material. However, if obtaining compaction is difficult with the site soils, use of a more easily compacted sand may be desirable. The upper foot of backfill in unimproved areas should consist of native material to reduce the potential for seepage of water into the backfill.

2. The upper 12 inches of trench backfill in areas to receive pavement should be compacted to a minimum 95 percent of maximum dry density. Trench backfill in other areas should be compacted to a minimum of 90 percent of maximum dry density.

3. Where utility trenches extend under perimeter foundations, exterior flatwork, or pavement the trenches should be backfilled entirely with compacted native soil. The zone of native soil should extend to a minimum distance of 2 feet on both sides of the foundation, flatwork, or pavement edges. If utility pipes pass through sleeves cast into the perimeter foundations, the annulus between the pipes and sleeves should be sealed.

Site Drainage and Finish Improvements

1. Unpaved ground surfaces should be finish graded to direct surface runoff away from site improvements at a minimum 5 percent grade for a minimum distance of 10 feet. The site should be similarly sloped to drain away from improvements during construction. If this is not practicable due to the terrain, property lines, or other site features, swales with improved surfaces or other drainage facilities should be provided to divert runoff from those areas. The landscape should be planned and installed to maintain proper surface drainage conditions.

2. Raised planter beds adjacent to foundations should be provided with sealed sides and bottoms so that irrigation water is not allowed to penetrate the subsurface beneath foundations. Outlets should be provided in the planters to direct accumulated irrigation water away from foundations.

3. Runoff should discharge in a non-erosive manner away from foundations, exterior flatwork, pavement, and other improvements in accordance with the requirements of the governing jurisdiction.

4. Stabilization of surface soils, particularly those disturbed during construction, by vegetation or other means during and following construction is essential to protect the site from erosion damage. Care should be taken to establish and maintain vegetation.

5. Due to the soil expansion potential, open areas adjacent to foundations, exterior flatwork, and other improvements should be irrigated or otherwise maintained so that constant moisture conditions are created throughout the year. Irrigation systems should be controlled to the minimum levels that will sustain the vegetation without saturating the soil.

Soil Percolation Rate Testing

Three sets of two soil infiltration (percolation) rate tests was performed in borings drilled at the expected location of the proposed stormwater management/treatment facilities. The approximate percolation test locations are indicated on the attached Boring and Infiltration Test Location Map.

The percolation tests were conducted at nominal depths ranging from 2 to 4-½ feet below the ground surface using the Shallow Quick Infiltration Testing Methodology, as detailed in the document *Native Soil Assessment for Small Infiltration-Based Stormwater Control Measures* prepared by Earth Systems Pacific for the Central Coast Low Impact Initiative (2013). The percolation test borings were cased with perforated PVC pipe, the annular spaces were backfilled with gravel, and the borings were saturated. They were then filled with clear water, and the water level was maintained at existing grade for approximately 30 minutes (i.e. kept at a constant head). From that point on, the tests were conducted as a falling head test, and measurements were taken as the water level dropped. Copies of the percolation test results are attached.

As previously mentioned, buried debris and undocumented fill were present in three of the infiltration test holes (I-3, I-4 and I-6). Therefore, the recorded percolation rates are likely not representative of the native soils.

The test results only indicate the infiltration rates at the specific locations and under specific conditions. Sound engineering judgment should be exercised in extrapolating the test results for other conditions or locations. Please note that the test results incorporate both downward and horizontal fluxes of water. Therefore, the test results will need to be adjusted to estimate the downward infiltration rates for design of the stormwater infiltration facilities. Technical design references vary in methods they present for using these types of test results. However, most references include reduction and/or correction factors for several parameters including, but not limited to, size of the stormwater infiltration system relative to the test volume, number of tests conducted, variability in the soil profile, anticipated silt loading, anticipated biological buildup, anticipated long-term maintenance, and other factors. The designer of the stormwater infiltration system should select the appropriate reduction and/or correction factors based on these considerations.

It is also pointed out that, except for noted above, the measured rates were for undisturbed native soils, and that site grading, fill placement, and soil compaction can have significant effects on the actual infiltration rates that will be experienced following construction.

Geotechnical Observation and Testing

1. It must be recognized that the recommendations contained in this report are based on a limited subsurface investigation and rely on continuity of the subsurface conditions encountered.

2. It is assumed that the geotechnical engineer will be retained to provide consultation during the design phase, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

3. Unless otherwise stated, the terms "compacted" and "recompacted" refer to soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent of maximum dry density. The standard tests used to define maximum dry density and field density should be ASTM D 1557-12 and ASTM D 6938-17, respectively, or other methods acceptable to the geotechnical engineer and jurisdiction.

4. Unless otherwise stated, “moisture conditioning” refers to adjusting the soil moisture to at least optimum moisture prior to application of compactive effort.

5. At a minimum, the following should be provided by the geotechnical engineer:

   - Review of grading and foundation plans as they near completion
   - Professional observation during site preparation, grading, and foundation construction
   - Oversight of soil compaction testing during grading
   - Oversight of soils special inspection during grading

6. Special inspection of grading should be provided as per Section 1705.6 and Table 1705.6 of the CBC; the soils special inspector should be under the direction of the geotechnical engineer. In our opinion, the following operations should be subject to *continuous* soils special inspection:

   - Overexcavation to the recommended depths
   - Removal of existing undocumented fill and buried debris
   - Scarification and recompaction
   - Fill placement and compaction

7. In our opinion, the following operations may be subject to *periodic* soils special inspection, subject to approval by the Building Official:

- Site preparation
- Proposed imported materials
- Building pad moisture conditioning
- Observation of retaining wall foundation excavations
- Compaction of retaining wall backfill
- Compaction of utility trench backfill
- Compaction of pavement subgrade and aggregate base

8. It will be necessary to develop a program of quality control prior to beginning grading. It is the responsibility of the owner, contractor, or project manager to determine any additional inspection items required by the architect/engineer or the governing jurisdiction.

9. The locations and frequencies of compaction tests should be as per the recommendations of the geotechnical engineer at the time of construction. The recommended test locations and frequencies may be subject to modification by the geotechnical engineer based upon soil and moisture conditions encountered, the size and type of equipment used by the contractor, the general trend of the compaction test results, and other factors.

10. A preconstruction conference between a representative of the owner, the geotechnical engineer, the soils special inspector, the architect/engineer, and contractors is recommended to discuss planned construction procedures and quality control requirements. The geotechnical engineer should be notified at least 48 hours prior to beginning grading operations.

Closure

This report is valid for conditions as they exist at this time for the type of project described herein. Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client for the subject project. Application beyond the stated intent is strictly at the user's risk.

If changes with respect to the project type or location become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions stated in this report are not correct, the geotechnical engineer should be notified for modifications to this report. Any items not specifically addressed in this report should comply with the California Building Code and the requirements of the governing jurisdiction.

The preliminary recommendations of this report are based upon the geotechnical conditions encountered during the investigation, and may be augmented by additional requirements of the architect/engineer, or by additional recommendations provided by the geotechnical engineer based on conditions exposed at the time of construction.

If Earth Systems Pacific is not retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising there from.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and his authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. Please do not hesitate to contact this office if you have any questions regarding this report.

Sincerely,

Earth Systems Pacific

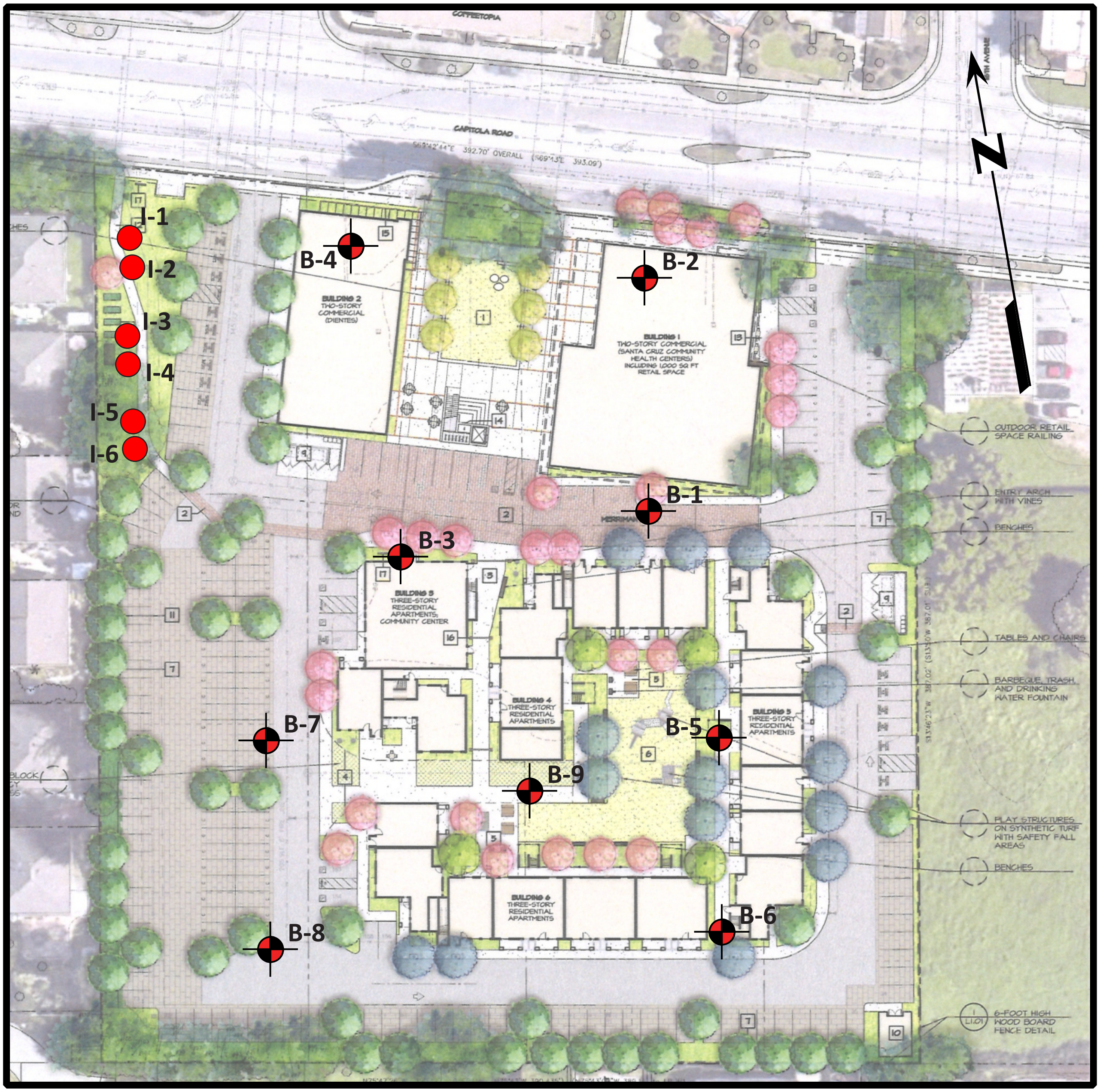
REGISTERED PROFESSIONAL ENGINEER
GEORGE J. BARNETT
GE2309
GEOTECHNICAL
STATE OF CALIFORNIA

George J. Barnett
Geotechnical Engineer

Phillip Penrose
Staff Engineer

Attachments: Boring and Infiltration Test Location Map
Boring Logs (9)
Laboratory Test Results
Infiltration Test Results

Doc. No.: 1810-133.SER.REV1/ev



B-9 Approximate boring location

I-6 Approximate infiltration test location

Base: Mid-Pen Housing Live Oak Town Center Mixed-Use, Landscape Site Plan, dated 10/30/2018

Earth Systems Pacific	MidPen Capitola Road Santa Cruz Site 1412, 1438, 1500 and 1514 Capitola Rd Santa Cruz, California	Boring and Infiltration Test Location Map 302482-001

Earth Systems Pacific

Boring No. 1

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

PAGE 1 OF 1
FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0–2.5	CL-ML	SANDY SILTY CLAY; hard, moist, dark yellow brown, fine-to-medium-grained sand [Fill?]	1.5-2.0	1-1	2.5" Mod Cal	106.6	8.8	16 30 25	4.5
2.5–6	SM	SILTY SAND; medium dense, moist, gray brown, fine-grained sand, some oxidation staining [Native]	4.0-4.5	1-2	2.5" Mod Cal	104.6	11.7	8 11 13	
6–11.5	CL	SANDY LEAN CLAY; very stiff, slightly moist, olive brown, fine-grained sand, some oxidation staining	9.5-10.0	1-3	2.5" Mod Cal	--	--	10 15 25	3.0
11.5–15	SW-SC	WELL-GRADED SAND with CLAY; dense, moist, dark yellow brown, trace fine-grained gravel	13.5-15.0	1-4	SPT			14 19 19	
15		Bottom of boring at 15' Groundwater was not encountered							

LEGEND: ■ 2.5" Mod Cal Sample ☐ 2.0" Cal Sample ● SPT ○ Bulk Sample Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0	CL-ML		SANDY SILTY CLAY; medium stiff, moist, brown, fine-grained sand [Organic]							
2				2.0-2.5	2-1	2.5" Mod Cal	--	--	6 5 5	1.5
2.5	SC		CLAYEY SAND; medium dense, moist, brown, fine-grained sand, some oxidation staining							
4.5				4.5-5.0	2-2	2.5" Mod Cal	111.2	15.3	5 10 8	
7	SM		SILTY SAND; medium dense, moist, yellow brown, fine-grained sand							
8.5				8.5-10.0	2-3	SPT			6 5 8	3.0
13.5				13.5-15.0	2-4	SPT			10 7 10	
15			Bottom of boring at 15' Groundwater was not encountered							

LEGEND: 2.5" Mod Cal Sample; 2.0" Cal Sample; SPT; Bulk Sample; Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

Boring No. 3

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0–2.5	CL-ML	SANDY SILTY CLAY; stiff, moist, dark brown, fine-grained sand [Organic]	0.0-5.0	Bag A	Bulk Sample				
			2.0-2.5	3-1	2.5" Mod Cal Sample	--	--	5 5 6	0.5
2.5–6.5	SC-SM	SILTY CLAYEY SAND; dense, moist, brown, fine-grained sand, some oxidation staining	4.5-5.0	3-2	2.5" Mod Cal Sample	104.6	19.5	10 20 32	4.5
		-increase in sand content							
6.5–11.5	ML	SANDY SILT; stiff, moist, olive brown, fine-grained sand	8.5-10.0	3-3	SPT			6 7 8	
11.5–15	SW	WELL-GRADED SAND; medium dense, moist, brown, trace fine-grained gravel	13.5-15.0	3-4	SPT			9 13 12	
15		Bottom of boring at 15' Groundwater was not encountered							

LEGEND: ■ 2.5" Mod Cal Sample ▭ 2.0" Cal Sample ● SPT ○ Bulk Sample ▽ Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

PAGE 1 OF 1
FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0	SC-SM		SILTY CLAYEY SAND; loose, moist, brown, fine-grained sand, trace rootlets, little oxidation staining	0.0-5.0	Bag B	Bulk Sample				
2				2.0-2.5	4-1	2.5" Mod Cal Sample	98.4	8.0	6 6 8	
3	SC		CLAYEY SAND; medium dense, moist, olive brown, fine-grained sand, heavy oxidation staining							
4.5				4.5-5.0	4-2	2.5" Mod Cal Sample	111.8	15.6	7 11 20	
6	SM		SILTY SAND; medium dense, moist, dark yellow brown, well-graded sand							
8.5				8.5-10.0	4-3	SPT			6 7 8	
12	SW		WELL-GRADED SAND; medium dense, slightly moist, brown, trace fine-grained gravel							
13.5				13.5-15.0	4-4	SPT			6 7 12	
15			Bottom of boring at 15' Groundwater was not encountered							

LEGEND: 2.5" Mod Cal Sample; 2.0" Cal Sample; SPT; Bulk Sample; Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 5

PAGE 1 OF 1

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0–3	CL-ML	SANDY SILTY CLAY; stiff, moist, yellow brown, fine-grained sand	2.0-2.5	5-1	2.5" Mod Cal Sample	98.7	16.1	8 10 11	4.5
3–6	ML	SANDY SILT; very stiff, moist, olive gray, fine-grained sand	4.5-5.0	5-2	2.5" Mod Cal Sample	113.7	16.0	9 14 32	4.5
6–12	SM	SILTY SAND; medium dense, moist, olive brown, fine-grained sand	8.5-10.0	5-3	SPT			6 8 12	
12–15	SW	WELL-GRADED SAND; medium dense, slightly moist, brown, trace fine-grained gravel	13.5-15.0	5-4	SPT			11 12 14	
15		Bottom of boring at 15' Groundwater was not encountered							

LEGEND: ■ 2.5" Mod Cal Sample ☐ 2.0" Cal Sample ● SPT ○ Bulk Sample Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 6

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0	SC-SM		SILTY CLAYEY SAND; loose, moist, dark yellow brown, fine-grained sand	0.0-5.0	Bag C	Bulk Sample				
1.5				1.5-2.0	6-1	2.5" Mod Cal Sample	104.2	10.4	6 6 8	
3	ML		SANDY SILT; hard, moist, olive brown, fine-grained sand							
4				4.0-4.5	6-2	2.5" Mod Cal Sample	103.6	15.7	5 29 50/3"	
5.5	SM		SILTY SAND; medium dense, moist, yellow brown, fine-grained sand							
8.5				8.5-10.0	6-3	SPT			9 15 13	
12			-very moist							
13.5				13.5-15.0	6-4	SPT			9 6 6	
15			Bottom of boring at 15' Groundwater was not encountered							

LEGEND: 2.5" Mod Cal Sample; 2.0" Cal Sample; SPT; Bulk Sample; Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 7

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0–2	CL-ML	SANDY SILTY CLAY; stiff, moist, dark brown, fine-grained sand [Organic]	0.0-5.0	Bag D	Bulk Sample				
			1.5-2.0	7-1	2.5" Mod Cal Sample	121.4	11.3	15 11 11	4.5
2–7	SC-SM	SILTY CLAYEY SAND; medium dense, moist, brown, fine-grained sand	4.5-5.0	7-2	2.5" Mod Cal Sample	--	--	6 10 11	4.5
		-color change to olive brown, heavy oxidation staining, increase in sand content							
7–11.5	SM	SILTY SAND; medium dense, moist, olive brown,fine-grained sand	8.5-10.0	7-3	SPT			5 6 7	
11.5–15	SW-SC	WELL-GRADED SAND with CLAY; medium dense, moist, dark yellow brown, trace fine-grained gravel	13.5-15.0	7-4	SPT			8 10 12	
15		Bottom of boring at 15' Groundwater was not encountered							

LEGEND: ■ 2.5" Mod Cal Sample □ 2.0" Cal Sample ● SPT ○ Bulk Sample ▽ Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 8

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0	CL-ML	SANDY SILTY CLAY; stiff, moist, dark brown, fine-to-medium-grained sand [Organic]	0.0-5.0	Bag E	Bulk Sample				
2			2.0-2.5	8-1	2.5" Mod Cal Sample	104.3	15.3	5 6 9	
2	SC	CLAYEY SAND; loose, moist, reddish brown, fine-grained sand							
3	SM	SILTY SAND; medium dense, moist, olive brown,fine-grained sand, oxidation staining						14 17 23	
4.5			4.5-5.0	8-2	2.5" Mod Cal Sample	112.3	15.6		
8.5			8.5-10.0	8-3	SPT			6 9 11	
11.5	SW	WELL-GRADED SAND; medium dense, moist, dark yellow brown, trace fine-grained gravel							
13.5			13.5-15.0	8-4	SPT			11 8 14	
15		Bottom of boring at 15' Groundwater was not encountered							

LEGEND: 2.5" Mod Cal Sample; 2.0" Cal Sample; SPT; Bulk Sample; Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 9

LOGGED BY: K. Ortiz
DRILL RIG: Mobile B-24
AUGER TYPE: 4" Solid Stem Auger

FILE NO.: 302482-001
DATE: 09/07/2018

MidPen Capitola Road Santa Cruz Site
1412, 1438, 1500, and 1514 Capitola Road
Santa Cruz, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE NUMBER	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.	POCKET PEN (t.s.f)
0	SC-SM		SILTY CLAYEY SAND; medium dense, slightly moist, yellow brown, fine-grained sand, oxidation staining							
1.5				1.5-2.0	9-1	2.5" Mod Cal	97.4	8.2	15 15 10	
3	CL		SANDY LEAN CLAY; hard, moist, olive brown,fine-grained sand, oxidation staining	3.5-4.0	9-2	2.5" Mod Cal	106.7	14.2	26 50/2"	
5	SM		SILTY SAND; medium dense, moist, dark yellow brown, fine-grained sand							
8.5				8.5-10.0	9-3	SPT			11 10 13	
13.5				13.5-15.0	9-4	SPT			6 8 7	
15			Bottom of boring at 15' Groundwater was not encountered							

LEGEND: 2.5" Mod Cal Sample; 2.0" Cal Sample; SPT; Bulk Sample; Groundwater

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

BULK DENSITY TEST RESULTS

ASTM D 2937-17 (modified for ring liners)

September 24, 2018

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
B-1	1.5 - 2.0	8.8	116.0	106.6
B-1	4.5 - 5.0	11.7	116.9	104.6
B-2	4.5 - 5.0	15.3	128.2	111.2
B-3	4.5 - 5.0	19.5	125.1	104.6
B-4	2.0 - 2.5	8.0	106.3	98.4
B-4	4.5 - 5.0	15.6	129.2	111.8
B-5	2.0 - 2.5	16.1	114.6	98.7
B-5	4.5 - 5.0	16.0	131.9	113.7
B-6	1.5 - 2.0	10.4	115.0	104.2
B-6	4.0 - 4.5	15.7	119.9	103.6
B-7	1.5 - 2.0	11.3	135.1	121.4
B-8	2.0 - 2.5	15.3	120.2	104.3
B-8	4.5 - 5.0	15.6	129.9	112.3
B-9	1.5 - 2.0	8.2	105.4	97.4
B-9	3.5 - 4.0	14.2	121.8	106.7

MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

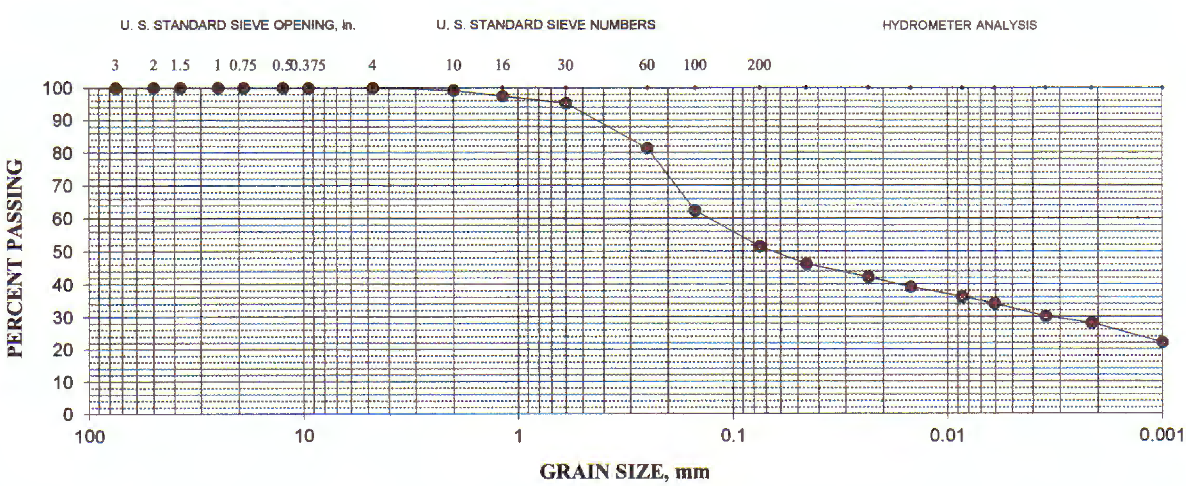
PARTICLE SIZE ANALYSIS

ASTM D 7928-17

Boring #3 @ 2.0 - 2.5'
Sandy Silty Clay (CL-ML)
LL = 17; PL = 13; PI = 4

September 24, 2018
Specific Gravity = 2.65 (assumed)
Gravel = 0%; Sand = 48%; Silt = 22%; Clay = 30%

Sieve size	% Retained	% Passing
3" (75.0-mm)	0	100
2" (50.0-mm)	0	100
1-1/2" (37.5-mm)	0	100
1" (25.0-mm)	0	100
3/4" (19.0-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	0	100
#10 (2.00-mm)	1	99
#16 (1.18-mm)	3	97
#30 (600-µm)	5	95
#60 (250-µm)	19	81
#100 (150-µm)	38	62
#200 (75-µm)	48	52
Hydrometer Analysis		
46-µm		46
23-µm		42
15-µm		39
9-µm		36
6-µm		34
3.5-µm		30
2.1-µm		28
Colloids		22



MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

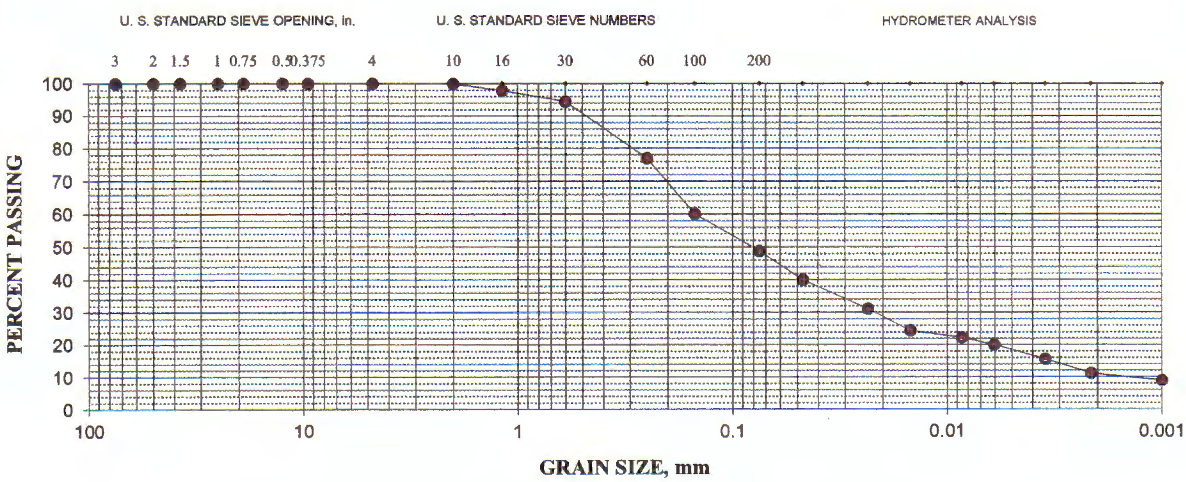
PARTICLE SIZE ANALYSIS

ASTM D 7928-17

Boring #7 @ 4.5 - 5.0'
Silty, Clayey Sand (SC)

September 24, 2018
Specific Gravity = 2.65 (assumed)
Gravel = 0%; Sand = 51%; Silt = 33%; Clay = 16%

Sieve size	% Retained	% Passing
3" (75.0-mm)	0	100
2" (50.0-mm)	0	100
1-1/2" (37.5-mm)	0	100
1" (25.0-mm)	0	100
3/4" (19.0-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	0	100
#10 (2.00-mm)	0	100
#16 (1.18-mm)	2	98
#30 (600-µm)	6	94
#60 (250-µm)	23	77
#100 (150-µm)	40	60
#200 (75-µm)	51	49
Hydrometer Analysis		
47-µm		40
23-µm		31
15-µm		24
9-µm		22
6-µm		20
3.5-µm		16
2.1-µm		11
Colloids		9



MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

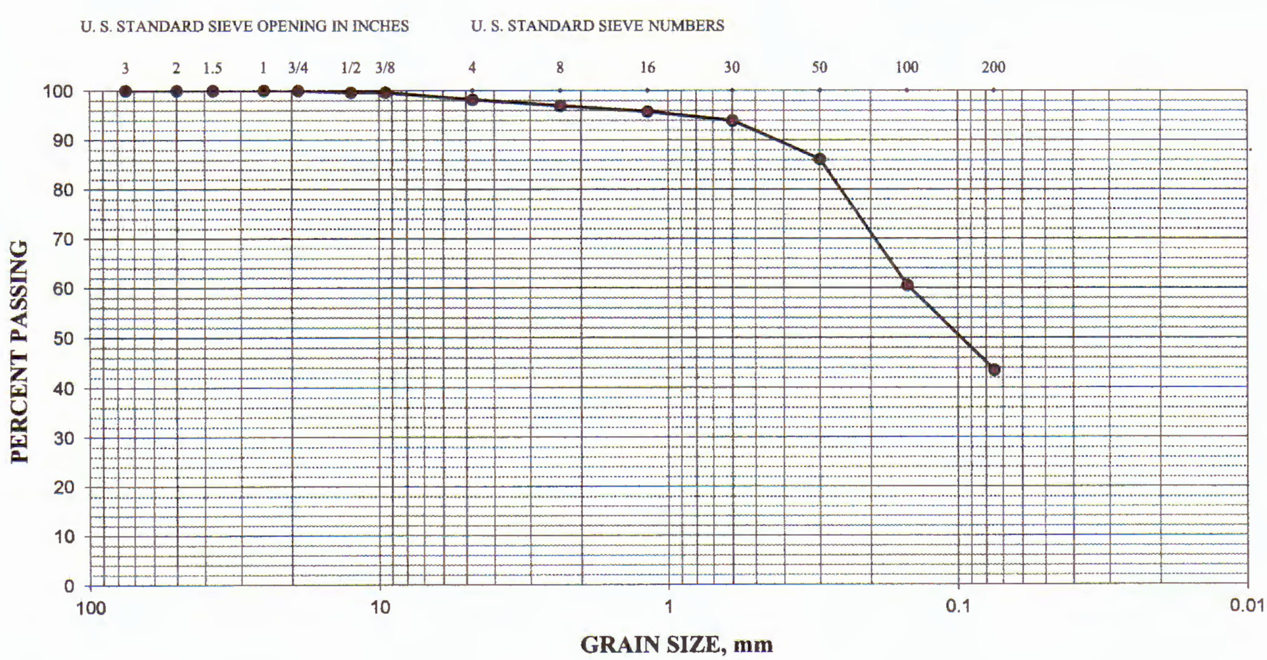
PARTICLE SIZE ANALYSIS

ASTM D 422-63/07; D 1140-17

Boring #7 @ 8.5 - 10.0'
Silty Sand (SM)

September 24, 2018

Sieve size	% Retained	% Passing
3" (75-mm)	0	100
2" (50-mm)	0	100
1.5" (37.5-mm)	0	100
1" (25-mm)	0	100
3/4" (19-mm)	0	100
1/2" (12.5-mm)	0	100
3/8" (9.5-mm)	0	100
#4 (4.75-mm)	2	98
#8 (2.36-mm)	3	97
#16 (1.18-mm)	4	96
#30 (600-µm)	6	94
#50 (300-µm)	14	86
#100 (150-µm)	40	60
#200 (75-µm)	57	43



MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

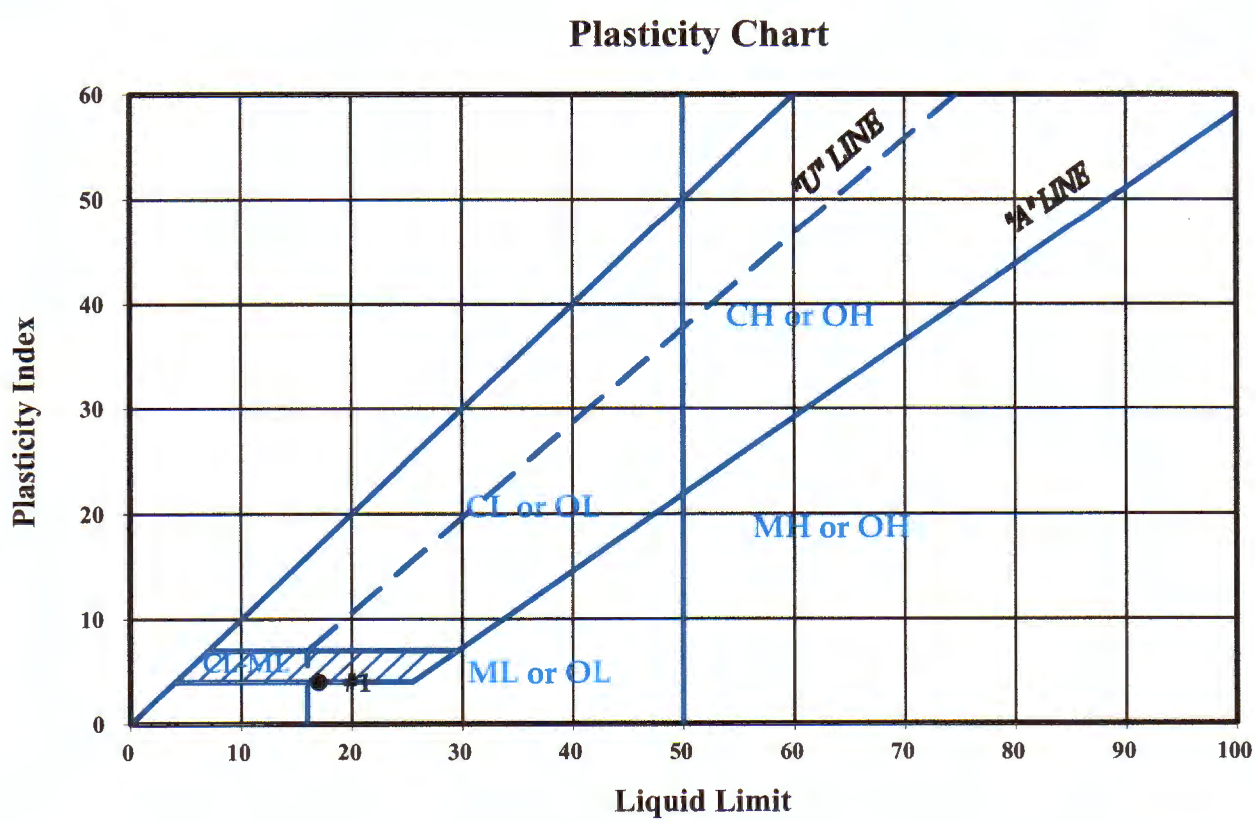
PLASTICITY INDEX

ASTM D 4318-17

Sandy Silty Clay (CL-ML)

September 24, 2018

Test No.:	1	2	3	4	5
Boring No.:	B-3				
Sample Depth:	2.0 - 2.5'				
Liquid Limit:	17				
Plastic Limit:	13				
Plasticity Index:	4				



MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

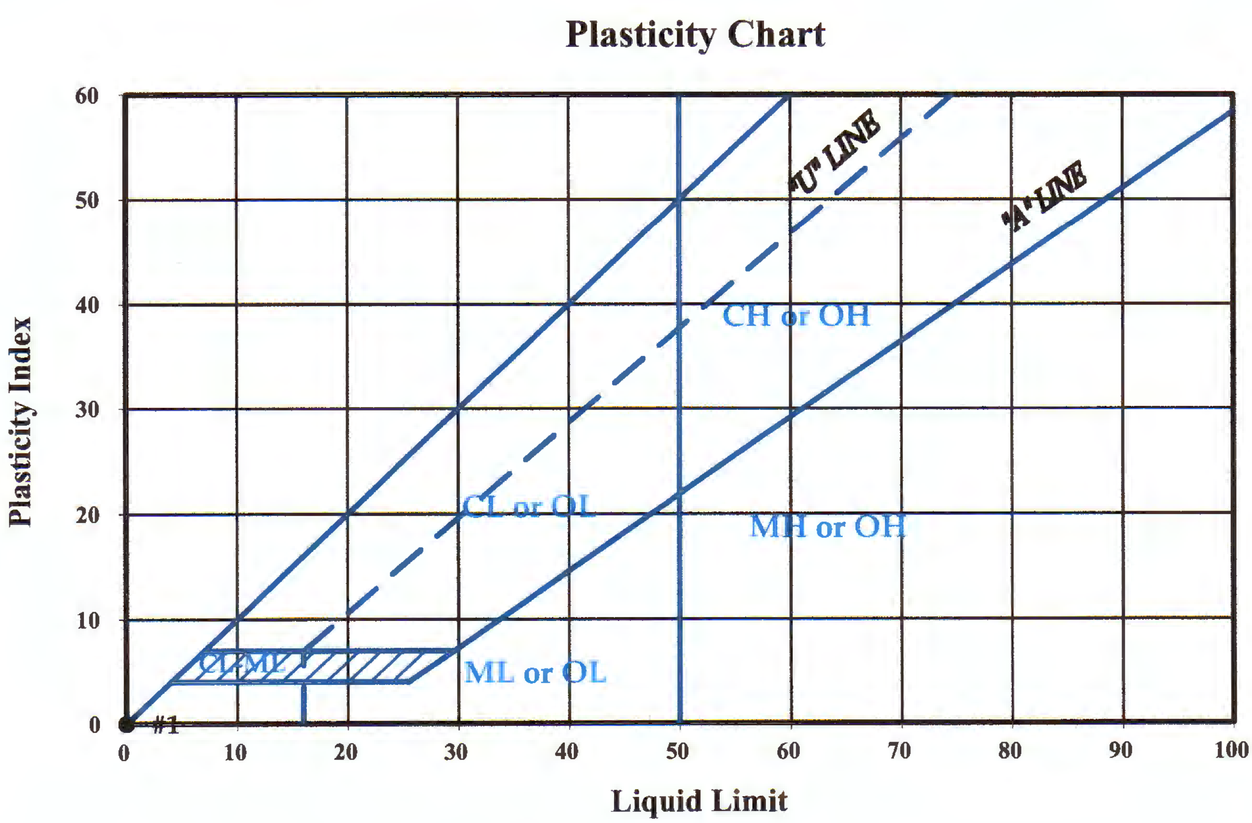
PLASTICITY INDEX

ASTM D 4318-17

Silty Clayey Sand (SC-SM)

September 24, 2018

Test No.:	1	2	3	4	5
Boring No.:	B-7				
Sample Depth:	4.5 - 5.0'				
Liquid Limit:	0				
Plastic Limit:	0				
Plasticity Index:	Non-Plastic				



MidPen Capitola Road
Santa Cruz Site

File No. 302482-001

UNCONFINED COMPRESSION ON COHESIVE SOIL

ASTM D 2166-16

September 24, 2018

Boring #2 @ 2.0 - 2.5'
Sandy Silty Clay (CL-ML)
Ring Sample
COMPRESSIVE STRENGTH: 9 psi (1,341 psf)

Dry Density: 98.5 pcf
Moisture Content: 9.2%
Degree Saturation: 35.9%
Specific Gravity: 2.65 (assumed)
H/D Ratio: 2.41

TIME (MINUTES)	DEFORM, in (X 1000)	AXIAL STRAIN	AREA (SQ. IN.)	APPLIED LOAD (LBS)	STRENGTH (PSI)	STRENGTH (PSF)
0.5	**20**	0.0035	4.45	16.8	4	544
1.0	**40**	0.0070	4.46	25.2	6	813
1.5	**60**	0.0105	4.48	33.6	8	1,081
2.0	**80**	0.0140	4.49	39.9	9	1,279
2.5	**100**	0.0175	4.51	42	9	1,341
3.0	**120**	0.0210	4.53	42	9	1,337
3.5	**140**	0.0245	4.54	39.9	9	1,265
4.0	**160**	0.0280	4.56	39.9	9	1,261
4.5	**180**	0.0315	4.57	33.6	7	1,058
5.0						
5.5						
6.0						
6.5						
7.0						
7.5						
8.0						
8.5						
9.0						
9.5						
10.0						
10.5						
11.0						
11.5						
12.0						
12.5						
13.0						
13.5						
14.0						
14.5						

MidPen Capitola Road
Santa Cruz Project

302482-001

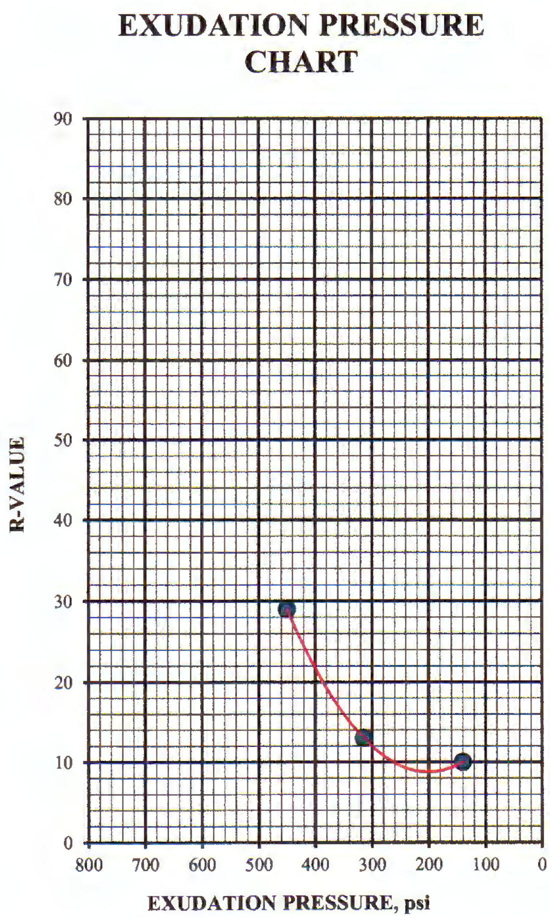
RESISTANCE '*R*' VALUE AND EXPANSION PRESSURE

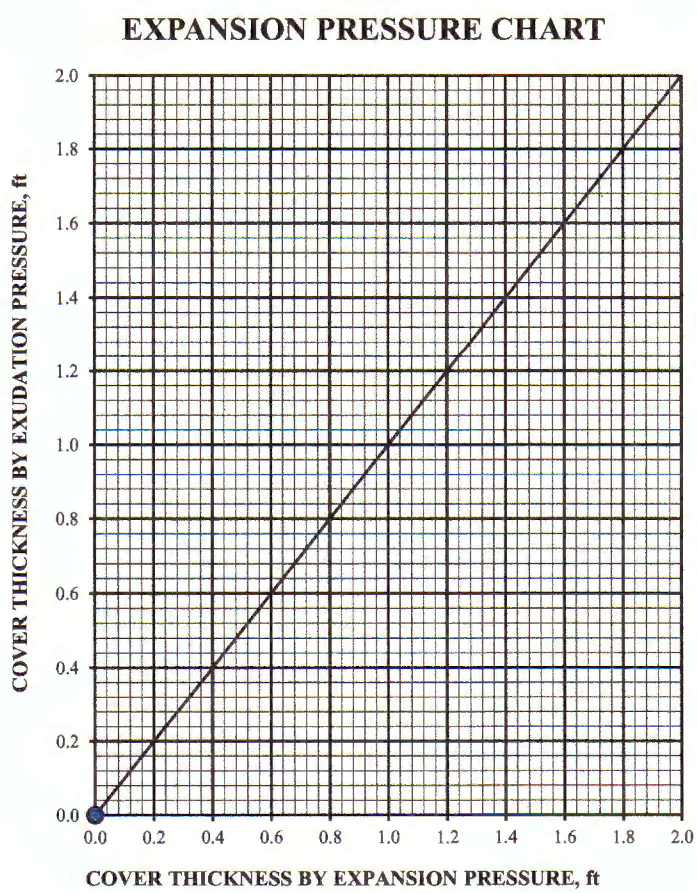
ASTM D 2844/D2844M-13

October 9, 2018

Boring #3 @ 0.0 - 5.0'
Sandy Silty Clay (CL-ML)

Dry Density @ 300 psi Exudation Pressure: 126.4-pcf
%Moisture @ 300 psi Exudation Pressure: 13.9%
R-Value - Exudation Pressure: 12
R-Value - Expansion Pressure: N/A
R-Value @ Equilibrium: 12





Project: MidPen Housing Santa Cruz

Project No. 302482-001

INFILTRATION TEST RESULTS

INFILTRATION TEST: I-1

PIPE DIMATER: 3 in

DATE DRILLED: 9/12/2018

TEST HOLE DIAMETER: 6 in

DATE TESTED: 9/18/2018

TEST HOLE DEPTH: 2.33 ft

TECHNICIAN: PP

RISER HEIGHT: 0.5 ft

CONSTANT HEAD DATA

Time of Constant Head: 30 minutes

Volume Added During Constant Head: 0.8 cubic feet

TEST DURATION: 2 hours

Reference of Measurement: Top of Riser

FALLING HEAD DATA

INTERVAL (Minutes)	READING (Feet)	INCREMENTAL FALL (Feet)	INFILTRATION RATE (Minutes / Inch)	INFILTRATION RATE (Inches / Hour)
Constant Head	0.70	---	---	---
15	1.15	0.45	2.8	21
15	1.31	0.16	7.8	7.7
15	1.40	0.09	14	4.3
15	1.49	0.09	14	4.3
15	1.54	0.05	25	2.4
15	1.60	0.06	21	2.9
15	1.64	0.04	31	1.9
15	1.66	0.02	63	1.0

Project: MidPen Housing Santa Cruz

Project No. 302482-001

INFILTRATION TEST RESULTS

INFILTRATION TEST: I-2

PIPE DIMATER: 3 in

DATE DRILLED: 9/12/2018

TEST HOLE DIAMETER: 6 in

DATE TESTED: 9/18/2018

TEST HOLE DEPTH: 2.33 ft

TECHNICIAN: PP

RISER HEIGHT: 0.5 ft

CONSTANT HEAD DATA

Time of Constant Head: 30 minutes

Volume Added During Constant Head: 1.1 cubic feet

TEST DURATION: 2 hours

Reference of Measurement: Top of Riser

FALLING HEAD DATA

INTERVAL (Minutes)	READING (Feet)	INCREMENTAL FALL (Feet)	INFILTRATION RATE (Minutes / Inch)	INFILTRATION RATE (Inches / Hour)
Constant Head	0.65	---	---	---
15	1.42	0.77	1.6	38
15	1.58	0.16	7.8	7.7
15	1.69	0.11	11	5.5
15	1.78	0.09	14	4.3
15	1.86	0.08	16	3.8
15	1.93	0.07	18	3.3
15	1.99	0.06	21	2.9
15	2.03	0.04	31	1.9

Project: MidPen Housing Santa Cruz

Project No. 302482-001

INFILTRATION TEST RESULTS

INFILTRATION TEST: I-3

PIPE DIMATER: 3 in

DATE DRILLED: 9/12/2018

TEST HOLE DIAMETER: 6 in

DATE TESTED: 9/18/2018

TEST HOLE DEPTH: 3.42 ft

TECHNICIAN: PP

RISER HEIGHT: 1.13 ft

CONSTANT HEAD DATA

Time of Constant Head: 30 minutes
Volume Added During Constant Head: 1.6 cubic feet

TEST DURATION: 2 hours
Reference of Measurement: Top of Riser

FALLING HEAD DATA

INTERVAL (Minutes)	READING (Feet)	INCREMENTAL FALL (Feet)	INFILTRATION RATE (Minutes / Inch)	INFILTRATION RATE (Inches / Hour)
Constant Head	1.11	---	---	---
15	2.52	1.41	0.89	67
15	2.86	0.34	3.7	16
15	3.03	0.17	7.4	8.1
15	3.17	0.14	8.9	6.7
15	3.30	0.13	9.6	6.3
Refill	1.09	---	---	---
15	2.31	1.22	1.0	60
15	2.69	0.38	3.3	18
15	2.87	0.18	6.9	8.7

Project: MidPen Housing Santa Cruz

Project No. 302482-001

INFILTRATION TEST RESULTS

INFILTRATION TEST: I-4

DATE DRILLED: 9/12/2018

DATE TESTED: 9/18/2018

TECHNICIAN: PP

PIPE DIMATER: 3 in

TEST HOLE DIAMETER: 6 in

TEST HOLE DEPTH: 4.50 ft

RISER HEIGHT: 0.67 ft

CONSTANT HEAD DATA

Time of Constant Head: 30 minutes

Volume Added During Constant Head: 2.0 cubic feet

TEST DURATION: 2 hours

Reference of Measurement: Top of Riser

FALLING HEAD DATA

INTERVAL (Minutes)	READING (Feet)	INCREMENTAL FALL (Feet)	INFILTRATION RATE (Minutes / Inch)	INFILTRATION RATE (Inches / Hour)
Hole did not hold water				

Project: MidPen Housing Santa Cruz

Project No. 302482-001

INFILTRATION TEST RESULTS

INFILTRATION TEST: I-5

PIPE DIMATER: 3 in

DATE DRILLED: 9/12/2018

TEST HOLE DIAMETER: 6 in

DATE TESTED: 9/18/2018

TEST HOLE DEPTH: 4.29 ft

TECHNICIAN: PP

RISER HEIGHT: 0.42 ft

CONSTANT HEAD DATA

Time of Constant Head: 30 minutes

Volume Added During Constant Head: 1.3 cubic feet

TEST DURATION: 2 hours

Reference of Measurement: Top of Riser

FALLING HEAD DATA

INTERVAL (Minutes)	READING (Feet)	INCREMENTAL FALL (Feet)	INFILTRATION RATE (Minutes / Inch)	INFILTRATION RATE (Inches / Hour)
Constant Head	0.55	---	---	---
15	1.81	1.26	0.99	61
15	2.21	0.40	3.1	19
15	2.43	0.22	5.7	11
15	2.58	0.15	8.3	7.2
15	2.70	0.12	10	6.0
15	2.79	0.09	14	4.3
15	2.83	0.04	31	1.9
15	2.86	0.03	42	1.4

Project: MidPen Housing Santa Cruz

Project No. 302482-001

INFILTRATION TEST RESULTS

INFILTRATION TEST: I-6

PIPE DIMATER: 3 in

DATE DRILLED: 9/12/2018

TEST HOLE DIAMETER: 6 in

DATE TESTED: 9/18/2018

TEST HOLE DEPTH: 2.38 ft

TECHNICIAN: PP

RISER HEIGHT: 0.33 ft

CONSTANT HEAD DATA

Time of Constant Head: 30 minutes

Volume Added During Constant Head: 1.1 cubic feet

TEST DURATION: 2 hours

Reference of Measurement: Top of Riser

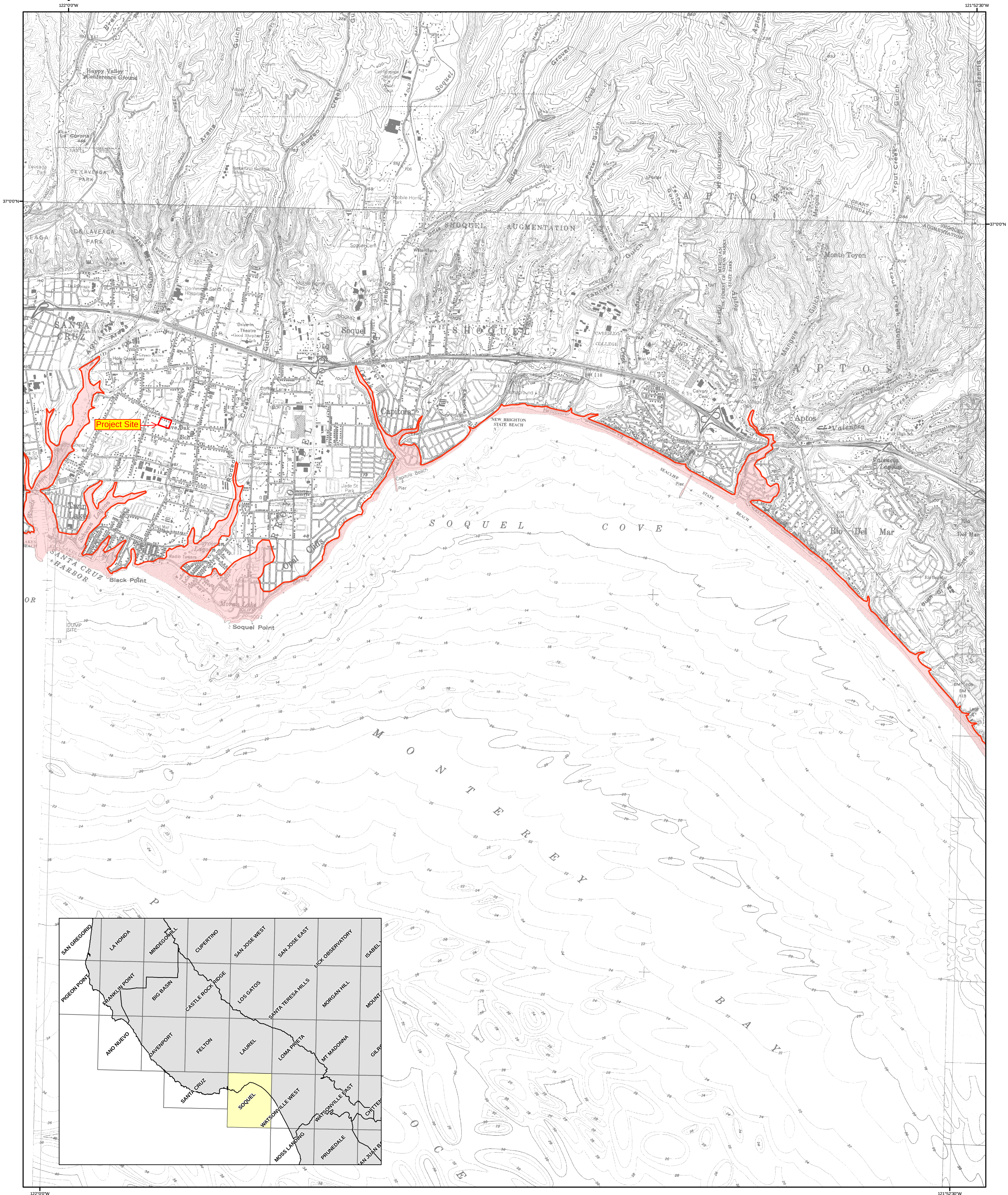
FALLING HEAD DATA

INTERVAL (Minutes)	READING (Feet)	INCREMENTAL FALL (Feet)	INFILTRATION RATE (Minutes / Inch)	INFILTRATION RATE (Inches / Hour)
Constant Head	0.46	---	---	---
15	1.65	1.19	1.1	55
15	1.99	0.34	3.7	16
15	2.18	0.19	6.6	9.1
15	2.30	0.12	10	6.0
Refill	0.55	---	---	---
15	1.51	0.96	1.3	46
15	1.82	0.31	4.0	15
15	2.01	0.19	6.6	9.1
15	2.14	0.13	9.6	6.3

California Emergency Management Agency
California Geological Survey
University of Southern California

Tsunami Inundation Map for Emergency Planning
Soquel Quadrangle

State of California
County of Santa Cruz



METHOD OF PREPARATION

Initial tsunami modeling was performed by the University of Southern California (USC) Tsunami Research Center funded through the California Emergency Management Agency (CalEMA) by the National Tsunami Hazard Mitigation Program. The tsunami modeling process utilized the MOST (Method of Splitting Tsunamis) computational program (Version 0), which allows for wave evolution over a variable bathymetry and topography used for the inundation mapping (Titov and Gonzalez, 1997; Titov and Synolakis, 1998).

The bathymetric/topographic data that were used in the tsunami models consist of a series of nested grids. Near-shore grids with a 3 arc-second (75- to 90-meters) resolution or higher, were adjusted to “Mean High Water” sea-level conditions, representing a conservative sea level for the intended use of the tsunami modeling and mapping.

A suite of tsunami source events was selected for modeling, representing realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides (Table 1). Local tsunami sources that were considered include offshore reverse-thrust faults, restraining bends on strike-slip fault zones and large submarine landslides capable of significant seafloor displacement and tsunami generation. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (1960 Chile and 1964 Alaska earthquakes) and others which can occur around the Pacific Ocean “Ring of Fire.”

In order to enhance the result from the 75- to 90-meter inundation grid data, a method was developed utilizing higher-resolution digital topographic data (3- to 10-meters resolution) that better defines the location of the maximum inundation line (U.S. Geological Survey, 1993; Intermap, 2003; NOAA, 2004). The location of the enhanced inundation line was determined by using digital imagery and terrain data on a GIS platform with consideration given to historic inundation information (Lander, et al., 1993). This information was verified, where possible, by field work coordinated with local county personnel.

The accuracy of the inundation line shown on these maps is subject to limitations in the accuracy and completeness of available terrain and tsunami source information, and the current understanding of tsunami generation and propagation phenomena as expressed in the models. Thus, although an attempt has been made to identify a credible upper bound to inundation at any location along the coastline, it remains possible that actual inundation could be greater in a major tsunami event.

This map does not represent inundation from a single scenario event. It was created by combining inundation results for an ensemble of source events affecting a given region (Table 1). For this reason, all of the inundation region in a particular area will not likely be inundated during a single tsunami event.

References:

Intermap Technologies, Inc., 2003, Intermap product handbook and quick start guide: Intermap NEXTmap document on 5-meter resolution data, 112 p.

Lander, J.F., Lockridge, P.A., and Kozuch, M.J., 1993, Tsunamis Affecting the West Coast of the United States 1806-1992: National Geophysical Data Center Key to Geophysical Record Documentation No. 29, NOAA, NESDIS, NGDC, 242 p.

National Atmospheric and Oceanic Administration (NOAA), 2004, Interferometric Synthetic Aperture Radar (IfSAR) Digital Elevation Models from GeoSAR platform (EarthData): 3-meter resolution data.

Titov, V.V., and Gonzalez, F.I., 1997, Implementation and Testing of the Method of Tsunami Splitting (MOST): NOAA Technical Memorandum ERL PMEL – 112, 11 p.

Titov, V.V., and Synolakis, C.E., 1998, Numerical modeling of tidal wave runup: Journal of Waterways, Port, Coastal and Ocean Engineering, ASCE, 124 (4), pp 157-171.

U.S. Geological Survey, 1993, Digital Elevation Models: National Mapping Program, Technical Instructions, Data Users Guide 5, 48 p.

TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

State of California ~ County of Santa Cruz

SOQUEL QUADRANGLE

July 1, 2009

SCALE 1:24,000

0.5 0.25 0 0.5 1 Miles

1,000 500 0 1,000 2,000 3,000 4,000 5,000 Feet

0.5 0.25 0 0.5 1 Kilometers

Table 1: Tsunami sources modeled for the Santa Cruz County coastline.

Sources (M = moment magnitude used in modeled event)		Areas of Inundation Map Coverage and Sources Used		
		Pescadero	Santa Cruz	Monterey Bay Big
Local Source	Monterey Canyon Landslide			X
Distant Sources	Cascadia Subduction Zone-full rupture (M9.0)		X	
	Central Aleutians Subduction Zone #1 (M8.9)	X	X	X
	Central Aleutians Subduction Zone #2 (M8.9)		X	
	Central Aleutians Subduction Zone #3 (M9.2)	X		X
	Chile North Subduction Zone (M9.4)		X	
	1960 Chile Earthquake (M9.3)		X	
	1964 Alaska Earthquake (M9.2)	X	X	X
	Japan Subduction Zone #2 (M8.8)		X	
	Kuril Islands Subduction Zone #2 (M8.8)		X	
	Kuril Islands Subduction Zone #3 (M8.8)		X	
	Kuril Islands Subduction Zone #4 (M8.8)		X	
	Marianas Subduction Zone (M8.6)	X		X

MAP EXPLANATION

Tsunami Inundation Line

Tsunami Inundation Area

PURPOSE OF THIS MAP

This tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only. This map, and the information presented herein, is not a legal document and does not meet disclosure requirements for real estate transactions nor for any other regulatory purpose.

The inundation map has been compiled with best currently available scientific information. The inundation line represents the maximum considered tsunami runup from a number of extreme, yet realistic, tsunami sources. Tsunamis are rare events; due to a lack of known occurrences in the historical record, this map includes no information about the probability of any tsunami affecting any area within a specific period of time.

Please refer to the following websites for additional information on the construction and/or intended use of the tsunami inundation map:

State of California Emergency Management Agency, Earthquake and Tsunami Program:
http://www.oes.ca.gov/WebPage/oeswebsite.nsf/Content/B1EC
51BA215931768825741F005E8D80?OpenDocument

University of Southern California – Tsunami Research Center:
http://www.usc.edu/dept/tsunamis/2005/index.php

State of California Geological Survey Tsunami Information:
http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/index.htm

National Oceanic and Atmospheric Agency Center for Tsunami Research (MOST model):
http://nctr.pmel.noaa.gov/time/background/models.html

MAP BASE

Topographic base maps prepared by U.S. Geological Survey as part of the 7.5-minute Quadrangle Map Series (originally 1:24,000 scale). Tsunami inundation line boundaries may reflect updated digital orthophotographic and topographic data that can differ significantly from contours shown on the base map.

DISCLAIMER