COUNTY OF SANTA CRUZ

PLANNING DEPARTMENT
701 OCEAN STREET, 4TH FLOOR, SANTA CRUZ, CA 95060
(831) 454-2580 FAX: (831) 454-2131 TDD: (831) 454-2123
KATHLEEN MOLLOY PREVISICH, PLANNING DIRECTOR
http://www.sccoplanning.com/

NOTICE OF DETERMINATION

To:

☒ County of Santa Cruz
Clerk of the Board
701 Ocean Street, Room 500
Santa Cruz, CA 95060

☒ Office of Planning and Research
State Clearinghouse
P.O. Box 3044
Sacramento, CA 95812-3044

Subject: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if applicable): 2014012044
Project Title: Nelson Road Reestablishment
Project Applicant: County of Santa Cruz
Project Location: Postmile marker 2.0, Nelson Road, in the Scotts Valley area.

Project Description:
The proposed project is the removal of the temporary access road crossing, restoration of the crossing area, and reestablishment of the permanent road adjacent to the previous alignment, Ruins Creek and the toe of the 2011 landslide. The scope of the work for the entire project shall consist of the following: excavation and backfill (2,675 cubic yards), two mechanically stabilized earth backfill (MSE) retaining walls, drainage culvert improvements, asphalt concrete pavement, erosion control, restoration of the creek channel, and removal of approximately 220 feet of the existing temporary bypass road where it crosses Ruins Creek, with associated upland and riparian revegetation,.

This is to advise that the County of Santa Cruz has approved the above described project on 2/20/2014 (Date) and has made the following determinations regarding the above described project:

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☐ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☒ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation Measures [☒ were ☐ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☒ was ☐ was not] adopted for this project.
5. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
6. Findings [☒ were ☐ were not] made pursuant to the provisions of CEQA.

This is to certify that the Final EIR with comments and responses and record of project approval, or the Negative Declaration, is available to the General Public at the following location:

County of Santa Cruz Planning Department
701 Ocean Street, 4th Floor
Santa Cruz, CA 95060

Signature — Environmental Coordinator (Title) — 2/20/2014 (Date)

February 28, 2014

Date Received for Filing at Clerk of the Board

Updated 12/11

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MITIGATED NEGATIVE DECLARATION

Project: Nelson Road Reestablishment **APN(S): 070-011-28**

Project Description: The proposed project is the removal of the temporary access road crossing, restoration of the crossing area, and reestablishment of the permanent road adjacent to the previous alignment, Ruins Creek and the toe of the 2011 landslide. The scope of the work for the entire project shall consist of the following: excavation and backfill (2,675 cubic yards), two mechanically stabilized earth backfill (MSE) retaining walls, drainage culvert improvements, asphalt concrete pavement, erosion control, restoration of the creek channel, and removal of approximately 220 feet of the existing temporary bypass road where it crosses Ruins Creek, with associated upland and riparian revegetation.

Project Location: Postmile marker 2.0, Nelson Road, in the Scotts Valley area.

Applicant: County of Santa Cruz

Staff Planner: Matt Johnston

This project will be This project will be administratively considered by the project planner after the comment period is complete.

California Environmental Quality Act Mitigated Negative Declaration Findings:

Find, that this Mitigated Negative Declaration reflects the decision-making body's independent judgment and analysis, and; that the decision-making body has reviewed and considered the information contained in this Mitigated Negative Declaration and the comments received during the public review period; and, that revisions in the project plans or proposals made by or agreed to by the project applicant would avoid the effects or mitigate the effects to a point where clearly no significant effects would occur; and, on the basis of the whole record before the decision-making body (including this Mitigated Negative Declaration) that there is no substantial evidence that the project as revised will have a significant effect on the environment. The expected environmental impacts of the project are documented in the attached Initial Study on file with the County of Santa Cruz Planning Department located at 701 Ocean Street, 4th Floor, Santa Cruz, California. A digital copy of the document can be reviewed at the following web address:

http://www.sccoplanning.com/

Required Mitigation Measures or Conditions:

☐ None

☒ Are Attached

Review Period Ends: February 19, 2014

Note: This Document is considered Draft until it is Adopted by the Appropriate County of Santa Cruz Decision-Making Body

Date: 1/15/14

MATT JOHNSTON, Environmental Coordinator
(831) 454-3201

NAME: Nelson Road Reestablishment
APPLICATION: 131330
A.P.N: County Right of Way, 070-011-28

NEGATIVE DECLARATION MITIGATIONS

A. In order to ensure that the mitigation measures and conditions set forth in the proposed project description are communicated to the various parties responsible for constructing the project, prior to any disturbance on the property the applicant shall convene a pre-construction meeting on the site. The following parties shall attend: The project engineer, project contractor supervisor, Santa Cruz County Environmental Planning staff, and project biologists. Results of pre-construction biotic surveys will be collected at that time and all protection measures shall be inspected.

B. Work done in and around the active channel has the potential to impact water quality. In order to prevent impacts to water quality, in channel work associated with the removal of the temporary bypass shall be timed to be completed when the channel is dry, and all erosion and sediment control measures shall be in place prior to the first predicted rain event.

C. Suitable nesting habitat for special-status and non-listed, native bird species is present on the study area. Direct removal of vegetation, noise and other disturbance during construction, could adversely impact nesting birds, if present, which could result in nest abandonment. In order to reduce potential impacts to special-status and non-listed, native bird species to less than significant, the following mitigations shall be implemented:

1. If work in any project site area must commence during the breeding season (February 1 to August 31), a qualified biologist shall conduct a pre-construction breeding bird survey throughout areas of suitable habitat within 300 feet of the work area within 15 days prior to the onset of any construction activity. If bird nests are observed within a project work area or surrounding buffer, an appropriate buffer zone shall be established around all active nests to protect nesting adults and their young from construction disturbance. The size and configuration of buffer zones shall be determined by a qualified biologist in consultation with CDFG based on the site conditions and the species potentially impacted. Work within the buffer zone shall be postponed until all the young are fledged, as determined by a qualified biologist.

D. In order to reduce potential impacts from the accidental release of hazardous materials into the riparian corridor, the following mitigation would be implemented: A spill prevention and response plan including all appropriate products will be available at the project site during the course of construction activities, and the staging area(s) will be a minimum of 50 feet from any stream.

E. In order to reduce the impacts on the residents in the project vicinity due to excessive noise, operation of heavy machinery and other construction-related activities that may generate loud noises will be limited to between the hours of 8:30 A.M. and 4:30 P.M.

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CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) ENVIRONMENTAL REVIEW INITIAL STUDY

Date January 13, 2014 **Application Number:** 131330

Staff Planner: Matt Johnston

I. OVERVIEW AND ENVIRONMENTAL DETERMINATION

APPLICANT: Santa Cruz County Department of Public Works

APN(s): 070-011-28, County Right of Way

OWNER: Eclectia and Santa Cruz County

SUPERVISORAL DISTRICT: Bruce McPherson Fifth District

PROJECT LOCATION: The project is located at the terminus of the County maintained portion of Nelson Road, in the unincorporated portion of Santa Cruz County, near the City of Scotts Valley. From Highway 17 south, exit Mt Herman Road west. At the far end of the city limits, turn right on Lockhart Gulch, and right onto Nelson Road. Continue 2 miles to the slide.

SUMMARY PROJECT DESCRIPTION:

The proposed project is the removal of the temporary access road crossing, restoration of the crossing area, and reestablishment of the permanent road adjacent to the previous alignment, Ruins Creek and the toe of the 2011 landslide. The scope of the work for the entire project shall consist of the following: excavation and backfill (2,675 cubic yards), two mechanically stabilized earth backfill (MSE) retaining walls, drainage culvert improvements, asphalt concrete pavement, erosion control, restoration of the creek channel, and removal of approximately 220 feet of the existing temporary bypass road where it crosses Ruins Creek, with associated upland and riparian revegetation (Attachment 1).

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED: All of the following potential environmental impacts are evaluated in this Initial Study. Categories that are marked have been analyzed in greater detail based on project specific information.

- ☒ Geology/Soils
- ☐ Hydrology/Water Supply/Water Quality
- ☒ Biological Resources
- ☐ Agriculture and Forestry Resources
- ☐ Noise
- ☐ Air Quality
- ☐ Greenhouse Gas Emissions
- ☐ Public Services

- ☐ Mineral Resources
- ☐ Visual Resources & Aesthetics
- ☐ Cultural Resources
- ☐ Hazards & Hazardous Materials
- ☐ Transportation/Traffic
- ☐ Recreation
- ☐ Utilities & Service Systems
- ☐ Land Use and Planning
- ☐ Population and Housing
- ☐ Mandatory Findings of Significance

DISCRETIONARY APPROVAL(S) BEING CONSIDERED:

- ☐ General Plan Amendment
- ☐ Land Division
- ☐ Rezoning
- ☐ Development Permit
- ☐ Coastal Development Permit
- ☐ Grading Permit
- ☒ Riparian Exception
- ☐ Other:

NON-LOCAL APPROVALS

Other agencies that may issue permits or authorizations:

Regional Water Quality Control Board (Section 401)

US Army Corp of Engineers (Nationwide Permit #27)

California Department of Fish and Wildlife (Streambed Alteration Agreement)

DETERMINATION: (To be completed by the lead agency)
On the basis of this initial evaluation:

- ☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
- ☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
- ☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
- ☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
- ☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed

adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Matthew Johnston
Environmental Coordinator

1/15/14
Date

II. BACKGROUND INFORMATION

EXISTING SITE CONDITIONS

Parcel Size: NA
Existing Land Use: Residential, public works facilities (streets, sewer, open space)
Vegetation: Riparian trees (alder, willows) and understory, oak woodland
Slope in area affected by project: ☒ 0 - 30% ☒ 31 – 100%
Nearby Watercourse: Ruins Creek
Distance To: A portion of the project would occur within the active channel of Ruins Creek and along the adjacent streambanks. The majority of the new roadway would be at the toe of the slide in ruderal scrub and oak woodland habitat.

ENVIRONMENTAL RESOURCES AND CONSTRAINTS

Water Supply Watershed: Yes
Groundwater Recharge: No
Timber or Mineral: No
Agricultural Resource: No
Biologically Sensitive Habitat: Yes
Fire Hazard: Yes
Floodplain: Yes
Erosion: Yes
Landslide: Yes
Liquefaction: No

Fault Zone: No
Scenic Corridor: No
Historic: No
Archaeology: No
Noise Constraint: No
Electric Power Lines: Yes
Solar Access: Yes
Solar Orientation: Multiple aspects
Hazardous Materials: No
Other:

SERVICES

Fire Protection: Scotts Valley
School District: N/A
Sewage Disposal: N/A

Drainage District: Zone 6
Project Access: Nelson Road
Water Supply: N/A

PLANNING POLICIES

Zone District: Agricultural (A), and County Right of Way
General Plan: Mountain Residential (R-M)

Special Designation:

Urban Services Line: ☐ Inside ☒ Outside
Coastal Zone: ☐ Inside ☒ Outside

ENVIRONMENTAL SETTING AND SURROUNDING LAND USES:

The project is the reestablishment of Nelson Road at the toe of a large slide that covered the existing roadway. Nelson Road is a rural road that runs parallel to Ruins Creek in a valley in the Santa Cruz Mountains. The area between the existing roadway and the creek channel was used by the residents as a goat corral and small barn adjacent to a mature riparian corridor. The 2011 slide that covered the road damaged the goat area as well. The proposed project would remove the damaged structures and reestablish the roadway along the toe of the debris flow. The project would also remove the temporary bypass from the stream channel and restore it to native riparian habitat.

PROJECT BACKGROUND:

Nelson Road at post mile 2.0 was blocked by a massive landslide on March 21, 2011, during the March 2011 Storms Event. The roughly 350-foot-long section of blocked road lies just south of Sky Meadow Lane (a private roadway) and provides access to over 30 residences north of the landslide.

Immediately following the slide, a temporary emergency access bypass was installed across Ruins Creek to provide vehicular access to the residents living upstream of the slide. A Focused Engineering Geologic Investigation was prepared by Pacific Geotech Engineering in December of 2011 (Attachment 2). This investigation considered various alternatives to reestablishing Nelson Road and identified two preferred alternatives; finding an alternative access to the valley beyond the slide that avoids the slide area completely, or reestablishing the roadway between Ruins Creek and the toe of the slide. The first option would formalize the existing emergency bypass through the center of a private community who have expressed opposition to this option and could only be done through eminent domain. It would result in the permanent impacts to the riparian corridor that would otherwise be avoided, would create non-conforming setback issues on the existing houses that are currently conforming to County codes, and would put a roadway through what was a communal children's play area. The second alternative avoids sensitive habitat to a greater degree and is supported by the community.

DETAILED PROJECT DESCRIPTION:

The permanent bypass road would be constructed between Ruins Creek and the toe of the 2011 landslide.

The scope of the work would consist of the following: excavation and backfill, two mechanically stabilized earth backfill (MSE) retaining walls, drainage improvements, energy dissipaters, asphalt concrete pavement, erosion control, revegetation, and removal of approximately 220 feet of the existing temporary bypass road where it crosses Ruins Creek.

The two mechanically stabilized earth backfill (MSE) retaining walls include a 35-foot long wall between the road and the creek and 325-foot long wall on the upland side of the road.

The project would require removing one live oak tree and several dead trees, as well as removal of a willow patch and limb trimming of other trees. The new road would not require any work within the creek channel, but removal of the temporary creek crossing would require removal of the culvert and rip rap in the channel. The project is expected to take approximately 12 weeks to complete.

III. ENVIRONMENTAL REVIEW CHECKLIST

A. GEOLOGY AND SOILS

Would the project:

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
1. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
A. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
B. Strong seismic ground shaking?	☐	☐	☒	☐
C. Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
D. Landslides?	☐	☐	☒	☐

Discussion (A through D): A Focused Engineering Geologic Investigation was prepared by Pacific Geotech Engineering in December of 2011 (Attachment 2). The report makes some recommendations regarding surface water control and location of the proposed roadway that have been incorporated into the project design. The incorporation of these measures ensures the potential for impacts to people or structures would be less than significant.

All of Santa Cruz County is subject to some hazard from earthquakes and the project site is likely to be subject to strong seismic shaking during the life of the improvements. However, the project site is not located within or adjacent to a County or state mapped fault zone, therefore the potential for ground surface rupture is low.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
2. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☒	☐

Discussion: The proposed project is the reestablishment of a roadway through a slide debris apron, which is inherently unstable. The Geologic report identifies measures to stabilize or avoid the area of proposed roadway alignment to a degree that the potential for failure is less than significant. These measures have been incorporated into the proposed project, therefore, this impact would be considered less than significant.

3. Develop land with a slope exceeding 30%?	☐	☐	☐	☒

Discussion: No improvements are proposed on slopes in excess of 30%.

4. Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐

Discussion: The potential for erosion exists during the construction phase of the project and shortly thereafter. A Stormwater Pollution Prevention Plan is a requirement of the proposed project and would address the potential for storm-related sediment erosion. In addition, erosion and sediment control Best Management Practices (BMP's) would be installed and monitored during and after construction activities are completed.

5. Be located on expansive soil, as defined in Section 1802.3.2 of the California Building Code (2007), creating substantial risks to life or property?	☐	☐	☐	☒

Discussion: There is no indication that the development site is subject to substantial risk caused by expansive soils.

6. Place sewage disposal systems in areas dependent upon soils incapable of adequately supporting the use of septic tanks, leach fields, or alternative waste water disposal systems where sewers are not available?	☐	☐	☐	☒

Discussion: This project does not include the use of any on-site sewage disposal system.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
7. Result in coastal cliff erosion?	☐	☐	☐	☒

Discussion: The proposed project is not located in the vicinity of a coastal cliff or bluff; and therefore, would not contribute to coastal cliff erosion.

B. HYDROLOGY, WATER SUPPLY, AND WATER QUALITY

Would the project:

1. Place development within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☒	☐

Discussion: This reach of Ruins Creek is not mapped for flood hazard on any of the flood maps; therefore, no development is proposed to be placed within a mapped 100-year flood hazard area. The proposed project includes the removal of the temporary stream crossing, which would be a beneficial impact on channel capacity, and the construction of an energy dissipater above the average high water mark.

2. Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☒	☐

Discussion: The project proposed would remove a culvert, RSP, and fill material from within a 100-year flood hazard area.

3. Be inundated by a seiche, tsunami, or mudflow?	☐	☐	☒	☐

Discussion: While this project area has been inundated by debris from a slide, there is no drainage or source of water that might lead to a debris flow, and the project is well outside of any coastal influence.

4. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☒

Discussion: The project involves the reestablishment of a roadway and would not

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

impact groundwater supplies or recharge.

5. Substantially degrade a public or private water supply? (Including the contribution of urban contaminants, nutrient enrichments, or other agricultural chemicals or seawater intrusion). ☐ ☐ ☐ ☒

Discussion: The project involves the reestablishment of a roadway and would not impact any public or private water supplies.

6. Degrade septic system functioning? ☐ ☐ ☐ ☒

Discussion: There is no indication that existing septic systems in the area would be affected by the project.

7. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding, on- or off-site? ☐ ☐ ☒ ☐

Discussion: The removal of the temporary stream crossing would reestablish the historic drainage within the Ruins Creek channel. Measures identified in the geologic report to divert sheet flow away from the debris slope in order to minimize surface water infiltration into the existing landslide mass are minor in nature and would have no effect on flood peak levels in Ruins Creek. They include filling cracks and smoothing the surface to encourage sheet flow away from the slide mass.

8 Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems, or provide substantial additional sources of polluted runoff? ☐ ☐ ☐ ☒

Discussion: This project would not create or contribute any runoff beyond the existing roadway.

9. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or ☐ ☐ ☒ ☐

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

dam?

Discussion: There are no levees or dams associated neither with this project nor in the vicinity of the project that could be impacted by work proposed.

10.	Otherwise substantially degrade water quality?	☐	☒	☐	☐

Discussion: Removal of the temporary crossing would take vehicles out of the riparian corridor. This is a beneficial impact on water quality.

Potentially Significant Impact 1: Work done in and around the active channel has the potential to impact water quality.

Mitigation Measure 1: In channel work associated with the removal of the temporary bypass shall be timed to be completed when the channel is dry, and all erosion and sediment control measures shall be in place prior to the first predicted rain event.

With the implementation of this measure, the impact of the proposed projects upon water quality would be less than significant.

C. BIOLOGICAL RESOURCES

Would the project:

1.	Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game, or U.S. Fish and Wildlife Service?	☐	☒	☐	☐

Discussion: A Biotic Report was prepared for this project by Biotic Resources Group, dated August 12, 2013 (Attachment 3). This report has been reviewed and accepted by the Planning Department (Environmental Section). The biotic report determined that there was no indication that listed plants or animals would be present in the project location, but that there was potential for impacts to nesting birds, and potential downstream impacts to steelhead.

Potentially Significant Impact 1: Suitable nesting habitat for special-status and non-listed, native bird species is present on the study area. Direct removal of vegetation, noise and other disturbance during construction, could adversely impact nesting birds, if present, which could result in nest abandonment.

Mitigation Measure 1*:* If work in any project site area must commence during the breeding season (February 1 to August 31), a qualified biologist shall conduct a pre-construction breeding bird survey throughout areas of suitable habitat within 300 feet of the work area within 15 days prior to the onset of any construction activity. If bird nests

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

are observed within a project work area or surrounding buffer, an appropriate buffer zone shall be established around all active nests to protect nesting adults and their young from construction disturbance. The size and configuration of buffer zones shall be determined by a qualified biologist in consultation with California Department of Fish and Wildlife (CDFW) based on the site conditions and the species potentially impacted. Work within the buffer zone shall be postponed until all the young are fledged, as determined by a qualified biologist.

Ruins Creek is a tributary to Bean Creek and the San Lorenzo River, both known to support steelhead and coho salmon. Downstream barriers prevent anadromous fish from reaching the project site, and the intermittent nature of the stream in this reach precludes the presence of resident trout.

Potential Significant Impact 2: Sediment associated with the roadway construction or the removal of the crossing could have an impact on downstream fish habitat.

Mitigation Measure 2: In channel work associated with the removal of the temporary bypass shall be timed to be completed when the channel is dry, and all erosion and sediment control measures shall be in place prior to the first predicted rain event. With the implementation of this measure, the impact of the proposed projects upon downstream fish habitat would be less than significant.

2.	Have a substantial adverse effect on any riparian habitat or sensitive natural community identified in local or regional plans, policies, regulations (e.g., wetland, native grassland, special forests, intertidal zone, etc.) or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☒	☐

Discussion: The project biotic report identifies impacts to 2,850 square feet of riparian habitat and oak woodland for construction access and roadway clearance, and 500 square feet of impact to the channel related to the removal of the stream crossing. The proposed project includes a restoration and revegetation plan that includes the planting of at least 100 willow stakes, 5 dogwood trees, and 15 oak trees to replace the single willow tree and five oak trees to be removed. It also includes native shrub species and seed mix sufficient to cover all exposed soils, with shrubs planted at 3, 6, or 8-foot on center depending upon the species. With the limited area of impact, the reestablishment of the stream channel where the crossing is to be removed and the revegetation of all exposed soils that result from the project, the impacts to oak woodland and riparian habitat are determined to be less than significant.

3.	Interfere substantially with the movement of any native resident or	☐	☐	☒	☐

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native or migratory wildlife nursery sites?

Discussion: The riparian corridor functions as a wildlife corridor even though fish are not present. However, given the limited scope of in-channel work and the avoidance otherwise of the corridor, and the restoration of the channel and revegetation of the associated riparian and upland habitat, the impacts to migration or species movements would be considered less than significant.

4.	Produce nighttime lighting that would substantially illuminate wildlife habitats?	☐	☐	☐	☒

Discussion: The project would not produce any nighttime lighting.

5.	Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐

Discussion: The biotic report and associated wetland delineation identified two small patches on in-channel wetlands both upstream and downstream of the temporary crossing. The report determined that the project would not impact these wetlands. The removal of the stream crossing will take place within the jurisdiction of the Army Corps of Engineers, and a Nationwide Permit #27 for aquatic habitat restoration would be obtained.

6.	Conflict with any local policies or ordinances protecting biological resources (such as the Sensitive Habitat Ordinance, Riparian and Wetland Protection Ordinance, and the Significant Tree Protection Ordinance)?	☐	☐	☐	☒

Discussion: The portions of the proposed project that require a riparian exception from the County Planning Department encompass the removal of the temporary crossing and the construction of a retaining wall to support the reestablished roadway. In order to comply with the Riparian Ordinance, the following findings would have to be made:

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

1. That there are special circumstances or conditions affecting the property.

   This finding can be made in that the existing public access cross through private property and the existing right f way can be reestablished.

2. That the exception is necessary for the proper design and function of some permitted or existing activity on the property.

   This finding can be made in that the retaining wall is necessary for the proper design and function of the proposed roadway. The permit that allowed the temporary bypass required that it be removed with the reestablishment of the roadway.

3. That the granting of the exception will not be detrimental to the public welfare or injurious to other property downstream or in the area in which the project is located.

   This finding can be made in that the removal of the crossing will be beneficial to downstream properties and habitat by removing an artificial impediment to stream flow and taking vehicular traffic out of the riparian corridor.

4. That the granting of the exception, in the Coastal Zone, will not reduce or adversely impact the riparian corridor, and there is no feasible less environmentally damaging alternative.

   This project is not located within the Coastal Zone.

5. That the granting of the exception is in accordance with the purpose of this chapter, and with the objectives of the General Plan and elements thereof, and the Local Coastal Program Land Use Plan.

   This project has been designed to enhance the riparian habitat and reestablish safe access to residents in the Upper Ruins Creek Watershed, in accordance with the objectives of the General Plan.

By securing a Riparian Exception from the County Planning Department, this project would be in conformance with all County codes.

7.	Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion: The proposed project would not conflict with the provisions of any adopted Habitat Conservation Plan Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. Therefore, no impact would occur.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

D. AGRICULTURE AND FOREST RESOURCES

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:

1.	Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒

Discussion: The project site does not contain any lands designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency. In addition, the project does not contain Farmland of Local Importance. Therefore, no Prime Farmland, Unique Farmland, Farmland of Statewide or Farmland of Local Importance would be converted to a non-agricultural use. No impact would occur from project implementation.

2.	Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☒	☐

Discussion: The project site is zoned agricultural, and the area that the proposed road alignment would take was used for the raising of goats. However, the slide impacted this area such that the infrastructure and space used for the animals was covered to a large extent by slide debris and was no longer useful for this purpose. Additionally, the project site's land is not under a Williamson Act Contract. Therefore, the project does not conflict with existing zoning for agricultural use, or a Williamson Act Contract. The impact is considered to be less than significant.

3.	Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by	☐	☐	☐	☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

Government Code Section 51104(g))?

Discussion: The project is not adjacent to land designated as Timber Resource.

4.	Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒

Discussion: No forest land occurs on the project site or in the immediate vicinity. No impact is anticipated.

5.	Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

Discussion: The proposed project would not change access to the upper Nelson Road area. Therefore, no impact is anticipated from project implementation.

E. MINERAL RESOURCES

Would the project:

1.	Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒

Discussion: The site does not contain any known mineral resources that would be of value to the region and the residents of the state. Therefore, no impact is anticipated from project implementation.

2.	Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion: The project site is zoned agricultural, which is not considered to be an Extractive Use Zone (M-3) nor does it have a Land Use Designation with a Quarry Designation Overlay (Q) (County of Santa Cruz 1994). Therefore, no potentially significant loss of availability of a known mineral resource of locally important mineral resource recovery (extraction) site delineated on a local general plan, specific plan or other land use plan would occur as a result of this project.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

F. VISUAL RESOURCES AND AESTHETICS

Would the project:

1. Have an adverse effect on a scenic vista? ☐ ☐ ☐ ☒

Discussion: Nelson Road is not considered a scenic resource.

2. Substantially damage scenic resources, within a designated scenic corridor or public view shed area including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway? ☐ ☐ ☐ ☒

Discussion: Refer to F.1. above.

3. Substantially degrade the existing visual character or quality of the site and its surroundings, including substantial change in topography or ground surface relief features, and/or development on a ridgeline? ☐ ☐ ☒ ☐

Discussion: This project would improve the visual character of the riparian corridor by removing the existing temporary stream crossing and restoring the disturbed riparian habitat.

4. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area? ☐ ☐ ☐ ☒

Discussion: This project does not include a source of light and would not affect either day or nighttime views in the area.

G. CULTURAL RESOURCES

Would the project:

1. Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5? ☐ ☐ ☐ ☒

Discussion: A review of the County of Santa Cruz historic resources list shows that there are no known historic resources on the subject parcel.

2. Cause a substantial adverse change in the significance of an archaeological ☐ ☐ ☐ ☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

resource pursuant to CEQA Guidelines Section 15064.5?

Discussion: The County of Santa Cruz GIS mapping system archeological resources layer does not map the subject parcel has a potential archeological site. Pursuant to County Code Section 16.40.040, if at any time in the preparation for or process of excavating or otherwise disturbing the ground, any human remains of any age, or any artifact or other evidence of a Native American cultural site which reasonably appears to exceed 100 years of age are discovered, the responsible persons shall immediately cease and desist from all further site excavation and comply with the notification procedures given in County Code Chapter 16.40.040.

3.	Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

Discussion: Pursuant to Section 16.40.040 of the Santa Cruz County Code, if at any time during site preparation, excavation, or other ground disturbance associated with this project, human remains are discovered, the responsible persons shall immediately cease and desist from all further site excavation and notify the sheriff-coroner and the Planning Director. If the coroner determines that the remains are not of recent origin, a full archeological report shall be prepared and representatives of the local Native California Indian group shall be contacted. Disturbance shall not resume until the significance of the archeological resource is determined and appropriate mitigations to preserve the resource on the site are established.

4.	Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒

Discussion: There is no known unique paleontological resource at the site. No unique geologic features would be directly or indirectly destroyed.

H. HAZARDS AND HAZARDOUS MATERIALS

Would the project:

1.	Create a significant hazard to the public or the environment as a result of the routine transport, use or disposal of hazardous materials?	☐	☒	☐	☐

Discussion: The equipment used during construction activities would involve routine use of fuel and other petroleum products and hydraulic fluids typically used by construction equipment. The leakage of these fluids may occur during the course of construction activities. In order to reduce potential impacts from the accidental release of hazardous materials into the riparian corridor, the following mitigation would be implemented: A spill prevention and response plan including all appropriate products

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

would be available at the project site during the course of construction activities.

2.	Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐

Discussion: Refer to H.1. above.

3.	Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒

Discussion: The construction methods and equipment associated with this project are typical. The project would produce emissions from the use of standard construction equipment and it is not located with one-quarter mile of an existing or proposed school.

4.	Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒

Discussion: The project site is not included on the November 15, 2013 list of hazardous sites in Santa Cruz County compiled pursuant to the specified code.

5.	For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒

Discussion: This project is not within two miles of an airport.

6.	For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing	☐	☐	☐	☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

or working in the project area?

Discussion: This project is not within the vicinity of a private airstrip.

7.	Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☒	☐	☐

Discussion: If the temporary stream crossing is removed prior to the reestablishment of the roadway, emergency service access and public access to the residences above the slide area will be inaccessible. In order to ensure emergency and public access to the homes above the slide area at all times, the removal of the stream crossing shall be timed to take place only after the new road has been installed to the point where vehicles can use it.

8.	Expose people to electro-magnetic fields associated with electrical transmission lines?	☐	☐	☐	☒

Discussion: This project does not include the addition of any electrical transmission lines.

9.	Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

Discussion: The project is to reestablish a road and would have no impact on the wildland urban interface.

I. TRANSPORTATION/TRAFFIC

Would the project:

1.	Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle	☐	☐	☐	☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

paths, and mass transit?

Discussion: There would be no impact because no additional traffic would be generated as a result of the project.

2.	Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒

Discussion: This project would have no impact on air traffic patterns.

3.	Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐

Discussion: This project has been designed to meet County Road Design Standards, which take into account the hazards related to design features. The proposed road alignment is straight and the project includes the removal or trimming of vegetation that could impact line of sight.

4.	Result in inadequate emergency access?	☐	☐	☒	☐

Discussion: Emergency vehicles would not be blocked from using the road at any time. See the mitigation in H.7 above.

5.	Cause an increase in parking demand which cannot be accommodated by existing parking facilities?	☐	☐	☐	☒

Discussion: This project does not create any increase in parking demand.

6.	Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☒	☐

Discussion: The proposed project would comply with current road requirements to prevent potential hazards to motorists, bicyclists, and/or pedestrians.

7.	Exceed, either individually (the project alone) or cumulatively (the project combined with other development), a level of service standard established	☐	☐	☐	☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
by the County General Plan for designated intersections, roads or highways?				

Discussion: See response I-1 above.

J. NOISE

Would the project result in:

1.	A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒

Discussion: No substantial permanent increase in ambient noise levels would be generated as part of the proposed project.

2.	Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐

Discussion: Groundborne vibration or groundborne noise levels may occur during construction activities, but would be temporary in nature. Given the rural location of the project and the riparian corridor between the project disturbance area and the nearest homes, any impacts from groundborne noise or vibration would be considered less than significant.

3.	Exposure of persons to or generation of noise levels in excess of standards established in the General Plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐

Discussion: Per County policy, average hourly noise levels shall not exceed the General Plan threshold of 50 L_{eq} during the day and impulsive noise levels shall not exceed 65 db. Construction-related noise is expected to periodically exceed the day-time threshold. In order to reduce the impacts on the residents in the project vicinity, operation of heavy machinery and other construction-related activities that may generate loud noises will be limited to between the hours of 8:30 A.M. and 4:30 P.M.

4.	A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☒	☐	☐

Discussion: See J.3. above.

5.	For a project located within an airport land use plan or, where such a plan	☐	☐	☐	☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				

Discussion: This project is not within two miles of an airport.

6. For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion: This project is not within the vicinity of a private airstrip.

K. AIR QUALITY

Where available, the significance criteria established by the Monterey Bay Unified Air Pollution Control District (MBUAPCD) may be relied upon to make the following determinations. Would the project:

1. Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☒	☐

Discussion: The North Central Coast Air Basin does not meet state standards for ozone and particulate matter (PM_{10}). Therefore, the regional pollutants of concern that would be emitted by the project are ozone precursors (Volatile Organic Compounds [VOCs] and nitrogen oxides [NO_x]), and dust.

Project construction may result in a short-term, localized decrease in air quality due to generation of dust. According to the Monterey Bay Unified Air Pollution Control District, to be considered a significant impact a project must produce particulate in excess of 82 pounds per day. Given the relatively small disturbance area (approximately 350 feet of roadway reestablished, plus 220 feet of temporary roadway removed), and standard dust control best management practices, such as periodic watering, that would be implemented during construction, this impact is considered less than significant.

2. Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐

Discussion: The project would not conflict with or obstruct implementation of the regional air quality plan. See K-1 above.

3. Result in a cumulatively considerable net increase of any criteria pollutant for	☐	☐	☒	☐

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?				

Discussion: See K-1 above.

4.	Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐

Discussion: Construction activities may result in a short term localized decrease in air quality due to generation of dust. Standard dust control BMPs are included in the project specifications and shall be implemented, if necessary, so air quality impacts associated with construction shall be at a less than significant level.

5.	Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

Discussion: There is a very small possibility that local residents would be exposed to short-term sewer odors (3-4 days) during the capping and removal of the existing sewer line.

L. GREENHOUSE GAS EMISSIONS

Would the project:

1.	Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐

Discussion: The proposed project, like all development, would be responsible for an incremental increase in green house gas emissions by usage of fossil fuels during the site grading and construction. Santa Cruz County has adopted a Climate Action Strategy (CAS - County of Santa Cruz, 2013) intended to establish specific emission reduction goals and necessary actions to reduce greenhouse gas levels to pre-1990 levels as required under AB 32 legislation. The CAS includes strategies to help reduce greenhouse gas emissions and energy consumption County-wide, including reducing vehicle miles travelled through County and regional long-range planning efforts, and increasing bicycle use and walking through incentive programs and infrastructure improvements. As a result, impacts associated with the temporary increase in green house gas emissions are expected to be less than significant.

2.	Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐

Discussion: See the discussion under L-1 above.

M. PUBLIC SERVICES

Would the project:

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
1. Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
a. Fire protection?	☐	☐	☐	☒
b. Police protection?	☐	☐	☐	☒
c. Schools?	☐	☐	☐	☒
d. Parks or other recreational activities?	☐	☐	☐	☒
e. Other public facilities; including the maintenance of roads?	☐	☐	☐	☒

Discussion (a through e): The project proposed is to reestablish a County roadway. This project would not result in any new housing and therefore would not affect public facility ratios.

N. RECREATION

Would the project:

1. Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒

Discussion: This project would not increase the use of any recreational facilities.

		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
2.	Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion: This project does not include any recreational facilities or require the expansion of recreational facilities.

O. UTILITIES AND SERVICE SYSTEMS

Would the project:

1.	Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐

Discussion: The project includes some drainage strategies to keep surface waters from inundating the slide mass. This will result in diverting some sheet flow away from the slide area, and installing an overside drain and energy dissipater above Ruins Creek. The overside drain and energy dissipater are common roadway drainage features and do not constitute a significant impact.

2.	Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒

Discussion: No new water or wastewater treatment facilities or expansion of existing facilities are proposed as part of this project.

3.	Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒

Discussion: No new wastewater would be produced as result of this project.

4.	Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒

Discussion: This project does not require a water supply.

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact
5. Result in determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒

Discussion: The reestablishment of Nelson Road would not require any increased wastewater treatment capacity.

6. Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐

Discussion: The project is expected to generate minimal construction debris and the nearby landfill has sufficient capacity to accommodate expected solid waste disposal.

7. Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒	☐

Discussion: As a Public Works project, this project is required to comply with federal, state and local statutes and regulations related to solid waste.

P. LAND USE AND PLANNING

Would the project:

1. Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐

Discussion: General Plan policy 5.2.3 (Activities Within Riparian Corridors & Wetlands) states: "Development activities, land alteration and vegetation disturbance within riparian corridors and wetlands and required buffers shall be prohibited unless an exception is granted per the Riparian Corridor and Wetlands Protection ordinance". The five "Findings" required (County Code Section: 16.30.060) to be made in order to grant the exception can be made for the proposed project. See C.6. for findings.

2. Conflict with any applicable habitat conservation plan or natural	☐	☐	☐	☒

	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less than Significant Impact	No Impact

community conservation plan?

Discussion: There is no applicable habitat conservation plan or natural community conservation plan in the project area.

3.	Physically divide an established community?	☐	☐	☐	☒

Discussion: The project would not include any element that would physically divide an established community, therefore no impact would occur

Q. POPULATION AND HOUSING

Would the project:

1.	Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒

Discussion: The proposed project would realign an existing road, which would not allow development that was otherwise prohibited.

2.	Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion: The proposed project would not displace any existing housing.

3.	Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion: The proposed project would not displace existing housing.

R. MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less than Significant with Mitigation	Less than Significant Impact	No Impact
1. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐

Discussion: The potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory were considered in the response to each question in Section III of this Initial Study. Resources that have been evaluated as significant would be potentially impacted by the project include biological resources and hazards & hazardous materials. However, mitigations have been included that clearly reduce these effects to a level below significance. The mitigations include: timing of activities to avoid impacts to species and habitat; revegetation of all disturbed ground within the project area upon project completion; the potential spill of hazardous materials from construction equipment in the riparian corridor would be mitigated by having a plan and readily available containment and absorbent material on site during construction activities. As a result of this evaluation, there is no substantial evidence that, after mitigation, significant effects associated with this project would result. Therefore, this project has been determined not to meet this Mandatory Finding of Significance.

	Potentially Significant Impact	Less than Significant with Mitigation	Less than Significant Impact	No Impact
2. Does the project have impacts that are individually limited, but cumulatively considerable? ("cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☒	☐

Discussion: In addition to project specific impacts, this evaluation considered the projects potential for incremental effects that are cumulatively considerable. As a result of this evaluation, there were determined to be no potentially significant cumulative effects due to the project. Therefore, this project has been determined not to meet this Mandatory Finding of Significance.

	Potentially Significant Impact	Less than Significant with Mitigation	Less than Significant Impact	No Impact
3. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

Discussion: In the evaluation of environmental impacts in this Initial Study, the potential for adverse direct or indirect impacts to human beings were considered in the response to specific questions in Section III (Aesthetics, Air Quality, Geology and Soils, Hazards and Hazardous Materials, Hydrology and Water Quality, Noise, Population and Housing, and Transportation and Traffic). As a result of this evaluation, there were determined to be potentially significant effects to human beings related to emergency service access to houses located beyond the project site. A mitigation to time the project components such that road access is maintained throughout the project has been included. Therefore, this project has been determined not to meet this Mandatory Finding of Significance.

V. REFERENCES USED IN THE COMPLETION OF THIS ENVIRONMENTAL REVIEW INITIAL STUDY

County of Santa Cruz 1994.
1994 General Plan and Local Coastal Program for the County of Santa Cruz, California. Adopted by the Board of Supervisors on May 24, 1994, and certified by the California Coastal Commission on December 15, 1994.

VI. ATTACHMENTS

1. Project Plans
2. Focused Engineering Geologic Investigation prepared by Pacific Geotech Engineering (December 2011)
3. Biotic Report prepared by Biotic Resources Group, dated August 12, 2013

NAME: Nelson Road Reestablishment
APPLICATION: 131330
A.P.N: County Right of Way, 070-011-28

NEGATIVE DECLARATION MITIGATIONS

A. In order to ensure that the mitigation measures and conditions set forth in the proposed project description are communicated to the various parties responsible for constructing the project, prior to any disturbance on the property the applicant shall convene a pre-construction meeting on the site. The following parties shall attend: The project engineer, project contractor supervisor, Santa Cruz County Environmental Planning staff, and project biologists. Results of pre-construction biotic surveys will be collected at that time and all protection measures shall be inspected.

B. Work done in and around the active channel has the potential to impact water quality. In order to prevent impacts to water quality, in channel work associated with the removal of the temporary bypass shall be timed to be completed when the channel is dry, and all erosion and sediment control measures shall be in place prior to the first predicted rain event.

C. Suitable nesting habitat for special-status and non-listed, native bird species is present on the study area. Direct removal of vegetation, noise and other disturbance during construction, could adversely impact nesting birds, if present, which could result in nest abandonment. In order to reduce potential impacts to special-status and non-listed, native bird species to less than significant, the following mitigations shall be implemented:

1. If work in any project site area must commence during the breeding season (February 1 to August 31), a qualified biologist shall conduct a pre-construction breeding bird survey throughout areas of suitable habitat within 300 feet of the work area within 15 days prior to the onset of any construction activity. If bird nests are observed within a project work area or surrounding buffer, an appropriate buffer zone shall be established around all active nests to protect nesting adults and their young from construction disturbance. The size and configuration of buffer zones shall be determined by a qualified biologist in consultation with CDFG based on the site conditions and the species potentially impacted. Work within the buffer zone shall be postponed until all the young are fledged, as determined by a qualified biologist.

D. In order to reduce potential impacts from the accidental release of hazardous materials into the riparian corridor, the following mitigation would be implemented: A spill prevention and response plan including all appropriate products will be available at the project site during the course of construction activities, and the staging area(s) will be a minimum of 50 feet from any stream.

E. In order to reduce the impacts on the residents in the project vicinity due to excessive noise, operation of heavy machinery and other construction-related activities that may generate loud noises will be limited to between the hours of 8:30 A.M. and 4:30 P.M.

DIST	COUNTY	ROUTE	POST MILE TOTAL PROJECT	SHEET No.	TOTAL SHEETS
02	SCr	--	---	1	20

INDEX OF SHEETS

CALTRANS STANDARD PLANS DATED MAY 2006

(SEE SPECIAL PROVISIONS FOR REQUIRED STANDARD PLANS)

65% SUBMITTAL

NOT FOR CONSTRUCTION USE

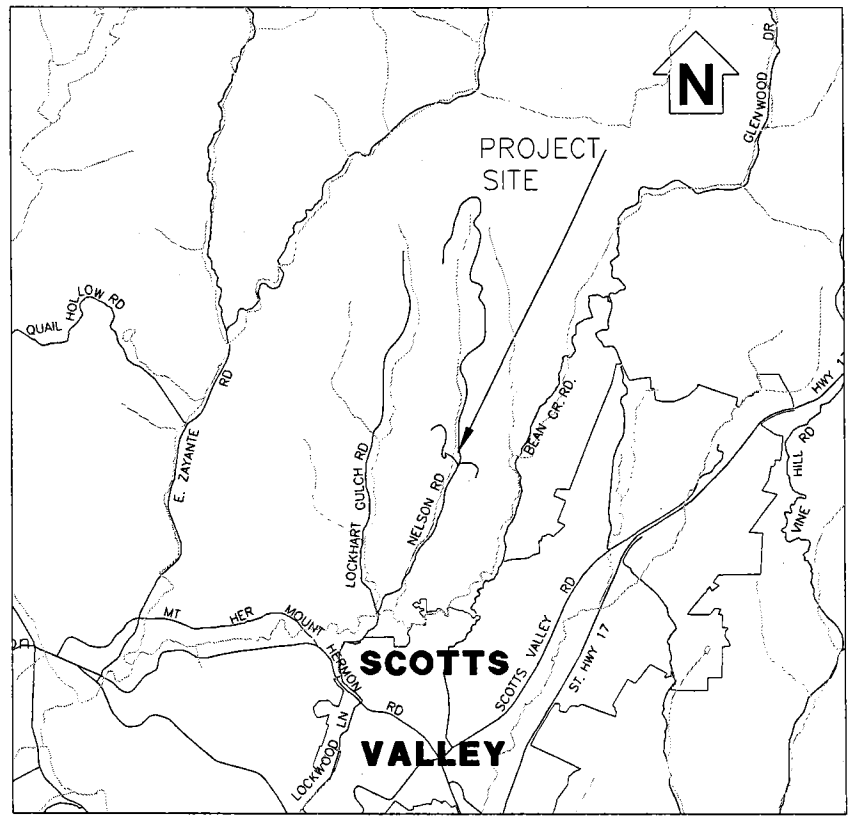
COUNTY OF SANTA CRUZ

DEPARTMENT OF PUBLIC WORKS

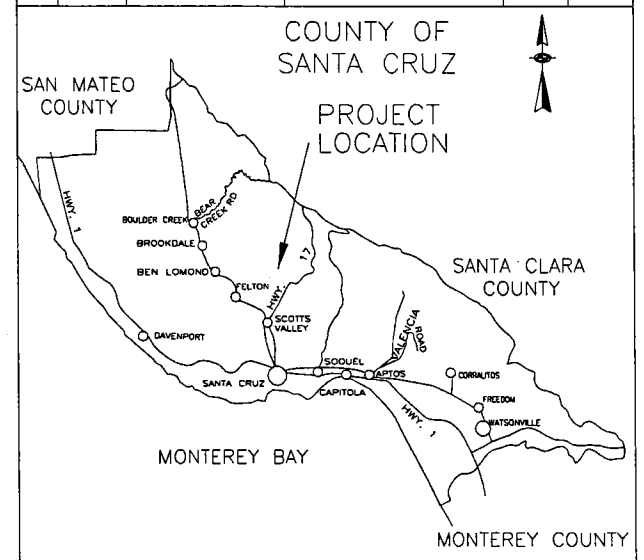
PROJECT PLANS FOR CONSTRUCTION ON

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

To be supplemented by The State of California Standard Specifications and Standard Plans dated May 2006, for Midwest Guardrail System related items refer to 2010 Revised Standard Plans.



VICINITY MAP
NO SCALE



LOCATION MAP

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916-858-0642 FAX:916-858-0643

Design Engineer
Registered Civil Engineer
MARTHA B. SHEDDEN, No. 39911, Exp. 12-31-15, CIVIL, STATE OF CALIFORNIA

Senior Design Engineer
Registered Civil Engineer
RUSSELL CHEN, No. 53154, Exp. 6-30-15, CIVIL, STATE OF CALIFORNIA

Assistant Director of Public Works
Transportation Engineering Division
Registered Civil Engineer
STEVEN B. WIESNER, No. 54814, Exp. 12-31-15, CIVIL, STATE OF CALIFORNIA

Director of Public Works
Registered Civil Engineer
JOHN P. PRESLEIGH, No. 42802, Exp. 3-31-14, CIVIL, STATE OF CALIFORNIA

Chair, Board of Supervisors

Approved by Board of Supervisors

GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO THE COUNTY OF SANTA CRUZ DESIGN CRITERIA, THE STATE STANDARD PLANS AND THE APPLICABLE PROVISIONS OF THE STATE STANDARD SPECIFICATIONS.
2. THERE SHALL BE NO CHANGES IN THE APPROVED IMPROVEMENT PLANS WITHOUT PRIOR APPROVAL BY THE SANTA CRUZ COUNTY DEPARTMENT OF PUBLIC WORKS.
3. PLEASE CALL "UNDERGROUND SERVICE ALERT" (U.S.A.) AT 800-227-2600 BEFORE DIGGING.
4. THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE APPROVED BY THE DESIGN ENGINEER.
5. THE CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY, AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF THE WORK ON THIS PROJECT, EXCEPTING LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL.

THE CONTRACTOR SHALL POSSESS A CLASS "A" LICENSE AT THE TIME THE CONTRACT IS AWARDED.

County Job No.	W.O. # 79082

Reviewed by: Laurie Goessel, Construction Engineer

Reviewed by: Terry Reynolds, Road Superintendent

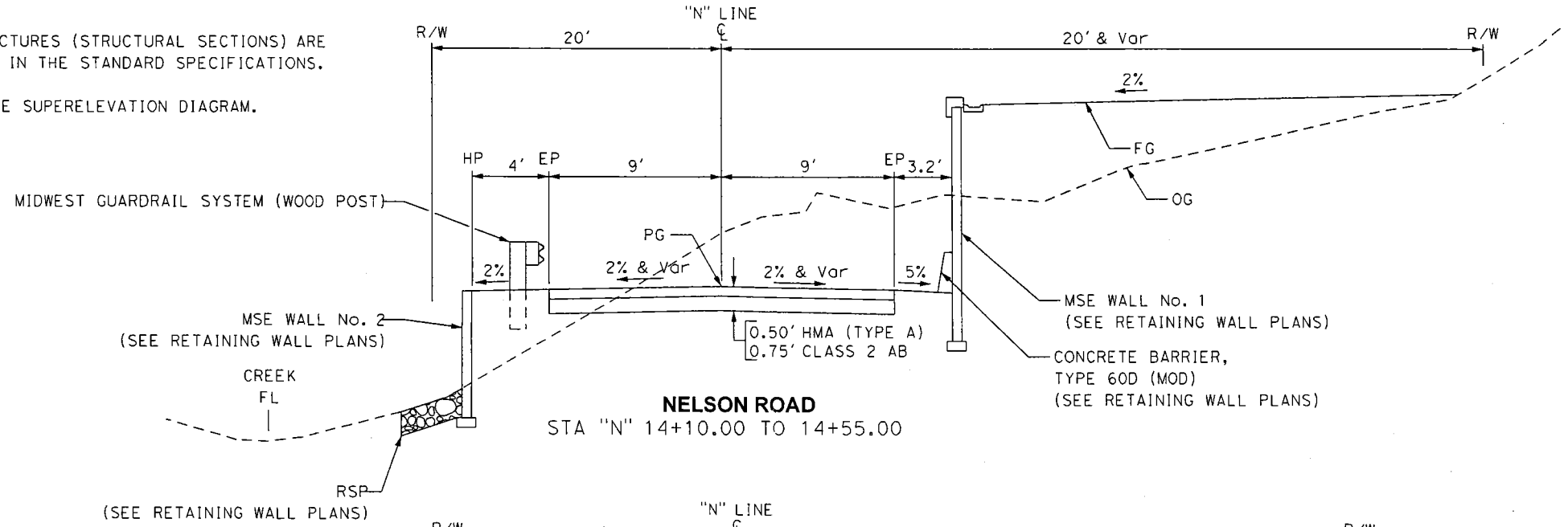
Reviewed by: Jack Sohriakoff, P.E., Traffic Engineer

s246bll.dwg

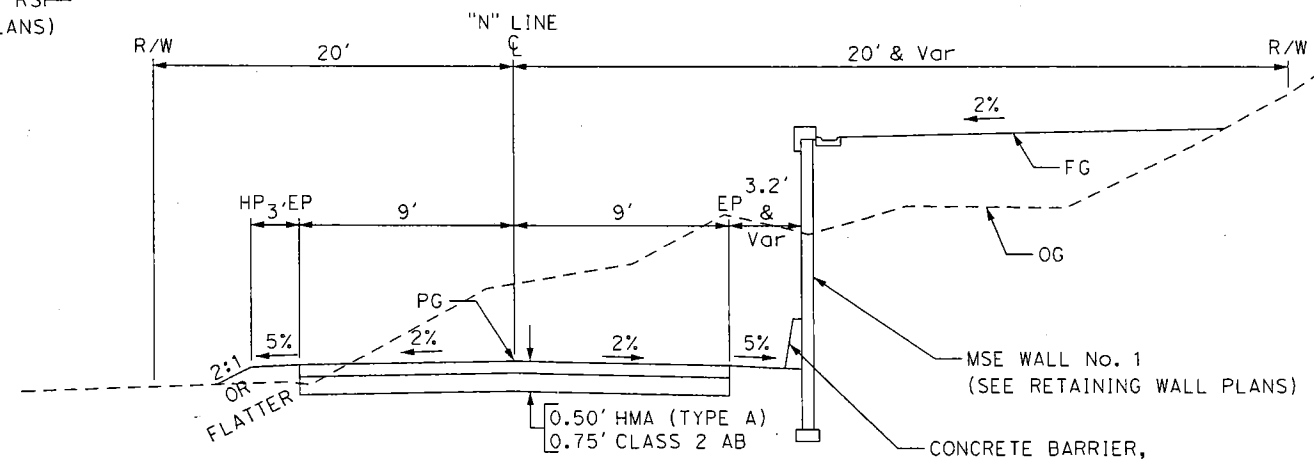
NOTES:

1. DIMENSIONS OF THE PAVEMENT STRUCTURES (STRUCTURAL SECTIONS) ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.

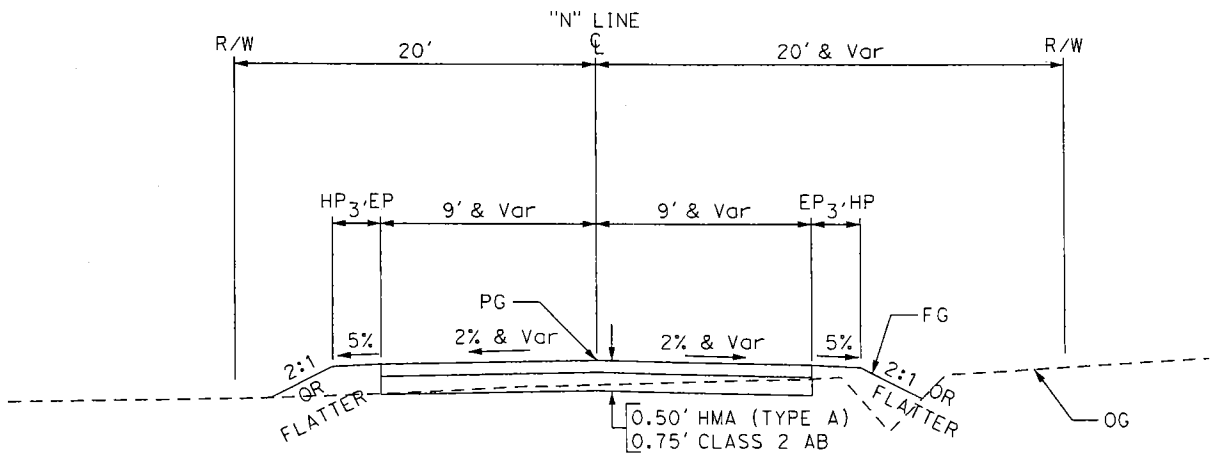
2. SUPERELEVATIONS ARE SHOWN ON THE SUPERELEVATION DIAGRAM.



NELSON ROAD
STA "N" 14+10.00 TO 14+55.00



NELSON ROAD
STA "N" 11+89.12 TO 14+10.00
STA "N" 14+55.00 TO 15+25.10



NELSON ROAD
STA "N" 10+81.34 TO 11+89.12
STA "N" 15+25.10 TO 15+47.16

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

TYPICAL CROSS SECTIONS

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_CA01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	REVISION	DATE
	65% SUBMITTAL	11/07

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 88432 — Exp. 6-30-15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER: LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: NO SCALE
JOB NO. 79082
SHEET 2 OF 20

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916.858-0642 FAX:916.858-0643

BASIS OF BEARINGS

THIS PROJECT IS BASED ON THE CALIFORNIA COORDINATE SYSTEM OF 1983, ZONE 3, EPOCH 2007.0. THE FOLLOWING CONTROL STATIONS WERE USED FOR HORIZONTAL AND VERTICAL CONTROL ESTABLISHMENT:

THE NGS CONTROL STATIONS REFERENCED ARE;
NGS-TRAILL
PID-HS4900
NAD83(2011)

SPC CA 3(FT) COORDINATE VALUES:
N=1,847,291.62 E=6,125,665.08

NGS-BURDETT
PID-HS4869
NAD83(2011)

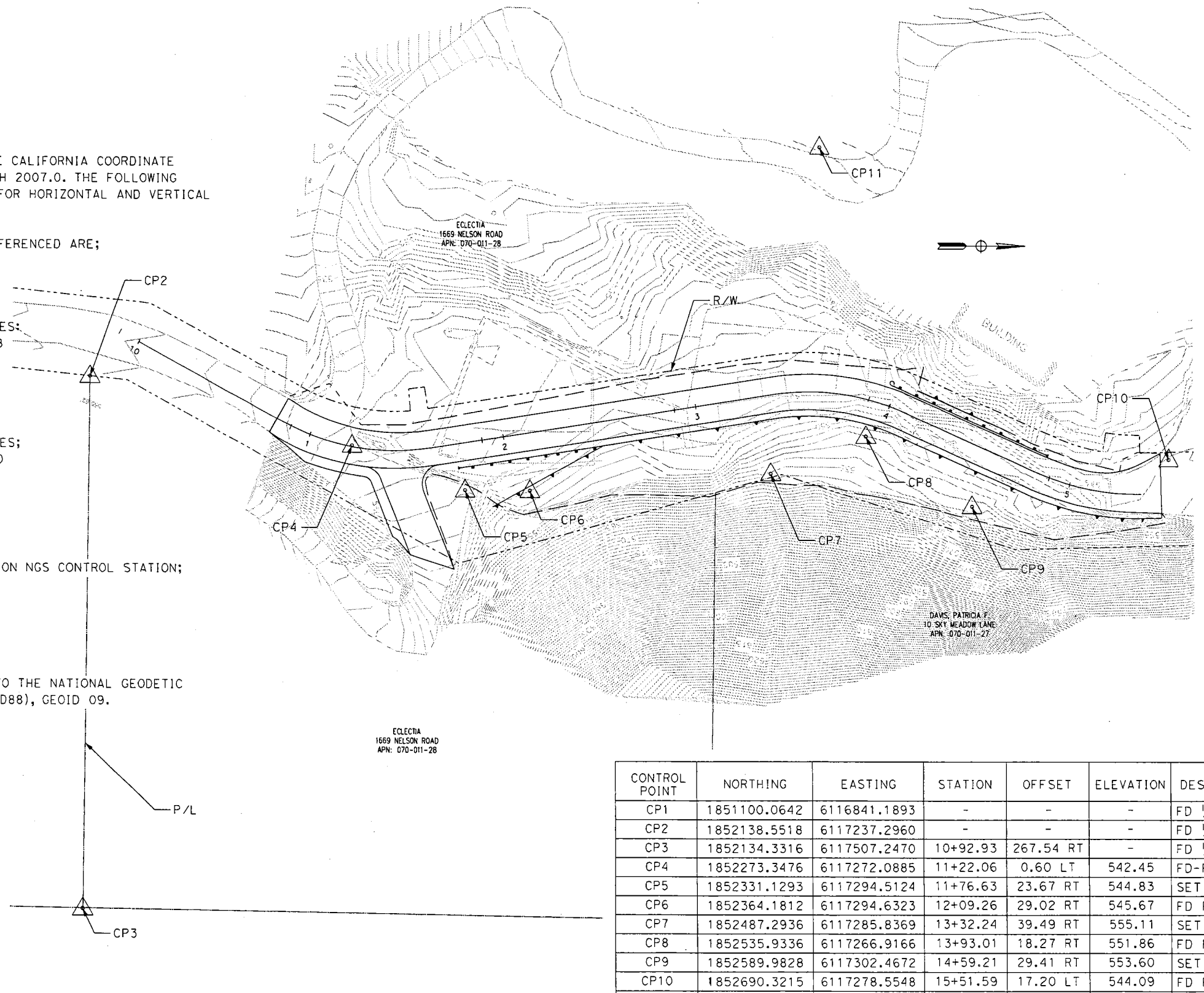
SPC CA 3(FT) COORDINATE VALUES;
N=1,865,891.14 E=6,139,833.00

BASIS OF ELEVATIONS

ELEVATIONS SHOWN ARE BASED ON NGS CONTROL STATION;

NGS DESIGNATION-M1455
PID-HT3567
NAD83(2011)
ELEV=447.91 FT

ELEVATIONS ARE REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1988 (NGVD88), GEOID 09.



CONTROL POINT	NORTHING	EASTING	STATION	OFFSET	ELEVATION	DESCRIPTION
CP1	1851100.0642	6116841.1893	-	-	-	FD ½" IRON PIPE, LS 2678 PER 6 PM 21
CP2	1852138.5518	6117237.2960	-	-	-	FD ½" IRON PIPE, LS 2678 PER 6 PM 21
CP3	1852134.3316	6117507.2470	10+92.93	267.54 RT	-	FD ½" IRON PIPE, LS 2678 PER 6 PM 21
CP4	1852273.3476	6117272.0885	11+22.06	0.60 LT	542.45	FD-PK W/SHINER
CP5	1852331.1293	6117294.5124	11+76.63	23.67 RT	544.83	SET MAG/FLAG
CP6	1852364.1812	6117294.6323	12+09.26	29.02 RT	545.67	FD PT 129
CP7	1852487.2936	6117285.8369	13+32.24	39.49 RT	555.11	SET SPK
CP8	1852535.9336	6117266.9166	13+93.01	18.27 RT	551.86	FD PT436
CP9	1852589.9828	6117302.4672	14+59.21	29.41 RT	553.60	SET SPK
CP10	1852690.3215	6117278.5548	15+51.59	17.20 LT	544.09	FD PT 128
CP11	1852512.6040	6117120.4850	13+60.80	123.87 LT	539.59	SET SPK

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

SURVEY CONTROL

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_CB01.dgn

SHEET NAME:

DRAWING NAME:

BY	DATE	REVISION
	11/07	65% SUBMITTAL

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 58432 — Exp. 3-30-15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER
LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: 1"=60'
JOB NO. 79082
SHEET 3 OF 20

LEGEND

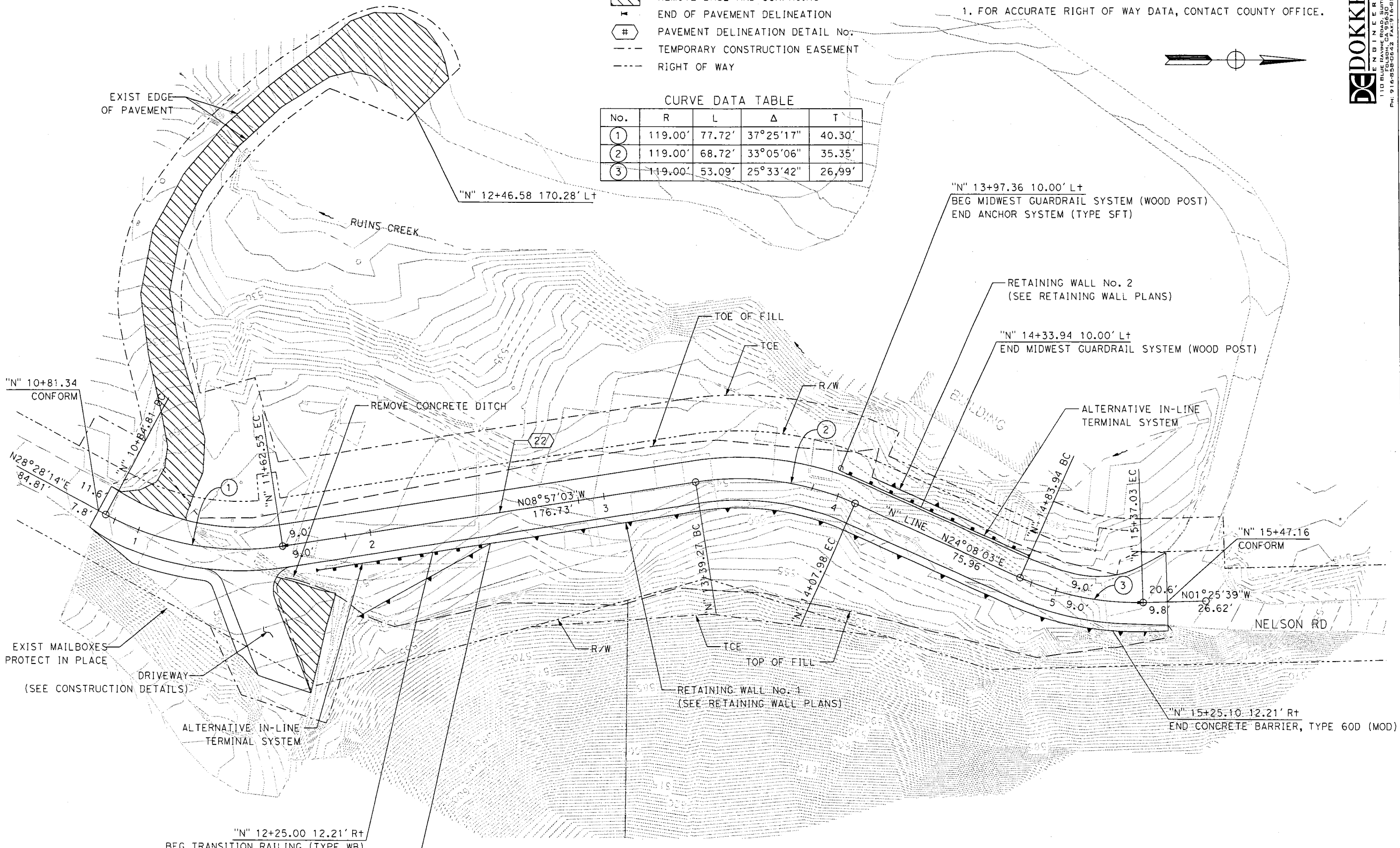
- REMOVE BASE AND SURFACING
- END OF PAVEMENT DELINEATION
- (#) PAVEMENT DELINEATION DETAIL No.
- TEMPORARY CONSTRUCTION EASEMENT
- RIGHT OF WAY

NOTES:

1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT COUNTY OFFICE.

CURVE DATA TABLE

No.	R	L	Δ	T
1	119.00'	77.72'	37°25'17"	40.30'
2	119.00'	68.72'	33°05'06"	35.35'
3	119.00'	53.09'	25°33'42"	26.99'



Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

LAYOUT

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_EA01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	REVISION	DATE
	65% SUBMITTAL	11/07/2013

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 58432 — Exp. 3-30-15 — CIVIL — REGISTERED — STATE OF CALIFORNIA

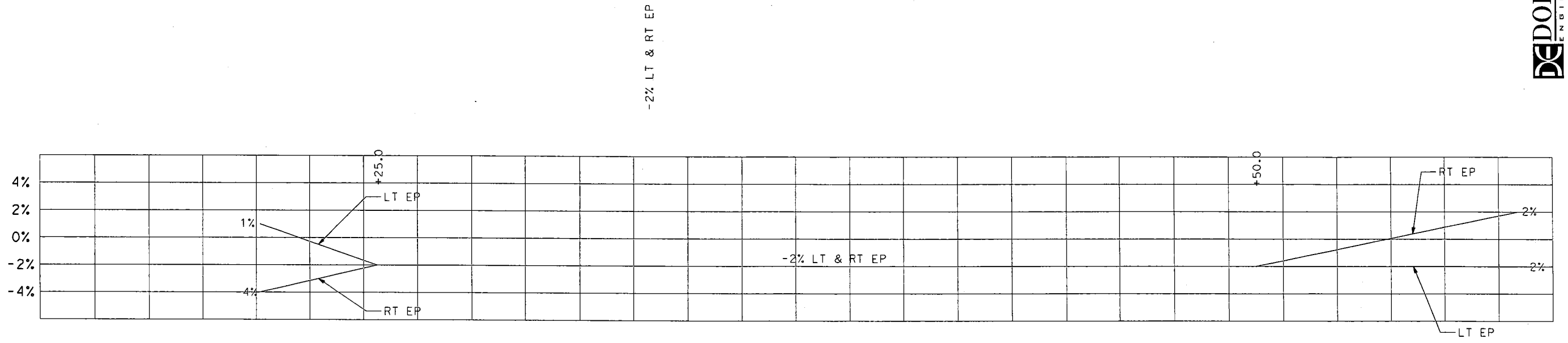
PROJECT ENGINEER: LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

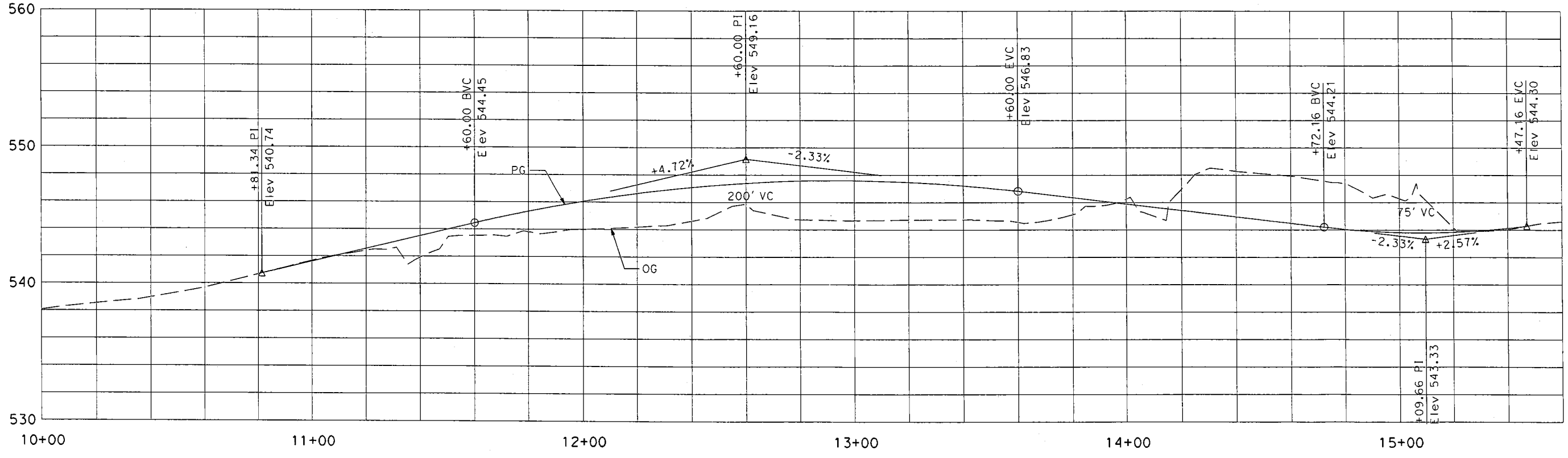
NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: 1"=20'
JOB NO. 79082
SHEET 4 OF 20

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916.858.0642 FAX:916.858.0643



"N" SUPERELEVATION



"N" PROFILE

HORZ 1" = 20'
VERT 1" = 4'

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

PROFILE

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_FA01.dgn

SHEET NAME:

DRAWING NAME:

BY	DATE	REVISION
	11/07	65% SUBMITTAL

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 58432 — Exp. 6-30-15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER
LINDSAY KATT

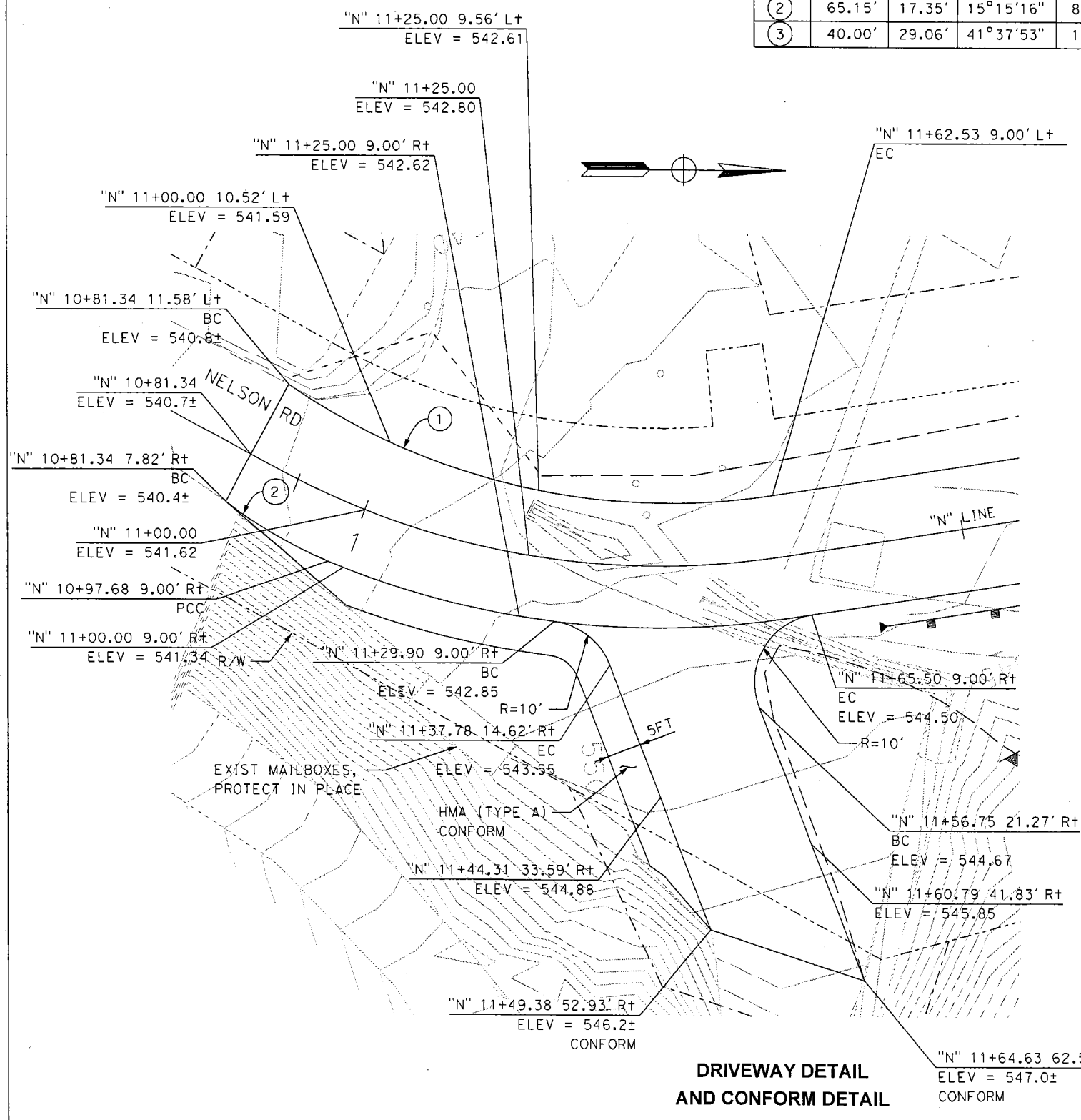
COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

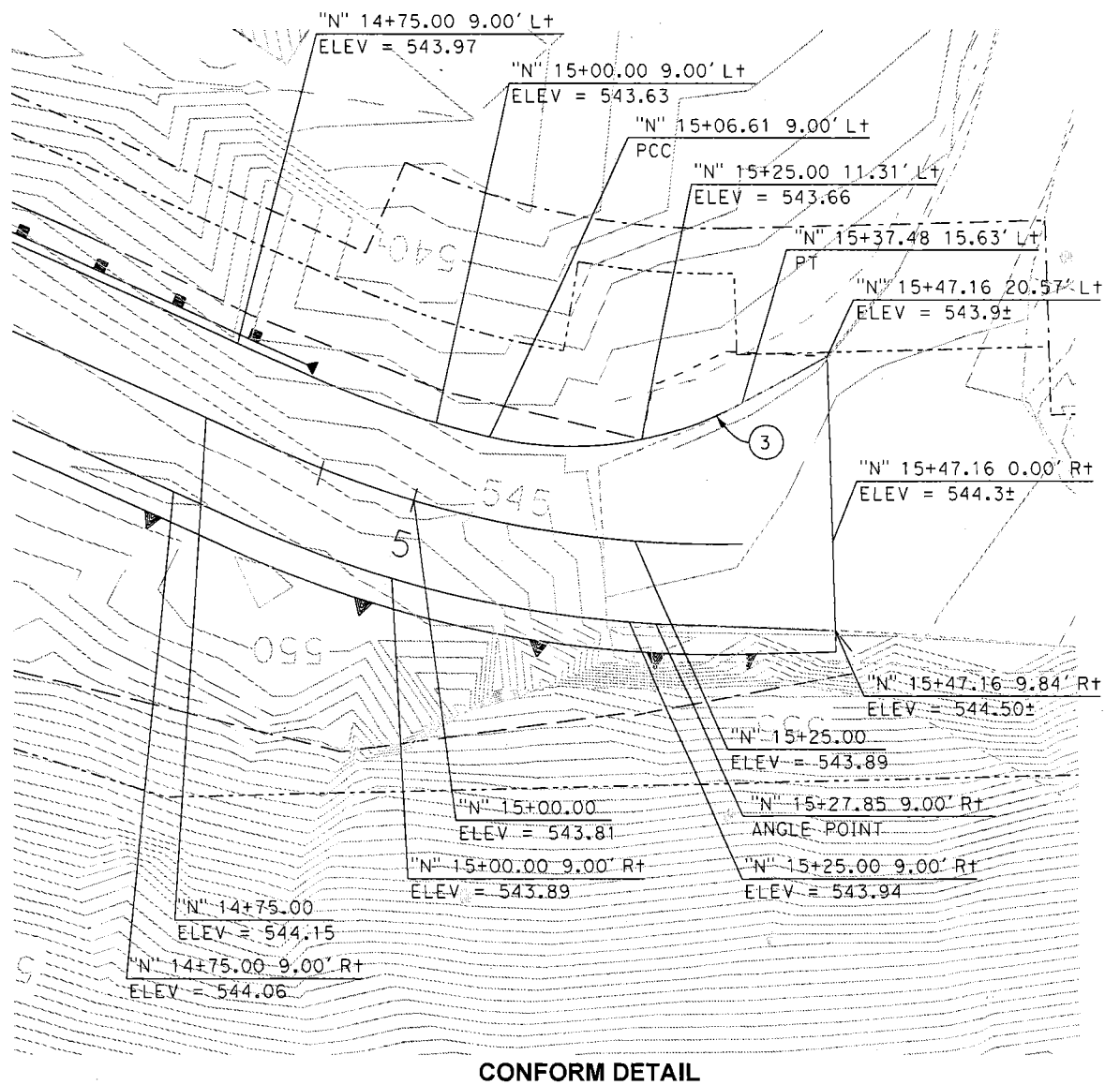
DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE:
JOB NO. 79082
SHEET 5 OF 20

CURVE DATA TABLE

No.	R	L	Δ	T
1	99.75′	74.87′	43°00′09"	39.30′
2	65.15′	17.35′	15°15′16"	8.72′
3	40.00′	29.06′	41°37′53"	15.21′



DRIVEWAY DETAIL AND CONFORM DETAIL



CONFORM DETAIL

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

CONSTRUCTION DETAILS

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX:916-858-0643

BY	REVISION	DATE
	65% SUBMITTAL	11/07

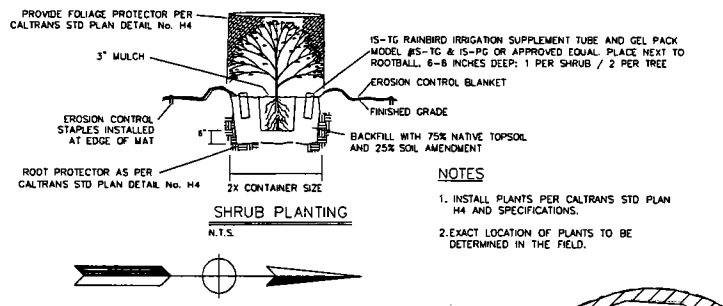
PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 68432 — Exp. 9-30-15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER: LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: 1"=10'
JOB NO. 79082
SHEET 6 OF 20



SHRUB PLANTING
N.T.S.

NOTES

1. INSTALL PLANTS PER CALTRANS STD PLAN H4 AND SPECIFICATIONS.
2. EXACT LOCATION OF PLANTS TO BE DETERMINED IN THE FIELD.

WETLAND RESTORATION (3:1 RATIO / 2,850 sq.ft.)

WETLAND RESTORATION AREA
(Mitigation for wetland habitat)

Riparian/Wetland area shall be planted with native vegetation.
Plants to be located and flagged in the field prior to installation.
See plant list for species and quanity. Work to include the removal of non-native invasive plant species.

WETLAND PLANT LIST

SYMBOL	SIZE	QUANITY	BOTANICAL NAME - COMMON NAME / SPACING
	TREES		
SA	Cuttings	100	Salix - Arroyo Willow / 8' o.c.
CS	Treepot 1	5	Cornus sericea - Creek Dogwood / 15' o.c.
	UNDERSTORY		
JR	Deepot	40	Juncus patens - Rush / 6' o.c.
SW	Deepot	20	Polystichum munitum - Sword Fern / 8' o.c.
SS	Deepot	16	Symphoricarpos sp. - Snowberry / 8' o.c.

All areas disturbed by proposed improvements shall be hydroseeded
Slopes over 3:1 install specified & approved erosion control fabric

EROSION CONTROL SEED MIXTURE (lbs./acre)

30 lbs. Bromus carinatus cucamonga - Cucamonga Brome
6 lbs. Vulpia microstachys - Three Weeks Fescue
4 lbs. Trifolium wildenovii -Tomcat Clover
4 lbs. Cyperus eragrostis - Flatsedge
10 lbs. Serile Barley (required for winter installation Dec.-Feb.)

UPLAND REVEGETATION AREA

Upland area shall be planted with native vegetation.
Plants to be located and flagged in the field prior to installation.
See plant list for species, quanity and spacing.

UPLAND PLANT LIST

SYMBOL	SIZE	QUANITY	BOTANICAL NAME - COMMON NAME / SPACING
	TREES		
QA	Treepot 1	15	Quercus agrifolia - Coast Live Oak / 15' o.c.
	UNDERSTORY		
RU	Deepot	20	Rubus Ursinus - California Blackberry / 8' o.c.
BP	Deepot	10	Baccharis pilularis / Coyote Brush / 10' o.c.
CC	1 Gallon	10	Corylus cornuta californica - Hazelnut / 15' o.c.

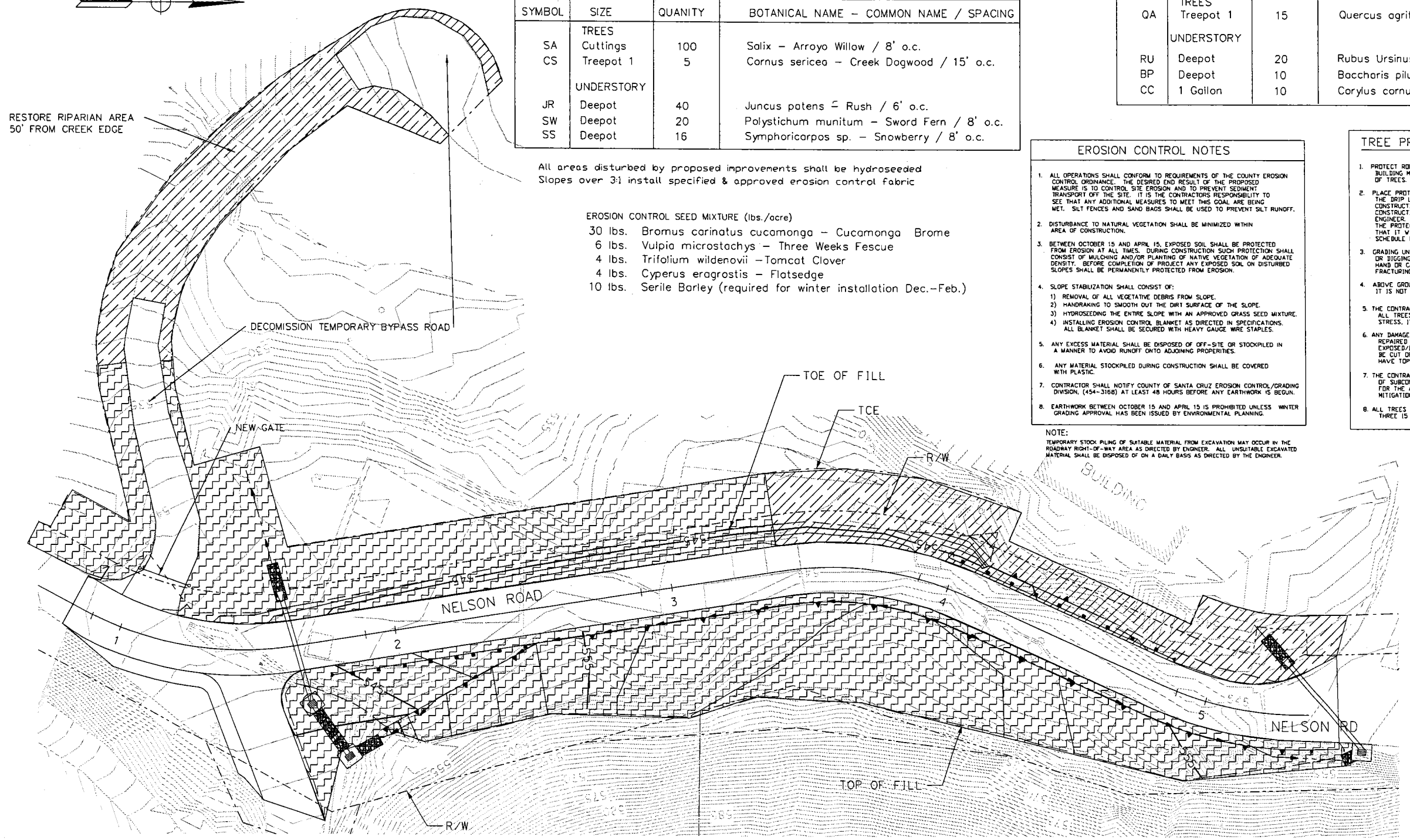
EROSION CONTROL NOTES

1. ALL OPERATIONS SHALL CONFORM TO REQUIREMENTS OF THE COUNTY EROSION CONTROL ORDINANCE. THE DESIRED END RESULT OF THE PROPOSED MEASURE IS TO CONTROL SITE EROSION AND TO PREVENT SEDIMENT TRANSPORT OFF THE SITE. IT IS THE CONTRACTORS RESPONSIBILITY TO SEE THAT ANY ADDITIONAL MEASURES TO MEET THIS GOAL ARE BEING MET. SILT FENCES AND SAND BAGS SHALL BE USED TO PREVENT SILT RUNOFF.
2. DISTURBANCE TO NATURAL VEGETATION SHALL BE MINIMIZED WITHIN AREA OF CONSTRUCTION.
3. BETWEEN OCTOBER 15 AND APRIL 15, EXPOSED SOIL SHALL BE PROTECTED FROM EROSION AT ALL TIMES. DURING CONSTRUCTION SUCH PROTECTION SHALL CONSIST OF MULCHING AND/OR PLANTING OF NATIVE VEGETATION OF ADEQUATE DENSITY. BEFORE COMPLETION OF PROJECT ANY EXPOSED SOIL ON DISTURBED SLOPES SHALL BE PERMANENTLY PROTECTED FROM EROSION.
4. SLOPE STABILIZATION SHALL CONSIST OF:
   1) REMOVAL OF ALL VEGETATIVE DEBRIS FROM SLOPE.
   2) HANDRAKING TO SMOOTH OUT THE DIRT SURFACE OF THE SLOPE.
   3) HYDROSEEDING THE ENTIRE SLOPE WITH AN APPROVED GRASS SEED MIXTURE.
   4) INSTALLING EROSION CONTROL BLANKET AS DIRECTED IN SPECIFICATIONS. ALL BLANKET SHALL BE SECURED WITH HEAVY GAUGE WIRE STAPLES.
5. ANY EXCESS MATERIAL SHALL BE DISPOSED OF OFF-SITE OR STOCKPILED IN A MANNER TO AVOID RUNOFF ONTO ADJOINING PROPERITIES.
6. ANY MATERIAL STOCKPILED DURING CONSTRUCTION SHALL BE COVERED WITH PLASTIC.
7. CONTRACTOR SHALL NOTIFY COUNTY OF SANTA CRUZ EROSION CONTROL/GRADING DIVISION, (454-3168) AT LEAST 48 HOURS BEFORE ANY EARTHWORK IS BEGUN.
8. EARTHWORK BETWEEN OCTOBER 15 AND APRIL 15 IS PROHIBITED UNLESS WINTER GRADING APPROVAL HAS BEEN ISSUED BY ENVIRONMENTAL PLANNING.

NOTE:
TEMPORARY STOCK PILING OF SUITABLE MATERIAL FROM EXCAVATION MAY OCCUR IN THE ROADWAY RIGHT-OF-WAY AREA AS DIRECTED BY ENGINEER. ALL UNSUITABLE EXCAVATED MATERIAL SHALL BE DISPOSED OF ON A DAILY BASIS AS DIRECTED BY THE ENGINEER.

TREE PROTECTION NOTES

1. PROTECT ROOT COLLAR FROM DAMAGE BY GRADING EQUIPMENT OR BUILDING MATERIALS TO BE STACKED OR STORED UNDER DRIP LINE OF TREES.
2. PLACE PROTECTIVE (CONSTRUCTION) FENCING AROUND TREE, UNDER THE DRIP LINE OR ON THE OUTERMOST EDGE OF THE PROJECT CONSTRUCTION LIMITS. FENCING SHOULD BE INSTALLED PRIOR TO CONSTRUCTION AND THE LOCATION APPROVED BY THE ENGINEER. INSTALL STRAW BALES AROUND THE TREE. THE PROTECTIVE FENCING SHOULD BE INSTALLED IN SUCH A MANNER THAT IT WILL BE STURDY ENOUGH TO LAST THROUGH THE ANTICIPATED SCHEDULE OF CONSTRUCTION.
3. GRADING UNDER TREE CANOPY IS TO BE LIMITED. ANY TRENCHING OR DIGGING UNDER THE DRIP LINE OF THE TREE SHALL BE DONE BY HAND OR CAREFUL USE OF BACKHOE IN ORDER TO PREVENT THE FRACTURING OF ROOTS.
4. ABOVE GROUND RUNOFF SHALL BE CONTROLLED IN SUCH A WAY THAT IT IS NOT DIVERTED UNDER TREE'S CANOPY.
5. THE CONTRACTOR SHALL, ON AN ON GOING BASIS, VISUALLY INSPECT ALL TREES. IF AT ANY TIME THE TREES APPEAR TO BE UNDER STRESS, IT SHALL BE REPORTED TO THE ENGINEER FOR ACTION.
6. ANY DAMAGE TO EXISTING TREE CROWNS OR ROOT SYSTEMS SHALL BE REPAIRED IMMEDIATELY BY A CERTIFIED ARBORIST. ROOTS EXPOSED/DAMAGED DURING GRADING OPERATIONS SHALL IMMEDIATELY BE CUT OFF CLEANLY INSIDE THE EXPOSED OR DAMAGED AREA AND HAVE TOPSOIL SPREAD OVER THE EXPOSED AREA.
7. THE CONTRACTOR SHALL EMPLOY (AND SO STATE WITHIN THE LIST OF SUBCONTRACTORS) A CERTIFIED ARBORIST TO BE RESPONSIBLE FOR THE ABOVE WORK AND ACT AS THE CONTACT PERSON FOR ALL MITIGATION DONE BY THE CONTRACTOR FOR THIS PROJECT.
8. ALL TREES REMOVED AT THIS PROJECT SITE SHALL BE REPLACED BY THREE (3) GALLON SPECIMENS OR AS DIRECTED BY ENGINEER.



NOTE: LOCATIONS FOR REVEGETATION & EROSION CONTROL INSTALLATIONS ARE APPROXIMATE AND SHOULD BE ADJUSTED IN FIELD AS NESSECARY AND APPROVED BY ENGINEER

Note:
The Contractor shall **verify all** controlling field dimensions before ordering or fabricating any material.

REVEGETATION PLAN

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_GE01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
Ph: 916-858-0642 Fax:916-858-0643

BY	DATE	REVISION
	11/07	65% SUBMITTAL

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 68432 — Exp. 3-30-15 — CIVIL — STATE OF CALIFORNIA — RECLAIMED

PROJECT ENGINEER
LINDSAY KATT

COUNTY OF SANTA CRUZ - DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: CS
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: 1"=20'
JOB NO. 79082
SHEET 7 OF 20

PLANTING NOTES

A. GENERAL PLANTING INFORMATION

1. THESE NOTES ARE FOR GENERAL REFERENCE, IN CONJUNCTION WITH, AND AS A SUPPLEMENT TO, THE WRITTEN SPECIFICATION ASSOCIATED WITH THE CONTRACT DOCUMENTS.
2. PRIOR TO PLANT MATERIAL INSTALLATION, LOCATIONS SHALL BE COORDINATED WITH LAYOUT OF UNDERGROUND UTILITIES. THE CONTRACTOR SHALL BE FAMILIAR WITH THE LOCATIONS OF EXISTING AND FUTURE UNDERGROUND SERVICES AND IMPROVEMENTS THAT MAY CONFLICT WITH THE WORK TO BE DONE. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL LOCATIONS OF UNDERGROUND UTILITIES PRIOR TO THE START OF WORK. THE CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER IMMEDIATELY SHOULD CONFLICTS ARISE.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE SITE IN A SAFE AND CLEAN CONDITION. AT THE END OF EACH DAY THE SITE SHALL BE CLEANED UP AND LEFT IN A CONDITION THAT IS SAFE.

B. NATIVE TOPSOIL

1. THE UNDERLYING SOIL, BUT AVOID EXCESSIVE COMPACTING, AS IT INCREASES RUNOFFSELECT A LOCATION FOR A STABILIZED TEMPORARY STOCKPILE SITE THAT WILL NOT ERODE, BLOCK DRAINAGE, OR INTERFERE WITH WORK WITHIN THE DESIGNATED STAGING AREA.
2. STRIP TOPSOIL ONLY FROM THOSE AREAS THAT WILL BE DISRUPTED BY EXCAVATION, FILLING, ROAD BUILDING, OR COMPACTING BY EQUIPMENT. A 4-6" STRIPPING DEPTH IS COMMON, BUT DEPTH VARIES DEPENDING ON THE SITE. STORE AT STOCKPILE SITE.
3. PROTECT TOPSOIL STOCKPILES BY TEMPORARILY COVERING WITH PLASTIC AS SOON AS POSSIBLE TO ASSURE THE STORED MATERIAL IS NOT EXPOSED AND ALLOWED TO ERODE. INSTALL SILT FENCE AROUND STOCKPILES TO CONTROL SEDIMENTATION INTO THE STREAM.
4. WHEN THE CONSTRUCTION PROJECT IS COMPLETED AND BEFORE PLANTING OPERATIONS AND SEEDING BEGIN, SCARIFY THE SUBSOIL TO A MINIMUM DEPTH OF 3". UNIFORMLY DISTRIBUTE TOPSOIL TO A MINIMUM, LIGHTLY COMPACTED DEPTH OF 4" ON 1V:3H (3:1) SLOPES AND 6" ON FLATTER SLOPES. THE UNDERLYING SOIL, BUT AVOID EXCESSIVE COMPACTING, AS IT INCREASES RUNOFF AND INHIBITS SEED GERMINATION.
5. DO NOT SPREAD TOPSOIL WHILE IT IS FROZEN OR MUDDY OR WHEN THE SUBGRADE IS WET OR FROZEN. CORRECT ANY IRREGULATITIES IN THE SURFACE THAT RESULT FROM TOPSOILING OR OTHER OPERATIONS TO PREVENT THE FORMATION OF DEPRESSIONS OR WATER POCKETS. COMPACT THE TOPSOIL ENOUGH TO ENSURE GOOD CONTACT WITH THE UNDERLYING SOIL, BUT AVOID EXCESSIVE COMPACTING, AS IT INCREASES RUNOFFAND INHIBITS SEED GERMINATION.

C. PLANTING OPERATIONS

1. PLANTING OPERATIONS SHALL BE COMPLETED IN STRICT ACCORDANCE WITH SPECIFICATIONS AND DETAILS FOR SITE PREPARATION AND PLANTING.
2. THE LOCATIONS OF REVEGETATION ELEMENTS ARE FOR PLANNING PURPOSES ONLY AND MAY BE ADJUSTED IN THE FIELD AT THE DIRECTION OF THE ENGINEER PRIOR TO INSTALLATION. THE CONTRACTOR SHALL TAKE CARE TO LOCATE PLANT MATERIALS TO OPTIMUM GROWTH CONDITIONS AND MAXIMUM AESTHETICS. PLANT MATERIAL SHALL NOT BE INSTALLED SO AS TO OBSTRUCT DRAINAGE PATTERNS OR HARM EXISTING PLANT MATERIAL. THE CONTRACTOR SHALL NOTIFY THE ENGINEER SHOULD CONFLICTS OCCUR.
3. PRIOR TO SITE WORK FOR THE INSTALLATION OF THE CONTAINER STOCK, THE CONTRACTOR SHALL LAYOUT PLANT MATERIALS, WHILE STILL IN CONTAINERS OR AS FLAGGED LOCATIONS IN THE FIELD. THE ENGINEER SHALL REVIEW AND APPROVE ALL PLANTING LOCATIONS PRIOR TO SITE WORK.
4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLYING PLANTS OF THE SPECIES AND SIZE SPECIFIED AND DELIVERY OF THE PLANT MATERIAL TO THE SITE. THE ENGINEER SHALL REVIEW AND APPROVE ALL PLANT MATERIALS, PRIOR TO THEIR INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY REPLACEMENT OF PLANT MATERIAL IF SAID MATERIAL IS IN POOR CONDITION AND REJECTED BY THE ENGINEER.
5. THE CONTRACTOR SHALL ENSURE THAT ALL PLANTS ARE TRUE TO NAME, WITH ONE PLANT IN EACH BUNDLE OR LOT TAGGED WITH THE BOTANICAL NAME AND PLANT SIZE, IN ACCORDANCE TO THE STANDARDS OF PRACTICE RECOMMENDED BY THE AMERICAN ASSOCIATION OF NURSERYMEN.
6. ALL PLANTS SHALL BE THE GENUS AND SPECIES AND SIZES SHOWN ON THE PLANS. UNDER NO CONDITIONS WILL THERE BE ANY SUBSTITUTION OF PLANTS OR SIZES, EXCEPT WITH THE EXPRESS WRITTEN CONSENT OF THE ENGINEER.
7. EXISTING VEGETATION THAT IS NOT WITHIN THE LIMITS OF THE PROJECT AREA SHALL NOT BE CUT, REMOVED OR OTHERWISE DISTUBED, EXCEPT FOR OCCURRENCES OF INVASIVE, NON-NATIVE PLANT SPECIES.
8. LIVE CUTTINGS SHALL BE INSTALLED AS SHOWN ON PLANTING PLAN AND SHALL BE ADJUSTED IN THE FIELD AS NECESSARY. LIVE CUTTINGS TO BE INSTALLED DURING ROCK SLOPE PROTECTION PLACEMENT SHALL FOLLOW POLE CUTTINGS FOR INSTALLATION IN RSP METHODS. LIVE CUTTINGS TO BE INSTALLED AFTER THE PROJECT IS FINISHED SHALL FOLLOW LIVE STAKING IN SOIL INSTALLATION METHODS (INSTALLATION BETWEEN DECEMBER-FEBRUARY OR AS DIRECTED BY THE ENGINEER).

D. SEEDING NOTES

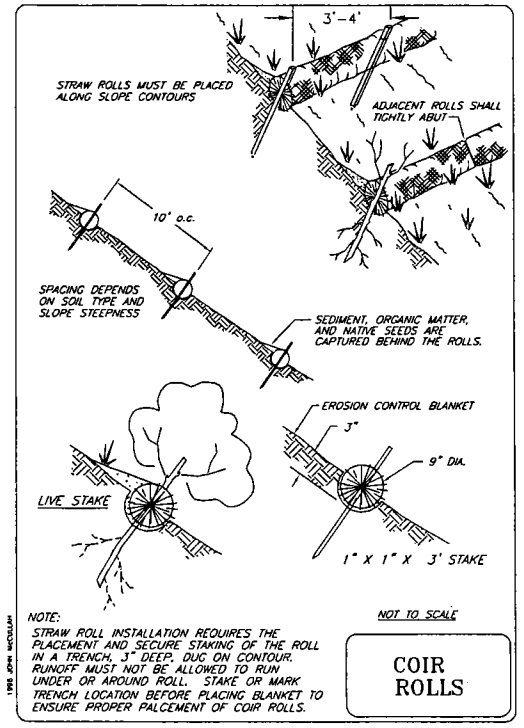
1. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE APPLICATION OF SEED ON ALL DISTURBED SOIL AREAS (SEE PLANTING PLAN FOR SEED MIX). SUBMIT 4-OUNCE SAMPLE OF SEED MIX TO ENGINEER WITH CERTIFICATION. SEED CAN BE OBTAINED FROM PACIFIC COAST SEED, LIVERMORE, CA (510) 373-4417, OR APPROVED EQUAL.
2. SEEDING OPERATIONS SHALL BE APPLIED BY HYDROSEEDING AND COMPLETED IN STRICT ACCORDANCE WITH SPECIFICATIONS AND DETAILS FOR SITE PREPARATION AND SEEDING.
3. THE LOCATIONS OF THE SEEDING AREAS ARE FOR PLANNING PURPOSES ONLY AND MAY BE ADJUSTED IN THE FIELD AT THE DIRECTION OF THE ENGINEER PRIOR TO INSTALLATION. THE GENERAL CONTRACTOR SHALL TAKE CARE TO INSTALL SEED AND RELATED MATERIALS TO PROVIDE OPTIMUM GROWTH CONDITIONS AND MAXIMUM AESTHETICS. SEEDED MATERIAL SHALL NOT BE INSTALLED SO AS TO OBSTRUCT DRAINAGE PATTERNS OR HARM EXISTING PLANT MATERIAL. THE GENERAL CONTRACTOR SHALL NOTIFY THE ENGINEER SHOULD CONFLICT OCCUR.
4. PRIOR TO SITE WORK, THE GENERAL CONTRACTOR SHALL FLAG THE BOUNDARIES OF THE SEEDING AREAS, DEMARCATING THE APPLICATION AREA FOR THE SPECIFIED SEED MIXES. THE ENGINEER SHALL REVIEW AND APPROVE ALL SEEDING LOCATIONS PRIOR TO SITE WORK.
5. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLYING ALL MATERIALS FOR THE SEED APPLICATION, AS SPECIFIED, AND DELIVERY OF THE MATERIALS TO THE SITE. THE ENGINEER SHALL REVIEW AND APPROVE ALL MATERIALS, PRIOR TO THEIR INSTALLATION. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF ANY MATERIAL IF SAID MATERIAL IS NOT AS SPECIFIED AND IS REJECTED BY THE ENGINEER.
6. GENERAL CONTRACTOR SHALL ENSURE THAT ALL SEED ARE TRUE TO NAME, WITH SEED MIXES IDENTIFIED WITH THE BOTANICAL NAME, APPLICATION RATE, PURITY AND GERM, AND THAT THE SEED AND/OR SEED MIX CONTAINS NO NOXIOUS WEEDS.
7. ALL SEEDS SHALL BE THE GENUS AND SPECIES SHOWN ON THE PLANS. UNDER NO CONDITIONS WILL THERE BE ANY SUBSTITUTION OF SPECIES, EXCEPT WITH THE EXPRESS WRITTEN CONSENT OF THE ENGINEER.
8. SEEDING SHALL OCCUR FOLLOWING ALL SITE WORK AND AFTER NATIVE TOPSOIL HAS BEEN SPREAD AND THE SEEDBED HAS BEEN PREPARED.

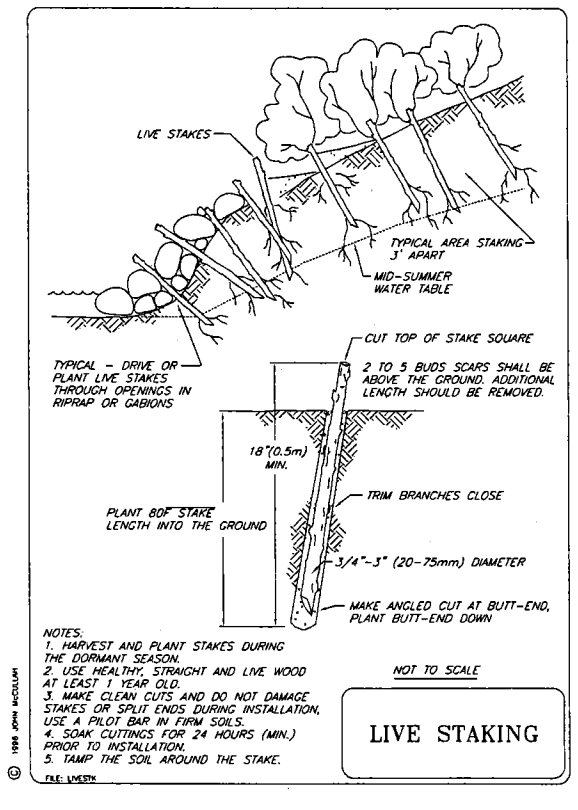
E. MAINTENANCE NOTES

1. WORK SHALL INCLUDE, BUT IS NOT LIMITED TO, MAINTENANCE OF PLANT MATERIALS, PLANT BASINS, WATERING AND WEEDING NECESSARY TO KEEP THE PLANT MATERIAL IN A HEALTHY, GROWING CONDITION AND KEEP THE PLANTING AREAS NEAT THROUGHOUT THE THIRTY (30) DAY MAINTENANCE PERIOD.
2. ALL WEEDS SHALL BE REMOVED FROM THE CONTAINER STOCK PLANTING BASINS THROUGHOUT THE THIRTY (30) DAY MAINTENANCE PERIOD. THE WEEDS WILL BE REMOVED IN ORDER TO REDUCE COMPETITION FOR AVAILABLE NUTRIENTS, MOISTURE, AND SUNLIGHT. WEEDS SHALL BE HAND-PULLED. ALL WEED CONTROL SHALL BE DONE IN A MANNER THAT PROTECTS THE INSTALLED PLANTS. WEEDS THAT GROW WITHIN THE PLANTING BASINS SHALL BE CONTROLLED WHEN THEY REACH A HEIGHT OF 4" COVER 20% OF THE PLANTING BASIN. WEEDING SHALL CONSIST OF BAGGING AND REMOVAL OF WEED PLANTS FROM THE PROJECT SITE. NO PRE-EMERGENT HERBICIDES SHALL BE ALLOWED.
3. IF INVASIVE, NON-NATIVE PLANT SPECIES ESTABLISH WITHIN THE REVEGETATION AREAS, CONTROLS SHALL BE IMPLEMENTED TO PREVENT THE INFESTATIONS FROM DEVELOPING AND TO FURTHER ENHANCE SURVIVAL OF THE PLANTED SPECIES. HAND REMOVAL SHALL BE UTILIZED TO REMOVE AND CONTROL THE OCCURRENCE OF THESE SPECIES FROM THE PROJECT WORK AREA. INVASIVE, NON-NATIVE SPECIES SHALL BE REMOVED THROUGH HAND HOEING AND HAND PULLING, WITH ALL PLANT MATERIAL BAGGED AND REMOVED FROM THE SITE. HAND HOEING SHALL SEVER THE ROOT A MINIMUM OF 4" INCHES BELOW THE GROUND SURFACE. HAND PULLING SHALL REMOVE THE ROOT OF THE PLANT. THE GOAL OF THE MAINTENANCE ACTIONS WILL BE TO REMOVE ALL INVASIVE PLANT SPECIES FROM THE PROJECT AREA PRIOR TO THEIR DEVELOPMENT OF FLOWERING HEADS AND/OR SPREADING INTO THE REVEGETATION AREA.
3. SUPPLEMENTAL WATERING SHALL BE IMPLEMENTED FOR THE CONTAINER STOCK AND LIVE CUTTINGS. PLANTS SHALL BE HAND-WATERED NO LESS THAN TWICE A WEEK DURING THE THIRTY (30) DAY MAINTENANCE PERIOD. APPROXIMATELY 1 GALLON OF WATER SHALL BE APPLIED TO EACH PLANT AT EACH WATERING EVENT. EACH WATERING SHALL BE OF SUCH A QUANTITY AS TO PROVIDE OPTIMUM GROWTH CONDITIONS. THIS WORK SHALL INCLUDE WATERING BY HAND FROM WATER TRUCK. THIS SUPPLEMENTAL IRRIGATION SHALL BE CONTINUED UNTIL NATURAL RAINFALL LEVELS REPLENISH SOIL MOISTURE OF THE GROUND.
5. EROSION CONTROL:

   ALL TEMPORARY AND PERMANENT EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE MAINTAINED AND REPAIRED AS NEEDED TO ASSURE CONTINUED PERFORMANCE OF THEIR INTENDED FUNCTION.

   PERIODIC INSPECTION REPAIR AND MAINTENANCE OF THE EROSION CONTROL MEASURES WILL BE REQUIRED DURING THE THIRTY (30) DAY MAINTENANCE PERIOD.





EROSION CONTROL FABRIC INSTALLATION

SITE PREPARATION:
PROPER SITE PREPARATION IS ESSENTIAL TO ENSURE COMPLETE CONTACT OF THE PROTECTION MATTING WITH THE SOIL.
GRADE AND SHAPE AREA OF INSTALLATION.
REMOVE ALL ROCKS, CLODS, VEGETATIVE OR OTHER OBSTRUCTIONS SO THAT THE INSTALLED BLANKETS, OR MATS WILL HAVE DIRECT CONTACT WITH THE SOIL.
PREPARE SEEDBED BY LOOSENING 2-3 INCHES OF TOPSOIL ABOVE THE FINAL GRADE. INCORPORATE AMENDMENTS, SUCH AS LIME AND FERTILIZER, INTO SOIL ACCORDING TO SOIL TEXT AND THE SEEDING PLAN.

SEEDING:
SEED AREA BEFORE BLANKET INSTALLATION FOR EROSION CONTROL AND RE-VEGETATION.
SEEDING INSTALLATION IS OFTEN SPECIFIED FOR TURF REINFORCEMENT APPLICATION. WHEN SEEDING PRIOR TO BLANKET INSTALLATION, ALL CHECK SLOTS AND OTHER AREAS DISTURBED DURING INSTALLATION MUST BE RESEEDED.
WHERE SOIL FILLING IS SPECIFIED, SEED THE MATTING AND THE ENTIRE DISTURBED AREA AFTER INSTALLATION AND PRIOR TO FILLING THE MAT WITH SOIL.

ANCHORING:
U-SHAPED WIRE STAPLES, METAL GEOTEXTILE STAKE PINS, OR TRIANGULAR WOODEN STAKES CAN BE USED TO ANCHOR MATS TO THE GROUND SURFACE. WIRE STAPLES SHALL BE A MINIMUM OF 11 GAUGE. METAL STAKE PINS SHALL BE 3/16 INCH DIAMETER STEEL WITH A 1 1/2 INCH STEEL WASHER AT THE HEAD OF THE PIN. WIRE STAPLES AND METAL STAKES SHALL BE DRIVEN FLUSH TO THE SOIL SURFACE. ALL ANCHORS SHALL BE 6-8 INCHES LONG AND SUFFICIENT GROUND PENETRATION TO RESIST PULLOUT. LONGER ANCHORS MAY BE REQUIRED FOR LOOSE SOILS.
INSTALLATION ON SLOPES:
BEGIN AT THE TOP OF THE SLOPE AND ANCHOR ITS BLANKET IN A 6 INCH DEEP X 6 INCH WIDE TRENCH. BACKFILL TRENCH AND TAMP EARTH FIRMLY.
UNROLL BLANKET DOWNSLOPE IN THE DIRECTION OF THE CREEK OR STREAMBED.
THE EDGES OF ADJACENT PARALLEL ROLLS MUST BE OVERLAPPED 2-3 INCHES AND BE STAPLED EVERY 3 FEET.
WHEN BLANKETS MUST BE SPLICED, PLACE BLANKETS END OVER END (SHINGLE STYLE) WITH 6 INCH OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12 INCHES APART.
LAY BLANKETS LOOSELY AND MAINTAIN DIRECT CONTACT WITH THE SOIL - DO NOT STRETCH.
BLANKETS SHALL BE STAPLED SUFFICIENTLY TO ANCHOR BLANKET AND MAINTAIN CONTACT WITH THE SOIL. STAPLES SHALL BE PLACED DOWN THE CENTER AND STAGGERED WITH THE STAPLES PLACED ALONG THE EDGES. STEEP SLOPES, 1:1 AND 2:1 REQUIRE 2 STAPLES PER SQUARE YARD. MODERATE SLOPES 2:1 TO 3:1 REQUIRE 2 STAPLES PER SQUARE YARD (1 STAPLE 3 FT. O.C.). GENTLE SLOPES REQUIRE 1 STAPLE PER SQUARE YARD.
INSTALLATION IN CHANNELS:
DIG INITIAL ANCHOR TRENCH 12 INCHES DEEP AND 6 INCHES WIDE ACROSS THE CHANNEL AT THE LOWER END OF THE PROJECT AREA.

COIR ROLLS

INSTALL PER MANUFACTURES SPECIFICATIONS.
THIS INCLUDES THE FOLLOWING: PREPARE THE SLOPE BEFORE THE INSTALLATION PROCEDURE IS STARTED. DIG 3-INCH DEEP TRENCHES ACROSS THE SLOPE ON CONTOUR TO PLACE THE ROLLS IN. START BUILDING TRENCHES FROM THE BOTTOM OF THE SLOPE AND WORK UP. CONSTRUCT TRENCHES AT CONTOUR INTERVALS OF 10-15 FEET APART DEPENDING ON STEEPNESS OF SLOPE.

MARK TRENCH LOCATION PRIOR TO HYDROSEEDING AND INSTALLATION OF EROSION CONTROL BLANKET (SEE HYDROSEEDING AND EROSION CONTROL BLANKET NOTES AND DETAIL FOR INSTALLATION METHODS).

INSTALL COIR ROLL AFTER EROSION CONTROL BLANKET IS INSTALLED AND BEFORE HYDROSEEDING. MAKE SURE NO GAPS EXIST BETWEEN THE SOIL EROSION CONTROL BLANKET AND THE STRAW WATTLE. USE A STRAIGHT BAR TO DRIVE HOLES THROUGH THE WATTLE AND INTO THE SOIL FOR THE POLE CUTTING OR WOODEN STAKES. DRIVE THE STAKE THROUGH PREPARED HOLE INTO THE SOIL. LEAVE ONLY 1-2 INCHES OF STAKE EXPOSED ABOVE ROLL. INSTALL STAKES AT LEAST EVERY 3 FEET APART. ALTERNATE STRAIGHT LIVE POLE WILLOW CUTTING STAKES, ¾ INCH DIAMETER; ALTERNATE WITH WOODEN STAKES

LIVE STAKING

Harvesting:
- Stakes shall be harvested and planted when the willows, or other chosen species, are dormant. This period is generally from late fall to early spring, or before the buds start to break.
- When harvesting cuttings, select healthy, live wood that is reasonably straight.
- Use live wood at least 1 year old or older. Avoid suckers of current years growth as they lack sufficient stored energy reserves to sprout consistently. The best wood is 2-5 years old with smooth bark that is not deeply furrowed.
- Make clean cuts with unsplit ends. Trim branches from cutting as close as possible. The butt end of the cutting shall be pointed or angled and the top end shall be cut square.
- Identification of the top and bottom of cutting as accomplished by angle cutting the butt end. The top, square cut, can be painted and sealed by dipping the top 1-2 inches into a 50-50 mix of light colored latex paint and water. Sealing the top of stake will reduce the possibility of desiccation and disease caused mortality, assure the stakes are planted with the top up, and makes the stakes more visible for subsequent planting evaluations.

Diameter:
- Cuttings should generally be 3/4 inch or larger depending on the species. Highest survival rates are obtained from using cuttings 2-3 inches in diameter. Larger diameter cuttings are needed for planting into rock riprap.

Length:
- Cuttings of small diameter (up to 1-1/2 inches) shall be 18 inches long minimum. Thicker cuttings should be longer. Cuttings should be long enough to reach into the midsummer water table, if possible.
- No less than 1/2 total length must be into the ground. - Stakes should be cut so that a terminal bud scar is within 1-4 inches of the top. At least 2 buds and/or bud scars shall be above the ground after planting.

Installation:
- Stakes must be planted with butt-ends into the ground. Leaf bud scars or emerging buds should always point up.
- Stakes must not be allowed to dry out. All cuttings should be soaked in water for a minimum of 24 hours. Soaking significantly increases the survival rate of the cuttings, however they may be planted the same day they are harvested.
- Plant stakes 3 feet on center.
- Set the stake as deep as possible into the soil, preferably with 80 percent of its length into the soil and in contact with midsummer water table.
- It is essential to have good contact between the stake and soil for roots to sprout. Tamp the soil around the cutting.
- Do not damage the buds, strip the bark or split the stake during installation.
- Split or damaged stakes shall be removed and replaced. Inspection and Maintenance:
- Periodic inspection repair and maintenance will be required during the first two years or until the vegetation is established.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

REVEGETATION DETAILS

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_GE02.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916.858.0642 FAX: 916.858.0643

BY	REVISION	DATE
	65% SUBMITTAL	11/07/13

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 58432 — Exp. 06-30-15 — CIVIL — STATE OF CALIFORNIA

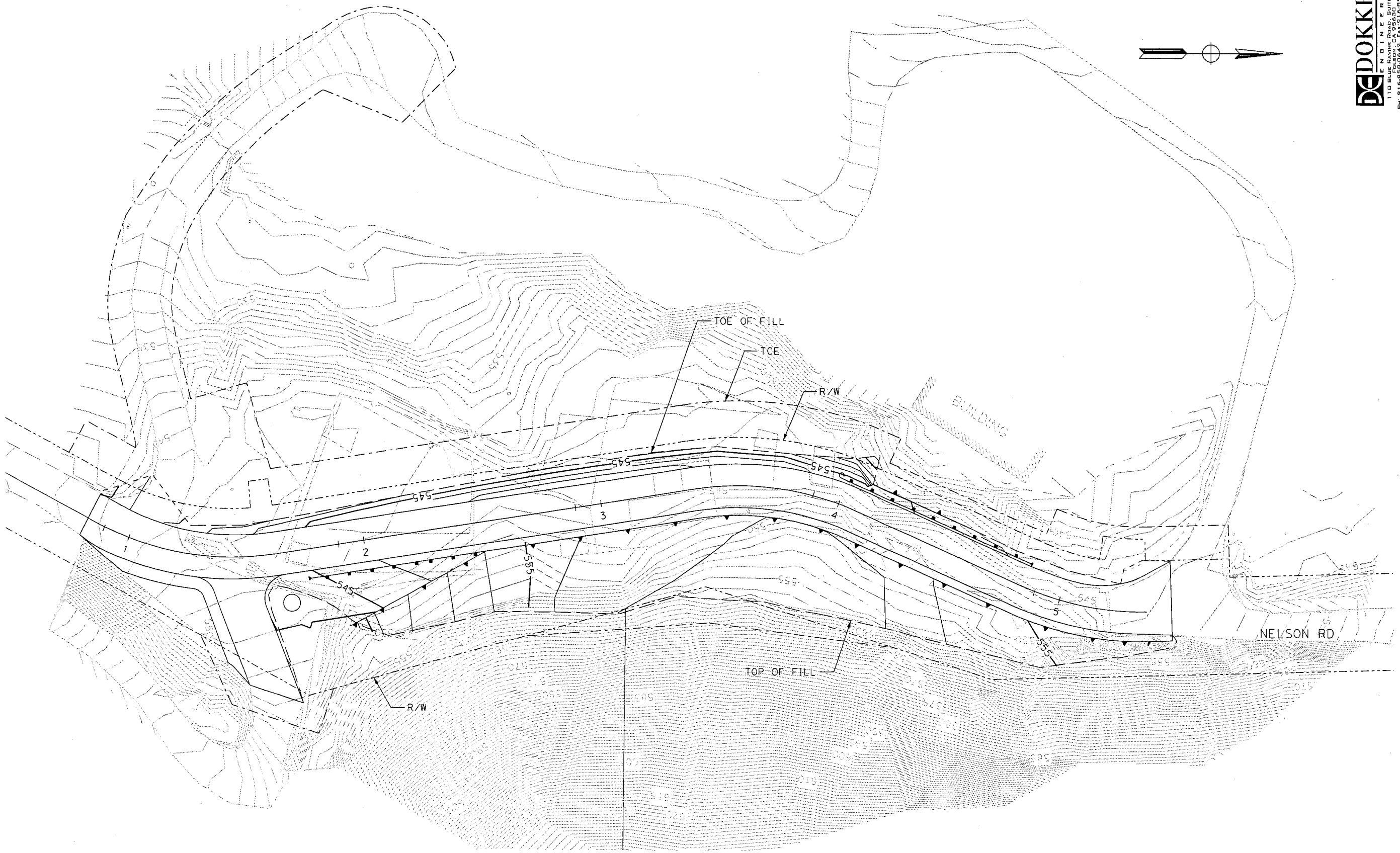
PROJECT ENGINEER: LINDSAY KATT

COUNTY OF SANTA CRUZ - DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: CS
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: 1"=20'
JOB NO. 79082
SHEET 8 OF 20

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
Ph: 916.858.0642 Fax:916.858.0643



Note:
The Contractor shall verify all
controlling field dimensions before
ordering or fabricating any material.

CONTOUR GRADING

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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SHEET NAME:

DRAWING NAME:

BY	REVISION	DATE
	65% SUBMITTAL	11/07/65

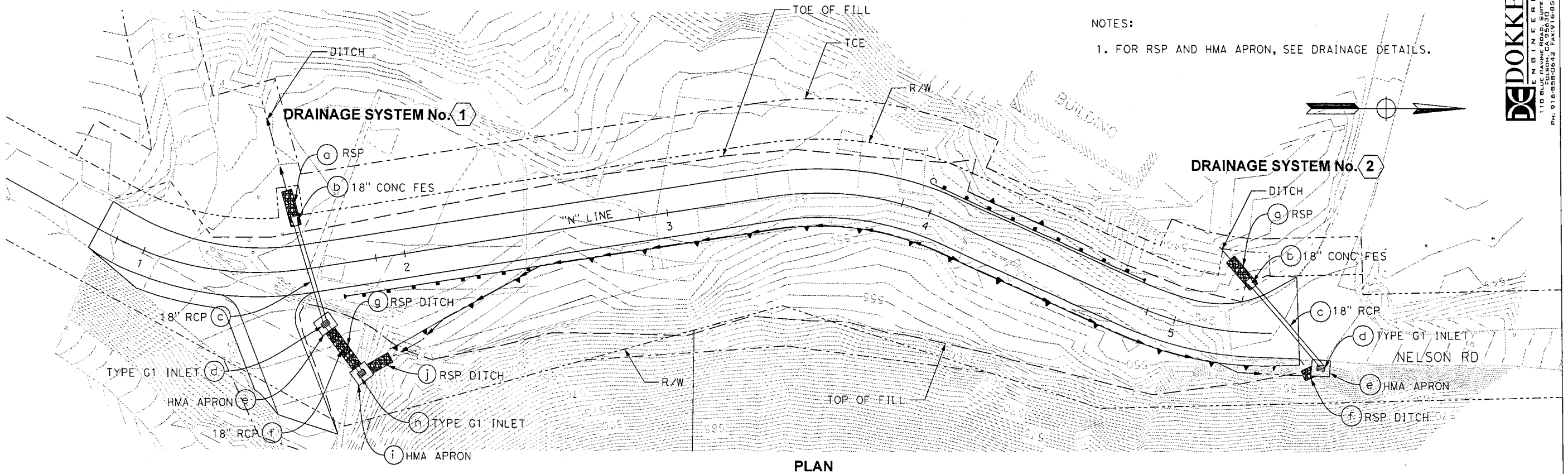
PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 68432 — Exp. 3-30-15 — CIVIL — REGISTERED — STATE OF CALIFORNIA

PROJECT ENGINEER
LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN:	M. ATKINSON
CHECKED:	L. KATT
DATE:	11/07/2013
SCALE:	1"=20'
JOB NO.	79082
SHEET	9 OF 20

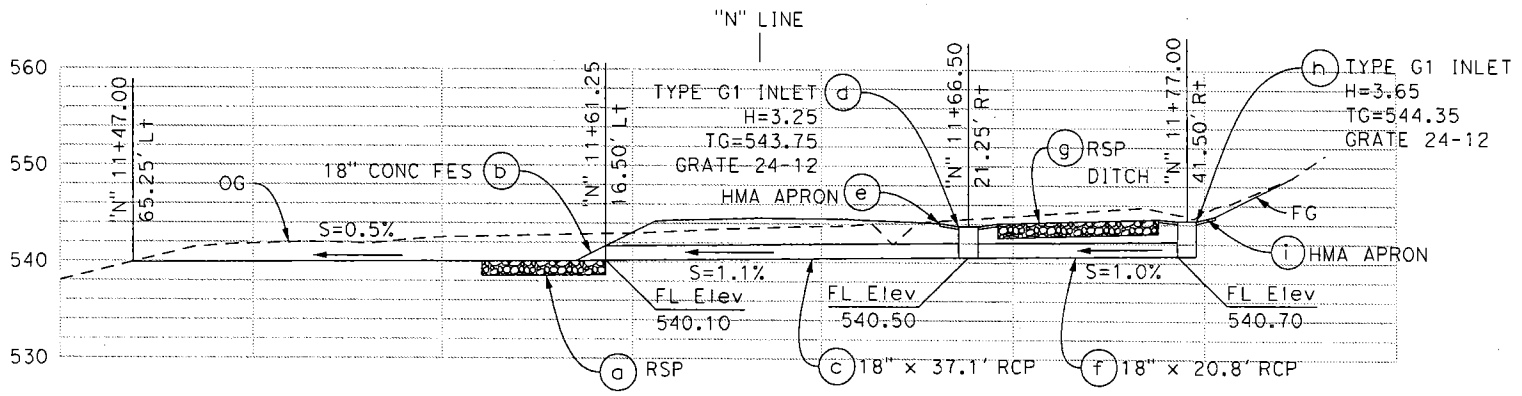


PLAN

SCALE: 1"=20'

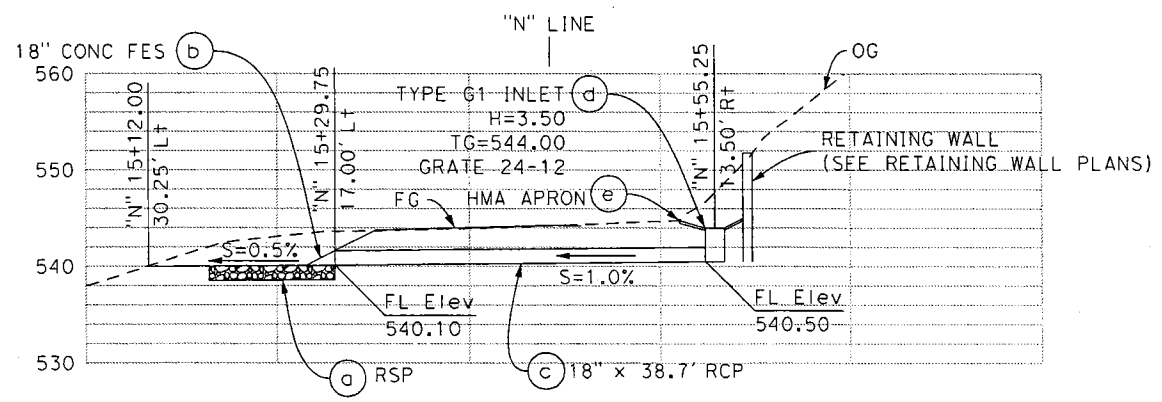
NOTES:

1. FOR RSP AND HMA APRON, SEE DRAINAGE DETAILS.



DRAINAGE SYSTEM No. 1
PROFILE

SCALE: 1"=10'



DRAINAGE SYSTEM No. 2
PROFILE

SCALE: 1"=10'

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DRAINAGE PLAN AND PROFILE

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_1A01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
Ph: 916-858-0642 Fax: 916-858-0643

BY	REVISION	DATE
	65% SUBMITTAL	11/07/13

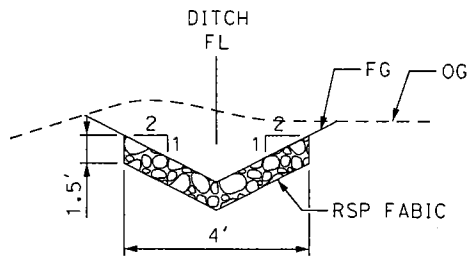
PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 88432 — Exp. 12-31-15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER: LINDSAY KATT

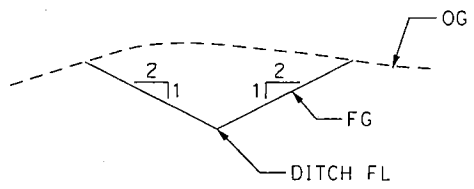
COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN:	M. ATKINSON
CHECKED:	L. KATT
DATE:	11/07/2013
SCALE:	AS SHOWN
JOB NO.	79082
SHEET	10 OF 20



RSP DITCH



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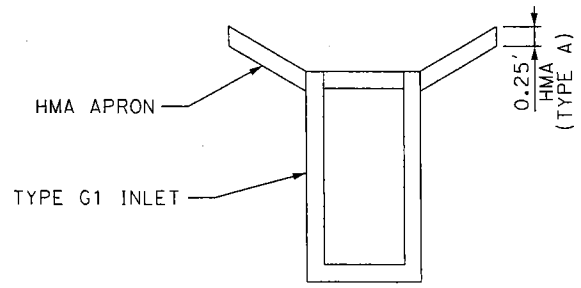
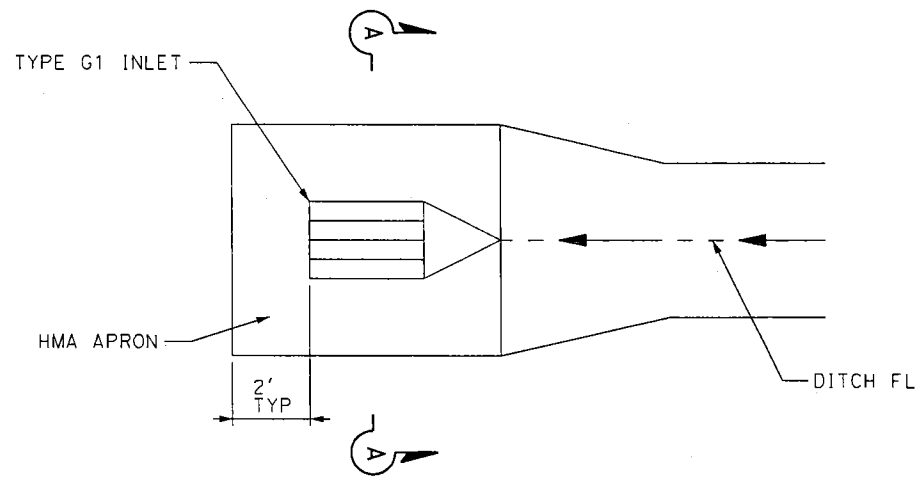


SECTION A-A

SECTION A-A

RSP



HMA APRON

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

DRAINAGE DETAILS

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	DATE	REVISION
	11/07	65% SUBMITTAL

PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 68432 — Exp. 6-30-15 CIVIL — REGISTERED — STATE OF CALIFORNIA

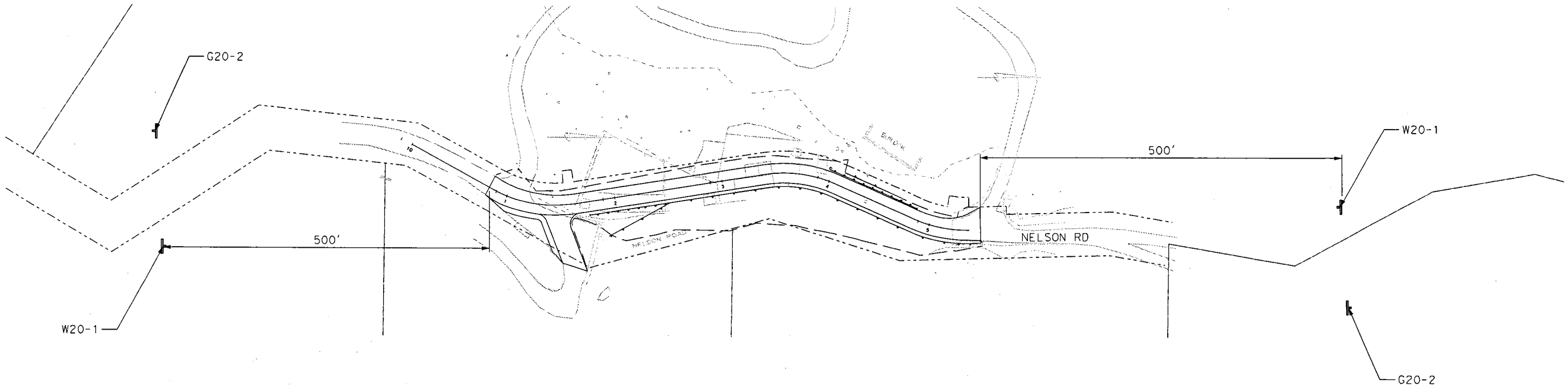
PROJECT ENGINEER
LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE: AS SHOWN
JOB NO. 79082
SHEET
11 OF 20

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX:916-858-0643



Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

CONSTRUCTION AREA SIGNS

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_LA01.dgn

SHEET NAME:

DRAWING NAME:

BY	REVISION	DATE
	65% SUBMITTAL	11/07/13

PROFESSIONAL ENGINEER * REGISTERED * LINDSAY J KATT No. 68432 Exp. 3-30-15 CIVIL * STATE OF CALIFORNIA *

PROJECT ENGINEER
LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE:
JOB NO. 79082
SHEET
12 OF 20

PAVEMENT DELINEATION QUANTITIES

SHEET	LOCATION/STATIONING	DIRECTION	DETAIL No.	THERMOPLASTIC TRAFFIC STRIPE	THERMOPLASTIC PAVEMENT MARKING	PAVEMENT MARKER (RETRO-REFLECTIVE)	DESCRIPTION/COMMENTS
				4" YELLOW SOLID		TYPE D	
				LF	SQFT	EA	
LAYOUT	"N" 11+62 TO 15+37	NB	22	750		18	
	SUBTOTAL						
	TOTAL			750		18	

ROADWAY ITEMS

STATION	LOCATION	CLASS 2 AB	HMA (TYPE A)	IMPORTED BORROW	ROADWAY EXCAVATION	ALTERNATIVE IN-LINE TERMINAL SYSTEM	TRANSITION RAILING (TYPE WB)	MBGR (WOOD POST)	END ANCHOR SYSTEM (TYPE SFT)	REMOVE BASE AND SURFACING
		CY	TON	CY	CY	EA	EA	LF	EA	CY
"N" 10+81.34 TO 15.47.16	—	239	323	385	462					
"N" 11+29.90 TO 11+65.50	RT	28	37	10	10					
"N" 10+81.34 TO 11+65.50	RT			40						40
"N" 10+81.34 TO 12+46.58	LT			78						78
"N" 12+25.00 TO 12+50.00	RT					1	1			
"N" 13+97.36 TO 14+33.94	LT					1		37	1	
TOTAL		267	360	513	472	2	1	37	1	118

DRAINAGE ITEMS

DRAINAGE SYSTEM No.	DRAINAGE UNIT	STATION/OFFSET	MISCELLANEOUS IRON AND STEEL	TYPE G1 INLET (N)	18" RCP	18" CONC FES	MINOR CONCRETE (MINOR STRUCTURE)	RSP (LIGHT, METHOD B)	RSP FABRIC	PLACE HMA (MISC AREA)	HMA (TYPE A)
			LB	EA	LF	EA	CY	CY	SQYD	SQYD	TON
1	a							2.7	5.4		
1	b					1					
1	c				37.1						
1	d		263	1			1.0				
1	e									4.7	1
1	f				20.8						
1	g							3.8	7.6		
1	h		263	1			1.1			4.7	1
1	i										
1	j							2.0	4.0		
2	a							2.7	5.4		
2	b					1					
2	c				38.7						
2	d		263	1			1.1				
2	e									4.7	1
2	f										
	TOTAL		789	3	96.6	2	3.2	11.2	22.4	14.1	3

(N) - NOT A SEPERATE PAY ITEM, FOR INFORMATION PURPOSES ONLY.

REVETATION ITEMS

SHEET	HYDROSEED
	SQYD
TOTAL	

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

SUMMARY OF QUANTITIES

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\SHEET FILES\1996N_PA01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 210
Folsom, CA 95630
Ph: 916.858.0642 Fax: 916.858.0643

BY	REVISION	DATE
	65% SUBMITTAL	11/07/13

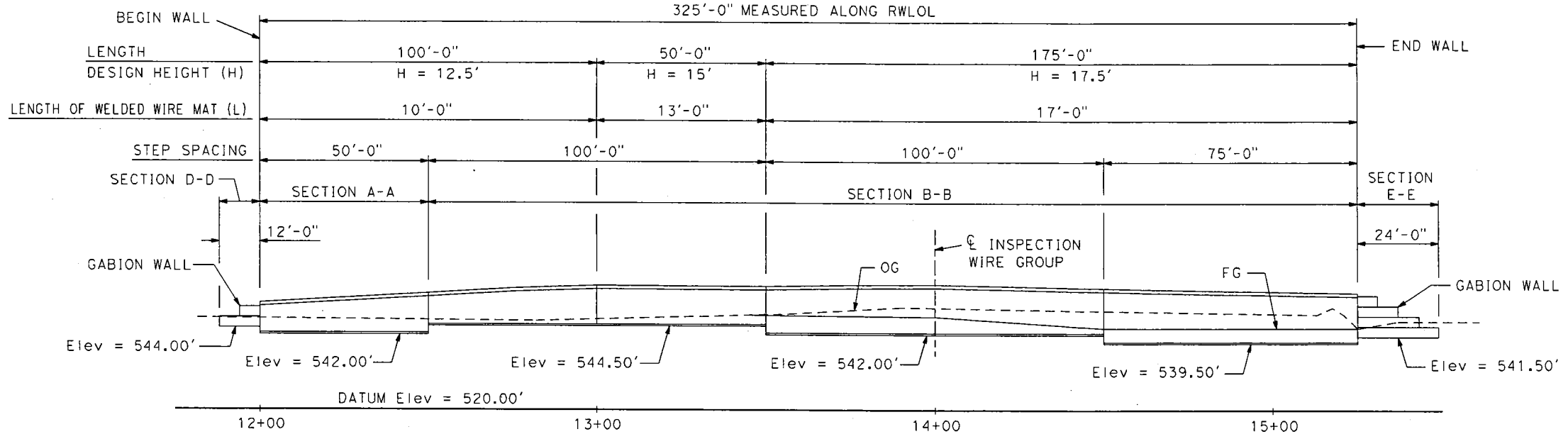
PROFESSIONAL ENGINEER — LINDSAY J. KATT — No. 58432 — Exp. 12-31-15 — CIVIL — REGISTERED — STATE OF CALIFORNIA

PROJECT ENGINEER: LINDSAY KATT

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: M. ATKINSON
CHECKED: L. KATT
DATE: 11/07/2013
SCALE:
JOB NO. 79082
SHEET 13 OF 20



RETAINING WALL No. 1
DEVELOPED MIRROR ELEVATION

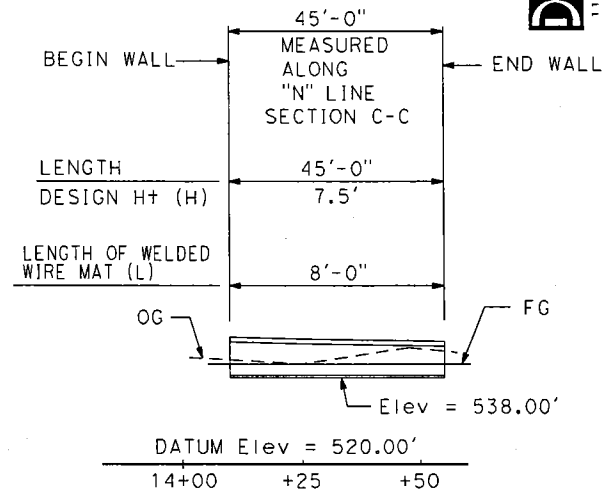
1" = 20'

RIGHT WALL
TOP OF WALL ELEVATIONS

STATION	ELEVATION
12+00.41	552.23'
12+25.00	553.64'
12+50.00	555.05'
12+75.00	556.51'
13+00.00	557.31'
13+25.00	557.50'
13+50.00	557.75'
13+75.00	558.07'
14+00.00	557.94'
14+25.00	557.81'
14+50.00	556.62'
14+75.00	556.12'
15+00.00	555.71'
15+25.10	555.25'

NOTE:

1. For "Sections A-A, B-B, C-C, D-D and E-E, see "CROSS SECTIONS" sheet.

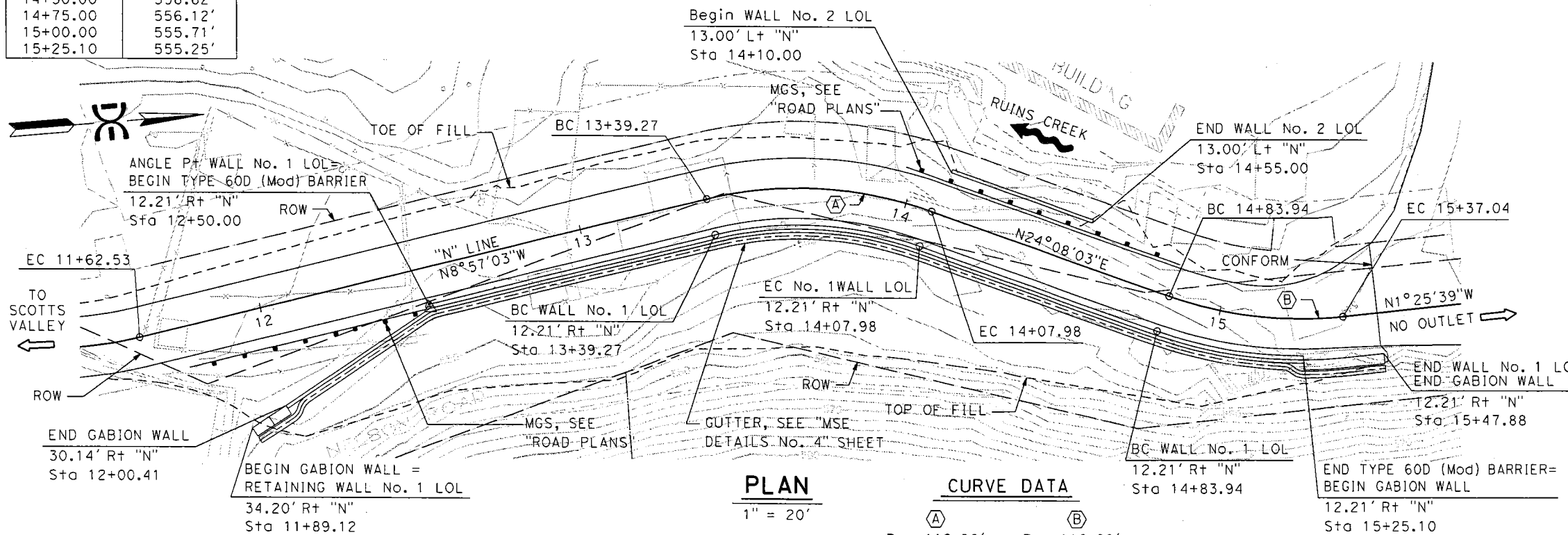


RETAINING WALL No. 2
MIRROR ELEVATION

1" = 20'

RETAINING WALL No. 2
TOP OF WALL ELEVATIONS

STATION	ELEVATION
14+10.00	546.40'
14+25.00	546.05'
14+55.00	545.54'



PLAN

1" = 20'

CURVE DATA

Ⓐ	Ⓑ
R = 119.00'	R = 119.00'
△ = 33°05'06"	△ = 25°33'42"
T = 35.35'	T = 26.99'
L = 68.72'	L = 53.09'

INDEX TO PLANS

STANDARD PLANS DATED MAY, 2006

Sheet No.	Title
A10A	ABBREVIATIONS (SHEET 1 OF 2)
A10B	ABBREVIATIONS (SHEET 2 OF 2)
A10C	LINES AND SYMBOLS (SHEET 1 OF 2)
A10D	LINES AND SYMBOLS (SHEET 2 OF 3)
A10E	LINES AND SYMBOLS (SHEET 3 OF 3)
A10F	LEGEND - SOIL (SHEET 1 OF 2)
A10G	LEGEND - SOIL (SHEET 2 OF 2)
A10H	LEGEND - ROCK
B0-3	BRIDGE DETAILS
D100A	GABION BASKET DETAILS No. 1
D100B	GABION BASKET DETAILS No. 2

STANDARD PLAN SHEET No.

DETAIL No.

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

GENERAL PLAN

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\517\Nelson\1996N_RWGP01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY | REVISION | DATE

PROFESSIONAL ENGINEER REGISTERED T. OSTERKAMP No. C46783 Exp. 6/30/15 STATE OF CALIFORNIA

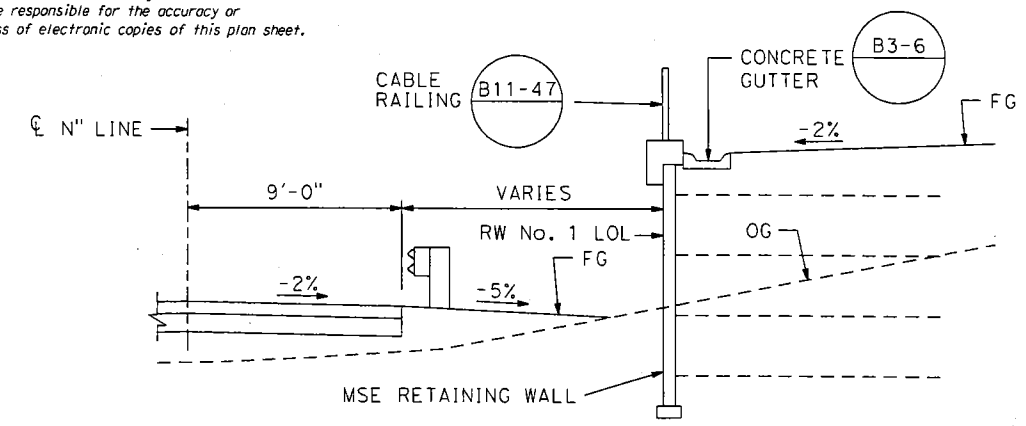
PROJECT ENGINEER

T. OSTERKAMP

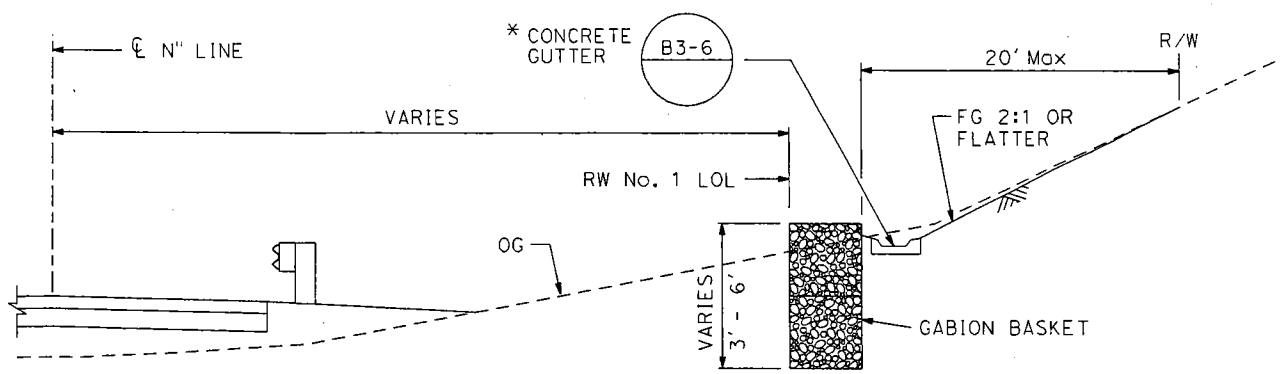
COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

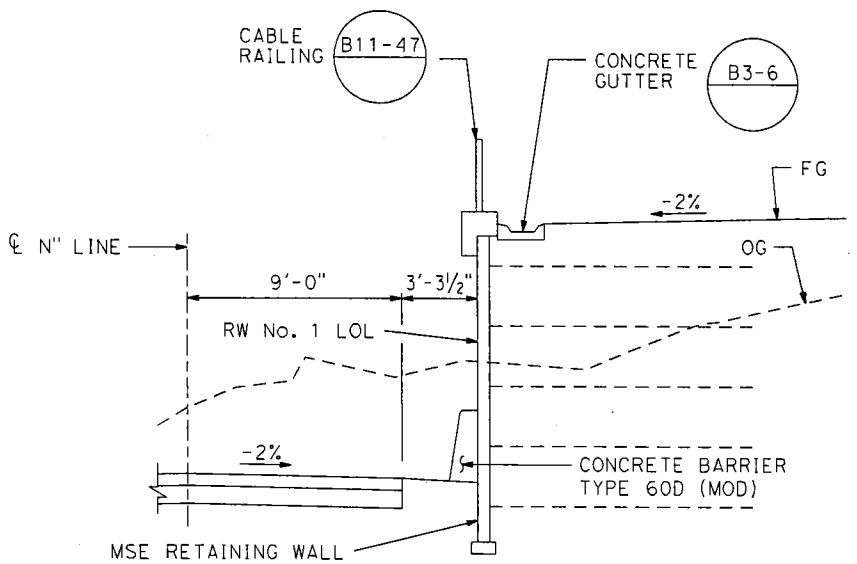
DRAWN: C. HOUGHTON
CHECKED: –
DATE: –
SCALE:
JOB NO. 79082
SHEET 1 OF 7



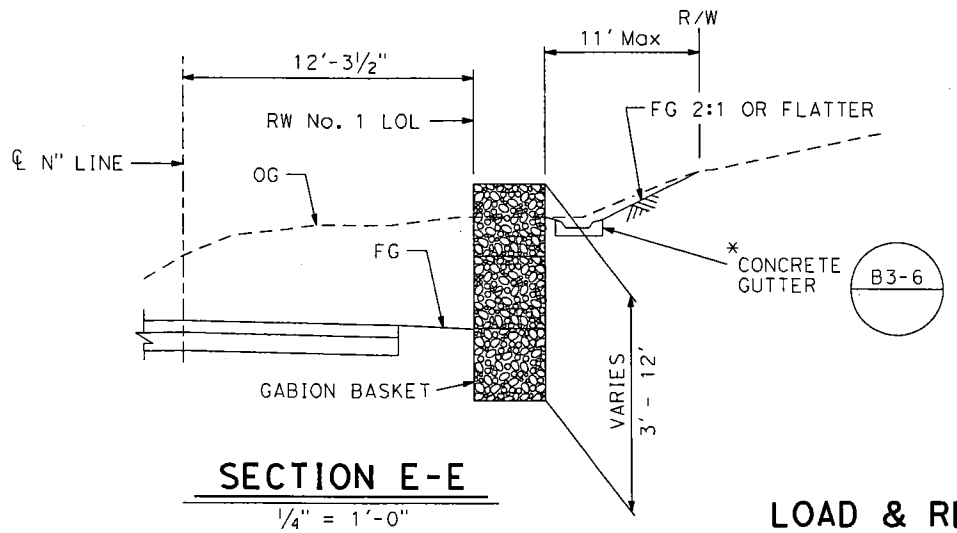
SECTION A-A
1/4" = 1'-0"



SECTION D-D
1/4" = 1'-0"

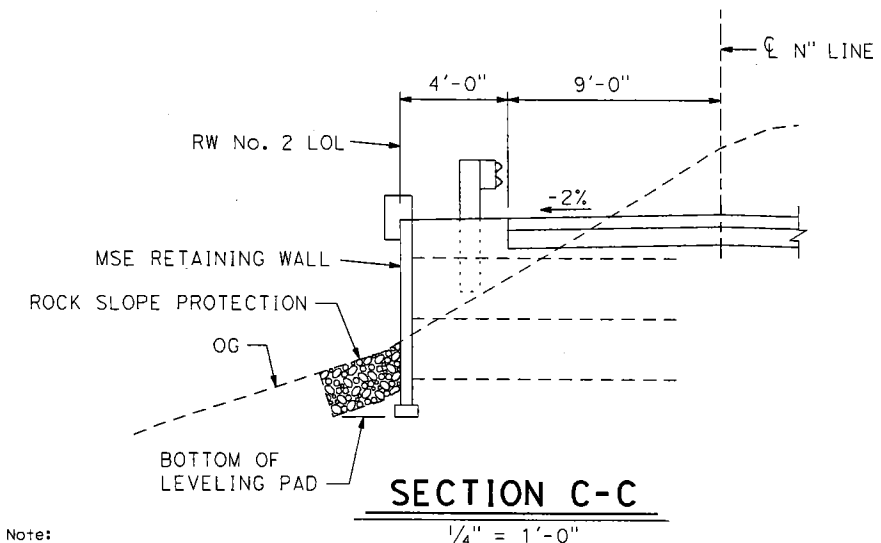


SECTION B-B
1/4" = 1'-0"



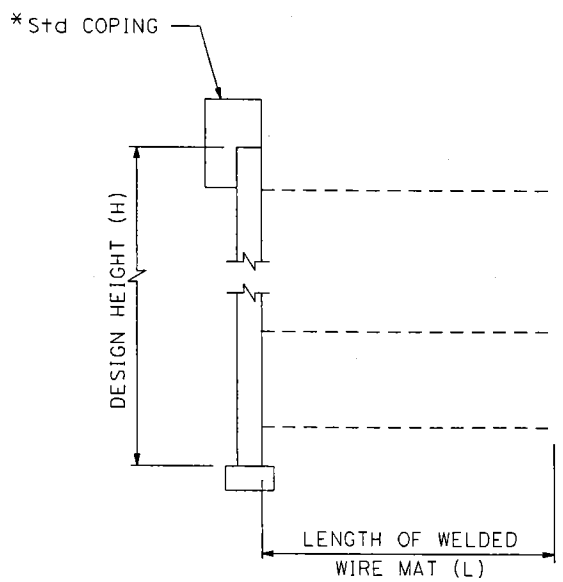
SECTION E-E
1/4" = 1'-0"

*For details, see "MSE DETAILS No. 4" sheet.



SECTION C-C
1/4" = 1'-0"

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.



TYPICAL SECTION
NO SCALE

GENERAL NOTES
LOAD & RESISTANCE FACTOR DESIGN

DESIGN: AASHTO LRFD Bridge Design Specifications, 4th Edition with California Amendments

LIVE LOAD: Surcharge = 240 lb/ft2

SOIL PARAMETERS:

Internal design ϕ = 34°, γ = 120 lb/ft3

External design ϕ (Retained Backfill) = 30°, γ = 120 lb/ft3

ϕ (Foundation) = 30°

K_h = 0.2

PRECAST CONCRETE PANELS:

f'c = 4,000 psi (Concrete compressive strength at 28 days)

fy = 60,000 psi (Yield strength of reinforcement)

SOIL REINFORCEMENT:

Welded wire mats: fy = 65,000 psi (Yield strength)

Coupler: fy = 36,000 psi (Yield strength)

Corrosion rate = 1.1 mils/year

REINFORCED CONCRETE:

f'c = 3,600 psi, except as noted (Concrete compressive strength at 28 days)

fy = 60,000 psi (Yield strength of reinforcement)

MSE = Mechanically Stabilized Embankment

CROSS SECTIONS

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY | REVISION | DATE

REGISTERED PROFESSIONAL ENGINEER — T. OSTERKAMP — No. C46783 — Exp. 6/30/15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER

T. OSTERKAMP

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

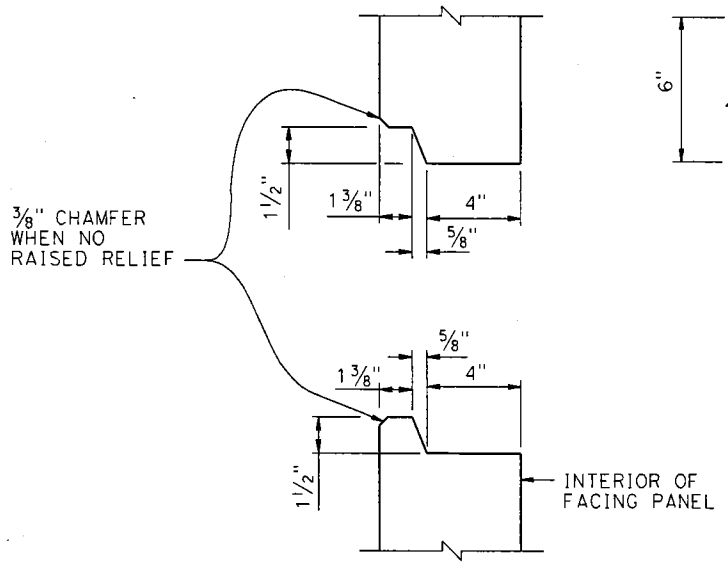
DRAWN: C. HOUGHTON
CHECKED: –
DATE: –
SCALE:
JOB NO. 79082
SHEET 2 OF 7

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

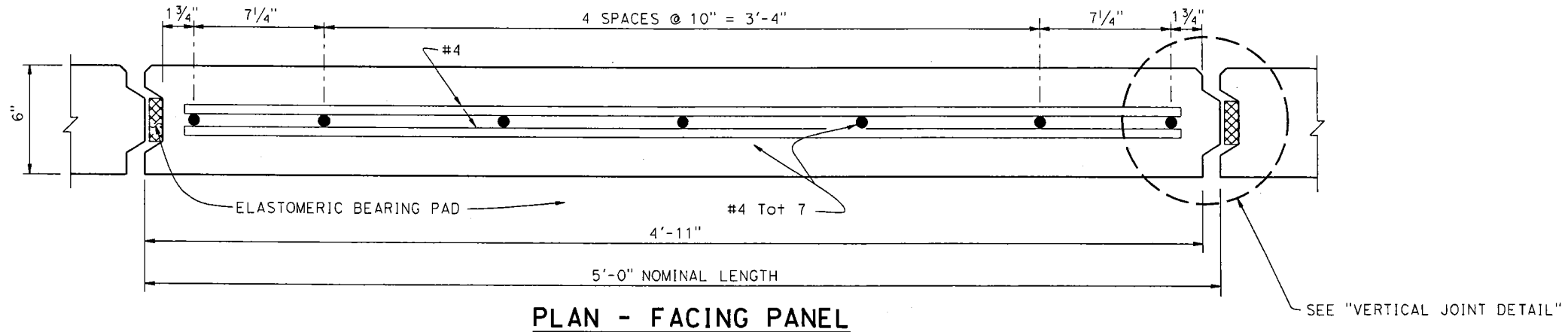
...\517\Nelson\1996N_RWXS.dgn

SHEET NAME:

DRAWING NAME:

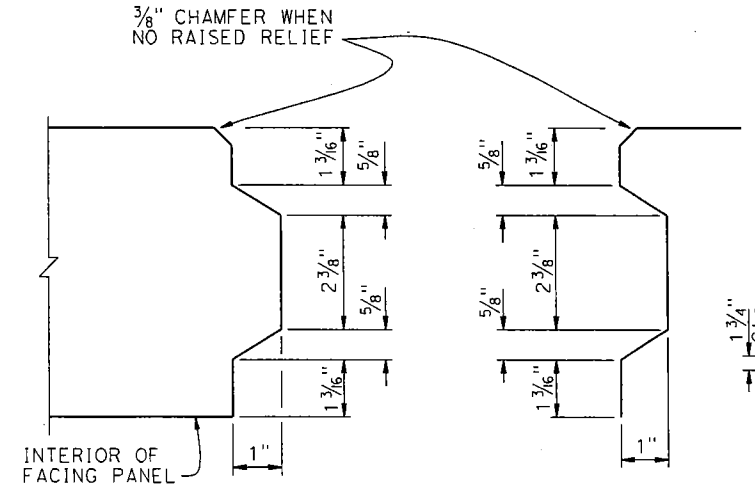


HORIZONTAL JOINT DETAIL
3" = 1'-0"

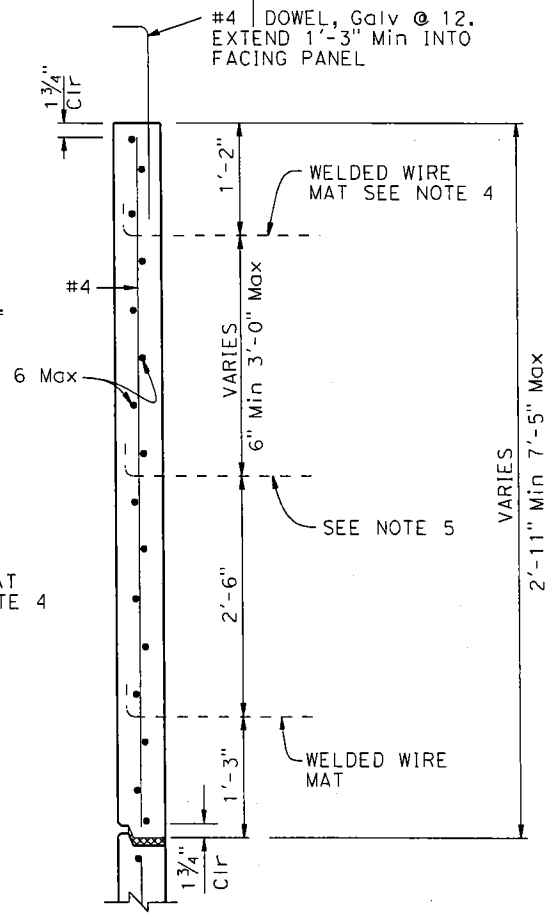


PLAN - FACING PANEL
3" = 1'-0"

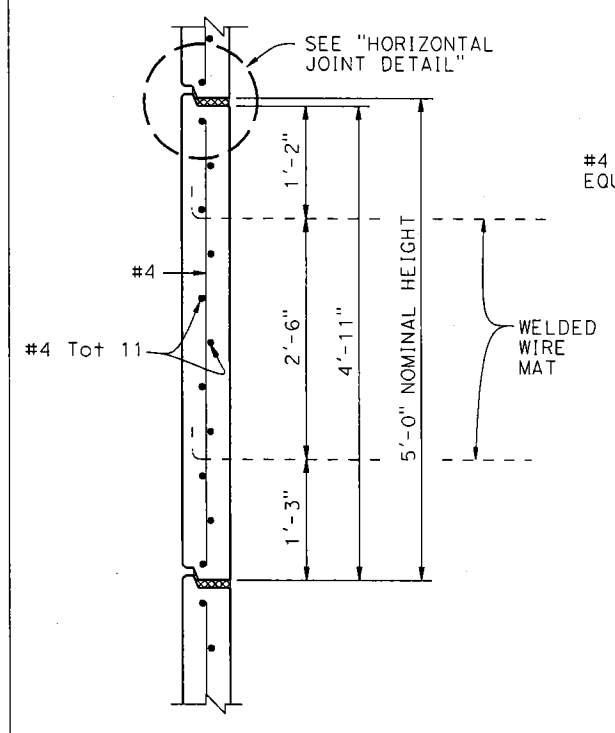
NOTES:
1. Architectural treatment not shown
2. Place reinforced elastomeric bearing pads in all of the panel joints between the panels. Place one in each vertical joint where the horizontal joints intersect. Place two per panel in each horizontal joint:
   3/4" x 2 3/8" x 6" for vertical joints
   3/4" x 4" x 6" for horizontal joints
3. Bond a strip of filter fabric, 1'-0" wide, over the full length of all panel joints
4. Top layer of welded wire mats attached parallel to top of panel when top of wall is angled or curved as shown elsewhere in "STRUCTURE PLANS"
5. Eliminate mid level mat when closer than 6" to top mat, continue variable dimension between remaining mats



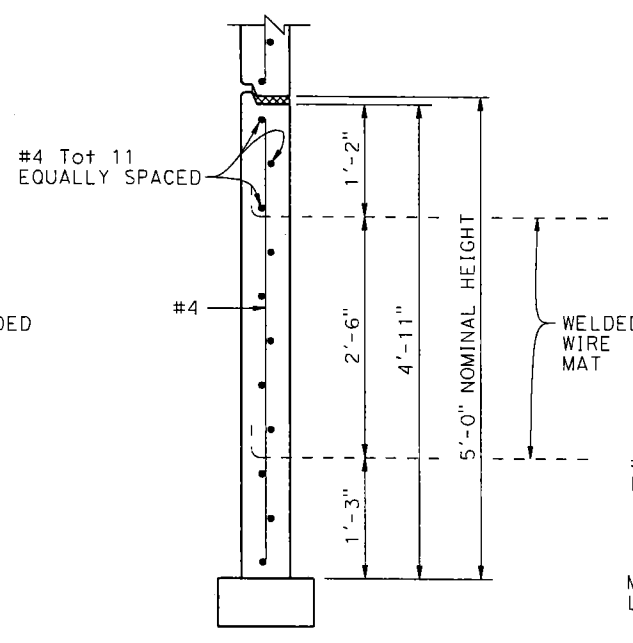
VERTICAL JOINT DETAIL
6" = 1'-0"



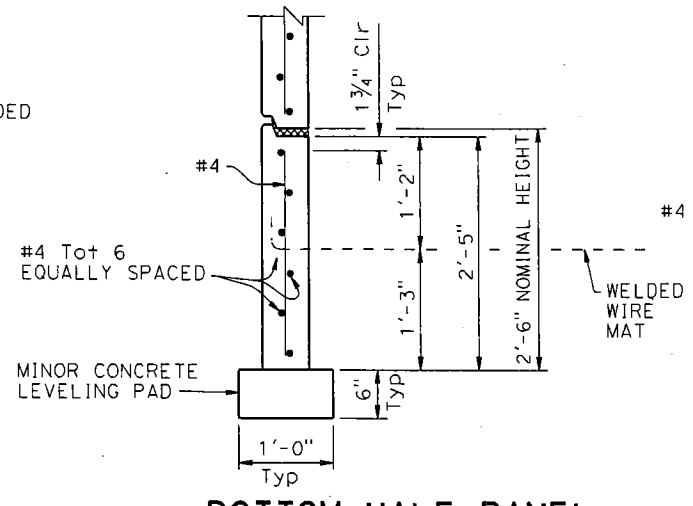
TOP PANEL WITH MULTIPLE MATS
1" = 1'-0"



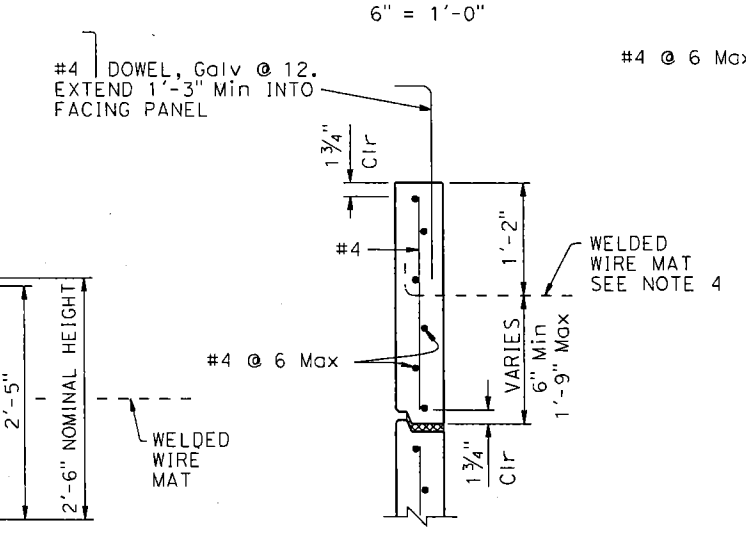
INTERMEDIATE PANEL
1" = 1'-0"



BOTTOM PANEL
1" = 1'-0"



BOTTOM HALF PANEL
1" = 1'-0"



TOP HALF PANEL
1" = 1'-0"

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

MSE DETAILS No. 1

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\517\Nelson\1996N_RWMD01.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	REVISION	DATE

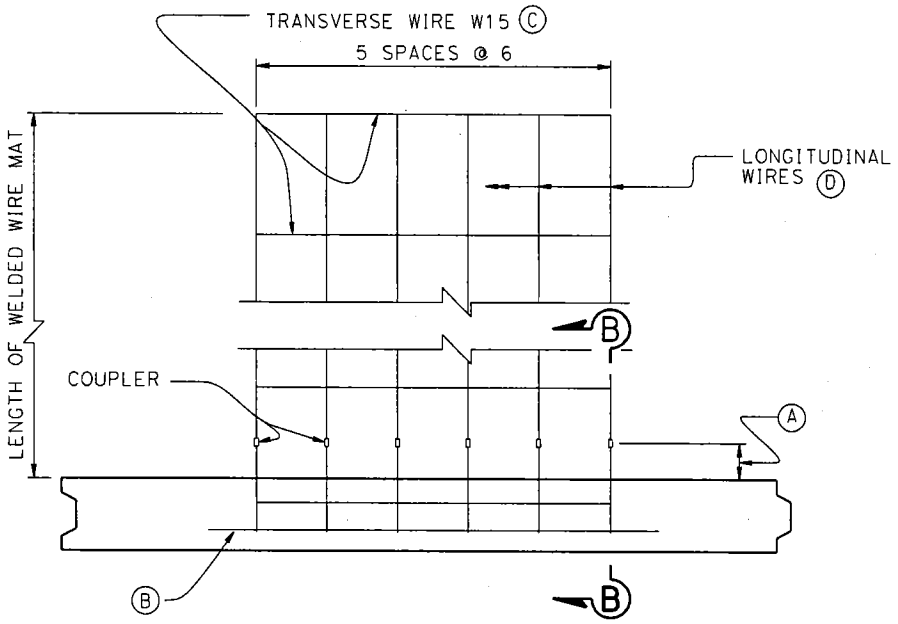
REGISTERED PROFESSIONAL ENGINEER — J. OSTERKAMP — No. C46783 — CIVIL — STATE OF CALIFORNIA — Exp. 6/30/15

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

PROJECT ENGINEER: J. OSTERKAMP

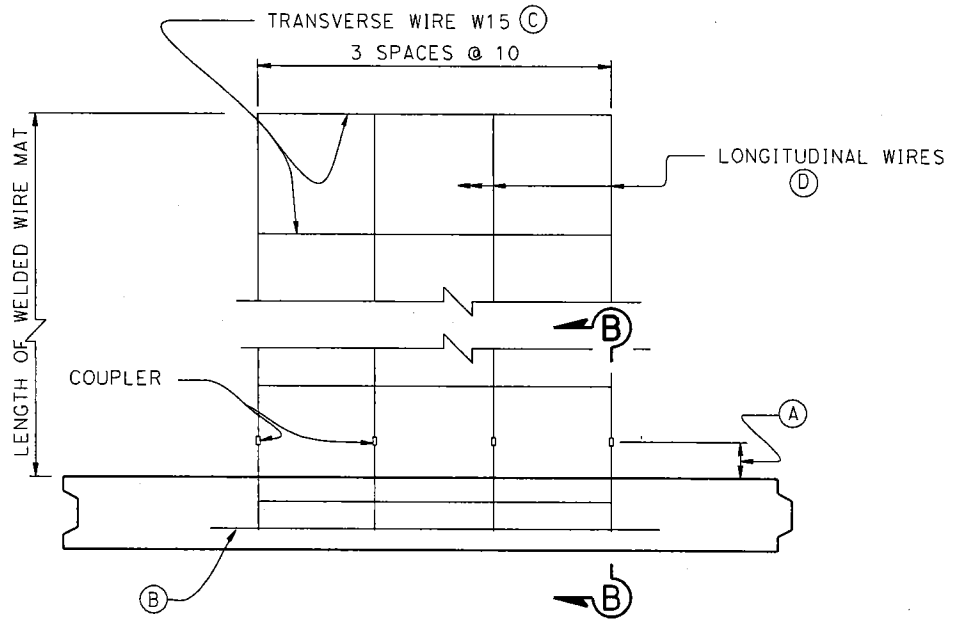
NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: C. HOUGHTON
CHECKED: –
DATE: –
SCALE:
JOB NO. 79082
SHEET 3 OF 7



PLAN OF PANEL WITH SIX WIRE MAT

1½" = 1'-0"



PLAN OF PANEL WITH FOUR WIRE MAT

1½" = 1'-0"

MSE WIRE MESH

DESIGN HEIGHT (H)	7'-6"	12'-6"
LENGTH OF WELDED WIRE MAT (L)	8'-0"	10'-0"
WELDED WIRE MAT CONFIGURATION	TOP 4 - W15 X W15 @ 6 1 OF 4 - W15 X W15 @ 6 BOT 4 - W15 X W15 @ 6	TOP 4 - W15 X W15 @ 6 3 OF 4 - W15 X W15 @ 6 BOT 4 - W20 X W15 @ 9

DESIGN HEIGHT (H)	15'-0"	17'-6"
LENGTH OF WELDED WIRE MAT (L)	13'-0"	17'-0"
WELDED WIRE MAT CONFIGURATION	TOP 4 - W15 X W15 @ 6 3 OF 4 - W15 X W15 @ 6 1 OF 4 - W20 X W15 @ 9 BOT 4 - W20 X W15 @ 9	TOP 4 - W15 X W15 @ 6 4 OF 4 - W15 X W15 @ 6 1 OF 4 - W20 X W15 @ 9 BOT 4 - W20 X W15 @ 9

Example Configuration: 3 of 4 - W20 x W15 @ 9
3 of = 3 levels of reinf mat with
4-W20 x = 4 longitudinal wires W20 size
W15 @ 9 = W15 sized transverse wire at 9 inch spacing

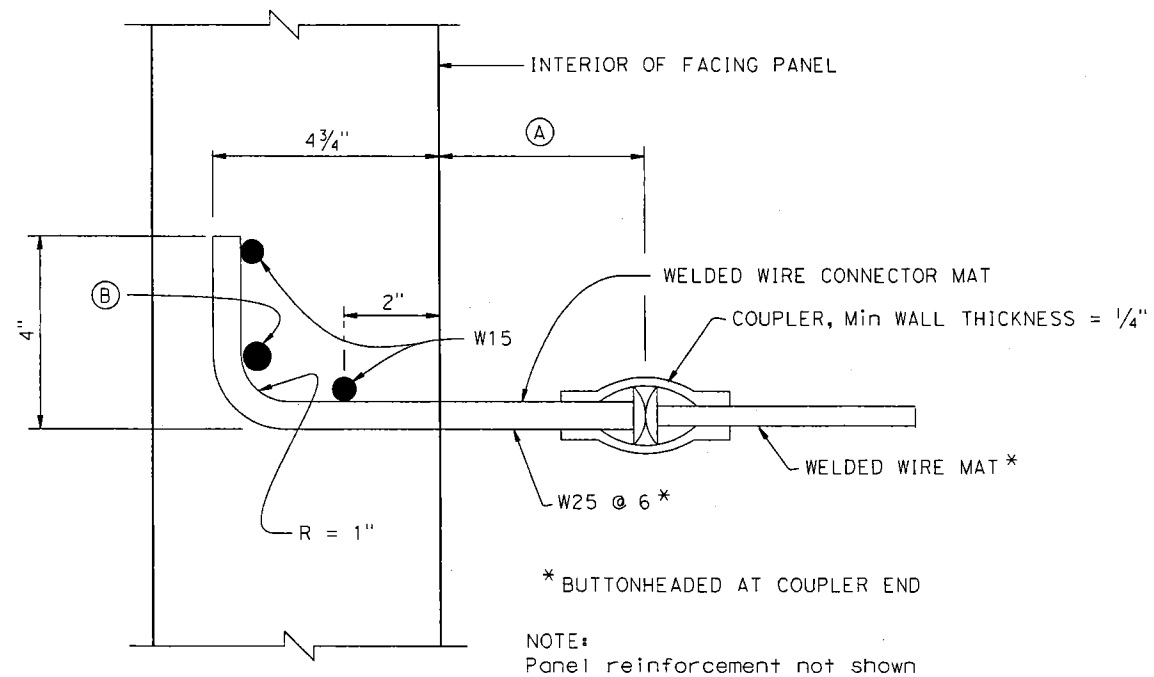
NOTES:

(A) Distance as required to permit coupler to be swaged

(B) Place #4 x 3'-2", centered on connector mat, but not welded to it

(C) All transverse wires size W15 at various spacing as shown elsewhere in plans

(D) Size of longitudinal wires shown elsewhere in plans



* BUTTONHEADED AT COUPLER END

NOTE:
Panel reinforcement not shown

SECTION B-B

6" = 1'-0"

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

MSE DETAILS No. 2

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\517\Nelson\1996N_RWMD02.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 BLUE RAVINE ROAD, SUITE 200
FOLSOM, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	REVISION	DATE

PROFESSIONAL ENGINEER — REGISTERED — L. OSTERKAMP — No. C46783 — Exp. 6/30/15 — CIVIL — STATE OF CALIFORNIA

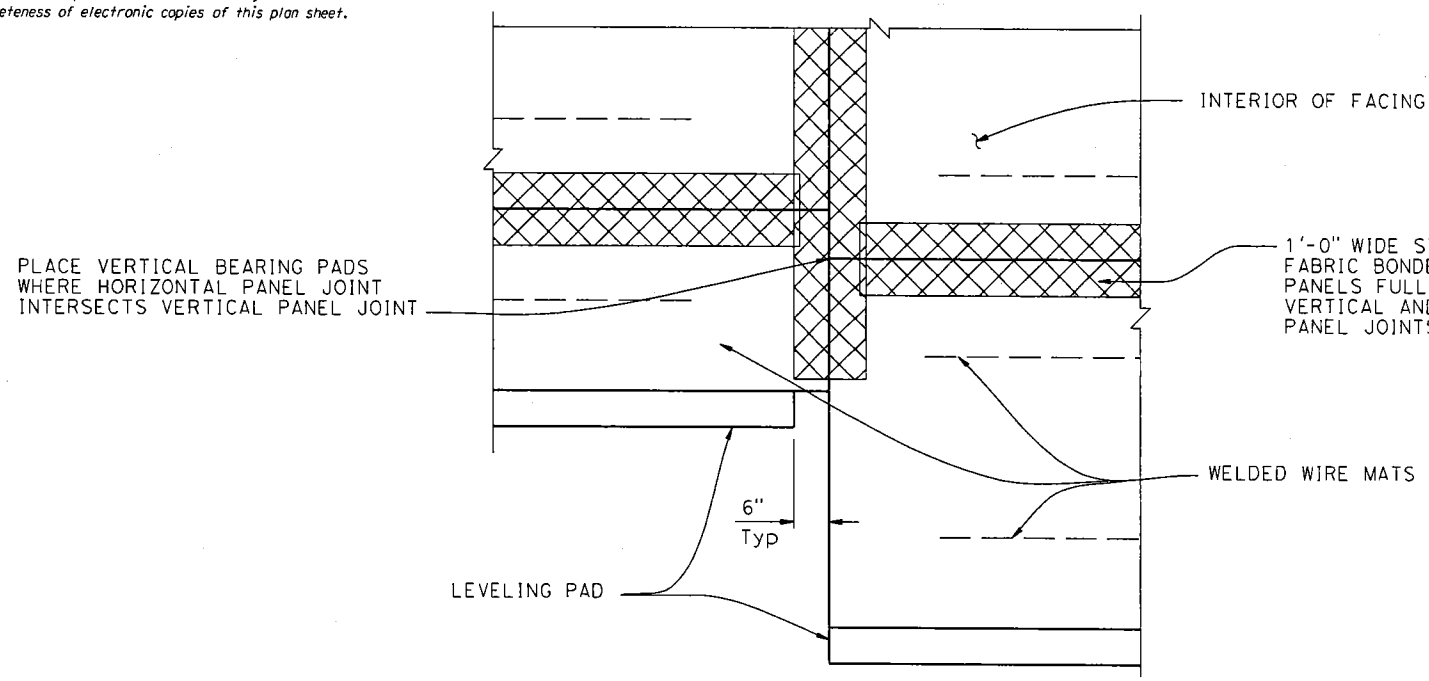
PROJECT ENGINEER

1

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

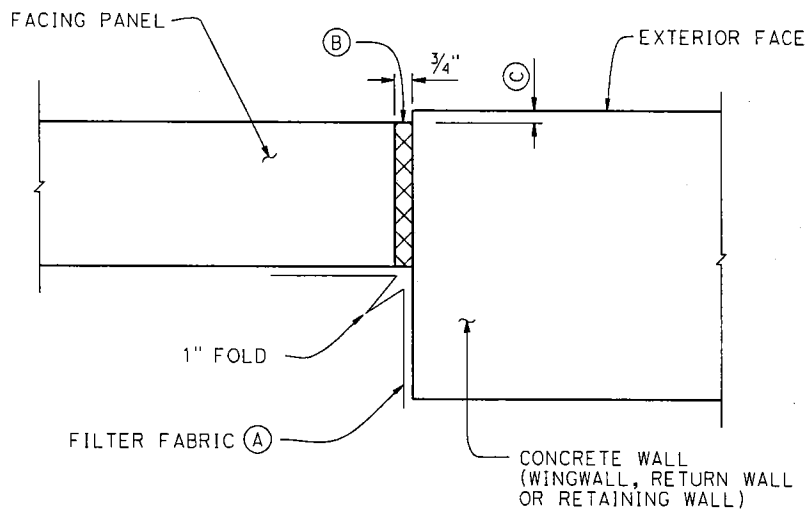
NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: C. HOUGHTON
CHECKED: –
DATE: –
SCALE:
JOB NO. 79082
SHEET 4 OF 7



PART ELEVATION

3/4" = 1'-0"



MSE FACING PANEL-TO-CONCRETE WALL JOINT DETAIL

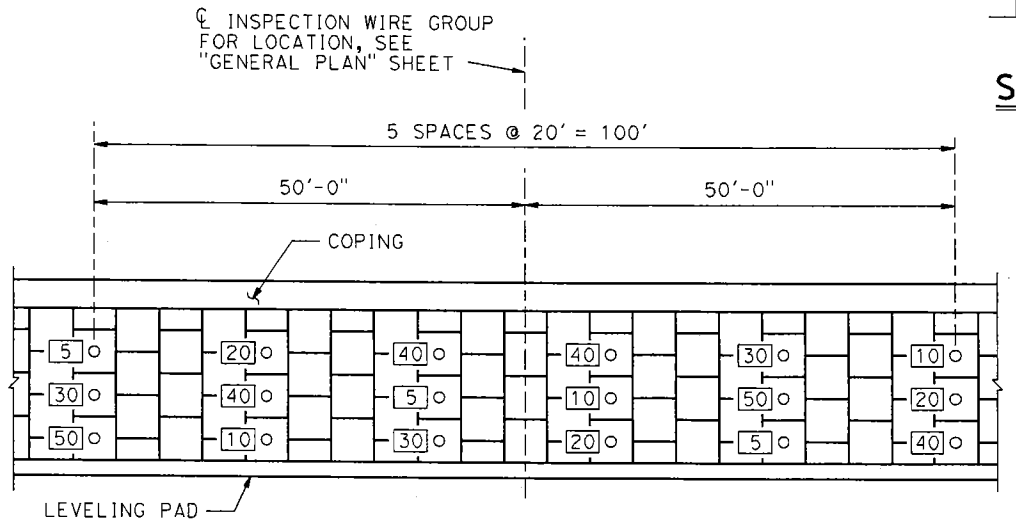
3" = 1'-0"

NOTES:

(A) Bond a strip of filter fabric, 1'-6" wide, to back of MSE panels and the adjacent concrete wall for entire length of vertical joint

(B) Bond expansion joint material to the concrete wall

(C) Offset between face of MSE facing panel and face of the concrete wall as dictated by location of layout lines shown elsewhere in "STRUCTURE PLANS"



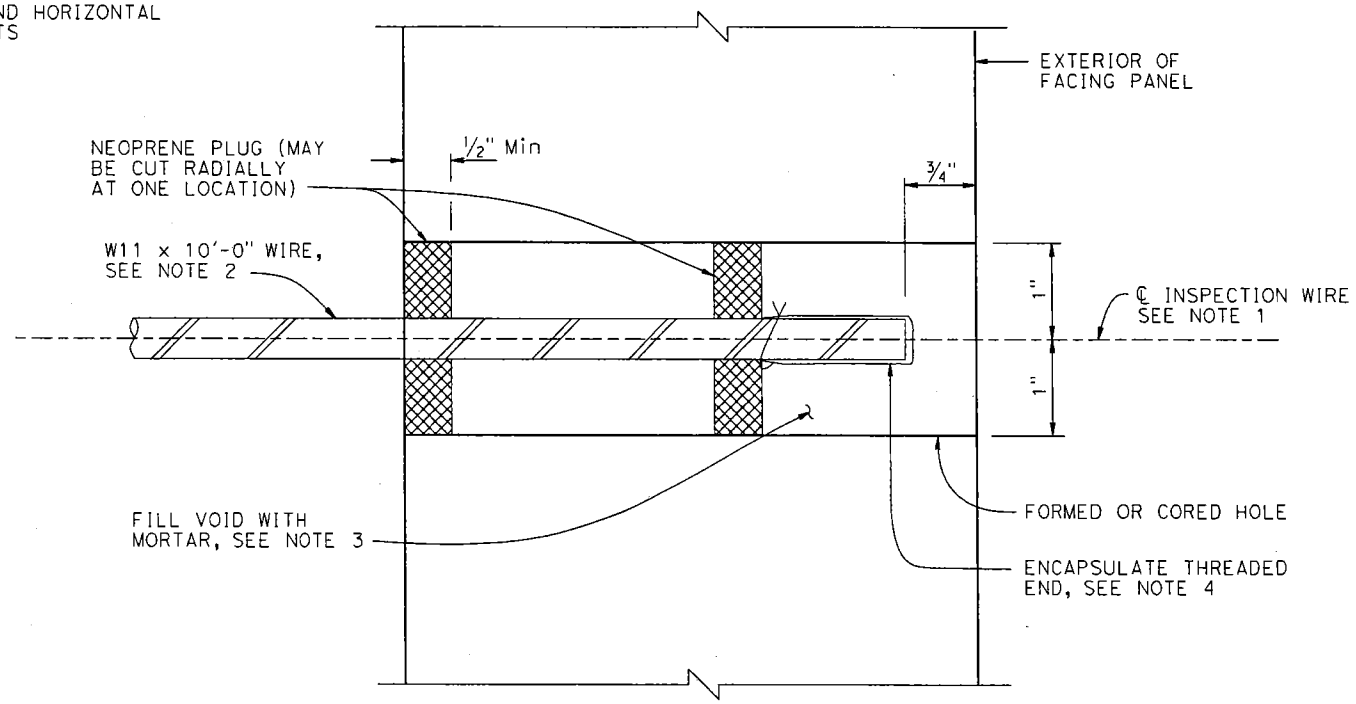
INSPECTION WIRE GROUP

NO SCALE

LEGEND:

o DENOTES LOCATION OF INSPECTION WIRE

[XX] DENOTES INTERVAL IN YEARS FROM TIME OF CONSTRUCTION TO REMOVAL OF INSPECTION WIRE



SECTION THRU INSPECTION WIRE

NO SCALE

NOTES:

1. Center inspection wire in facing panel.
2. Fabricated inspection wire from W11 wire representative of the welded wire mats, with 3/8" ø 16 UNC threads for at least 1 1/2" of one end.
3. Place inspection wire horizontal and perpendicular to the wall panel prior to backfilling.
4. Encapsulate threaded end with corrosion inhibiting mastic, vinyl covering, and secure with plastic tie.

   UNC = Unified Coarse Threads

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

MSE DETAILS No. 3

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\517\Nelson\1996N_RWMD03.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	REVISION	DATE

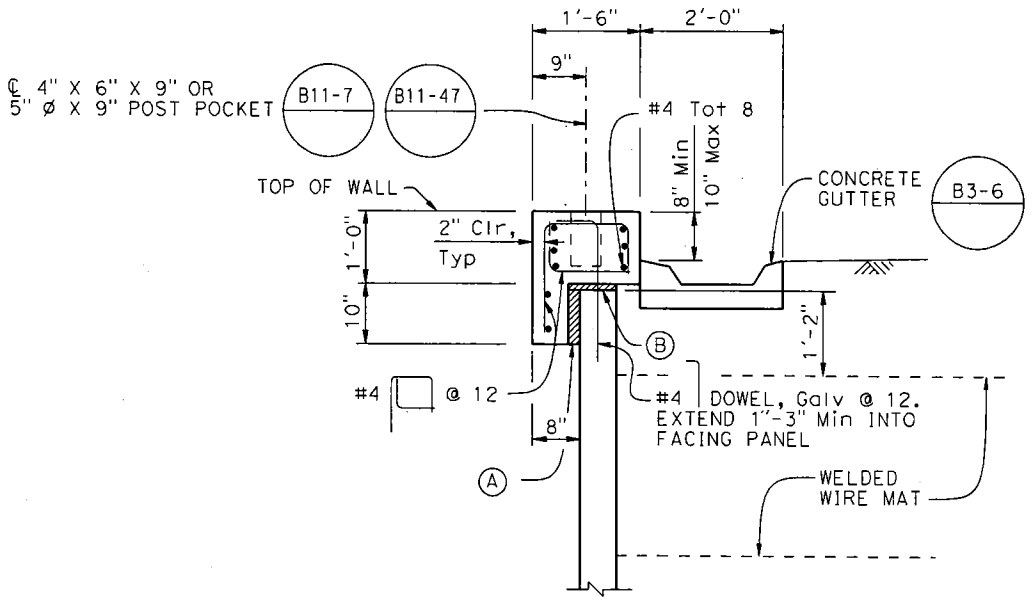
REGISTERED PROFESSIONAL ENGINEER T. OSTERKAMP No. C46783 Exp. 6/30/15 CIVIL STATE OF CALIFORNIA

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

PROJECT ENGINEER

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: C. HOUGHTON
CHECKED: -
DATE: -
SCALE:
JOB NO. 79082
SHEET 5 OF 7



STANDARD COPING

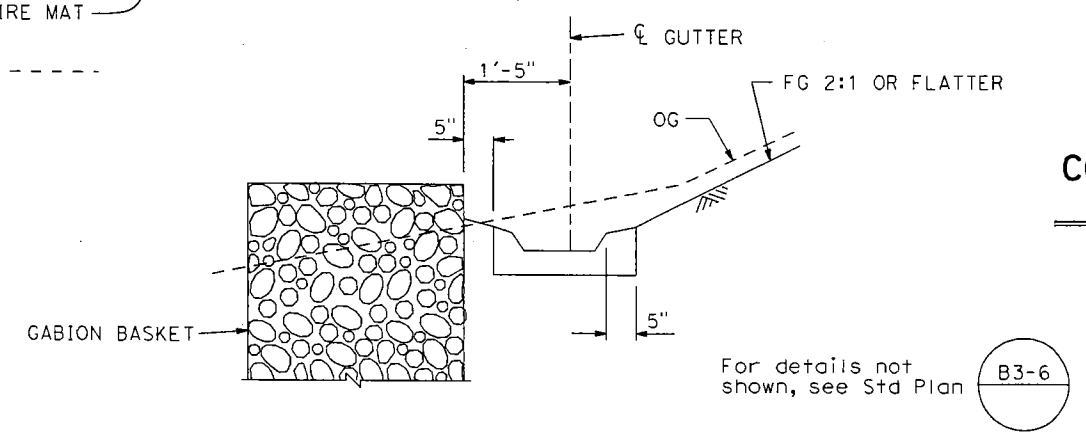
¾" = 1'-0"

NOTES:

1. Install cable railing or chain link railing when indicated

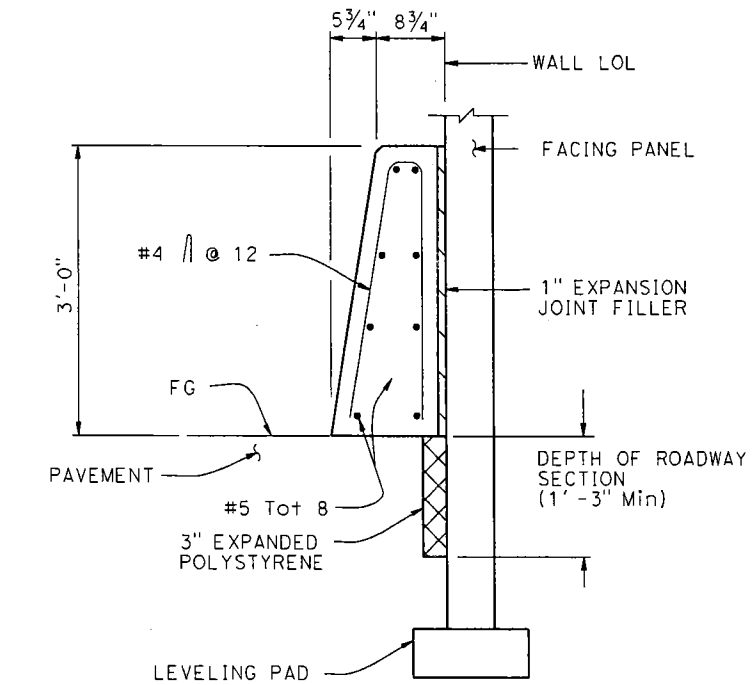
(A) 2" Expanded Polystyrene

(B) 1" Expanded Polystyrene



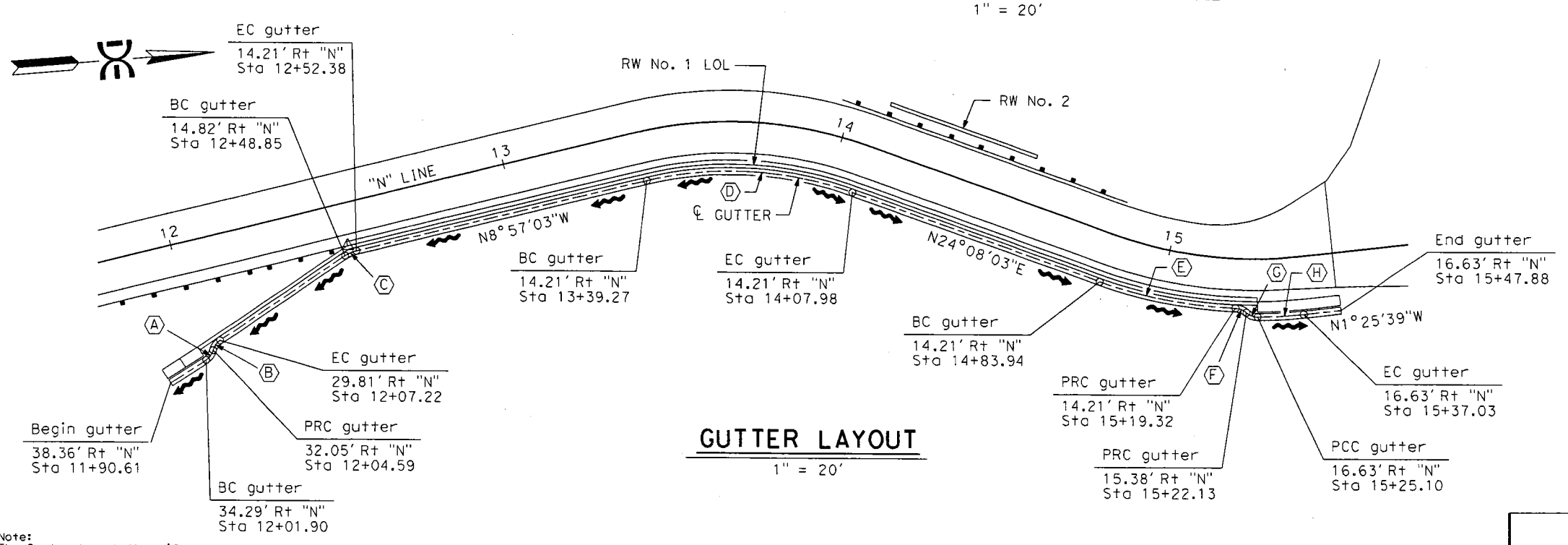
GUTTER SECTION AT GABION

1" = 20'



CONCRETE BARRIER TYPE 60D (MOD) AT FACE OF MSE

1" = 1'-0"



GUTTER LAYOUT

1" = 20'

CURVE DATA

(A)	(B)	(C)
R = 5.00'	R = 5.00'	R = 10.00'
△ = 40°40'58"	△ = 40°40'58"	△ = 19°47'56"
T = 1.85'	T = 1.85'	T = 1.75'
L = 3.55'	L = 3.55'	L = 3.46'

(D)	(E)	(F)
R = 104.79'	R = 133.21'	R = 5.00'
△ = 33°05'06"	△ = 17°02'13"	△ = 39°18'45"
T = 31.12'	T = 19.95'	T = 1.79'
L = 60.51'	L = 39.61'	L = 3.43'

(G)	(H)
R = 5.00'	R = 135.63'
△ = 42°05'33"	△ = 5°44'41"
T = 1.92'	T = 6.81'
L = 3.67'	L = 13.60'

LEGEND:

Denotes gutter flow direction

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

MSE DETAILS No. 4

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\517\Nelson\1996N_RWMD04.dgn

SHEET NAME:

DRAWING NAME:

DOKKEN ENGINEERING
110 Blue Ravine Road, Suite 200
Folsom, CA 95630
PH: 916-858-0642 FAX: 916-858-0643

BY	REVISION	DATE

PROFESSIONAL ENGINEER — T. OSTERKAMP — No. C46783 — Exp. 6/30/15 — CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER

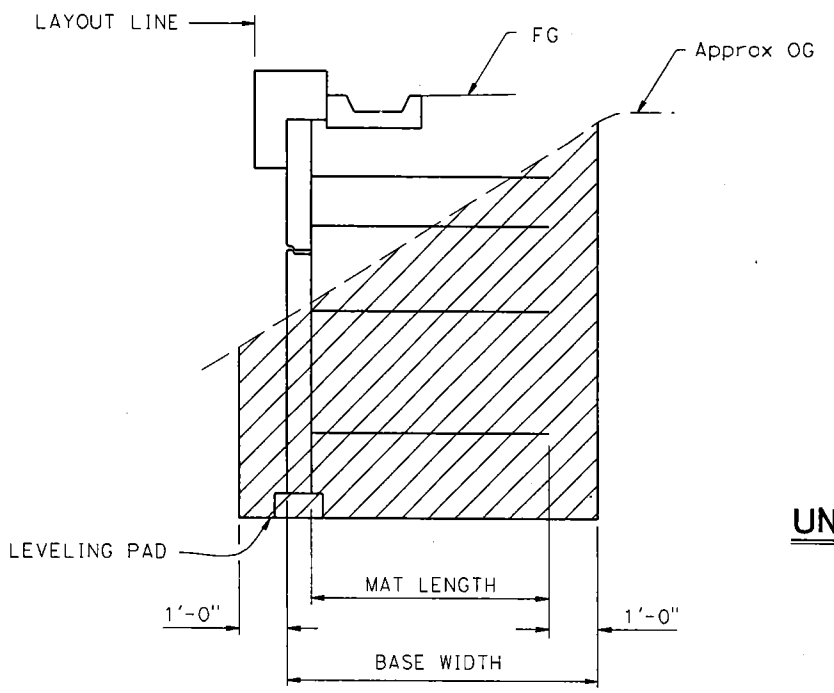
T. OSTERKAMP

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0

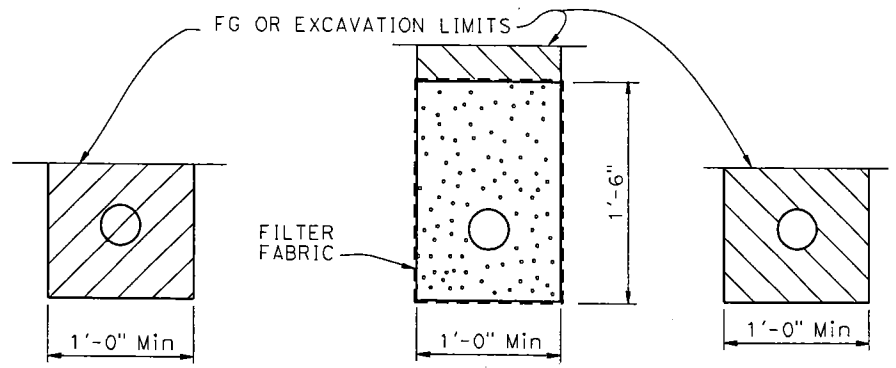
STORM DAMAGE REPAIR PROJECT

DRAWN: C. HOUGHTON
CHECKED: –
DATE: –
SCALE:
JOB NO. 79082
SHEET 6 OF 7



LIMITS OF EXCAVTION

1/2" = 1'-0"



OUTLET PIPE CLEANOUT PIPE

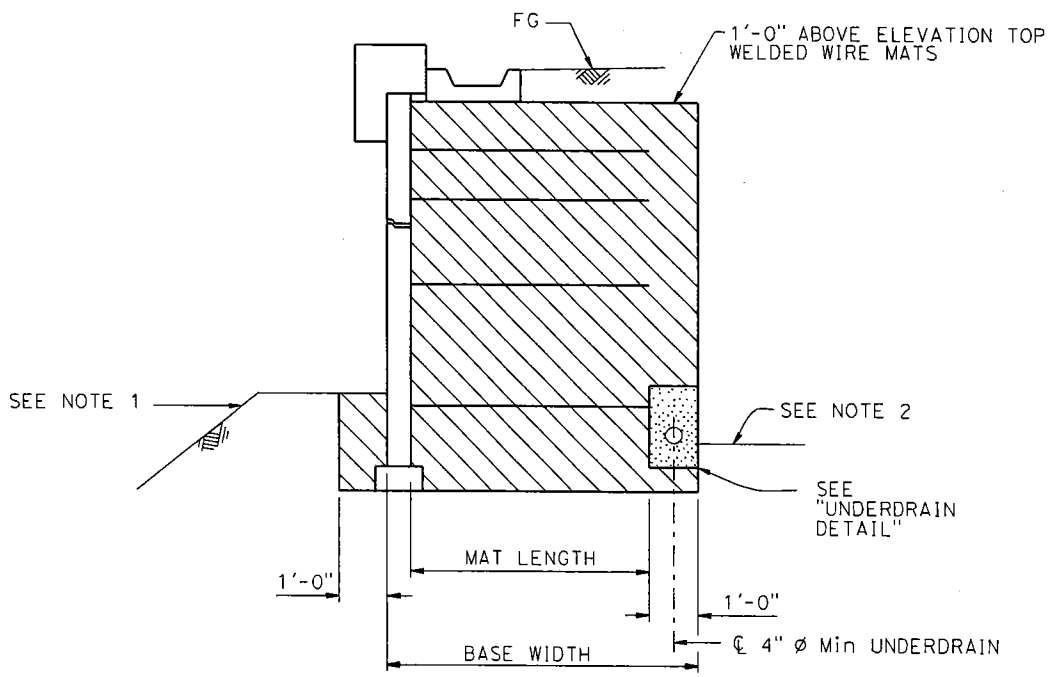
EXCAVATION BACKFILL

UNPERFORATED OUTLET OR CLEAN OUT PIPE FOR UNDERDRAIN

NO SCALE

NOTES:

1. Limits to FG except to GP when in roadway section.
2. Locate underdrain behind bottom level of welded wire mats wherever possible, or at elevation needed to drain, as shown elsewhere on plans.
3. Place perforated pipe underdrain of diameter shown elsewhere on plans or minimum 4" ø smoothed wall PVC or minimum 8" ø corrugated HDPE.
4. Maximum spacing of outlet pipe is 200 feet.
5. At sags in profile of underdrain, install outlet pipe for each direction of flow.



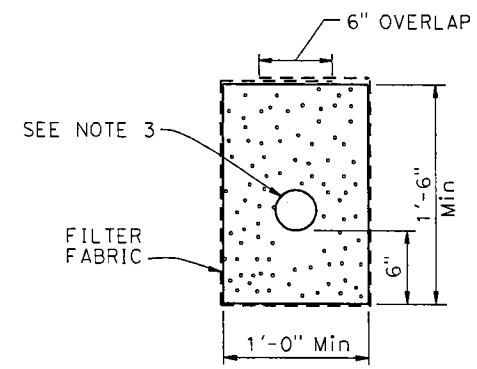
SLOPING FINISHED SURFACE

1/2" = 1'-0"

LIMITS OF BACKFILL

LEGEND:

- Limits of Structure Excavation
- Limits of Structure Backfill
- Limits of Permeable Material



UNDERDRAIN DETAIL

Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

MSE DETAILS No. 5

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

...\517\Nelson\1996N_RWMD05.dgn

SHEET NAME:

DRAWING NAME:

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BY | REVISION | DATE

PROFESSIONAL ENGINEER — REGISTERED — T. OSTERKAMP No. C46783 Exp. 6/30/15 CIVIL — STATE OF CALIFORNIA

PROJECT ENGINEER

COUNTY OF SANTA CRUZ – DEPARTMENT OF PUBLIC WORKS

NELSON ROAD PM 2.0
STORM DAMAGE REPAIR PROJECT

DRAWN: C. HOUGHTON
CHECKED: –
DATE: –
SCALE:
JOB NO. 79082
SHEET 7 OF 7

FOCUSED ENGINEERING GEOLOGIC INVESTIGATION
NELSON ROAD LANDSLIDE
SANTA CRUZ COUNTY,
CALIFORNIA

PROJECT 2011.0068

For

Mr. Jason Heath
Assistant County Counsel
County of Santa Cruz
701 Ocean Street, Room 505
Santa Cruz, CA 95060

By

PACIFIC GEOTECHNICAL ENGINEERING
16055 Caputo Drive, Suite D
Morgan Hill, California 95037
(408) 778-2818

December 20, 2011

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FOCUSED ENGINEERING GEOLOGIC INVESTIGATION
NELSON ROAD LANDSLIDE
SANTA CRUZ COUNTY, CALIFORNIA

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our focused engineering geologic investigation regarding a 2011 landslide that affected a portion of Nelson Road, northwest of Scotts Valley, in Santa Cruz County, California. The site location is depicted on our Site Location Map (Fig. 1). The goal of our investigation has been to gain enough of an understanding of the landslide's mechanics to form the basis for decisions on potential mitigation options.

Based on the results of our investigation, we conclude that the 2011 slide is latest in an extended history of landsliding affecting the slopes encompassing the 2011 slide.

We provide a review of conceptual mitigation approaches aimed at restoring access, and of the geologic/geotechnical issues associated with each.

1.2 PROJECT DESCRIPTION

On March 21, 2011, a landslide originating east of the Nelson Road right-of-way buried the roadway, blocking access to approximately 27 homes. Nelson Road at the 2011 landslide location is a public road; the public portion terminates several tens of feet north of the landslide boundary and private roadways extend on past that point. The 2011 landslide blocked a private driveway stemming eastward off of Nelson Road at a point just south of the landslide. The headscarp of the 2011 landslide encroached upslope nearly to Sky Meadow Lane, a private road serving several homes.

As expressed to us, the Santa Cruz County Department of Public Works' (County DPW in this report) primary goal is to restore the public access provided by Nelson Road to homeowners served by that road. County DPW asked us to investigate the nature of the 2011 landslide in order to assess a number of possible mitigation options. Given that the bulk of the 2011 landslide lies outside the public right-of-way, County DPW asked us to focus in particular on the likely geotechnical effects of clearing the existing Nelson Road alignment. Our investigation was scoped accordingly.

Alternatives that we considered included (described in detail Section 4.5 of this report):

- Alternate access route past landslide
- Removal of 2011 landslide debris and reestablishment of previous road grades
- Removal of 2011 landslide debris and reestablishment of previous road grades, with limited scaling of slope
- Construction of energy-absorbing catchment
- Reconstruction of Nelson Road at a higher elevation along the existing road alignment
- Installation of a hydrauger array
- Removal and replacement of the landslide mass

The scope of investigation was necessarily limited, with subsurface exploration restricted to the perimeter of the 2011 landslide. This decision was made on the basis of several factors:

- A relatively large, heavy drill rig would be needed to provide the best opportunity for obtaining samples and subsurface data.
- Significant grading within the potentially unstable landslide debris would be needed to create access for such a drill rig.
- The 2011 landslide deposits are largely confined to private property, thus both the geotechnical drilling and the grading to create access for it would be on private property.
- Drilling conditions in a landslide mass composed primarily of fragmented rock are difficult, and based on our experience, the likelihood of obtaining testable samples from the zones of weakest material are low under such conditions

Based on the combined potential for the drilling effort to adversely affect a metastable landslide mass, coupled with the low probability of obtaining high-quality samples, it was decided that drilling within the 2011 landslide limits would be imprudent.

The above limitations notwithstanding, the information gleaned from our investigation provides sufficient basis for preliminarily ranking and eliminating mitigation alternatives, and for developing a geotechnically preferred alternative: providing an alternate access route past the 2011 landslide.

1.3 INFORMATION PROVIDED

For this investigation we were provided with the following documents:

- A hand-held video of the progressing landslide, reportedly taken on March 21, 2011 (original source unknown).
- GIS files for 2010 LiDAR obtained by AMBAG, provided in preliminary form by County of Santa Cruz GIS personnel.
- Pre- and post-landslide photographs of Nelson Road slope conditions, kindly provided by area residents D. Evans and T. Lorek.
-
- Well logs on file with the County Division of Environmental Health, for information regarding geologic materials encountered during drilling.

1.4 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of this investigation was to characterize the 2011 Nelson Road landslide sufficiently to permit decisions regarding possible mitigation options, in particular the clearing of debris from the existing Nelson Road alignment.

For this study, we completed the following scope of work:

1. Review of geologic maps and literature in our office files regarding the site and its environs.
2. Review and interpretation of stereo pairs of aerial photographs.

3. Geologic reconnaissance of the site and general vicinity.
4. Exploration, sampling, and classification of soils and bedrock materials by means of two small-diameter exploratory borings and two large-diameter borings drilled to assess landslide hazards.
5. Installation of slope inclinometer casing in each of the two small-diameter borings in order to permit monitoring of subsurface deformation and possible further sliding.
6. Installation of a vibrating-wire piezometer and programmable datalogger in each of the two small-diameter borings in order to monitor groundwater conditions.
7. Laboratory testing of samples recovered from our borings.
8. Installation of 5 sets of stakes across landslide scarp features to facilitate detection of any ongoing deformation through stake-to-stake measures..
9. Acquisition of oblique aerial photographs of the 2011 landslide area, courtesy of a helicopter overflight provided by CalFire.
10. Acquisition of LiDAR data flown for this project on June 18, 2011, and processing of that data to generate a "bare earth" digital elevation model (DEM) and derivative map products.
11. Development of three geologic cross-sections using the LiDAR topography. The geologic cross-sections were used for slope stability analyses.
12. Assessment and re-processing of 2010 (pre-landslide) LiDAR data obtained by AMBAG and provided to us in preliminary form for evaluation, by County of Santa Cruz GIS personnel.
13. Geologic and engineering analysis of our data, including two dimensional slope stability analyses using SLIDE software.
14. Development of conclusions regarding the mechanics and apparent controls on landslide movement.
15. Research into possible mitigation options, in particular the geologic/geotechnical feasibility of clearing the existing Nelson Road alignment.
16. Meetings with County personnel, and attendance at an early public meeting with area residents.
17. Preparation of this report, presenting our findings, conclusions and recommendations.

2. REGIONAL SETTING

2.1 PHYSICAL

The site is located on the eastern hillslopes of the north-trending valley occupied by Ruins Creek, in hilly terrain northwest of Scotts Valley. The primary access road up the Ruins Creek drainage is Nelson Road, which extends up the eastern side of the valley. Nelson Road is served by Mt. Hermon Road and Lockhart Gulch Road. Elevations in the site vicinity range from approximately 540 to 680 feet above mean sea level. The site location is shown on our Site Location Map (Fig. 1).

2.2 GEOLOGIC

The regional geologic setting is shown on our Geologic Index Map (Figure 2). Regionally, the site lies within the Santa Cruz Mountains. The Santa Cruz Mountains consist primarily of a core of metamorphic rocks overlain in the site vicinity by younger sedimentary rocks. These rocks have been uplifted and folded.

Regional geologic mapping by Brabb and others (1997) show the hillslopes in the site vicinity as being underlain by Miocene-age Santa Cruz Mudstone, with the overlying Miocene and Pliocene-age Purisima Formation capping the ridgecrest areas. The Miocene-age Santa Margarita Sandstone underlies the Santa Cruz Mudstone regionally, and forms the bedrock that underlies the valley floor in the site vicinity.

There is an unconformity between the Santa Cruz Mudstone and the overlying Purisima Formation; the angular discordance appears to be generally slight based on regional map relations (Brabb and others, 1997; Aiello and others, 1999; Powell and others, 2007). An unconformity and associated contrast between rock types can provide a possible plane of weakness, and can affect groundwater infiltration. The Santa Cruz Mudstone/Purisima contact in the site vicinity appears to lie structurally below a resistant bed visible in the site topography. Springs present in the north and south swales are located where the top of this resistant bed intersects the hillslopes.
The Santa Cruz Mudstone is locally diatomaceous, which results in an unusually low rock density (Hecht and Golling, 1982; Clark, 1981).

The valley floor in the site vicinity is fairly broad, and is mapped (Brabb and others, 1997) as infilled by creek alluvium deposited by Ruins Creek. To the south, the valley narrows down and Ruins Creek is essentially cut through rock (see Figures 1 and 2).

The hinge of a west-northwest-plunging syncline (trough-shaped fold) is mapped in the general site vicinity (Brabb and others, 1997; see Figure 2). Regional bedding attitudes imply that the site is near the core of this fold, with bedding overall dipping shallowly to the west and southwest, an adverse condition for west-facing slopes.

2.3 LANDSLIDING

Regional landslide maps (Cooper-Clark and Associates, 1975; Roberts and others, 1998) show scattered landslides in the hilly terrain encompassing the site vicinity, but no landslides are shown at the site.

There has not yet been a Seismic Hazard Zone Map prepared for the site vicinity by the California Geological Survey.

No landslides are shown at the site on County of Santa Cruz Landslide Zones 2009, and subsequent updates [accessed at http://gis.co.santa-cruz.ca.us/Gis/Map_Gallery/ and http://gissc.co.santa-cruz.ca.us/].

2.4 FAULTING AND SEISMICITY

No active earthquake faults are mapped at the site. The property is not within a California Geological Survey (CGS) Earthquake Fault Zone (Hart, 2007) or a County of Santa Cruz fault rupture hazard zone (Hall and others, 1974; County of Santa Cruz Fault Zones 2009, and subsequent updates [accessed at http://gis.co.santa-cruz.ca.us/Gis/Map_Gallery/ and http://gissc.co.santa-cruz.ca.us/].

Seismic shaking at the site is relevant insofar as it can reduce slope stability, and we briefly review the seismic setting of the site below.

Broadly speaking, the property can be considered to be within the San Andreas fault system. Collectively, most faults in the California Coast Range together form a diffuse boundary between two large tectonic plates on the earth surface: The North American plate to the northeast and the Pacific plate to the southwest. Several faults within this plate boundary are known to be seismically active, capable of generating strong earthquake shaking at the site.

A number of active and potentially active seismic sources (faults) cross the southern San Francisco Bay area; several are listed below (Jennings, 2010), and the more significant ones are described in detail in Appendix B of this report. Seismic sources of significance to the site include the following.

Fault	Approximate Map Distance	Orientation from Site
Zayante-Vergeles	3.4 km	Northeast
San Andreas	9.5 km	Northeast
Sargent	10.0 km	Northeast
Monterey Bay-Tularcitos	19.2 km	Southwest
San Gregorio	19.7 km	Southwest
Calaveras	37 km	Northeast
Hayward	46 km	Northeast

The WGCEP's estimates of the probabilities of major earthquakes are now in their fourth iteration, with the greatest changes in approach being the treatment of major faults as segmented, unsegmented or capable of different rupture scenarios; in the progressive consideration of more potential seismic sources, and in use of time-independent versus time-dependent models. Current estimates (WGCEP, 2003, 2008) are most detailed for the greater San Francisco Bay Area; WGCEP (2008) estimated a 63% probability of a large (magnitude 6.7 or greater) earthquake in the San Francisco Bay area as a whole over a 30-year period; this overall probability differed only slightly from the previous (WGCEP, 2003) probability of 62%. The estimate for the Calaveras fault alone is 7% (revised down from the 11% presented by WGCEP, 2003); for the (northern) San Andreas fault alone, 21%; and for the Hayward fault, 31% (revised upward from the WGCEP (2003) value of 27%).

3. SITE CONDITIONS

3.1 SITE TERRAIN

The hillslopes along the east side of the Ruins Creek valley that encompass the 2011 landslide have overall slope gradients in the range of 35 degrees at midslope, lessening upslope to approximately 25 degrees in the area above the landslide. The hillslopes above a certain point are distinctly more gently sloping and form broad ridge crests. The valley floor, along the eastern margin of which Nelson Road runs, has overall slopes on the order of less than 5 degrees.

The hillslopes on the eastern flank of the Ruins Creek valley are cut by smaller, unnamed drainages and spur ridges that generally trend east-west. One such unnamed drainage – "south swale" in this report -- lies at the southern margin of the 2011 Nelson Road landslide, where a private driveway meets Nelson Road. A second – "north swale" in this report -- lies just north of the landslide, where the private Sky Meadow Lane meets Nelson Road.

The area of the landslide is fairly densely covered with brush and a more broken tree canopy. Areas north and south of the slide are more typically tree-covered, with oak, bay laurel, and madrone present. The relatively less dense tree cover on the 2011 landslide is consistent with a history of landsliding.

3.1.1 Existing Improvements and Previous Grading

Nelson Road is a paved roadway, apparently first constructed primarily by cutting along the uphill side and filling along the downhill side. In general the road hugs the eastern margin of the valley floor. Cut slope heights north and south of the 2011 landslide vary from zero in swale areas, to approximately 5 to 12 feet where the road rounds topographic spurs. Through the interval now buried by the 2011 landslide, we examined 2010 (pre-landslide) 2-foot-contour topographic base maps developed from LiDAR, and any cut slope along the roadway is not resolved by that topographic base.

A photograph taken in January 2011 (see Appendix) shows the northern approximately one-third of the (now buried) Nelson Road and the adjacent hillslope. The toe of the approximately 1:1 (horizontal:vertical) hillslope is located an estimated 3 feet from the edge of pavement. The slope is nearly bare except for sparse, low fresh grass. The slope steps up at its northern end to a ground surface covered with trees and brush; the step exposes the root mat of the trees and brush beyond. We interpret this bare slope to have have experienced relatively recent localized shallow sliding that stripped it of near-surface soils, and the vegetation with its root mat. Recency of sliding is suggested by the lack of revegetation. There is no slope debris on the road surface or next to it.

The private driveway south of the 2011 slide and the private Sky Meadow Lane are similarly both constructed by cutting along the uphill side and filling along the downhill side. Both are paved with asphalt concrete.

Immediately west of the 2011 landslide toe and Nelson Road are a barn and llama pens.

A home and barn (the Williams residence) is located northwest of the 2011 landslide toe, on the valley floor just west of Ruins Creek.

PG&E power poles in the area include one pole within the 2011 slide limits, one within 20 feet of the 2011 headscarp, and others farther away. Some of these are shown on the Site Geologic Map (Figure 3).

A private well is located immediately north of the lower end of Sky Meadow Lane (see Fig. 3).

There is a water tank directly upslope of the 2011 landslide, east of Sky Meadow Lane and near the ridge crest.

There is a PVC water line exposed in the "north swale" (immediately north of the 2011 landslide) that we understand links this tank to the well described above. We not investigate the history of the well, water line or tank. We are not aware of evidence of leakage.

There is a remnant graded bench within the 2011 landslide, associated with a PG&E power pole. We interpret the bench to represent a rough construction equipment access road. It is unclear whether in the past there was a graded connection between this bench and more established roadways.

An approximately 1-foot-diameter culvert passes beneath Sky Meadow Lane, conveying runoff collected in an inboard ditch to a discharge point located approximately 26 feet directly upslope of the 2011 landslide headscarp's center. The drainage area that drains toward this culvert, based on field reconnaissance (no field surveying data) appears to be confined to an area between Sky Meadow Lane and the ridge crest (wrapping partway around into the "south swale"), and is probably no larger than on the order of 100 by 300 feet.

3.1.2 Drainage and Groundwater

To the extent there is sheetflow, water generally flows toward unimproved seasonal drainage axes such as the "north swale" and "south swale" that pass north and south of the 2011 landslide, respectively.

Immediately above the 2011 landslide, Sky Meadow Lane is pitched toward the inboard side, and runoff appears to flow parallel to the roadway, between the edge of pavement and the toe of the adjacent cut slope.

The approximately 1-foot-diameter culvert described above conveys runoff from the inboard edge of Sky Meadow Lane to the outboard edge, discharging it directly above the 2011 headscarp (see Fig. 3). A relatively small debris cone was formed on the upper 2011 landslide scarp where runoff discharged by the culvert deposited debris, then incised down through it.

A second culvert passes under Sky Meadow Lane in the "north swale," north of the 2011 slide area (see Fig. 3).

The axis of the "south swale" has local exposures of rock, indicating minimal colluvium is present.

Surface water on the ridge crests, such as the area east of the 2011 landslide, appears to infiltrate relatively easily into the Purisima Formation underlying ridge areas (Kennedy-Jenks, 2011), with lesser runoff by overland sheet flow.

We did not investigate water usage patterns by residents upslope of the 2011 landslide, such as amounts consumed for domestic purposes, irrigation, stock ponds, etc. We did not investigate routing of water lines or septic systems, or potential presence of leakage from any facilities.

Springs are present near the transition from upper hillslope to ridge crest. These appear to daylight near the top of a slightly resistant bed in local bedrock; we infer this to be near the base of the Purisima Formation. The spring mapped southeast of the 2011 landslide was flowing copiously in March 2011 following the landslide, but had completely dried up by July. Seepage from near the southern toe of the slide continued to sheet across Nelson Road near the blocked private driveway through the summer of 2011. By October 12, 2011, the only seepage we observed in the field was in the axis of the south swale and in the axis of the southern of two tributary forks to that swale. The updrainage limit of seepage in that swale fork was obscured by overgrowth, but appears to be near the top of the resistant bed.

Seepage was reported by area residents to occur seasonally on the slope east of (uphill of) Nelson Road (visible from the road), in the years before the 2011 landslide (anecdotal reports by area residents at Scotts Valley Firehouse meeting, Mar 29, 2011).

We observed seepage from fractures exposed in the 2011 landslide headscarp, within about a week of the landslide's occurrence, in late March, 2011. The elevation of these seeps is approximately 670 to 680 feet.

Regionally, the Purisima Formation is commonly considered to be an important aquifer (B. Hecht, personal comm.. 2011; Kennedy-Jenks, 2011). Internal variations in cementation can result in locally perched water tables.

In contrast, the Santa Cruz Mudstone from a regional water supply management perspective is considered a "dense shale" and an impediment to groundwater movement (Kennedy-Jenks, 2011). Groundwater flow through the Santa Cruz Mudstone is heavily dominated by fracture flow (B. Hecht, personal comm.., 2011). Fractures in this formation tend strongly to parallel bedding, with much more widely spaced secondary joint sets cutting the rock mass into a stack of tabular rock masses. The "grain" of these fracture nets and tabular masses parallels bedding and tends to direct groundwater flow along it. The underlying Santa Margarita Sandstone is considered a second major aquifer in the general area (Kennedy-Jenks, 2011).

We reviewed well logs from a number of nearby properties that are on file with the County of Santa Cruz Division of Environmental Health in the hope of gleaning useful information regarding rock type(s) and local geohydrology. Typically, these logs are prepared by well drillers uninterested in materials at the depths of concern for this investigation, and lack sufficient detail to be of significant benefit.

We encountered groundwater in alluvium at a depth of approximately 7.2 feet below ground surface in our large-diameter boring LD-2, drilled near the eastern valley floor margin. This groundwater level essentially reflects the level of water in Ruins Creek. Valley floor alluvium tends to be saturated below this depth.

The rotary wash drilling technique employed for DH-1 and DH-2 makes it difficult to assess groundwater conditions during bedrock coring. The piezometers installed in each appear to have equilibrated, subject to confirmation by analysis of long-term trends. Groundwater elevations recorded are reviewed in Section 3.2.11. Groundwater at shallow depths near DH-1 we interpret to reflect primarily infiltration and lateral flow toward the valley sideslopes. Groundwater at deeper intervals near DH-1 we interpret to reflect water held in fracture systems. Groundwater at the location of DH-2 is interpreted to reflect groundwater flow from beneath the ridge that encompasses the 2011 landslide toward the valley axis, where it encounters the Ruins Creek/valley floor groundwater system. The Santa Margarita Sandstone, where encountered at depth in DH-2 on the valley floor, is a nearly uncemented sandstone, consistent with its regional aquifer character.

Summarizing, the available information suggests that there are two groundwater regimes: a lower one associated with valley floor alluvium and creek flow that transitions laterally into fracture flow deep within the hillside; and an upper perched one that is much more changeable in response to seasonal and storm events. This upper regime is dominated by infiltration and then lateral flow atop less-permeable Purisima Formation interbeds toward the flanks of the ridge crest, where seepage either daylights as springflow or drops down through the rock mass via fractures into the Santa Cruz Mudstone. Once in the Santa Cruz Mudstone, flow tends to be downdip to the west, toward the slope face. The extent to which the Purisima and uppermost Santa Cruz Mudstone rocks are saturated is largely dependent on the amount of antecedent rainfall in a given season, and the intensity and duration of rainfall during individual storm events.

Ground water levels are subject to seasonal fluctuations depending on rainfall, pumping, local irrigation and other factors.

Effect of Groundwater On Rock Mass

Groundwater movement can affect the rock mass through chemical effect on clays, and leaching of cement. Seasonal and drought cycles appear to characteristically result in salinity changes in this setting (B. Hecht, personal communication, 2011). The result is a tendency to leach and mobilize Na ions from the (marine) Santa Cruz Mudstone rock mass. Although the Santa Cruz Mudstone does not have a reputation for susceptibility to slaking, this availability of Na in turn tends to encourage the deflocculation (breakup) of clay minerals in the rock, weakening the rock mass (Hecht and Golling, 1982; Hecht, personal comm.., 2011). This effect is more pronounced where erosion has reduced the confining pressure on the rock mass.

There are intervals of rock in the site vicinity which remain better-cemented and less pervious. The resistant bed evident in site topography south of the 2011 landslide and encountered in LD-2 has sufficient cement to cause it to stand out subtly on the topography, and to cause springs to form where that interval intersects the ground

surface. Locally, the silica cement is sufficient to present refusal to the large diameter auger used in drilling LD-2.

3.2 SITE GEOLOGY

We gathered data used for our investigation from several sources, including: research of published and unpublished geologic maps, LiDAR analysis; geologic field mapping, review of aerial photographs, and exploratory borings completed at the site. The findings from each of these are summarized below.

3.2.1 Aerial Photograph Analysis

We studied stereo aerial photographs of the site and surrounding area using the collection of the UC Santa Cruz Map Room, and monoscopic imagery such as that available through GoogleEarth. Ground surface conditions recorded on photographs at different times, seasons, and under differing lighting conditions aided us in interpreting the geologic structure of the site. We looked for topographic or geomorphic features that would suggest the presence of landsliding at the site. Such features include topographic benches and depressions, concave, convex, and arcuate landforms, topographic breaks in slope, and hummocky topography. We also looked for topographic or geomorphic evidence that would suggest the presence of an active fault trace, such as linear topographic elements, vegetation lineaments, aligned deflections of drainages, planar landform facets, and tonal lineaments indicative of fault contacts.

Aerial photographs are most useful for features such as landsliding and grading that are not obscured by the tree canopy.

Imagery taken in 1973 shows an irregular area of highly reflective ground within the 2011 landslide area. The reflective ground extends westward of Nelson Road, and southward into the adjacent drainage. We interpret this to represent a landslide scar and debris apron, with probable remobilization of debris by subsequent storms. Open ground to the north of the 2011 landslide area and approximately east of the Nelson Road/Sky Meadow junction may also record landsliding.

Air photos taken in 1982 following the intense January 1982 storms show a similar area of highly reflective ground in approximately the southern half of the 2011 landslide area; we interpret this to represent shallow landsliding.

Air photos taken in 2003 again show very sparse to no grass cover in approximately the same area – the southern half of the 2011 landslide area. We interpret the bare ground to reflect a landslide origin. The 2003 photos are consistent with 2010 oblique ground-based photos supplied by area residents.

Air photos taken in 2009 (see *2010 LiDAR and 2009 Air Photo Composite* in report Appendix) again show the same bare area.

The aerial photographs document a fairly smooth, wide alluvial floor to the valley near the site, pinching out southward. Regional topography and the aerial photographs strongly suggest that deep-seated landsliding at one time pinched off the valley, likely resulting in ponding of water and alluvium to the north. The timing of this closure and its

duration are not known at this point; regional geologic relations suggest the closure occurred several thousands of years ago.

Monoscopic images accessible through GoogleEarth from 2003 onward show essentially the same area of open ground as in the 1973, 1982, and 2003 air photos, unhealed (not revegated) over time. A 1991 image shows the same area, with two highly reflective areas west of Nelson Road, north and south of the llama barn/pens. The resolution of the image is such that the origin of the highly reflective ground is not clear; possible origins include landslide debris runout, post-storm sedimentation, and/or grading. A 2009 image also shows two patches of bare ground directly east of the Nelson Road/Sky Meadow Lane intersection. We interpret these as probable shallow landslide areas.

No evidence of active faulting was observed at or adjacent to the site in the aerial photographs we reviewed or during our site reconnaissance.

3.2.2 Pre-2011 LiDAR Analysis

We also obtained preliminary pre-landslide LiDAR data from the Santa Cruz County GIS group. This dataset was obtained in 2010 by AMBAG (Association of Monterey Bay Area Governments), of which Santa Cruz County is a member. We independently reprocessed or refiltered the raw data to reveal topographic detail not originally apparent in the processed dataset originally received, and confirmed in the field that those features were not artifacts of processing. This 2010 LiDAR dataset fortuitously provided an opportunity to compare slope features pre-dating and post-dating the 2011 landslide.

The key observations apparent from analyzing the two datasets include:

- The older landslide features (dormant and older landslides ranging from decades to thousands of years in age) are clearly documented by both datasets.

- The 2011 Nelson Road landslide area has experienced past landsliding at a number of scales. Most immediately, the 2010 LiDAR shows a concave section of slope immediately above Nelson Road, in the south portion of the 2011 slide area. This area corresponds to highly reflective areas noted in aerial photography, and to a ground photograph provided by an area resident showing the area in detail (see figure in Appendix "2010 LiDAR and Air Photo Composite").

- Comparison of the pre- and post- land surface clearly document the translational block character of the 2011 landslide, ruling out a deep-seated rotational mechanism.

3.2.3 2011 LiDAR Analysis

We obtained LiDAR (Light Detection and Ranging) data from a flight on June 18, 2011. The dataset was obtained by Towill, Inc., under a subcontract to Pacific Geotechnical Engineering.

Briefly, this technology aims millions of laser pulses from an aircraft at the ground, in closely spaced swaths. The pulses bounce back from whatever they encounter

(vegetation, buildings, ground surface). Through intensive computer analysis of the bounce-backs ("returns") and the aircraft's position, and subsequent filtering, only those returns from the ground surface remain. A map of the ground surface beneath the vegetative canopy can then be made, resolving features such as landslide scarps not otherwise capable of being mapped in the field because of vegetation masking.

Towill acquired the data using their Optech M200 system installed in a fixed wing aircraft. Data was acquired at a minimum density of approximately 2 points per square foot. The data were processed to derive a "bare earth" DEM, provided in a 1-foot grid format. The coordinate system for the project is based on NAD83(NSRS 2007) and NAVD88. A GPS base station was placed near the site during LiDAR acquisition, and kinematic GPS at the Watsonville Airport was used in calibrating the LiDAR. Additionally, a profile was surveyed along Nelson Road to provide quality control; shiners were set in the pavement to mark selected field shot locations.

Towill, Inc. did the processing (filtering) of the raw data to generate the "bare-earth" digital elevation model (DEM) of post-landslide conditions that is used as a base map for our Site Geologic Map (Figure 3). We did additional processing and manipulation of the raw data to generate other imagery that assisted in locating and identifying site features.

2011 Slide Features

The upper scarp is a semi-continuous headscarp.

There are numerous internal semi-intact blocks in the upper half of the slide. We found east-facing (upslope-facing) scarps within the 2011 landslide mass as well as west-facing scarps. These locally define grabens (fault-bounded troughs) indicating downdrop of some blocks, and downslope-directed movement by others. We found soil shed from a westerly source on preserved ground surface immediately above the open slope that is the source of the debris apron. This demonstrates that east-facing scarps were present in at least the eastern (upslope) one-half of the landslide mass.

Comparison of 2011 topography to pre-2011 topography (for example, see Figure 4, Section A-A') indicates translational movement by bedrock slide blocks toward the slope face. We considered whether a rotational landslide mechanism could generate the observed distribution of earth materials, the observed void (source) volume at the upper end of the landslide, and the observed ground surface gradients. We found that the radius of curvature required to match the pre- and post-landslide ground surface gradients cannot be accommodated by a rotational landslide.

The presence of east-facing scarps throughout the entire upslope half of the landslide mass is also inconsistent with a rotational slide mechanism.

The toe of the main 2011 landslide mass appears to daylight at least approximately 18 vertical feet above Nelson Road, based on analysis of the 2011 landslide in progress (see Section 3.2.6 below). A talus debris apron is present along the downslope margin of the slide area. The debris apron appears to be derived through secondary failure of the main mass by rockfall and toppling.

The dominant landslide direction of movement is toward the west, with the southern margin of the 2011 slide area splaying/spreading southward into the adjacent unnamed drainage, blocking a private driveway.

Tension cracks splay off of both sides of the 2011 slide area, particularly to the north.

There are other active and dormant landslides (active likely within tens to hundreds of years) present on the slopes north of the 2011 landslide area. Their surface morphology suggests that relatively shallow debris slides involving colluvium and the uppermost weathered rock are common.

Older Landslide Features

Muted scarps and steps indicate landsliding likely thousands of years old in the site vicinity (see Fig. 3). Headscarps marked by topographic steps are preserved near the western limit of the gently sloping ridge crest. The toe of these ancient features are not expressed, and may either have been blanketed by alluvium and/or partly eroded.

Debris apron(s) predating the 2011 landslide extend locally to the eastern bank of Ruins Creek, leaving a topographic surface distinctly above the alluvial terrace surface that remains west of the creek. We interpret these aprons to represent the deposits of fast-moving debris slides similar to the origin of the 2011 debris apron.

A photograph taken in summer of 2010 shows an area of bare ground in approximately the southern one-half of the 2011 landslide mass, as viewed from Nelson Road (see Appendix). The lack of vegetation, as contrasted with the surrounding densely vegetated ground, indicates relatively recent, shallow landsliding sourced near the upper end of the bare patch. This area of shallow landsliding is evident on pre-2011 aerial photographs, and corresponds to a topographically concave area interpreted to represent a past landslide scar.

3.2.4 Field Mapping

We performed field mapping to check, refine and supplement the base maps and interpretations prepared from aerial photographic and LiDAR analysis.

Field visits in the days following the initial major event on March 21, 2011, found an increase in height of the main scarp of up to at least 4 feet. We are not aware of any evidence that the landslide toe advanced, indicating that this deformation was accommodated by compressional deformation and bulging within the slide mass. The extreme western landslide toe – the toe of the debris apron – would not be expected to advance, since it is the limit of a fast-moving runout deposit. The southern margin of the 2011 landslide mass, at the south swale and buried private driveway, may have experienced slight toe advance and bulging of the slope above the toe.

Our reconnaissance confirms the presence of the scarps visible on the LiDAR imagery, with additional fine-scale tension cracks present to the north and south of the 2011 landslide area, but not mappable at the ground scale of this investigation.

Bedding in the local bedrock appears to consistently dip westward at a shallow inclination, based on roadcut exposures to the north and south of the site, and in our

large-diameter borings drilled directly upslope of the 2011 landslide. A cemented horizon observed at the bottom of large-diameter boring LD-2 (see below), drilled directly above the 2011 landslide headscarp, appears to correspond to a resistant bed traceable on hillslopes to the south and north; we infer that bed to parallel the unconformity between the Purisima Formation and Santa Cruz Mudstone. An average bedding strike appears to characterize the site vicinity, with dips ranging from approximately 5 to 10 degrees. We used a dip of 10 degrees in our geologic cross-sections.

Fracture sets in the local bedrock also appear to have fairly consistent orientations. One set (mean orientation approximately 165/53 SW is expressed as the control on the 2011 landslide headscarp, where it is visible as long continuous faces, and offset parallel planar faces, each with slickenlines oriented downdip. This same fracture set is well expressed in roadcut exposures to the north of the site.

Virtually all surface exposures of fractures in the general vicinity have experienced dilation, possibly attributable to stress relaxation due to unloading through mass wasting. The presence of dilated cracks is consistent with active rock creep. Fracture surfaces exposed on the 2011 headscarp are stained by iron oxides, and are coated/infilled with clay.

Planar fractures observed in LD-2, directly upslope of the scarp, mirror those observed in the scarp itself. We observed dilated cracks infilled with clay, and occupied by roots.

A large block immediately east of the open talus debris slope is partly covered by debris shed from a western source. This detail indicates that there was enough sliding and extension by block sliding to form grabens, before the more catastrophic failure of the slide toe generated the debris apron. The surfaces forming these east-facing scarps expose only colluvium at the ground surface, and it is not clear what their dip is at depth (within rock), and what their relation to pre-existing joint sets is.

The 2011 landslide appears to have involved two phases of movement. The first was slow movement as translation blocks moved toward the slope face, likely causing bulging of the slope face. This is consistent with reports of minor rubble being sloughed from the slope in advance of the rapid, large-scale failure. At some point, the oversteepening of the toe gave way to a rapid failure and generation of a fast-moving debris apron.

Seasonal springs appear to occur at geomorphic pockets visible on LiDAR imagery (see Figure 3), in association with the resistant bed described above.

The asymmetrical cross-section of the south swale indicates that within the mass involved in the 2011 landslide, there has been either repeated or slow ongoing (or both) slide movement increments into the south swale drainage axis. Clumps of mature trees are leaning, and appear to have slid out over the drainage axis, deflecting the drainage axis to the south. Slopes on the 2011 landslide (northern) side of the south swale are approximately 70 degrees, while those on the south side of the swale are approximately 58 degrees.

The colluvium in the drainage south of the landslide is thin with local windows exposing rock, suggesting that erosion is more than sufficient to keep pace with colluvium formation and soil creep toward the drainage axis.

3.2.5 Stereonet Analysis

We plotted structural data acquired in the field on equal-area, lower hemisphere stereonet in order to assess the potential role of persistent fracture/joint sets and bedding in mass wasting (slope movement). Data plots are presented in the report Appendix.

As described above, bedding dips shallowly (5 to 10 degrees) westward, toward the Ruins Creek valley axis, which is an adverse orientation. We did not observe evidence of significant bedding rotation within the 2011 landslide. The two clusters of poles to bedding evident appear to reflect the unconformity between the Santa Cruz Mudstone and Purisima Formation.

A tightly clustered, strong fracture set with mean orientation 165/53SW is expressed in roadcut exposures north of the site, in the large-diameter boring LD-2 immediately above the 2011 landslide headscarp (but within an older bedrock landslide), and in planar portions of the 2011 landslide headscarp (with down-dip slickensides on them). These joints dip steeply toward the valley, and serve as "release" joints with respect to potential sliding parallel to bedding.

3.2.6 Landslide Video

We were fortunate in that a County DPW employee captured rapid movement of the 2011 landslide on cell phone video. The video was taken from Nelson Road, south of the "south swale." The video and sound capture the shedding of ever-growing volumes of rubble from areas considerably above Nelson Road. In the closing moments of the video, large-scale failure brings debris cascading down onto and across Nelson Road.

The video contains clues to landslide behavior. No deformation or rupturing of Nelson Road or the valley floor is evident. The observed debris appears to be derived from upslope of a prominent rock ledge located on the hillside above Nelson Road. A line drawn on the slope, parallel to contour at this point represents the minimum permissible elevation for the failure surface of the 2011 landslide (minimum elevation of the toe).

Contained in the report Appendix is a still frame excerpted from the video, with the minimum toe elevation line drawn on it. The gray garbage can pictured fortuitously provides a 3-foot scale bar that indicates the lowest permissible elevation of the failure surface at the 2011 landslide toe is approximately 18 feet above the Nelson Road pavement elevation at that location. The minimum toe elevation line was transferred to the Geologic Site Map (Figure 3) through the use of 2-foot contoured topography derived from the 2011 LiDAR. In transferring this line from the immediately pre-landslide slope face to the post-slide slope face represented by the Geologic Site Map, the position of this line has necessarily been shifted valleyward by the horizontal thickness of landslide debris at that point.

We interpret the video to document the relatively slow movement of large blocks toward the slope face, probably along roughly bedding-parallel planes. At some point, the resultant oversteepened slope face begins to shed debris. As shallow failures of the slope face occur, block movement from behind accelerates.

3.2.7 Large-Diameter Borings

As noted above, we did not perform subsurface exploration within the limits of the 2011 landslide, for several reasons centering on the potential for exploration to adversely affect the metastable landslide mass, and the low probability of obtaining high-quality samples for testing. Large-diameter borings and small-diameter borings were sited immediately above and below the limits of the 2011 landslide mass, with the upper borings located within ancient landslide deposits.

Our large-diameter subsurface exploration was performed on June 28, 2011, using a solid flight auger 2.5 feet in diameter affixed to the "Extendahoe" boom of a 4WD rubber-tire backhoe. The aim of large-diameter borings was to expose local bedrock where not overly influenced by near-surface creep, and obtain information regarding bedding and fracture orientation.

LD-1 was drilled along the inboard edge of Nelson Road, north of the 2011 landslide toe. Geomorphically, this site is near the transition from modern stream alluvium deposited by Ruins Creek, and slope-derived colluvium. LD-1 was terminated in relatively coarse clayey gravel with sand due to heavy groundwater inflow and unstable boring walls. This crudely stratified material was interpreted to represent the lateral margins of Ruins Creek alluvium, overlain by finer-grained slopewash. LD-1 was grouted with a weak cement grout to mitigate against potential settlement next to the roadway, using a grout weak enough to permit excavation and grading in the event of future roadway repairs.

LD-2 was drilled immediately downslope of the Sky Meadow Lane fill prism, near an existing overhead utility line. This site was selected in order to examine the character of rock immediately upslope of the 2011 landslide for aspects relevant to the 2011 landslide features. This site is located within an older landslide deposit. A very thin colluvial surface layer (approximately 2 feet thick) overlies diffusely bedded and variably cemented silty sandstone, sandy claystone, and sandstone. LD-2 was terminated due to auger refusal in an interval of very hard, siliceous-cemented sandstone. In the walls of LD-2 we observed slightly dilated fractures coated with thin, dark brown clay films. We also observed local open voids around small blocks of rock, and disaggregated, dilated rock fabric. One 1/8-inch-thick dilated fracture was infilled with a dark brown clay seam and abundant roots. The observed separations between the walls of cracks was nearly uniform from top to bottom. The orientations of fractures was recorded, and are shown on the stereonet plots contained in the report Appendix.

3.2.8 Small-Diameter Borings

Our small-diameter subsurface exploration was performed between July 5 and 8, 2011, using a track-mounted CME 55 drill rig equipped with both 8-inch-diameter hollow-stem augers and rotary wash HQ coring equipment. Two small-diameter drill holes (DH-1 and DH-2) were drilled. DH-1, located just upslope of the 2011 landslide headscarp, was drilled to a depth of 143 feet below ground surface using HQ coring equipment. DH-2, located near the southern toe of the 2011 landslide, was drilled to a depth of 70 feet, using a combination of hollow stem auger (in valley floor alluvium) and HQ coring equipment. The approximate boring locations are shown on Figure 4 of this report. The locations of the borings were field-measured using a rangefinder and compass from existing site features and should be considered accurate only to the degree implied by the method used.

In the field, our personnel visually classified the materials encountered in the drill holes and maintained a log of each drill hole. Continuous core samples were collected from both borings, beginning at the depth semi-intact rock was encountered. The coring technique uses an abrasive circular bit that spins in contact with the rock, slowly cutting a 2.5-inch-diameter cylinder of rock that slides upward into an internal tube within the sampler. Cuttings are flushed from the whole by recirculating drilling fluid. Once a length of core is obtained, the internal tube is withdrawn from the boring, and the core is extruded for examination and logging. The length of the core run can be varied; a five-foot-long core run is typical. Core log descriptions included determination of RQD (Rock Quality Designation), a measure of how intact the rock encountered is. RQD as applied to this project was defined as (the sum of core sticks longer than 100mm in a given core run, measured along the center line) divided by (the total length of the core run), expressed as a percent.

Core recovery for DH-1 was generally in the range of 80 to 100%. RQD varied widely, from 10 to 92. Fracture dip (unoriented core) for persistent fracture sets was recorded (see drillhole logs), with the most common fracture set mimicking bedding. Crush zones not attributable to the drilling process are present in the rock mass. The degree of weathering varies, with most of the rock mass characterized as moderately weathered. The coring process results in overrepresentation of more intact intervals of the dominant sandy siltstone and clayey sandstone, with soft and crushed intervals tending to be washed out by the drilling fluid and not observed in the retrieved core.

For DH-2, samples in unconsolidated materials near the ground surface were obtained from the drill hole by driving a 2-inch outside diameter Standard Penetration Test (SPT) sampler up to a depth of 18 inches into the earth material using a 140-pound auto-hammer falling 30 inches. The number of blows required to drive the samplers was recorded for each 6-inch penetration interval. The number of blows required to drive the sampler the last 12 inches, or the penetration depth indicated where higher resistance material was encountered, is shown as blows per foot on the drill hole logs. Soil samples were sealed in the field and transported to our laboratory for further evaluation and testing. Once rock was encountered in DH-2, drilling switched to HQ coring.

Detailed descriptions of the soils encountered within the drill holes and penetration resistance recorded in the field are presented on our drill hole logs (see Appendix).

Our drilling observations correlated well with surface manifestations of the 2011 landslide character. At the ground surface of the 2011 landslide, large blocks of semi-intact rock with intervening voids and soft soil infill are visible. The ancient landslide morphology expressed at the ground surface (scarps and toes resembling the 2011 features), and dilated joints documented in the subsurface (in LD-2) indicate that similar blocks, voids and soft infill likely characterize the ancient landslide deposit.

DH-1 was drilled within the older landslide, and encountered intervals of blocky rock, with narrow intervals of much softer material and/or voids in two notable intervals: between 34.6 and 35.5 feet below ground surface; and a cluster of zones between approximately 114.4 and 123 feet below ground surface . In such a setting, obtaining samples of the softest material is unlikely, given the limitations of the drilling equipment and technique needed to penetrate the rock. We were unable to obtain samples of the softest intervals/voids in DH-1, although the field investigation did establish that such zones are present.

This field verification of these weak intervals, at depths consistent with the translational block style of landsliding suggested by surface observations, permitted us to develop a

laboratory program (discussed below) aimed at approximating the properties of the weak materials present along bedding planes where landslide shearing has taken place.

The core is currently stored at our soils testing laboratory, in paraffin-coated core boxes.

3.2.9 Landslide Reference Stakes

On April 12, 2011, we installed 6 pairs of rebar stakes across various headscarp segments as landslide reference stakes. The locations for each pair of stakes were selected to provide a clear line-of-site for direct distance and gradient measurement between the tops of stakes. For this reason, the tops of the stakes could be driven no closer than approximately 2 to 3 feet above grade. For each of these pairs of stakes, we measured the slope inclination and slope distance between tops of the rebar stakes. We reoccupied these stakes on July 29, 2011 and compared readings. The stakes are vulnerable to being flexed and/or pulled from the ground by curious visitors and then reinserted. We estimate that due to the flexible nature of the stakes above grade, measurement repeatability is no finer than approximately 0.2 feet. The stake pairs indicate that no more than approximately 0.2 feet of additional separation occurred by July 29, 2011, which is within measurement error. The stakes clearly indicate that there has not been post-April movement of any greater than approximately 0.5 feet across the intervals monitored.

3.2.10 Slope Inclinometers

Slope inclinometer casing was installed in both DH-1 and DH-2, extending to the bottom of each boring (143 feet in DH-1, and 70 feet in DH-2) The casing used was 70mm O.D. Geo-Lok casing, grouted in place. A protective locking well box was installed over each SI casing. The inclinometer in DH-1 is numbered SI-1, and the inclinometer in DH-2 is number SI-2.

Following casing installation and grout setup, we profiled each inclinometer casing three times to obtain baseline profiles with which future profile measurements can be compared. No movement has yet been documented, nor was any expected during baseline readings. Slope inclinometer plots are contained in the report Appendix.

The upper slope inclinometer (SI-1, in DH-1) was installed on private land. The decision whether to pursue long-term monitoring of this slope inclinometer (and associated piezometer) will need to be discussed by the users of Sky Meadow Lane, the County, and the property owner. The lower slope inclinometer (and piezometer) was installed within the Nelson Road right-of-way.

3.2.11 Piezometers

A vibrating-wire piezometer (RocTest model PWS) was attached to the outside of the slope inclinometer casing in DH-1 and DH-2, and the cable taped to the outside of the casing at intervals as the casing was installed. The piezometer in DH-1 was installed at a depth of 130.0 feet below ground surface. The piezometer in DH-2 was installed at a depth of 61.0 feet below ground surface.

A RocTest model DL-100 datalogger was connected to each of the piezometers, protected within the locking above-grade well box.

The grout mix used for these installation was designed to be sufficiently permeable to allow the instrument to measure changes in piezometric pressure but not so permeable as to allow different pressure zones to communicate via the grout column. Equilibration of this type of piezometer installation is influenced by the transmissivity of the surrounding earth materials, and can take months in clay-rich rock masses.

Our piezometer program conceived of installing the piezometers near the deepest levels of potential sliding judged to be geologically reasonable. The surface presence of dilated, fractured rock and observations of seepage from the slope face originally suggested a simple unconfined groundwater system.

Our piezometric readings, and the results of our slope stability modeling, indicate that the hydrologic system is more complex. The piezometers appear to be tracking a relatively deep aquifer. The near-surface rocks involved in landsliding, however, appear to experience a transient perched water condition whenever there is sufficient rainfall and infiltration to permit saturation of the near-surface rocks. A "dry" interval within the slope separates the near-surface perched zone from the deeper bedrock aquifer. Over time without rainfall, the water in the upper, perched zone infiltrates the slope or seeps out the slope face, greatly reducing or eliminating the perched condition.

As of 8/11/11, the piezometer in DH-1 indicated a piezometric surface at 78.3 feet below ground surface. As of 8/5/11, the piezometer in DH-2 indicated a piezometric surface at 61.0 feet below ground surface. The length and trend of data recordings is not yet sufficient to know if these depths reflect full equilibration. We interpret these data to reflect the deep aquifer, and to be consistent with our model of a winter-time perched water condition at shallow depths.

If additional instrumentation is contemplated, piezometers could be placed at shallower depths to track near-surface groundwater behavior.

3.2.12 Laboratory Testing

Soil samples were logged in the field and returned to our laboratory for testing. Soil and rock classifications made in the field were refined based on further examination and selected testing of the samples. Laboratory tests were performed on selected soil and rock samples. These tests included dry density, water content, % passing #200 sieve, hydrometer analysis and Atterberg limits. Fully softened and residual friction angles of landslide debris were derived based on correlations with these parameters (Stark, 2005). The results of these tests are presented on laboratory test sheets appended herein. A more detailed description of our laboratory testing methodology is presented in Sections 3.4.2.4 and 3.4.4.2.

3.2.13 Earth Materials

Bedrock at the site and in the vicinity is generally only exposed along roadcuts, and within the 2011 landslide. Although colluvium is not thick, it mantles most slopes to a depth of approximately 2 feet maximum.

Detailed observations of material characteristics are recorded on our exploratory boring logs and summary descriptions of the different earth material units encountered are presented below:

Colluvium (Qcol) – Colluvium is not shown on our geologic map (Figure 4) or cross section (Figure 5) because it thinly mantles the bedrock that underlies the site. Colluvium is texturally variable, commonly consisting of sandy clay with gravel (CL) and ranging in thickness from about 1.5 to 2 feet thick where exposed in road cuts and landslide scarps. Sub-angular, tabular clasts of fine-grained sandstone and mudstone are common within colluvium, especially in the approximately 1 foot directly overlying bedrock.

Alluvium (Qal) – Alluvium deposited by Ruins Creek, as exposed in DH-2, consists of sandy lean clay with gravel (CL) with gravel content increasing downward such that the approximately 5 to 7 feet above top of bedrock is clayey gravel (GC). Alluvium encountered in LD-1 consisted of sandy silt (ML) transitional downward to clayey gravel with sand (GC). Blow counts in all of the alluvium encountered were very low, with N values ranging from 5 to 6.

Landslide Deposits (Qls and subdivisions Qlsy, Qlso) –The 2011 Nelson Road landslide debris apron consists primarily of disaggregated masses of platy Santa Cruz Mudstone, with intermixed colluvium now intermixed.

Purisima Formation (Tp) – Thick-bedded to massive, very fine-grained sandstone, as represented by roadcut exposures along Sky Meadow Lane. Faint bedding measured in LD-1, and in the headscarp of the 2011 landslide, characteristically has a shallow westward dip ranging from approximately 5 to 10 degrees. Bedding attitudes in some exposures are steeper, however, they appear to have been affected by rock creep and dilation. Back-rotated bedding is also observed in individual landslide blocks. The Purisima Formation regionally varies in composition (Ellen and Wentworth, 1995).

Santa Cruz Mudstone (Tsc) – This formation comprises the bulk of the hillslope encompassing the 2011 landslide. It is typically faintly, thinly bedded (commonly ¾ inch to 1 inch) with finer laminations; grain size ranges from sandy silt to silty, very fine sand. Due to diatom content, the density of this formation is unusually low (61 to 82 pcf; see lab data).

Santa Margarita Sandstone (Tsm) – The Santa Margarita Formation was observed at the site only in DH-2 below a depth of approximately 41.75 feet below ground surface, although it crops out farther to the south along the valley walls. The Santa Margarita Formation where we encountered it is moderately cemented, transitional to virtually uncemented sand.

3.3 FAULTING

No evidence of faulting at or adjacent to the subject site was observed during our geologic reconnaissance or review of aerial photographs.

3.4 LANDSLIDING

3.4.1 Engineering Geologic Model

We considered several possible landslide mechanisms or geometries:

- *Slump/flow failure*
- *Translational (block) sliding*
- *Rotational failure*

Slump/Flow Failure - The clearly angular blocks and deep tension cracks eliminated the slump/flow model at the outset. The debris apron portion of the 2011 landslide mass is the result of a fast-moving debris slide. However, this apron is a secondary feature to the 2011 landslide mass as a whole.

Rotational Sliding - In order to assess whether rotational sliding was dominant, we examined the distribution of landslide materials in the slope.

One tool for this comparison made use of the pre-landslide 2011 LiDAR topographic dataset, as contrasted with the post-landslide 2011 LiDAR dataset. As shown on Figure 4, section A-A', the slope face appears to have moved relatively uniformly toward the valley (consistent with movement on a dominantly planar surface) as opposed to variable movement (along a curving surface).

We also examined the radius of curvature needed to achieve the observed limited backrotation of individual landslide blocks and the overall landslide ground surface. We found that the radii of curvature needed were incompatible with a rotational slide given the overall slope dimensions.

Translational (block) sliding - Field observations strongly suggested this mechanism at the outset, particularly the presence of adversely oriented bedding planes with associated parting, and a propensity for rock creep along them. The presence of release joints with evidence of dilation further supports this model.

The comparison of pre- and post-landslide slope face geometries using the 2010 and 2011 LiDAR dataset indicates translational (block) sliding.

The distribution and magnitude of internal graben structures within the 2011 landslide mass is consistent with block sliding, and inconsistent with rotational sliding. Sizeable tension cracks that locally define uphill-facing internal scarps are present throughout the upper approximately one-half to two-thirds of the landslide mass. These scarps appear to reflect the downdrop of material into voids left behind by block movement away from the headscarp.

3.4.2 Slope Stability Techniques Considered

In conjunction with our consideration of the landslide mechanism/geometry, we considered how to model and analyze slope stability.

We considered:

3.4.2.1 *Analysis of an intact, isotropic (internally uniform in all directions) rock mass*
This model is inappropriate, as fracturing and jointing is pervasive in the rock masses at the site.

3.4.2.2 *Analysis of a fractured, isotropic rock mass (Hoek-Brown Criterion)*
Analysis of such a system is commonly done using the Hoek-Brown Criterion (Hoek, 2007), which provides a rational way to arrive at rock strength values depending on the degree of fracturing, and the overall rock quality. The Hoek-Brown Criterion was developed specifically to permit slope stability analysis of fractured rocks by assessing the degree to which fracture sets reduce the rock mass strength. At its current level of development, the Hoek-Brown Criterion has been incorporated into the software application RocLab (available free at www.rocscience.com). Various observations such as regarding the rock structure (i.e. number and nature of fractures sets, rock integrity), and surface quality of fractures are used to arrive at a GSI (Geologic Strength Index; Marinos and Hoek, 2000), and other parameters.

A key aspect of the Hoek-Brown Criterion is that it applies to essentially isotropic rock masses, though it has been extended to rocks with some degree of internal fabric. It also implicitly is intended to model the potential for new failures through a fractured rock mass. It specifically is not intended for structurally controlled failures, or landslides where rock surfaces are not in contact with each other but rather separated by fine-grained material.

These features of the Hoek-Brown Criterion do not apply to the Nelson Road 2011 landslide setting. Bedding and the associated parting, particularly once the rock is unloaded near a slope face, impart a strong anisotropic fabric to the rock mass. Even more importantly, well-developed slide masses are present with preserved slide planes within and beneath them. The strength values we obtained from a sensitivity analysis approach using RocLab were not appropriate to the Nelson Road landslide system, with its well-developed planar anisotropy.

3.4.2.3 *Analysis of a soil mass*
In order to model the slope as a soil mass, internal properties would need to be treated as largely isotropic and uniform, and the presence of pre-existing slide planes would be largely disregarded. Again, these do not apply to the Nelson Road landslide system.

3.4.2.4 *Analysis of shear strength of pre-existing planar surfaces*
The strength of the material between and beneath landslide blocks is the key aspect, together with the geometry of the slide planes modeled.

We developed a laboratory program to approximate the weakest material likely present between landslide blocks. Our laboratory results were then used in combination with a back analysis of the landslide to obtain the parameters used for our forward analysis.

Our scope of work did not allow us to sample material within the actual landslide body itself, so it was necessary to simulate in the laboratory the degradation of the landslide materials and their subsequent strength reduction due to strain. Our technique

consisted of selecting the finest grain size samples retrieved from select intervals from our rock coring. Samples were selected from the weakest intervals that we interpret to be at the approximate elevation of the slide plane. Prior to testing, these samples were soaked for 48 hours and then blended in a mechanical stirring device for one minute. This procedure essentially broke the sample down into its inherent grain size. This mixing action was done to approximate the mechanical degradation that would occur due to strain along fracture and sliding zones (e.g. deformation in the zone of sliding would break up and pulverize the rock to some degree). The samples were then tested for clay fraction and atterberg limits and these parameters then used to correlate to residual and fully softened shear strength (Stark 2005).

It should be noted that prior to blending, the rock samples consisted of predominantly ½ to ¾"gravel size fragment with less than 5% fines. After the mixing process, the samples contained between 25 and 40 percent fine grained material, with the majority of the fines consisting of silt (see individual Grain Size Test Result sheets in the report Appendix. The mixing process appeared to increase the percentage of fines significantly (up to 45% fines) but the clay fraction remained low (maximum of 5% clay fraction). In our opinion, our laboratory mixing process thoroughly degraded the rock samples into their smallest constituent properties. Because Stark's correlations to shear strength are based on clay fraction and liquid limit, it is unlikely that the strength of the formation could be significantly less than the strengths obtained from the above process. Therefore the above process represents a conservative approach to estimating the shear strength of the actual landslide surfaces.

3.4.3 Qualitative Stability Assessment

This section summarizes key features of landsliding at the site. A following section presents our quantitative modeling of slope stability. Key features include the following:

The 2011 landslide mass appears to involve large blocks, likely sliding on one or more surfaces subparallel to bedding.

Steep fracture sets observed at various locations along the main 2011 scarp formed the release joint for the blocks to mobilize. This fracture set is observed to the north and south of the Nelson Road landslide area, indicating it is present in areas well outside the limits of the 2011 landslide.

The toe of the 2011 slide complex appears to have daylighted on the hillslope above Nelson Road, with the toe subsequently failing and generating a debris apron. The evidence does not indicate that 2011 landslide planes pass beneath Nelson Road. This bedding-and-fracture controlled block-style of sliding has been characteristic in the past (as evidenced by linear scarps in upslope areas, and debris aprons reaching Ruins Creek) and will likely be characteristic of large failures in the future as well (as evidenced by dilated cracks encountered in LD-2 that have the same orientation as the joint-conrolled headscarp of the 2011 landslide).

We estimate the approximate volume of the 2011 landslide mass to be between 30,000 and 45,000 cubic yards, depending on subsurface geometry.

The strong association of the 2011 landslide with an extended period of heavy rainfall, and observations regarding springs and seepage, strongly suggest that

rainfall/groundwater is a major control on slide behavior. The relative lack of movement after the end of winter rains, despite freshly exposed, near-vertical faces, also suggest this.

From a qualitative standpoint, the many open fissures and disrupted blocks mean that there are large volumes of rock present on the slope between Nelson Road and Sky Meadow Lane that have broken completely free of the underlying rock mass (i.e. there is no rock fabric tying them to their point of origin).

3.4.4 Limited Quantitative Stability Assessment

To inform and substantiate our qualitative assessment, a limited quantitative slope stability analysis was performed. Recognizing the limitations of the data, and the complexity of the landslide system, we used this approach to gain a ***relative*** sense of what effect the proposed debris clearing might have, rather than an ***absolute*** measure of the factor of safety. For example, our analysis gives information on whether or not, and to what degree the existing factor of safety of the landslide will be reduced or increased by alternative mitigation measures. The actual values of the factor of safety against sliding (the absolute value) should be viewed as preliminary estimates only.

The following is a discussion of how the critical elements of our subsurface model for quantitatively analyses were developed, and it presents the results of our analyses.

3.4.4.1 *Section Analyzed*

Geologic Cross Section A-A' (Figure 4) was used to develop the surface and subsurface geometry for our computer modeling of the slope stability. This line of section was selected since it is the most centrally located of the three representative lines of section constructed, passes near the center of a large debris lobe, crosses several of the larger internal surface landslide features, and captures the ground surface transition to an ancient landslide scarp at its upper end. For purposes of analysis the subsurface profile was divided into 4 units: Unit 1:Tsm (Santa Margarita Sandstone, Unit 2: Tp (Purisima Formation), Unit 3: Tsc (Santa Cruz Mudstone) and Unit 4: Alluvium.

3.4.4.2 *Determination of Strength Parameters*

We attempted to model the strength of the rock mass using the Hoek-Brown failure criteria and "Roc-Lab", a program developed by RocScience Inc. Multiple slope stability analyses runs using Hoek-Brown-derived strength parameters resulted in unrealistic deep seated failures that do not reflect the failure geometry observed in the field. The literature supporting the Hoek-Brown method also clearly states that this method is not applicable to rock masses that are structurally controlled and anisotropic (Hoek, 2007). For these reasons this method of rock strength determination was judged inappropriate for this landslide system.

Our focus on shear strength determination was then directed at the strength of the Tsc layer, because the failure surfaces are inferred to be in this layer. Our borings did not recover material from a discrete slide plane so strength estimates were made by a combination of performing a "back-analysis" (e.g. setting the factor of safety = 1.0 and solving for the shear strength) and comparing those results with residual and fully softened shear strengths. As described previously, our laboratory testing techniques broke the rock samples down into their constituent grain size, yielding the lower bound strengths for the material (see discussion re laboratory testing techniques and shear

strength analysis in Section 3.4.2.4). Our "back-analysis" yielded a phi angle of 28 degrees and this value was in turn used for forward analysis. This value also approximately corresponds to the fully softened strength achieved from our laboratory testing.

Static shear strengths for the three other subsurface layers were estimated based on our general knowledge of properties of these layers from previous investigations. Because our analysis is limited to the relative stability of the 2011 Landslide and failure surfaces are almost entirely confined to the Tsc unit, further refinement of shear strengths of the other units was not warranted.

Evaluation of ground water characteristics
We used field observations (seepage observed in the 2011 landslide headscarp, springs in the south and north swales; and seepage from the slopes visible from Nelson Road before the 2011 landslide, as reported by area residents) to assign the ground water elevations shown on our stability analysis sections (Figures 5 – 7). This ground water elevation is inferred to be the highest level reached at the time of the 2011 failure.

As discussed below, a second analysis was done assuming that this ground water elevation is perched and that the lower half of the Tsc layer is not saturated (see Figure 6). In our opinion this condition best models the actual field conditions at the site (see Figures 5 through 7 and discussion re ground water characteristics in Section 3.1.2).

3.4.4.3 *Stability Analysis Approach*
Slope stability analyses were performed using SLIDE v. 6.0; a computer program for two-dimensional limit equilibrium slope stability analysis developed by Rocscience Inc. Our analysis employed specified landslide surfaces based on geomorphology and our engineering judgment.

Firstly, a back analysis was performed, employing the existing ground surface, an assumed ground water elevation and two specified failure surfaces. The upper failure surface corresponds to the 2011 Landslide, and a second lower surface corresponds to ancient landslide features that appear to share similar geometry. For all analyses, we specified these sliding surfaces, given the strong field evidence of translational block style landsliding. It should be noted that the slope geometry modeled is perhaps best described as the geometry at which the landslide came to rest after the bulk of movement had occurred.

Secondly, using the strength information gained from our back analysis, we then adjusted the ground water model to obtain results that better reflect the field conditions.

Thirdly, after refining our model based on the results of the above two steps, forward analyses were performed to determine the relative change in stability due to alternative mitigation techniques: debris removal from Nelson Road and limited scaling of blocks and steep faces from the slopes immediately above Nelson Road (see mitigation concept illustrated in Fig. 9).

Back Analysis Results (2011 Slide, Ancient Slide Geometries): Geologic Cross Section A-A'

Our first analysis was performed using a "back analysis" -- solving for strength values based on an assumed ground water elevation and a Factor of Safety = 1.0. This

analysis yielded a lower factor of safety for the ancient lower slide surface than upper 2011 slide surface (see Figure 5). Since this test produces results that do not accurately reflect field observations, the model's assumptions required adjustments. Possible adjustments to the model we considered include:

- the lower portion of the Tsc unit could have a higher strength than the upper portion of the Tsc unit, or
- the water table is perched, and the lower portions of Tsc unit are not saturated.

We have no evidence that the Tsc unit increases in strength with depth, and the core we retrieved does not qualitatively reflect such an increase downward (as evidenced by hardness) apart from any trends that might be indicated by changes in RQD (no significant trends with depth observed). However, in our opinion, the geologic evidence does indicate that perched ground water conditions within the unit are likely.

Therefore, for our second back analysis we modeled a perched ground water condition that did not affect the lower portions of the Tsc unit (in the software this is done by creating a second layer within the Tsc unit, identical in strength to the upper layer but not subject to the ground water table). This analysis shows that when the upper (2011) slide surface has F.S. = 1.0, the lower ancient surface has a F.S. = 1.18 (see Figure 6). These results appear to better reflect the actual field conditions and this model was used for our forward analysis.

The exercise indicates some significant findings. Based on the above, the ancient landslide does not appear to be significantly more stable than the 2011 landslide, but mobilizing it requires that perched ground water conditions infiltrate much more deeply into the Tsc unit, creating buoyant weights (or seepage forces) and reducing stability. This would require longer duration and intensity storm events than have occurred under geologically recent conditions.

Forward Analysis Results (Debris Removal Geometry): Geologic Cross Section A-A'

We then looked at the effect of removing slope debris from Nelson Road, and limited scaling of blocks and local steep faces from the slopes immediately above Nelson Road. Removing debris from the roadway would result in undermining and mobilizing loose debris from the slopes above. To account for this we estimate that a laterally extensive but thin slice of the slope face would need to be removed. Any remaining loose material would not stand any steeper than its angle of repose (in the range of 30 – 35 degrees). We assumed for this analysis that, small projecting portions of the large landslide blocks would be scaled or shaved off (compare existing topographic profile on Figure 4 and the debris-removal profile on Figures 7 and 9).

The model indicates that removal of the debris apron would lower the factor of safety for the 2011 slide by approximately 3 percent. This value is not large, but neither is it zero.

The model also indicates that removal of the debris apron would lower the factor of safety for the ancient slide by approximately 5 percent.

4. DISCUSSION AND CONCLUSIONS

4.1 GENERAL SUMMARY

This section provides discussion of the geologic hazards pertinent to the site, focusing on landsliding.

Mitigation alternatives are discussed in Section 4.5 following.

4.2 LANDSLIDING

To review, in the sections above we described how we evaluated the various potential landslide mechanisms (e.g. rotational, translational block-style sliding) and determined that translational block-style sliding is dominant. We also reviewed our consideration of various slope stability analysis approaches (e.g. analysis of intact rock; analysis of fractured rock through use of the Hoek-Brown Criterion; analysis of a soil-like mass; and analysis of translational blocks sliding along pre-existing defined surfaces), determining that the latter form of analysis is appropriate.

Our slope stability analyses, described above, found that water plays a key role at the site, and that a perched groundwater condition appears to characterize the 2011 landslide system.

In this section we summarize our professional judgment regarding future landslide potential at the site of the 2011 landslide. The 2011 landslide and future slope behavior at the site involve both deep-seated landslides (essentially those involving bedrock or large semi-intact rock masses), and shallow landslides (those involving disaggregated debris and colluvium). At this site, deep-seated landsliding is dominant, however, shallow landsliding of materials within the 2011 slide mass and on adjacent slopes is also a consideration.

4.2.1 Deep-Seated Landsliding

It is unknown whether the groundwater system w/in the 2011 slide mass has been disrupted so as to encourage horizontal drainage via more open fractures (increasing stability), or whether newly opened fractures will provide a more direct route for water to reach the slide plane(s), decreasing stability. We suspect that the 2011 slide mass will at first drain more freely. Over time, as colluvium and mass wasting infill the tension cracks, it will likely drain less freely, potentially decreasing stability.

There is a high potential for the 2011 headscarp to encroach headward over time toward, and past, Sky Meadow Lane. Previously observed distress to the roadway will likely continue.

There is a low to moderate potential for the ancient headscarp upslope of Sky Meadow Lane to reactivate under current conditions.

4.2.2 Shallow Landsliding

There is a high potential for boulders to calve off the front of the translational portion of the 2011 slide. The rapid breakup of these boulders in the months since the March

failure is evidence of the weak nature of rock at the site. Boulders of weak, soft rock such as this will likely roll a relatively limited distance, and are likely to break up substantially as they roll.

There is a high potential for the mobilized translational blocks within the 2011 slide to move incrementally toward the slope face. It is unclear if this will happen in one event or several, in one year or over many. This movement will likely be in association with extended rainy periods followed closely by short-duration, intense rainfall.

If any one event mobilizes a substantial volume of these translational landslide blocks toward the slope face, there is a high potential for rockfall at the toe to generate a debris apron with runout similar to that observed in 2011. The geometry of the slope and landsliding that generated the ancient debris runout deposits is not known at this time. As a result the potential for a repeat event is not currently known.

4.2.3 Future Behavior of 2011 Landslide Debris Apron

The 2011 landslide debris apron was composed of cobble- to boulder-sized clasts at the time of its formation. Within a period of 3 to 6 months, however, the combined effects of unloading, and wetting/drying have substantially broken down or begun the breakup of boulders into platy, tabular chips commonly on the order of ¾ inch thick, and 1 to 6 inches in maximum dimension.

Based on the regional behavior of weathered Santa Cruz and Purisima Formation in road cuts, the scree or talus that accumulates at the toe of such cuts does not tend to break down over time into clay-rich soil with a propensity for earthflow landsliding.

The 2011 landslide debris apron is largely the product of a fast-moving debris slide mechanism, which resulted in a relatively low slope gradient in the northern approximately half of the landslide. We judge there to be a low potential for this debris to remobilize, and judge there to be a low potential for significant quantities of this debris to reach Ruins Creek.

4.2.4 Seismically Induced Landsliding

Our slope stability analyses assumed static (non-earthquake) conditions. The site vicinity is located in a seismically active region, with a high potential for significant seismic shaking within the span of tens of years. As a generalization, earthquake shaking has an adverse effect on slope stability when ground accelerations exceed a critical value. The 1989 Loma Prieta earthquake resulted in the reactivation of pre-existing deep-seated landslides in the Santa Cruz Mountains. The extent of seismic shaking and whether it induces sliding is related to the intensity, duration and specific nature of shaking; the strength characteristics of the earth materials involved; and the distribution of groundwater.

The stability of a slope under seismic shaking conditions is reduced under saturated conditions, as compared to dry conditions.

At this point, there is insufficient information to accurately model the extent to which strong earthquake shaking would reduce slope stability at the site.

4.3 FAULTING

In our judgment, the potential for fault ground rupture at the site is low. No active faults are mapped at the site, and no evidence of faulting was observed at the site during our review of aerial photographs and geologic reconnaissance.

4.4 SECONDARY SEISMIC HAZARDS

Secondary seismic hazards potentially relevant to the site include:

Liquefaction – Our scope did not include evaluation of liquefaction potential. We note that saturated, young sediment and a shallow water table are locally present along the Ruins Creek valley floor, both of which are conducive to liquefaction. Based on the materials we encountered within the hillside, we infer that the rock formations have a low probability of liquefaction.

Ridgetop fissuring/shattering - Ridge-top shattering can be partially attributed to focusing of seismic energy along the crests of ridges in zones of intense shaking. The focussing of seismic waves along ridge tops can result in shattering of rock masses, and to the differential displacement of earth materials along planes of weakness during seismic shaking, as also happened during the 1989 Loma Prieta earthquake. Dilation of existing fracture sets in the site vicinity could be exacerbated by seismic shaking.

4.5 POTENTIAL MITIGATION CONCEPTS

We considered potential mitigation concepts ranging from leaving the landslide unmodified to removal/replacement of all landslide deposits (see conceptual illustrations Fig. 8 through Fig. 13). The focus of all of these is re-establishing Nelson Road access. Specifically, we considered a number of potential mitigations, and the associated geologic/geotechnical issues. We stress that we have not attempted to catalog or weigh the non-geologic/geotechnical issues and recognize that there are many of those that will require careful consideration.

The 2011 landslide is the latest event in a long history of landsliding that has affected the slopes encompassing the 2011 slide. It is likely that the earliest of these significantly predates human habitation of the area, with episodic landsliding occurring at various scales on through to the present. For example, the 2011 landslide debris apron appears to overlie a previous debris apron that locally reaches the bank of Ruins Creek. East of the 2011 headscarp are dilated rock fractures in the same orientation as the fracture set that forms the 2011 headscarp, indicating that the slope east of the 2011 slide was already beginning to creep westward well before the 2011 landslide. The muted topographic steps east of Sky Meadow Lane indicate that at times past, the upslope limit of deep-seated landsliding has involved Sky Meadow Lane and terrain upslope of Sky Meadow Lane.

With such a history of landsliding, it may not be practical to "repair" the 2011 landslide without addressing the larger stability issues, and/or it may not be practical to mitigate the larger stability issues.

4.5.1 Alternate Access Route

The intent of this concept would be to establish an alternate access for area residents that previously used the buried section of Nelson Road for access, without taking any direct grading action on the landslide deposit itself.

Issues – An alternate access route, regardless of location, will have geologic/geotechnical considerations requiring evaluation.

From a geologic/geotechnical standpoint alone, possible routes to consider include formalizing the emergency access road currently in use or some variant of it; establishing an alternate access completely bypassing the 2011 slide and emergency access road; and constructing a portion of the access road on the ground between Ruins Creek and the toe of the 2011 landslide and then crossing the creek.

4.5.2 Removal of 2011 Landslide Debris Apron

The intent of this concept would be to take the minimalist approach of removing only so much loose material as would be needed to re-expose the existing Nelson Road. We note that existing information indicates that the 2011 Landslide does not underlie Nelson Road.

Removal of 2011 landslide debris will involve excavation of bouldery debris from the roadway and adjacent upslope areas. Approximately 12 – 15 feet of boulder debris would need to be removed along the northern approximately 2/3 of the buried section of Nelson Road. A greater thickness of material would need to be removed in the southern approximately 1/3. Bouldery material such as this generally will not stand even temporarily at slopes greater than approximately 30 – 33 degrees (the angle of repose). Excavation will bring down additional loose material, until the supply of loose material is exhausted or the toe of the angle-of-repose slope meets grade east of the roadway. This concept is illustrated in Figure 9 (except that Figure 9 incorporates limited block scaling).

Issues - Removal of 2011 landslide debris apron alone would expand the area of exposed, relatively loose, dilated rock upslope of Nelson Road. The potential for rockfall and topple from these areas would thus be increased. In the event of further increments of movement by large translational blocks in the manner of the 2011 landslide, additional material could be shed from the toe of these blocks, generating a debris apron with a potential to runout across Nelson Road.

4.5.3 Removal of 2011 Landslide Debris Apron, Limited Scaling

This approach is the same as "Removal of 2011 Landslide Debris Apron" with the addition of limited scaling. The intent of this concept would be to remove enough of the 2011 debris apron to re-expose the existing Nelson Road, with the addition of a scaling component along the slopes above the road. The scaling is intended to preemptively bring down dilated, loose rock blocks and lay back the steepest rock faces, thereby reducing the potential for rockfall and topple. This concept is shown in Figure 9.

Issues – This approach reduces but does not eliminate the potential for future increments of translational block sliding to generate a debris apron with potential to runout across Nelson Road.

Excavation of material from this portion of the slope preferentially removes material from the inferred toe area of the 2011 landslide. This necessarily reduces the amount of support supplied by that material for the slope as a whole. We modeled the relative effect of this concept on both the stability of the 2011 landslide mass, and the inferred older landslide mass (see Slope Stability section, above).

We preliminarily estimate that tens of thousands of cubic yards of material would need to be removed, assuming an approximately uniform debris distribution. We suspect that the thickness of the debris apron increases to the south, which would increase the volume to be removed.

4.5.4 Energy-Absorbing Catchment Structure, Removal of 2011 Debris Apron, Limited Scaling

The intent of this approach would be to address the potential for rockfall and topple to send fast-moving landslide masses onto or across Nelson Road.

This conceptual approach would combine the debris apron removal and block scaling concept with an energy absorbing barrier constructed immediately east of the reestablished Nelson Road. This concept is shown in Figure 10.

Issues – An energy-absorbing barrier is aimed at addressing only the potential for fast-moving shallow landslide debris; it does not provide a buttressing or retaining function for potential deep seated landslides.

Energy-absorbing barrier systems are very expensive, especially in contrast to measures involving grading.

Such a barrier could be designed for events of various scales: isolated failures of small portions of the steep face, or larger failures.

The energy absorbed by such a barrier must be transferred to earth materials at depth through some form of tiebacks and anchors. One difficulty with this approach in this particular setting is the weak nature of bedrock encountered in borings to date at the toe of the slope, and the great thickness of older landslide deposits that the tiebacks would presumably need to penetrate (depending on design loads).

An energy-absorbing barrier would involve maintenance and cleanout costs, and the hardware would have a design lifetime due to corrosion potential.

4.5.5 Reconstruction of Nelson Road Atop Berm

The intent of this approach would be to restore access via a roadway constructed atop existing landslide deposits. This concept is illustrated on Figure 11.

Our mapping and drilling indicate that the 2011 landslide debris apron is underlain by older landslide debris apron deposits that in turn overlie alluvium. A berm could be constructed atop these older landslide apron deposits, with geotextile fabric placed on a graded surface, followed by engineered fill up to a design road grade. The lateral position of this berm could be anywhere from next to Ruins Creek, to approximately the location of the existing Nelson Road.

An important positive effect of elevating the roadway is the debris catchment function provided by even a small upslope in the path of a potential debris runout. The farther from the toe of slope the berm is constructed, the greater the catchment function.

A second positive effect of the berm concept is that it provides additional ballast to the toe of the overall slope, providing an incremental increase in overall slope stability (i.e. reducing the potential for reactivation of the modeled ancient landslide).

A variation of this concept would involve construction of the road west of the berm crest, which would then serve as a debris-catchment windrow.

Issues – Given the saturated, soft/loose nature of alluvium encountered in borings to date, and the heterogeneity of the older debris apron materials, the added loads imposed by the berm would likely result in differential settlement. Maintenance of this section of roadway would need to be anticipated. The available information would suggest that the extent of settlement and deformation would increase to the west, with proximity to Ruins Creek.

In order to avoid redistribution of landslide mass, with an unanalyzed potential for destabilization, we have assumed that no substantial quantity of landslide debris would be removed, and that the berm would be constructed of import material. The volume of import will depend on the length of the alignment, and the height and width of the berm.

If the berm is constructed of landslide debris, there would be some redistribution of mass, with some attendant change in overall stability of the 2011 landslide deposits. The magnitude of this change would depend primarily on the degree to which the toe of the slide is unweighted, and from which part of the slope the material is removed.

4.5.6 Hydrauger Array

The intent of this concept would be to draw down groundwater levels, providing a positive effect on slope stability.

This approach could consist of fan-shaped arrays of hydrauger drilled from (the re-exposed) Nelson Road back into the slope. The hydraugers would be drilled at an inclination such that they would discharge at Nelson Road. Hydraugers in general function better at capturing water transmitted via a fairly dense fracture network (believed to be the case at the site at depth) than water transmitted slowly through clay-rich soils (not the case). This concept is shown in Figure 12.

Issues – Hydraugers are vulnerable to shearing in the event that they are cut by landsliding. This essentially precludes their use in the 2011 landslide deposit. Their greatest effect therefore would be on the stability of the older deep-seated landslide deposit.

The 2011 landslide appears to be associated with an upper perched groundwater regime that would not be addressed by hydraugers drilled at the toe of the slope. It is conceivable that hydraugers drilled from midslope could help address the potential for headward enlargement of the 2011 landslide headscarp. However, hydraugers drilled from Sky Meadow Lane could be at too high an elevation to provide significant benefit.

4.5.7 Remove and Replace Landslide Mass

The intent of this concept would be to remove landslide deposits and replace them with drained engineered fill. It is highly likely that such an approach would need to include not only the 2011 landslide volume, but the deep-seated older landslide deposits as well, given that these deposits are indicated by slope stability analysis to be only marginally more stable than the 2011 slide mass. This concept is shown in Figure 13.

Issues – The grading volumes for a remove-and-replace ("R & R") repair would be tremendous. As noted above, we preliminarily estimate that the volume of the 2011 landslide mass alone is between 30,000 and 45,000 cubic yards. Our slope stability analysis using the existing limited information indicates that the ancient landslide mass may not be much more stable than the 2011 landslide mass to permit leaving the ancient deposit in situ for a remove-and-replace repair. Insufficient information exists to generate estimated grading volumes with any confidence, but it is clear that a remove-and-replace approach addressing the ancient landslide would likely involve excavation on the order of 150,000 cubic yards of material, plus whatever volume of additional material backcuts during grading require. Assuming that the existing material could be re-used as fill, it would need to be stockpiled for processing before replacement as fill, requiring a large work area. Moisture conditioning of this material would highly likely be required, introducing an additional challenge. The inclination and stability of the back and side cuts for such a repair will be a potentially problematic, given the weak rocks present at the site. Offhaul of spoils and import of fill would subject Nelson Road and downvalley areas to truck traffic it may not support from a geotechnical standpoint, given its history of stability issues near the drainage axis. A detailed geotechnical investigation would be needed to evaluate and develop this concept further.

5. RECOMMENDATIONS

5.1 PREFERRED ALTERNATIVES

In our judgment, the two most practical concepts, with the highest potential for a successful outcome are: 1) seeking alternate access; and 2) reconstruction of Nelson Road atop (or west of) a berm located as close to Ruins Creek as practical. Apart from the Alternate Access Route alternative, the other mitigation alternatives would involve work outside of the County's right-of-way along Nelson Road, and thus on private property.

The extensive surficial geologic information and albeit limited subsurface information demonstrate that 2011 landslide itself is a large, complicated system that is difficult to model accurately. This complexity is exacerbated by strong evidence of previous landsliding affecting adjacent areas.

As a result, in our judgment there is a high potential for a costly, disruptive repair or mitigation effort to incompletely address the suite of problems. This is complicated by the difficulty of staging construction operations from the relatively narrow Nelson Road alignment, with the bulk of the landslide lying on private property. Construction equipment access to the site is hindered by the relatively narrow Nelson Road south of the site.

Management of the effects of the landslide if left in place is preferable in our judgment. Landslide management issues will center around a slope that episodically is likely to deliver additional rock and soil to the toe of the slope, and a headscarp that will likely encroach headward. The establishment of an alternate access route and reconstruction of Nelson Road atop a berm in our view provide the most practical long-term approaches.

Our analyses indicate that infiltration of surface water into the slide mass is an important control on landslide behavior, since a perched groundwater condition appears to have accompanied the 2011 landslide, following an extended rainy period. Surface drainage measures can reduce the potential for, or degree of, a perched groundwater condition, and should be part of management of the slope.

In general, surface water infiltration into the existing landslide mass should be minimized wherever possible. Existing ground cracks may provide an avenue for the introduction of water at depth into the area, reducing the stability of the area. Consideration should be given to filling ground cracks and smoothing the ground surface to encourage sheet flow off of the slide mass, thus reducing infiltration of water. Such measures involve considerable grading, will the possible effects on slope stability described above in connection with our limited subsurface exploration. These measures would all be undertaken on private land outside the County's Right-of-Way.

We recommend that the existing culvert that discharges immediately upslope of the 2011 landslide headscarp be eliminated. Surface runoff that currently is collected by the culvert should be collected and conveyed for discharge at a suitable location. These include: the active channel of Ruins Creek; and the axis of the north swale well below

the Sky Meadow Lane crossing and the toe of fill along Sky Meadow Lane. The outfall of the conveyed runoff should incorporate appropriate energy dissipation measures.

We recognize that there can be many variations on mitigation concepts and on their combinations, and would be glad to discuss and research them for you upon request.

6. LIMITATIONS

In preparing the findings and professional opinions presented in this report, we have endeavored to follow generally accepted principles and practices of the engineering geologic and geotechnical engineering professions in the area and at the time our services were performed. No warranty, express or implied, is provided.

The conclusions and recommendations contained in this report are based, in part, on information that has been provided to us. Additionally, our scope of work was limited, and subsurface exploration for this level of investigation was limited to areas adjacent to the 2011 landslide mass. .

Subsurface exploration is necessarily confined to selected locations and conditions may, and often do, vary between these locations. Should conditions different from those described in this report be encountered during project development, Pacific Geotechnical Engineering should be consulted to review the conditions and determine whether our recommendations are still valid. Additional exploration, testing, and analysis may be required for such evaluation.

In the event that the general mitigation concepts or general location and type of structures are modified, our conclusions and recommendations shall not be considered valid unless we are retained to review such changes and to make any necessary additions or changes to our recommendations. Should persons concerned with this project observe geotechnical features or conditions at the site or surrounding areas which are different from those described in this report, those observations should be reported immediately to Pacific Geotechnical Engineering for evaluation.

It is important that the information in this report be made known to the design professionals involved with the project, that our recommendations be incorporated into project drawings and documents, and that the recommendations be carried out during construction by the contractor and subcontractors. It is not the responsibility of Pacific Geotechnical Engineering to notify the design professionals and the project contractors and subcontractors.

The findings, conclusions and recommendations presented in this report are applicable only to the specific project development on this specific site. These data should not be used for other projects, sites or purposes unless they are reviewed by Pacific Geotechnical Engineering or a qualified geotechnical professional.

Report prepared by,

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7. REFERENCES

Maps and Literature

Aiello, I.W., and 3 others, 1999, Vent structures in the upper Miocene Santa Cruz Mudstone at Santa Cruz, California, in Garrison, R.E., et al., eds., Late Cenozoic fluid seeps and tectonics along the San Gregorio fault zone in the Monterey Bay region, California: Santa Fe Springs, California, Pacific Section AAPG, Volume and Guidebook GB-76, p. 35-51

Aiello, I.W. and Garrison, R.E., 2002, Subsurface plumbing and three-dimensional geometry in Miocene fossil cold seep fields, coastal California: Contribution No. 3.

Brabb, E.E., 1970, Preliminary geologic map of central Santa Cruz Mountains, California: U.S. Geological Survey Basic Data Contribution 6, scale 1:62,500.

Brabb, E.E., 1983, Studies in Tertiary stratigraphy of the California Coast Ranges: US Geological Survey Professional Paper 1213.

Brabb, E.E., 1989, Geologic map of Santa Cruz County, California: U.S. Geological Survey Miscellaneous Field Investigations Map I-1905, scale 1:62,500.

Brabb, E.E., Graymer, R.W., and Jones, D.L., Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California, Miscellaneous Field Studies Map MF-2332, 2000.

California Division of Mines and Geology, 1997, Guidelines for evaluating and mitigating seismic hazards in California: CDMG Special Publication 117.

Clark, J.C., 1981, Stratigraphy, paleontology, and geology of the central Santa Cruz Mountains, Calfiornia Coast Ranges: US Geological Survey Professional Paper 1168.

Clark, J.C., and Rietman, J.D., 1973, Oligocene stratigraphy, tectonics, and paleogeography southwest of the San Andreas Fault, Santa Cruz Mountains and Gabilan Range, California Coast Ranges: U.S. Geological Survey Professional Paper 783.

Cooper-Clark and Associates, 1975, see Roberts and others (1998).

Ellen, S.D. and Wentworth, C.M., 1995, Hillside materials and slopes of the San Francisco Bay Region, California: US Geological Survye, Prof. Paper 1357.

Hall, N.T., Sarna-Wojcicki, A.M., and Dupré, W.R., 1974, Faults and their potential hazards in Santa Cruz County: U.S. Geological Survey, Miscellaneous Field Studies Map MF-626, scale 1:62,500.

Hart, E.W., and Bryant, W.A., interim rev. 2007, Fault-rupture hazard zones in California, Alquist-Priolo Earthquake Fault Zoning Act of 1972 with Index to Earthquake Fault Zones Maps: California Division of Mines and Geology Special Pub. 42.

Hecht, B., and Golling, R., 1982, Selected physical and chemical characteristics of diatomaceous mudstones, Big Basin Redwoods State Park Area: Cooperators' Research Rept. #2 Discussion Draft for State of California Div. of Beaches and Parks, Sta. Cruz Mountains Unit.

Hoek, Evert, 2007, Practical Rock Engineering: semi-formalized text and course notes revised 2007, accessible at www.rocscience.com

Jennings, C.W., and Bryant, W.A., 2010, Fault activity map of California and adjacent areas: California Geological Survey, California Geologic Data Map No. 6, scale 1:750,000.

Kennedy-Jenks Consultants, 2011, Annual report 2010 Water Year, Scotts Valley Water District Groundwater Management Program: consultant report for Scotts Valley Water District.

Marinos, P. and Hoek, E., 2000, GSI: a geologically friendly tool for rock mass strength estimation: Proc. Internat'l Conf. on Geotechnical & Geological Engineering, Geo Eng 2000, Technomic public. Pp. 1422-1442.

Powell, C.L. and 6 others, 2007, Age, stratigraphy, and correlations of the Late Neogene Purisima Formation, central California Coast Ranges: US Geological Survey Prof. Paper 1740.

Roberts, Sebastian, Baron, Andrew D. , Brabb, Earl E. , and Pike, Richard J. , 1998, Digital Compilation of "Preliminary Map of Landslide Deposits in Santa Cruz County, California, By Cooper-Clark and Associates, 1975": A Digital Map Database: U.S. Geological Survey Open-File Report 98-0792.

Rocscience, 2011, RocLab: online software application for implementation of the Hoek-Brown Criterion, accessed October, 2011 at www.rocscience.com..

Southern California Earthquake Center, 2002, Recommended Procedures for Implementation of DMG Special Publication 117; Guidelines for Evaluating and Mitigating Landslide Hazards in California.

Stark, T.D., and McCone, D. Sean, 2005, Drained Parameters for Analysis of Landslides, Journal of Geotechnical and Geoenvironmental Engineering, vol. 131, no. 5, pp. 575-588

Stewart, J.P., Blake, T.F., and Hollingsworth, R.A., 2003, A screen analysis procedure for seismic slope stability: Earthquake Spectra, v. 19, n.3, p. 697-712.

U.S. Geological Survey and California Geological Survey, 2006, Quaternary fault and fold database for the United States, accessed August 2011, from Quaternary fault KMZ files on Google Earth (www.earthquake.usgs.gov/regional/qfaults)

Working Group on California Earthquake Probabilities, 1990, Probabilities of large earthquakes in the San Francisco Bay region, California: U.S. Geological Survey Circular 1053.

Working Group on California Earthquake Probabilities., 1999, Understanding earthquakes in the San Francisco Bay Region, major quake likely to strike between 2000 and 2030: U.S. Geological Survey Fact Sheet 152-99, 4p.

Working Group on California Earthquake Probabilities, 2003, Earthquake probabilities in the San Francisco Bay region: 2002-2031: U.S. Geological Survey Open-File Report 03-214.

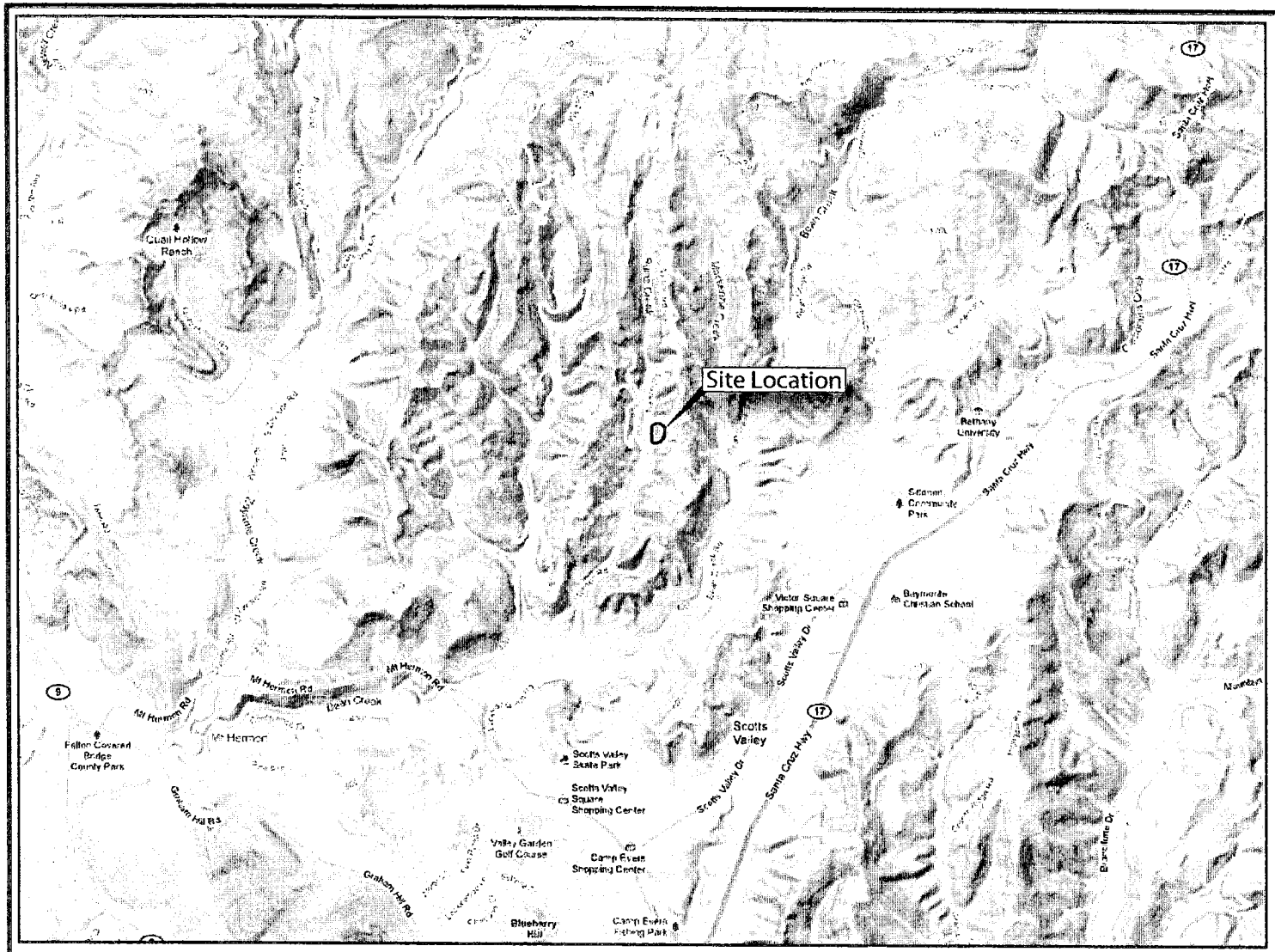
Working Group on California Earthquake Probabilities, 2008, Forecasting California's Earthquakes – What Can We Expect in the Next 30 Years?: U.S. Geological Survey Fact Sheet 2008-3027.

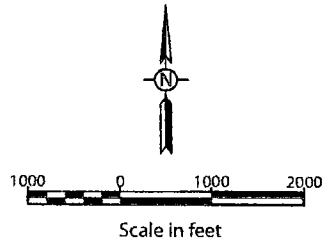
2007 Working Group on California Earthquake Probabilities, 2008, The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2): U.S. Geological Survey Open-File Report 2007-1437, California Geological Survey Special Report 203, and SCEC Contribution 1138 [http://pubs.usgs.gov/of/2007/1437/].

Aerial Photographs

Date	Scale	Flight Line	Roll/ Frame No.	Source
1940	1:10,200	1940-A	3-15,16	UCSC
1973	1:15,840	1973-74	5-10, 11	UCSC
1982	1:20,000	1982-C	8-7, 8	UCSC
6/27/2003	1:12,000	2003-A	319-5,6	UCSC

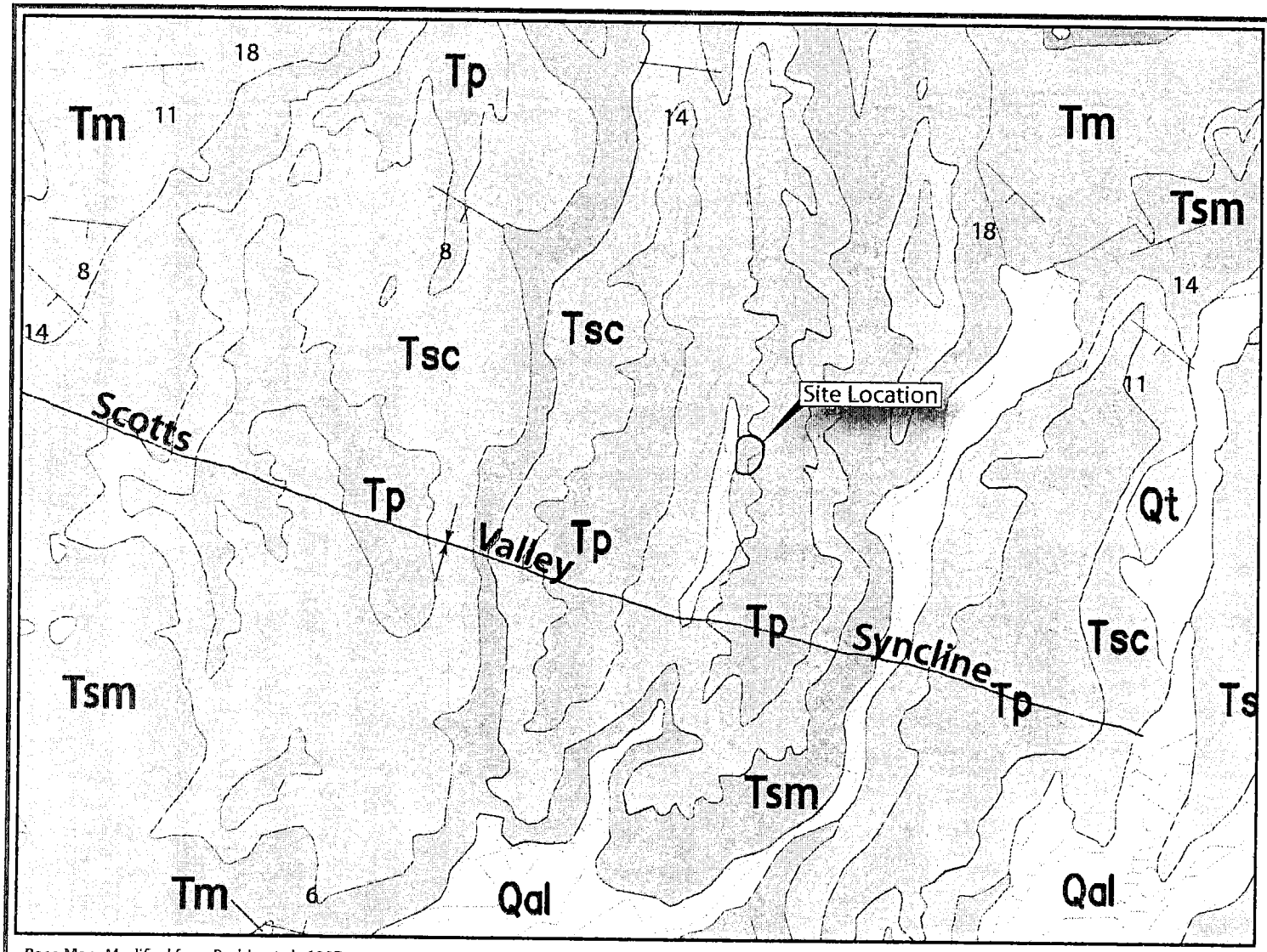
FIGURES





Base Map: © Google Map Data 2011

PACIFIC GEOTECHNICAL ENGINEERING	DATE **Draft 9/23/11**	**SITE LOCATION MAP**	FIGURE **1**
	SCALE **As Shown**	Nelson Road Landslide Santa Cruz County, California	PROJECT **2011.0068**



EXPLANATION

EARTH MATERIALS

Qal	Alluvium
Qt	Terrace deposits
Tp	Purisima Formation
Tsc	Santa Cruz Mudstone
Tsm	Santa Margarita Sandstone
Tm	Monterey Formation

MAP SYMBOLS

- Geologic contact
- Syncline axis
- 18 Strike and dip of bedding

N

1000 0 1000 2000

Scale in feet

Base Map: Modified from Brabb, et.al., 1997

PACIFIC GEOTECHNICAL ENGINEERING

DATE
Draft
9/23/11

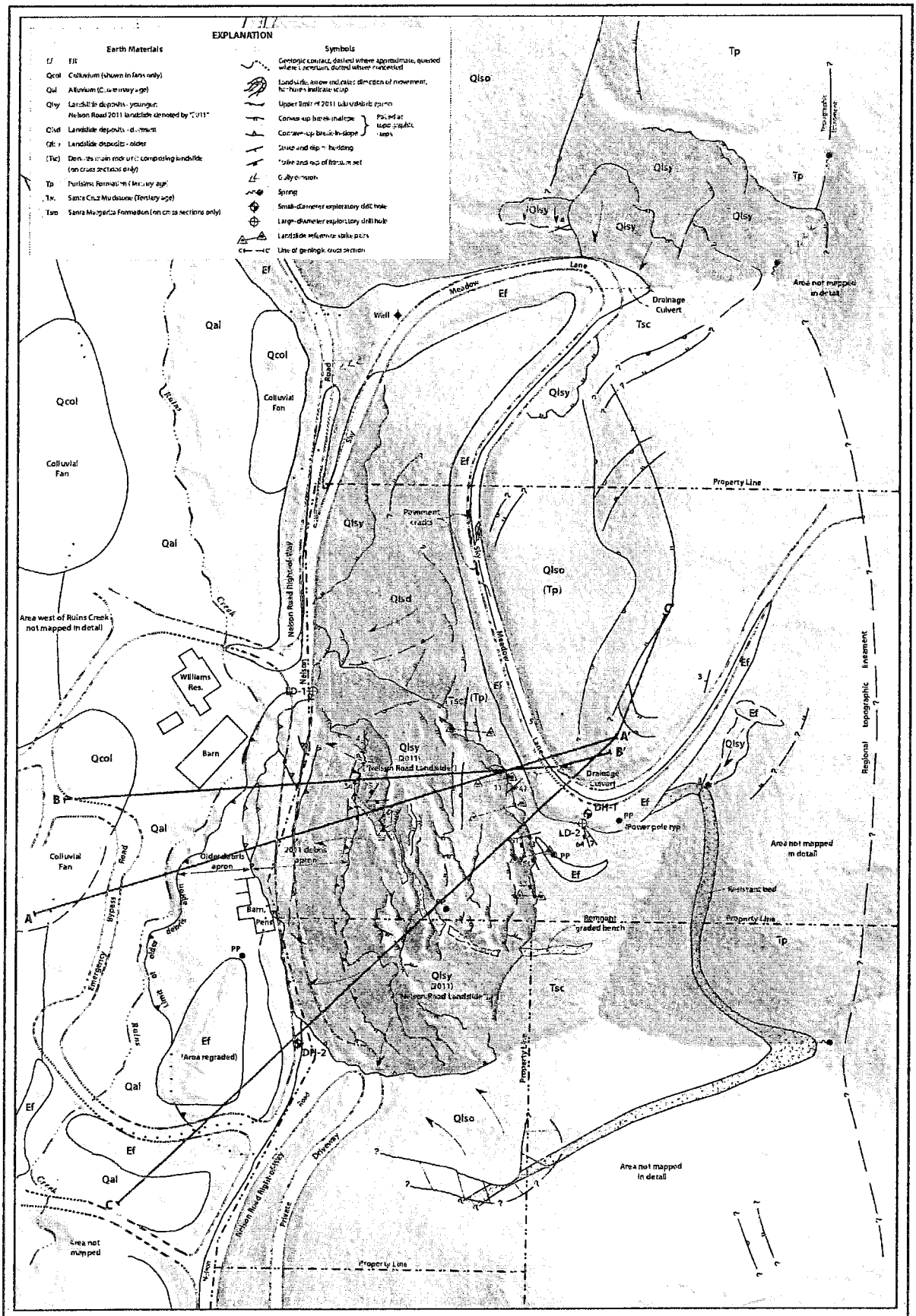
SCALE
As Shown

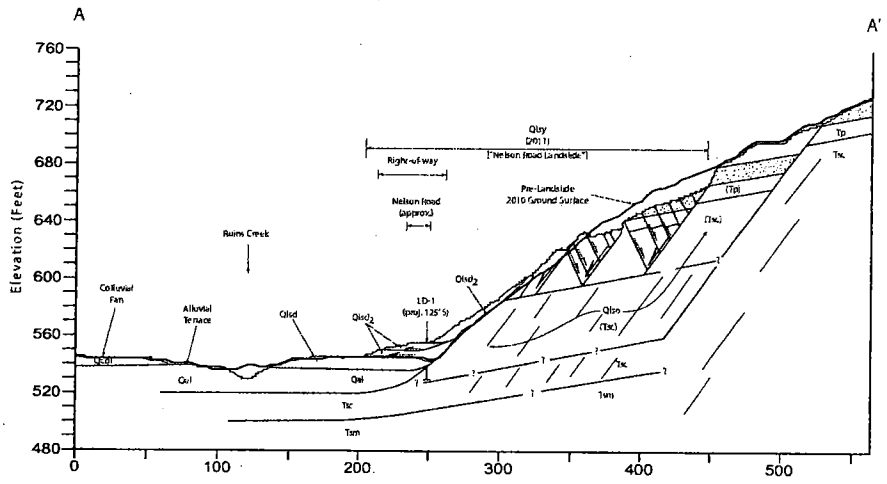
GEOLOGIC INDEX MAP

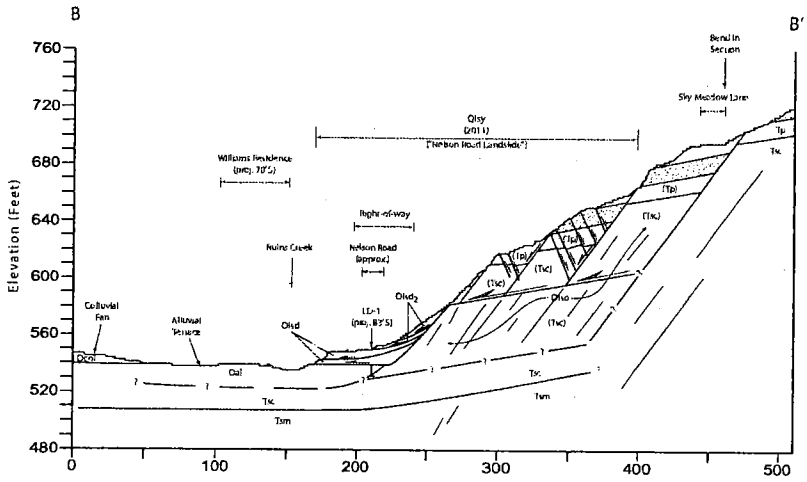
Nelson Road Landslide
Santa Cruz County, California

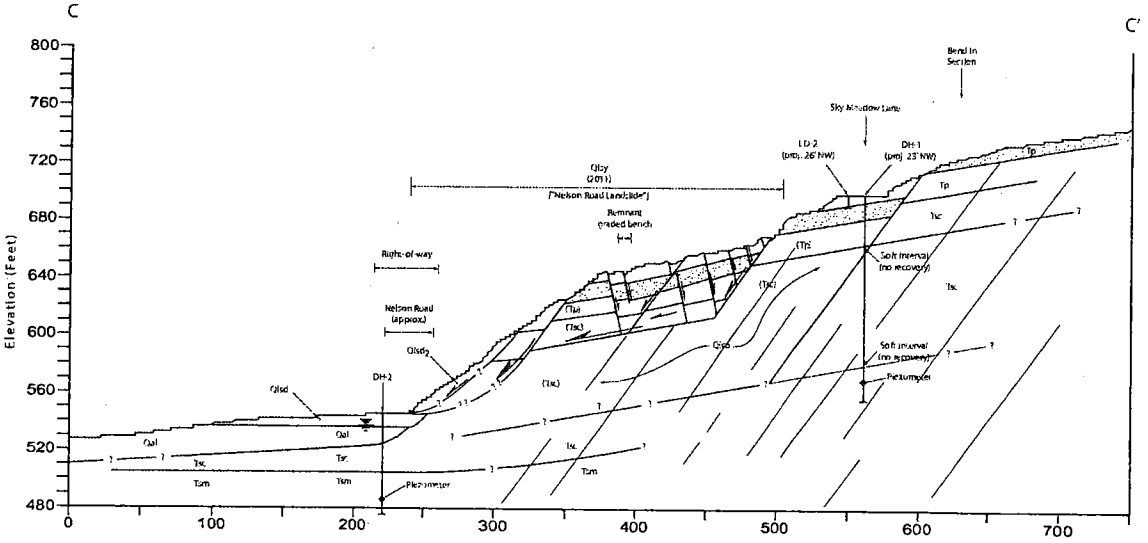
FIGURE
2

PROJECT
2011.0068

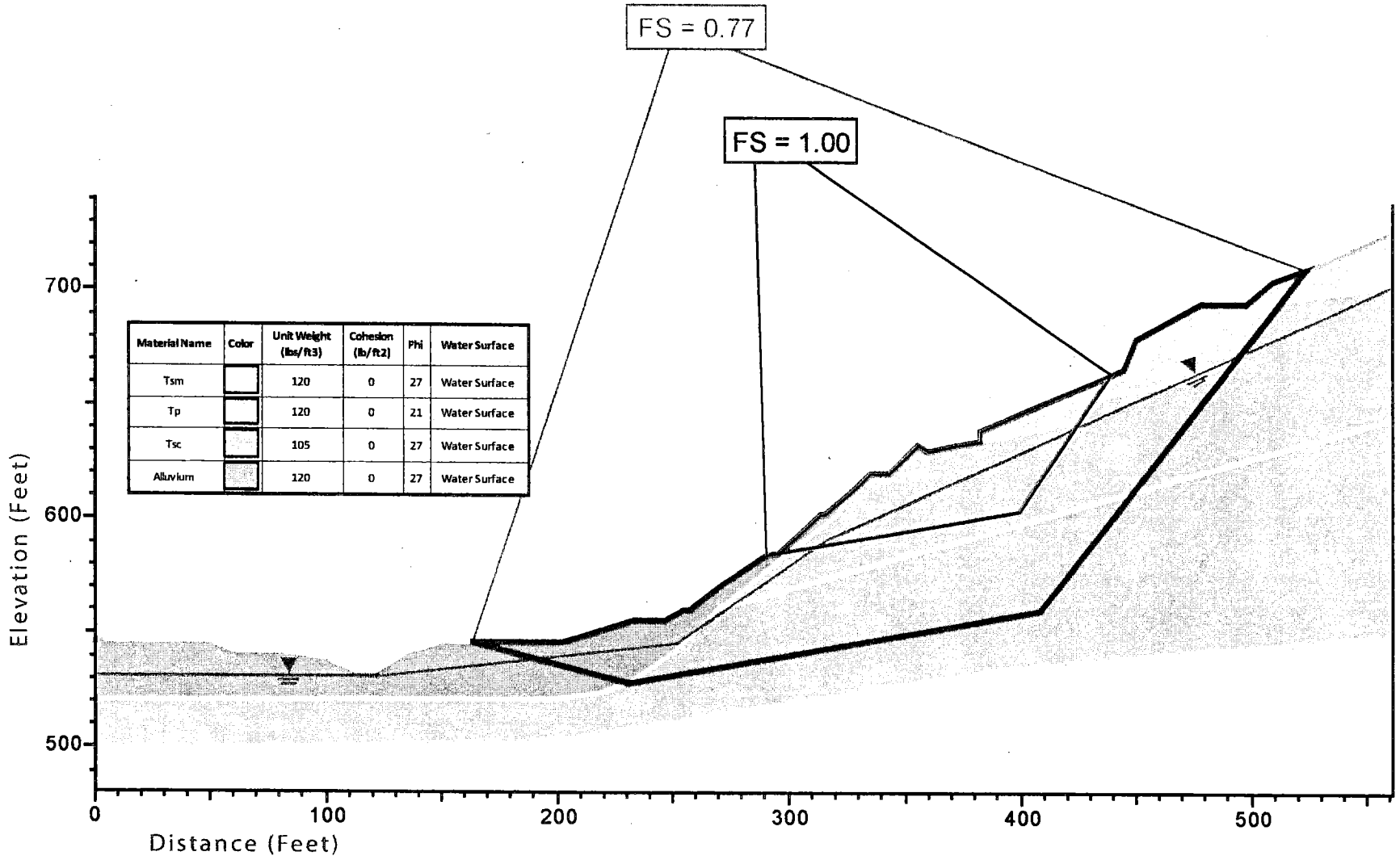

EXPLANATION
Earth Materials
Ef Fill
Qcol Colluvium (shown in fans only)
Qal Alluvium (Quaternary age)
Qlsy Landslide deposits - youngest
Nelson Road 2011 landslide denoted by "Qls11"
Qlsd Landslide deposits - dormant
Qls Landslide deposits - older
[Tsc] Denotes main moderate composing landslide (on cross sections only)
Tp Purisima Formation (Tertiary age)
Tsc Santa Cruz Mudstone (Tertiary age)
Tsm Santa Margarita Formation (on cross sections only)
Symbols
Geologic contact, dashed where approximate, queried where uncertain, dotted where concealed
Landslide, arrow indicates direction of movement, hachures indicate scarp
Upper limit of 2011 failure plane
Convex-up break in slope
Concave-up break-in-slope
Failed at upper graben scarp
Strike and dip of bedding
Strike and dip of fracture set
Gully erosion
Spring
Small-diameter exploratory drill hole
Large-diameter exploratory drill hole
Landslide reference strike pairs
Line of geologic cross section
Tp
Qlso
Qlsy
Qlsd
Qal
Qcol
Ef
Tsc
(Tp)
Colluvial Fan
Alluvial Fan
Qlsy (2011) Nelson Road Landslide
Area not mapped in detail
Area west of Ruins Creek not mapped in detail
Area not mapped in detail
Area not mapped in detail
Area not mapped
Property Line
Drainage Culvert
Well
Meadow
Lane
Road
Ruins Creek
Nelson Road Highway
Williams Res.
Barn
Barn, Pens
Pavement cracks
Older debris apron
2011 debris apron
Power pole typ
Remnant graded bench
Resistant bed
Regional topographic lineament
Ef (Area regraded)
DH-1
DH-2
DH-7
LD-1
LD-2
A
A'
B
B'
Notes:
1. Base map is hillshade derived from 2011 Lidar "bare earth" DEM provided by Towill, Inc. Illumination is from azimuth = 45 degrees; illumination angle = 45 degrees above horizontal.
2. Right-of-way and property lines provided by County of Santa Cruz, Department of Public Works, "Site Survey.dwg" file, November, 2011.
PACIFIC GEOTECHNICAL ENGINEERING
DATE Sept. 2011
SCALE As Shown
GEOLOGIC SITE MAP
Nelson Road Landslide
Santa Cruz County, California
FIGURE 3
PROJECT 2011.0068





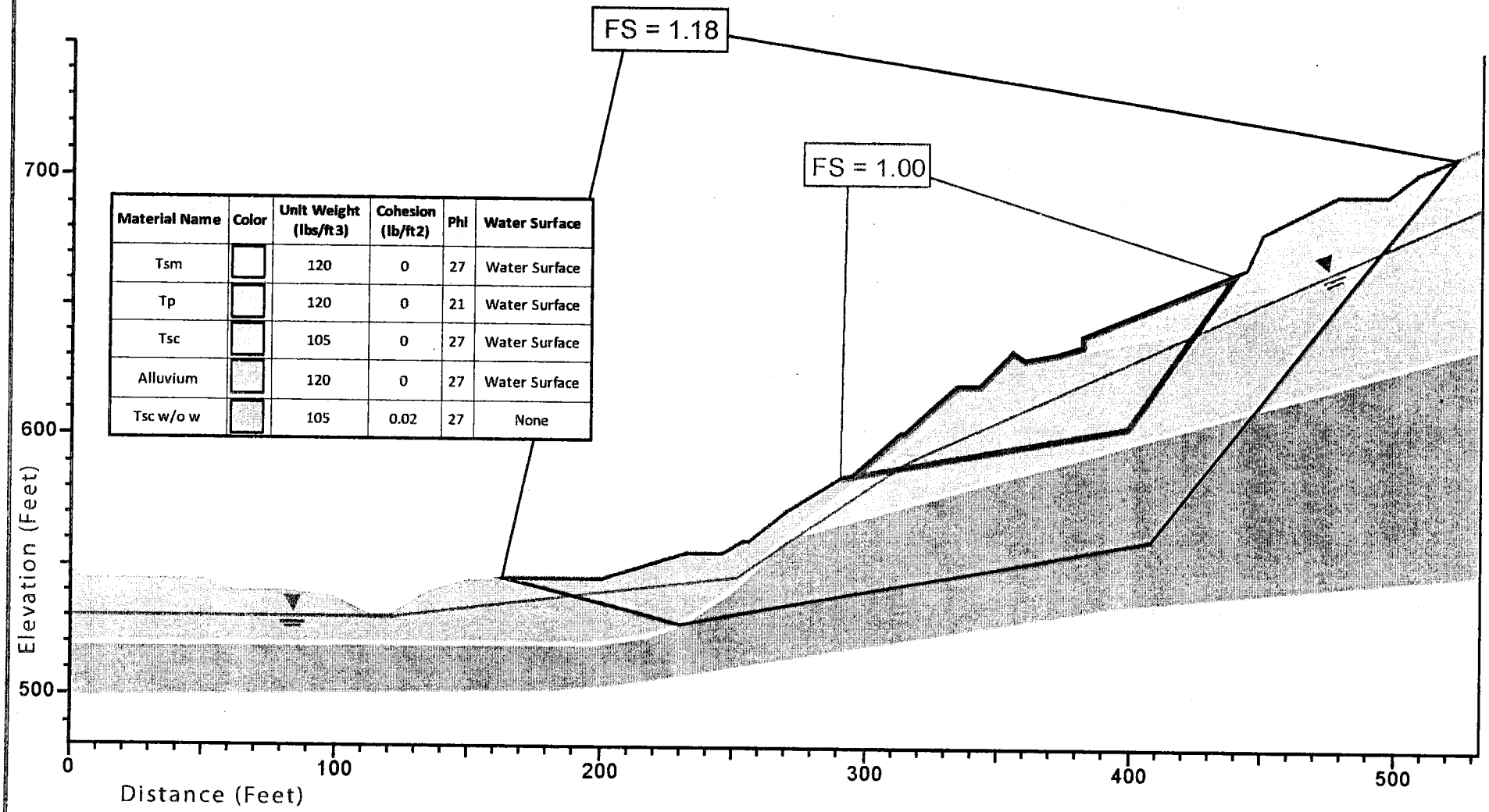


PACIFIC GEOTECHNICAL ENGINEERING	DATE: Sept. 2011	GEOLOGIC CROSS SECTIONS A-A', B-B', & C-C'	FIGURE: 4
	SCALE: As Shown	Nelson Road Landslide Santa Cruz County, California	PROJECT: 2011.0068



PACIFIC GEOTECHNICAL ENGINEERING

DATE Sept. 2011	**BACK ANALYSIS I** **GEOLOGIC CROSS SECTION** **A - A'**	FIGURE 5
File Name Nelson A-A' w28	Nelson Road Landslide Santa Cruz County, California	PROJECT 2011.0068



PACIFIC GEOTECHNICAL ENGINEERING

DATE
Sept. 2011

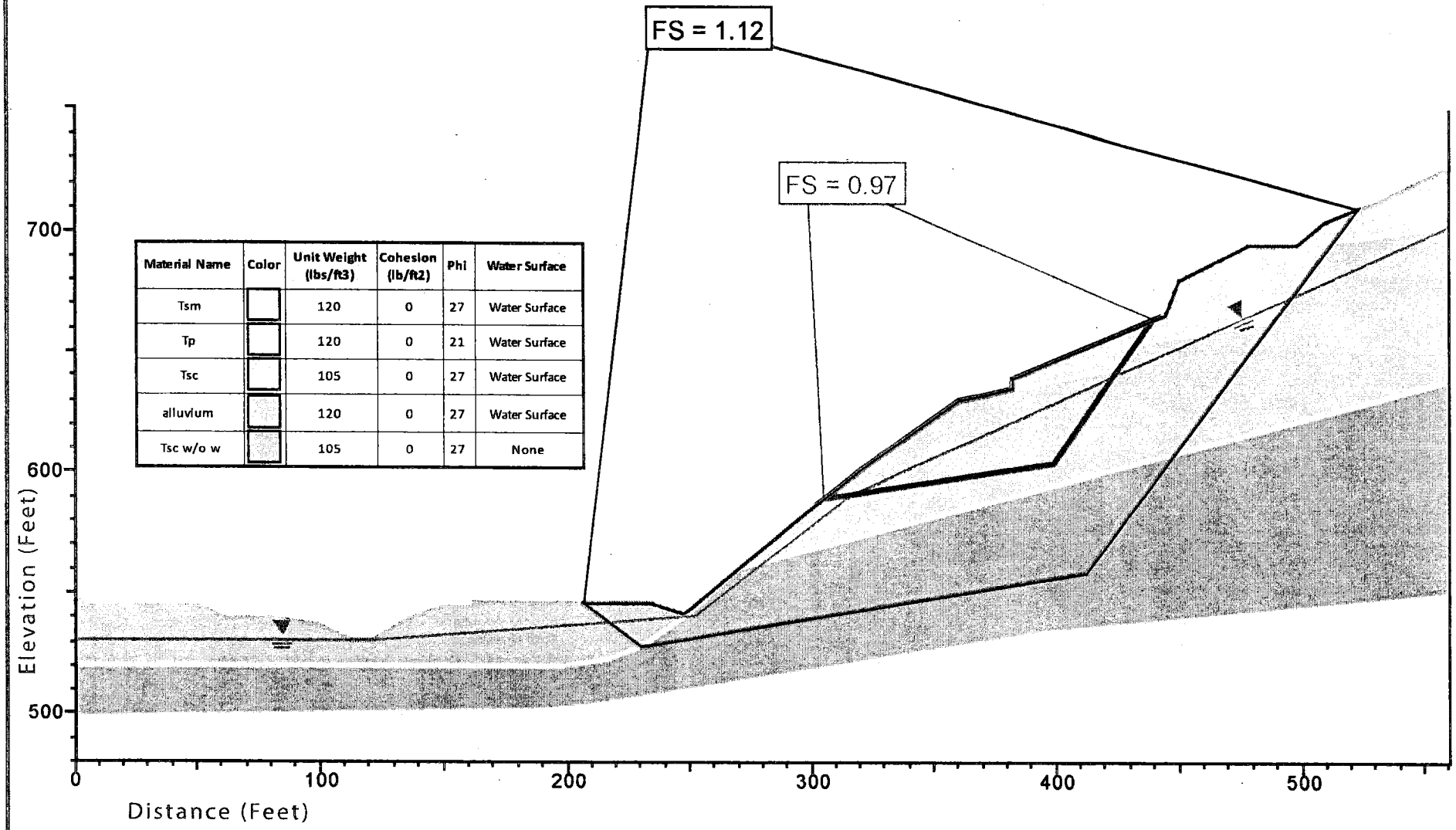
File Name
Nelson A-A' w28 b

BACK ANALYSIS II
GEOLOGIC CROSS SECTION
A - A'

Nelson Road Landslide
Santa Cruz County, California

FIGURE
6

PROJECT
2011.0068



PACIFIC GEOTECHNICAL ENGINEERING

DATE
Sept. 2011

File Name
Nelson A-A' repaired c

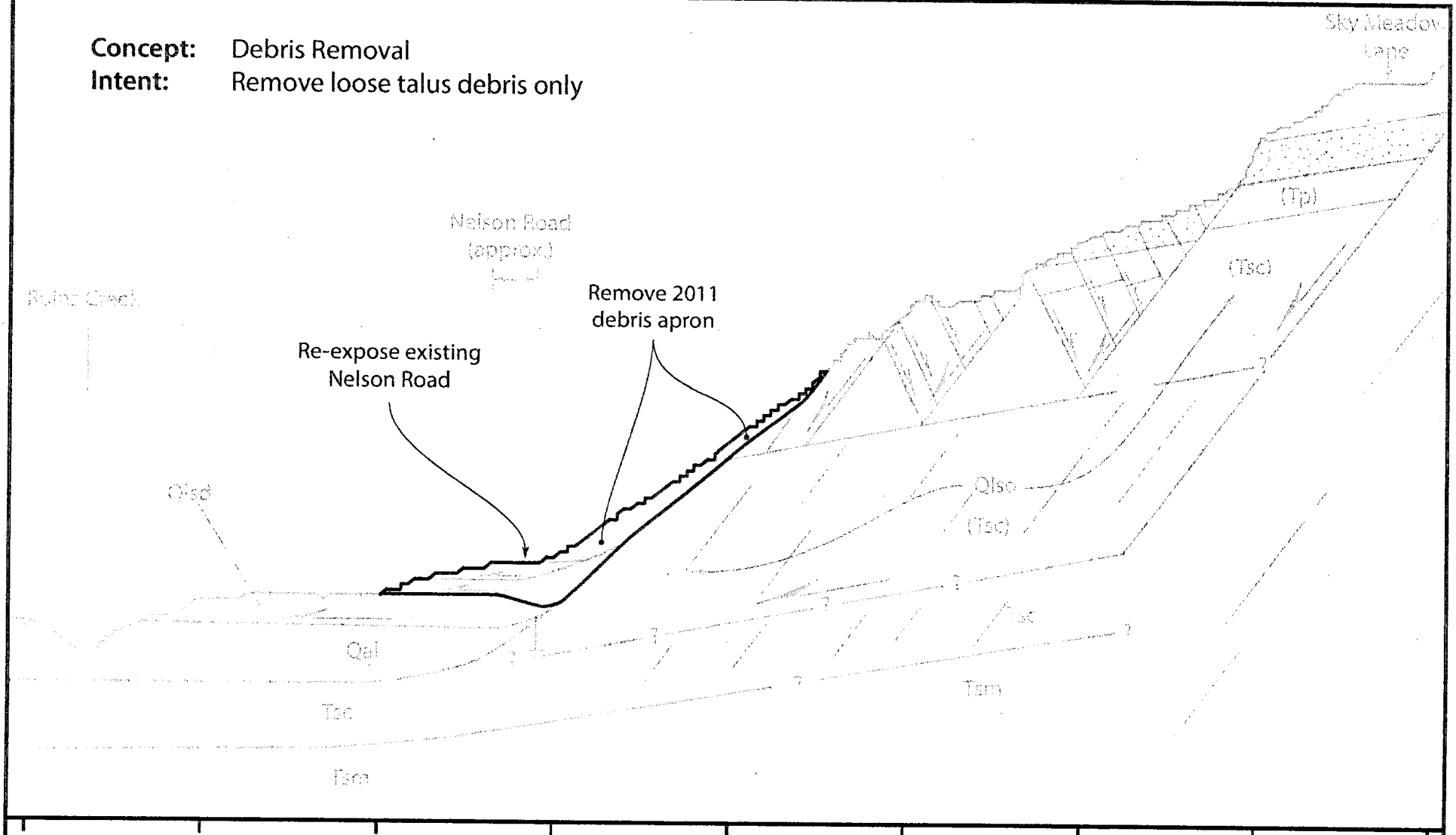
DEBRIS REMOVAL GEOMETRY
GEOLOGIC CROSS SECTION
A - A'

Nelson Road Landslide
Santa Cruz County, California

FIGURE
7

PROJECT
2011.0068

Concept: Debris Removal
Intent: Remove loose talus debris only

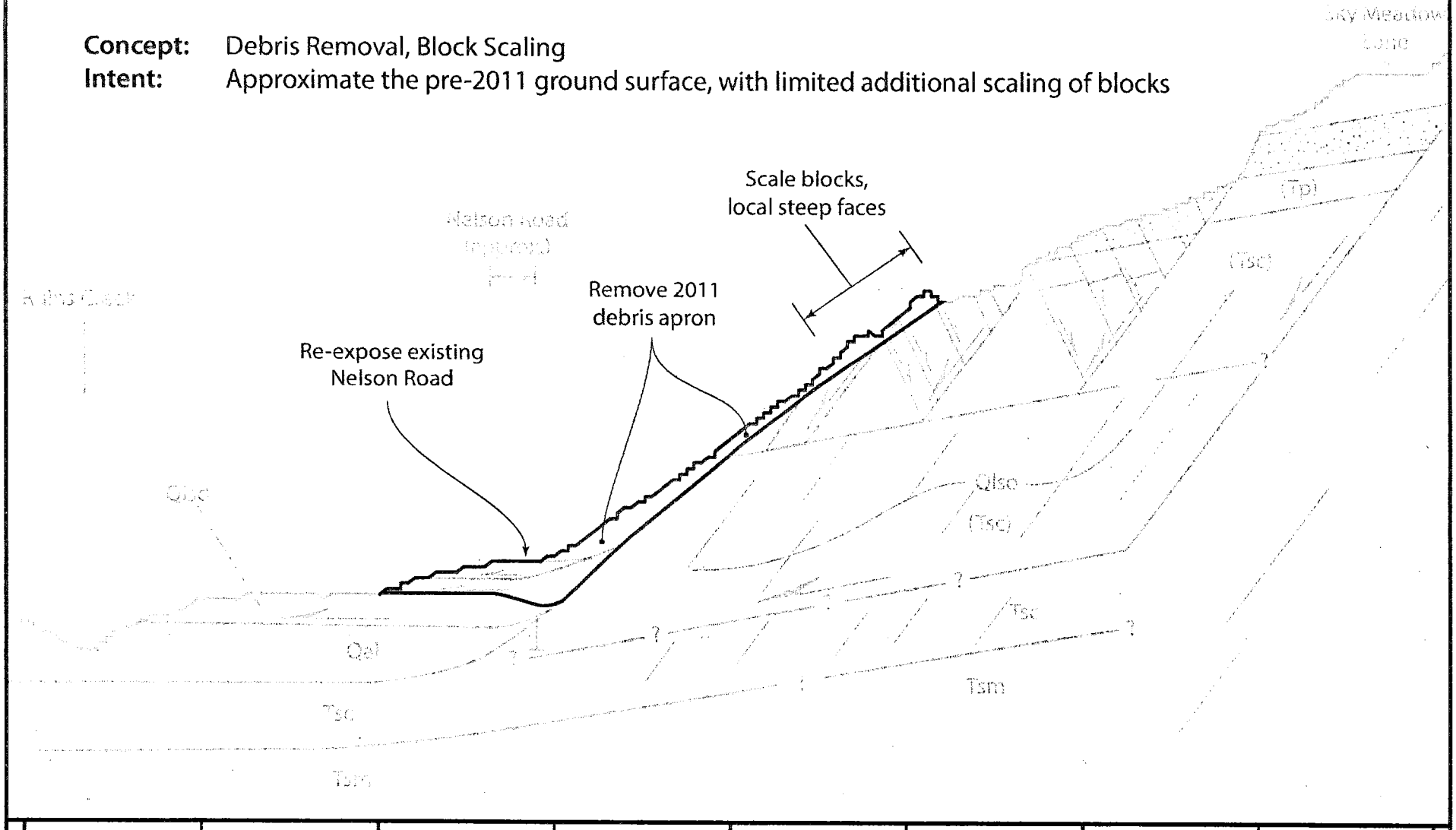


PACIFIC GEOTECHNICAL ENGINEERING

DATE: Draft 9/23/11	**CONCEPTUAL MITIGATION APPROACHES** **Debris Removal**	FIGURE: 8
SCALE: As Shown	Nelson Road Landslide Santa Cruz County, California	PROJECT: 2011.0068

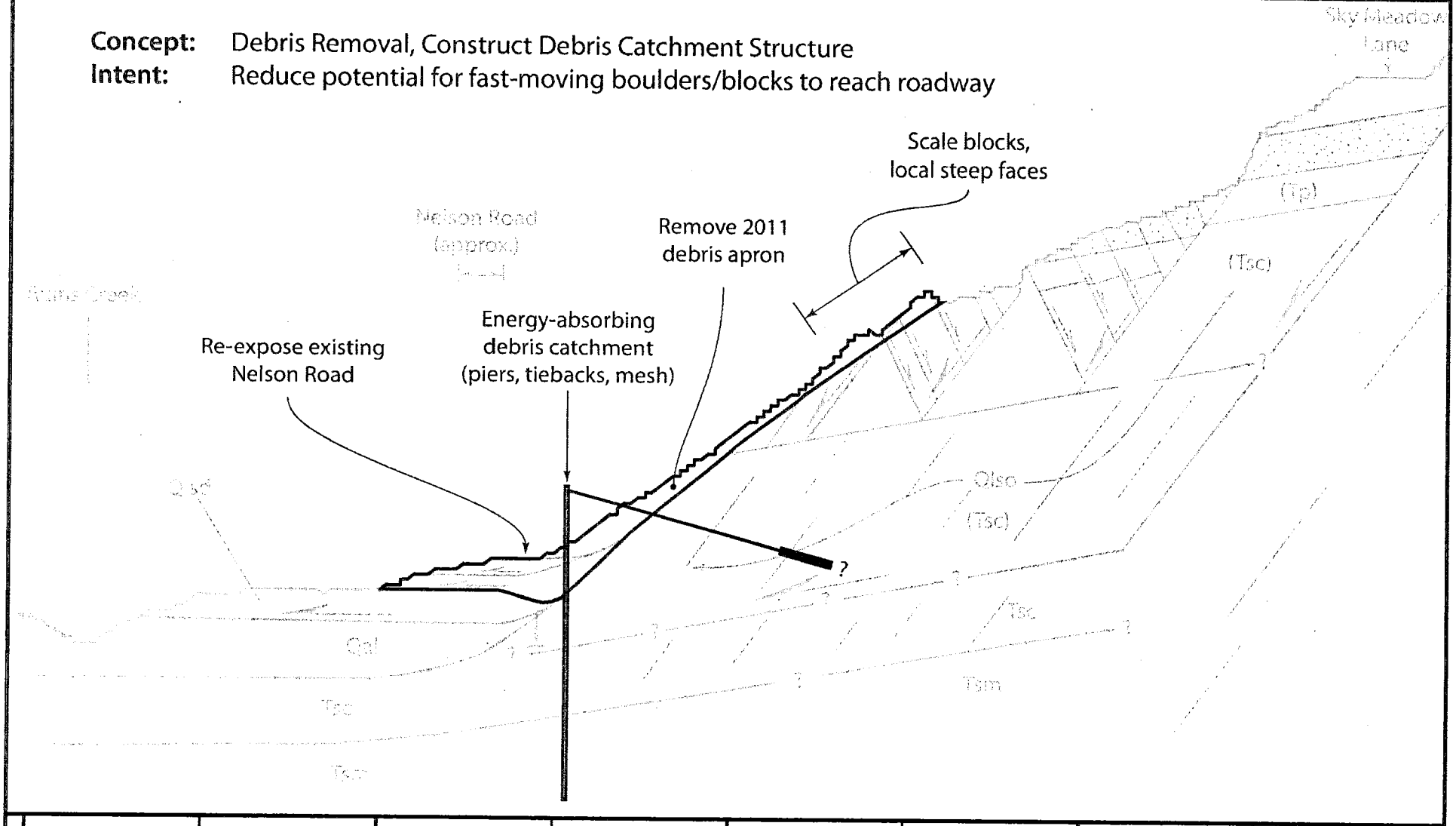
Concept: Debris Removal, Block Scaling

Intent: Approximate the pre-2011 ground surface, with limited additional scaling of blocks



PACIFIC GEOTECHNICAL ENGINEERING	DATE **Draft 9/23/11**	**CONCEPTUAL MITIGATION APPROACHES** **Debris Removal, Block Scaling**	FIGURE **9**
	SCALE **As Shown**	Nelson Road Landslide Santa Cruz County, California	PROJECT **2011.0068**

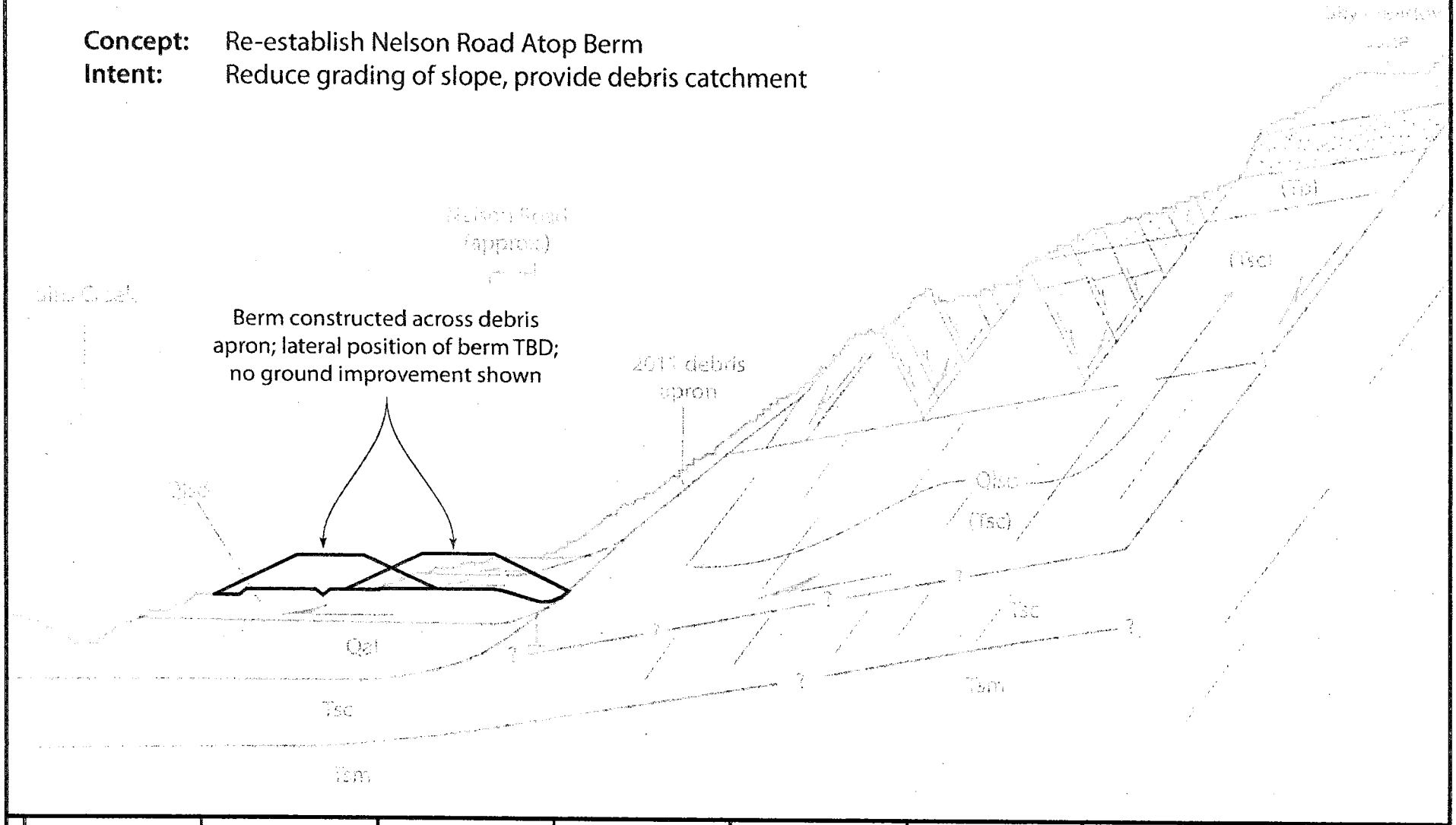
Concept: Debris Removal, Construct Debris Catchment Structure
Intent: Reduce potential for fast-moving boulders/blocks to reach roadway



PACIFIC GEOTECHNICAL ENGINEERING

DATE **Draft 9/23/11**	**CONCEPTUAL MITIGATION APPROACHES** **Debris Removal, Debris Catchment**	FIGURE **10**
SCALE **As Shown**	Nelson Road Landslide Santa Cruz County, California	PROJECT **2011.0068**

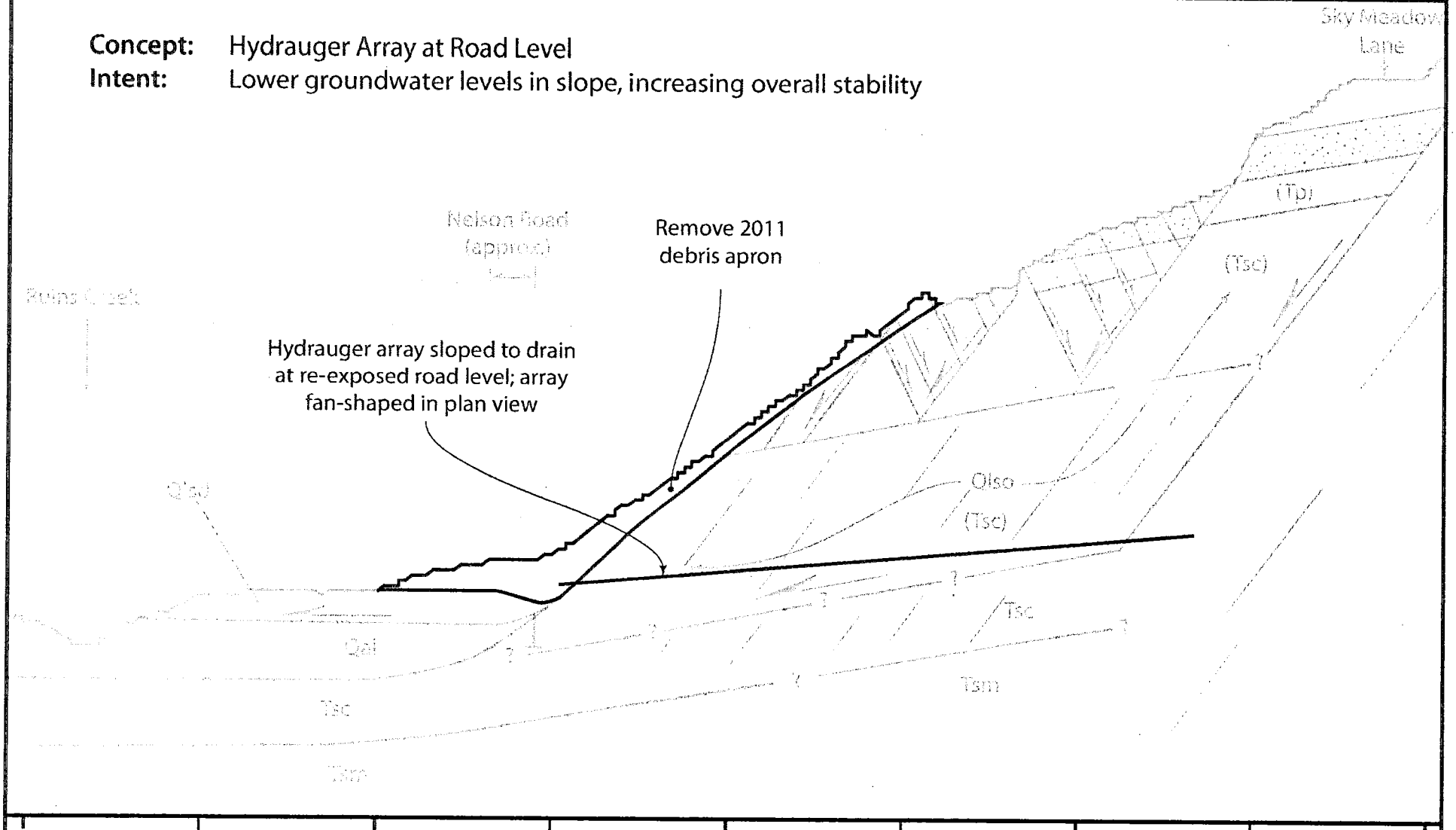
Concept: Re-establish Nelson Road Atop Berm
Intent: Reduce grading of slope, provide debris catchment



PACIFIC GEOTECHNICAL ENGINEERING

DATE **Draft 9/23/11**	**CONCEPTUAL MITIGATION APPROACHES** **Road on Berm**	FIGURE **11**
SCALE **As Shown**	Nelson Road Landslide Santa Cruz County, California	PROJECT **2011.0068**

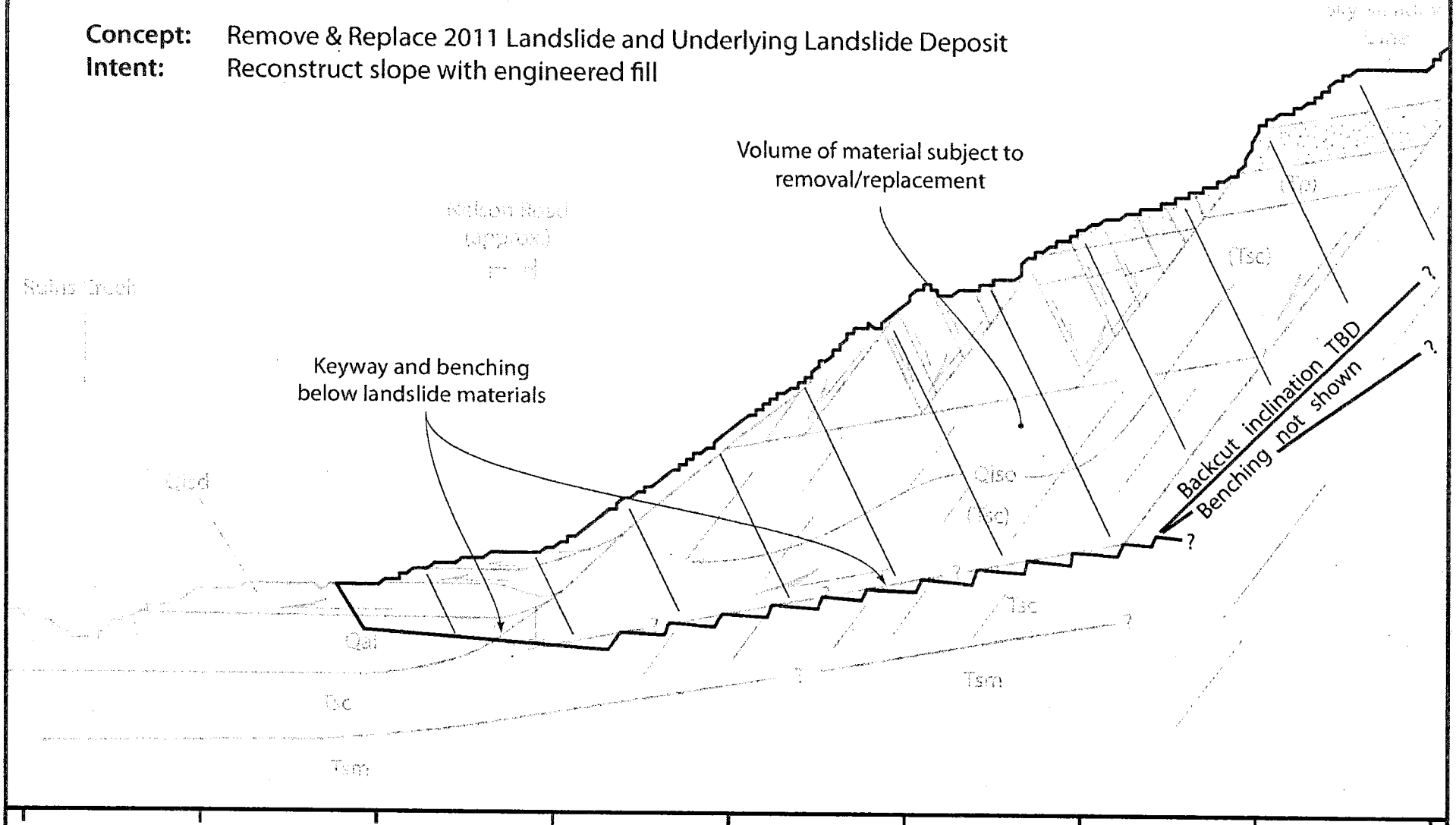
Concept: Hydrauger Array at Road Level
Intent: Lower groundwater levels in slope, increasing overall stability



PACIFIC GEOTECHNICAL ENGINEERING

DATE **Draft 9/23/11**	**CONCEPTUAL MITIGATION APPROACHES** **Hydrauger Array**	FIGURE **12**
SCALE **As Shown**	Nelson Road Landslide Santa Cruz County, California	PROJECT **2011.0068**

Concept: Remove & Replace 2011 Landslide and Underlying Landslide Deposit
Intent: Reconstruct slope with engineered fill



PACIFIC GEOTECHNICAL ENGINEERING

DATE: Draft 9/23/11	**CONCEPTUAL MITIGATION APPROACHES**	FIGURE: 13
SCALE: As Shown	**Remove & Replace**	PROJECT: 2011.0068
	Nelson Road Landslide Santa Cruz County, California	

APPENDIX A

ROCK QUALITY DESCRIPTIONS

HARDNESS**

Very Hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of the geologist's pick
Hard	Can be scratched with knife or pick only with difficulty. Hard blow with hammer required to break sample.
Moderately Hard	Can be scratched with knife or pick. Gouges or grooves to ½ inch can be excavated by hard blow of point of a geologist's pick. Hand specimens broken with moderate blow.
Medium	Can be grooved or gouged 1/16 inch deep by firm pressure on knife or pick point. Can be excavated in small chips about 1 inch maximum in dimension by hard blows of the point of a geologist's pick.
Soft	Can be grooved or gouged readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small pieces can be broken by finger pressure,
Very Soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces one inch or more thickness can be broken with finger pressure. Can be scratched readily by finger nail.

WEATHERING**

Fresh or Unweathered	Rock fresh, crystals bright, few joints and fractures may show slight staining. Rock rings under hammer if crystalline.
Very Slight	Rock generally fresh, fractures and joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints and fractures stained, and discoloration extends into rock up to 1 inch. Joints may contain clay. In granitic rock, some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitic rock, most feldspars are dull and discolored; some show clay. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately Severe	All rock except quartz discolored or stained. In granitic rock, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick. Rock goes "clunk" when struck.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitic rock, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very Severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil." Rock "fabric" not discernible or discernible only in small scattered locations. Quartz may be present as dikes or stringers.

FRACTURE DIMENSIONS*

Fracture	Block Size (or Spacing[1])
Crushed	~5 microns to 0.1 ft
Intensely	0.05 to 0.1 ft
Closely	0.1 to 0.5 ft
Moderately	0.5 to 1.0 ft
Slightly	1.0 to 3.0 ft
Massive	3.0 ft and larger

1 Average distance between adjacent fractures

* Source of data unknown

** Source of data: "Subsurface Investigaiton for Design and Constructio of Foundation Buildings," (1976) American Society of Civil Engineers, Manuals and Reports on Engineering Practice – No. 5

KEY TO SOIL CLASSIFICATION - FINE GRAINED SOILS

(50% OR MORE IS SMALLER THAN NO. 200 SIEVE SIZE)

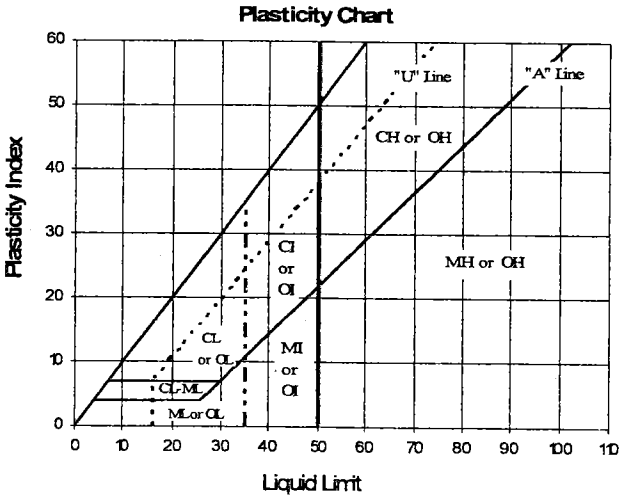
(modified from ASTM D2487 to include fine grained soils with intermediate plasticity)

MAJOR DIVISIONS			GROUP SYMBOLS	GROUP NAMES
SILTS AND CLAYS (Liquid Limit less than 35) Low Plasticity	Inorganic	PI < 4 or plots below "A" line	ML	Silt, Silt with Sand or Gravel, Sandy or Gravelly Silt, Sandy or Gravelly Silt with Sand or Gravel
	Inorganic	PI > 7 or plots on or above "A" line	CL	Lean Clay, Lean Clay with Sand or Gravel, Sandy or Gravelly Lean Clay, Sandy or Gravelly Lean Clay with Sand or Gravel
	Inorganic	PI between 4 and 7	CL-ML	Silty Clay, Silty Clay with Sand or Gravel, Sandy or Gravelly Silty Clay, Sandy or Gravelly Silty Clay with Sand or Gravel
	Organic	See footnote 3	OL	Organic Silt (below "A" Line) or Organic Clay (on or above "A" Line) [1,2]
SILTS AND CLAYS (35 ≤ Liquid Limit < 50) Intermediate Plasticity	Inorganic	PI < 4 or plots below "A" line	MI	Silt, Silt with Sand or Gravel, Sandy or Gravelly Silt, Sandy or Gravelly Silt with Sand or Gravel
	Inorganic	PI > 7 or plots on or above "A" line	CI	Clay, Clay with Sand or Gravel, Sandy or Gravelly Clay, Sandy or Gravelly Clay with Sand or Gravel
	Organic	See footnote 3	OI	Organic Silt (below "A" Line) or Organic Clay (on or above "A" Line) [1,2]
SILTS AND CLAYS (Liquid Limit 50 or greater) High Plasticity	Inorganic	PI plots below "A" line	MH	Elastic Silt, Elastic Silt with Sand or Gravel, Sandy or Gravelly Elastic Silt, Sandy or Gravelly Elastic Silt with Sand or Gravel
	Inorganic	PI plots on or above "A" line	CH	Fat Clay, Fat Clay with Sand or Gravel, Sandy or Gravelly Fat Clay, Sandy or Gravelly Fat Clay with Sand or Gravel
	Organic	See note 3 below	OH	Organic Silt (below "A" Line) or Organic Clay (on or above "A" Line) [1,2]

1. If soil contains 15% to 29% plus No. 200 material, include "with sand" or "with gravel" to group name, whichever is predominant.
2. If soil contains ≥30% plus No. 200 material, include "sandy" or "gravelly" to group name, whichever is predominant. If soil contains ≥15% of sand or gravel sized material, add "with sand" or "with gravel" to group name.
3. Ratio of liquid limit of oven dried sample to liquid limit of not dried sample is less than 0.75.

CONSISTENCY	UNCONFINED SHEAR STRENGTH (KSF)	STANDARD PENETRATION (BLOWS/FOOT)
VERY SOFT	< 0.25	< 2
SOFT	0.25 – 0.5	2 – 4
FIRM	0.5 – 1.0	5 – 8
STIFF	1.0 – 2.0	9 – 15
VERY STIFF	2.0 – 4.0	16 – 30
HARD	> 4.0	> 30

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



PACIFIC GEOTECHNICAL ENGINEERING

KEY TO SOIL CLASSIFICATION – COARSE GRAINED SOILS

(MORE THAN 50% IS LARGER THAN NO. 200 SIEVE SIZE)

(modified from ASTM D2487 to include fines with intermediate plasticity)

MAJOR DIVISIONS			GROUP SYMBOLS	GROUP NAMES[1]
GRAVELS (more than 50% of coarse fraction is larger than No. 4 sieve size)	Gravels with less than 5% fines	Cu ≥ 4 and 1 ≤ Cc ≤ 3	GW	Well Graded Gravel, Well Graded Gravel with Sand
		Cu < 4 and/or 1 > Cc > 3	GP	Poorly Graded Gravel, Poorly Graded Gravel with Sand
	Gravels with 5% to 12% fines	ML, MI or MH fines	GW-GM	Well Graded Gravel with Silt, Well Graded Gravel with Silt and Sand
			GP-GM	Poorly Graded Gravel with Silt, Poorly Graded Gravel with Silt and Sand
		CL, CI or CH fines	GW-GC	Well Graded Gravel with Clay, Well Graded Gravel with Clay and Sand
			GP-GC	Poorly Graded Gravel with Clay, Poorly Graded Gravel with Clay and Sand
	Gravels with more than 12% fines	ML, MI or MH fines	GM	Silty Gravel, Silty Gravel with Sand
		CL, CI or CH fines	GC	Clayey Gravel, Clayey Gravel with Sand
		CL-ML fines	GC-GM	Silty Clayey Gravel; Silty, Clayey Gravel with Sand
SANDS (50% or more of coarse fraction is smaller than No. 4 sieve size)	Sands with less than 5% fines	Cu ≥ 6 and 1 ≤ Cc ≤ 3	SW	Well Graded Sand, Well Graded Sand with Gravel
		Cu < 6 and/or 1 > Cc > 3	SP	Poorly Graded Sand, Poorly Graded Sand with Gravel
	Sands with 5% to 12% fines	ML, MI or MH fines	SW-SM	Well Graded Sand with Silt, Well Graded Sand with Silt and Gravel
			SP-SM	Poorly Graded Sand with Silt, Poorly Graded Sand with Silt and Gravel
		CL, CI or CH fines	SW-SC	Well Graded Sand with Clay, Well Graded Sand with Clay and Gravel
			SP-SC	Poorly Graded Sand with Clay, Poorly Graded Sand with Clay and Gravel
	Sands with more than 12% fines	ML, MI or MH fines	SM	Silty Sand, Silty Sand with Gravel
		CL, CI or CH fines	SC	Clayey Sand, Clayey Sand with Gravel
		CL-ML fines	SC-SM	Silty, Clayey Sand; Silty, Clayey Sand with Gravel

US STANDARD SIEVES	3 Inch	¾ Inch	No. 4	No. 10	No. 40	No. 200	
	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES & BOULDERS	GRAVELS		SANDS				SILTS AND CLAYS

RELATIVE DENSITY (SANDS AND GRAVELS)	STANDARD PENETRATION (BLOWS/FOOT)
Very Loose	0 - 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 - 50
Very Dense	50+

1. Add "with sand" to group name if material contains 15% or greater of sand-sized particle. Add "with gravel" to group name if material contains 15% or greater of gravel-sized particle.

MOISTURE	CRITERIA
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soi is below the water table

PACIFIC GEOTECHNICAL ENGINEERING

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
PAGE 1 OF 11

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/05			HSA			0					
						1					
						2					
						3				PURISIMA FORMATION (Tp): Sandstone; gray with orange mottling; massive, severely weathered, fracture indeterminate; soft; uncemented; fine-grained; variably clayey	
						4					
					N/A	5					SPT at 5': 13, 28, 40
						6					
						7					
						8				As above	
						9					
			SPT			10					SPT at 10': 14, 50/6"
07/05			HQ			11					
				65	0	12				Sandstone; gray to light brownish gray (5Y 5/1 to 2.5Y 6/2); fracture spacing 0.5-2"; varies from soft to moderately hard; well cemented to weakly cemented @ 11' Planar fracture at ~44° with pervasive Fe-oxide staining	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/05	11:39		HQ			13				PURISIMA FORMATION SANDSTONE: Appears massive; fine-grained; moderately hard; fissile;	
										@ 13.5' 0.2' soft crushed zone	
						14				Fracture spacing 2-4"	
						15					
				92	32					@ ~15.5' 1" thick crushed zone	
						16				@ 16.4' Planar fracture 45° dip; most fractures lined with Mn or Fe oxides	
						17				@ 16.8' Bedding dips 15°	
										17 - 18' Soft sediment deformation	
	11:49									Clayey sandstone; thinly bedded	
			HQ			18				18 - 20' Fractures subparallel to and across bedding (25° bedding parallel); 40-50° dip across bedding; subplanar to rough irregular fractures spaced approx 2" apart; sandstone is very fine-grained	
						19					
						20				20 - 23' Massive to weakly bedded with soft sediment deformation; moderately hard to hard; moderately to well cemented; very fine-grained; many fissile crushed zones	
				90	18						
						21				20.8 - 21.2' Crushed zone	
										21.6 - 22' Crushed zone	
						22					
	12:13									@ 23' 1-2mm thick gypsum veins orthogonal to core	
	1:08		HQ			23				23 - 24.5' Sandstone; moderately hard to hard; well cemented; massive with zones of soft sediment deformation	
						24				24.5 - 25.9' Clayey sandstone with sandy claystone interbeds; soft; uncemented	
										@ 24.8' 1/4" gypsum vein with 40° dip	
						25					
				100	50					25.3 - 25.9' Crushed interval	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/05			HQ			26				PURISIMA FORMATION SANDSTONE: as above	
										26.3 - 26.5' Crushed interval	
						27				@ 27.5' Planar bedding parallel fracture dips 50°	
	1:15										
	1:33		HQ			28				28 - 29' 1-2" fracture spacing	
						29				@ 29' Fracture dips 80°; rough fracture surface	
						30				30.3 - 32.1' Sandstone; soft; uncemented; variably clayey and crushed	
				100	26						
						31				Bedding difficult to see (soft sediment deformation)	
						32				@ ~32' Clayey sandstone; dark gray; soft; interbedded; variably sandy claystone	
	1:45										
	2:05		HQ			33				@ 33' Bedding horizontal	
										33 - 33.8' Soft; fractured orthogonal to core; very clayey; very fine-grained	
						34				33.8 - 34.6' Sandstone; dark gray; hard; cemented; unfractured	
										34.6 - 35.5' Very soft 10-12" zone; void or washed out; landslide plane (?)	
						35					
				78	24					SANTA CRUZ MUDSTONE (map unit Tsc): Variable as below Dark gray brown	
						36				36 - 36.5' Crushed; fissile with zones of intact hard cemented sandstone	
						37				@ 37' Bedding is subhorizontal	
						38					
	2:35		HQ							38 - 42' Mostly sandstone; dark gray; hard; cemented; very fine-grained; variably cemented	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/05			HQ	88	24	39				SANTA CRUZ MUDSTONE (Tsc): as above Dark gray; fresh to moderately weathered; mostly hard; fracture along bedding parallel partings (horizontal); very fine-grained; variably cemented shale; few laminations	
						40					
						41					
						42				42.2 - 42.7' Soft; uncemented	
	2:45					43				42.7 - 43' Fissile; hard; crushed	
	3:00		HQ	N/A	N/A	44				43 - 48' Sandstone; very fine-grained; hard; fissile; irregular fractures; subhorizontal bedding; variable to hard; massive; cemented shale;core integrity lost during expulsion from barrel	
						45					
						46					
						47					
			HQ	80	64	48				48 - 53' Sandstone; dark gray (5Y 5/4); massive; soft to moderately hard; lightly weathered; clayey; very fine-grained; well sorted; generally unfractured; weakly cemented; will fracture roughly along subhorizontal partings	
						49					
						50					
						51					

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/05			HQ			52				SANTA CRUZ MUDSTONE (Tsc): as above	
	4:00		HQ			53					
						54				Dark gray (5Y 5/11); moderately soft to hard; massive; bedding is difficult to see, appears subhorizontal	
						55					
				100	64	56					
						57					
						58				@ 57.5' Planar fracture dips 30°	
			HQ			59				59.1 - 59.3' Crushed zone	Circulation loss to fractures
						60					
				100	64	61					
						62					
07/05						63					
07/06	8:02		HQ			64				63 - 68' Silty to clayey sandstone, variable to sandy siltstone; moderately hard; well cemented; bedding horizontal (thin laminations)	
				98	90						

PACIFIC GEOTECHNICAL ENGINEERING

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/06			HQ			65				SANTA CRUZ MUDSTONE (Tsc): Sandy siltstone and fine-grained sandstone; very dark gray (5Y 3/1)	
						66					
						67				Low density	
	8:11					68					Loss of circulation continues
	8:35		HQ							68 - 73' Soft to moderately hard; finely laminated; horizontal bedding partings	
						69					
						70					
				100	72	71					
						72					
	8:52					73					
			HQ			74				73.7 - 74.2' Pervasively fractured parallel to horizontal bedding	
						75					
				100	52	76				Sandy siltstone as above	
						77					
	9:29										

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/06			HQ			78				SANTA CRUZ MUDSTONE (Tsc):	
										78 - 83' Siltstone and clayey sandstone; fine-grained; laminated; moderately hard; fractured parallel to bedding (horizontal)	
						79					
						80					
				90	18					80.3 - 80.5' crushed	
						81					
						82					
										82.5 - 84.7' Crushed; rounded fragments (mechanical breakage)	
			HQ			83					
											83 - 84' Driller notes fast drilling
						84					
										84.7 - 85.7' Sandy siltstone; moderately hard; crushed zone, approx. 1" thick each @ 85.2' and 85.7'	
				94	36	85					
										85.7 - 88' Clayey sandstone; very fine-grained	
	10:53					86					
						87					
	12:35		HQ			88					
										89 - 89.7' Crushed internal	
						89					
						90					
				100	76						

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
PAGE 8 OF 11

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/06			HQ			91				SANTA CRUZ MUDSTONE (Tsc): As above	
						92				@ 92' Planar fracture dips 55°	
	1:00					93					
			HQ							93 - 98' Sandstone, sandy siltstone; very fine-grained; moderately hard; closely fractured along bedding partings (horizontal)	
						94					
						95					
				96	66	96					
						97					
	1:35					98					
			HQ								
						99				99.1 - 99.3' crushed with many bedding parallel partings; gray (5Y 6/1)	
						100				Sandstone and sandy siltstone (as above); very fine-grained	
				100	86						
						101					
						102					
	2:15					103					
			HQ							103.5' Crushed zone	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/06			HQ			104				SANTA CRUZ MUDSTONE (Tsc): As above Very fine-grained clayey sandstone, sandy siltstone	
						105				@ ~105' 55° fracture	
				100	56	106					
						107					
	2:50					108				@ 108' 52° fracture	
	3:01		HQ			109					
						110					
				100	50					110.4 - 111.5' Vertical fracture	
						111					
										111.5 - 111.7' Bleached siltstone; soft; pale yellow (5Y 8/2)	
						112					
	3:17					113					
	3:25		HQ							113 - 118' Sandy siltstone	
						114					
										114.4 - 114.8' crushed; washed out	Driller notes two 4-inch sudden drops about 2' apart
						115					
				82	42						
						116				115.8 - 116.2' Crushed interval	
										@ 116.6 Planar fracture dips 25°	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/06	3:45		HQ			117				SANTA CRUZ MUDSTONE (Tsc): Sandy siltstone as above 117.2' Crushed interval 117.5 - 118' Multiple 15-20° fractures (parallel)	
	4:00		HQ			118					
						119					
						120					
				72	10					@ 120.5' conjugate faces at 20° and 55° dip 120.7 - 121.5' Very closely spaced fractures	
						121					Driller notes last 2 feet of run very fast
										@ 121.5' 20" fracture above crushed zone	
						122		?		121.5 - 123 Soft; crushed; partially washed out	
	4:09					123					
			HQ					?			
						124				Crushed; rounded fragments (mechanical breakage)	
						125				@ 125' 25° and 80° conjugate fracture	
				86	32					125 - 126.5' Sandy siltstone and clayey sandstone; soft to moderately hard	
						126					
										@ 126.5' 55° planar fracture	
						127				126.5 - 128' Sandstone; fine- to medium grained; varies from soft and uncemented to very well cemented; gray as above	
07/06	4:40					128					
07/06			HQ							128 - 133' Clayey sandstone; fine-grained	
						129					
				92	64						

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-1
PAGE 11 OF 11

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~703'
DATE STARTED: 7-5-11
DATE FINISHED: 7-7-11
GW DEPTH: N/A
TOTAL DEPTH: 143'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/07			HQ			130				SANTA CRUZ MUDSTONE (Tsc)	
						131					
						132					
	8:55					133					
	9:11		HQ							133 - 138' Clayey sandstone; dark gray (5Y 4/1); fine-grained; soft; uncemented to weakly cemented; massive	
						134					
						135					
				100	92					Bedding partings dip 8°	
						136					
						137					
	~9:30					138					
			HQ							Sandy claystone bed; 1/2" thick; soft	
						139				138.9 - 139.4' Hard; very well cemented	
										139.4 - 142' Clayey sandstone; soft; uncemented	
						140					
				100	92						
						141					
						142				142 - 143' Grades to sandy siltstone; moderately hard; subhorizontal partings	
										Bottom of Hole 143 Feet	
07/07	10:02					143				Vibrating wire piezometer installed on slope inclinometer casing at 130' below ground surface	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-2
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~545'
DATE STARTED: 7-7-11
DATE FINISHED: 7-8-11
GW DEPTH: N/A
TOTAL DEPTH: 70'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/07			HSA			0					
						1					
						2					
						3					
										ALLUVIUM:	
						4			CL	Sandy lean CLAY with gravel; moist; soft; fine sand and gravel fraction	SPT at 4.0': 2, 2, 4
						5					
						6					
						7					
						8					
						9				As above - very moist	SPT at 9.0': 1, 2, 3 Lost 2/3 of sample
						10					
						11					
						12					

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-2
PAGE 2 OF 6

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core: Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~545'
DATE STARTED: 7-7-11
DATE FINISHED: 7-8-11
GW DEPTH: N/A
TOTAL DEPTH: 70'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/07			HSA			13					
						14				COLLUVIUM:	SPT at 14': 1, 3, 3
						15			CL	Angular sand and gravel; angular siltstone fragments in sample 14.7-15.1'; variably gravelly clay	
						16					
						17					
						18					
						19					SPT at 19': 2, 3, 3
						20			GC	Clayey GRAVEL; gray to orange brown; loose; wet; angular siltstone fragments; variably gravelly clay	
						21					
						22				SANTA CRUZ MUDSTONE (map unit Tsc) Sandy siltstone; gray (5Y 5/1), mottled with brownish yellow (10YR 6/6); horizontal partings; soft; clayey; very fine sand fraction; severely weathered	
						23					
						24					SPT at 24': 10, 20, 23
07/07	3:20		HQ			25					Switch to HQ Core at 25'

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-2

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~545'
DATE STARTED: 7-7-11
DATE FINISHED: 7-8-11
GW DEPTH: N/A
TOTAL DEPTH: 70'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/07			HQ			26				SANTA CRUZ MUDSTONE (Tsc) SANDSTONE; soft; clayey; easily carved with knife; fine-grained; massive with trace horizontal laminations	
						27				26.4 - 27' Sharp transition; oxidized color above to gray (2.5Y 5/1); transition dips 70-80°, core run generally unfractured	
				80	76	28					
						29					
	3:34					30					
	3:43		HQ			31				@ 31' Irregular fracture dips 60°	
						32				31.7 - 31.8 Gray (2.5Y 6/1); sandstone lens; completely weathered to loose clayey sand; variably sandy clay; adjacent sandstone crushed; subhorizontal dip	
				100	54	33				~33 - 34' Soft; severely weathered; brownish yellow (10YR 6/6); oxidized zone (brownish yellow colors) in sharp contact with reduced zone (gray colors) along one of several planar fractures with 60° dip; mottled with gray	
						34				34 - 35' Soft gray sandstone as above; uncemented; massive	
	3:56					35					
			HQ			36				Variably weakly cemented; dense with clayey groundmass; massive with no visible bedding	
						37					
				100	96	38				38.3 - 38.9' Oxidized zone with sharp subparallel contacts; same as at 33-34'; contacts dip 65-70° with preferential parallel fractures	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-2

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~545'
DATE STARTED: 7-7-11
DATE FINISHED: 7-8-11
GW DEPTH: N/A
TOTAL DEPTH: 70'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
			HQ			39				SANTA CRUZ MUDSTONE (Tsc)	
	4:27									Clayey sandstone as above; soft; gray; massive	
			HQ			40					
						41				41.7 - 41.8' Crushed shale interval	
						42				SANTA MARGARITA FORMATION (map unit Tsm)	
				100	76					Sandstone with clayey groundmass; coarse-grained; moderately hard; moderately to well cemented; angular sand grains; glauconitic	
						43					
						44					
07/07	4:55									@ 44.3' Sandstone becomes loose; uncemented; weak; subhorizontal layering; olive gray (5Y 4/2)	
07/08	8:27		HQ			45					
						46					
						47					
				82	34					47.8 - 50' Sandstone; fine- to coarse-grained; soft to moderately hard; weakly cemented;	
						48					
						49					
	8:35										
			HQ			50				50 - 52.9' Sand; loose; uncemented	
						51					

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-2
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JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~545'
DATE STARTED: 7-7-11
DATE FINISHED: 7-8-11
GW DEPTH: N/A
TOTAL DEPTH: 70'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/08			HQ	86	76	52				SANTA MARGARITA FORMATION (Tsm) Sandstone with clayey groundmass; coarse-grained; moderately hard; moderately to well cemented; angular sand grains; glauconitic	
						53					
						54					
	8:55					55				@ 55' Trace rounded gravel	
	9:10		HQ							55 - 60' Sand; gray (gley 1 7/1); massive; fine-grained; well sorted; loose; completely uncemented; variably silty to no fines; faint subhorizontal laminations	
						56					
						57			SW to SM		
				78	0						
						58				As above	
						59					
	9:13					60					
			HQ								
						61					
						62					
				46	0						
						63				As above	
						64					

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: DH-2
PAGE 6 OF 6

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: Hollow Stem Auger; HQ Core; Rotary Wash
CONTRACTOR: Britton
LOGGED BY: John Feltman

SURFACE ELEVATION: ~545'
DATE STARTED: 7-7-11
DATE FINISHED: 7-8-11
GW DEPTH: N/A
TOTAL DEPTH: 70'

Date	Time (start/stop)	Drill Rate (feet/min.)	Drilling Technique	Core Recovery (percent)	RQD	DEPTH (feet)	ELEVATION	MATERIAL SYMBOL	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
07/08			HQ	82	0	65 66 67 68 69				SANTA MARGARITA FORMATION (Tsm) Sandstone; fine-grained; massive; uncemented; loose; wet	
07/08	10:00					70				Bottom of Hole 70 Feet Piezometer installed on slope inclinometer casing at 61.0' below ground surface	

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: LD-1
PAGE 1 OF 1

JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: 30" solid stem auger
CONTRACTOR: CE
LOGGED BY: GRF, BT

SURFACE ELEVATION: 546'
DATE STARTED: 6-28-11
DATE FINISHED: 6-28-11
GW DEPTH: 7.1' at 9:30am
TOTAL DEPTH: 8.1'

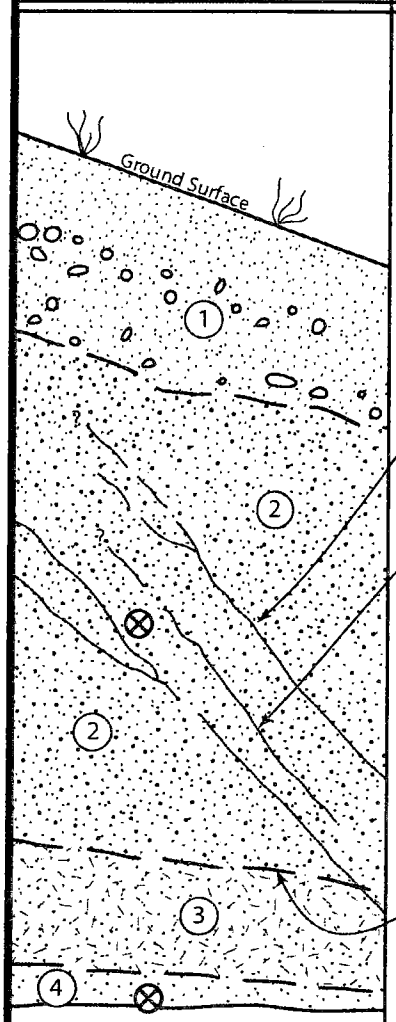
LARGE DIAMETER BORING GRAPHIC LOG View Looking 177°	DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
	0			~2" Asphalt pavement; no baserock	
①	2		ML	① SANDY SILT (ML): Very dark brown (10YR 3/2, moist); stiff; moist; common rootlets; internally massive	PP at 2.4 feet: 2.3, 2.75, 2.4, 2.6, 2.5 tsf
②	4				
	6		GC	② CLAYEY GRAVEL w/SAND (GC): Mottled very dark grayish brown (10YR 3/2); wet to moist; medium dense; matrix-supported tabular clasts and subequant subrounded clasts to 2"; rare 5" clast (one)	
③	8			③ CLAYEY GRAVEL w/SAND: as above in "2" except clast-to-clast contact; tabular clasts typically 3/4" x 2-4"; rapid seepage inflow below approximately 7.1'	
	10			Bottom of Hole 8.1 Feet	
	12				
	14				
	16				

PACIFIC GEOTECHNICAL ENGINEERING

BORING NO.: LD-2
PAGE 1 OF 1

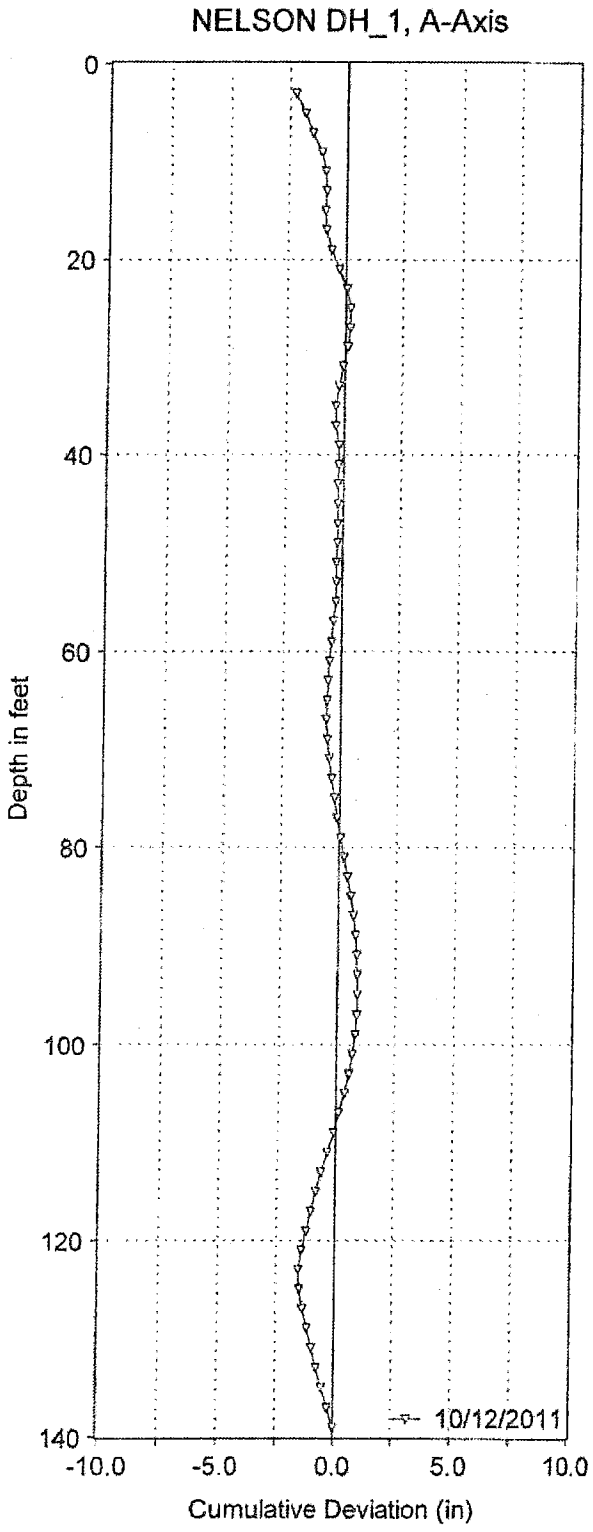
JOB NO.: 2011.0068
SITE LOCATION: Nelson Road, Santa Cruz County
DRILLING METHOD: 30" solid stem auger
CONTRACTOR: CE
LOGGED BY: GRF, BT

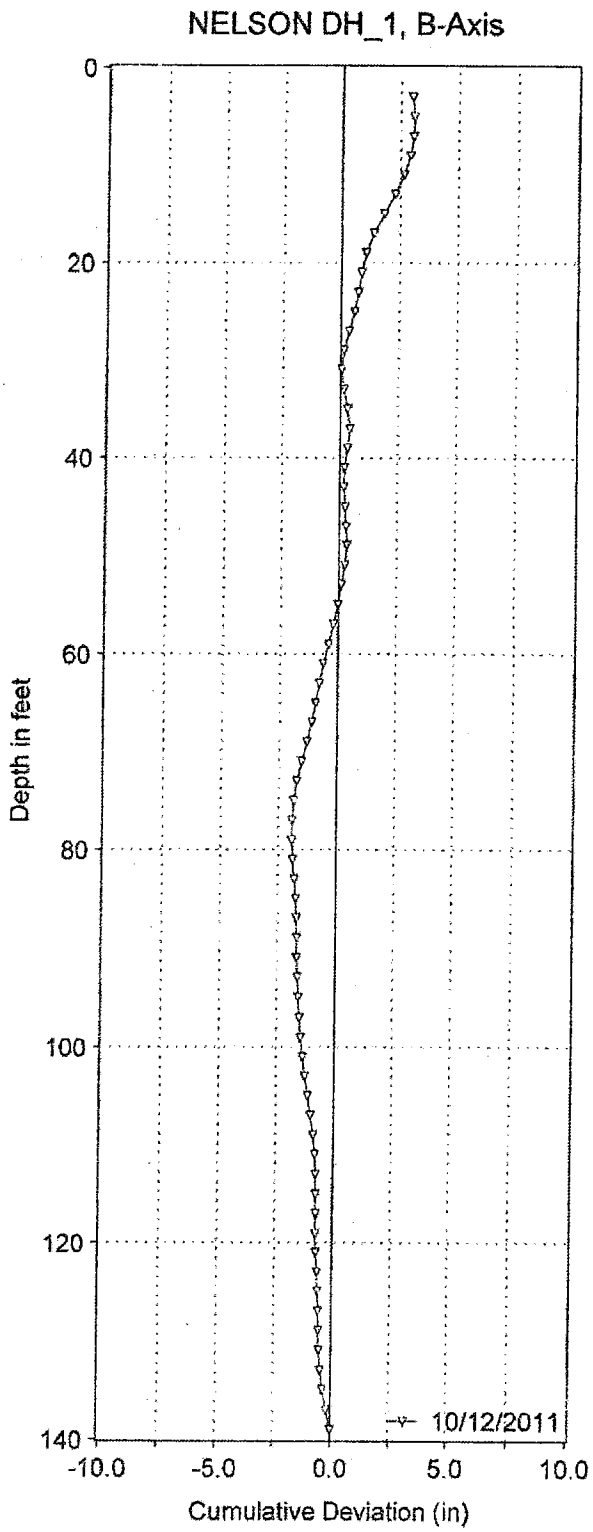
SURFACE ELEVATION: 699'
DATE STARTED: 6/28/11
DATE FINISHED: 6/28/11
GW DEPTH: N/A
TOTAL DEPTH: 8.7'



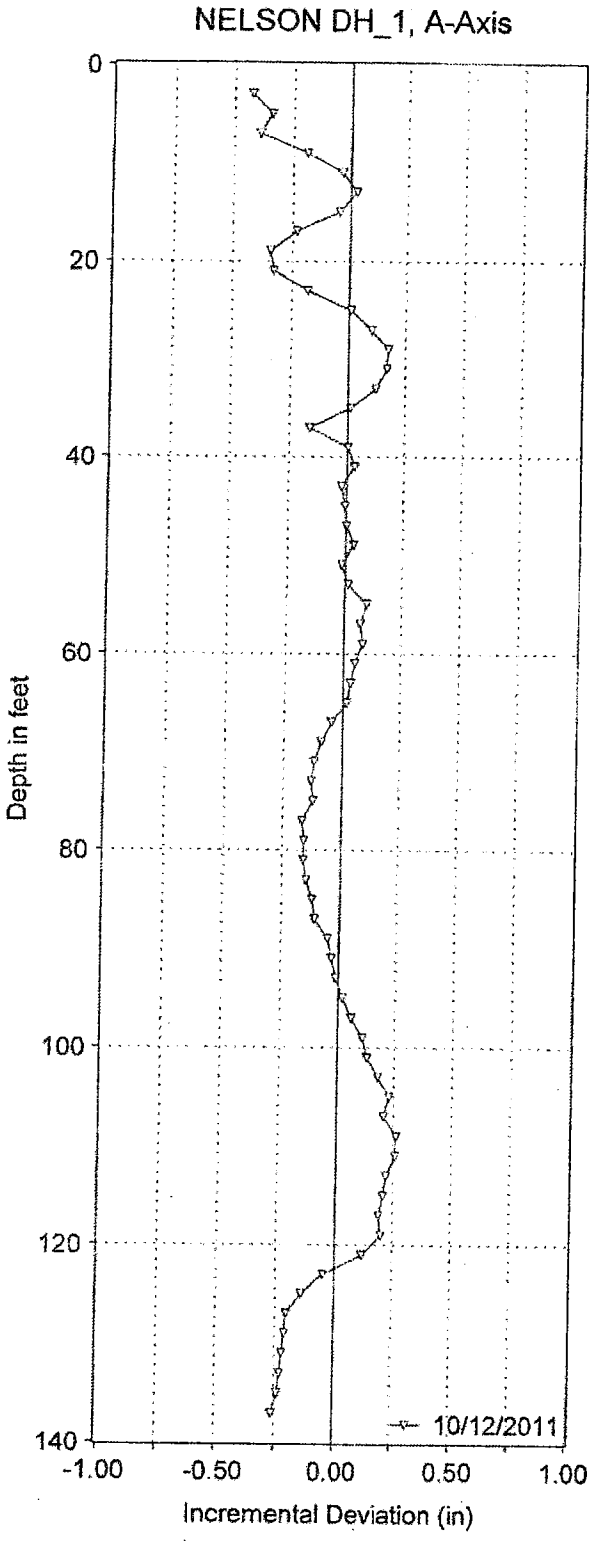
LARGE DIAMETER BORING GRAPHIC LOG
View Looking 166°

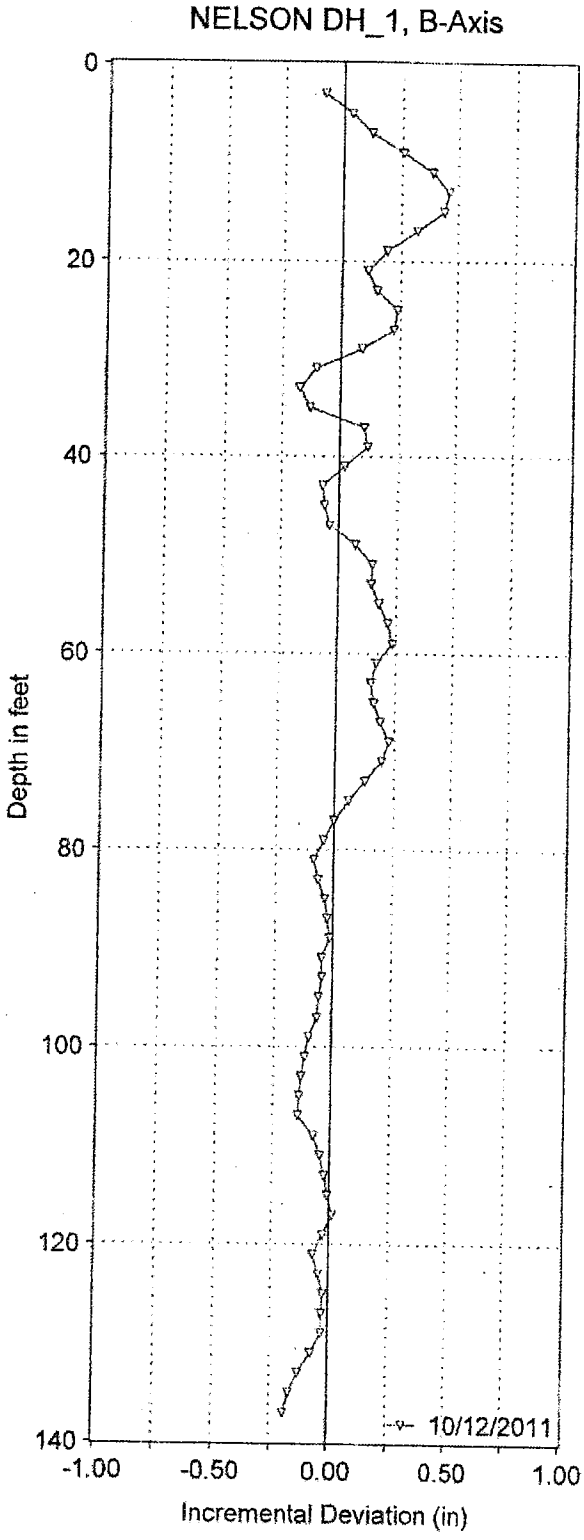
DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0			(1) CLAYEY SAND (SC): Very dark brown (10YR 4/4, moist); stiff; moist; extensive roots; colluvium	
2			Fracture - 162/64 SW; 7/8" Fe_2O_3 halo with internal Liesegang banding parallel to fracture; fracture actually a set of anastomosing planar fractures each with <1/16" dark brown clay film; above ~4' below ground surface fractures are discontinuous open voids around small blocks (~1") of rock; roots common	
			Fracture - 164/55 SW; 1/16"-1/8" Fe_2O_3 seam; tight; undulating; no roots	
4			Fracture - dip 64° SW strike 251°; 1" Fe_2O_3 halo with Liesegang banding mostly parallel to fracture; fracture is infilled with 1/8"-thick dark brown clay seam; abundant roots; above 5.2 feet below ground surface there are voids, and rock fabric adjacent to fracture is disaggregated	Sample at 4.6' taken from fracture zone
			(2) SILTY SANDSTONE: Mottled light olive brown (5Y 5/4, dry to moist); massive, thickly bedded (~2.5' minimum locally); fracture spacing 0.5"-8", fractures irregular, locally continuous; pervasive Fe_2O_3 Liesegang banding; quartzofeldspathic micaceous; contains highly cemented hard nodules up to 6"	
6			Diffuse bedding: 143/7 SW	
			(3) SANDY CLAYSTONE: Yellowish brown (10YR 5/4, dry); massive; fracture spacing 2-6", fractures apparently tight except clay infill as labelled; moderately hard; moderately weathered	
8			(4) SANDSTONE: Dark grayish brown (10YR 4/2); bedding undetermined; fracture unclear, appears ~1"; very hard; moderately weathered along tight fractures; fine-grained sand; silicious cement; refusal to auger	Sample at 8.6'
10			Bottom of Hole 8.7 Feet	
12				
14				





PACIFIC GEOTECHNICAL ENGINEERING





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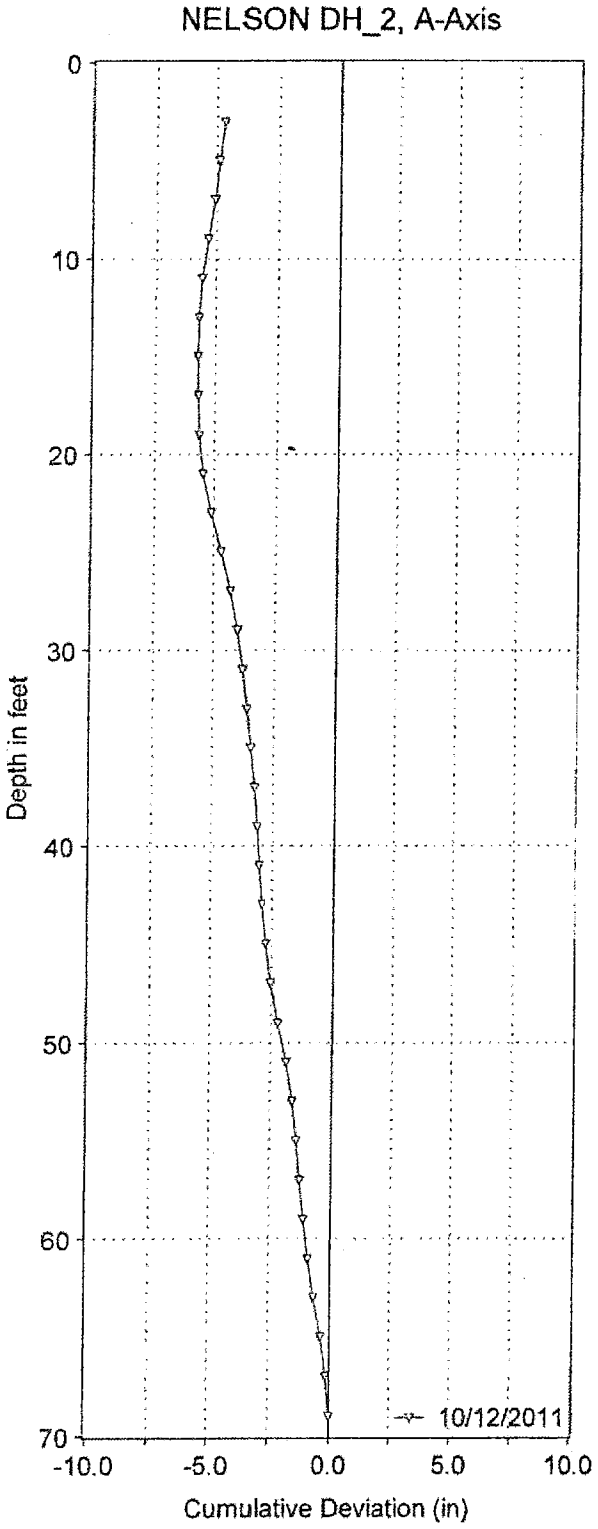

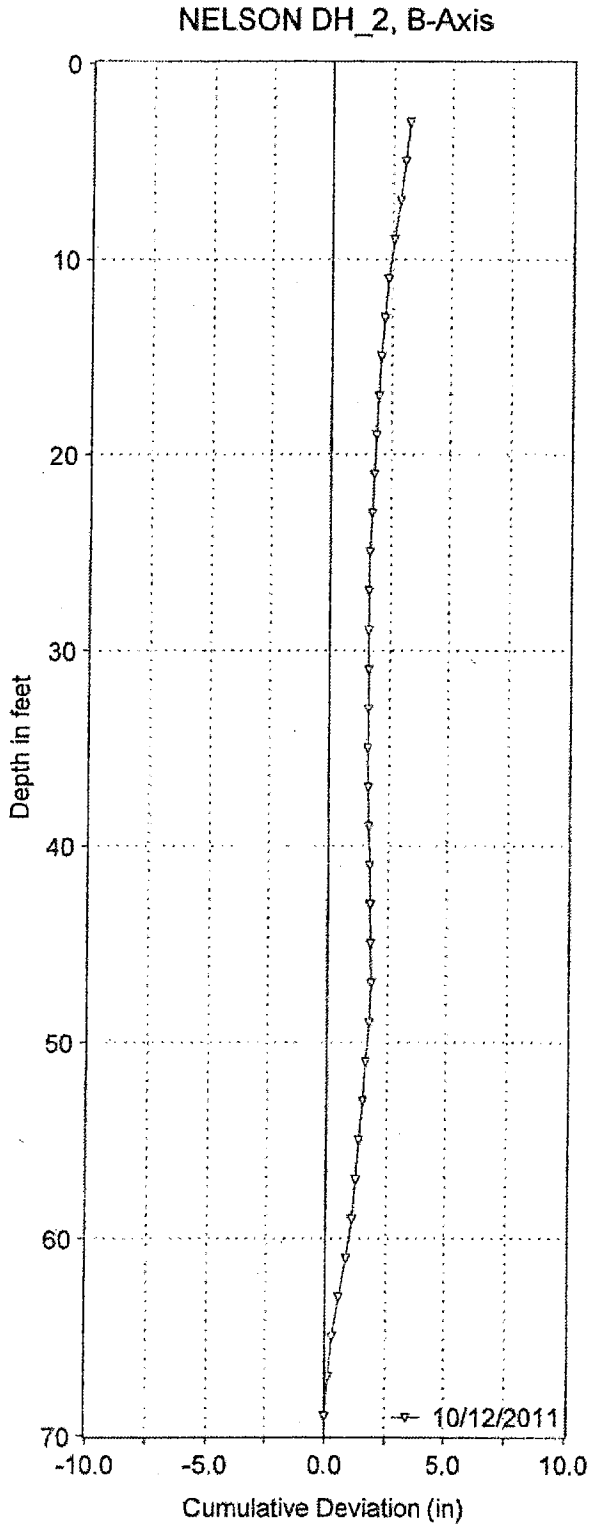

PACIFIC
GEOTECHNICAL
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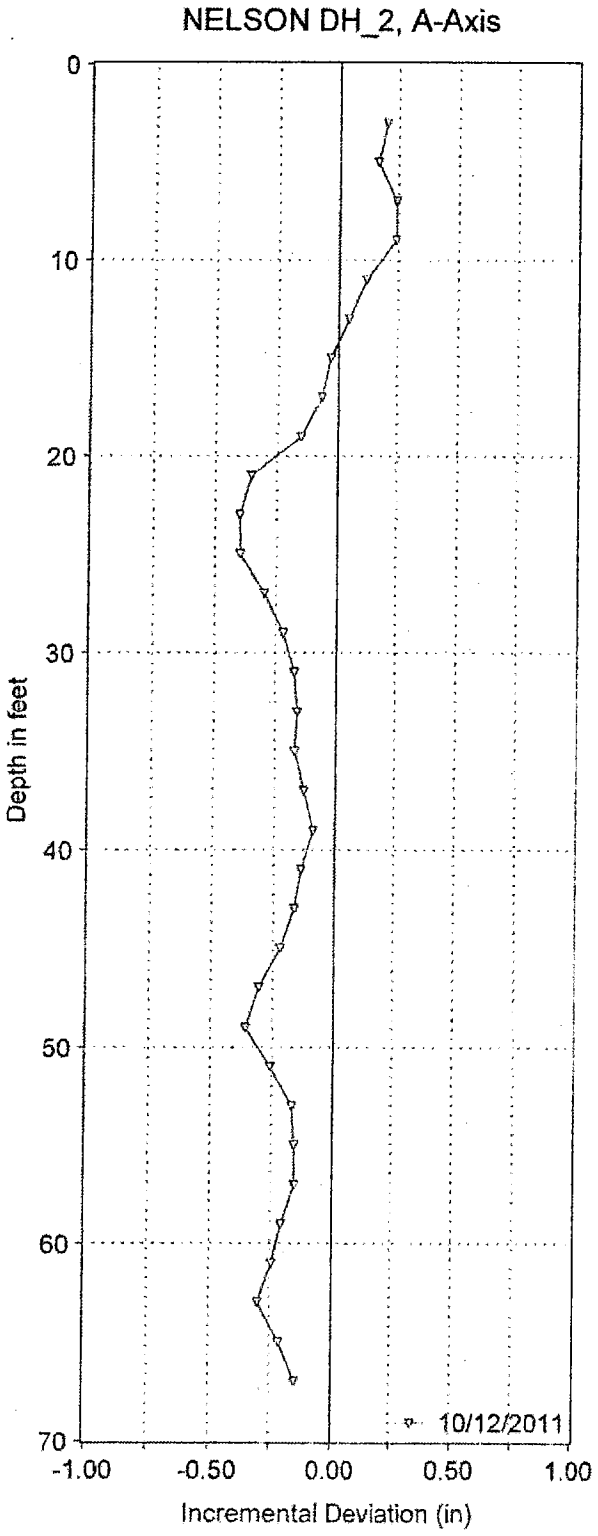

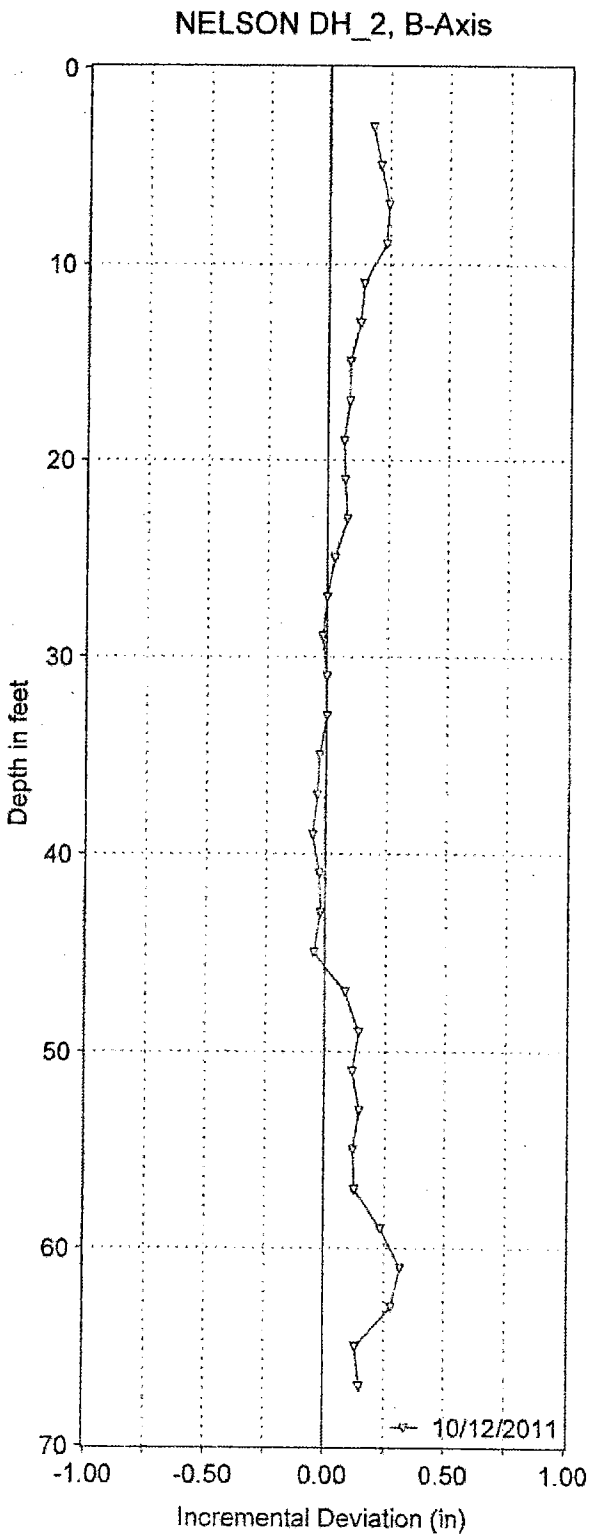

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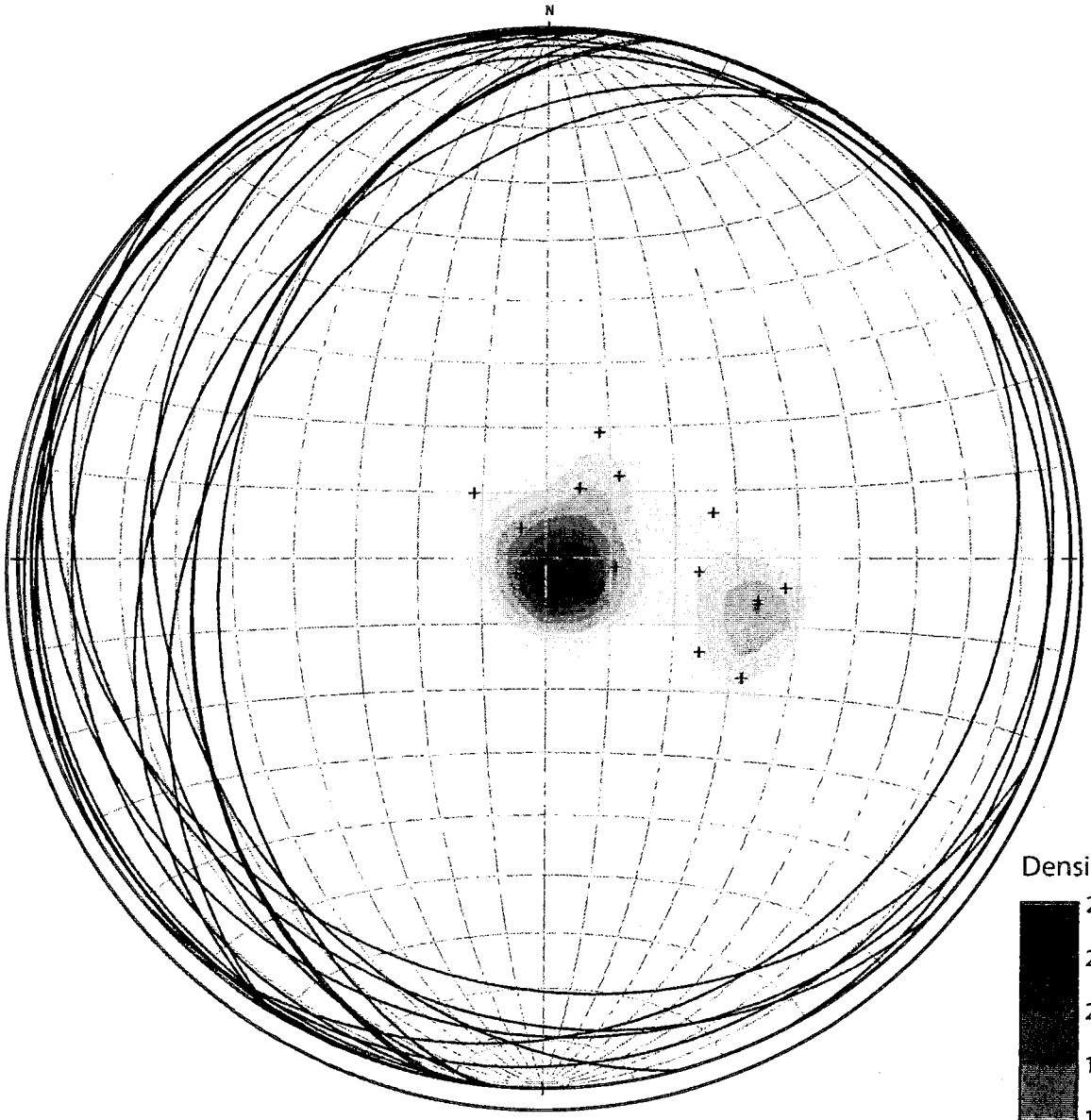


Density
28.66
25.48
22.29
19.11
15.92
12.74
9.55
6.37
3.18
0.00

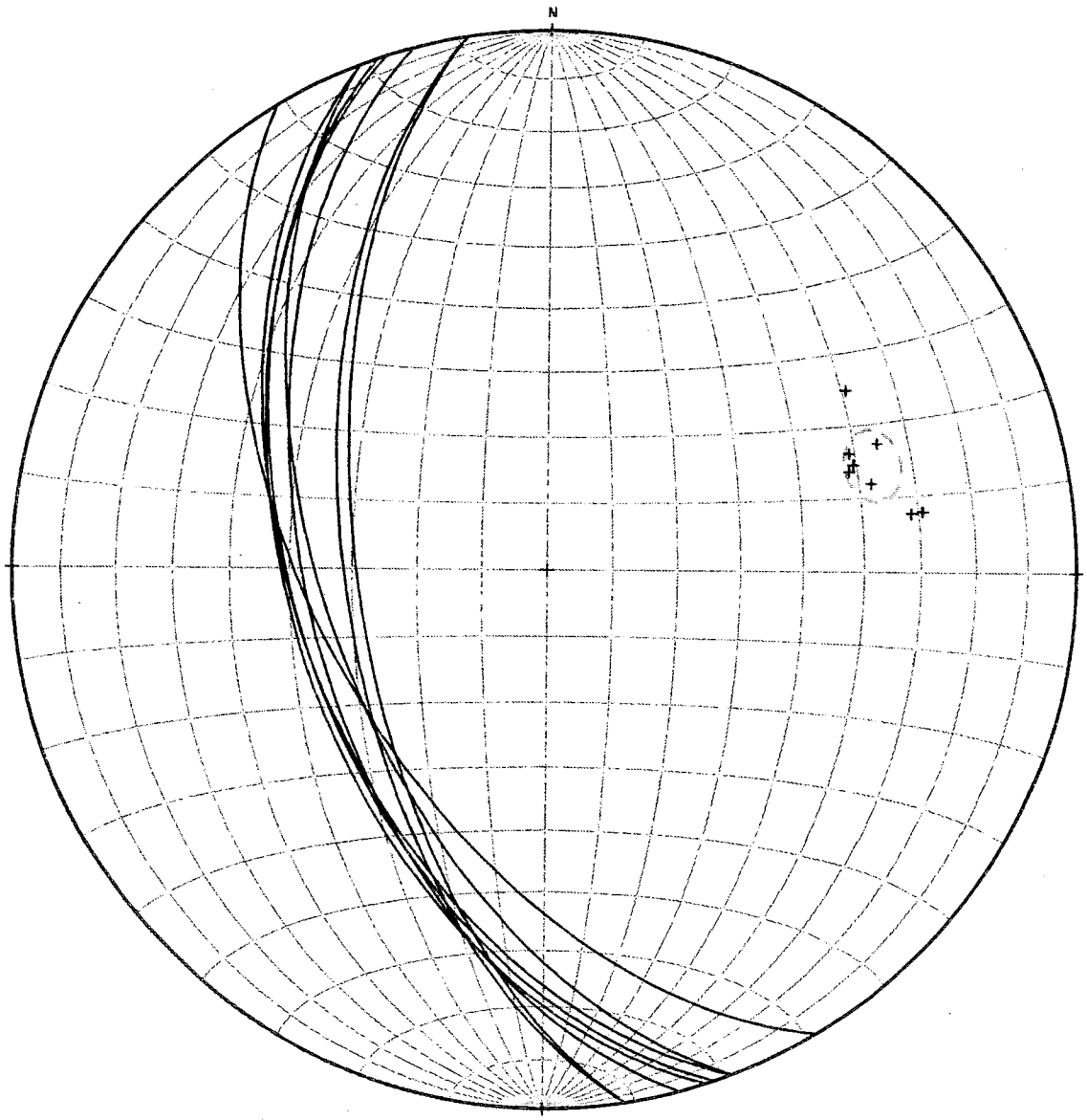
Equal-area
Lower hemisphere

—— Great circles
+ Poles to planes

Maximum density: 28.7%
at 120.0/84.6 (pole)
300.0/5.4 (plane)

PACIFIC GEOTECHNICAL ENGINEERING

DATE	STEREO PLOT BEDDING ATTITUDES w/CONTOURS Nelson Road Landslide Santa Cruz County, California	FIGURE
APPROVED		PROJECT 2011.0068



Equal-area
Lower hemisphere

—— Great circles
\+ Poles to planes
- - - 95% Confidence cone

PACIFIC GEOTECHNICAL ENGINEERING	DATE	**STEREO PLOT JOINT-CONTROLLED SCARP SEGMENT ATTITUDES**	FIGURE
	APPROVED	**Nelson Road Landslide** **Santa Cruz County, California**	PROJECT 2011.0068

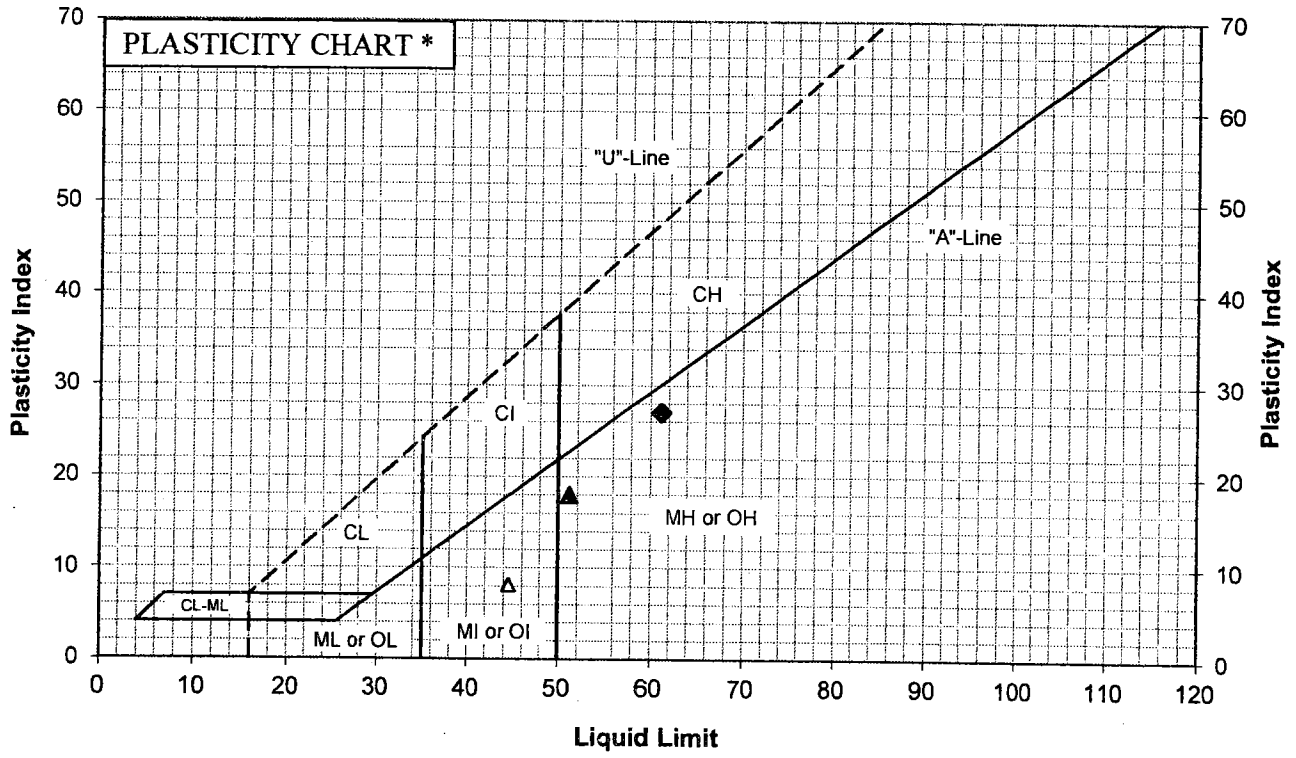
SUMMARY OF
LABORATORY TEST RESULTS
NELSON LANDSLIDE

DRILL HOLE #	DEPTH (FT.)	DESCRIPTION*	DRY DENSITY (PCF)	WATER CONTENT (%)	% PASSING #200 SIEVE	PLASTICITY INDEX (%)	LIQUID LIMIT (%)	CLAY FRACTION (% ASTM)	FULLY SOFTENED FRICTION ANGLE (DEGREES)	RESIDUAL FRICTION ANGLE (DEGREES)
LD-1	17.5	Silty Sand	84	28	47	27	61	5	--	--
LD-1	25	Silty Sand	86	28	42	18	51	5	26	20
LD-1	33	Silty Sand	--	25	29	NP	NP	3	--	--
LD-1	57.5	Silty Sand	61	39	26	--	--	2	--	--
LD-1	135	Silty Sand	82	21	37	8	45	5	28	23

*Note – all samples are landslide bedrock materials that were soaked in water for 2 days and then broken down with a mechanical stirring device for one minute prior to washing and sieveing.

ATTERBERG LIMITS TEST RESULTS

PROJECT NAME	Nelson			PROJECT No.	2011.0068
DATE OF TEST	8/26/2011	8/26/2011	8/26/2011		8/26/2011
KEY SYMBOL	♦	▲	●		Δ
DRILL HOLE No.	LD1	LD1	LD1		LD1
DEPTH (ft)	17.5	25	33		135
NATURAL WATER CONTENT (%)	28	28	25		21
% Retained No. 40 SIEVE (Est.)	32	31	61		36
% PASSING No. 200 SIEVE	47	42	29		37
LIQUID LIMIT	61	51	NP		45
PLASTIC LIMIT	34	33	NP		36
PLASTICITY INDEX	27	18	NP		8
CLASSIFICATION SYMBOL	MH	MH	--		MI



* Based on the Unified Soil Classification System modified to incorporate the "intermediate" classifications CI, MI, and OI for soils with liquid limits between 35 and 50. In the unmodified Unified Soil Classification System, such soils would be classified as CL, ML and OL, respectively.

PACIFIC GEOTECHNICAL ENGINEERING

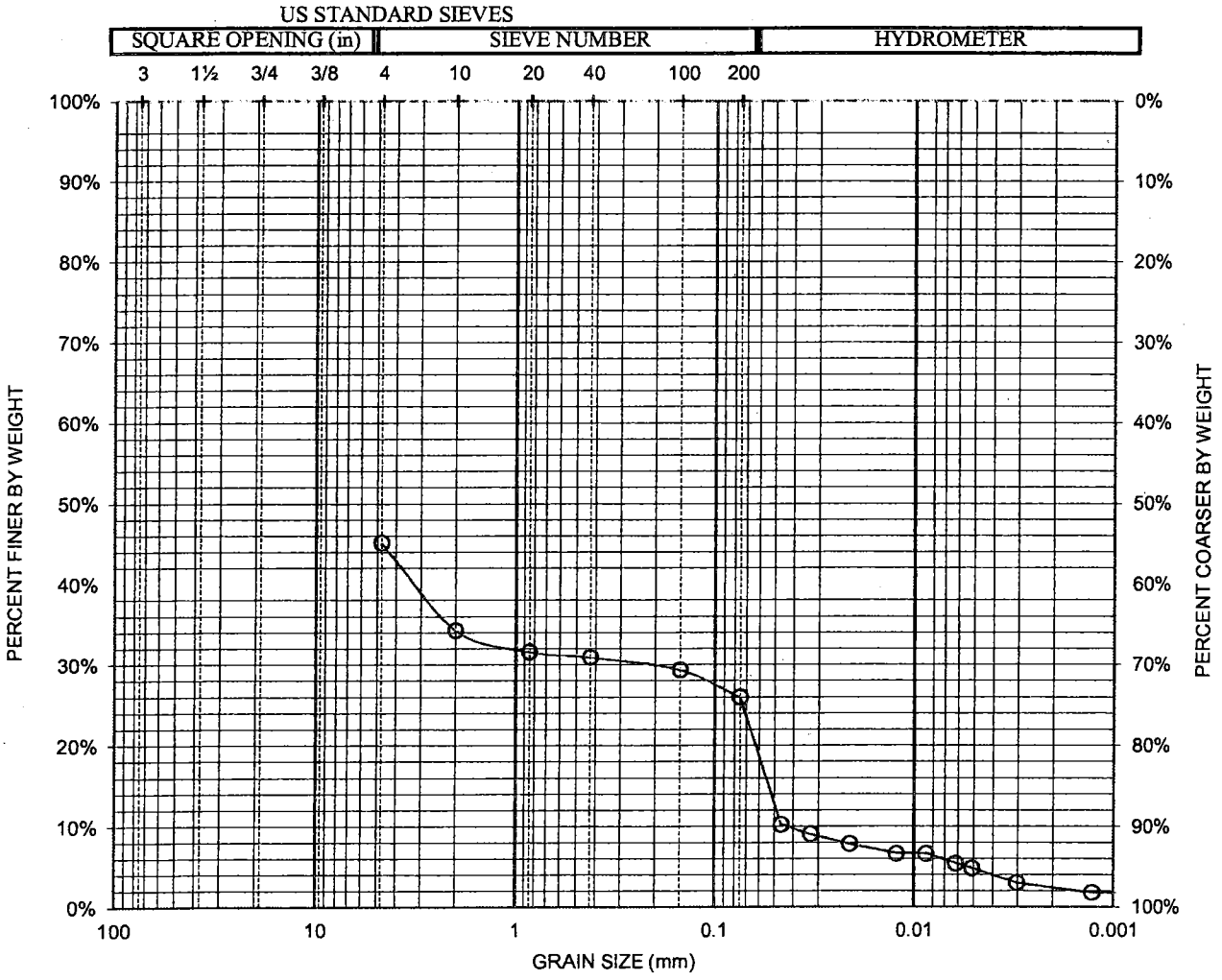
Rev030106

GRAIN SIZE TEST RESULTS

PROJECT NAME	Nelson			**PROJECT No.**	2011.0068
DRILL HOLE No.	LD-1	**DEPTH (ft)** 57.5	**SAMPLE** 0	**DATE OF TEST**	8/26/2011

SOURCE/QUARRY: --

DESCRIPTION OF SOIL: SILTY SAND: Light olive brown (5Y 6/2), dry to moist, hard



	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES	GRAVEL		SAND			SILT	CLAY
	54.8%		19.2%			23.6%	2.4%

REMARKS: Sample soaked in water for two days and then mixed in a mechanical stirring device for one minute prior to washing and sieving.

PACIFIC GEOTECHNICAL ENGINEERING | **Figure**

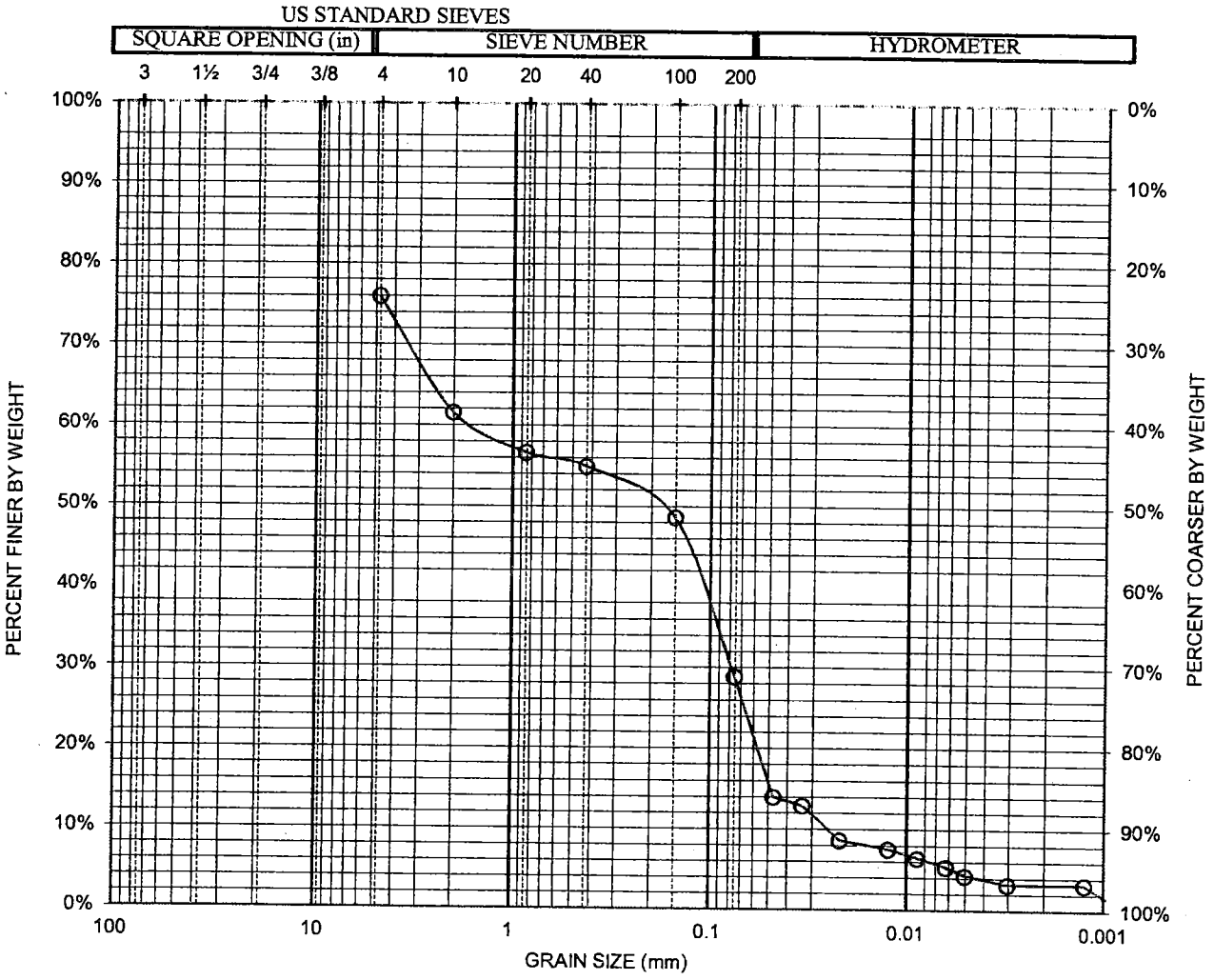
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Nelson					**PROJECT No.**	2011.0068
DRILL HOLE No.	LD-1	**DEPTH (ft)**	33.0'	**SAMPLE**	0	**DATE OF TEST**	8/26/2011

SOURCE/QUARRY: --

DESCRIPTION OF SOIL: SILTY SAND: Dark olive gray (5Y 3/2) to light olive brown (2.5Y 5/4), dry to moist



	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES	GRAVEL		SAND			SILT	CLAY
	24.1%		47.0%			25.6%	3.2%

REMARKS: Sample soaked in water for two days and then mixed in a mechanical stirring device for one minute prior to washing and sieving.

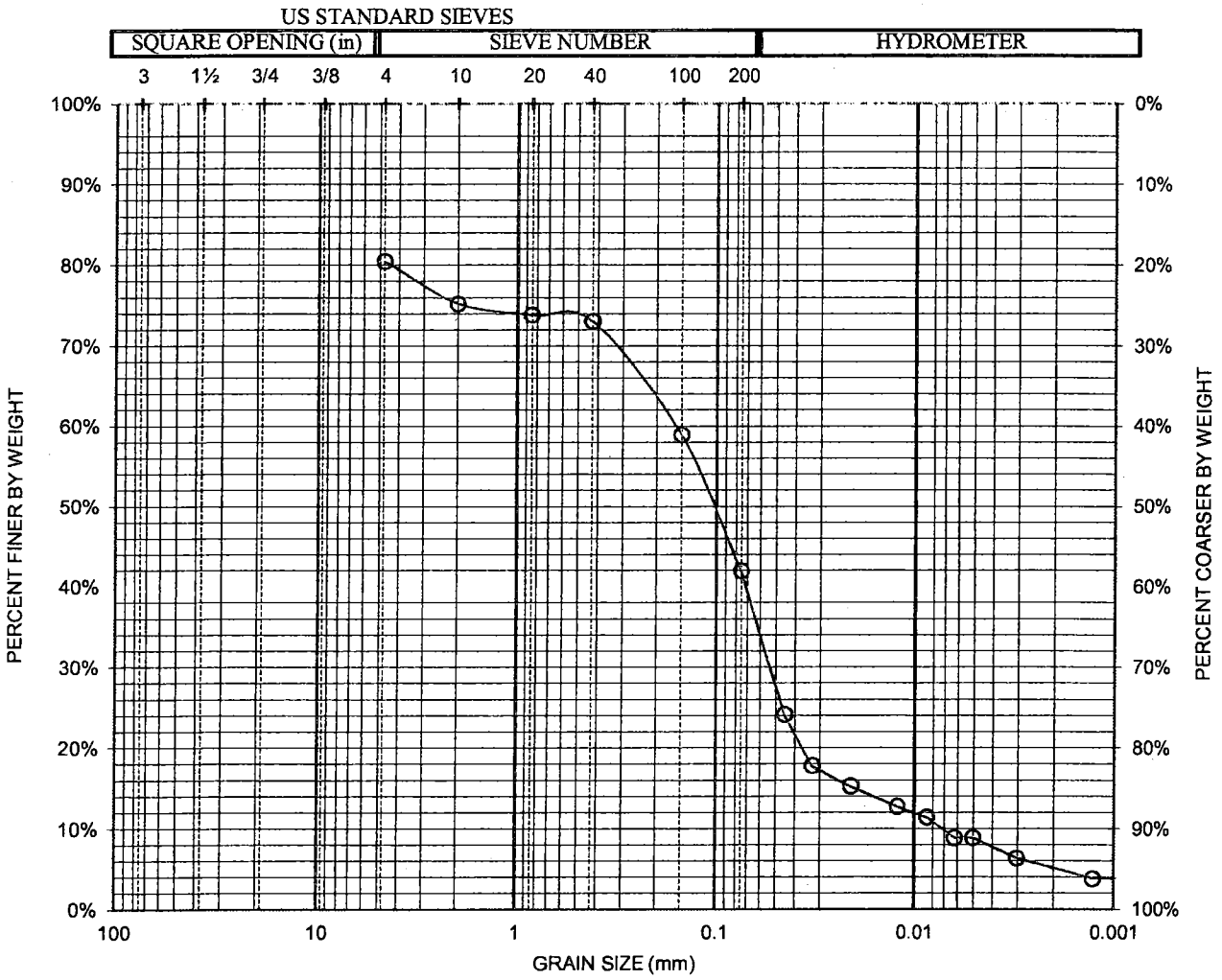
PACIFIC GEOTECHNICAL ENGINEERING

RevOct20070

Figure

GRAIN SIZE TEST RESULTS

PROJECT NAME	Nelson					**PROJECT No.**	2011.0068
DRILL HOLE No.	LD-1	**DEPTH (ft)**	25.0'	**SAMPLE**	0	**DATE OF TEST**	8/26/2011
SOURCE/QUARRY: --							
DESCRIPTION OF SOIL: SILTY SAND: Dark olive gray (5Y 3/2), moist, hard							



	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES	GRAVEL		SAND			SILT	CLAY
	19.6%		38.5%			36.9%	5.1%

REMARKS: Sample soaked in water for two days and then mixed in a mechanical stirring device for one minute prior to washing and sieving.

PACIFIC GEOTECHNICAL ENGINEERING

Figure

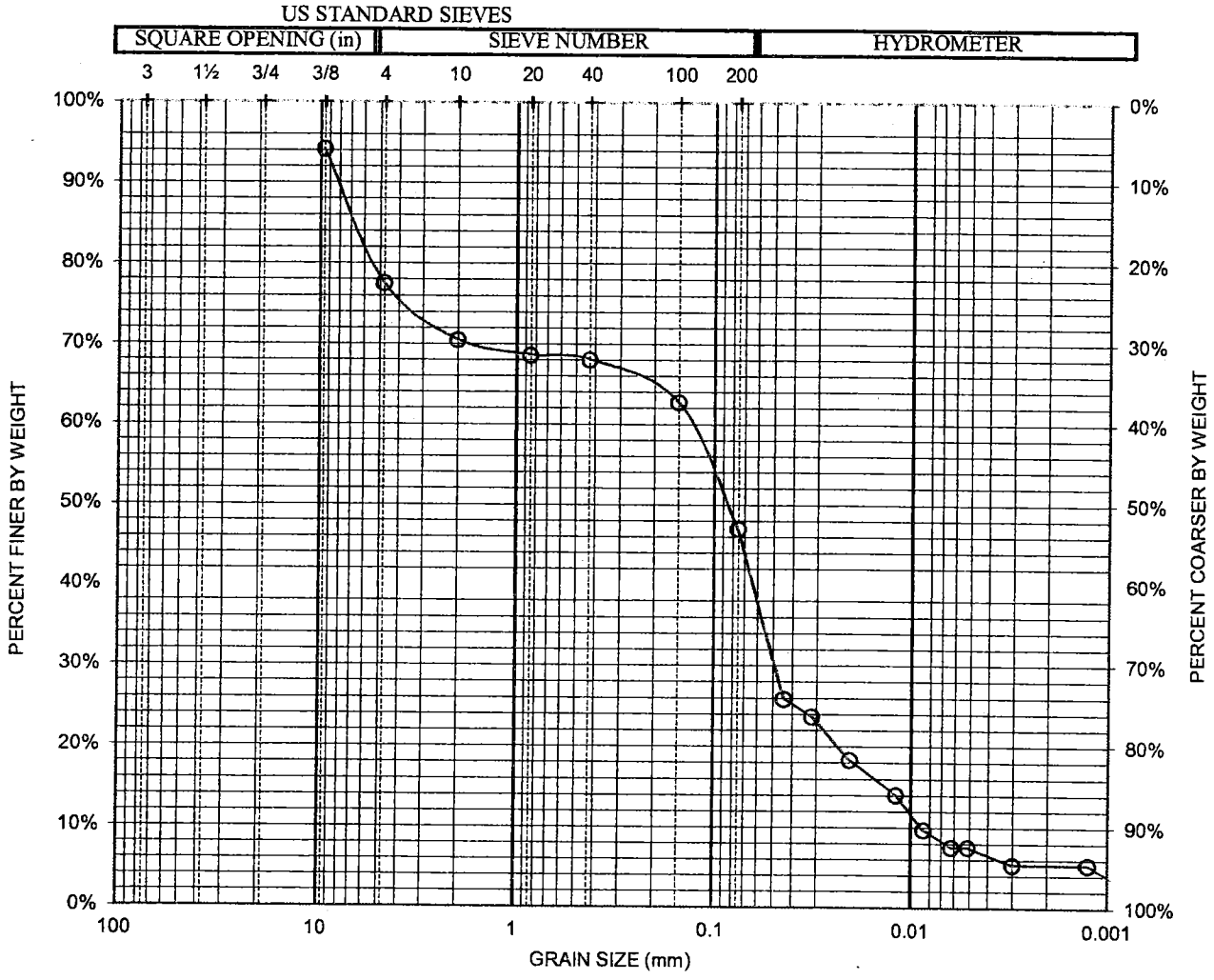
RevOct20070

GRAIN SIZE TEST RESULTS

PROJECT NAME	Nelson			**PROJECT No.**	2011.0068
DRILL HOLE No.	LD-1	**DEPTH (ft)** 17.5	**SAMPLE** 0	**DATE OF TEST**	8/26/2011

SOURCE/QUARRY: --

DESCRIPTION OF SOIL: SILTY SAND: Light olive brown (2.5Y 7/4), dry, dense



	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES	GRAVEL		SAND			SILT	CLAY
	22.5%		30.5%			41.6%	5.4%

REMARKS: Sample soaked in water for two days and then mixed in a mechanical stirring device for one minute prior to washing and sieving.

PACIFIC GEOTECHNICAL ENGINEERING

RevOct20070

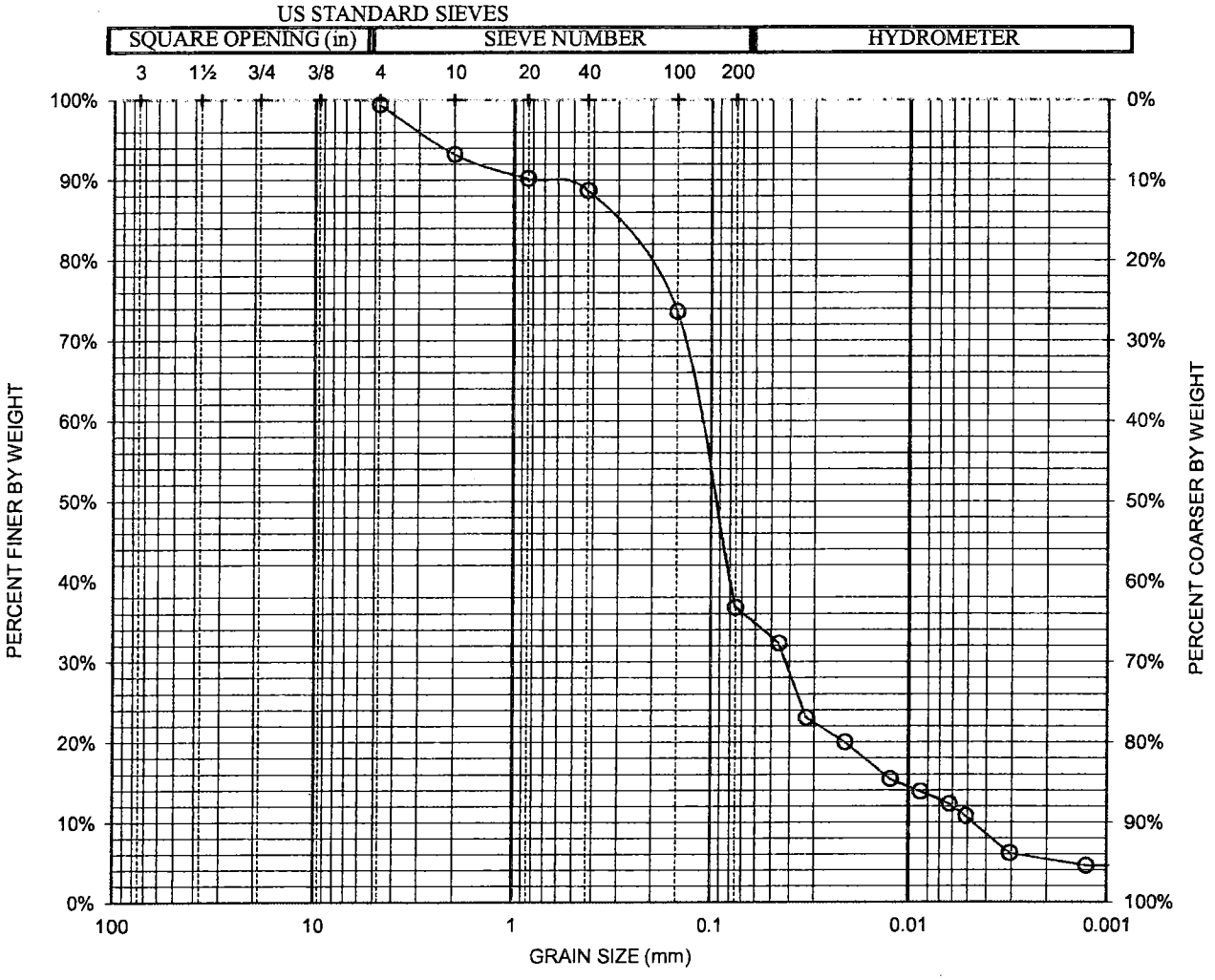
Figure

GRAIN SIZE TEST RESULTS

PROJECT NAME Nelson				**PROJECT No.**	2011.0068
DRILL HOLE No. LD-1	**DEPTH (ft)** 135.0'	**SAMPLE** 0		**DATE OF TEST**	8/26/2011

SOURCE/QUARRY: --

DESCRIPTION OF SOIL: SILTY SAND: Olive gray (5Y 4/2), dry to moist, dense



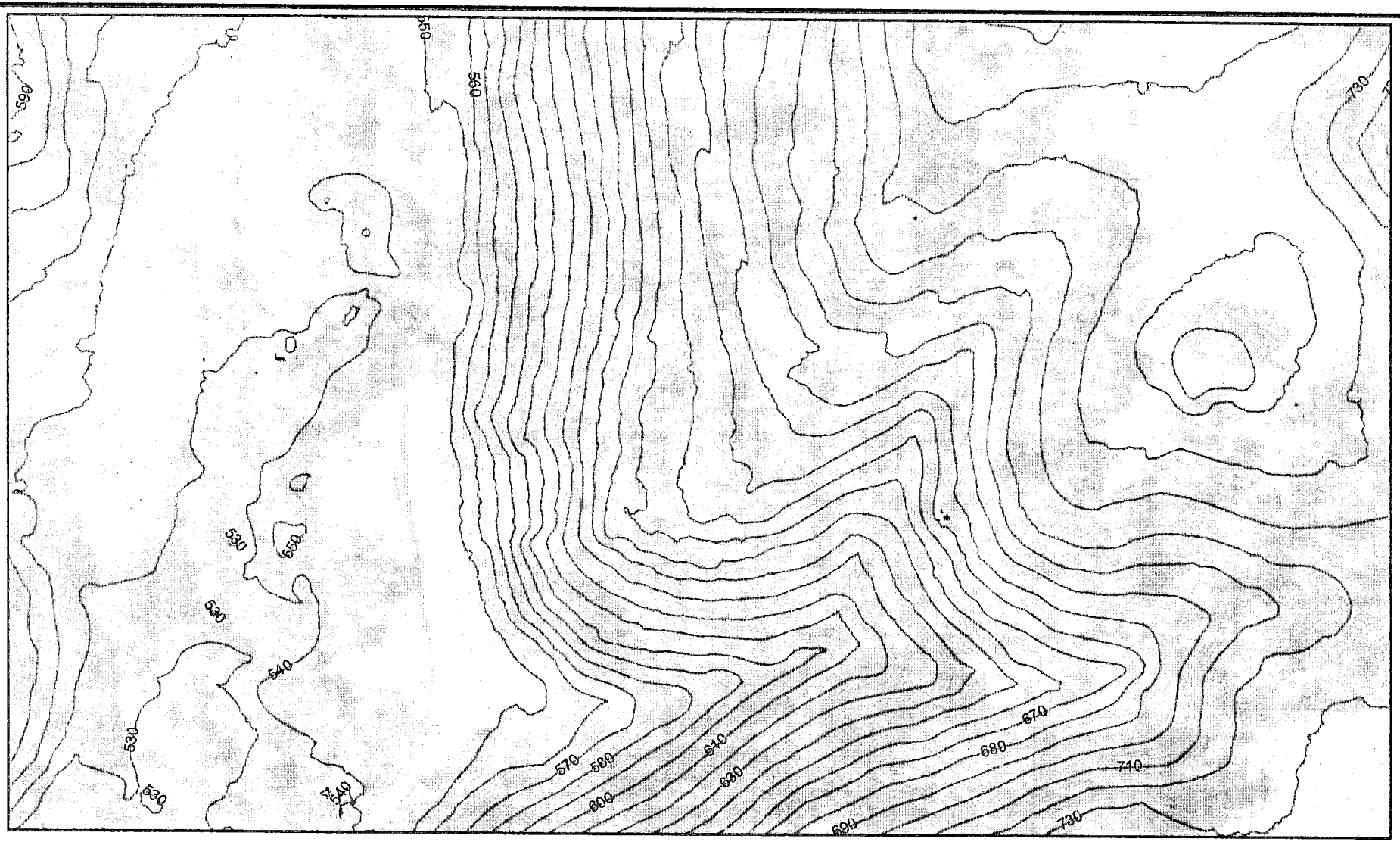
	COARSE	FINE	COARSE	MEDIUM	FINE		
COBBLES	GRAVEL		SAND			SILT	CLAY
	0.6%		62.6%			31.4%	5.4%

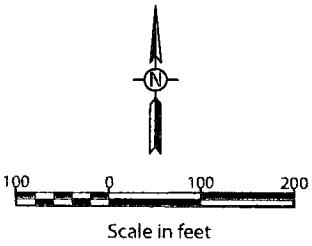
REMARKS: Sample soaked in water for two days and then mixed in a mechanical stirring device for one minute prior to washing and sieving.

PACIFIC GEOTECHNICAL ENGINEERING | **Figure**

RevOct20070

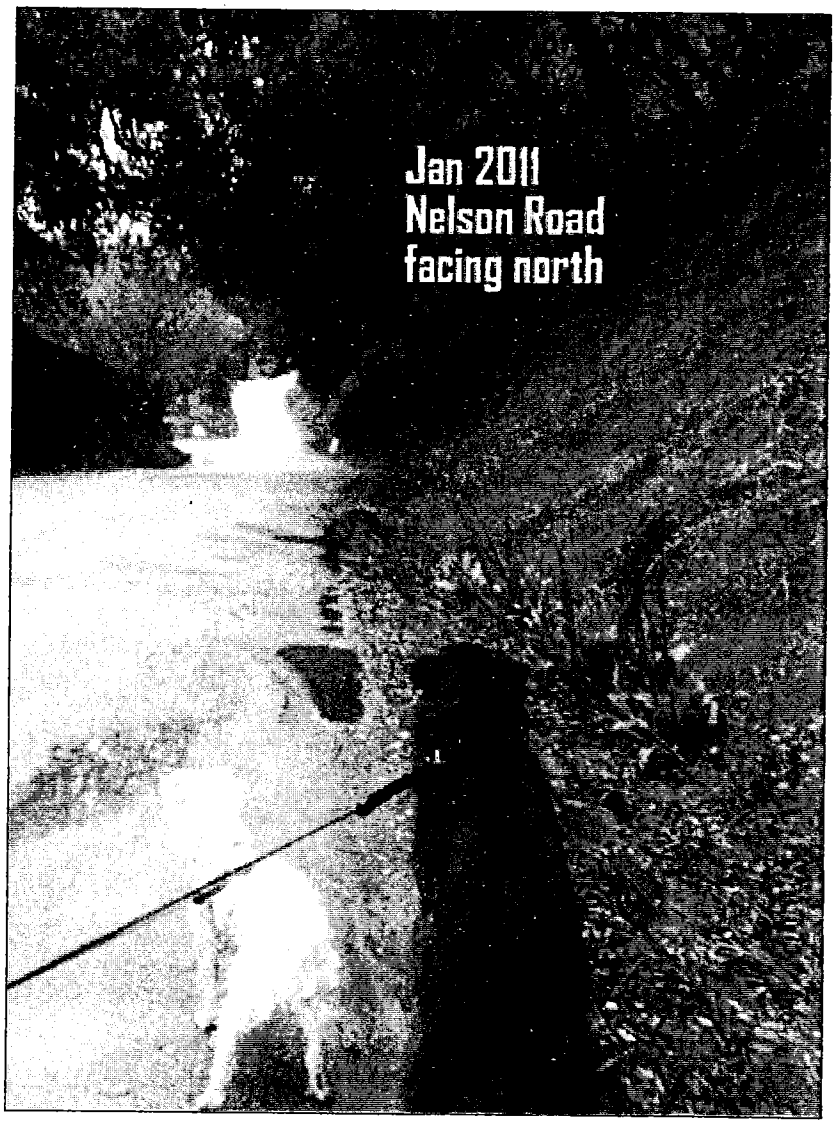
APPENDIX B





PACIFIC GEOTECHNICAL ENGINEERING

DATE	2010 LIDAR AND 2009 AERIAL PHOTO COMPOSITE	FIGURE
Sept. 2011		See Report
SCALE	Nelson Road Landslide Santa Cruz County, California	PROJECT
As Shown		2011.0068



Nelson Road in January 2011. View is to the north from a vantage point now buried by the 2011 landslide. The intersection and access to Eclectica is visible in the distance. Note bare slope to right, bordered by truncated root mat in forested area; bare slope is interpreted to have experienced previous landsliding. Photo annotated and provided by Daja Evans.

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NELSON ROAD LANDSLIDE

Photo 1

Project No. 2011.0068

Slope adjacent to Nelson Road in Summer 2010. Vantage point is in approximately southern one-third of 2011 landslide, near the landslide toe. The bare area is interpreted to have experience previous landsliding. The entire field of view is encompassed by the 2011 landslide. Photo annotated and provided by Daja Evans.

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NELSON ROAD LANDSLIDE

Photo 2

Project No. 2011.0068

First of three oblique aerial photographs showing approximately the northern one-third of the 2011 landslide. View is toward the east. Intersection of Nelson Road with access to Eclectica visible at left. Sky Meadow Lane visible upslope of landslide. The bare, bouldery slope extending up from approximate Nelson Road location is dominated by debris shed from bedrock blocks within the landslide. The arcuate strip of bare ground just below Sky Meadow Lane is the main headscarp of the 2011 landslide.

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NELSON ROAD LANDSLIDE

Photo 3

Project No. 2011.0068

Second of three oblique aerial photographs, approximately centered on the 2011 landslide.
View is toward the east. Llama pens visible at toe of landslide. Emergency access road visible at lower right.

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NELSON ROAD LANDSLIDE

Photo 4

Project No. 2011.0068

Third of three oblique aerial photographs, showing approximate southern one-third of the 2011 landslide. View is toward the east. Sky Meadow Lane visible at upper left. Llama pens visible at toe of landslide. Emergency access road visible at lower right.

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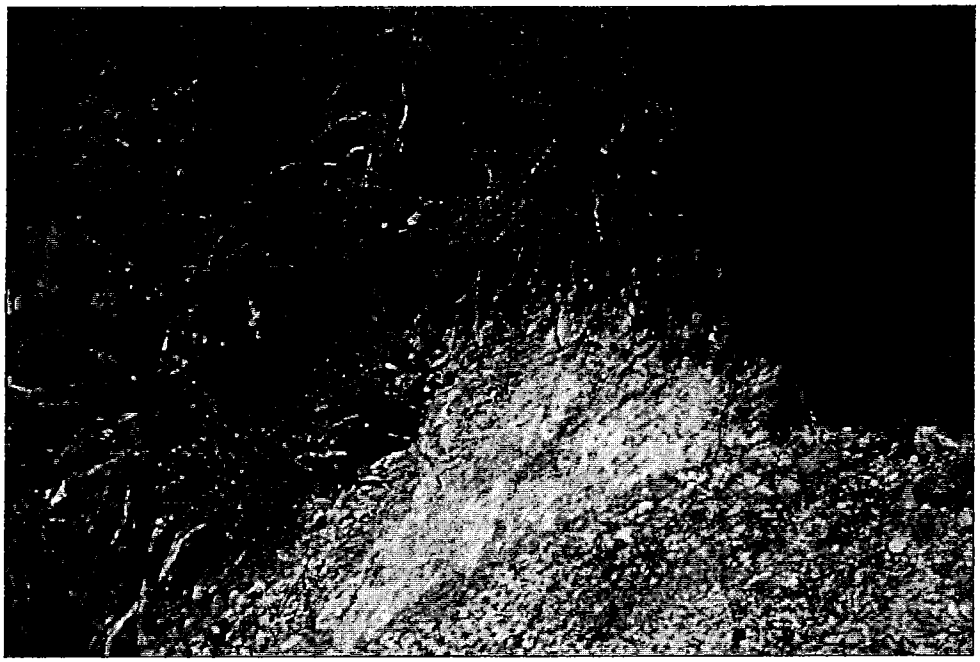
NELSON ROAD LANDSLIDE

Photo 5

Project No. 2011.0068



Portion of 2011 landslide headscarp, illustrating strong control of rock joints on landslide geometry. The reflective bare face is nearly planar, and exposes rock along the upslope side of the joint. The exposed rock has a very light brown color. The remants of material infilling the dilated joint (clay and iron oxides) tend to have a dark brown to rusty orange color.

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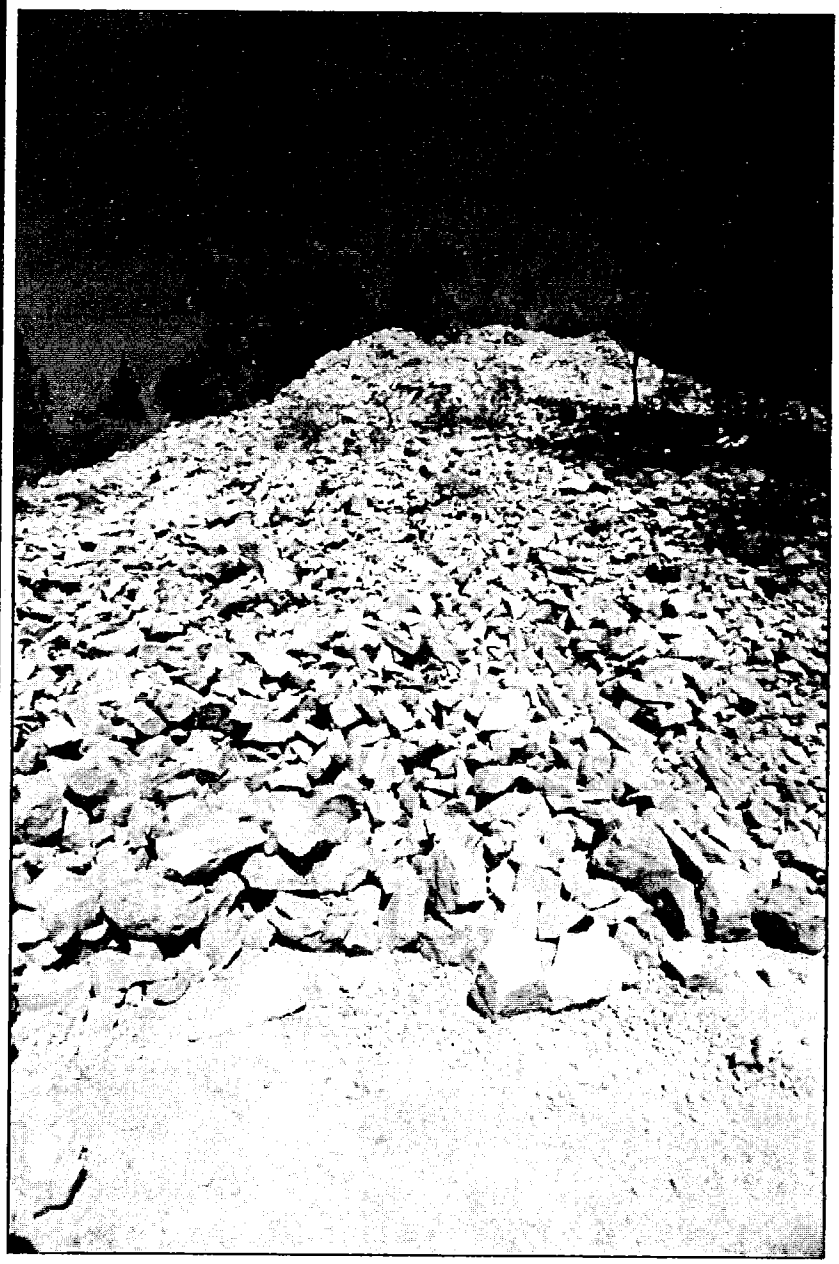
NELSON ROAD LANDSLIDE

Photo 6

Project No. 2011.0068



View of 2011 landslide debris apron, taken shortly after March rains ceased. Note relatively consistent boulder size, and lack of visible internal fracturing of boulders; this contrasts with boulder appearance after 3 months of exposure (following photos).

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NELSON ROAD LANDSLIDE

Photo 7

Project No. 2011.0068

Two views of the 2011 landslide debris apron, taken June 22, 2011, approximately 3 months after the landslide occurred. Note how boulders are tending to disaggregate into tabular plates that parallel the original bedding. Camera case for scale is 4.5 inches long.

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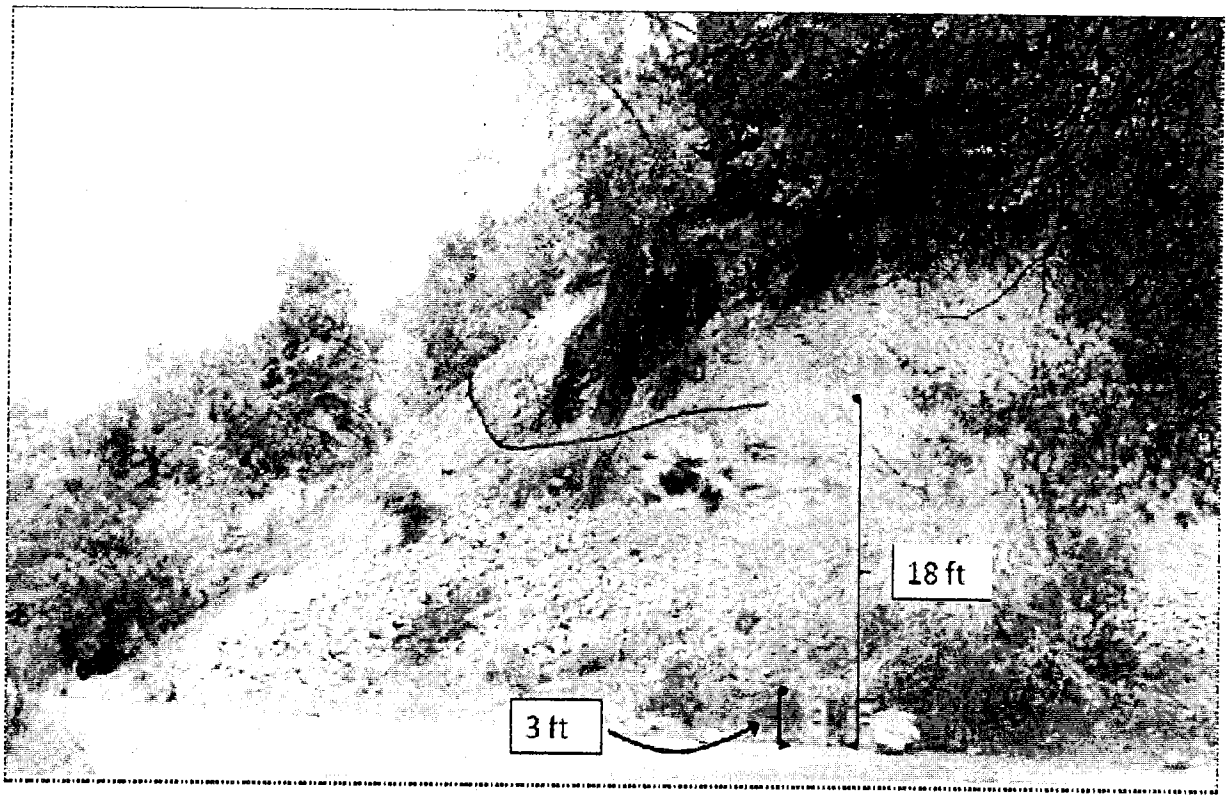
NELSON ROAD LANDSLIDE

Photo 8

Project No. 2011.0068



View of 2011 landslide toe, at intersection of Nelson Road (visible at left), and south swale (outside frame of view to right). Image is a frame from hand-held video of landslide in progress, obtained by County of Santa Cruz Public Works; image is from approximately 40 seconds into the video. Red line shows minimum elevation of toe of 2011 landslide, as evidenced by observation that all slope debris visible in video is derived from upslope of the line. Gray trash container for scale is 3.0 feet tall.

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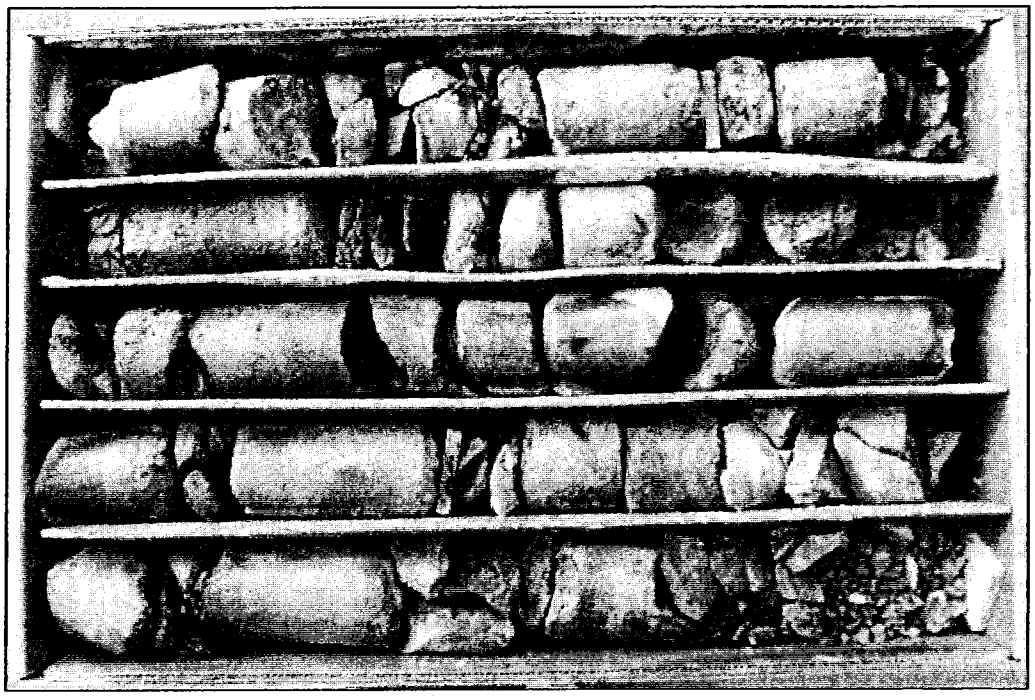
NELSON ROAD LANDSLIDE

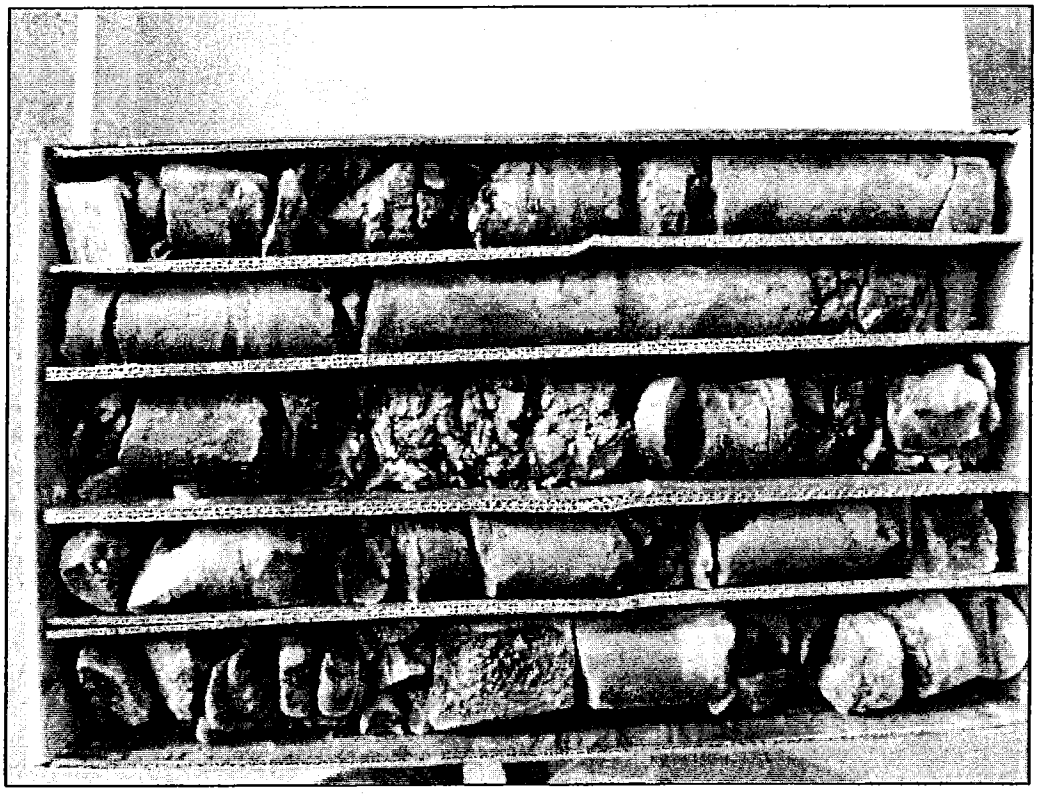
Photo 9

Project No. 2011.0068

Core from DH-1 (10.0'-21.2'). Core is arranged like lines of text, with top of interval at upper left, bottom of interval at lower right.



Core from DH-1 (21.2'-30.3')



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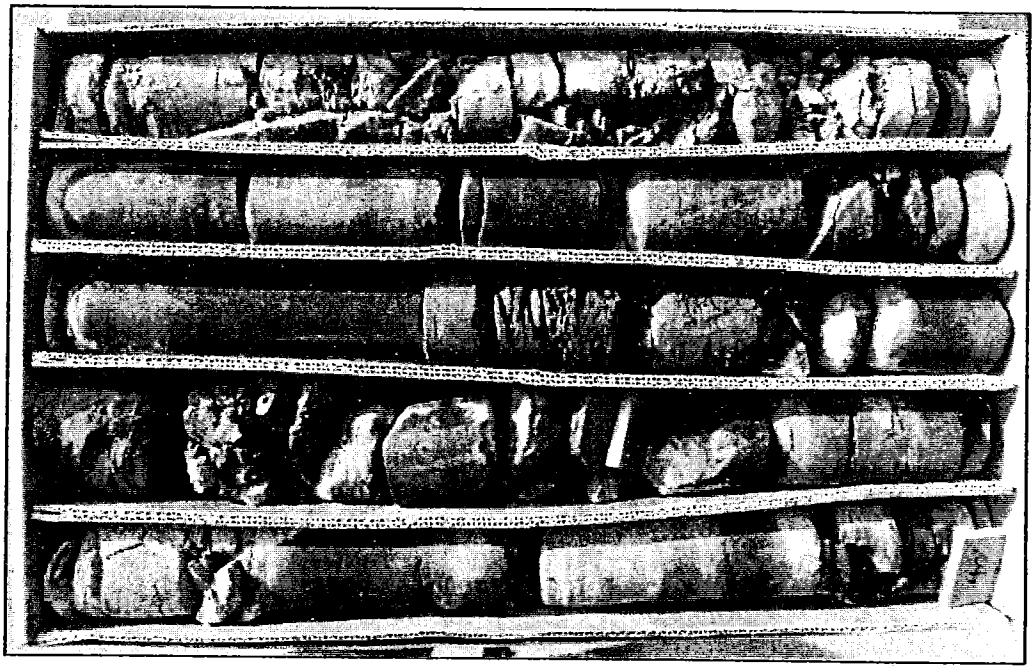
NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

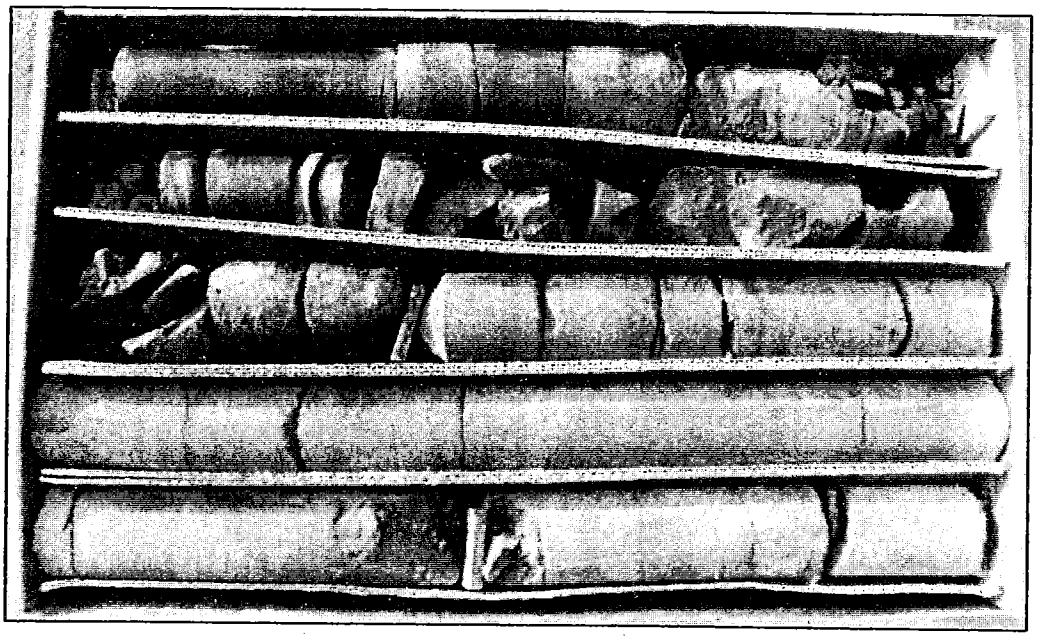
Photo 1

Project No. 2011.0068

Core from DH-1 (30.3'-40.0'). Drilling encountered a soft zone or void in the interval 34.6 to 35.5 feet, inferred to represent landslide plane.



Core from DH-1 (40.0'-54.0').



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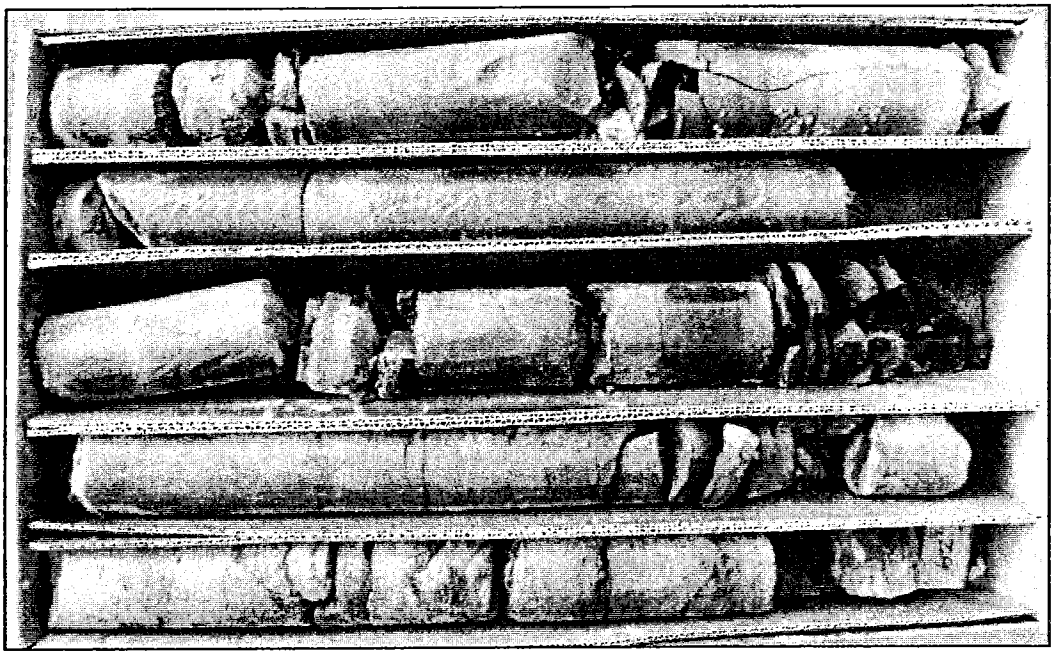
NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

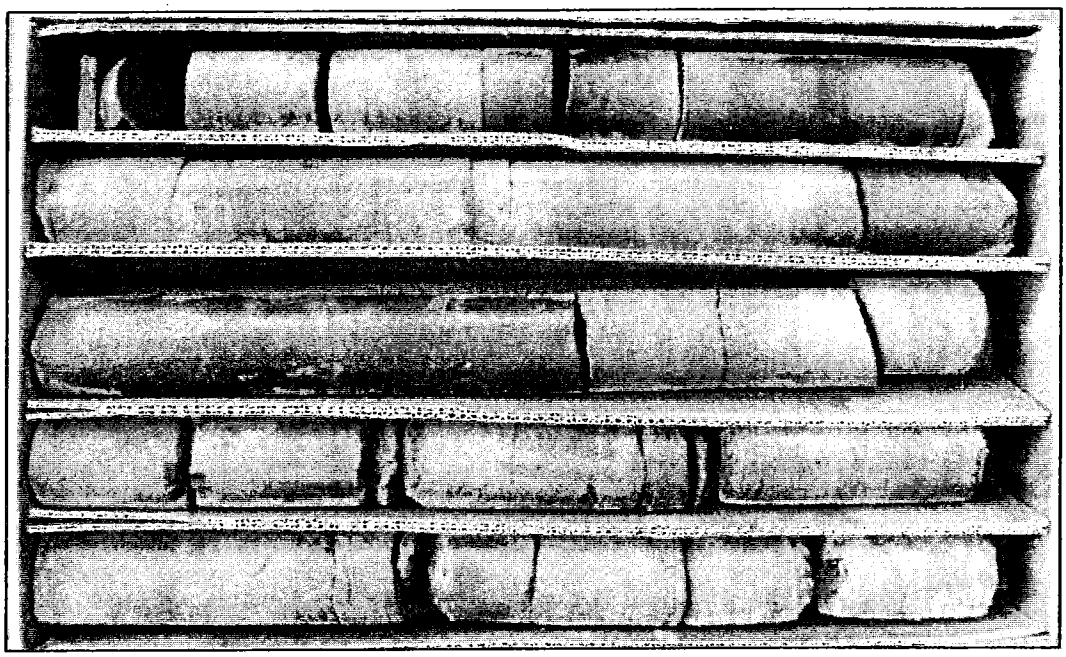
Photo 2

Project No. 2011.0068

Core from DH-1 (54.0'-62.0').



Core from DH-1 (62.0'-71.5').



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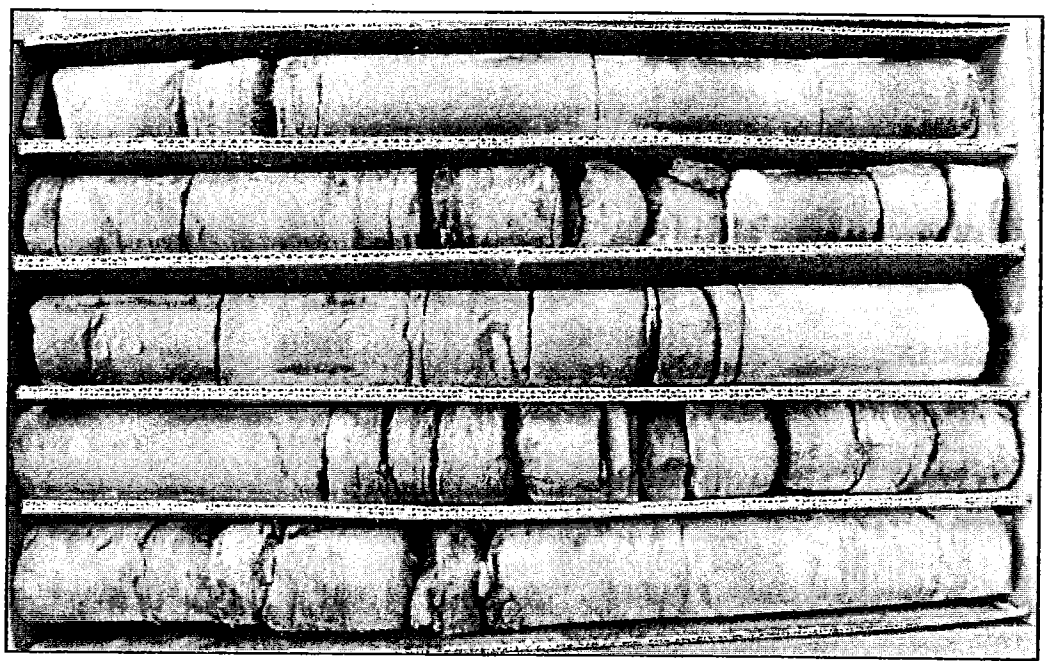
NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

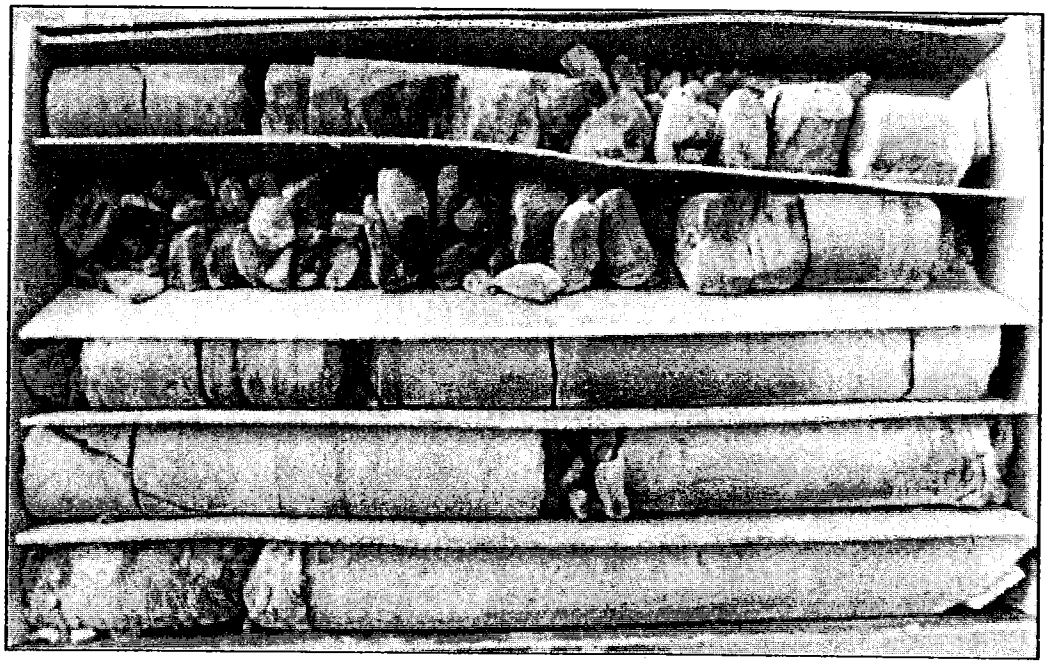
Photo 3

Project No. 2011.0068

Core from DH-1 (71.5'-81.3').



Core from DH-1 (81.3'-91.0').



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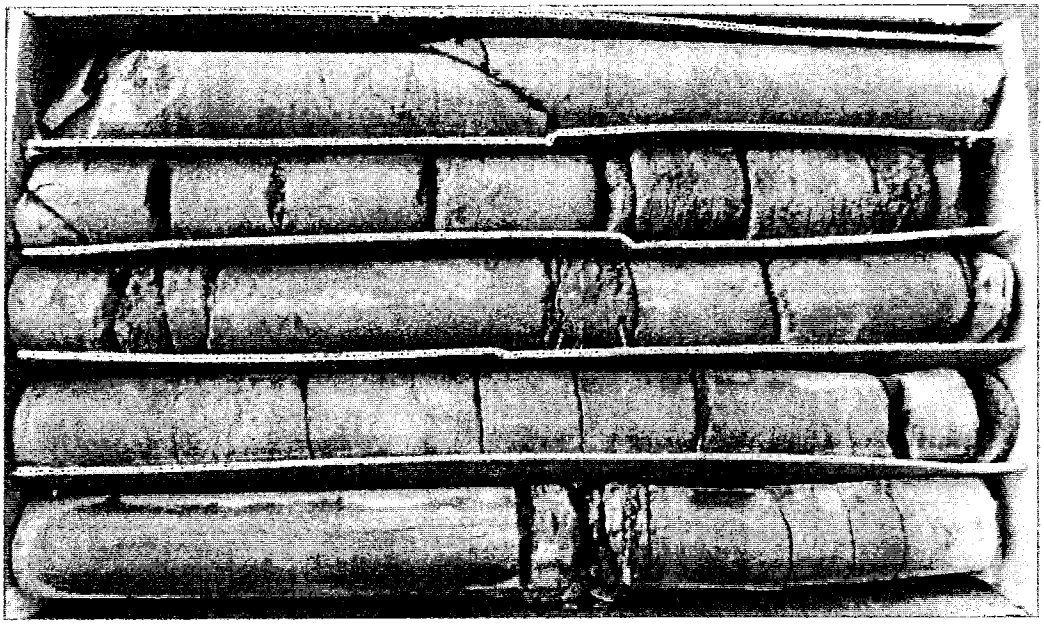
NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

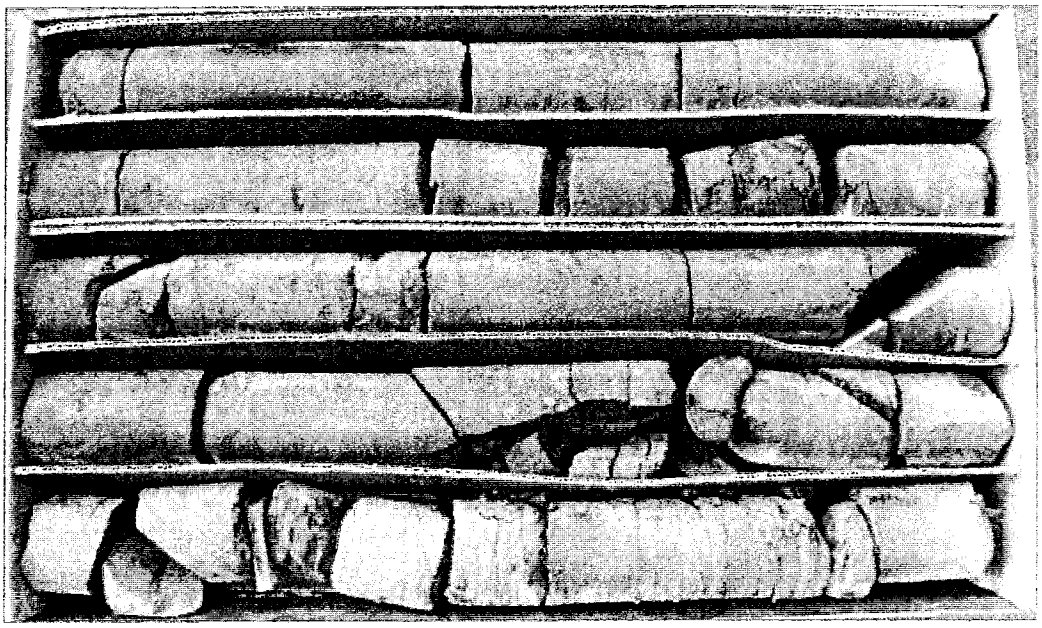
Photo 4

Project No. 2011.0068

Core from DH-1
(91.0'-100.0')



Core from DH-1
(100.0'-109.5').



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NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

Photo 5

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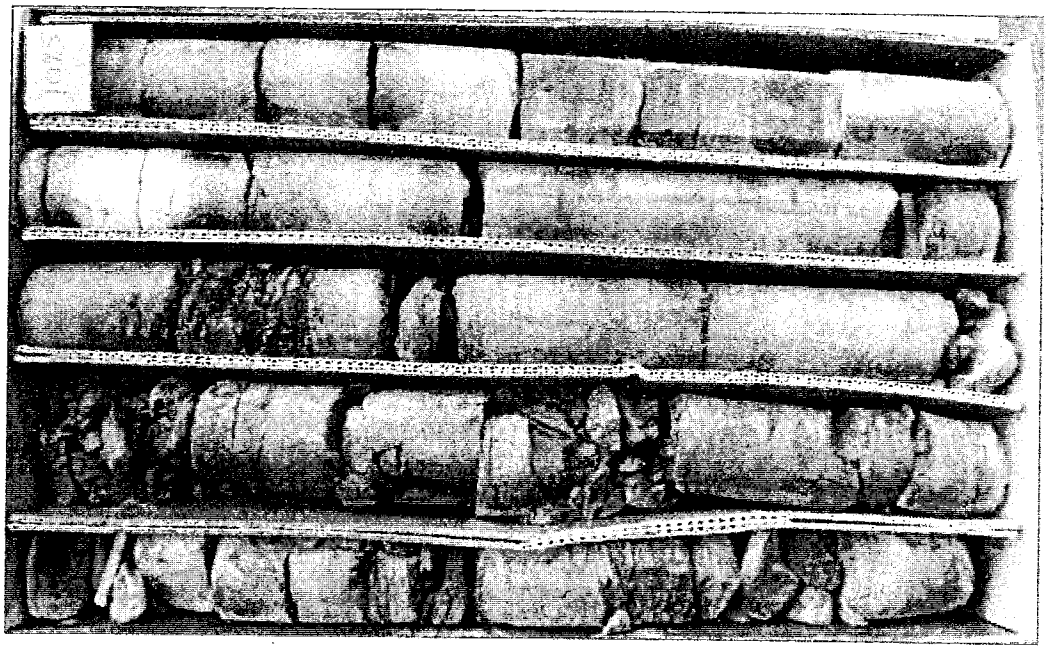
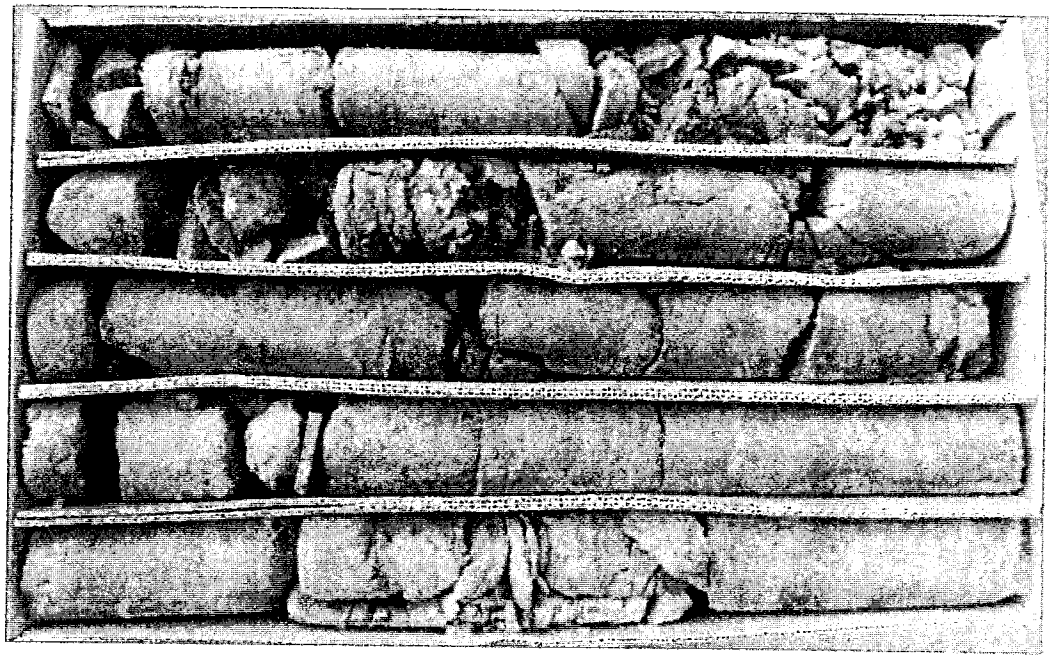
Core from DH-1 (109.5'-119.7').



Core from DH-1 (119.7'-132.0').



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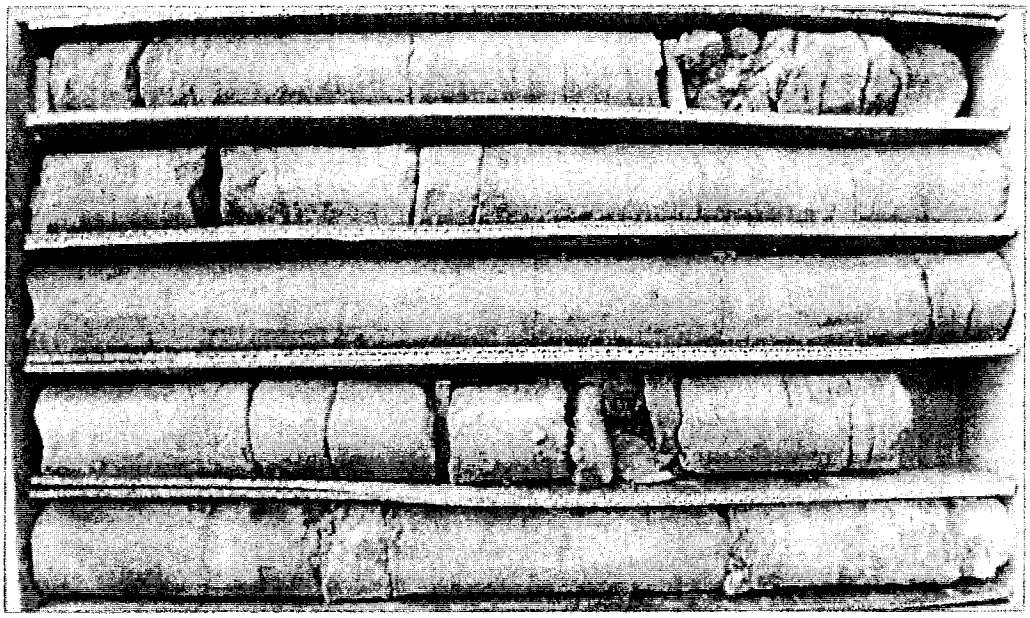
NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

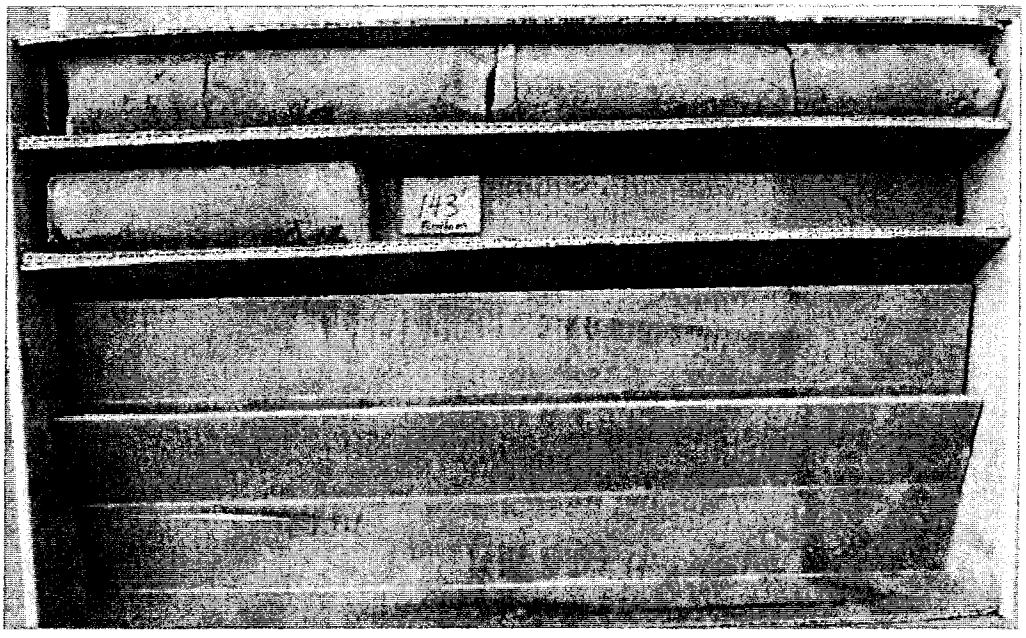
Photo 6

Project No. 2011.0068

Core from DH-1 (132.0'-140.6').



Core from DH-1 (140.6'-143.0' [Bottom of Hole]).



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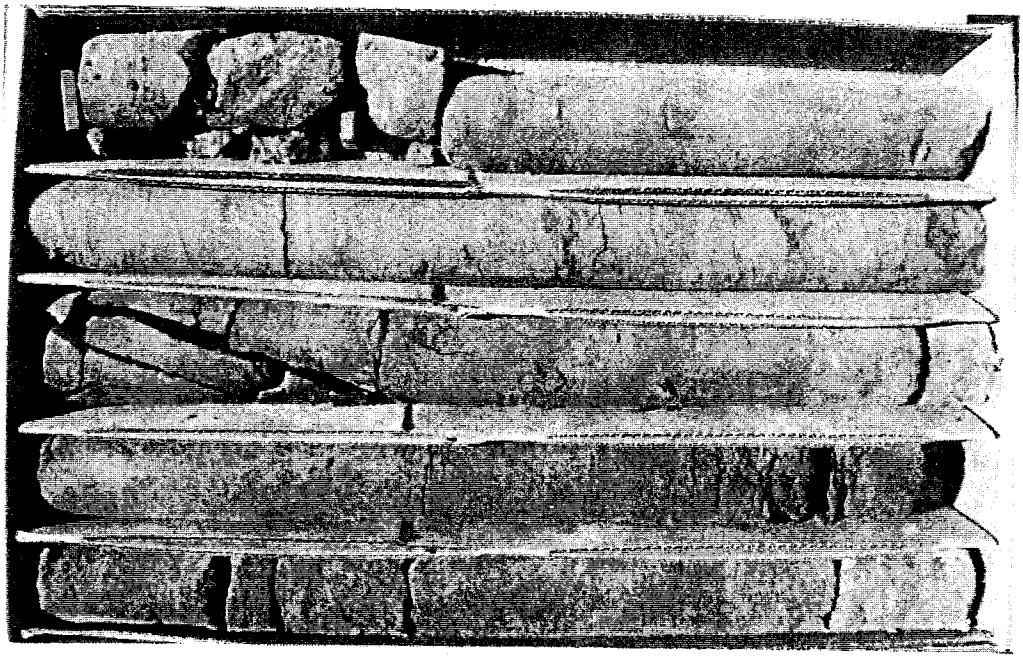
NELSON ROAD LANDSLIDE
Core Photographs (DH-1)

Photo 7

Project No. 2011.0068

Core from DH-2 (24.0'-34.5'). Upper interval (0.0' to 24.0' not cored).

Core from DH-2 (34.5'-43.8').



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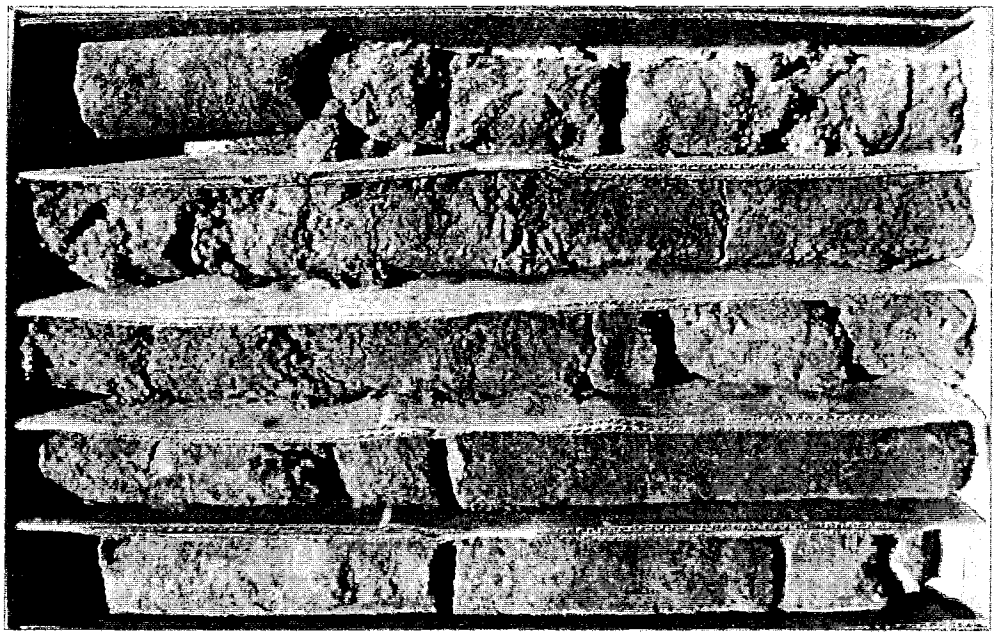
NELSON ROAD LANDSLIDE
Core Photographs (DH-2)

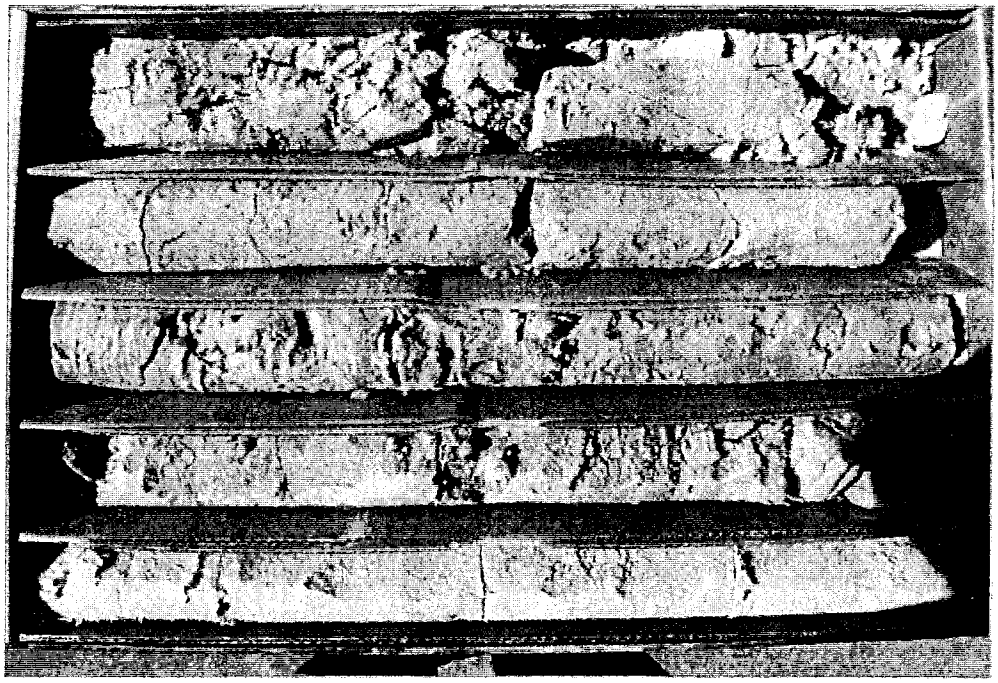
Photo 8

Project No. 2011.0068

Core from DH-2 (43.8'-55.0').



Core from DH-2 (55.0'-70.0' [Bottom of Hole]).



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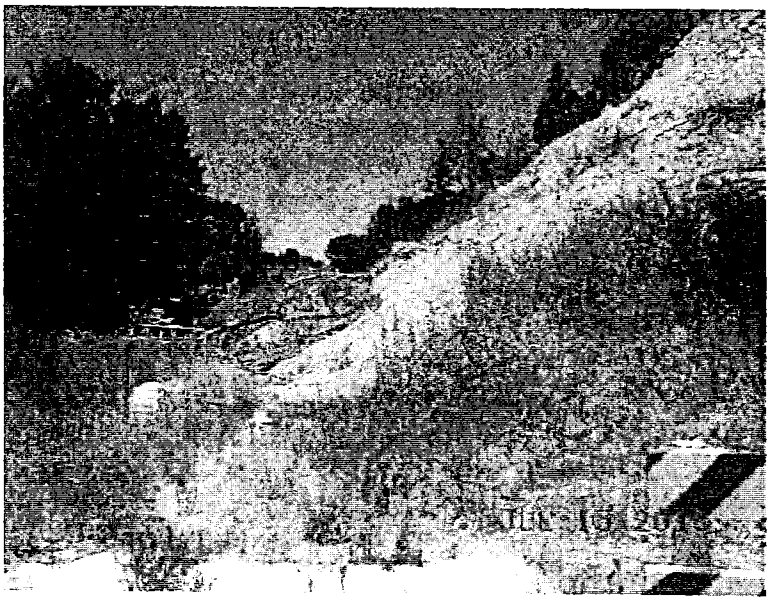
NELSON ROAD LANDSLIDE
Core Photographs (DH-2)

Photo 9

Project No. 2011.0068

NELSON ROAD PM 2.0
Permanent Bypass Road

SANTA CRUZ COUNTY, CA
Biological Report
August 12, 2013



Biotic Resources Group
Biotic Assessments ◆ Resource Management ◆ Permitting

Biotic Resources Group
Biotic Assessments ◆ Resource Management ◆ Permitting

NELSON ROAD PM 2.0
Permanent Bypass Road

SANTA CRUZ COUNTY, CA
Biological Report

Prepared for
Santa Cruz County Department of Public Works
Russell Chen, Project Engineer
Santa Cruz, CA 95060

Prepared by:
Biotic Resources Group
Kathleen Lyons, Plant Ecologist

And

Dana Bland & Associates
Dana Bland, Wildlife Biologist

August 12, 2013

2551 S. Rodeo Gulch Road #12 • Soquel, California 95073 • (831) 476-4803 • brg@cruzio.com

1.0 INTRODUCTION

The Biotic Resources Group and Dana Bland & Associates documented and evaluated the biotic resources of a permanent bypass road located at PM 2.0 on Nelson Road in the unincorporated Scotts Valley area of Santa Cruz County.

Specific tasks conducted for this study include:

- Characterize and map the major plant communities within the proposed project area.
- Identify sensitive biotic resources, including habitats, plant or wildlife species of concern.
- Evaluate the potential effects of the proposed project activities on sensitive biotic resources and recommend measures to avoid or reduce such impacts.

1.1 PROPOSED PROJECT

The project is located just approximately two miles north of Lockhart Gulch Road just south of Sky Meadow Lane (a private roadway), at PM 2.0 on Nelson Road in Santa Cruz County as shown on Figure 1. During Storm Event of March 2011, a major landslide blocked Nelson Road at PM 2.0. The roughly 350-foot-long section of blocked road provides access to over 30 residences north of the landslide. A temporary bypass road that crosses Ruins Creek was constructed to the east of the blocked road. Due to the magnitude of the landslide, the geologist has determined that a permanent bypass road is now needed to restore access.

The permanent bypass road will be constructed between Ruins Creek and the toe of the 2011 landslide. The scope of the work will consist of the following: excavation and backfill, two mechanically stabilized earth backfill (MSE) retaining walls, drainage culvert improvements, asphalt concrete pavement, erosion control, revegetation, and removal of approximately 80 feet of the existing temporary bypass road where it crosses Ruins Creek. The two MSE retaining walls include a 35-foot long wall between the road and the creek and 325-foot wall on the upland (west) side of the road.

The project will require removal of seven coast live oak trees (alive), four dead oak trees (located at base of slide), one willow tree and limbing of willows, oaks and big leaf maples growing adjacent to the construction area. The bypass road will not require any work within the creek channel, but removal of the temporary creek crossing will require removal of existing CMP pipes and rip rap in the channel. The project is expected to take approximately 12 weeks to complete.

1.2 INTENDED USE OF THIS REPORT

The findings presented in this biological report are intended for the sole use of Santa Cruz County Department of Public Works and its consultants in evaluating the proposed project. The findings presented by the Biotic Resources Group in this report are for information purposes only; they are not intended to represent the interpretation of any State, Federal or County law or ordinance pertaining to permitting actions within sensitive habitat or endangered species. The interpretation of such laws and/or ordinances is the responsibility of the applicable governing body.

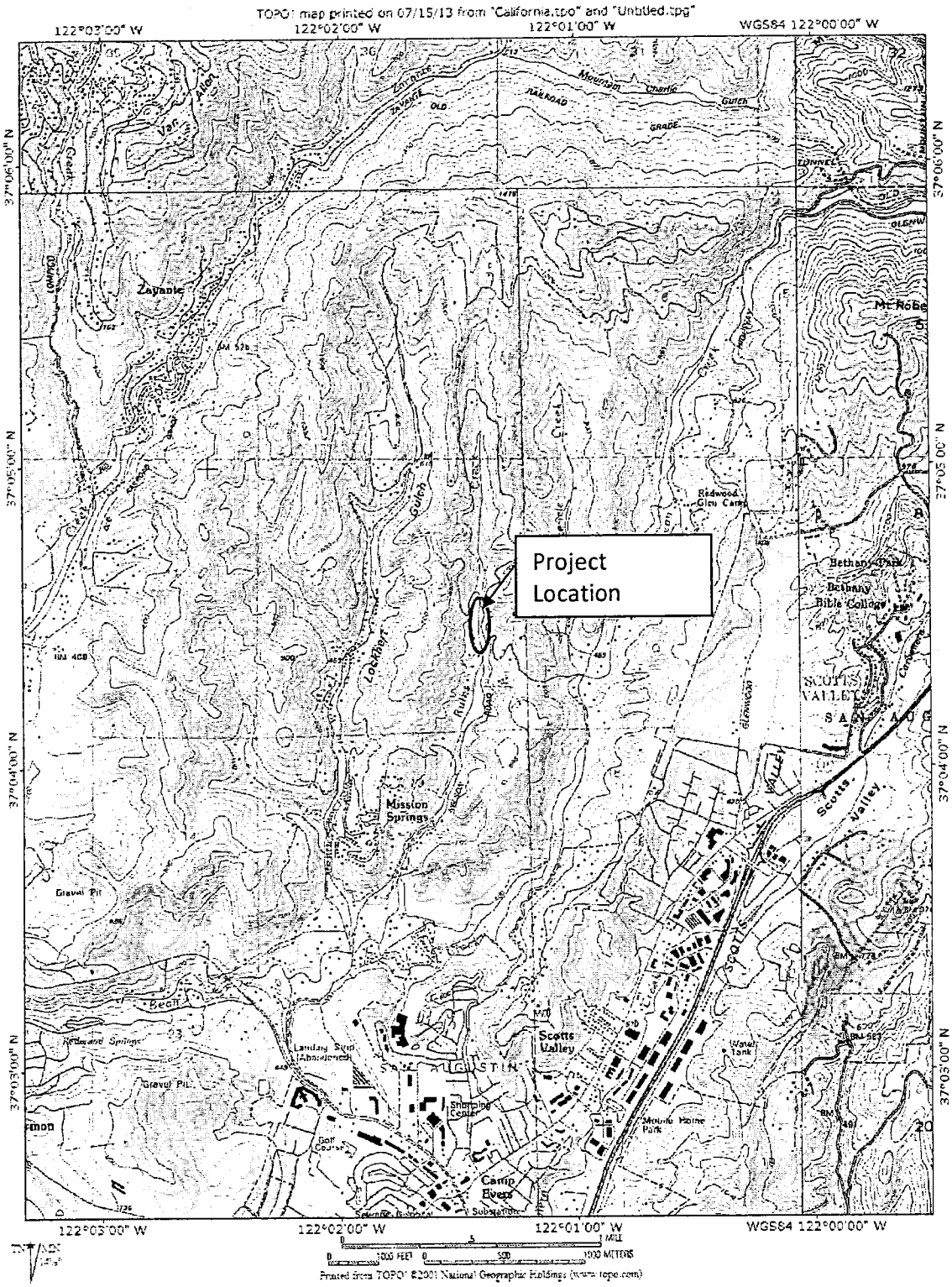


Figure 1. Proposed Project Location

(USGS Felton USGS Topographic Map)

2.0 EXISTING BIOTIC RESOURCES

2.1 METHODOLOGY

The biotic resources of the project site were assessed through literature review and field observations. Site observations were made on July 15 and August 6, 2013 by Kathleen Lyons (plant ecologist) and Dana Bland (wildlife biologist).

Vegetation mapping of the study area was conducted from review of aerial photos, a topographic map, and field observations. The major plant communities within the project area, based on the classification system developed by *California Terrestrial Natural Communities* (California Department of Fish and Game, 2003 and 2007) and *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995) and as amended to reflect site conditions, were identified during the field surveys. Modifications to the classification system's nomenclature were made, as necessary, to accurately describe the site's resources. The plant communities were mapped onto the engineer's base map. All plant species observed were recorded and identified to a level sufficient to determine their rarity; all species observed at listed in the narrative section of this report. Plant nomenclature follows The *Jepson Manual – Vascular Plants of California* (2012); *An Annotated Checklist of the Vascular Plants of Santa Cruz County, California* (CNPS, 2005) was also reviewed.

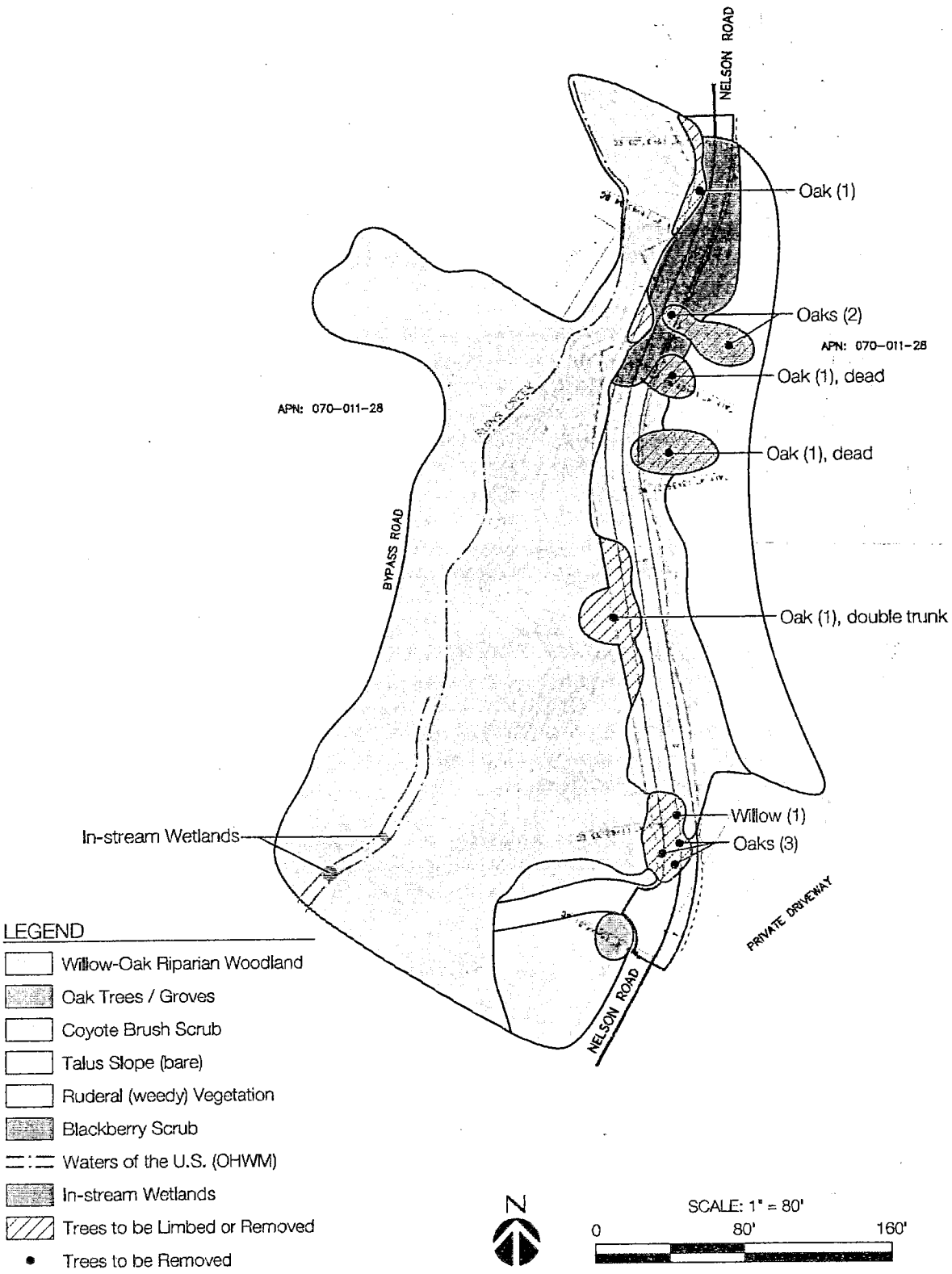
To assess the potential occurrence of special status biotic resources, two electronic databases were accessed to determine recorded occurrences of sensitive plant communities and sensitive species. Information was obtained from the California Native Plant Society's (CNPS) Electronic Inventory (2013), and California Department of Fish & Wildlife (CDFW) RareFind database (CDFW, 2013) for the Felton USGS quadrangles and surrounding quadrangles. A delineation of State and Federal Jurisdictional Waters was conducted; the results of the delineation are summarized in this report.

This report summarizes the findings of the biotic assessment for the proposed project. The potential impacts of the proposed permanent bypass road project on sensitive resources are discussed below. Measures to reduce significant impacts to a level of less-than-significant are recommended, as applicable.

2.2 ENVIRONMENTAL SETTING

2.2.1 Geographic Setting

The project is located on the Felton USGS quadrangle (see Figure 1). The project is located adjacent to Ruins Creek. Low density residential development and forest lands surround the site; the site is located outside the County-designated urban and rural service areas. Ruins Creek is depicted as a perennial creek on the Felton USGS quadrangle; however, at the proposed project site the creek is intermittent. The creek flows southward into Bean Creek, and then into the San Lorenzo River, over 2 miles downstream from this project site. Soil within the project area is mapped as Soquel loam; uphill material from the slide is mapped as Nisene-Aptos complex, 50-75% slopes. As depicted on Figure 2, seven plant community types were observed within the study area: willow-oak riparian woodland (along Ruins Creek), coast live oak trees/tree groves, blackberry scrub, coyote brush scrub, ruderal (weedy) areas, bare talus (landslide deposit), and in-stream wetlands.



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Nelson Road PM 2.0 - Permanent Bypass Road
Existing Vegetation

Figure 2
8/13
697-01

The project area also supports bare talus material from the landslide. Each vegetation type, its California vegetation code, and state ranking (rarity) are listed in Table 1.

Table 1. Vegetation Types at Nelson Road PM 2.0

CaCode[1]	Vegetation Type	Plant Association	State Ranking[2]
61.204.00	Willow-Oak Riparian Woodland	Willow – Dogwood- Coast live oak/ California blackberry	S3
71.060.02	Coast Live Oak Trees/tree groves	Coast live oak	S4
63.901.05	Blackberry Scrub	California blackberry/stinging nettle /gooseberry	S4
32.060.23	Coyote Brush Scrub	Coyote brush	S5
-	Ruderal (weedy)	Soft chess- rattail fescue – Italian thistle	-
-	In-stream Wetlands	Nutgrass – giant horsetail	-

[1] – California vegetation code as per CDFW/CNDDB (2010); [2]- Vegetation types are ranked between S1 and S5. For vegetation types with ranks of S1-S3, all associations within the type are considered to be highly imperiled.

2.2.2 *Vegetation and Wildlife Habitats*

In-channel wetlands occur within the bed of Ruins Creek. Two small patches of in-stream wetlands were observed upstream and downstream of the existing ford. The upstream wetland patch is comprised of nutsedge (*Cyperus eragrostis)*; the downstream patch is comprised of giant horsetail (*Equisetum hyemale)*. Collectively the two patches encompass approximately 41 square feet.
Figures 3 and 4 depict the character of these in-channel wetland patches, upstream and downstream of the ford, respectively. The location of the wetland patches is also depicted on Figure 2.

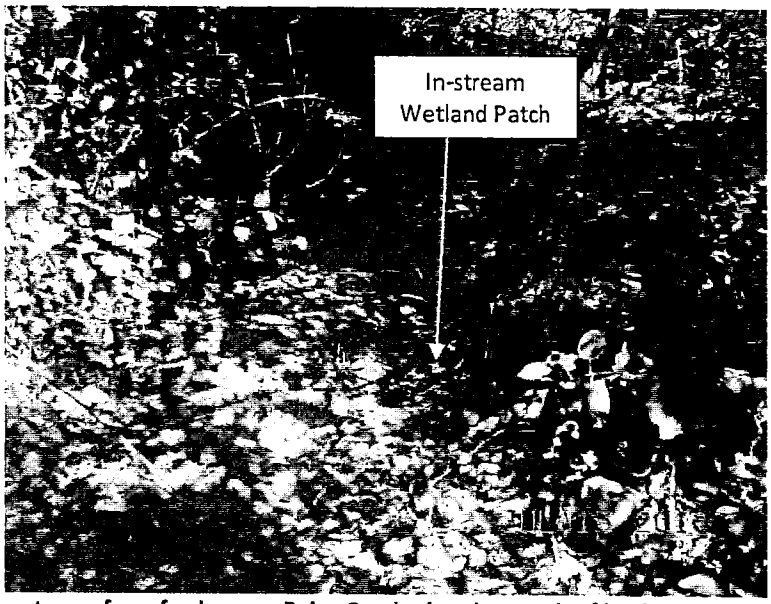

Figure 3. Looking upstream from ford across Ruins Creek, showing patch of in-channel wetlands, measuring 1 square foot, July 2013

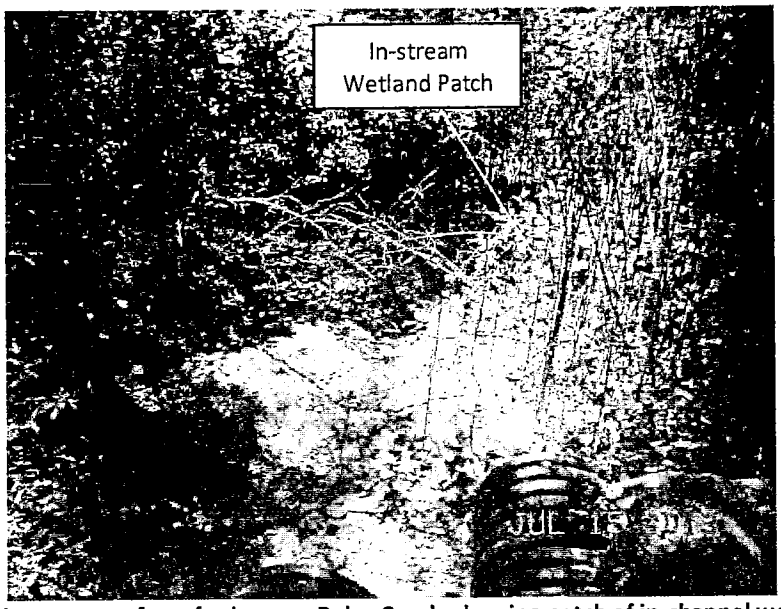

Figure 4. Looking downstream from ford across Ruins Creek, showing patch of in-channel wetlands, measuring 40 square foot, July 2013

Ruins Creek also supports riparian woodland. The woodland is characterized by trees of willow (*Salix spp.)*, creek dogwood (*Cornus sericea*), and coast live oak (*Quercus agrifolia).* The distribution of the riparian woodland is depicted on Figure 2. The riparian understory vegetation includes stinging nettle (*Urtica dioica)*, California blackberry (*Rubus ursinus),* poison oak (*Toxicodendron diversilobum)* and oceanspray (*Holodiscus discolor).* Figure 5 depicts the character of the riparian woodland along Ruins Creek at the existing ford.

Figure 5. Riparian woodland at temporary crossing (ford) of Ruins Creek, August 2013

In the vicinity of the road bypass work area, willow, dogwood, big leaf maple (*Acer macrophyllum)*, and oak trees grow along the top of bank and a few trees grow in the proposed road re-alignment work area. The approximate location of the trees (trunks) within the road bypass work area is depicted on Figure 2.

Small oak trees/oak tree groves grow within the slide material amid the loose talus. Four oak trees occur in the slide material; two of these trees are dead. Other portions of the slide debris (talus) support a bramble of California blackberry; other species within the bramble include stinging nettle, gooseberry (*Ribes* sp.), and young California buckeye (*Aesculus californica)*. One brittle-leaf manzanita (*Arctostaphylos crustacea subsp. crustacea)* was observed in the scrub – presumably re-establishing from its burl after the being transported down slope in the landslide. Most of the road bypass area supports ruderal (weedy) vegetation. This vegetation is co-dominated by soft chess (*Bromus hordeaceus)*, rattail fescue (*Festuca myuros)*, and Italian thistle (*Carduus pycnocephalus)*. Most of the ruderal area has been disturbed from previous land uses, as animal pens and sheds occupy this area. The character of the road bypass area is depicted in Figure 6.

Figure 6. Vegetation within road bypass area, showing scrub and talus slope, July 2013

The wildlife value of the wetlands and riparian habitat of Ruins Creek within the project vicinity is moderated by the proximity of the site to the road and residences (i.e., human disturbance) and the intermittent creek flows. Common wildlife that can tolerate human presence are expected to occur along this portion of the creek, such as Pacific chorus frog (*Pseudacris regilla*), black phoebe (*Sayornis nigricans*), western scrub-jay (*Aphelocoma californica*), chestnut-backed chickadee (*Poecile rufescens*), and raccoon (*Procyon lotor*). This portion of Ruins Creek is intermittent, and therefore does not support anadromous fish.

2.3 SENSITIVE BIOTIC RESOURCES

2.3.1 Regulated Habitats

The project area is located within Santa Cruz County outside the urban and rural service lines.

The project area supports riparian woodland, with in-stream wetlands. According to County Code (Section 16.32), all lakes, wetlands, estuaries, lagoons, streams and rivers are considered sensitive habitat. According to County Code (Section 16.30), the riparian corridor along perennial channels extends 50 feet outward from the bank-full flow line or edge of riparian vegetation, whichever is greater. The riparian corridor along intermittent channels is 30 feet outward from the bank-full flow line or edge of riparian vegetation, whichever is greater. The project area is located within the riparian corridor of Ruins Creek, which has perennial flow (as per USGS mapping); although this section is intermittent.

California Department of Fish and Wildlife (CDFW) is a trustee agency that has jurisdiction under Section 1600 et seq. of the CDFW Code. Under Sections 1600-1603 of the California Fish and Game Code, CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel or bank of any river, stream or lake which supports fish or wildlife. CDFW also regulates alterations to ponds and impoundments. CDFW jurisdictional limits typically extend to the top of bank or to the edge of riparian habitat if such habitat extends beyond top of bank (outer drip line), whichever is greater. The proposed project is located within CDFW's jurisdiction.

Water quality in California is governed by the Porter-Cologne Water Quality Control Act and certification authority under Section 401 of the Clean Water Act, as administered by the Regional Water Quality Control Board (RWQCB). The Section 401 water quality certification program allows the State to ensure that activities requiring a Federal permit or license comply with State water quality standards. Water quality certification must be based on a finding that the proposed discharge will comply with water quality standards which are in the regional board's basin plans. The Porter-Cologne Act requires any person discharging waste or proposing to discharge waste in any region that could affect the quality of the waters of the state to file a report of waste discharge. The RWQCB issues a permit or waiver that includes implementing water quality control plans that take into account the beneficial uses to be protected. Waters of the State subject to RWQCB regulation extend to the top of bank, as well as isolated water/wetland features and saline waters. Should there be no Section 404 nexus (i.e., isolated feature not subject to USACE jurisdiction); a report of waste discharge (ROWD) is filed with the RWQCB. The RWQCB interprets waste to include fill placed into water bodies. The proposed project is located within the RWQCB's jurisdiction.

The US Army Corps of Engineers (USACE) regulates activities within waters of the United States pursuant to congressional acts: Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (1977, as amended). Section 10 of the Rivers and Harbors Act requires a permit for any work in, over, or under navigable waters of the United States. Navigable waters are defined as those waters subject to the ebb and flow of the tide to the Mean High Water mark (tidal areas) or below the Ordinary High Water mark (freshwater areas). The proposed project includes work below the Ordinary High Water Mark (OHWM) of Ruins Creek, such that work occurring in these areas would be within USACE's jurisdiction.

Field evidence of an OHWM was observed along Ruins Creek. Water marks, exposed roots, and other vegetation patterns, were observed to indicate the elevation of the OHWM. The OHWM was found to

correspond to approximately 1.0 feet above the thalweg (channel bottom). The approximate location of the OHWM is depicted on Figure 2. A wetland delineation report has been prepared for the project (Appendix A).

2.3.2 *Sensitive Habitats*

Sensitive habitats are defined by local, State, or Federal agencies as those habitats that support special status species, provide important habitat values for wildlife, represent areas of unusual or regionally restricted habitat types, and/or provide high biological diversity.

CDFW classifies and ranks the State's natural communities to assist in the determining the level of rarity and imperilment. Vegetation types are ranked between S1 and S5. For vegetation types with ranks of S1-S3, all associations within the type are considered to be highly imperiled. If a vegetation alliance is ranked as S4 or S5, these alliances are generally considered common enough to not be of concern; however, it does not mean that certain associations contained within them are not rare (CDFW, 2010). The proposed project area supports one vegetation type with an imperiled status: willow-oak riparian woodland (see Table 1).

According to County Code, development activities shall conform to permitted uses and impacts to sensitive habitat be avoided. If development occurs within any sensitive habitat area the County requires projects mitigate significant environmental impacts and restoration of any area which is degraded sensitive habitat or has caused or is causing the degradation, with restoration commensurate with the scale of the development.

2.3.3 *Special Status Plant Species*

Plant species of concern include those listed by either the Federal or State resource agencies as well as those identified as rare by CNPS (List 1B). The search of the CNPS and CNDDB inventories identified the special status plant species with potential to occur in the project area. No special status plant species have been recorded in the CNDDB as occurring within the immediate project area, although occurrences of species are known from sandhills chaparral within the Weston Road area and on slopes/ridges between Bean Creek/McKenzie Creek (i.e., sandhills chaparral northwest of Camp Redwood Glen supporting ponderosa pine, Bonny Doon [silver-leaved] manzanita, and robust spineflower). All species evaluated for potential occurrence within the proposed project area as per CNDDB and CNPS records are listed on Table 2.

Surveys for rare plants were limited to species deemed identifiable during the July and August 2013 site visit. No special status species were observed and none are expected due to the habitat conditions present at the site. The project area lacks specialized micro habitats (i.e., sandy substrate) conducive to the occurrence of special status plant species.

Table 2. List of Special Status Plant Species Evaluated to Occur at Nelson Road PM 2.0,

Species	CNPS	State Status	Federal Status	Habitat Type Potential Occurrence on Site?
Slender silver moss *(Anombryum julaceum)*	List 2.2	None	None	Broadleaf forest, coniferous forests, acidic substrates Unlikely to occur due to lack of suitable habitat
Santa Cruz manzanita *(Arctostaphylos andersonii)*	List 1B.2	None	None	Maritime chaparral and intermixes with woodlands and redwood forest Unlikely to occur due to lack of suitable habitat; not observed during surveys
Bonny Doon manzanita *(Arctostaphylos silvicola)*	List 1B.2	None	None	Maritime chaparral, closed cone pine forest within Zayante sandhills Unlikely to occur due to unsuitable habitat; not observed during surveys
Marsh sandwort *(Arenaria paludicola)*	List 1B.1	None	None	Marshes and swamps Unlikely to occur due to unsuitable habitat
Swamp harebell *(Campanula californica)*	List 1B.2	None	None	Mesic areas, marshes Unlikely to occur due to unsuitable habitat
Deceiving sedge *(Carex saliniformis)*	List 1B.2	None	None	Coastal prairie, scrub, meadows, seeps Unlikely to occur due to unsuitable habitat
Robust spineflower *(Chorizanthe robusta var. robusta)*	List 1B.1	None	Endangered	Sandy terraces and bluffs, often intermixed with oak woodland/maritime chaparral, coastal scrub Unlikely to occur due to lack of suitable habitat
Ben Lomond spineflower *(Chorizanthe pungens var. hartwegiana)*	List 1B.1	None	Endangered	Chaparral and pine forest on Zayante soils Unlikely to occur due to lack of suitable habitat
Tear drop moss *(Dacryophyllum falcifolium)*	List 1B.3	None	None	Coast redwood forest, limestone substrate and outcrops Unlikely to occur due to lack of suitable habitat; not observed during surveys
Ben Lomond buckwheat *(Eriogonum nudum var. decurrens)*	List 1B.1	None	None	Maritime chaparral within Zayante sandhills Unlikely to occur due to unsuitable habitat
Santa Cruz wallflower *(Erysimum teretifolium)*	List 1B.1	Endangered	Endangered	Maritime chaparral within Zayante sandhills No suitable habitat in project area
Santa Cruz cypress *(Hesperocyparis abramsiana)*	List 1B.2	Endangered	Endangered	Chaparral, closed-cone pine forests No suitable habitat in project area; not observed during surveys
Santa Cruz tarplant *(Holocarpha macradenia)*	List 1B.1	Endangered	Threatened	Grasslands, prairie Unlikely to occur due to lack of suitable habitat
Kellogg's horkelia *(Horkelia cuneata ssp. sericea)*	List 1B.1	None	None	Closed cone pine forest, coastal scrub, chaparral; old dunes, sandy openings No suitable habitat in project area; not observed during surveys
Pt. Reyes horkelia *(Horkelia marinensis)*	List 1B.2	None	None	Coastal dunes, coastal prairie, coastal scrub; sandy flats

Table 2. List of Special Status Plant Species Evaluated to Occur at Nelson Road PM 2.0,

Species	CNPS	State Status	Federal Status	Habitat Type Potential Occurrence on Site?
				No suitable habitat in project area; not observed during surveys
Woodland woollythreads *(Monolopia gracilens)*	List 1B.2	None	None	Chaparral, grasslands, broadleaf forests, coniferous forests; grassy sites, sandy to rocky areas Unlikely to occur due to lack of suitable habitat
White-rayed pentachaeta *(Pentachaeta bellidiflora)*	List 1B.1	Endangered	Endangered	Grassland; dry open slopes; often on serpentine Unlikely to occur due to lack of suitable habitat
San Francisco popcorn flower *(Plagiobothrys diffusus)*	List 1B.1	Endangered	None	Seasonally moist grasslands/prairie Unlikely to occur due to lack of suitable habitat
Santa Cruz Clover *(Trifolium buckwestiorum)*	List 1B.1	None	None	Seasonally moist grasslands/prairie Unlikely to occur due to lack of suitable habitat
Marsh microseris *(Microseris paludosa)*	List 1B.2	None	None	Pine forest, coastal scrub, grassland No suitable habitat in project area
Santa Cruz Mountains beardtongue *(Penstemon rattanii var. kleei)*	List 1B.2	None	None	Sandy, shale soil in chaparral or burned chaparral, coniferous forest No suitable habitat in project area; not observed during surveys
White-flowered rein orchid *(Piperia candida)*	List 1B.2	None	None	Rock outcrops in scrub, chaparral and pine woodlands No suitable habitat in project area; not observed during surveys
Choris' popcorn flower *(Plagiobothrys chorisianus var. chorisianus)*	List 1B.2	None	None	Seasonally moist grasslands/prairie, coastal scrub No suitable habitat in project area
Scotts Valley polygonum *(Polygonum hickmanii)*	List 1B.1	Endangered	Endangered	Grassland, on Purisima outcrops No suitable habitat in project area
Pine rose *(Rosa pinetorum)*	List 1B.2	None	None	Chaparral and pine woodlands No suitable habitat in project area; not observed during surveys

Source: CNDDB, 2013.

CNPS Status: **List 1B:** These plants (predominately endemic) are rare through their range and are currently vulnerable or have a high potential for vulnerability due to limited or threatened habitat, few individuals per population, or a limited number of populations. List 1B plants meet the definitions of Section 1901, Chapter 10 of the CDFG Code.

2.3.4 *Special Status Wildlife Species*

Special status wildlife species include those listed, proposed or candidate species by either the Federal or the State resource agencies as well as those identified as State species of special concern. In addition, all raptor nests are protected by CDFW Code, and all migratory bird nests are protected by the Federal Migratory Bird Treaty Act. Special status wildlife species were evaluated for their potential presence in the project area as described in Table 3 below.

Table 3. Special status wildlife species and their predicted occurrence at Nelson Road PM 2.0, August 2013.

SPECIES	STATUS[1]	HABITAT	POTENTIAL OCCURRENCE ON SITE
Invertebrates			
Ohlone tiger beetle *Cicindela ohlone*	FE	Coastal terrace prairie with sparse vegetation and openings, Watsonville loam soils	None, no suitable habitat on site.
Mt. Hermon June beetle *Polyphylla barbata*	FE	Chaparral and ponderosa pine with Zayante sandy soils	No suitable habitat on site.
Zayante band-winged grasshopper *Trimerotropis infantilis*	FE	Openings in sand hills parkland habitat with Zayante sandy soils	No suitable habitat on site.
Smith's blue butterfly *Euphilotes enoptes smithi*	FE	Coastal dunes and coastal sage scrub with buckwheat plants	No suitable habitat on site.
Fish			
Coho salmon *Oncorhynchus kisutch*	FE, SE	Perennial creeks and rivers with gravels for spawning	Believed to be extirpated from the San Lorenzo River watershed. No suitable habitat on site; creek is intermittent.
Steelhead *Oncorhynchus mykiss*	FT	Perennial creeks and rivers with gravels for spawning	No suitable habitat on site; creek is intermittent.
Amphibians			
California red-legged frog *Rana aurora draytonii*	FT, CSC	Riparian, marshes, estuaries and ponds with still water at least into June.	Closest known observation is 2.5 miles to northeast in Mtn. Charlie Gulch. Unlikely to occur on site due to lack of breeding areas within 1 mile, high human presence/activity in area, and ephemeral nature of the creek.
Reptiles			
Western pond turtle *Actinemys marmorata*	CSC	Creeks and ponds with water of sufficient depth for escape cover, and structure for basking; grasslands or bare areas for nesting.	No suitable habitat; creek is too ephemeral.
Birds			
White-tailed kite *Elanus leucurus*	FP	Nests in tall riparian trees adjacent to open lands for foraging	None, no suitable habitat on site.
Mammals			
Pallid bat *Antrozous pallidus*	CSC	Roosts in caves, hollow trees, mines, buildings, bridges, rock outcroppings	None, no suitable habitat on site.
Santa Cruz kangaroo rat *Dipodomys venustus venustus*	None	Manzanita chaparral with sandy soils	None. No suitable habitat on site.
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	CSC	Woodlands including oaks, willow riparian, Eucalyptus	No nests observed.
American badger *Taxidea taxus*	CSC	Grasslands with friable soils	None, no suitable habitat on site.

[1] Key to status: FE=Federally listed as endangered species; FT= Federally listed as threatened species; FP=Fully protected species by State; CSC=California species of special concern

The California red-legged frog is uncommon in the San Lorenzo River watershed. The closest known location is 2.5 miles to the northeast of this site in Mountain Charlie Gulch, not far from a pond. There are no ponds within 1 mile of this project site to provide a source breeding population of frogs. This

portion of Ruins Creek is not only intermittent, it is ephemeral, only flowing after a heavy rain. It is unlikely that red-legged frogs occur at this site.

3.0 IMPACT AND MITIGATION DISCUSSION

3.1 IMPACT CRITERIA

3.1 Thresholds of Significance

The thresholds of significance presented in Appendix G of the CEQA Guidelines were used to evaluate project impacts and to determine if implementation of the proposed Project would pose significant impacts to botanical resources. For this analysis, significant impacts are those that substantially affect, either directly or through habitat modifications:

- A species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFW or USFWS or NMFS;
- Riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by CDFW or USFWS;
- Federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance;
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.2 ENVIRONMENTAL IMPACTS, MITIGATION MEASURES AND SIGNIFICANCE DETERMINATION FOR THE PROPOSED PROJECT

The proposed permanent bypass road project was evaluated for its potential direct and indirect impacts to biotic resources. Impacts to sensitive habitats/resources were considered potentially significant.

3.2.1 Impacts to Sensitive Habitats

The proposed project will require work within Ruins Creek to remove the temporary creek crossing. Work within the creek will be scheduled to occur when the creek is dry. The proposed project will place no fill within the limits of OHWM. Construction will entail removal of the existing ford across the creek, removal of riprap, and the two culverts. The native creek bed materials will be retained on-site. The project includes riparian revegetation; plantings are proposed along the creek after road removal work is complete which will provide compensatory mitigation for riparian vegetation removed during placement of the temporary crossing/ford.

The creek area supports two small patches of in-channel wetlands. The wetlands occur within the bed of Ruins Creek, encompassing approximately 41 square feet. These areas meet the definition of wetlands. The in-channel wetlands will not be affected by the removal of the roadway, riprap or culverts as the vegetation is location upstream and downstream of the work area.

The road bypass work area supports trees within the riparian woodland that will be removed to accommodate construction of the new road and retaining walls. One willow and five oak trees will be removed from the riparian woodland (see Figure 2). In addition, limbs of riparian trees that overhang the work area will be removed. A total of approximately 2,850 square feet (0.06 acre) of riparian woodland will be removed. Measures are listed in Section 3.2.3 to provide compensation for the removal of this riparian woodland.

Assuming concurrence from regulatory agencies, permits will be required prior to commencement of proposed bypass road work. Ruins Creek was found to support federal and state jurisdictional areas, as summarized in Table 4. Removal of the existing crossing (ford) will be located within the jurisdiction of CDFW and RWQCB. Removal of an existing roadway and culverts, as well as a small area of the road re-alignment work will be located within the jurisdiction of CDFW and RWQCB (i.e., below top-of-bank and/or within riparian corridor. The road removal work will not result in the placement of fill within waters of the U.S. (USACE jurisdiction); however, road removal work will occur within the limits of Ordinary High Water. No fill will be placed in the creek bed and no natural creek material will be removed.

Table 4. Summary of Impacts to Jurisdictional Areas

Agency	Permit Required	Permit Type	Jurisdictional Impact Acreage	
			Temporary	Permanent
USACE	No	None	500 sq. ft.[1]	0
RWQCB	Yes	401 Water Quality Certification	500 sq. ft [1]	200 sq. ft.[2]
CDFW	Yes	1601 Streambed Alteration Agreement	500 sq. ft.[1]	2,850 sq. ft.[3]
County of Santa Cruz	Yes	Riparian Exception	500 sq. ft.[1]	2,850 sq. ft.[3]

[1] removal of existing roadway, rock riprap and culverts from creek bed; no fill to be placed in creek; no dewatering required as work will occur in dry season; [2] removal of riparian vegetation and work below top of bank for retaining wall along Ruins Creek; [3] removal of riparian woodland vegetation and limbing of canopy for construction access and roadway clearances

Upland vegetation will be removed to accommodate the road bypass. This vegetation includes four oak trees (two are dead), ruderal (weedy areas), and a blackberry thicket.

3.2.2 Impacts to Wildlife

Steelhead are not known from this portion of Ruins Creek because it has intermittent flow. No mitigation for steelhead is recommended.

Nesting birds may occur in the riparian vegetation adjacent to the project site. Because most nesting birds are protected by the Migratory Bird Treat Act, measures are listed in Section 3.2.3 to avoid potentially significant impacts if any are present during construction.

3.2.3 Recommended Measures

The following measures are recommended to avoid or mitigate potentially significant impacts to riparian and in-stream resources, and wildlife, to a less-than significant level:

1. The County shall secure all necessary permits from regulatory agencies prior to any work.

2. The County shall implement riparian habitat protection measures to minimize impacts to the riparian woodland (including native trees) adjacent to the work area, including:
    a. Install plastic mesh fencing at the perimeter of the work area to prevent inadvertent impacts to the adjacent riparian woodland and in-stream wetlands, and injury to adjacent native trees. Protective fencing shall be in place prior to ground disturbances and removed once all construction is complete. During construction, no grading, construction or other work shall occur outside the designated limits of work.
    b. No excess soil, chemicals, debris, equipment or other materials shall be dumped or stored outside the designated limits of work.
    c. Hand tools shall be used to trim vegetation to the extent necessary to gain access to the work area. All removed material/vegetation shall be removed from the riparian corridor.
3. Implement standard erosion control BMP's to prevent construction materials from entering the creek and adjacent riparian woodland. Install perimeter silt fencing and construction area limit-of-work fencing.
4. All staging of equipment and materials, and refueling of equipment, shall be located in existing roadways, driveways, and parking areas. The contractor shall prepare and implement a fuel spill prevention and clean-up plan.
5. Schedule construction work within the riparian corridor to take place from July 1 to October 15 of any given year or when the creek is dry.
6. To avoid impacting breeding birds, if present, schedule construction to occur between August 1 and October 15 of any given year, which is outside the bird breeding season. If this is not practical, then have a qualified biologist conduct a preconstruction survey for nesting birds. If any active bird nests are found within 50 feet of the work area, postpone construction until the biologist has determined that all young have fledged.
7. The County shall prepare and implement a riparian revegetation plan to provide replacement riparian vegetation along the bank of Ruins Creek. Areas identified for erosion control shall be seeded with a native grass and forb mixture. Dormant native willow cuttings or rooted native container stock riparian trees and/or shrubs shall be planted approximately 10 -15 feet on-center adjacent to the former creek crossing. The County shall maintain the plantings for a period of 5 years; the plantings shall maintain a yearly survival rate of 80%.

LITERATURE CITED AND REFERENCES

Baldwin, B., D. Goldman, D. Keil, R Patterson, T Rosatti and D. Wilken, editors. 2012. The Jepson Manual: Vascular Plants of California. 2nd edition. University of California Press. Berkeley

Barbour & Major, 1988. Terrestrial Vegetation of California. California Native Plant Society, Sacramento, CA

California Native Plant Society. 2013. Electronic Inventory of Rare and Endangered Vascular Plants of California. CNPS, Sacramento CA.

California, State of, Department of Fish & Wildlife. 2010. The Vegetation Classification and Mapping Program, List of California Terrestrial Natural Communities Recognized by the CNDDB. December 2010.

California, State of, Department of Fish & Wildlife. 2013. Natural Diversity DataBase, Natural Communities. Rarefind 3 Program, May 2013

Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. CDFW Unpublished report, October 1986.

Sawyer & Keller-Wolf, 1995. A Manual of California Vegetation. California Native Plant Society, Sacramento, CA

USDA, 1974. Soil Survey of Santa Cruz County, California. United States Department of Agriculture, Soil Conservation Service in cooperation with University of California Agricultural Experiment Station.

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APPENDIX A

WETLAND DELINEATION

NELSON ROAD PM 2.0

Appendix A

NELSON ROAD PM 2.0
Permanent Bypass Road

SANTA CRUZ COUNTY, CALIFORNIA

Delineation of State and Federal Jurisdictional Waters

August 12, 2013

Biotic Resources Group

Biotic Assessments • Resource Management • Permitting

Biotic Resources Group
Biotic Assessments • Resource Management • Permitting

NELSON ROAD PM 2.0
Permanent Bypass Road

SANTA CRUZ COUNTY, CALIFORNIA
Delineation of State and Federal Jurisdictional Waters

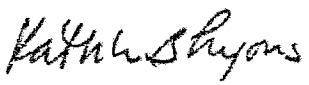
Prepared For:

Santa Cruz County Public Works Department
Attn: Martha Shedden, Project Engineer

Prepared By

Biotic Resources Group

The undersigned certifies that this report is a complete and accurate account of the findings and conclusion of a jurisdictional "waters of the U.S." (including wetlands) and "waters of the State" determination for the above-referenced project.



Kathleen Lyons, M.A.
Plant Ecologist

August 12, 2013

2551 S. Rodeo Gulch Road #12 • Soquel, California 95073 • (831) 476-4803 • brg@cruzio.com

Executive Summary

At the request of the Santa Cruz County Public Works Department, Biotic Resources Group (BRG) has prepared this Delineation of Jurisdictional Waters for a roadway repair project located along Nelson Road in Santa Cruz County, California. This delineation was conducted in July 2013 to document the regulatory authority of the U.S. Army Corps of Engineers (USACE), the Regional Water Quality Control Board (RWQCB), and California Department of Fish and Wildlife (CDFW) pursuant to the Federal Clean Water Act (CWA), California Porter-Cologne Water Quality Act, and California Fish and Game Code. The project area was surveyed pursuant to the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region, Version 2.0* (USACE, 2008) to identify evidence of hydrology, hydrophytic vegetation, and hydric soils; and the *Field Guide to Lake and Streambed Alteration Agreements Section 1600-1607* (CDFG, 1994) to identify evidence of streambeds and associated riparian vegetation.

Based on the review of current site conditions, this study has found that it will be necessary for the project applicant to obtain concurrence from regulatory agencies on the findings of this delineation, and assuming concurrence, permits will be required prior to commencement of the proposed repair work. Ruins Creek within the study area was found to support federal and state jurisdictional areas, as summarized in Table ES-1. Removal of an existing roadway and culverts, as well as a small area of the road re-alignment work will be located within the jurisdiction of CDFW and RWQCB (i.e., below top-of-bank and/or within riparian corridor. The road removal work will not result in the placement of fill within waters of the U.S. (USACE jurisdiction); however, road removal work will occur within the limits of Ordinary High Water. No fill will be placed in the creek bed and no natural creek material will be removed.

Table ES-1. Summary Table, indicating regulatory agency and jurisdiction

Agency	Permit Required	Permit Type	Jurisdictional Impact Acreage	
			Temporary	Permanent
USACE	No	None	500 sq. ft.[1]	0
RWQCB	Yes	401 Water Quality Certification	500 sq. ft [1]	200 sq. ft.[2]
CDFW	Yes	1601 Streambed Alteration Agreement	500 sq. ft.[1]	2,850 sq. ft.[3]
County of Santa Cruz	Yes	Riparian Exception	500 sq. ft.[1]	2,850 sq. ft.[3]

[1] removal of existing roadway, rock riprap and culverts from creek bed; no fill to be placed in creek; no dewatering required as work will occur in dry season; [2] removal of riparian vegetation and work below top of bank for retaining wall along Ruins Creek for 50 linear feet; [3] removal of riparian woodland vegetation and limbing of canopy for construction access and roadway clearances

Intended Use of this Report

The findings presented in this delineation are intended for the sole use of Santa Cruz County Public Works Department in evaluating regulatory jurisdiction for the proposed scour repair project and presents BRG's best effort at determining the jurisdictional boundaries using the most current regulations and regulatory agency guidance. The findings presented by BRG in

this report are for information purposes only; they are not intended to represent the interpretation of any State, Federal or local laws, polices or ordinances pertaining to permitting actions within jurisdictional areas, sensitive habitat, or endangered species. The interpretation of such laws and/or ordinances is the responsibility of the applicable governing body. Each regulatory agency is responsible for making the final determination of their jurisdiction.

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Chapter 1. Introduction

1.1. Purpose of Delineation

This delineation was prepared for Santa Cruz County Public Works Department in order to delineate the U.S. Army Corps of Engineers (USACE), Regional Water Quality Control Board (RWQCB), and California Department of Fish and Wildlife (CDFW) jurisdictional authority for the Nelson Road Permanent Bypass Road Project in Santa Cruz County, California (wetland study area).

The County of Santa Cruz is proposing to re-align a failed section of Nelson Road. Nelson Road at post mile 2.0 was blocked by a massive landslide on March 21, 2011 during a storm event. The roughly 350-foot long section of blocked road lies just south of Sky Meadow Lane (a private roadway) and provides access to over 30 residences north of the landslide. An emergency bypass road, with a ford across Ruins Creek, was constructed in April 2011; this temporary bypass road is currently in use.

The permanent road re-alignment project consists of a new roadway constructed between the toe of the landslide and Ruins Creek. The scope of the work will consist of the following: excavation and backfill, two mechanically stabilized earth backfill (MSE) retaining walls, drainage culvert improvements, asphalt concrete pavement, erosion control, and revegetation. Two MSE retaining walls include a 35-foot long wall between the road and the creek and 325-foot wall on the upland (west) side of the road. This work area encompasses approximately 0.5 acre. In addition, the project includes removal of a portion of the existing temporary bypass road. The emergency ford across Ruins Creek will be removed once the new Nelson Road re-alignment work is complete. This work will include the removal of existing asphalt roadway, rock riprap and drain rock, and two 36-inch culverts. Minor re-shaping of native creek materials within the creek bed may also be necessary to re-create the previous natural channel condition. Riparian vegetation will be planted at the ford removal area to compensate for riparian vegetation removed for the emergency crossing and to provide compensation for riparian vegetation affected by the permanent road re-alignment. The ford removal work area encompasses approximately 500 square feet.

Although depicted as a perennial waterway on the USGS map, Ruins Creek is seasonal in this section. Removal of the temporary ford across Ruins Creek will be conducted during the dry season and creek dewatering is not anticipated. The entire project will take approximately 12 weeks and will be completed prior to October 15 of the construction year.

The wetland study area is located along Nelson Road, approximately 1.25 mile north of Lockwood Lane near Scotts Valley, Santa Cruz County as shown on Figure 1. The site is located on the Felton USGS quadrangle in the southeastern quarter of Section 12, T10S, R01W; Mt Diablo Base and Meridian. The site is reached from Nelson Road, a public street accessed from Lockwood Lane, and Mt. Hermon Road just outside the City of Scotts Valley.

The findings presented in this delineation present BRG's best effort at determining the jurisdictional boundaries using the most current regulations and regulatory agency guidance; however, the interpretation of such regulations is the responsibility of the applicable governing body. Each regulatory agency is responsible for making the final determination of their jurisdiction.

1.2. Property Information

The Nelson Road Permanent Bypass Road Project area encompasses approximately 0.51 acre. The project area is situated parallel to and across Ruins Creek. Ruins Creek is a tributary to Bean Creek, joining Zayante Creek in Felton; Zayante Creek is a tributary to the San Lorenzo River which ultimately empties into Monterey Bay/Pacific Ocean in the City of Santa Cruz. The portion of Ruins Creek at the project site is depicted as a perennial blue-line stream on the USGS topographic map; however, the creek is currently believed to be intermittent in this location. Nelson Road is parallel to the east side of the creek.

1.3. Project Description

The wetland study area is located along Nelson Road and over/along the creek bank of Ruins Creek. The study area encompasses the construction area outlined for the re-alignment and repair of the failed roadway and removal of the temporary ford across Ruins Creek. Figure 2 depicts the wetland study area superimposed onto the proposed road re-alignment/repair construction plans.

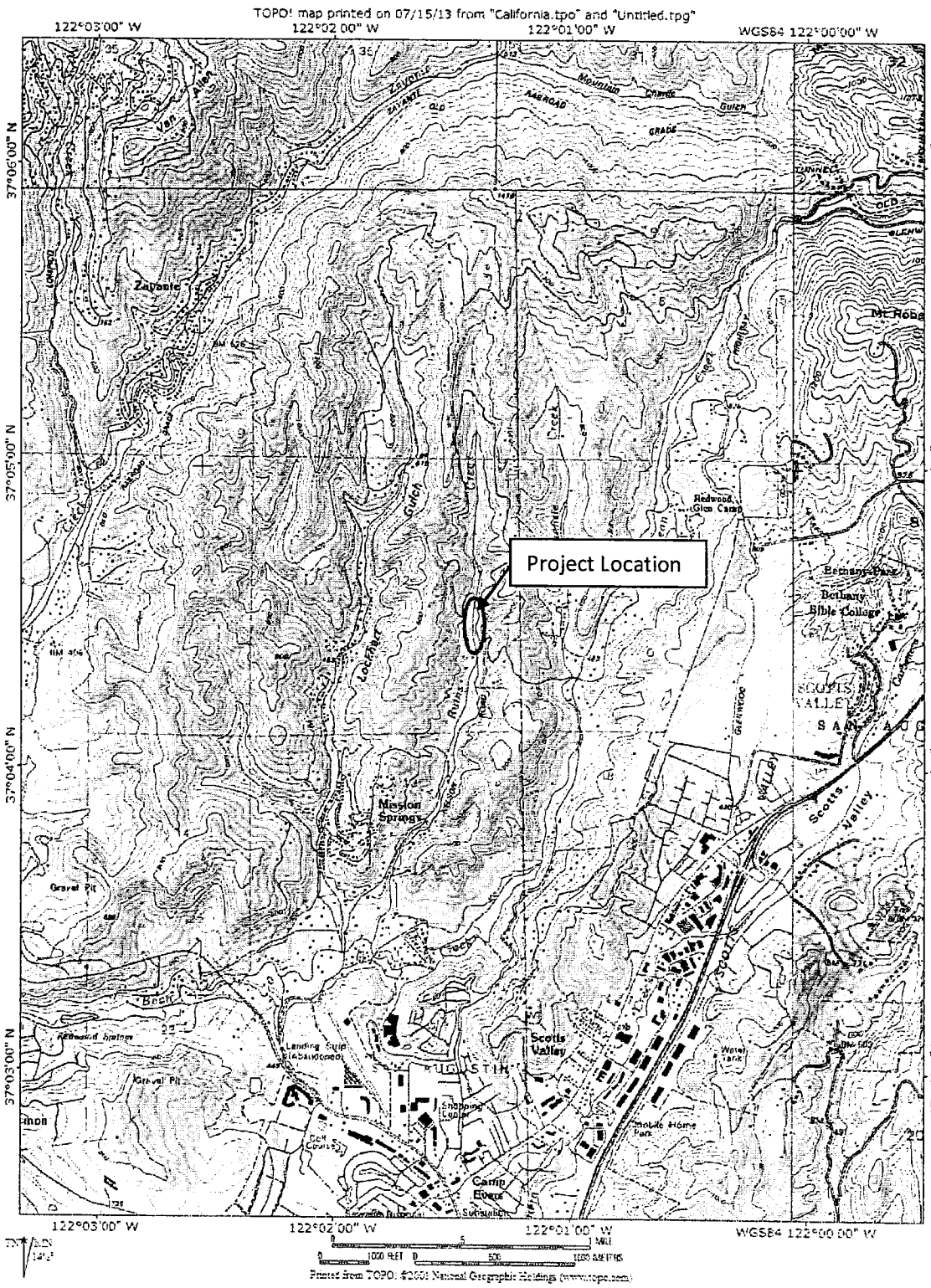
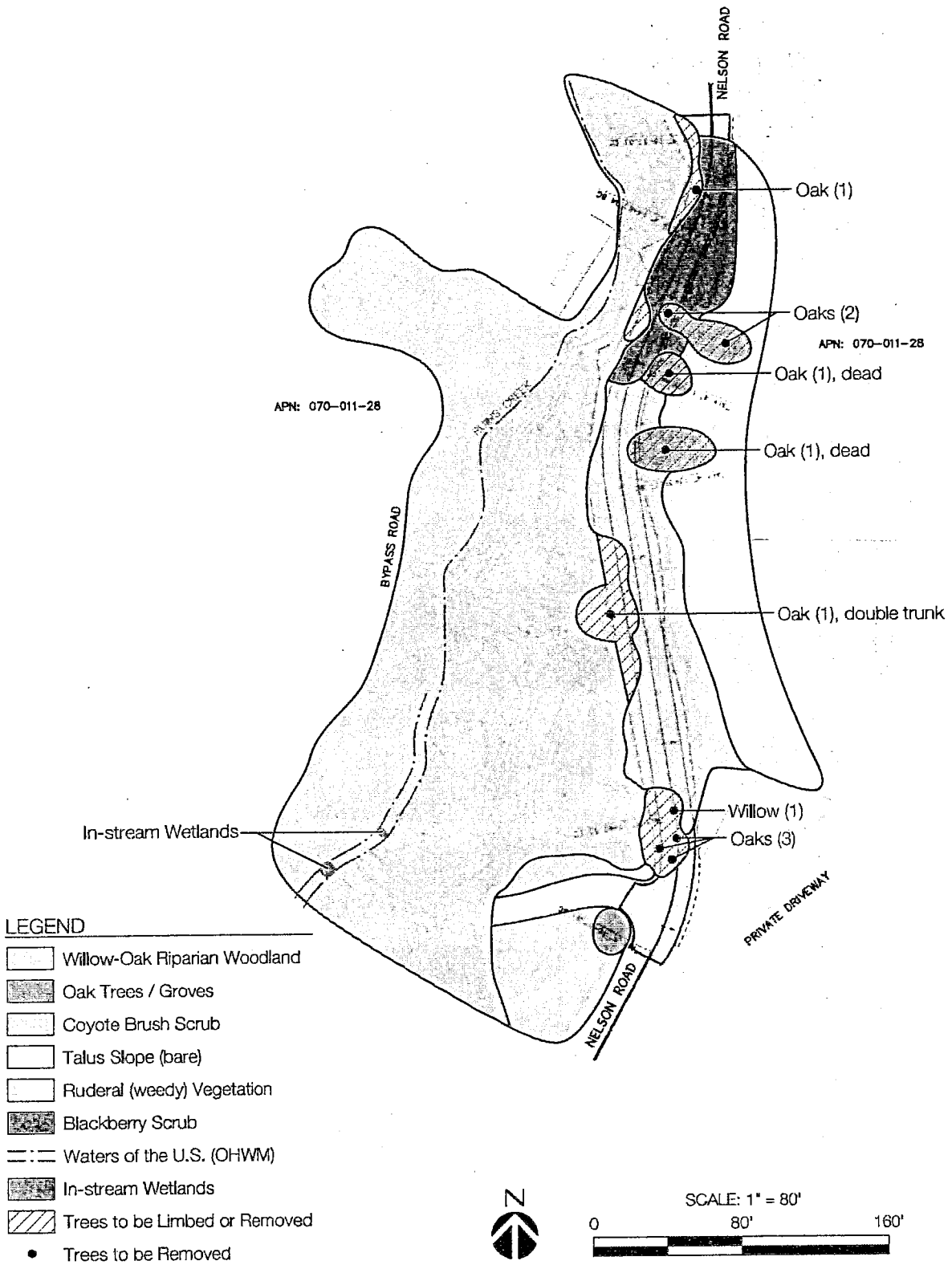


Figure 1. Proposed Project Location

(USGS Felton USGS Topographic Map)



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Nelson Road PM 2.0 - Permanent Bypass Road
Existing Vegetation

Figure 2
8/13
697-01

Chapter 2. Summary of Regulations

2.1. United States Army Corps of Engineers (USACE)

The USACE regulates activities within waters of the United States pursuant to congressional acts: Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (1977, as amended).

Section 10 of the Rivers and Harbors Act requires a permit for any work in, over, or under navigable waters of the United States. Examples of work include piers, docks, breakwaters, and dredging. Navigable waters are defined as those waters subject to the ebb and flow of the tide to the Mean High Water mark (tidal areas) or below the Ordinary High Water mark (freshwater areas). Navigable waters may be used currently, in the past, or in the future, to transport interstate or foreign commerce.

Section 404 of the Clean Water Act (CWA, 1977, as amended) requires a permit for discharge of dredged or fill material into Waters of the United States. Under Section 404, Waters of the United States is defined as all waters which are used currently, or were used in the past, or may be used in the future for interstate or foreign commerce, including waters subject to the ebb and flow of the tide up to the high tide line. Additionally, areas such as wetlands, rivers and streams (including intermittent streams and tributaries) are considered Waters of the U.S. Man-made ponds created by excavating dry land to collect and retain water for purposes of stock watering, irrigation or settling basins are typically not considered to be Waters of the U.S. (USACE Definitions, 2004).

The extent of wetlands is typically determined by examining the presence of hydrophytic vegetation, hydric soils and wetland hydrology. Under normal circumstances, all three of these parameters must be satisfied for an area to be considered a jurisdictional wetland under Section 404 of the Clean Water Act.

2.1.1. Isolated Waters (SWANCC Decision)

In 2001 the U.S. Supreme Court issued a decision on the scope of the USACE's Section 404 CWA permitting as it related to isolated waters. Known as the SWANCC decision, the Court found that the USACE does not have the authority over isolated, non-navigable, intrastate waters that are not tributary or adjacent to navigable waters or tributaries.

2.1.2. Intermittent and Ephemeral Streams and Wetlands (Rapanos Decision)

In 2006, the U.S. Supreme Court issued a decision that limits the definition of "wetlands" and waters of the U.S." under the CWA. In a 4-1-4 decision, four justices advocated for a narrower interpretation of the Clean Water Act, stating that waters of the U.S. should exclude intermittent or ephemeral streams and wetlands that have no continuous surface connection to navigable waters. In 2007, the USACE and the EPA issued guidance on this decision, stating that agencies will continue to assert jurisdiction over navigable waters and all wetlands adjacent to navigable

waters. Jurisdiction over waters, including wetlands will be made if either of the following standards are met: 1) relatively permanent (perennial or at least seasonally) non-navigable tributaries and wetlands with a continuous surface connection with such tributaries; or 2) certain adjacent and non-navigable tributaries where there is a significant nexus to navigable waters, such as chemical, physical, or biological connection.

2.1.3. Section 7 of the Endangered Species Act

The USFWS and the National Oceanic and Atmospheric Administration (NOAA) Marine Fisheries administer the federal Endangered Species Act (ESA). In general, NOAA is responsible for protection of ESA-listed marine species and anadromous fishes, while other fish and terrestrial species are under USFWS jurisdiction. A Proposed Project may permit the take of federally-listed species through a Section 7 Biological Opinion from USFWS or NOAA issued to another federal agency that funds or permits an action (e.g., USACOE). Under ESA, adverse impacts to protected species are avoided, minimized or mitigated for impacts to federally-listed species. This requires consultation with the USFWS and/or NOAA, which ultimately issues a Biological Opinion to USACE determining whether the federally listed species will be adversely impacted by a proposed project.

2.2. Regional Water Quality Control Board (RWQCB)

Water quality in California is governed by the Porter-Cologne Water Quality Control Act and certification authority under Section 401of the Clean Water Act, as administered by the Regional Water Quality Control Board (RWQCB). The Section 401 water quality certification program allows the State to ensure that activities requiring a Federal permit or license comply with State water quality standards. Water quality certification must be based on a finding that the proposed discharge will comply with water quality standards which are in the regional board's basin plans.

The Porter-Cologne Act requires any person discharging waste or proposing to discharge waste in any region that could affect the quality of the waters of the state to file a report of waste discharge. The RWQCB issues a permit or waiver that includes implementing water quality control plans that take into account the beneficial uses to be protected. Waters of the State subject to RWQCB regulation extend to the top of bank, as well as isolated water/wetland features and saline waters. Should there be no Section 404 nexus (i.e., isolated feature not subject to USACE jurisdiction) a report of waste discharge should be filed with the RWQCB. The RWQCB interprets waste to include fill placed into water bodies.

2.3. California Department of Fish and Wildlife (CDFW)

The California Department of Fish and Wildlife (CDFW) is a trustee agency that has jurisdiction under Section 1600 et seq. of the State Code. Under Sections 1600-1603 of the California Fish and Game Code, CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel or bank of any river, stream or lake which supports fish or wildlife. CDFW defines a "stream" as a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having surface or subsurface flow that supports or has supported riparian vegetation. CDFW definition of lakes includes natural lakes and man-made reservoirs. Along watercourses, CDFW jurisdictional

limits typically extend to the top of bank or to the edge of riparian habitat if such habitat extends beyond top of bank (outer drip line), whichever is greater. If an existing fish or wildlife resource may be substantially adversely affected by the activity, the CDFW may propose reasonable measures that will allow protection of those resources. If these measures are agreeable to the party, they may enter into an agreement with the CDFW identifying the approved activities and associated mitigation measures.

2.4. Activities Requiring Permits

Projects that involve impacting drainages, streams or wetlands through filling, stockpiling, channelization, bank stabilization, road or utility crossing or any other modification would require permits from the USACE (including Section 7 consultation for endangered species, if required), RWQCB, and CDFG prior to and during site construction. Both permanent and temporary impacts are regulated and would require permitting.

The USACE has two permit categories: a Nationwide Permit (NP) or Individual Permit (IP), depending upon the project description and jurisdictional impacts. The USACE permit requires the RWQCB to complete their Section 401 Water Quality Certification. This certification, as well as 1602 SAA with CDFG can occur concurrently with the USACE permit process. A ROWD is required by the RWQCB of SWANCC or Rapanos waters are present. Applications to both the RWQCB and CDFG require submittal of a valid CEQA document.

Chapter 3. Methodology

The field and reporting methodology followed the protocol specified in the 1987 USACE Manual (Environmental Laboratory, 1987) and Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region, Version 2.0 (USACE, 2010) to delineate the extent of federal waters and wetlands. Existing reference materials relevant to the proposed project were gathered and reviewed. These materials included the following:

- Topographic Map: Felton quadrangle (USGS)
- NRCS, Web Soil Survey, Santa Cruz County, California, 2013.
- Hydric Soils List; Official List of Hydric Soil Map Units for Santa Cruz County, California (SCS, 1989)
- National Wetland Plant List, California for the Western Mountains, Valley, and Coasts, (Lichvar and Minkin, 2012)
- Project Construction Plans, Santa Cruz County Public Works Department, 2013
- National Wetlands Inventory, USFWS, 2013

A field survey was conducted on July 15 and August 6, 2013. Evidence of potential jurisdictional areas were searched by viewing the study area (i.e., banks of Ruins Creek) and searching for field indicators of wetlands, such as topographic features, wetland vegetation, and wetland soil conditions. Evidence of an Ordinary High Water Mark (OHWM) was examined. Features within the creek were photographed. Information gathered is described in this delineation report.

3.1. Waters of the U.S. and State Waters

The limits of USACE's jurisdiction in non-tidal waters extend to the OHWM which is typically defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, or the presence of litter and debris. Vegetation that is bent, matted down, or absent may indicate water flow and scour. The OHWM can be recorded as a line on the project base map, as an elevation and/or as a measurement above the lowest point of the channel (thalweg). The RWQCB jurisdiction and CDFG's jurisdiction is determined by the break in slope of the creek bank and the top-of-bank or dripline of riparian vegetation, respectively. This information is obtained from field surveys and review of aerial photos and topographic maps. This information can be recorded as an elevation (top-of bank) and/or as a line on the project base map (dripline of riparian vegetation).

3.2. Wetlands

The extent of wetlands is typically determined by examining the presence of hydrophytic vegetation, hydric soils and wetland hydrology. Under normal circumstances, all three of these parameters must be satisfied for an area to be considered a jurisdictional wetland under Section

404 of the Clean Water Act as outlined in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (USACOE, May 2010). The locations where all three parameters are met are typically depicted as polygons on the project base map.

3.1.1. Vegetation

Hydrophytic vegetation is plant life that occurs in areas where the frequency and duration of inundation or soil saturation exerts a controlling influence on the plant species present. Plant species are characterized by their tendency to occur in wetlands; the five categories are listed and described below:

- OBL: almost always is a hydrophtye, rarely in uplands
- FACW: usually is a hydrophyte but occasionally found in uplands
- FAC: commonly occurs as either a hydrophyte or non-hydrophyte
- FACU: occasionally is a hydrophyte but usually occurs in uplands
- UPL: rarely is a hydrophyte, almost always in uplands.

Typically, an area is considered meet the USACE wetland vegetation criteria when the plant community passes the dominance test. In this test more than 50 percent of the dominant plant species across all strata are rated OBL, FACW or FAC. Species not listed on the wetland plant list are treated as upland species (Lichvar and Minkin, 2012). A stratum (tree, sapling/shrub, herb and woody vine) is defined as having 5% or more total plant cover. For the dominance test, cover of vegetation is estimated and ranked according to dominance. Species that contribute to a cumulative total of 50% of the total dominant coverage, plus any species that comprise at least 20% of the total dominant coverage are recorded. The "50/20 rule" also states that plant species from the ranked cover list be included, in decreasing order of coverage, until cumulative cover of selected species exceeds 50%. Therefore, in these instances, plant species providing less than 20% are included in the 50/20 rule analysis. The prevalence index is used to determine whether hydrophytic vegetation is present where indicators of hydric soil and wetland hydrology are present but the vegetation initially fails the dominance test. This test evaluates all plant species in the community and assigns weighted- numeric values to species within each indicator status categories. Hydrophytic vegetation is present if the prevalence index in 3.0 or less. This information is recorded on the Wetland Determination Data Form.

3.1.2. Hydrology

The assessment of the hydrologic criterion is based on four groups or indicators. Indicators include direct observation of surface water or groundwater, evidence of recent inundation (i.e., water marks, drift deposits, sediment deposits), and evidence of recent soil saturation (i.e., presence of oxidized rhizospheres within upper 12 inches). Other site conditions or data can also be used, such as shallow aquitards and the FAC-neutral test. This information is recorded on the Wetland Determination Data Form.

3.1.3. Soils

Hydric soils are surveyed in accordance with the USACE manuals. Soil pits are excavated to a depth of approximately 16 inches, with progressive pits dug laterally away from the channel/wetland features until hydric features are no longer present. At each soil pit, the soil texture and color are recorded and compared to a Munsell Soil Chart (1994) to designate hue, value and chroma. Indicators of hydric soil include organic accumulations, iron reduction, translocation and accumulation and sulfate reduction are recorded on the Wetland Determination Data Form. Soil survey information is also used to obtain soil information in regards to soil characteristics, drainage and color. The County Hydric Soil List is also referenced for soils considered to be hydric.

3.3. SWANCC Waters

The term "isolated waters" is generally applied to waters/wetlands that are not connected by surface water to a river, lake, ocean or other body of water. In the presence of isolated conditions, the RWQCB and CDFG have jurisdiction via the OHWM/streambed and/or the 3-parameter wetland methodology utilized by the USACE.

3.4. Rapanos Waters

Rapanos drainage features apply to non-navigable, ephemeral tributaries and their adjacent wetlands where there is a significant nexus to traditional navigable water (TNW). Factors considered in the significant nexus evaluation typically include volume, duration and frequency of flow, proximity to the TNW, size of the watershed, and average annual rainfall. Ecological factors can include the ability for tributaries to carry pollutants and flood waters to a TNW, ability to provide aquatic habitat that supports a TNW, the ability of the wetland to trap and filter pollutants, and the maintenance of water quality. Swales or erosion features (e.g., gullies, small washes) and ditches (including roadside ditches) excavated wholly in and draining only uplands and do not carry a relatively permanent flow of water are generally not considered federally jurisdictional waters. If Rapanos drainage conditions exist, the RWQCB and CDFG have jurisdiction via the OHWM and/or the 3-parameter wetland methodology utilized by the USACE.

Chapter 4. Existing Site Conditions

Seven plant community types were observed within the wetland study area: willow-oak riparian woodland (along Ruins Creek), coast live oak trees/tree groves, blackberry scrub, coyote brush scrub, ruderal (weedy) areas, bare talus (landslide deposit), and in-stream wetlands. The distribution of these vegetation types are depicted on Figure 2. Only the willow-riparian riparian woodland and in-stream wetlands pass the dominance test for wetland vegetation, having greater than 50% of the dominant plant species rated OBL, FACW, or FAC; these communities are described below. All other communities in the study area are dominated by plant species typical of upland conditions.

In-channel wetlands occur within the bed of Ruins Creek. Within the wetland study area, two small patches of in-stream wetlands were observed upstream and downstream of the existing ford. The upstream wetland patch is comprised of nutsedge (*Cyperus eragrostis)* (FACW); the downstream patch is comprised of giant horsetail (*Equisetum hyemale)* (FACW). Collectively the two patches encompass approximately 41 square feet. Figures 3 and 4 depict the character of these in-channel wetland patches, upstream and downstream of the ford, respectively, and their location relative to the Ordinary High Water Mark. The location of the wetland patches is also depicted on Figure 2.

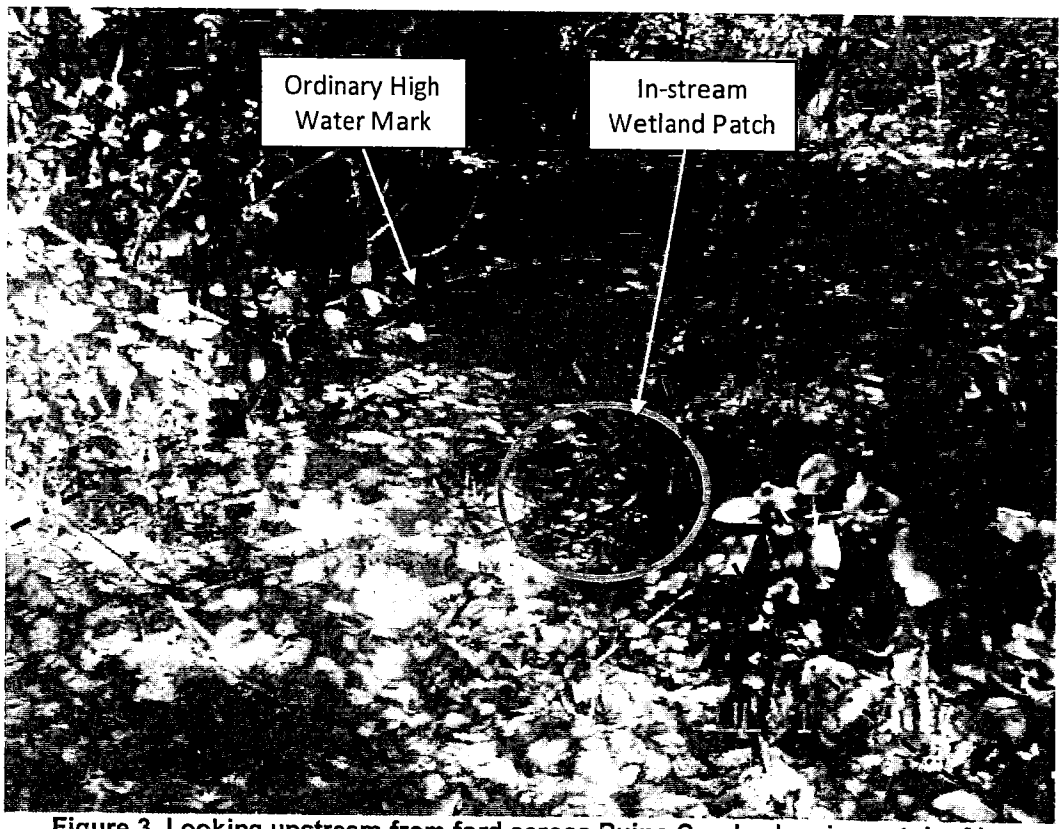


Figure 3. Looking upstream from ford across Ruins Creek, showing patch of in-channel wetlands, measuring 1 square foot, July 2013

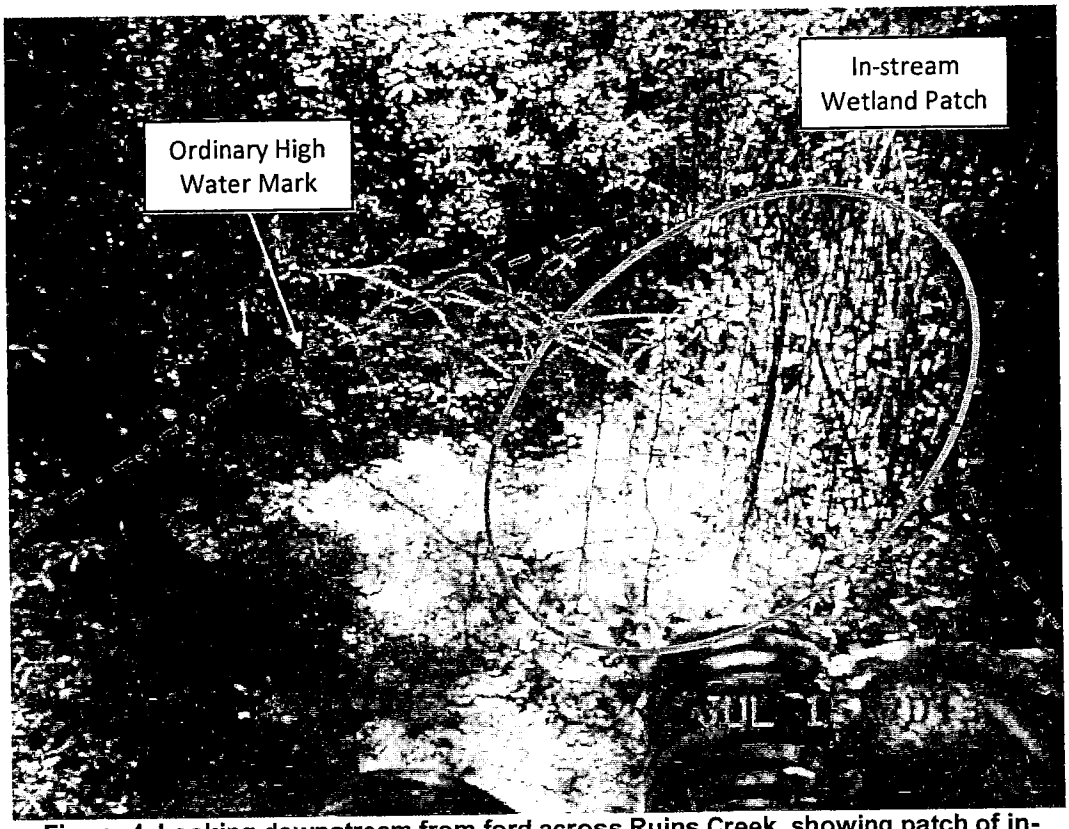


Figure 4. Looking downstream from ford across Ruins Creek, showing patch of in-channel wetlands, measuring 40 square foot, July 2013

Ruins Creek also supports riparian woodland. The woodland is characterized by trees of willow (*Salix spp.)* (FACW), creek dogwood (*Cornus sericea)* (FACW), and lesser amounts of coast live oak (*Quercus agrifolia)* (NI). The distribution of the riparian woodland is depicted on Figure 2. The riparian understory vegetation includes stinging nettle (*Urtica dioica)* (FAC), California blackberry (*Rubus ursinus)* (FACU), poison oak (*Toxicodendron diversilobum)* (NI) and oceanspray (*Holodiscus discolor)* (FACU). Figure 5 depicts the character of the riparian woodland along Ruins Creek.

Two wetland sample points were obtained within the wetland study area. Due to the presence of FACW plant species growing along within the bed of the creek channel, wetland attributes were suspected at these locations; the results of the sample points is presented in Table 1.

Figure 5. Looking downstream from ford across Ruins Creek, showing character of riparian woodland along Ruins Creek, July 2013

Table 1. Plant Community Types and Site Features Recorded, July 2013

Plant Community	Dominant Plant Species and Wetland Indicator Status	Soil Features	Hydrology Features	Meets Definition of USACE Wetlands?	Sample Point
In-stream Wetlands	*Cyperus eragrostis* (FACW) (SP#1 - upstream of culverts)) *Equisetum hyemale* (FACW) (SP#2 - downstream of culverts) *Salix lasiolepis* (FACW)	In-stream gravel and cobbles; positive hydric soils inferred due to presence below OHWM	Creek morphology; no surface water present at time of survey, yet evidence of winter season flow observed	Yes	SP#1 SP#2
Willow-Oak Riparian Woodland	*Salix spp.* (FACW) *Cornus sericea* (FACW)	Loam and clay loam; dry conditions on stream bank	None observed	No	-

4.1 Vegetation

At sample points #1 and #2, positive wetland vegetation was observed (i.e., more than 50% of the dominant plant species are FAC, FACW or OBL species). Two patches of wetland vegetation were observed, collectively measuring 41 square feet; these two sites meet the wetland vegetation criteria.

4.2 Soils

According to current County soil survey maps (NRCS Web Soil Survey, 2013) the wetland study area is mapped as Soquel loam, 2-9 percent slopes (171). The slide area/talus material is mapped as Aptos – Nisene complex, 50-75% slopes (158). The web soil survey map for the project area is presented in Attachment A.

The typical pedon of the Soquel loam is loam to 37 inches. Within the upper 16 inches, the loam is dark grey brown (10YR 3/1). The soil is formed in alluvium and mapping of this soil type includes small narrow valleys that are subject to intermittent flooding.

Field observations conform to the survey mapping. The creek banks support loam to clay loams; the bed of Ruins Creek supports gravels and cobbles. Positive hydric soil conditions were inferred to be present in the creek bed.

4.3 Hydrology

The wetland study area is located along a perennial-to-intermittent waterway; Ruins Creek is a tributary to Bean Creek, which empties into Zayante Creek, a tributary to the San Lorenzo River that enters Monterey Bay/Pacific Ocean within the City of Santa Cruz. No surface water was observed in Ruins Creek at the time of the July 2013 field survey, although evidence of winter season flow was observed. Debris was deposited in vegetation along the creek edge and at the culvert entrances and a defined scour line was evident.

4.3.1 Ordinary High Water Mark

Field evidence of an OHWM was observed. Water marks, exposed roots, and other vegetation patterns, such as a scour line, were observed to indicate the elevation of the OHWM.

The OHWM was found to correspond to approximately 1.0 foot above the thalweg (i.e., lowest point within channel bed. The approximate location of the OHWM is depicted in Figures 2, 3, and 4.

Chapter 5. Delineation Findings

5.1 U.S. Army Corps of Engineers Determination

5.1.1 Waters of the U.S. (Non-Wetland)

The wetland study area supports a creek channel. The unvegetated areas within the limits of the OHWM would be considered waters of the U.S.

The proposed project will have no fill within the limits of OHWM. Construction will entail removal of the existing ford across the creek, removal of riprap, and the two culverts. The native creek bed materials will be retained on-site.

5.1.2 Wetlands

The wetland study area supports two small patches of in-channel wetlands. The wetlands occur within the bed of Ruins Creek, encompassing approximately 41 square feet. These areas meet the definition of wetlands.

The in-channel wetlands will not be affected by the removal of the roadway, riprap or culverts as the vegetation is location upstream and downstream of the work area.

5.2 Regional Water Quality Control Board Determination

The wetland study area includes areas below the top of bank of Ruins Creek. All areas below top of bank, including the wetlands and open water features within the channel meet the definition of waters of the State subject to RWQCB jurisdiction.

To protect riparian resources and waters of the State, the project includes erosion control measures during and following construction. Revegetation of riparian vegetation at the road removal area along Ruins Creek is also included in the project.

5.3 California Department of Fish and Wildlife Determination

The wetland study area includes areas within the top of bank of Ruins Creek. All areas below top of bank, including the wetlands and open water features within the channel, as well as riparian woodland that may extend beyond top-of-bank, meet the definition of waters of the State subject to CDFW jurisdiction.

To protect riparian resources and waters of the State, the project includes erosion control measures during and following construction. Revegetation of riparian vegetation at the road removal area along Ruins Creek is also included in the project.

Chapter 6. References

Baldwin, B., D. Goldman, D. Keil, R Patterson, T Rosatti and D. Wilken, editors. 2012. The Jepson Manual: Vascular Plants of California. 2nd edition. University of California Press. Berkeley

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. La Roe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS 79-31. Washington: United States Fish & Wildlife Service Office of Biological Services.

Department of Defense, Department of the Army, Corps of Engineers and Environmental Protection Agency. 1993. 33 CFR Parts 323 and 328 and 40 CFR Part 110, et al. Clean Water Act Regulatory Programs; Final Rule, August 25, 1993. Federal Register 58 (163): 45008-45038.

Environmental Laboratory. 1987. Army Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. 100 pp. with Appendixes.

Environmental Laboratory. 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region, Version 2.0. U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Kollmorgan Instruments Corporation. 1975. Munsell Soil Color Chart, revised edition (1990). Macbeth Division of Kollmorgan Instruments Corporation, Baltimore, Maryland.

Lichvar, Robert and John T. Kartesz. 2012. National Wetland Plant List for California (Arid West and Western Mountains, Valleys, and Coasts) https://wetland_plants.usace.army.mil). U.S. Army Corps of Engineers, Engineer Research and Development Center.

National Technical Committee for Hydric Soils [NTCHS]. 1991. Hydric Soils of the United States, USDA, Soil Conservation Service Misc. Publ. 1491.

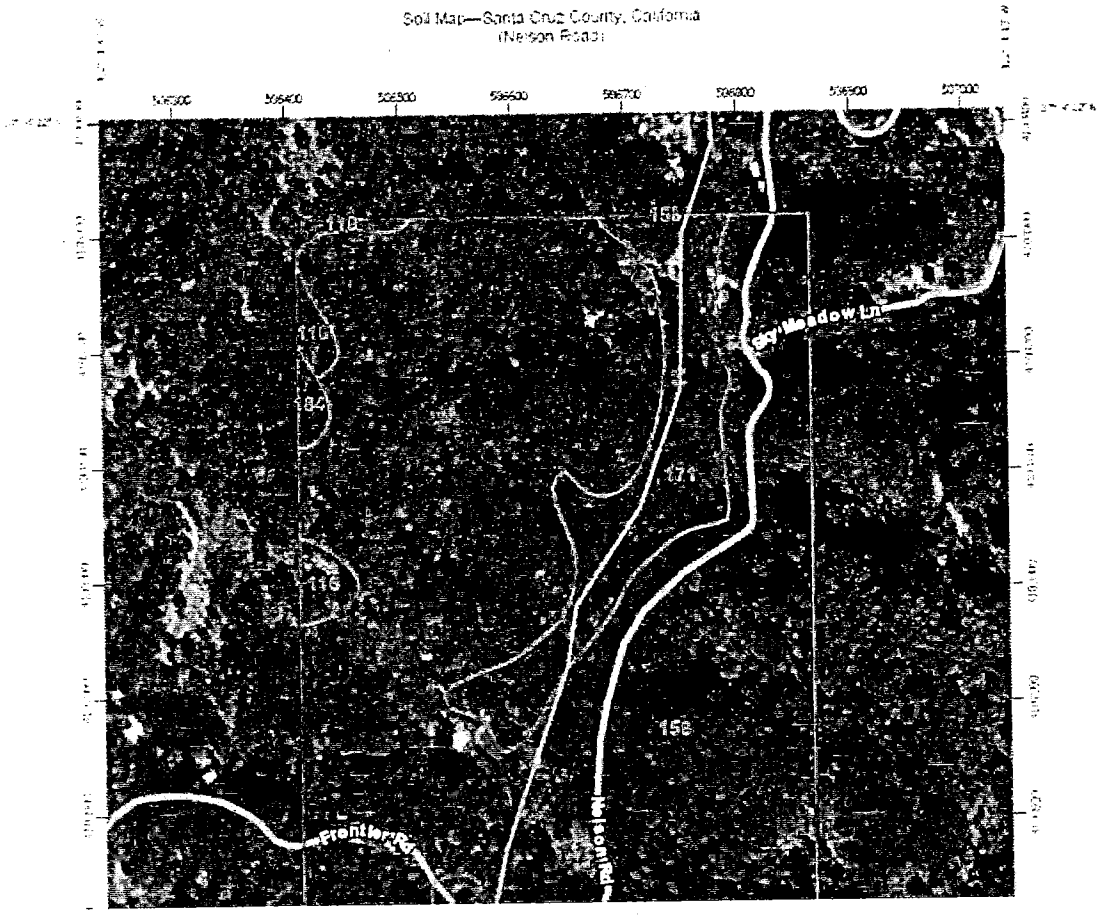
Soil Conservation Service. 1989. Field Office Official List of Hydric Soil Map Units for Santa Cruz County, California.

USDA/NRCS. 2013. Web Soil Survey for Santa Cruz County.

USFWS, 2012. Wetlands Mapper, National Wetlands Inventory.

USGS. 1980. Felton, California 7-1/2 minute topographic quadrangle.

Attachment A - Web Soil Survey Map



171	Soquel loam, 2 to 9 percent slopes

Soil Types in Project Area