

# **INFORMATION HANDOUT**

**For Contract No. 03-1F2604**

**03-SIE-89-0.6/1.8**

**IN SIERRA COUNTY**

**NEAR SIERRAVILLE**

**FROM 0.8 MILE NORTH OF NEVADA COUNTY LINE**

**TO 1.4 MILES NORTH OF NEVADA COUNTY LINE**

**Identified by**

**Project ID 0312000004**

## **ADDITIONAL INFORMATION**

**NATINA ESTIMATE FOR STEEL**

## **GEOTECHNICAL INFORMATION**

**DISTRICT PRELIMINARY GEOTECHNICAL REPORT, JUNE 20, 2013**

**For Contract No. 03-1F2604**

**03-SIE-89-0.6/1.8**

**IN SIERRA COUNTY**

**NEAR SIERRAVILLE**

**FROM 0.8 MILE NORTH OF NEVADA COUTNY LINE**

**TO 1.4 MILES NORTH OF NEVADA COUNTY LINE**

**Identified by**

**Project ID 0312000004**

**ADDITIONAL INFORMATION**

**NATINA ESTIMATE FOR STEEL**

# NATINA

License #983993

Page No. 1 of 1

P.O. Box 4563  
 Palm Desert, CA 92261  
 (877) 762-8462

## ESTIMATE

PROPOSAL SUBMITTED TO <b>Caltrans</b> <b>Attn: Lesley Morgan</b>		TODAY'S DATE 7/21/15	LOCATION Sierra County Route 89
PHONE NUMBER <b>(530)741-5297</b>	FAX NUMBER	CONTRACT NUMBER 03-1F260	
ADDRESS, CITY, STATE, ZIP <b>703 B Street</b> <b>Marysville, CA 95901</b>		CLIENT Caltrans - Marysville, CA	

We propose hereby to furnish Natina staining material and labor necessary for the completion of:

Material	Apply Natina Steel stain to:	Unit Price	Total
	14,150 LF of Fence Type WM (8'tall) with Metal Posts	\$1.60/LF	\$22,640.25
	Shipping from our Casa Grande, AZ facility back to the jobsite	\$2,250/truck	\$10,250.00
<b>TOTAL:</b>			<b>33,890.25</b>

**PLEASE NOTE:** This quote expires one year from the date above and includes all labor, material, taxes, and delivery of stained items to the jobsite. **Items to receive color treatment must be shipped to our facility located at 1555 North V.I.P. Blvd., Casa Grande, AZ 85122.** Staining of posts and hardware for the above items are included in the above pricing. Material cost is \$149.95/gallon and approximately 1,000 gallons will be used.

**Proposal Includes:** Staining of above items. Material needed for any touch-ups required to fix any scratches caused during transportation and/or installation. Touch-ups are done by applying Natina Steel to the scratched areas with a sponge and are fairly simple. Shipping from our facility to the jobsite.

**Proposal Excludes:** We only do the staining and do not supply the items to be stained. Touch-ups needed to repair any of the color/finish harmed during transportation or installation. Shipping to our facility in Casa Grande, AZ.

We propose hereby to furnish material and labor - complete in accordance with above specifications for the sum of:  
 Thirty-three thousand eight hundred ninety and 25/100 dollars ( \$33,890.25 )

Payment as follows: Due when application is completed

All material is guaranteed to be as specified. All work to be completed in a substantial workmanlike manner according to specifications submitted, per standard practices. Any alteration or deviation from above specifications involving extra costs will be executed only upon written orders, and will become an extra charge over and above the estimate. All agreements contingent upon strikes, accidents or delays beyond our control. Owner to carry fire, tornado and other necessary insurance. Our workers are fully covered by Workmen's Compensation Insurance. If either party commences legal action to enforce its rights pursuant to this agreement, the prevailing party in said legal action shall be entitled to recover its reasonable attorney's fees and costs of litigation relating to said legal action, as determined by a court of competent jurisdiction.

Authorized Signature  Brian Hardin

Note: this proposal may be withdrawn by us if not accepted within 360 days.

**ACCEPTANCE OF PROPOSAL** The above prices, specifications and conditions are satisfactory and are hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Signature \_\_\_\_\_

Signature \_\_\_\_\_

Date of Acceptance \_\_\_\_\_

**For Contract No. 03-1F2604**

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**GEOTECHNICAL INFORMATION**

**DISTRICT PRELIMINARY GEOTECHNICAL  
REPORT, JUNE 20, 2013**

## Memorandum

*Flex your power!  
Be energy efficient!*

To: TAREK TABSHOURI  
NR-Division of Engineering, District 3

Date: June 20, 2013

Attention: Jonathan Wing

File: 03-SIE-89-PM 0.8 & 1.45  
03-1F260, 0312000004  
Wildlife Under Crossings

From: **DEPARTMENT OF TRANSPORTATION  
DIVISION OF ENGINEERING SERVICES  
GEOTECHNICAL SERVICES – MS 5**

Subject: District Preliminary Geotechnical Report

### INTRODUCTION

As requested, the Office of Geotechnical Design North (OGDN) is providing this District Preliminary Geotechnical Report (DPGR) for the design and construction of the proposed two deer crossing and wildlife barriers beneath the pavement on Route 89 between post miles 0.8 and 1.25 in Sierra County (See Plate 1).

### Project Description

The project consists of constructing two deer crossing under route 89 at the base of a road fill slope at PM's 0.8 and 1.45. These structures will allow wildlife to get across the highway without posing a threat both to the motorist and the wildlife. These structures will be a precast box culvert and a cast-in-place steel arch culvert respectively. This project will involve trenching of existing fill slopes, placing culverts, backfilling the trenches to existing fill slopes ratios, and replacing pavement to match the existing one.

The purpose of this report is to provide preliminary geotechnical recommendations for the design and construction of the proposed project work. The conclusions and opinions in this DGPR are intended to assist in the design process and are based solely on field reconnaissance and a review of published data. No subsurface exploration, laboratory testing, or other analyses were performed for this report. At the time of this report only two satellite images and two crude cross sections of the embankments where each structure will be located were available from District 3. These sections are more conceptual in nature as they are not based on current surveys or existing topographic

mapping, and may not accurately represent the existing site conditions; therefore, actual conditions encountered may vary from the information provided by the District.

This report included performing a literature review in an effort to obtain geological and geotechnical data pertaining to the subject site that could provide insight into the design and construction of the proposed wildlife under crossings.

### **Existing Facilities and Proposed Improvements**

The project site is located in a hilly, tree-studded terrain within the Tahoe National Forest. The project area is generally rural and sparsely inhabited; the only residence within the project limits is located 250 feet east of the wildlife crossing at PM 1.45.

According to the web-based Caltrans Post-mile Query Tool (Reference No. 5), the PM 0.8 and 1.45 wildlife under crossing locations are located at latitude and longitude coordinates of 39.453876° North and -120.22186° West, and 39.461437° North and -120.226977° West respectively; these coordinates are the basis for obtaining data in this report available through GIS related information sources. Within the project limits, State Route 89 is a two-lane highway paved with asphalt concrete (AC). The roadway has two 12-foot wide traveled ways with variable 2 to 4 foot wide paved shoulders

While performing our site visit, we did not observe any indication of underground utilities within the project limits by ground surface posting, or other features.

### **Man-Made and Natural Features of Engineering and Construction Significance**

Based on the preliminary cross sections provided by the District and our observations during our site visit, the subject sites are built entirely of fill with a maximum height of 20 feet and slopes ratios of 1.5:1(H:V) on both sides of the road. Two existing 48-inch, corrugated metal pipes (CMP) culverts are located at the bottom of each fill where the wildlife under crossing will be constructed. These culverts drain water from runoff streams coming from the west side of the hill; however, the CMP at PM 1.45 drains a perennial or permanent stream.

The existing road between the two wildlife under crossings was built entirely by cutting into decomposed rock of andesitic composition utilizing cut slope angles that vary from 20° to 26°, and extend to a maximum height of 25 feet. The cut slopes are denudated of vegetation with hard boulders protruding from the slope. The cut slopes appear to be performing well.

The slopes below roadway at the subject sites appear to be performing well, and are vegetated with mature and young pines.

### **Physical Setting**

The physical setting of the project site and the surrounding area was reviewed to provide climate, topography and drainage, geology and seismicity characteristics to aid in the project design and construction. The following is a discussion of our review:

#### Climate

The project area and its surrounding have an abundant sunshine in summer and frequent cloudiness in winter; moderate to heavy precipitation, generally in the form of snowfall; and a wide range of temperature. Temperature readings can reach down to subzero level and highs in the upper 80's during the summer.

According to the National Weather Service (Reference No. 7), the average annual precipitation at Boca Station (040931) is 125.36 inches from which 103.1 inches are snowfall, based on record from 7/1/1948 to 12/31/2005. Over 80 percent of the precipitation falls between November and March. The highest average daily temperature is 83.5°F during the month of July and the lowest average daily temperature of 9.8°F during the month of January. A moderately hot and dry season extends from June through September. Most of the snowfall occurs during the months of December and January. The climate historical data indicates that significant periods of daily temperature above 50°F, required for paving operations, are not likely from December through March. Work efforts can be hampered by the low temperatures during the months of December and January.

**Table 2: Average Monthly Climate Summary, Boca Station, California  
 Period of Record: 7/1/1948 to 12/31/2005**

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave. Max. Temp °F	40.9	44.7	49.0	56.7	65.3	74.3	83.5	82.5	76.2	66.0	51.7	42.6	61.1
Ave. Min. Temp °F	9.8	12.6	18.1	23.5	29.8	34.3	34.3	35.6	30.2	24.3	19.6	12.9	24.0
Ave. Total Precipitation (in.)	3.96	3.09	2.78	1.29	1.15	0.72	0.48	0.51	0.67	1.28	2.57	3.85	22.35
Average Total Snow Fall (in.)	23.9	19.3	19.1	7.0	1.8	0.1	0.0	0.0	0.1	1.2	8.0	22.7	103.5
Average Snow Depth (in.)	11	12	7	1	0	0	0	0	0	0	1	5	3

Source: Western Regional Climate Center, "<http://www.wrcc.dri.edu>"

### Topography and Drainage

The project is located in the southeastern section of Sierra County bordering with Nevada County. In general, the area is made up of relatively steep mountains dissected by narrow and deep valleys carved by streams that flow eastward. The project area and its surroundings are drained by the Little Truckee River which flows southward. The area is sparsely forested land.

The project site is located in moderately steep north-south hillside facing to the east a wide and relatively flat valley carved by the Little Truckee River. This hill is approximately 700 feet high, with a toe elevation of 6100 feet above the sea level and top elevation of 6800 feet approximately. The hill is steep for the first 400 feet and crowned by a relative softly inclined summit (See Plate No. 2).

### Soil Survey Mapping

According to the National Resource Conservation Soil Survey, U. S. Department of Agriculture, Website, <Http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> (Reference No. 7), the project site is underlain by a variety of soil types. The United States Department of Agriculture (USDA) maps the following soils within the project limits (See Plate No. 3):

*Aquolls and Borolls, 0 to 5 percent slopes (AQB).* The *Aquolls and Borolls* association soils consist of very poorly drained and found in marshes, toeslopes and flat areas. The landform of this material is swales.

*Fugawee-Rock outcrop-Tahoma Complex, 30 to 50 percent slopes (FRF).* These soils are well drained with moderately low to moderately high permeability. This soil is generally located on the shoulders or flanks of the mountains. The parent material of these soils is residuum weathered from volcanic rock.

*Fugawee-Tahoma Complex, 2 to 30 percent slopes (FTE).* These soils are well drained with moderately high permeability. Bedrock is found 41 to 45 inches below the soil. The location of this soil association is on the back slopes and upper third of mountain flanks.

*Fugawee-Tahoma Complex, 30 to 50 percent slopes (FTF).* These soils are underlain the two wildlife under crossings and are described as well drained with moderately high permeability. Bedrock is found 41 to 45 inches below the soil. The location of this soil association is on the back slopes and upper third of mountain flanks.

*Sierra-Trojan-Kyburz Complex, 2 to 30 percent slopes (SIE).* These soils are well drained with moderately high permeability. Bedrock is found 67 to 71 inches below the soil. The location of this soil association is on the back slopes and upper third of mountain flanks.

### Regional Geology

The project site is located within the Sierra Nevada geomorphic province of California. The Sierra Nevada stretches for about 375 miles along much of the California's eastern border and its width ranges from 40 to 80 miles. It trends from south-southeast to north-northwest. The mountain range was formed by the uplift and tilting that has taken place in the past 5 million years. However, the majority of rocks that formed the Sierra Nevada are much older, roughly 120 to 130 million years. These rocks are best described as plutonic rocks or igneous rocks and constitute the Sierra Batholith. Most of the rocks in the batholith are granitic in their composition. The most common granitic rocks of the Sierra Nevada are classified as granite, granodiorite, or tonalite; granodiorite is the most abundant. Other plutonic rocks such as diorite are much less abundant than granitic rocks.

### Site Geologic Conditions

According to the Geologic Map of California, Chico Quadrangle (1992) (Reference No. 1), the rocks that underlay the project site are Miocene-Pliocene rocks consisting of Andesitic rocks, and andesitic pyroclastic rocks. Outcrops exposed along the existing cut slopes compare favorably with those described above. (See figure 4 and 5 Geologic Map, and Geologic Map Legend).

### Project Site Seismicity

According to the report accompanying the Caltrans Deterministic PGA Map (Reference No. 3), Caltrans defines a fault as “active” if the fault known to have ruptured within the past 700,000 years (late-Quaternary to present). The Caltrans ARS Online (v.2.2.06) spectrum tool at [http://dap3.dot.ca.gov/ARS\\_Online/index.php](http://dap3.dot.ca.gov/ARS_Online/index.php) indicates that the closest “active” faults to the site is the Polaris 2011 CFM fault (Fault ID: 69). This web-based tool indicates the closest distance to the Polaris 2011 CFM fault trace (or surface projection of the top of rupture plane) is approximately 0.1 miles west of the project site (see Plate No. 6). Additionally, this fault is identified to be a “strike-slip” fault type which dip vertically and is capable of generating a Maximum Moment Magnitude (MMax) of 6.7.

In accordance with the Caltrans Geotechnical Services Design Manual (Reference No. 4), the average small strain shear velocity for the top 100 feet at the site ( $V_{S30}$ ) is estimated to be about 2500 feet per second. Utilizing the estimated  $V_{S30}$ , and the ARS Online (v.2.2.06) response spectrum web-based tools which includes the near fault adjustment factor for sites less than 15 miles, a Peak Ground Acceleration (PGA) of 0.54g was generated based on the nearest active fault as mentioned above.

### Surface Fault Rupture

The project site does not lie within the Polaris 2011 CFM fault zone and no splay from same fault crosses the study area. Furthermore, the fault is considered non-active. Therefore, the potential for surface fault rupture or ground displacement at the site to adversely affect the proposed structures is very low.

### Naturally Occurring Asbestos (NOA)

The Caltrans Map “Areas Likely to Contain Naturally Occurring Asbestos – District 3” (Reference No. 2) states:

*Natural occurrences of asbestos are more likely to be encountered in, and immediately adjacent to, areas of ultramafic rocks including landslide deposits or soils originating from ultramafic rock sources.*

The referenced Caltrans map does not depict an area likely to contain Naturally Occurring Asbestos (NOA) within or immediately adjacent to, the project limits. Based on the geologic conditions observed during site visits and on the Caltrans maps mentioned above, the potential for the presence of ultramafic rocks within the project limits is considered very low.

### **Preliminary Geotechnical Conditions**

#### Water

##### Surface water

One perennial creek and one intermittent creek, tributaries of the Little Truckee River, cross under the project interval through the culverts previously mentioned in section Man-Made and Natural Features of Engineering and Construction Significance. The general direction of both creeks is west to east. The creek that crosses the roadway at PM 1.45 (see Photograph No. 1 at the end of this report) originates at a spring located outside of the project and is considered perennial.

#### Erosion

Evidence of erosion was observed during our visit to the site mainly on the cut slopes above the roadway formed by decomposed andesite. Effects of erosion in this material are shown in partial removal of the decomposed material exposing large boulders and cobbles and bedrock.

The fill slopes where the wildlife undercrossing will be constructed present no signs of erosion since they were vegetated immediately after their construction.

#### Ground Water

During the field visits to the project site, slopes in the vicinity of the cut slope appeared absent of seeps and springs. Based on our field observations and for construction purpose, the elevation of the static ground water table within the project limits may be regarded as similar or slightly higher to that of the surface water of the Little Truckee River. Therefore, ground water may not be encountered during the construction of the

structures. Therefore, ground water may not interfere with the construction of the wildlife under crossings.

#### Naturally Occurring Asbestos (NOA)

As discussed in the "Physical Setting" section of this report, OGDN concludes that the project site has a very low potential for the presence of ultramafic rocks and NOA. In consideration for the potential presence of NOA materials, the North Region Hazardous Material Officer should be contacted to determine if the project has the need for Airborne Toxic Control Measures (ATCMs) during project construction.

#### **Preliminary Geotechnical Recommendations**

Based on our visual inspection of the soil and rock conditions on the surface of the existing slope, the fill at both locations appears to contain silty sand mixed with cobbles and boulders. The existing fill material is estimated to consist of the following geotechnical engineering properties: unit weight ( $\gamma$ ) of 125 lbs/ft<sup>3</sup>, cohesion ( $c$ ) of 250 lbs/ft<sup>2</sup>, and internal friction angle ( $\phi^\circ$ ) of 33°. The boulders on the surface of the existing slope are flat and elongated with an average length and width of 4 feet and average thickness of 1 foot. These boulders and cobbles are generally volcanic (mostly andesite) and are considered to be very hard (See Photograph No. 2 at the end of this report).

#### Rippability and Grading Factor

Based on our field observations our Office anticipates that rippable soils and large boulders may be encountered in the existing fill where the wildlife under crossings will be constructed. Oversize boulders may be encountered during the excavation for the structures. These oversize boulders might require boulder size reduction methods using conventional equipment. The soil can be excavated with conventional excavation equipment and may have an estimated grading factor of 0.90 approximately.

Due to the variability of the existing fill material and the numerous variable factors that determine the actual earthwork balance, the factors given here should be considered as estimates. Grading factors for averaged and oversize boulders assume that the boulders will be broken by mechanical means into pieces small enough for scrapers to move. Under typical conditions, a smaller maximum boulder piece when broken into small pieces for removal will result in a larger empirical grading factor. It is estimated that boulders may have a grading factor of 1.2 approximately.

**Future Investigations**

The above-mentioned recommendations are intended for preliminary design and estimating purposes only. In order to more accurately characterize bedrock and determine groundwater levels within the limits of the project we recommended a subsurface investigation. A subsurface investigation may consist of a geotechnical field investigation, sampling and laboratory testing to support our final recommendations. Our Office recommends drilling an exploratory boring on each location of the wildlife under crossings to provide information for the final foundation recommendations. A total of 2 exploratory borings with an estimated depth of 30 feet is recommended for the geotechnical field investigation.

**Estimated Geotechnical Services Time and Duration Required**

A request for a Foundation Report should include a General Plan (GP), Foundation Plan (FP), and any additional plans available for the proposed wildlife structures. Sufficient time is required for scheduling for utility clearances, road, or lane closures, site access and site hazardous assessments reports. If a site hazardous assessment report for soil and groundwater contamination is available, it should be communicated to our Office prior to starting the subsurface investigation.

The table below presents the resource estimate for the time to complete the work for the proposed wildlife under crossings.

**Table 4: Resource Estimate for the Proposed Wildlife Under Crossings.**

Office Name	Unit #	Hours						Totals
		100	160	230	270	285	290	
Drafting Services	296	-	-	40	-	-	-	40
Geotech Support	316	-	-	-	-	-	-	-
Drilling Services	322	-	-	200	-	-	-	200
GDN	323	30	120	300	40	-	-	490
<b>Totals</b>		30	120	540	40			730

TAREK TABSHOURI  
June 20, 2013  
Project ID:0312000004 (03-1F260)

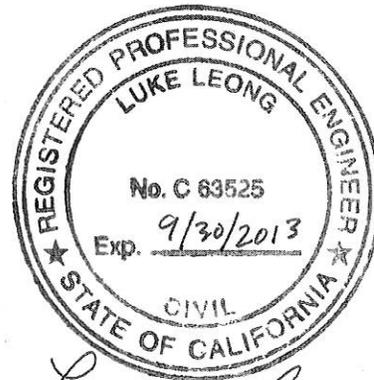
Dist. Prelim. Geotechnical Report  
Wildlife Under Crossings  
02-SIE-89-PM 0.8 & 1.4  
Page 10

Our Office estimates that a total of 730 hours, including construction support, will be needed in order to complete the Final Foundation Recommendations.

If you have any questions or comments, please call Luis Paredes-Mejia at (916) 227-1047, or Luke Leong at (916) 227-1081 or Reza Mahallati at (916) 227-1033.



LUIS M. PAREDES-MEJIA, CEG  
Engineering Geologist  
Office of Geotechnical Design North  
Branch C



LUKE LEONG, PE  
Transportation Engineer  
Office of Geotechnical Design North  
Branch C

C: Reza Mahallati  
GS Corporate  
GDN File  
RE Pending File  
GS File

## ATTACHMENTS

### REFERENCES

- Plate No. 1. Vicinity Map
- Plate No. 2. Topography of Project Area
- Plate No. 3. Soils Map
- Plate No. 4. Geologic Map
- Plate No. 5. Geologic Map Legend
- Plate No. 6. Fault Map

### REFERENCES

1. CDMG (1992), Saucedo, G.J., and Wagner, D. L., "Geologic Map of California, Chico Sheet, - Scale 1: 250,000 (1962)", published by California Division of Mines and Geology, 1992.
2. Caltrans (2005) "Areas Likely to contain Naturally Occurring Asbestos – Caltrans District 3", mapping prepared by the Division of Maintenance GIS in coordination with the Division of Environmental Analysis, 2005 at:  
<http://onramp.dot.ca.gov/hq/maint/roadway/gis/noa.shtml>
3. Caltrans (2009) "Development of the Caltrans Deterministic PGA Map and Caltrans ARS Online", prepared by Tom Shantz, Caltrans Division of Research and Innovation, and Martha Merriam, Caltrans Geotechnical Services, July 2009.
4. Caltrans (2009) "Geotechnical Services Design Manual", prepared by the Caltrans Division of Engineering Services, Geotechnical Services, Version 1.0, August 2009.
5. Caltrans (2012) "Postmile Query Tool", based on Google Maps, provided by the Caltrans GIS Services Branch at:  
<http://svhqgisapp1.dot.ca.gov/postmilewebclient/PostmileQueryTool.html>
6. National Resource Conservation Soil Survey, U. S. Department of Agriculture (2012), "Web Soil Survey", at: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>
7. Western Regional Climate Center (2012) "Climate Summaries, Western U.S. Climate Summaries – NOAA coop stations", at:  
<http://www.wrcc.dri.edu/summary/Climsmsca.html>

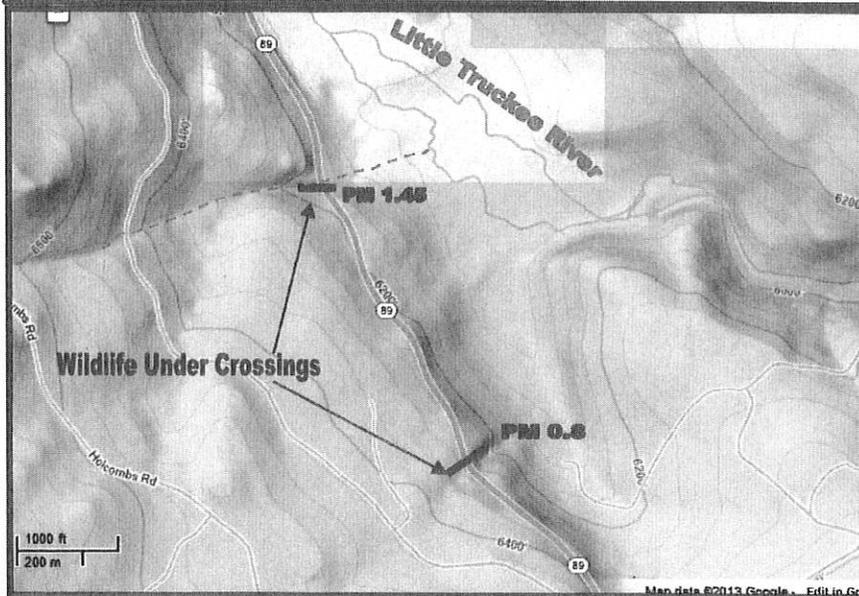
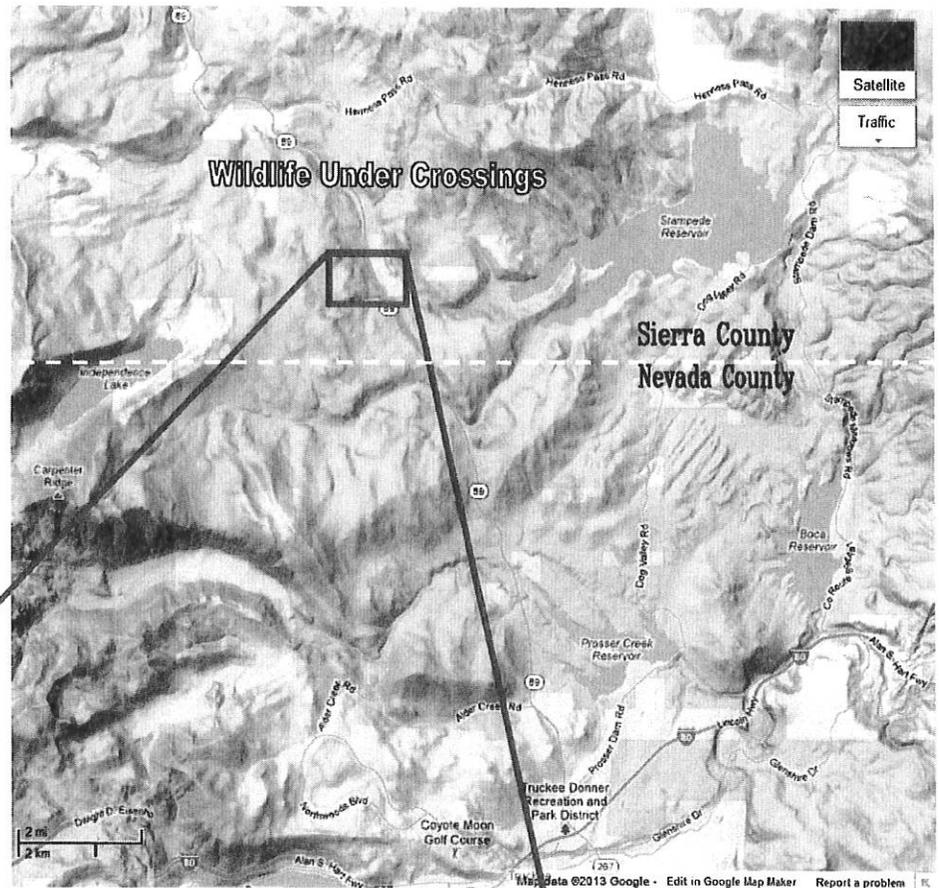
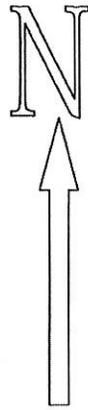
## PHOTOS



Photo 1.- Perennial creek flowing out of culvert at PM 1.45



Photo 2.- Slope fill boulders at PM 0.85



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 Geotechnical Design – North

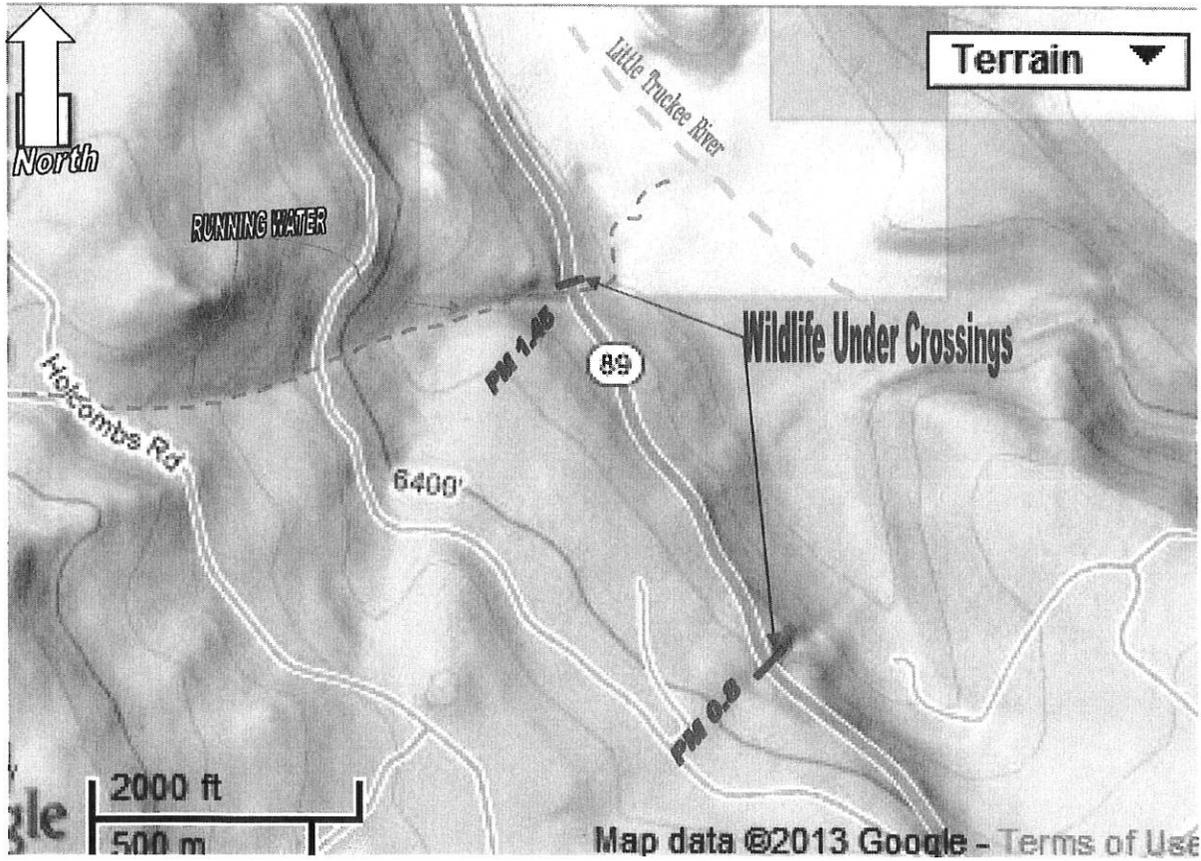
EA: 03-1F260

Date: June 2013

**VICINITY MAP**

03-SIE-89-PM 0.8/1.45  
 WILDLIFE UNDER CROSSINGS

Plate No.  
 1



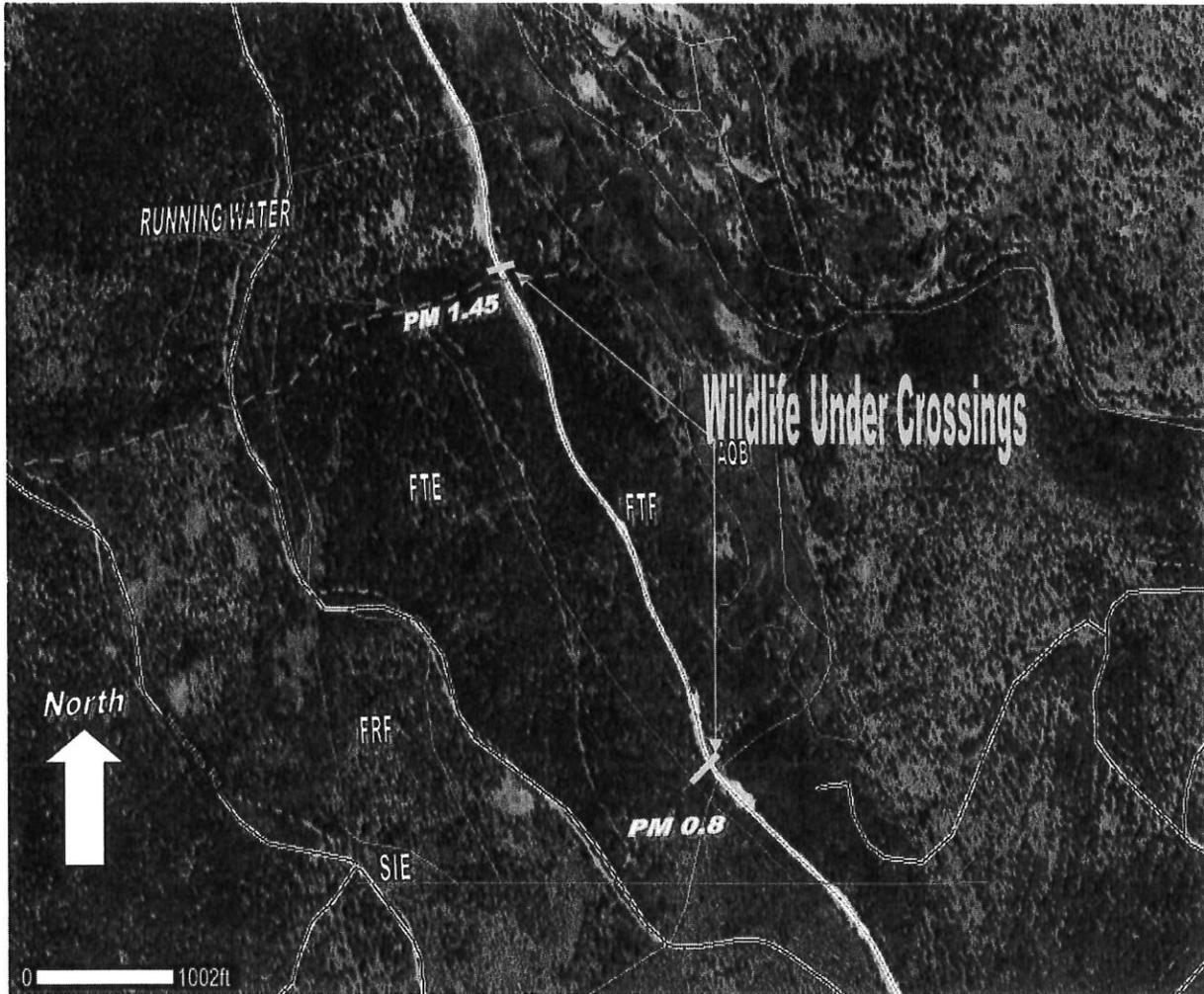
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 Geotechnical Design – North

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 Date: June 2013

**Topography of  
 Project Area**

03-SIE-89-PM 0.8 AND 1.45  
 WILDLIFE UNDER CROSSINGS

Plate No.  
 2



- AQB Aquolls and Borolls, 0 to 5 percent slopes
- FRF Fugawee-Rock outcrop-Tahoma complex, 30 to 50 percent slopes
- FTE Fugawee-Tahoma complex, 2 to 30 percent slopes
- FTF Fugawee-Tahoma complex, 30 to 50 percent slopes
- SIE Sierraville-Trojan-Kyburz complex, 2 to 30 percent slopes



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 Geotechnical Services  
 Geotechnical Design – North

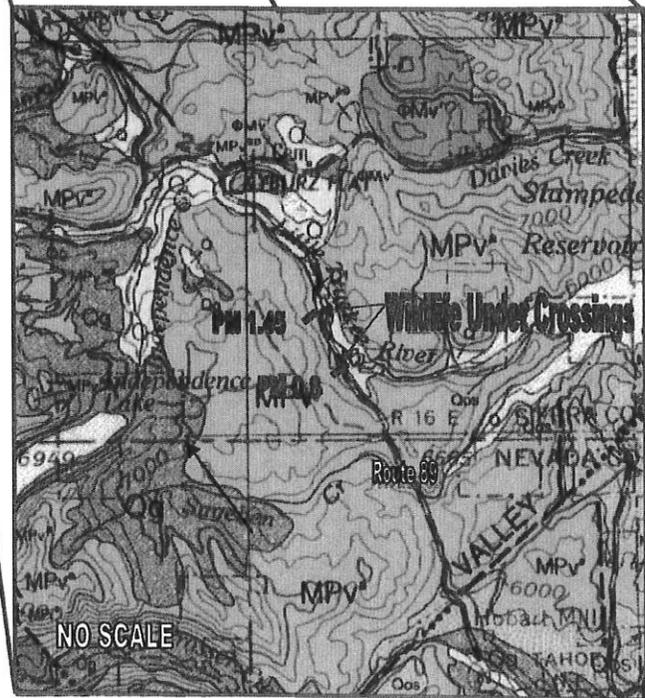
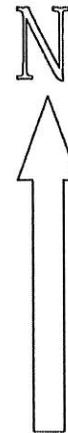
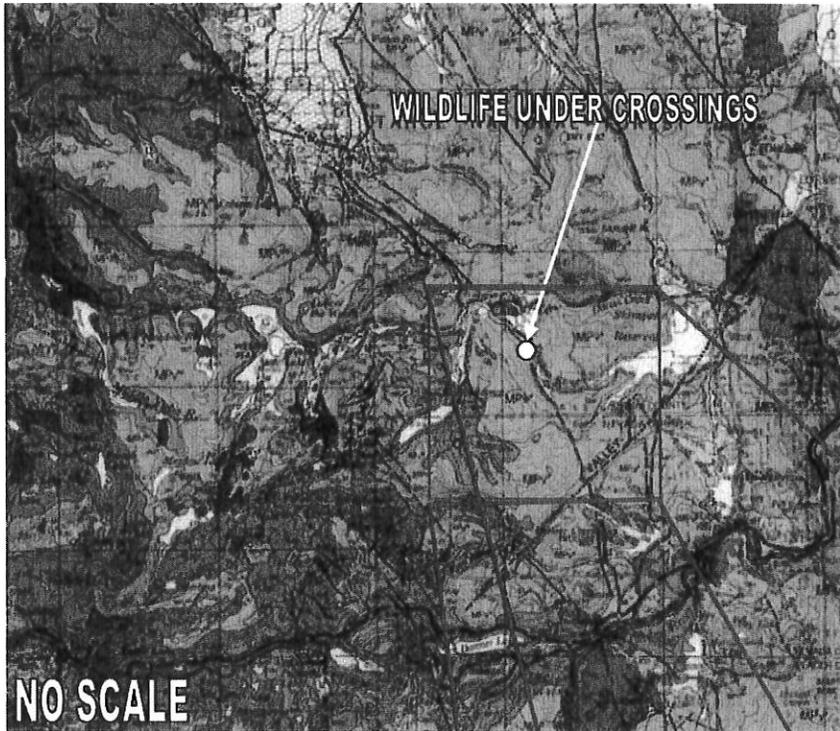
EA: 03-1F260

Date: June 2013

**SOILS MAP**

03-SIE-89-PM 0.8 AND 1.45  
 WILDLIFE UNDER CROSSINGS

Plate No.  
 3



From Saucedo, G.J. and Wagner, D.L., 1992, Geologic Map of the Chico Quadrangle: California Division of Mines and Geology, Regional Geologic Map 7A, scale 1:250,000.

See Plate 5 for Explanations



CALTRANS  
 Division of Engineering  
 Services  
 Geotechnical Services  
 Geotechnical Design – North

EA: 03-1F260

Date: June 2013

**GEOLOGIC MAP**

03-SIE-89-PM 0.8 & 1.45  
**WILDLIFE UNDER CROSSINGS**

Plate No.  
 4

**ABBREVIATED EXPLANATION**

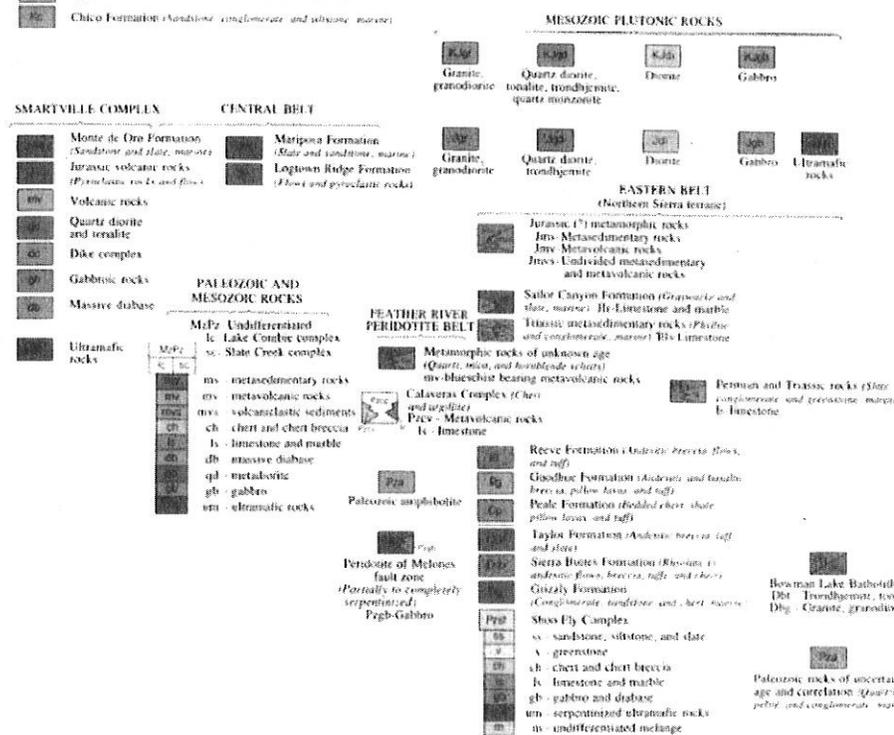
Approximate stratigraphic relationships only, see Geologic Map Explanation for more accurate age designations and unit descriptions.

From Saucedo, G.J. and Wagner, D.L., 1992, Geologic Map of the Chico Quadrangle: California Division of Mines and Geology, Regional Geologic Map 7A, scale 1:250,000.

CENOZOIC  
 QUATERNARY  
 PLEISTOCENE  
 HOLOCENE  
 MISPLCENE  
 PLEISTOCENE  
 MIOCENE  
 OLIGOCENE  
 CRETACEOUS  
 MESSIZOIC  
 JURASSIC  
 TRIASSIC  
 PERMIAN  
 DEVONIAN  
 SILURIAN  
 ORDOVICIAN

- af Artificial fill
- t Trench or mine tailings
- o Alluvium
- Qa Natural levee and channel deposits
- Qb Basin deposits (Alluvium)
- Qc Landslide deposits
- Qd Lake deposits
- Qe Fan deposits
- Qf Terrace deposits
- Qg Glacial deposits
- Qm Modesto Formation (Alluvium)
- Qr Riverbank Formation (Alluvium)
- Qs Pleistocene nonmarine sedimentary rocks (fluvial and lacustrine gravel, sand, silt and clay)
- Qp Red Bluff Formation ( coarse sand gravel, sand and silt)
- Qq Volcanic sediments of Sutter Buttes (volcaniclastic sediments and tuffs)
- Qr QP Volcanic lake beds
- Qs Tuffs of Oroville (volcaniclastic sediments and tuff)
- Qt Pat-Newell Tuff
- Qv Tuscan Formation (shales, volcanoclastic sediments, and tuff)
- Qw Pat-Newell Tuff
- Qx Laguna Formation (fluvial gravel, sand and silt)
- Qy Pleistocene nonmarine sedimentary rocks (fluvial and lacustrine shale, sandstone and silt)
- Qz Miocene-Pliocene channel deposits (fluvial conglomerates and sandstones)
- Ms Sutter Formation (volcaniclastic sediments, conglomerate)
- Eu Capay Formation (sandstone and shale, marl)
- Je Jene Formation (quartzite sandstone, claystone and conglomerate mostly nonmarine)
- Gr "Auriferous" Gravels
- Uc Upper Cretaceous rocks (shale and sandstone, marl)
- Ch Chico Formation (sandstone, conglomerate and silty sandstone)

- Pt Pleistocene volcanic rocks (tuff, lava, and tuff)
- V Volcanic rocks of Sutter Buttes (QP and QV)
- Pi Pliocene intrusive rocks (andesite, basalt)
- Pv Pliocene volcanic rocks (andesite, basalt)
- C Cinder cones or volcanic mugs (Pleistocene at Sutter Buttes)
- Mi Miocene-Pliocene intrusive rocks (andesite, basalt)
- Mv Miocene-Pliocene volcanic rocks (andesite, andesite, andesite flows, andesite pyroclastic rocks, tuff, tuff-breccia)
- Lb Lavaey Basalt
- OM Oligocene-Miocene volcanic rocks (trachyte tuff and sedimentary rocks)



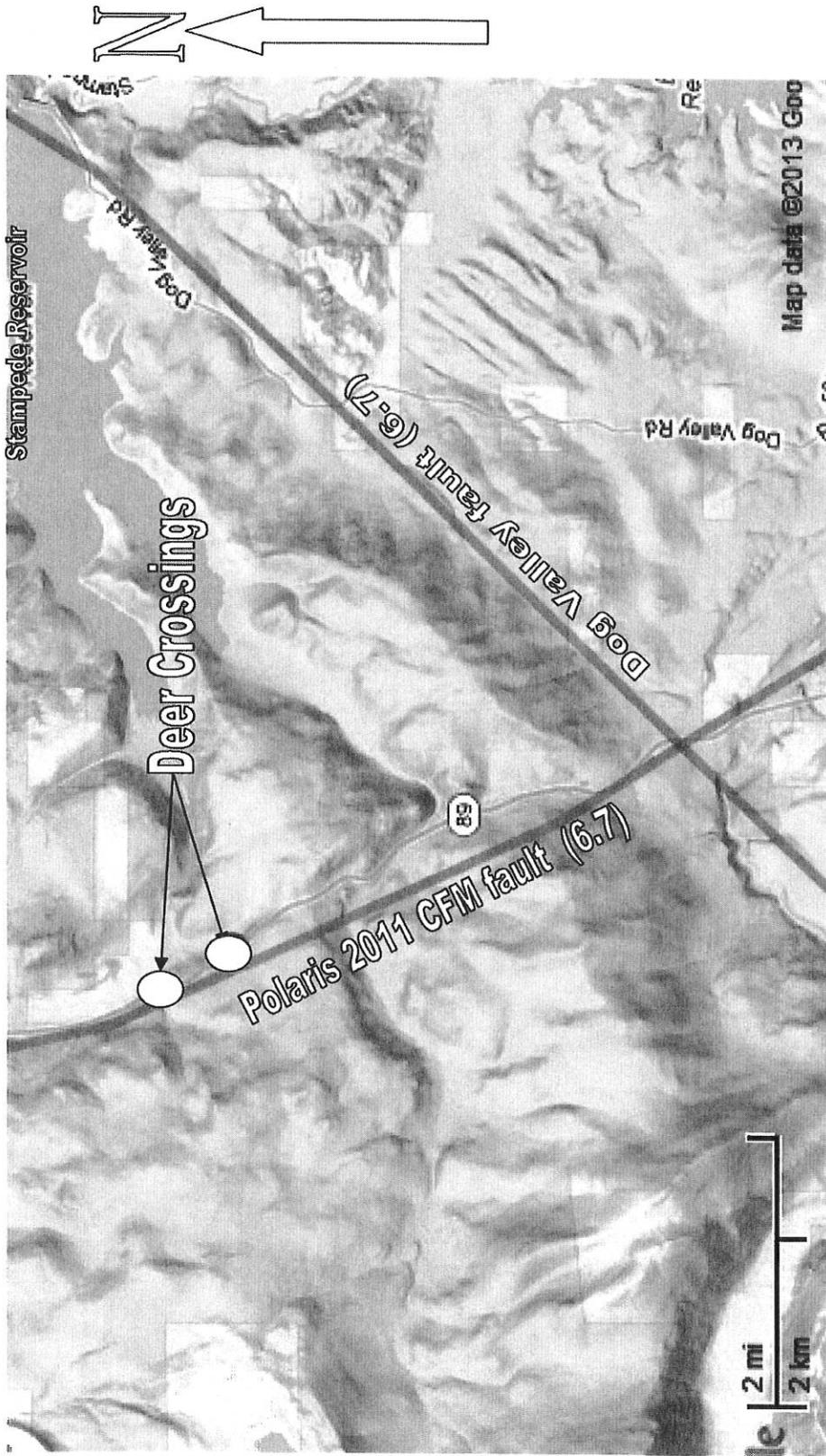
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**GEOLOGIC MAP LEGEND**

**03-SIE-89-PM 0.8 & 1.45 WILDLIFE UNDER CROSSINGS**

Plate No. 5



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**FAULT MAP**

Plate No.  
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