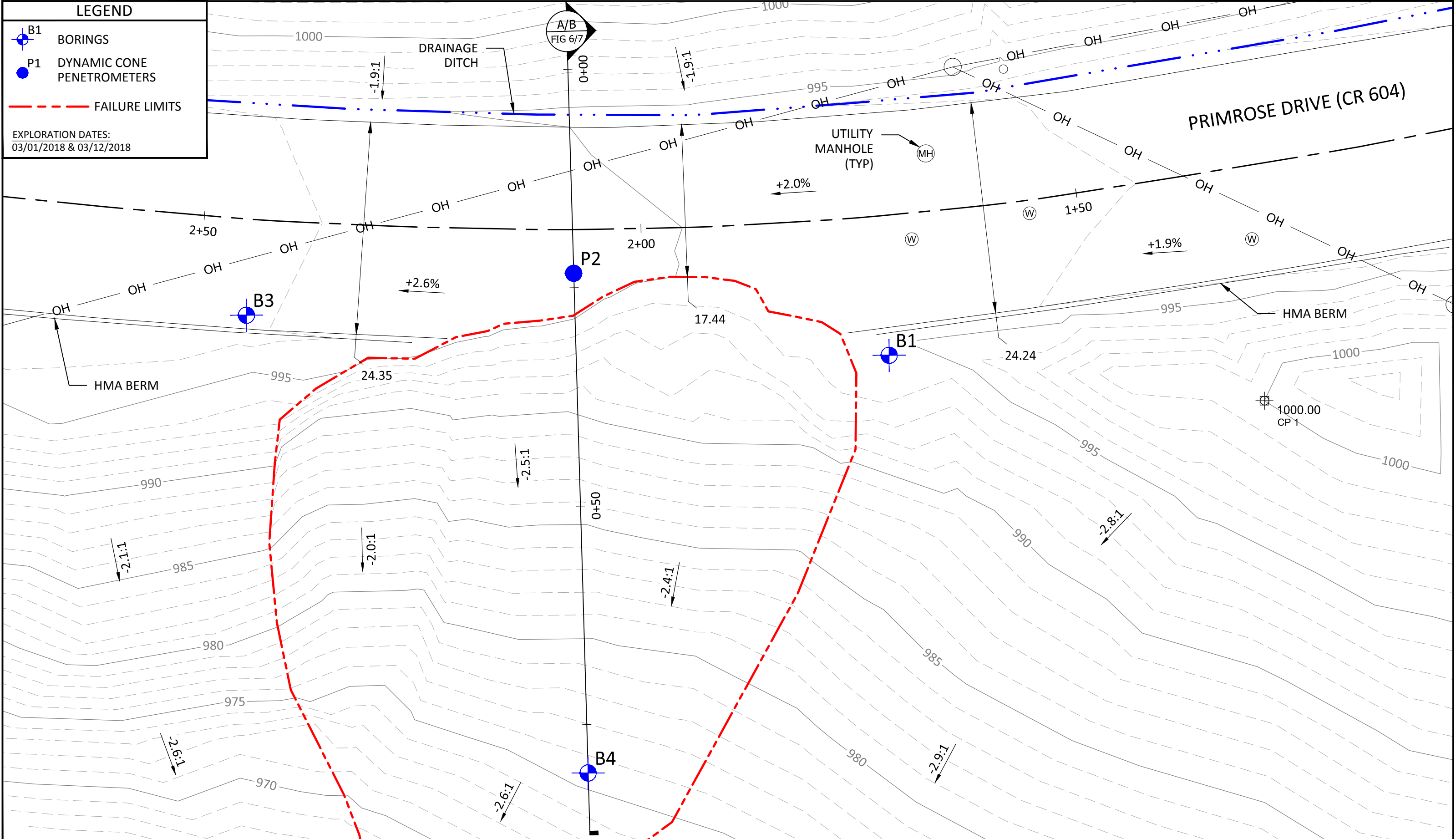
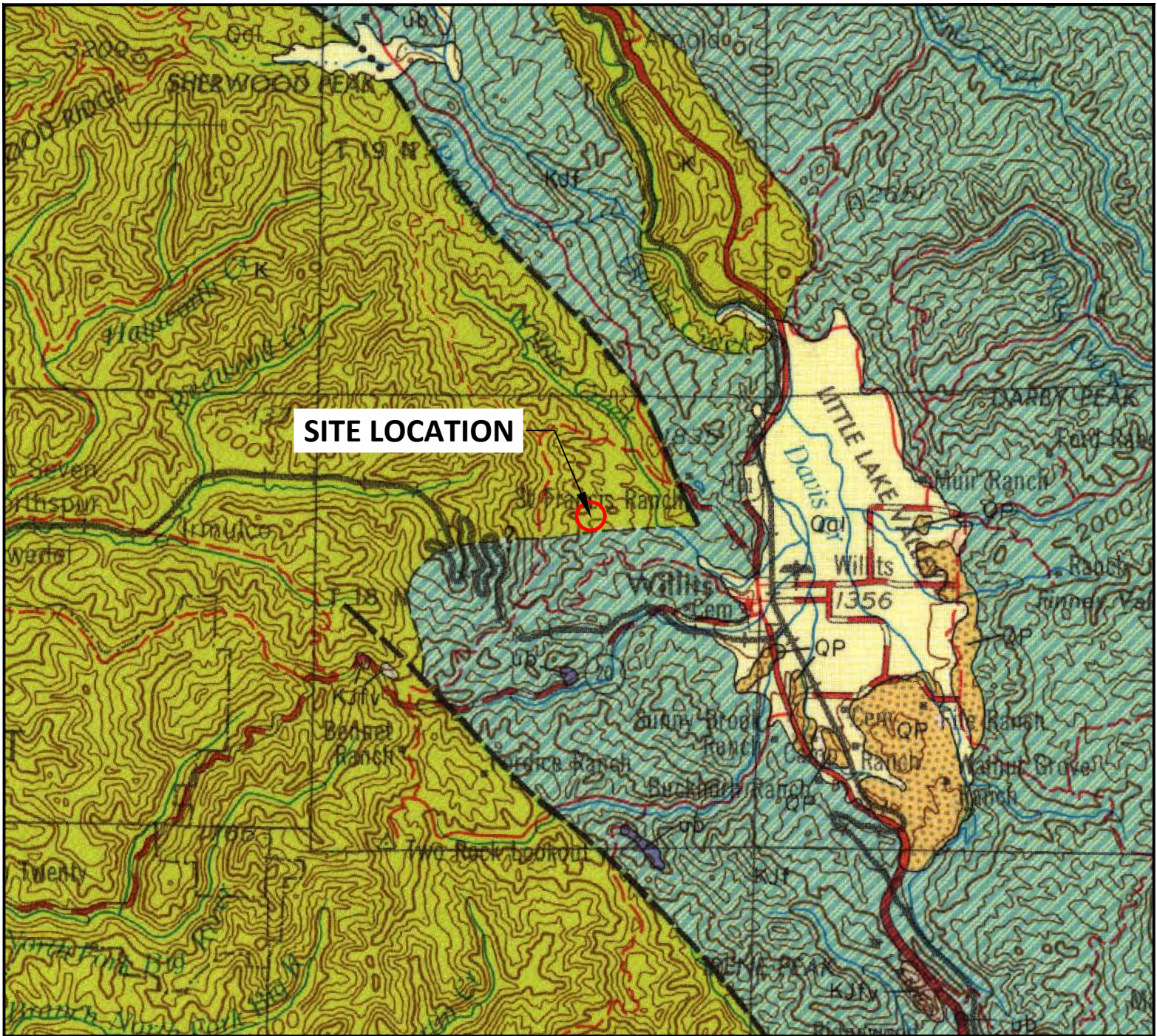




 NORTH	Map and Data Source: Topographic Survey provided by MCDOT via electronic transfer on 10/31/2017. Survey completed by MCDOT.	 Crawford & Associates, Inc. Geotechnical Engineering, Design and Construction Services 1100 Corporate Way Suite 230 Sacramento, CA 95831 (916) 455-4225 Taber Since 1954	GEOTECHNICAL INVESTIGATION PRIMROSE DRIVE (CR 604) FAILURE AT MP 3.40	Figure 2 Exploration Location Map
				Prj. No: 16-337.15 Scale: 1" = 10' Date: 09/20/2018



LEGEND

Geologic Formations



Alluvium (Recent) - alluvial materials (sand, silt, clay); valley fill.



Undivided Marine Sedimentary Rocks (Cretaceous) - sandstone, shale, and conglomerate.



Franciscan Formation (Jurassic-Cretaceous) - sandstone, shale, chert, and conglomerate, with locally small areas of greenstone, limestone, basalt, schist, and related metamorphic rocks.

CONTACT

(Dashed where approximately located, gradational or inferred)

FAULT

(Dashed where approximately located)



NORTH

Map Source:

Jennings, C.W. and Strand, R.G., 1960, *Geologic Map of California, Ukiah Sheet, California Division of Mines and Geology*, Scale 1:250,000



Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
1100 Corporate Way
Suite 230
Sacramento, CA 95831
(916) 455-4225

Taber
Since 1954

**GEOTECHNICAL INVESTIGATION
PRIMROSE DRIVE (CR 604)
FAILURE AT MP 3.40**

BROOKTRAILS, MENDOCINO CO., CA

Figure 3
Regional
Geologic Map

Prj. No: 16-337.15
Scale: 1" = 10,000'
Date: 06/20/2018



SEE FIGURE 4B FOR LEGEND



NORTH

Map Source:

Kilbourne, R.T., 1984, *Geology and Geomorphic Features Related to Landsliding, Willits NW (Burbeck) 7.5' Quadrangle, OFR 84-19, California Division of Mines and Geology, Scale 1:24,000*



Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services

Taber
Since 1954

1100 Corporate Way
Suite 230
Sacramento, CA 95831
(916) 455-4225

**GEOTECHNICAL INVESTIGATION
PRIMROSE DRIVE (CR 604)
FAILURE AT MP 3.40**

BROOKTRAILS, MENDOCINO CO., CA

Figure 4A
Landslide and
Geologic Map

Prj. No: 16-337.15
Scale: 1" = 2,000'
Date: 06/20/2018

EXPLANATION



TRANSLATIONAL/ROTATIONAL SLIDE: relatively cohesive slide mass with a failure plane that is deep-seated in comparison to that of a debris slide of similar areal extent; sense of motion along slide plane is linear in a translational slide and arcuate or "rotational" in a rotational slide; complex versions with rotational heads and translational movement or earthflows downslope are common; translational movement along a planar joint or bedding discontinuity may be referred to as a block glide; $\nwarrow$ indicates scarp, $\rightarrow$ indicates direction of movement; solid where active, dashed where dormant, queried where uncertain.



EARTHFLOW: mass movement resulting from slow to rapid flowage of saturated soil and debris in a semiviscous, highly plastic state; after initial failure, the flow may move, or creep, seasonally in response to destabilizing forces; $\nwarrow$ indicates scarp, $\rightarrow$ indicates direction of movement; solid where active, dashed where dormant, queried where uncertain.



DEBRIS SLIDE: unconsolidated rock, colluvium, and soil that has moved slowly to rapidly downslope along a relatively steep (generally greater than 65 percent), shallow translational failure plane; forms steep, unvegetated scars in the head region and irregular hummocky deposits (when present) in the toe region; scars likely to ravel and remain unvegetated for many years; revegetated scars recognized by steep, even-faceted slope and light-bulb shape; includes scarp and slide deposits; solid where active, dashed where dormant.



DEBRIS FLOW/TORRENT TRACK: long stretches of bare, generally unstable stream channel banks scoured and eroded by the extremely rapid movement of water-laden debris; commonly triggered by debris sliding in the upper part of the drainage during high intensity storms; scoured debris may be deposited downslope as a tangled mass of organic material in a matrix of rock and soil; debris may be reactivated or washed away during subsequent events; solid where active, dashed where dormant.



DEBRIS SLIDE SLOPE: geomorphic feature characterized by steep (generally greater than 65 percent), slopes that have been sculpted by numerous debris slide events; vegetated soils and colluvium above shallow soil/bedrock interface may be disrupted by active debris slides or bedrock exposed by former debris sliding; slopes near angle of repose may be relatively stable except where weak bedding planes and extensive bedrock joints and fractures parallel slope.

- **ACTIVE SLIDE:** too small to delineate at this scale.



DISRUPTED GROUND: irregular ground surface caused by complex landsliding processes resulting in features that are indistinguishable or too small to delineate individually at this scale; also may include areas affected by downslope creep, expansive soils, and/or gully erosion; boundaries usually are indistinct.

Q LACUSTRINE DEPOSITS (Holocene): flat-lying, uncemented alluvial deposits of fine sand and silt containing significant amounts of organic matter.

Qf ALLUVIAL FAN DEPOSITS (Holocene): fan-shaped deposits of unconsolidated, poorly sorted sand and gravel; found in lowlands at the mouth of steep drainage canyons; deposits may represent material transported by debris torrents.

Q ALLUVIUM (Holocene): unconsolidated, fine-grained sand and silt along modern river flood plains; minor amounts of gravel in channel areas.

TKs SANDSTONE (Tertiary-Cretaceous): deeply weathered, gently folded, massive sandstone with small amounts of mudstone; overlying, in fault contact, or possibly within TKfs unit.

TKfs COASTAL BELT FRANCISCAN (Tertiary-Cretaceous): well consolidated, clastic sedimentary rocks; includes arkosic sandstone, pebble conglomerate, and shale, with small amounts of limestone; sandstone and conglomerate units predominant on ridgetops; streams tend to lie in less competent, sheared shale; on the Willits NW quadrangle, TKfs beds are generally homoclinally folded to strike NW and dip moderately to the NE except where they are disrupted near fault contacts.

fm FRANCISCAN MELANGE (Tertiary-Cretaceous): pervasively sheared argillaceous matrix surrounding pebble-sized to individually mappable blocks of graywacke, sandstone, greenstone, chert, schist, serpentinite, and serpentinized ultramafic rocks; the highly erodible, sheared shale matrix generally is unstable and prone to landsliding, even on gentle slopes; locally the melange is indistinguishable from fault gouge of the Maacama fault zone.

ss graywacke, sandstone

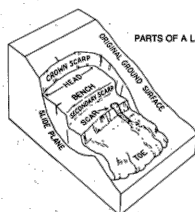
gs greenstone and metamorphosed volcanic rock

ch chert

um serpentine and serpentinized ultramafic rocks

sch greenschist

ls limestone



PARTS OF A LANDSLIDE

LITHOLOGIC CONTACT: solid where well located, dashed where approximately located; faults and lineaments are sometimes used to depict contacts when such features coincide.

X ROCK OUTCROP: too small to delineate at this scale.

Fault: solid where well located, dashed where approximately located, dotted where concealed or inferred, queried where uncertain; usually associated with highly sheared, landslide-prone fault gouge; arrows ($\rightarrow$) and letters (D=Down, U=Up) indicate sense of movement.

Thrust Fault: solid where well located, dashed where approximately located; barbs on upper plate.

LINEAMENT: linear feature of unknown origin observed on aerial photographs; usually associated with more erodible portions of rock units such as fault gouge.

45 STRIKE AND DIP OF BEDDING: does not apply to Quaternary units; when appearing in these units the symbol represents underlying bedrock exposed in small outcrops along stream channel banks.

30 STRIKE AND DIP OF OVERTURNED BEDDING

0 HORIZONTAL BEDDING

1 STRIKE OF VERTICAL BEDDING

70 STRIKE AND DIP OF FAULT

9 SPRING

32 MARSH

X QUARRY OR BORROW PIT

REFERENCES

California Department of Forestry, 1981 Cal Aero Photos: Photos CDF-ALL-UK; Flight 7/9/81; Frames 21-21 to 21-28, 23-21 to 23-28, and 25-20 to 25-28; black and white, scale 1:24,000.

California Division of Mines and Geology, 1984, Alquist-Priolo Special Studies Zone Map of the Willits NW 7.5-minute quadrangle, scale 1:24,000.

California Division of Mines and Geology, 1976-1983, Geologic review of Timber Harvesting Plans: Unpublished field studies conducted for the California Department of Forestry.

Durham, J., 1979, Geologic map, Willits 15-minute quadrangle: California Department of Forestry, Title II Geologic Data Compilation Project, unpublished, scale 1:62,500.

Kramer, J.C., 1976, Geology and tectonic implications of the Coastal Belt Franciscan, Fort Bragg-Willits area, northern Coast Ranges, California: Unpublished Ph.D. Thesis, University of California, Davis, 128 pages.

Pampeyan, E.H., Harsh, P.W., and Coakley, J.M., 1981, Preliminary map showing recently active breaks along the Maacama fault zone between Laytonville and Hopland, Mendocino County, California: United States Geological Survey, Miscellaneous Field Studies Map, MF 1217, scale 1:24,000.

SOURCES OF GEOLOGIC DATA

Geologic data were compiled from aerial photo interpretation, field reconnaissance, and the modification of published and unpublished geologic maps listed in references above. The author was assisted in field and office studies by Charles Smith and Jerald Rich.

1. Mapping from aerial photo interpretation, previously existing geologic data, and reconnaissance level field work.
2. Mapping from aerial photo interpretation and previously existing geologic data; field access not available.



ACTIVITY OF LANDSLIDES

Active or probably active - presently moving or recently moved. Distinct topographic slide features present, i.e., sharp barren scarps, cracks, jacketed trees. Major revegetation has not occurred.

Dormant - little evidence of recent movement. Slide features modified by weathering and erosion. Vegetation generally well established. Some mass movements may have developed under climatic conditions different from today. Causes of failure may remain and movement could be renewed.

RATES OF LANDSLIDE MOVEMENT*

10 ft/sec or more	= extremely rapid
1 ft/min-10 ft/sec	= very rapid
5 ft/day-1 ft/min	= rapid
5 ft/mo-5 ft/day	= moderate
5 ft/yr-5 ft/mo	= slow
1 ft/yr-5 ft/yr	= very slow
1 ft/yr or less	= extremely slow

*Modified from Varnes, D.J., 1978, Slope movement types and processes, in Landslides: Analysis and Control, Transportation Research Board, National Academy of Sciences, Washington, D.C., Special Report 176, Figure 2.1.

SEE FIGURE 4A FOR MAP



NORTH

Map Source:

Kilbourne, R.T., 1984, *Geology and Geomorphic Features Related to Landsliding, Willits NW (Burbeck) 7.5' Quadrangle, OFR 84-19, California Division of Mines and Geology, Scale 1:24,000*



Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
1100 Corporate Way
Suite 230
Sacramento, CA 95831
(916) 455-4225

Taber
Since 1954

GEOTECHNICAL INVESTIGATION
PRIMROSE DRIVE (CR 604)
FAILURE AT MP 3.40

BROOKTRAILS, MENDOCINO CO., CA

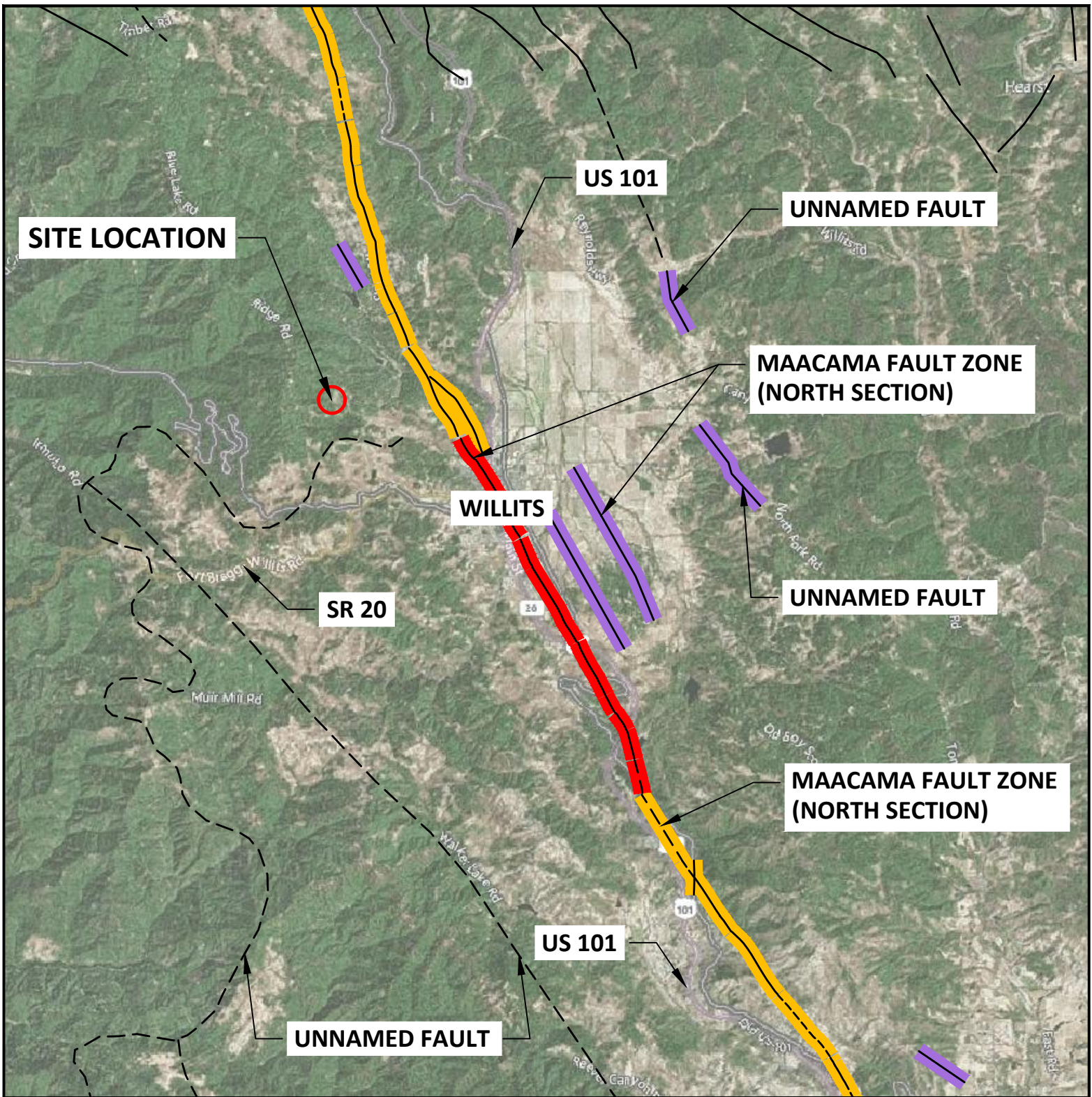
Figure 4B

Landslide and Geologic Map Legend

Prj. No: 16-337.15

Scale: N/A

Date: 06/20/2018



LEGEND

CGS Faults (Last Activity Age)

- <200 years (Historic)
- <11,700 years (Holocene)
- <700,000 years (Late Quaternary)

CGS Faults (Last Activity Age)

- <1.6 million years (Quaternary)
- >1.6 million years (Pre-Quaternary)

Fault Location

- Certain
- - - Approx. or Inferred
- Concealed



NORTH

Map and Data Sources:

1. Basemap via AutoCAD Civil 3D geolocation tool
2. Fault data via CGS Fault Activity Map of California 2010 GIS data



Crawford & Associates, Inc.
Geotechnical Engineering, Design
and Construction Services

Taber
Since 1954

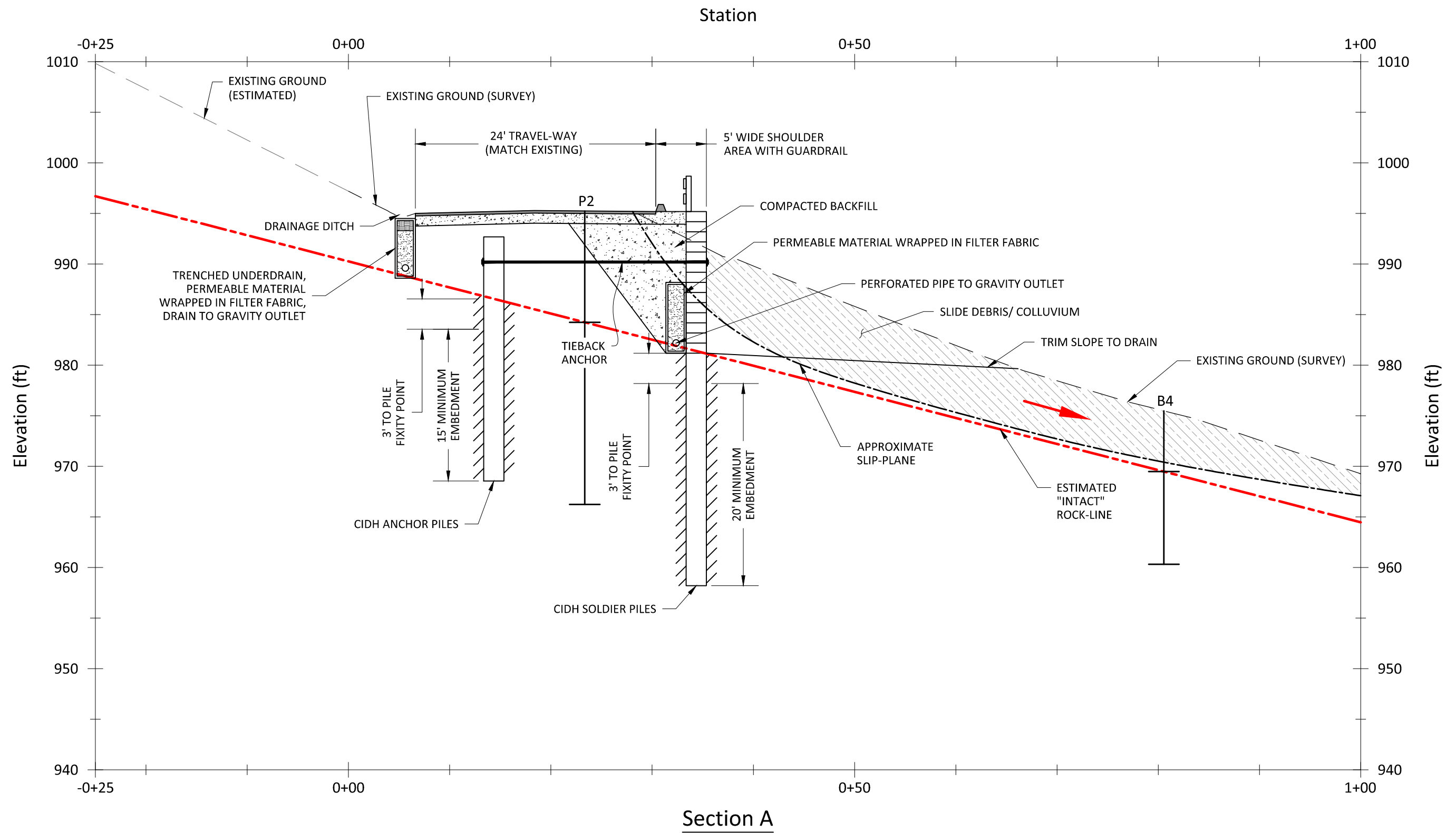
1100 Corporate Way
Suite 230
Sacramento, CA 95831
(916) 455-4225

GEOTECHNICAL INVESTIGATION
PRIMROSE DRIVE (CR 604)
FAILURE AT MP 3.40

BROOKTRAILS, MENDOCINO CO., CA

Figure 5
Fault Activity
Map

Prj. No: 16-337.15
Scale: 1" = 10,000'
Date: 06/20/2018



NORTH

Data Source:
Topographic Survey provided by MCDOT via electronic transfer on 10/31/2017. Survey completed by MCDOT.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
1100 Corporate Way Suite 230
Sacramento, CA 95831
(916) 455-4225

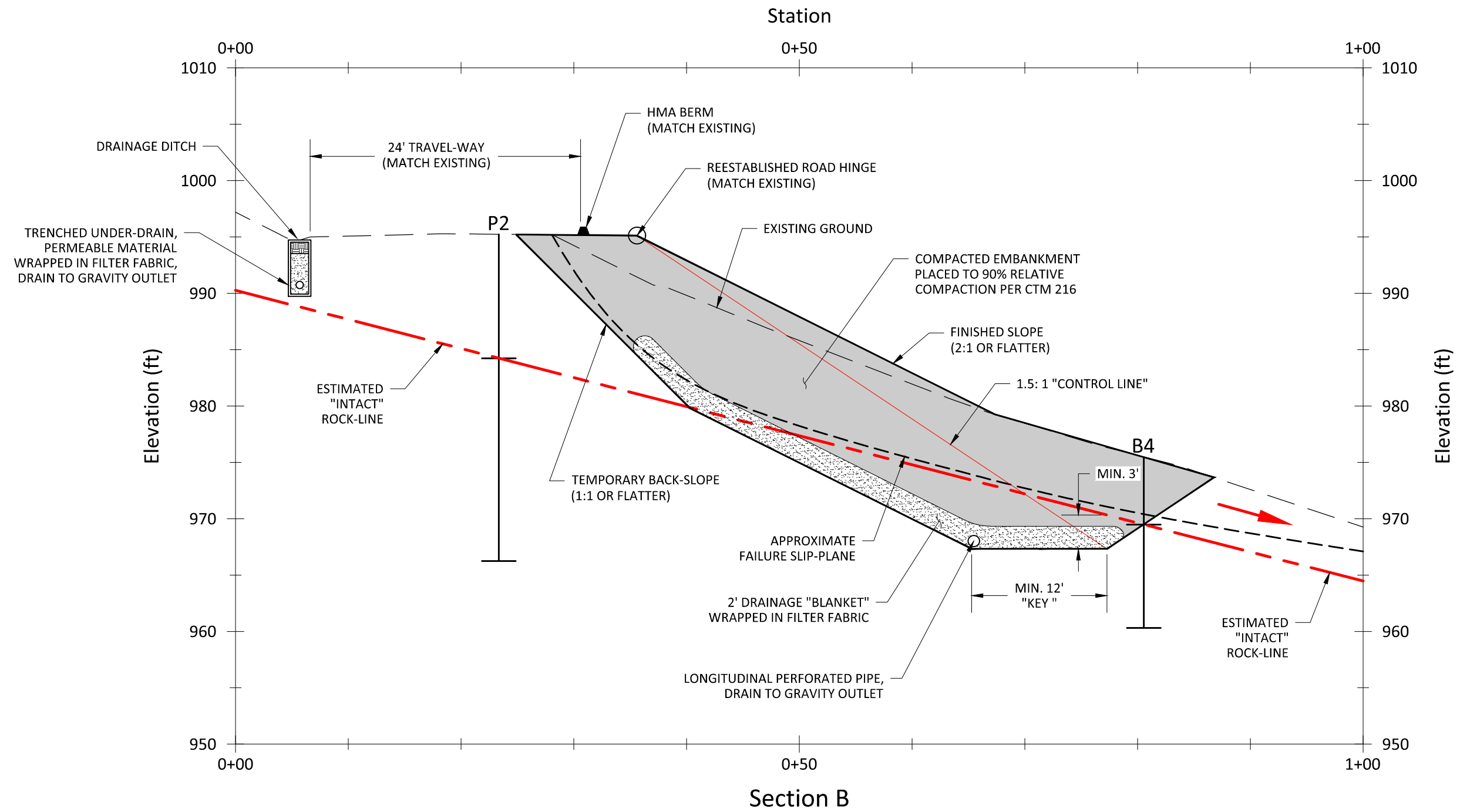
Taber
Since 1954

GEOTECHNICAL INVESTIGATION
PRIMROSE DRIVE (CR 604)
FAILURE AT MP 3.40

BROOKTRAILS, MENDOCINO CO., CA

Figure 6
Typical Section
Soldier Pile
Tieback Wall
Prj. No: 16-337.15
Scale: 1" = 10'
Date: 09/20/2018

Path: \\Mac\Home\Box\Projects\16-337.X Mendocino 2016 Quadrennial Support Projects\16-337.15 Primrose Drive (CR 604) at MP 3.40 and 3.80\CAD\16-337.15-Figures-MP 3.40.dwg Plot Date: Sep 20, 2018 at 3:16pm



NORTH

Data Source:
Topographic Survey provided by MCDOT via electronic transfer on 10/31/2017. Survey completed by MCDOT.

Crawford & Associates, Inc.
Geotechnical Engineering, Design and Construction Services
1100 Corporate Way Suite 230
Sacramento, CA 95831
(916) 455-4225
Taber
Since 1954

GEOTECHNICAL INVESTIGATION
PRIMROSE DRIVE (CR 604)
FAILURE AT MP 3.40
BROOKTRAILS, MENDOCINO CO., CA

Figure 7
Typical Section
Reconstructed
Embankment
Prj. No: 16-337.15
Scale: 1" = 10'
Date: 09/20/2018

Path: \\Mac\Home\Box\Projects\16-337.X Mendocino 2016 Quadrennial Support Projects\16-337.15 Primrose Drive (CR 604) at MP 3.40 and 3.80\CAD\16-337.15-Figures-MP 3.40.dwg Plot Date: Sep 19, 2018 at 8:15pm

APPENDIX A

BORING LOGS LEGEND

BORING LOGS

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names	Graphic / Symbol	Group Names
	GW Well-graded GRAVEL Well-graded GRAVEL with SAND		CL Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
	GP Poorly graded GRAVEL Poorly graded GRAVEL with SAND		CL-ML SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
	GW-GM Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND		ML SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
	GW-GC Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		OL ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
	GP-GM Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND		OL ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
	GP-GC Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		OH ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
	GM SILTY GRAVEL SILTY GRAVEL with SAND		OL/OH ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	GC CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
	GC-GM SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND		
	SW Well-graded SAND Well-graded SAND with GRAVEL		
	SP Poorly graded SAND Poorly graded SAND with GRAVEL		
	SW-SM Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
	SW-SC Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)		
	SP-SM Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
	SP-SC Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)		
	SM SILTY SAND SILTY SAND with GRAVEL		
	SC CLAYEY SAND CLAYEY SAND with GRAVEL		
	SC-SM SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
	PT PEAT		
	COBBLES and BOULDERS		

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 4546)
CP	Compaction Curve (CTM 216)
CR	Corrosion, Sulfates, Chlorides (CTM 643, CTM 417, CTM 422)
CU	Consolidated Undrained Triaxial (ASTM D 4767)
DR	Drained Residual Shear Strength (ASTM D 6467)
DS	Direct Shear (ASTM D 3080)
EI	Expansion Index (ASTM D 4829)
M	Moisture Content (ASTM D 2216)
OC	Organic Content (ASTM D 2974)
P	Permeability (CTM 220)
PA	Particle Size Analysis (ASTM D 422)
PI	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89, AASHTO T 90)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
R	R-Value (CTM 301)
SE	Sand Equivalent (CTM 217)
SG	Specific Gravity (AASHTO T 100)
SW	Swell Potential (ASTM D 4546)
UC	Unconfined Compression - Soil (ASTM D 2166) Unconfined Compression - Rock (ASTM D 7012-C)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850)
UW	Unit Weight (ASTM D 7263)

SAMPLER GRAPHIC SYMBOLS

	Standard Penetration Test (SPT)
	Standard California Sampler (ID 2.5 in.)
	Modified California Sampler (ID 2.0 in.)
	Shelby Tube
	Piston Sampler
	NX Rock Core
	HQ Rock Core
	Bulk Sample
	Other (see remarks)

DRILLING METHOD SYMBOLS

	Auger Drilling		Rotary Drilling		Dynamic Cone or Hand Driven		Diamond Core
--	----------------	--	-----------------	--	-----------------------------	--	--------------

WATER LEVEL SYMBOLS

	First Water Level Reading (during drilling)
	Static Water Level Reading (short-term)
	Static Water Level Reading (long-term)

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010) with Errata Sheet (2015).

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N ₆₀ (blows / 12 inches)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

MOISTURE

Descriptor	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

Descriptor	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

Descriptor	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled, and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll, and not much time is required to reach the plastic limit; it cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

CEMENTATION

Descriptor	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

ROCK GRAPHIC SYMBOLS



IGNEOUS ROCK



SEDIMENTARY ROCK



METAMORPHIC ROCK

BEDDING SPACING

Descriptor	Thickness or Spacing
Massive	> 10 ft
Very thickly bedded	3 ft - 10 ft
Thickly bedded	1 ft - 3 ft
Moderately bedded	4 in - 1 ft
Thinly bedded	1 in - 4 in
Very thinly bedded	1/4 in - 1 in
Laminated	< 1/4 in

WEATHERING DESCRIPTORS FOR INTACT ROCK

	Diagnostic Features					
Descriptor	Chemical Weathering-Discoloration-Oxidation		Mechanical Weathering and Grain Boundary Conditions	Texture and Solutioning		General Characteristics
	Body of Rock	Fracture Surfaces		Texture	Solutioning	
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No solutioning	Hammer rings when crystalline rocks are struck.
Slightly Weathered	Discoloration or oxidation is limited to surface of, or short distance from, fractures; some feldspar crystals are dull	Minor to complete discoloration or oxidation of most surfaces	No visible separation, intact (tight)	Preserved	Minor leaching of some soluble minerals may be noted	Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately Weathered	Discoloration or oxidation extends from fractures usually throughout; Fe-Mg minerals are "rusty"; feldspar crystals are "cloudy"	All fracture surfaces are discolored or oxidized	Partial separation of boundaries visible	Generally preserved	Soluble minerals may be mostly leached	Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Intensely Weathered	Discoloration or oxidation throughout; all feldspars and Fe-Mg minerals are altered to clay to some extent; or chemical alteration produces in situ disaggregation (refer to grain boundary conditions)	All fracture surfaces are discolored or oxidized; surfaces are friable	Partial separation, rock is friable; in semi-arid conditions, granitics are disaggregated	Altered by chemical disintegration such as via hydration or argillation	Leaching of soluble minerals may be complete	Dull sound when struck with hammer; usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures or veinlets. Rock is significantly weakened.
Decomposed	Discolored or oxidized throughout, but resistant minerals such as quartz may be unaltered; all feldspars and Fe-Mg minerals are completely altered to clay		Complete separation of grain boundaries (disaggregated)	Resembles a soil; partial or complete remnant rock structure may be preserved; leaching of soluble minerals usually complete		Can be granulated by hand. Resistant minerals such as quartz may be present as "stringers" or "dikes".

Note: Combination descriptors (such as "slightly weathered to fresh") are used where equal distribution of both weathering characteristics is present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, combination descriptors should not be used where significant identifiable zones can be delineated. Only two adjacent descriptors shall be combined. "Very intensely weathered" is the combination descriptor for "decomposed to intensely weathered".

PERCENT CORE RECOVERY (REC)

$$\frac{\sum \text{Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

ROCK QUALITY DESIGNATION (RQD)

$$\frac{\sum \text{Length of intact core pieces} > 4 \text{ in.}}{\text{Total length of core run (in.)}} \times 100$$

Note: RQD* indicates soundness criteria not met

ROCK HARDNESS

Descriptor	Criteria
Extremely Hard	Specimen cannot be scratched with pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows
Very hard	Specimen cannot be scratched with pocket knife or sharp pick; breaks with repeated heavy hammer blows
Hard	Specimen can be scratched with pocket knife or sharp pick with heavy pressure; heavy hammer blows required to break specimen
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure; breaks with moderate hammer blows
Moderately Soft	Specimen can be grooved 1/16 in. with pocket knife or sharp pick with moderate or heavy pressure; breaks with light hammer blow or heavy hand pressure
Soft	Specimen can be grooved or gouged with pocket knife or sharp pick with light pressure, breaks with light to moderate hand pressure
Very Soft	Specimen can be readily indented, grooved, or gouged with fingernail, or carved with pocket knife; breaks with light manual pressure.

FRACTURE DENSITY

Descriptor	Criteria
Unfractured	No fractures
Very Slightly Fractured	Core lengths greater than 3 ft.
Slightly Fractured	Core lengths mostly from 1 ft. to 3 ft.
Moderately Fractured	Core lengths mostly from 4 in. to 1 ft.
Intensely Fractured	Core lengths mostly from 1 in. to 4 in.
Very Intensely Fractured	Mostly chips and fragments.

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

LOG OF BORING B1

PROJECT NO: 16-337.15
 PROJECT: Primrose Drive MP 3.40
 LOCATION: Primrose Dr. (CR 604), Willits
 CITY/COUNTY: Mendocino
 CLIENT: MCDOT
 LOGGED BY: MVG
 DEPTH OF BORING: 51.5 (ft)

BEGIN DATE: 3/12/18
 COMPLETION DATE: 3/12/18
 SURFACE ELEVATION: 994.5 (ft)*
 SURFACE CONDITION: Dirt/Grass
 WATER DEPTH: 43.5 (ft)
 READING TAKEN: 3/12/18
 HAMMER EFFICIENCY: 80 (%)

DRILLING CONTRACTOR: Clear Heart Drilling, Inc.
 DRILLING METHOD: Hollow-Stem Auger (6" OD, 2.25" ID)
 DRILL RIG: Deeprock - DR5K (Truck)
 HAMMER TYPE: Automatic, 140 lbs, 30" drop
 SAMPLER TYPE & SIZE: SPT (ID 1.4"), BULK
 BOREHOLE DIAMETER: 6"
 BACKFILL METHOD: Cement Grout

FIELD						GRAPHIC LOG	DESCRIPTION	RECOVERY (%)	RQD (%)	LABORATORY					DRILL METHOD	CASING DEPTH	REMARKS
ELEV (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 INCH	BLOWS PER FOOT	POCKET PEN. (TSF)				LIQUID LIMIT	PLASTIC LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE			
994	0		0				SANDY lean CLAY (CL); dark brown; moist; about 33% medium to fine SAND; medium plasticity, medium toughness fines [FILL].	100		44	22			67			Chemical Analysis pH = 6.14 Min. Res. = 1390 ohm-cm Chloride = 3.6 ppm Sulfate = 43.4 ppm
992	1																
990	2																
988	3																
	4																
	5																
	6		1	3	7		Medium stiff; light brown variegated yellowish brown; about 40% SAND; low plasticity, low to medium toughness fines.	50				33.8	77.4				
	7			3		0.75											
	8			4													
	9																
	10																
984	11		2	5	27		SEDIMENTARY ROCK (SHALE), clay, dark gray, decomposed, (SANDY Lean CLAY (CL), hard, dry) [FRANCISCAN MELANGE].	100				9.5	122.8				
	12			10		>4.50											
	13			17													
	14																
	15																
	16		3	44	67		Thickly bedded, intensely to moderately weathered, moderately soft.	100				3.8	109.1				
	17			47		>4.50											
	18			20													
	19																
	20																
974	21		4	23	50/3			89									
	22			50/3"		>4.50											
	23																
	24																
	25																
	26		5	10	34		Very intensely weathered, very soft to soft, with <5% decomposed Serpentinite.	78				7.5	132.1				UC = 8899 psf
968	27			14		>4.50											
	28			20													
	29																
	30																
	31																
	32																
962	33																



Crawford & Associates, Inc.
 Geotechnical Engineering, Design
 and Construction Services

Crawford & Associates, Inc.
 1100 Corporate Way, Suite 230
 Sacramento, CA 95831
 (916) 455-4225

PROJECT NUMBER: 16-337.15
 PROJECT: Primrose Drive MP 3.40
 BORING: B1
 ENTRY BY: MVG
 CHECKED BY: RRH

SHEET 1 of 2

ELEV (ft)	DEPTH (ft)	FIELD					GRAPHIC LOG	DESCRIPTION	RECOVERY (%)	RQD (%)	LABORATORY						REMARKS
		SAMPLE	SAMPLE NO	BLOWS PER 6 INCH	BLOWS PER FOOT	POCKET PEN. (TSF)					LIQUID LIMIT	PLASTIC LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	DRILL METHOD	
960	33							SEDIMENTARY ROCK (Shale) <i>(continued)</i> .									
	34																
	35																
	36	X	6	12 15 23	38	3.25 >4.50		Decomposed, with <5% decomposed Serpentinite; (SANDY Lean CLAY (CL), hard, moist).	100				10.4	130.8			
958	37																
	38																
956	39																
	40																
954	41	X	7	15 17 29	46	>4.50		Thickly bedded, intensely weathered, soft to moderately soft.	72								
	42																
952	43																
	44																
950	45		8	50/2"	REF	>4.50		Open fractures filled with Calcite.	100								
	46																
948	47																
	48																
946	49																
	50																
944	51	X	9	20 31 36	67	>4.50		Very intensely weathered, very soft to soft.	100								
	52							Bottom of borehole at 51.5 ft bgs									
942	53							Backfilled with 6, 94lbs bags of portland cement grout and 60 gals of water									
	54																
940	55							*Elevation Reference: CP 1, Elev. 1000.00 feet per MCDOT topographic survey									
	56																
938	57																
	58																
936	59																
	60																
934	61																
	62																
932	63																
	64																
930	65																
	66																
928	67																
	68																
926	69																
	70																
924	71																
	72																

LOG OF BORING P2

PROJECT NO: 16-337.15
 PROJECT: Primrose Drive MP 3.40
 LOCATION: Primrose Dr. (CR 604), Willits
 CITY/COUNTY: Mendocino
 CLIENT: MCDOT
 LOGGED BY: MVG
 DEPTH OF BORING: 29 (ft)

BEGIN DATE: 3/1/18
 COMPLETION DATE: 3/1/18
 SURFACE ELEVATION: 995.2 (ft)*
 SURFACE CONDITION: HMA
 WATER DEPTH: Not Encountered (ft)
 READING TAKEN: 3/1/18
 HAMMER EFFICIENCY: 81.5 (%)

DRILLING CONTRACTOR: Clear Heart Drilling, Inc.
 DRILLING METHOD: Dynamic Cone Penetrometer (2" OD)
 DRILL RIG: Deeprock - DR8K (Track)
 HAMMER TYPE: Automatic, 140 lbs, 30" drop
 SAMPLER TYPE & SIZE: N/A
 BOREHOLE DIAMETER: 2"
 BACKFILL METHOD: Cement Grout

FIELD						GRAPHIC LOG	DESCRIPTION	RECOVERY (%)	LABORATORY							REMARKS
ELEV (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 INCH	BLOWS PER FOOT	POCKET PEN. (TSF)			RQD (%)	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	DRILL METHOD	
994	1															HSA used as casing
992	2															
990	3															
988	4															
986	5				5											
984	6				5											
982	7				11											
980	8				16											
978	9				26											
976	10				16											
974	11				63											
972	12				75											
970	13				53											
968	14				44											
966	15				41											
964	16				26											
962	17				31											
960	18				35											
958	19				17											
956	20				24											
954	21				36											
952	22				33											
950	23				35											
948	24				40											
946	25				34											
944	26				50											
942	27				53											
940	28				100											
938	29						REFUSAL.									100/12" at 29'
936	30						Bottom of borehole at 29.0 ft bgs									
934	31						Backfilled with 1, 94lbs bag of portland cement grout and 7 gals of water									
932	32						*Elevation Reference: CP 1, Elev. 1000.00 feet per MCDOT topographic survey									
930	33															

LOG OF BORING B3

PROJECT NO: 16-337.15
PROJECT: Primrose Drive MP 3.40
LOCATION: Primrose Dr. (CR 604), Willits
CITY/COUNTY: Mendocino
CLIENT: MCDOT
LOGGED BY: MVG
DEPTH OF BORING: 50.5 (ft)

BEGIN DATE: 3/12/18
COMPLETION DATE: 3/12/18
SURFACE ELEVATION: 996.1 (ft)*
WATER DEPTH: 15.0 (ft)
READING TAKEN: 3/12/18
HAMMER EFFICIENCY: 80 (%)

DRILLING CONTRACTOR: Clear Heart Drilling, Inc.
DRILLING METHOD: Hollow-Stem Auger (6" OD, 2.25" ID)
DRILL RIG: Deeprack - DR5K (Truck)
HAMMER TYPE: Automatic, 140 lbs, 30" drop
SAMPLER TYPE & SIZE: SPT (ID 1.4"), BULK
BOREHOLE DIAMETER: 6"
BACKFILL METHOD: Cement Grout

FIELD						GRAPHIC LOG	DESCRIPTION	RECOVERY (%)	RQD (%)	LABORATORY					DRILL METHOD	CASING DEPTH	REMARKS
ELEV (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 INCH	BLOWS PER FOOT	POCKET PEN. (TSF)				LIQUID LIMIT	PLASTIC LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE			
994	0		0				CLAYEY SAND with GRAVEL (SC); brown; moist; about 30% fine, subrounded GRAVEL; about 39% medium to fine SAND; medium plasticity, medium toughness fines [FILL].	100						31			
990	1		1	16	35	>4.50	Lean CLAY with SAND (CL); hard; olive brown; moist; about 10% coarse to fine, subangular GRAVEL; about 20% medium to fine SAND; medium plasticity, medium toughness fines.	44				11.3	113				
986	2		2	19	34	2.00	SEDIMENTARY ROCK (SHALE), clay, thickly bedded, dark gray, very intensely weathered, very soft to soft [FRANCISCAN FORMATION].	33									
984	3						METAMORPHIC ROCK (SERPENTINITE), aphanitic, pale green, decomposed, very soft.										
980	4		3	10	55	3.50	SEDIMENTARY ROCK (SHALE), clay, dark gray, decomposed, (SANDY Lean CLAY (CL), very stiff, moist).	67				7.1	130.2				Chemical Analysis pH = 7.33 Min. Res. = 560 ohm-cm Chloride = 1.3 ppm Sulfate = 321.9 ppm
976	5		4	45	50/3	>4.50	Thickly bedded, intensely weathered, soft to moderately soft.	100									
970	6		5	50/6"	REF	3.50	Very soft to soft.	100									
964	7																Very hard drilling, slow auger advancement at 28'

FIELD							GRAPHIC LOG	DESCRIPTION	RECOVERY (%)		LABORATORY						REMARKS
ELEV (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 INCH	BLOWS PER FOOT	POCKET PEN. (TSF)			RQD (%)	LIQUID LIMIT	PLASTIC LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	DRILL METHOD	CASING DEPTH	
962	33							SEDIMENTARY ROCK (Shale) (continued).									
	34																
	35		6	50/1"	REF			Interbedded with hard, lithified Sandstone.	100								
960	36																
	37																
	38																
958	39																
	40																
956	41																
	42																
954	43																
	44																
952	45		7	50/3"	REF				67								
	46																
950	47																
	48																
948	49																
	50		8	50/6"	REF	3.50			100								
946	51							Bottom of borehole at 50.5 ft bgs									
	52							Backfilled with 7, 94lbs bags of portland cement grout and 70 gals of water									
944	53																
	54							*Elevation Reference: CP 1, Elev. 1000.00 feet per MCDOT topographic survey									
942	55																
	56																
940	57																
	58																
938	59																
	60																
936	61																
	62																
934	63																
	64																
932	65																
	66																
930	67																
	68																
928	69																
	70																
926	71																
	72																

LOG OF BORING B4

PROJECT NO: 16-337.15
 PROJECT: Primrose Drive MP 3.40
 LOCATION: Primrose Dr. (CR 604), Willits
 CITY/COUNTY: Mendocino
 CLIENT: MCDOT
 LOGGED BY: MVG
 DEPTH OF BORING: 15.17 (ft)

BEGIN DATE: 3/1/18
 COMPLETION DATE: 3/1/18
 SURFACE ELEVATION: 975.5 (ft)*
 SURFACE CONDITION: Dirt/Grass
 WATER DEPTH: Not Encountered (ft)
 READING TAKEN: 3/1/18
 HAMMER EFFICIENCY: 60 (%)

DRILLING CONTRACTOR: Clear Heart Drilling, Inc.
 DRILLING METHOD: Solid-Stem Auger (4" OD)
 DRILL RIG: Remote Access Drill (Portable)
 HAMMER TYPE: Cathead, 140 lbs, 30" drop
 SAMPLER TYPE & SIZE: SPT (ID 1.4"), BULK
 BOREHOLE DIAMETER: 4"
 BACKFILL METHOD: Cement Grout

FIELD						GRAPHIC LOG	DESCRIPTION	RECOVERY (%)	RQD (%)	LABORATORY						REMARKS
ELEV (ft)	DEPTH (ft)	SAMPLE	SAMPLE NO	BLOWS PER 6 INCH	BLOWS PER FOOT	POCKET PEN. (TSF)				LIQUID LIMIT	PLASTIC LIMIT	MOISTURE (%)	D. DENSITY (PCF)	% PASSING 200 SIEVE	DRILL METHOD	
974	0						Lean CLAY with SAND (CL); light brown; moist; about 20 to 25% medium to fine SAND; medium to high plasticity, medium to high toughness fines [RESIDUAL SOIL].									
972	1															
970	2															
	3															
	4															
	5		1	11	53		Hard; light brown variegated reddish yellow; about 10% subangular GRAVEL.	100				12.9	120.4			
	6			21								6.6	127.2			
	7		A	32			METAMORPHIC ROCK (SERPENTINITE), pale green, decomposed, (SANDY Lean CLAY (CL), hard, moist) [FRANCISCAN MELANGE].	100								
968	8															
	9															
966	10															
	11		2	15	42		SEDIMENTARY ROCK (SHALE), dark gray, decomposed, (Lean CLAY with SAND (CL), very stiff to hard, moist).	100				11.3	114.7			
964	12			17												
	13			25												
	14															
	15															
960	15.17	3	50/2"	REF		>4.50	Intensely weathered, soft to moderately soft. Bottom of borehole at 15.2 ft bgs	100								
	16															
	17						Backfilled with 1, 94lbs bag of portland cement grout and 7 gals of water									
958	18															
	19						*Elevation Reference: CP 1, Elev. 1000.00 feet per MCDOT topographic survey									
956	20															
	21															
954	22															
	23															
952	24															
	25															
950	26															
	27															
948	28															
	29															
946	30															
	31															
944	32															
	33															

APPENDIX B

LABORATORY AND FIELD TEST SUMMARY

Job: Primrose Drive MP 3.40
 Job No: 16-337.15
 Date: 9/14/18

Laboratory and Field Test Summary

	Boring I.D.	Top of Sampling Depth (ft)	Sample I.D.	Retained Sample Depths (ft)	USCS Class.	Field Blows N (bpf)	SPT Blows N ₆₀ (bpf)	Moisture/Density			Classification				Strength				Chemical Analysis			
								Dry Density (pcf)	Moist. Content (%)	In-Situ Density (pcf)	Atterberg Limits			Fines (%)	Pocket Pent. (tsf)	Uncon. Comp. (psf)	Direct Shear		pH	Minimum Resistivity (ohm-cm)	Chloride Content (ppm)	Sulfate Content (ppm)
											Liquid Limit	Plastic Limit	Plasticity Index				Phi (deg)	Cohesion (psf)				
Road-level Borings	B1	0.0	0	0.0-5.0	CL	N/A	-				44	22	22	67	-				6.14	1,390	3.6	43.4
	B1	5.0	1	5.5-6.5	CL	7	9	77.4	33.8	103.6					0.75							
	B1	10.0	2	10.5-11.5	W. ROCK	27	36	122.8	9.5	134.5					+4.50							
	B1	15.0	3	15.5-16.5	W. ROCK	67	89	109.1	3.8	113.2					+4.50							
	B1	20.0	4	None	W. ROCK	50/3"	-								+4.50							
	B1	25.0	5	25.5-26.5	W. ROCK	34	45	132.1	7.5	142.0					+4.50	8,899						
	B1	35.0	6	35.5-36.5	W. ROCK	38	51	130.8	10.4	144.4					3.25 - +4.50							
	B1	40.0	7	40.5-41.5	W. ROCK	46	61								+4.50							
	B1	45.0	8	None	W. ROCK	REF	-								+4.50							
	B1	50.0	9	50.5-51.5	W. ROCK	67	89								+4.50							
	B3	0.0	0	0.0-5.0	SC	N/A	-							31	-							
	B3	5.0	1	6.0-6.5	CL	35	47	113.0	11.3	125.8					+4.50							
	B3	10.0	2	11.0-11.5	W. ROCK	34	45								2.00							
	B3	15.0	3	15.5-16.5	W. ROCK	55	73	130.2	7.1	139.4					3.50				7.33	560	1.3	321.9
	B3	20.0	4	20.0-20.8	W. ROCK	50/3"	-								+4.50							
	B3	25.0	5	25.0-25.5	W. ROCK	REF	-								3.50							
	B3	35.0	6	None	W. ROCK	REF	-								-							
	B3	45.0	7	None	W. ROCK	REF	-								-							
	B3	50.0	8	50.0-50.5	W. ROCK	REF	-								3.50							
Slope Boring	B4	5.0	1B	5.5-6.0	CL	53	53	120.4	12.9	135.9					-							
			1A	6.0-6.5	W. ROCK			127.2	6.6	135.6					+4.50							
	B4	6.5	A	6.5-10.0	W. ROCK	N/A	-								-		19.5	175				
	B4	10.0	2	10.5-11.5	W. ROCK	42	42	114.7	11.3	127.7					4.00							
	B4	15.0	3	None	W. ROCK	REF	-								+4.50							



Project Name: Primrose Drive MP 3.40

CAInc File No: 16-337.15

Date: 7/20/18

Technician: KE/AC

MOISTURE-DENSITY TESTS - D2216

	1	2	3	4	5
Sample No.	B1-1A	B1-2A	B1-3A	B1-6A	B3-1A
USCS Symbol	CL	CL	ROCK	CL	ROCK
Depth (ft.)	6	11	16	36	6
Sample Length (in.)	5.665	4.089	5.279	5.679	4.286
Diameter (in.)	1.394	1.420	1.417	1.411	1.409
Sample Volume (ft ³)	0.00500	0.00375	0.00482	0.00514	0.00387
Total Mass Soil+Tube (g)	365.8	359.7	381.8	458.0	351.8
Mass of Tube (g)	130.9	131.2	134.2	121.5	131.1
Tare No.	C2	D20	G11	G23	B19
Tare (g)	20.8	20.9	20.5	20.5	13.7
Wet Soil + Tare (g)	63.3	78.3	81.0	77.3	63.4
Dry Soil + Tare (g)	52.6	73.4	78.8	71.9	58.4
Dry Soil (g)	31.8	52.5	58.3	51.4	44.7
Water (g)	10.8	5.0	2.2	5.3	5.1
Moisture (%)	33.8	9.5	3.8	10.4	11.3
Dry Density (pcf)	77.4	122.8	109.1	130.8	113.0

Notes:



Project Name: Primrose Drive MP 3.40

CAInc File No: 16-337.15

Date: 7/20/18

Technician: KE/AC

MOISTURE-DENSITY TESTS - D2216

	1	2	3	4	5
Sample No.	B3-3A	B4-1B	B4-1A	B4-2A	
USCS Symbol	W. ROCK	ROCK	ML	SP-SM	
Depth (ft.)	16	5.5'	6	11	
Sample Length (in.)	5.387	5.136	5.445	4.964	
Diameter (in.)	1.390	1.405	1.417	1.418	
Sample Volume (ft ³)	0.00473	0.00461	0.00497	0.00453	
Total Mass Soil+Tube (g)	430.0	415.1	437.0	393.6	
Mass of Tube (g)	130.9	131.1	131.4	131.0	
Tare No.	G5	H24	E3	H3	
Tare (g)	13.6	13.5	13.9	13.4	
Wet Soil + Tare (g)	53.4	59.9	63.9	73.1	
Dry Soil + Tare (g)	50.7	54.6	60.8	67.0	
Dry Soil (g)	37.2	41.1	46.9	53.6	
Water (g)	2.6	5.3	3.1	6.1	
Moisture (%)	7.1	12.9	6.6	11.3	
Dry Density (pcf)	130.2	120.4	127.2	114.7	

Notes:

Project Name: Primrose Drive MP 3.40

CAInc File No: 16-337.15

Date: 7/23/18

Technician: AC/GL

200 Wash - ASTM D1140

Method A

Max Particle Size (100% Passing)	Standard Sieve Size	Recommended Min Mass of Test Specimens
2 mm or less	No. 10	20 g
4.75 mm	No. 4	100 g
9.5 mm	3/8 "	500 g
19.0 mm	3/4 "	2.5 kg
37.5 mm	1 1/2 "	10 kg
75.0 mm	3 "	50 kg

Table from 6.2 of ASTM D1140

Sample No.	B1 Bulk	B3 Bulk			
USCS Symbol	CL	SC			
Depth (ft.)	0-5'	0-5'			
Tare No.	101.6	100.3			
Tare (g)	126.8	125.4			
Dry Soil + Tare (g)	452.5	463.8			
Dry Mass before (g)	325.7	338.4			
Dry Mass after (g)	106.3	232.1			
Percent Fines (%)	67	31			

Notes:

Project Name: Primrose Road MP 3.40

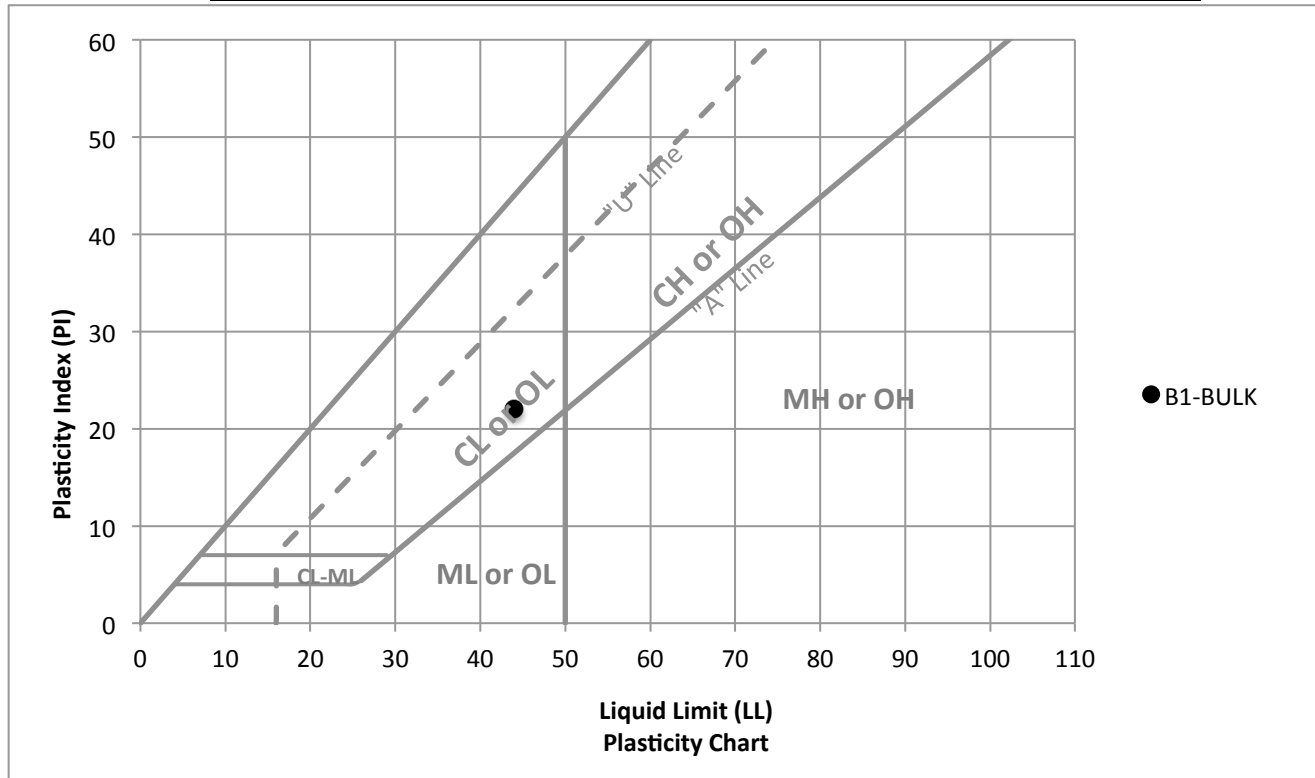
CAInc File No: 16-337.15

Date: 7/23/18

Technician: AC/CAP

Plastic Index - ASTM D4318

Sample ID	Depth (ft)	Liquid Limit	Plastic Limit	PI
B1-BULK	0'-5'	44	22	22



Project Name: Primrose Drive MP 3.40

CAInc File No: 16-337.15

Date: 7/5/18

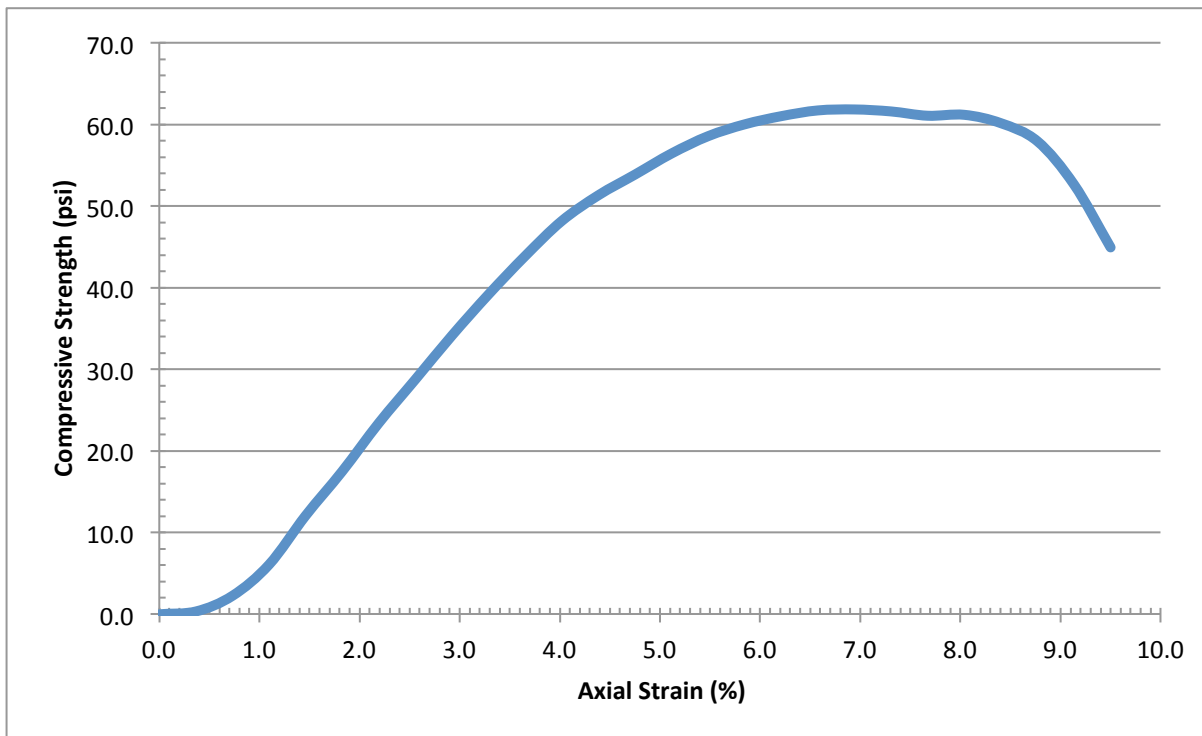
Technician: HFW

Sample ID: B1-5B

Depth (ft): 26'

USCS Classification: W. ROCK

UNCONFINED COMPRESSION TEST - D2166



Dry Density (pcf) 132.1

Water Content (%) 7.5

Unconfined Compressive Strength (psi) 61.8

Unconfined Compressive Strength (psf) 8899

Shear Strength (psf) 4449.6

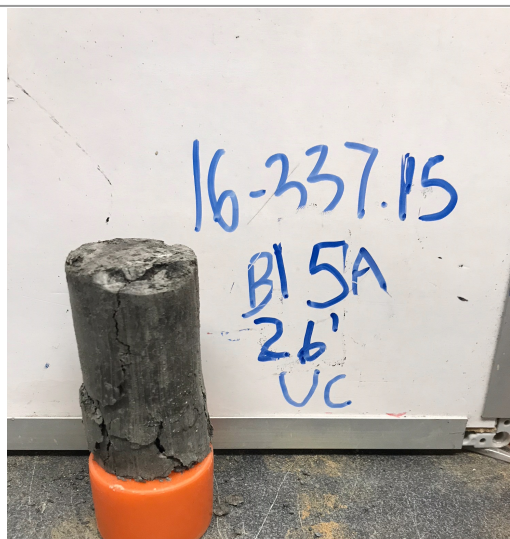
Average Height (in) 2.754

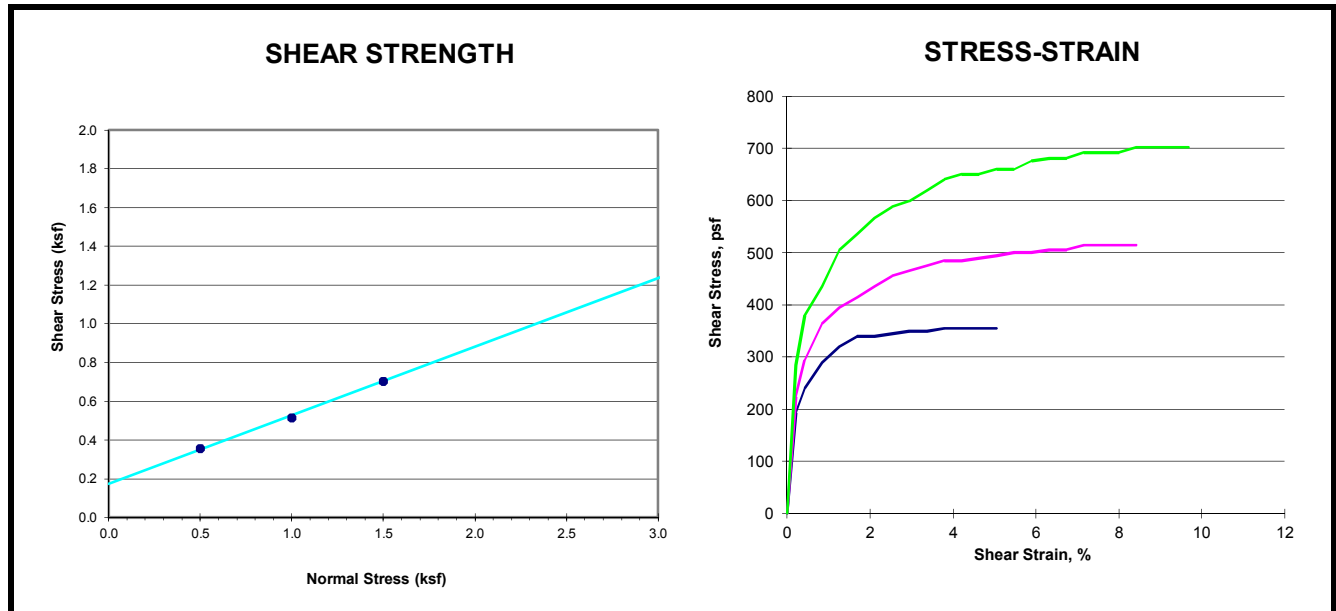
Average Diameter (in) 1.379

Rate of strain (%) 1.0

Strain at Failure (%) 6.9

Notes:





Sample Description **Remolded to Approximately 90% of Wet Density of CTM 216**

Boring Number	B4-Bulk
Sample Depth (feet)	
Material Description	Dark Gray CLAY

Initial Conditions at Start of Test

Sample ID (psf)	500	1000	1500
Height (inch)	1.00	1.00	1.00
Diameter (inch)	2.375	2.375	2.375
Moisture Content (%)	8.9	9.2	9.4
Wet Density (g/cm ³)	2.00	2.00	2.00
Dry Density (pcf)	114.7	114.4	114.2
Estimated Specific Gravity	3.00	3.00	3.00
Saturation (%)	42.3	43.4	44.3

Shear Test Conditions

Strain Rate (%/min)	0.361	0.169	0.081
Major Principle Stress at Failure (psf)	355	515	702
Strain at Failure (%)	3.79	7.19	8.42

Test Results

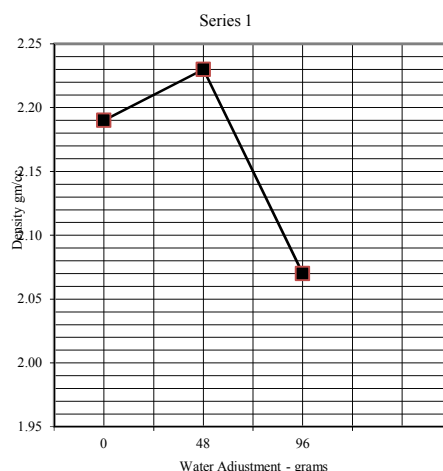
ϕ , degrees	19.5
c, psf	175

 Geocon Consultants, Inc. 3160 Gold Valley Drive, Suite 800 Rancho Cordova, California 95742 Telephone: (916) 852-9118 Fax: (916) 852-9132	Direct Shear Strength Test (ASTM D3080) Project: Crawford Lab 16-337.16 Location: Number: S9763-05-132 Figure:
--	--

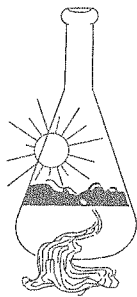
Project Number	S9763-05-132	SAMPLE I.D.	B4-Bulk
Project Name	Crawford 16-337.16 Primrose Drive		
Client Name	Crawford and Associates		
Date	Wednesday, July 18, 2018		

IMPACT TEST DATA					
I	Initial Wet Weight of Test Specimen (g)	2400			
	Increment	1	2	3	4
	Water Adjustment (g)	0	48	96	
J	Tamper Reading	10.4	10.2	11	
K	Adjusted Wet Density (g/cc)	2.19	2.23	2.07	

ROCK CORRECTION					
L	Total Sample Weight				
	< 3/4-inch (g)				
M	+ 3/4 - inch Weight in Air (g)				
N	+ 3/4 - inch Weight in Water (g)				
O	+ 3/4 - Inch Volume (M-N)				
P	% + 3/4 inch 100(M/L)				
Q	% - 3/4 inch 100-P				
R	Density of + 3/4 inch (M/O)				
S	(% + 3/4 - inch)/Density of + 3/4 - inch (P/R)				
T	(% - 3/4 - inch)/Density of - 3/4 - inch (Q/K)				
U	Sum of S and T (S + T)				
V	Average Adjusted Wet Density (100/U)				



+ 3/4 - inch Aggregate Adjustment (Y)					
% + 3/4 - inch (P)	Adjustment	% Moisture by CTM 226			
20 or Less	1.00	Increment	1	2	3
21 - 25	0.99	Pan I.D.		C-214	
26 - 30	0.98	Tare (g)		215	
31 - 35	0.97	Wet Wt (g)		2647.9	
36 - 40	0.96	Dry Wt (g)		2418.7	
41 - 45	0.95	Water Wt (g)		229.2	
46 - 50	0.94	% Water		10.4%	



Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 07/11/2018
Date Submitted 07/05/2018

To: Hailey Wagenman
Crawford & Associates, Inc.
1100 Corporate Way STE. 230
Sacramento, CA 95831-6120

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 16-337.15 MP 3.40 Site ID : B1-BULK@0-5FT.
Thank you for your business.

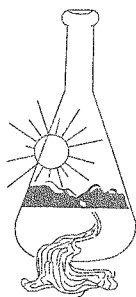
* For future reference to this analysis please use SUN # 77469-161814.

EVALUATION FOR SOIL CORROSION

Soil pH	6.14		
Minimum Resistivity	1.39	ohm-cm (x1000)	
Chloride	3.6 ppm	00.00036	%
Sulfate	43.4 ppm	00.00434	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422



Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 07/11/2018
Date Submitted 07/05/2018

To: Hailey Wagenman
Crawford & Associates, Inc.
1100 Corporate Way STE. 230
Sacramento, CA 95831-6120

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 16-337.15 MP 3.40 Site ID : B3-3@15.5FT.
Thank you for your business.

* For future reference to this analysis please use SUN # 77469-161815.

EVALUATION FOR SOIL CORROSION

Soil pH	7.33		
Minimum Resistivity	0.56	ohm-cm (x1000)	
Chloride	1.3 ppm	00.00013	%
Sulfate	321.9 ppm	00.03219	%

METHODS

pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422