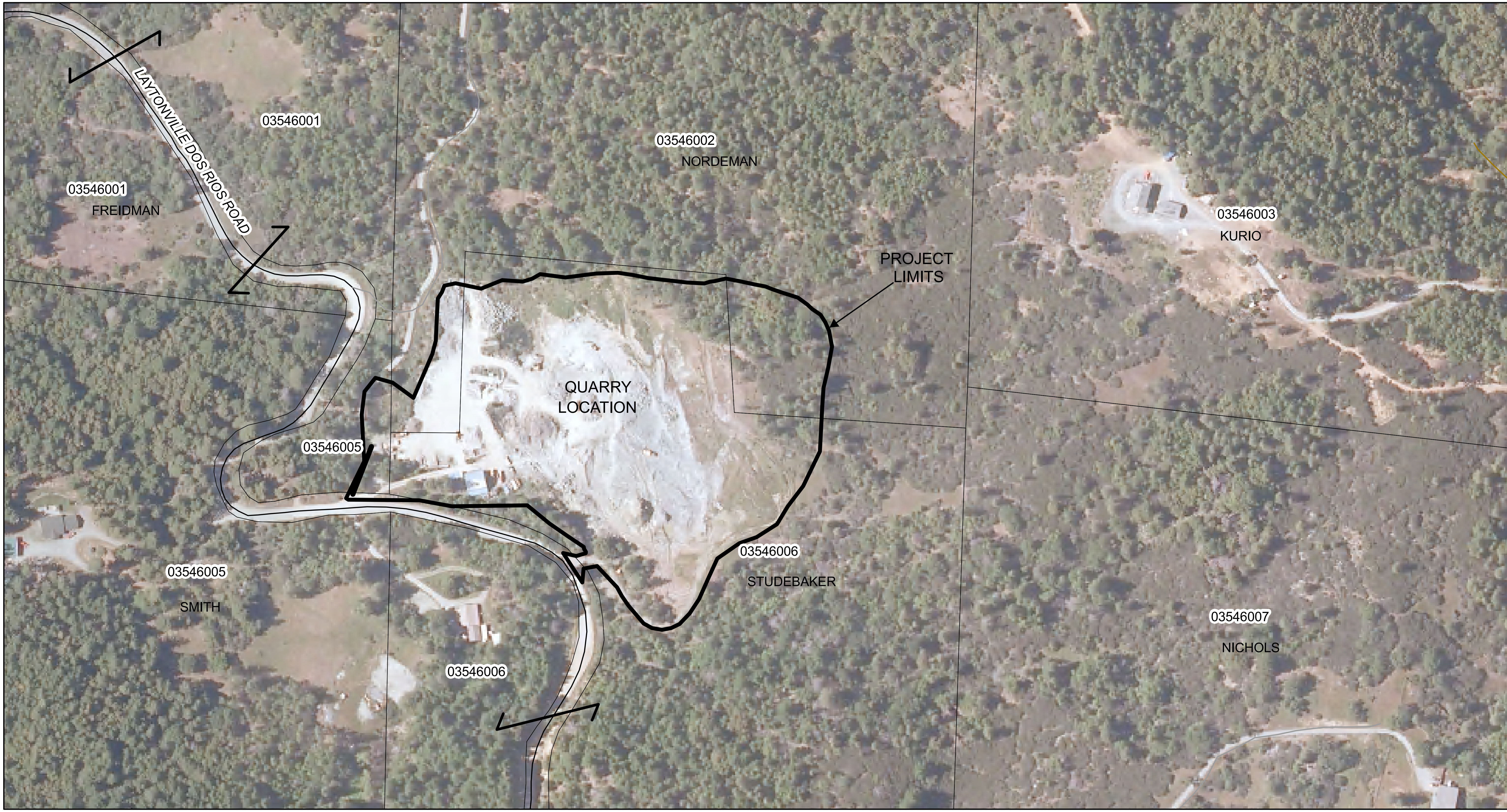


Note: Property Lines are from County GIS data base and are approximate only. For more accurate property boundaries see project plans

N

0 100 200 400

1"=200'

Note: Property lines shown are approximate
Data Source: Mendocino County
2010 Ortho Photo courtesy USDA

SITE MAP
Laytonville Rock Quarry
APN 035-460-02 & 035-460-06
Laytonville, CA
R12023

ATTACHMENT A

MINING AND RECLAMATION PLAN
LAYTONVILLE ROCK
1136 LATYONVILLE DOS RIOS ROAD
LAYTONVILLE, CA

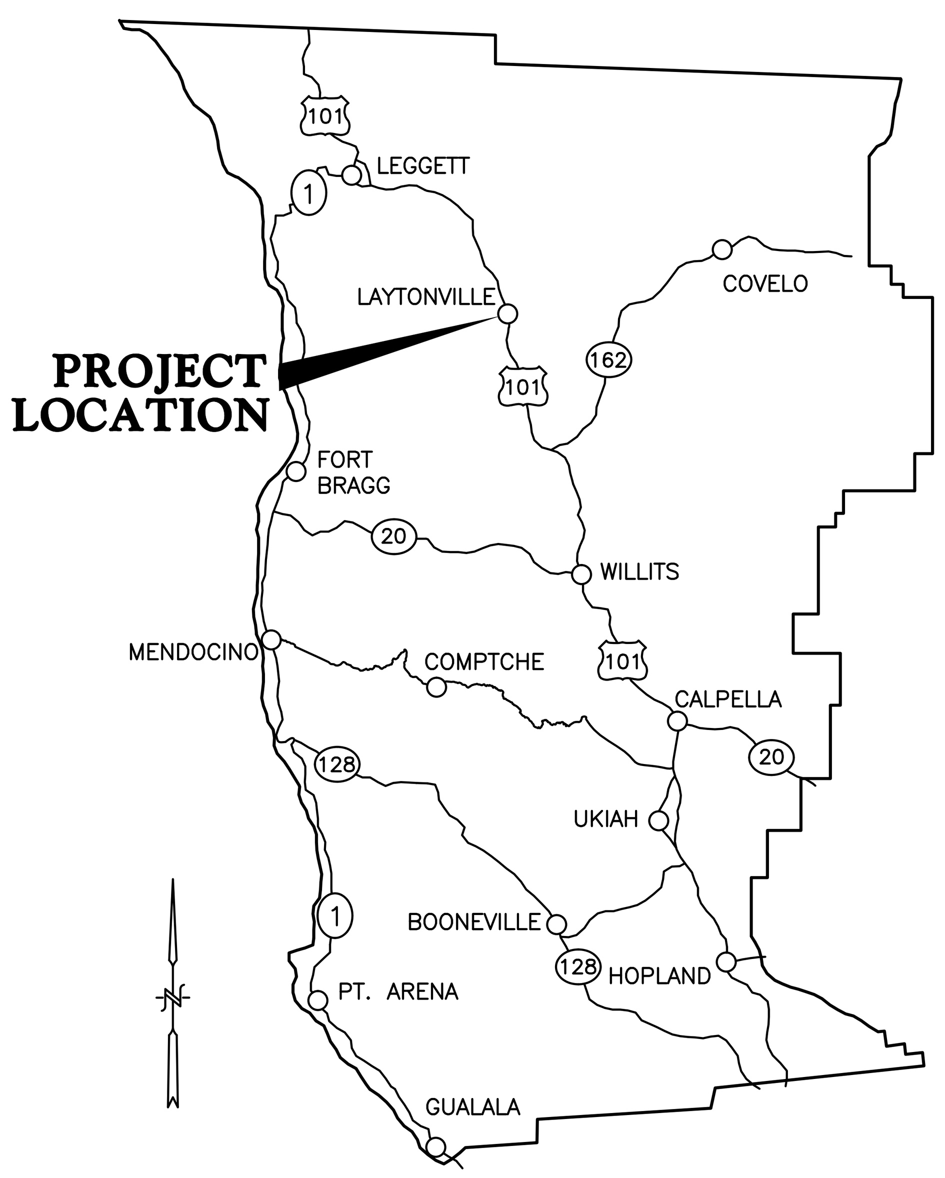
PREPARED FOR

LAYTONVILLE ROCK

PREPARED BY

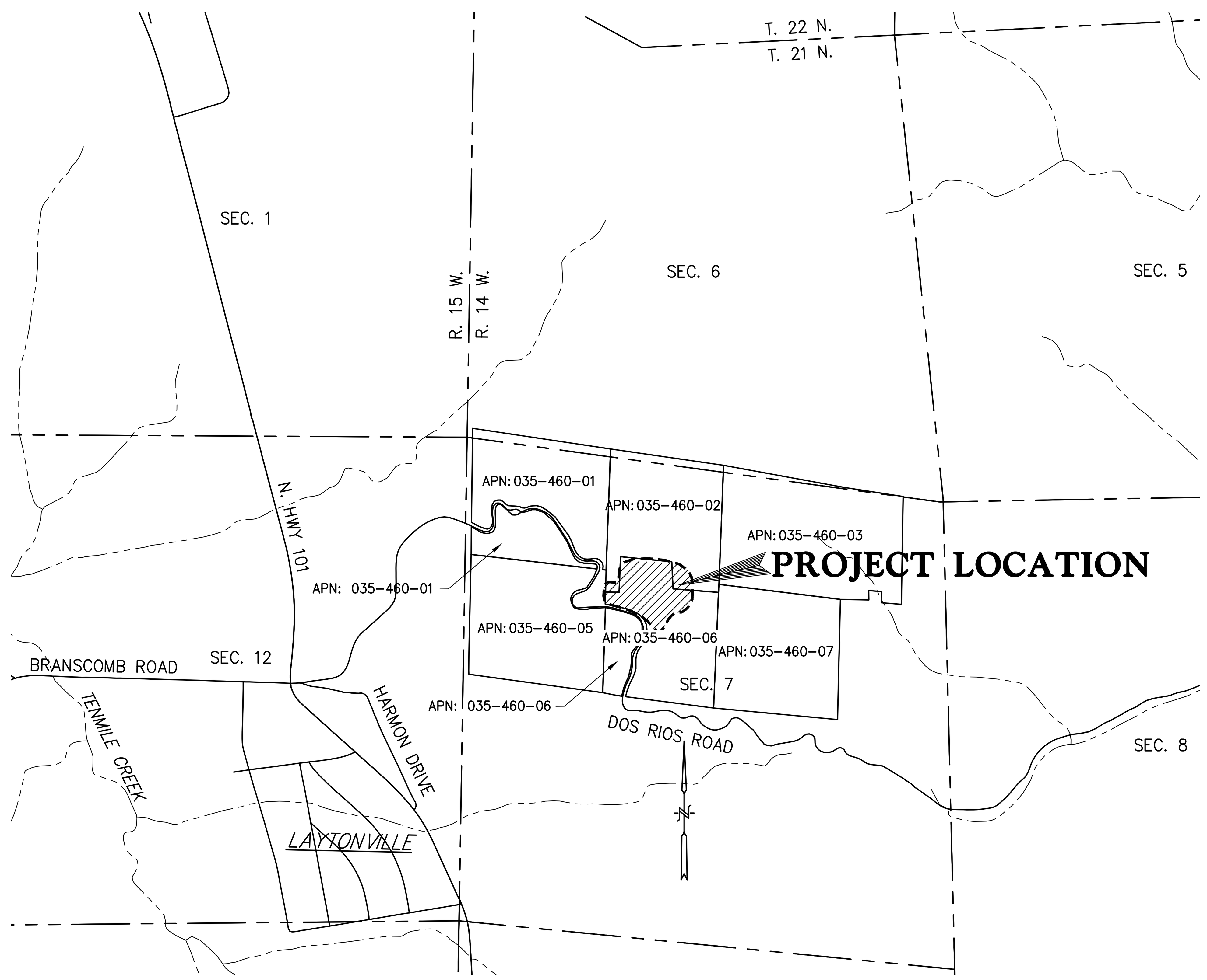
RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

AUGUST 2014
UR # 15-92/13



MENDOCINO COUNTY MAP
NOT TO SCALE

CALIFORNIA MAP
NOT TO SCALE



VICINITY MAP
SCALE: 1"=1000'

ABBREVIATIONS

AB	AGGREGATE BASE
AC	ASPHALT CONCRETE
ALT	ALTERNATE
BVCE	BEGIN VERTICAL CURVE ELEVATION
BVCS	BEGIN VERTICAL CURVE STATION
CL	CENTERLINE
CP	CONTROL POINT
CMP	CORRUGATED METAL PIPE
CPP	CORRUGATED POLYETHYLENE PIPE
EVCE	END VERTICAL CURVE ELEVATION
EVCS	END VERTICAL CURVE STATION
ELEV	ELEVATION
EP	EDGE OF PAVEMENT
EXIST,(E)	EXISTING
FES	FLARED END SECTION
FG	FINISHED GRADE
FHWA	FEDERAL HIGHWAY ADMINISTRATION
F&C	FRAME AND COVER
FL	FLOW LINE
GB	GRADE BREAK
HDPE	HIGH DENSITY POLYETHYLENE
INV	INVERT
LF	LINEAR FOOT
Lt	LEFT
NTS	NOT TO SCALE
OG	ORIGINAL GROUND
(P)	PROPOSED
PC	POINT OF CURVATURE
PGL	PROPOSED GRADE LINE
PCC	PORTLAND CEMENT CONCRETE
PM	POST MILE
PMP	PERMEABLE MATERIAL
PT	POINT OF TANGENT
PVI	POINT OF VERTICAL INTERSECTION
PL	PROPERTY LINE
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
Rt	RIGHT
ROW	RIGHT OF WAY
SC	SAW CUT
STA	STATION
TYP	TYPICAL
VAR	VARIABLE

INDEX OF SHEETS:

MINING INITIATION: CONTINUOUS

MINING TERMINATION: 30 YEARS AFTER INITIATION.
MINING VOLUME: 325,000
NOTES:

PROPERTY LINES SHOWN ARE FROM COUNTY GIS. FOR MORE ACCURATE PROPERTY BOUNDARIES SEE SHEETS 2–4.

REGISTERED PROFESSIONAL ENGINEER CATHY A. MCKEON NO. 51026 EXP. 9-30-15 CIVIL STATE OF CALIFORNIA

CERTIFICATION:

I CERTIFY THAT THIS PROJECT WAS DESIGNED BY ME OR UNDER MY DIRECTION IN ACCORDANCE WITH GENERALLY ACCEPTED ENGINEERING PRACTICES

CATHY A. MCKEON, R.C.E. 51026 — DATE 8-29-14

REGISTERED PROFESSIONAL ENGINEER GEORGE C. RAU NO. 21908 EXP. 9-30-15 CIVIL STATE OF CALIFORNIA

GEORGE C. RAU, R.C.E. 21908 — DATE 8-29-14

DATE:	REVISION:	BY:	
			COMPUTER NO. Z:\R12023\
			PATH: Drawings\Civil-2012\
			FILE:
			PSVIEW:
			MSVP:
			MSVIEW:

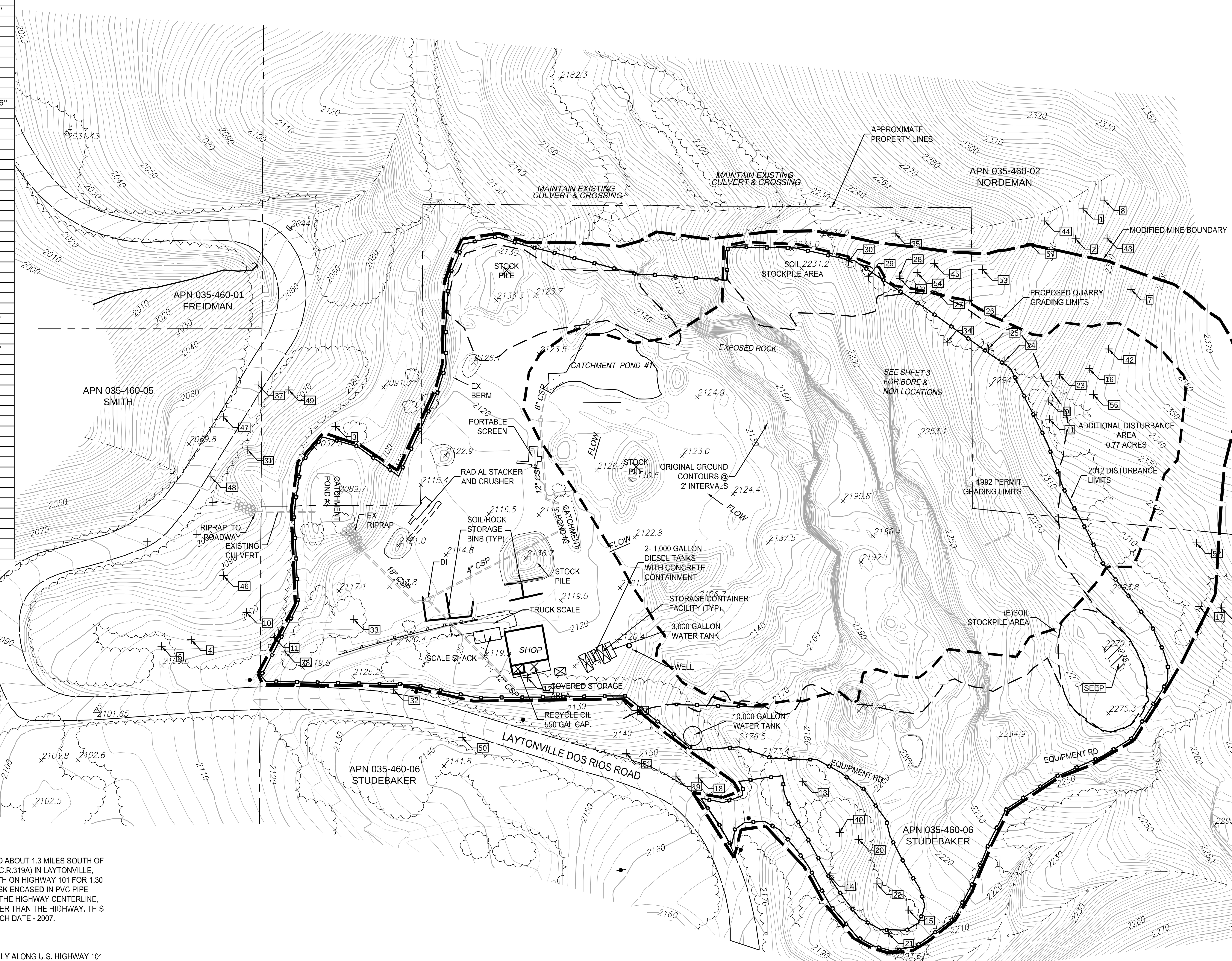
OWNER:	LAYTONVILLE ROCK
LOCATION:	1136 LAYTONVILLE DOS RIOS ROAD LAYTONVILLE, CALIFORNIA
DRAWING:	COVER SHEET
PROJECT:	MINING AND RECLAMATION PLAN

RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

Date:	AUGUST 2014
Scale:	AS SHOWN
Drawn:	MAW
Checked:	CAM
Reviewed:	GCR
JOB NO.	R12023

Xrefs: R12023 XC TITLE 2.dwg
Path: Z:\R12023\Drawings\Civil – 2012\R12023 PC-COVER 2014.dwg Plot Date: Aug 28, 2014 at 9:44am

TREE IDENTIFICATION TABLE			
GROUP NO.	TREE DESCRIPTION	TREE ID NO.	SIZE (DIA)
1	VALLEY OAK	1	27"
4	CANYON LIVE OAK	1	7"
5	CANYON LIVE OAK	14, 15, 16, 17	40", 15", 20", 9"
6	CANYON LIVE OAK	18, 19	3", 3"
7	CANYON LIVE OAK	20, 21	10", 4"
8	CANYON LIVE OAK	2	10"
9	CANYON LIVE OAK	3	3"
10	CANYON LIVE OAK	4	4"
11	CANYON LIVE OAK	5	48"
12	CANYON LIVE OAK	6	3"
13	CANYON LIVE OAK	7	6"
14	CANYON LIVE OAK	9, 10, 11, 12, 13	4", 5", 9", 10", 16"
15	CANYON LIVE OAK	22	8"
16	OREGON OAK	11	27"
17	OREGON OAK	12	8"
18	OREGON OAK	13	10"
19	OREGON OAK	14	26"
20	OREGON OAK	15	25"
21	OREGON OAK	16	12"
22	OREGON OAK	17	12"
23	OREGON OAK	18	50"
24	OREGON OAK	20,21	20", 12"
25	OREGON OAK	22,23	30", 10"
26	OREGON OAK	24, 25, 26	8", 10", 15"
27	OREGON OAK	27	15"
28	OREGON OAK	28	24"
29	OREGON OAK	3	11"
30	OREGON OAK	7, 8, 9, 10	4", 3", 12", 7"
31	OREGON OAK	1, 2	10", 10"
32	OREGON OAK	19	17"
33	OREGON OAK, BLACK OAK*	28, 21*	15", 15"*
34	OREGON OAK	3	30"
35	OREGON OAK, BLACK OAK*	4, 5, 6, 7*	4", 5", 10", 10"*
36	BLACK OAK	1	15"
37	BLACK OAK	10, 11	5", 6"
38	BLACK OAK	12, 13, 14, 15	15", 13", 12" 8"
39	BLACK OAK	16	14"
40	BLACK OAK	17	18"
41	BLACK OAK	18	14"
42	BLACK OAK	19	26"
43	BLACK OAK	20	9"
44	BLACK OAK	2	7"
45	BLACK OAK	3	10"
46	BLACK OAK	4, 5	13", 11"
47	BLACK OAK	6	6"
48	BLACK OAK	8	15"
49	BLACK OAK	9	32"
50	VALLEY OAK	4	21"
51	VALLEY OAK	6	10"
52	VALLEY OAK	7, 8	17", 40"
53	VALLEY OAK	5	12"
54	VALLEY OAK	3	24"
55	VALLEY OAK	6	30"
56	VALLEY OAK	9	15"
57	VALLEY OAK	10	30"
58	VALLEY OAK	11	15"
	TOTAL TREES	83	



LEGEND

- 2012 DISTURBANCE LIMITS
- 1992 GRADING PERMIT LIMITS
- PROPOSED QUARRY GRADING LIMITS
- MODIFIED MINE BOUNDARY
- TREE
- STRUCTURES
- STORAGE CONTAINERS
- EDGE OF ROAD
- EDGE OF WATER
- FLOWLINE
- ×100.5 SPOT ELEVATIIONS
- 100 CONTOUR LINE 2' INTERVALS
- (E) EXISTING
- AC ASPHALTIC CONCRETE
- EP EDGE OF PAVEMENT
- UTILITY POLE
- 56 TREE GROUP NUMBER

SCALE: 1" = 60'

0 60 120

SCALE IN FEET

NOTE:
PROPERTY LINES SHOWN ARE APPROXIMATE ONLY AND ARE BASED ON THE 1992 PERMIT DOCUMENTATION.

HORIZONTAL BASIS: NAD 83
STATE PLANE COORDINATES
HELD HPGN (101 MEN 72.5) PT NO 4, ROTATED THROUGH
HPGN (D CA 01 GE) PT NO 3
EPOCH DATE 2007
COMBINED SCALE FACTOR 0.99990326...COMPUTED FROM LEICA GEO-OFFICE
CONVERGENCE ANGLE -0°56'01"

VERTICAL DATUM:
NGVD 1929
BASED ON CAL-TRANS MONUMENT LOCATED ALONG HWY 101
IN FRONT OF HEALTH FOOD STORE IN LAYTONVILLE. INFORMATION OBTAINED
FROM RANDY HAROLSON OF CAL-TRANS.
STAMPED CALTRANS 2003
ORTHO HT= 1655.98 FT
ALUMINUM CAP & REBAR SET AT GRADE, SEE DETAIL.

HPGN D CA 01 GE
DESCRIBED BY CALTRANS 1993:
THE STATION IS LOCATED ON U.S. HIGHWAY 101, ABOUT 20 MILES NORTH OF WILLITS AND ABOUT 1.3 MILES SOUTH OF LAYTONVILLE. TO REACH THE STATION FROM THE U.S. POST OFFICE ON RAMSEY ROAD (C.R.319A) IN LAYTONVILLE, GO EAST ON RAMSEY ROAD FOR 0.10 MILES TO HIGHWAY 101. TURN RIGHT AND GO SOUTH ON HIGHWAY 101 FOR 1.30 MILES TO THE STATION ON THE RIGHT AT POST MILE 68.00. THE STATION IS A SURVEY DISK ENCASED IN PVC PIPE WITH ACCESS COVER SET IN CONCRETE FLUSH WITH THE GROUND, 58.0 FEET WEST OF THE HIGHWAY CENTERLINE, 3.0 FEET EAST OF A FENCE, 3.0 FEET EAST OF A WITNESS POST, AND ABOUT 3 FEET LOWER THAN THE HIGHWAY. THIS STATION WAS OCCUPIED AS PART OF A CALIFORNIA HPGN DENSIFICATION SURVEY. EPOCH DATE - 2007.

101 MEN 72.85
DESCRIBED BY CALTRANS 2004:
THE STATION IS LOCATED IN MENDOCINO COUNTY, APPROXIMATELY 3.3 MILES NORTHERLY ALONG U.S. HIGHWAY 101 FROM LAYTONVILLE AND 18.4 MILES SOUTHERLY OF LEGGETT. TO REACH THE STATION FROM THE INTERSECTION OF BRANSCOMB ROAD IN LAYTONVILLE AND HIGHWAY 101 PROCEED 3.35 MILES NORTHERLY ALONG HIGHWAY 101 TO VALLEY DRIVE. PROCEED WESTERLY ON VALLEY DRIVE TO TEH STATION ON THE LEFT. THE STATION IS A SURVEY DISK ENCASED WITH PVC PIPE WITH ACCESS COVER SET IN CONCRETE FLUSH WITH THE GROUND. 0.9 METERS WEST OF A STEEL FENCE POST AND CARSONITE MARKER, 12.1 METERS SOUTH OF THE CENTERLINE OF HIGHWAY 101, 193.0 METERS SOUTH OF A CULVERT ON HIGHWAY 101 AT POST MILE MARKER 72.73, WEST OF THE EDGE OF PAVEMENT ON HIGHWAY 101. THE STATION IS LOCATED WITHIN THE CALIFORNIA DEPARTMENT OF TRANSPORTATION HIGHWAY RIGHT-OF-WAY. EPOCH DATE - 2007

CONTROL POINT TABLE				
POINT NUMBER	NORTHING	EASTING	ELEVATION	DESCRIPTION
4	2381330.2212	6147409.8768	2031.4344	SET 1\2" IP (AERIAL PANEL)
5	2380721.7760	6147441.1945	2101.6520	SET 1\2" IP (AERIAL PANEL)
6	2380466.4985	6148280.7091	2203.6065	SET 1\2" IP (AERIAL PANEL)
7	2380725.5534	6148676.0205	2302.7079	SET 1\2" IP (AERIAL PANEL)
8	2381204.4536	6148828.8811	2430.6367	SET 1\2" IP (AERIAL PANEL)

PoinT Co.
Photogrammetric Services
FAIR OAKS, CALIFORNIA
(9 6) 536-0487

REGISTERED PROFESSIONAL ENGINEER
CATHY A. MCKEON
8-29-14
NO. 51026
EXP. 9-30-15
CIVIL
STATE OF CALIFORNIA

DATE:	REVISION:	BY:

COMPUTER NO. Z:\R12023\
PATH: Drawings\Civil-2012\
FILE: R12023 PC EC.dwg
PSVIEW:
MSVP:
MSVIEW:

OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD
LAYTONVILLE, CALIFORNIA

RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

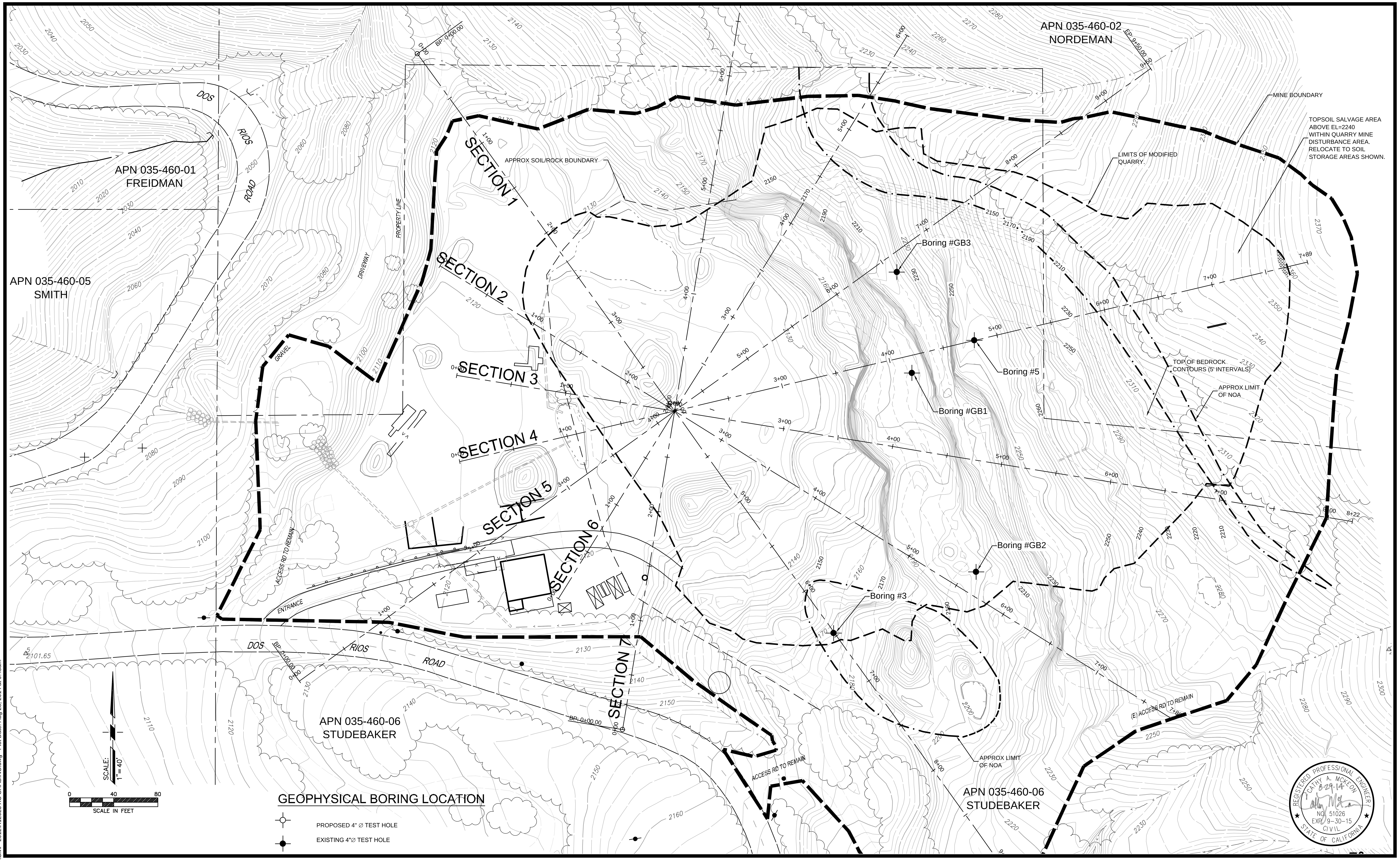
DRAWING: EXISTING CONDITIONS

PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
Drawn:	MAW
Checked:	CAM
Reviewed:	GCR
JOB NO.	R12023

SHEET 2 of 9 SHEETS

Xrefs: R12023 XC TOPO.dwg; R12023 XC TITLE 2.dwg; R12023 XC ORTHO.dwg; R12023 XC GRADING.dwg; 120404-ortho.dwg
Path: Z:\R12023\Drawings\Civil - 2012\R12023 PC EC.dwg Plot Date: Aug 28, 2014 at 9:44am



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Path: Z:\R12023\Drawings\Civil - 2012\R12023 XC GRADING.dwg Plot Date: Aug 28, 2014 at 9:45am

DATE:	REVISION:	BY:	
			COMPUTER NO. Z:\R12023\
			PATH: Drawings\Civil-2012\
			FILE:
			PSVIEW:
			MSVP:
			MSVIEW:

OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD
LAYTONVILLE, CALIFORNIA

RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

DRAWING: GEOPHYSICAL BORING PLAN

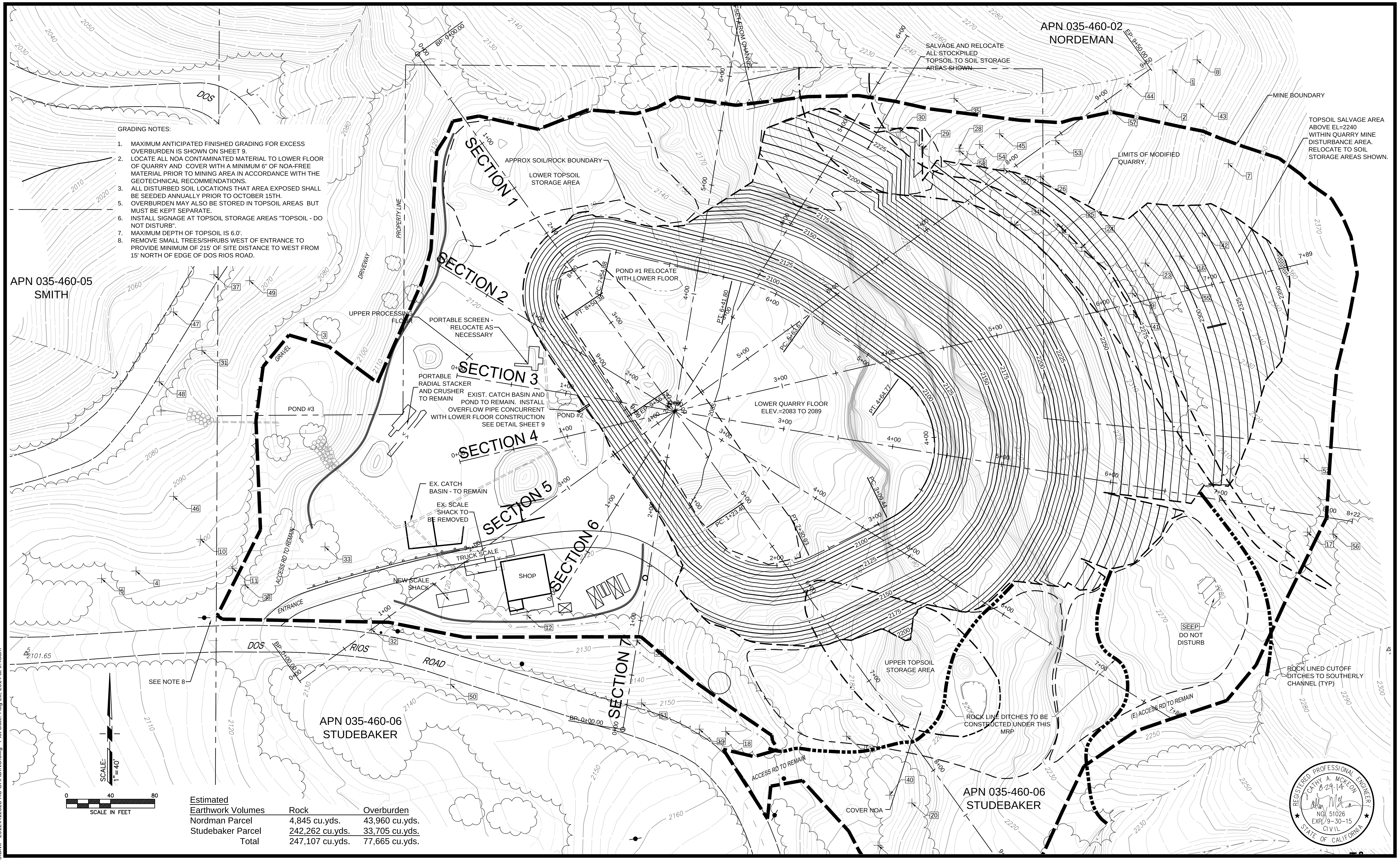
PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
Drawn:	MAW
Checked:	CAM
Reviewed:	GCR
JOB NO.	R12023

SHEET 3 of 9 SHEETS

GRADING NOTES:

1. MAXIMUM ANTICIPATED FINISHED GRADING FOR EXCESS OVERBURDEN IS SHOWN ON SHEET 9.
2. LOCATE ALL NOA CONTAMINATED MATERIAL TO LOWER FLOOR OF QUARRY AND COVER WITH A MINIMUM 6" OF NOA-FREE MATERIAL PRIOR TO MINING AREA IN ACCORDANCE WITH THE GEOTECHNICAL RECOMMENDATIONS.
3. ALL DISTURBED SOIL LOCATIONS THAT AREA EXPOSED SHALL BE SEEDED ANNUALLY PRIOR TO OCTOBER 15TH.
5. OVERBURDEN MAY ALSO BE STORED IN TOPSOIL AREAS BUT MUST BE KEPT SEPARATE.
6. INSTALL SIGNAGE AT TOPSOIL STORAGE AREAS "TOPSOIL - DO NOT DISTURB".
7. MAXIMUM DEPTH OF TOPSOIL IS 6.0'.
8. REMOVE SMALL TREES/SHRUBS WEST OF ENTRANCE TO PROVIDE MINIMUM OF 215' OF SITE DISTANCE TO WEST FROM 15' NORTH OF EDGE OF DOS RIOS ROAD.



Estimated

Earthwork Volumes	Rock	Overburden
Nordman Parcel	4,845 cu.yds.	43,960 cu.yds.
Studebaker Parcel	242,262 cu.yds.	33,705 cu.yds.
Total	247,107 cu.yds.	77,665 cu.yds.

Xrefs: 120404-ortho.dwg; R12023 XC TOPO.dwg; R12023 XC TITLE 2.dwg
Path: Z:\R12023\Drawings\Civil - 2012\R12023 XC GRADING.dwg Plot Date: Aug 28, 2014 at 9:45am

DATE:	REVISION:	BY:

COMPUTER NO. Z:\R12023\
PATH: Drawings\Civil-2012\
FILE:
PSVIEW:
MSVP:
MSVIEW:

OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD LAYTONVILLE, CALIFORNIA

RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

DRAWING: GRADING PLAN

PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
Drawn:	MAW
Checked:	CAM
Reviewed:	GCR
JOB NO.	R12023

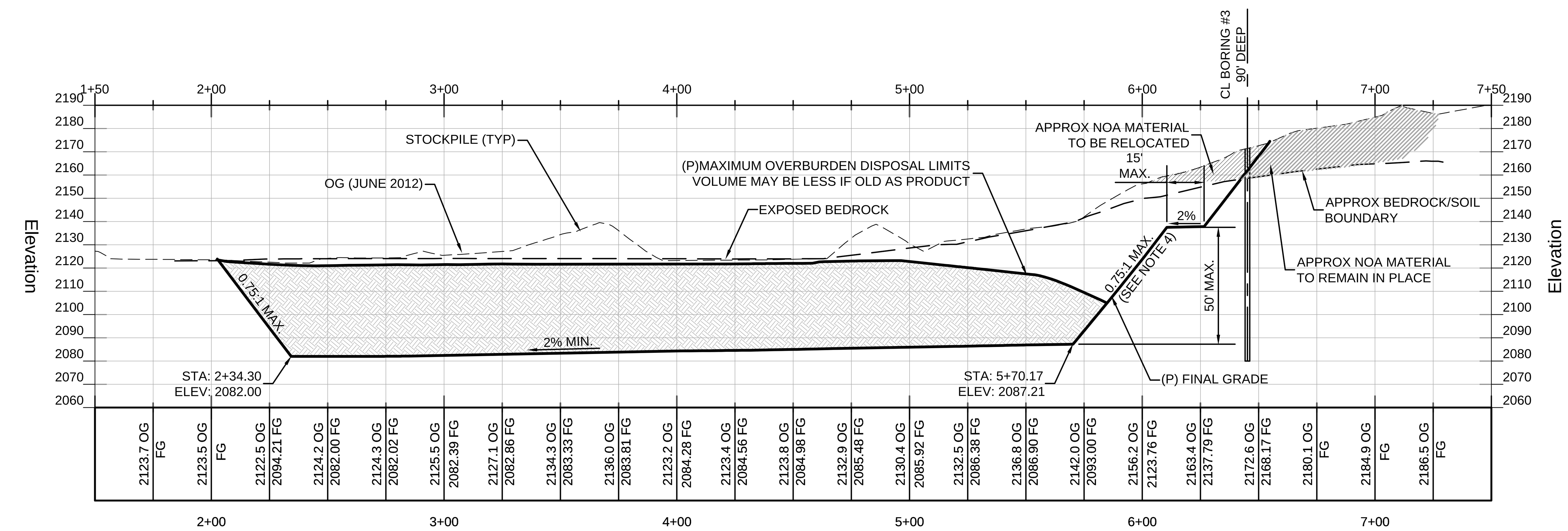
SHEET 4 of 9 SHEETS

NOTES:

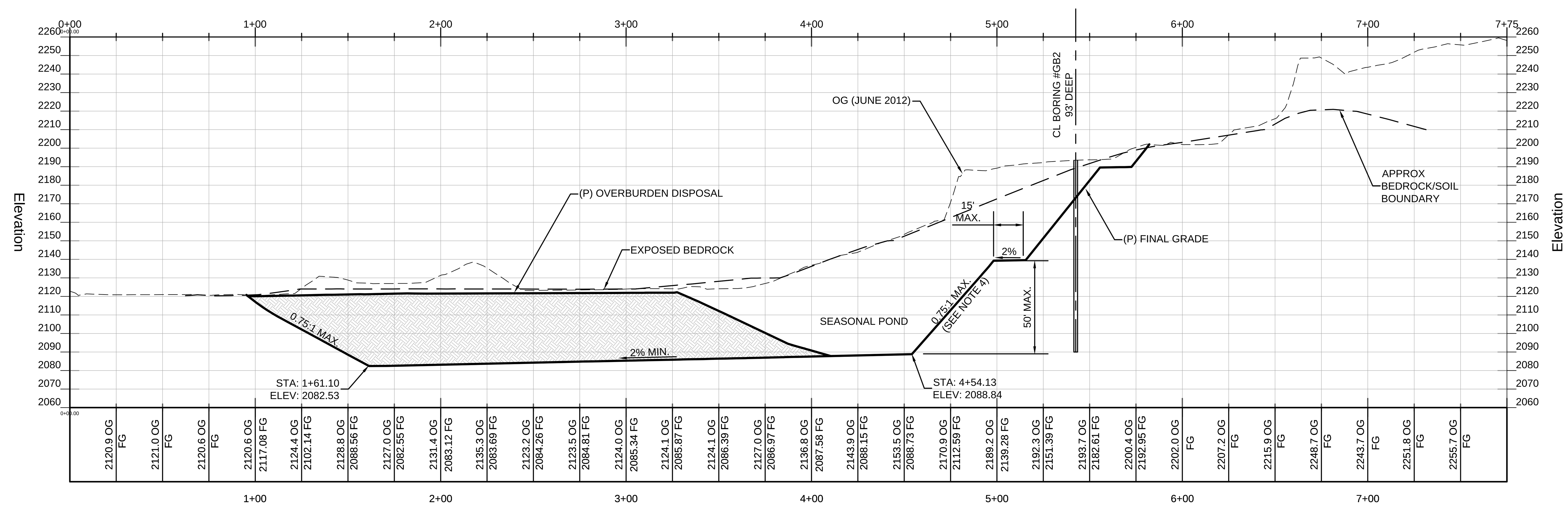
1. LIMITS OF BEDROCK AND NOA CONTAINING MATERIAL ARE APPROXIMATE ONLY. LIMITS SHOWN BASED ON LIMITED BORINGS AVAILABLE AS OF DECEMBER 2013.
2. MATERIAL CONTAINING NOA SHALL BE RELOCATED TO THE LOWER QUARRY FLOOR AND SHALL NOT BE SOLD OR INCORPORATED INTO PRODUCT.
3. SEE GEOTECHNICAL REPORT FOR NOA MITIGATION AND MONITORING.
4. SEE MRP FOR SLOPE CRITERIA. SLOPES SHOWN ARE APPROXIMATE ONLY AND SUBJECT TO THE SLOPE CRITERIA BASED ON ACTUAL MATERIAL ENCOUNTERED.

LEGEND:

- OVER BURDEN
- NOA TO BE RELOCATED
- NOA TO REMAIN IN PLACE



Profile View of SECTION 1



Profile View of SECTION 2

SCALES: HORIZ. 1"=40'
VERT. 1"=40'

Xrefs: 120404-ortho.dwg; R12023 XC TOPO.dwg; R12023 XC TITLE 2.dwg
Path: Z:\R12023\Drawings\Civil - 2012\R12023 XC GRADING.dwg Plot Date: Aug 28, 2014 at 9:45am

DATE:	REVISION:	BY:

COMPUTER NO. Z:\R12023\
PATH: Drawings\Civil-2012\
FILE:
PSVIEW:
MSVP:
MSVIEW:

OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD
LAYTONVILLE, CALIFORNIA

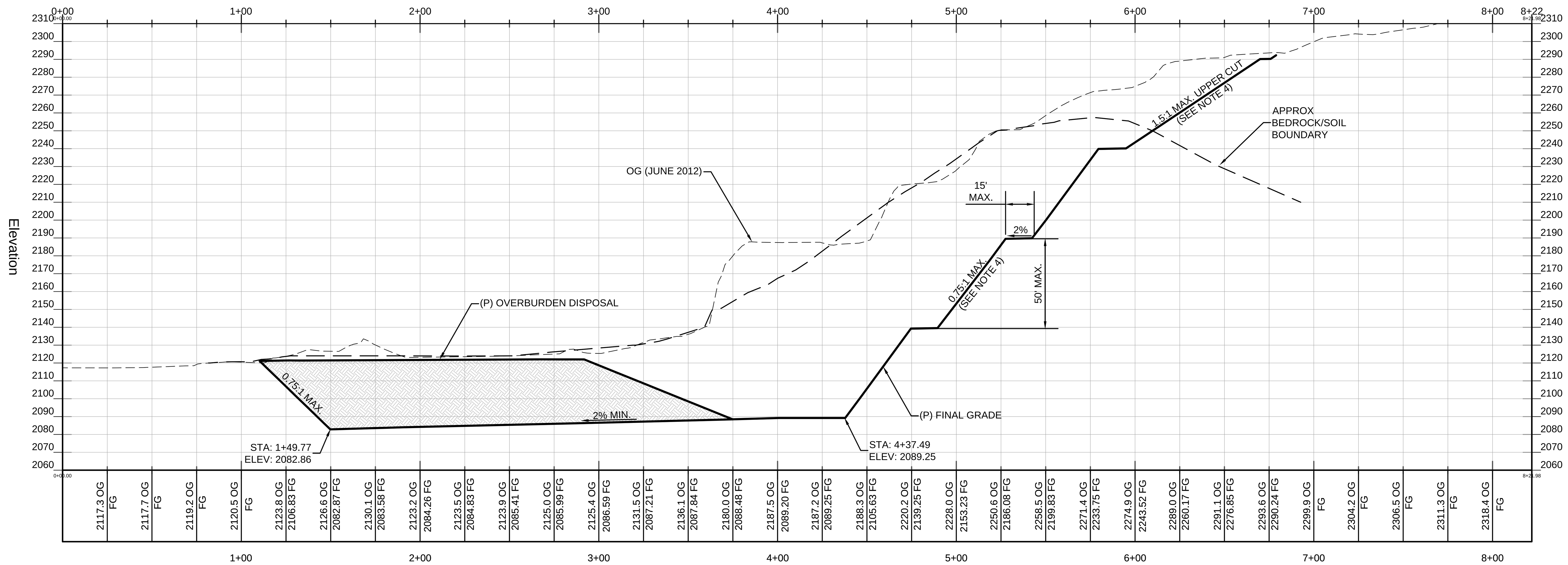
RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

DRAWING: CROSS SECTIONS

PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
Drawn:	MAW
Checked:	CAM
Reviewed:	GCR
JOB NO.	R12023

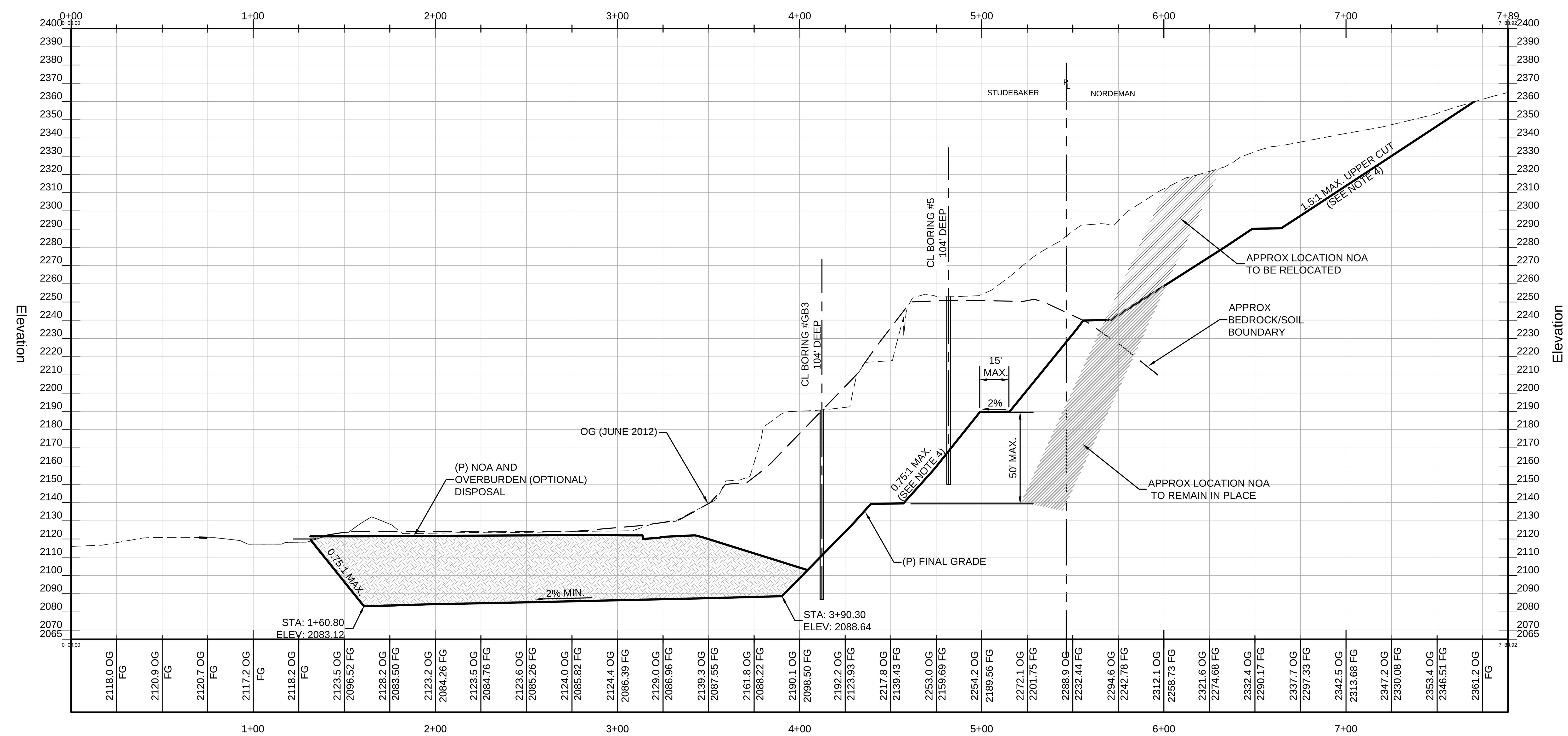
SHEET 5 of 9 SHEETS



Profile View of SECTION 3

NOTE:

SEE GRADING SPECIFICATIONS AND NOTE ON SHEET 5



Profile View of SECTION 4

LEGEND:

- OVER BURDEN
- NOA TO BE RELOCATED
- NOA TO REMAIN IN PLACE

SCALES: HORIZ. 1"=40'
VERT. 1"=40'

REGISTERED PROFESSIONAL ENGINEER
CATHY A. MCKEON
8-29-14
NO. 51026
EXP. 9-30-15
CIVIL
STATE OF CALIFORNIA

Xrefs: 120404-ortho.dwg; R12023 XC TOPO.dwg; R12023 XC TITLE 2.dwg
Path: Z:\R12023\Drawings\Civil - 2012\R12023 XC GRADING.dwg Plot Date: Aug 28, 2014 at 9:45am

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OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD
LAYTONVILLE, CALIFORNIA

RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

DRAWING: CROSS SECTION

PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
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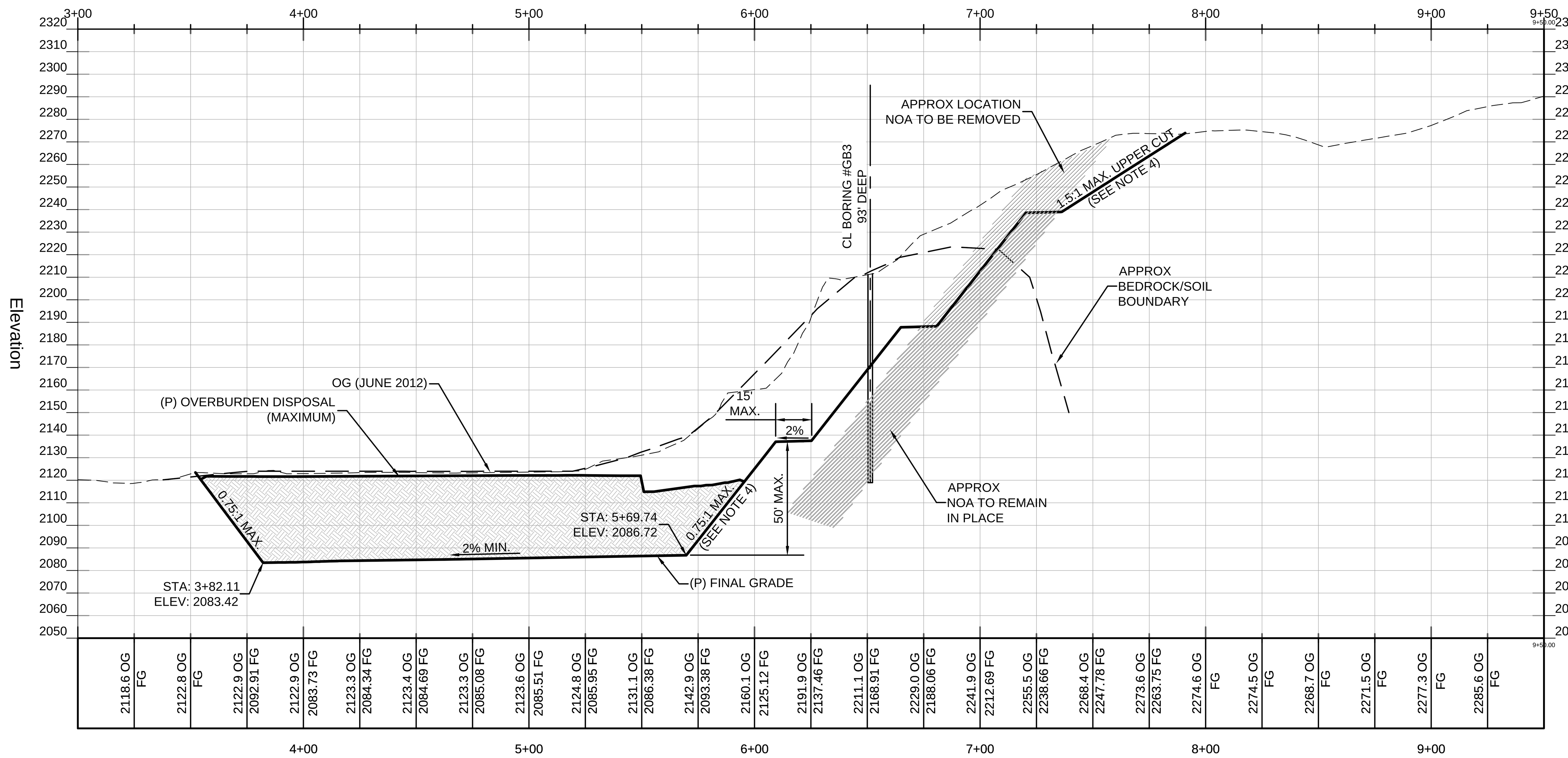
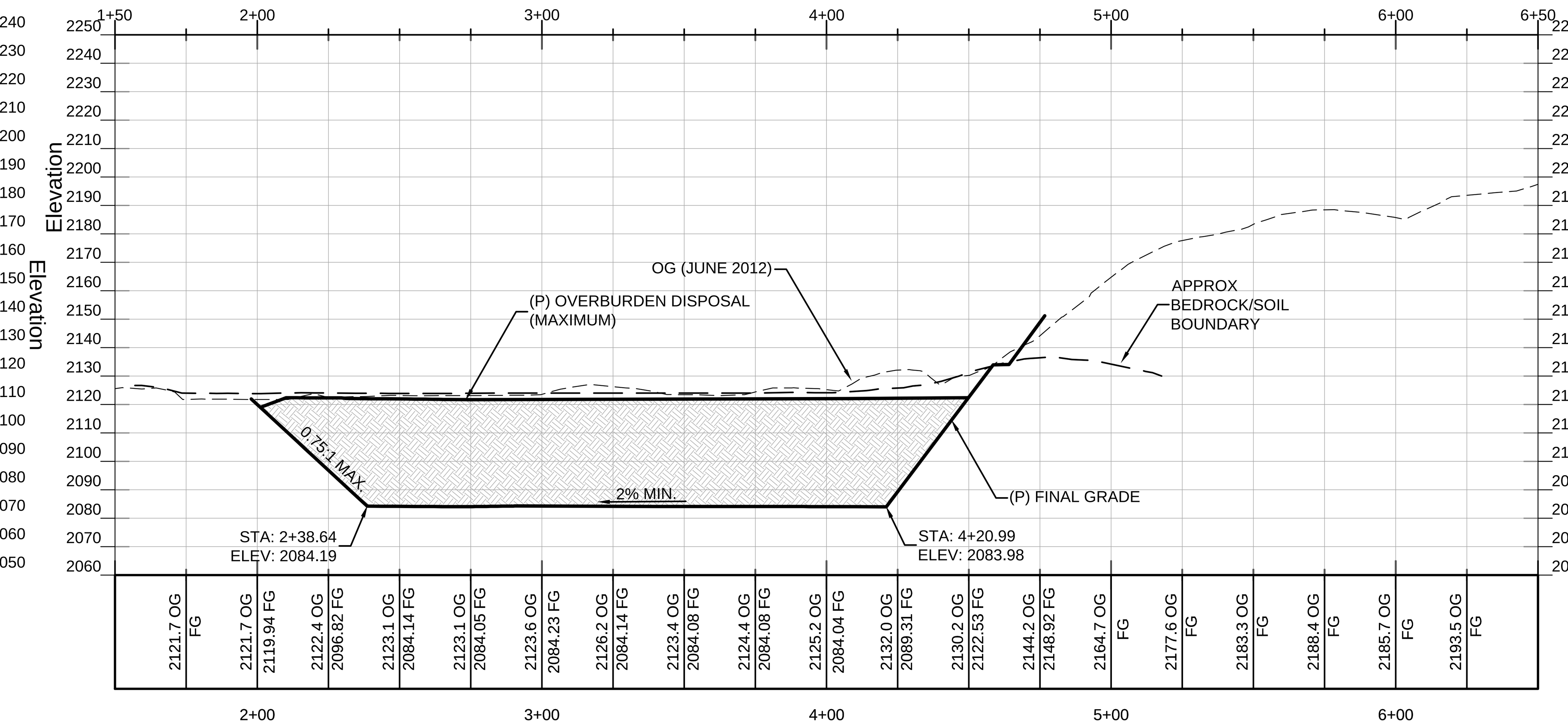
JOB NO.	R12023

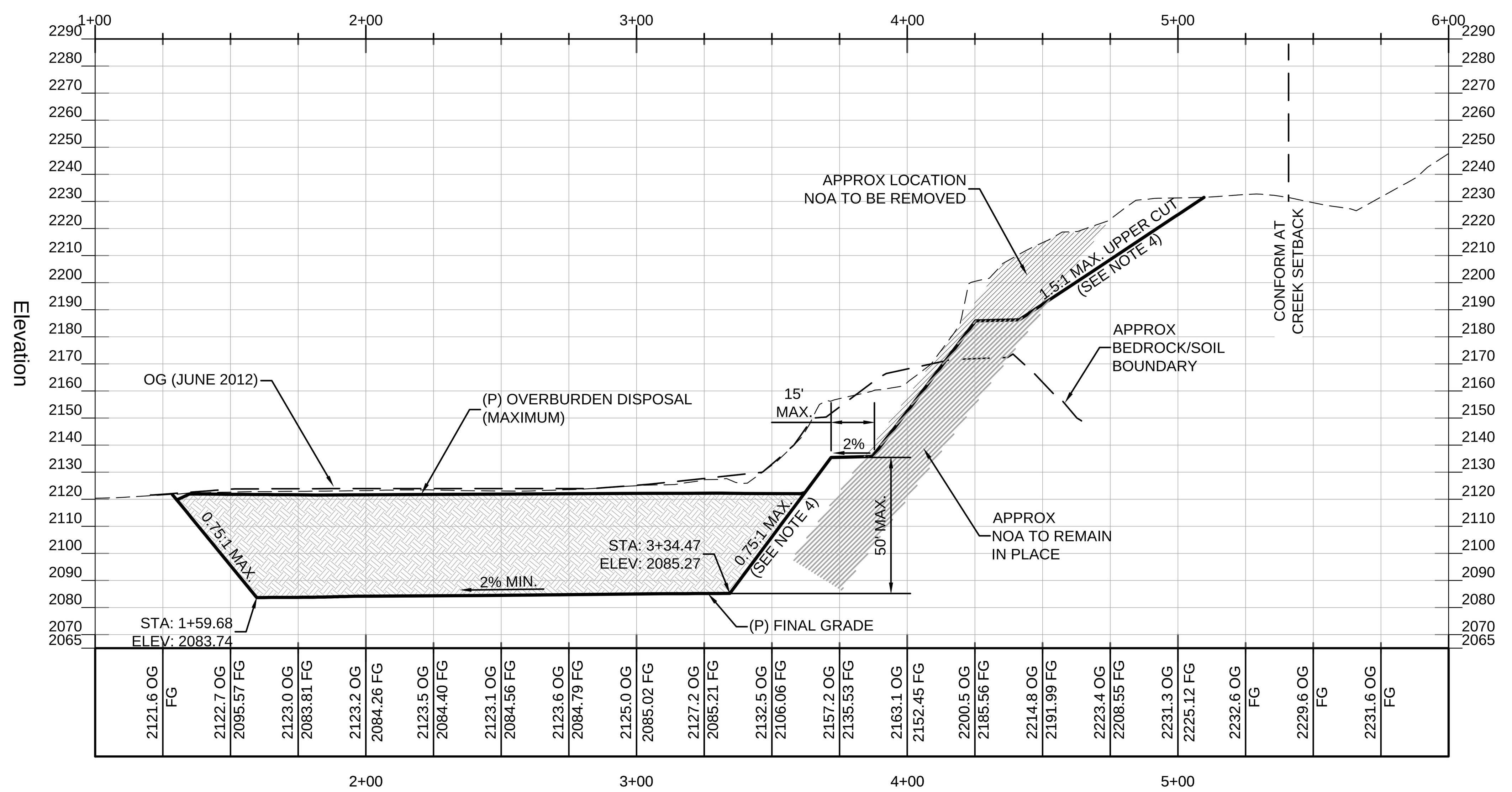
SHEET 6 of 9 SHEETS



Profile View of SECTION 5



Profile View of SECTION 7



Profile View of SECTION 6

NOTE:

SEE GRADING SPECIFICATIONS AND NOTE ON SHEET 5

LEGEND:

OVER BURDEN

NOA TO BE RELOCATED

NOA TO REMAIN IN PLACE

SCALES: HORIZ. 1"=40'
VERT. 1"=40'

Xrefs: 120404-ortho.dwg; R12023 XC TOPO.dwg; R12023 XC TITLE 2.dwg
Path: Z:\R12023\Drawings\Civil - 2012\R12023 XC GRADING.dwg Plot Date: Aug 28, 2014 at 9:45am

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OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD
LAYTONVILLE, CALIFORNIA

RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

DRAWING: CROSS SECTIONS

PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
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SHEET 7 of 9 SHEETS

LEGEND

- MINE BOUNDARY AREA
- 1.5:1 UPPER SLOPED AREA; PILOT AND FINAL STAGES:
  - 25% GRASSLANDS
  - 25% SHRUBLAND
  - 50% WOODLAND
  - SLOPE AREA~ 58,600 SF OR 1.34 ACRES
- BENCH AREA; PILOT AND FINAL STAGES
  - 50% SHRUBLAND
  - 50% WOODLAND
  - SLOPE AREA~ 29,720 SF OR 0.68 ACRES
- LOWER QUARRY FLOOR & UPPER TOPSOIL AREAS; FINAL STAGES:
  - 100% GRASSLANDS
  - FLOOR & UPPER TOPSOIL AREA~ 90,050 SF OR 2.07 ACRES
- UPPER QUARRY FLOOR; FINAL STAGES:
  - 100% WOODLAND
  - FLOOR AREA~ 70,236 SF OR 1.61 ACRES
- ROADS TO REMAIN
- PILOT PLANTING AREA: 10308 SF/ 0.24 ACRE
  - UPPER SLOPE
  - BENCH
  - 10–20 YEARS AFTER EXTRACTION BEGINS.

- TOTAL AREA RECLAIMED UNDER THIS MRP = 5.70 ACRES
- TOTAL AREA PREVIOUS RECLAIMED = 0.51 ACRES

NOTE:

1. SEE TEXT PORTION OF RECLAMATION PLAN FOR ADDITIONAL PLANTING INFORMATION.
2. ALL AREAS NOT SHOWN AS PILOT PLANTING AREAS SHALL BE COMPLETED UPON CLOSURE OF QUARRY.
3. PILOT AREAS ACREAGE IS INCLUDED IN ABOVE NOTED PLANTING.
4. ALL AREAS TO BE RECLAIMED FOR AN END USE OF RANGELAND.
5. RECLAMATION AREAS NOTED DO NOT INCLUDE ROADS OR MAINTENANCE AREAS TO REMAIN OR SLOPES STEEPER THAN 1.5:1 (ROCK).
6. DISTURBED AREAS ON SLOPES THAT ARE NOT IN ROCK/OVERBURDEN WHICH ARE 1.5:1 OR FLATTER SHALL BE SEEDED IN ACCORDANCE WITH GRASSLANDS.

REGISTERED PROFESSIONAL ENGINEER CATHY A. MCKEON 8-29-14 NO. 51026 EXP. 9-30-15 CIVIL STATE OF CALIFORNIA

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			COMPUTER NO. Z:\R12023\
			PATH: Drawings\Civil-2012\
			FILE:
			PSVIEW:
			MSVP:
			MSVIEW:

OWNER: LAYTONVILLE ROCK

LOCATION: 1136 LAYTONVILLE DOS RIOS ROAD LAYTONVILLE, CALIFORNIA

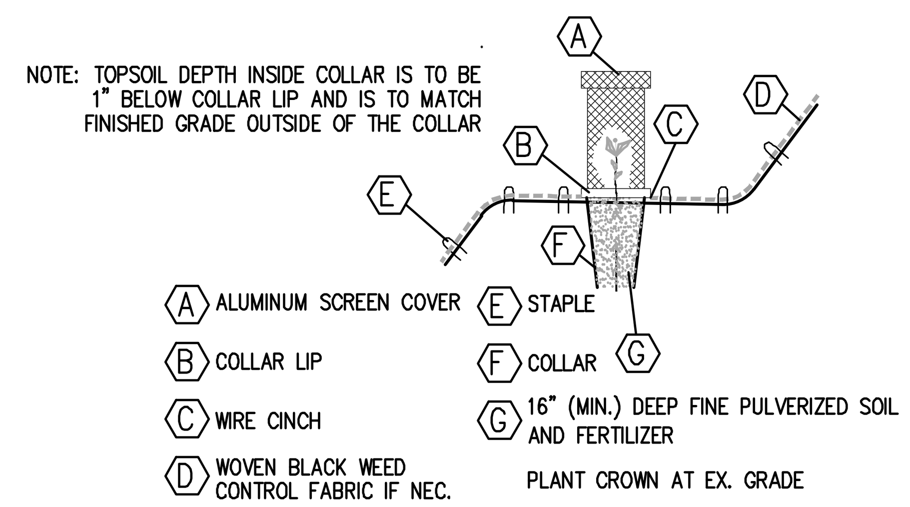
RAU AND ASSOCIATES INC.
CIVIL ENGINEERS · LAND SURVEYORS
100 NORTH PINE STREET · (707) 462-6536 · UKIAH, CA 95482

DRAWING: RECLAMATION PLAN

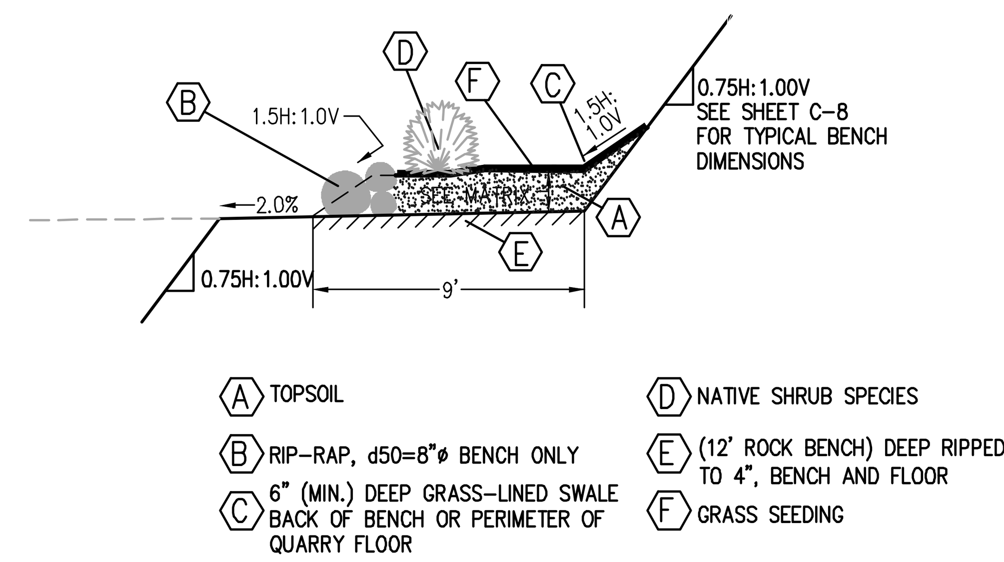
PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
Scale:	AS SHOWN
Drawn:	MAW
Checked:	CAM
Reviewed:	GCR
JOB NO.	R12023

SHEET 8 of 9 SHEETS



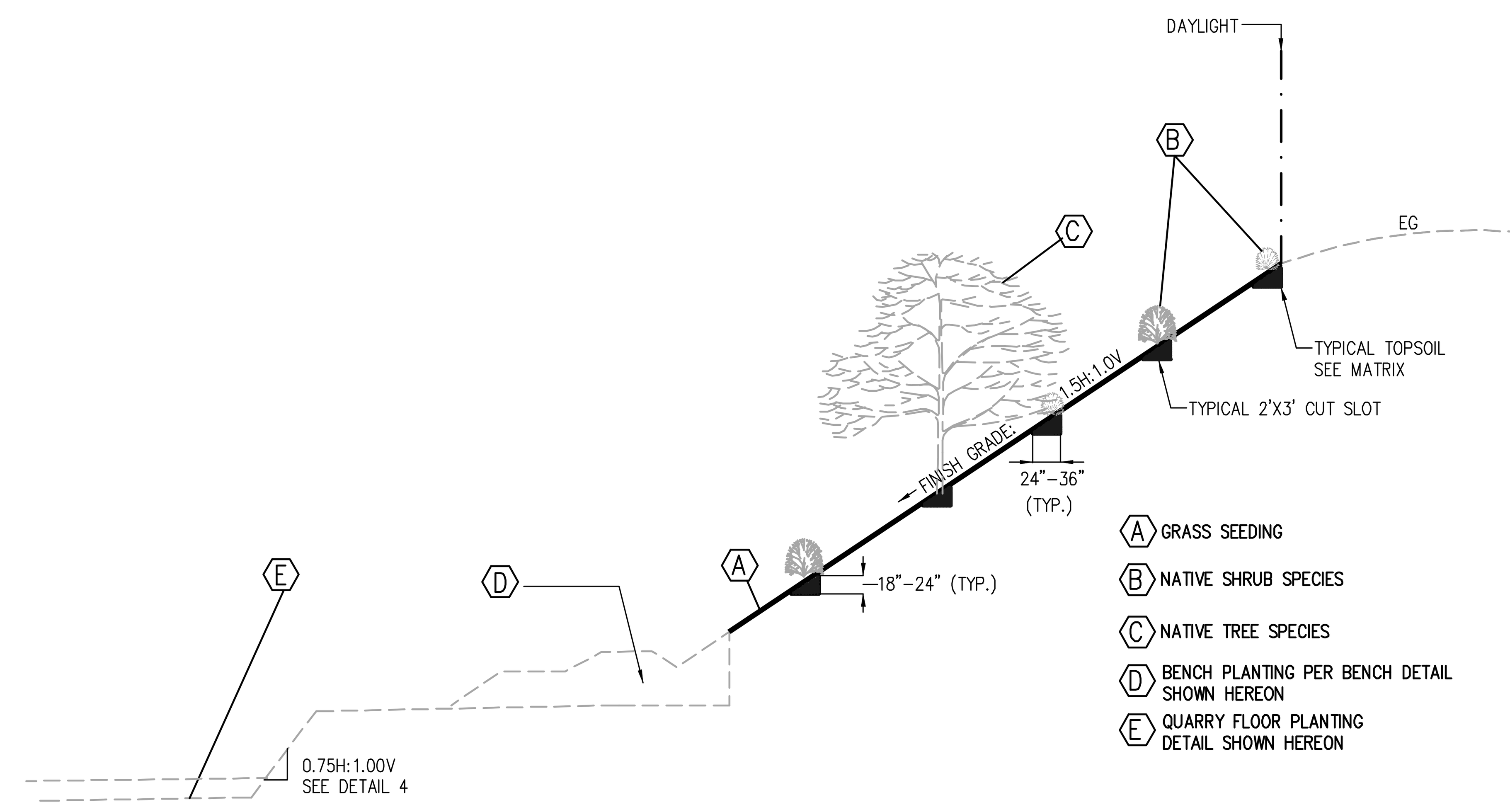
PLANTING COLLAR & SCREEN
NTS-DETAIL



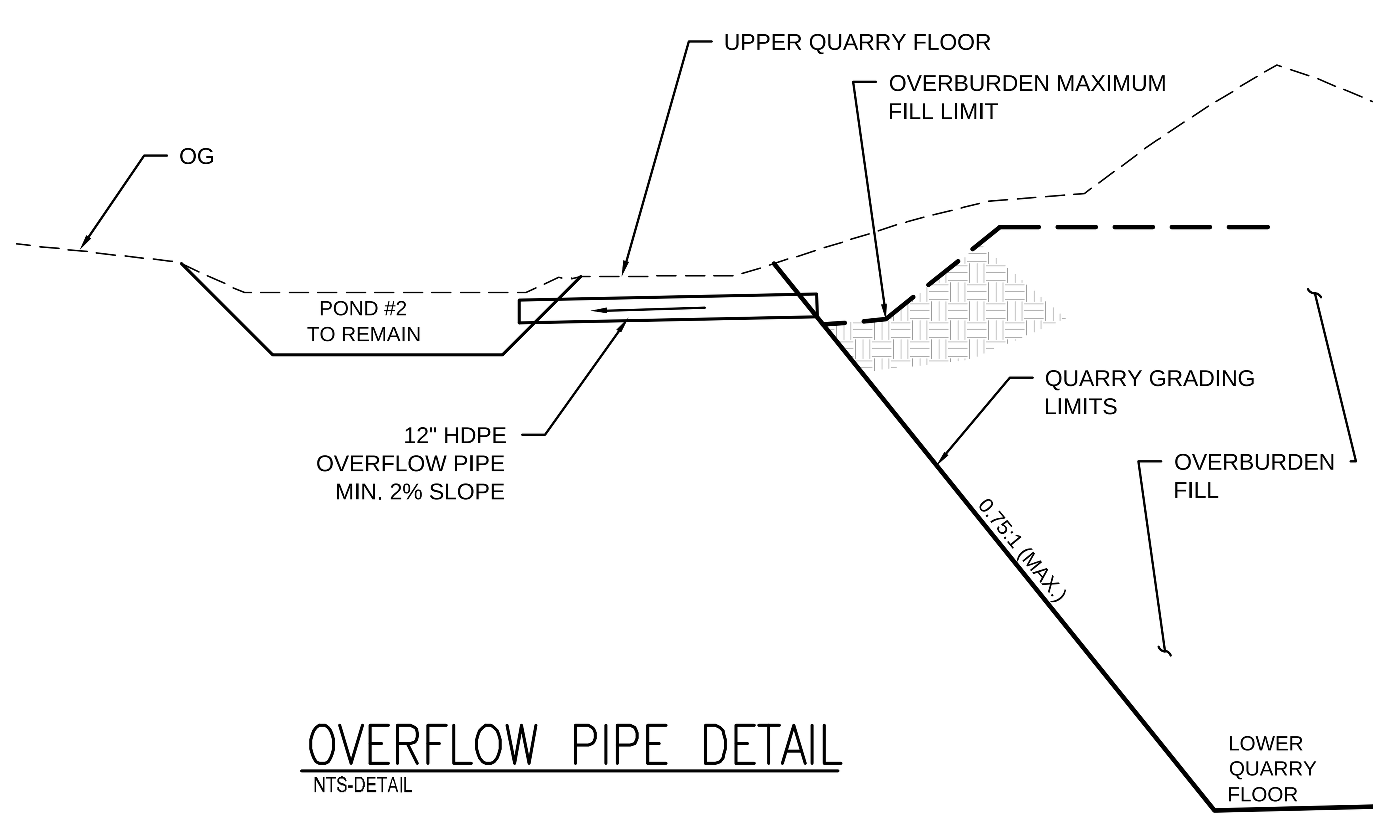
BENCH PLANTING
NTS-DETAIL

TOPSOIL MATRIX THICKNESS

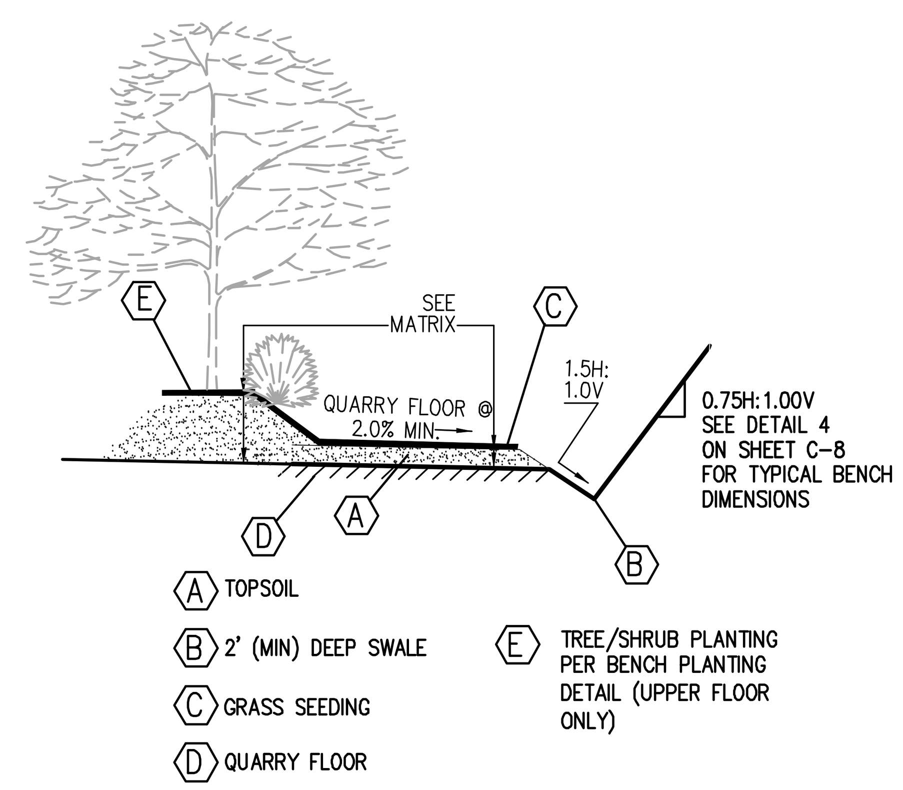
LOCATION	TREES	SHRUBS	GRASSES
BENCHES	N/A	18" MIN.	8" MIN.
QUARRY FLOOR	24" MIN.	12"-24"	6" MIN.
1 1/2:1 CUT SLOPE	12"-24".	12"-24".	2" MIN.



1 1/2:1 SLOPE PLANTING
NTS-SECTION



OVERFLOW PIPE DETAIL
NTS-DETAIL



QUARRY FLOOR PLANTING
NTS-DETAIL

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DRAWING: RECLAMATION PLAN DETAILS

PROJECT: MINING AND RECLAMATION PLAN

Date:	AUGUST 2014
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Reviewed:	GCR
JOB NO.	R12023

SHEET 9 of 9 SHEETS

Engineering Geologic Exploration, Quantitative Slope Stability Assessment, and Evaluation for the Presence of Naturally Occurring Asbestos

May 9, 2014

Prepared for:
Rau and Associates, Inc.

Prepared By:
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LACO Project No. 7294.14

LACO

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1.0 INTRODUCTION AND PURPOSE

This report presents the results of our engineering geologic exploration in support of the continued development of the existing Laytonville Quarry (Project Site). This report has been prepared for Rau and Associates, Inc. (Rau) on behalf of the Project Site Owners, Shawn and Aurora Studebaker.

In January 2013, LACO submitted a *Preliminary Engineering Geologic Investigation* report to support preliminary project planning (LACO 2013). On January 16, 2013, LACO accompanied Department of Conservation Office of Mines and Reclamation (OMR) staff on a site visit to review the site and discuss preliminary reclamation plans. OMR documented their site visit and provided a request for additional engineering geologic analysis in correspondence dated February 21, 2013 (OMR 2013).

The purpose of our services was to prepare a post-mining rock slope stability assessment on the basis of our engineering geologic exploration, and to evaluate the exposed rock slopes for the presence of Naturally Occurring Asbestos (NOA). This report is an updated version of our 2013 report which includes the additional analysis requested by OMR and supersedes our 2013 report.

Herein we provide our recommendations for the mitigation of slope hazards for future mine planning, use, and reclamation.

2.0 PROJECT DESCRIPTION

As we understand, the Project is a mining and reclamation plan to expand existing mining operations for the existing quarry development at the Project Site. The existing quarry is situated along the Laytonville-Dos Rios Road approximately 0.5 miles east of Highway 101 in Mendocino County, California, and 0.5 miles northeast of the town of Laytonville (Figures 1 and 2). Grading details prepared by Rau for the proposed expansion are included as Figures 3 through 6. Pertinent Project Site location information is listed in Table 1.

Table 1 - Project Location Information

Latitude and Longitude	39.6905° North and -123.4692° West
Assessor's Parcel Number	035-460-06
Parcel Size	±40.4 acres
United States Geologic Survey Quadrangle (USGS)	Laytonville 7.5-minute topographic quadrangle

3.0 SCOPE OF SERVICES

The services described in this report were performed in accordance with the Scope of Services outlined in Task Orders No. 1 and No. 2 executed on September 28, 2012, and June 24, 2013, respectively. Our scope of services was limited to:

1) Reconnaissance-level engineering geologic field explorations to record rock structures within the existing and proposed quarry expansion area on the basis of natural and man-made exposures, map areas of suspected NOA, quantitatively evaluate potential areas of slope instability;
2) The collection and analysis of rock types suspected of containing NOA. Sampling locations were determined in the field by the project geologist based on site conditions exposed in the quarry working faces;
3) Subsurface exploration at 21 locations and to a maximum depth of 100± feet to characterize subsurface conditions, collect rock chips samples for analysis of NOA, and record rock structures using down-hole geophysical survey techniques; and
4) Preparation of this Engineering Geologic Report documenting the following:
    i. Description of the proposed project.
    ii. A geologic map depicting site conditions on the basis of surficial exposures and borings encountered during our reconnaissance mapping and field exploration, including areas of known NOA confirmed by laboratory testing and those areas of suspected NOA based on bedrock composition.
    iii. Characterization of the site geology with a discussion of potential slope instability hazards based on the existing quarry conditions.
    iv. Discussion of the proposed quarry expansion slope configuration with a quantitative factor of safety evaluation of modeled slope stability conditions.
    v. Laboratory analysis results of up to five samples for NOA by CARB Method 435 with recommendations for mitigation measures to control airborne dust laden with NOA, if applicable.
    vi. Design and construction recommendations for the engineering geologic/geotechnical aspects of the quarry expansion area including:
        - Site preparation and specifications of slope gradients flatter than the critical gradient for the type of material anticipated to be encountered.
    vii. Performance standards for backfilling, re-grading, slope stability, and re-contouring of final reclaimed slopes, including permanent piles or dumps of mine waste rock and overburden.

4.0 FIELD EXPLORATION

Initial field reconnaissance was conducted by Certified Engineering Geologists from LACO on October 2, 2012, and November 19, 2012, to support preparation of our Preliminary Engineering Geologic report (LACO 2013). During our initial field reconnaissance, readily accessible areas were reviewed including the mine pit floor and stockpiles areas, the working mine cut faces, and the approximate upper limits of the proposed mine expansion. We recorded fault, fracture, joint, and foliation orientation data where systematic discontinuity features were observed and accessible along the base of the working faces. The steepness of the working faces precluded the ability to safely collect measurements near the top of the cut faces. Rock structure orientation was measured with a Brunton Pocket Transit with the magnetic declination set to 16.5 degrees east. The relative rock strength was evaluated based on the audible blow of a rock hammer and the ability to fracture in-place rock.

A second phase of field reconnaissance and exploration was conducted by Certified Engineering Geologists from LACO on October 18, 2013, October 23, 2013, and October 25, 2013, to record additional rock structural data from the existing mine faces and to supervise the installation of deep borings to characterize the subsurface conditions. Deep borings were drilled using an air-percussion track rig fitted to map the elevation of the rock surface beneath overlying soil and/or mélange unit and for planned geophysical surveys. On October 23, 2013, Norcal Geophysical Consultants Incorporated performed a geophysical exploration to measure P- and S-wave velocities and map rock discontinuities in deep three borings (Norcal 2013; Attachment 1).

5.0 SITE CONDITIONS

The following report subsections describe the Project Site's topography, the local and regional geologic and seismic settings, rock and soil units, and groundwater conditions.

5.1 Topography

The Project Site occupies an east-west trending side hill ridge with a westerly aspect that has formed on the flank of the valley-bounding, northwesterly trending range front. The side hill ridge forms the drainage divide between two local ephemeral water courses that coalesce near the valley floor. Elevation of the Project Site ranges from 2,120 feet to 2,380 feet when including the undisturbed forested areas near the top of the ridge. The current average mine slope of the existing ground surface measured from the back edge of the pit floor to the upper limits of the disturbed areas is approximately 1.35:1 horizontal to vertical (Figures 4 through 6). The high-wall consists of multiple benches with bench faces sloped at 0.5:1 or steeper with heights up to 30± feet. Bench face slopes are separated by benches with widths of about 40± feet.

5.2 Geology and Seismicity

The Project Site is located within the northern Coast Ranges Geomorphic Province (CGS 2002), a seismically active region in which large earthquakes and strong ground shaking should be expected to occur during the economic and reclaimed life span of the mine development. The Coast Ranges are composed of a thick sequence of late Mesozoic and Cenozoic sedimentary strata consisting locally of the Coastal Belt Franciscan Complex. Based on our site reconnaissance and a review of published geologic mapping (CDMG 1984), the local area is underlain by Tertiary to Cretaceous age Franciscan Complex rock. The Project Site specifically is located within a sub-unit of the Franciscan consisting of mélange and is directly underlain by a landscape-scale, relatively coherent knocker of blueschist facies metamorphic rock that contains areas of serpentinization (Figures 2, 4, 5, 6, and 7). The depth below the current mine pit floor to the contact with less resistant and lower-strength mélange matrix is unknown, but is anticipated to be lower than an elevation of 2,080 feet based on data obtained from on-site borings and information reported by the quarry owner from historic exploratory borings drilled in the quarry floor.

Structurally, the northern Coast Ranges trend northwest, sub-parallel to the San Andreas and Maacama faults. Both the San Andreas fault and Maacama fault zone are north-northwest trending, right-lateral strike-slip faults. The San Andreas fault is situated approximately 24 miles to the west of the Project Site (Figure 4) (CDMG 1983; CGS 2010). The San Andreas fault represents the boundary between the relatively stationary North American Plate and northward-migrating Pacific Plate. The Maacama fault zone has been interpreted as the northern extension of the Hayward and Rodgers Creek faults, all of which are products of distributed slip associated with the San Andreas fault along the North American plate margin. The San Andreas fault and Maacama fault are designated as being active by the State of California (CGS 2007), and capable of generating moderate to strong future earthquakes with estimated moment magnitudes (M_w) of 7.9 and 7.1, respectively (Petersen *et al* 1996; Upp 1989).

The Maacama fault zone is the nearest recognized Holocene-aged active fault to the Project Site. The northern limits of the trace currently zoned as being active terminates a distance of approximately 2 miles to the south (CDMG 1983; CDMG 2000). Sub-parallel traces of the Maacama fault zone continue to the north and are located within 0.4 miles to the west of the Project Site. Although not zoned as being active in the Holocene, these Quaternary fault traces form a northwest-trending zone of lineaments that deflect local drainage patterns and define the lateral margins of the valley. Faults denoted as undifferentiated Quaternary age show evidence of displacement sometime during the past 1.6 million years. Faults may be younger, but lack of younger overlying deposits precludes more accurate age classification (CGS 2010).

5.3 Bedrock Geology

Review of the Laytonville 7.5-minute quadrangle *Geology and Geomorphic Features Related to Landsliding* map (CDMG 1984; Figures 7 and 8) indicates the Project Site is underlain by glaucophane schist and blueschist within a mélange sub-unit of Coastal Belt Franciscan. The mélange is locally in both stratigraphic and fault contact with Upper Cretaceous age White Rock Sandstone. Franciscan mélange is described as pervasively sheared, argillaceous matrix surround pebble-size to individually mappable blocks of greywacke, greenstone, chert, conglomerate, serpentinite, and serpentinized ultramafic rocks.

The highly erodible, sheared shale matrix generally is unstable and within the Laytonville area is prone to landsliding. Two east-west trending landscape-scale earthflows denoted as inactive by DMG are present to the north and south of the Project Site where mélange matrix is in contact with blueschist. These areas currently display deeply-incised and well-developed drainage patterns. During our field exploration we did not observe evidence or recent or incipient movement within the DMG mapped earthflows.

The blueschist block underlying the Project Site is part of a larger north-northwesterly trending zone of map-scale size blueschist blocks that occupy the west-facing slopes along the eastern range front of the Laytonville valley. The foliated fabric within the blueschist blocks including those observed at the Project Site generally strike to the north with a westerly dip direction of 65 degrees to 85 degrees as depicted on the DMG map. Bedding attitudes identified within the Project Site as depicted on the DMG map indicate a northwesterly strike and easterly dip direction of 35 to 45 degrees.

Faults, fractures, and systematic joint sets are present in exposures throughout the working faces of the Project Site. Faults generally display apparent offsets on the order of inches to a few feet, and are generally antithetic in nature. Larger displacements appear to be present where offset planar discontinuities could not be matched on either side of a fault. The density of planar discontinuities varies from north to south across the Project Site as viewed in the working face exposures, with the greatest density occurring near both the northern and southern edges of the existing excavation limits. The observed failure mechanism is localized raveling and rock fall of loose material out of the working rock faces.

The eastern limit of the blueschist block underlying the Project Site is covered with a soil unit consisting primarily of slope colluvium derived from Franciscan Melange derived materials. The surface elevation of the top of the rock was mapped with a series of vertical borings throughout the eastern limits of the quarry (borings B-1 through B-12 on Figure 2). Borings were advanced with air percussion drilling equipment by the quarry owner. Boring details are summarized in Table 2.

Table 2 – Boring Details

Boring Number	Boring Depth	Elevation (Project Datum)		
		Ground Surface	Rock Surface	Groundwater
B-1	170	2220	>2050	NA
B-2	104	2320	>2216	NA
B-3	90	2170	2170	NA
B-4	NA	NA	NA	NA
B-5	100	2253	2250	2165
B-6	104	2218	2213	2200
B-7A	22	2263	2247	NA
B-7B	35	2257	2248	NA
B-8	35	2273	2245	NA
B-9	35	2280	2264	NA
B-10	47	2290	2256	NA
B-11	40	2290	2250	2253
B-12	58	2291	2233	2275
B-13	93	2217	2211	<2124
B-14	93	2220	2214	<2127
B-15	90	2223	2213	<2134
B-16	82	2225	2151	<2175
B-17	90	2227	2149	2151
B-18	93	2281	2206	<2188
GB-1	104	2191	2191	2112
GB-2	93	2194	2194	2119
GB-3	93	2215	2209	2127

NA = Not available (data was not recorded by driller)

5.4 Groundwater Conditions

Photographic documentation of the site conducted in December 2011, by Rau indicate an area of ponded water within a topographic depression near the back edge of the pit floor at the base of the rock face near the northern excavation limits.

Based on groundwater data obtained during subsurface exploration and observations of existing surficial conditions, two groundwater zones are apparent at the project area: shallow groundwater, which is percolating along the rock/overburden boundary; and deeper groundwater percolating through fractures in the rock. Refer to Table 2 for groundwater elevations recorded in borings.

Subsurface explorations within the existing quarry face recorded hydraulic head elevations of the deeper groundwater greater than 10 feet above the existing quarry floor which is consistent with the emergent groundwater observed in the 2011 photographs and the water present in shallow ponds dug within the existing quarry floor. Groundwater conditions recorded in the exploratory borings were incorporated into our quantitative slope instability analysis.

6.0 QUANTITATIVE SLOPE STABILITY EVALUATION

To evaluate the stability of the proposed quarry faces, LACO performed quantitative slope instability analysis utilizing software to analyze site specific structural data and rock strength parameters. Our evaluation included both kinematic and overall slope stability under both static and pseudostatic (seismic) conditions. The analysis was completed on three separate quarry face aspects (Southeast, East, and Northeast).

The slope stability results are given as a "factor of safety" (F). The factor of safety is the ratio of forces resisting failure to the forces driving failure. In a stable slope, the forces resisting failure exceed the driving forces and the resultant F is greater than 1.0. When the two forces are equal, the F is equal to 1.0 and slope failure is imminent. The greater the F, the greater the stability of the slope. The seismic coefficient used in psuedostatic analysis was calculated following the guidelines of California Geologic Survey Special Publication 117A (CGS 2008).

Typical practice is to consider slopes with a static factor of safety (F_S) equal to or greater than 1.5 and a psuedostatic factor of safety (F_D) equal to or greater than 1.1 as adequately stable for most development purposes (SCEC 2002; OMR 2009).

6.1 Kinematic Analysis

Kinematic analysis evaluates the orientation of structural discontinuities (joints, fracture, faults) with respect to the proposed quarry face gradients and strength characteristics of the discontinuities to predict the potential for plane failures, wedge failures, and toppling.

Plane failures occur as result of sliding along a single discontinuity and generally occur when a discontinuity dips in the same direction (within ± 20°) as the slope face at an angle lower than the slope angle, but greater than the friction angle of the discontinuity.

Wedge failures occur as a result of sliding along two intersecting discontinuities intersects where the angle and the line of intersection plunges out of the slope face at an angle greater than the friction angle of the discontinuity.

Toppling failures occur as a result of rotation of a rock mass out of the slope due to steeply dipping discontinuities.

The kinematic analysis performed for this project utilized the computer programs DipAnalyst, Swedge (version 5.0), RocPlane (version 2.0), and RocTopple (version 1.0) to evaluate 203 structural discontinuities measured at the project site at three different quarry face aspects (Section 1, 3, and 6). DipAnalyst presents results as a “failure index”. The failure index is the percentage of discontinuities that have an orientation consistent with a specific failure mode. Swedge, Rocplane, and RocTopple present results as a factor of safety.

Structural discontinuties utilized in the analysis were limited to fractures and faults that were not healed. The structural discontinuity data set is included as Attachment 2 and DipAnalyst output files are included as Attachment 3. Rock and discontinuity parameters used in the kinematic analysis are summarized in Table 3.

Table 3 – Rock and Discontinuity Parameter Used in the Kinematic Analysis

Parameter	Value
Joint Roughness Coefficient (JRC)	8[A]
Joint Wall Compressive Strength (JCS)	288 tons per square foot[B]
Friction Angle	32 degrees[C]
Unit Weight	160 pounds per cubic foot[D]

[A] JRC based on equivalent ratio of Joint Condition Rating
[B] JCS based on unconfined compressive strength testing.
[C] Friction angle based on published data (Table 4.1; Wyllie and Mah, 2004) and laboratory tilt testing
[D] Unit weight based on laboratory analysis

The results of the preliminary kinematic analysis for the main east quarry face (oriented at an azimuth of 224°) predict that under a proposed quarry configuration with an average slope gradient of 0.9:1 (50°), approximately 5 percent of the structural discontinuities are oriented in a direction consistent with plane failures, 13 percent with wedge failures, and 5 percent with toppling failures.

Under all potential quarry face orientations, the percentage of discontinuities with orientations favorable to plane, wedge, and toppling failures are each less than 15 percent. A Graphs depicting variations in failure index with respect to slope angle, azimuth, and friction angle are included in Attachment 4. Factor of safety analysis of wedge, plane, and topple failures are summarized in Attachment 5.

With a few exceptions, the kinematic factor of safety analysis indicates that the F_S and F_D are 1.5 and 1.1 or greater, respectively, on all quarry faces under the modeled conditions. The exceptions for wedge failures are on the east and northeast faces under both static and dynamic conditions where gradients are 0.8:1 and 0.7:1, respectively. The exceptions for plane failure are on all proposed quarry faces under dynamic conditions where slope gradients are 0.8:1 or steeper.

The modeling predicts that the exceptions noted above are associated with relatively small failures (estimated to be less the approximately 2 feet thick). Based on the predicted shallow nature of the modeled failures and the design for low gradient benches every 50 vertical feet, we judge the predicted shallow failures (should they occur) will be contained by the benches.

6.2 Slope Instability

We evaluated the potential for rotational (soil/rock) failure of the proposed quarry faces using the computer program Slide (version 5.0).

The strength of the rock in the quarry was estimated using the Generalized Hoek-Brown criterion. Strength parameters required for the Generalized Hoek-Brown criterion were estimated using the following values:

- Intact Uniaxial Compressive Strength: 1,000 kilopounds per square foot[A]
- Geologic Strength Index: 25[B]
- Intact Rock Constant (mi): 15[C]
- Disturbance Factor: 0.7[D]

[A] Compressive strength estimated based on specimens requiring more than one blow with a rock hammer to fracture.

[B] Geological strength index of 25 selected based on the "blocky" to "disintegrated" appearance of the lowest quality rock exposed in the quarry faces and the "poor" condition of discontinuity surfaces observed in the most weathered and faults surfaces.

[C] Intact rock constant for a schistose meta-volcanic rock.

[D] Disturbance factor selected based on small scale blasting of the quarry face and mechanical excavation methods used.

The strength of the mélange surrounding the rock was estimated using the Mohr-Coulomb criterion and the following soil parameters based on published literature (Kim et al. 2004):

- Cohesion 100 pounds per square foot
- Friction Angle 25 degrees

Groundwater data recorded in our borings was incorporated into the analysis. Groundwater was assumed to fill in the quarry to the elevation of the existing quarry base with a positive gradient of 1 percent extending back into the slope.

Factor of safety analysis results are summarized and graphically presented in Attachment 6.

Based on the results of the rock mass stability analysis, the factor of safety of the proposed quarry faces are estimated to be greater than 1.9 under static conditions and 1.2 under psuedostatic conditions, and are considered adequately stable for industry standards (SCEC 2002; OMR 2009).

7.0 ASSESSMENT FOR PRESENCE OF NATURALLY OCCURRING ASBESTOS

Geologic mapping of working face exposures was conducted to identify potential asbestos-bearing rock and to describe their occurrence and distribution on the Project Site. Emphasis was placed on identifying and describing geologic features and rock types that may host or influence the distribution or transport of naturally occurring asbestos (NOA) at the Project Site.

Areas with serpentinization, faults, and shear zone contacts between relatively intact and coherent bedrock outcrops were identified as being the most likely asbestos-bearing source. The orientation of structural features including faults, fractures, joints, and rock foliation fabric were recorded and their relationship to potential asbestos mineralization noted.

Targeted samples were collected from shear zones, areas of serpentinization, from faulted rock containing secondary mineralization along the fault surface, as well as bulk samples from select deep borings. Five surficial locations, denoted as Station 1 through Station 5, and encompassing the limits of excavation along the lower quarry working face were sampled (Figure 2) as well as cuttings from borings GB1, GB2, GB3, B16 (New#7), and B18 (New#9). The samples were submitted to Micro Analytical Laboratories, Inc. under standard chain of custody. Bulk asbestos analysis was performed by test method PLM (polarized light) CARB 435. Laboratory reports are included as Attachment 8.

7.1 Asbestos Analysis Results

Based on the reported laboratory analysis, asbestiform minerals comprised of Tremolite-Actinolite and/or Chrysotile were detected in the samples collected from Station 1 (see Attachment 7, Photographs 1-3), boring GB3, and boring B16 (New#7). Samples collected from Stations 2, 3, 4, and 5 as well as boring GB1, GB2, and B18 (New #9) were reported to lack any asbestos fibers above the limits of detection.

Two shear zones (southern and eastern) containing asbestiform Tremolite-Actinolite were visually identified and mapped in the field. The southern zone comprised an approximate east-northeast to west-northwest trending pocket of schistose material extending along the lower working face near the southern limits of the current quarry excavation. Outcrop exposures of the southern shear zone are up to 100 feet wide and based on the orientation of the shear zone, it is anticipated to be present in the upslope and downslope directions and will likely be encountered as mining progresses to greater depths. The eastern zone comprised a narrow north-south striking seam of schistose material above the limits of the working face within a mélange unit.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Mining Slopes

During our site reconnaissance, we did not observe any evidence of large-scale active slope failure at the Project Site, nor did we observe obvious signs of incipient block failures in the pit walls. Based on our site observations and quantitative stability assessment of the proposed mining slopes, the proposed pit walls are expected to be stable from a rock mass slope failure under both static and psuedostatic conditions.

Based on the results of our site reconnaissance and geologic evaluation, in our judgment the proposed site can be made suitable for the proposed slope configuration from an engineering geologic perspective provided the Project Site Owners accepts the following assumptions and design recommendations:

- In the absence of additional site specific testing and analysis, overburden soil exposed at the top of the quarry should be sloped at a 1:1 or flatter for granular materials and 1.5:1 or flatter for fine-grained materials. Exposed mélange soils should be sloped at 2:1 or flatter and include a minimum 10-foot wide bedrock bench along the base of the contact.
- LACO is retained for periodic review of the exposed slopes to verify our kinematic analysis assumptions and recommendations remain valid. If our review of newly exposed site conditions indicate the assumptions of our analysis are invalid, one or more of the following will be required: (1) mapping/measurement of newly exposed discontinuities; (2) updated kinematic analysis; and (3) subsurface exploration/testing. Our periodic review should occur for every 40,000 cubic yards of excavation.

8.2 Mitigation of NOA

Two zones of Tremolite-Actinolite were identified in the field as described in Section 7.1 of this report (see Figure 2). As mining progresses, caution on the part of the Project Site owner will be required to avoid mixing NOA material with the commercially available stockpiles. The following are our recommendations for segregating the asbestiform-laden material from the rock to be quarried and stockpiled as aggregate:

1. Proximal to and within the mapped NOA zone, the material may periodically be over-excavated to depths attainable by an excavator. The excavated material could be stockpiled on site and covered to protect it from wind and rain. During over-excavation, dust-suppression methods (ex. periodic wetting) should be employed. Over-excavation could occur on an as needed basis so as to allow for the removal of aggregate from the working faces and benches while minimizing the potential contamination with the NOA. LACO should be retained to observe the over-excavation and map the newly exposed limits of NOA.
2. Periodically collect composited samples from the stockpiled aggregate in compliance with the Mendocino County Air Quality Management District requirements to verify the concentration of NOA in the commercially available material is less than 0.25 percent.
3. Excavation of the proposed quarry face slopes may expose differing site conditions which may increase the potential for NOA to be exposed. Periodic sampling of the exposed slopes is recommended to verify that our NOA recommendations remain valid. If our review of newly exposed site conditions record new areas of NOA, additional mapping/measurement of newly exposed NOA and updated mitigation recommendation may be required. Our periodic review should occur for every 40,000 cubic yards of excavation.

9.0 CONSULTATION, OBSERVATION, AND TESTING

During the design phase, we recommend communications between the Client, design team, and LACO be maintained to optimize conformance between the design and site conditions. We also recommend LACO be retained to review the plans and specifications pertaining to earthwork construction, where prepared by others, to check that our recommendations have been properly implemented.

10.0 LIMITATIONS

This report has been prepared for the exclusive use of our Client (Rau and Associates), our Client's contractors and subconsultants, and appropriate public authorities for specific application to the development of the tank project. LACO has endeavored to comply with the generally accepted geotechnical engineering standard of care common to the local area. LACO makes no other warranty, express or implied.

The findings, analyses, and recommendations contained in this report are based on data obtained from surface explorations and laboratory tests. The exploration methods used indicate surface conditions only at specific locations where samples were obtained, only at the time they were obtained, and only to the depths penetrated. Samples cannot always be relied upon to accurately reflect stratigraphic variations that commonly exist between sampling locations, nor do they necessarily represent conditions at any other time. Results of sample testing obtained during this project will be retained on file in our office.

The recommendations included in this report are based in part on assumptions about subsurface conditions that may only be confirmed during exploratory drilling. Accordingly, the validity of these recommendations is contingent upon LACO being retained to provide additional professional services during project design and construction. LACO cannot assume responsibility or liability for the adequacy of the report recommendations when they are applied in the field unless LACO is retained to observe construction. Please contact us to further discuss the extent of such observations required to check the validity of our recommendations.

This report's findings, conclusions, or recommendations should not be used if the nature, design, or location of the proposed development is changed. If changes are contemplated, LACO should be consulted to review their impact on the applicability of the findings, conclusions, or recommendations contained in this report. Also, LACO will not be responsible for any claims, damages, or liability associated with any other party's interpretation of the subsurface data or reuse of this report for other projects or at other locations without LACO's express written authorization.

11.0 REFERENCES CITED

California Division of Mines and Geology (CDMG), 1983, State of California Special Studies Zones, Laytonville 7.5-Minute Quadrangle Official Map, Mendocino County, California.

California Division of Mines and Geology (CDMG), 1984, OFR 84-41, Geology and Geomorphic Features related to Landsliding, Laytonville 7.5' Quadrangle, Mendocino County, California.

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Kim C., Snell C., Medley E., 2004, Shear Strength of Franciscan Complex Mélange as Calculated from Back-Analysis of a Landslide, Proceedings: Fifth International Conference on Case Histories in Geotechnical Engineering, New York, April 13-17, 2004.

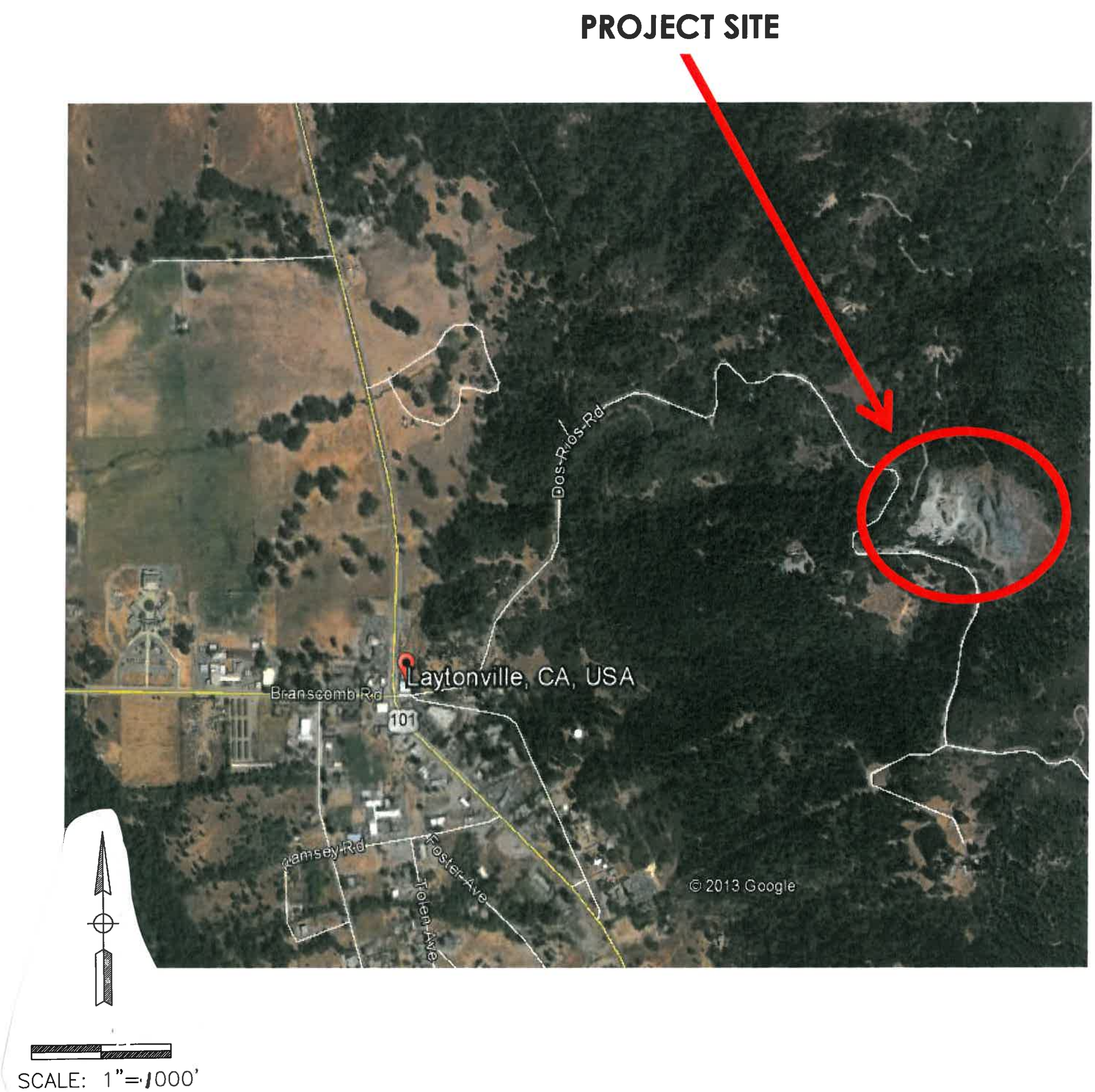
Petersen, M. D., Bryant, W. A., Cramer, C. H., Tianqing Cao, Reichle M. S., Frankel, A. D., Lienkaemper, J. J., McCrory, P. A., and Schwartz, D. A., 1996, Probabilistic Seismic Hazard Assessment for the State of California: Division of Mines and Geology, Open-File Report 96-08, U. S. Geological Survey Open-File Report 96-706.

Upp, R. Rexford, 1989, Holocene activity and tectonic setting of the Maacama fault zone, Mendocino county, California, in Johnson, A.M., Burnham, C.W., Allen, C.R., and Muehlberger, W.R., editors, Richard Henry Jahns Memorial Volume: Engineering Geology, v. 27, p. 375-412.

FIGURES

Project	Laytonville Quarry	By	BED
Client	Rau and Associates	Date	1/9/2014
Proj. No.	7294.14	Figure	1

SITE VICINTY MAP



Source: lat 39.686185 lon -123.460982 . Google Earth Image dated July 9,2012. Accessed January 9, 2014.

LACO

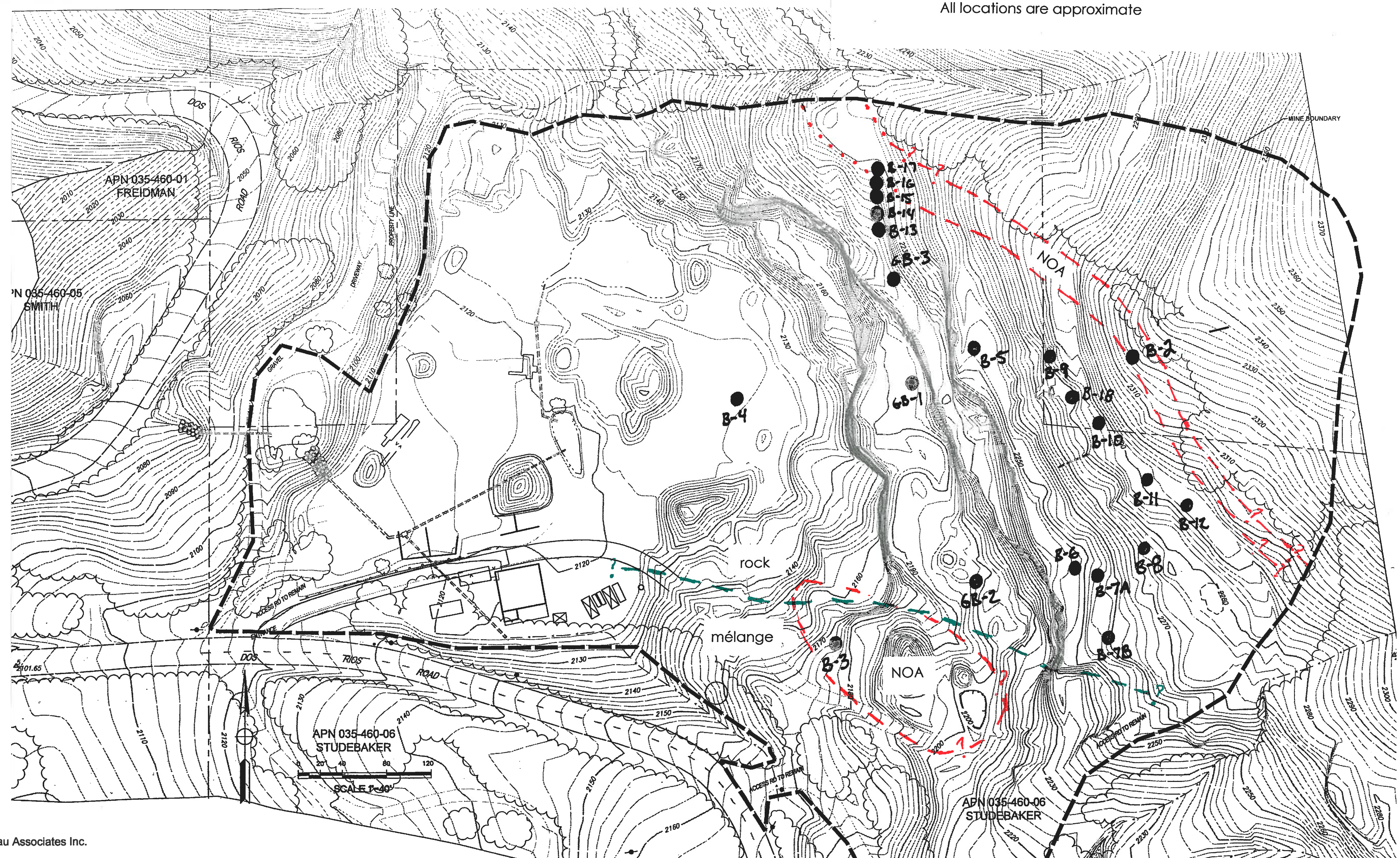
Project	Laytonville Quarry	By	BED
Client	Rau and Associates	Date	1/9/2014
Proj. No.	7294.14	Figure	2

SITE PLAN

KEY

- B-1 ● = Boring for rock surface mapping
- GB-1 ● = Boring for geophyiscial investigation
- (green dashed line) = Approximate mélange/rock boundary
- (red dashed line) = Approximate area containing Naturally Occurring Asbestos (NOA)

All locations are approximate



Base map provide by Rau Associates Inc.

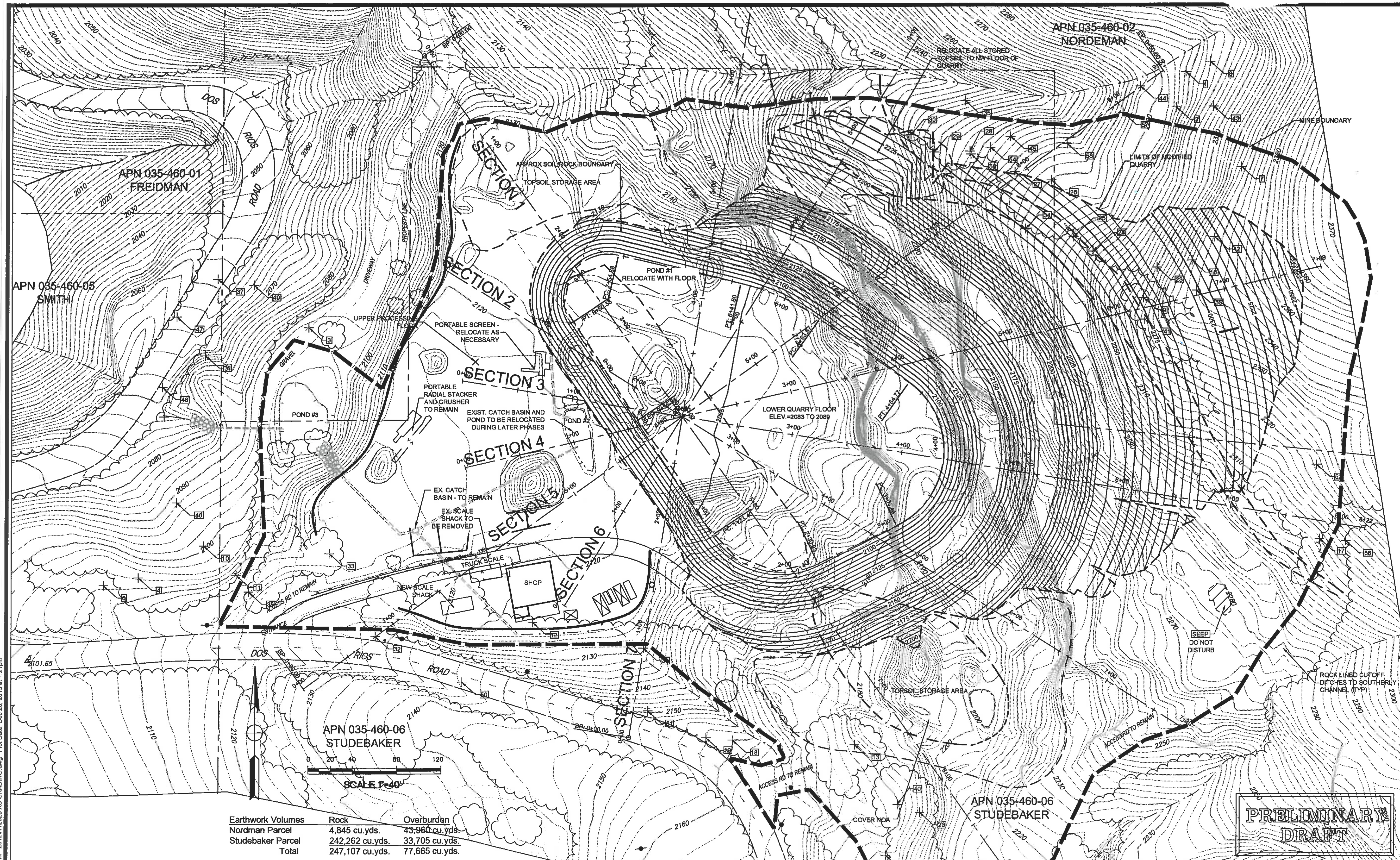
LACO

Project: Laytonville Quarry | By: BED

Client: Rau and Associates | Date: 1/9/2014

Proj. No. 7294.14 | Figure 3

PROPOSED GRADING PLAN



Earthwork Volumes	Rock	Overburden
Nordman Parcel	4,845 cu.yds.	43,960 cu.yds.
Studebaker Parcel	242,262 cu.yds.	33,705 cu.yds.
Total	247,107 cu.yds.	77,665 cu.yds.

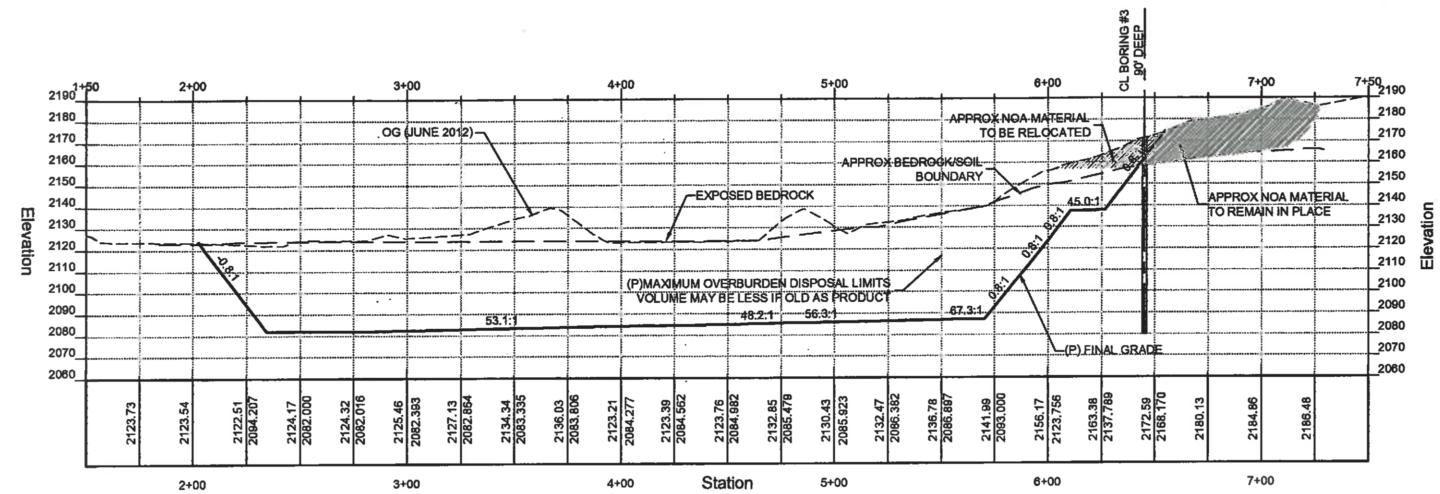
LACO

Project: Laytonville Quarry
By: BED
Client: Rau and Associates
Date: 1/9/2014
Proj. No.: 7294.14
Figure: 4

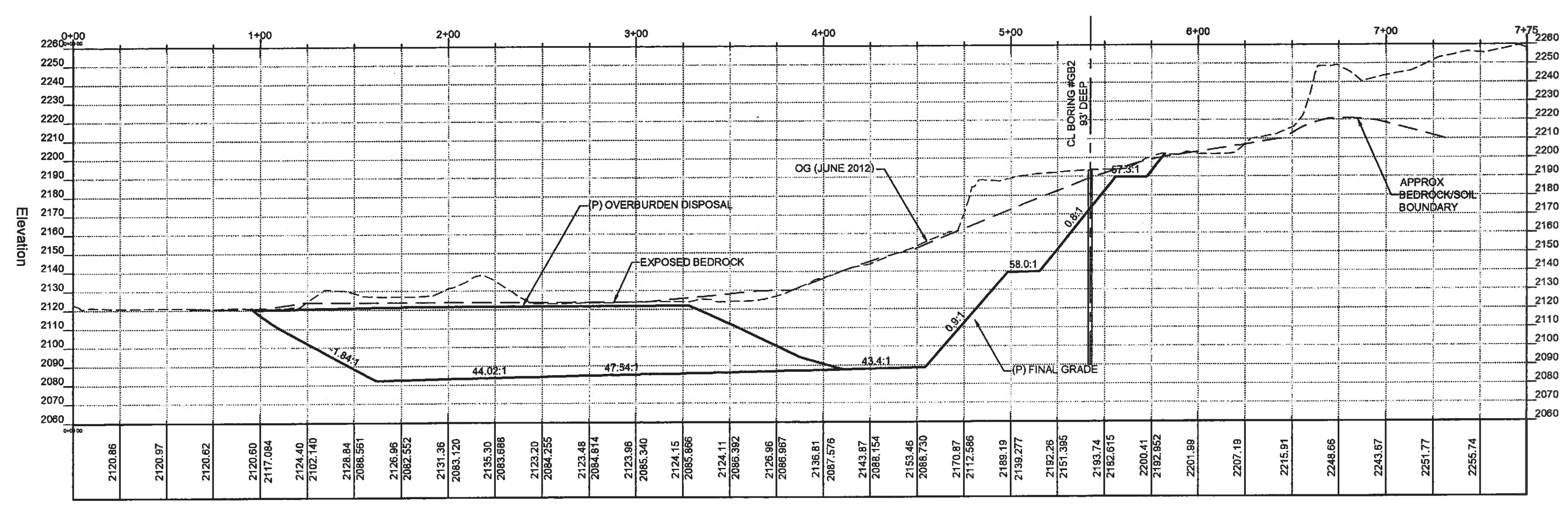
SECTIONS 1 AND 2

NOTES:

1. LIMITS OF BEDROCK AND NOA CONTAINING MATERIAL ARE APPROXIMATE ONLY. LIMITS SHOWN BASED ON LIMITED BORINGS AVAILABLE AS OF DECEMBER 2013.
2. MATERIAL CONTAINING NOA SHALL BE RELOCATED TO THE LOWER QUARRY FLOOR AND SHALL NOT BE SOLD OR INCORPORATED INTO PRODUCT.
3. SEE GEOTECHNICAL REPORT FOR NOA MITIGATION AND MONITORING.
4. SEE GEOTECHNICAL REPORT FOR SLOPE CRITERIA. SLOPES SHOWN ARE APPROXIMATE ONLY AND SUBJECT TO THE SLOPE CRITERIA BASED ON ACTUAL MATERIAL ENCOUNTERED.



Profile View of SECTION 1



Profile View of SECTION 2

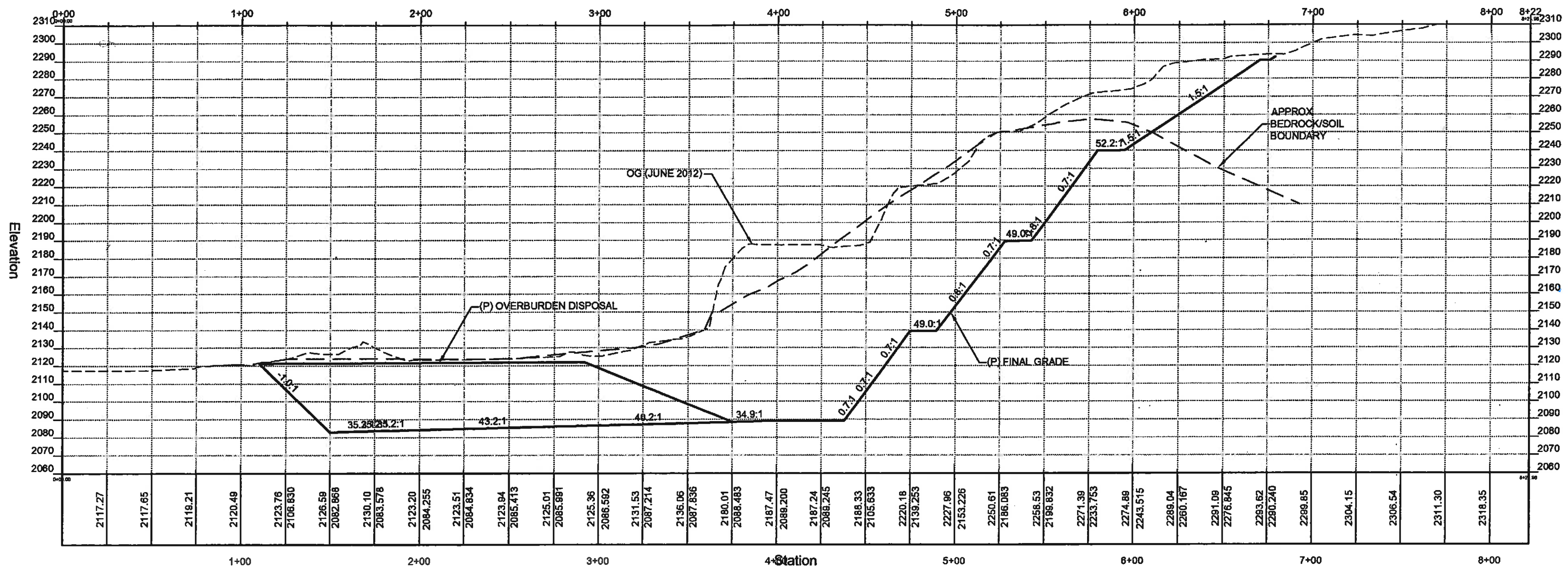
SCALES: HORIZ. 1"=40'
VERT. 1"=40'

PRELIMINARY DRAFT

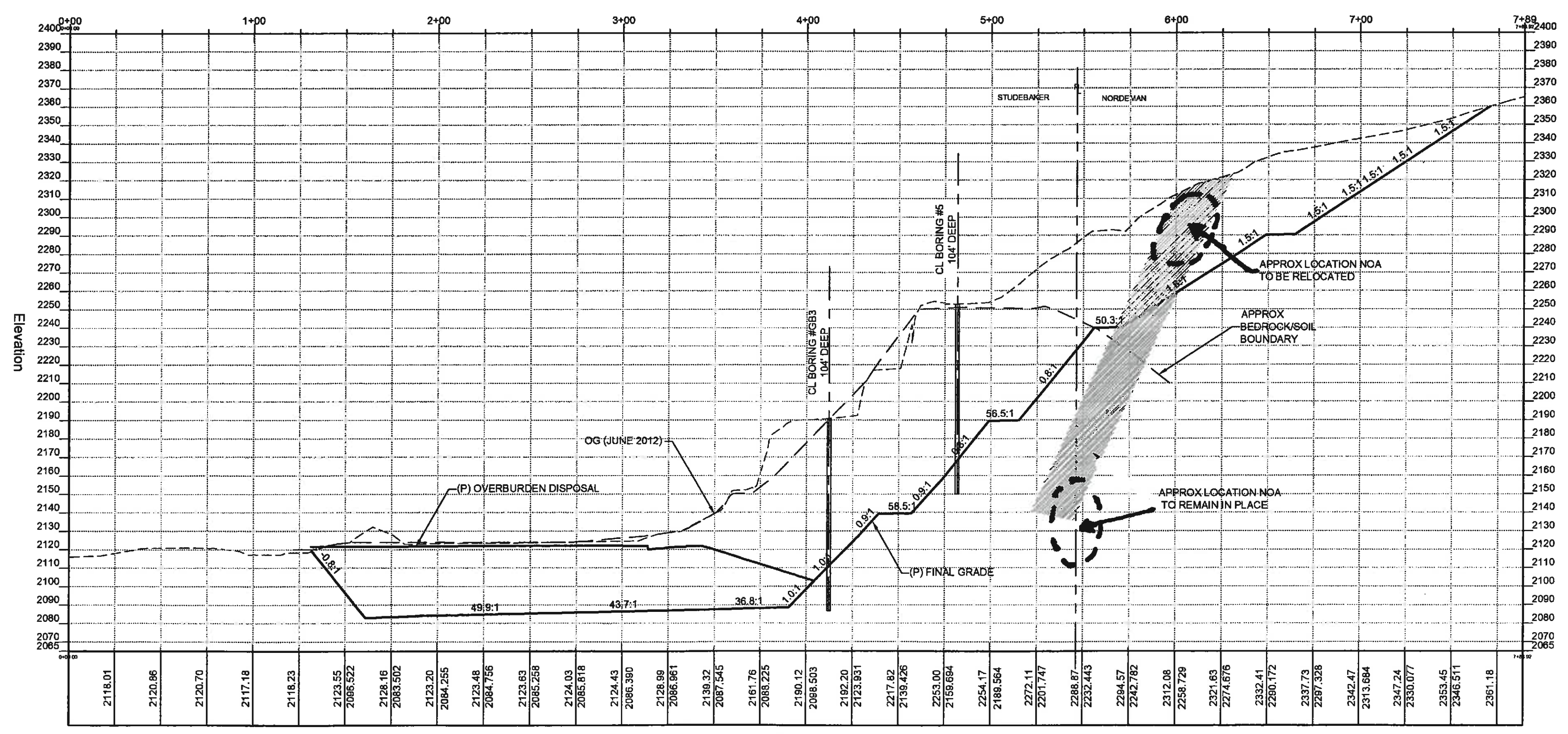
LACO

Project: Laytonville Quarry
By: BED
Client: Rau and Associates
Date: 1/9/2014
Proj. No.: 7294.14
Figure: 5

SECTIONS 3 AND 4



Profile View of SECTION 3



Profile View of SECTION 4

SCALES: HORIZ. 1"=40'
VERT. 1"=40'

PRELIMINARY DRAFT

P:\Civil - 2012\R12023 XC GRADING.dwg Plot Date: Dec 20, 2013 at 1:26pm

LACO

Project: Laytonville Quarry

By: BED

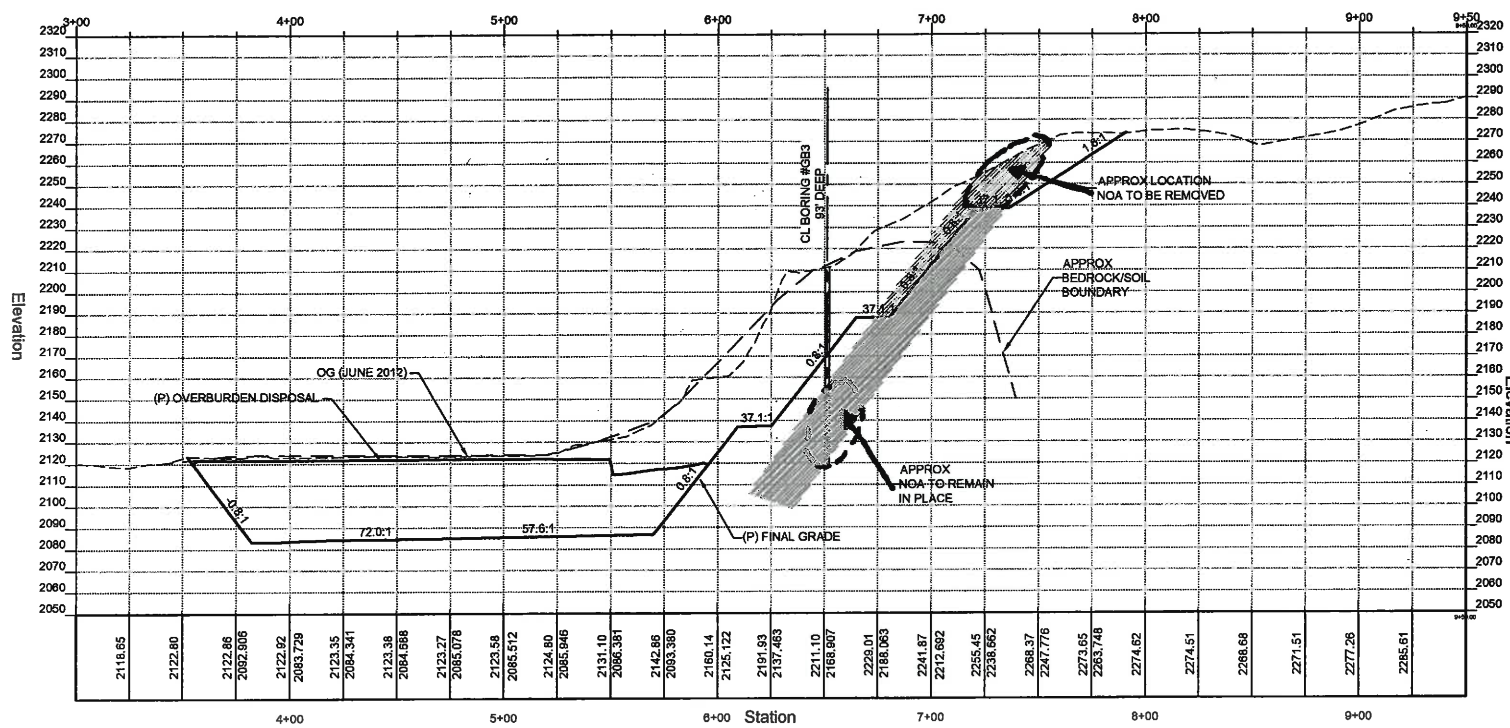
Client: Rau and Associates

Date: 1/9/2014

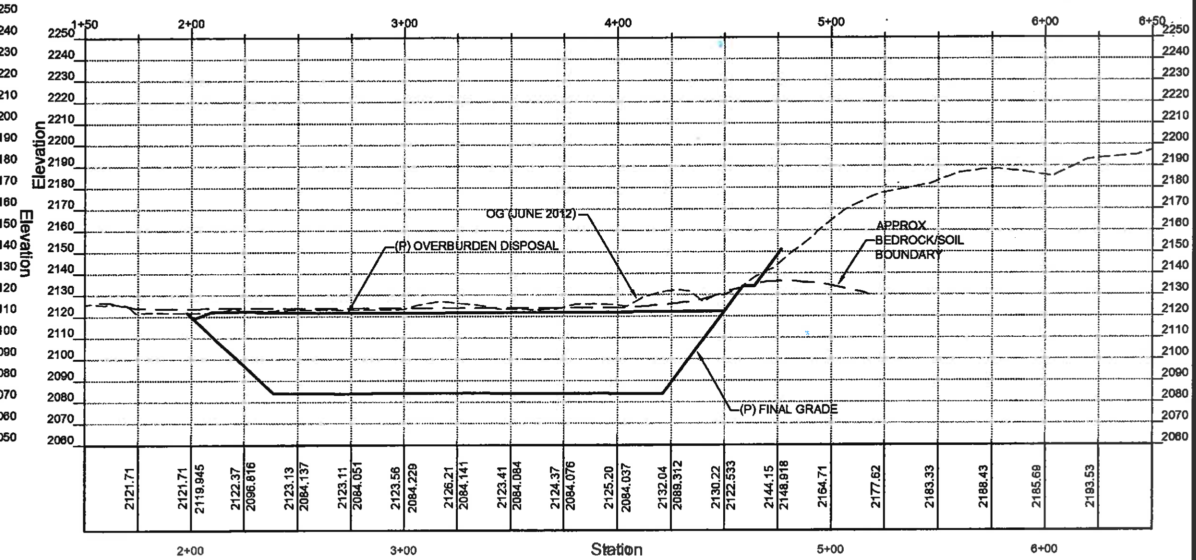
Proj. No. 7294.14

Figure 6

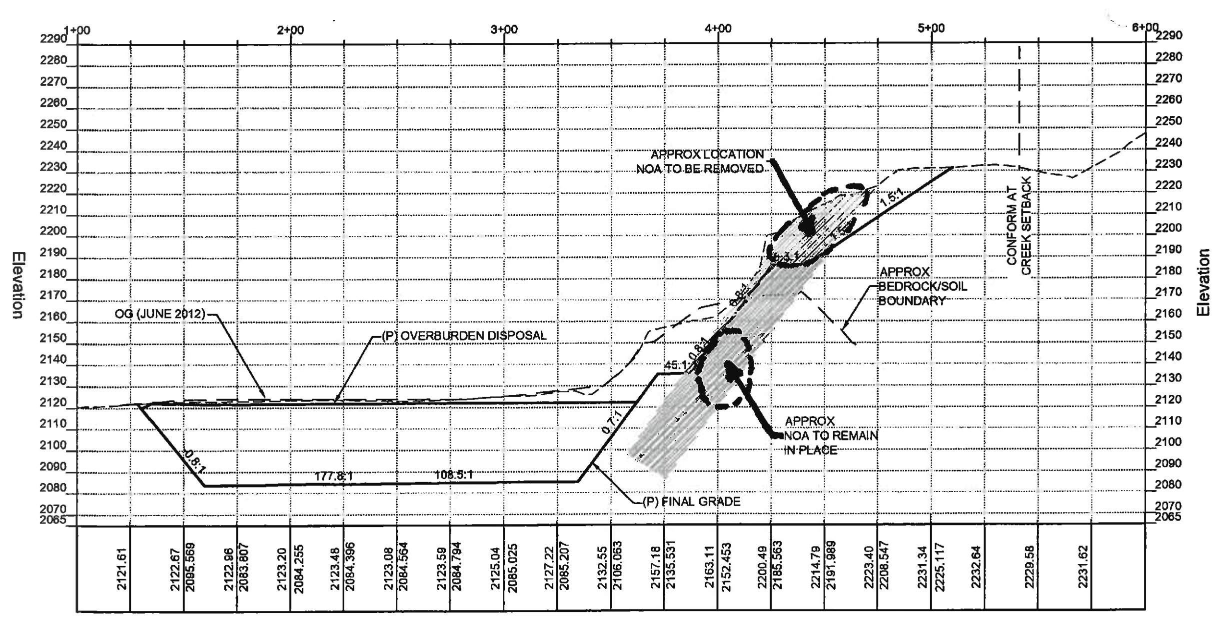
SECTIONS 5, 6, AND 7



Profile View of SECTION 5



Profile View of SECTION 7



Profile View of SECTION 6

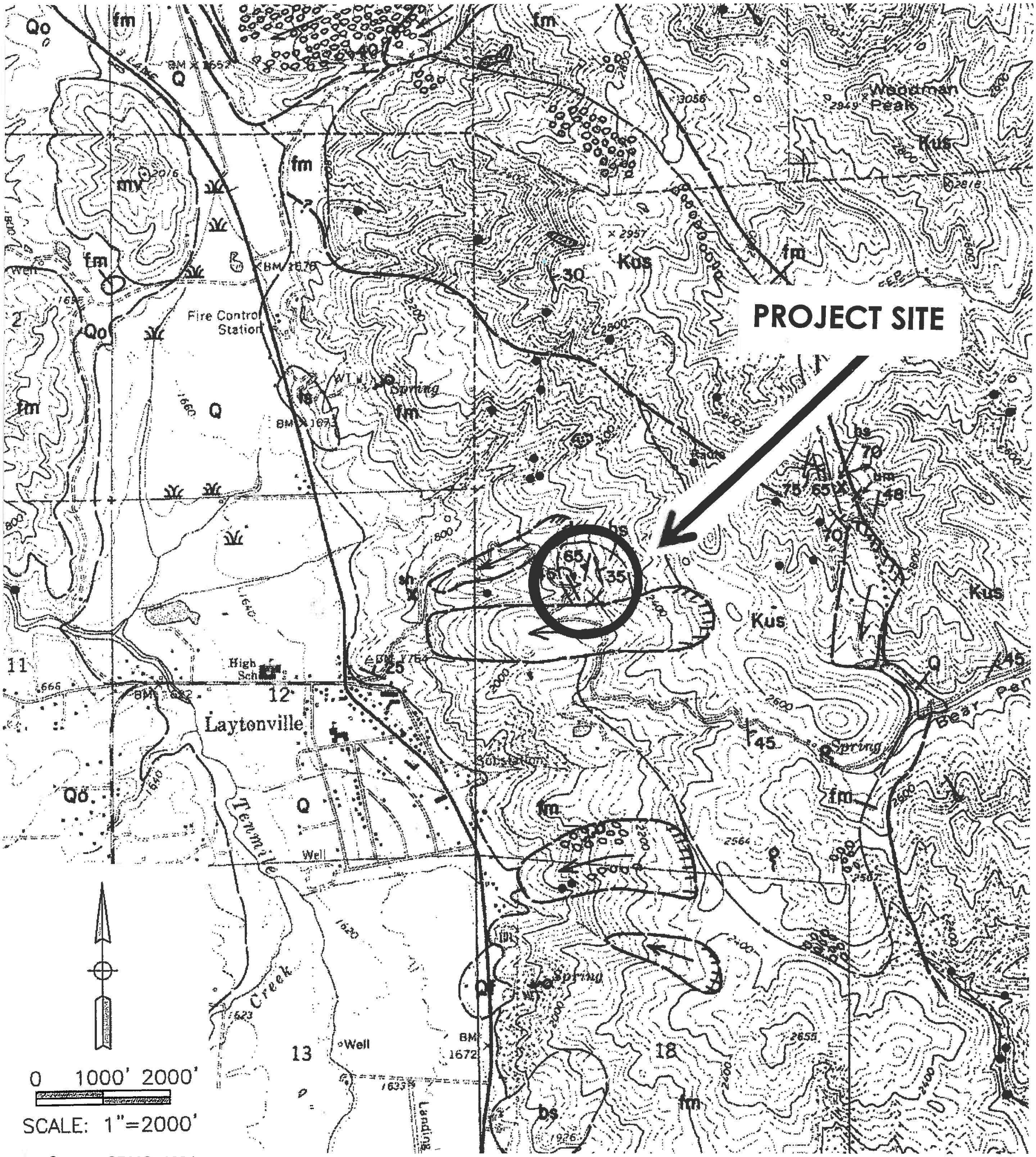
SCALES: HORIZ. 1"=40'
VERT. 1"=40'

PRELIMINARY DRAFT

LACO

Project	Laytonville Quarry	By	BED
Client	Rau and Associates	Date	1/9/2014
Proj. No.	7294.14	Figure	7

REGIONAL GEOLOGIC MAP



Source: CDMG 1984

Project Laytonville Quarry By BED

Client Rau and Associates Date 1/9/2014

Proj. No. 7294.14 Figure 8

REGIONAL GEOLOGIC MAP LEGEND

GEOLOGY AND GEOMORPHIC FEATURES RELATED TO LANDSLIDING LAYTONVILLE 7.5' QUADRANGLE, MENDOCINO COUNTY, CALIFORNIA

Compiled by

Richard T. Kilbourne, Geologist

California Department of Conservation

Division of Mines and Geology

1984

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; indicates scarp, indicates direction of movement; 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; indicates scarp, indicates direction of movement; 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), usually well vegetated 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 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 **ALLUVIUM (Holocene):** unconsolidated, fine-grained sand and silt along modern river flood plains; minor amounts of gravel in channel areas.

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

Qo **OLDER ALLUVIUM (Holocene-Pleistocene):** flat-lying, compact but uncemented river and lake deposits ranging from boulder conglomerate and breccia to fine sand and silt; coarser facies more common at base along edge of deposit near contact with upland areas of Franciscan melange (fm).

mv **VOLCANIC ROCKS:** principally greenstone; includes altered diabase, pillow basalt, and volcanic breccia; chert is commonly mixed with the volcanics.

TKfs **COASTAL BELT FRANCISCAN (Tertiary-Cretaceous):** well consolidated, folded and fractured, clastic sedimentary rocks; includes arkosic sandstone, shale, and small amounts of pebble conglomerate; sandstones commonly are laumontized.

Kws **WHITE ROCK SANDSTONE (Upper Cretaceous):** deformed, but well consolidated; includes volcanic and quartz arenite, shale, and small amounts of pebble conglomerate; sandstones commonly are laumontized, massive units that develop steep slopes; boundaries slightly modified from White Rock unit of Gucwa (1974).

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

- ls – limestone
- um – serpentinite and ultramafic rocks
- bs – glaucophane schist and blueschist
- cg – conglomerate
- sh – shale

KJfs **FRANCISCAN CENTRAL BELT SEDIMENTARY ROCKS (Cretaceous-Jurassic):** large, well consolidated blocks of graywacke, siltstone, mudstone, conglomerate, and small amounts of greenstone surrounded by a sheared clayey matrix; on the Laytonville and Iron Peak quadrangles this unit is lithologically the same as the Eel River melange of Gucwa (1974), but is considered to be gradational with, and less sheared than, typical melange.

LITHOLOGIC CONTACT: dashed where approximately located.

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

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

SHEAR ZONE: fault zone without distinctive mappable fault trace; landslide prone.

LINEAMENT: linear feature of unknown origin observed on aerial photographs; usually associated with erodible rock units.

36 STRIKE AND DIP OF BEDDING

APPROXIMATE STRIKE AND DIP OF BEDDING: appears without numerical designation or dip angle.

STRIKE OF VERTICAL BEDDING

86 STRIKE AND DIP OF FAULT PLANE

14 STRIKE AND DIP OF FOLIATION

SPRING

MARSH OR SMALL POND

QUARRY OR BORROW PIT

REFERENCES

California Department of Forestry, 1981, Cal Aero Photos: Photos CDF-ALL-UK; Flight 6/30/81; Frames 20-9 to 20-14, 22-8 to 22-14, 24-9 to 24-15, and 26-10 to 26-16; black and white, scale 1:24,000.

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Gucwa, P.R., 1974, Geology of the Covelo/Laytonville area, northern California: University of Texas at Austin, unpublished Ph.D. thesis, 82 pages, map scale 1:62,500.

Kilbourne, R.T., 1984, Geology and geomorphic features related to landsliding, Iron Peak 7.5' quadrangle, Mendocino County, California: California Department of Conservation, Division of Mines and Geology, Open File Report 84-40 FR, scale 1:24,000.

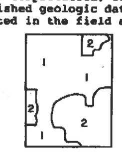
Kilbourne, R.T., 1983, Geology and geomorphic features related to landsliding, Cahto Peak 7.5' quadrangle, Mendocino County, California: California Division of Mines and Geology, Open File Report 83-39 SF, scale 1:24,000.

Kilbourne, R.T., 1984, Geology and geomorphic features related to landsliding, Longvale 7.5' quadrangle, Mendocino County, California: California Division of Mines and Geology, Open File Report 84-18 SF, scale 1:24,000.

SOURCES OF GEOLOGIC DATA

Geologic data were compiled from aerial photo interpretation, field reconnaissance, and the modification of unpublished geologic data from references listed above. The author was assisted in the field and office studies by Dan Trumbly and Lydia Lofgren.

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.



Source: CDMG 1984

ATTACHMENT 1

Geophysical Report

November 26, 2013

LACO Associates
P.O. Box 1023, 21 W. 4th Street
Eureka, CA, 95502

Subject: Borehole Geophysical Logging Investigation
Laytonville Rock Quarry
Mendocino County, California
NORCAL Job No. 13-627.10B

Attention: Mr. Chris Watt

This report summarizes the findings of a borehole geophysical investigation performed by NORCAL Geophysical Consultants, Inc. at the subject site for LACO Associates. The investigation was conducted on October 23th, 2013 by NORCAL Professional Geophysicist William J. Henrich (PGp No. 893). Mr. Chris Watt, Principal Geologist of LACO Associates provided background information, coordination and on-site logistical support.

The purpose of the borehole geophysical investigation was to measure P- and S-wave velocities and map borehole discontinuities within metamorphosed volcanic bedrock. These data will be used by others to assess slope stability and create a grading plan for future quarry operations.

1.0 SCOPE

Geophysical borehole logging was conducted in three boreholes labeled as GB-1, -2 and GB-3. GB-1 and GB-2 were situated on a middle level bench about the center of the rock mass. GB-3 was situated at the northern higher elevation edge of the quarry. Geophysical logging methods consisted of suspension P- and S-wave velocity profiling, optical/acoustic televiewer and caliper logging.

2.0 BOREHOLE CONDITIONS

All boreholes were advanced with a 4-inch diameter air track drilling method. No fluid was introduced to the borehole. The bedrock consisted of metamorphosed volcanic rock. Total depths of the boreholes ranged from 93 to 102-ft below ground surface (bgs). Borehole stability was generally good; however, boreholes did slough-in to the extent that the lower 10 to 15 feet of each borehole was lost to sediment/cuttings accumulation. We added approximately 40 to 50 gallons to each borehole to maintain water levels for suspension logging surveys. One unusual feature of the downhole condition was that borehole trajectories deviated up to 20 degrees from true vertical at depths of 70 ft-bgs (Boreholes G B-1 and -2 in particular). This deviation was probably due to the drilling method in conjunction with the high degree of rock consolidation which deflected the bit as drilling advanced with depth.

3.0 BOREHOLE GEOPHYSICAL LOGGING METHODOLOGY

Complete descriptions of the methodology, data acquisition, data analysis procedures and results for the suspension P- and S-wave and televiewer logging are presented in Appendices A and B, respectively. Specific survey data-log plots for each of these logging methods are presented at the end of each Appendix plus other supporting tables and illustrations.

Caliper logs are a measure of the borehole diameter versus depth. The tool was used both as a survey technique to assess borehole stability and quantify the relative consolidation of bedrock. The caliper tool consists of three interconnected mechanical arms that are spring loaded against the borehole wall. The horizontal deflections of the arms gauge the borehole diameter in units of inches with depth. The logging measurement was made in the uphole direction at a speed of approximately 10-ft per minute. The data sampling rate for this instrument was every 0.2-ft.

NORCAL conducted the borehole geophysical investigation using a digital ***Robertson Geologging,*** **Ltd.** Model ***MICROLOGGER2 System***. This system consisted of a control console, a computer, the logging tools, and a winch. The borehole logging tools consisted of a Suspension P- and S-wave velocity tool, optical and acoustic televiewer and a mechanical three-arm caliper.

4.0 INTERPRETATION and DISCUSSION

1) Suspension P- and S-wave Velocity Profiles

The results of our Suspension P- and S-wave Velocity Profiles are presented in Appendix A, labelled as A-1 through A-3. On the basis of interval velocities, the P- and S-wave velocities considering all three boreholes ranged from 9400 to 17,300 feet per second (fps) and 3500 to 10,300 fps, respectively.

Overall, the above P- and S-wave velocities range signifies a highly consolidated, little fractured, moderate to un-weathered rock mass. The little amount of fracture character was substantiated by televiewer logging.

2) Televiewer Discontinuity Analysis

The interpreted results of the televiewer logging are presented in Appendix B. The bedrock exhibited discontinuities that we classed as minor fracture/joint and foliations. Re-healed or cemented fractures and joints were not tabulated because these represent past deformations that have been part or reconstituted into the rock matrix and therefore do not substantially affect rock strength or stability.

All boreholes had a relatively low frequency of fracturing and jointing. These features were mostly imaged as incomplete traces with very small (<1 mm) little or no apertures.

Because of the limited number of discontinuities present in each borehole we combined all three tabulations (fracture/joint and foliation) into one data set in order to increase the sample number and reduce statistical variance. Directional and angle diagrams of this data set are presented at the end of Appendix B. Results of the stereo-net projection and Rose diagram indicate a trend dipping northeast at a moderately steep 55 to 65 degree angle. A minor directional trend in foliation was indicated dipping southwest at a 30 degree dip.

5.0 STANDARD CARE

The scope of NORCAL's services for this project consisted of using geophysical logging techniques to measure P- and S-wave velocities and map borehole discontinuities. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate the opportunity to provide our services to LACO Associates for this project. If you have any questions, or require additional geophysical services, please do not hesitate to call on us.

Sincerely,

NORCAL Geophysical Consultants, Inc.

William J. Henrich PGp
Professional Geophysicist-893

Enclosures: Appendix A: Suspension P- and S-Wave Velocity Survey
Appendix B: Borehole Imaging Televiewer Survey

Appendix A:

Suspension P- and S- Wave Logging Survey

NORCAL

APPENDIX A

SUSPENSION P- AND S-WAVE VELOCITY SURVEY

The Suspension tool is a highly specialized downhole methodology that measures P- and S-wave velocities at discrete depths. The following presents a narrative on its operation, data reduction procedures, velocity profiles and complete velocity data tables.

1) Methodology

We measured downhole compressional (P-) and shear (S-) wave velocities using an OYO-Robertson Model 3403 digital suspension logging system. The tool is equipped with a dipole seismic energy source located near the base of the probe and a pair of geophones (detectors R-1 and R-2) located within the middle to the upper section of the probe. A schematic diagram depicting the probe configuration and equipment attachment is shown in Figure 1. The distance from the energy source to the first geophone was 10.3-ft (3.14 meters) when assembled with a detachable 2-meter isolation tube. The in-line distance between the geophone pair is 3.28-ft (1.0 meter). Each geophone contains one horizontal and one vertical oriented element. The horizontal phone elements preferentially record the shear wave. The vertical geophone elements record first arriving P-wave energy.

Suspension seismic data are collected at discrete depths in the fluid-filled portion of the borehole. At each measurement depth, the energy source is activated via commands from the surface control console. This activation causes a metal solenoid to strike a plate (anvil) mounted inside the probe housing. This energy transmits through the fluid to the borehole wall which produces a seismic wave (“flexure”) in the adjacent formation. As this wave propagates radially into the formation a seismic interaction between the seismic wave and the borehole wall creates tube waves together with a refracted compressional P-wave that travels up the borehole to the two recording geophones.

When assembled with a 2-meter isolation tube, the suspension logging tool measures approximately 23-ft in length (Figure 1). The measuring point of the tool is taken at the center of the pair of receiver geophones. This measuring point is approximately 15-ft from the probe tip. Therefore, the maximum depth of our survey given a non-sloughing borehole will always be reported 15-ft less than the total depth of the borehole.

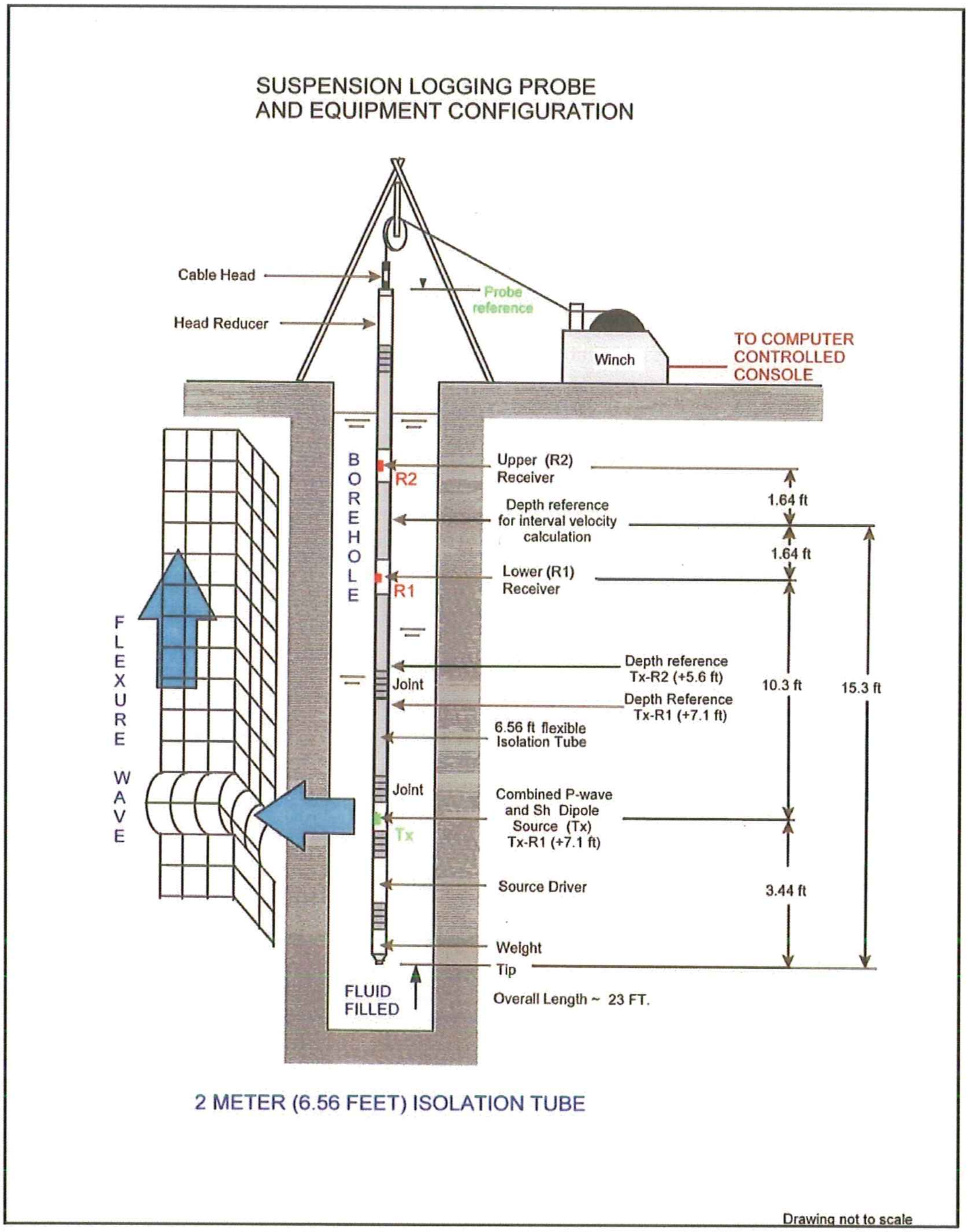


Figure 1: Schematic of suspension logging tool.

2) Data Acquisition

Typically, we measured seismic suspension velocities at stationary 1.0- to 2.0-ft intervals. The surveys began at the bottom of each borehole interval and proceeded up the borehole to the tip of the drill rod casing shoe or HWT steel casing. At each measurement station, we cycled the energy source to fire 2 times in succession into each of the geophone elements. This cycling stacks the seismic energy resulting in an improved signal-to-noise ratio. We also recorded S-wave data using a 2.4 KHz low pass filter. This filtering reduces high frequency interference from the onset of earlier arriving P-wave energy. We recorded P-wave waveforms using a 10 KHz low pass filter. At some measurement depths, we made essentially duplicate records by offsetting the depth by 0.1 feet. This was performed for one of two reasons: 1) determine repeatability and 2) modify recording times and/or stacking number to improve the waveform record at that depth position.

3) Data Analysis

Suspension P- and S-wave velocities were calculated with the interpretation computer software ***Glog SUS***, Version 1.12 published by ***Oyo Corporation*** (2000). An example suspension waveform interpretation of arrival times and velocity determination is presented in Figure 2. The example record was taken from Borehole GB-2 data set. The record shows six detector (geophone) traces. The upper four traces are related to horizontal detector elements labeled R1 and R2. The red traces result from a left strike or impact of the dipole source (anvil) to the probe housing (cycle 1); the green traces result from a right strike (cycle 2) of the dipole source. By superimposing and pairing the respective left and right strike detector traces, phase reversals associated with the arrival times of the S-wave energy can be identified. The lower two traces (blue color) are related to the vertical detector elements which are preferentially aligned to record P-waves. With P-wave energy, the direction of the dipole strike can be in either direction. P-wave arrival times are determined by noting the first breaks on the set of vertical detector traces. Note that at a minimum, a complete suspension waveform record requires at least three recording cycles.

All seismic waveform records were analyzed for P- and S-wave arrival times in this manner. Interval seismic P- and S-wave velocities in meters per second are calculated by dividing the detector spacing (R1-R2 spacing = 1 meter) by the difference in interpreted arrival times in microseconds. Two separate S-wave velocities (dipole source striking left then right) are calculated at each depth measurement station. We averaged the results of these two S-wave interval velocities and presented a single S-wave value at each measurement station.

SAMPLE WAVEFROM RECORD ILLUSTRATED FROM GLOG-SUSP INTERPRETATION PROGRAM, BOREHOLE GB-2, DEPTH 65 FT BGS

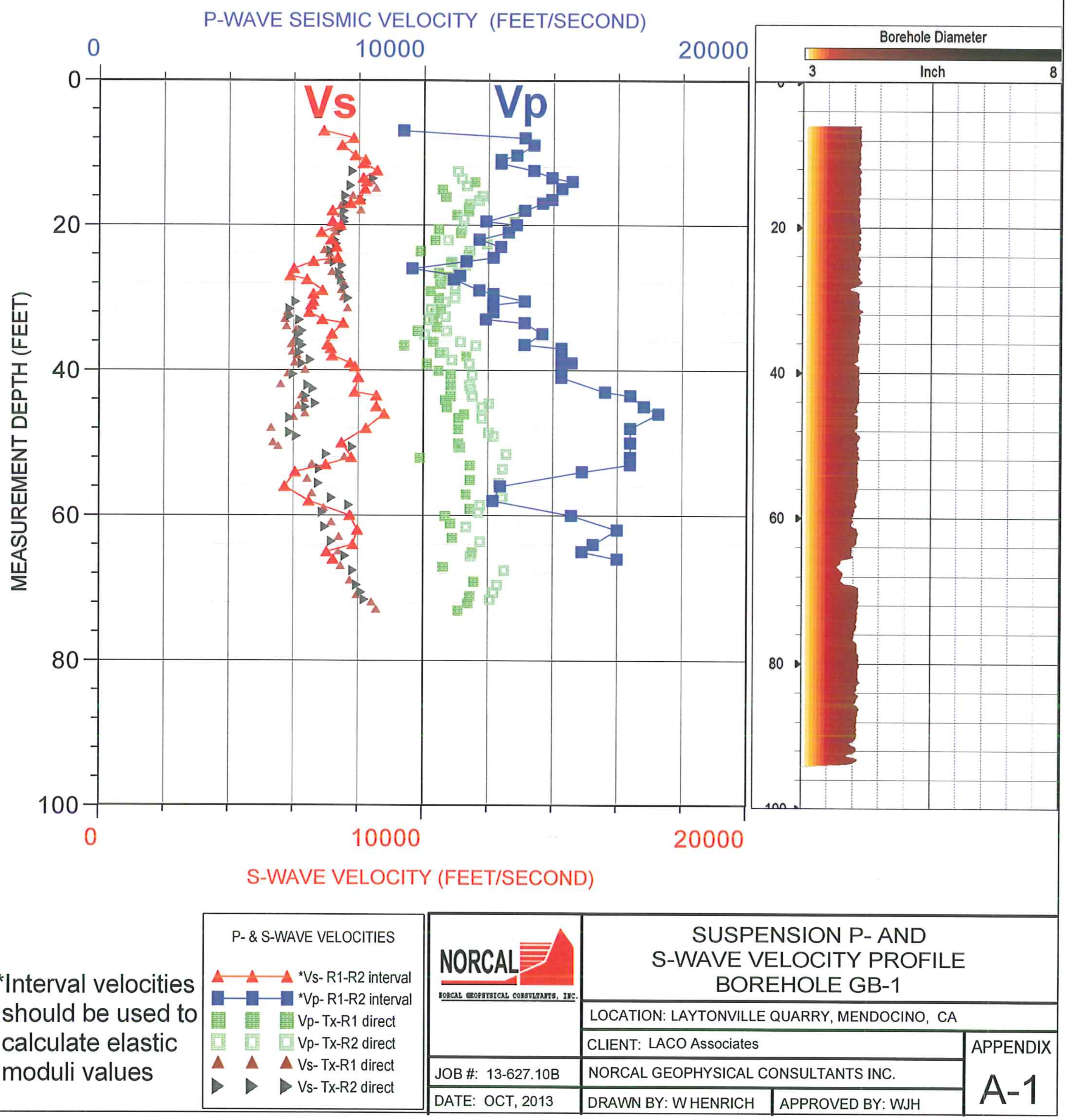
Figure 2 : Sample record showing P- and S- waveforms

As an internal data analysis check, we also computed direct P-wave and S-wave velocities from the interpreted arrival time data. These "direct" velocities are determined by taking the in-line distances from source (Tx) to lower (R1) and upper (R2) detectors and dividing by respective P- and S-wave arrival times. The very small time delays due to offset distances from the source to the borehole wall and borehole wall to detectors are neglected. Note that the depth references for direct velocities are taken as the mid-point between the source and successive detectors. As a consequence, reference depths of the direct velocity computations will always plot several feet lower than the depths of the interval velocities. The interval and direct velocities are then comparatively plotted on depth versus velocity graphs. When significant velocity variations are noted between the different computations of the respective P- and S-waves, we reinterpret the arrival times within the ***Glog-SUS*** program so that the final interpreted interval velocities, to the extent permissible by the detector response, converges more closely to the trends and magnitude of direct velocities.

4) Results

The results of the Suspension Log P- and S-wave surveys are illustrated by the plots that follow this appendix labeled A-1 through A-3. The results include all sources to near and far detector P- and S-wave velocity combinations (see Legend to distinguish the various symbols denoting interval and direct velocities). We have highlighted the interval P- and S-wave velocities on the profiles (see red and blue colored symbols) as these velocities should be used to calculate elastic moduli values for the subsurface layering. This is because the interval velocity method compensates for any delayed arrival time errors and stand-off ray paths and therefore is the most accurate. Caliper logs have been plotted to the right of the velocity profile. This comparison illustrated the correlation of relatively low velocities to borehole enlargements and conversely, intact borehole wall to relatively higher velocities.

Data tabulation, in terms of depth, arrival times and various derived interval direct velocities follow Plots A-1 through A-3.



*Interval velocities should be used to calculate elastic moduli values

NORCAL GEOPHYSICAL CONSULTANTS, INC.

SUSPENSION P- AND S-WAVE VELOCITY PROFILE
BOREHOLE GB-1

LOCATION: LAYTONVILLE QUARRY, MENDOCINO, CA

CLIENT: LACO Associates

JOB #: 13-627.10B

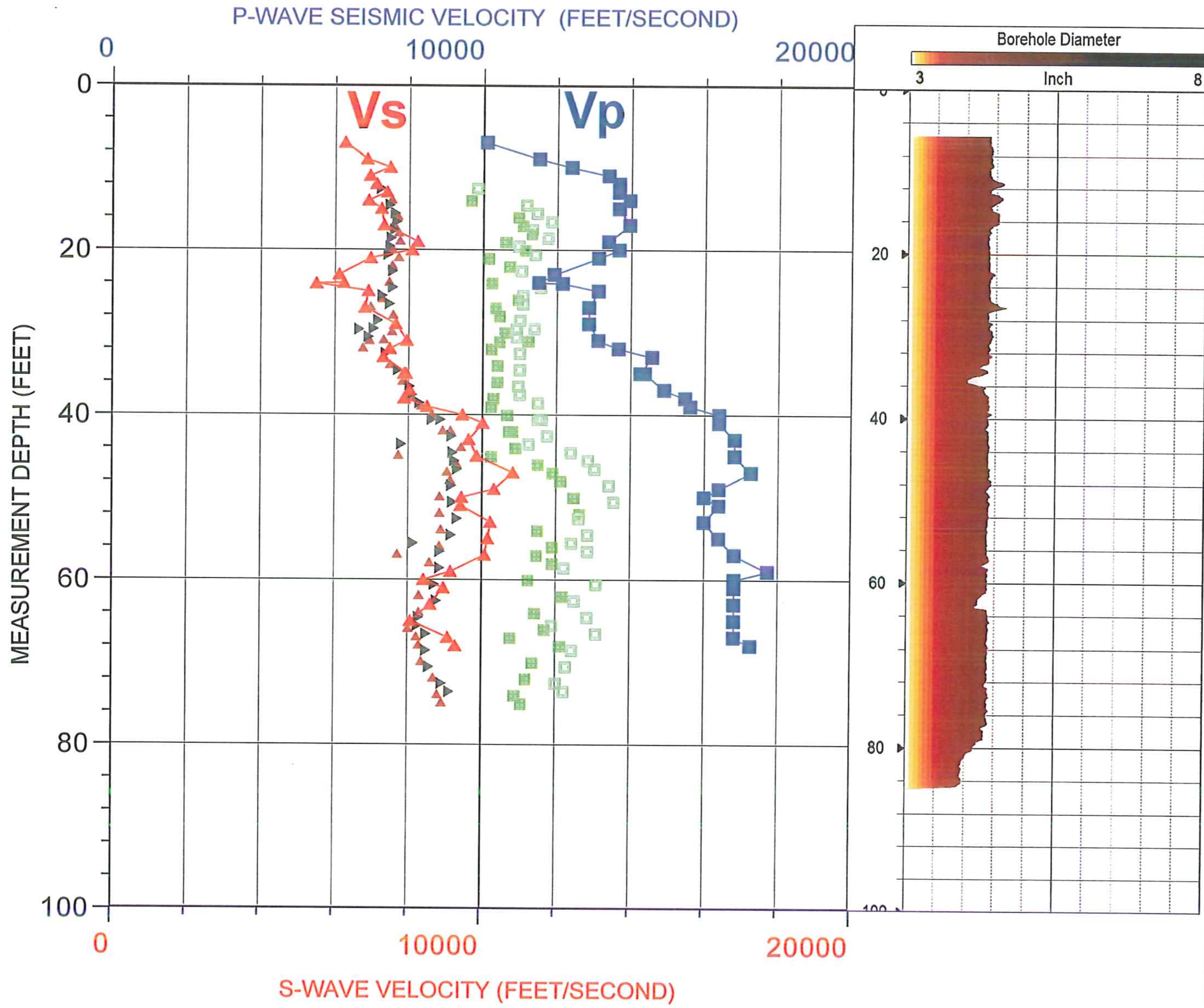
NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: OCT, 2013

DRAWN BY: W HENRICH

APPROVED BY: WJH

APPENDIX A-1



*Interval velocities should be used to calculate elastic moduli values

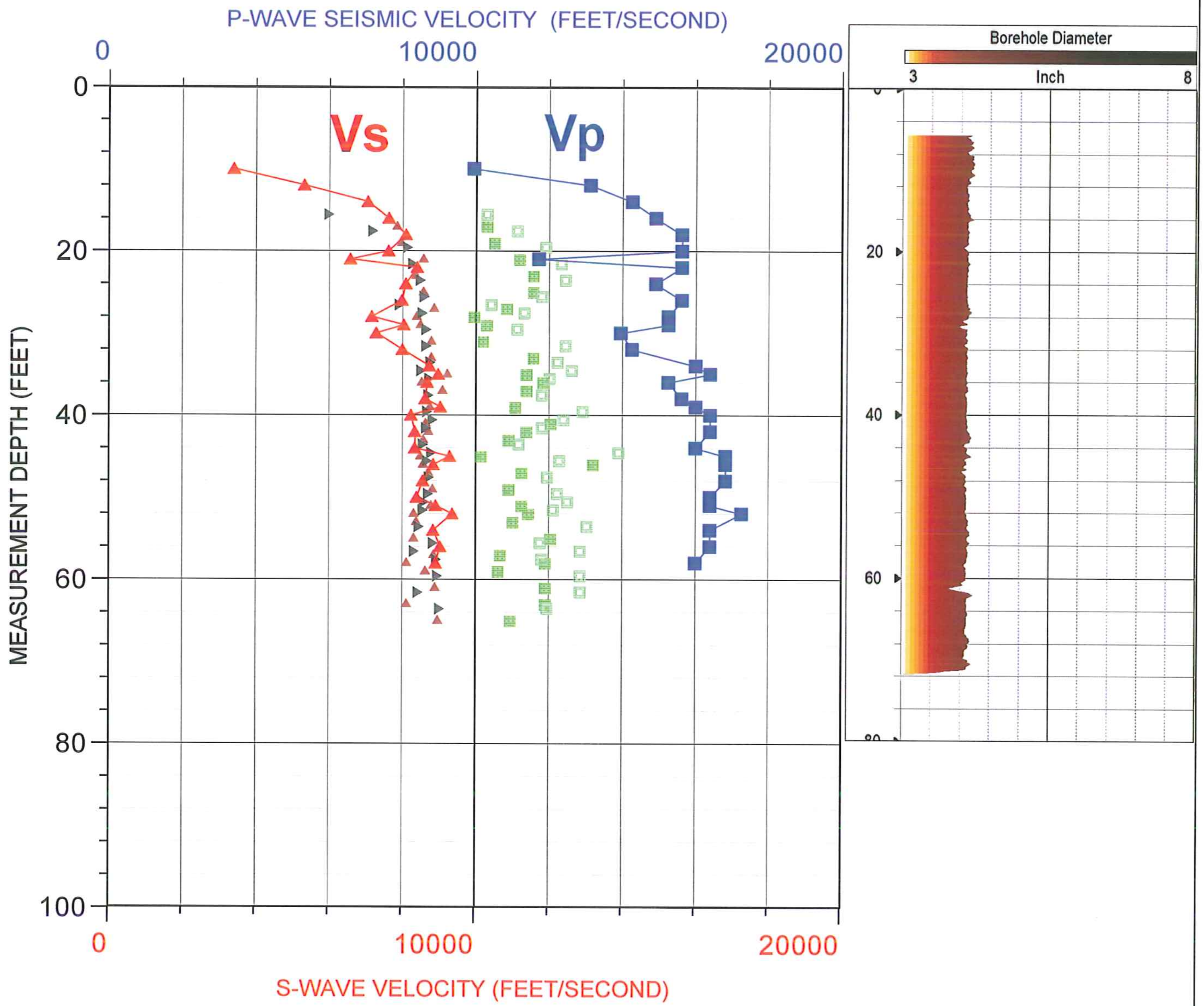
P- & S-WAVE VELOCITIES

- *Vs- R1-R2 interval
- *Vp- R1-R2 interval
- Vp- Tx-R1 direct
- Vp- Tx-R2 direct
- Vs- Tx-R1 direct
- Vs- Tx-R2 direct

NORCAL

NORCAL GEOPHYSICAL CONSULTANTS, INC.

SUSPENSION P- AND S-WAVE VELOCITY PROFILE BOREHOLE GB-2	
LOCATION: LAYTONVILLE QUARRY, MENDOCINO, CA	
CLIENT: LACO Associates	APPENDIX
JOB #: 13-627.10B	NORCAL GEOPHYSICAL CONSULTANTS INC.
DATE: OCT, 2013	DRAWN BY: W HENRICH / APPROVED BY: WJH
	A-2



*Interval velocities should be used to calculate elastic moduli values

P- & S-WAVE VELOCITIES

- *Vs- R1-R2 interval
- *Vp- R1-R2 interval
- Vp- Tx-R1 direct
- Vp- Tx-R2 direct
- Vs- Tx-R1 direct
- Vs- Tx-R2 direct

NORCAL GEOPHYSICAL CONSULTANTS, INC.

SUSPENSION P- AND S-WAVE VELOCITY PROFILE BOREHOLE GB-3

LOCATION: LAYTONVILLE QUARRY, MENDOCINO, CA

CLIENT: LACO Associates

JOB #: 13-627.10B

NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: OCT, 2013

DRAWN BY: W HENRICH

APPROVED BY: WJH

APPENDIX A-3

SUSPENSION LOG DATA TABLE BOREHOLE GB-1, LAYTONVILLE QUARRY, MENDOCINO CO. , CALIFORNIA

DEPTH	Vs ARRIVAL TIMES				Vp ARRIVAL TIMES		INTERVAL VELOCITIES					DIRECT TRAVEL VELOCITIES				Offset Depth References	
(ft bgs)	R2-right (us)	R1-right (us)	R2-left (us)	R1-left (us)	R2 (us)	R1 (us)	Vs-rt (m/s)	Vs-left(m/s)	Vp (m/s)	Vs-ave (fps)	Vp (fps)	Vs Tx-R2 (fps)	Vs Tx-R1(fps)	Vp Tx-R1(fps)	Vp Tx-R2 (fps)	Tx-R1	Tx-R2
7	2010	1580	2000	1475	1240	890	2326	1905	2857	6941	9374	8408	7829	11573	11048	14.1	12.6
8	1995	1575	1870	1455	1225	975	2381	2410	4000	7859	13124	8548	8457	10564	11184	15.1	13.6
9	2110	1685	2015	1565	1210	965	2353	2222	4082	7505	13393	7833	7762	10674	11322	16.1	14.6
10.4	2135	1725	2050	1630	1160	905	2439	2381	3922	7907	12868	7464	7611	11381	11810	17.5	16
11	2005	1620	1940	1525	1170	905	2597	2410	3774	8214	12382	8078	8107	11381	11709	18.1	16.6
11.5	2135	1745	2045	1630	1200	935	2564	2410	3774	8160	12382	7464	7632	11016	11417	18.6	17.1
12.5	2140	1760	2060	1675	1050	805	2632	2597	4082	8578	13393	7228	7569	12795	13048	19.6	18.1
13.5	2195	1785	2060	1665	1220	985	2439	2532	4255	8155	13960	7279	7569	10457	11230	20.6	19.1
14	2125	1730	2060	1660	1150	925	2532	2500	4444	8255	14580	7305	7569	11135	11913	21.1	19.6
15	2155	1765	2080	1670	1225	995	2564	2439	4348	8207	14265	7254	7486	10352	11184	22.1	20.6
16.5	2230	1815	2130	1730	1275	1040	2410	2500	4255	8055	13960	6959	7287	9904	10745	23.6	22.1
17	2175	1755	2120	1695	1145	905	2381	2353	4167	7766	13672	7128	7326	11381	11965	24.1	22.6
18	2240	1790	2165	1705	1200	950	2222	2174	4000	7211	13124	7079	7154	10842	11417	25.1	23.6
19.5	2170	1715	2135	1680	1260	985	2198	2198	3636	7211	11929	7203	7268	10457	10873	26.6	25.1
20	2080	1640	2075	1635	1215	960	2273	2273	3922	7457	12868	7437	7507	10729	11276	27.1	25.6
21	2210	1735	2095	1615	1240	980	2105	2083	3846	6870	12618	7546	7425	10510	11048	28.1	26.6
22	2180	1720	2080	1625	1290	1010	2174	2198	3571	7172	11716	7491	7486	10198	10620	29.1	27.6
23	2135	1680	2055	1615	1250	985	2198	2273	3774	7334	12382	7546	7590	10457	10960	30.1	28.6
24.5	2160	1710	2030	1590	1250	980	2222	2273	3704	7374	12152	7687	7697	10510	10960	31.6	30.1
25	2495	1990	2500	2015	1285	995	1980	2062	3448	6631	11313	5836	6089	10352	10661	32.1	30.6
26	2600	2040	2570	2040	1340	1000	1786	1887	2941	6025	9649	5754	5905	10300	10224	33.1	31.6
27	2590	2025	2570	2025	1285	990	1770	1835	3390	5914	11122	5803	5905	10404	10661	34.1	32.6
27.5	2470	1970	2460	1940	1350	1050	2000	1923	3333	6435	10935	6095	6199	9810	10148	34.6	33.1
29	2410	1930	2430	1960	1280	1000	2083	2128	3571	6908	11716	6023	6284	10300	10703	36.1	34.6
29.5	2480	1980	2470	1980	1365	1095	2000	2041	3704	6629	12152	5954	6171	9406	10037	36.6	35.1
30.5	2470	1970	2460	1970	1230	980	2000	2041	4000	6629	13124	5988	6199	10510	11138	37.6	36.1
31	2430	1930	2430	1930	1180	910	2000	2000	3704	6562	12152	6131	6284	11319	11610	38.1	36.6
32	2460	1960	2460	1950	1290	1020	2000	1961	3704	6498	12152	6059	6199	10098	10620	39.1	37.6
33	2340	1870	2345	1865	1260	985	2128	2083	3636	6908	11929	6378	6539	10457	10873	40.1	38.6
33.5	2450	2000	2430	2010	1200	950	2222	2381	4000	7551	13124	5852	6284	10842	11417	40.6	39.1
35	2540	2080	2530	2080	1190	950	2174	2222	4167	7211	13672	5628	6009	10842	11513	42.1	40.6
36.5	2340	1890	2370	1890	1200	950	2222	2083	4000	7062	13124	6280	6462	10842	11417	43.6	42.1
37	2345	1880	2320	1870	1195	965	2151	2222	4348	7174	14265	6358	6618	10674	11464	44.1	42.6
38	2370	1930	2390	1920	1190	960	2273	2128	4348	7220	14265	6168	6402	10729	11513	45.1	43.6
39	2280	1865	2295	1865	1140	915	2410	2326	4444	7769	14580	6378	6699	11257	12018	46.1	44.6
39.5	2350	1950	2390	1960	1160	930	2500	2326	4348	7917	14265	6023	6402	11075	11810	46.6	45.1
41	2570	2140	2570	2180	1160	930	2326	2564	4348	8022	14265	5337	5905	11075	11810	48.1	46.6
43	2550	2130	2570	2160	1140	930	2381	2439	4762	7907	15624	5393	5905	11075	12018	50.1	48.6
43.5	2490	2110	2490	2105	1125	925	2632	2597	5000	8578	16405	5553	6116	11135	12178	50.6	49.1
45	2005	1630	1995	1605	1235	1040	2667	2564	5128	8581	16824	7601	7851	9904	11093	52.1	50.6
46	2195	1835	2195	1810	1090	900	2778	2597	5263	8817	17267	6603	7044	11444	12569	53.1	51.6

48	2230	1845	2255	1845	1100	900	2597	2439	5000	8261	16405	6458	6833	11444	12455	55.1	53.6
50	2265	1845	2265	1810	1110	910	2381	2198	5000	7512	16405	6603	6799	11319	12342	57.1	55.6
52	2220	1800	2150	1730	1100	900	2381	2381	5000	7812	16405	6959	7211	11444	12455	59.1	57.6
53	2135	1650	2020	1570	1165	965	2062	2222	5000	7028	16405	7803	7740	10674	11760	60.1	58.6
54	2240	1710	2230	1680	1170	950	1887	1818	4545	6078	14912	7203	6919	10842	11709	61.1	59.6
56	2230	1660	2205	1635	1210	945	1754	1754	3774	5755	12382	7437	7008	10899	11322	63.1	61.6
58	2160	1660	2150	1640	1165	895	2000	1961	3704	6498	12152	7410	7211	11508	11760	65.1	63.6
60	2105	1680	2045	1625	1195	970	2353	2381	4444	7766	14580	7491	7632	10619	11464	67.1	65.6
62	2035	1630	1990	1575	1095	890	2469	2410	4878	8004	16004	7774	7874	11573	12511	69.1	67.6
64	1995	1585	1965	1540	1115	900	2439	2353	4651	7861	15259	7984	7988	11444	12287	71.1	69.6
65	1955	1490	1935	1470	1125	905	2151	2151	4545	7057	14912	8443	8131	11381	12178	72.1	70.6
66	1970	1530	1915	1450	1135	930	2273	2151	4878	7257	16004	8583	8228	11075	12070	73.1	71.6

Vs & Vp Interval Velocities
see red triangle & blue squares
on graph

COLUMN HEADER LEGEND

DEPTH: Reference point of the Interval Velocity Measurement

Vs ARRIVAL TIMES: Shear Wave

R2-right (us): Upper Detector arrival time in micro seconds due to right side strike of the dipole source

R1-right (us): Lower Detector arrival time in micro seconds due to right side strike of dipole source

R2-left (us): Upper Detector arrival time in micro seconds due to left side strike of the dipole source

R1-left (us): Lower Detector arrival time in micro seconds due to left side strike of dipole source

Vp ARRIVAL TIMES: Compression P-Wave

R2 (us): Upper Detector arrival time in micro seconds

R1 (us): Lower Detector arrival time in micro seconds

INTERVAL VELOCITY:

Vs-rt (m/s): Interval Shear wave velocity derived from right dipole strike in Meters/sec.

Vs-left(m/s): Interval Shear wave velocity derived from left dipole strike in Meters/sec.

Vp (m/s): Interval P-wave velocity in Meters/sec.

Vs-ave.(fps): Average interval Shear wave velocity in feet/sec.

Vp (fps): Interval P-wave velocity in feet/sec.

DIRECT TRAVEL VELOCITIES:

Vs Tx-R2(fps): Shear wave velocity = inline distance from source to upper detector divided by travel time measurement at the upper detector

Vs Tx-R1(fps): Shear wave velocity = inline distance from source to lower detector divided by travel time measurement at the lower detector

Vp Tx-R1(fps): P-wave velocity = inline distance from source to the lower detector divided by travel time measurement at the lower detector

Vp Tx-R2(fps): P-wave velocity = inline distance from source to the upper detector divided by travel time measurement at the upper detector

OFF SET DEPTH MEASUREMENT POINT:

Tx-R1: Depth reference for source to near detector velocity value; mid-point

Tx-R2: Depth reference for source to far detector velocity value, mid-point

SUSPENSION LOG DATA TABLE BOREHOLE GB-2, LAYTONVILLE QUARRY, MENDOCINO CO. , CALIFORNIA

DEPTH	Vs ARRIVAL TIMES				Vp ARRIVAL TIMES		INTERVAL VELOCITIES					DIRECT TRAVEL VELOCITIES				Offset Depth References	
(ft bgs)	R2-right (us)	R1-right (us)	R2-left (us)	R1-left (us)	R2 (us)	R1 (us)	Vs-rt (m/s)	Vs-left(m/s)	Vp (m/s)	Vs-ave (fps)	Vp (fps)	Vs Tx-R2 (fps)	Vs Tx-R1(fps)	Vp Tx-R1(fps)	Vp Tx-R2 (fps)	Tx-R1	Tx-R2
7	2220	1695	2135	1615	1390	1065	1905	1923	3077	6280	10095	7546	7268	9671	9856	14.1	12.6
9	2135	1670	2075	1585	1225	940	2151	2041	3509	6877	11513	7715	7507	10957	11184	16.1	14.6
10	2115	1675	2040	1605	1195	930	2273	2299	3774	7500	12382	7601	7654	11075	11464	17.1	15.6
11	2080	1585	2030	1580	1155	910	2020	2222	4082	6959	13393	7744	7697	11319	11861	18.1	16.6
12	2090	1640	2045	1575	1210	970	2222	2128	4167	7136	13672	7774	7632	10619	11322	19.1	17.6
13	2165	1735	2065	1610	1165	925	2326	2198	4167	7421	13672	7574	7548	11135	11760	20.1	18.6
14	2185	1730	2075	1580	1250	1015	2198	2020	4255	6919	13960	7744	7507	10148	10960	21.1	19.6
15	2145	1715	2085	1610	1200	960	2326	2105	4167	7269	13672	7574	7466	10729	11417	22.1	20.6
17	2175	1710	2055	1625	1240	1005	2151	2326	4255	7344	13960	7491	7590	10249	11048	24.1	22.6
19	2130	1730	2055	1660	1185	940	2500	2532	4082	8255	13393	7305	7590	10957	11561	26.1	24.6
20	2140	1730	2125	1725	1235	995	2439	2500	4167	8102	13672	6983	7307	10352	11093	27.1	25.6
21	2145	1675	2075	1605	1235	985	2128	2128	4000	6982	13124	7601	7507	10457	11093	28.1	26.6
23	2190	1665	2155	1610	1245	970	1905	1835	3636	6135	11929	7574	7192	10619	11004	30.1	28.6
24	2242	1727	2187	1652	1202	917	1942	1869	3509	6252	11513	7347	7073	11232	11398	31.1	29.6
24.1	2315	1695	2300	1730	1255	985	1613	1754	3704	5523	12152	6959	6683	10457	10916	31.2	29.7
25	2260	1765	2225	1770	1255	1005	2020	2198	4000	6919	13124	6776	6937	10249	10916	32.1	30.6
27	2155	1675	2100	1620	1245	990	2083	2083	3922	6834	12868	7518	7405	10404	11004	34.1	32.6
29	2085	1685	2020	1560	1245	990	2500	2174	3922	7667	12868	7863	7740	10404	11004	36.1	34.6
31	2025	1630	1950	1520	1250	1000	2532	2326	4000	7969	13124	8110	8059	10300	10960	38.1	36.6
32	1970	1550	1935	1480	1245	1005	2381	2198	4167	7512	13672	8374	8131	10249	11004	39.1	37.6
33	1950	1510	1895	1440	1190	965	2273	2198	4444	7334	14580	8655	8328	10674	11513	40.1	38.6
35	1855	1445	1790	1375	1190	960	2439	2410	4348	7955	14265	9156	8896	10729	11513	42.1	40.6
35	1887	1487	1832	1400	1180	952	2500	2315	4386	7899	14390	8957	8660	10819	11610	42.1	40.6
37	1805	1390	1740	1340	1165	945	2410	2500	4545	8055	14912	9450	9195	10899	11760	44.1	42.6
38	2082	1672	1997	1577	1217	1005	2439	2381	4717	7907	15476	7762	7842	10249	11257	45.1	43.6
39	1775	1385	1735	1355	1105	895	2564	2632	4762	8524	15624	9321	9226	11508	12398	46.1	44.6
40	1787	1437	1727	1385	1065	865	2857	2924	5000	9483	16405	9075	9276	11908	12864	47.1	45.6
41	1735	1420	1715	1375	1050	850	3175	2941	5000	10033	16405	9156	9352	12118	13048	48.1	46.6
43	1765	1415	1740	1410	1020	825	2857	3030	5128	9657	16824	8879	9195	12485	13431	50.1	48.6
45	1765	1425	1735	1410	1010	815	2941	3077	5128	9872	16824	8879	9226	12638	13564	52.1	50.6
47	1760	1465	1715	1405	1085	895	3390	3226	5263	10853	17267	8918	9352	11508	12627	54.1	52.6
49	1765	1460	1740	1410	1065	865	3279	3030	5000	10350	16405	8879	9195	11908	12864	56.1	54.6
50	1890	1542	1925	1580	1102	897	2874	2899	4878	9470	16004	7744	8179	11483	12432	57.1	55.6
51	1820	1470	1790	1445	1065	865	2857	2899	5000	9442	16405	8619	8896	11908	12864	58.1	56.6
53	1850	1530	1790	1470	1120	915	3125	3125	4878	10253	16004	8443	8896	11257	12232	60.1	58.6
55	1835	1520	1815	1485	1045	845	3175	3030	5000	10179	16405	8340	8754	12189	13110	62.1	60.6
57	1840	1510	1805	1485	1095	900	3030	3125	5128	10097	16824	8340	8810	11444	12511	64.1	62.6
59	1895	1545	1895	1530	1065	880	2857	2740	5405	9182	17733	8047	8328	11705	12864	66.1	64.6
60	1972	1600	1900	1495	1150	955	2688	2469	5128	8460	16824	8273	8303	10785	11913	67.1	65.6
61	1930	1570	1855	1485	1045	850	2778	2703	5128	8991	16824	8340	8536	12118	13110	68.1	66.6

63	1885	1505	1855	1475	1100	905	2632	2632	5128	8635	16824	8408	8536	11381	12455	70.1	68.6
65	1855	1455	1840	1430	1115	920	2500	2439	5128	8102	16824	8729	8616	11196	12287	72.1	70.6
67	1855	1500	1780	1415	1140	945	2817	2740	5128	9116	16824	8841	8954	10899	12018	74.1	72.6
68	1840	1480	1745	1400	1120	930	2778	2899	5263	9313	17267	8957	9164	11075	12232	75.1	73.6

Vs & Vp Interval Velocities
see red triangle & blue squares
on graph

COLUMN HEADER LEGEND

DEPTH: Reference point of the Interval Velocity Measurement

Vs ARRIVAL TIMES: Shear Wave

R2-right (us): Upper Detector arrival time in micro seconds due to right side strike of the dipole source

R1-right (us): Lower Detector arrival time in micro seconds due to right side strike of dipole source

R2-left (us): Upper Detector arrival time in micro seconds due to left side strike of the dipole source

R1-left (us): Lower Detector arrival time in micro seconds due to left side strike of dipole source

Vp ARRIVAL TIMES: Compression P-Wave

R2 (us): Upper Detector arrival time in micro seconds

R1 (us): Lower Detector arrival time in micro seconds

INTERVAL VELOCITY:

Vs-rt (m/s): Interval Shear wave velocity derived from right dipole strike in Meters/sec.

Vs-left(m/s): Interval Shear wave velocity derived from left dipole strike in Meters/sec.

Vp (m/s): Interval P-wave velocity in Meters/sec.

Vs-ave.(fps): Average interval Shear wave velocity in feet/sec.

Vp (fps): Interval P-wave velocity in feet/sec.

DIRECT TRAVEL VELOCITIES:

Vs Tx-R2(fps): Shear wave velocity = inline distance from source to upper detector divided by travel time measurement at the upper detector

Vs Tx-R1(fps): Shear wave velocity = inline distance from source to lower detector divided by travel time measurement at the lower detector

Vp Tx-R1(fps): P-wave velocity = inline distance from source to the lower detector divided by travel time measurement at the lower detector

Vp Tx-R2(fps): P-wave velocity = inline distance from source to the upper detector divided by travel time measurement at the upper detector

OFF SET DEPTH MEASUREMENT POINT:

Tx-R1: Depth reference for source to near detector velocity value; mid-point

Tx-R2: Depth reference for source to far detector velocity value, mid-point

SUSPENSION LOG DATA TABLE BOREHOLE GB-3, LAYTONVILLE QUARRY, MENDOCINO CO. , CALIFORNIA

DEPTH	Vs ARRIVAL TIMES				Vp ARRIVAL TIMES		INTERVAL VELOCITIES					DIRECT TRAVEL VELOCITIES				Offset Depth Referer	
(ft bgs)	R2-right (us)	R1-right (us)	R2-left (us)	R1-left (us)	R2 (us)	R1 (us)	Vs-rt (m/s)	Vs-left(m/s)	Vp (m/s)	Vs-ave (fps)	Vp (fps)	Vs Tx-R2 (fps	Vs Tx-R1(fps)	Vp Tx-R1(fps)	Vp Tx-R2 (fps	Tx-R1	Tx-R2
10	2510	1560	2530	1560	1330	1000	1053	1031	3030	3419	9941	7863	6009	10300	10301	17.1	15.6
12	2160	1540	2150	1540	1230	980	1613	1639	4000	5335	13124	7984	7211	10510	11138	19.1	17.6
14	1950	1500	1930	1450	1150	920	2222	2083	4348	7062	14265	8583	8155	11196	11913	21.1	19.6
16	1930	1490	1900	1480	1110	890	2273	2381	4545	7635	14912	8374	8303	11573	12342	23.1	21.6
18	1900	1500	1860	1450	1100	890	2500	2439	4762	8102	15624	8583	8509	11573	12455	25.1	23.6
20	1870	1440	1840	1410	1160	950	2326	2326	4762	7631	15624	8879	8616	10842	11810	27.1	25.6
21	1980	1485	1975	1475	1315	1035	2020	2000	3571	6595	11716	8408	7942	9952	10418	28.1	26.6
22	1860	1470	1850	1460	1210	1000	2564	2564	4762	8412	15624	8512	8563	10300	11322	29.1	27.6
24	1870	1470	1830	1420	1230	1010	2500	2439	4545	8102	14912	8803	8671	10198	11138	31.1	29.6
26	1880	1470	1830	1420	1100	890	2439	2439	4762	8002	15624	8803	8671	11573	12455	33.1	31.6
28	1870	1400	1810	1365	1120	905	2128	2247	4651	7177	15259	9238	8782	11381	12232	35.1	33.6
29	1860	1445	1855	1455	1085	870	2410	2500	4651	8055	15259	8548	8536	11839	12627	36.1	34.6
30	1850	1385	1815	1380	1140	905	2151	2299	4255	7300	13960	9115	8754	11381	12018	37.1	35.6
32	1855	1430	1820	1425	1160	930	2353	2532	4348	8014	14265	8766	8726	11075	11810	39.1	37.6
34	1875	1510	1825	1440	1060	855	2740	2597	4878	8755	16004	8655	8698	12047	12925	41.1	39.6
35	1805	1445	1800	1430	1105	905	2778	2703	5000	8991	16405	8729	8839	11381	12398	42.1	40.6
36	1885	1510	1830	1450	1160	945	2667	2632	4651	8693	15259	8583	8671	10899	11810	43.1	41.6
38	1905	1530	1845	1460	1225	1015	2667	2597	4762	8635	15624	8512	8589	10148	11184	45.1	43.6
39	1815	1445	1805	1450	985	780	2703	2817	4878	9055	16004	8583	8810	13205	13909	46.1	44.6
40	1865	1465	1825	1430	1115	915	2500	2532	5000	8255	16405	8729	8698	11257	12287	47.1	45.6
42	1870	1485	1815	1415	1145	945	2597	2500	5000	8361	16405	8841	8754	10899	11965	49.1	47.6
44	1885	1500	1820	1420	1120	915	2597	2500	4878	8361	16004	8803	8726	11257	12232	51.1	49.6
45	1865	1515	1840	1485	1095	900	2857	2817	5128	9308	16824	8340	8616	11444	12511	52.1	50.6
46	1860	1490	1845	1475	1130	935	2703	2703	5128	8868	16824	8408	8589	11016	12124	53.1	51.6
48	1870	1485	1865	1485	1050	855	2597	2632	5128	8578	16824	8340	8483	12047	13048	55.1	53.6
50	1845	1450	1795	1410	1165	965	2532	2597	5000	8414	16405	8879	8867	10674	11760	57.1	55.6
51	1905	1545	1890	1515	1065	865	2778	2667	5000	8932	16405	8142	8354	11908	12864	58.1	56.6
52	1820	1460	1780	1440	1160	970	2778	2941	5263	9382	17267	8655	8954	10619	11810	59.1	57.6
54	1845	1475	1775	1405	1065	865	2703	2703	5000	8868	16405	8918	8984	11908	12864	61.1	59.6
56	1860	1490	1870	1515	1065	865	2703	2817	5000	9055	16405	8142	8457	11908	12864	63.1	61.6
58	1880	1515	1765	1395	1145	940	2740	2703	4878	8929	16004	8996	9043	10957	11965	65.1	63.6

Vs & Vp Interval Velocities
see red triangle & blue squares
on graph

COLUMN HEADER LEGEND

DEPTH: Reference point of the Interval Velocity Measurement

Vs ARRIVAL TIMES: Shear Wave

R2-right (us): Upper Detector arrival time in micro seconds due to right side strike of the dipole source

R1-right (us): Lower Detector arrival time in micro seconds due to right side strike of dipole source

R2-left (us): Upper Detector arrival time in micro seconds due to left side strike of the dipole source

R1-left (us): Lower Detector arrival time in micro seconds due to left side strike of dipole source

Vp ARRIVAL TIMES: Compression P-Wave

R2 (us): Upper Detector arrival time in micro seconds

R1 (us): Lower Detector arrival time in micro seconds

INTERVAL VELOCITY:

Vs-rt (m/s): Interval Shear wave velocity derived from right dipole strike in Meters/sec.

Vs-left(m/s): Interval Shear wave velocity derived from left dipole strike in Meters/sec.

Vp (m/s): Interval P-wave velocity in Meters/sec.

Vs-ave.(fps): Average interval Shear wave velocity in feet/sec.

Vp (fps): Interval P-wave velocity in feet/sec.

DIRECT TRAVEL VELOCITIES:

Vs Tx-R2(fps) Shear wave velocity = inline distance from source to upper detector divided by travel time measurement at the upper detector

Vs Tx-R1(fps) Shear wave velocity = inline distance from source to lower detector divided by travel time measurement at the lower detector

Vp Tx-R1(fps) P-wave velocity = inline distance from source to the lower detector divided by travel time measurement at the lower detector

Vp Tx-R2(fps) P-wave velocity = inline distance from source to the upper detector divided by travel time measurement at the upper detector

OFF SET DEPTH MEASUREMENT POINT:

Tx-R1: Depth reference for source to near detector velocity value; mid-point

Tx-R2: Depth reference for source to far detector velocity value, mid-point

Appendix B:

Borehole Imaging Televiewer Survey

APPENDIX B

BOREHOLE IMAGING TELEVIEWER SURVEY

The optical and acoustic televiewers are oriented imaging tools used to map borehole discontinuities. The output of these tools is presented as unwrapped (unfolded cylinder on a two-dimensional surface) image plots with sinusoid overlays that identify interpretable discontinuities. These plots, tabulations and directional analysis of oriented discontinuities are presented in the following section.

1) Methodology-Data Acquisition

The occurrence and orientation of borehole discontinuities (fractures, bedding, geologic contacts, etc.), rock textures, and other descriptive geologic information can be viewed with an optical (OPTV) imaging tool. The OPTV tool uses a digital optical sensor to produce radial images at a resolution down to 0.004 feet. These radial images are then composited sequentially via computer software to produce continuous color (unwrapped) video-like images on a field computer screen. The tool can operate in either dry or water-filled portions of the borehole providing that the water-filled portion is optically clear. The final "unwrapped" radial images are referenced to magnetic north as determined by an on-board magnetic compass. In addition, to the magnetic compass bearing, the inclination and azimuth of the borehole was recorded by a combination three-axis magnetic-inclinometer sensor package.

Logging speed was approximately 4 feet per minute. Generally two logs were acquired in each borehole; one in the up and one in the down direction. Orientations of common features between the two logs were compared to assess the tools compass stability. The clearer or sharper image was used in the final analysis of discontinuities.

In the event borehole fluid is optically "cloudy" or too opaque for visual discrimination of borehole features an acoustic televiewer BHTV is used to image borehole features. The BHTV tool is an ultrasonic acoustic send and receive device. Sidewall borehole images are created by measuring variations of thousands of two-way travel times and amplitudes of reflected ultrasonic pulses as the device is moving up the borehole. The BHTV logging technique requires a water column to act as a medium to transmit and receive acoustic signals to and from the borehole wall. The data sampling rate for the BHTV tool is every 0.004 foot. The left margin of the borehole images plot corresponds to the direction of magnetic north as determined by an on-board magnetic compass. In addition to the magnetic compass, the inclination of the borehole was recorded by an omni-directional three-axis accelerometer. Image data were conducted in the up hole direction. Logging speed was approximately 4 feet per minute.

2) Data Analysis

We used the computer program *WELLCAD* (Version 4.4, ALT, Luxemburg) to produce merged televiewer image plots and to calculate orientations of interpreted discontinuities (e.g. fractures). Corrections for the magnetic declination in the survey area required adding 15 degrees to the magnetic compass bearings in order to orient the borehole images to true north (NOAA, Magnetic Declination Map, 2010). Since borehole diameter is a major reduction parameter in determining dip magnitude, we input caliper log measurements. Discontinuities analysis was performed interactively on sections of the unwrapped acoustic amplitude images as viewed on a computer monitor. An interpretable discontinuity on a two-dimensional unwrapped borehole televiewer log appears as a recognizable sinusoidal shaped trace that usually extends across the full width of the borehole image. The sinusoidal shape is a manifestation of a planar discontinuity intercepting a three-dimensional cylindrical borehole. Planar discontinuities can be geologic features that include discrete fractures or joints, bedding planes, and planar intrusions such as veins and geologic contacts. Identified discontinuity traces on the image logs were fitted with a bendable sinusoid that overlies the trend of the trace. *WELLCAD* then calculates a plane that represents the orientation of the discontinuity in terms of dip direction and dip magnitude based on the position of the sinusoid overlay. The process is repeated for every significant discontinuity until the entire borehole is interpreted. At this stage, apparent dip direction and dip magnitude of the discontinuities are converted to true geographic dip azimuth and dip magnitude by factoring in the borehole tilt (inclination) and azimuth at the depth of the discontinuity.

We assigned a descriptive hierarchy to the fractures/joints as follows: 1) minor fracture/joints and 2) foliation. The minor fracture/joint classification refers to incomplete or partial discontinuity traces and typically displayed very thin (one millimeter or less) but open apertures of approximately one millimeter or less. On some occasions these traces were continuous but due to the very small apparent aperture we have included these in this minor category. We used the classification foliation to describe very fine, closely spaced discontinuities.

3) Presentation and Results

Televiewer image log plots can be found in Appendix B. These plots contain a series of illustrations from left to right across the page as follows:

- Unwrapped; BHTV image corrected to true North. A caliper log trace was superimposed over the OPTV log colored white. Lower column header ("Sinusoids") depicts the interpreted sinusoid curves fitted over traces of visible discontinuities.

- "DIPS" plot; The DIPS plot shows tadpole symbols that represent identified discontinuities on the aforementioned image plots in terms of dip direction and dip angle magnitude. The discontinuity dip angle is depicted by the tadpoles position on the depth versus degrees (0° to 90°) plot where 0° represents horizontal and 90° represents vertical. Dip direction is depicted by the position of the symbol's tail as if it were positioned on a 360° compass face where north is the tail pointing vertically up the page, east is the tail pointing 90° to the right of vertical, south is pointing vertically down the page and west is 90° from vertical to the left of the page. Various colored tadpole symbols convey the classification of the interpreted discontinuities as follows: light orange = minor fracture/joint and green = foliation.

- Borehole deviation in terms of azimuth (bearing) direction and tilt (borehole angle with respect to vertical).

Each tadpole symbol represents a fracture at depth. The plane is defined by its dip direction and dip magnitude. The latter is the angle made from horizontal plane. A discontinuity table with this information is presented in Appendix B.

Directional diagrams used to determine dip azimuth and dip angle trends of the fracture distribution within each borehole are presented (compiled with ***WELLCAD***, Ver. 4.4). These diagrams plot from left to right as follows: Condensed Interpreted DIP Plot from Televiewer Analysis, Poles to Planes stereo-net project, Rose Petal Diagram of dip azimuth and Dip Angle Histogram. The Poles to Planes projection uses the upper hemisphere. This means that the poles plot in the direction of dip.

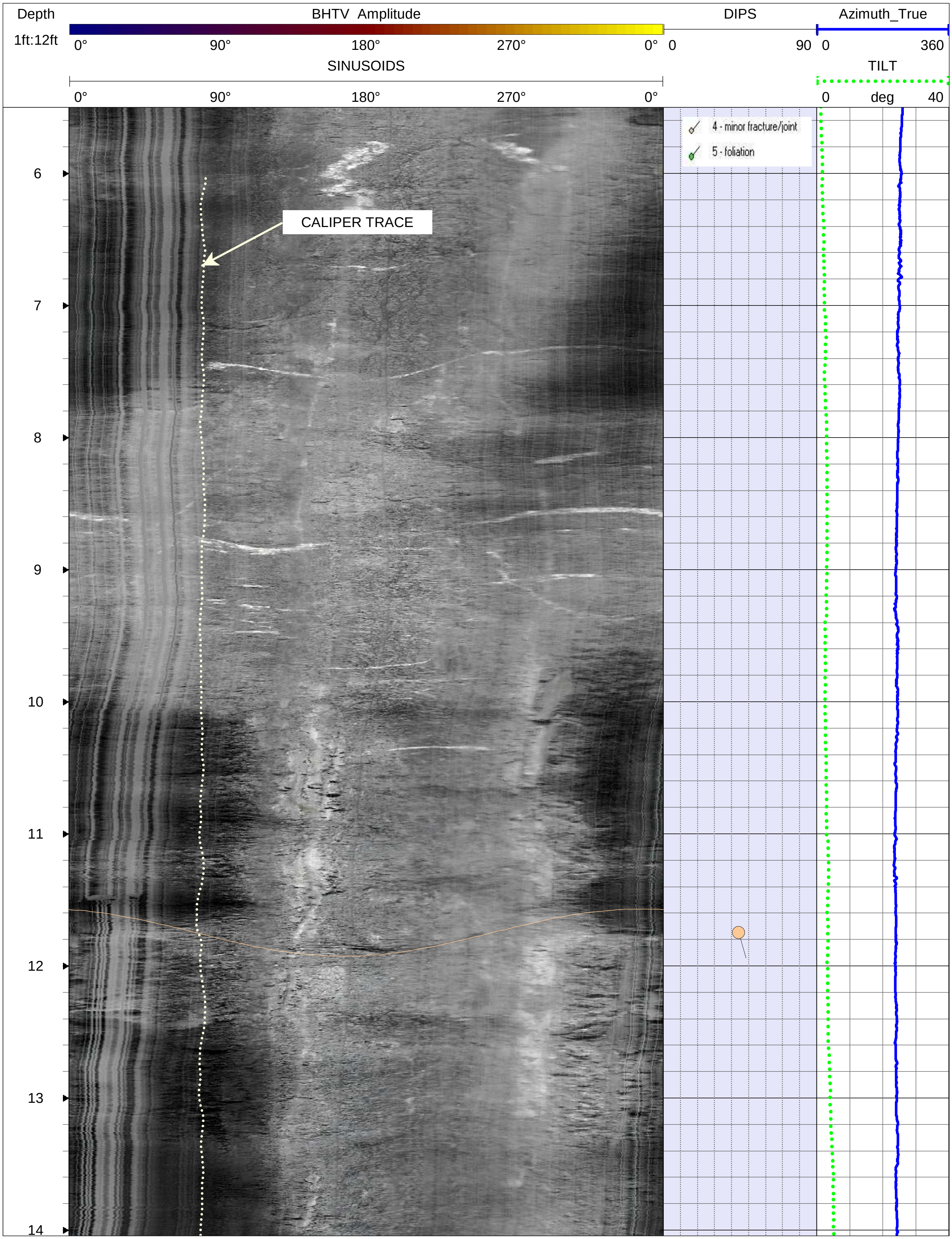
Various concentrations of poles by way of contouring on a stereo-net projection can indicate discontinuity populations associated with joint or fracture trends. These dip direction (azimuth) trends of specific populations can be indicated with a Rose diagram. In this diagram, directional trends are expressed by a preponderance or frequency of dip azimuths within a given compass interval (or petal). We used a 15 degree compass sample interval. The distribution of dip angle is shown by the Dip Angle Histogram. In this diagram we used a sampling interval of 5 degrees. Dip angle trends are associated with the relatively high number of occurrences in one or adjacent 5-degree dip intervals that occur along the full range of possible dip angles ranging from 0 to 90 degrees.

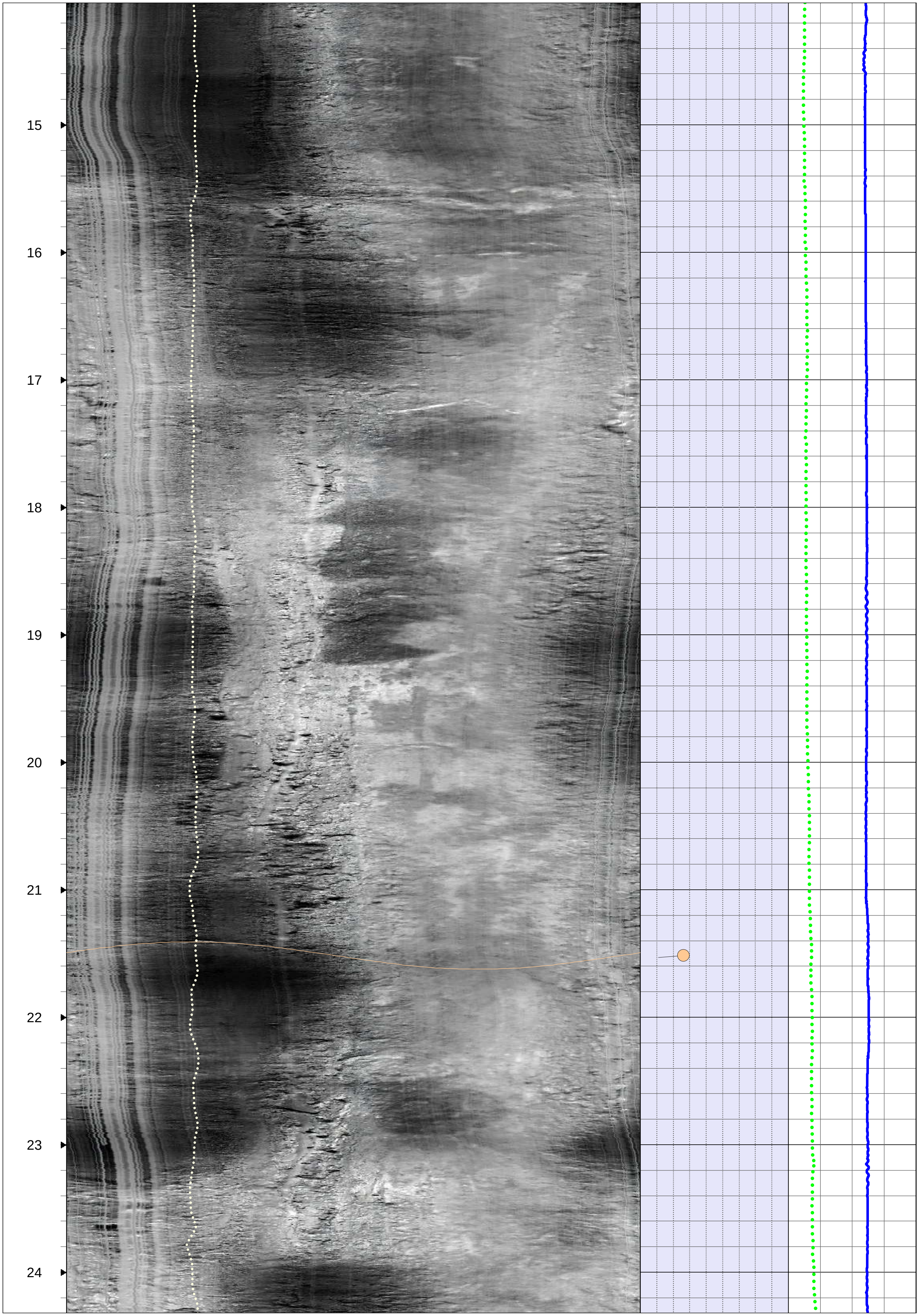
NORCAL GEOPHYSICAL CONSULTANTS, INC.

TELEVIEWER ANALYSIS

COMPANY: LACO	DATE: Oct. 23, 2013
WELL ID: GB-1	CASING: NONE
FIELD: LAYTONVILLE	JOB NO. 13-627.10B
COUNTY: MENDOCINO	STATE: CA

NOTES:

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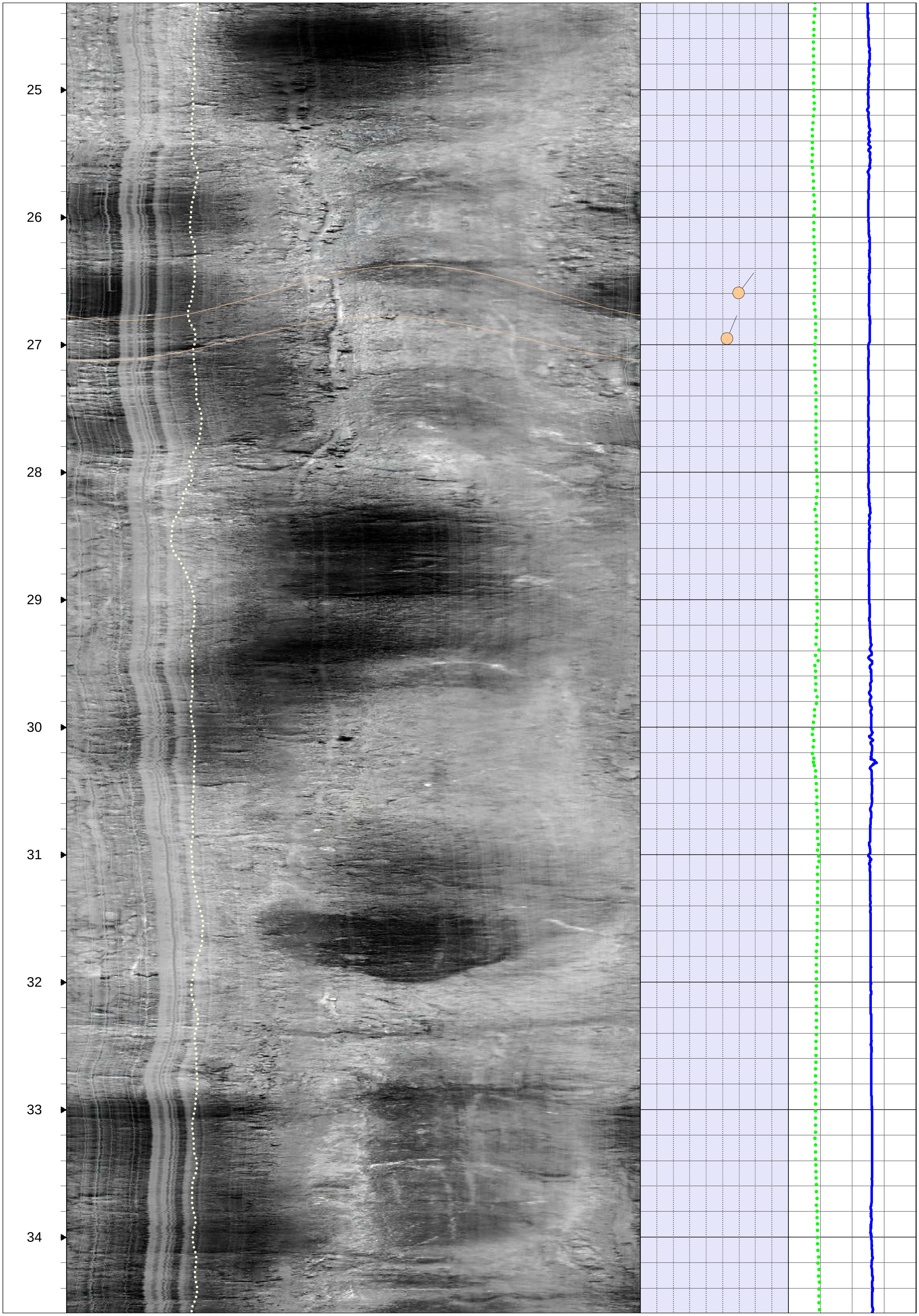
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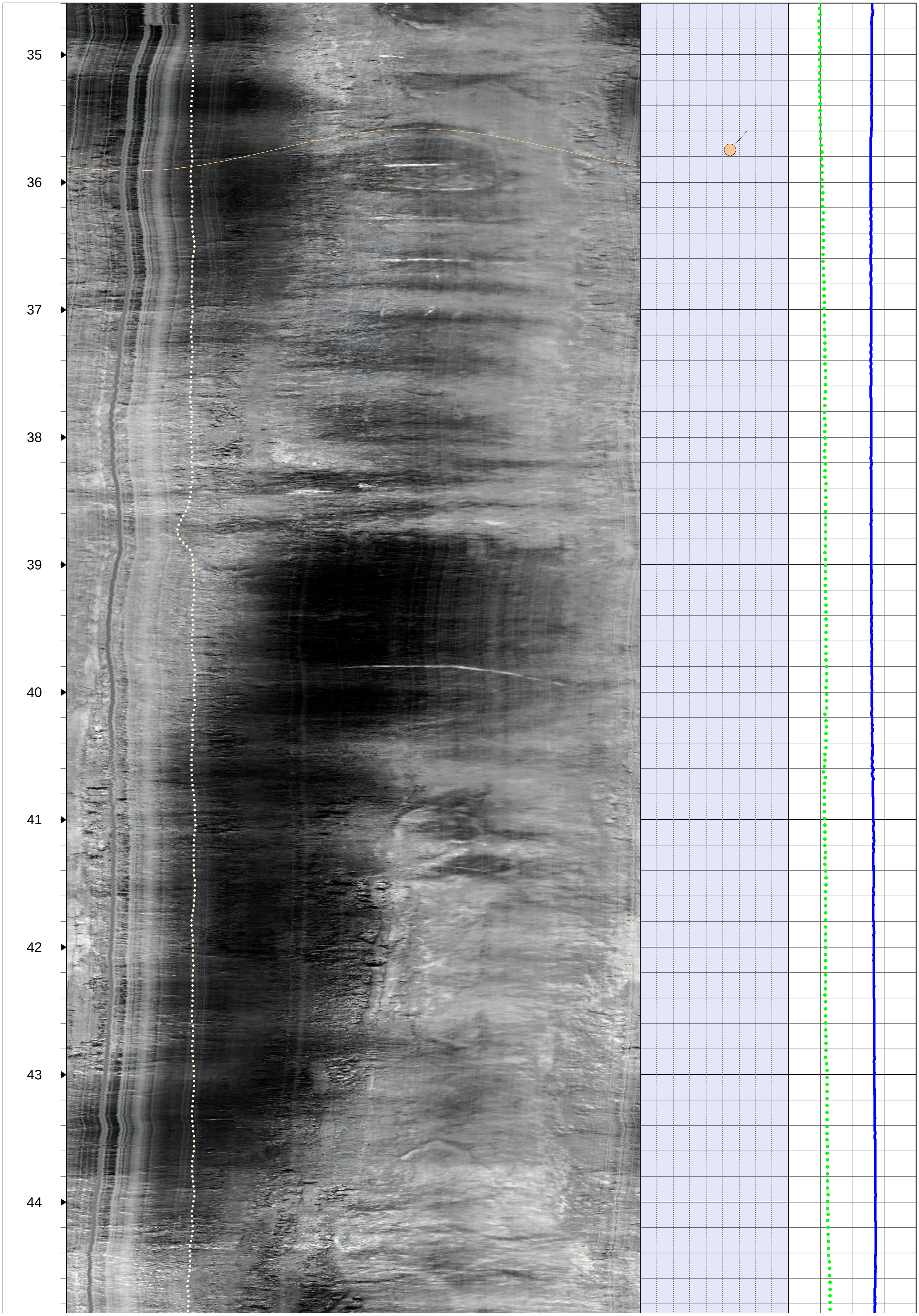
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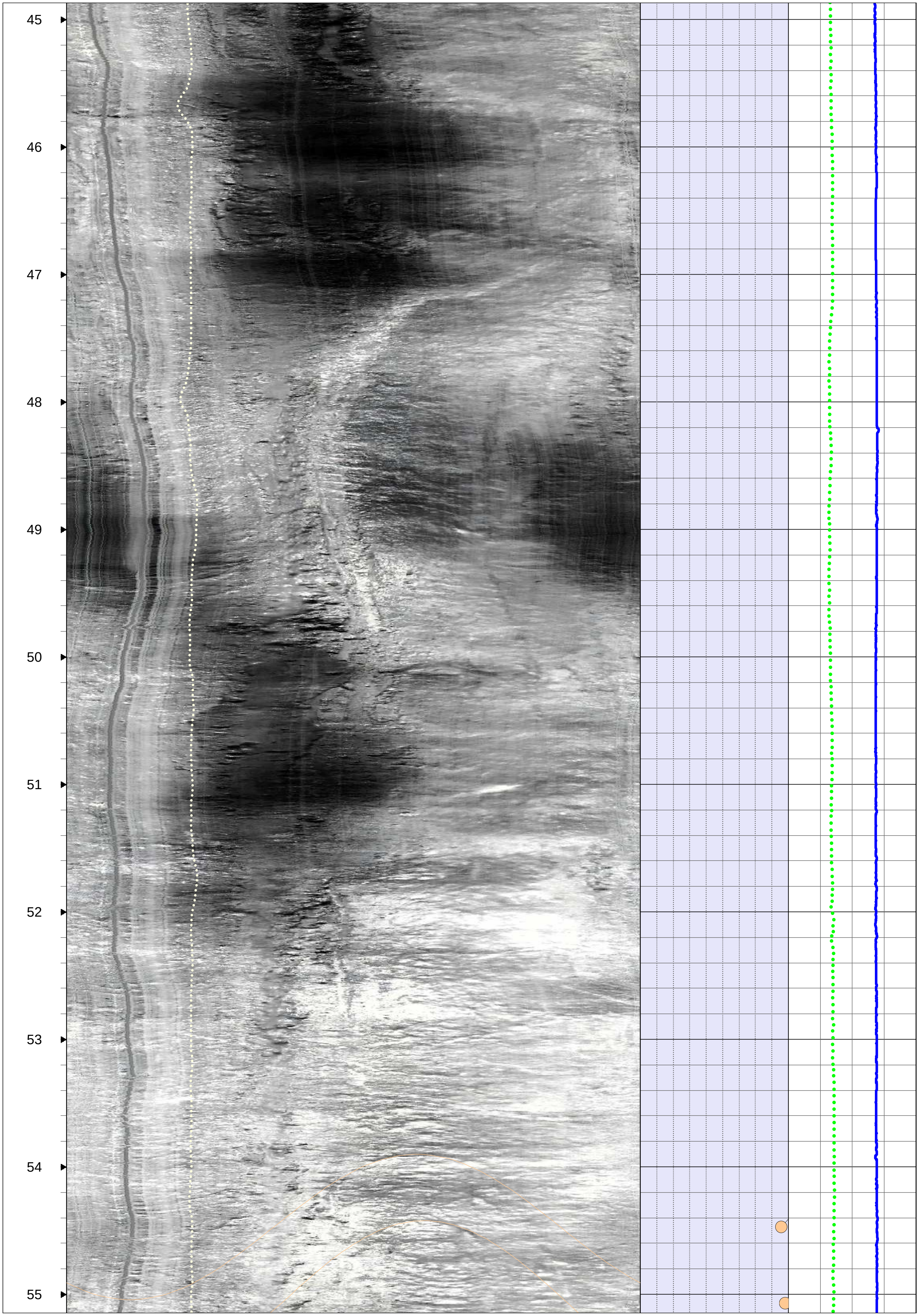
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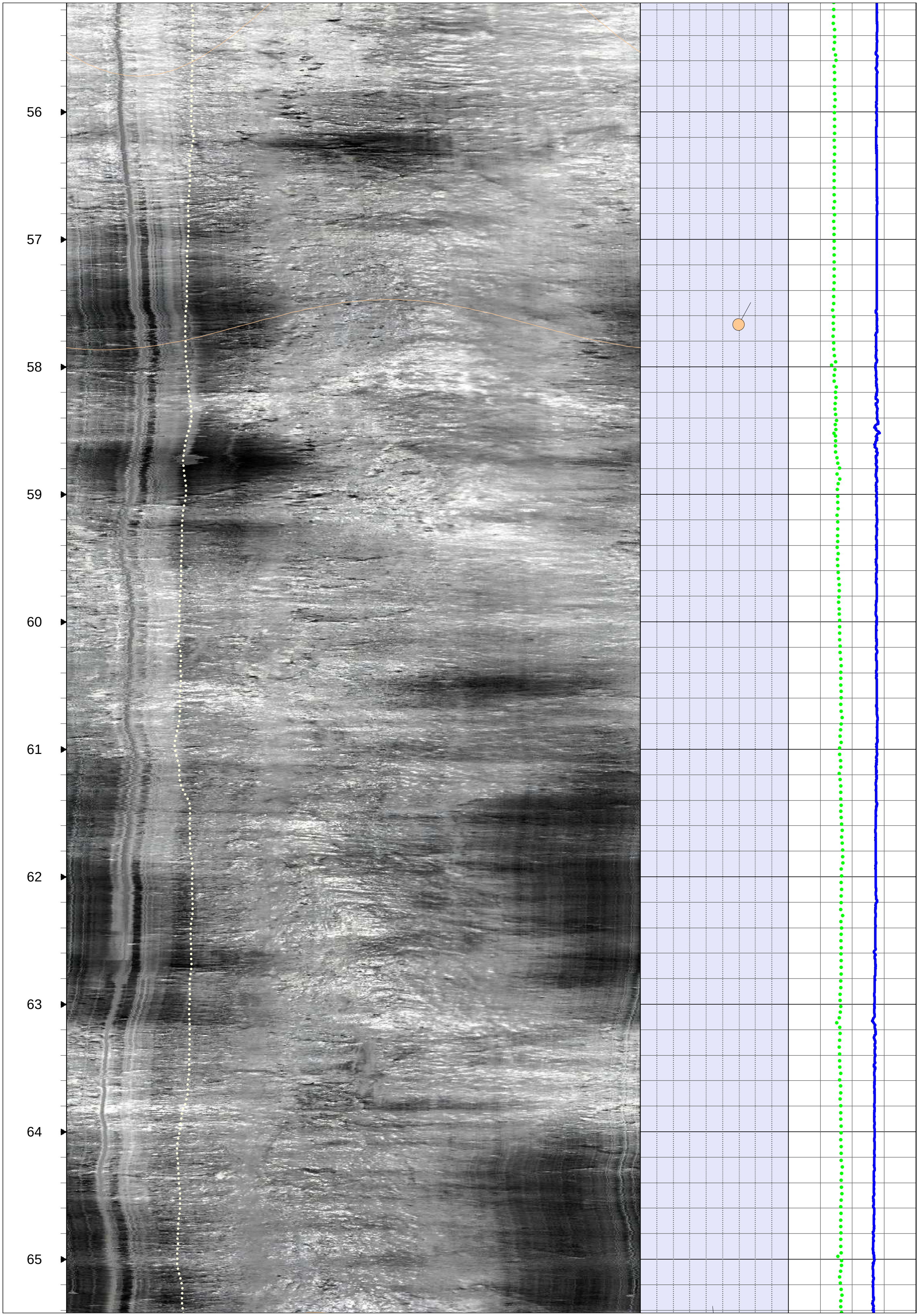
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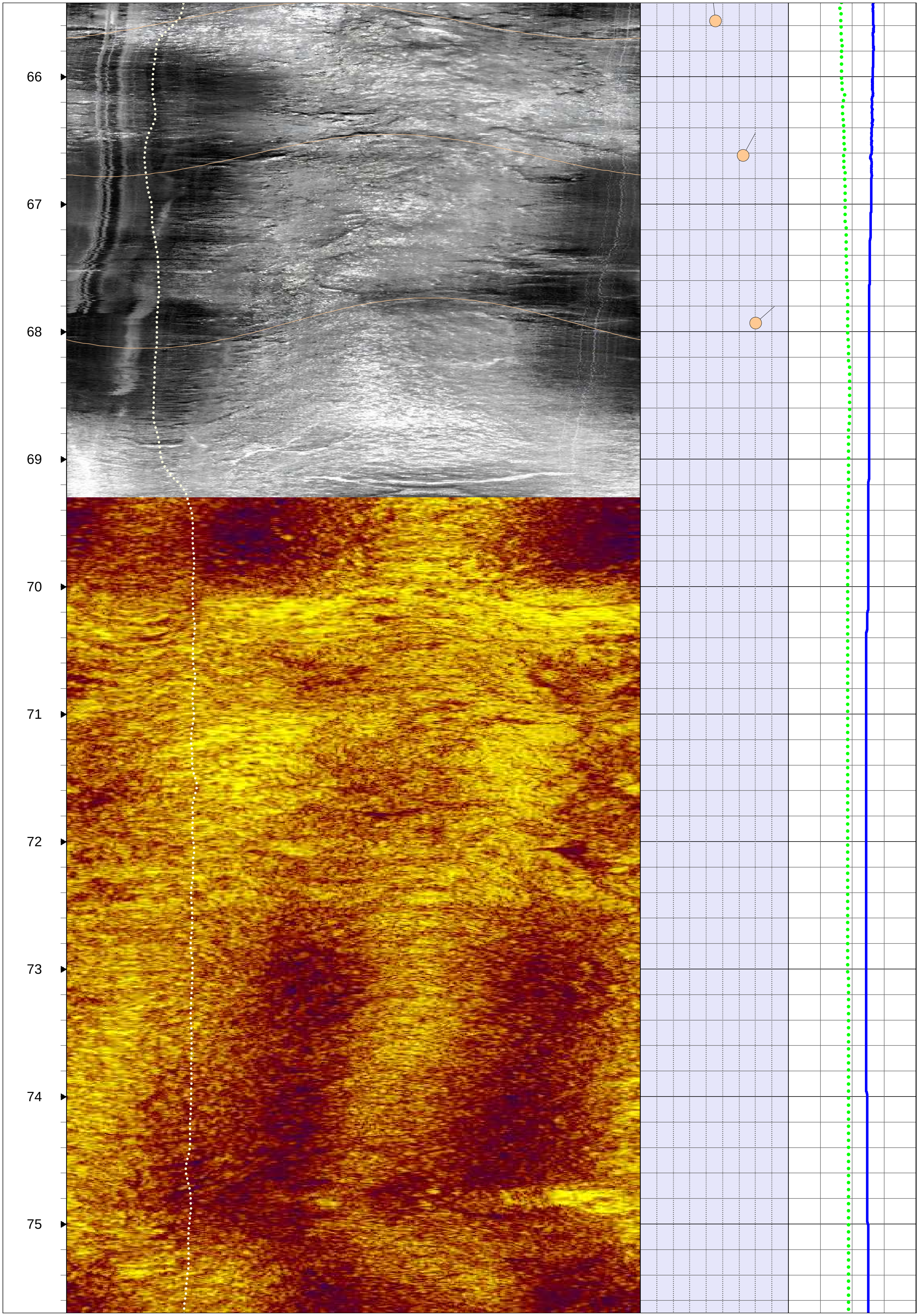
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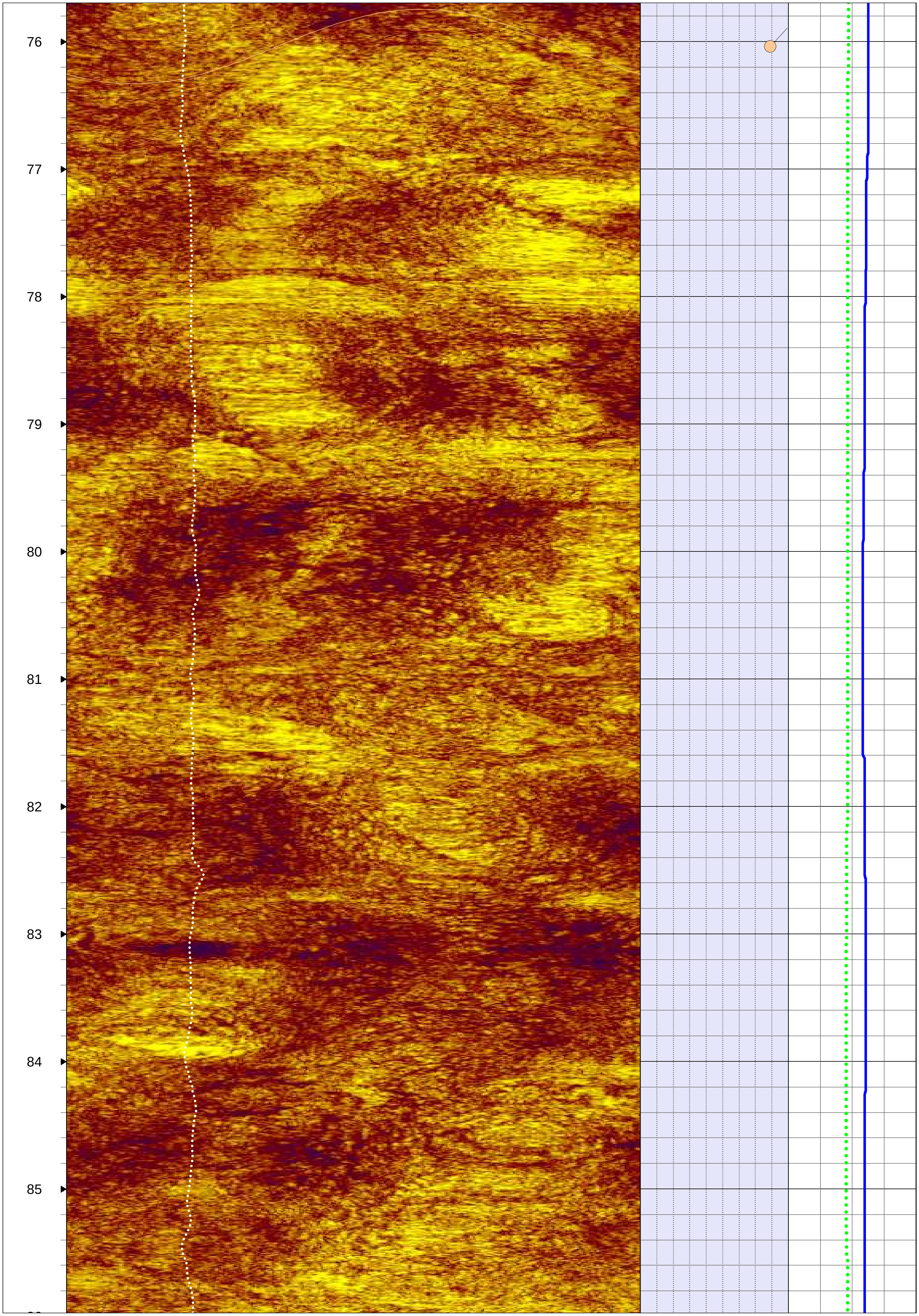
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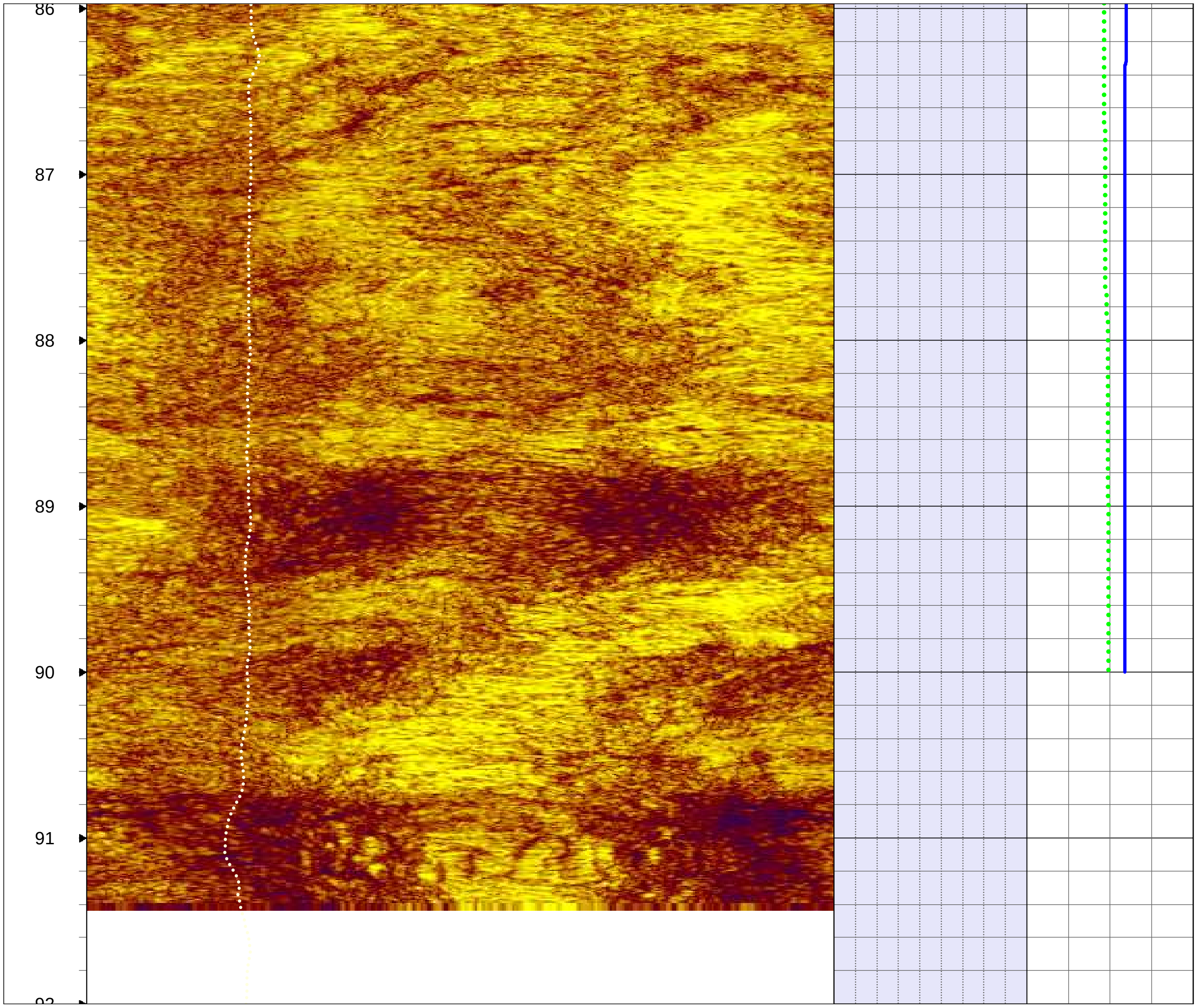
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Laytonville Quarry, Mendocino County, California
Discontinuity Tables
from Televiewer Analysis
NORCAL GEOPHYSICAL CONSULTANTS, INC.
Job No. 13-627.10B

Discontinuity Legend
4 - minor fracture/joint
5 - foliation

BOREHOLE GB-1

Depth	Dip Azimuth	Dip Angle	Aperture	Discontinuity
ft	deg	deg	mm	Class*
11.75	164.22	44.27	0	4
21.51	265.84	26.33	0	4
26.59	36.77	59.66	0	4
26.95	21.73	52.92	0	4
35.75	41.89	54.66	0	4
54.47	41.15	85.66	0	4
55.07	45.45	88.08	0	4
57.67	29.11	59.75	0	4
65.56	353.47	45.66	0	4
66.62	28.72	62.49	0	4
67.93	48.33	70.1	0	4
76.04	42.23	79	0	4

BOREHOLE GB-2

Depth	Dip Azimuth	Dip Angle	Aperture	Discontinuity
ft	deg	deg	mm	Class*
9.21	31.7	63.83	0	5
9.47	31.04	62.26	0	5
16.72	18.27	73.7	0	4
18.36	10.93	25.59	0	4
19.07	20.32	27.35	0	4
23.76	46.93	29.13	0	4
24.89	34.52	31.56	0	5
28.28	58.3	58.3	0	4
35.27	58.96	32.43	0	4
36.92	302.71	61.12	0	4
51.75	9.24	39.21	0	4
55.42	218.52	53.12	0	4
59.91	63.01	72.34	0	4
73.5	75.55	60.21	0	4

BOREHOLE GB-3

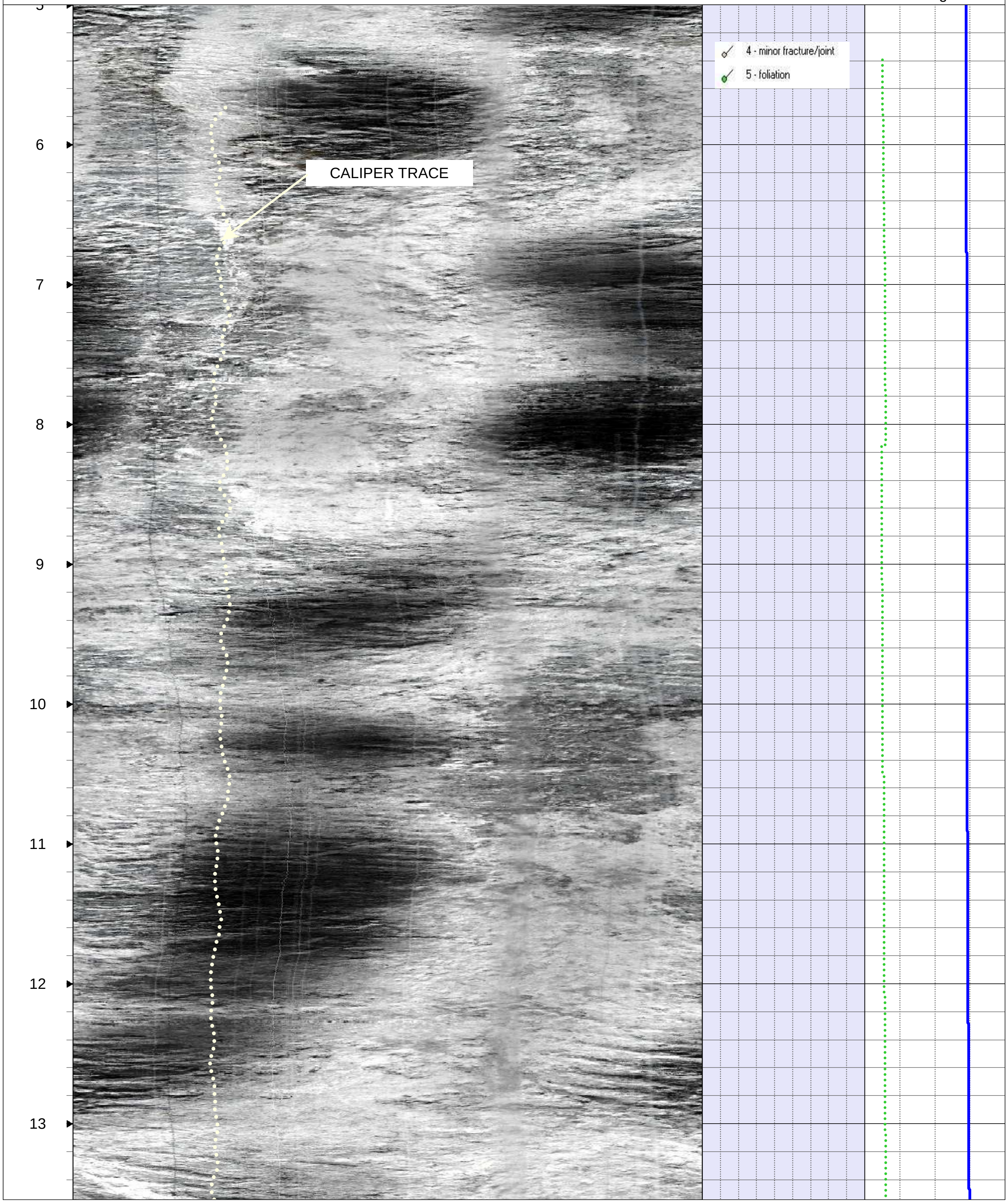
Depth	Dip Azimuth	Dip Angle	Aperture	Discontinuity
ft	deg	deg	mm	Class*
17.26	105	75.96	0	4

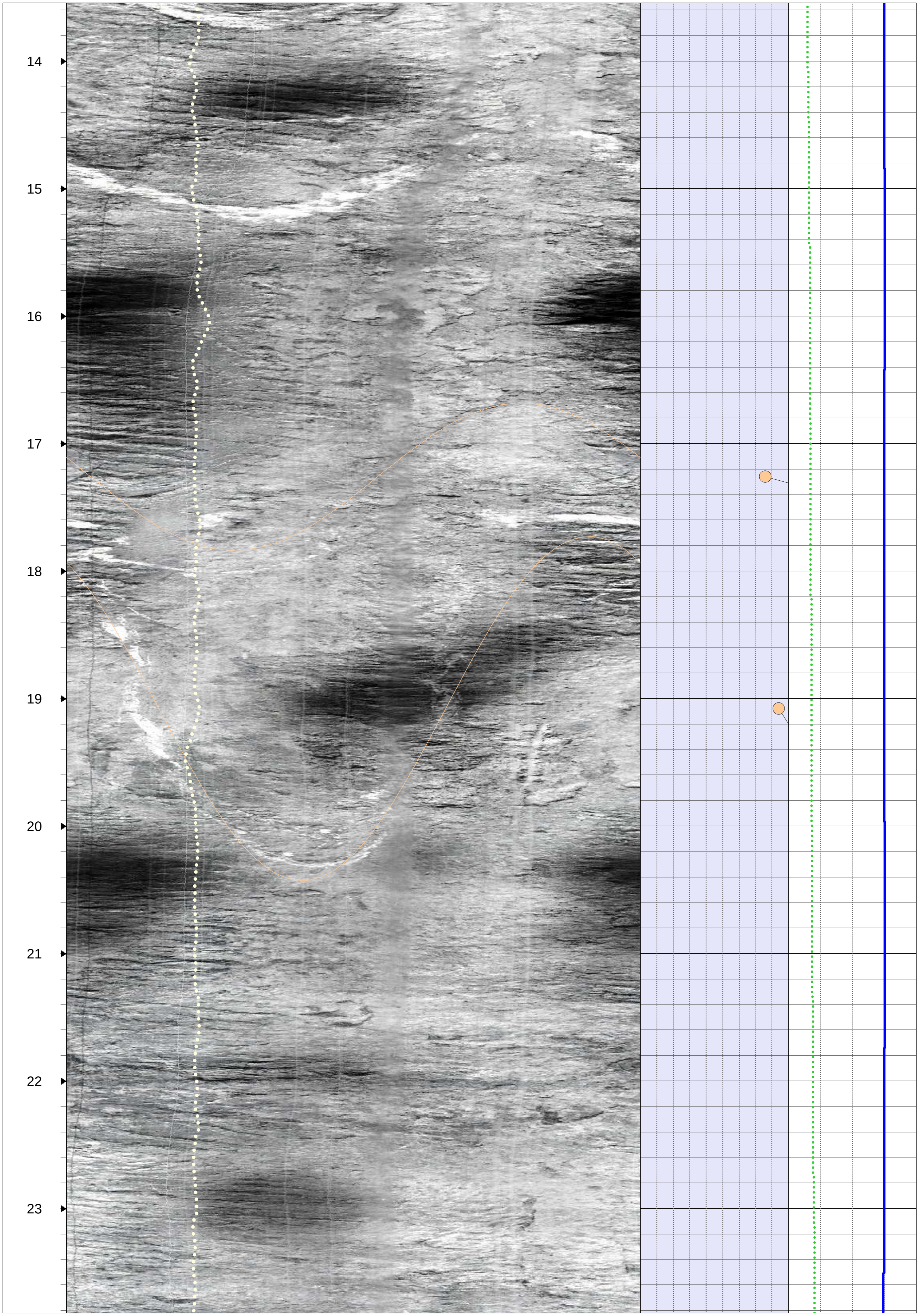
19.08	147.61	84.08	0	4
25.81	244.32	22.99	0	4
26.55	326.14	69.17	0	4
27.13	315.24	60.14	0	4
33.28	159.62	85.59	0	4
37.41	102.15	83.14	0	4
38.84	108.42	76.22	0	4
39.04	169.09	79.14	0	4
39.68	327.03	65.44	0	4
41.78	240.8	14.09	0	4
43.86	114.56	67.01	0	4
44.52	122.22	76.65	0	4
46.36	332.7	60.81	0	4
51.93	147.52	76.03	0	4
55.64	221.49	71.26	0	4
59.87	245.56	22.06	0	5
60.55	229.02	30.74	0	5
61.07	212.08	32.39	0	5
63.53	227.69	58.28	0	5
64.16	52.29	47.98	0	5
64.51	54.27	51.83	0	5
64.77	55.77	64.31	0	5
66.77	169.53	22.03	0	5
67.04	189.73	19.38	0	5
68.28	246.55	37.93	0	5
68.45	239.76	40.99	0	5
69.81	237.47	51.67	0	4

NORCAL GEOPHYSICAL CONSULTANTS, INC.	**TELEVIEWER ANALYSIS**	COMPANY: LACO WELL ID: GB-3 FIELD: LAYTONVILLE COUNTY: MENDOCINO	DATE: Oct. 23, 2013 CASING: NONE JOB NO. 13-627.10B STATE: CA

NOTES:

Depth 1ft:12ft	Amplitude 0° 90° 180° 270° 0° SINUSOIDS 0° 90° 180° 270° 0°	DIPS 0 90	Azimuth_True 0 deg 360 Tilt 0 deg 15

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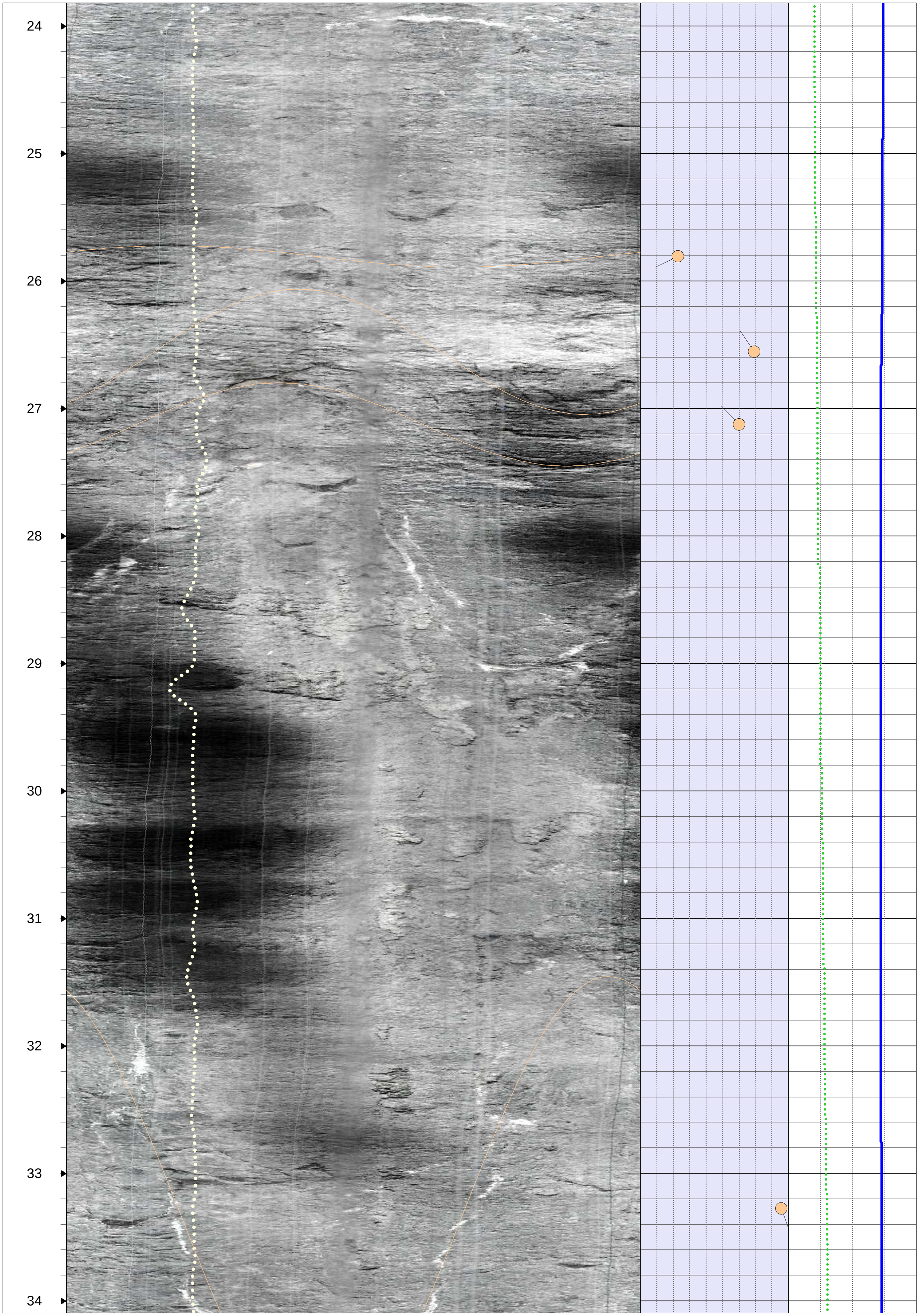
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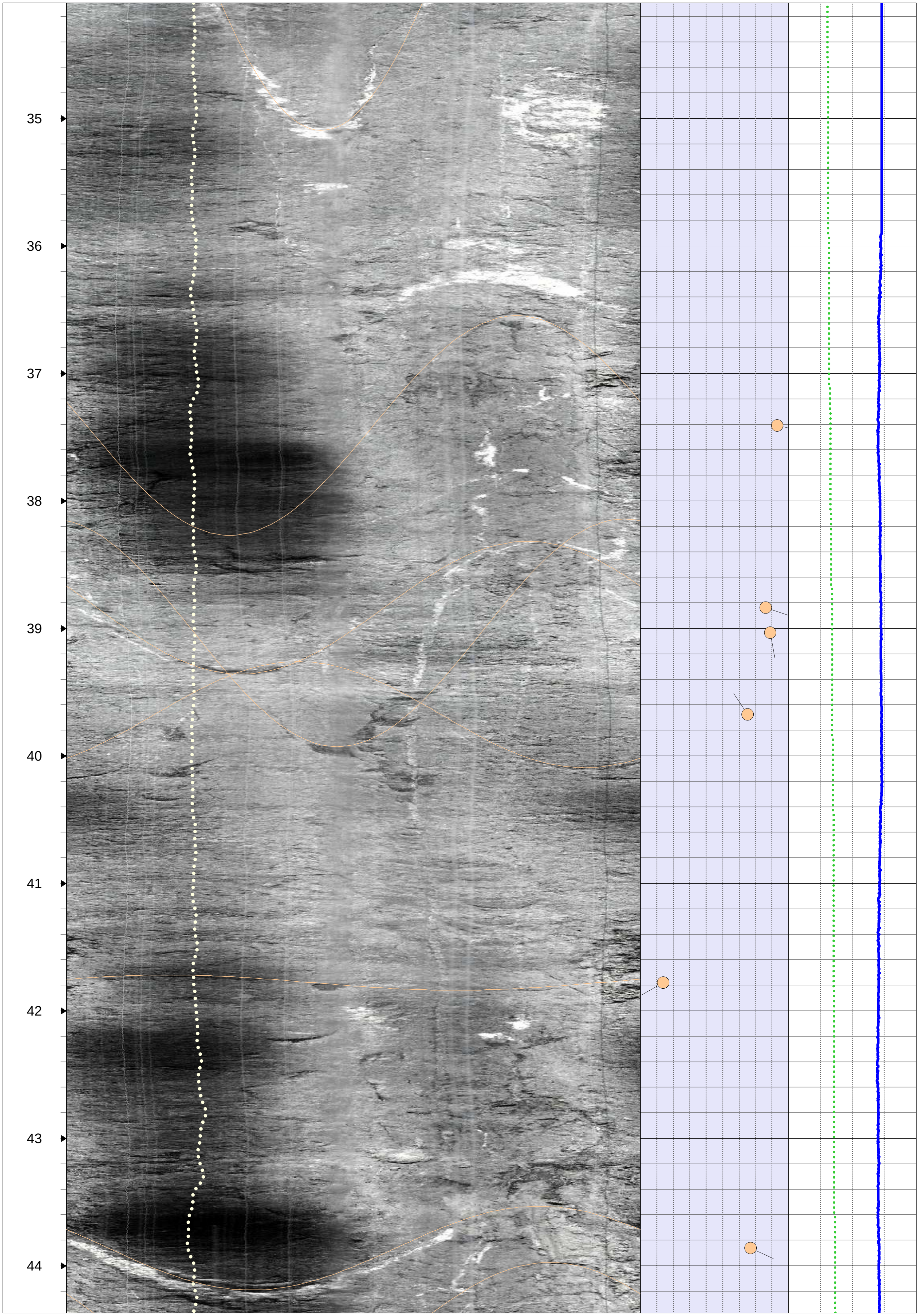
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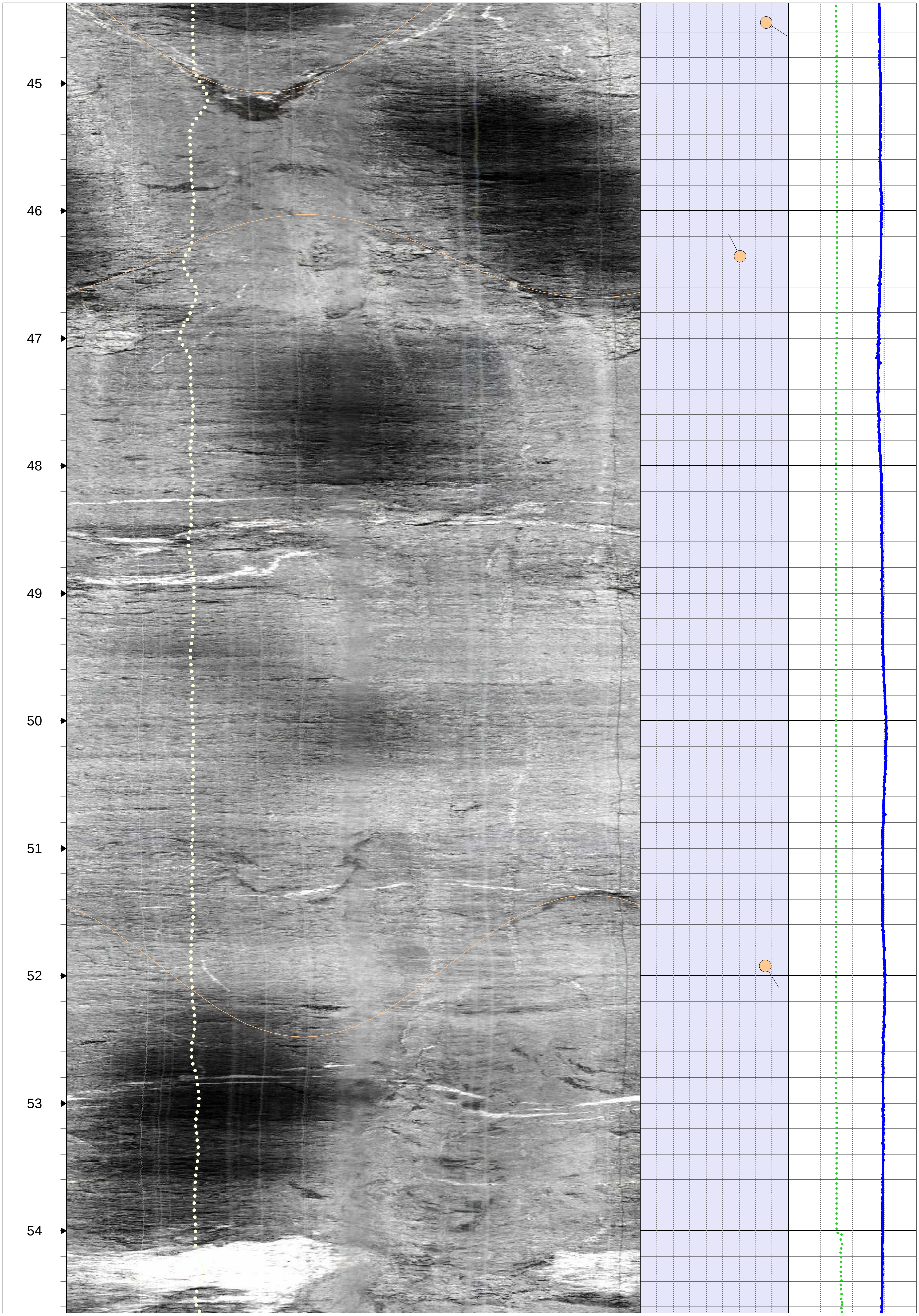
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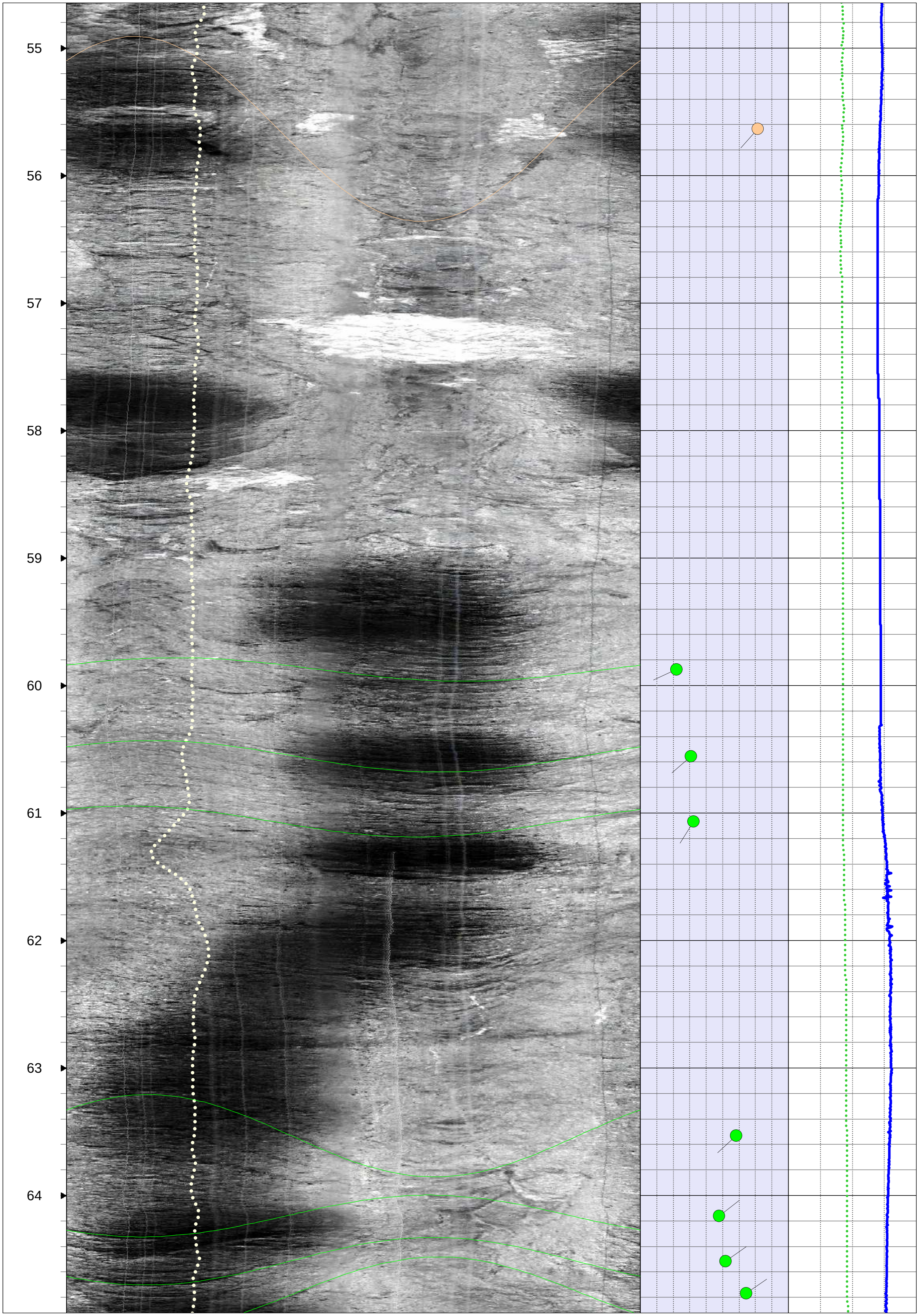
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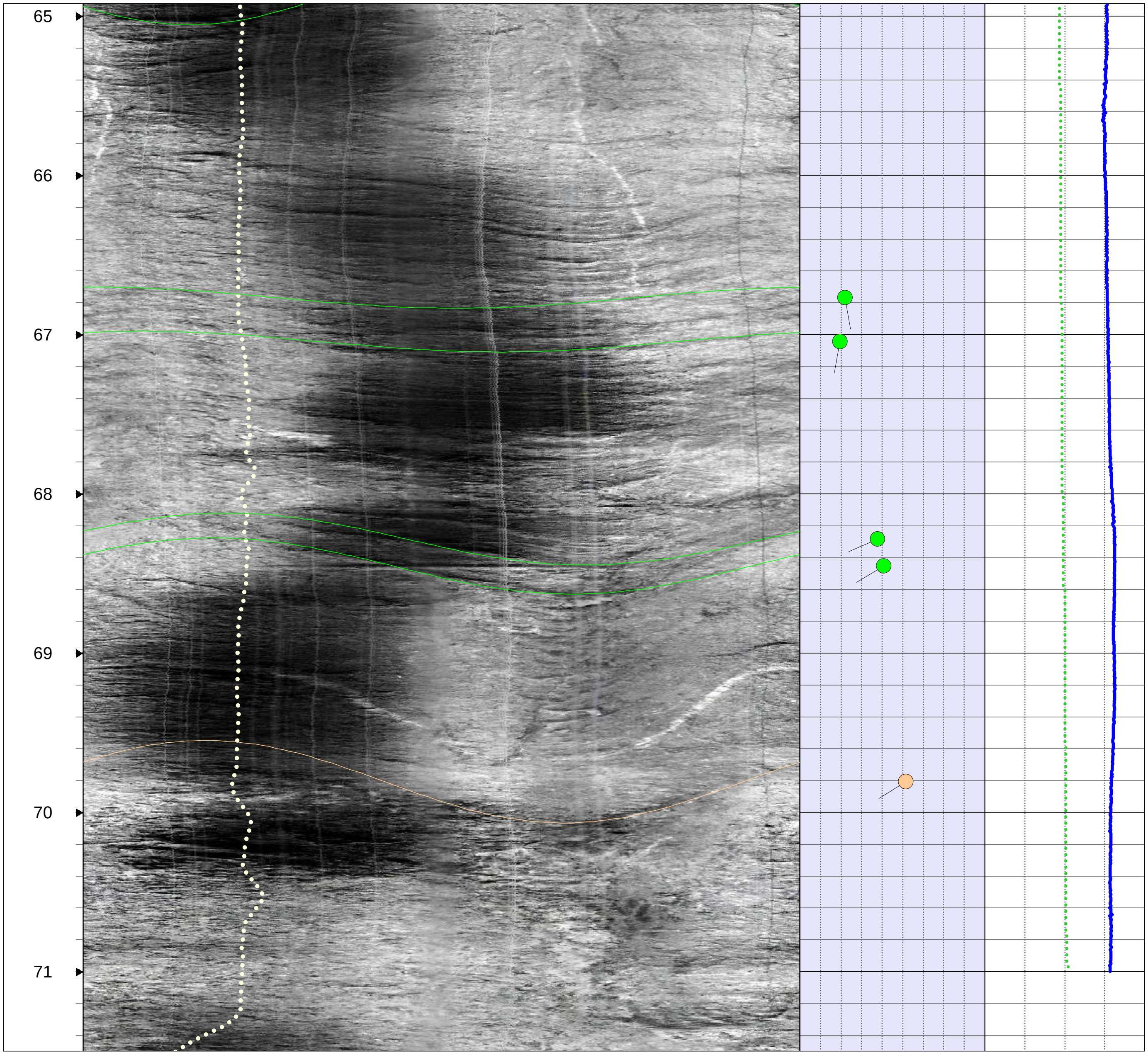
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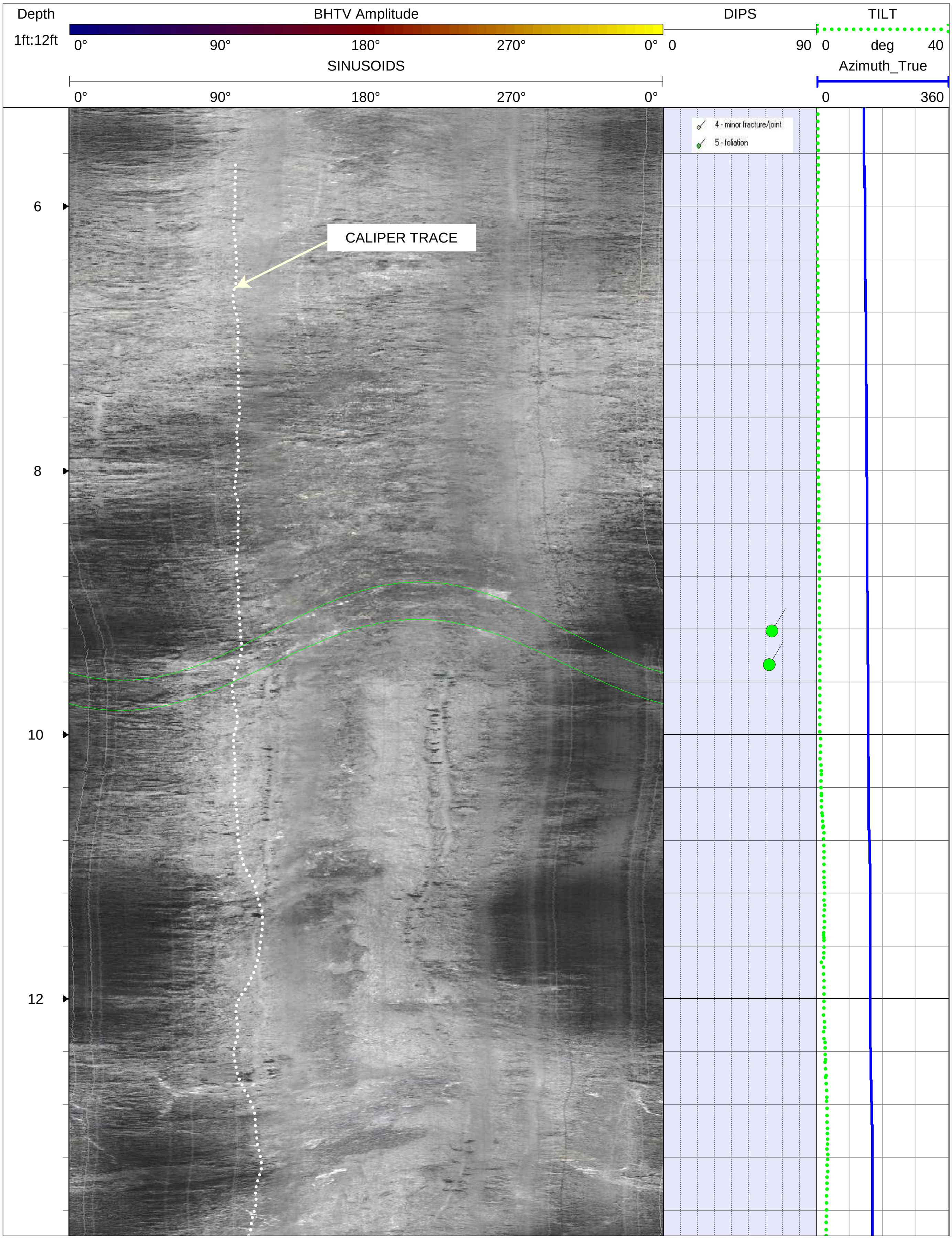
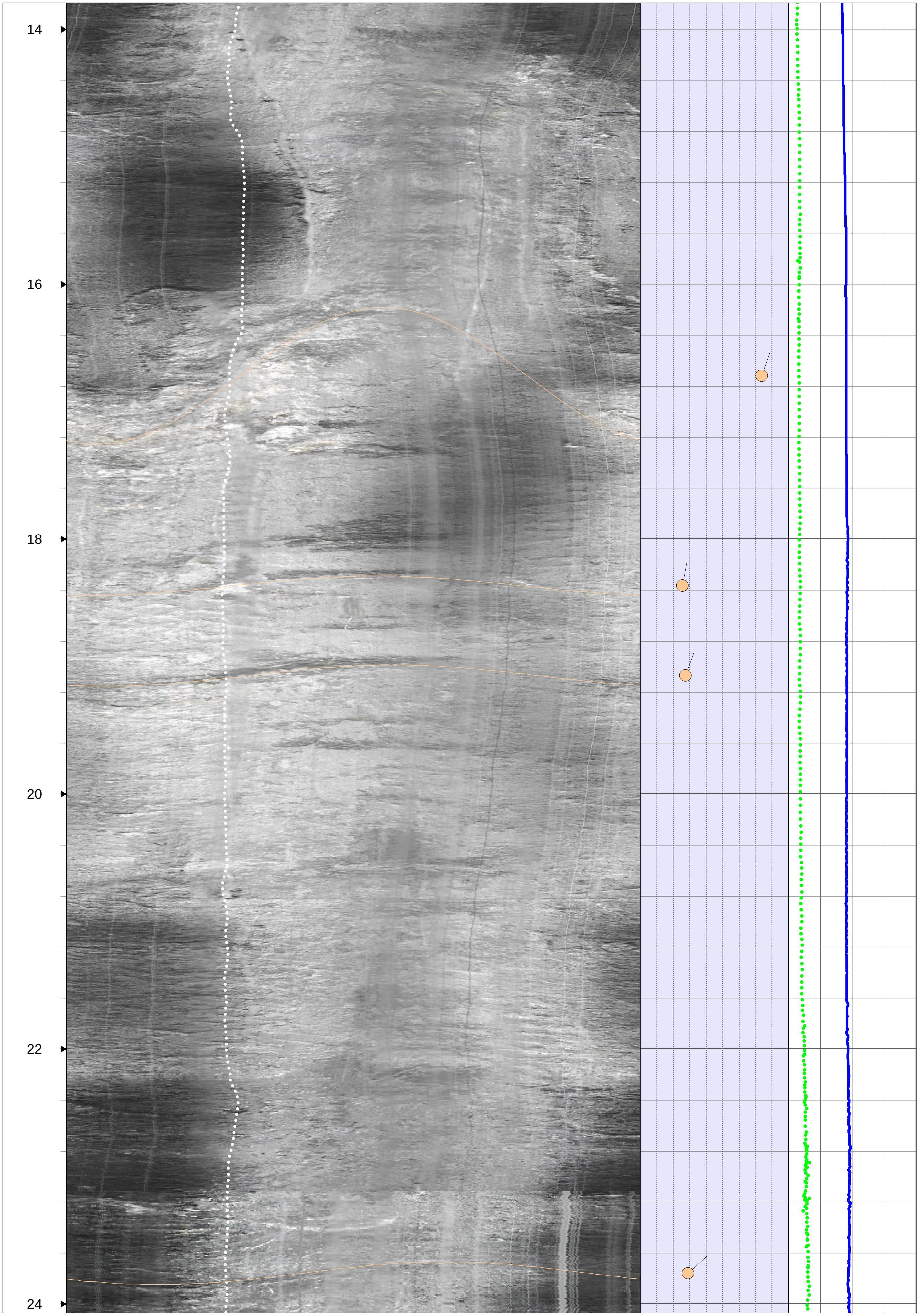
NORCAL GEOPHYSICAL CONSULTANTS, INC.	TELEVIEWER ANALYSIS	COMPANY: LACO WELL ID: GB-2 FIELD: LAYTONVILLE COUNTY: MENDOCINO	DATE: Oct. 23, 2013 CASING: NONE JOB NO. 13-627.10B STATE: CA

NOTES:

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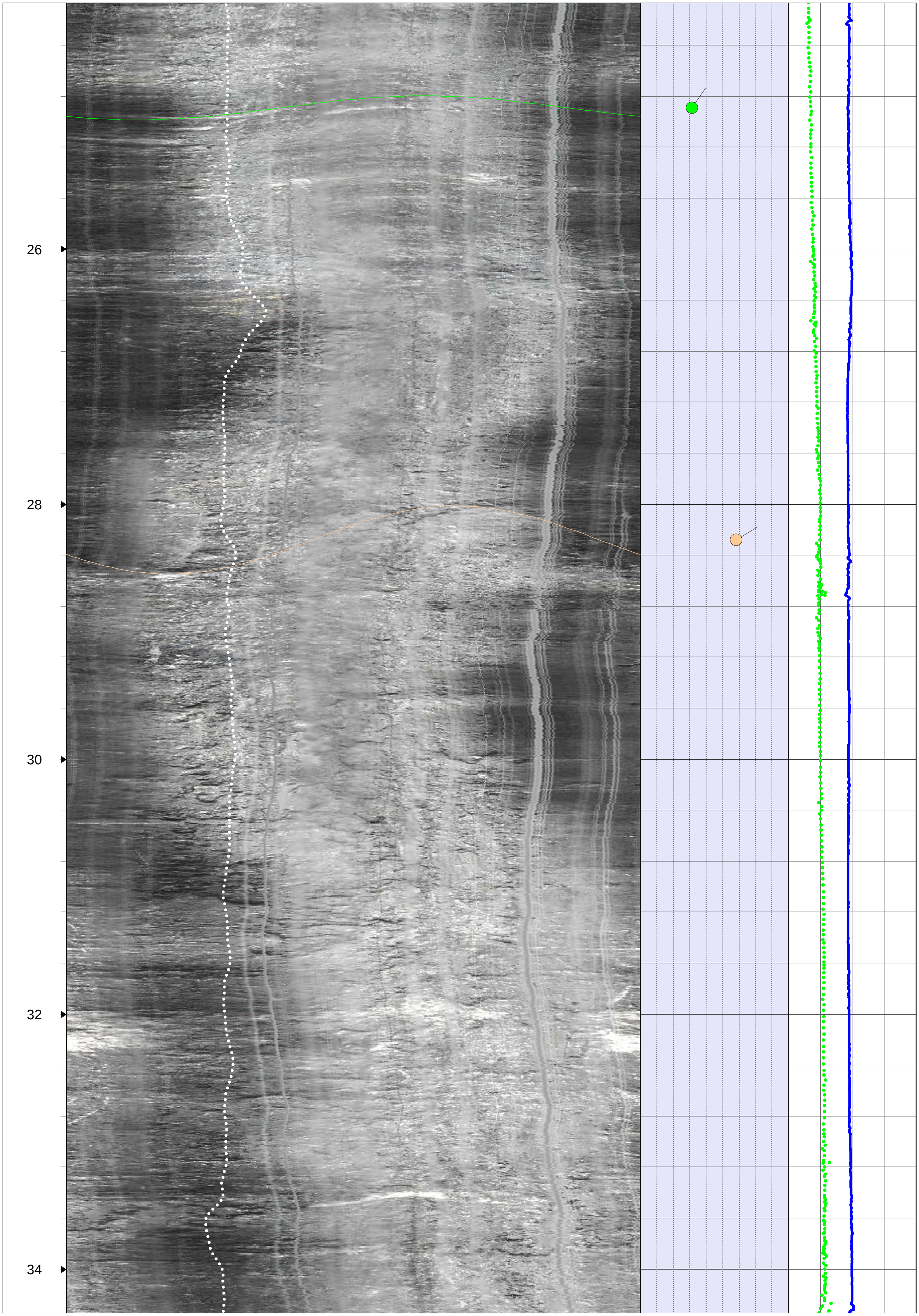
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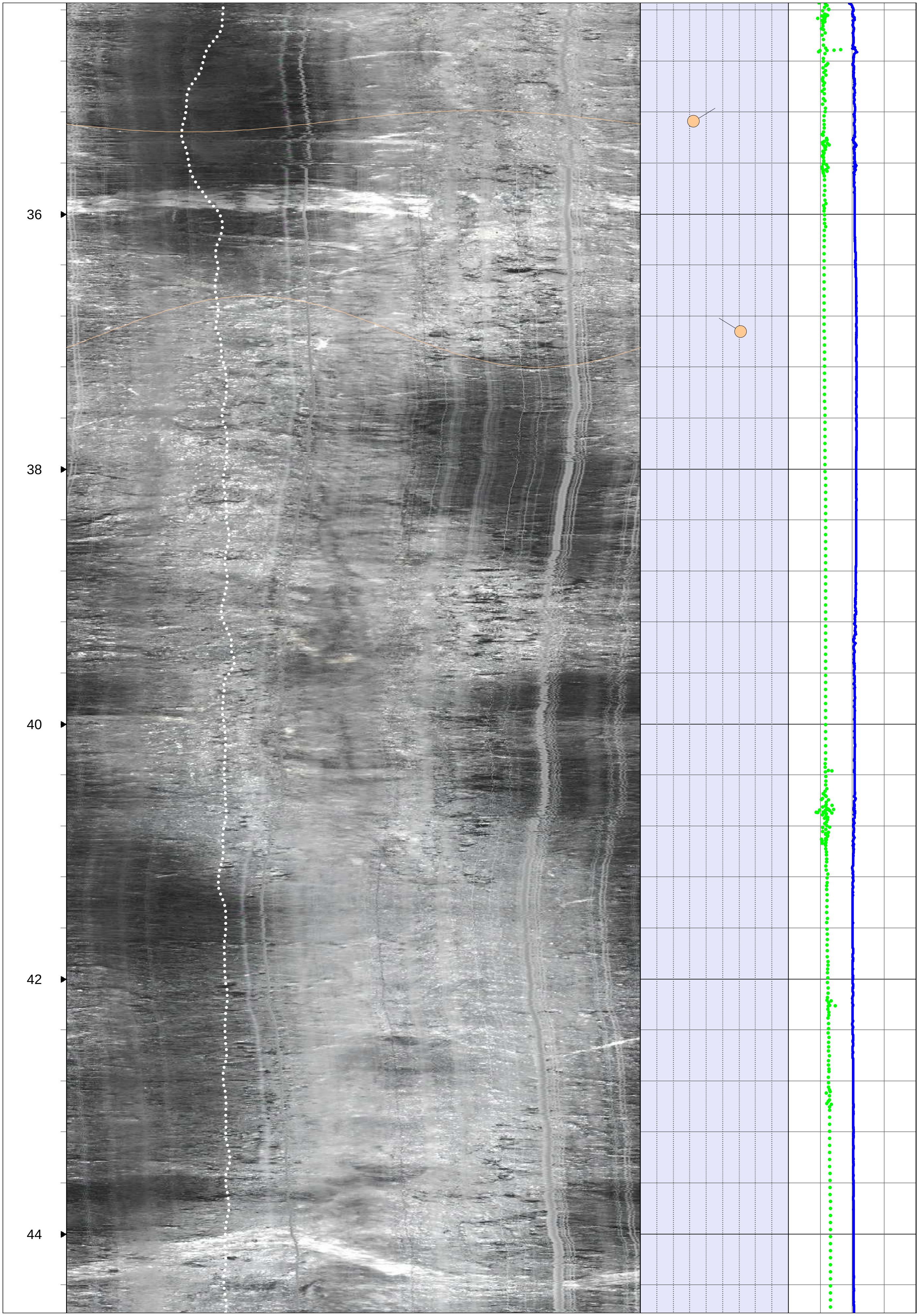

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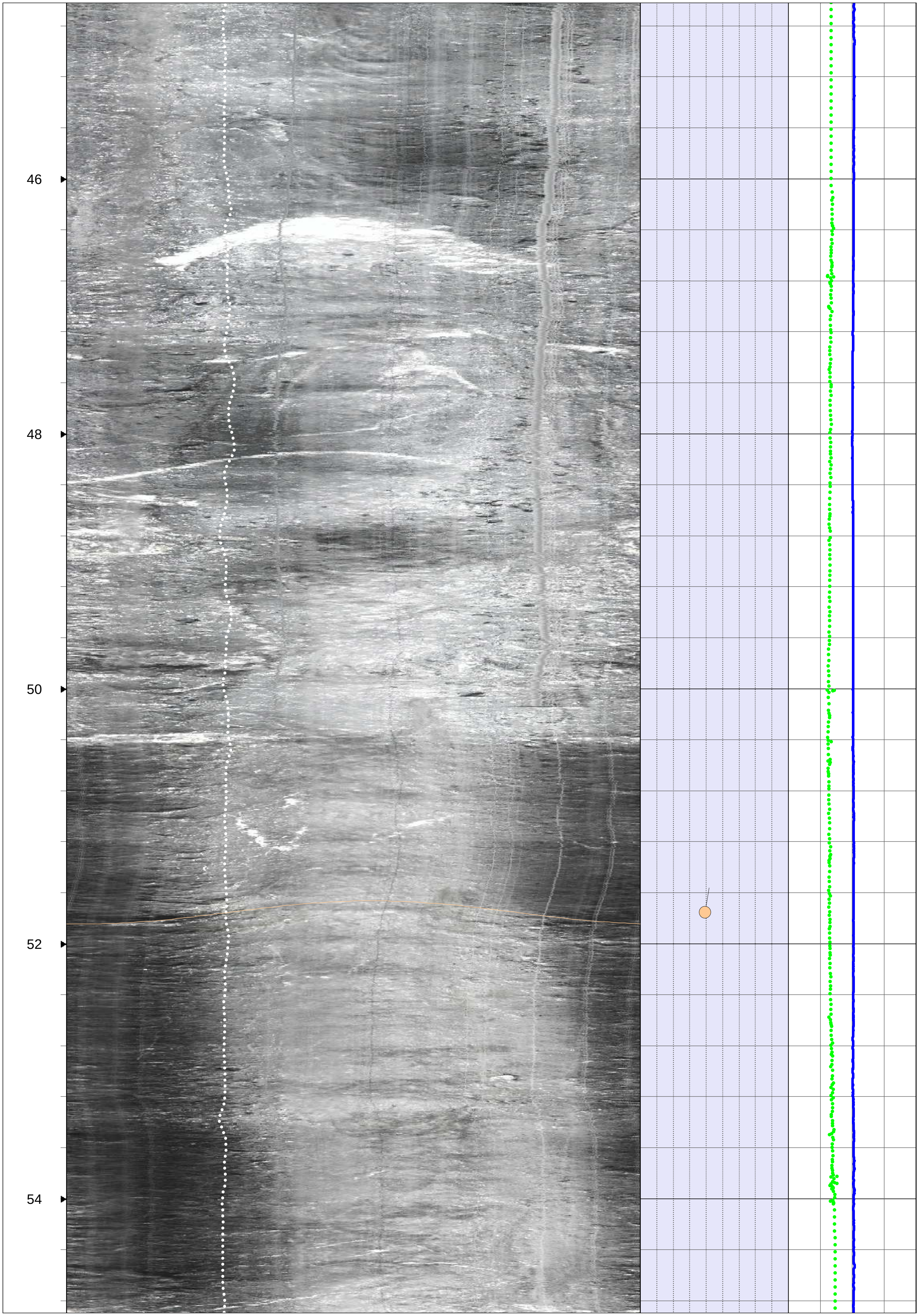
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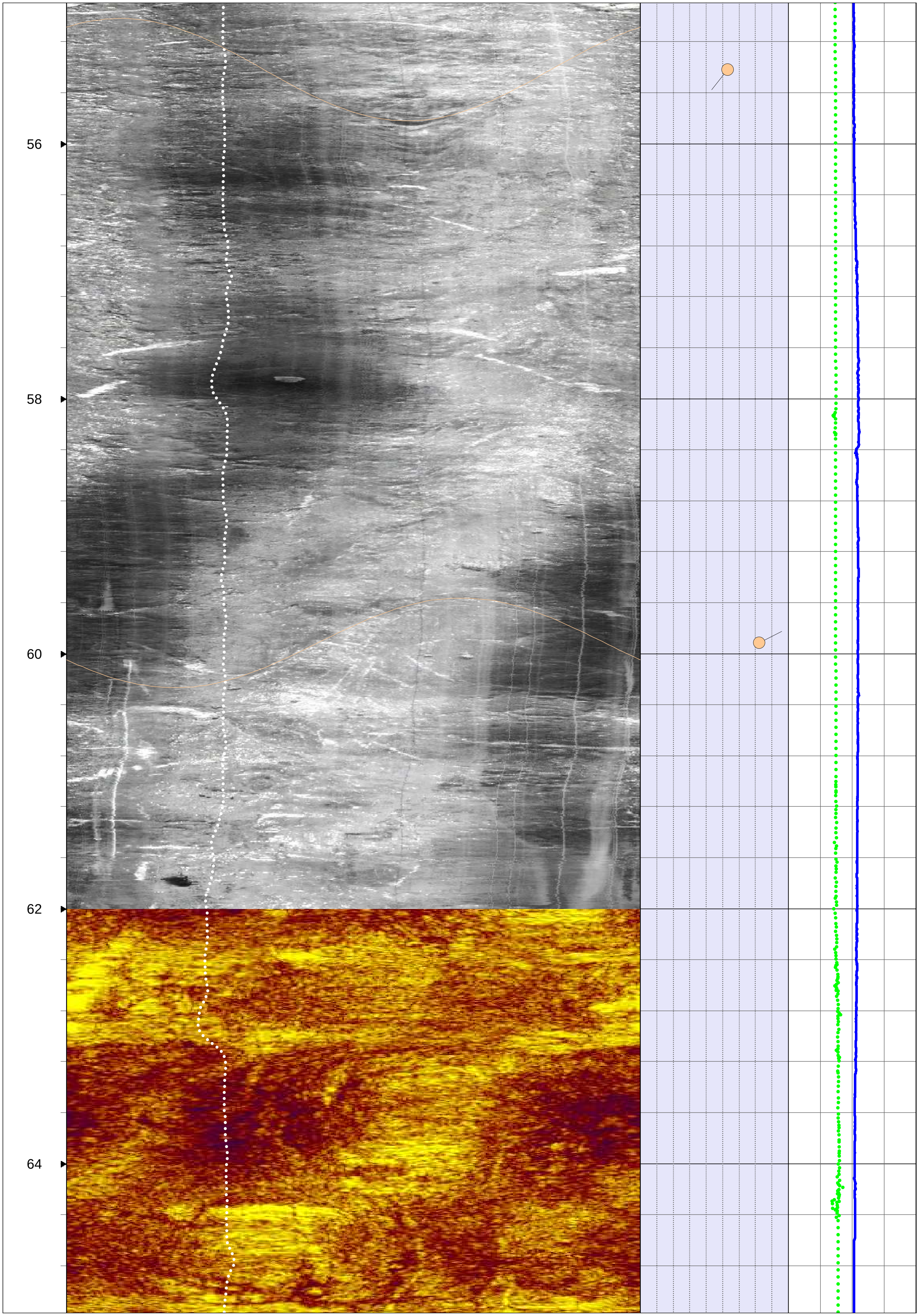
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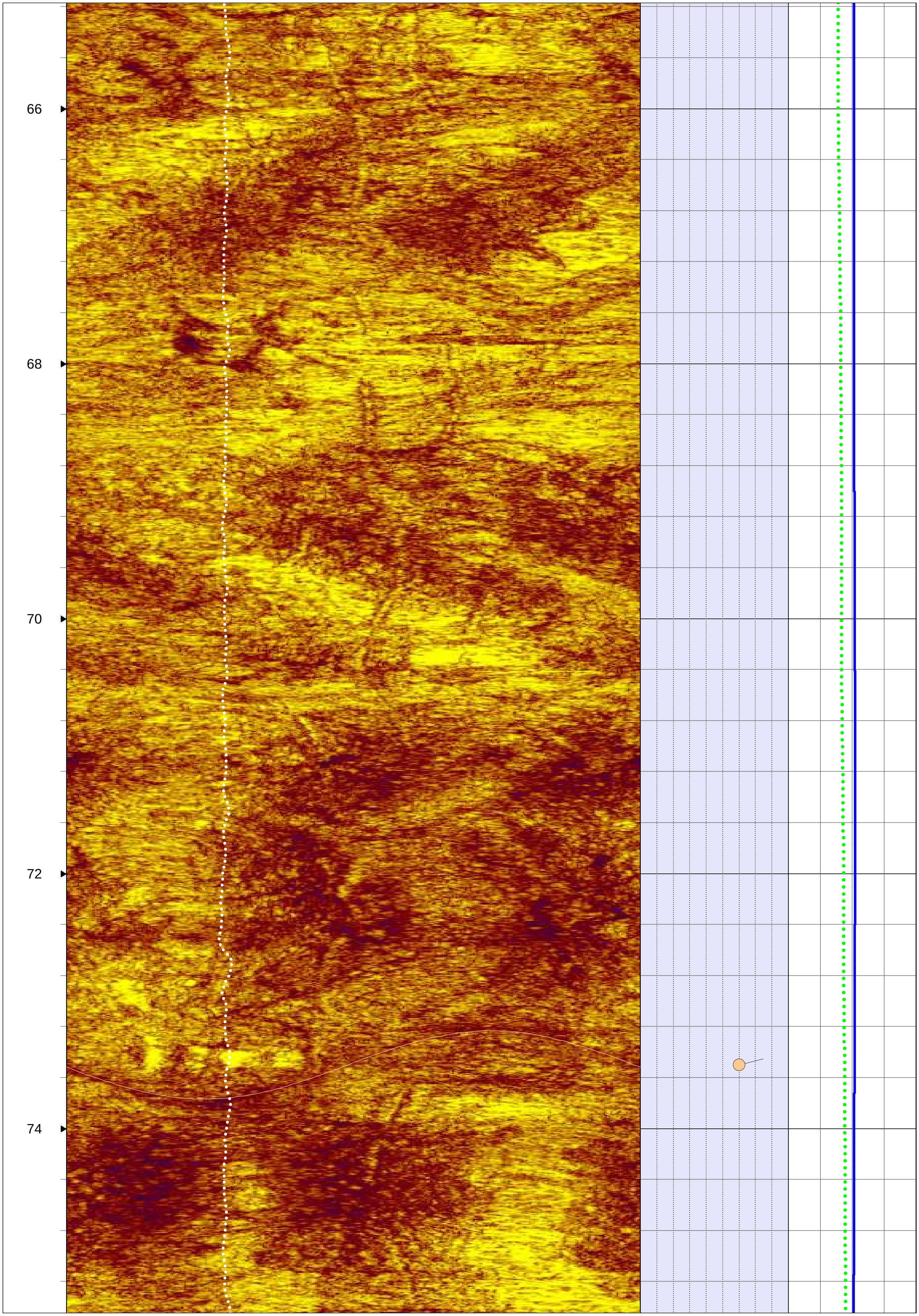
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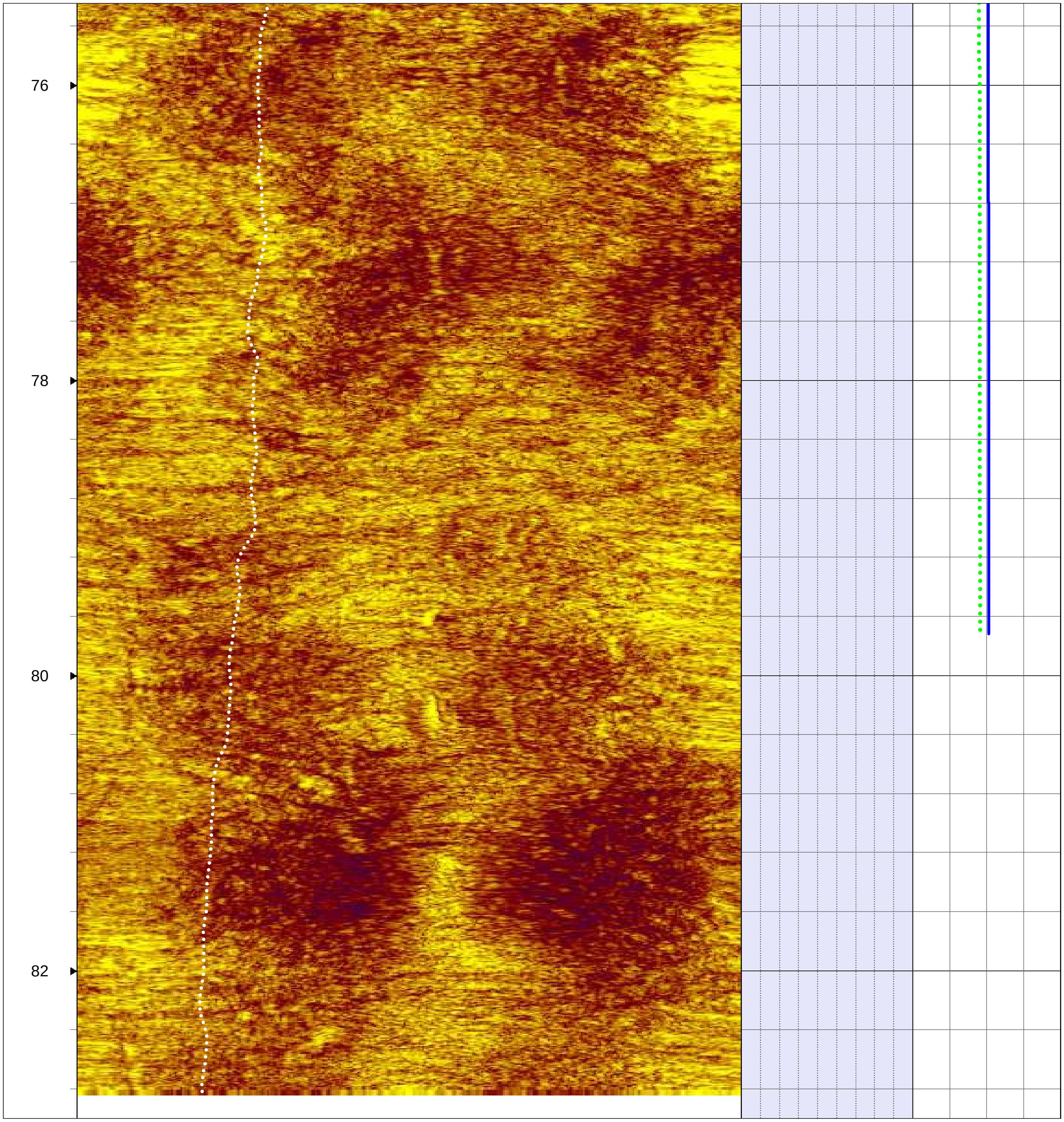
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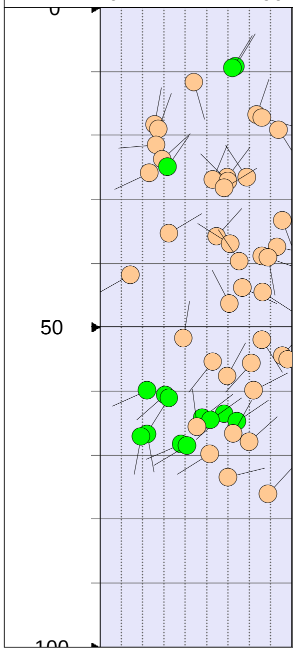
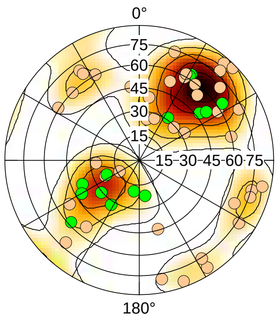
NORCAL GEOPHYSICAL CONSULTANTS, INC.	**Discontinuity Directional Diagrams**	COMPANY: LACO WELL ID: GB-1, -2 & GB-3 FIELD: Laytonville Rock Quarry COUNTY: Mendocino	DATE: Oct. 23, 2013 CASING: none JOB NO. 13-627.10B STATE: CA

NOTES:

Depth	DIPS GB-1,-2&GB-3	POLES TO PLANES	ROSE DIAGRAM	DIP ANGLE HISTOGRAM
1ft:360ft	0 90	Schmidt Plot - UH - Type	Azimuth - Absolute (Count)	Dip Histogram (Count)

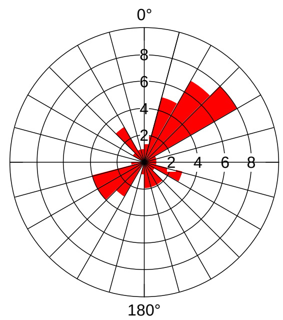


Schmidt Plot - UH - Type
Depth: 0.00 [ft] to 100.00 [ft]



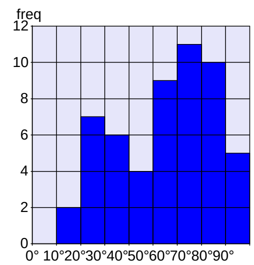
	Counts	Dip[deg]	Azi[deg]
Mean	54	51.12	34.69
● (green)	14	13.62	224.40
● (orange)	40	56.11	26.60

Azimuth - Absolute (Count)
Depth: 0.00 [ft] to 100.00 [ft]



Counts:	54.00
Mean:	34.69
Std.Dev.:	0.00
Min:	9.24
Max:	353.47

Dip Histogram (Count)
Depth: 0.00 [ft] to 100.00 [ft]



Counts:	54.00
Mean:	51.12
Std.Dev.:	0.00
Min:	14.09
Max:	88.08

ATTACHMENT 2

Structural Discontinuity Data

		Classification of Discontinuity											Rating					Total
Station	Location	Type	Dip Angle	Dip Azimuth	Discontinuity length (m)	Separation (mm)	Roughness	Spacing (ft)	Infilling (gouge)	Weathering	Rock Type	Comment	Discontinuity length	Seperation	Roughness	Infilling (gouge)	Weathering	JRC
1a	1	J	37	155	4.5	5	SS	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	1	0	4	5	12
1a	2	J	26	213	9	0.1-1	SR	N/A	None	Slight	Blueschist with pyrite (<1%) and quart veins.		2	6	3	6	5	22
1a	3	J	56	85	4.5	1-5	SS	N/A	None	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated	2	1	0	6	5	14
1a	4	J	81	110	15	5	SS	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, vertical joint	1	1	0	4	5	11
1a	5	J	31	95	6	<0.1	SS	5	None	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated	2	5	0	6	5	18
1a	6	J	76	101	15	5	SS	5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	1	0	4	5	11
1a	7	J	76	93	1.5	<0.1	SS	2	None	Slight	Blueschist with pyrite (<1%) and quart veins.		4	5	0	6	5	20
1a	8	J	30	254	9	10	SS	N/A	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	0	0	2	5	9
1a	9	J	82	160	3	>5	SR	>6	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		4	0	3	2	5	14
1a	10	J	68	340	3	>5	SR	N/A	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		4	0	3	2	5	14
1a	11	F	53	155	3	<1	R	1.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	highly fractured shear zone	4	4	5	4	5	22
1a	12	F	72	156	6	1	S	2	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	highly fractured shear zone	2	4	1	4	5	16
1a	13	J	40	205	1	2-5	SS	2	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	highly fractured shear zone	6	1	0	4	5	16
1a	14	Fault/F	36	153	15	1	VR	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated	1	4	6	4	5	20
1a	15	F	72	330	6	1	SR	2-3	Hard <5mm	Highly	Blueschist with pyrite (<1%) and quart veins.		2	4	3	4	1	14
1b	16	J	86	359	9	20	SS	2	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickside along joint face	2	0	0	4	5	11
1b	17	J	54	348	1.5	>5	SS	10	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	very undulated, slickenside along joint face	4	0	0	4	5	13
1b	18	J	79	354	2.5	1	SS	2	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	4	4	0	4	5	17
1b	19	J	88	25	15	10	SS	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	very undulated, slickenside along joint face	1	0	0	4	5	10
1b	20	J	61	36	15	>10	SS	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	1	0	0	4	5	10
1b	21	J	82	254	9	1	SS	10	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	2	4	0	4	5	15
1b	22	J	64	211	6	>5	SS	1"-2"	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	2	0	0	4	5	11
1b	23	J	59	292	6	5	R	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	2	0	5	4	5	16
1b	24	J	78	208	6	<0.1	SS	1"-2"	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	2	5	0	4	5	16
1b	25	J	86	305	6	1-5	SR	5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	2	1	3	4	5	15
1b	26	F	65	324	15	>150	SR	N/A	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	1	0	3	2	5	11
1b	27	J	78	220	4.5	1	R	2	Hard <5mm	Slight	Blueschist with interlayered chlorite, epidote and acicular glaucophane.	Very sheared/fractured.	2	4	5	4	5	20
1b	28	J/F	51	310	4.5	10-20	VR	1	Hard >5mm	Slight	Blueschist with interlayered chlorite, epidote and acicular glaucophane.	Very sheared/fractured.	2	0	6	2	5	15
1b	29	J	65	220	1.5	<0.1	SS	1	None	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	4	5	0	6	5	20
1b	30	J	59	315	3	1-2	SS	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	4	1	0	4	5	14
1b	31	J	84	105	15	10	SS	1-2	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	1	0	0	4	5	10

		Classification of Discontinuity											Rating					Total
Station	Location	Type	Dip Angle	Dip Azimuth	Discontinuity length (m)	Separation (mm)	Roughness	Spacing (ft)	Infilling (gouge)	Weathering	Rock Type	Comment	Discontinuity length	Seperation	Roughness	Infilling (gouge)	Weathering	JRC
1b	32	J	59	322	2	1-5	SS	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	slickenside along joint face	4	1	0	4	5	14
1b	33	J	86	251	15	1-10	SR	2	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	0	3	2	5	11
1b	34	F	70	120	>15	1-10	SR	1-2	Soft >5mm	Slight - moderate	Blueschist with interlayered chlorite, epidote and acicular glaucophane.	highly sheared/fractured	1	0	3	0	3	7
1b	35	S	89	273	>15	10	R	6	Soft >5mm	Slight	Blueschist with interlayered chlorite, epidote and acicular glaucophane.	highly sheared/fractured	1	0	5	2	5	13
1b	36	S	59	124	>15	0.1-1	VR	5	Hard <5mm	Slight	Blueschist with interlayered chlorite, epidote and acicular glaucophane.	highly sheared/fractured	1	4	6	4	5	20
1b	37	J	66	97	>15	>5	SR	1	Soft >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	0	3	0	5	9
1b	38	S	74	320	>15	1-5	S	1	Soft <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	1	1	2	5	10
1b	39	J	29	206	>3	0.1-1	SR	<1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	5	3	4	5	19
1b	40	J	60	309	>15	10	SR	3	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	0	3	2	5	11
1b	41	Fault	11	306	>30	40	SR	N/A	Soft >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	highly sheared/fractured	0	0	3	0	5	8
1b	42	J	33	228	>15	1-5	SR	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	1	3	4	5	14
1b	43	J	67	325	3	0.1-1	S	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	5	1	4	5	17
1b	44	Fault	76	335	>15	5-10	R	N/A	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	Normal fault (approx. 1 foot offset)	1	0	5	2	5	13
1b	45	J	50	234	>15	1-5	SR	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	1	3	4	5	14
1b	46	Fault	89	303	>10	10	R	N/A	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	Approximately 1 foot offset	1	0	5	2	5	13
1b	47	major Fault	71	290	>100	>10	R	N/A	Hard >5mm	Moderate to highly	Blueschist with pyrite (<1%) and quart veins.	Evidence of water on rock surface. Highly sheared/fractured	0	0	5	2	1	8
1c	48	J	50	30	10	5-10	S	1-2	Hard >5mm	Slight to moderate	Blueschist with pyrite (<1%) and quart veins.		1	0	1	2	3	7
1c	49	J	45	225	>15	0.1-1	S	0.5-1	Hard <5mm	Slight to moderate	Blueschist with pyrite (<1%) and quart veins.		1	4	1	4	3	13
1c	50	J	86	227	>3	0.1-1	SS	2	Hard <5mm	Slight to moderate	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	2	4	0	4	3	13
1c	51	S	48	310	>20	10	R	2	Hard >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.	Evidence of water on rock surface	0	0	5	2	3	10
1c	52	Fault	68	85	>15	10	R	N/A	Soft >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	0	5	0	5	11
1c	53	J	66	321	5	5-10	SS	2	Hard >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		2	0	0	2	3	7
1c	54	J	66	54	>10	1-5	SS	0.5	Soft <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		1	1	0	2	3	7
1c	55	Fault	--	--	>50	>10	R	20-30	Hard >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.	Bearing on major fault, highly sheared/fractured.	0	0	5	2	3	10
1c	56	Fault	67	325	>10	>10	R	20-30	Soft >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		1	0	5	0	3	9
1c	57	J	15	135	>10	1-5	R	5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joint face	1	1	5	4	5	16
1c	58	J	84	187	3	5-10	SR	N/A	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	0	3	2	5	12
1c	59	Fault	72	310	>15	>10	SR	N/A	Hard >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		1	0	3	2	3	9
1c	60	J/S	44	39	>10	0.1-1	S	0.25	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated	1	4	1	4	5	15
1c	61	J	66	253	>15	0.1-1	SR	5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	4	3	4	5	17
1c	62	Fault	76	135	>30	>10	SR	N/A	Hard >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		0	0	3	2	3	8
1c	63	J	30	250	3-5	0.1-1	S	0.5	Hard <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		2	4	1	4	3	14
1c	64	Fault	90	128	>15	0.1-1	R	N/A	Hard <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.	Vertical fault	1	4	5	4	3	17
1c	65	S	79	280	5	5-10	SR	1	Hard >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.	Undulated, shear zone	2	0	3	2	3	10
1c	66	J	49	281	3-5	0.1-1	R	1	Hard <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		2	4	5	4	3	18
1c	67	J	76	240	3-5	5-10	R	10	Soft >5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		2	0	5	0	3	10

		Classification of Discontinuity											Rating					Total
Station	Location	Type	Dip Angle	Dip Azimuth	Discontinuity length (m)	Separation (mm)	Roughness	Spacing (ft)	Infilling (gouge)	Weathering	Rock Type	Comment	Discontinuity length	Seperation	Roughness	Infilling (gouge)	Weathering	JRC
1c	68	S	82	112	6-10	>10	VR	N/A	Soft >5mm	Highly	Blueschist with pyrite (<1%) and quart veins.		2	0	6	0	1	9
1c	69	S	80	314	3-5	>10	VR	2	Soft >5mm	Highly	Blueschist with pyrite (<1%) and quart veins.		2	0	6	0	1	9
1c	70	J	33	15	1-3	0.1-1	VR	1	Hard <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.		4	4	6	2	3	19
1c	71	Fault	50	45	>10	5-10	R	2	Soft>5mm	Highly	Blueschist with pyrite (<1%) and quart veins.		1	0	5	0	1	7
1c	72	J	79	44	3-5	1-5	SR	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	Highly sheared/fractured	2	1	3	4	5	15
1c	73	J	53	116	>10	1-5	SR	1	Soft <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.	Undulated, highly sheared/fractured	1	1	3	2	3	10
1c	74	J	60	330	>10	1-5	R	2	Hard <5mm	Moderate	Blueschist with pyrite (<1%) and quart veins.	Undulated	1	1	5	4	3	14
1c	75	J	84	220	9-10	0.1-1	SS	0.25	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	4	0	4	5	14
1c	76	J	89	130	>20	1-5	S	3	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		0	1	1	4	5	11
1c	77	J	89	227	>15	0.1-1	SS	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	4	0	4	55	64
1c	78	J	41	237	3-5	0.1-1	SS	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	4	0	4	5	15
1c	79	J	80	50	15	0.1-1	SS	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	4	0	4	5	14
1c	80	J	66	204	2	0.1-1	SR	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		4	4	3	4	5	20
1c	81	Fault	78	124	>15	0.1-1	SR	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	4	3	4	5	17
1c	82	J	71	335	>10	1-5	SR	4	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	1	3	4	5	14
1c	83	Fault	81	160	>15	1-5	SR	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	1	3	4	5	14
1a	84	J	32	203	>10	5-10	SR	0.5	Hard >5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		1	0	3	2	5	11
1a	85	Fault	63	300	3	0.1-1	S	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	small reverse fault	4	4	1	4	5	18
1a	86	J	80	190	3	0.1-1	SS	0.5	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	slickensided along joing face	4	4	0	4	5	17
1a	87	Fault	40	285	6	0.1-1	S	N/A	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	4	1	4	5	16
1a	88	J	69	145	>10	1-5	SS	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joing face	1	1	0	4	5	11
1a	89	J	55	76	>10	1-5	SS	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	undulated, slickenside along joing face	1	1	0	4	5	11
1a	90	Fault	49	65	9-10	1-5	SS	N/A	Soft <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.	Normal Fault	2	1	0	2	5	10
1a	91	J	47	224	>5	0.1-1	S	1	Hard <5mm	Slight	Blueschist with pyrite (<1%) and quart veins.		2	4	1	4	5	16
--	92	--	55	120	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	93	--	78	50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	94	--	68	68	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	95	--	26	155	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	96	--	17	184	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	97	--	55	286	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	98	--	61	289	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	99	--	70	263	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	100	--	53	333	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	101	--	75	356	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	102	--	38	292	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	103	--	38	261	--	--	--	--	--	--	--	--	--	--	--	--	--	--

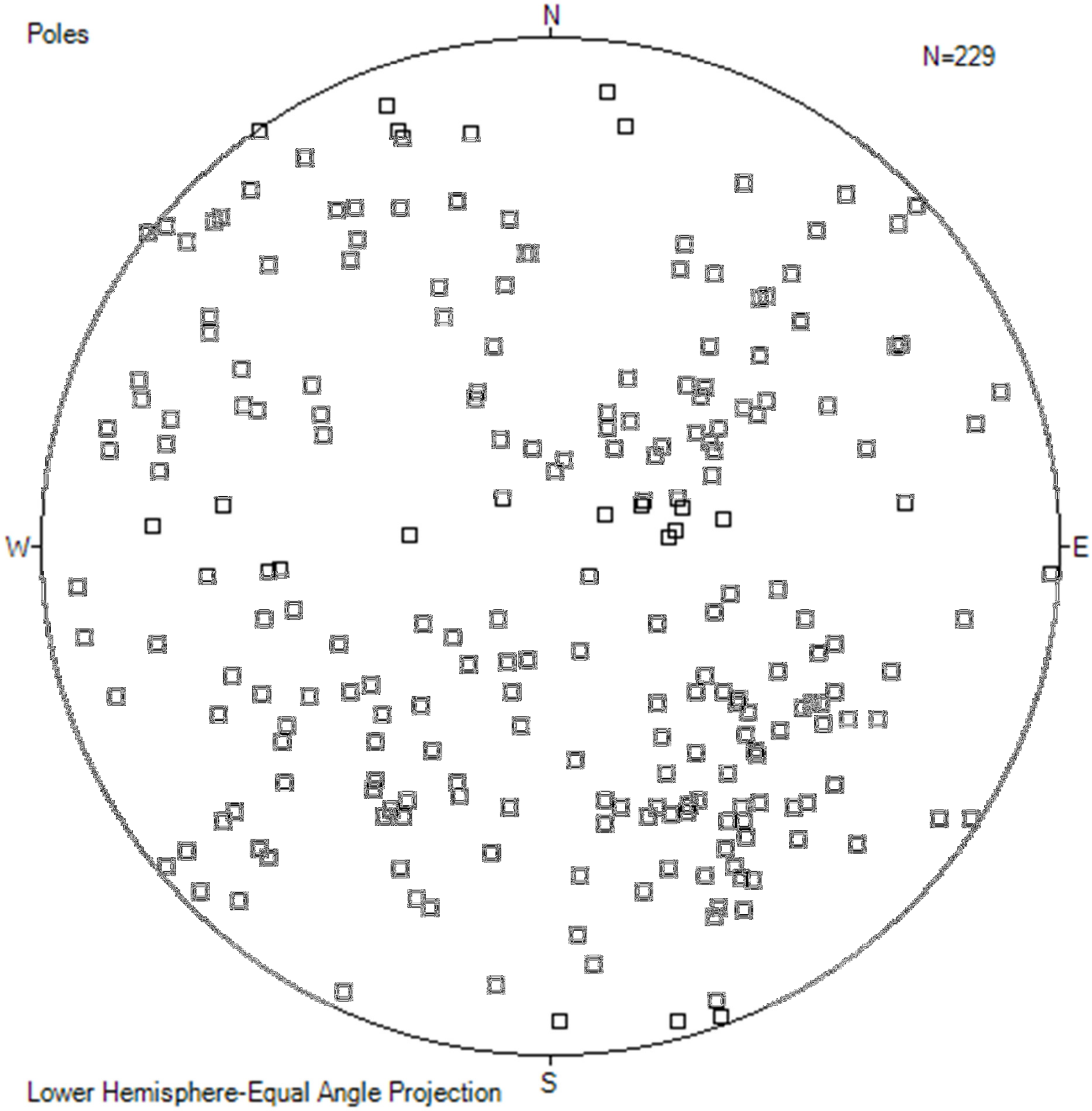
Station	Location	Classification of Discontinuity											Rating					Total
		Type	Dip Angle	Dip Azimuth	Discontinuity length (m)	Separation (mm)	Roughness	Spacing (ft)	Infilling (gouge)	Weathering	Rock Type	Comment	Discontinuity length	Seperation	Roughness	Infilling (gouge)	Weathering	JRC
--	104	--	29	306	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	105	--	24	344	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	106	--	28	263	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	107	--	59	340	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	108	--	58	338	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	109	--	58	349	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	110	--	86	79	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	111	--	86	85	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	112	--	77	76	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	113	--	84	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	114	--	69	330	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	115	--	41	326	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	116	--	75	329	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	117	--	43	310	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	118	--	58	85	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	119	--	63	243	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	120	--	73	21	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	121	--	82	7	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	122	--	63	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	123	--	44	235	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	124	--	74	330	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	125	--	60	332	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	126	--	44	315	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	127	--	54	299	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	128	--	54	236	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	129	--	62	205	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	130	--	66	221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	131	--	67	228	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	132	--	68	300	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	133	--	72	298	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	134	--	58	157	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	135	--	60	176	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	136	--	66	173	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	137	--	53	325	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	138	--	51	309	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	139	--	66	355	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	140	--	88	345	--	--	--	--	--	--	--	--	--	--	--	--	--	--

		Classification of Discontinuity											Rating					Total
Station	Location	Type	Dip Angle	Dip Azimuth	Discontinuity length (m)	Separation (mm)	Roughness	Spacing (ft)	Infilling (gouge)	Weathering	Rock Type	Comment	Discontinuity length	Seperation	Roughness	Infilling (gouge)	Weathering	JRC
--	141	--	70	345	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	142	--	65	303	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	143	--	60	175	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	144	--	65	115	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	145	--	70	165	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	146	--	45	220	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	147	--	55	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	148	--	77	240	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	149	--	55	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	150	--	90	145	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	151	--	85	140	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	152	--	89	50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	153	--	86	50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	154	--	75	150	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	155	--	54	310	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	156	--	20	35	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	157	--	71	315	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	158	--	85	134	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	159	--	65	63	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	160	--	70	317	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	161	--	89	340	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	162	--	85	135	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	163	--	56	314	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	164	--	62	301	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	165	--	60	336	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	166	--	70	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	167	--	87	340	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	168	--	86	130	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	169	--	56	345	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	170	--	40	232	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	171	--	77	336	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	172	--	71	148	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	173	--	55	9	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	174	--	47	330	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	175	--	78	332	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	176	--	64	297	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	1	J	44	164	--	0	--	--	--	--	--	--	--	--	--	--	--	--

		Classification of Discontinuity											Rating					Total
Station	Location	Type	Dip Angle	Dip Azimuth	Discontinuity length (m)	Separation (mm)	Roughness	Spacing (ft)	Infilling (gouge)	Weathering	Rock Type	Comment	Discontinuity length	Seperation	Roughness	Infilling (gouge)	Weathering	JRC
GB-1	2	J	26	266	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	3	J	60	37	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	4	J	53	22	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	5	J	55	42	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	6	J	86	41	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	7	J	88	45	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	8	J	60	29	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	9	J	46	353	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	10	J	62	29	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	11	J	70	48	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-1	12	J	79	42	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-2	1	J	64	32	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	2	J	62	31	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	3	J	74	18	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	4	J	26	11	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	5	J	27	20	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	6	J	29	47	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	7	J	32	35	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	8	J	58	58	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	9	J	32	59	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	10	J	61	303	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	11	J	39	9	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	12	J	53	219	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	13	J	72	63	--	0	--	--	--	--	--	--	--	--	--	--	--	--
--	14	J	60	76	--	0	--	--	--	--	--	--	--	--	--	--	--	--
GB-3	1	J	76	105	--	0	--	--	--	--	--	--	--	--	--	--	--	--

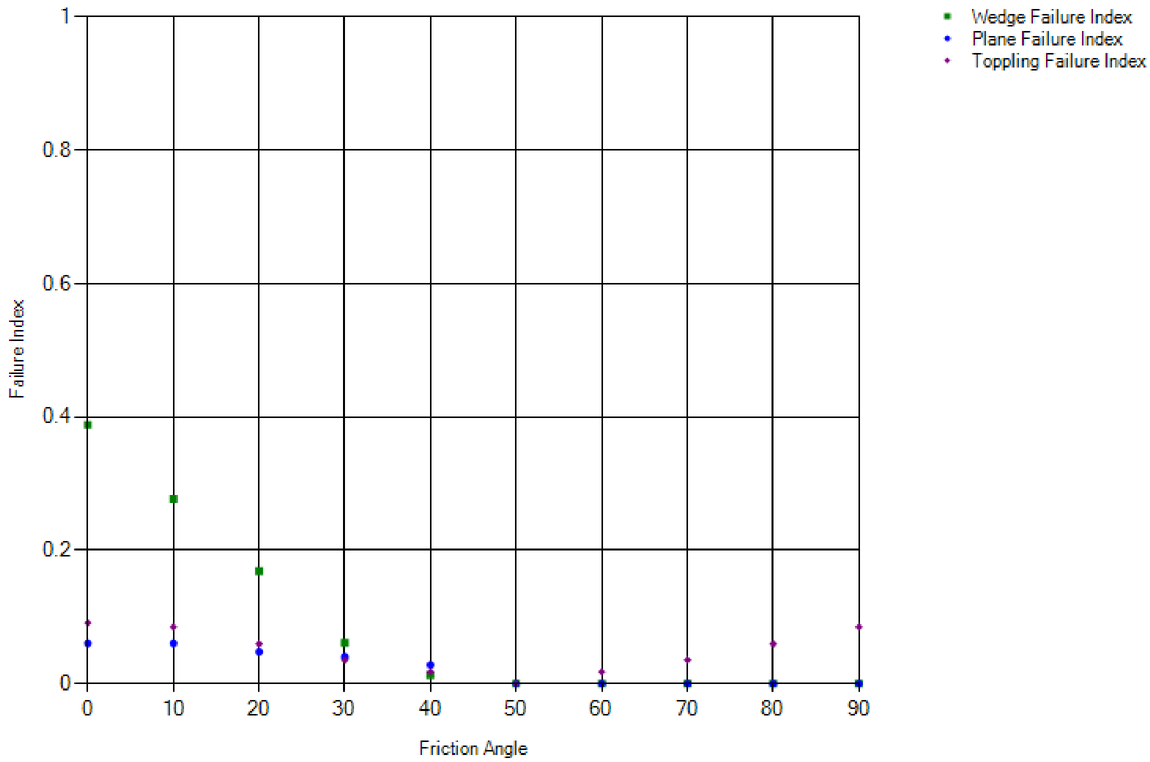
ATTACHMENT 3

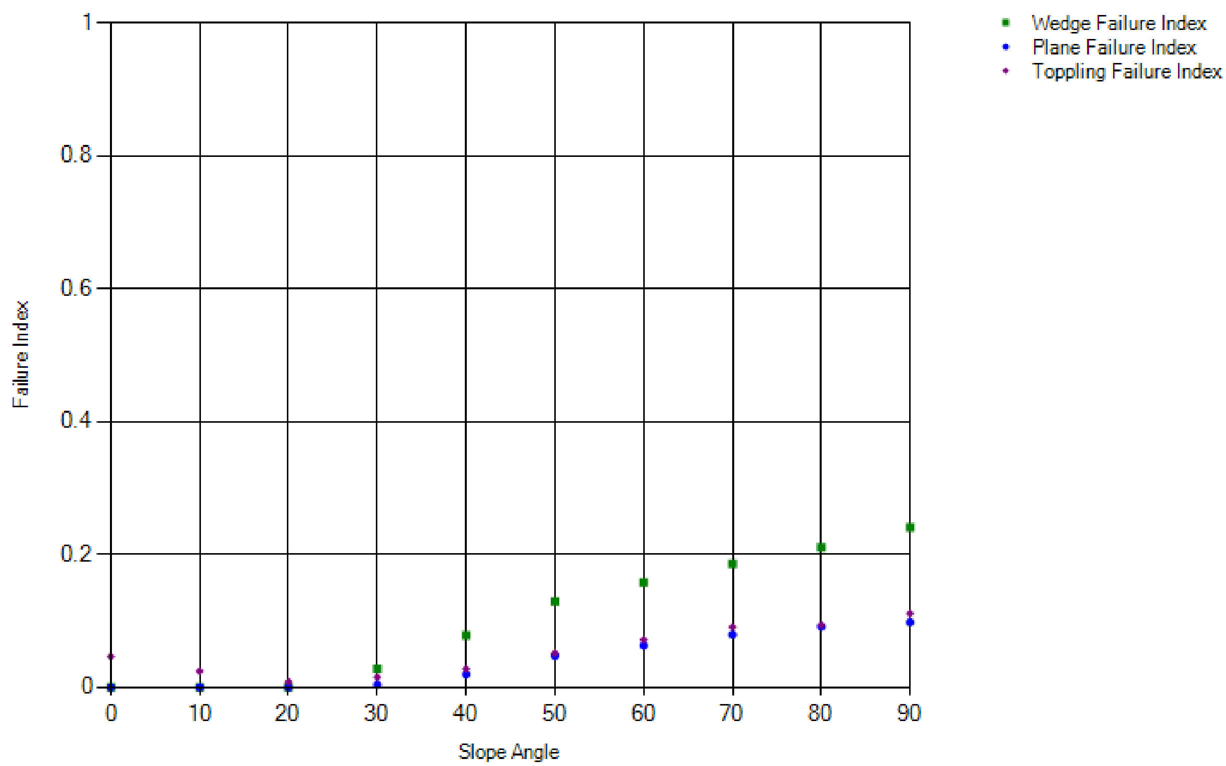
Stereo Net Plot

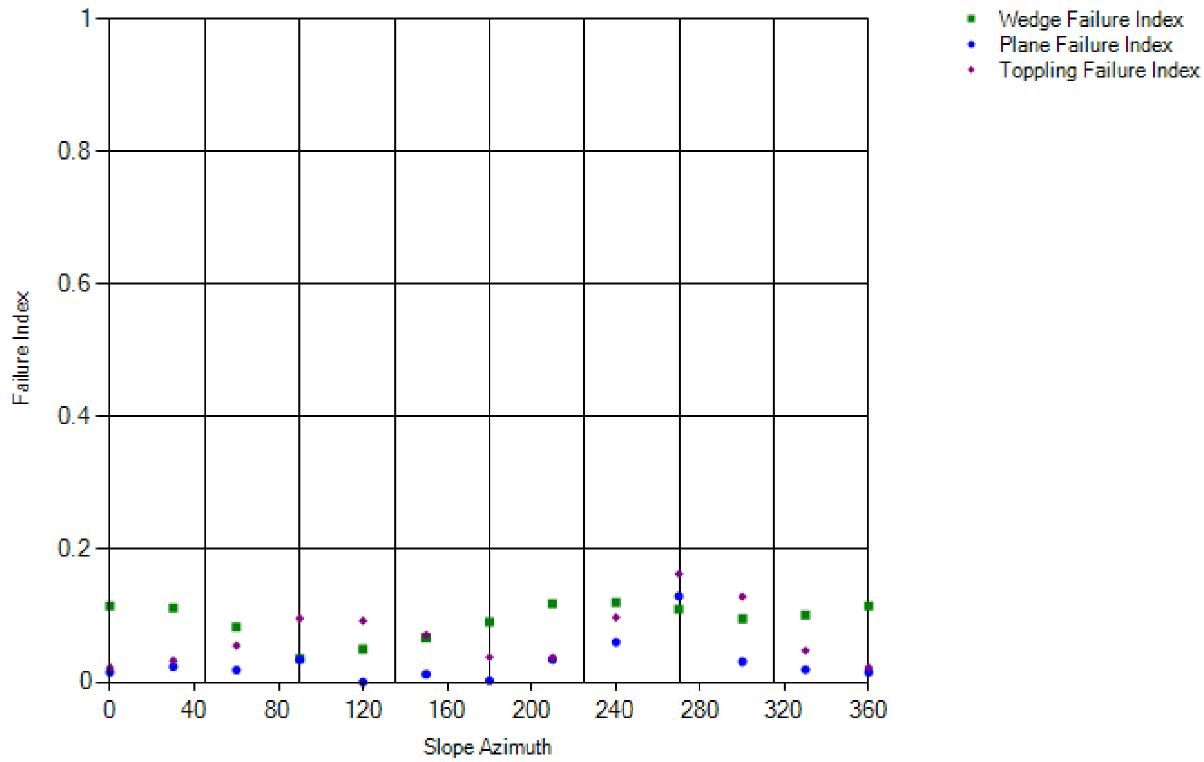

Poles
N
N=229
W
E
S
Lower Hemisphere-Equal Angle Projection

ATTACHMENT 4

Kinematic Failure Index Results


Wedge Failure Index
Plane Failure Index
Toppling Failure Index
Failure Index
Friction Angle
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
60
70
80
90


Wedge Failure Index
Plane Failure Index
Toppling Failure Index
Failure Index
Slope Angle
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
60
70
80
90

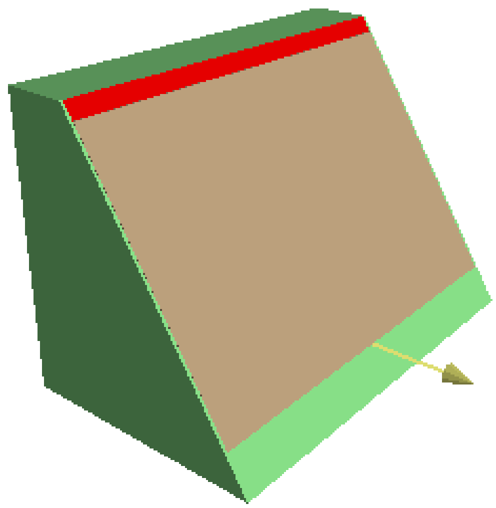

Wedge Failure Index
Plane Failure Index
Toppling Failure Index
Failure Index
1
0.8
0.6
0.4
0.2
0
0
40
80
120
160
200
240
280
320
360
Slope Azimuth

ATTACHMENT 5

Kinematic Factor of Safety Results

Project	Laytonville Quarry	By	MRL
Client	Rau and Associates	Date	12/20/2013
Proj. No.	7294.14	Page	3 of 3

Plane Failure Analysis



Program RocPlane 2.045

Inputs

Rock Strength	JRC	8
	JSS	288 tons/ft^2
	Friction Angle	32°
	Unit Weight	160 pcf

Quarry Wall Side	SE Face				E Face				NE Face			
Slope Height	50 ft				50 ft				50 ft			
Slope Angle (xH:1V)	0.9	0.8	0.7	0.6	0.9	0.8	0.7	0.6	0.9	0.8	0.7	0.6
Upper Slope Angle	1°				1°				1°			
Min. Failure Slope	27°				24°				24°			
Max Failure Slope	81°				89°				89°			

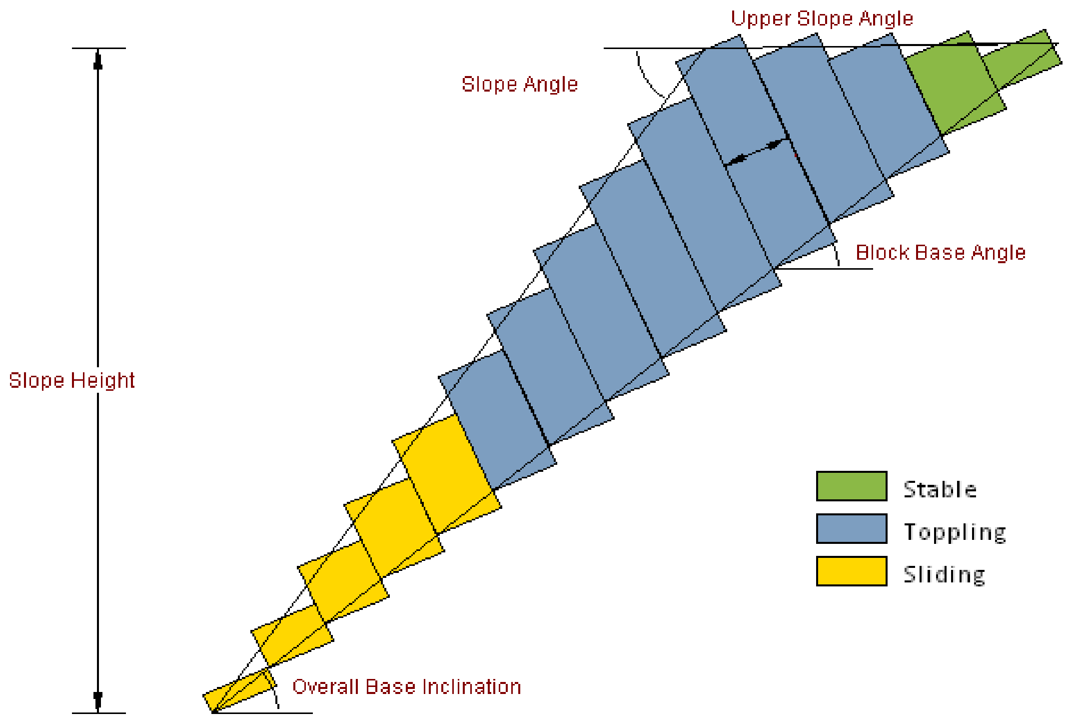
Results

Static F.S.	**1.8**	**1.6**	**1.5**	**1.3**	**1.8**	**1.7**	**1.5**	**1.3**	**1.8**	**1.6**	**1.5**	**1.3**
Seismic F.S. (k=0.28)	**1.1**	**1.0**	**0.9**	**-**	**1.1**	**1.0**	**0.8**	**-**	**1.1**	**1.0**	**0.9**	**-**

Note: Slopes are considered stable when static factor of safety is greater than 1.5 and when seismic factor of safety is greater than 1.1. Slopes with factor of safety results highlighted in red are considered unstable.

	Project	Laytonville Quarry	By	MRL
	Client	Rau and Associates	Date	12/20/2013
	Proj. No.	7294.14	Page	1 of 3

Rock Topple Analysis



Program RocTopple Ver. 1.003

Inputs

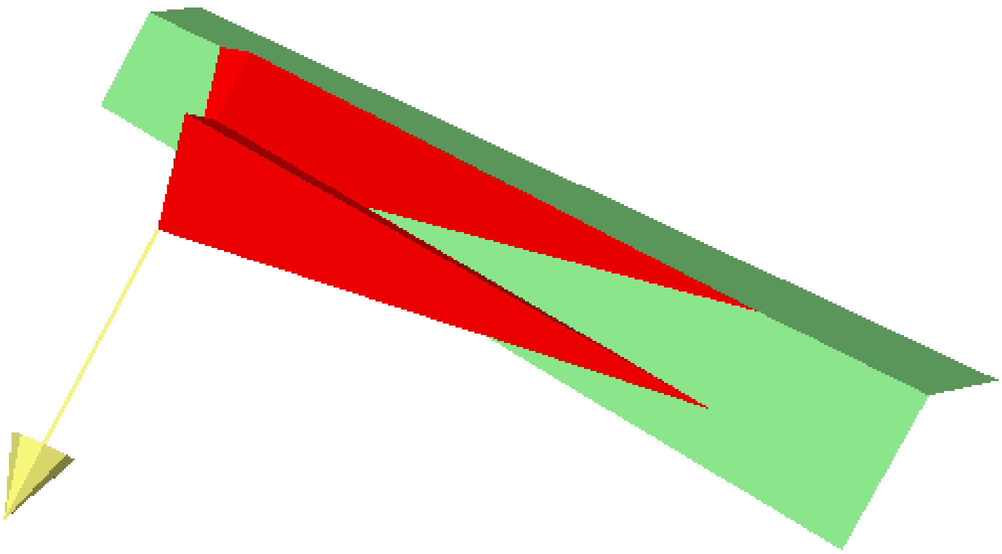
Rock Strength	JRC				8							
	JSS				288 tons/ft^2							
	Friction Angle				32°							
	Unit Weight				160 pcf							
Quarry Wall Side	SE Face				E Face				NE Face			
Slope Height	50				50				50			
Slope Angle (xH:1V)	0.9	0.8	0.7	0.6	0.9	0.8	0.7	0.6	0.9	0.8	0.7	0.6
Upper Slope Angle	1°				1°				1°			
Dip Angle Min.	51°				51°				51°			
Dip Angle Max.	88°				88°				88°			
Base Inclination	40°				40°				40°			
Static F.S.	**2.1**	**1.8**	**1.7**	**1.5**	**1.9**	**1.8**	**1.7**	**1.5**	**2.0**	**1.9**	**1.8**	**1.5**
Seismic F.S. (k=0.28)	**1.3**	**1.3**	**1.2**	**-**	**1.3**	**1.3**	**1.1**	**-**	**1.3**	**1.3**	**1.1**	**-**

Results (Static F.S. and Seismic F.S. rows above)

Note: Slopes are considered stable when static factor of safety is greater than 1.5 and when seismic factor of safety is greater than 1.1. Slopes with factor of safety results highlighted in red are considered unstable.

Project	Laytonville Quarry	By	MRL
Client	Rau and Associates	Date	12/20/2013
Proj. No.	7294.14	Page	

Wedge Failure Analysis



Program Swedge Ver. 5.016

Inputs

Rock Strength	JRC	8											
	JSS	288 tons/ft^2											
	Friction Angle	32°											
	Unit Weight	160 pcf											
Quarry Wall Side	SE Face				E Face				NE Face				
Slope Height	50 ft				50 ft				50 ft				
Slope Angle (xH:1V)	0.9	0.8	0.7	0.6	0.9	0.8	0.7	0.6	0.9	0.8	0.7	0.6	
Upper Slope Angle	1°				1°				1°				
Joint Dip and Direction	See Attachment 2 of the Report												

Results

	SE 0.9	SE 0.8	SE 0.7	SE 0.6	E 0.9	E 0.8	E 0.7	E 0.6	NE 0.9	NE 0.8	NE 0.7	NE 0.6
Static F.S.	**2.1**	**1.9**	**1.7**	**1.5**	**1.6**	**1.4**	**1.4**	**1.3**	**1.8**	**1.6**	**1.2**	**1.1**
Seismic F.S. (k=0.28)	**1.3**	**1.3**	**1.2**	**-**	**1.1**	**1.0**	**1.0**	**-**	**1.2**	**1.1**	**0.9**	**-**

Note: Slopes are considered stable when static factor of safety is greater than 1.5 and when seismic factor of safety is greater than 1.1. Slopes with factor of safety results highlighted in red are considered unstable.

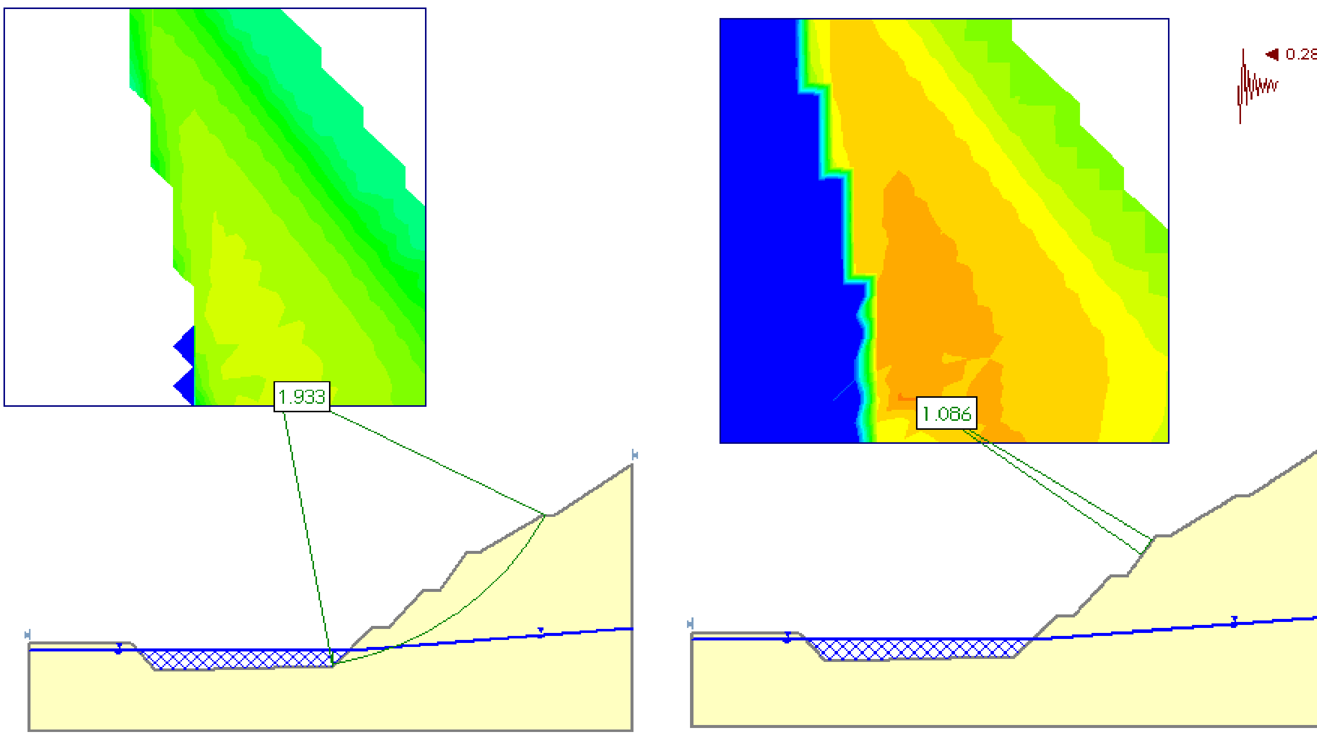
ATTACHMENT 6

Factor of Safety Results

LACO

Project	Laytonville Quarry	By	MRL
Client	Rau and Associates	Date	12/20/2013
Proj. No.	7294.14	Page	2 of 3

Slope Analysis (E Face)



Program Slide Ver. 5.043

Inputs

Rock Strength	Uniaxial Compressive Strength	1,000,000 psf
	Geologic Strength Index	25
	Intact Rock Strength	15
	Disturbance Factor	1

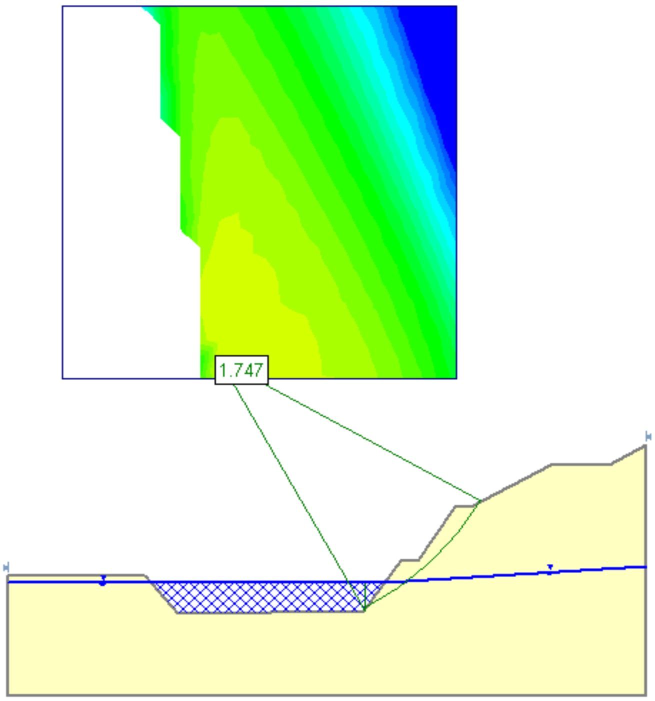
Results

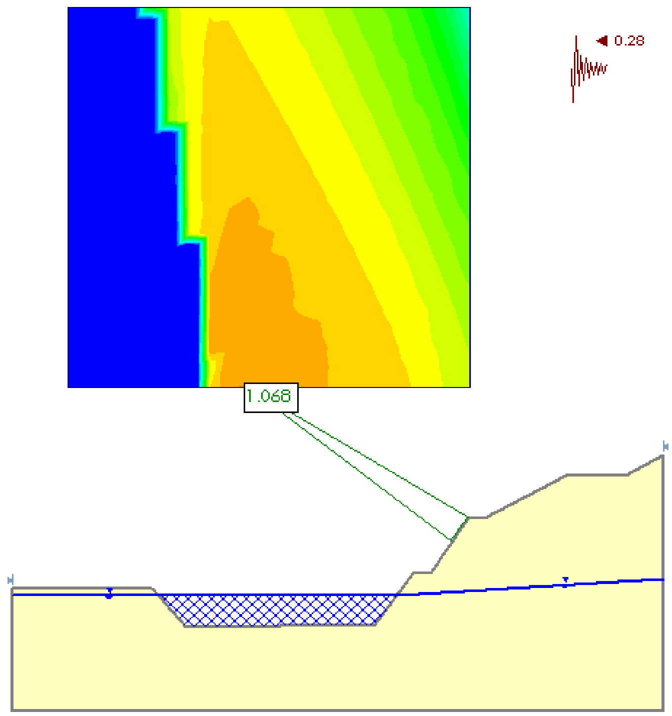
Static F.S.	**2.0**
Seismic F.S. (k=0.28)	**1.2**

Note: Slopes are considered stable when static factor of safety is greater than 1.5 and when seismic factor of safety is greater than 1.1. Slopes with factor of safety results highlighted in red are considered unstable.

Project	Laytonville Quarry	By	MRL
Client	Rau and Associates	Date	12/20/2013
Proj. No.	7294.14	Page	3 of 3

Slope Analysis (NE Face)





Program Slide Ver. 5.043

Inputs

Rock Strength	Uniaxial Compressive Strength	1,000,000 psf
	Geologic Strength Index	25
	Intact Rock Strength	15
	Disturbance Factor	1

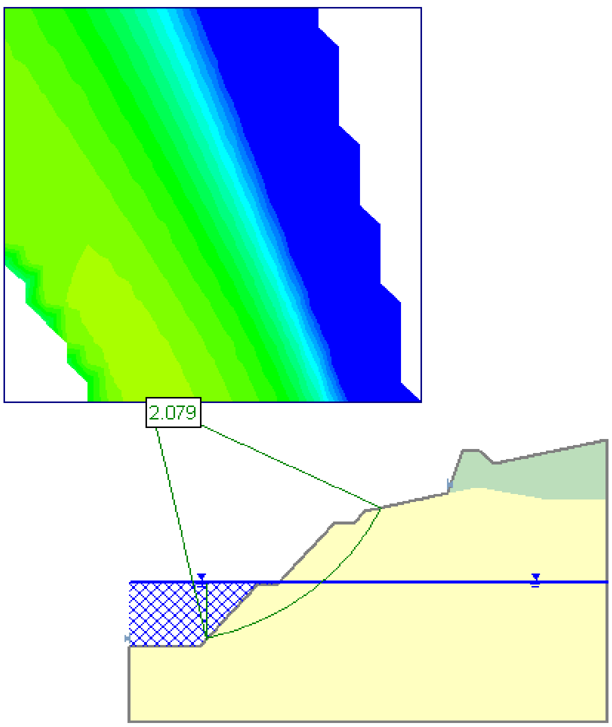
Results

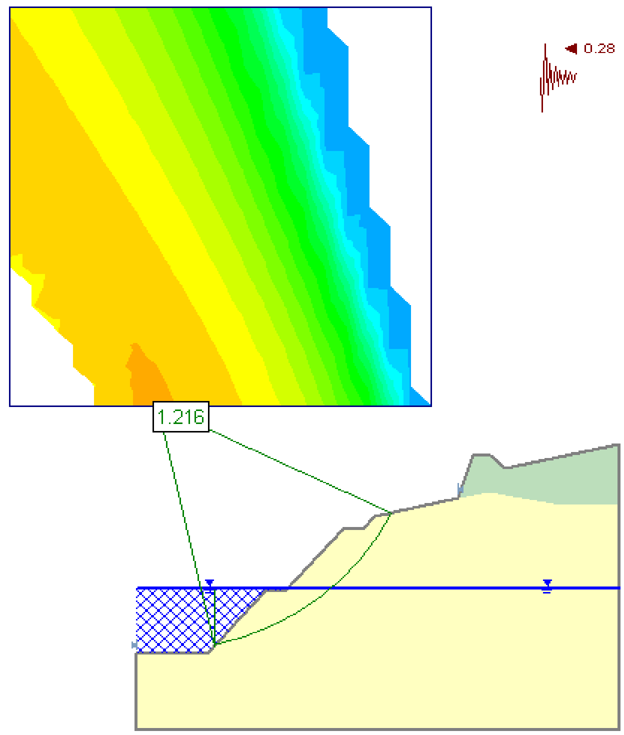
Static F.S.	**1.9**
Seismic F.S. (k=0.28)	**1.2**

Note: Slopes are considered stable when static factor of safety is greater than 1.5 and when seismic factor of safety is greater than 1.1. Slopes with factor of safety results highlighted in red are considered unstable.

LACO	Project	Laytonville Quarry	By	MRL
	Client	Rau and Associates	Date	12/20/2013
	Proj. No.	7294.14	Page	

Slope Analysis (SE Face)





Program Slide Ver. 5.043

Inputs

Rock Strength	Uniaxial Compressive Strength	1,000,000 psf
	Geologic Strength Index	25
	Intact Rock Strength	15
	Disturbance Factor	1

Results

Static F.S.	**2.2**
Seismic F.S. (k=0.28)	**1.3**

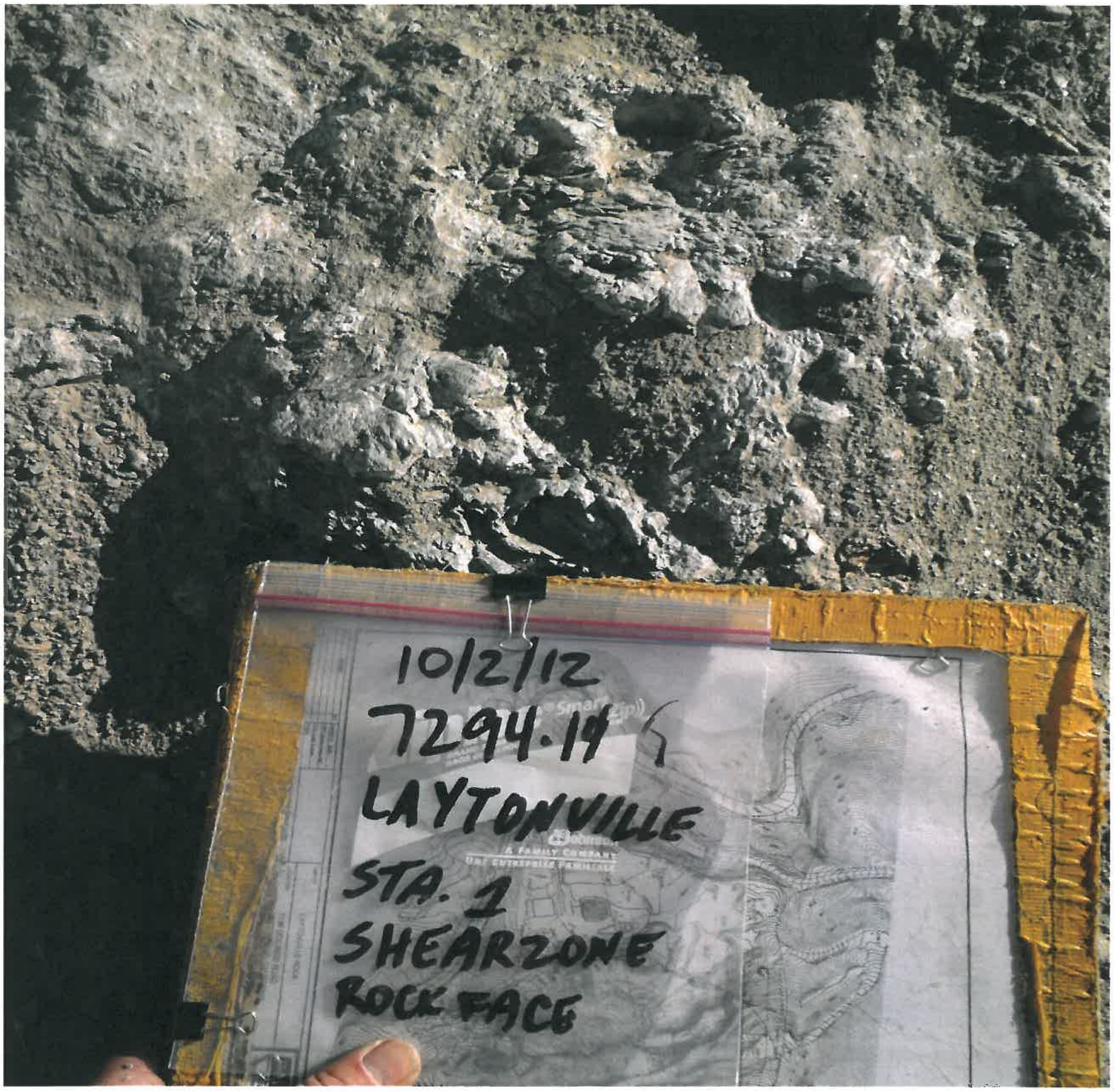
Note: Slopes are considered stable when static factor of safety is greater than 1.5 and when seismic factor of safety is greater than 1.1. Slopes with factor of safety results highlighted in red are considered unstable.

ATTACHMENT 7

Photographs of NOA Sampling Locations

Photograph 1: View looking north along lower quarry working face. Shear zone containing NOA is located in center right of photo denoted by arrow and light brownish gray material.

Photograph 2: View looking north along lower quarry working face with close-up view of shear zone containing NOA denoted by arrow and light brownish gray material.



Photograph 3: Close-up view of in-place shear zone material containing NOA and sampled at Station 1.

ATTACHMENT 8

NOA Laboratory Analytical Results

CLEAR FORM SAVE FORM E-MAIL

Client ID # 1804

MICRO ANALYTICAL LABORATORIES, INC.

5900 Hollis St., Suite M, Emeryville, CA 94608
(510) 653-0824 - (510) 653-1361 - FAX

Log in # 175055

Name / Client / Address:
Giovanni Vadurro
LACO ASSOCIATES
21 West 4th Street
Eureka, Ca 95501

Tel. (707) 443-5054
Fax (707) 443-0553
E-mail vadurrog@lacoassociates.com

Project
Rau - Laytonville Rock

Job No. 7294.14

Asbestos (TEM)
Asbestos PLM ARB 435
Lead Only
Metals (Specify)
Mold, Non-Viable
Other (Specify)

Number of Samples: 5
Turn-Around Time: 3-5 DAYS

Micro ID # (For Lab Use Only)	Client Sample ID#	Description	Date Sampled	Time Sampled Start / Stop / Total Minutes	Average LPM	Total Liters	Filter Pore Size
1	Station 1	Quarry face	10/02/2012	: : 0		0.00	
2	Station 2	Quarry face	10/02/2012	: : 0		0.00	
3	Station 3	Quarry face	10/02/2012	: : 0		0.00 -	
4	Station 4	Quarry face	10/02/2012	: : 0		0.00	
5	Station 5	Quarry face	10/02/2012	: : 0		0.00	
				: : 0		0.00	
				: : 0		0.00	
				: : 0		0.00	
				: : 0		0.00	
				: : 0		0.00	

Instructions / Comments: ☐ Fax ☑ E-mail To: vadurrog@lacoassociates.com
and cc wattc@lacoassociates.com

Sample Return: YES ☐ NO ☑ If "YES" is checked, samples will be returned to the client or archived at Micro Analytical if required.
If "NO" is checked, solid samples may be disposed of within three months (one week for liquid samples, lab suspensions, and digestates).

Giovanni A. Vadurro [signature]
Sampler's Signature / Name

Note to Lab: If any samples are not acceptable, record reasons for rejection.

Relinquished By	Date / Time	Drop Box / Courier	Received By	Date / Time
			[signature]	10-8-12 9:50

MICRO ANALYTICAL LABORATORIES, INC.

BULK ASBESTOS ANALYSIS - PLM (CARB 435, 1991)

1004-175055

1004
Giovanni Vadurro
Laco Associates
311 South Main Street
Ukiah, CA 95482

PROJECT:
RAU - LAYTONVILLE ROCK
JOB NO. 7294.14

Micro Log In	**175055**
Total Samples	5
Date Sampled	10/02/2012
Date Received	10/08/2012
Date Analyzed	10/09/2012

ASBESTOS INFORMATION

SAMPLE INFORMATION	QUANTITY (AREA %) / TYPES / LAYERS / DISTINCT SAMPLES	DOMINANT OTHER MATERIALS
Client #: **STATION 1** Micro #: 175055-01 Analyst: GR DA **QUARRY FACE** Asb. / Total Pts. / Sensitivity	25% TREMOLITE-ACTINOLITE ASBESTOS **NOTE: No point count needed for this sample, due to high asbestos content. Asbestos was quantified by visual estimation.**	Matrix Type: ROCK FRAGMENTS
Client #: **STATION 2** Micro #: 175055-02 Analyst: MO **QUARRY FACE** Asb. / Total Pts. / Sensitivity	NONE DETECTED **NOTE: No point count needed for this sample, due to lack of asbestos fibers.**	Matrix Type: ROCK FRAGMENTS
Client #: **STATION 3** Micro #: 175055-03 Analyst: DA **QUARRY FACE** Asb. / Total Pts. / Sensitivity	NONE DETECTED **NOTE: No point count needed for this sample, due to lack of asbestos fibers.**	Matrix Type: ROCK FRAGMENTS
Client #: **STATION 4** Micro #: 175055-04 Analyst: SC GR **QUARRY FACE** Asb. / Total Pts. / Sensitivity	NONE DETECTED **NOTE: No point count needed for this sample, due to lack of asbestos fibers.**	Matrix Type: ROCK FRAGMENTS
Client #: **STATION 5** Micro #: 175055-05 Analyst: GR **QUARRY FACE** Asb. / Total Pts. / Sensitivity	NONE DETECTED **NOTE: No point count needed for this sample, due to lack of asbestos fibers.**	Matrix Type: ROCK FRAGMENTS

Technical Supervisor: for Gamini Ranatunga, Ph.D. — 10/12/2012 Date Reported

NOTES: Weight % cannot be determined by PLM estimation or point counts. Asbestos fibers with diameter below ~1 µm may not be detected by PLM. The absence of asbestos in dust or debris (including wipe or microvacuum), and in some compact materials, including floor tiles, cannot be conclusively established by PLM, and should be confirmed by Transmission Electron Microscopy (TEM). Only dominant non-asbestos materials are indicated. This report must not be interpreted as a conclusive identification of non-asbestos (fibrous or not). Quantities of non-asbestos fibers are estimated, not point counted. Preparation (all samples): grinding, milling; teasing bundles apart; drying, if needed, by hotplate. Acid dissolution, ashing, or other matrix reduction techniques may be applied to some samples; residue asbestos % is corrected for amount of matrix removed. Various sample interferences may prevent detection of small asbestos fibers, and hinder determination of some optical properties. Notes are made if point counting is used; otherwise, asbestos is quantified by calibrated visual estimation. Detection limit is material dependent. Detection of asbestos traces (<<1%) may not be reliable or reproducible by PLM. Lower quantitation limit (reporting limit) of PLM estimation is 1%. The Cal-OSHA definition of asbestos-containing construction material is 0.1% asbestos by weight; however, reliable determination of asbestos weight percent at this level cannot be done by PLM, and TEM is recommended. Sample heterogeneity is indicated by listing more than one distinct layer or material on the report. Layers are analyzed separately and asbestos percentages are reported for individual layers. Interlayer contamination is possible among any layers in a sample. Composite asbestos percentages on multilayered samples are applicable only to layered wall systems (wallboard, joint compound, and related materials); compositing is based on clients' descriptions of a material as "joint compound". Clients are solely responsible for identification and description of bulk materials listed on field forms. Laboratory sample descriptions may differ from descriptions given by the client. Quality Control (QC): all results have been determined to be within acceptance limits prior to reporting. Samples that were reanalyzed are denoted by two sets of analyst initials. NIST / NVLAP Accreditation Lab Code: #101872-0. California ELAP Certification #1037. EPA test method is based on the EPA Interim Method (1982), with several improvements in analytical techniques. Unless otherwise stated in this report, all samples were received in acceptable condition for analysis. This report must not be used to claim product endorsement by NIST or any U.S. Government agency. This report shall not be reproduced without the approval of Micro Analytical Laboratories, Inc., shall not be reproduced except in full, and pertains only to the samples analyzed. ND = NO ASBESTOS DETECTED.

MICRO ANALYTICAL LABORATORIES, INC.

BULK ASBESTOS ANALYSIS - PLM ARB 435

1004
Chris Watt
LACO Associates
311 S. Main Street
Ukiah, CA 95482

PROJECT:
LAYTONVILLE QUARRY
JOB NO. 7294.14

Micro Log In **187850**
Total Samples 7
Date Sampled 10/29/2013
Date Received 10/30/2013
Date Analyzed 11/02/2013

SAMPLE INFORMATION	ASBESTOS INFORMATION QUANTITY (AREA %) / TYPES / LAYERS / DISTINCT SAMPLES	DOMINANT OTHER MATERIALS
Client #: **GB1@80'-100'** Micro #: 187850-01 Analyst: MO DA **QUARRY MATERIAL** Asb. / Total Pts. 0 / 400 Matrix Removed 0% Sensitivity 0.250%	NONE DETECTED NON-REGULATED AMPHIBOLE FRAGMENTS DETECTED.	Matrix Type: ROCK FRAGMENTS CLAY
Client #: **GB2@30'-40'** Micro #: 187850-02 Analyst: MO DA **QUARRY MATERIAL** Asb. / Total Pts. 0 / 400 Matrix Removed 0% Sensitivity 0.250%	NONE DETECTED NON-REGULATED AMPHIBOLE FRAGMENTS DETECTED.	Matrix Type: ROCK FRAGMENTS CLAY
Client #: **GB3@60'-70'** Micro #: 187850-03 Analyst: MO DA **QUARRY MATERIAL** Asb. / Total Pts. 0 / 400 Matrix Removed 0% Sensitivity 0.250%	<0.25% ACTINOLITE ASBESTOS ACTINOLITE ASBESTOS WAS DETECTED BUT NO POINTS WERE COUNTABLE (ASBESTOS IS BELOW THE DETECTION LIMIT OF THE METHOD).	Matrix Type: ROCK FRAGMENTS CLAY
Client #: **NEW#7** Micro #: 187850-04 Analyst: MO **QUARRY MATERIAL** Asb. / Total Pts. 1 / 400 Matrix Removed 0% Sensitivity 0.250%	0.25% CHRYSOTILE ASBESTOS	Matrix Type: ROCK FRAGMENTS CLAY
Client #: **NEW#9** Micro #: 187850-05 Analyst: MO DA **QUARRY MATERIAL** Asb. / Total Pts. 0 / 400 Matrix Removed 0% Sensitivity 0.250%	<0.25% ACTINOLITE ASBESTOS ACTINOLITE ASBESTOS WAS DETECTED BUT NO POINTS WERE COUNTABLE (ASBESTOS IS BELOW THE DETECTION LIMIT OF THE METHOD).	Matrix Type: ROCK FRAGMENTS CLAY

Technical Supervisor: [signature] 11/8/2013
Gamini Ranatunga, Ph.D. Date Reported

Analyses use Polarized Light Microscopy (PLM), Micro Analytical SOP PLM-101,Rev.1/4/2013 for building materials (based on EPA-600/R93-116 (1993)), and California ARB 435 (1991) for applicable soil, rock, or aggregate samples. NOTES: Weight % cannot be determined by PLM estimation or point counts. Asbestos fibers with diameter below ~1 µm may not be detected by PLM. The absence of asbestos in dust or debris (including wipe or microvacuum), and in some compact materials, including floor tiles, cannot be conclusively established by PLM, and should be confirmed by Transmission Electron Microscopy (TEM). Only dominant non-asbestos materials are indicated. This report must not be interpreted as a conclusive identification of non-asbestos (fibrous or not). Quantities of non-asbestos fibers are estimated, not point counted. Preparation (all samples): grinding, milling; teasing bundles apart; drying, if needed, by hotplate. Acid dissolution, ashing, or other matrix reduction techniques may be applied to some samples; residue asbestos % is corrected for amount of matrix removed. Various sample interferences may prevent detection of small asbestos fibers, and hinder determination of some optical properties. Notes are made if point counting is used; otherwise, asbestos is quantified by calibrated visual estimation. Detection limit is material dependent. Detection of asbestos traces (<<1%) may not be reliable or reproducible by PLM. Lower quantitation limit (reporting limit) of PLM estimation is 1%. The Cal-OSHA definition of asbestos-containing construction material is 0.1% asbestos by weight; however, reliable determination of asbestos weight percent at this level cannot be done by PLM, and TEM is recommended. Sample heterogeneity is indicated by listing more than one distinct layer or material on the report. Composite asbestos percentages on multilayered samples are applicable only to layered wall systems (wallboard, joint compound, and related materials); compositing is based on clients' descriptions of a material as "joint compound". Clients are solely responsible for identification and description of bulk materials listed on field forms. Laboratory sample descriptions may differ from descriptions given by the client. Quality Control (QC): all results have been determined to be within acceptance limits prior to reporting. Samples that were reanalyzed are denoted by two sets of analyst initials. Unless otherwise stated in this report, all samples were received in acceptable condition for analysis. This report must not be used to claim product endorsement by NIST or any U.S. Government agency. This report shall not be reproduced except in full without the approval of Micro Analytical Laboratories, Inc., and pertains only to the samples analyzed. ND = NO ASBESTOS DETECTED.

MICRO ANALYTICAL LABORATORIES, INC.

BULK ASBESTOS ANALYSIS - PLM ARB 435

1004
Chris Watt
LACO Associates
311 S. Main Street
Ukiah, CA 95482

PROJECT:
LAYTONVILLE QUARRY
JOB NO. 7294.14

Micro Log In **187850**
Total Samples 7
Date Sampled 10/29/2013
Date Received 10/30/2013
Date Analyzed 11/02/2013

SAMPLE INFORMATION	ASBESTOS INFORMATION QUANTITY (AREA %) / TYPES / LAYERS / DISTINCT SAMPLES	DOMINANT OTHER MATERIALS
Client #: RC1 Micro #: 187850-06 Analyst: MO ROCK CHIP Asb. / Total Pts. / Sensitivity	NONE DETECTED NO ASBESTOS DETECTED: NO POINT COUNT PERFORMED	Matrix Type: ROCK FRAGMENTS
Client #: RC2 Micro #: 187850-07 Analyst: MO ROCK CHIP Asb. / Total Pts. / Sensitivity	NONE DETECTED NO ASBESTOS DETECTED: NO POINT COUNT PERFORMED	Matrix Type: ROCK FRAGMENTS

Technical Supervisor: [signature] 11/8/2013
Gamini Ranatunga, Ph.D. Date Reported

Analyses use Polarized Light Microscopy (PLM), Micro Analytical SOP PLM-101,Rev.1/4/2013 for building materials (based on EPA-600/R93-116 (1993)), and California ARB 435 (1991) for applicable soil, rock, or aggregate samples. NOTES: Weight % cannot be determined by PLM estimation or point counts. Asbestos fibers with diameter below ~1 μm may not be detected by PLM. The absence of asbestos in dust or debris (including wipe or microvacuum), and in some compact materials, including floor tiles, cannot be conclusively established by PLM, and should be confirmed by Transmission Electron Microscopy (TEM). Only dominant non-asbestos materials are indicated. This report must not be interpreted as a conclusive identification of non-asbestos (fibrous or not). Quantities of non-asbestos fibers are estimated, not point counted. Preparation (all samples): grinding, milling; teasing bundles apart; drying, if needed, by hotplate. Acid dissolution, ashing, or other matrix reduction techniques may be applied to some samples; residue asbestos % is corrected for amount of matrix removed. Various sample interferences may prevent detection of small asbestos fibers, and hinder determination of some optical properties. Notes are made if point counting is used; otherwise, asbestos is quantified by calibrated visual estimation. Detection limit is material dependent. Detection of asbestos traces (<<1%) may not be reliable or reproducible by PLM. Lower quantitation limit (reporting limit) of PLM estimation is 1%. The Cal-OSHA definition of asbestos-containing construction material is 0.1% asbestos by weight; however, reliable determination of asbestos weight percent at this level cannot be done by PLM, and TEM is recommended. Sample heterogeneity is indicated by listing more than one distinct layer or material on the report. Composite asbestos percentages on multilayered samples are applicable only to layered wall systems (wallboard, joint compound, and related materials); compositing is based on clients' descriptions of a material as "joint compound". Clients are solely responsible for identification and description of bulk materials listed on field forms. Laboratory sample descriptions may differ from descriptions given by the client. Quality Control (QC): all results have been determined to be within acceptance limits prior to reporting. Samples that were reanalyzed are denoted by two sets of analyst initials. Unless otherwise stated in this report, all samples were received in acceptable condition for analysis. This report must not be used to claim product endorsement by NIST or any U.S. Government agency. This report shall not be reproduced except in full without the approval of Micro Analytical Laboratories, Inc., and pertains only to the samples analyzed. ND = NO ASBESTOS DETECTED.

CLEAR FORM | SAVE FORM | MAIL

Client ID #

MICRO ANALYTICAL LABORATORIES, INC.

5900 Hollis St., Suite M, Emeryville, CA 94608
(510) 653-0824 • (510) 653-1361 • FAX

Log in # 191950

Name / Client / Address:
Chris Watt
LACO Associates
311 S. Main St
Ukiah, CA 95482

Tel. (707) 462-0222

Fax

E-mail wattc@lacoassociates.com

Project: Laytonville Quarry

Job No. 7294.14

Asbestos (TEM):

Asbestos: PLM by CARB 435

Lead Only:

Metals (Specify):

Mold, Non-Viable:

Other (Specify):

Number of Samples | Turn-Around Time

Micro ID # (For Lab Use Only)	Client Sample ID#	Description	Date Sampled	Time Sampled Start / Stop / Total Minutes	Average LPM	Total Liters	Filter Pore Size
1	GB1@80'-100'	Quarry Material		: / :			
2	GB2@30'-40'	"		: / :			
3	GB3@60'-70'	"		: / :			
4	NEW #7	"		: / :			
5	NEW #9	"		: / :			
6	RC1	Rock chip		: / :			
7	RC2	Rock chip		: / :			
				: / :			
				: / :			
				: / :			

Instructions / Comments: ☐ Fax ☒ E-mail To: wattc@lacoassociates.com

Sample Return: YES ☐ NO ☒ If "YES" is checked, samples will be returned to the client or archived at Micro Analytical if required.
If "NO" is checked, solid samples may be disposed of within three months (one week for liquid samples, lab suspensions, and digestates).

Sampler's Signature / Name: Jason Weiss

Note to Lab: If any samples are not acceptable, record reasons for rejection.

Relinquished By	Date / Time	Drop Box / Courier	Received By	Date / Time
Jason Weiss	10/29/13		[initials]	10.30.13 16:06

Page ☐ of ☐