



Figure A-1. Map showing Saddle Road (in blue) extending westward from Hilo to the intersection with SR 190. The PTA Quarry is shown to the southwest of Mauna Kea at approximate MP 38. (MapQuest, 2005)

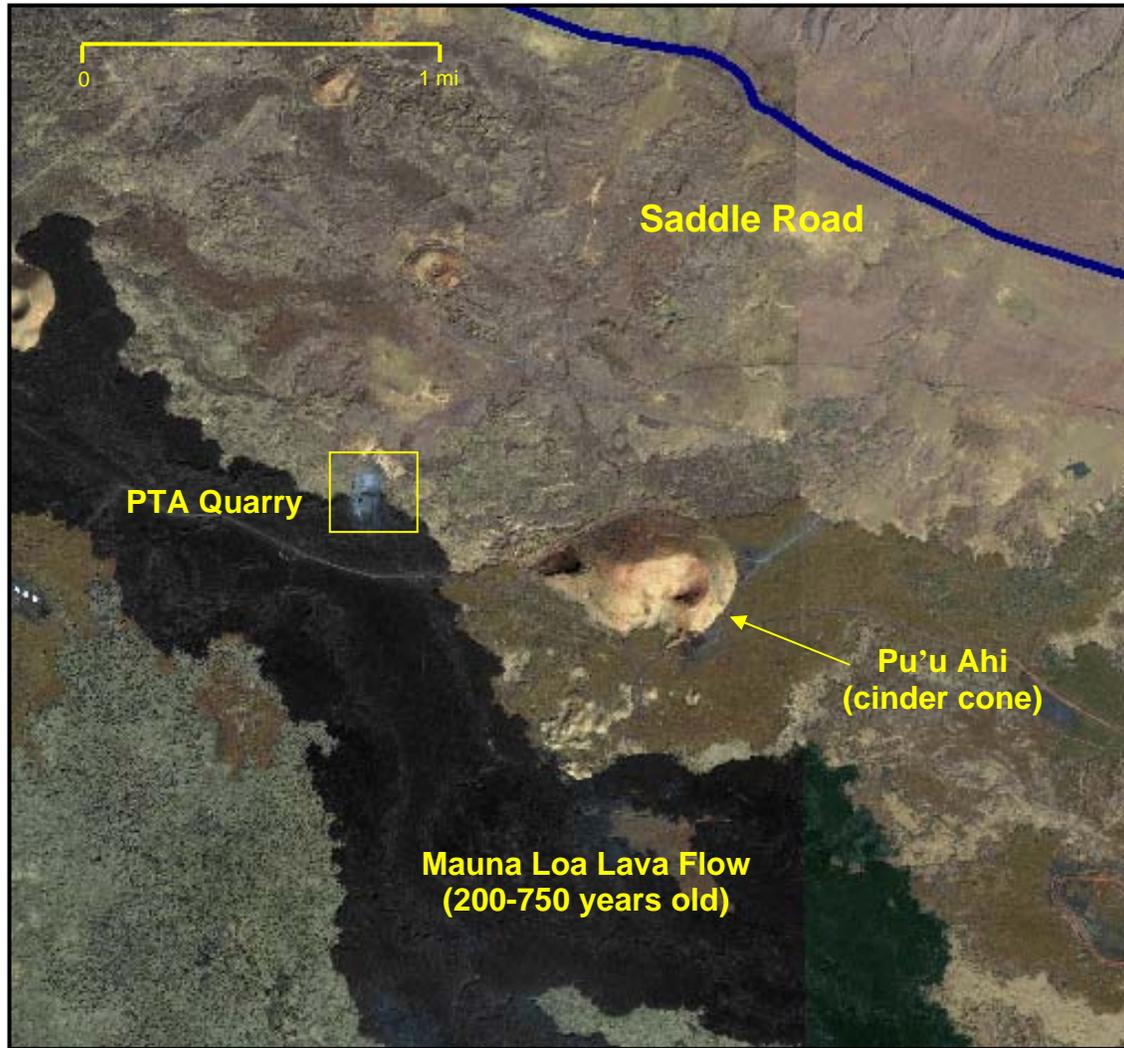


Figure A-2. Aerial photo showing typical lava flow and cinder cone topography in the vicinity of the PTA Quarry.

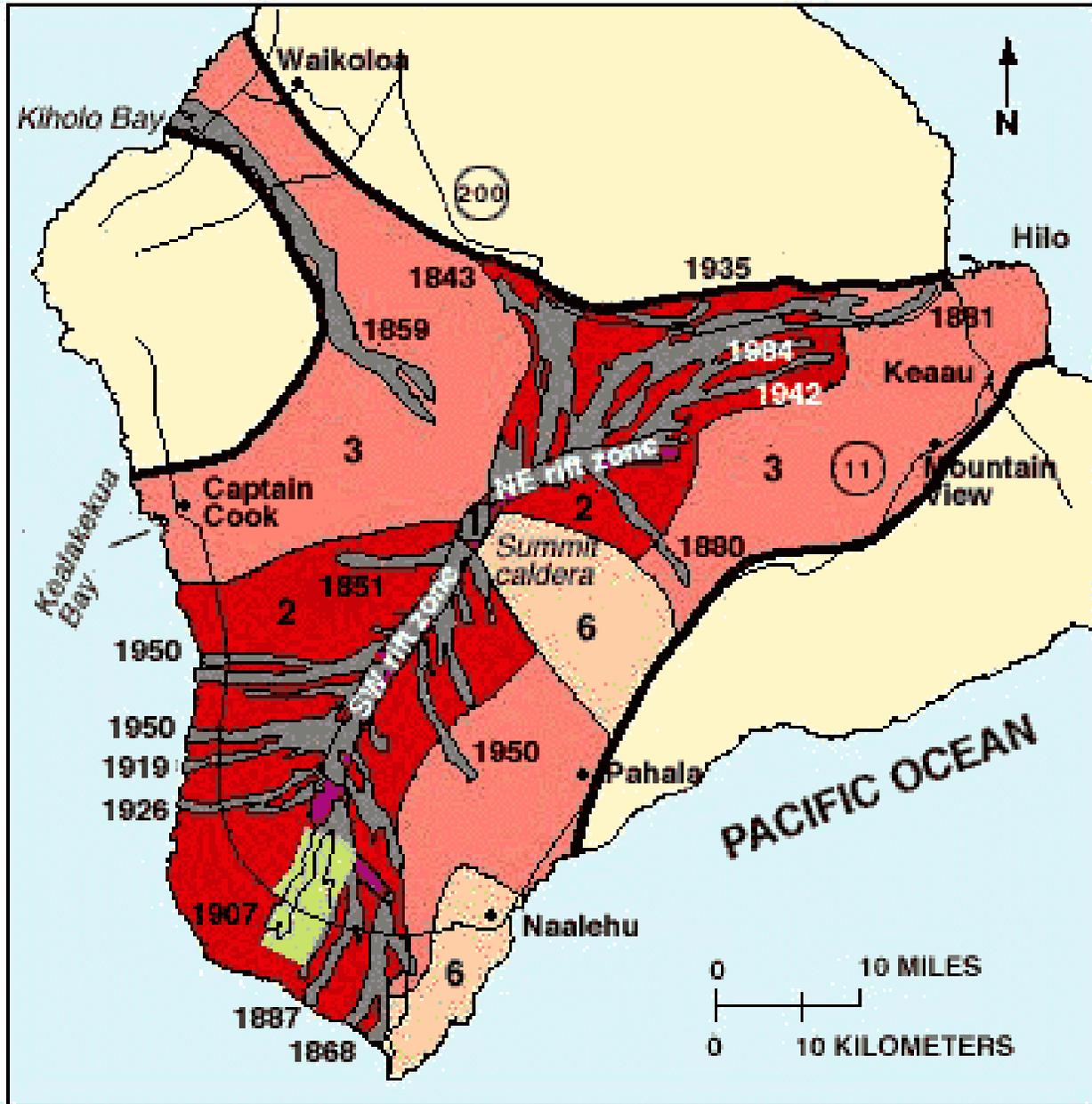


Figure A-3. Generalized map of Mauna Loa Volcano lava flows. Lava flows within the last 150 years are shown in gray and dated. Relative modern day hazard zones are indicated by colored and numbered zones. (USGS, 2005)

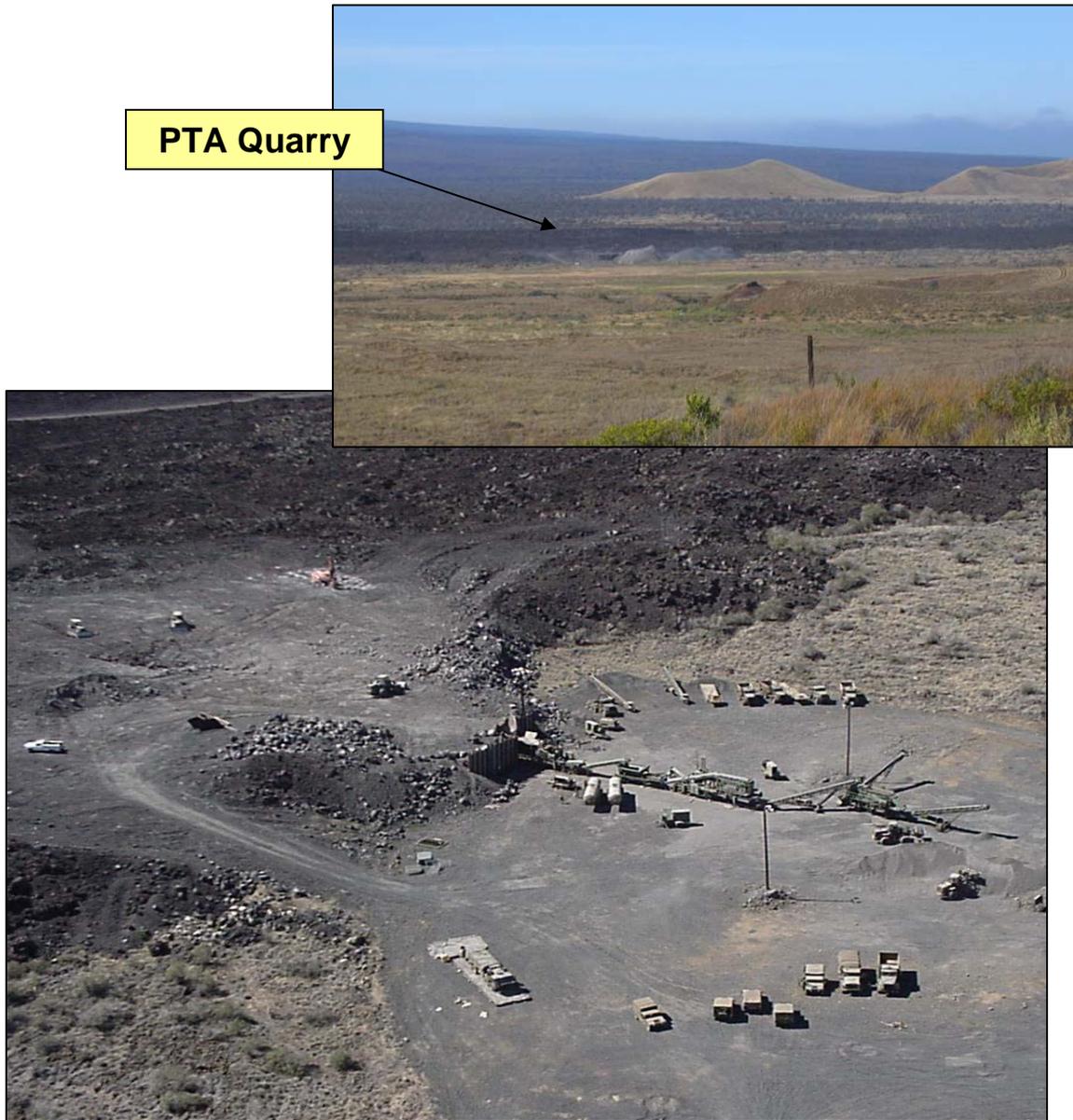


Figure A-4. Upper photos are looking south across the Humuula Saddle plateau region. The PTA quarry currently produces aggregate from the edge of an extensive a'ā lava flow originating from Mauna Loa from 1,500 to 3,000 years ago.

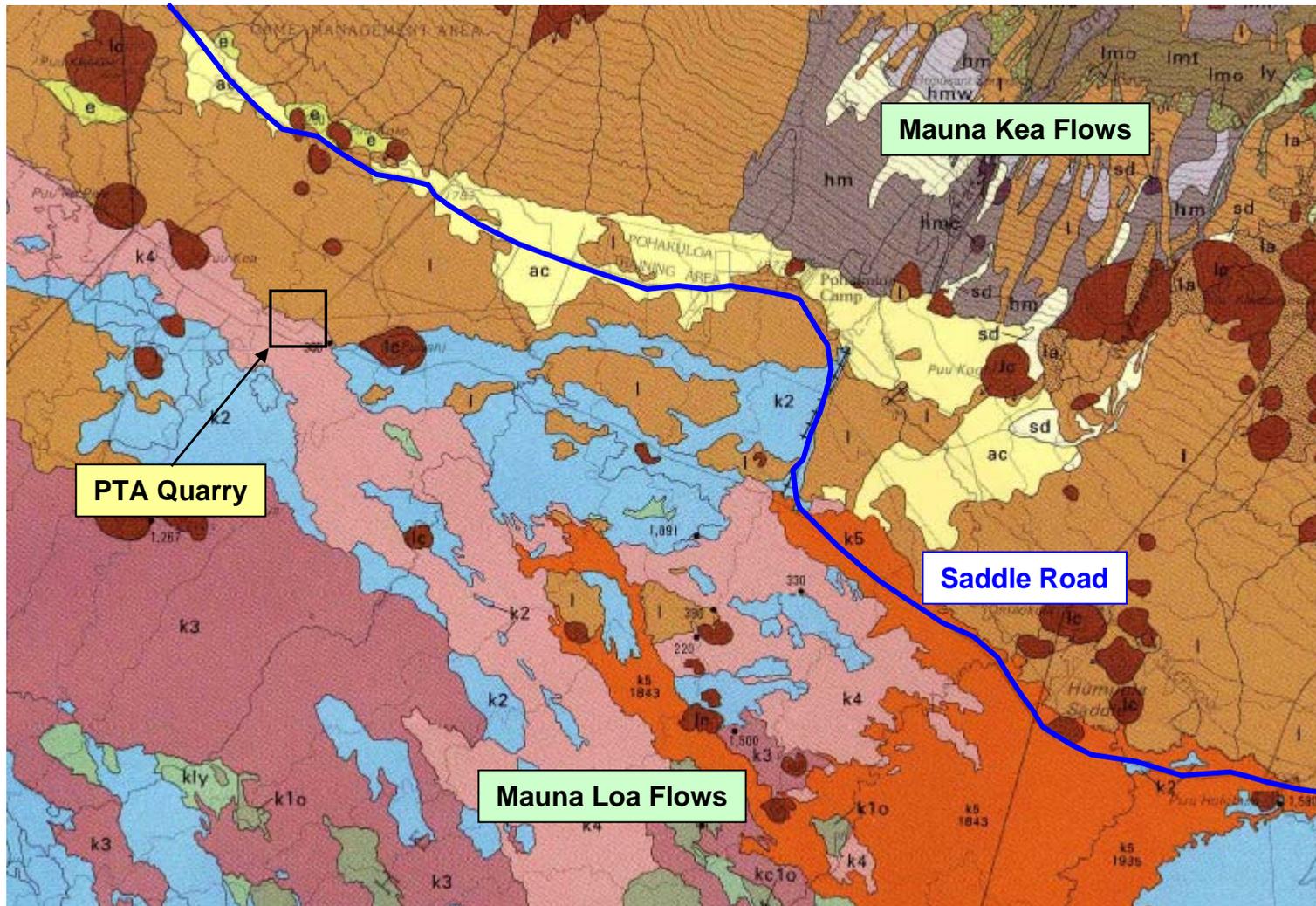
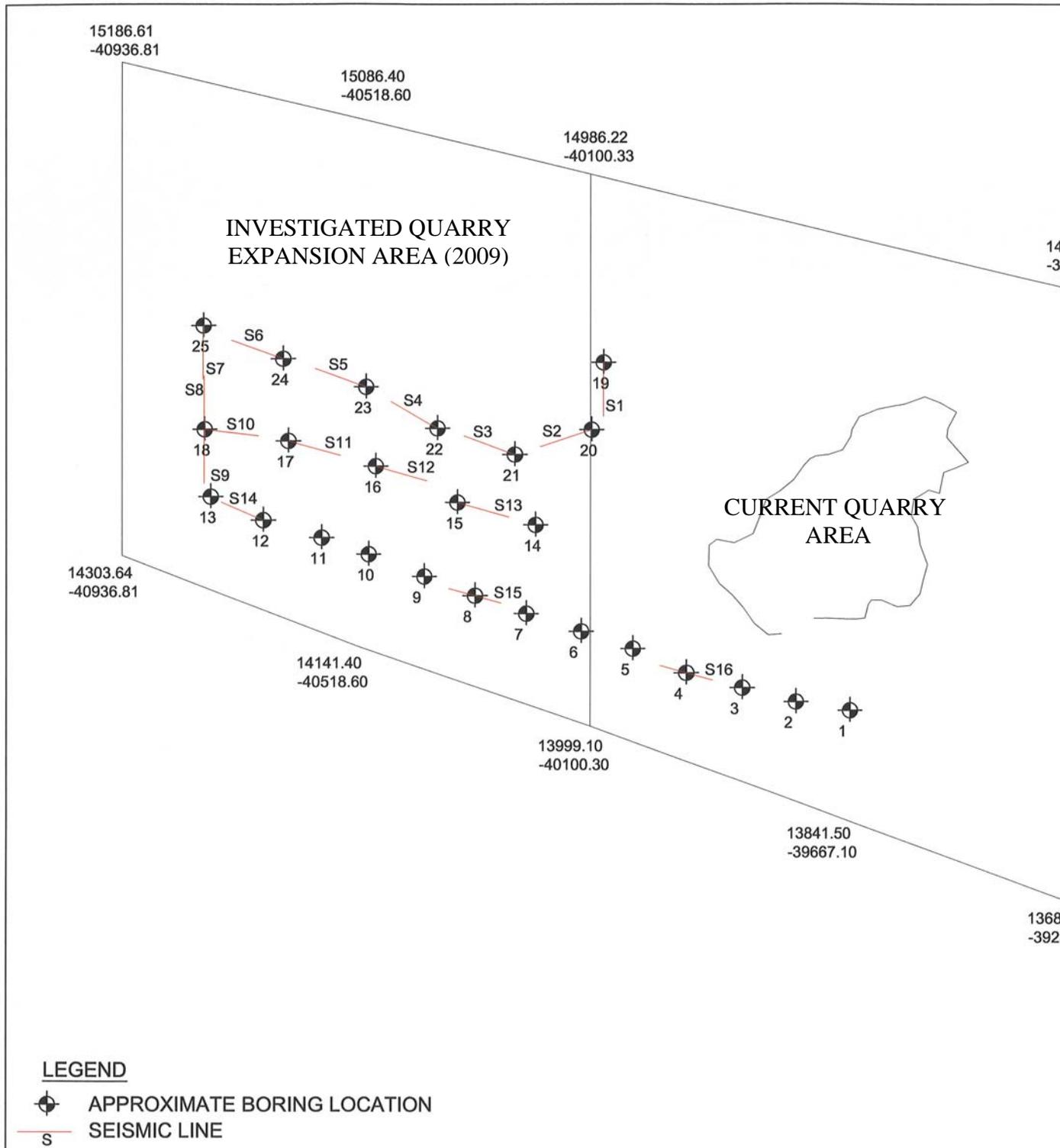
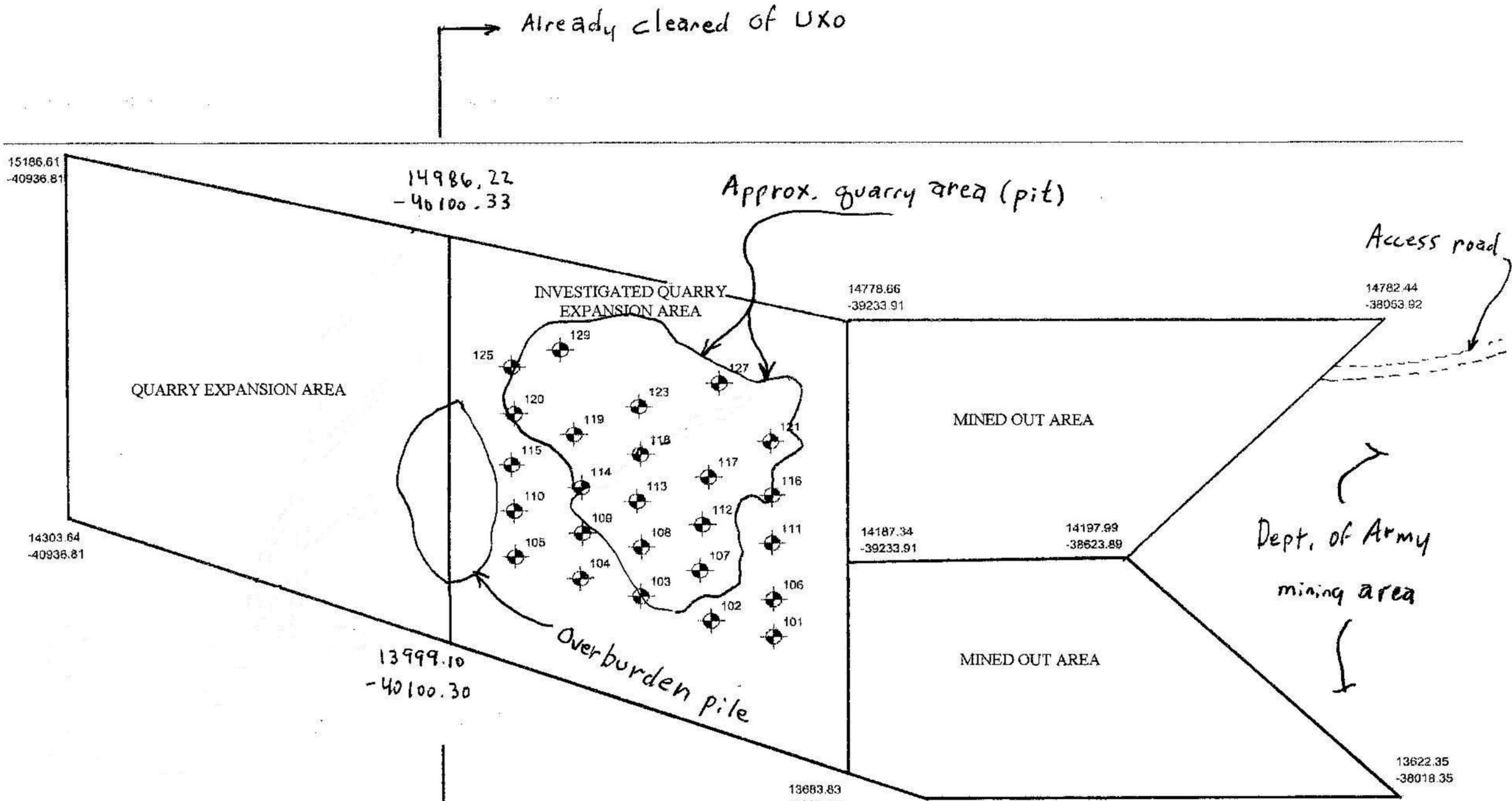


Figure A-5. Geologic map indicating general lava flow trends in the vicinity of the Humuula Saddle plateau and PTA quarry.



A-6. Plan map showing initial quarry areas, potential expansion areas, boring locations and approximate seismic line locations within one of the expansion areas.



LEGEND:  
 APPROXIMATE BORING LOCATION

REFERENCE: SITE PLAN TRANSMITTED BY U.S. FEDERAL HIGHWAY ADMINISTRATION, DEPARTMENT OF TRANSPORTATION ON OCTOBER 31, 2007.



**SITE PLAN**  
 SADDLE ROAD PROJECT  
 HI-A-AD 6(5)  
 POHAKULOA TRAINING AREA (PTA) QUARRY  
 ISLAND OF HAWAII

**GEOLABS, INC.**  
 Geotechnical Engineering

DATE	DRAWN BY	PLATE
NOVEMBER 2007	HYC	
SCALE	W.C.	
1" = 200'	3411-80	2

A-6. Plan map showing initial quarry areas, and possible subsequent expansion areas with approximate boring locations within one of the expansion areas.

# **Appendix B**

## **Corehole Field Logs**

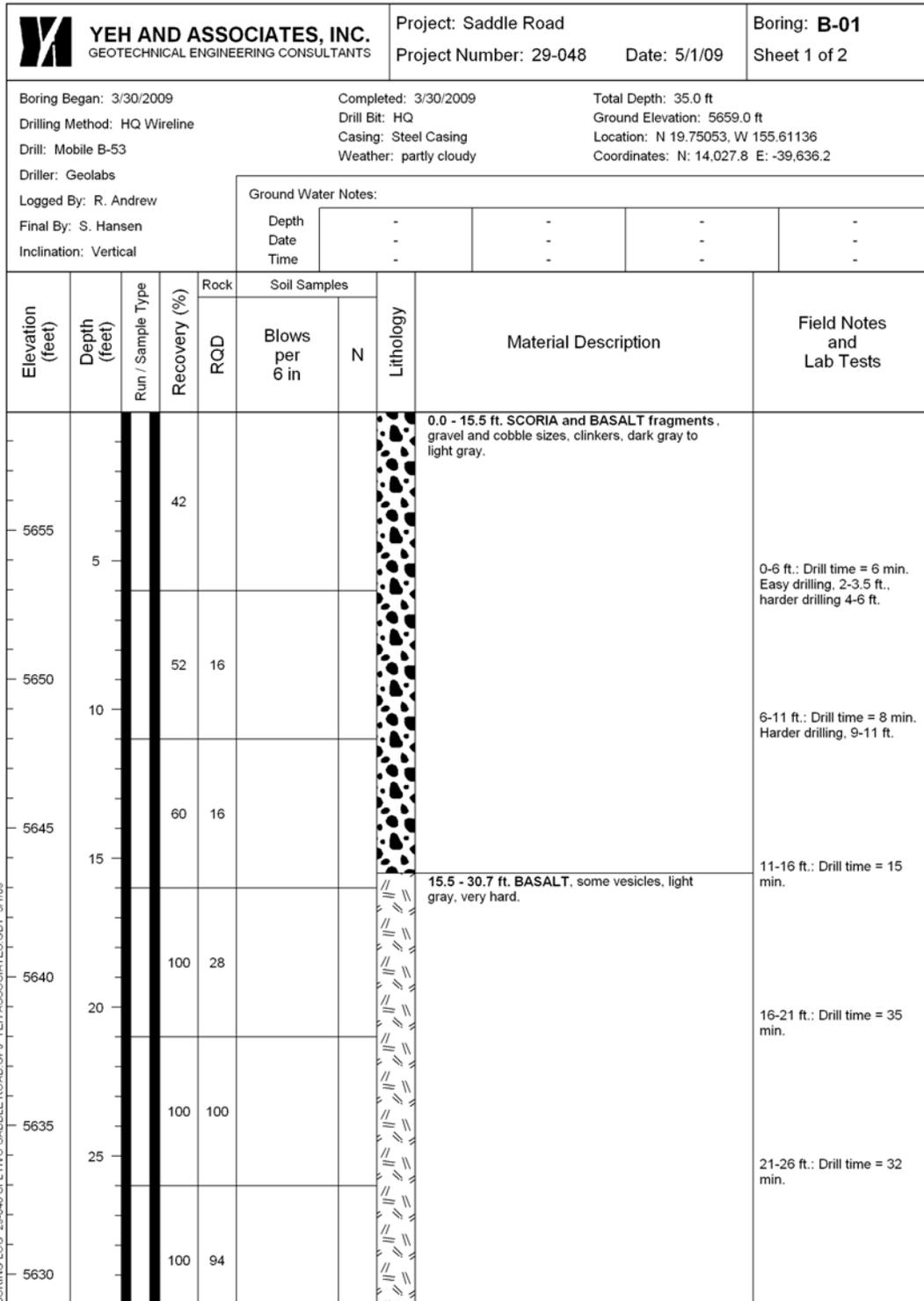


Figure B-1. Boring log for corehole B-01.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09				Boring: <b>B-01</b> Sheet 2 of 2			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5625	35		100	100				30.7 - 35.0 ft. <b>BASALT</b> , highly vesicular, light gray, very hard.	26-31 ft.: Drill time = 34 min.
								Bottom of Hole at 35.0 ft.	31-35 ft.: Drill time = 37 min.
5620	40								
5615	45								
5610	50								
5605	55								
5600	60								
5595	65								

BORING LOG 29-048 CFL HVO SADDLE ROAD.GPJ YEH ASSOCIATES.GDT 5/1/09

Continue boring log for corehole B-01.

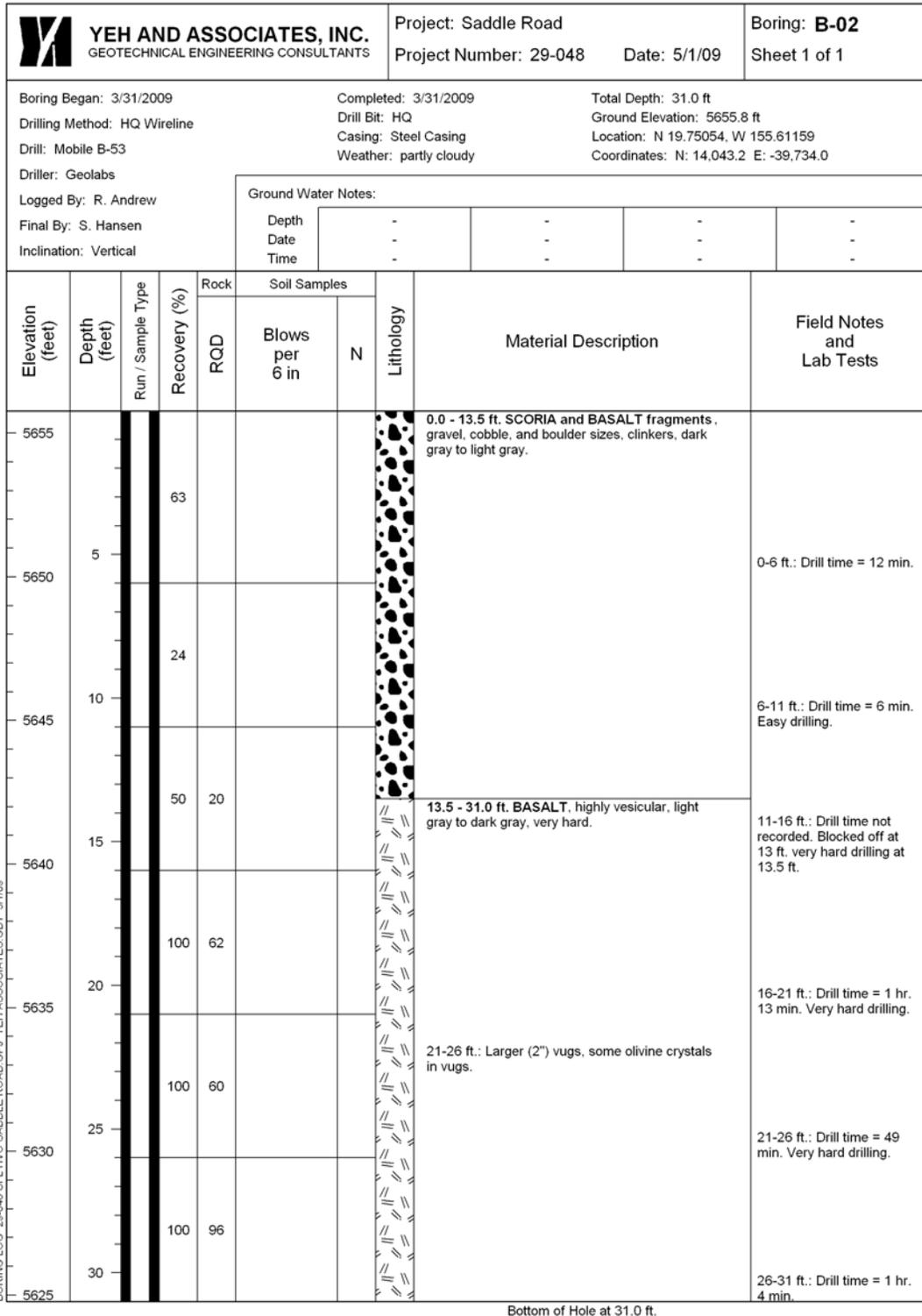


Figure B-2. Boring log for corehole B-02.

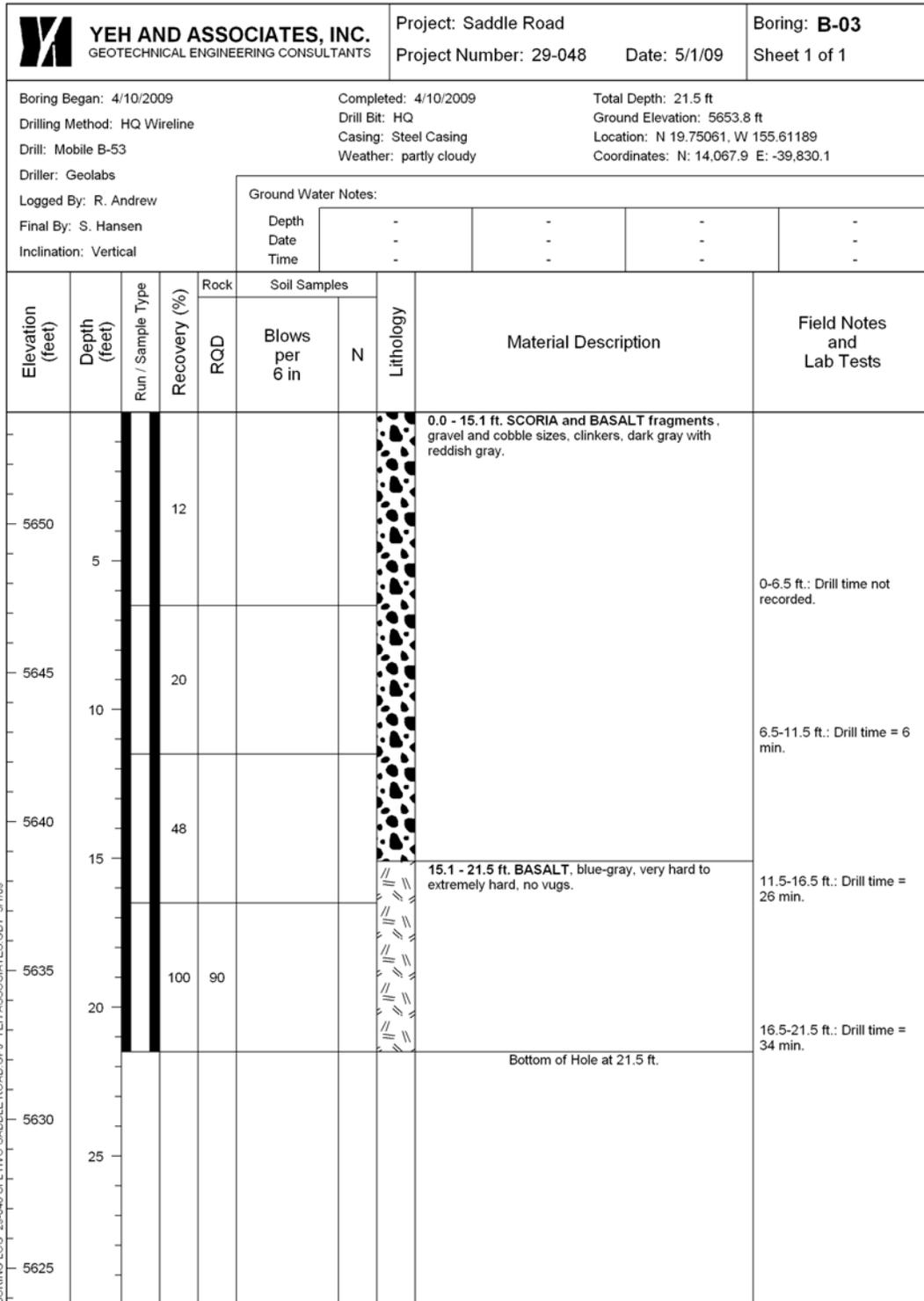


Figure B-3. Boring log for corehole B-03.

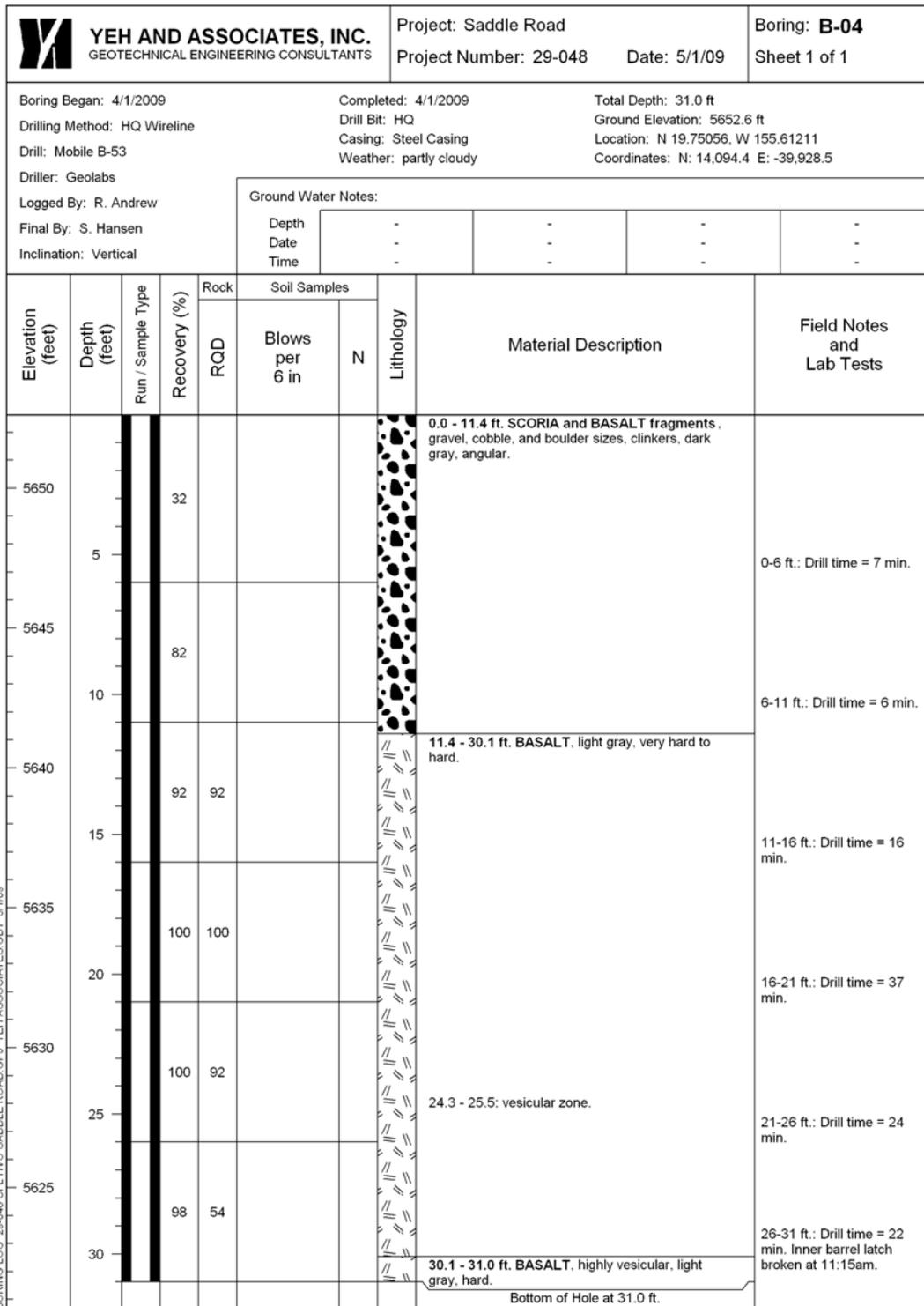


Figure B-4. Boring log for corehole B-04.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-05</b> Sheet 1 of 2				
Boring Began: 4/10/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/10/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 35.0 ft Ground Elevation: 5650.5 ft Location: N 19.75082, W 155.61244 Coordinates: N: 14,137.4 E: -40,023.9				
		Ground Water Notes:						
		Depth	-	-	-	-		
		Date	-	-	-	-		
		Time	-	-	-	-		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in			
5650			31				0.0 - 7.9 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray.	0-6.5 ft.: Drill time = 5 min.
5645	5							
5640	10		78				7.9 - 23.5 ft. BASALT, highly vesicular, gray to light gray, hard to very hard, some fractures, parallel to barrel. Medium vugs.	6.5-11.5 ft.: Drill time = 6 min.
5635	15		100	66				11.5-16.5 ft.: Drill time = 16 min.
5630	20		100	60				16.5-21.5 ft.: Drill time = 54 min.
5625	25		98	88			23.5 - 35.0 ft. BASALT, some vesicles, blue-gray, very hard, very small to medium vugs, fractures caused by drilling.	21.5-26.5 ft.: Drill time = 48 min. High drilling pressure.
			100	94				

Figure B-5. Boring log for corehole B-05.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09				Boring: <b>B-05</b> Sheet 2 of 2			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5620			100	100					26.5-31.5 ft.: Drill time = 53 min. High drilling pressure.
	35							Bottom of Hole at 35.0 ft.	31.5-35.0 ft.: Drill time = 48 min.
5615									
5610									
5605									
5600									
5595									
5590									
5585									

BORING LOG 29-048 CFL HVO SADDLE ROAD.GPJ YEH ASSOCIATES.GDT 5/1/09

Continued boring log for corehole B-05.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-06</b> Sheet 1 of 2				
Boring Began: 4/1/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/1/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 35.0 ft Ground Elevation: 5650.5 ft Location: N 19.75090, W 155.61272 Coordinates: N: 14,168.1 E: -40,116.5				
Ground Water Notes:								
		Depth	-	-	-	-		
		Date	-	-	-	-		
		Time	-	-	-	-		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				Blows per 6 in	N			
5650			15				0.0 - 18.9 ft. SCORIA and BASALT fragments, gravel and cobble sizes, clinkers, dark gray.	
	5							0-6 ft.: Drill time = 15 min.
5645			32					
	10							6-11 ft.: Drill time = 3 min.
5640			68					
	15							11-16 ft.: Drill time = 7 min.
5635			100	50			18.9 - 24.8 ft. BASALT, highly vesicular, gray, hard, small vugs.	
	20							16-21 ft.: Drill time = 13 min.
5630			100	88				
	25						24.8 - 35.0 ft. BASALT, light gray, hard to very hard, small vugs.	
5625			100	92				21-26 ft.: Drill time = 17 min.

Figure B-6. Boring log for corehole B-06.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09				Boring: <b>B-06</b> Sheet 2 of 2			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5620			100	83					26-31 ft.: Drill time = 42 min.
	35							Bottom of Hole at 35.0 ft.	31-35 ft.: Drill time = 26 mn.
5615									
5610									
5605									
5600									
5595									
5590									
5585									

BORING LOG 29-048 CFL HVO SADDLE ROAD.GPJ YEH ASSOCIATES.GDT 5/1/09

Continued boring log for corehole B-06.

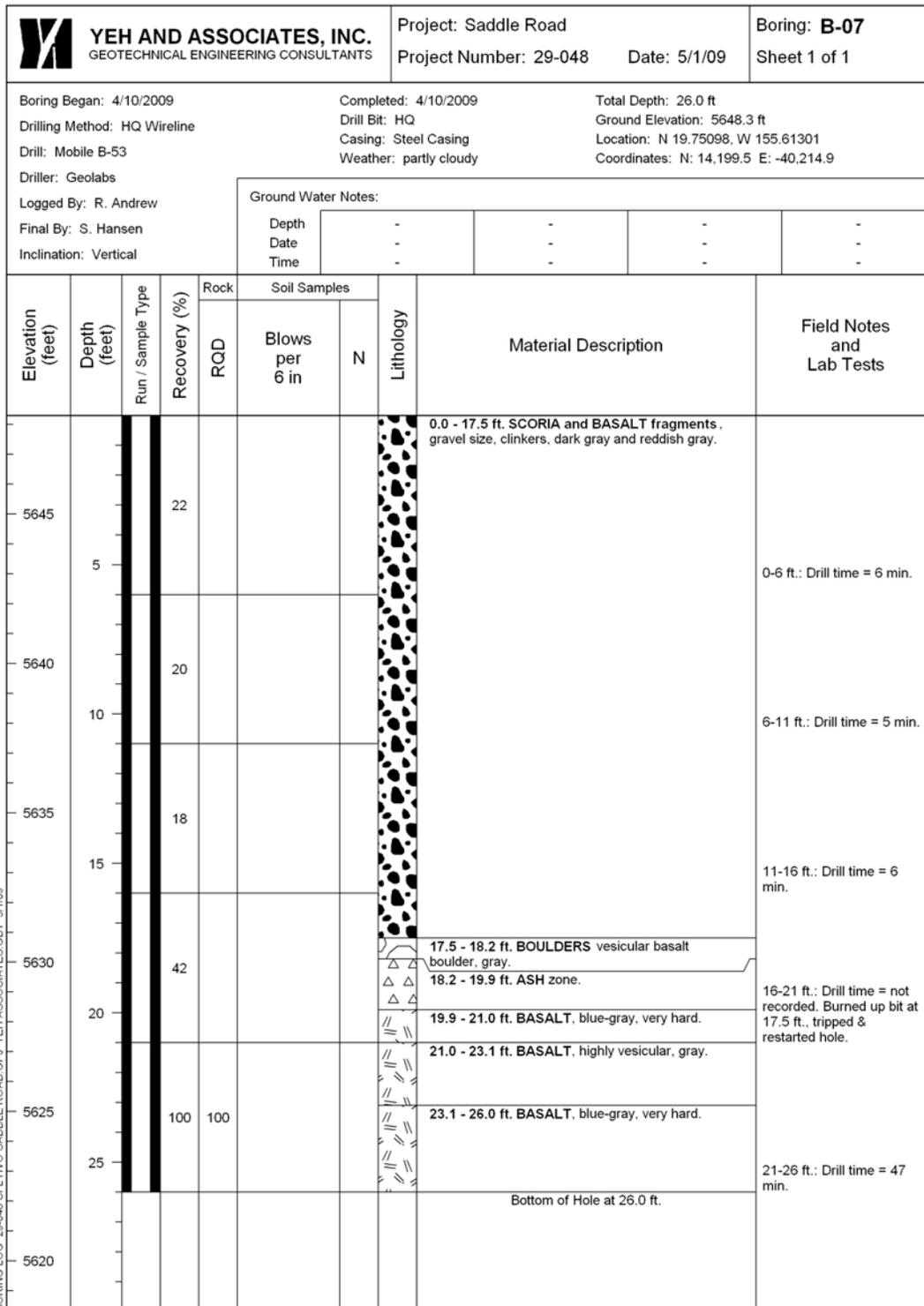


Figure B-7. Boring log for corehole B-07.

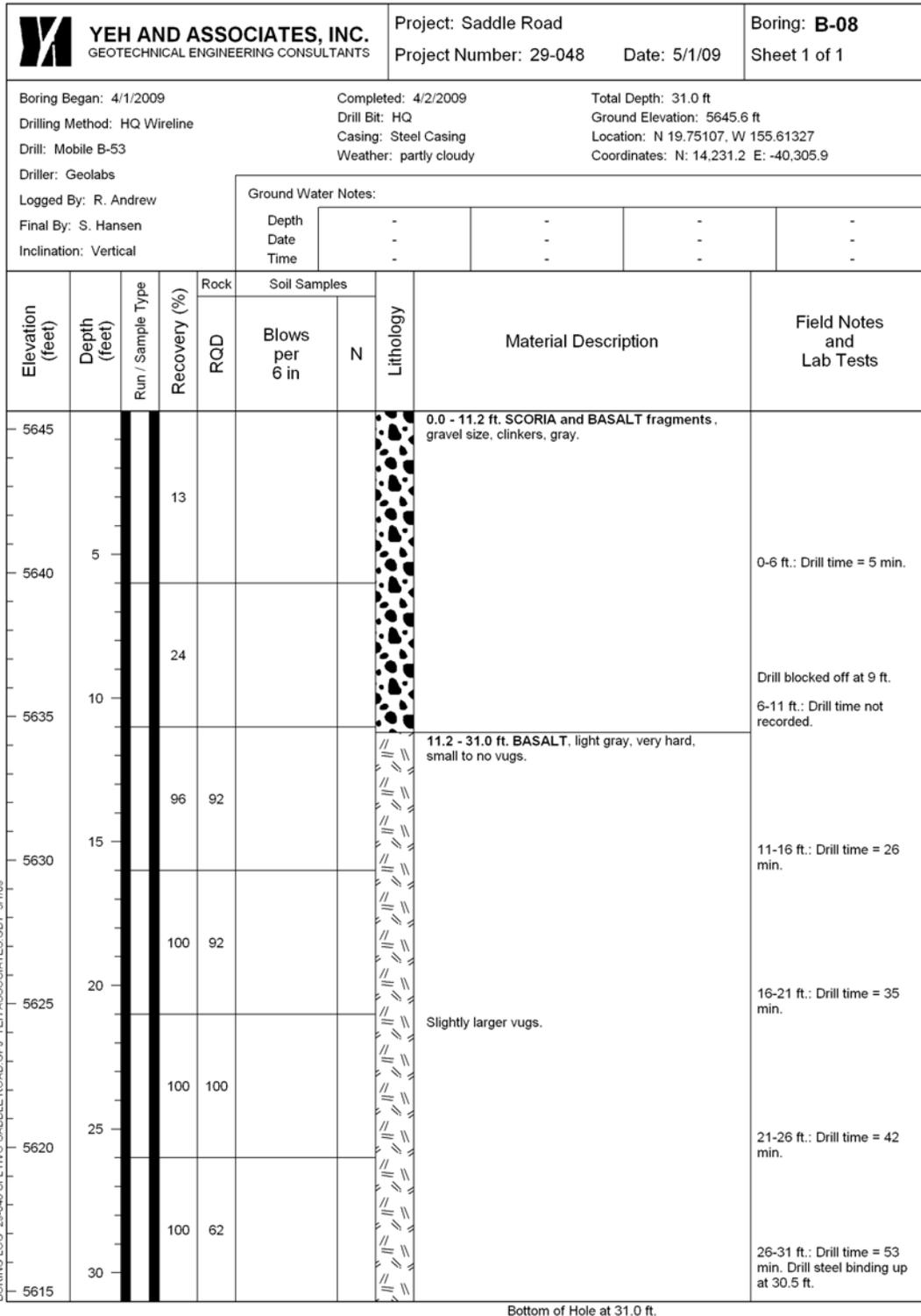


Figure B-8. Boring log for corehole B-08.

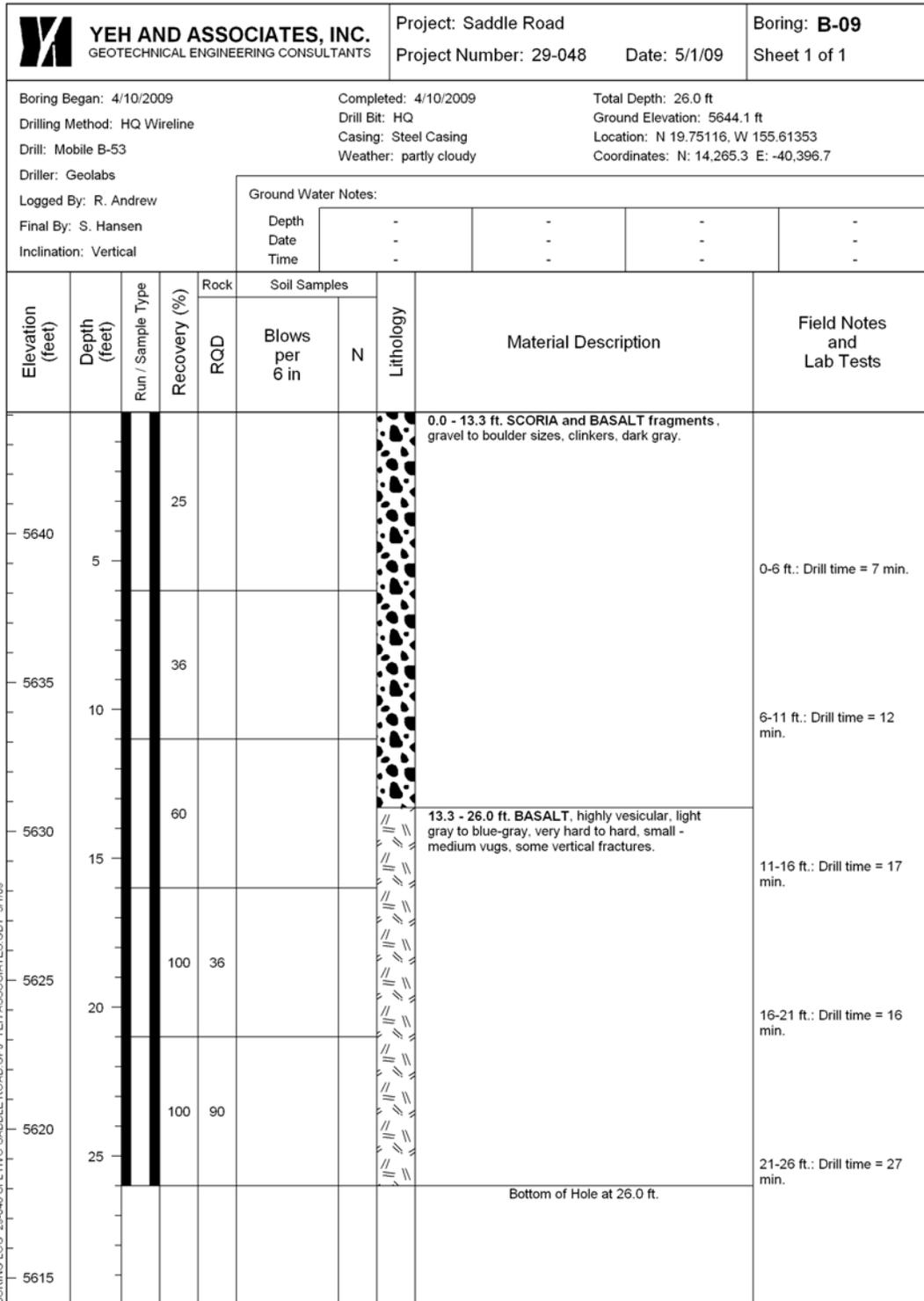


Figure B-9. Boring log for corehole B-09.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-10</b> Sheet 1 of 2					
Boring Began: 4/2/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/2/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 34.6 ft Ground Elevation: 5642.3 ft Location: N 19.75127, W 155.61382 Coordinates: N: 14,305.3 E: -40,497.3					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5640	5		17					0.0 - 17.0 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray and reddish gray.	0-6 ft.: Drill time = 8 min.
5635	10		26						6-11 ft.: Drill time = 13 min.
5630	15		22						11-16 ft.: Drill time = 17 min.
5625	20		76	70				17.0 - 19.9 ft. PUMICE, highly vesicular, reddish gray, medium hard, pumice matrix with scoria fragments. Welded clinker zone.	
5620	25		100	26				19.9 - 34.6 ft. BASALT, light gray, very hard, fractures parallel and orthogonal to core barrel. Small vugs. 22.8 ft.: 3" Ash layer.	16-21 ft.: Drill time = 16 min. Harder drilling at 17 ft.
5615			100	58					21-26 ft.: Drill time = 27 min.

BORING LOG: 29-048-CFL-HVO-SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Figure B-10. Boring log for corehole B-10.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09				Boring: <b>B-10</b> Sheet 2 of 2			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5610			100	81					26-31 ft.: Drill time = 49 min.  31-34.6 ft.: Drill time = 32 min.
	35							Bottom of Hole at 34.6 ft.	
	5605								
	40								
	5600								
	45								
	5595								
	50								
	5590								
	55								
	5585								
	60								
	5580								
	65								

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-10.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-11</b> Sheet 1 of 2					
Boring Began: 4/9/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/9/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5640.4 ft Location: N 19.75135, W 155.61409 Coordinates: N: 14,334.8 E: -40,581.3					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5640			12					0.0 - 15.3 ft. SCORIA and BASALT fragments, gravel to boulder sizes, clinkers, dark gray and reddish brown.	
5635	5								0-6 ft.: Drill time not recorded
5630	10		58						6-11 ft.: Drill time not recorded
5625	15		64						11-16 ft.: Drill time not recorded
5620	20		100	66				15.3 - 18.1 ft. BASALT, highly vesicular, light gray, hard, med-large vugs.	16-21 ft.: Drill time not recorded
5615	25		100	80				18.1 - 26.0 ft. BASALT, blue-gray, very hard.	21-26 ft.: Drill time not recorded
			100	90				26.0 - 36.0 ft. BASALT, highly vesicular, blue-gray, very hard.	

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Figure B-11. Boring log for corehole B-11

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048    Date: 5/1/09			Boring: <b>B-11</b> Sheet 2 of 2			
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			RQD	Recovery (%)	Blows per 6 in			
5610				100	70			26-31 ft.: Drill time not recorded
5605	35							31-36 ft.: Drill time not recorded
							Bottom of Hole at 36.0 ft.	
5600	40							
5595	45							
5590	50							
5585	55							
5580	60							
5575	65							

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-11.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-12</b> Sheet 1 of 1					
Boring Began: 4/2/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/2/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 26.0 ft Ground Elevation: 5636.4 ft Location: N 19.75143, W 155.61436 Coordinates: N: 14,365.9 E: -40,684.2					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5635	5		77					0.0 - 11.3 ft. SCORIA and BASALT fragments, gravel, cobble, and boulder sizes, clinkers, dark gray.	0-6 ft.: Drill time = 16 min.
5630	10		86						6-11 ft.: Drill time = 12 min.
5625	15		96	38			11.3 - 14.7 ft. BASALT, highly vesicular, light gray.		11-16 ft.: Drill time = 37 min.
5620	20		100	100			14.7 - 21.3 ft. BASALT, blue-gray, very hard.		
5615	25		100	16			21.3 - 26.0 ft. BASALT, highly vesicular, gray, moderately fractured.		16-21 ft.: Drill time = 47 min.
5610								Bottom of Hole at 26.0 ft.	21-26 ft.: Drill time = 31 min. Inner barrel stuck at 26 ft.

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Figure B-12. Boring log for corehole B-12.

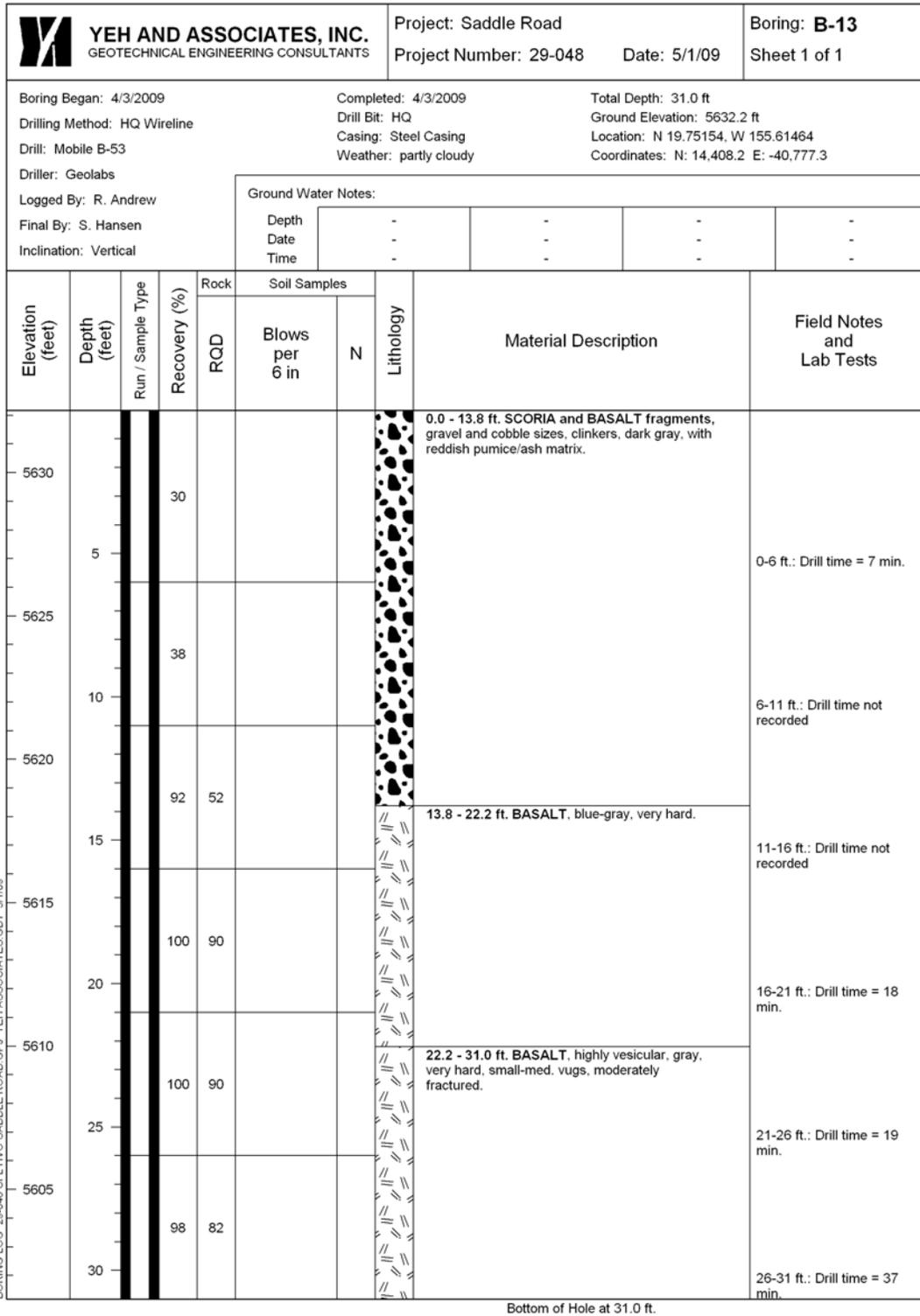


Figure B-13. Boring log for corehole B-13.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-14</b> Sheet 1 of 2				
Boring Began: 4/8/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/9/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5648.0 ft Location: N 19.75141, W 155.61290 Coordinates: N: 14,357.9 E: -40,198.4				
Ground Water Notes:								
		Depth	-	-	-	-		
		Date	-	-	-	-		
		Time	-	-	-	-		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in			
5645	5		13				0.0 - 11.0 ft. SCORIA and BASALT fragments, gravel and cobble sizes, clinkers, dark gray.	0-6 ft.: Drill time = 5 min.
5640	10		38				11.0 - 13.4 ft. BASALT FRAGMENTS, boulder size, blue-gray.	6-11 ft.: Drill time = 11 min.
5635	15		70				13.4 - 15.5 ft. BASALT clast in reddish ash matrix, welded clinker zone.	11-16 ft.: Drill time = 22 min.
							15.5 - 16.8 ft. BASALT, blue-gray, very hard.	
5630	20		78				16.8 - 20.0 ft. BASALT clast in red pumice matrix, welded clinker zone.	16-21 ft.: Drill time = 18 min.
							20.0 - 27.1 ft. BASALT, blue-gray, very hard, no vugs.	
5625	25		100	90			27.1 - 36.0 ft. BASALT, highly vesicular, blue-gray, very hard.	21-26 ft.: Drill time = 57 min. Very slow drilling.
5620			100	88				

Figure B-14. Boring log for corehole B-14.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048    Date: 5/1/09			Boring: <b>B-14</b> Sheet 2 of 2				
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5615	35		100	92					26-31 ft.: Drill time = 47 min.  31-36 ft.: Drill time = 43 min.
								Bottom of Hole at 36.0 ft.	
5610	40								
5605	45								
5600	50								
5595	55								
5590	60								
5585	65								

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ YEH ASSOCIATES.GDT 5/1/09

Continued boring log for corehole B-14.

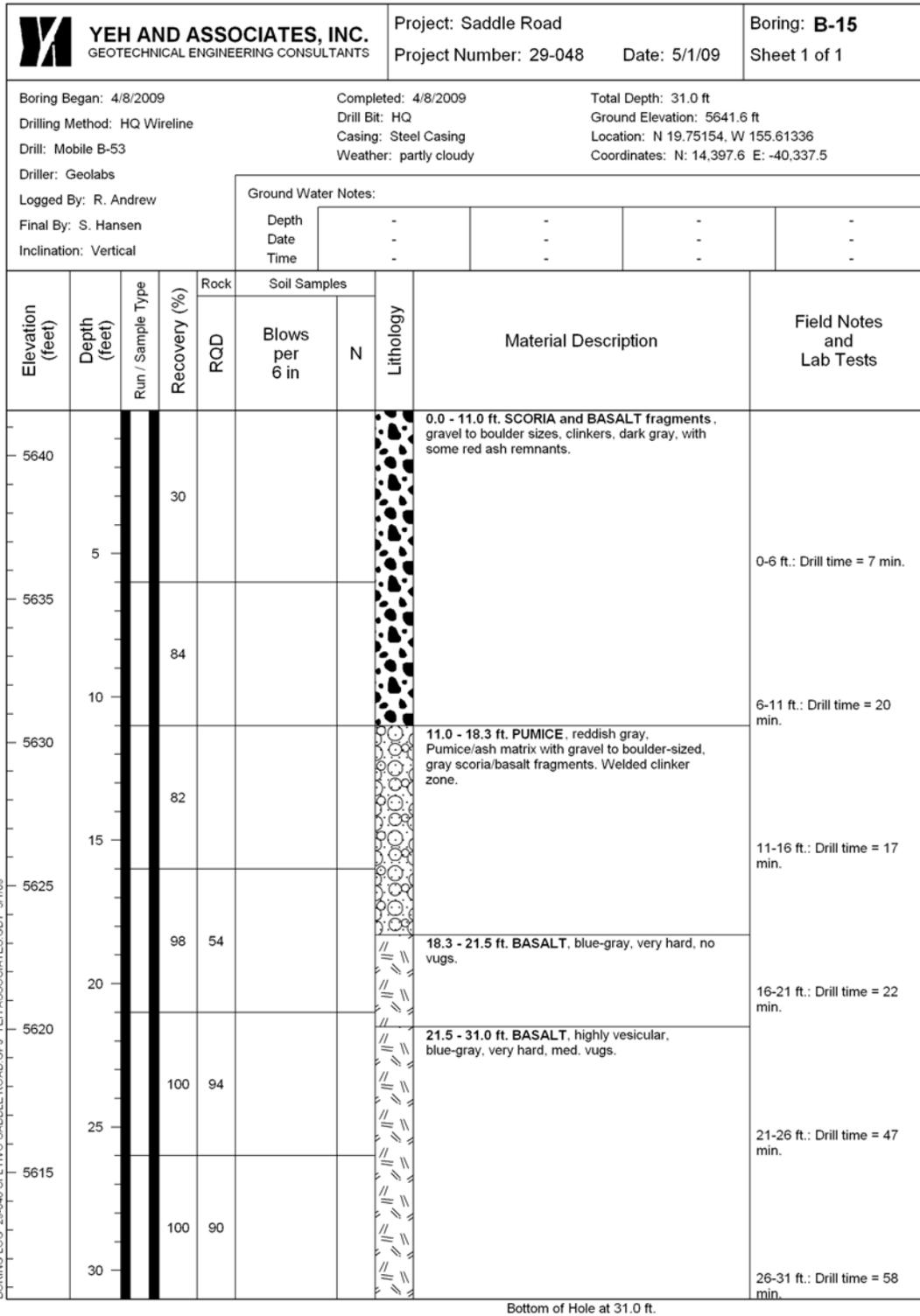


Figure B-15. Boring log for corehole B-15.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048    Date: 5/1/09		Boring: <b>B-16</b> Sheet 1 of 1				
Boring Began: 4/8/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/8/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 26.0 ft Ground Elevation: 5641.3 ft Location: N 19.75171, W 155.61377 Coordinates: N: 14,462.3 E: -40,484.6				
Ground Water Notes:								
		Depth	-	-	-	-		
		Date	-	-	-	-		
		Time	-	-	-	-		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in			
5640	5		13				0.0 - 6.4 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray.	0-6 ft.: Drill time = 8 min.
5635	10		100	90			6.4 - 14.2 ft. BASALT, highly vesicular, gray to light gray, very hard, medium-large vugs, fractured.	6-11 ft.: Drill time = 34 min.
5630	15		100	24			14.2 - 26.0 ft. BASALT, highly vesicular, blue-gray, hard to very hard, medium vugs.	11-16 ft.: Drill time = 16 min.
5625	20		100	90				16-21 ft.: Drill time = 31 min.
5620	25		100	94				21-26 ft.: Drill time = 1 hr. 24 min. Could not latch inner barrel, pulled casing.
5615							Bottom of Hole at 26.0 ft.	

BORING LOG: 29-048-CFL-HVO-SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Figure B-16. Boring log for corehole B-16.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-17</b> Sheet 1 of 1				
Boring Began: 4/7/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/7/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 26.0 ft Ground Elevation: 5637.2 ft Location: N 19.75182, W 155.61423 Coordinates: N: 14,507.5 E: -40,640.1				
Ground Water Notes:								
		Depth      - Date        - Time        -						
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in			
5635	5		28				0.0 - 10.2 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray.	0-6 ft.: Drill time = 7 min.
5630	10		40				10.2 - 11.6 ft. BASALT, highly vesicular, light gray, hard.	6-11 ft.: Drill time = 11 min.
5625	15		100	88			11.6 - 21.0 ft. BASALT, blue-gray, very hard.	11-16 ft.: Drill time = 26 min.
5620	20		100	40			Becoming more vuggy, small vugs.	16-21 ft.: Drill time = 29 min.
5615	25		92	20			21.0 - 26.0 ft. BASALT, highly vesicular, light gray, very hard, fractured.	21-26 ft.: Drill time = 33 min. Ears/latch collar broke, core dropped in bit. Pulled casing/stopped drilling at 26 ft.
5610							Bottom of Hole at 26.0 ft.	

Figure B-17. Boring log for corehole B-17.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-18</b> Sheet 1 of 2				
Boring Began: 4/9/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/9/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5628.8 ft Location: N 19.75187, W 155.61462? Coordinates: N: 14,528.5 E: -40,788.2				
Ground Water Notes:								
		Depth	-	-	-	-		
		Date	-	-	-	-		
		Time	-	-	-	-		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in			
5625	5		50				0.0 - 16.0 ft. SCORIA and BASALT fragments, gravel and cobble sizes, clinkers, dark gray.	0-6 ft.: Drill time = 5 min.
5620	10		44				1 light gray basalt boulder.	6-11 ft.: Drill time = 11 min.
5615	15		54				16.0 - 21.0 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray.	11-16 ft.: Drill time = 4 min.
5610	20		36				21.0 - 22.7 ft. BASALT clast in red pumice matrix, welded clinker zone.	16-21 ft.: Drill time = 5 min.
5605	25		100	68			22.7 - 29.8 ft. BASALT, blue-gray, very hard.	21-26 ft.: Drill time = 22 min. Slower drilling at end of run.
5600			100	84				

Figure B-18. Boring log for corehole B-18.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09			Boring: <b>B-18</b> Sheet 2 of 2				
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5595	35		100	52			 29.8 - 35.4 ft. <b>BASALT</b> , highly vesicular, light gray, very hard, med. vugs. Some fractures due to driller lifting.	26-31 ft.: Drill time = 49 min.	
							 35.4 - 36.0 ft. <b>SCORIA</b> , red, soft. Bottom of Hole at 36.0 ft.	31-36 ft.: Drill time = 43 min.	
5590	40								
5585	45								
5580	50								
5575	55								
5570	60								
5565	65								

BORING LOG: 29-048-CFL-HVO-SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-18.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-19</b> Sheet 1 of 2					
Boring Began: 4/7/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/7/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5655.5 ft Location: N 19.75222, W 155.61261 Coordinates: N: 14,648.3 E: -40,076.7					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5655			57					0.0 - 10.4 ft. SCORIA and BASALT fragments, gravel to boulder sizes, clinkers, light gray.	
	5								0-6 ft.: Drill time = 11 min.
5650			70						
	10							10.4 - 21.4 ft. BASALT, highly vesicular, light gray, hard, small vugs.	6-11 ft.: Drill time = 10 min.
5645			100	72					
	15								11-16 ft.: Drill time = 17 min.
5640			100	88					
	20							21.4 - 22.9 ft. BASALT, blue-gray, very hard.	16-21 ft.: Drill time = 22 min.
5635			62	32				22.9 - 26.4 ft. SCORIA and BASALT fragments, gravel size, clinkers, gray, with reddish ash.	
	25								21-26 ft.: Drill time = 16 min. 22.9-26 ft.: Fast drilling
5630			72	64				26.4 - 34.4 ft. BASALT, blue-gray, very hard, no fractures.	

Figure B-19. Boring log for corehole B-19.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048    Date: 5/1/09			Boring: <b>B-19</b> Sheet 2 of 2				
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5625			98	98					26-31 ft.: Drill time = 36 min.
5620	35						 34.4 - 36.0 ft. <b>BASALT</b> , highly vesicular, light gray, very hard.	31-36 ft.: Drill time = 57 min.	
							Bottom of Hole at 36.0 ft.		
5615	40								
5610	45								
5605	50								
5600	55								
5595	60								
5590	65								

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-19.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-20</b> Sheet 1 of 2					
Boring Began: 4/4/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/6/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 35.5 ft Ground Elevation: 5651.8 ft Location: N 19.75190, W 155.61264 Coordinates: N: 14,528.2 E: -40,098.0					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5650	5		18					0.0 - 9.2 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray.	0-5.5 ft.: Drill time = 7 min.
5645	10		66					9.2 - 15.7 ft. BASALT, highly vesicular, gray, hard to very hard, moderately fractured, small-med. vugs.	5.5-10.5 ft.: Drill time = 17 min.
5640	15		100	70				15.7 - 19.5 ft. BASALT fragments in ash/pumice matrix, reddish matrix, gray clasts. Welded clinker zone.	10.5-15.5 ft.: Drill time = 23 min.
5635	20		54	0				19.5 - 31.4 ft. BASALT, light gray to blue-gray, very hard, joints parallel to barrel, few fractures.	15.5-20.5 ft.: Drill time = 35 min.
5630	25		100	86					Drilled ~2.5' in 45 min., tripped, changed bit. very hard drilling. 20.5-25.5 ft.: Drill time = 1 hr. 55 min. with trip.
5625			100	28					25.5-30.5 ft.: Drill time =

Figure B-20. Boring log for corehole B-20.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048    Date: 5/1/09			Boring: <b>B-20</b> Sheet 2 of 2				
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5620	35		100	92			 31.4 - 35.5 ft. <b>BASALT</b> , highly vesicular, light gray, very hard.	32 min.  30.5-35.5 ft.: Drill time = 43 min.	
5615							Bottom of Hole at 35.5 ft.		
5610									
5605									
5600									
5595									
5590									
65									

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-20.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-21</b> Sheet 1 of 2				
Boring Began: 4/7/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/7/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5648.8 ft Location: N 19.75177, W 155.61305 Coordinates: N: 14,483.4 E: -40,235.4				
Ground Water Notes:								
		Depth	-	-	-	-		
		Date	-	-	-	-		
		Time	-	-	-	-		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in			
5645	5		52				0.0 - 11.0 ft. SCORIA and BASALT fragments, gravel to boulder sizes, clinkers, dark gray.	0-6 ft.: Drill time = 11 min.
5640	10		68					6-11 ft.: Drill time = 23 min.
5635	15		100	48			11.0 - 16.0 ft. BASALT, highly vesicular, gray, hard, small vugs, fractures parallel to barrel.	11-16 ft.: Drill time = 17 min.
5630	20		14				16.0 - 21.0 ft. SCORIA and BASALT fragments, gravel size, clinkers, dark gray and reddish gray.	16-21 ft.: Drill time = 11 min. Fast drilling.
5625	25		40				21.0 - 27.8 ft. BASALT clasts in reddish pumice matrix, dark gray gravel to cobble-sized clasts. Welded clinker zone.	21-26 ft.: Drill time = 13 min. Fast/easy drilling.
5620			96	68			27.8 - 31.0 ft. BASALT, blue-gray, very hard.	

Figure B-21. Boring log for corehole B-21.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09				Boring: <b>B-21</b> Sheet 2 of 2			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5615	35		100	94			 31.0 - 35.7 ft. <b>BASALT</b> , highly vesicular, light gray, very hard.	26-31 ft.: Drill time = 23 min.	
5610	40						 35.7 - 36.0 ft. <b>SCORIA</b> , reddish gray. Bottom of Hole at 36.0 ft.	31-36 ft.: Drill time 26 min.	
5605	45								
5600	50								
5595	55								
5590	60								
5585	65								

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-21.

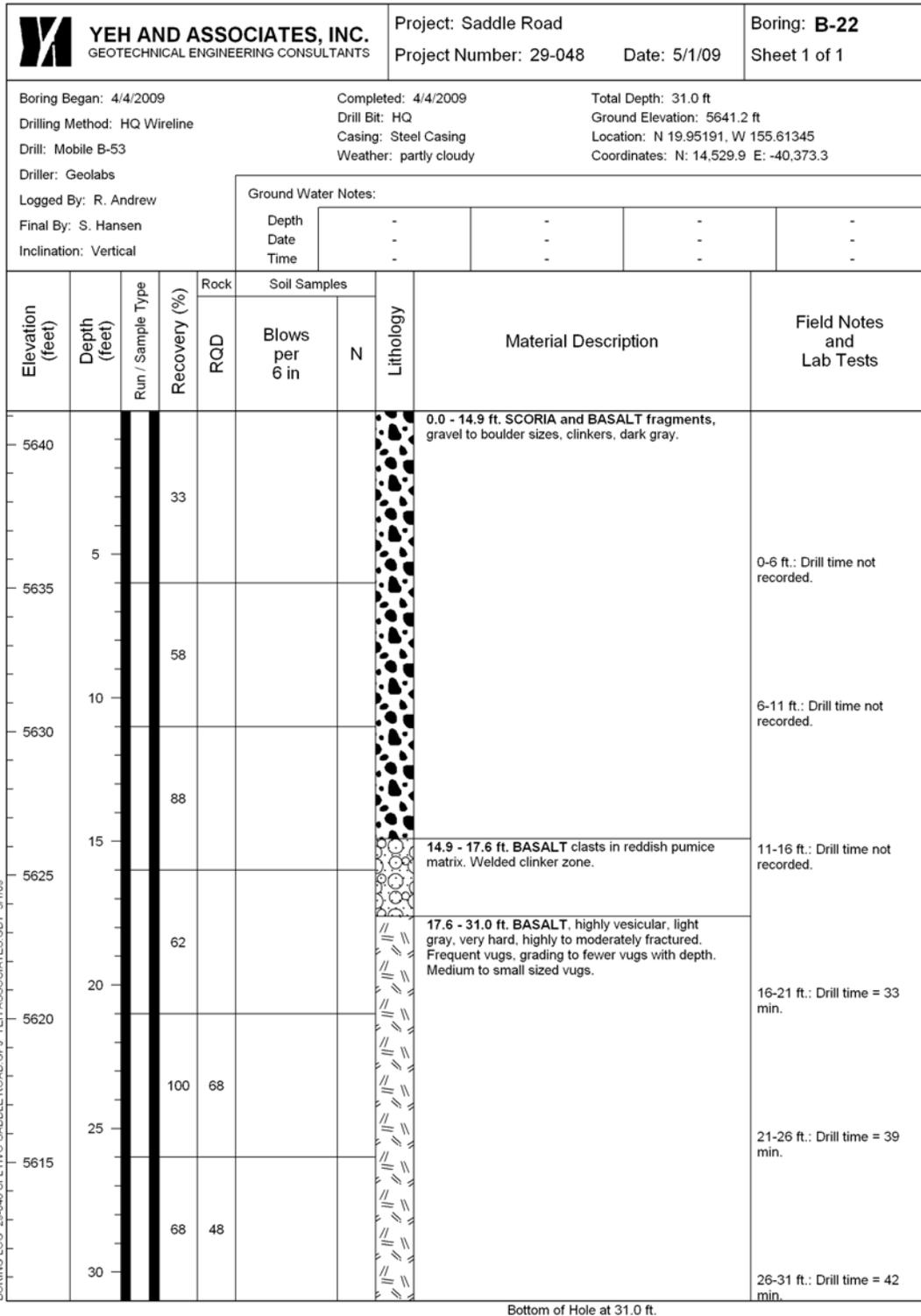


Figure B-22. Boring log for corehole B-22.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048    Date: 5/1/09		Boring: <b>B-23</b> Sheet 1 of 2					
Boring Began: 4/3/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/3/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5637.6 ft Location: N 19.75212, W 155.61383 Coordinates: N: 14,604.1 E: -40,502.1					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5635	5		45					0.0 - 21.6 ft. SCORIA and BASALT fragments, gravel to boulder sizes, clinkers, dark gray to light gray.	0-6 ft.: Drill time not recorded.
5630	10		80						6-11 ft.: Drill time not recorded.
5625	15		34						11-16 ft.: Drill time not recorded.
5620	20		68						16-21 ft.: Drill time not recorded.
5615	25		88	0				21.6 - 31.9 ft. BASALT, highly vesicular, light gray, very hard, joints parallel to barrel.	21-26 ft.: Drill time = 33 min.
5610			100	76					

Figure B-23. Boring log for corehole B-23.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09			Boring: <b>B-23</b> Sheet 2 of 2				
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Rock	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				RQD	Blows per 6 in	N			
5605	35		50	18			 31.9 - 36.0 ft. BASALT, highly vesicular, dark gray, hard, fragments.	26-31 ft.: Drill time = 42 min.  31-36 ft.: Drill time = 22 min.	
							Bottom of Hole at 36.0 ft.		

BORING LOG: 29-048-CFL-HVO-SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-23.

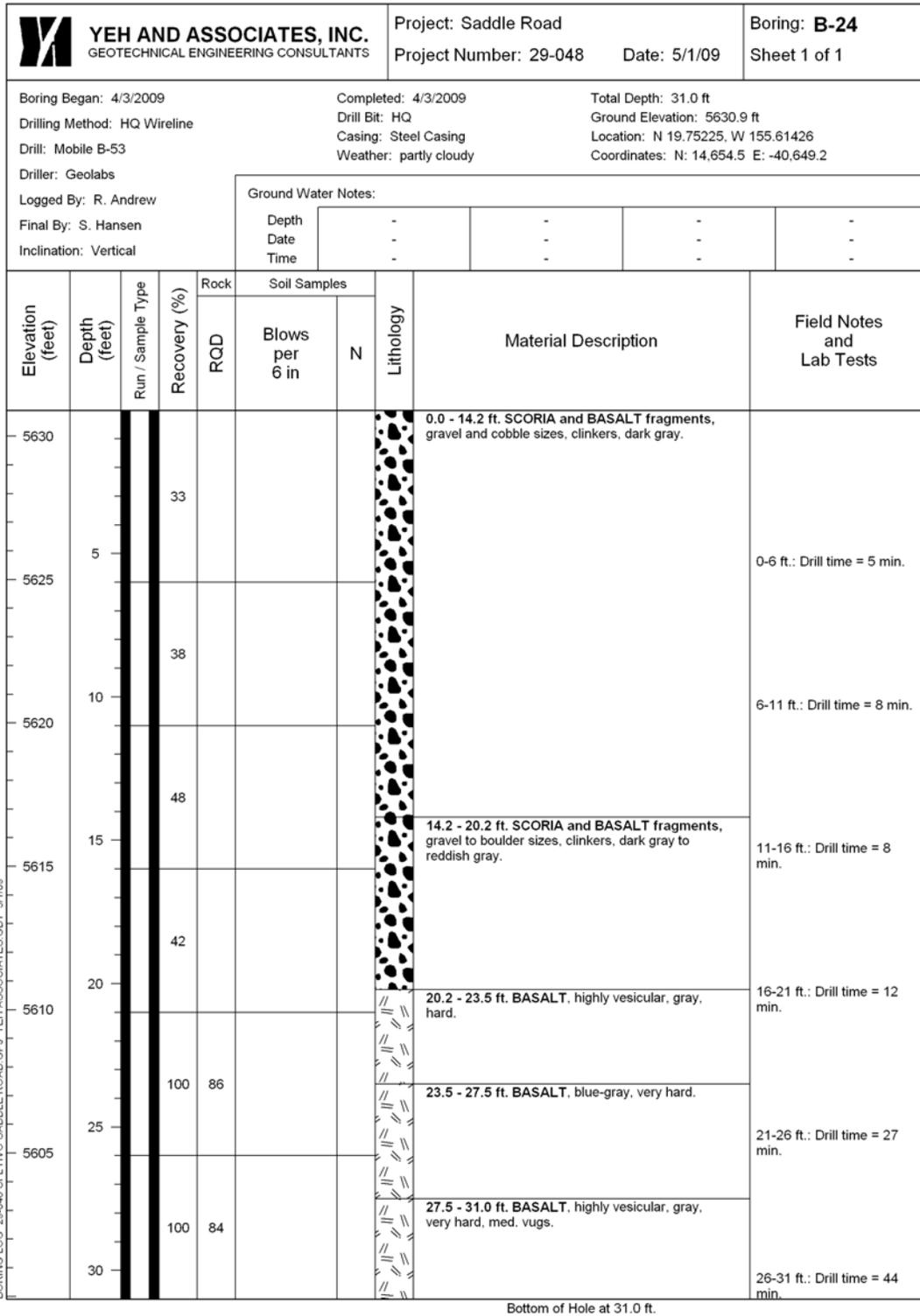


Figure B-24. Boring log for corehole B-24.

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09		Boring: <b>B-25</b> Sheet 1 of 2					
Boring Began: 4/3/2009 Drilling Method: HQ Wireline Drill: Mobile B-53 Driller: Geolabs Logged By: R. Andrew Final By: S. Hansen Inclination: Vertical		Completed: 4/3/2009 Drill Bit: HQ Casing: Steel Casing Weather: partly cloudy		Total Depth: 36.0 ft Ground Elevation: 5634.8 ft Location: N 19.75238, W 155.61469 Coordinates: N: 14,714.3 E: -40,790.2					
Ground Water Notes:									
		Depth	-	-	-	-			
		Date	-	-	-	-			
		Time	-	-	-	-			
Elevation (feet)	Depth (feet)	Run / Sample Type	Rock		Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
			Recovery (%)	RQD	Blows per 6 in	N			
5630	5		28					0.0 - 6.0 ft. SCORIA and BASALT fragments, gravel to boulder sizes, clinkers, gray and reddish gray.	0-6 ft.: Drill time = 10 min.
5625	10		18					6.0 - 15.5 ft. SCORIA and BASALT fragments, gravel size, clinkers, gray and reddish gray.	6-11 ft.: Drill time = 9 min.
5620	15		28					15.5 - 23.5 ft. BASALT, highly vesicular, gray, fractured, small-med. vugs.	11-16 ft.: Drill time = 22 min.
5615	20		100	42				23.5 - 28.7 ft. BASALT fragments in ash matrix, gray clasts in red matrix. Welded clinker zone.	16-21 ft.: Drill time = 32 min.
5610	25		92	54				28.7 - 31.2 ft. BASALT, highly vesicular, gray, very hard.	21-26 ft.: Drill time = 26 min.
5605			96	16					

Figure B-25. Boring log for corehole B-25

 <b>YEH AND ASSOCIATES, INC.</b> GEOTECHNICAL ENGINEERING CONSULTANTS		Project: Saddle Road Project Number: 29-048      Date: 5/1/09				Boring: <b>B-25</b> Sheet 2 of 2		
Elevation (feet)	Depth (feet)	Run / Sample Type	Recovery (%)	Soil Samples		Lithology	Material Description	Field Notes and Lab Tests
				Rock	N			
				RQD	Blows per 6 in			
5600	35		100	58			31.2 - 36.0 ft. <b>BASALT</b> , blue-gray, very hard.	26-31 ft.: Drill time not recorded.
							Bottom of Hole at 36.0 ft.	31-36 ft.: Drill time = 42 min.
5595	40							
5590	45							
5585	50							
5580	55							
5575	60							
5570	65							

BORING LOG: 29-048 CFL HVO SADDLE ROAD.GPJ, YEH ASSOCIATES.GDT, 5/1/09

Continued boring log for corehole B-25.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>101</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5700 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			17	0			0	x	Gray <b>GRAVEL AND COBBLES (BASALTIC)</b> with traces of boulders, medium dense, dry (clinker)
			80	50			5	x	Gray vesicular to vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt)
			55	25			10	x	Gray <b>GRAVEL (BASALTIC)</b> , medium dense (clinker)
			100	93			15	x	Gray vesicular to vugular <b>BASALT</b> , closely fractured, unweathered, hard (a'a basalt)
			100	88			20	x	grades to dense Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			97	92			25	x	
			100	100			30	x	grades to massive
							35	x	
Date Started: July 17, 2007 Date Completed: July 17, 2007		Water Level: ∇ Not Encountered				Plate <b>A - 1.1</b>			
Logged By: S. Latronic		Drill Rig: MOBILE B-53							
Total Depth: 41 feet		Drilling Method: HQ Coring							
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop							

BORING LOG 3411-60.GPJ GEOLABS 8 30.GDT 11/13/07

Figure B-1. Boring log for corehole 101.



		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>102</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5397 *				
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
			62	12			0				Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt)
							5				Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry to damp (clinker)
			100	73			10				Reddish gray vugular <b>BASALT</b> with welded clinker, moderately fractured, unweathered, hard
			100	92			15				Gray vugular <b>BASALT</b> , slightly fractured, unweathered, hard (a'a basalt) grades with scoria grades to very hard
			100	85			20				Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	47			25				grades to moderately fractured
			100	87			30				
			100	80			35				
Date Started: July 17, 2007 Date Completed: July 17, 2007 Logged By: S. Latronic Total Depth: 41.5 feet Work Order: 3411-60				Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 2.1</b>			

BORING LOG 3411-60.GPJ, GEOLABS 8\_30.GDT, 11/13/07

Figure B-2. Boring log for corehole 102.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII			Log of Boring <b>102</b>		
Laboratory		Field				(Continued from previous plate) <b>Description</b>	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)		
			60	37			Depth (feet) 40 Sample Graphic USCS Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker) Boring terminated at 41.5 feet
							Depth (feet) 45 50 55 60 65 70

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Date Started: July 17, 2007	Water Level: $\nabla$ Not Encountered	Plate <b>A - 2.2</b>
Date Completed: July 17, 2007		
Logged By: S. Latronic	Drill Rig: MOBILE B-53	
Total Depth: 41.5 feet	Drilling Method: HQ Coring	
Work Order: 3411-60	Driving Energy: 140 lb. wt., 30 in. drop	

Continue boring log for corehole 102.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>103</b>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5695 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Description
			58	15			0			Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry (clinker)
			70	40			5			
			98	83			10			Reddish gray <b>BASALT</b> with welded clinker, moderately fractured, unweathered, hard
			100	85			15			Gray dense <b>BASALT</b> , massive, unweathered, very hard
			100	82			20			grades to slightly fractured
			100	75			25			
			100	63			30			
							35			
Date Started: July 17, 2007 Date Completed: July 18, 2007 Logged By: S. Latronic Total Depth: 41.5 feet Work Order: 3411-60		Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 3.1</b>				

BORING LOG 3411-60.GPJ GEOLABS 8\_30.GDT 11/13/07

Figure B-3. Boring log for corehole 103.



 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>104</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5695 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			40	0			0		Gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry (clinker)
			80	50			5		grades to welded clinker
			100	55			10		Gray dense <b>BASALT</b> , moderately fractured, unweathered, very hard (a'a basalt)
			100	93			15		grades to massive
			100	100			20		
			100	92			25		
			100	92			30		
			100	92			35		
Date Started: July 18, 2007 Date Completed: July 18, 2007 Logged By: S. Latronic Total Depth: 41 feet Work Order: 3411-60			Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 4.1</b>		

BORING LOG 3411-60.GPJ GEOLABS 8 30.GDT 11/13/07

Figure B-4. Boring log for corehole 104.

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>104</b>			
Laboratory			Field				(Continued from previous plate) <b>Description</b>				
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)				Depth (feet)	Sample
			85	50			40				Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker) Boring terminated at 41 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 18, 2007		Date Completed: July 18, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate			
Logged By: S. Latronic		Total Depth: 41 feet		Drill Rig: MOBILE B-53				A - 4.2			
Work Order: 3411-60				Drilling Method: HQ Coring							
				Driving Energy: 140 lb. wt., 30 in. drop							

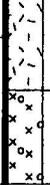
BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Continue boring log for corehole 104.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>105</b>		
Laboratory		Field				Approximate Ground Surface Elevation (feet MSL): 5692 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet) Sample Graphic USCS	Description
			52	15				0-5
			95	35			5-10	Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard to very hard (a'a basalt)
			60	37			10-15	<b>VOID</b>
			100	30			15-20	grades to closely vertically fractured
			100	75			20-25	Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	80			25-35	
Date Started: July 19, 2007		Water Level: ∇ Not Encountered				Plate <b>A - 5.1</b>		
Date Completed: July 19, 2007		Drill Rig: MOBILE B-53						
Logged By: S. Latronic		Drilling Method: HQ Coring						
Total Depth: 41.5 feet		Driving Energy: 140 lb. wt., 30 in. drop						
Work Order: 3411-60								

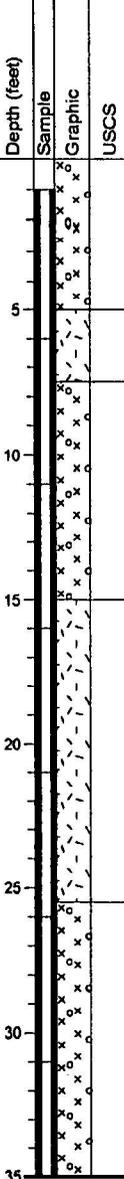
BORING LOG 3411-60.GPJ, GEOLABS & 30.GDT 11/13/07

Figure B-5. Boring log for corehole 105.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>105</b>				
Laboratory			Field							
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	USCS	Description
			60	20						
							40			Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker)
							41.5			Boring terminated at 41.5 feet
							45			
							50			
							55			
							60			
							65			
							70			
Date Started: July 19, 2007 Date Completed: July 19, 2007 Logged By: S. Latronic		Water Level: $\nabla$ Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 5.2</b>				

BORING LOG 3411-60, CPJ GEOLABS & SO. CDOT, 11/13/07

Continue boring log for corehole 105.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>106</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5699 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			37	10			0		Gray <b>GRAVEL, COBBLES, AND BOULDERS (BASALTIC)</b> , medium dense, dry (clinker)
			70	20			5		Gray dense <b>BASALT</b> , closely fractured, unweathered, very hard (a'a basalt)
			45	20			10		Gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry (clinker)
			100	92			15		Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			90	42			20		grades to vugular, moderately fractured
			40	0			25		Reddish gray <b>GRAVEL (BASALTIC)</b> with some cobbles, medium dense, damp (clinker)
			53	0			30		
							35		
Date Started: July 16, 2007 Date Completed: July 16, 2007 Logged By: S. Latronic Total Depth: 36 feet Work Order: 3411-60		Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 6.1</b>			

BORING LOG 3411-60 CPU GEOLABS & 30.GDT 11/1/2007

Figure B-6. Boring log for corehole 106.

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>106</b>	
Laboratory			Field				Depth (feet)	Sample Graphic	USCS
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)			
							40 45 50 55 60 65 70	x	Boring terminated at 36 feet
Date Started: July 16, 2007		Date Completed: July 16, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 6.2</b>	
Logged By: S. Latronic		Drill Rig: MOBILE B-53							
Total Depth: 36 feet		Drilling Method: HQ Coring							
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop							

BORING LOG 3411-60.GPJ, GEOLABS 8\_30.GDT, 11/13/07

Continue boring log for corehole 106.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>107</b>	
Laboratory			Field			Approximate Ground Surface Elevation (feet MSL): 5696 *	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Description USCS
			73	17			
			67	47			Gray vugular <b>BASALT</b> , closely fractured, unweathered, hard
			100	83			Reddish gray <b>GRAVEL (BASALTIC)</b> , medium dense, dry to damp (clinker)
			100	93			Gray dense vugular <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			62	35			
			58	18			Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker)

BORING LOG 3411-60.GPJ GEOLABS 8\_30.GDT 11/13/07

Figure B-6. Boring log for corehole 107

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII			Log of Boring <b>107</b>	
		Laboratory		Field			(Continued from previous plate)	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	<b>Description</b> Reddish gray vugular <b>BASALT</b> , closely fractured, unweathered, hard (a'a basalt) Boring terminated at 36 feet
							Sample Graphic USCS	
							40 45 50 55 60 65 70	
Date Started: July 20, 2007		Date Completed: July 21, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 7.2</b>
Logged By: S. Latronic		Drill Rig: MOBILE B-53						
Total Depth: 36 feet		Drilling Method: HQ Coring						
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop						

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Continue boring log for corehole 107.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>108</b>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5696 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	USCS	Description
			32	0			0			Gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , loose to medium dense, dry (clinker)
			75	50			5			
			88	58			10			Gray dense <b>BASALT</b> , moderately fractured, unweathered, hard to very hard (a'a basalt)
			73	23			15			Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker)
			80	8			20			Gray vugular <b>BASALT</b> , severely fractured, unweathered, hard to very hard (a'a basalt)
			100	80			25			grades to slightly fractured
			100	80			30			grades to closely fractured
							35			
Date Started: July 20, 2007 Date Completed: July 20, 2007 Logged By: S. Latronic Total Depth: 41.5 feet Work Order: 3411-60			Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 8.1</b>			

BORING LOG 3411-60 G.P.J. GEOLABS & 30.GDT. 11/13/07

Figure B-7. Boring log for corehole 108

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>108</b>					
Laboratory		Field				(Continued from previous plate) <b>Description</b>					
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)		Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS
			72	37			40				Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker)
							41.5				Boring terminated at 41.5 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 20, 2007 Date Completed: July 20, 2007 Logged By: S. Latronic		Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 8.2</b>					

BORING LOG 3411-40.GPJ GEOLABS 8 30.6DT 11/13/07

Continue boring log for corehole 108.

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>109</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5695 *				
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
			48	10			0				Gray <b>COBBLES AND GRAVEL (BASALTIC)</b> , medium dense, dry (clinker)
			95	30			5				Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt)
			100	72			10				grades to very hard
			100	80			15				Gray dense vugular <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	100			20				grades to massive
			100	100			25				
			100	100			30				grades to slightly fractured
							35				
Date Started: July 19, 2007 Date Completed: July 20, 2007 Logged By: S. Latronic Total Depth: 40 feet Work Order: 3411-60				Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 9.1</b>			

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/15/07

Figure B-8. Boring log for corehole 109

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>109</b>			
Laboratory			Field				Depth (feet)	Sample	Graphic	USCS	Description
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)					
			100	100			40				(Continued from previous plate)
							45				Boring terminated at 40 feet
							50				
							55				
							60				
							65				
							70				
Date Started: July 19, 2007		Date Completed: July 20, 2007		Water Level: $\nabla$ Not Encountered				Plate <b>A - 9.2</b>			
Logged By: S. Latronic		Drill Rig: MOBILE B-53									
Total Depth: 40 feet		Drilling Method: HQ Coring									
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop									

BORING LOG 3411-60.GPJ, GEOLABS & 30.GDT, 11/13/07

Continue boring log for corehole 109.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>110</b>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5691 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Description
			38	0			0			Reddish gray <b>COBBLES AND GRAVEL (BASALTIC)</b> , medium dense, dry (clinker)
			35	0			5			
			40	8			10			Reddish gray scoriaceous <b>BASALT</b> with welded clinker, closely to moderately fractured, unweathered, medium hard to hard
			70	37			15			
			100	83			20			Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)  grades to massive  grades to slightly fractured
			100	95			25			
			100	92			30			
							35			

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/15/07

Date Started: July 19, 2007	Water Level: $\nabla$ Not Encountered	Plate <b>A - 10.1</b>
Date Completed: July 19, 2007	Drill Rig: MOBILE B-53	
Logged By: S. Latronic	Drilling Method: HQ Coring	
Total Depth: 41.5 feet	Driving Energy: 140 lb. wt., 30 in. drop	
Work Order: 3411-60		

Figure B-9 Boring log for corehole 110

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>110</b>					
Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	(Continued from previous plate)
Description											
			77	70			40				Reddish gray <b>GRAVEL (BASALTIC)</b> , medium dense, damp (clinker)
							41.5				Boring terminated at 41.5 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 19, 2007 Date Completed: July 19, 2007 Logged By: S. Latronic Total Depth: 41.5 feet Work Order: 3411-60		Water Level: $\nabla$ Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 10.2</b>					

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Continue boring log for corehole 110.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>111</b>		
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5704 *	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Description
			100	50			0	Reddish gray <b>COBBLES AND GRAVEL (BASALTIC)</b> , medium dense, dry (clinker) grades to welded clinker
			70	63			5	Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			10	0			10	Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , loose to medium dense, damp (clinker)
			100	78			15	Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	90			20	Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	80			25	grades with welded clinker Reddish gray scoriaceous <b>BASALT</b> with welded clinker, closely to moderately fractured, unweathered, hard
			17	0			30	Reddish gray <b>GRAVEL (BASALTIC)</b> , loose to medium dense, damp (clinker)
							35	

BORING LOG 3411-60, GPJ GEOLABS & 30.GDT 11/15/07

Figure B-10. Boring log for corehole 111

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>111</b>	
		Laboratory		Field		Depth (feet)		Sample Graphic USCS	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	(Continued from previous plate)		
							Description		
							Boring terminated at 36.5 feet		
							40		
							45		
							50		
							55		
							60		
							65		
							70		
Date Started: July 21, 2007		Date Completed: July 21, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 11.2</b>	
Logged By: S. Latronic		Drill Rig: MOBILE B-53							
Total Depth: 36.5 feet		Drilling Method: HQ Coring							
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop							

BORING LOG 3411-60.GPJ, GEOLABS & 30.GDT, 11/13/07

Continue boring log for corehole 111.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <h1>112</h1>	
Laboratory		Field				Approximate Ground Surface Elevation (feet MSL): 5696 *	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Description
			58	7			
			65	0			Gray vugular <b>BASALT</b> , severely fractured, unweathered, hard (a'a basalt)
			100	90			grades to moderately fractured, very hard
			100	100			Gray dense vugular <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			95	72			
			100	62			grades to closely to moderately fractured
			92	92			grades to massive
Date Started: July 21, 2007 Date Completed: July 21, 2007 Logged By: S. Latronic Total Depth: 36 feet Work Order: 3411-60		Water Level: ∅ Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <h2>A - 12.1</h2>	

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Figure B-11. Boring log for corehole 112

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>112</b>			
Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	(Continued from previous plate) Description
							40				Boring terminated at 36 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 21, 2007 Date Completed: July 21, 2007 Logged By: S. Latronic				Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53				Plate <b>A - 12.2</b>			
Total Depth: 36 feet Work Order: 3411-60				Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop							

BORING LOG 3411-60.GPJ GEOLABS & SO.GDT 11/13/07

Continue boring log for corehole 112.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>113</b>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5696 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	USCS	Description
			55	0			0			
			13	0			5			
			78	40			10			Gray dense <b>BASALT</b> , moderately fractured, unweathered, very hard (a'a basalt)
			100	63			15			
			100	95			20			Reddish gray scoriaceous <b>BASALT</b> with welded clinker, moderately fractured, unweathered, hard
			100	87			25			Gray dense <b>BASALT</b> , slightly fractured to massive, unweathered, very hard (a'a basalt)
							30			Boring terminated at 32 feet
							35			
Date Started: July 23, 2007 Date Completed: July 23, 2007 Logged By: S. Latronic Total Depth: 32 feet Work Order: 3411-60		Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 13</b>				

BORING LOG 3411-60.GPJ GEOLABS 8\_30.GDT 11/13/07

Figure B-12. Boring log for corehole 113

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>114</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5697 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			83	50			0		Gray <b>COBBLES AND GRAVEL (BASALTIC)</b> , medium dense, dry (clinker)
			17	0			5		Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard
			37	8			10		Reddish gray <b>GRAVEL (BASALTIC)</b> , medium dense, damp (clinker)
			97	70			15		Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard to very hard (a'a basalt)
			100	75			20		Reddish gray <b>BASALT</b> with welded clinker, moderately fractured, unweathered, medium hard
			100	92			25		grades to hard
			100	75			30		Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
							35		

Date Started: July 23, 2007 Date Completed: July 23, 2007 Logged By: S. Latronic Total Depth: 35.5 feet Work Order: 3411-60		Water Level: ♀ Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop		Plate <b>A - 14.1</b>
---	--	--	--	--------------------------

BORING LOG 3411-60.GPJ, GEOLABS 8 30.GDT 11/13/07

Figure B-13. Boring log for corehole 114

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII			Log of Boring <span style="font-size: 24pt; font-weight: bold;">114</span>				
Laboratory		Field						(Continued from previous plate) <span style="font-size: 18pt; font-weight: bold;">Description</span>			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)			Sample	Graphic
							40				Boring terminated at 35.5 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 23, 2007		Date Completed: July 23, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered		Plate <span style="font-size: 24pt; font-weight: bold;">A - 14.2</span>					
Logged By: S. Latronic		Total Depth: 35.5 feet		Drill Rig: MOBILE B-53							
Work Order: 3411-60				Drilling Method: HQ Coring							
				Driving Energy: 140 lb. wt., 30 in. drop							

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Continue boring log for corehole 114.

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>115</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5692 *				
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
			25	0			0				Gray <b>COBBLES AND GRAVEL (BASALTIC)</b> , medium dense, dry (clinker)
			47	7			5				
			98	35			10				Reddish gray vugular <b>BASALT</b> with some welded clinker, moderately fractured, unweathered, hard
			100	80			15				Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard
			97	60			20				Reddish gray <b>BASALT</b> with welded clinker, severely fractured, unweathered, medium hard
			97	75			25				Gray dense <b>BASALT</b> , slightly fractured to massive, unweathered, very hard (a'a basalt)
			100	100			30				Boring terminated at 32 feet
							35				
Date Started: July 24, 2007			Water Level: ∇ Not Encountered				Plate <b>A - 15</b>				
Date Completed: July 24, 2007											
Logged By: S. Latronic			Drill Rig: MOBILE B-53								
Total Depth: 32 feet			Drilling Method: HQ Coring								
Work Order: 3411-60			Driving Energy: 140 lb. wt., 30 in. drop								

BORING LOG: 3411-60.GPJ GEOLABS 8\_30.GDT 11/13/07

Figure B-14. Boring log for corehole 115

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>116</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5697 *				
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
			50	12			0				Reddish gray <b>COBBLES AND GRAVEL (BASALTIC)</b> with traces of boulders, medium dense, dry (clinker)
			47	0			5				
			43	17			10				
			30	0			15				grades to welded clinkers
			100	73			20				
			95	95			25				Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	40			30				
							35				
Date Started: July 25, 2007 Date Completed: July 26, 2007 Logged By: S. Latronic		Water Level: ∇ Not Encountered				Plate <b>A - 16.1</b>					
Total Depth: 35.5 feet Work Order: 3411-60		Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop									

BORING LOG 3411-60 GPJ GEOLABS & 30.GDT 11/13/07

Figure B-15. Boring log for corehole 116

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>116</b>	
		Laboratory		Field				(Continued from previous plate)	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	<b>Description</b> Reddish gray vugular <b>BASALT</b> with some clinker, moderately fractured, slightly weathered, hard (a'a basalt) Boring terminated at 35.5 feet
								Graphic	
							40	USCS	
							45		
							50		
							55		
							60		
							65		
							70		
Date Started: July 25, 2007		Date Completed: July 26, 2007		Water Level: $\nabla$ Not Encountered				Plate	
Logged By: S. Latronic		Total Depth: 35.5 feet		Drill Rig: MOBILE B-53				A - 16.2	
Work Order: 3411-60				Drilling Method: HQ Coring					
				Driving Energy: 140 lb. wt., 30 in. drop					

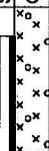
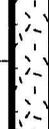
BORING LOG 3411-60.GPJ, GEOLABS 8 30.GDT 11/13/07

Continue boring log for corehole 116.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>117</b>		
Laboratory			Field			Approximate Ground Surface Elevation (feet MSL): 5697 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet) Sample Graphic USCS	Description
			17	0			0	Reddish gray <b>GRAVEL (BASALTIC)</b> , loose to medium dense, dry (clinker)
			90	35			5	Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt)  grades to massive
			93	72			10	
			38	0			15	Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, damp (clinker)
			60	12			20	
			100	75			25	Gray dense <b>BASALT</b> , slightly to moderately fractured, unweathered, very hard (a'a basalt)
			100	67			30	
							35	Boring terminated at 35 feet
Date Started: July 25, 2007 Date Completed: July 25, 2007 Logged By: S. Latronic Total Depth: 35 feet Work Order: 3411-60			Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop			Plate <b>A - 17</b>		

BORING LOG 3411-60.GPJ GEOLABS 8\_30.GDT 11/13/07

Figure B-16. Boring log for corehole 117

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>118</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5694 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			60	8			0		Gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry (clinker)
			83	47			5		Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt)
			100	83			10		grades to very hard  grades to slightly fractured
			100	88			15		grades to dense
			100	73			20		Gray dense vugular <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	48			25		grades to moderately fractured
			100	75			30		
							35		
Date Started: July 25, 2007			Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate		
Date Completed: July 25, 2007			Drill Rig: MOBILE B-53				A - 18.1		
Logged By: S. Latronic			Drilling Method: HQ Coring						
Total Depth: 40 feet			Driving Energy: 140 lb. wt., 30 in. drop						
Work Order: 3411-60									

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/15/07

Figure B-17. Boring log for corehole 118

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>118</b>					
Laboratory			Field				(Continued from previous plate) <b>Description</b>				
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)			Depth (feet)	Sample	Graphic
			100	63			40				Boring terminated at 40 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 25, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 18.2</b>					
Date Completed: July 25, 2007											
Logged By: S. Latronic		Drill Rig: MOBILE B-53									
Total Depth: 40 feet		Drilling Method: HQ Coring									
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop									

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/15/07

Continue boring log for corehole 118.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>119</b>	
Laboratory			Field			Approximate Ground Surface Elevation (feet MSL): 5692 *	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Description
			47	12			Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry (clinker)
			100	30			Gray vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt)
			88	72			grades with traces of clinker from 10.5 to 11 feet
			100	100			grades to very hard
			100	100			Gray dense <b>BASALT</b> , massive, unweathered, very hard (a'a basalt)
			100	58			grades to moderately fractured
							Boring terminated at 30 feet
Date Started: July 24, 2007 Date Completed: July 24, 2007 Logged By: S. Latronic Total Depth: 30 feet Work Order: 3411-60			Water Level: <input checked="" type="checkbox"/> Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop			Plate <b>A - 19</b>	

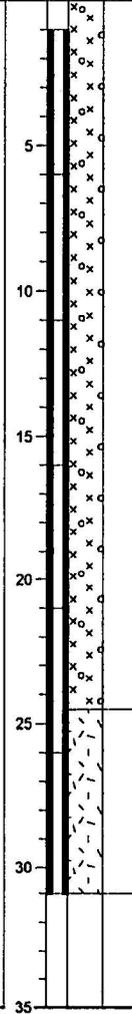
BORING LOG 3411-60.GPJ GEOLABS 8 30.GDT 11/15/07

Figure B-18. Boring log for corehole 119

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>120</b>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5692 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Description
			43	0			0			Reddish gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , medium dense, dry (clinker)
			70	43			5			
			95	80			10			Gray dense vugular <b>BASALT</b> , moderately fractured, unweathered, hard (a'a basalt) grades with traces of clinker from 10.8 to 11.2 feet
			100	97			15			grades to massive
			100	100			20			grades to slightly fractured
			100	63			25			
							30			
							31			Boring terminated at 31 feet
							35			
Date Started: July 24, 2007 Date Completed: July 24, 2007 Logged By: S. Latronic Total Depth: 31 feet Work Order: 3411-60			Water Level: ∇ Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <b>A - 20</b>			

BORING LOG 3411-60.GPJ, GEOLABS 8 30.GDT, 11/13/07

Figure B-19. Boring log for corehole 120

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>121</b>			
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5698 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			70	15			0		Reddish gray <b>COBBLES, GRAVEL, AND BOULDERS (BASALTIC)</b> , medium dense, dry (clinker)
			45	8			5		
			53	10			10		
			23	0			15		
			65	28			20		
			100	90			25		Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
							30	Boring terminated at 31 feet	
							35		
Date Started: July 26, 2007 Date Completed: July 26, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 21</b>			
Logged By: S. Latronic		Drill Rig: MOBILE B-53							
Total Depth: 31 feet		Drilling Method: HQ Coring							
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop							

BORING LOG: 3411-60.CPJ, GEOLABS & SO. GDT: 11/13/07

Figure B-20. Boring log for corehole121

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>123</b>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5695 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	USCS	Description
			23	0			0			Gray <b>GRAVEL AND COBBLES (BASALTIC)</b> , loose to medium dense, dry (clinker)
			38	12			5			
			100	85			10			Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	100			15			
			100	82			20			
			100	98			25			
			100	100			30			
							35			
Date Started: July 27, 2007		Date Completed: July 28, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 22.1</b>		
Logged By: S. Latronic				Drill Rig: MOBILE B-53						
Total Depth: 41.5 feet				Drilling Method: HQ Coring						
Work Order: 3411-60				Driving Energy: 140 lb. wt., 30 in. drop						

BORING LOG 3411-60 GP, GEOLABS & 30.GDT, 11/13/07

Figure B-21. Boring log for corehole 123

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII					Log of Boring <b>123</b>				
Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	(Continued from previous plate)
Description											
			62	37			40				Reddish gray scoriaceous <b>BASALT</b> with welded clinker, moderately fractured, unweathered, medium hard Reddish gray <b>GRAVEL (BASALTIC)</b> , medium dense, damp (clinker) Boring terminated at 41.5 feet
							45				
							50				
							55				
							60				
							65				
							70				
Date Started: July 27, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered				Plate <b>A - 22.2</b>					
Date Completed: July 28, 2007											
Logged By: S. Latronic		Drill Rig: MOBILE B-53									
Total Depth: 41.5 feet		Drilling Method: HQ Coring									
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop									

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Continue boring log for corehole 123.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <h1>125</h1>				
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5696 *			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic	USCS	Description
			60	28			0			Reddish gray <b>COBBLES, GRAVEL, AND BOULDERS (BASALTIC)</b> , medium dense, dry (clinker)
			65	33			5			
			58	15			10			
			87	60			15			Gray dense <b>BASALT</b> , moderately fractured, unweathered, very hard (a'a basalt)  grades to massive locally
			100	100			20			
			97	58			25			
			100	87			30			
							35			
Date Started: July 27, 2007 Date Completed: July 27, 2007 Logged By: S. Latronic Total Depth: 36 feet Work Order: 3411-60			Water Level: ☒ Not Encountered Drill Rig: MOBILE B-53 Drilling Method: HQ Coring Driving Energy: 140 lb. wt., 30 in. drop				Plate <h2>A - 23.1</h2>			

BORING LOG 3411-60.GPJ GEOLABS & 30.GDT 11/13/07

Figure B-22. Boring log for corehole 125

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>125</b>		
Laboratory			Field				(Continued from previous plate) <b>Description</b>			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)			Depth (feet)	Sample
							40 45 50 55 60 65 70			
Boring terminated at 36 feet										
Date Started: July 27, 2007		Date Completed: July 27, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered						
Logged By: S. Latronic		Drill Rig: MOBILE B-53								
Total Depth: 36 feet		Drilling Method: HQ Coring								
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop							Plate <b>A - 23.2</b>	

BORING LOG 3411-60.GPJ GEOLABS 8 30.GDT 11/13/07

Continue boring log for corehole 125.

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII			Log of Boring <b>127</b>		
Laboratory			Field				Approximate Ground Surface Elevation (feet MSL): 5695 *		
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample Graphic USCS	Description
			63	30			0		Reddish gray <b>GRAVEL, COBBLES, AND BOULDERS (BASALTIC)</b> , medium dense, dry (clinker)
			95	43			5		grades to welded clinker
			78	47			10		Reddish gray <b>BASALT</b> with welded clinker, moderately fractured, unweathered, medium hard
			100	87			15		Gray dense <b>BASALT</b> , slightly fractured, unweathered, very hard (a'a basalt)
			100	100			20		grades with vugs
			100	70			25		grades with some welded clinker
			100	71			30		Boring terminated at 35 feet
							35		
Date Started: July 26, 2007		Water Level: $\nabla$ Not Encountered				Plate  <b>A - 24.1</b>			
Date Completed: July 26, 2007		Drill Rig: MOBILE B-53							
Logged By: S. Latronic		Drilling Method: HQ Coring							
Total Depth: 35 feet		Driving Energy: 140 lb. wt., 30 in. drop							
Work Order: 3411-60									

BORING LOG 3411-60.GPJ GEOLABS 8.30.GDT 11/13/07

Figure B-23. Boring log for corehole 127

		<b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>127</b>		
Laboratory			Field				(Continued from previous plate) <b>Description</b>			
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)				Depth (feet)
							40 45 50 55 60 65 70			
Date Started: July 26, 2007 Date Completed: July 26, 2007		Water Level: <input checked="" type="checkbox"/> Not Encountered		Plate <b>A - 24.2</b>						
Logged By: S. Latronic		Drill Rig: MOBILE B-53								
Total Depth: 35 feet		Drilling Method: HQ Coring								
Work Order: 3411-60		Driving Energy: 140 lb. wt., 30 in. drop								

BORING LOG 3411-60.GPJ, GEOLABS & 30.GDT, 11/13/07

Continue boring log for corehole 127.

 <b>GEOLABS, INC.</b> Geotechnical Engineering		SADDLE ROAD PROJECT HI-A-AD 6(5) POHAKULOA TRAINING AREA (PTA) QUARRY ISLAND OF HAWAII				Log of Boring <b>129</b>	
Laboratory		Field				Approximate Ground Surface Elevation (feet MSL): 5699 *	
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Description USCS
			65	27			
			100	68			Gray dense <b>BASALT</b> , moderately fractured, unweathered, very hard (a'a basalt)
			57	22			Reddish gray <b>COBBLES AND GRAVEL (BASALTIC)</b> , medium dense, damp (clinker)
			52	0			
			70	25			
			70	20			
			100	33			Reddish gray <b>BASALT</b> with welded clinker, moderately fractured, unweathered, medium hard to hard Gray dense <b>BASALT</b> , moderately fractured, unweathered, very hard (a'a basalt)

BORING LOG 3411-60.GPJ GEOLABS 8\_30.GDT 11/13/07

Figure B-24. Boring log for corehole 129

# **Appendix C**

## **Rock Core and Drilling Photos**



Figure C-1. HX corehole B-1, 0.0 to 16.0 ft.



Figure C-2. HX corehole B-1, 16.0 to 24.3 ft.



Figure C-3. HX corehole B-1, 24.3.0 to 35.0 ft.



Figure C-4. HX corehole B-2, 0.0 to 17.8 ft.



Figure C-5. HX corehole B-2, 17.8 to 26.0 ft.



Figure C-6. HX corehole B-2, 26.0 to 31.0 ft.



Figure C-7. HX corehole B-3, 0.0 to 21.5 ft.



Figure C-8. HX corehole B-4, 0.0 to 14.3 ft.



Figure C-9. HX corehole B-4, 14.3 to 22.4 ft.



Figure C-10. HX corehole B-4, 22.4 to 31.0 ft.



Figure C-11. HX corehole B-5, 0.0 to 15.5 ft.



Figure C-12. HX corehole B-5, 15.5 to 23.5 ft.



Figure C-13. HX corehole B-5, 23.5 to 32.0 ft.



Figure C-14. HX corehole B-5, 32.0 to 35.0 ft.



Figure C-15. HX corehole B-6, 0.0 to 18.9 ft.



Figure C-16. HX corehole B-6, 18.9 to 28.0 ft.



Figure C-17. HX corehole B-6, 28.0 to 35.0.



Figure C-18. HX corehole B-7, 0.0 to 26.0 ft.



Figure C-19. HX corehole B-8, 0.0 to 18.8 ft.



Figure C-20. HX corehole B-8, 18.8 to 26.0 ft.



Figure C-21. HX corehole B-8, 26.0 to 31.0 ft.



Figure C-22. HX corehole B-9, 0.0 to 18.4 ft.



Figure C-23. HX corehole B-9, 18.4 to 26.0 ft.



Figure C-24. HX corehole B-10, 0.0 to 21.0 ft.



Figure C-25. HX corehole B-10, 21.0 to 30.0 ft.



Figure C-26. HX corehole B-10, 30.0 to 34.6 ft.



Figure C-27. HX corehole B-11, 0.0 to 17.1 ft.



Figure C-28. HX corehole B-11, 17.1 to 26.0 ft.



Figure C-29. HX corehole B-11, 26.0 to 36.0 ft.



Figure C-30. HX corehole B-12, 0.0 to 11.0 ft.



Figure C-31. HX corehole B-12, 11.0 to 18.7 ft.



Figure C-32. HX corehole B-12, 18.7 to 26.0 ft.



Figure C-33. HX corehole B-13, 0.0 to 16.0 ft.



Figure C-34. HX corehole B-13, 16.0 to 25.4 ft.



Figure C-35. HX corehole B-13, 25.4 to 31.0 ft.



Figure C-36. HX corehole B-14, 0.0 to 20.0 ft.



Figure C-37. HX corehole B-14, 20.0 to 29.3 ft.



Figure C-38. HX corehole B-14, 29.3 to 36.0 ft.



Figure C-39. HX corehole B-15, 0.0 to 15.0 ft.



Figure C-40. HX corehole B-15, 15.0 to 24.2 ft.



Figure C-41. HX corehole B-15, 24.2 to 31.0 ft.



Figure C-42. HX corehole B-16, 0.0 to 13.8 ft.



Figure C-43. HX corehole B-16, 13.8 to 21.0 ft.



Figure C-44. HX corehole B-16, 21.0 to 26.0 ft.



Figure C-45. HX corehole B-17, 0.0 to 16.0 ft.



Figure C-46. HX corehole B-17, 16.0 to 26.0 ft.



Figure C-47. HX corehole B-18, 21.0 to 29.8 ft.



Figure C-48. HX corehole B-18, 29.8 to 36.0 ft.



Figure C-49. HX corehole B-19, 0.0 to 12.8 ft.



Figure C-50. HX corehole B-19, 12.0 to 22.6 ft.



Figure C-51. HX corehole B-19, 22.6 to 36.0 ft.



Figure C-52. HX corehole B-20, 0.0 to 15.5 ft.



Figure C-53. HX corehole B-20, 15.5 to 25.5 ft.

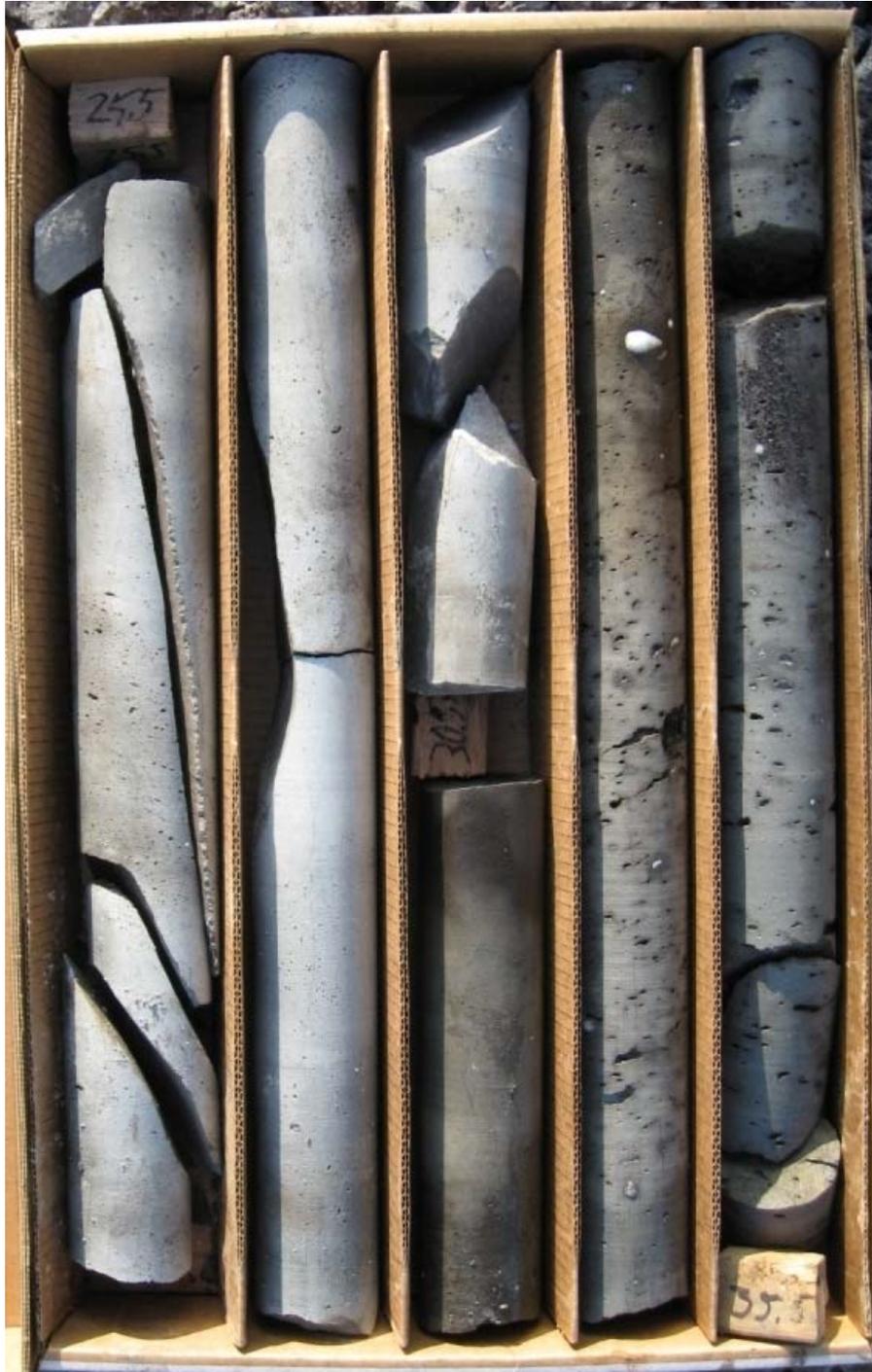


Figure C-54. HX corehole B-20, 25.5 to 35.5 ft.



Figure C-55. HX corehole B-21, 0.0 to 14.0 ft.



Figure C-56. HX corehole B-21, 14.0 to 31.0 ft.



Figure C-57. HX corehole B-21, 31.0 to 36.0 ft.



Figure C-58. HX corehole B-22, 0.0 to 16.0 ft.



Figure C-59. HX corehole B-22, 16.0 to 27.5 ft.

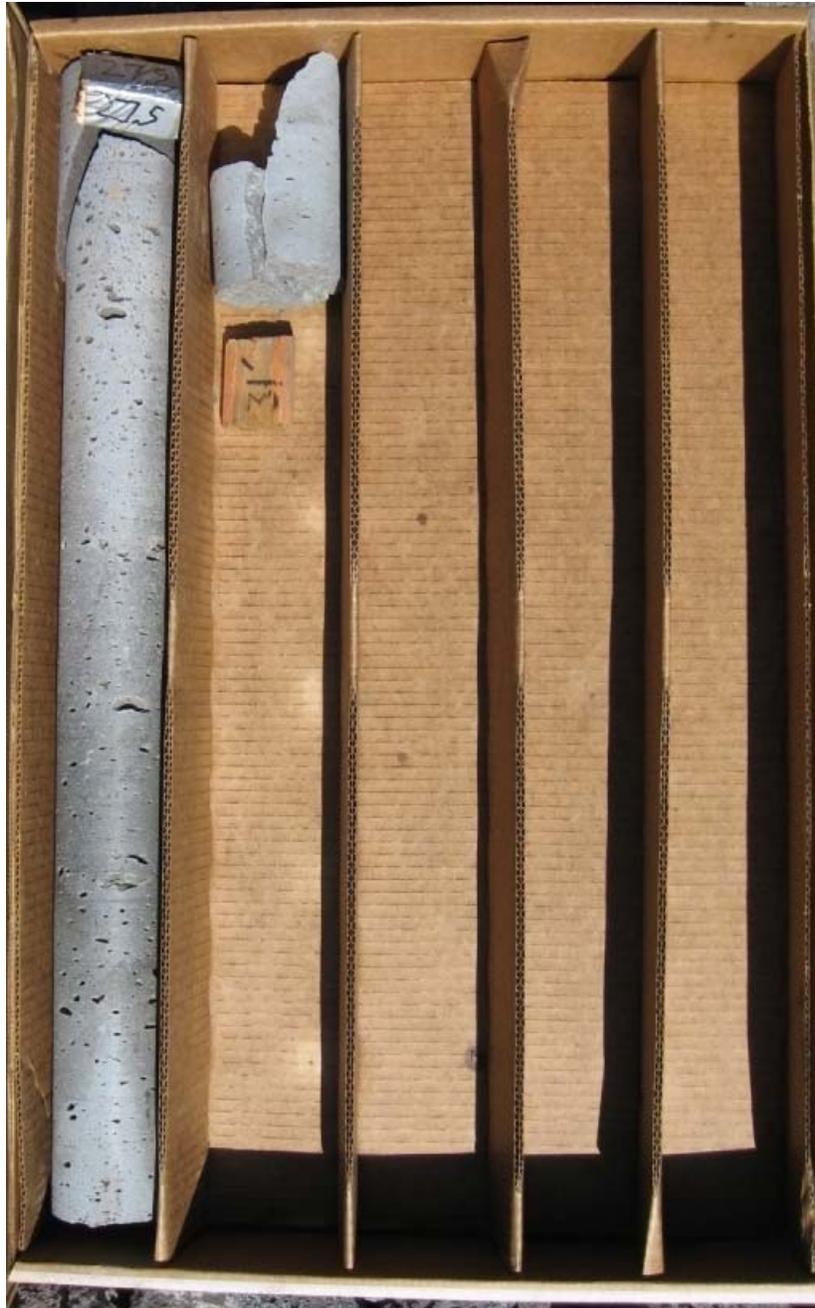


Figure C-60. HX corehole B-22, 27.5 to 31.0 ft.



Figure C-61. HX corehole B-23, 0.0 to 11.0.



Figure C-62. HX corehole B-23, 11.0 to 25.0 ft.



Figure C-63. HX corehole B-23, 25.0 to 36.0 ft.



Figure C-64. HX corehole B-24, 0.0 to 21.6 ft.



Figure C-65. HX corehole B-24, 21.6 to 31.0 ft.



Figure C-66. HX corehole B-25, 0.0 to 16.4 ft.



Figure C-67. HX corehole B-25, 16.4 to 26.0 ft.



Figure C-68. HX corehole B-25, 26.0 to 36.0 ft.



Figure C-69. Rotary corehole location B-1, looking northwest.



Figure C-70. Rotary corehole location B-2, looking west.



Figure C-71. Rotary corehole location B-4, looking northwest.



Figure C-72. Rotary corehole location B-6, looking northwest.



Figure C-73. Rotary corehole location B-7, looking west.



Figure C-74. Rotary corehole location B-16, looking northeast.



Figure C-75. Rotary corehole location B-24, looking west.



Figure C-1. Corehole 101: Box 1—1.0 - 18.0 ft

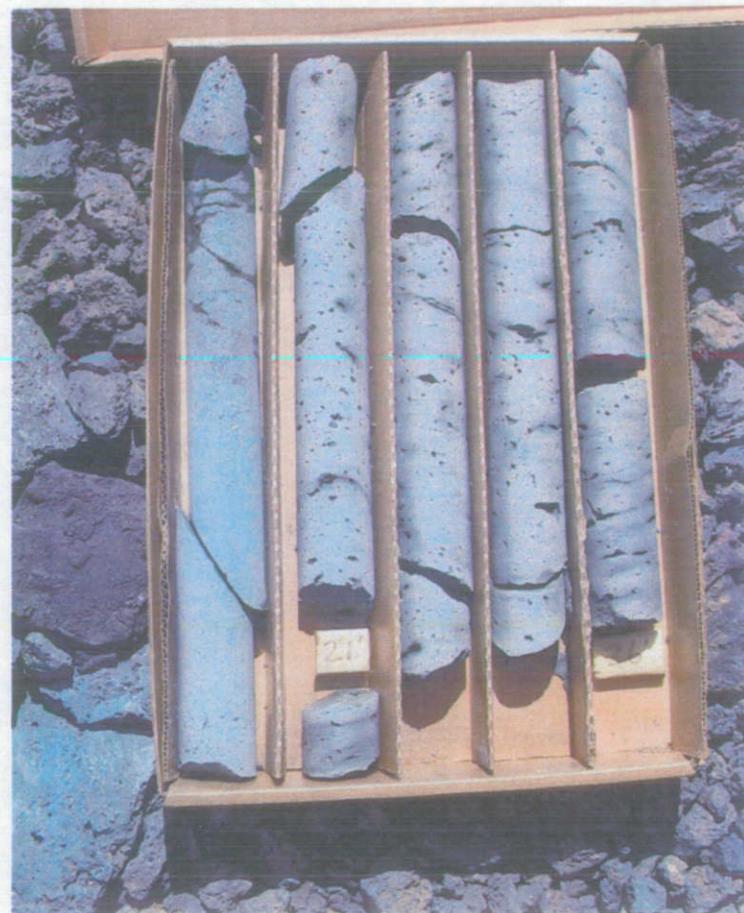


Figure C-2. Corehole 101: Box 2 —18.0 - 26.0 ft



Figure C-3. Corehole 101: Box 3 —26.0 - 35.0 ft



Figure C-4. Corehole 101: Box 4 —35.0 - 41.0 ft

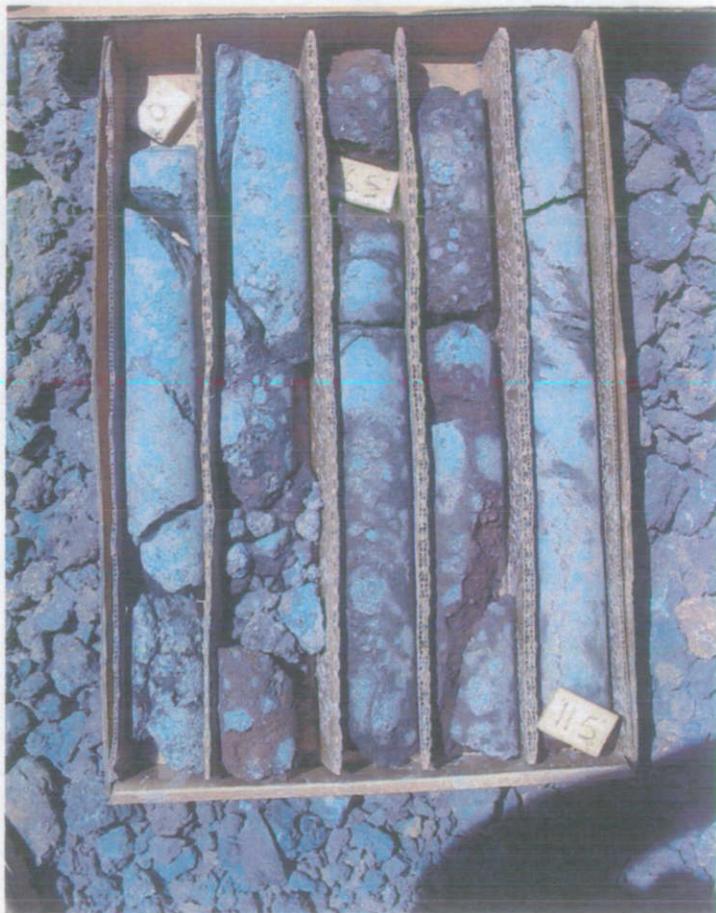


Figure C-5. Corehole 102: Box 1 —1.0 - 11.5 ft



Figure C-6. Corehole 102: Box 2 —11.5 - 21.0 ft

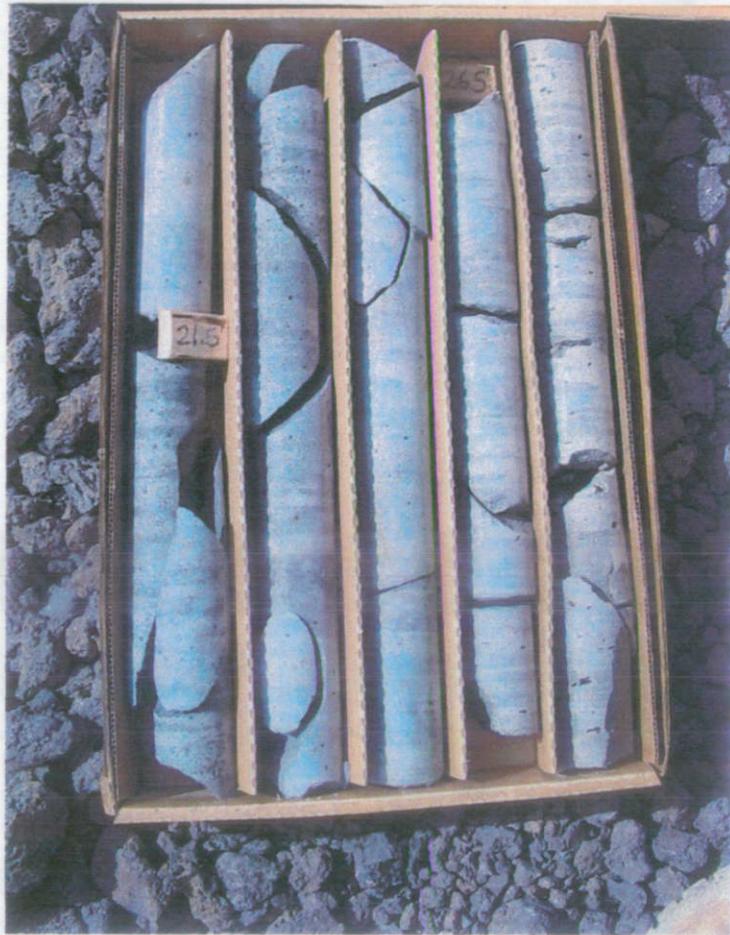


Figure C-7. Corehole 102: Box 3 —21.0 - 30.0 ft



Figure C-8. Corehole 102: Box 4 —30.0 - 41.5 ft



Figure C-9. Corehole 103: Box 1 —1.5 - 14.5 ft



Figure C-10. Corehole 103: Box 2 —14.5 - 23.5 ft



Figure C-11. Corehole 103: Box 3 —23.5 - 33.0 ft



Figure C-12. Corehole 103: Box 4 —33.0 - 41.5 ft

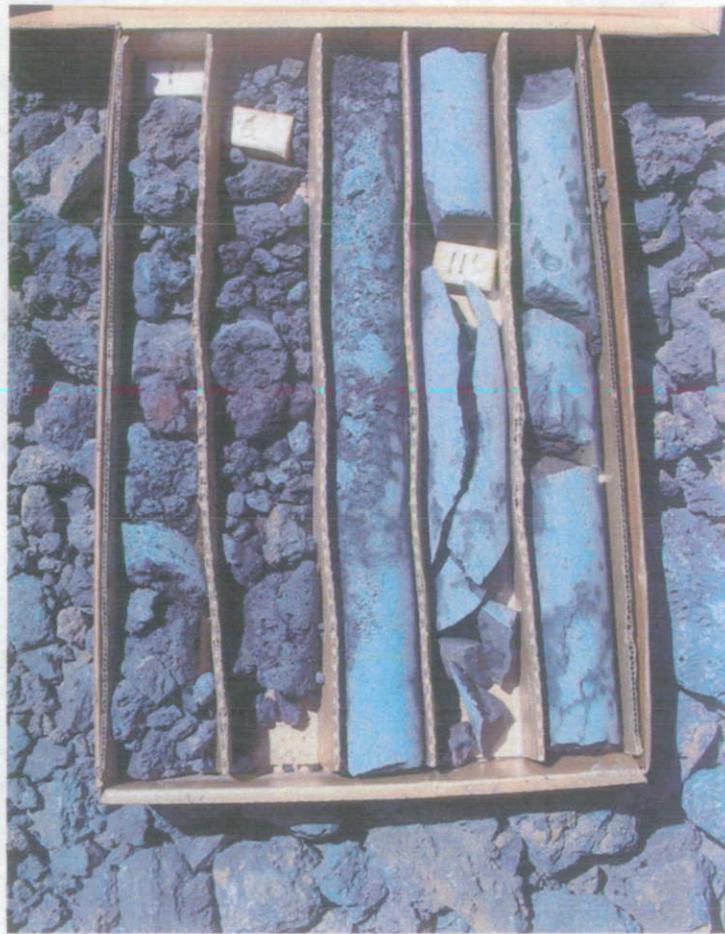


Figure C-13. Corehole 104: Box 1 —1.0 - 14.0 ft

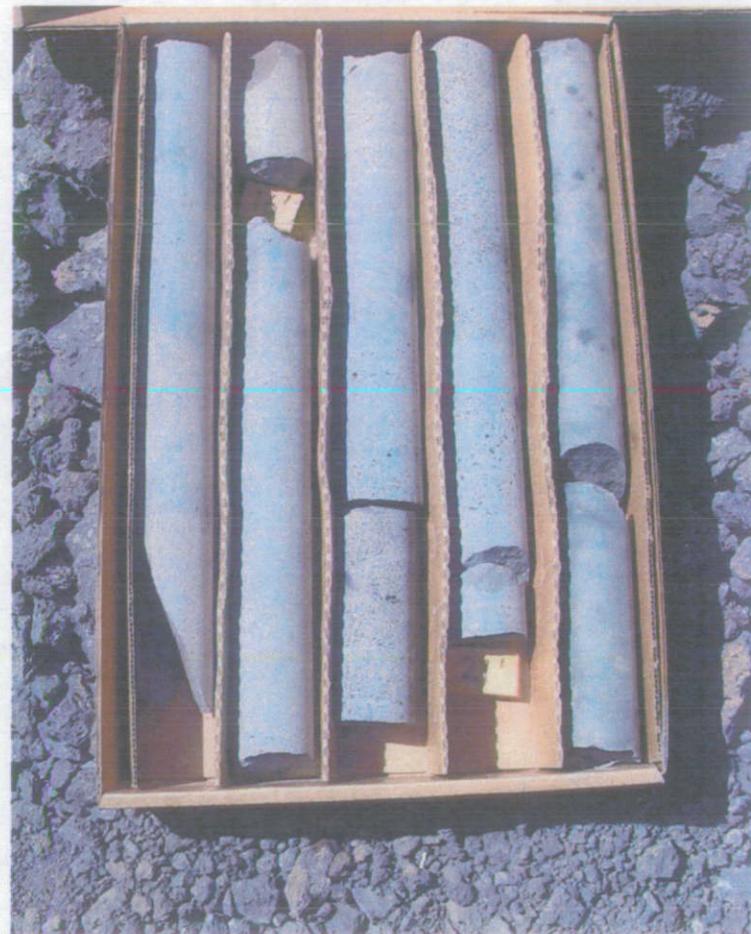


Figure C-14. Corehole 104: Box 2 —14.0 - 23.0 ft



Figure C-15. Corehole 104: Box 3 —23.0 - 31.5 ft



Figure C-16. Corehole 104: Box 4 —31.5 - 41.0 ft



Figure C-17. Corehole 105: Box 1 —1.5 - 15.5 ft



Figure C-18. Corehole 105: Box 2 —15.5 - 24.0 ft



Figure C-19. Corehole 105: Box 3 —24.0 – 33.0 ft



Figure C-20. Corehole 105: Box 4 —33.0 – 41.5 ft



Figure C-21. Corehole 106: Box 1 —1.0 – 17.0 ft



Figure C-22. Corehole 106: Box 2 —17.0 – 26.5 ft



Figure C-23. Corehole 106: Box 3 —26.5 – 36.0 ft



Figure C-24. Corehole 107: Box 1 —1.0 – 13.5 ft

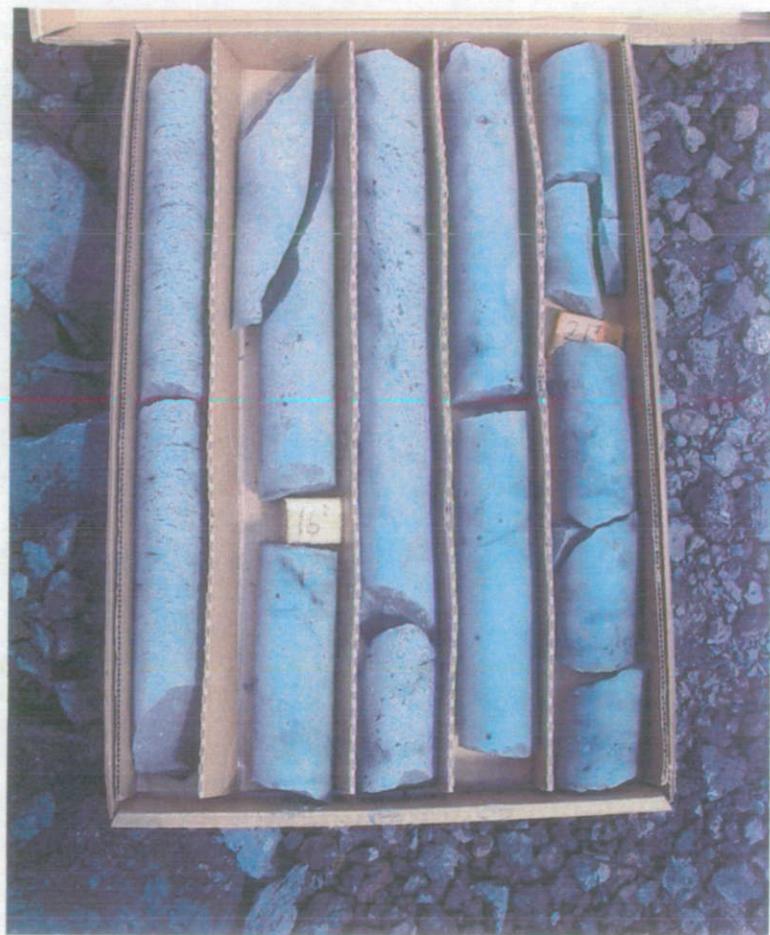


Figure C-25. Corehole 107: Box 2 —13.5 – 22.0 ft



Figure C-26. Corehole 107: Box 3 —22.0 – 36.0 ft



Figure C-27. Corehole 108: Box 1 —1.5 - 15.5 ft

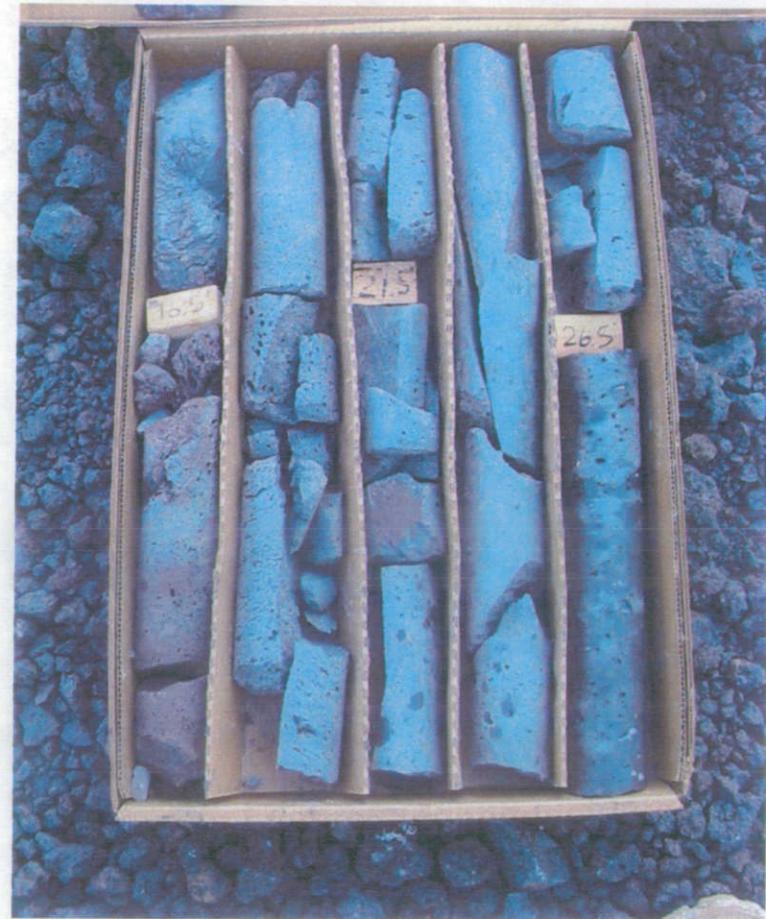


Figure C-28. Corehole 108: Box 2 —15.5 - 27.5 ft



Figure C-29. Corehole 108: Box 3 —27.5 – 36.5 ft

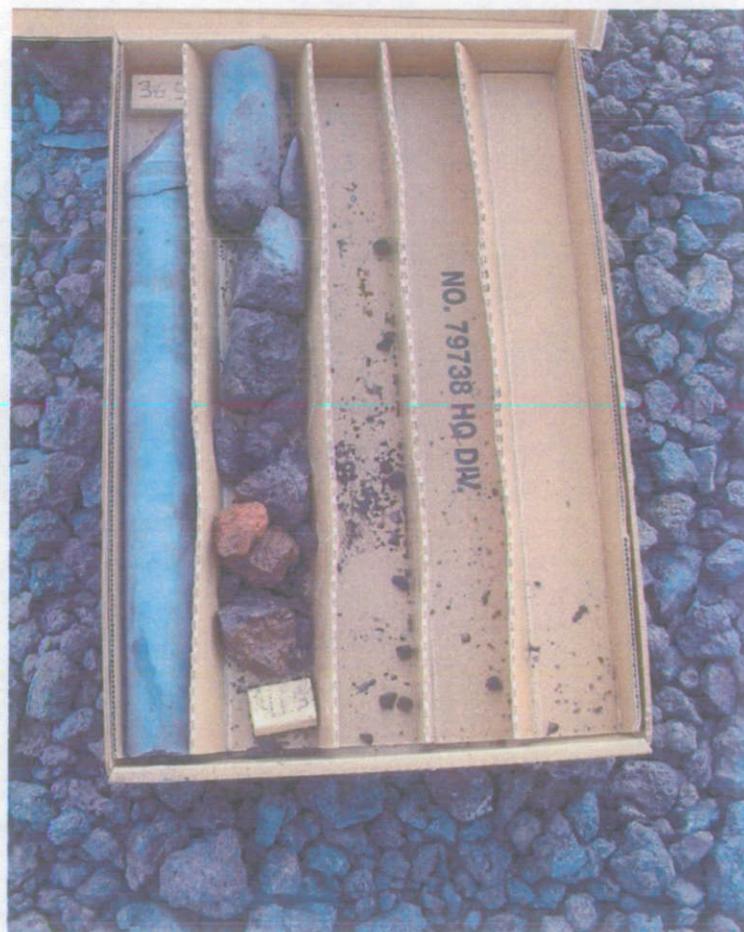


Figure C-30. Corehole 108: Box 4 —36.5 – 41.5 ft



Figure C-31. Corehole 109: Box 1 —1.0 - 13.5 ft

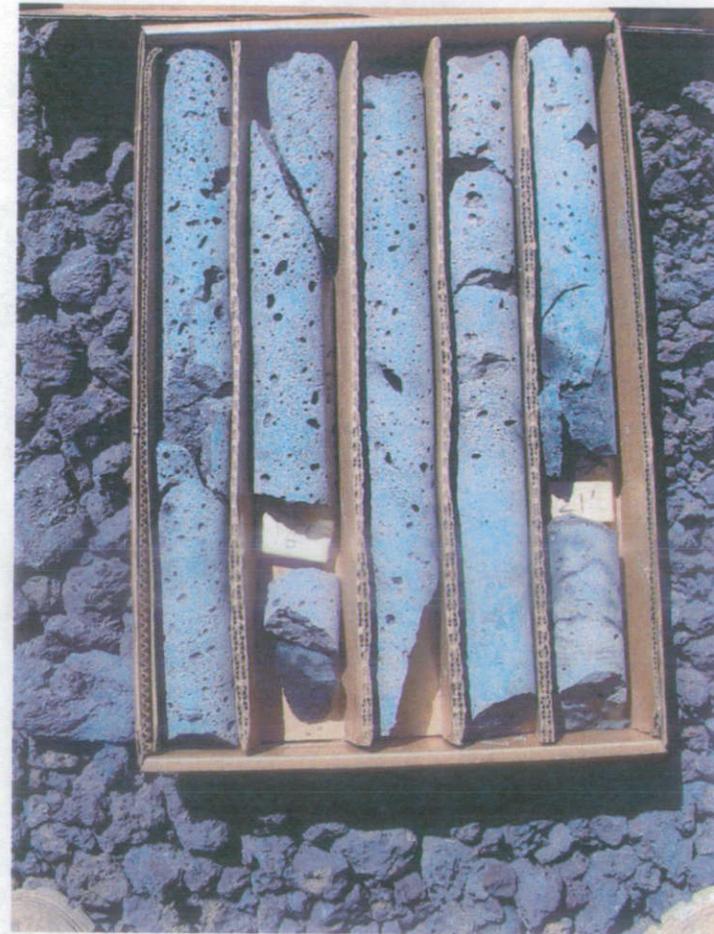


Figure C-32. Corehole 109: Box 2 —13.0 - 21.5 ft

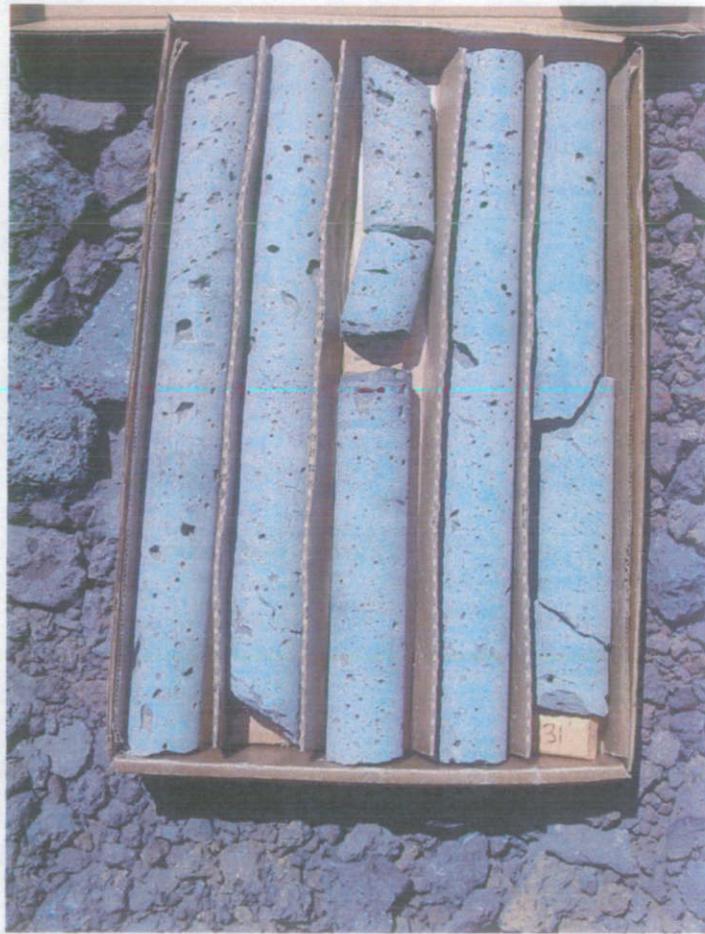


Figure C-33. Corehole 109: Box 3 —21.5 - 31.0 ft



Figure C-34. Corehole 109: Box 4 —31.0 - 40.0 ft

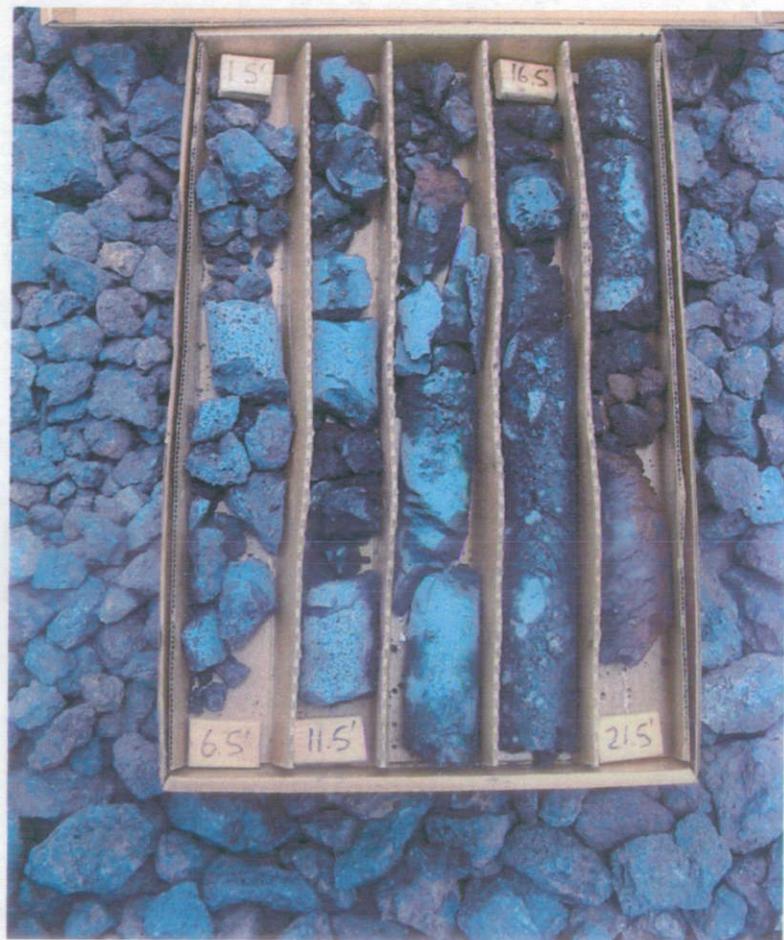


Figure C-35. Corehole 110: Box 1 —1.5 - 21.5 ft

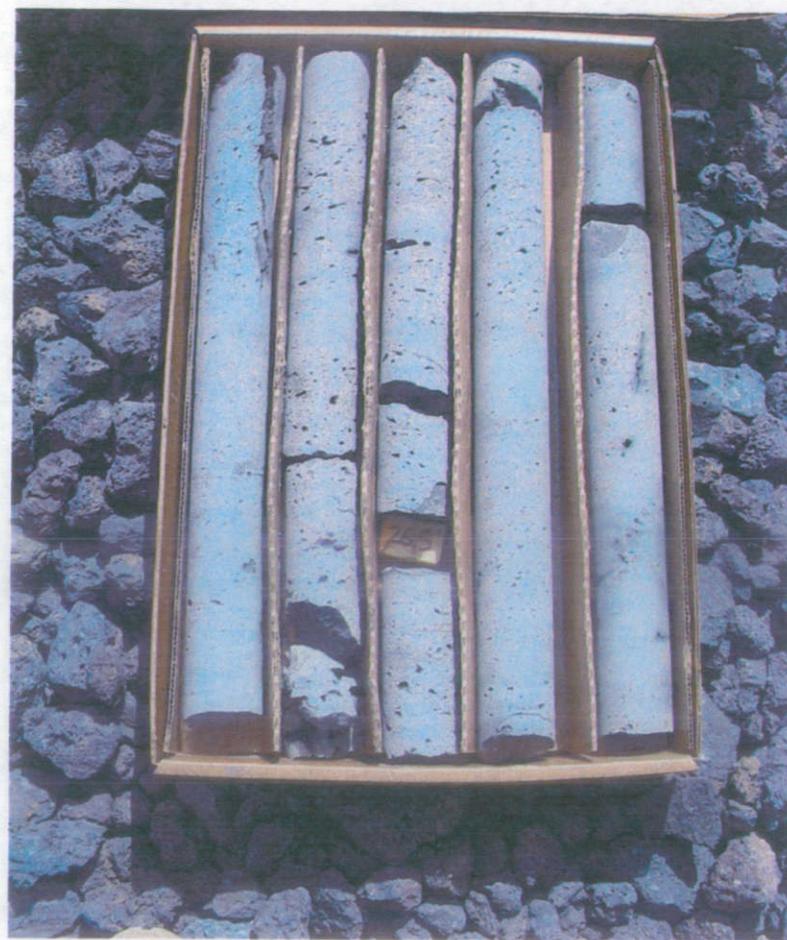


Figure C-36. Corehole 110: Box 2 —21.5 – 31.0 ft



Figure C-37. Corehole 110: Box 3 —31.0 - 41.5 ft



Figure C-38. Corehole 111: Box 1 —1.5 - 11.5 ft



Figure C-39. Corehole 111: Box 2 —11.5 - 25.5 ft

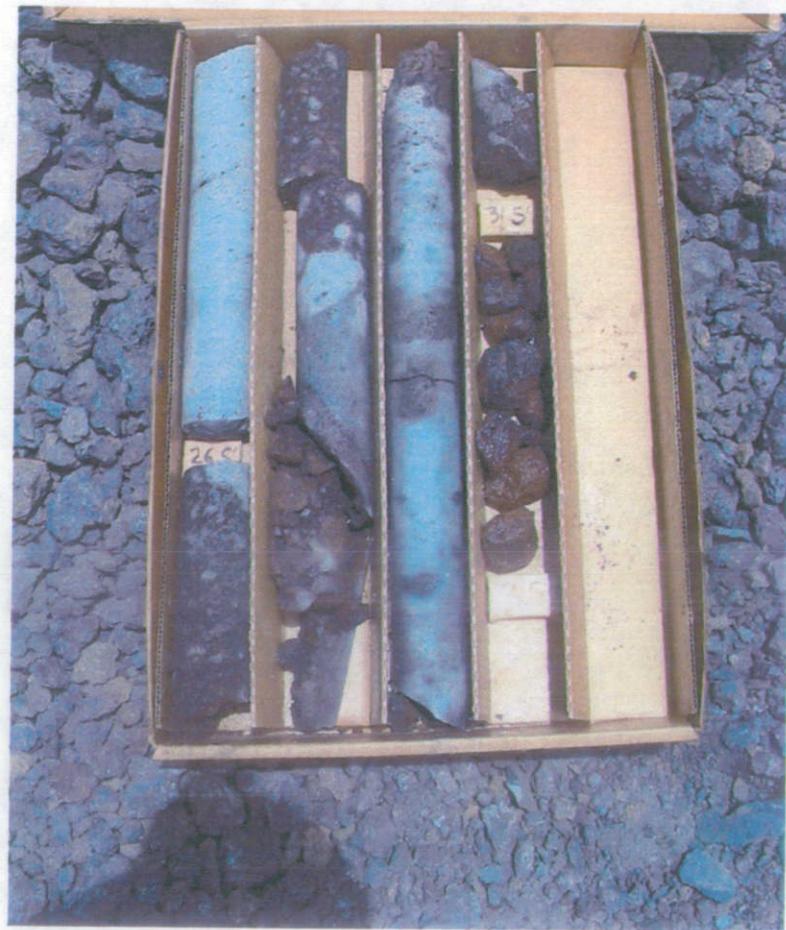


Figure C-40. Corehole 111: Box 3 —25.5 – 36.5 ft



Figure C-41. Corehole 112: Box 1 —1.0 - 14.0 ft



Figure C-42. Corehole 112: Box 2 —14.0 - 23.0 ft



Figure C-43. Corehole 112: Box 3 —23.0 – 31.0 ft

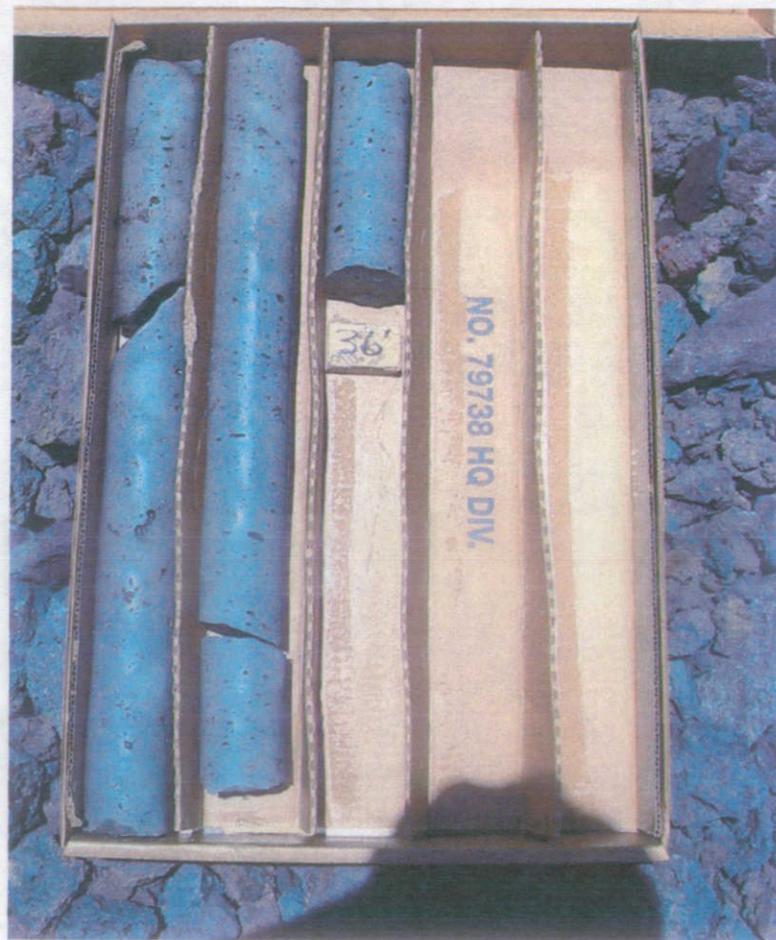


Figure C-44. Corehole 112: Box 4 —31.0 – 36.0 ft

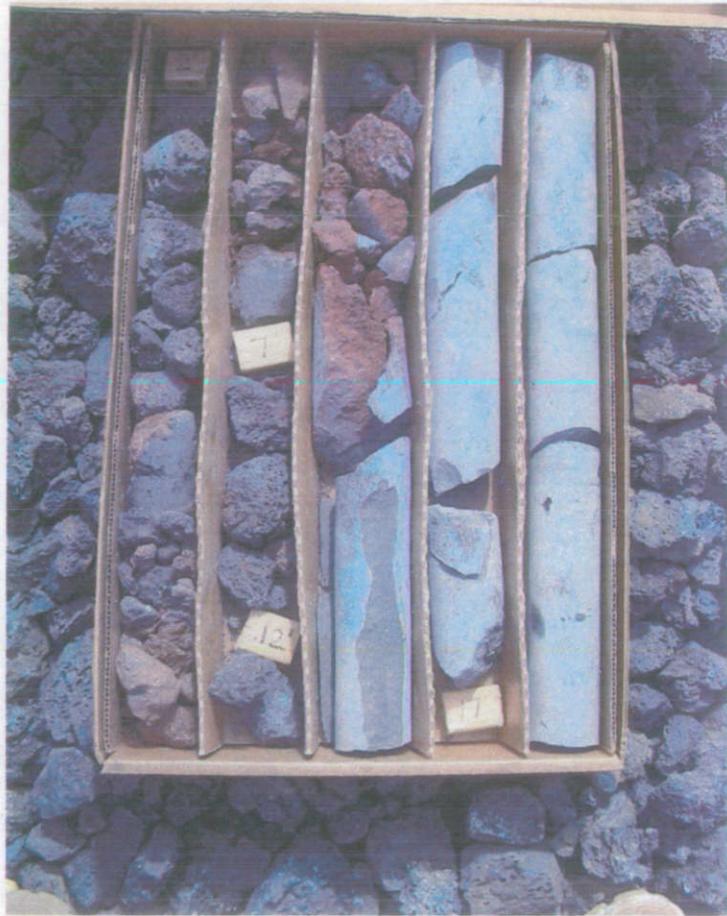


Figure C-45. Corehole 113: Box 1 —2.0 - 19.0 ft

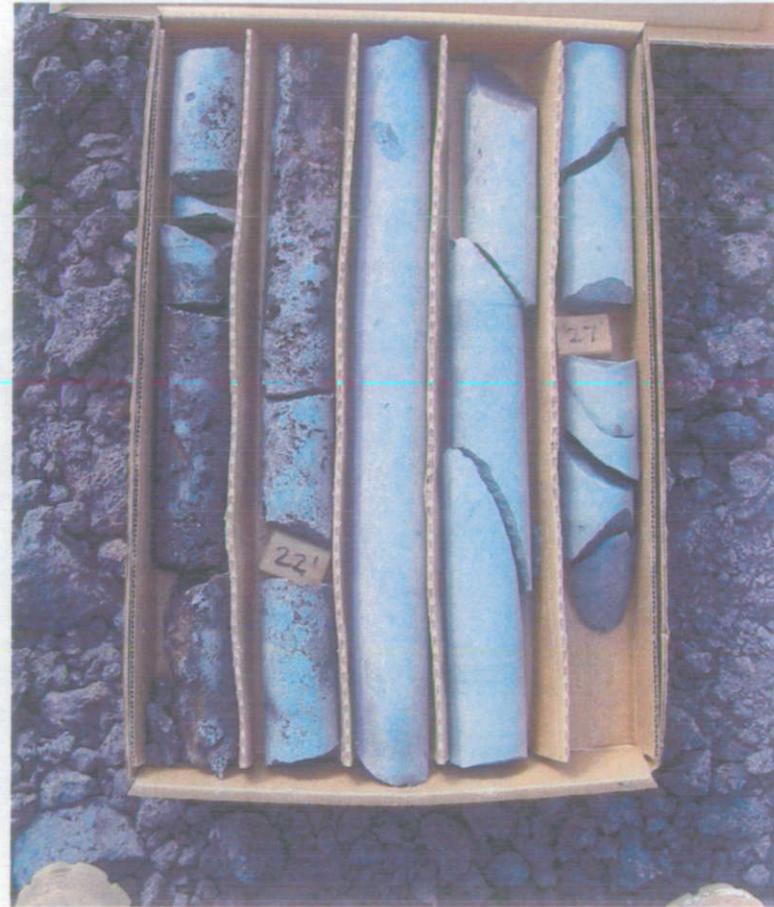


Figure C-46. Corehole 113: Box 2 —19.0 - 27.5 ft

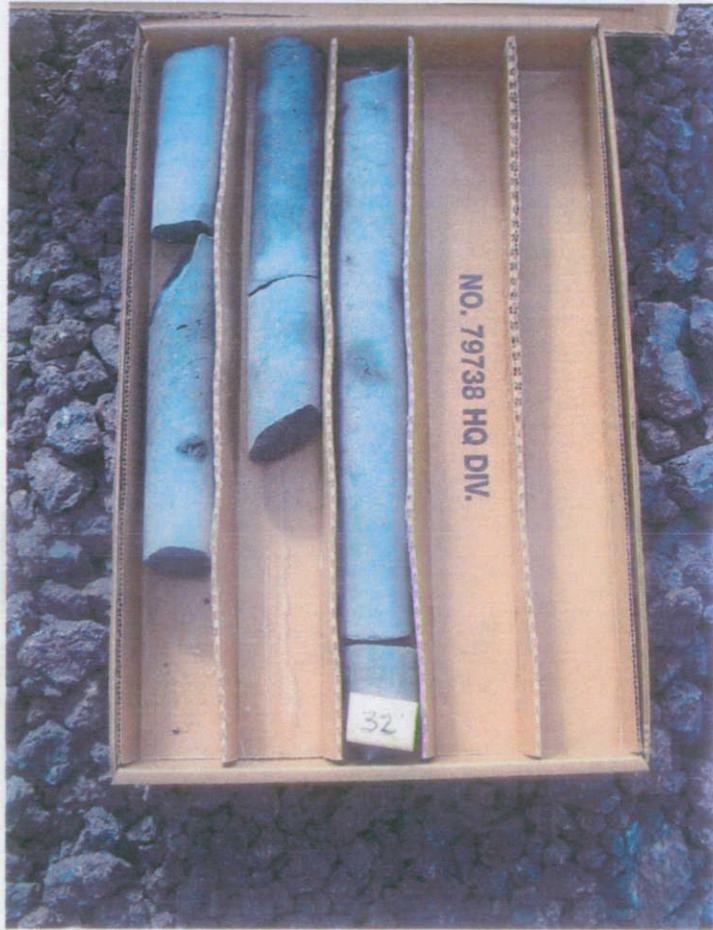


Figure C-47. Corehole 113: Box 3 —27.5 – 32.0 ft



Figure C-48. Corehole 114: Box 1 —1.5 – 18.5 ft

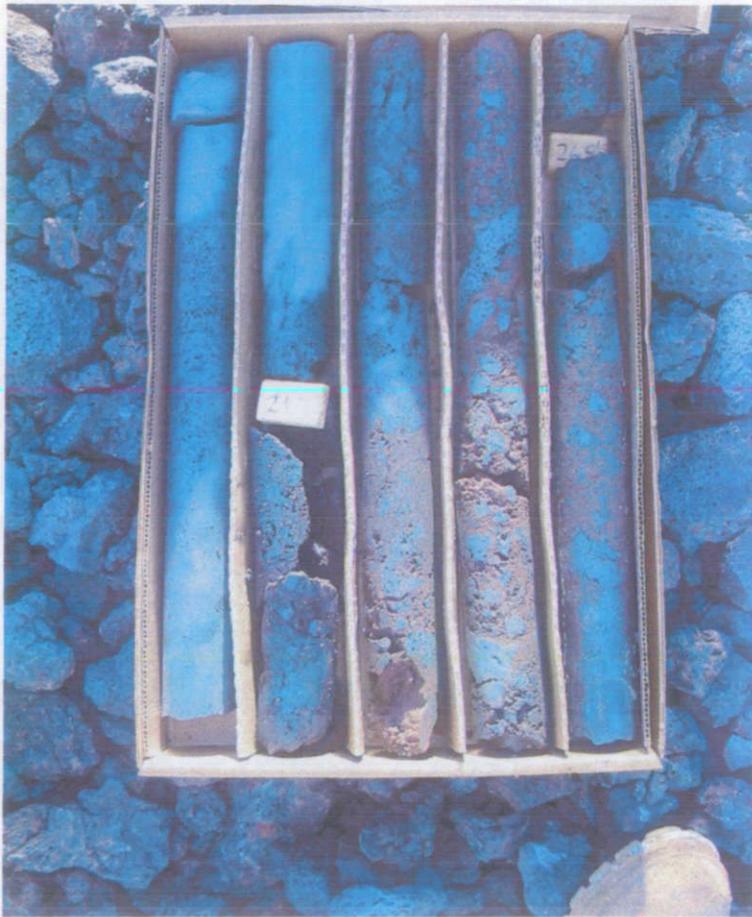


Figure C-49. Corehole 114: Box 2 —18.5 – 28.0 ft



Figure C-50. Corehole 114: Box 3 —28.0 – 35.5 ft



Figure C-51. Corehole 115: Box 1 —1.0 - 16.5 ft



Figure C-52. Corehole 115: Box 2 —16.5 - 26.0 ft



Figure C-53. Corehole 115: Box 3 —26.0 – 32.0 ft



Figure C-54. Corehole 116: Box 2 —0.5 – 20.5 ft

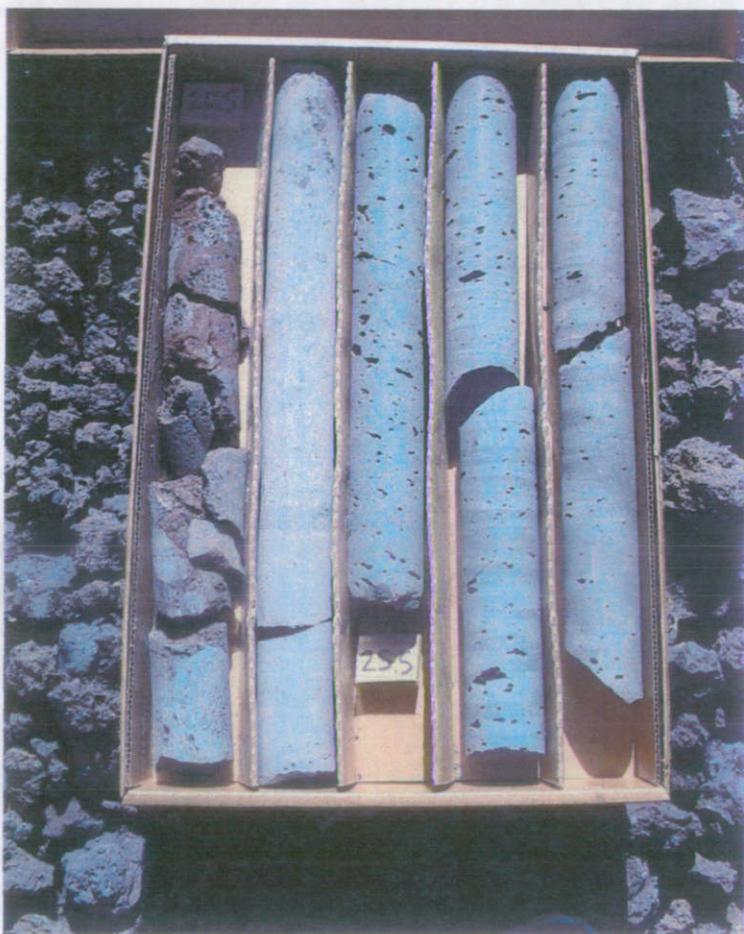


Figure C-55. Corehole 116: Box 2 —20.5 - 29.5 ft

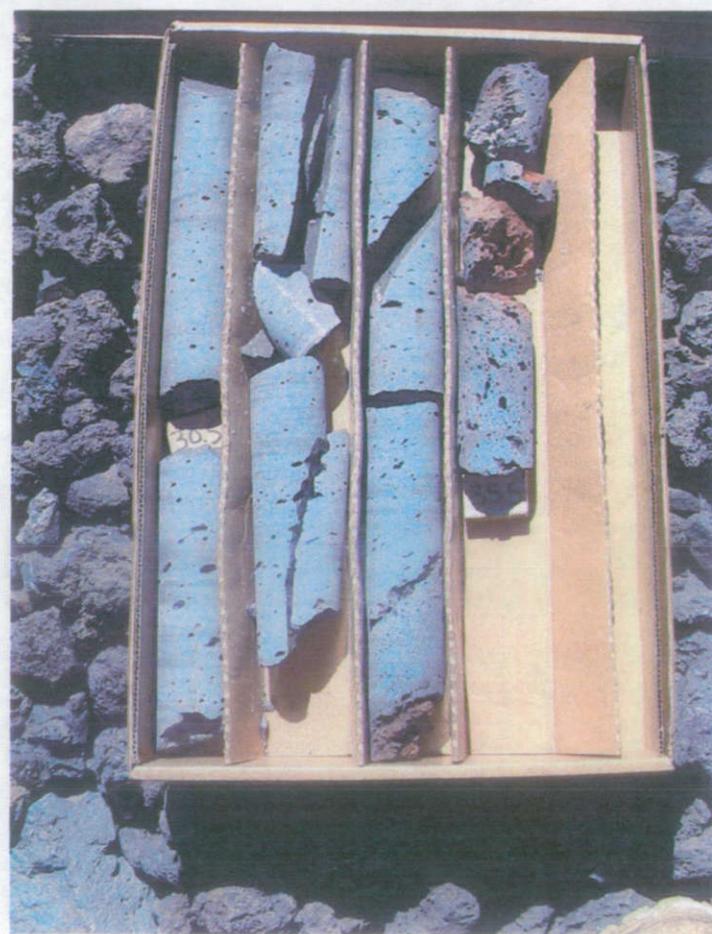


Figure C-56. Corehole 116: Box 3 —29.5 - 35.5 ft

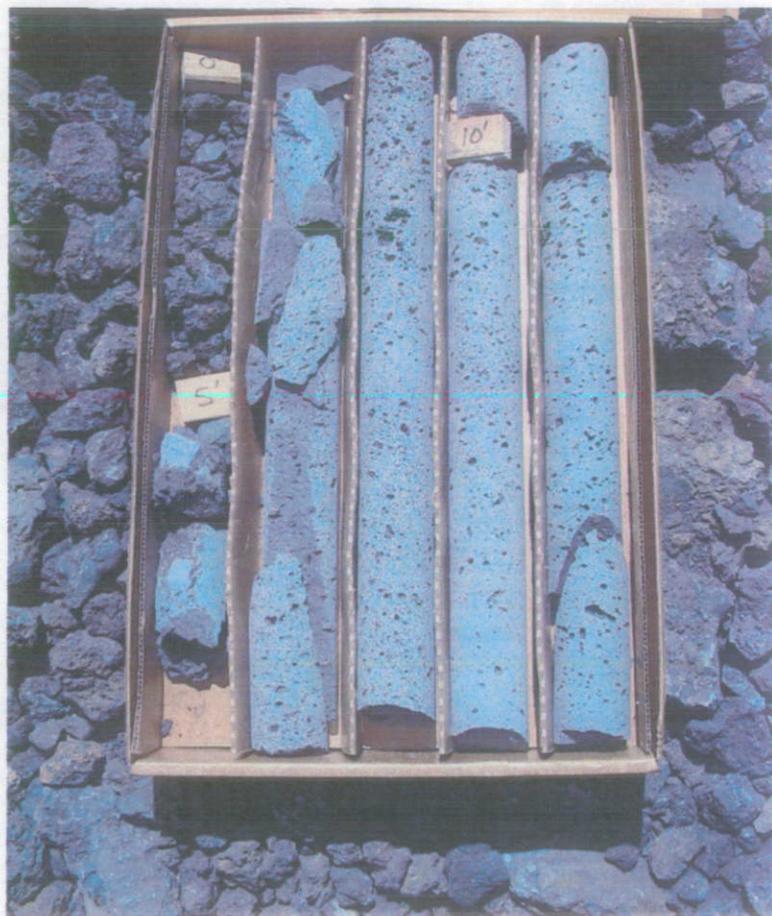


Figure C-57. Corehole 117: Box 1 —0.0 – 14.0 ft



Figure C-58. Corehole 117: Box 2 —14.0.- 28.0 ft



Figure C-59. Corehole 117: Box 3 —28.5 – 33.0 ft



Figure C-60. Corehole 118: Box 1 —1.0 – 13.0 ft



Figure C-61. Corehole 118: Box 2 —13.0 – 22.0 ft

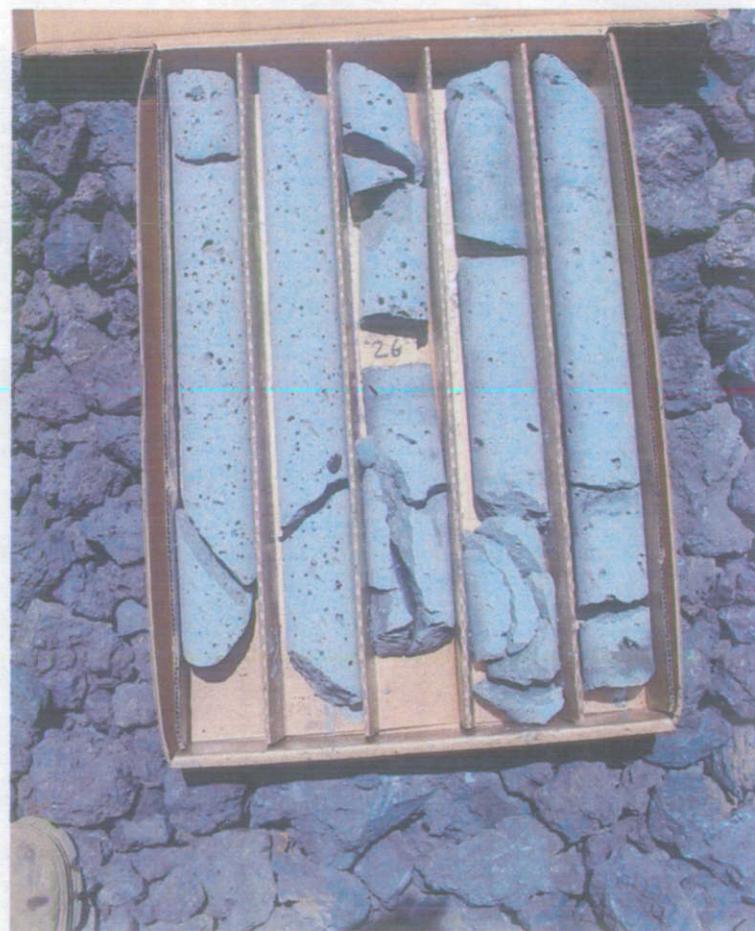


Figure C-62. Corehole 118: Box 3 —22.0 – 30.5 ft



Figure C-63. Corehole 118: Box 4 —30.5 – 40.0 ft



Figure C-64. Corehole 119: Box 1 —0.5 – 12.5 ft

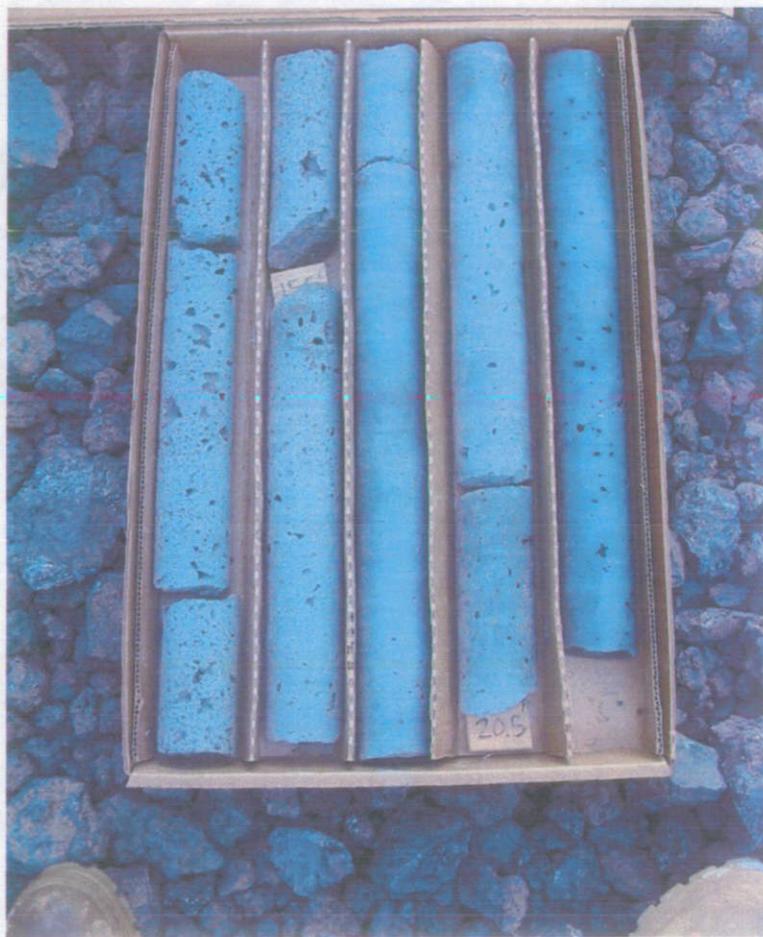


Figure C-65. Corehole 119: Box 2 —12.5 – 22.0 ft

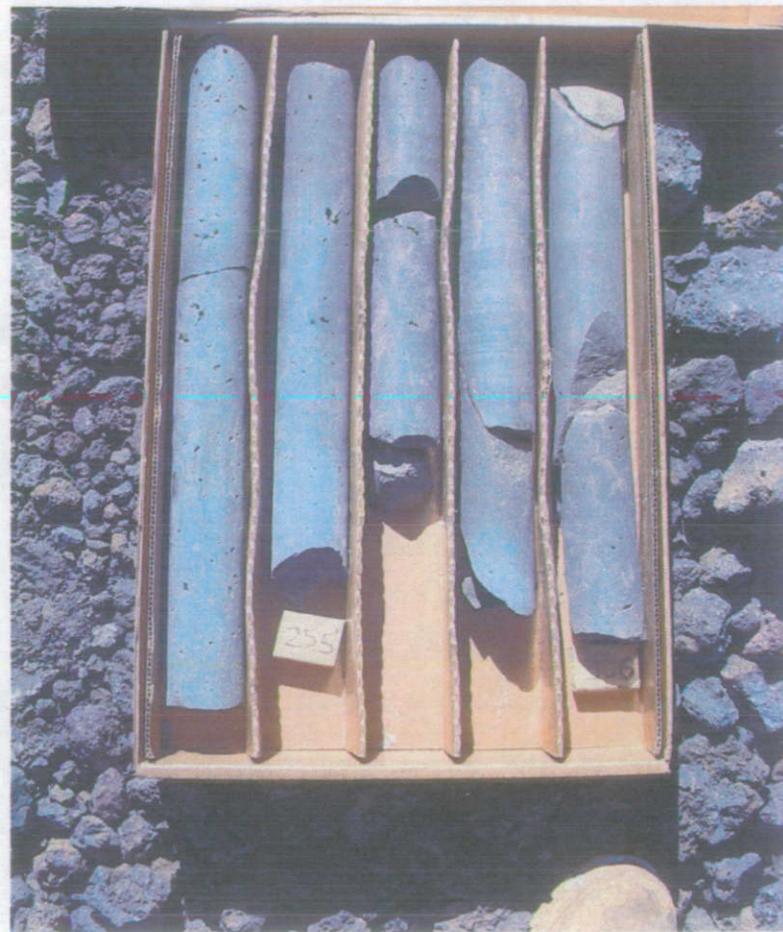


Figure C-66. Corehole 119: Box 3 —22.0 – 30.0 ft

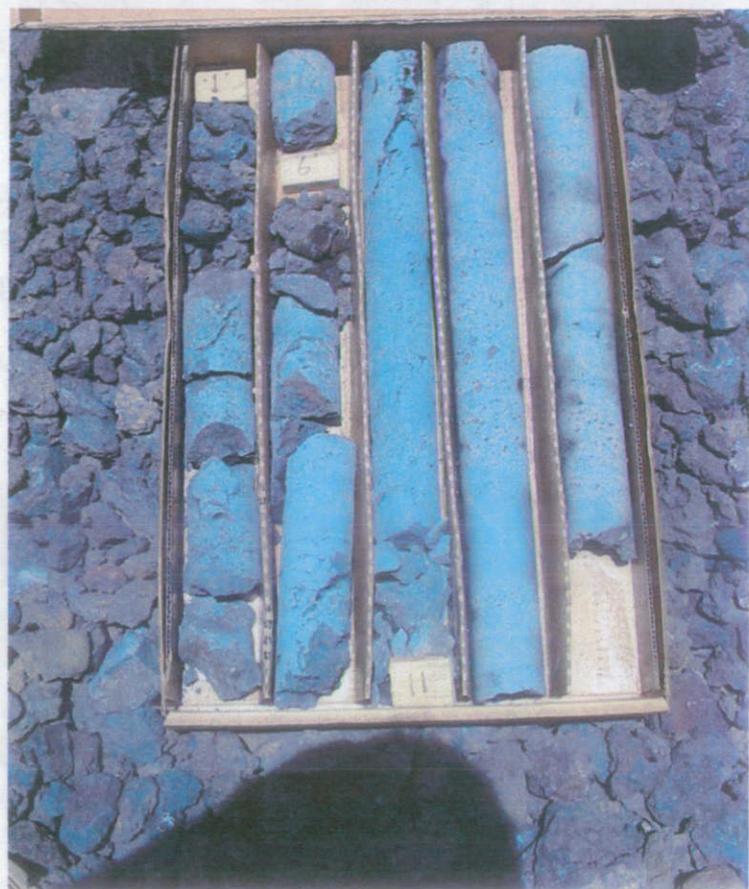


Figure C-67. Corehole 120: Box 1 -1.0 - 15.0 ft

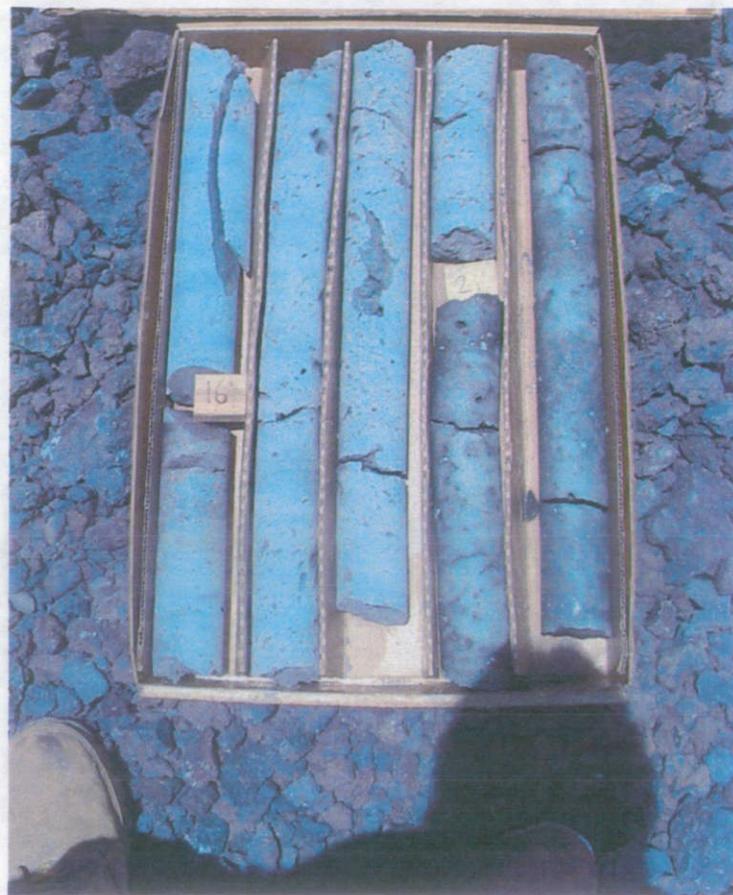


Figure C-68. Corehole 120: Box 2 -15.0 - 24.0 ft

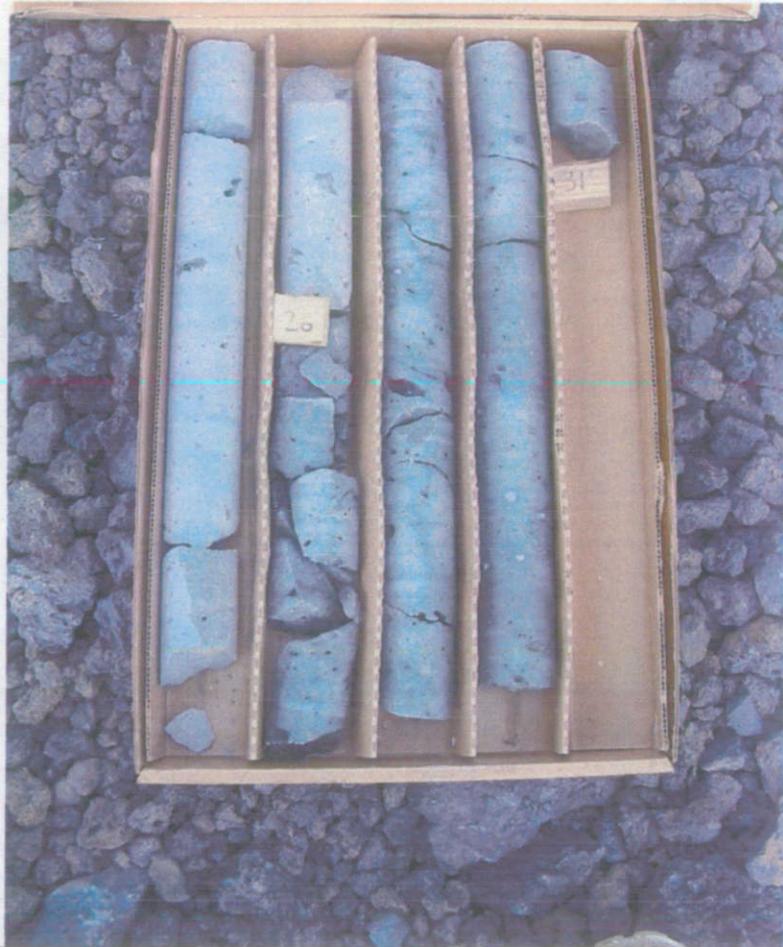


Figure C-69. Corehole 120: Box 3 —24.0 – 31.0 ft

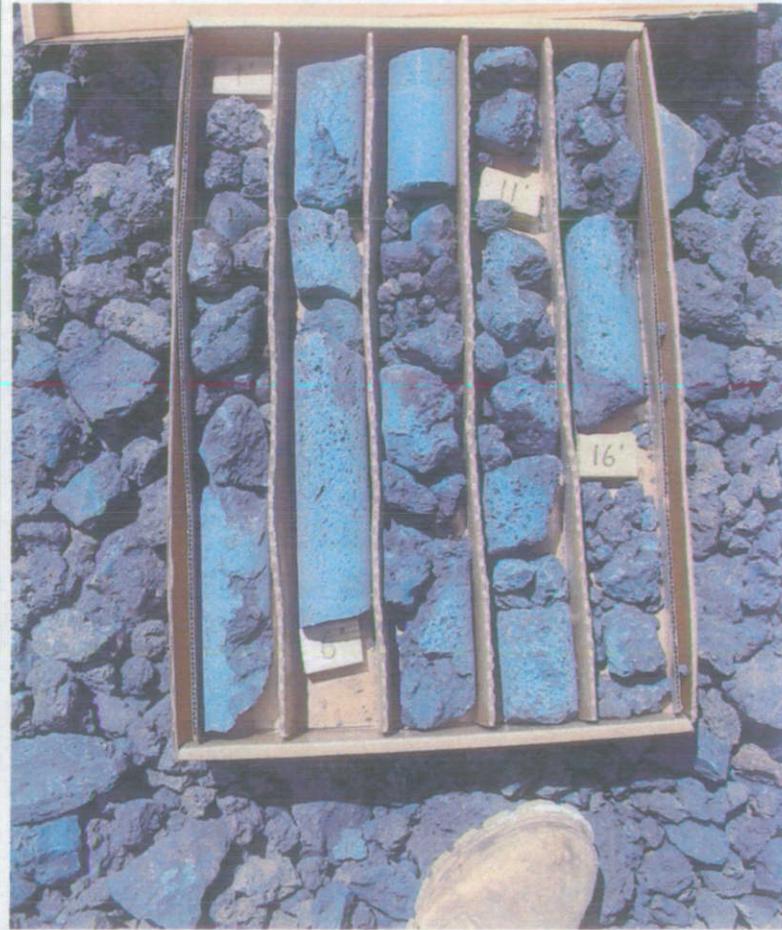


Figure C-70. Corehole 121: Box 1 —1.0 – 16.5 ft



Figure C-71. Corehole 121: Box 2 —16.5 – 31.0 ft



Figure C-72. Corehole 123: Box 1 —1.5 – 17.5 ft



Figure C-73. Corehole 123: Box 2 —17.5 - 26.5 ft



Figure C-74. Corehole 123: Box 3 —26.5 - 35.5 ft

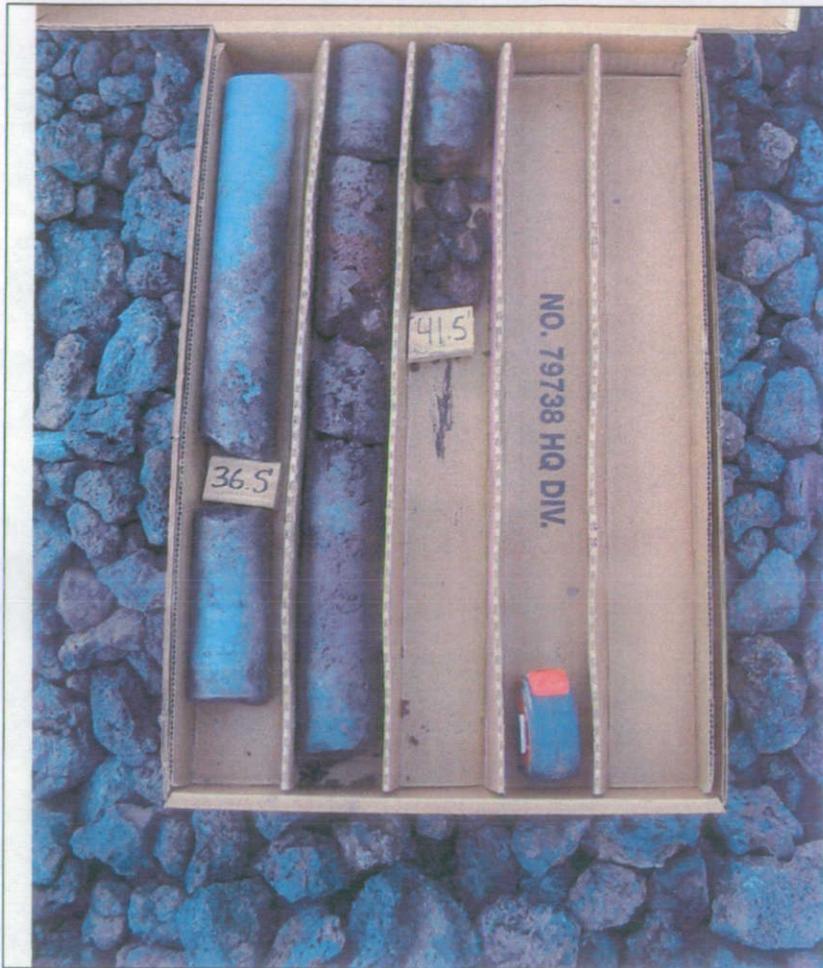


Figure C-75. Corehole 123: Box 4 —35.5 - 41.5 ft

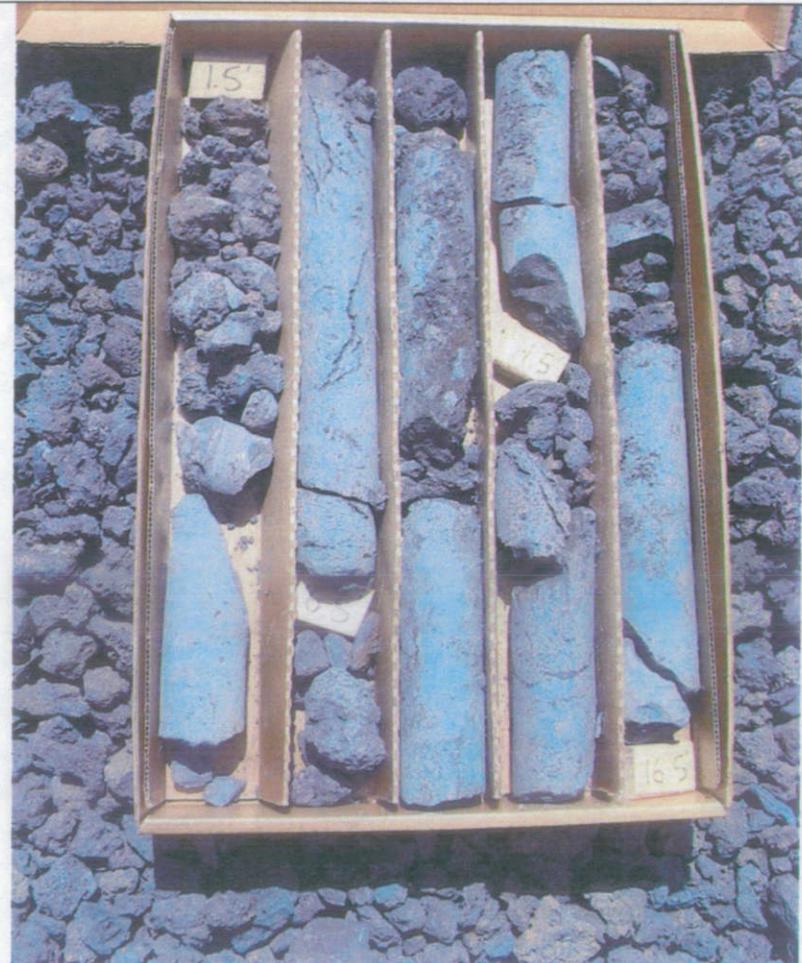


Figure C-76. Corehole 125: Box 1 —1.5 - 16.5 ft

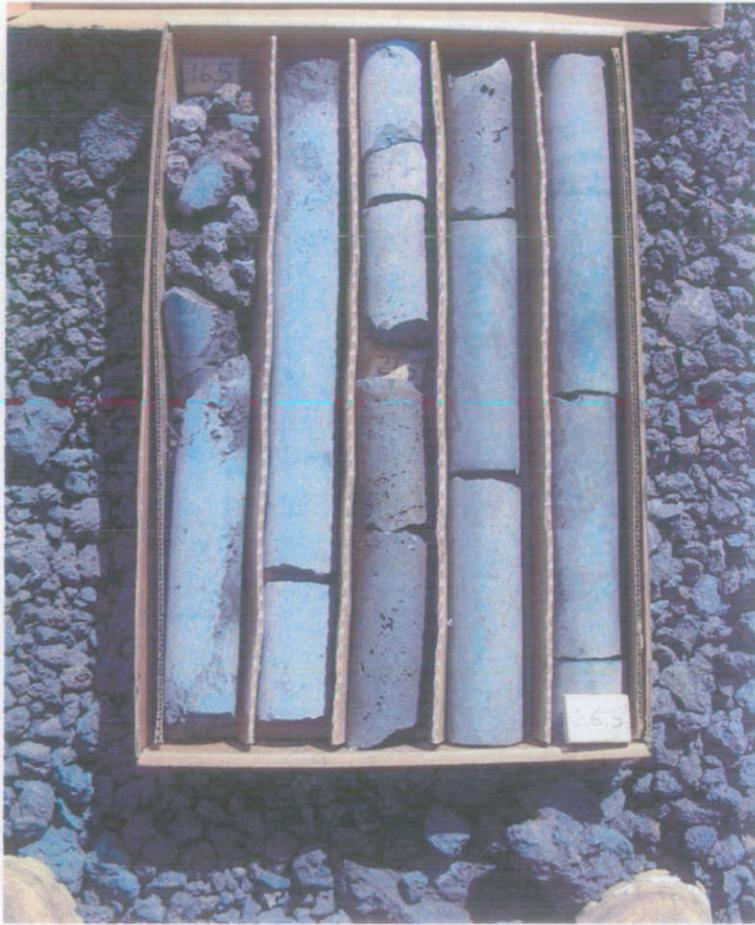


Figure C-77. Corehole 125: Box 2 —16.5 - 26.5 ft

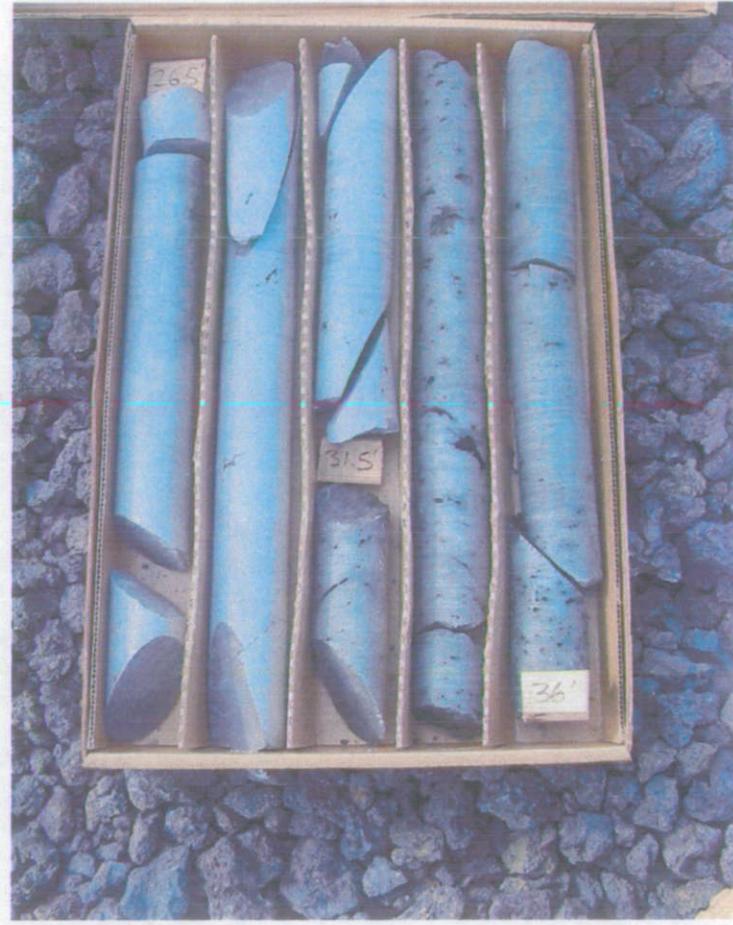


Figure C-78. Corehole 125: Box 3 —26.5 - 36.0 ft



Figure C-79. Corehole 127: Box 1 —1.5 – 12.0 ft



Figure C-80. Corehole 127: Box 2 —12.0 – 22.5 ft



Figure C-81. Corehole 127: Box 3 —22.5 - 30.5 ft



Figure C-82. Corehole 127: Box 4 —30.5 - 35.0 ft

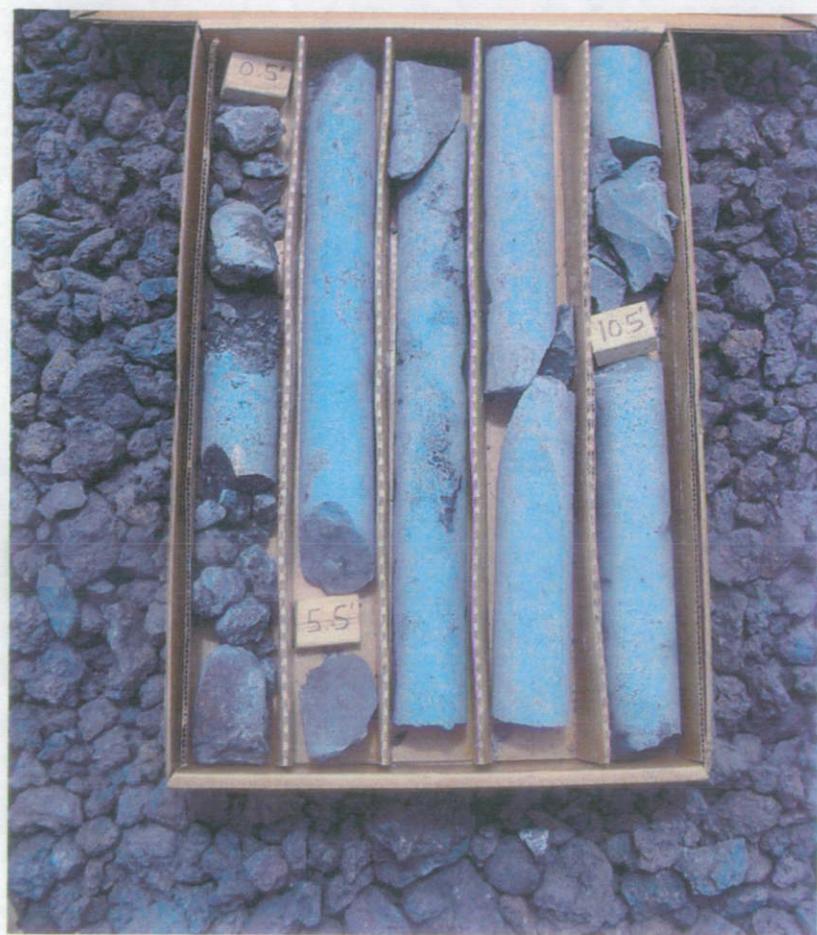


Figure C-83. Corehole 129: Box 1 —0.5 - 11.5 ft

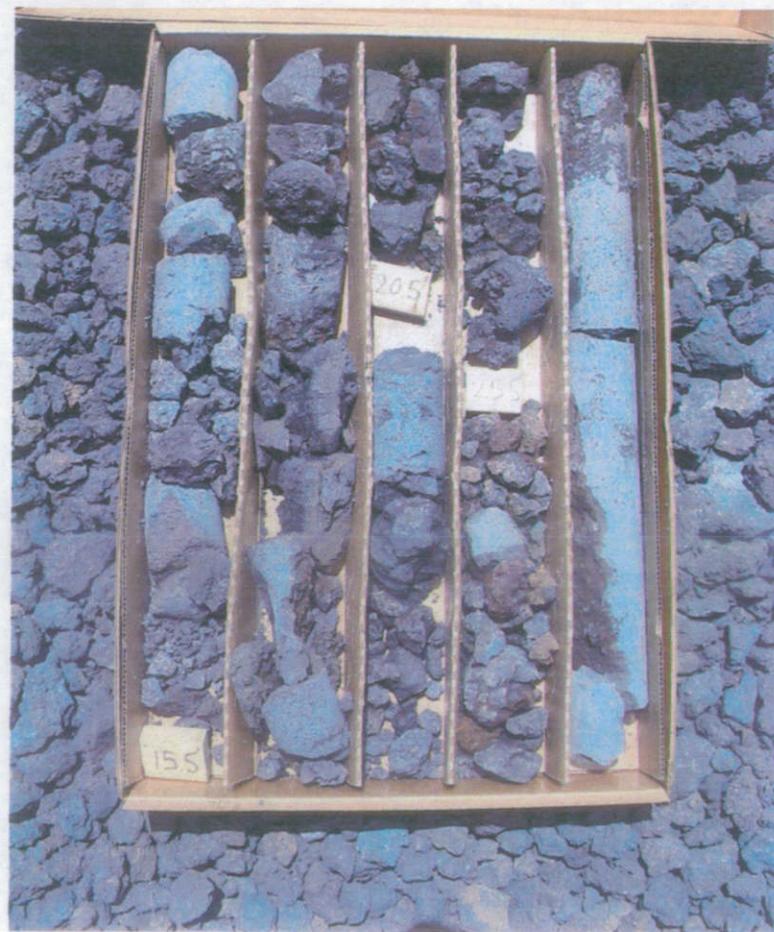


Figure C-84. Corehole 129: Box 2 —11.5 - 30.0 ft

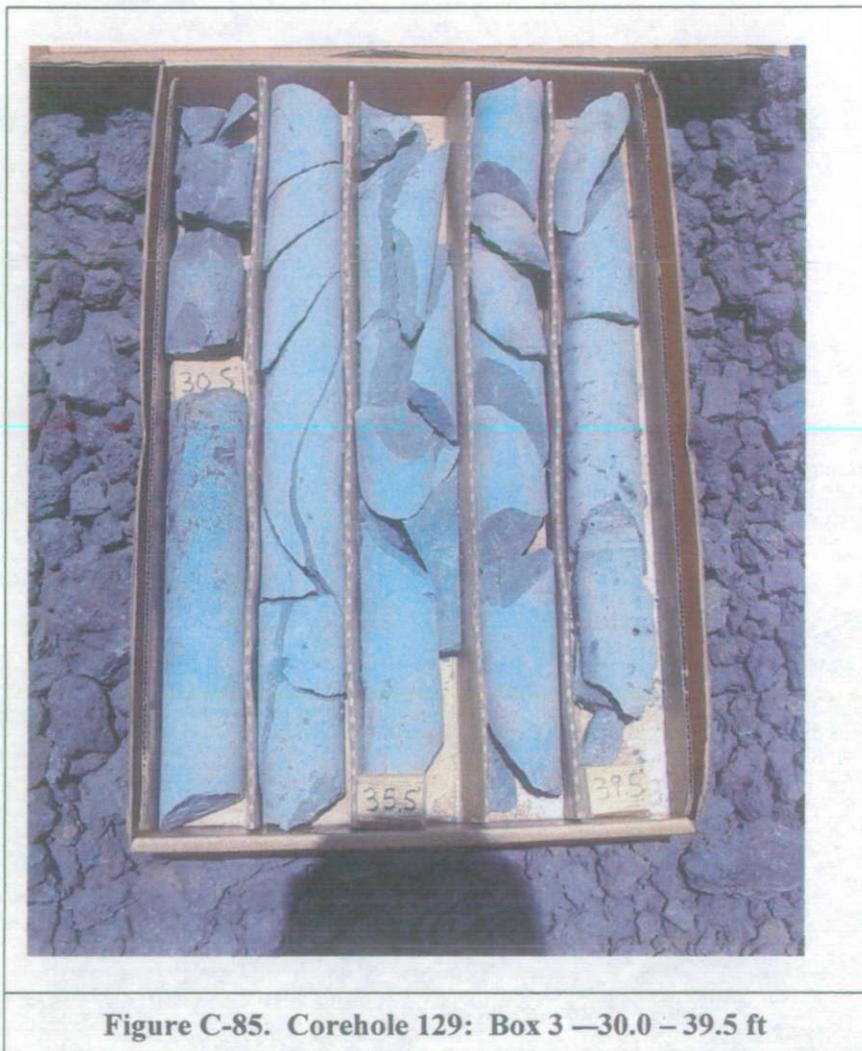


Figure C-85. Corehole 129: Box 3 —30.0 – 39.5 ft



Figure C-86 Drill rig set up for corehole 101 (Blurred)



Figure C-87 Drill rig set up for corehole 102



Figure C-88 Drill rig set up for corehole 103



Figure C-89 Drill rig set up for corehole 104



Figure C-90 Drill rig set up for corehole 105



Figure C-91 Drill rig set up for corehole 106



Figure C-92 Drill rig set up for corehole 107



Figure C-93 Drill rig set up for corehole 108

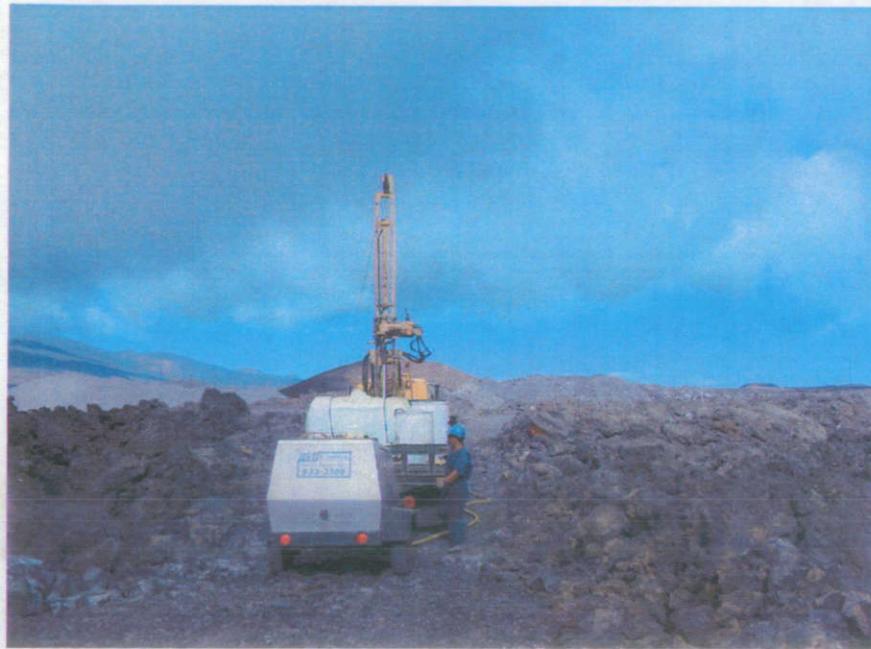


Figure C-94 Drill rig set up for corehole 109

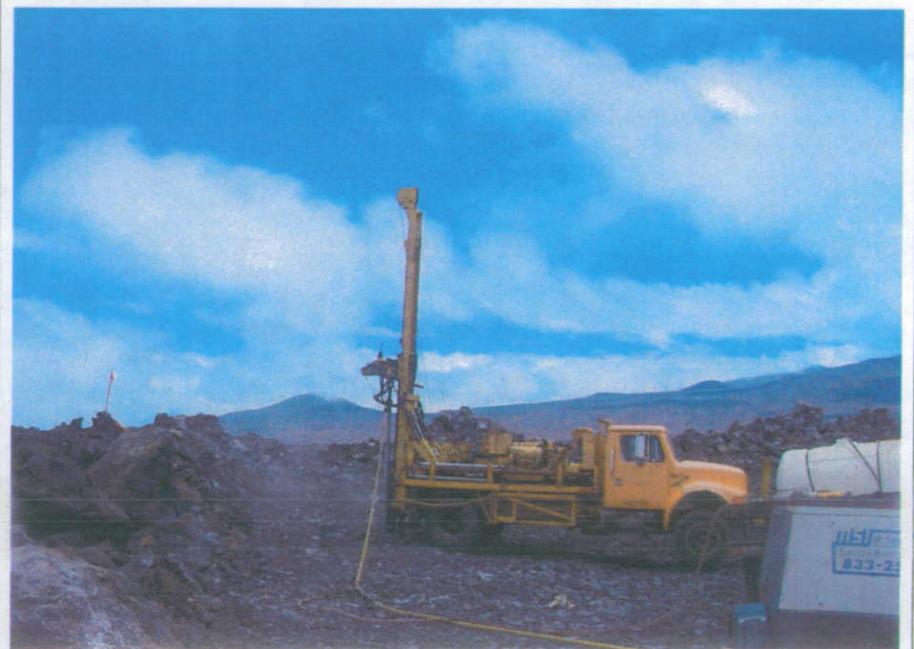


Figure C-95 Drill rig set up for corehole 110



Figure C-96 Drill rig set up for corehole 111



Figure C-97 Drill rig set up for corehole 112



Figure C-98 Drill rig set up for corehole 113



Figure C-99 Drill rig set up for corehole 114



Figure C-100 Drill rig set up for corehole 115



Figure C-101 Drill rig set up for corehole 116



Figure C-102 Drill rig set up for corehole 117



Figure C-103 Drill rig set up for corehole 118



Figure C-104 Drill rig set up for corehole 119



Figure C-105 Drill rig set up for corehole 120



Figure C-106 Drill rig set up for corehole 121



Figure C107- Drill rig set up for corehole 123



Figure C-108 Drill rig set up for corehole 125



Figure C-109 Drill rig set up for corehole 127



Figure C-110 Drill rig set up for corehole 129

# **Appendix E**

## **Laboratory Test Results**



845 Navajo Street • Denver, CO 80204

**SPECIALISTS TO THE PAVING INDUSTRY**

Phone: 303.975.9959 • Fax: 303.975.9969 • Email: office@westest.net

Federal Highway Administration  
Central Federal Lands Division  
Denver Federal Center  
Building 52, PO Box 25246  
Denver, CO 80225

November 1, 2006

Attention: Mr. Randall S. Caley

Subject: Hot Mix Asphalt Mix Design - Marshall Method – 75 Blows per Side  
FHWA Grading E  
Pohakuloa Training Area Quarry, Tesoro Refining PG 64-16 Binder  
Saddle Road, FHWA Project No.: Hawaii – A-AD/STP 6(3) & 200(1)  
WesTest Mix Design No. 166206

Gentlemen:

Enclosed are the results of a hot mix asphalt mix design done in general accordance with the Asphalt Institute's *Mix Design Methods for Asphalt Concrete* Marshall procedures, using 75 blows per side compactive effort. All tests have been conducted in general accordance with AASHTO procedures current at the time of design. The aggregate used in the mix design is from Pohakuloa Training Area Quarry. The asphalt cement used in the mix design consisted of a PG 64-16, with a specific gravity of 1.020, supplied by Tesoro Refining.

The aggregate gradations and blend percentages were provided, and are presented on Figure 1, along with a graphical presentation of the combined gradation plotted on a 0.45 Power Graph. The results of additional aggregate testing performed by WesTest or the FHWA are also included on Figure 1. Gradations of the aggregate as delivered are included on Table 2. The results of sodium sulfate soundness testing will be provided when complete.

The design was performed at asphalt cement contents of 5.0, 5.5, 6.0 and 6.5 percent. The results of the tests performed at each asphalt content are outlined on Table 1 and graphically presented on Figures 2 and 3. At a target asphalt cement content of 5.8% this mix indicates a theoretical maximum specific gravity of 2.605, bulk specific gravity of 2.474, unit weight of 154.0 pcf, 5.0% voids in total mix, 16.2% voids in mineral aggregate, 69.2% voids filled with asphalt, Marshall stability of 4600 lbs. and a flow of 0.13 inches. The effective specific gravity of the aggregate in the mix is 2.880.3

This hot mix asphalt mix design is based on specific materials and laboratory preparation of the test specimens. Variations between laboratories and variation between laboratory produced and field produced samples should be anticipated. It is recommended the mix design be field verified during initial production. Field verification often results in the optimum asphalt cement content being adjusted to meet design voids in total mix or voids in mineral aggregate criteria.

If you have any questions on the design presented, please contact us at your convenience.

Sincerely,  
WesTest

Eric R. West, P.E.





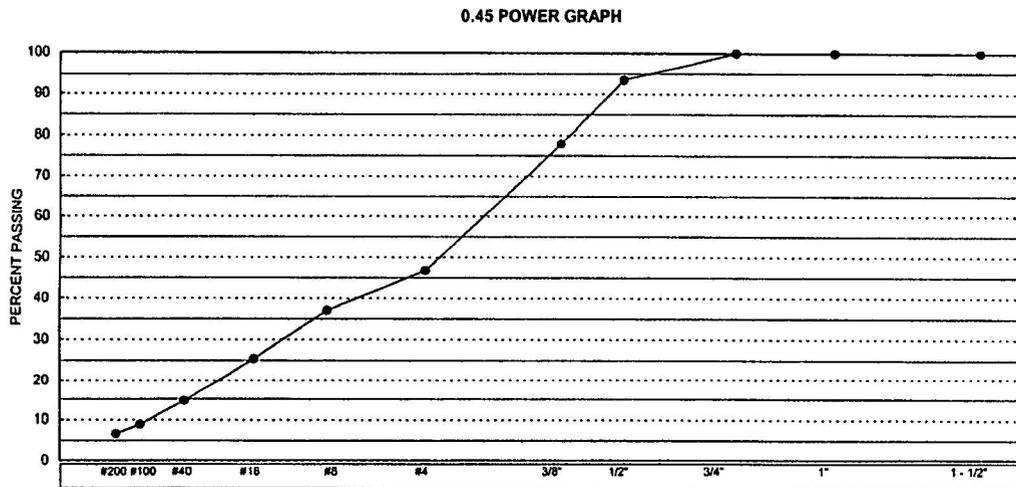
Client: Federal Highway Administration  
 Mix Design No.: 166206  
 Mix Design Method: Marshall, 75 Blows per Side  
 Grading: E  
 Aggregate Source: Pohakuloa Training Area Quarry

November 1, 2006

AGGREGATE BLEND*								
PERCENT OF BLEND	29%	27%	43%		1%	100%	Grading	PRODUCTION
DESCRIPTION	#57 Crushed Stone	#8 Crushed Stone	Manuf. Stone Sand		Lime	Combination	E	GRADATION
SOURCE	PTA Quarry	PTA Quarry	PTA Quarry		Hawallan Cement	Job Mix	Spec.	TOLERANCE
1 1/2"	100	100	100		100	100		
1"	100	100	100		100	100		
3/4"	100	100	100		100	100	97 - 100	97 - 100
1/2"	77	100	100		100	93		86 - 100
3/8"	36	87	100		100	78		71 - 85
#4	5	7	89		100	47		41 - 53
#8	3	2	80		100	37		
#16	2	2	54		100	25		
#40	2	1	30		100	15		11 - 19
#100	1	1	17		100	9		
#200	1.1	0.7	11.7		97.0	6.5	40 - 8.0	35 - 9.5

AGGREGATE PHYSICAL PROPERTIES							
BULK SPECIFIC GRAVITY					2.430	2.783	
APPARENT SPECIFIC GRAVITY					2.430	2.900	
WATER ABSORPTION (%)						1.5	
L.A. ABRASION (% LOSS)**						22	45 Max.
FRACTURED FACES, 2+ (%)						100	80 Min.
FLAT & ELONGATED 1:3 (%)						0	10 Max.
AGGREGATE DURABILITY INDEX D <sub>c</sub> **						96	35 Min.
AGGREGATE DURABILITY INDEX D <sub>s</sub> **						90	35 Min.
FINE AGGREGATE ANGULARITY (%)						51.7	45.0 Min.
LIQUID LIMIT (%)**						NV	
PLASTICITY INDEX**						NP	Non-Plastic
SAND EQUIVALENT (%)						77	45 Min.
SODIUM SULFATE SOUNDNESS, 5 CYCLES (% LOSS)							12 Max.

\*Aggregate gradations and blend percentages provided by client.  
 \*\*Data provided by client.



SIEVE SIZE RAISED TO THE 0.45 POWER

FIGURE 1



Client: FHWA  
 Mix Design No.: 166206  
 Mix Design Method: Marshall, 75 Blows per Side

November 1, 2006

Grading: E  
 Aggregate Source: Pohakuloa Training Area Quarry  
 Mixing Temperature: 312 ± 5 °F  
 Compaction Temperature: 292 ± 4 °F

A.C. Source & Grade: Tesoro Refining

**ASPHALT CONTENT DETERMINATION**

MIX PROPERTIES	LABORATORY TRIAL DATA				SPEC.	OPTIMUM
ASPHALT CEMENT CONTENT (% BY WEIGHT OF MIX)	5.0	5.5	6.0	6.5		5.8
THEORETICAL MAXIMUM SPECIFIC GRAVITY	2.640	2.618	2.596	2.575		2.605
THEORETICAL MAXIMUM DENSITY (PCF)	164.3	162.9	161.6	160.3		162.1
BULK SPECIFIC GRAVITY	2.445	2.460	2.486	2.510		2.474
DENSITY (PCF)	152.2	153.1	154.7	156.2		154.0
% VOIDS IN TOTAL MIX	7.4	6.0	4.3	2.5	3.0 - 6.0	5.0
% VOIDS IN MINERAL AGGREGATE	16.5	16.5	16.0	15.7	13.0 Min.	16.2
% VOIDS FILLED WITH ASPHALT	55.4	63.4	73.5	83.9		69.2
STABILITY (LBS.)	4685	5111	4277	3696	2000 Min.	4600
FLOW (0.01in.)	10	13	13	14	8 - 16	13

**MOISTURE SENSITIVITY TEST**

LOTTMAN MOISTURE SENSITIVITY TEST RESULTS (AASHTO T 283), FREEZE CYCLE INCLUDED, 6.0% BINDER				
DRY SUBSET	AVERAGE SPECIMEN VOIDS, 3 SPECIMENS (%)		6.5 - 7.5	7.0
	TENSILE STRENGTH, SPECIMEN A (PSI)			94
	TENSILE STRENGTH, SPECIMEN B (PSI)			104
	TENSILE STRENGTH, SPECIMEN C (PSI)			94
	AVERAGE TENSILE STRENGTH (PSI)			97
CONDITIONED SUBSET	AVERAGE SPECIMEN VOIDS, 3 SPECIMENS (%)		6.5 - 7.5	7.0
	TENSILE STRENGTH, SPECIMEN A (PSI)			84
	TENSILE STRENGTH, SPECIMEN B (PSI)			84
	TENSILE STRENGTH, SPECIMEN C (PSI)			87
	AVERAGE TENSILE STRENGTH (PSI)			85
TENSILE STRENGTH RATIO			70 Min.	88
Minor moisture damage noted in a few of the finer aggregate particles, Scale:1.				
Several broken aggregate particles in conditioned and dry specimens.				

TABLE 1



Client: FHWA  
Mix Design No.: 166206  
Grading: E  
Mix Design Method: Marshall, 75 Blows per Side

November 1, 2006

### VOLUMETRIC PROPERTIES

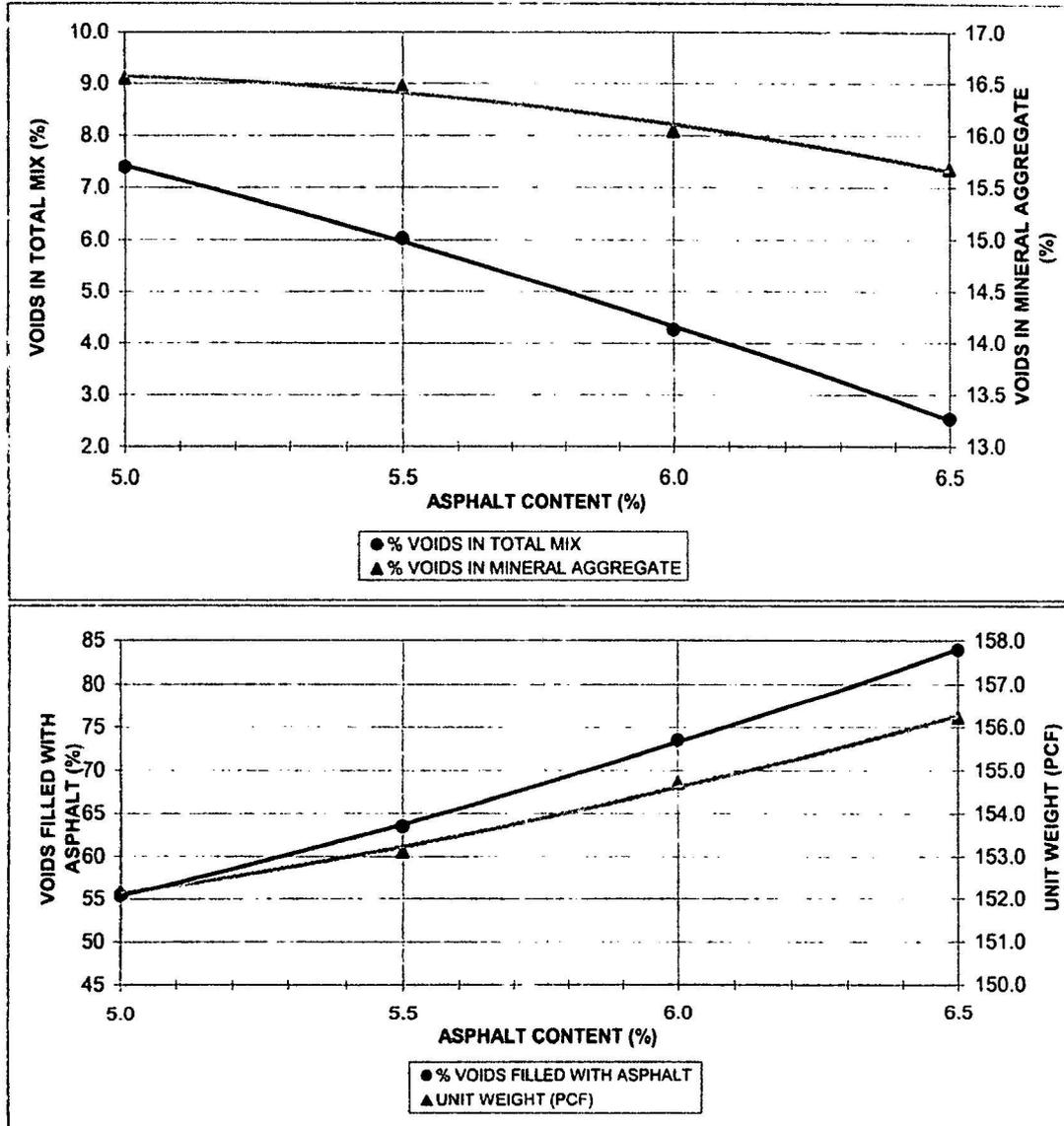


FIGURE 2



Client: FHWA  
Mix Design No.: 166206  
Grading: E  
Mix Design Method: 75 Blows per Side

November 1, 2006

### MARSHALL PROPERTIES

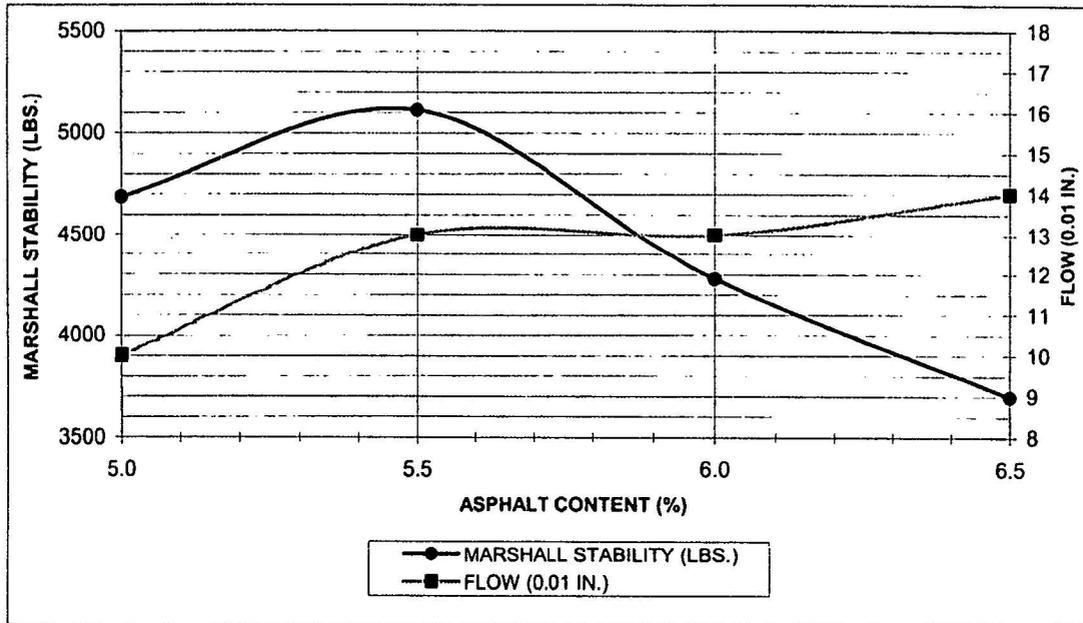


FIGURE 3



845 Navajo Street  
 Denver, CO 80204  
 303.975.9959, Fax: 303.975.9969

**LABORATORY TEST REPORT**  
**AS DELIVERED GRADATIONS**

PROJECT: Saddle Road  
 FHWA PROJECT NO.: HI A-AD/STP 6(3) & 200(1)

REPORT DATE: October 26, 2006  
 DATE SAMPLED: September 19, 2006  
 DATE RECEIVED: October 23, 2006  
 DATE TESTED: October 24, 2006  
 SAMPLED BY: Client  
 SOURCE: Pohakuloa Training Area Quarry

WesTest PROJECT NO.: 166206  
 CLIENT: Federal Highway Administration  
 Denver Federal Center  
 Randall S. Caley  
 Building 2  
 Box 25246  
 Denver, CO 80225

GRADATION ANALYSIS - AASHTO T 11 & T 27

SIEVE SIZE	PERCENT PASSING					
	#67 CRUSHED STONE	TARGET	#8 CRUSHED STONE	TARGET	MANUF. STONE SAND	TARGET
2						
1 - 1/2"						
1"						
3/4"	100	100				
1/2"	72	77	100	100		
3/8"	27	36	92	87	100	100
#4	3	5	17	7	98	99
#8	2	3	3	2	73	80
#16	2	2	3	2	48	54
#40	2	2	2	1	26	30
#100	1	1	2	1	15	17
#200	1.2	1.1	1.9	0.7	11.4	11.7

TABLE 2



# Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory



## Report of Superpave Asphalt Concrete Mix Design

**Project:** Hawaii A-AD/STP 6(3) & 200 (1) Saddle Road

**Submitted By:** D.S. Scanlon

**G<sub>b</sub> = 1.019**

**Date Reported:**

**Aggregate Source:** Pohakuloa Training Area Quarry

**Design Type:** Hot Asphalt Concrete Pavement

**Aggregate Nominal Maximum Size:** 12.5 mm **Asphalt Cement Source and Grade:** Tesoro Refining, Honolulu, Hawaii PG 64-16

Lab Number	06-1691-AGG	06-1692-AGG	06-1693-AGG		06-1977-AGG			
Field Number	ACC-5/8	ACC-3/8	ACC-#4 Sand		Combined			
Description	5/8" Aggregate (# 67 Stone*)	3/8" Aggregate (# 8 Stone*)	Sand (Manufactured Stone Sand*)	Lime	As Received	As Built	Specs	T.V. (D)
Bin Combination%	29	27	43	1				
1" 25.0mm								
3/4" 19.0mm	100 (100)				100 (100)	100	100	
1/2" 12.5mm	74 (79)	100 (100)			92 (93.9)	94	90-100	94
3/8" 9.5mm	34 (40)	93 (90)			79 (79.8)	80	90 MAX	
#4 4.75mm	4 (14)	21 (21)	100 (97.8)		51 (52.7)	53		53 6
#8 2.36mm	2 (10)	5 (10)	72 (71.5)		34 (37.4)	37	28-58	37 6
#16 1.18mm								
#30 600µm	2 (3.4)	2 (4)	32 (33)		18 (17.4)	17		17 4
#40 425µm	2				13	14		
#50 300µm	1 (3.3)	2 (3.5)	20 (19.9)	100 (100)	11 (11.1)	12		11 3
#100 150µm								
#200 75µm	1.2 (1.5)	1.3 (2.8)	10.5 (10.2)	100 (95)	6.2 (6.9)	6.7	2-10	6.9 2
Limit								
Stability Index								

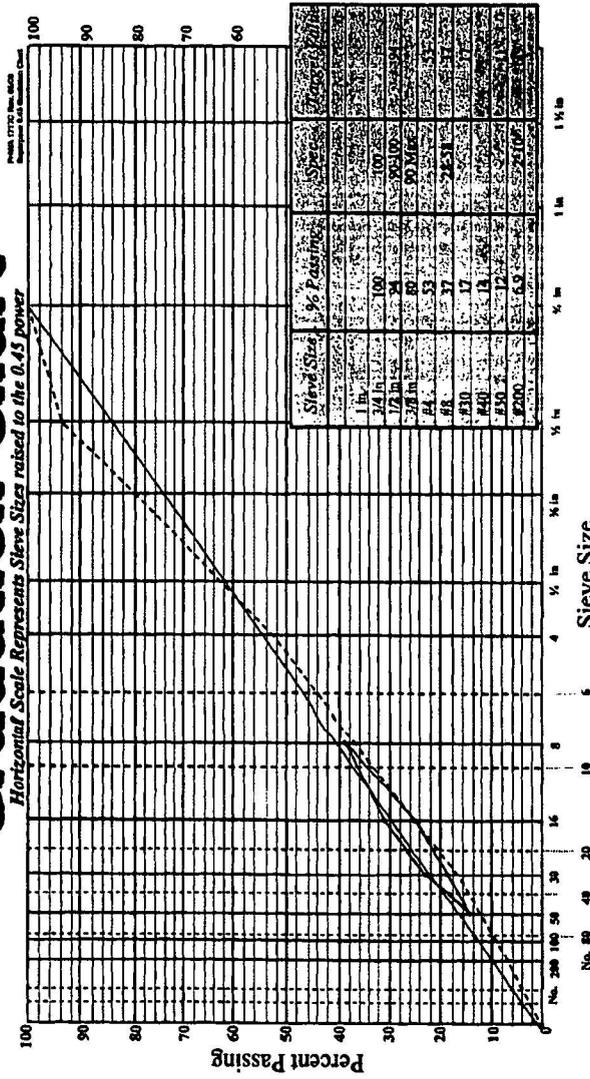
Design Parameters	Specs.	Mixture Induced Damage T 283
Optimum AC by Total Mix Weight, %	6.8	
Maximum Density, pcf AASHTO T 209	158.6	Asphalt Content, %
Air Voids, %	4.0	Additive Type
VFA, %	65-78	Additive %
VMA, %	14.0 min	Cond. Strength, psi
Lab Mixing Temperature, °C	160°	Dry Strength, psi
Dust-to-Binder Ratio	0.8-1.6	TSR, %
		Avg. Air Voids, %
		Saturation, %
Antistrip, %, Type		Crack/Broke Agg, %
Aggregate Quality	Specs.	Design Gyrotory Compactive Effort
L.A. Abrasion, Grading, % AASHTO T 96	35 MAX	Design High Air Temp, Centigrade
Micro-Deval Abrasion, % Loss AASHTO T 327	--	ESAL's
NaSO <sub>4</sub> Soundness, % Loss AASHTO T 104	17	Ninit
Fractured Faces, % ASTM D 5821	90 100	Ndesign
Sand Equivalent, Ref. Ail. 2 AASHTO T 176	45	Nmax
Uncompacted FA Voids, A % AASHTO T 304	40	Specification (% of Maximum Density)
F & E Particles, 1:3 Ratio, % ASTM D 4791	10 3.4	< 90.5 96.0 < 98.0
		Specific Gravity & Absorption T 84 & T 85
		Reported values are one place more than AASHTO specifics
		+ #4 - #4 Combined
		Apparent Specific Gravity
		Bulk Specific Gravity
		Absorption, %
		Effective Specific Gravity

**Distribution:** Num. / Project File  
 1 / 2006  
 by Darrell Harding  
 Project Engineer Eric Zeller  
 Construction Bill Hakala  
 Materials 4 Copies

**Remarks:** \*As indicated in the mix design paperwork received 12/18/2006.  
 ( ) Indicates Jas. W. Glover's test results.

**Reported By:**

# Gradation Chart



State: Hawaii	Project: A-AD/STP-63 & 200(1)	Label No: 12787/2006	Date: 12/28/2006
Type, Source, Producer of Aggregate: PTA Quarry	State: Hawaii	US 197 AGG	Item: 401
Material Description: Superpave Hot Asphalt Concrete Pavement			



### Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory  
Superpave Mix Design

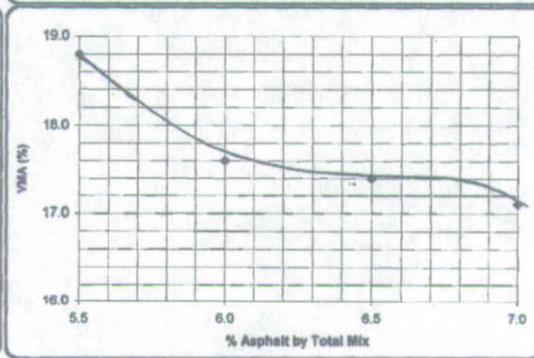
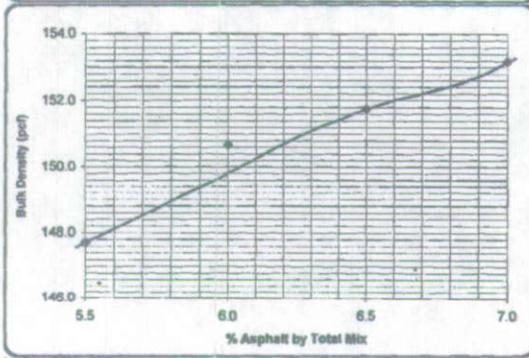
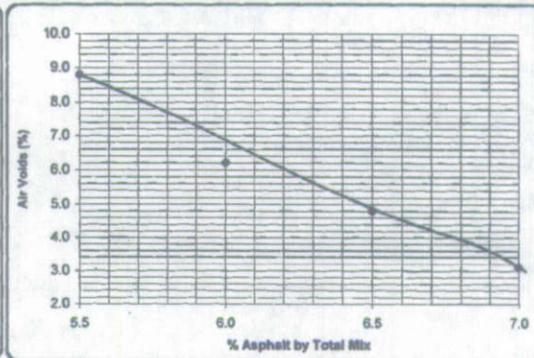
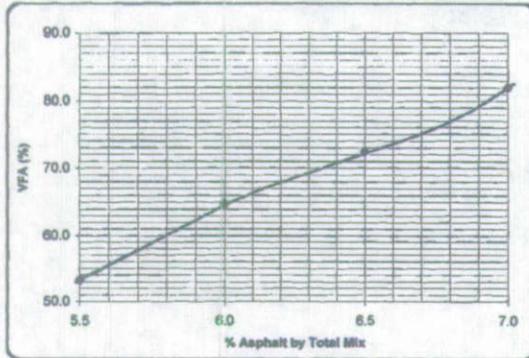
Page



Project: HI A-AD/STP 6(3) & 200(1) Saddle Road

Lab No: 06-1977-AGG

Date: 12/28/2006



Form FMAA 1711B Rev. 10/04



**Central Federal Lands Highway Division Laboratory**  
 An AASHTO and ISO Accredited Laboratory



**Report of Miscellaneous Tests**

**Project:** Hawaii SR 200 (2) Saddle Road East Side

**Date Reported:** 6/15/2005

**Laboratory Numbers:** 05-(260, 263, 265, 268, 270 & 271)-C

**Submitted By:** Charlie Martinez

**Material Type:** Mainly Basalt

**Material Source:** Bore Holes – PTA Quarry

**Tested For:** Aggregate Quality

**Field Sample Numbers:** B-2, B-5, B-7, B-10, B-12 & B-13

**Test Results**

Laboratory Number	Boring Number	AASHTO T 96	AASHTO T 104	AASHTO T 85			
		Los Angeles Abrasion Grading A, % Loss	Sodium Sulfate Soundness, % Loss	Apparent Specific Gravity	Bulk Specific Gravity	Bulk SSD Specific Gravity	Absorption, %
05-260-C	B-2	24	0	2.84	2.70	2.74	2.0
05-263-C	B-5	27	0	2.82	2.65	2.71	2.4
05-265-C	B-7	28	0	2.87	2.72	2.78	1.9
05-268-C	B-10	27	0	2.85	2.68	2.74	2.3
05-270-C	B-12	26	0	2.93	2.80	2.85	1.5
05-271-C	B-13	26	0	2.92	2.79	2.84	1.6
<b>05-207-AGG*</b>	<b>--</b>	<b>27</b>	<b>0</b>	<b>2.79</b>	<b>2.59</b>	<b>2.66</b>	<b>2.7</b>

\* This stockpiled material was previously reported on 5/19/2005.

Photos of all the submitted cores are attached.

The cores were laboratory crushed to -1 1/2" before quality testing was initiated.

Distribution: Num. / Project File  
 Laboratory Darrell Harding  
 Project Engineer Eric Zeller  
 Construction Bill Hakala  
 Project Management Dave Gedeon  
 Geotechnical **Kristine Haremy**  
 Pavements Mike Voth  
 Materials 4 Copies

Reported By:

Darrell Harding

Form FHWA 1742 Rev. 12/01

Figure E-1. Summary of material source testing on bulk samples from indicated coreholes.



## Central Federal Lands Highway Division Laboratory

An AASHTO and ISO Accredited Laboratory

U.S. Department of Transportation  
Federal Highway Administration

### Report of Superpave Asphalt Concrete Mix Design



Page 1 of 4

**Project:** Hawaii SR 200(2) Saddle Road East Side

**Submitted By:** Eric P. Zeller **Date Reported:** 6/14/2005

**Aggregate Source:** PTA Quarry Stockpile; Pohakuloa Training Area **Design Type:** Superpave Hot Asphalt Concrete Pavement

**Aggregate Nominal Maximum Size:** 12.5 mm **Asphalt Cement Source and Grade:** Chevron, Kapolei, HI; PG 64-16

Lab Number				05-207-AGG					
Field Number				Combined					
Description				As Received	As Built	Specs	T.V.	(D)	
Bin Combination%									
1"	25.0mm			After 1/2"					
3/4"	19.0mm			Scalp		100			
1/2"	12.5mm			100		90-100			
3/8"	9.5mm			87		90 Max.			
#4	4.75mm			64				6	
#8	2.36mm			45		28-58		6	
#16	1.18mm								
#30	600µm			22				4	
#40	425µm			18					
#50	300µm			15				3	
#100	150µm								
#200	75µm			7.1		2-10		2	
Liquid Limit				NV					
Plasticity Index				NP					

Design Parameters		Specs.		Moisture Induced Damage T 283			
Optimum AC by Total Mix Weight, %		6.9		Specs.			
Maximum Density, pcf	AASHTO T 209	158.2		Asphalt Content, %	6.9	6.7	
Air Voids, %	4.0	4.0		Additive Type	None	Lime	
VFA, %	65-78	75.8		Additive, %	---	1.0	
VMA, %	14.0 Min.	16.6		Cond. Strength, psi	31.3	82.7	
Lab Mixing Temperature, °C		158		Dry Strength, psi	88.3	91.8	
Dust-to-Binder Ratio	0.8-1.6	1.3		TSR, %	80 Min.	*35	90
Hveem, S-value	30 Min.	40		Avg. Air Voids, %	6-8	7.2	7.1
Antistrip, %, Type				Saturation, %	70-80	76.0	75.1
				Crack/Broke Agg, %			

Aggregate Quality		Specs.		Design Gyrotory Compactive Effort 7/75/115				
L.A. Abrasion, Grading A, %	AASHTO T 96	35 Max.	27	Design High Air Temp, Centigrade	ESAL's	Ninit	Ndesign	Nmax
Micro-Deval Abrasion, % Loss	AASHTO TP 58		---		0.3-3	86.0	96.0	--
NaSO <sub>4</sub> Soundness, % Loss	AASHTO T 104	12 Max.	0	Specification (% of Maximum Density)		< 90.5	96.0	< 98.0
Fractured Faces, % 1 or more	ASTM D 5821	75 Min.	100	<b>Specific Gravity &amp; Absorption T 84 &amp; T 85</b>				
Sand Equivalent, Ref. Alt. 2	AASHTO T 176	40 Min.	77	<small>Reported values are one place more than AASHTO specifies</small>				
Uncompacted FA Voids, A %	AASHTO T 304	40 Min.	50.1	Apparent Specific Gravity	2.791	2.941	2.887	
F & E Particles, 1:3 Ratio, %	ASTM D 4791	10 Max.	8	Bulk Specific Gravity	2.593	2.793	2.721	
				Absorption, %	2.74	1.80	2.14	
				Effective Specific Gravity			2.854	

Distribution:	Nam / Project File	
Laboratory:	Darrell Harding	
Project Engineer:	Eric Zeller	
Geotechnical:	<del>John ...</del>	
Construction:	Bill Hakala	
Pavements:	Mike Voith	
Project Management:	Dave Gideon	
Materials:	4 Copies	

**Remarks:** The mix design was done without lime however T 283 results show that 1.0% lime is required.

The optimum asphalt content using 1.0% lime would be approximately 6.7%.

Reported By:

Form FHWA 1717 Rev. 01/05

Figure E-2. Summary of Superpave asphalt concrete mix design.

Figure E-3. Superpave mix design.

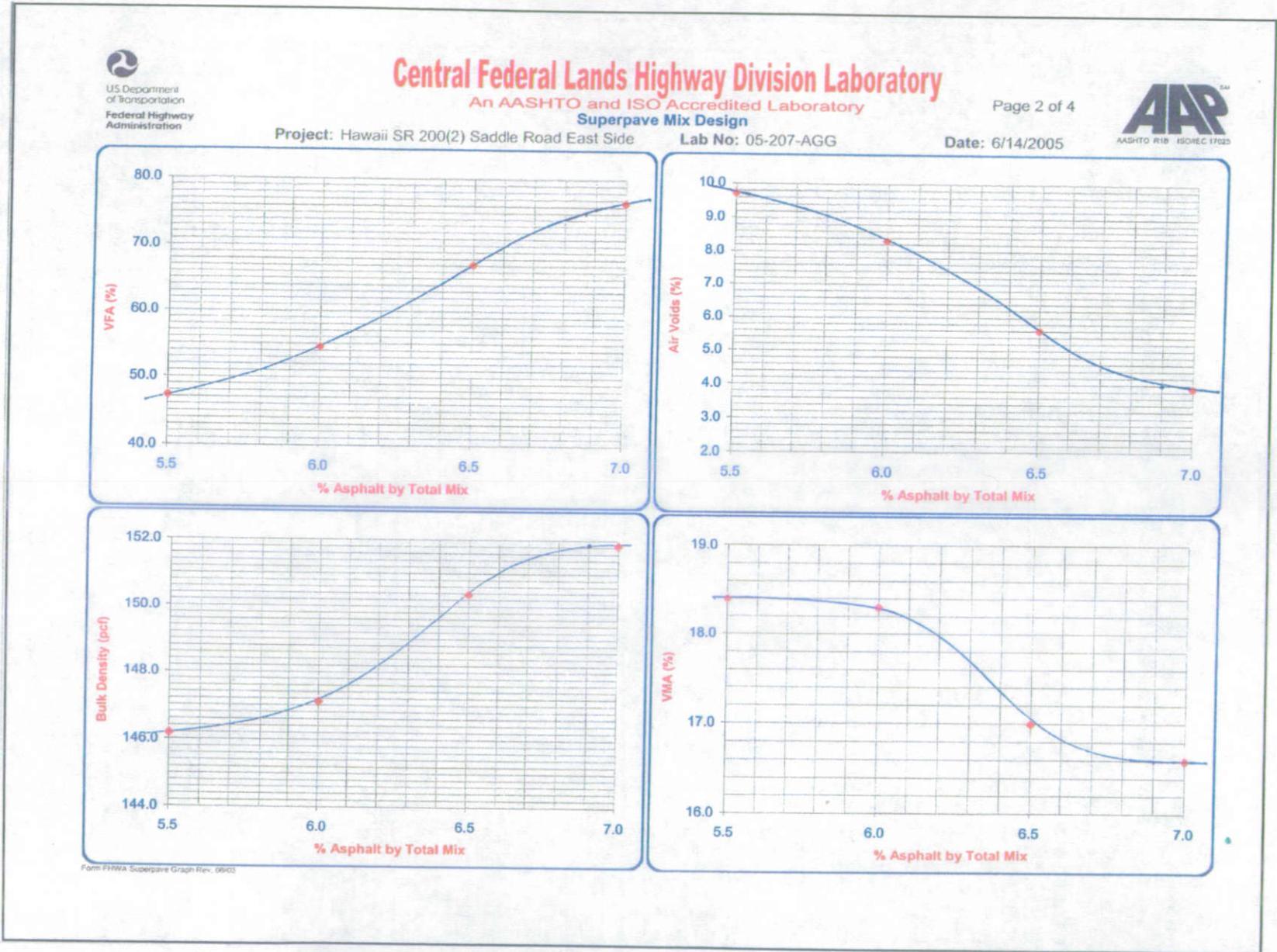
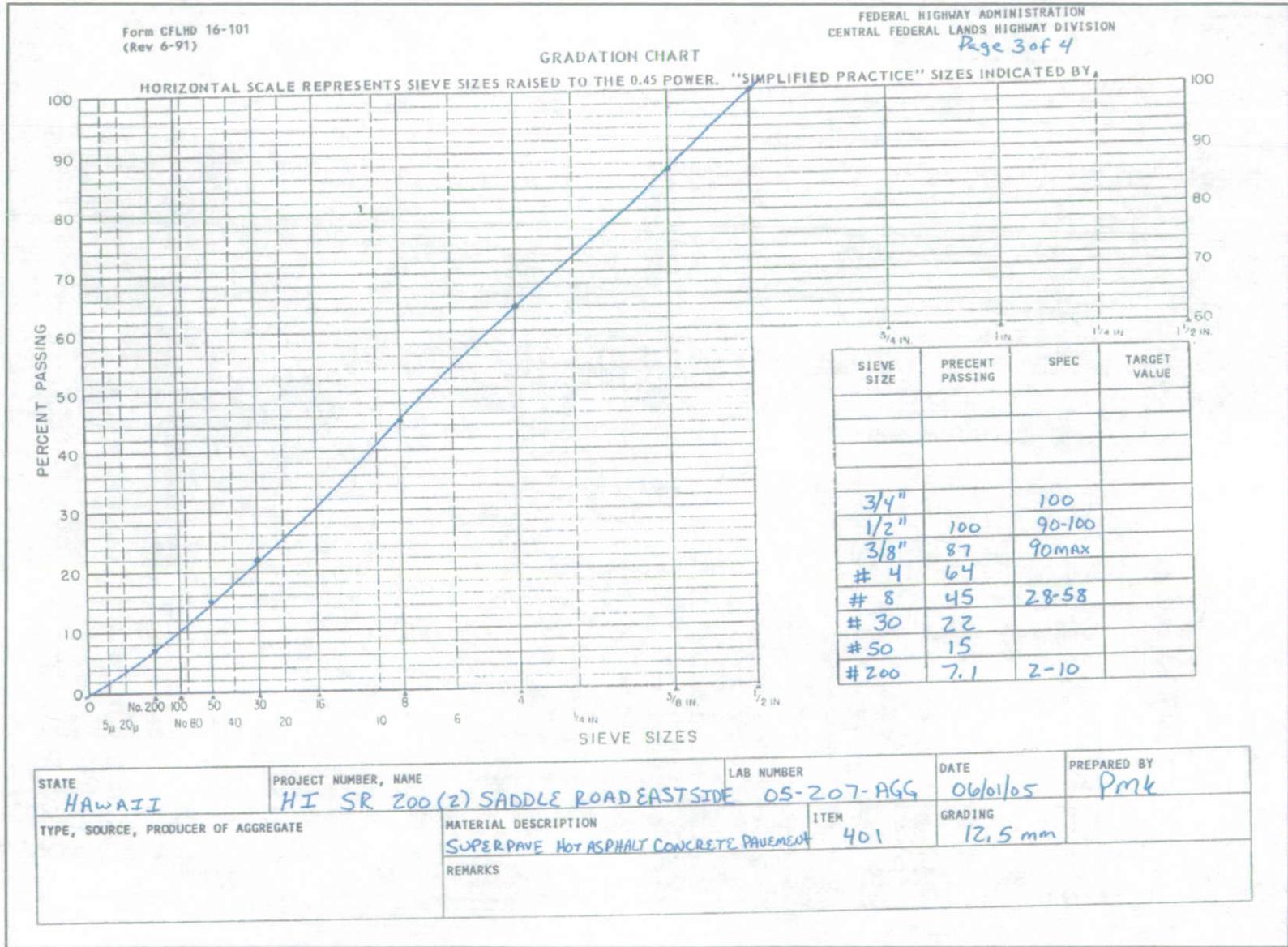


Figure E-4. Gradation tested for Superpave mix design.



MAY-25-2005 WED 02:33 PM

FAX NO. 9 1 925 842 8410

P. 02

CHEVRONTEXACO, ASPHALT DIVISION, NORTHWEST REGION, PG TESTING LABORATORY, PORTLAND, OREGON

*Page 4 of 4*



### SuperPave PG 64-16 Binder Certification ChevronTexaco Hawaii Refinery



SAMPLE INFORMATION				SAMPLE I.D. #	
BATCH NO.		TANK NO.	102	LIMS #	25755
DATE SAMPLED	May 11, 2005	DATE TESTED	May 23, 2005		

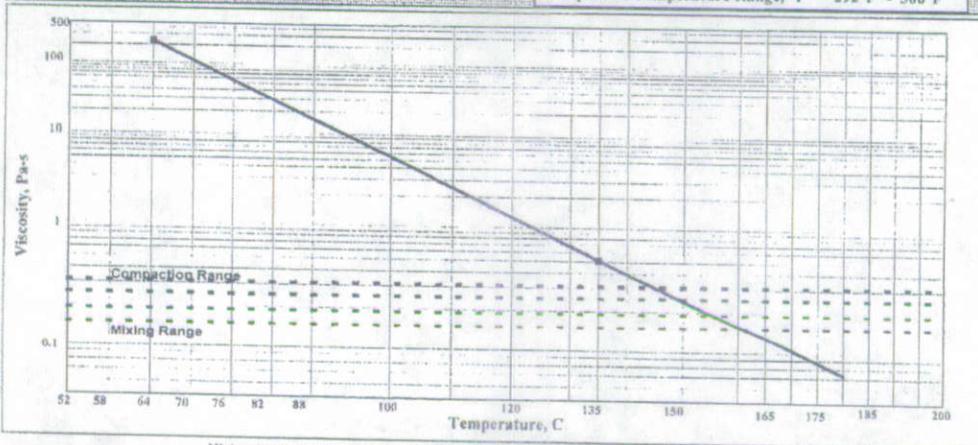
ORIGINAL BINDER	Test Temperature	Test Result	AASHTO MP1 Specification	ChevronTexaco Target Specification
Flash Point, T48		288+ °C	Min. 230 °C	Min. 275 °C
Viscosity, ASTM D 2171	60 °C	3.980 P	None	3000-3200
Viscosity, ASTM D 4402	135 °C	0.512 Pa-s	Max. 3 Pa-s	Max. 1 Pa-s
	175 °C	0.137 Pa-s	None	Record
Dynamic Shear, TP5, G*/sin(delta)	64 °C	2.35 KPa	Min. 1.00 KPa	Min. 2.00 KPa
<b>RTFO RESIDUE</b>				
Mass Loss			Max 1.0 wt%	Max 0.5 wt%
Viscosity, ASTM D 2171	60 °C	7,342 P	None	8,000 - 11,000
Dynamic Shear, TP5, G*/sin(delta)	64 °C	3.87 KPa	Min. 2.20 KPa	Min. 4.0 KPa
<b>PAV AGING</b>				
PAV Aging Temperature	100 °C			
Dynamic Shear, TP5, G* sin(delta)	28 °C	2228 KPa	Max. 5000 KPa	Max. 4000 KPa
Creep Stiffness, TP1, S	-6 °C	93 MPa	Max. 300 MPa	Max. 250 MPa
m-value, TP1	-6 °C	0.387	Min. 0.300	Min. 0.32

**TEMPERATURE-VISCOSITY CURVE (CALCULATED USING ASPHALT INSTITUTE PROGRAM)**

Note: This data is for informational purposes. Actual mixing and compaction temperatures may require adjustments to meet field conditions. A compaction test strip is recommended

**CALCULATED CONSTRUCTION TEMPERATURES**

Mixing Temperature Range, °C	155°C - 161°C
Compaction Temperature Range, °C	145°C - 149°C
Mixing Temperature Range, °F	311°F - 321°F
Compaction Temperature Range, °F	292°F - 300°F



Mixing temperature range is where the binder viscosity is 0.17 +/- 0.02 Pa-s.  
Compaction temperature range is where the binder viscosity is 0.28 +/- 0.03 Pa-s.

Lab Tester: RSRR  
ChevronTexaco PG Binder Laboratory, Chevron Asphalt Plant, El Paso, Texas.

OK to Ship: WTOL

Notes: \_\_\_\_\_

Figure E-5. Superpave binder certification.