

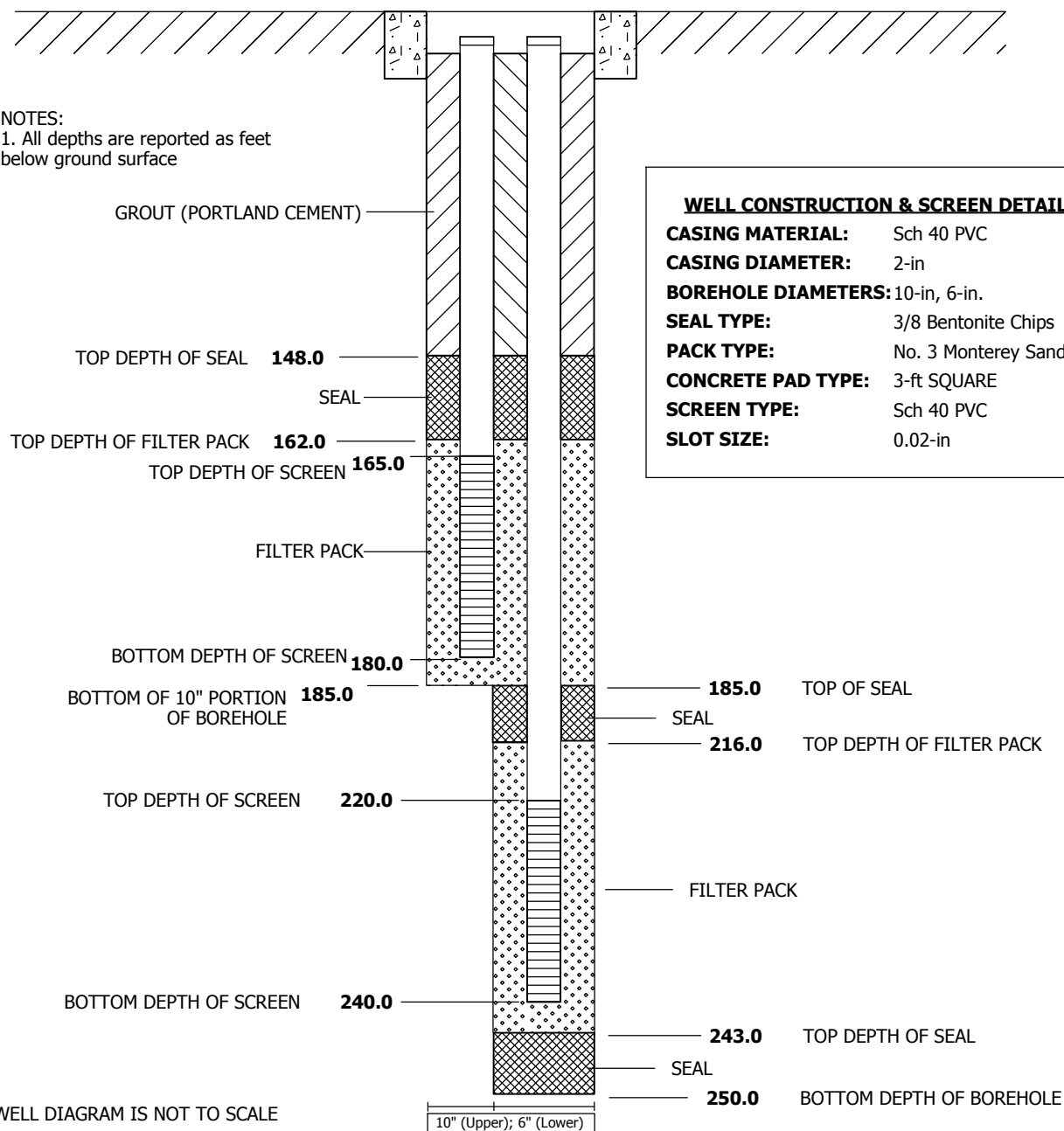
# WELL COMPLETION DIAGRAM

<b>PROJECT NO:</b> 417981.ER.02.FW	<b>PROJECT:</b> ER-TCS Groundwater Investigation	<b>WELL NO:</b> <i><b>MW-68-180</b></i> <i><b>MW-68-240</b></i>
<b>LOCATION:</b> Site 3		
<b>DRILLING CONTRACTOR:</b> Boart Longyear (R. Sawrey)	<b>DRILLING START:</b> 5/13/2011	
<b>DRILLING METHOD:</b> Rotosonic	<b>DRILLING END:</b> 5/16/2011	
<b>LOGGER:</b> A. Brewster (Northstar)	<b>WELL COMPLETION DATE:</b> 5/18/2011	
<b>GROUND SURFACE ELEVATION (NAVD 88):</b> 621.6 ft AMSL	<b>GENERAL REMARKS:</b> Centralizers at 10, 25, 40, 55, 70, 85, 100, 115, 130, 145, 160, and 215 ft bgs.	
<b>NORTHING (CCS NAD 83 Z 5):</b> 2100773.64		
<b>EASTING (CCS NAD 83 Z 5):</b> 7615453.36		

## 12-in DIAMETER WELL VAULT (FLUSH WITH GRADE)

**NOTES:**

1. All depths are reported as feet below ground surface





PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68**

SHEET 1 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011



LOGGER : R. Tweidt (Northstar)

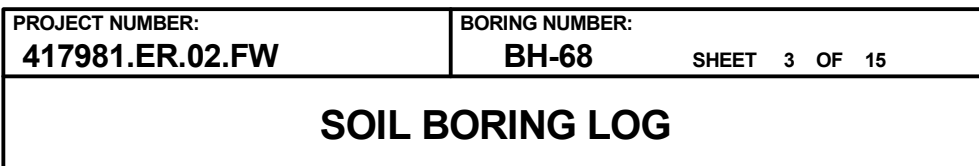
DEPTH BELOW EXISTING GRADE (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE					
	0.0	COMPLETE	10301	SP	<b>Poorly Graded Sand (SP)</b> 0.0-17.0' - dark yellowish brown, (10YR 4/4), dry, loose, 5% gravel, 90% sand, 5% fines, angular to subangular, poorly graded, predominantly quartz.	Soil sample collected between 0.0 and 1.0 ft bgs.	
	1.0						
	2.0		10302				
	3.0						
5	5.0						
	6.0		10303, 50009				
	9.0						
10	10.0		10304				
	14.0			14' - Color change to yellowish brown, (10YR 5/4)	Soil sample collected between 14.0 and 15.0 ft bgs.		
15	15.0	10305					
	19.0		SM			<b>Silty Sand (SM)</b> 17.0-35.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz.	Soil sample collected between 19.0 and 20.0 ft bgs.
20	20.0	10306					



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 2 OF 15	
<b>SOIL BORING LOG</b>	

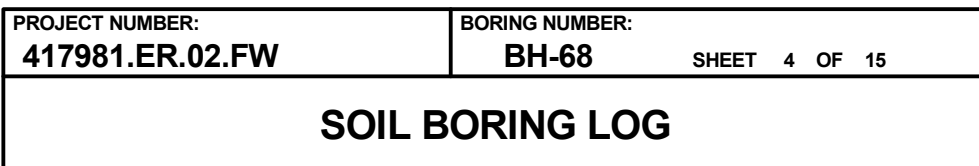
PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVELS : Approx. 104 ft bgs				START : 9/19/2011		END : 9/19/2011		LOGGER : R. Twardt (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
	RECOVERY (in)		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION						
	LAB SAMPLE								
25	COMPLETE			SM	<b>Silty Sand (SM)</b> 17.0-35.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 10% gravel, 60% sand, 30% fines, subangular to subrounded, poorly graded, predominantly quartz.		Soil sample collected between 29.0 and 30.0 ft bgs.		
30	29.0 30.0	10307							
35									
40	39.0 40.0	10308		SW	<b>Well Graded Sand With Gravel (SW)</b> 35.0-62.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 25% gravel, 75% sand, subrounded to subangular, predominantly quartz.		Soil sample collected between 39.0 and 40.0 ft bgs.		



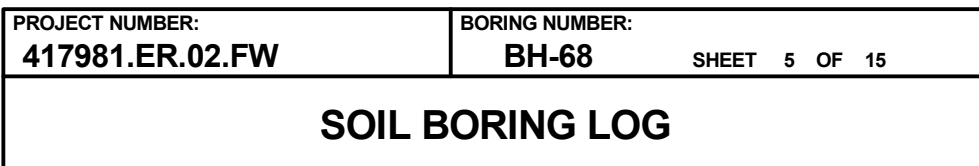
LOGGER : R. Tweidt (Northstar)

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LOGGER : R. Tweidt (Northstar)

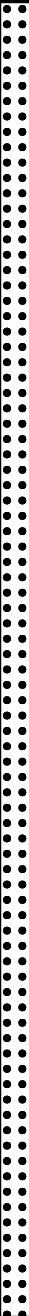
DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)		RECOVERY (in)	LAB SAMPLE				
<div style="display: flex; align-items: center;"> <div style="flex: 1; border-left: 1px solid black; border-right: 1px solid black; text-align: center; font-size: 0.8em;">COMPLETE</div> </div>				SW	<b>Well Graded Sand With Gravel (SW)</b> 35.0-62.0' - brown, (10YR 5/3), dry, loose to partially consolidated, 25% gravel, 75% sand, subrounded to subangular, predominantly quartz.		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
				GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - greyish brown, (10YR 5/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.		
65							
70	69.0 70.0		10311		69' - color change to light yellow brown, (2.5Y 6/3)  70.0-71.0' - Rock flour		Soil sample collected between 69.0 and 70.0 ft bgs.
75							
80	79.0 80.0		10312				Soil sample collected between 79.0 and 80.0 ft bgs.

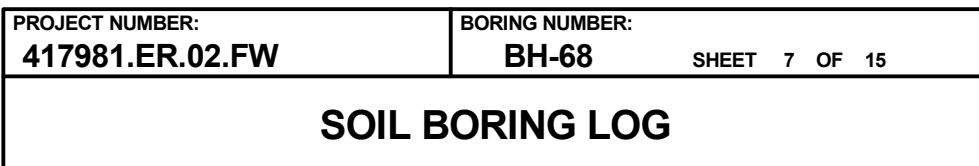




<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 6 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVELS : Approx. 104 ft bgs				START : 9/19/2011		END : 9/19/2011		LOGGER : R. Thwait (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)		INTERVAL (ft)		USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS		
		RECOVERY (in)					DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		LAB SAMPLE							
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.				
					102' - Change to partially consolidated				
105					105' - Color change to light yellow brown (2.5Y 6/3)				
	109.0				109.0-110.0' - Rock flour			Soil sample collected between 109.0 and 110.0 ft bgs.	
110	110.0	10315			111.5-112.0' - Rock flour				
				115.0-115.5' - Rock flour					
115									
	119.0						Soil sample collected between 119.0 and 120.0 ft bgs.		
120	120.0	10316							









PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 9 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	LAB SAMPLE					
165	COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - greyish brown, (10YR 5/2), dry, loose to partially consolidated, 40% gravel, 40% sand, 20% fines, angular to subangular, no dominant mineralogy.  163' - Increase in metadiorite fraction of gravel; increase in average gravel size to coarse; change to subangular. 164' - Saturated   <		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 10 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.		
185		COMPLETE	BH-68-20301				
187.0							Grab groundwater sample collected from borehole between 187.0 and 197.0 ft bgs.
190				GW			
195							
200					197.0-198.0' - Metadiorite boulder		



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 11 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

WATER LEVELS: Approx. 104 ft bgs			START: 9/19/2011		END: 9/19/2011		LOGGER: R. Twardt (Northstar)	
DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)			USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS	
	RECOVERY (in)		LAB SAMPLE					
		COMPLETE		GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - light yellow brown, (2.5Y 6/3), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.			
205					205.0-207.0' - Coarse-grained sand			
207.0							Grab groundwater sample collected from borehole between 207.0 and 217.0 ft bgs.	
210			BH-68-20302			212' - Color change to pale olive (5Y 6/3)		
215								
217.0							Stop 05/14/2011 at 1700 at 217 ft bgs. Resume 05/15/2011 at 1130	
220								



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 12 OF 15

## SOIL BORING LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

DRILLING EQUIPMENT AND METHOD : RS-350, Rotasonic drill head and tools

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)				USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	COMPLETE			GW	<b>Well Graded Gravel (GW)</b> 62.0-243.0' - olive grey, (5Y 5/2), 40% gravel, 40% sand, 20% fines, highly angular from 173.0 ft bgs, predominantly metadiorite gravel from 163.0 ft bgs, partially consolidated from 102.0 ft bgs, matrix-supported, saturated from 164.0 ft bgs.		
225				CL	<b>Clay With Silt (CL)</b> 226.5-227.0' - olive grey, (5Y 5/2), saturated, 100% fines, low dilatancy, soft, matrix-supported		
				GW	<b>Well Graded Gravel (GW)</b> 227.0-243.0' - pale olive, (5Y 6/3), saturated, 40% gravel, 40% sand, 20% fines, angular to subangular, predominantly metadiorite gravel, dense. 229.0-230.0' - Rock flour  233.0-234.0' - Change to 40% gravel, 50% sand, 10% fines, color change to light olive brown (2.5Y 5/3)  238.5-239.0' - Color change to black 239' - Color change to brown (10YR 5/3)		
230							
235	235.0						Grab groundwater sample collected from borehole between 235.0 and 245.0 ft bgs.
240							



<b>PROJECT NUMBER:</b> <b>417981.ER.02.FW</b>	<b>BORING NUMBER:</b> <b>BH-68</b>
SHEET 13 OF 15	
<b>SOIL BORING LOG</b>	

PROJECT : PG&E Topock, ER-TCS Investigation	LOCATION : Site 3 (2100773.6 N, 7615453.4 E)
ELEVATION : 621.6 ft	DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)
DRILLING EQUIPMENT AND METHOD : RS-350, Rotosonic drill head and tools	ORIENTATION : Vertical
WATER LEVELS : Approx. 164 ft BGS	START : 5/13/2011      END : 5/16/2011      LOGGER : R. Tweidt (Northstar)

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (in)	LAB SAMPLE	USCS CODE/ LITHOLOGY	SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
					<b>Well Graded Gravel (GW)</b> 227.0-243.0' - brown, (10YR 5/3), saturated, 40% gravel, 40% sand, 20% fines, angular to subangular, poorly graded, predominantly metadiorite gravel, dense, matrix-supported,		
					<b>Conglomerate (Tmc)</b> 243.0-257.0' - massive, red (2.5YR 4/8)		Stop 05/15/2011 at 1630 at 245 ft bgs. Resume 05/16/2011 at 1000
245	245.0						
							Stop 05/16/2011 at 1100. Drilling complete.
250							
							Initiate rock core drilling at 1115 on 8/10/2011
255							
					Begin rock coring from 257.0 ft bgs See the next page for the rock core log.		
257.0							
260							



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:

**BH-68**

SHEET 14 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : RS-350, Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		RQD (%)	FRACTURES PER FOOT	DESCRIPTION			
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
257.0	R1 3 ft 70%	28	NR			<b>Miocene Conglomerate (Tmc)</b> 257.0-257.8' - moderate brown, (5YR 4/4)	Run 1 (257 ft - 260 ft), Drill rate = 0.55 ft/min
260	260.0		8	258.0-258.5' - abundant joints, no dominant orientation, not healed, rough, dry			
			>10	258.5-263.5' - fracture zone, no dominant orientation, presence of moderately to totally healed fractures, some 60 degree dip angles between 262 and 263 ft bgs.		<b>Metadiorite (pTbr)</b> 257.8-280.5' - pale yellowish brown (10YR 8/6), non-foliated, uniform, slightly to moderately decomposed, slightly disintegrated, slightly to moderately fractured	
			>10				Run 2 (260 ft - 264.5 ft), Drill rate = 0.28 ft/min
			3				
	R2 4.5 ft 75%	44	>10	263.0-264.5' - shear zone, dry, rough			
			>10				
265	264.5		>10	264.5-269.5' - undulating, few joints observed, narrow presence of totally healed fractures, mineralization, dry		265.5' - Color change to dusky yellow green (5GY 5/2)	Run 3 (264.5 ft - 269.5 ft), Drill rate = 0.41 ft/min
			2				
	R3 5 ft 80%	93	1				
			1				
			1				
270	269.5		>10	269.5-273.5' - undulating, fracture zones, no dominant orientation, not healed, dry			Run 4 (269.5 ft - 270.5 ft), Drill rate = 0.44 ft/min
	R4 1 ft 50%	0	>10				Run 5 (270.5 ft - 275.5 ft), Drill rate = 0.45 ft/min
			>10				
			>10				
	R5 5 ft 70%	15	>10				
			3				
			5				
275	275.5		>10				Run 6 (275.5 ft - 280.5 ft), Drill rate = 0.3 ft/min
			>10	276.0-280.5' - undulating, fracture zone, no dominant orientation, not healed, surface staining			



PROJECT NUMBER:  
**417981.ER.02.FW**

BORING NUMBER:  
**BH-68** SHEET 15 OF 15

## ROCK CORE LOG

PROJECT : PG&E Topock, ER-TCS Investigation

LOCATION : Site 3 (2100773.6 N, 7615453.4 E)

ELEVATION : 621.6 ft

DRILLING CONTRACTOR : Boart Longyear (R. Sawrey)

CORING EQUIPMENT AND METHOD : RS-350, Wire-Line Rotary

ORIENTATION : Vertical

WATER LEVELS : Approx. 164 ft BGS

START : 5/13/2011

END : 5/16/2011

LOGGER : R. Tweidt (Northstar)

DEPTH BELOW SURFACE (ft)	CORE RUN LENGTH AND RECOVERY (%)	DISCONTINUITIES			SYMBOLIC LOG	LITHOLOGY	COMMENTS
		R Q D (%)	FRACTURES PER FOOT	DESCRIPTION		ROCK TYPE, COLOR, MINERALOGY, TEXTURE, HARDNESS, WEATHERING, AND ROCK MASS CHARACTERISTICS	SIZE AND DEPTH OF CASING, FLUID LOSS, CORING RATE AND SMOOTHNESS, CAVING ROD DROPS, TEST RESULTS, ETC.
				DEPTH, TYPE, ORIENTATION, ROUGHNESS, PLANARITY, INFILLING MATERIAL AND THICKNESS, SURFACE STAINING, AND TIGHTNESS			
280	R6 5 ft 70%	15	>10			<b>Metadiorite (pTbr)</b> 257.8-280.5' - pale yellowish brown (10YR 8/6), non-foliated, uniform, slightly to moderately decomposed, slightly disintegrated, slightly to moderately fractured	
			>10				
			>10				
280.5			>10	276.0-280.5' - undulating, fracture zone, no dominant orientation, not healed, surface staining			
						End Drilling on 5/16/2011 Total Borehole Depth: 280.5 ft bgs	This borehole was converted into the following monitoring well(s): MW-68-180, MW-68-240, and MW-68BR-280
285							
290							
295							