GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA 8-40 DATE: 6/28/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 8 OF 8

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
100.5	329.72	201		
101.0	331.36	202		
101.5	333.01	203		
102.0	334.65	204		
102.5	336.29	205		
103.0	337.93	206		
103.5	339.57	207		
104.0	341.21	208		
104.5	342.85	209		
105.0	344.49	210		
105.5	346.13	211		
106.0	347.77	212		
106.5	349.41	213		
107.0	351.05	214		
107.5	352.69	215		
108.0	354.33	216		
108.5	355.97	217		
109.0	357.61	218		
109.5	359.25	219		
110.0	360.89	220		
110.5	362.53	221		
111.0	364.17	222		
111.5	365.81	223		
112.0	367.45	224		
112.5	369.09	225		
113.0	370.73	226		
113.5	372.38	227		
114.0	374.02	228		
114.5	375.66	229		
115.0	377.30	230		
115.5	378.94	231		
116.0	380.58	232		
116.5	382.22	233		
117.0	383.86	234		
117.5	385.50	235		
118.0	387.14	236		
118.5	388.78	237		HIT BOTTOM @ 118.7m =>
119.0	390.42			TIP OF PROBE @ 401.5'
119.5	392.06			
120.0	393.70			

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B-401 ACOUSTIC TELEVIEWER FIELD LOG

SITE: CCNPP COLA DATE: 6 / 28 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-401 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED ___ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 7/8" 0 TO 400' ; ___ ___ TO ___
BOREHOLE TOTAL DEPTH AS DRILLED: 400
CONDUCTOR CASING?: YES ___ DEPTH TO BOTTOM OF CASING ___ ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ___ ; FRESH WATER MUD ✓ ; SALT WATER MUD ___ ;
OTHER:
DEPTH TO BOREHOLE FLUID: ~6' TIME SINCE LAST CIRCULATION: ~2 hrs.

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SITE: CCNPP COLA B-401 DATE: 6/28/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

LOGGING CREW: R. STELLER, C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK, MD DEPARTURE TIME: 8:30
ARRIVED ON SITE: 9:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 15:10 LOGGING COMPLETED: 16:59

WINCH: COMPROBE ___ SILVER ✓ OYO ___ OTHER ___
MICROLOGGER 5301 ✓ OTHER ___
TELEVIEWER OPTICAL #5117 ___ ACOUSTIC ~~#5174~~ 5500 OTHER ___

PROBE TILT TEST 81.2° BRUNTON TILT 82° HANGING 0.2°
PROBE AZIMUTH TEST 140.9° BRUNTON AZIMUTH 141°

PROBE OFFSET	OPTICAL 1.88M(6.17FT)	ACOUSTIC 1.44M(4.72FT)
CASING STICK-UP	-	- 1.5'
DEPTH REF. OFFSET		3.22'

3.22' ON EXIT.

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B401AGDOON01	3.22	15:05	401.0	16:59

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

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B-401 CALIPER FIELD LOG

SITE: CCNPP COLA DATE: 6 / 28 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-401 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4½" 0 TO 400' ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 400'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER: GEL & Polymer
DEPTH TO BOREHOLE FLUID: TIME SINCE LAST CIRCULATION: 4 hr.

LOGGING CREW: R. STELLER, C. CARLSON
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LOCATION, MD. DEPARTURE TIME: 8:30
ARRIVED ON SITE: 9:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 12:17 LOGGING COMPLETED: 17:55

SITE: CCNPP COLA B-401 DATE: 6/20/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
CALIPER PROBE 5368 ____ OTHER 2915

PROBE OFFSET	12 IN MAX 2.08M(6.82 FT)	24 IN MAX
CASING STICK-UP	ARMS - 1.5'	ARMS - ____
DEPTH REF. OFFSET	5.32'	5.45' ON EXIT

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B401 CALTEST 01	Ø	17:17	Ø	17:20
B401 CALUP 01	397.0	17:28	Ø	17:48
B401 CALTEST 02	Ø	17:50	Ø	17:55

CALIBRATION PLATE S/N 201

		AS BUILT		
		1.968 IN	3.937 IN	8.000 IN
	FILE NAME	(50 MM)	(100 MM)	203.2 MM
AS MEAS.	B401 CALTEST01	1.97	3.94	8.00
AS MEAS.	B401 CALTEST02	2.01	3.97	8.04
AS MEAS.				
AS MEAS.				
AS MEAS.				
AS MEAS.				

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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B-401 ELOG FIELD LOG

SITE: CCNPP COLA DATE: 6/28/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-401 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4½ 0 TO 400' ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 400'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: Ø TIME SINCE LAST CIRCULATION: 25 HR

LOGGING CREW: R. STELLER, C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK, MD. DEPARTURE TIME: 8:30
ARRIVED ON SITE: 9:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 18:34 LOGGING COMPLETED: 19:14

SITE: CCNPP COLA B - 401 DATE: 6/28/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
ELOG PROBE 5490 ✓ OTHER ____

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	2.50M(8.20 FT) 1.5 6.70'	6.75' AT EXIT

RAS 6/28/06

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
~~B401 ELOG DOWN 01~~				
B401 ELOG UP 01	399.5'	18:34	1.85	19:14

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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B-404 BORING GEOPHYSICS FIELD LOG SUMMARY

SITE: CCNPP COLA
CLIENT: SCHNABEL
AUTHOR: R. STELLER

DATE: 6 / 27 /2006
JOB: 6165
PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI

PHONE: 703-906-1797

BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4"L 0 TO 200' ; ____ , ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____ ; NO ✓
DEPTH TO BEDROCK: NA
BOREHOLE FLUID: WATER ____ ; FRESH WATER MUD ✓ ; SALT WATER MUD ____ ;

LOGGING CREW: R. STELLER

LOG TYPE	FILE NAME	DEPTH RANGE	DATE	TIMES
SUSPENSION PS	001 - 114	1.6' - 187.0'	6/27/06	10:45 - 12:07
ACOUSTIC TV	B404 AU DOWN01	3.1' - 196.0'	6/27/06	12:50 - 14:00
CAMPER TEST	B404 CAL TEST01	Ø	6/27/06	14:20 - 14:25
CAMPER/GAMMA	B404 CAL UP01	195.0 - Ø	6/27/06	14:32 - 14:52
CAMPER TEST	B404 CAL TEST02	Ø	6/27/06	14:55 - 14:59
ELOG	B404 ELOG UP01	195.0 - 19.2'	6/27/06	15:10 - 15:28

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P-S SUSPENSION VELOCITY FIELD LOG

SITE: CALVERT CLIFFS COLA B-404 DATE: 8/27/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 5

CONTACT: _____ OFFICE PHONE: _____
CELL PHONE: _____
CONTACT: _____ OFFICE PHONE: _____
PHONE: _____
CONTACT: _____ PHONE: _____
PHONE: _____
CONTACT: _____ PHONE: _____
PHONE: _____
DRILLER: _____ PHONE: _____
COMPANY: _____ PHONE: _____

DIRECTIONS TO SITE: --

GENERAL SITE CONDITIONS/LOCATION: _____

EA#: _____
BOREHOLE DESIGNATION: B-404 LOCATION: _____

COUNTY: _____ RANGE: _____ TOWNSHIP: _____ SECTION: _____
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 1/2 0 TO 240' ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 240'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE: ____
BOREHOLE FLUID: WATER ____; FRESH WATER MUD ✓; SALT WATER MUD ____;
OTHER: _____
DEPTH TO BOREHOLE FLUID: ~ TIME SINCE LAST CIRCULATION: 1/2 HR.

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SITE: CALVERT CLIFFS COLA B-404 DATE: 6/27/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 5

LOGGING CREW: R STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK DEPARTURE TIME: 8:30
ARRIVED ON SITE: 9:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 10:45 LOGGING COMPLETED: 12:07
STANDBY TIME: CAUSE:
LOGGING STARTED: LOGGING COMPLETED:
DEMOBILIZED TO: ARRIVAL TIME:
ADDITIONAL DEMOB TIME: REASON:

BATTERIES CHANGED BEFORE LOGGING: YES ___; NO ✓; STORED WITH NEW ___

WINCH	COMPROBE ☐	GREY ☐	OYO ☐	RG ☐	OTH ☑	
INSTRUMENT	OYO 12004 ☐	15014 ☐	19029 ☐	RG 160023 ☑	160024 ☐	
RECEIVER S/N	12008 ☐	20042 ☐	26066 ☐	11001 ☐	23053 ☐	30086 ☑

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

COMMENTS: DEPTH REFERENCE AT TOP RECIEVER 1.64' - 1.6' = 0' m.
DEPTH AT EXIT = 0.0 m.

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-404 DATE: 6/21/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 3 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64	001		
1.0	3.28	2		
1.5	4.92	3		
2.0	6.56	4		
2.5	8.20	5		
3.0	9.84	6		
3.5	11.48	7		
4.0	13.12	8		
4.5	14.76	9		
5.0	16.40	10		
5.5	18.04	11		
6.0	19.69	12		
6.5	21.33	13		
7.0	22.97	14		
7.5	24.61	15		
8.0	26.25	16		
8.5	27.89	17		
9.0	29.53	18		
9.5	31.17	19		
10.0	32.81	20		
10.5	34.45	21		
11.0	36.09	22		
11.5	37.73	23		
12.0	39.37	24		
12.5	41.01	25		
13.0	42.65	26		
13.5	44.29	27		
14.0	45.93	28		
14.5	47.57	29		
15.0	49.21	30		
15.5	50.85	31		
16.0	52.49	32		
16.5	54.13	33		
17.0	55.77	34		
17.5	57.41	35		
18.0	59.06	36		
18.5	60.70	37		
19.0	62.34	38		
19.5	63.98	39		
20.0	65.62	40		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-404 DATE: 10/27/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 4 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
20.5	67.26	41		
21.0	68.90	42		
21.5	70.54	43		
22.0	72.18	44		
22.5	73.82	45		
23.0	75.46	46		
23.5	77.10	47		
24.0	78.74	48		
24.5	80.38	49		
25.0	82.02	50		
25.5	83.66	51		
26.0	85.30	52		
26.5	86.94	53		
27.0	88.58	54		
27.5	90.22	55		
28.0	91.86	56		
28.5	93.50	57		
29.0	95.14	58		
29.5	96.78	59		
30.0	98.43	60		
30.5	100.07	61		
31.0	101.71	62		
31.5	103.35	63		
32.0	104.99	64		
32.5	106.63	65		
33.0	108.27	66		
33.5	109.91	67		
34.0	111.55	68		
34.5	113.19	69		
35.0	114.83	70		
35.5	116.47	71		
36.0	118.11	72		
36.5	119.75	73		
37.0	121.39	74		
37.5	123.03	75		
38.0	124.67	76		
38.5	126.31	77		
39.0	127.95	78		
39.5	129.59	79		
40.0	131.23	80		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-404 DATE: 6/27/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 5 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
40.5	132.87	81		
41.0	134.51	82		
41.5	136.15	83		
42.0	137.80	84		
42.5	139.44	85		
43.0	141.08	86		
43.5	142.72	87		
44.0	144.36	88		
44.5	146.00	89		
45.0	147.64	90		
45.5	149.28	91		
46.0	150.92	92		
46.5	152.56	93		
47.0	154.20	94		
47.5	155.84	95		
48.0	157.48	96		
48.5	159.12	97		
49.0	160.76	98		
49.5	162.40	99		
50.0	164.04	100		
50.5	165.68	101		
51.0	167.32	102		
51.5	168.96	103		
52.0	170.60	104		
52.5	172.24	105		
53.0	173.88	106		
53.5	175.52	107		
54.0	177.17	108		
54.5	178.81	109		
55.0	180.45	110		
55.5	182.09	111		
56.0	183.73	112		
56.5	185.37	113		
57.0	187.01	114		Bottom measurement
57.5	188.65			Hit bottom @ 57.2 m.
58.0	190.29			
58.5	191.93			
59.0	193.57			
59.5	195.21			
60.0	196.85			

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B-404 ACOUSTIC TELEVIEWER FIELD LOG

SITE: CCNPP COLA DATE: 6/26/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-404 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4" 0 TO 200' ; TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: 0 TIME SINCE LAST CIRCULATION: 12 HR.

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SITE: CCNPP COLA B-404 DATE: 6 / 24/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK DEPARTURE TIME: 8:30
ARRIVED ON SITE: 7:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 12:50 LOGGING COMPLETED: 14:00

WINCH: COMPROBE ___ SILVER ✓ OYO ___ OTHER ___
MICROLOGGER 5301 ✓ OTHER ___
TELEVIEWER OPTICAL #5117 ___ ACOUSTIC #5174 5500 OTHER ___

PROBE TILT TEST 0.8° BRUNTON TILT 0°
PROBE AZIMUTH TEST 211.2° BRUNTON AZIMUTH 214° PROBE HEAD @ 6.5'

PROBE OFFSET	OPTICAL 1.88M(6.17FT)	ACOUSTIC 1.44M(4.72FT)
CASING STICK-UP	-	- 1.6
DEPTH REF. OFFSET		5.12'

3.45' on bott.

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
Borehole geophysics	5.1'	12:50	194'	14:00

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

GEOVision
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B-404 CALIPER FIELD LOG

SITE: CCNPP COLA DATE: 6/26/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-404 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 ½" 0 TO 200' ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: 0 TIME SINCE LAST CIRCULATION: 0 HRS

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Germantown, MD DEPARTURE TIME: 8:30
ARRIVED ON SITE: 9:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 14:20 LOGGING COMPLETED: 14:58

SITE: CCNPP COLA B2 – 404 DATE: 6 / 24/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
CALIPER PROBE 5368 ____ OTHER * 2915

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	12 IN MAX 2.08M(6.82 FT) ARMS - 1.7' 5.12'	24 IN MAX ARMS - ____ 10 arms out

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B404 Cal. Test01	0	14:20	0	14:25
B404-Cal. Up 01	195	14:32	0	14:52
B404-Cal. Test 02	0	14:55	0	15:00

CALIBRATION PLATE S/N 201

		AS BUILT		
	FILE NAME	1.968 IN (50 MM)	3.937 IN (100 MM)	8.000 IN 203.2 MM
AS MEAS.	B404-Cal Test 01	1.97	3.93	8.04
AS MEAS.	B404-Cal Test 02	1.94	3.97	7.97
AS MEAS.				
AS MEAS.				
AS MEAS.				
AS MEAS.				

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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geophysical services

B-404 ELOG FIELD LOG

SITE: CCNPP COLA DATE: 6/26/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-404 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4" Ø TO 200' ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____; NO ✓
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ____; FRESH WATER MUD ✓; SALT WATER MUD ____;
OTHER:
DEPTH TO BOREHOLE FLUID: Ø TIME SINCE LAST CIRCULATION: 4 HRS

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK DEPARTURE TIME: 9:30
ARRIVED ON SITE: 9:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 15:10 LOGGING COMPLETED: 15:28

SITE: CCNPP COLA B-404 DATE: 6/26/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
ELOG PROBE 5490 ✓ OTHER ____

PROBE OFFSET	2.50M(8.20 FT)	
CASING STICK-UP	-1.5' + 52.8	
DEPTH REF. OFFSET	39.4'	39.45 on EXIT.

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B404ELOGUP01	19.5	15:10	~~19.15~~ 0K	15:28
			~~15:45~~ PM	
			6/26/06	

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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B-407 BORING GEOPHYSICS FIELD LOG SUMMARY

SITE: CCNPP COLA DATE: 6/16/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI PHONE: 703-906-1797

BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 7/8" 0 TO 200' ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____ ; NO ✓
DEPTH TO BEDROCK: N/A
BOREHOLE FLUID: WATER ____ ; FRESH WATER MUD ✓ ; SALT WATER MUD ____ ;

LOGGING CREW: R. STELLER

LOG TYPE	FILE NAME	DEPTH RANGE	DATE	TIMES
GAMMA/GAMMA	001 – 112	1.0' – 185.7'	6/16/06	9:08 – 10:28
CALIPER-TEMP	B407TEMPCAL01	0	6/16/06	10:50 – 11:04
CALIPER	B407 CAL 001	199.0 – 0	6/16/06	11:10 – 11:30
CALIPER-TEMP	B407-TEMPCAL02	0	6/16/06	11:36 – 11:42
E-LOG/GAMMA	B407 ELOG001	192.0 – 17.6	6/16/06	11:55 – 12:16
DEVIATION	B407 DEV 001	0 – 192.8'	6/16/06	12:53 – 13:37

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P-S SUSPENSION VELOCITY FIELD LOG

SITE: CALVERT CLIFFS COLA B-407 DATE: 6/16/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF ____

CONTACT: ____ OFFICE PHONE: ____
CELL PHONE: ____
CONTACT: ____ OFFICE PHONE: ____
____ PHONE: ____
CONTACT: ____ ____ PHONE: ____
____ PHONE: ____
CONTACT: ____ ____ PHONE: ____
____ PHONE: ____
DRILLER: ____ ____ PHONE: ____
COMPANY: ____ ____ PHONE: ____

DIRECTIONS TO SITE: ____

GENERAL SITE CONDITIONS/LOCATION: ____

EA#: ____
BOREHOLE DESIGNATION: B-407 LOCATION: ____

COUNTY: ____ RANGE: ____ TOWNSHIP: ✓ SECTION: ____
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 1/4 0 TO ~~200'~~ 200'; ~~4 1/4~~ ____ TO 200'
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____; NO ✓
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: ____
BOREHOLE FLUID: WATER ____; FRESH WATER MUD ✓; SALT WATER MUD ____;
OTHER: ____
DEPTH TO BOREHOLE FLUID: Ø TIME SINCE LAST CIRCULATION: 1/2 HR

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SITE: CALVERT CLIFFS COLA B-401 DATE: 10/16/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 5

LOGGING CREW: R. Steller
VEHICLE(S) USED AND MILEAGE: Rental
MOBILIZED FROM: Lexington Park DEPARTURE TIME: 7:05
ARRIVED ON SITE: 7:35
STANDBY TIME: CAUSE:
LOGGING STARTED: 9:00 LOGGING COMPLETED: 10:25
STANDBY TIME: CAUSE:
LOGGING STARTED: LOGGING COMPLETED:
DEMOBILIZED TO: ARRIVAL TIME:
ADDITIONAL DEMOB TIME: REASON:

BATTERIES CHANGED BEFORE LOGGING: YES ; NO ✓ ; STORED WITH NEW

WINCH		COMPROBE ☐		GREY ☐	OYO ☐	RG ☐	OTH ☑					
INSTRUMENT	OYO 12004 ☐	15014 ☐	19029 ☐		RG 160023 ☑	160024 ☐						
RECEIVER S/N	12008 ☐	20042 ☐	26066 ☐	11001 ☐	23053 ☐	3e06 ☑						

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

COMMENTS:

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-407 DATE: 6/16/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 5 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64	1		
1.0	3.28	2		
1.5	4.92	3		
2.0	6.56	4		
2.5	8.20	5		
3.0	9.84	6		
3.5	11.48	7		
4.0	13.12	8		
4.5	14.76	9		
5.0	16.40	10		
5.5	18.04	11		
6.0	19.69	12		
6.5	21.33	13		
7.0	22.97	14		
7.5	24.61	15		
8.0	26.25	16		
8.5	27.89	17		
9.0	29.53	18		
9.5	31.17	19		
10.0	32.81	20		
10.5	34.45	21		
11.0	36.09	22		
11.5	37.73	23		
12.0	39.37	24		
12.5	41.01	25		
13.0	42.65	26		
13.5	44.29	27		
14.0	45.93	28		
14.5	47.57	29		
15.0	49.21	30		
15.5	50.85	31		
16.0	52.49	32		
16.5	54.13	33		
17.0	55.77	34		
17.5	57.41	35		
18.0	59.06	36		
18.5	60.70	37		
19.0	62.34	38		
19.5	63.98	39		
20.0	65.62	40		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA b-402 DATE: 6/16/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 4 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
20.5	67.26	41		
21.0	68.90	42		
21.5	70.54	43		
22.0	72.18	44		
22.5	73.82	45		
23.0	75.46	46		
23.5	77.10	47		
24.0	78.74	48		
24.5	80.38	49		
25.0	82.02	50		
25.5	83.66	51		
26.0	85.30	52		
26.5	86.94	53		
27.0	88.58	54		
27.5	90.22	55		
28.0	91.86	56		
28.5	93.50	57		
29.0	95.14	58		
29.5	96.78	59		
30.0	98.43	60		
30.5	100.07	61		
31.0	101.71	62		
31.5	103.35	63		
32.0	104.99	64		
32.5	106.63	65		
33.0	108.27	66		
33.5	109.91	67		
34.0	111.55	68		
34.5	113.19	69		
35.0	114.83	70		
35.5	116.47	71		
36.0	118.11	72		
36.5	119.75	73		
37.0	121.39	74		
37.5	123.03	75		
38.0	124.67	76		
38.5	126.31	77		
39.0	127.95	78		
39.5	129.59	79		
40.0	131.23	80		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-407 DATE: 6/14/08
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 5 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
40.5	132.87	B1		
41.0	134.51	B2		
41.5	136.15	B3		
42.0	137.80	B4		
42.5	139.44	B5		
43.0	141.08	B6		
43.5	142.72	B7		
44.0	144.36	B8		
44.5	146.00	B9		
45.0	147.64	90		
45.5	149.28	91		
46.0	150.92	92		
46.5	152.56	93		
47.0	154.20	94		
47.5	155.84	95		
48.0	157.48	96		
48.5	159.12	97		
49.0	160.76	98		
49.5	162.40	99		
50.0	164.04	100		
50.5	165.68	101		
51.0	167.32	102		
51.5	168.96	103		
52.0	170.60	104		
52.5	172.24	105		
53.0	173.88	106		
53.5	175.52	107		
54.0	177.17	108		
54.5	178.81	109		
55.0	180.45	110		
55.5	182.09	111		
56.0	183.73	112		
56.5	185.37			HIT BOTTOM @ EL. 2 AND 196.5' BOTTOM PREARRANGEMENT
57.0	187.01			
57.5	188.65			
58.0	190.29			
58.5	191.93			
59.0	193.57			
59.5	195.21			
60.0	196.85			

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B-407 CALIPER FIELD LOG

SITE: CCNPP COLA DATE: 6/16/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-407 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 3/4 0 TO 280' ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 280'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____; NO ✓
DEPTH TO BEDROCK: N/R DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ____; FRESH WATER MUD ✓; SALT WATER MUD ____;
OTHER:
DEPTH TO BOREHOLE FLUID: TIME SINCE LAST CIRCULATION: 5 hr.

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Lexington Park DEPARTURE TIME: 7:05
ARRIVED ON SITE: 7:35
STANDBY TIME: CAUSE:
LOGGING STARTED: 10:58 LOGGING COMPLETED: 11:42

SITE: CCNPP COLA B2-B407 DATE: 9/14/2008
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
CALIPER PROBE 5388 ✓ OTHER ____

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	12 IN MAX 2.08M(6.82 FT) ARMS - 1.5 5.32'	24 IN MAX ARMS - ____

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B407 TEST CAL. 01	0	10:58	0	11:04
B407 CAL-UP 01	193.0	11:10	0	11:30
B407 TEST CAL. 02	0	11:36	0	11:42

CALIBRATION PLATE S/N 201

		AS BUILT		
		1.968 IN	3.937 IN	8.000 IN
	FILE NAME	(50 MM)	(100 MM)	203.2 MM
AS MEAS.	B407 TEST CAL.01	1.96	3.94	8.00
AS MEAS.	B407 TEST CAL.02	1.98	3.94	8.00
AS MEAS.				
AS MEAS.				
AS MEAS.				
AS MEAS.				

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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B-407 ELOG FIELD LOG

SITE: CCNPP COLA DATE: 6/16/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-407 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 3/4 0 TO 200' ; ____ ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____ ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ____ ; FRESH WATER MUD ✓ ; SALT WATER MUD ____ ;
OTHER:
DEPTH TO BOREHOLE FLUID: TIME SINCE LAST CIRCULATION: 0 HRS

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Lusby, MD DEPARTURE TIME: 7:45
ARRIVED ON SITE: 7:45
STANDBY TIME: CAUSE:
LOGGING STARTED: 11:50 LOGGING COMPLETED: 12:20

SITE: CCNPP COLA B-407 DATE: / /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ___ SILVER ✓ OYO ___ OTHER ___
MICROLOGGER 5301 ✓ OTHER ___
ELOG PROBE 5490 ✓ OTHER ___

PROBE OFFSET	2.50M(8.20 FT)	
CASING STICK-UP	-1.50	+32.8
DEPTH REF. OFFSET	39.5'	

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B407 ELOG UP OR	192.8	11:55	17.6	12:16

MAINTENANCE PERFORMED ON SITE: ___

EQUIPMENT PROBLEMS OR FAILURES: ___

SUGGESTIONS, ADDITIONS, CHANGES: ___

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B-407 ~~ACOUSTIC TELEVIEWER~~ DESIGNATION FIELD LOG

SITE: CCNPP COLA DATE: 6/14/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-407 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 3/4 0 TO 200' ; TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: 0 TIME SINCE LAST CIRCULATION: 5 HRS

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SITE: CCNPP COLA B-407 DATE: 6 / 16 /2006
CLIENT: SCHNABEL JOB: 8165
AUTHOR: R. STELLER PAGE 2 OF 2

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK DEPARTURE TIME: 7:05
ARRIVED ON SITE: 7:35
STANDBY TIME: CAUSE:
LOGGING STARTED: 12:53 LOGGING COMPLETED:

WINCH: COMPROBE ___ SILVER ___ OYO ___ OTHER Max II
MICROLOGGER 5301 ___ OTHER Max II
TELEVIEWER OPTICAL #5117 ___ ACOUSTIC #5174 ___ OTHER 2VDA

PROBE TILT TEST 88.3 BRUNTON TILT 89°
PROBE AZIMUTH TEST 21.5 BRUNTON AZIMUTH 25°

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	OPTICAL 1.88M(6.17FT) -	ACOUSTIC 1.44M(4.72FT) -

zero @ −1.5'

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B407 DEV DOWN01	Ø	12:53	181.80	13:37

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

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B-418 BORING GEOPHYSICS FIELD LOG SUMMARY

SITE: CCNPP COLA DATE: 6/29/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI PHONE: 703-906-1797

BOREHOLE CONSTRUCTION: CASED ___ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 1/2 0 TO 200' ; ___ ; ___ TO ___
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ___ DEPTH TO BOTTOM OF CASING ___ ; NO ✓
DEPTH TO BEDROCK: NA
BOREHOLE FLUID: WATER ___ ; FRESH WATER MUD ✓ ; SALT WATER MUD ___ ;

LOGGING CREW: R. STELLER, C. CARTER

LOG TYPE	FILE NAME	DEPTH RANGE	DATE	TIMES
[illegible]	001-114	1.6' - 187.8'	6/29/06	13:53 - 15:24
ACOUSTIC TV	B418 ALL UP 01	199.4' - 3.5'	6/29/06	15:51 - 16:49
CALIPER TEST	B418 CAL TEST 01	Ø	6/29/06	16:55 - 17:00
CALIPER/GAMMA	B418 CAL UP 01	197.0' - 162.8'	6/29/06	17:05 - 17:17
CALIPER TEST	B418 CAL TEST 02	Ø	6/30/06	8:05 - 8:09
CALIPER/GAMMA	B418 CAL UP 02	197.0' - Ø	6/30/06	9:15 - 9:40
CALIPER TEST	B418 CAL TEST 03	Ø	6/30/06	9:41 - 9:45
ELOG	B418 ELOG UP 01	197.0' - 20.0	6/30/06	9:58 - 10:15

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P-S SUSPENSION VELOCITY FIELD LOG

SITE: CALVERT CLIFFS COLA B-416 DATE: 10/22/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 6

CONTACT: _____ OFFICE PHONE: _____
CELL PHONE: _____
CONTACT: _____ OFFICE PHONE: _____
PHONE: _____
CONTACT: _____ PHONE: _____
PHONE: _____
CONTACT: _____ PHONE: _____
PHONE: _____
DRILLER: _____ PHONE: _____
COMPANY: _____ PHONE: _____

DIRECTIONS TO SITE: _____

GENERAL SITE CONDITIONS/LOCATION: _____

EA#: _____
BOREHOLE DESIGNATION: B-416 LOCATION: _____

COUNTY: _____ RANGE: _____ TOWNSHIP: _____ SECTION: _____
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 1/4" 0 TO 200' ; _____ TO _____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING _____ ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE: N/A
BOREHOLE FLUID: WATER ____ ; FRESH WATER MUD ✓ ; SALT WATER MUD ____ ;
OTHER: _____
DEPTH TO BOREHOLE FLUID: 0 TIME SINCE LAST CIRCULATION: ≈ 1 Hr.

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SITE: CALVERT CLIFFS COLA B-41B DATE: 6/29/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 6

LOGGING CREW: R. STELLER, C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: DEPARTURE TIME: 12:30
ARRIVED ON SITE: 13:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 13:55 LOGGING COMPLETED: 15:24
STANDBY TIME: CAUSE:
LOGGING STARTED: LOGGING COMPLETED:
DEMOBILIZED TO: ARRIVAL TIME:
ADDITIONAL DEMOB TIME: REASON:

BATTERIES CHANGED BEFORE LOGGING: YES ___ ; NO ✓ ; STORED WITH NEW ___

WINCH	COMPROBE ☐		GREY ☐	OYO ☐	RG ☐	OTH ☑					
INSTRUMENT	OYO 12004 ☐	15014 ☐	19029 ☐		RG 160023 ☑	160024 ☐					
RECEIVER S/N	12008 ☐	20042 ☐	26066 ☐	11001 ☐	23053 ☐	300BC ☑					

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

COMMENTS: ZERO = 1.5' - 1.5' = 0.0m 0.0m UN EXIT

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-418 DATE: 6/29/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 6

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64	001		
1.0	3.28	2		
1.5	4.92	3		
2.0	6.56	4		
2.5	8.20	5		
3.0	9.84	6		
3.5	11.48	7		
4.0	13.12	8		
4.5	14.76	9		
5.0	16.40	10		
5.5	18.04	11		
6.0	19.68	12		
6.5	21.33	13		
7.0	22.97	14		
7.5	24.61	15		
8.0	26.25	16		
8.5	27.89	17		
9.0	29.53	18		
9.5	31.17	19		
10.0	32.81	20		
10.5	34.45	21		
11.0	36.09	22		
11.5	37.73	23		
12.0	39.37	24		
12.5	41.01	25		
13.0	42.65	26		
13.5	44.29	27		
14.0	45.93	28		
14.5	47.57	29		
15.0	49.21	30		
15.5	50.85	31		
16.0	52.49	32		
16.5	54.13	33		
17.0	55.77	34		
17.5	57.41	35		
18.0	59.06	36		
18.5	60.70	37		
19.0	62.34	38		
19.5	63.98	39		
20.0	65.62	40		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-418 DATE: 6/24/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 4 OF 6

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
20.5	67.26	41		
21.0	68.90	42		
21.5	70.54	43		
22.0	72.18	44		
22.5	73.82	45		
23.0	75.46	46		
23.5	77.10	47		
24.0	78.74	48		
24.5	80.38	49		
25.0	82.02	50		
25.5	83.66	51		
26.0	85.30	52		
26.5	86.94	53		
27.0	88.58	54		
27.5	90.22	55		
28.0	91.86	56		
28.5	93.50	57		
29.0	95.14	58		
29.5	96.78	59		
30.0	98.43	60		
30.5	100.07	61		
31.0	101.71	62		
31.5	103.35	63		
32.0	104.99	64		
32.5	106.63	65		
33.0	108.27	66		
33.5	109.91	67		
34.0	111.55	68		
34.5	113.19	69		
35.0	114.83	70		
35.5	116.47	71		
36.0	118.11	72		
36.5	119.75	73		
37.0	121.39	74		
37.5	123.03	75		
38.0	124.67	76		
38.5	126.31	77		
39.0	127.95	78		
39.5	129.59	79		
40.0	131.23	80		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-418 DATE: 6/29/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 5 OF 6

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
40.5	132.87	81		
41.0	134.51	82		
41.5	136.15	83		
42.0	137.80	84		
42.5	139.44	85		
43.0	141.08	86		
43.5	142.72	87		
44.0	144.36	88		
44.5	146.00	89		
45.0	147.64	90		
45.5	149.28	91		Mud cavern?
46.0	150.92	92		
46.5	152.56	93		
47.0	154.20	94		
47.5	155.84	95		
48.0	157.48	96		
48.5	159.12	97		
49.0	160.76	98		
49.5	162.40	99		
50.0	164.04	100		
50.5	165.68	101		
51.0	167.32	102		
51.5	168.96	103		
52.0	170.60	104		
52.5	172.24	105		
53.0	173.88	106		
53.5	175.52	107		
54.0	177.17	108		
54.5	178.81	109		
55.0	180.45	110		
55.5	182.09	111		
56.0	183.73	112		
56.5	185.37	113		
57.0	187.01	114		Bottom of Equipment?
57.5	188.65			Hit Bottom @ 57.2 m.
58.0	190.29			
58.5	191.93			
59.0	193.57			
59.5	195.21			
60.0	196.85			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-418 DATE: 6/29/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 6 OF 6

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
60.5	198.49			
61.0	200.13			T.D. @ 200'
61.5	201.77			
62.0	203.41			
62.5	205.05			
63.0	206.69			
63.5	208.33			
64.0	209.97			
64.5	211.61			
65.0	213.25			
65.5	214.90			
66.0	216.54			
66.5	218.18			
67.0	219.82			
67.5	221.46			
68.0	223.10			
68.5	224.74			
69.0	226.38			
69.5	228.02			
70.0	229.66			
70.5	231.30			
71.0	232.94			
71.5	234.58			
72.0	236.22			
72.5	237.88			
73.0	239.50			
73.5	241.14			
74.0	242.78			
74.5	244.42			
75.0	246.06			
75.5	247.70			
76.0	249.34			
76.5	250.98			
77.0	252.62			
77.5	254.27			
78.0	255.91			
78.5	257.55			
79.0	259.19			
79.5	260.83			
80.0	262.47			

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B-418 ACOUSTIC TELEVIEWER FIELD LOG

SITE: CCNPP COLA DATE: 6 / 29 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-418 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 1/2" 0 TO 200' ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____ ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ____ ; FRESH WATER MUD ✓ ; SALT WATER MUD ____ ;
OTHER:
DEPTH TO BOREHOLE FLUID: ? TIME SINCE LAST CIRCULATION: ? 2 hrs.

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SITE: CCNPP COLA B-418 DATE: 6/29/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

LOGGING CREW: R. STELLER, C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Lexington Park, MD DEPARTURE TIME: 12:30
ARRIVED ON SITE: 13:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 15:51 LOGGING COMPLETED: 16:49

WINCH: COMPROBE ___ SILVER ✓ OYO ___ OTHER ___
MICROLOGGER 5301 ✓ OTHER ___
TELEVIEWER OPTICAL #5117 ___ ACOUSTIC #6474 5500 OTHER ___

PROBE TILT TEST 89° BRUNTON TILT 83° probe hanging 15°
PROBE AZIMUTH TEST 168.4° BRUNTON AZIMUTH 168°

PROBE OFFSET	OPTICAL 1.88M(6.17FT)	ACOUSTIC 1.44M(4.72FT)
CASING STICK-UP	- ___	- 1.5'
DEPTH REF. OFFSET	___	3.22'

3.25' on Exit

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B418AUHP 01	199.4	15:51	3.25'	16:49

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

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B-418 CALIPER FIELD LOG

SITE: CCNPP COLA DATE: 6/29/2006, 6/30/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-418 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 1/4" 0 TO 200' ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: Ø TIME SINCE LAST CIRCULATION: ≈ 2 HR

LOGGING CREW: R. STELLER, C. CARTER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK DEPARTURE TIME: 12:30
ARRIVED ON SITE: 13:00
STANDBY TIME: CAUSE:
LOGGING STARTED: 6/29/06 16:55 LOGGING COMPLETED: 6/30/06 9:45

SITE: CCNPP COLA -B- 418 DATE: 6 / 29 /2006 6/30/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
CALIPER PROBE 5368 ____ OTHER 2915

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	12 IN MAX 2.08M(6.82 FT) ARMS - -1.5 5.32'	24 IN MAX ARMS - ____ 5.35' ON EXIT

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME	
B418 CAL TEST 01	Ø	16:55	Ø	17:00	6/29/06
B418 CAL UP 01	197.0'	17:05	Ø 162.8'	17:17	6/29/06
B418 CAL TEST 02	Ø	8:05	Ø	8:09	6/30/06
B418 CAL UP 02	197.0'	9:15	Ø	9:40	6/30/06
B418 CAL TEST 03	Ø	9:41	Ø	9:45	6/30/06

CALIBRATION PLATE S/N 201

	FILE NAME	AS BUILT 1.968 IN (50 MM)	3.937 IN (100 MM)	8.000 IN 203.2 MM
AS MEAS.	B418 CAL TEST 01	1.97	3.91	7.96
AS MEAS.	B418 CAL TEST 02	1.98	3.94	7.98
AS MEAS.	B418 CAL TEST 03	2.00	3.94	7.97
AS MEAS.				
AS MEAS.				
AS MEAS.				

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

GEOVision Geophysical Services 1151 Pomona Road, Unit F, Corona, CA 92882 Ph (951) 549-1234 Fx (951) 549-1236

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B-418 ELOG FIELD LOG

SITE: CCNPP COLA DATE: 6 / 30 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-418 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4½ 0 TO 200' ; TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: NA DEPTH TO WATER TABLE: NA
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: Ø TIME SINCE LAST CIRCULATION: ~ 1 HR.

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Lexington Park, MD DEPARTURE TIME: 7:00
ARRIVED ON SITE: 7:30
STANDBY TIME: CAUSE:
LOGGING STARTED: 9:50 LOGGING COMPLETED: 10:15

SITE: CCNPP COLA B-41B DATE: 6/30/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
ELOG PROBE 5490 ✓ OTHER ____

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	2.50M(8.20 FT) ~1.5 + 32.0 39.5	

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B41BELOG0P01	197.0	9:58	20.0	10:15

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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B-423 BORING GEOPHYSICS FIELD LOG SUMMARY

SITE: CCNPP COLA DATE: 6 / 13 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI PHONE: 703-906-1797

BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 3/4 0 TO 200' ; ____, ____ TO ____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING ____ ; NO ✓
DEPTH TO BEDROCK: NA
BOREHOLE FLUID: WATER ____ ; FRESH WATER MUD ✓ ; SALT WATER MUD ____ ;

LOGGING CREW: R. STELLER

LOG TYPE	FILE NAME	DEPTH RANGE	DATE	TIMES
DEVIATION	B423DEVUP01	195.5 – 187.0	6/13/06	16:15 – 16:20
DEVIATION	B423DEVUP02	195.5 – (-3.1)	6/13/06	16:20 – 17:12
SUSCEPTIBILITY	001 – 113	1.0' – 185.4'	6/13/06	17:44 – 18:58
CALIPER TEST	B423TESTCAL01	0	6/13/06	19:25 – 19:30
CALIPER TEST	B423TESTCAL02	0	6/13/06	19:35 – 19:40
CALIPER	B423CALIPER01	195' – 0	6/13/06	19:47 – 20:08
CALIPER TEST	B423TESTCAL03	-2.95	6/13/06	20:11 – 20:15
FLUID	B423FLUID UP01	200' – 3.3'	6/13/06	20:24 – 20:50

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B-423 ~~ACOUSTIC TELEVIEWER~~ DEVIATION FIELD LOG

SITE: CCNPP COLA DATE: 6/13/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

DIRECTIONS TO SITE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-423 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4"± 0 TO 200' ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ; DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: N/A DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: TIME SINCE LAST CIRCULATION: 6 HR.

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SITE: CCNPP COLA B-423 DATE: 6 / 13 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEXINGTON PARK DEPARTURE TIME: 7:00
ARRIVED ON SITE: 7:30
STANDBY TIME: CAUSE:
LOGGING STARTED: 16:15 LOGGING COMPLETED:

WINCH: COMPROBE ___ SILVER ___ OYO ___ OTHER MEX II
MICROLOGGER 5301 ___ OTHER MEX II
TELEVIEWER OPTICAL #5117 ___ ACOUSTIC #5174 ___ OTHER COMPROBE

PROBE TILT TEST 2.8 BRUNTON TILT 4°
PROBE AZIMUTH TEST 11.2 BRUNTON AZIMUTH

PROBE OFFSET	OPTICAL 1.88M(6.17FT)	ACOUSTIC 1.44M(4.72FT)
CASING STICK-UP	-	- 1.8'
DEPTH REF. OFFSET		- 1.8'

GOPRIS DEV. 0

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B423DEVUP01	193.5	16:15	187.0	16:20
B423DEVUP02	193.5	16:20	-3.1	17:12

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES: Runout zero -3.1'

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P-S SUSPENSION VELOCITY FIELD LOG

SITE: CALVERT CLIFFS COLA B-423 DATE: 6/13/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 5

CONTACT: _____ OFFICE PHONE: _____
CELL PHONE: _____
CONTACT: _____ OFFICE PHONE: _____
PHONE: _____
CONTACT: _____ PHONE: _____
PHONE: _____
CONTACT: _____ PHONE: _____
PHONE: _____
DRILLER: _____ PHONE: _____
COMPANY: _____ PHONE: _____

DIRECTIONS TO SITE: _____

GENERAL SITE CONDITIONS/LOCATION: _____

EA#: _____
BOREHOLE DESIGNATION: B-423 LOCATION: _____

COUNTY: _____ RANGE: _____ TOWNSHIP: _____ SECTION: _____
BOREHOLE CONSTRUCTION: CASED ____ UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 3/4 TO 200' : _____ TO _____
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES ____ DEPTH TO BOTTOM OF CASING _____; NO ✓
DEPTH TO BEDROCK: NR DEPTH TO WATER TABLE: _____
BOREHOLE FLUID: WATER ____; FRESH WATER MUD ✓; SALT WATER MUD ____;
OTHER: _____
DEPTH TO BOREHOLE FLUID: 0 TIME SINCE LAST CIRCULATION: 5 hr

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SITE: CALVERT CLIFFS COLA B-423 DATE: 6/12/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 5

LOGGING CREW: R. Steller
VEHICLE(S) USED AND MILEAGE: Rental
MOBILIZED FROM: Lexington Park DEPARTURE TIME: 7:00
ARRIVED ON SITE: 7:50
STANDBY TIME: CAUSE:
LOGGING STARTED: 11:44 LOGGING COMPLETED: 12:58
STANDBY TIME: CAUSE:
LOGGING STARTED: LOGGING COMPLETED:
DEMOBILIZED TO: ARRIVAL TIME:
ADDITIONAL DEMOB TIME: REASON:

BATTERIES CHANGED BEFORE LOGGING: YES ✓ ; NO ; STORED WITH NEW

WINCH		COMPROBE	☐	GREY	☐	OYO	☐	RG	☐	OTH	☑
INSTRUMENT	OYO 12004	☐	15014	☐	19029	☐		RG 160023	☑	160024	☐
RECEIVER S/N	12008	☐	20042	☐	26066	☐	11001	☐	23053	☐	30080 ☑

MAINTENANCE PERFORMED ON SITE:

EQUIPMENT PROBLEMS OR FAILURES:

SUGGESTIONS, ADDITIONS, CHANGES:

COMMENTS: Depth Zero 2.49m – .55m (1.8') – 1.93m

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-423 DATE: 6/13/06

CLIENT: SCHNABEL JOB: 6165

AUTHOR: R. STELLER PAGE 3 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64	1		
1.0	3.28	2		
1.5	4.92	3		
2.0	6.56	4		
2.5	8.20	5		
3.0	9.84	6		
3.5	11.48	7		
4.0	13.12	8		
4.5	14.76	9		
5.0	16.40	10		
5.5	18.04	11		
6.0	19.69	12		
6.5	21.33	13		
7.0	22.97	14		
7.5	24.61	15		
8.0	26.25	16		
8.5	27.89	17		
9.0	29.53	18		
9.5	31.17	19		
10.0	32.81	20		
10.5	34.45	21		
11.0	36.09	22		
11.5	37.73	23		
12.0	39.37	24		
12.5	41.01	25		
13.0	42.65	26		
13.5	44.29	27		
14.0	45.93	28		
14.5	47.57	29		
15.0	49.21	30		
15.5	50.85	31		
16.0	52.49	32		
16.5	54.13	33		
17.0	55.77	34		
17.5	57.41	35		
18.0	59.06	36		
18.5	60.70	37		
19.0	62.34	38		
19.5	63.98	39		
20.0	65.62	40		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-423 DATE: 6/12/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 4 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
20.5	67.26	41		
21.0	68.90	42		
21.5	70.54	43		
22.0	72.18	44		
22.5	73.82	45		
23.0	75.46	46		
23.5	77.10	47		
24.0	78.74	48		
24.5	80.38	49		
25.0	82.02	50		
25.5	83.66	51		
26.0	85.30	52		
26.5	86.94	53		
27.0	88.58	54		
27.5	90.22	55		
28.0	91.86	56		
28.5	93.50	57		
29.0	95.14	58		
29.5	96.78	59		
30.0	98.43	60		
30.5	100.07	61		
31.0	101.71	62		
31.5	103.35	63		
32.0	104.99	64		
32.5	106.63	65		
33.0	108.27	66		
33.5	109.91	67		
34.0	111.55	68		
34.5	113.19	69		
35.0	114.83	70		
35.5	116.47	71		
36.0	118.11	72		
36.5	119.75	73		
37.0	121.39	74		
37.5	123.03	75		
38.0	124.67	76		
38.5	126.31	77		
39.0	127.95	78		
39.5	129.59	79		
40.0	131.23	80		

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: CALVERT CLIFFS COLA B-423 DATE: 6/13/06
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 5 OF 5

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
40.5	132.87	81		
41.0	134.51	82		
41.5	136.15	83		
42.0	137.80	84		
42.5	139.44	85		
43.0	141.08	86		
43.5	142.72	87		
44.0	144.36	88		
44.5	146.00	89		
45.0	147.64	90		
45.5	149.28	91		
46.0	150.92	92		
46.5	152.56	93		
47.0	154.20	94		
47.5	155.84	95		
48.0	157.48	96		
48.5	159.12	97		
49.0	160.76	98		
49.5	162.40	99		
50.0	164.04	100		
50.5	165.68	101		
51.0	167.32	102		
51.5	168.96	103		
52.0	170.60	104		
52.5	172.24	105		
53.0	173.88	106		
53.5	175.52	107		
54.0	177.17	108		
54.5	178.81	109		
55.0	180.45	110		
55.5	182.09	111		
56.0	183.73	112		
56.5	185.37	113		
57.0	187.01			BOTTOM MEASUREMENT?
57.5	188.65			HIT BOTTOM @ 56.7m TIPE 198.1
58.0	190.29			
58.5	191.93			
59.0	193.57			
59.5	195.21			
60.0	196.85			

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B-423 CALIPER FIELD LOG

SITE: CCNPP COLA DATE: 10 / 13 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-423 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED ✓
DIAMETERS AND DEPTH RANGES: 4 3/4 0 TO 200' ; TO
BOREHOLE TOTAL DEPTH AS DRILLED: 200'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: TIME SINCE LAST CIRCULATION: 6 HR.

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: LEESBURG, VA DEPARTURE TIME: 7:00
ARRIVED ON SITE: 7:30
STANDBY TIME: CAUSE:
LOGGING STARTED: 14:25 LOGGING COMPLETED: 20:15

SITE: CCNPP COLA B-423 DATE: 09/13/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ GYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
CALIPER PROBE 5368 ✓ OTHER ____

PROBE OFFSET CASING STICK-UP DEPTH REF. OFFSET	12 IN MAX 2.08M(6.82 FT) ARMS - 1.8' 5.02	24 IN MAX ARMS - ____

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B423TESTCAL01	0	17:25	0	17:30
B423TESTCAL02	0	17:35	0	17:40
B423CAL03	193'	19:47	0	20:00
B423 TESTCAL03	-2.95	20:11	-2.95	20:15

CALIBRATION PLATE S/N 201

		AS BUILT		
		1.968 IN	3.937 IN	8.000 IN
	FILE NAME	(50 MM)	(100 MM)	203.2 MM
AS MEAS.	B423TESTCAL01	2.02	4.01	8.07
AS MEAS.	B423TESTCAL02	1.97	3.94	8.00
AS MEAS.	B423TESTCAL03	1.96	3.92	8.01
AS MEAS.				
AS MEAS.				
AS MEAS.				

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

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B-423 ELOG FIELD LOG

SITE: CCNPP COLA DATE: 6 / 13 /2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 1 OF 2

CONTACT: RUBEN TARUSELLI OFFICE PHONE:
CELL PHONE: 703-906-1797
CONTACT: OFFICE PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
CONTACT: PHONE:
PHONE:
DRILLER: PHONE:
COMPANY: PHONE:

GENERAL SITE CONDITIONS/LOCATION:

BOREHOLE DESIGNATION: B-423 LOCATION:

COUNTY: RANGE: TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION: CASED UNCASED 1'
DIAMETERS AND DEPTH RANGES: 4 3/4 0 TO 280' ; , TO
BOREHOLE TOTAL DEPTH AS DRILLED: 280'
CONDUCTOR CASING?: YES DEPTH TO BOTTOM OF CASING ; NO ✓
DEPTH TO BEDROCK: DEPTH TO WATER TABLE:
BOREHOLE FLUID: WATER ; FRESH WATER MUD ✓ ; SALT WATER MUD ;
OTHER:
DEPTH TO BOREHOLE FLUID: TIME SINCE LAST CIRCULATION: 2 S.H.P.

LOGGING CREW: R. STELLER
VEHICLE(S) USED AND MILEAGE: RENTAL
MOBILIZED FROM: Lusby MD DEPARTURE TIME: 7:00
ARRIVED ON SITE: 7:30
STANDBY TIME: CAUSE:
LOGGING STARTED: 20:24 LOGGING COMPLETED: 20:50

SITE: CCNPP COLA B-423 DATE: 6/13/2006
CLIENT: SCHNABEL JOB: 6165
AUTHOR: R. STELLER PAGE 2 OF 2

WINCH: COMPROBE ____ SILVER ✓ OYO ____ OTHER ____
MICROLOGGER 5301 ✓ OTHER ____
ELOG PROBE 5490 ✓ OTHER ____

PROBE OFFSET	2.50M(8.20 FT)	
CASING STICK-UP	-1.8	
DEPTH REF. OFFSET	6.4	

LOG NAME	START DEPTH	START TIME	END DEPTH	END TIME
B423ELOGOP01	200'	20:24	3.3'	20:50

MAINTENANCE PERFORMED ON SITE: ____

EQUIPMENT PROBLEMS OR FAILURES: ____

SUGGESTIONS, ADDITIONS, CHANGES: ____

APPENDIX E

BORING GEOPHYSICAL LOGGING FIELD MEASUREMENT PROCEDURES

PROCEDURE FOR

OYO P-S SUSPENSION SEISMIC VELOCITY LOGGING

Background

This procedure describes a method for measuring shear and compressional wave velocities in soil and rock. The OYO P-S Suspension Method is applied by generating shear and compressional waves in a borehole using the OYO P-S Suspension Logger borehole tool and measuring the travel time between two receiver geophones or hydrophones located in the same tool.

Objective

The outcome of this procedure is a plot and table of P and S_H wave velocity versus depth for each borehole. Standard analysis is performed on receiver to receiver data. Data is presented in report format, with ASCII data files and digital records transmitted on diskette.

Instrumentation

1. OYO Model 170 Digital Logging Recorder or equivalent
2. OYO P-S Suspension Logger probe or equivalent, including two sets horizontal and vertical geophones, seismic source, and power supply for the source and receivers
3. Winch and winch controller, with logging cable
4. Batteries to operate P-S Logger and winch

The Suspension P-S Logger system, manufactured by OYO Corporation, or the Robertson Digital P-S Suspension Probe with the Robertson Micrologger2 are currently the only commercially available suspension logging systems. As shown in Figure 1, these systems consists of a borehole probe suspended by a cable and a recording/control electronics package on the surface.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave generator (S_H) and compressional-wave generator (P), joined to

two biaxial geophones by a flexible isolation cylinder. The separation of the two geophones is one meter, allowing average wave velocity in the region between the geophones to be determined by inversion of the wave travel time between the two geophones. The total length of the probe is approximately 7 meters; the center point of the geophones is approximately 5 meters above the bottom end of the probe.

The probe receives control signals from, and sends the amplified geophone signals to, the instrumentation package on the surface via an armored 4 or 7 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured by a rotary encoder to provide probe depth data.

The entire probe is suspended by the cable and may be centered in the borehole by nylon "whiskers." Therefore, source motion is not coupled directly to the borehole walls; rather, the source motion creates a horizontally propagating pressure wave in the fluid filling the borehole and surrounding the source. This pressure wave produces a horizontal displacement of the soil forming the wall of the borehole. This displacement propagates up and down the borehole wall, in turn causing a pressure wave to be generated in the fluid surrounding the geophones as the soil displacement wave passes their location.

Environmental Conditions

The OYO P-S Suspension Logging Method can be used in either cased or uncased boreholes. For best results, the uncased borehole must be between 10 and 20 cm in diameter, or 4 to 8 inches. A cased borehole may be as small as 3 inches, if properly grouted (see below) and the grout annulus does not exceed 1 inch.

Uncased boreholes are preferred because the effects of the casing and grouting are removed. It is recommended that the borehole be drilled using the rotary mud method. This method does little damage to the borehole wall, and the drilling fluid coats and seals the borehole wall reducing fluid loss and wall collapse. The borehole fluid is required for the logging, and must be well circulated prior to logging.

If the borehole must be cased, the casing must be PVC and properly installed and grouted. Any voids in the grout will cause problems with the data. Likewise, large grout bulbs used to fill cavities will also cause problems. The grout must be set before testing. This means the grouting must take place at least 48 hours before testing.

For borehole casing, applicable preparation procedures are presented in ASTM Standard D4428/D4428M-91 Section 4.1 (see ASTM website for copy).

Calibration

Calibration of the digital recorder is required. Calibration is limited to the timing accuracy of the recorder. GEOVision's Seismograph Calibration Procedure or equivalent should be used. Calibration must be performed on an annual basis.

Measurement Procedure

The entire probe is lowered into the borehole to a specific measurement depth by the winch. A measurement sequence is then initiated by the operator from the instrumentation package control panel. No further operator intervention is then needed to complete the measurement sequence described below.

The system electronics activates the SH-wave source in one direction and records the output of the two horizontally oriented geophone axes which are situated parallel to the axis of motion of the source. The source is then activated in the opposite direction, and the horizontal output signals are again recorded, producing a SH-wave record of polarity opposite to the previous record. The source is finally actuated in the first direction again, and the responses of the vertical geophone axes to the resultant P-wave are recorded during this sampling.

The data from each geophone during each source activation is recorded as a different channel on the recording system. The seismograph has at least six channels (two simultaneous recording channels), each with at least a 12 bit 1024 sample record. Newer seismographs may have longer record lengths. The recorded data is displayed on a CRT or LCD display and possibly on paper tape output as six channels with a common time scale. Data is stored on digital media for further processing. Up to 8 sampling sequences can be stacked (averaged) to improve the signal to noise ratio of the signals.

Review of the data on the display or paper tape allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and stacking number in order to optimize the quality of the data before recording. In the case of the Model 170, printed data is verified by the operator prior to moving the probe. In the case of the Robertson Micrologger2, storage on the hard disk should be verified from time-to-time, certainly before exiting the borehole.

Typical depth spacing for measurements is 1.0 meters, or 3.3 feet. Alternative spacing is 0.5 meter, or 1.6 feet.

Required Field Records

1) Field log for each borehole showing

   a) Borehole identification

   b) Date of test

   c) Tester or data recorder

d) Description of measurement

e) Any deviations from test plan and action taken as a result

f) QA Review

2) Paper output records are no longer required, since the Micrologger2 cannot generate them. However, data must be stored in at least 2 places prior to leaving the site

3) List of record ID numbers (for data on digital media) and corresponding depth

4) Diskettes, CDRom, or USB flash drives with backup copies of data on hard disk, labeled with borehole designation, record ID numbers, date, and tester name.

An example Field Log is attached to this procedure.

Analysis

Following completion of field work, the recorded digital records are processed by computer using the OYO Corporation software program PSLOG and interactively analyzed by an experienced geophysicist to produce plots and tables of P and S_H wave velocity versus depth.

The digital time series records from each depth are transferred to a personal computer for analysis. Figure 2 shows a sample of the data from a single depth. These digital records are analyzed to locate the first minima on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between these arrivals is used to calculate the P-wave velocity for that 1-meter interval. When observable, P-wave arrivals on the horizontal axis records are used to verify the velocities determined from the vertical axis data. In addition, the soil velocity calculated from the travel time from source to first receiver is compared to the velocity derived from the travel time between receivers.

The digital records are studied to establish the presence of clear SH-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the SH-wave signals from the ‘normal’ and ‘reverse’ source pulses are very nearly inverted images of each other. Digital FFT – IFFT lowpass filtering are used to remove the higher frequency P-wave signal from the SH-wave signal.

The first maxima are picked for the ‘normal’ signals and the first minima are picked for the 'reverse' signals. The absolute arrival time of the ‘normal’ and ‘reverse’ signals may vary by +/- 0.2 milliseconds, due to differences in actuation time of the solenoid source caused by constant mechanical bias in the source or by borehole inclination. This variation does not affect the velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity

value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

In Figure 2, the time difference over the 1-meter interval of 1.70 millisecond is equivalent to a SH-wave velocity of 588 m/sec. Whenever possible, time differences are determined from several phase points on the S_H -wave pulse trains to verify the data obtained from the first arrival of the S_H -wave pulse. In addition, the soil velocity calculated from the travel time from source to first receiver is compared to the velocity derived from the travel time between receivers.

Figure 3 is a sample composite plot of the far normal horizontal geophone records for a range of depths. This plot shows the waveforms at each depth, clearly showing the S-wave arrivals. This display format is used during analysis to observe trends in velocity with changing depth.

Once the proper picks are entered in PSLOG, the picks are transferred to an Excel spreadsheet where Vs and Vp are calculated. The spreadsheet allows output for presentation in charts and tables.

Standard analysis is performed on receiver 1 to receiver 2 data, with separate analysis performed on source to receiver data as a quality assurance procedure.

Registered Geophysicist Antony Martin Date 4/10/06

QA Review Date 4/10/06

References:

1. "In Situ P and S Wave Velocity Measurement", Ohya, S. 1986. Proceedings of In-Situ '86, *Use of In-Situ Tests In Geotechnical Engineering*, an ASCE Specialty Conference sponsored by the Geotechnical Engineering Division of ASCE and co-sponsored by the Civil Engineering Dept of Virginia Tech.

2. Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Sections 7 and 8.

3. "Standard test Methods for Crosshole Seismic Testing", ASTM Standard D4428/D4428M-91, July 1991, Philadelphia, PA

OYO SUSPENSION P-S VELOCITY LOGGING SETUP

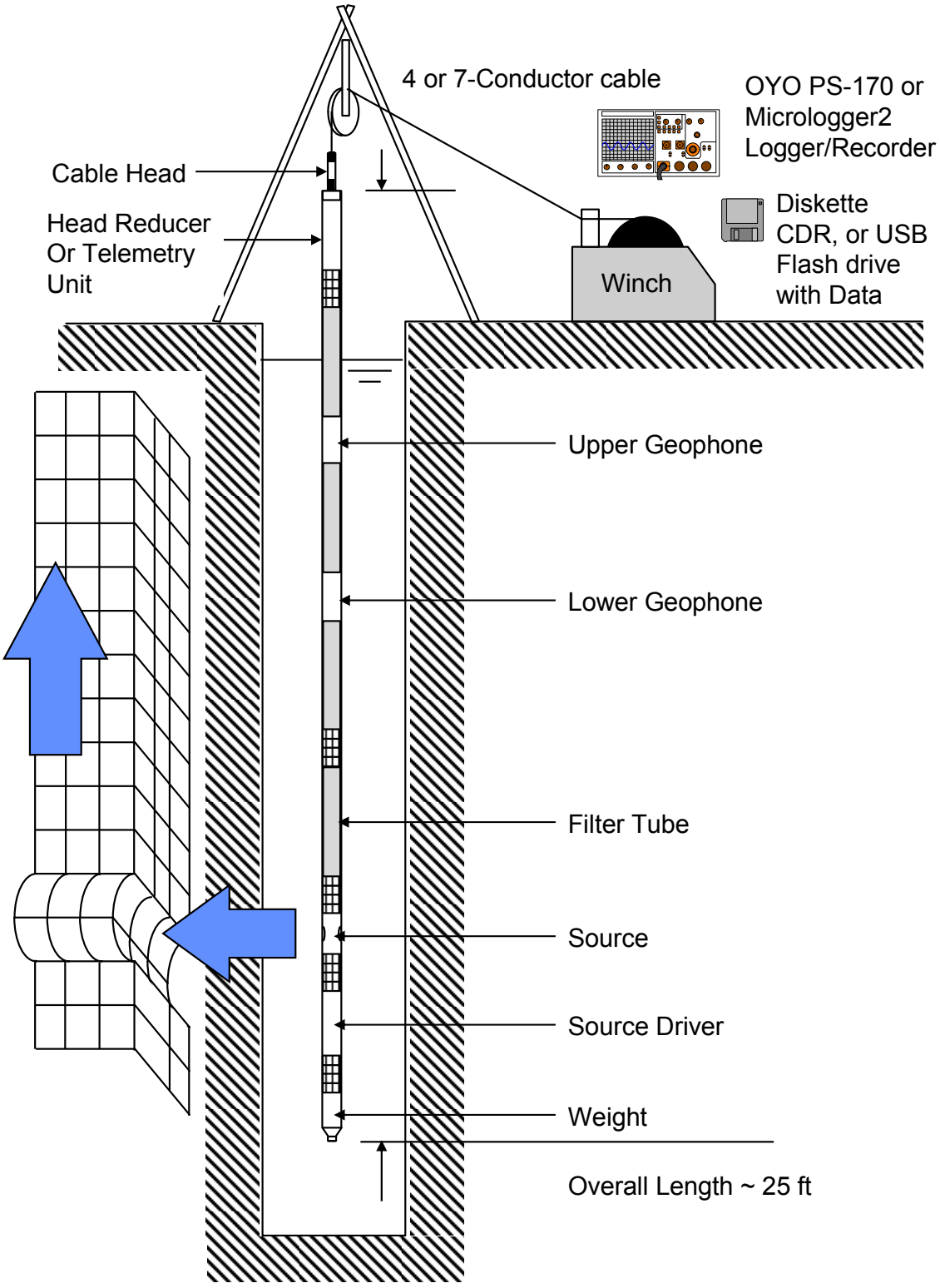

Figure 1. Suspension PS logging method setup

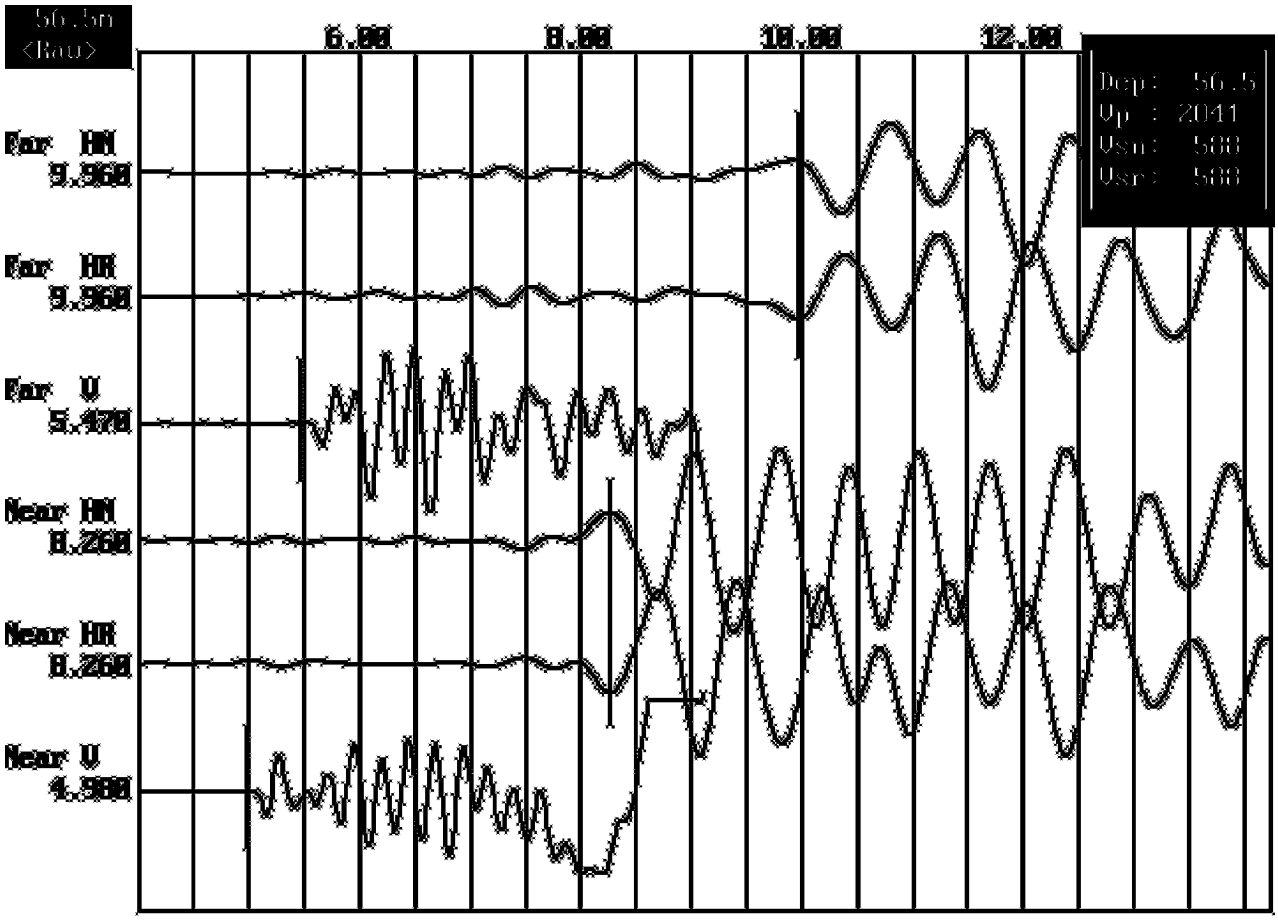

Figure 2. Sample suspension method waveform data showing horizontal normal and reversed (HR and HN), and vertical (V) waveforms received at the near (bottom 3 channels) and far (top 3 channels) geophones. The arrivals in milliseconds for each pick are shown on the left. The box in the upper right corner shows the depth in the borehole and the velocities calculated based on the picks.

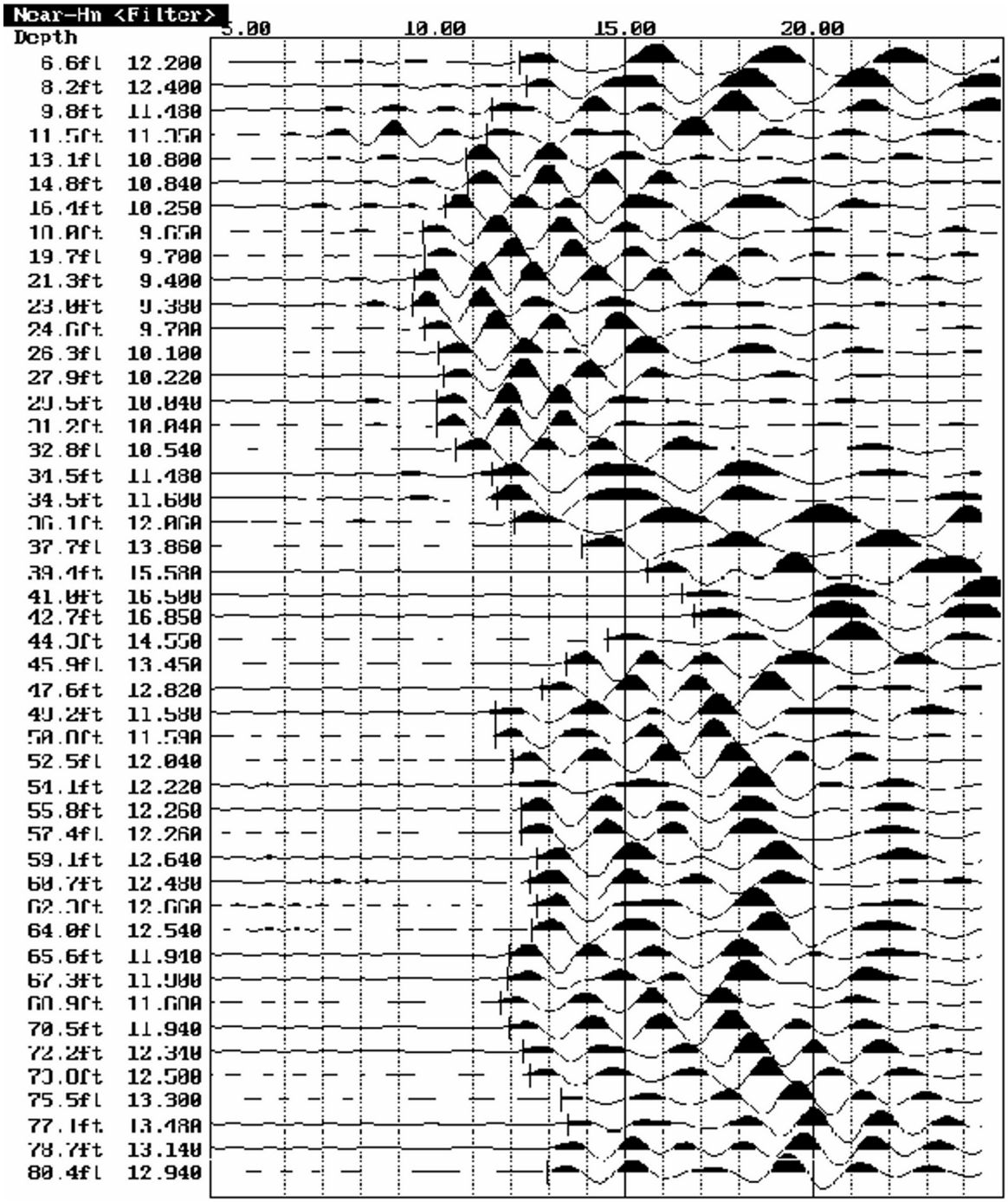

Figure 3. Sample composite waveform plot for normal shear waves received at the near geophone in a single borehole

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P-S SUSPENSION VELOCITY FIELD LOG

SITE:_____ DATE:_____
CLIENT:_____ JOB:_____
AUTHOR:_____ PAGE 1 OF _____

CONTACT:_____ _OFFICE__ PHONE:_____
_____ PHONE:_____
CONTACT:_____ _OFFICE__ PHONE:_____
_____ PHONE:_____
CONTACT:_____ _____ PHONE:_____
_____ PHONE:_____
CONTACT:_____ _____ PHONE:_____
_____ PHONE:_____
DRILLER:_____ _____ PHONE:_____
COMPANY:_____ _____ PHONE:_____

DIRECTIONS TO SITE:_____
_____
_____
_____
_____

GENERAL SITE CONDITIONS/LOCATION:_____
_____

EA#:_____
BOREHOLE DESIGNATION:_____LOCATION:_____
_____
COUNTY:_____RANGE:_____TOWNSHIP:_____SECTION:_____
BOREHOLE CONSTRUCTION: CASED_____ UNCASED_____
DIAMETERS AND DEPTH RANGES: _____ 0 TO _____ ; _____, _____ TO _____
BOREHOLE TOTAL DEPTH AS DRILLED:_____
CONDUCTOR CASING?: YES____ DEPTH TO BOTTOM OF CASING_____; NO____
DEPTH TO BEDROCK:_____ DEPTH TO WATER TABLE:_____
BOREHOLE FLUID: WATER_____; FRESH WATER MUD_____; SALT WATER MUD _____;
OTHER:_____
DEPTH TO BOREHOLE FLUID:_____ TIME SINCE LAST CIRCULATION:_____

GEOVision geophysical services

SITE:_____ DATE:_____
CLIENT:_____ JOB:_____
AUTHOR:_____ PAGE 2 OF _____

LOGGING CREW:_____
VEHICLE(S) USED AND MILEAGE: _____
MOBILIZED FROM:_____ DEPARTURE TIME:_____
ARRIVED ON SITE:_____
STANDBY TIME:_____ CAUSE:_____
LOGGING STARTED:_____ LOGGING COMPLETED:_____
STANDBY TIME:_____ CAUSE:_____
LOGGING STARTED:_____ LOGGING COMPLETED:_____
DEMOBILIZED TO:_____ ARRIVAL TIME:_____
ADDITIONAL DEMOB TIME:_____ REASON:_____

BATTERIES CHANGED BEFORE LOGGING: YES_____; NO_____; STORED WITH NEW_____

WINCH		COMPROBE ☐		GREY ☐	OYO ☐	RG ☐		OTH ☐	
INSTRUMENT	OYO 12004 ☐	15014 ☐	19029 ☐		RG 160023 ☐	160024 ☐			
RECEIVER S/N	12008 ☐	20042 ☐	26066 ☐	11001 ☐	23053 ☐				

MAINTENANCE PERFORMED ON SITE:_____
_____
_____
_____
EQUIPMENT PROBLEMS OR FAILURES:_____
_____
_____

SUGGESTIONS, ADDITIONS, CHANGES:_____
_____
_____

COMMENTS:_____
_____
_____
_____
_____
_____

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
0.5	1.64			
1.0	3.28			
1.5	4.92			
2.0	6.56			
2.5	8.20			
3.0	9.84			
3.5	11.48			
4.0	13.12			
4.5	14.76			
5.0	16.40			
5.5	18.04			
6.0	19.69			
6.5	21.33			
7.0	22.97			
7.5	24.61			
8.0	26.25			
8.5	27.89			
9.0	29.53			
9.5	31.17			
10.0	32.81			
10.5	34.45			
11.0	36.09			
11.5	37.73			
12.0	39.37			
12.5	41.01			
13.0	42.65			
13.5	44.29			
14.0	45.93			
14.5	47.57			
15.0	49.21			
15.5	50.85			
16.0	52.49			
16.5	54.13			
17.0	55.77			
17.5	57.41			
18.0	59.06			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
18.5	60.70			
19.0	62.34			
19.5	63.98			
20.0	65.62			
20.5	67.26			
21.0	68.90			
21.5	70.54			
22.0	72.18			
22.5	73.82			
23.0	75.46			
23.5	77.10			
24.0	78.74			
24.5	80.38			
25.0	82.02			
25.5	83.66			
26.0	85.30			
26.5	86.94			
27.0	88.58			
27.5	90.22			
28.0	91.86			
28.5	93.50			
29.0	95.14			
29.5	96.78			
30.0	98.43			
30.5	100.07			
31.0	101.71			
31.5	103.35			
32.0	104.99			
32.5	106.63			
33.0	108.27			
33.5	109.91			
34.0	111.55			
34.5	113.19			
35.0	114.83			
35.5	116.47			
36.0	118.11			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
36.5	119.75			
37.0	121.39			
37.5	123.03			
38.0	124.67			
38.5	126.31			
39.0	127.95			
39.5	129.59			
40.0	131.23			
40.5	132.87			
41.0	134.51			
41.5	136.15			
42.0	137.80			
42.5	139.44			
43.0	141.08			
43.5	142.72			
44.0	144.36			
44.5	146.00			
45.0	147.64			
45.5	149.28			
46.0	150.92			
46.5	152.56			
47.0	154.20			
47.5	155.84			
48.0	157.48			
48.5	159.12			
49.0	160.76			
49.5	162.40			
50.0	164.04			
50.5	165.68			
51.0	167.32			
51.5	168.96			
52.0	170.60			
52.5	172.24			
53.0	173.88			
53.5	175.52			
54.0	177.17			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
54.5	178.81			
55.0	180.45			
55.5	182.09			
56.0	183.73			
56.5	185.37			
57.0	187.01			
57.5	188.65			
58.0	190.29			
58.5	191.93			
59.0	193.57			
59.5	195.21			
60.0	196.85			
60.5	198.49			
61.0	200.13			
61.5	201.77			
62.0	203.41			
62.5	205.05			
63.0	206.69			
63.5	208.33			
64.0	209.97			
64.5	211.61			
65.0	213.25			
65.5	214.90			
66.0	216.54			
66.5	218.18			
67.0	219.82			
67.5	221.46			
68.0	223.10			
68.5	224.74			
69.0	226.38			
69.5	228.02			
70.0	229.66			
70.5	231.30			
71.0	232.94			
71.5	234.58			
72.0	236.22			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
72.5	237.86			
73.0	239.50			
73.5	241.14			
74.0	242.78			
74.5	244.42			
75.0	246.06			
75.5	247.70			
76.0	249.34			
76.5	250.98			
77.0	252.62			
77.5	254.27			
78.0	255.91			
78.5	257.55			
79.0	259.19			
79.5	260.83			
80.0	262.47			
80.5	264.11			
81.0	265.75			
81.5	267.39			
82.0	269.03			
82.5	270.67			
83.0	272.31			
83.5	273.95			
84.0	275.59			
84.5	277.23			
85.0	278.87			
85.5	280.51			
86.0	282.15			
86.5	283.79			
87.0	285.43			
87.5	287.07			
88.0	288.71			
88.5	290.35			
89.0	291.99			
89.5	293.64			
90.0	295.28			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
90.5	296.92			
91.0	298.56			
91.5	300.20			
92.0	301.84			
92.5	303.48			
93.0	305.12			
93.5	306.76			
94.0	308.40			
94.5	310.04			
95.0	311.68			
95.5	313.32			
96.0	314.96			
96.5	316.60			
97.0	318.24			
97.5	319.88			
98.0	321.52			
98.5	323.16			
99.0	324.80			
99.5	326.44			
100.0	328.08			
100.5	329.72			
101.0	331.36			
101.5	333.01			
102.0	334.65			
102.5	336.29			
103.0	337.93			
103.5	339.57			
104.0	341.21			
104.5	342.85			
105.0	344.49			
105.5	346.13			
106.0	347.77			
106.5	349.41			
107.0	351.05			
107.5	352.69			
108.0	354.33			

GEOVISION SUSPENSION LOGGING FIELD NOTES

SITE: _____ DATE: _____

CLIENT: _____ JOB: _____

AUTHOR: _____ PAGE _____ OF _____

DEPTH METERS	DEPTH FEET	UNFILTERED FILE NO.	FILTERED FILE NO.	COMMENTS CASING, WATER, ROCK, ETC
108.5	355.97			
109.0	357.61			
109.5	359.25			
110.0	360.89			
110.5	362.53			
111.0	364.17			
111.5	365.81			
112.0	367.45			
112.5	369.09			
113.0	370.73			
113.5	372.38			
114.0	374.02			
114.5	375.66			
115.0	377.30			
115.5	378.94			
116.0	380.58			
116.5	382.22			
117.0	383.86			
117.5	385.50			
118.0	387.14			
118.5	388.78			
119.0	390.42			
119.5	392.06			
120.0	393.70			
120.5	395.34			
121.0	396.98			
121.5	398.62			
122.0	400.26			
122.5	401.90			
123.0	403.54			
123.5	405.18			
124.0	406.82			
124.5	408.46			
125.0	410.10			
125.5	411.75			
126.0	413.39			

PROCEDURE FOR USING THE ROBERTSON GEOLOGGING HI-RESOLUTION ACOUSTIC TELEVIEWER (HiRAT)

Reviewed 2/13/06

Background

The acoustic televiewer is a device for producing a qualitative image of the wall of a borehole. Because it uses ultrasound rather than visible light it is able to work in dirty or opaque borehole fluids, although heavy drilling mud will cause excessive dispersion of the acoustic beam. The picture below shows the sonde's lower nylon section, and one of the bowspring attachments which are used to centralize the sonde in the borehole.

Pulses of ultrasound (0.5 - 1.5MHz) are generated by a piezo-electric resonator. The pulses are transmitted through the oil in which the resonator is immersed, through the wall of the acoustic housing, then propagate through the borehole fluid and are reflected from the wall of the borehole. The reflected energy is picked up by the same transducer, from which is recorded both the ***amplitude*** of the returned pulse and the ***travel-time*** which have elapsed. Blanking must be applied to prevent the transducer from registering reflections from the inside surface of the acoustic housing. The material of the housing is chosen so that its acoustic properties are similar to the oil which fills it. The housing is not designed to withstand borehole fluid pressures, but has a piston device to allow equalization between inside and outside pressure.

The ***amplitude*** of the returned pulse is a function of the acoustic reflectivity of the borehole wall. If the beam strikes a hard borehole wall normally to the surface the energy will be returned to the transducer and a strong return will be recorded. If the formation is softer, then less energy will be reflected. Also, if the surface of the borehole is rough, or effectively missing because of the presence of a fracture or other structure, then energy will be dispersed and a poor return will be recorded.

The ***travel-time*** is a simple function of the diameter of the borehole and the velocity of sound in the borehole fluid (typically 1.5Km/sec). An A/D converter monitors the output from the transducer once the blanking period has expired and a comparator is used to detect the peak amplitude during the sampling window.

The coaxially-mounted transducer has a planar radiating surface, but the vibration characteristics are such that the acoustic pulse is emitted as a 'pencil' beam. The emitted beam is deflected by a planar mirror so that it leaves the acoustic housing at right angles to the sonde axis. The mirror is rotated to scan the borehole wall. The ultrasound pulses are synchronized with rotation of the mirror so that up to 360 pulses are emitted in every revolution. Because of the time which must elapse for the two-way transit of the borehole fluid, there is an upper limit upon the number of radial samples that may be acquired from a borehole of a particular radius. In larger boreholes, therefore, it may be necessary to reduce the number of radial samples. The sonde is able to operate at 90, 180 or 360 samples per revolution.