869 389B
File: 660.22A
S.E.

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 869

Part II of II

APPENDIX D

PIEZOMETER/MONITORING WELL LOGS AND WELL CONSTRUCTION DETAILS

Appendix D-1

OU8 HTW Logs / Monitoring Well Construction Details

869 391A

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental F.S PROJECT NO. _____

WELL NO. MWANP-24 WELL LOCATION Baseball Field

DATE 11/11/03 TIME 1120

GROUND SURFACE ELEVATION _____

TOP OF SCREEN ELEVATION _____

REFERENCE POINT ELEVATION _____

TYPE FILTER PACK SAND GRADATION 20-40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2inch SLOT SIZE .01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Auger Drill

AUGER/BIT SIZE AND TYPE 8-inch OD hollow stemaugers

REMARKS _____

BENTONITE TYPE Pellets 3/8 inch

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 2-inch

MACTEC FIELD REPRESENTATIVE AEC

DRILLING CONTRACTOR Prichard Summers Drilling Co.

AMOUNT BENTONITE USED (SEAL) 5-gal bucket

AMOUNT BENTONITE USED (GROUT) _____

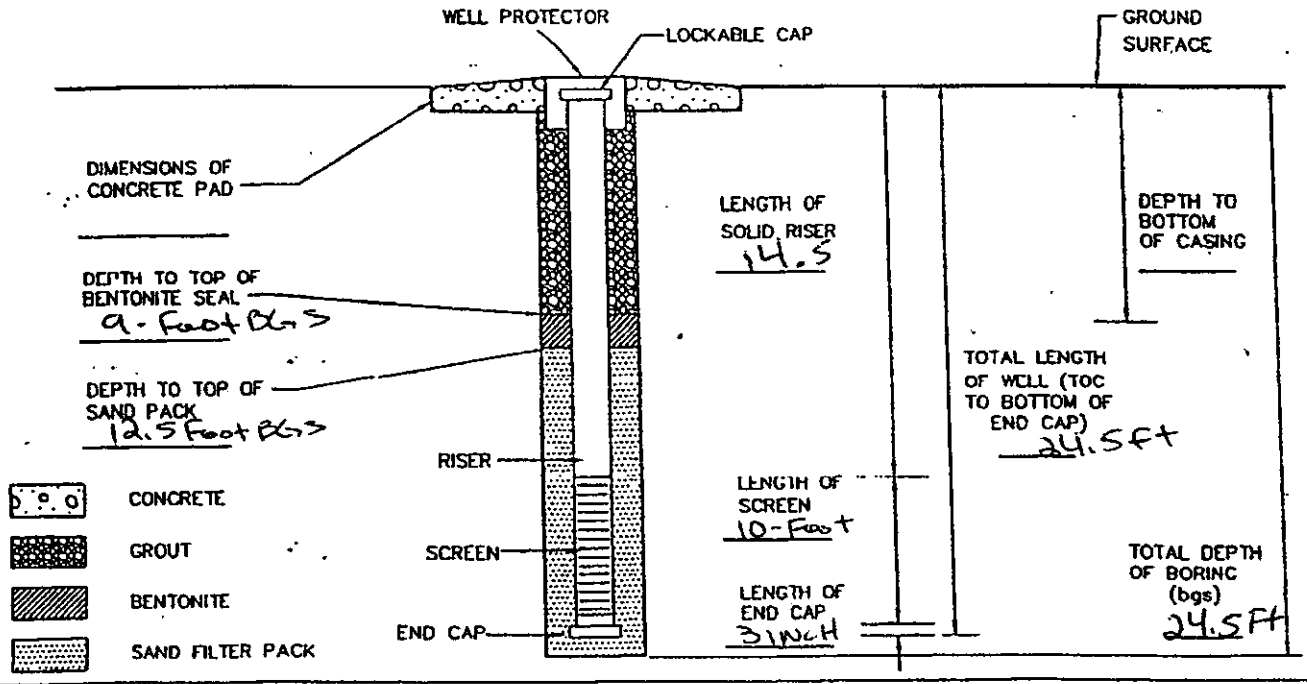
AMOUNT CEMENT USED (GROUT) 1.5 lbs bags

AMOUNT SAND USED 250 lbs

STATIC WATER LEVEL (>24 hrs after dev) 15.08 Ft BGS

MEASURED ON (Date/Time) 11/12/03 @ 940

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: _____ INSPECTOR: Ali Crawford

DISCREPANCIES: _____ CHECKED BY: _____ DATE: _____

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869 392

HTW DRILLING LOG

MWANP-24

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: RICHARD SIMMONS	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): RICHMOND VA	
5. NAME OF DRILLER: DANNY JASON	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-INCH SPLIT BARREL SAMPLER; 8 INCH 4.25 ID HOLLOW STEM AUGERS	9. HOLE LOCATION (SITE): BASEBALL FIELD	
	10. SURFACE ELEVATION: WILL BE PROVIDED AS SEPARATE SHEET	
8. WEATHER: SUNNY COOL	11. DATE STARTED: 11/11/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: MORE THAN 27.0 FT	16. DEPTH GROUNDWATER ENCOUNTERED:	
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 27.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
	✓		NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						NA

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	TOP SOIL				9,10,8,9	
		FILL- GRAVEL, ASPHALT					
	1	FILL- VERY STIFF, RED (2.5YR 4/8) SLIGHTLY FINE SANDY CLAYEY SILT (ML)					
	2						
	3						
	4	HARD, MOTTLED RED (2.5YR 4/8) REDDISH YELLOW (5YR 6/8) SLIGHTLY FINE SANDY CLAYEY SILT (ML)				13,14,19 19	
	5						
	6						
	7						
	8						
	9	MOTTLED REDDISH BROWN (5YR 4/4) YELLOWISH BROWN (10YR 5/8) FIRM SILTY SAND (SM)				99,10,8	
	10						

MRK FORM JUN 89 55

PROJECT NAME & NO.: DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No.: MWANP-24

HF - Rev. 4/9

HTW DRILLING LOG

HOLE No. MWAMP-24

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11	LENSE OF SANDY SILT					
	12					3,4,9,7	
	13	FIRM, MOTTLED REDISH BROWN (5YR 4/4) YELLOWISH BROWN (10YR 5/8) SILTY	0.1			5,6,8,8	
	14	POORLY GRADED MEDIUM SAND (SP-SM) WET-WITH SOME					
	15	COARSE GRAVEL	0.0			2,4,9,8	
	16						
	17	REDISH FIRM, REDISH BROWN (5YR 4/6) SILTY POORLY GRADED COARSE SAND (SP-SM WET	0.0 0.0 BZ			3,9,50/3	
	18						
	19						
	20					18,25,25	
	21	STRONG BROWN (7.5YR 5/8) WELL-GRADED SANDY GRAVEL (GW) WET	0.0 Background 0.0 BZ			17	
	22	YELLOWISH DENSE, YELLOWISH RED (5YR 5/8) GRAVELLY POORLY-GRADED					
	23	SAND (SP-SM) WET				17,11,18	
	24	YELLOW (10YR 7/8 WELL GRADED SANDY GRAVEL (GW) WET				15	
	25	VERY STIFF, YELLOW (10YR 7/6)				14,14,14	
	26	SILTY CLAY (CH) dry				12	
	27	BORING TERMINATED TO 27.0 FT BELOW GROUND SURFACE					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

869 394

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0011
WELL NO. MWANP-25 WELL LOCATION OUB
DATE 11/11/03 TIME —

GROUND SURFACE ELEVATION N/A
TOP OF SCREEN ELEVATION N/A
REFERENCE POINT ELEVATION N/A
TYPE FILTER PACK SAND GRADATION 20/40
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC
MANUFACTURER DSI
SCREEN DIAMETER 2-inch SLOT SIZE 0.01
RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2-INCH
DRILLING TECHNIQUE Hollow Steam Auger
AUGER/BIT SIZE AND TYPE 8-inch

BENTONITE TYPE 3/8 Pellets
MANUFACTURER DSI
CEMENT TYPE PORTLAND TYPE I/II
MANUFACTURER ROANOKE CEMENT

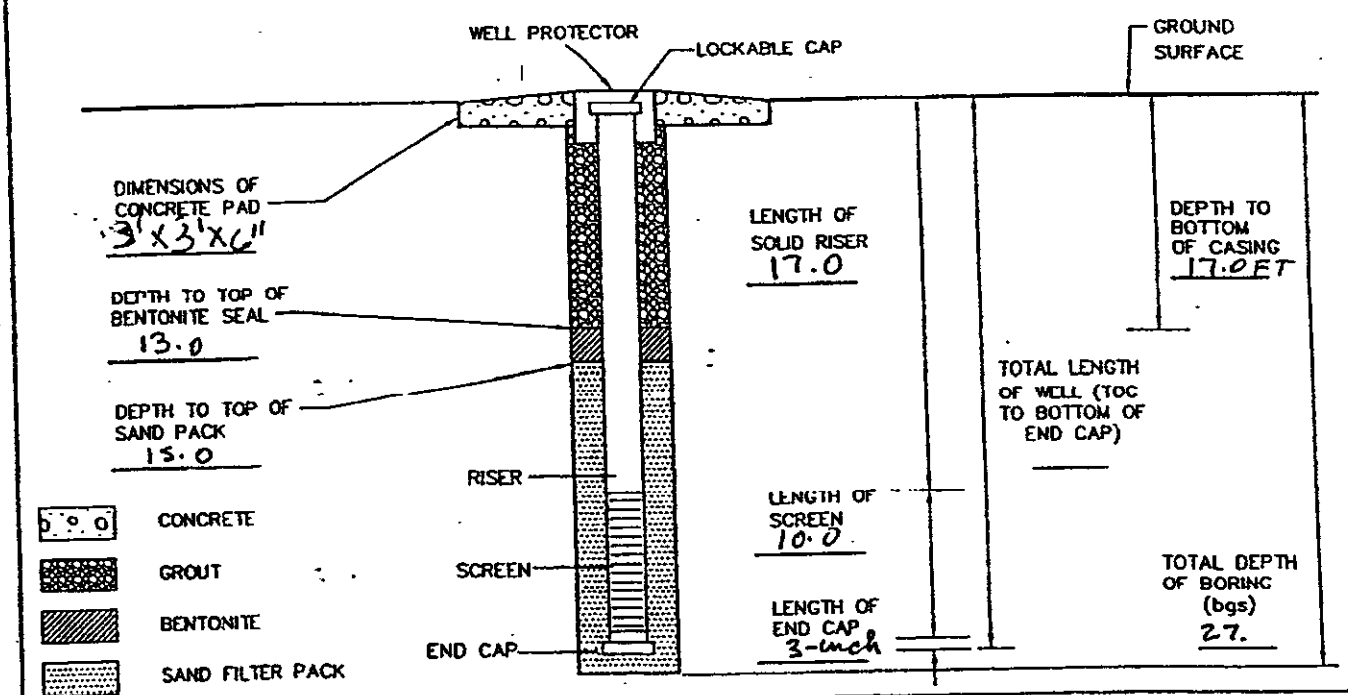
BOREHOLE DIAMETER 8-inch
MACTEC FIELD REPRESENTATIVE M. VAZQUEZ
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 5-gallons Bucket
AMOUNT BENTONITE USED (GROUT) 1 POUND
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED ~400 LB

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) 15.62 FT BGS 11/12/03/0940

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Richard Simmons INSPECTOR: M. VAZQUEZ
DISCREPANCIES: CHECKED BY: DATE:

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HTW DRILLING LOG

HOLE No. MWANP-25

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR
SHEET 1 OF 3 SHEETS	
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): RICHMOND VA
5. NAME OF DRILLER: CHRIS LADCO	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-INCH x 2FT SPLIT BARREL SAMPLER; 4.25 INCH ID HOLLOW STEM AUGER	9. HOLE LOCATION (SITE): BASEBALL FIELD
	10. SURFACE ELEVATION: WILL BE PROVIDED ON SEPARATE SHEET
8. WEATHER: SUNNY COOL	11. DATE STARTED: 11/11/03 — 12. DATE COMPLETED: 11/13/03
13. OVERBURDEN THICKNESS: MORE THAN 28.0 FT	16. DEPTH GROUNDWATER ENCOUNTERED
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE: 27.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
	✓		NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	TOP SOIL				19,9,12,10	
	1	FILL GRAVEL					
	2						
	3						
	4	VERY STIFF, MOTTLED RED (10R 5/8) light yellowish BROWN (2.5 Y 6/3) CLAYEY SILT (MH) with FINE SAND				6,13,18,22	
	5						
	6						
	7						
	8						
	9	SAMES AS ABOVE SAMPLE GETTING WET MORE (DAMP).				7,11,15,21	
	10						

HTW DRILLING LOG

HOLE No. MWANP-25

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14	FIRM, MOTTLED RED (2.5YR 4/8) BROWNISH YELLOW (10YR 6/6) VERY SILTY POORLY GRADED FINE SAND (SP-SM) WITH GRAVEL (WET)					
	15					5,5,10,8	
	16						
	17					4,3,4,4	
	18	FIRM, MOTTLED RED (2.5YR 4/8) BROWNISH YELLOW (10YR 6/6) WELL GRADED FINE TO COARSE SILTY SAND (SW) WET				11,13,8,18	
	19						
	20					17, 32, 50/3"	
	21	VERY DENSE, STRONG BROWN (7.5YR 5/6) VERY GRAVELLY POORLY GRADED COARSE SAND (SP) WET					
	22						
	23					26,34,45 50	
	24	YELLOWISH BROWN (5YR 5/8) POORLY GRADED SANDY GRAVEL (GP) WET					
	25						
	26					17,4,8,13	
	27	VERY STIFF, REDISH YELLOW (7.5YR 6/8) SILTY CLAY (CH) DRY					
	28						

HTW DRILLING LOG

HOLE No. MW ANP-25

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	26	Boring Completed to					
	29	27.6 FT BELOW GROUND SURFACE - SOIL SAMPLING TERMINATED to 28 FT BELOW GROUND SURFACE.					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No. MW ANP-25

HF - Rev. 4/94

869 398

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME ~~MWANP-26~~ MWANP-26 DSCR PROJECT NO. 6301-03-0011
WELL NO. MWANP-26 WELL LOCATION 008 adjacent to Baseball field
DATE 11-12-03 TIME 1307

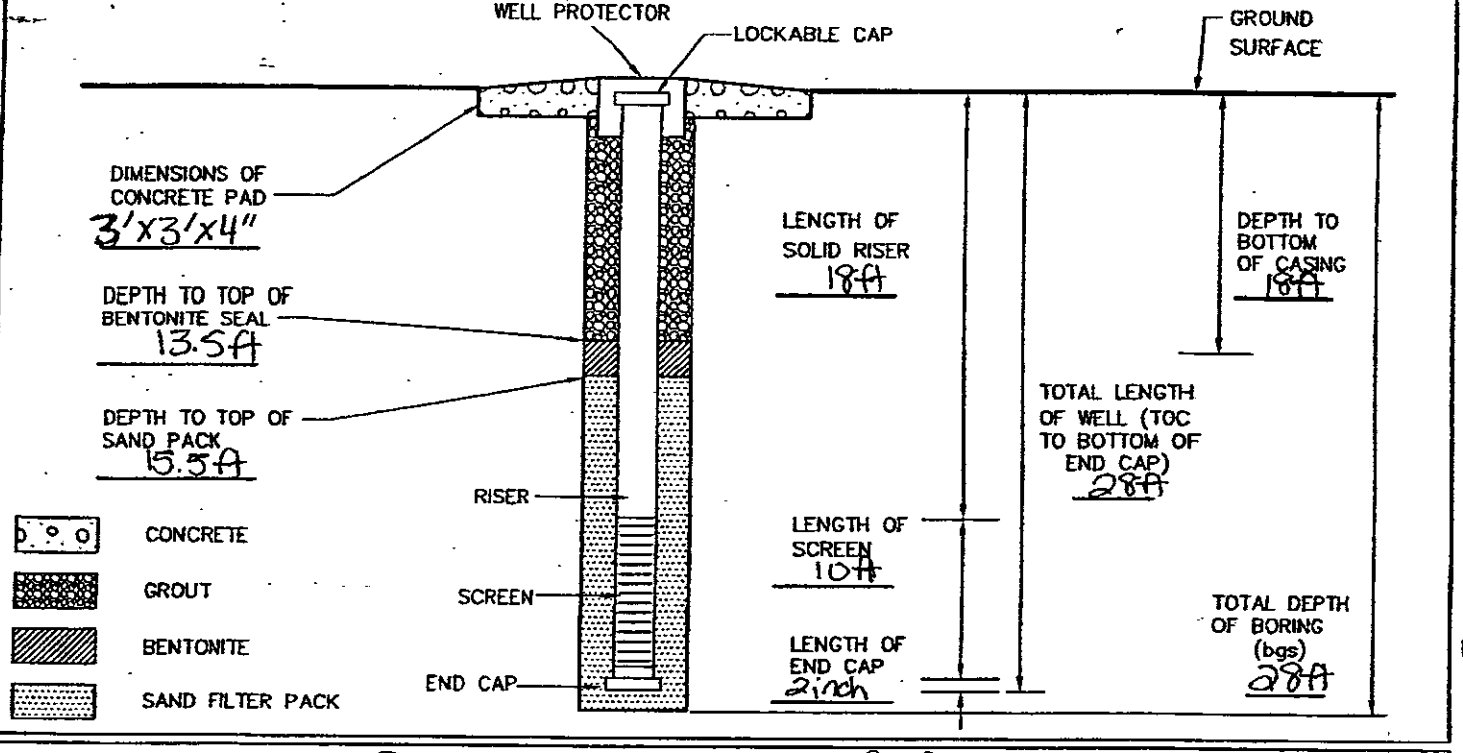
GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION
TYPE FILTER PACK Sand GRADATION 20/40
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2-inch SLOT SIZE 0.010"
RISER MATERIAL Sch. 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2-inch
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 8-inch
MACTEC FIELD REPRESENTATIVE A. Crawford
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 1 bucket
AMOUNT BENTONITE USED (GROUT)
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 7 (50lb) bags
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Danny INSPECTOR: A. Crawford
DISCREPANCIES: CHECKED BY: DATE:

HTW DRILLING LOG

HOLE No. MWANP-26

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 3 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: DANNY	6. MANUFACTURER'S DESIGNATION OF DRILL: GP-1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" x 2' split Barrel Samplers; 4.25-inch ID Hollow STEM Augers	9. HOLE LOCATION (SITE): OUB Adjacent to baseball field	
	10. SURFACE ELEVATION: PROVIDED AS SEPARAT SHEET	
8. WEATHER: SUNNY Cool	11. DATE STARTED: 11/12/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than 29 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 15 FT BGS	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 15 FT 11/13/03 10Z.	
15. TOTAL DEPTH OF HOLE: 28.0 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE		~				

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		

25. CHECKED BY:	26. NAME OF INSPECTOR

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	TOP SOIL	0.0 Background			5,18,15,7	16" Recovery
	1	Fill: GRAVEL, Asphalt dry	0.1 BZ				
	2	VERY STIFF, Yellowish Red (5YR5/8) Silty CLAY (CH) dry					
	3						
	4	HARD MOTTLED Yellow with (5YR 4/4)	0.0 Background			13,11,24,5	19,16,24,19 (NW)
	5	Brownish Yellow (10YR 5/8) (Unsat) SILT with SOME COARSE gravel DRY	0.1 BZ				24" Recovered
	6						
	7						
	8						
	9	STIFF, MOTTLED Yellowish Red (5YR5/6) Brownish Yellow (10YR6/8) Slightly FINE SANDY CLAYEY SILT (ML) DRY	0.0 Background 0.1 BZ			9,7,6,8	1st Recovery
	10						

869 400

HTW DRILLING LOG

HOLE No. MWANP-26

PROJECT: DSCR Supplemental FS

INSPECTOR:

SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS ppm	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14		0.2 Background				
	15		0.3 ppm BZ			19,7,6,7	18" RECOVERY
	16	STIFF, MOTTLED PINKISH GRAY (5YR 7/2) YELLOWISH RED (5YR 5/8) SLIGHTLY FINE SANDY CLAYEY SILT (ML) MOIST					
	17						
	18						
	19	VERY DENSE, STRONG BROWN (7.5YR 5/8) POORLY GRADED MEDIUM SAND	0.2 background			14,41,30	24" RECOVERED
	20	(SP-SM) WITH COARSE GRAVEL - WET	0.2 BZ			35	
	21	VERY DENSE, REDDISH YELLOW (7.5YR 6/8)				12,24,22	24" RECOVERED
	22	WELL GRADED SAND (SW) WITH GRAVEL				24	
	23	STRONG VERY DENSE, STRONG BROWN (7.5YR 4/6) GRAVELLY POORLY GRADED	0.4 Background			25,28,29	
	24	SAND (SP-SM) WET	1.2 BZ			41	
						9,4,3,5	NO RECOVERY
	25	REDDISH YELLOW (7.5YR 6/8) WELL-GRADED GRAVELLY SAND (SP-SM) WET					
	26						
	27	FIRM, STRONG BROWN (7.5YR 5/6) POORLY GRADED SAND WITH COARSE GRAVEL					
	28	(SP-SM) WET					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. MWANP-26

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HTW DRILLING LOG

HOLE No. MWANP-26

PROJECT: DSCR Supplemental FS

INSPECTOR:

SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	MOTTLED REDDISH YELLOW (7.5YR 7/8) VERY PALE BROWN (10YR 7/3) WET SILTY CLAY (CH) DRY					
	29	BORING TERMINATED AT 29 FT BELOW GROUND SURFACE					
	30	MONITORING WELL INSTALLED TO 28.0 FT BELOW GROUND SURFACE.					

869 402

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME _____ PROJECT NO. 6301-03-0011

WELL NO. MWANP-27 WELL LOCATION adjacent to DBRV

DATE 11/13/03 TIME _____

GROUND SURFACE ELEVATION _____

TOP OF SCREEN ELEVATION _____

REFERENCE POINT ELEVATION _____

TYPE FILTER PACK SAND GRADATION 20-40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2 inch SLOT SIZE .010

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2 inch

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4 1/4 ID

BENTONITE TYPE Pellets 3/8 inch

MANUFACTURER DSI

CEMENT TYPE PORTLAND Type I/II

MANUFACTURER ROANOKE CEMENT

BOREHOLE DIAMETER 8 inches

MACTEC FIELD REPRESENTATIVE R Futch

DRILLING CONTRACTOR Simmons Drilling

AMOUNT BENTONITE USED (SEAL) 1 5-gallon bucket

AMOUNT BENTONITE USED (GROUT) 35 lb

AMOUNT CEMENT USED (GROUT) 150 lb

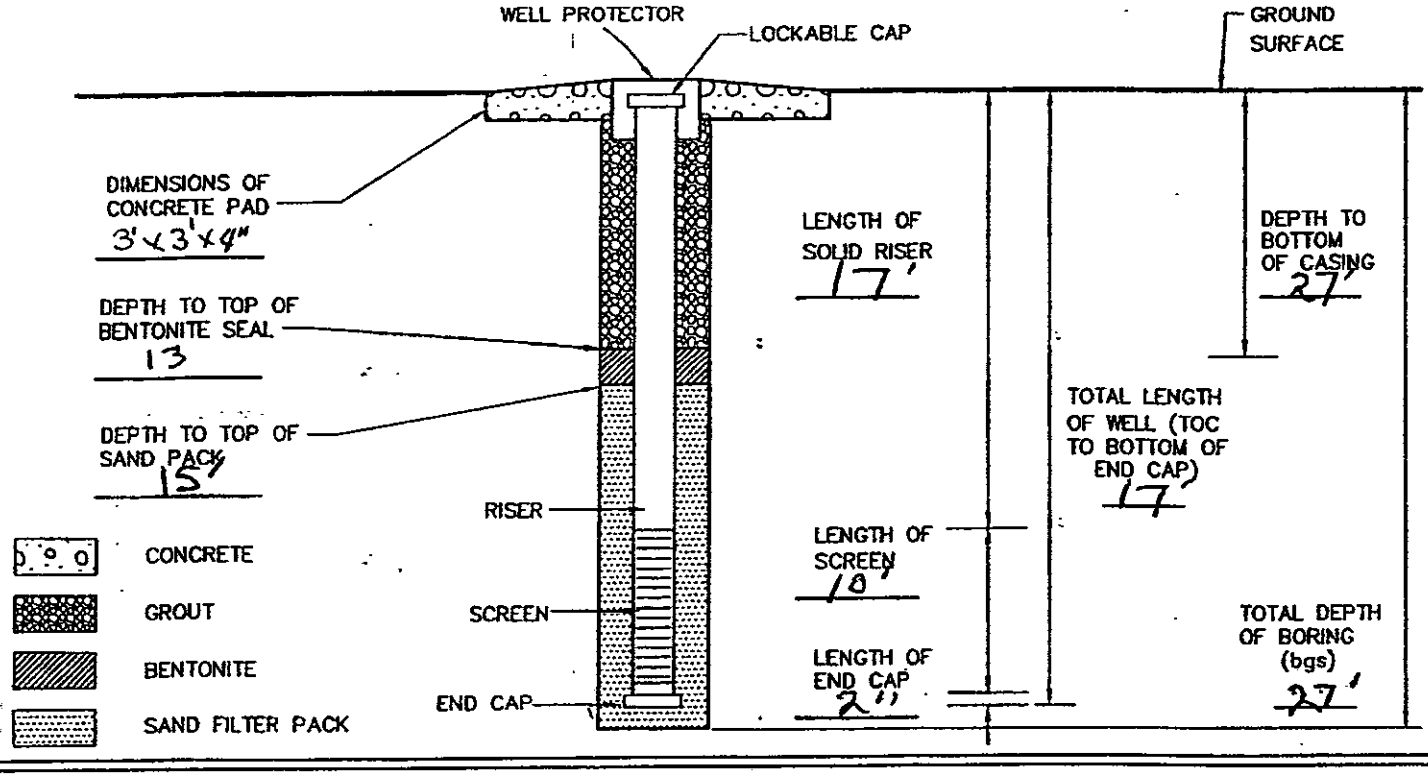
AMOUNT SAND USED 9 80 lb bags

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) _____

REMARKS _____

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: R. Simmons INSPECTOR: R. Futch

DISCREPANCIES: _____ CHECKED BY: _____ DATE: 11/13/03

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HTW DRILLING LOG

HOLE No. MWANP-27

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 3 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Chris Lacko	6. MANUFACTURER'S DESIGNATION OF DRILL: IMPG GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25-inch ID Hollow STEAM Auger; 2-inch x 2 FT Split Barrel Sampler	9. HOLE LOCATION (SITE): DSCR Adjacent to Softball Field	
	10. SURFACE ELEVATION: ____	
8. WEATHER: Sunny Cold	11. DATE STARTED: 11/13/03	12. DATE COMPLETED: 11/14/03
13. OVERBURDEN THICKNESS: more than 29.0 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ± 10.0 FT BGS	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 14.12 FT BGS 11/18/03; 0905	
15. TOTAL DEPTH OF HOLE: 29.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		

25. CHECKED BY:	26. NAME OF INSPECTOR: Robin Futch

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	GRASS / TOP SOIL				4,4,8,9	0-2 Split-spoon 18" Recovery
	1	STIFF, STRONG BROWN (7.5YR 5/8) CLAYEY SILT (ML) - DRY					
	2						
	3						
	4	STIFF, RED (2.5YR 4/8) SANDY				11,16,22, 26	4-6 Split spoon 2FT Recovery
	5	SILT (ML) DRY					
	6						
	7						
	8						
	9	VERY STIFF, RED (2.5YR 4/8) SANDY				5,7,10,12	2FT Recovery
	10	SILT BECOMING SANDIER AT BOTTOM OF SAMPLE					

869 404

HTW DRILLING LOG

HOLE No. MWANP-27

PROJECT: DSCR Supplemental FS

INSPECTOR: R. Futch

SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14	STIFF, MOTTLED REDDISH YELLOW (7.5YR 6/8), Light brownish gray (10YR 6/2) SANDY CLAYEY SILT (MH)				3,5,5,5	
	15						
	16						
	17						
	18						
	19	VERY DENSE, REDDISH YELLOW (7.5YR 6/8) POORLY GRADED SP FINE TO MEDIUM SAND (SP) WITH NO AND GRAVEL				20,30,30 16	Split Spoon 19-21 FT
	20						
	21	VERY DENSE, REDDISH YELLOW (7.5YR 6/8) WELL GRADED FINE TO COARSE SAND WITH GRAVEL (SW)				19,30,50/2	
	22						
	23	LOOSE, REDDISH YELLOWISH SANDY GRAVEL (GP)				27,57,32 14	25% (9 inch) Recovery
	24						
	25	REDDISH, SAND (WET) (SP)				9,3,4,6	25-27' Split Spoon 9" Recovery
	26	BECOMING Clay (CL) 27.5 gravel grades to grey green CLAY DARK greenish gray (GLEY 2/10G 4/1)				3,7,12 28	9 inches Recovery 27-29 Spoon
	27						
	28						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. PSCR SUPPLEMENTAL FS 6301-03-0011 | HOLE No. MWANP-27

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. MWANP-27

PROJECT: DSCR Supplemental FS

INSPECTOR: R. Futch

SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29	Boring terminated at 29 ft below ground surface. Monitoring well installed to 29.0 ft below ground surface.					

Appendix D-2

OU6 HTW Logs / Piezometer Construction Details

HTW DRILLING LOG

869 407

HOLE No. OU6 DPT-1

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: CONETEC /	SHEET 1 OF 4 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): Richmond City	
5. NAME OF DRILLER: Mike Thomas	6. MANUFACTURER'S DESIGNATION OF DRILL: GEOPROBE	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-INCH MACRO SAMPLER	9. HOLE LOCATION (SITE): AREA 50	
	10. SURFACE ELEVATION: Will BE Provided under SEPARATE SHEET	
8. WEATHER: COLD	11. DATE STARTED: 9/21/03	12. DATE COMPLETED: 01/13/04
13. OVERBURDEN THICKNESS: More than 46 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ± 8 FT BGS	
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
15. TOTAL DEPTH OF HOLE: 46 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
NONE			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
~~3~~ NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			GROUT	Miguel A V-S

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	TOP SOIL FILL - RED (10R 4/8) CLAYEY SILT with COARSE SAND AND ORGANIC (MH					
	2	STRONG BROWN, POORLY GRADED SILTY MEDIUM TO COARSE SAND AND GRAVEL (GP-GM) FILL - RED (2.5YR 4/8) WELL SORTED POORLY GRADED MEDIUM SAND with SILT (SP-SM)					
	3	FILL - DARK GREENISH GRAY (GLEY1 10Y4/1) ~~POORLY GRADED~~ SM MEDIUM SANDY					
	4	SILT BECOMING SILTY MEDIUM SAND (SP/MH)					
	5	OLIVE GRAY (5Y 4/2) CLAYEY POORLY GRADED FINE TO MEDIUM SAND (SC) with WOOD FRAGMENTS					
	6	OLIVE GRAY (5YR 4/2) SILTY CLAYEY POORLY GRADED VERY FINE SAND SC NO RECOVERY					
	7						
	8	FILL - OLIVE (5Y5/4) CLAYEY SILTY VERY FINE SAND (SC/CL) with WOOD FRAGMENTS (WET)					
	9	MOTTLED GRAY (5Y6/1), YELLOWISH BROWN (10YR5/8) SILTY VERY SANDY CLAY (CL/SC)					
	10						

869 408

HTW DRILLING LOG

PROJECT: DSCR Supplemental FS
INSPECTOR: M. Vazquez
HOLE No.: OU6DPT-1
SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12	MOTTLED GRAY (5Y 6/1) YELLOWISH BROWN (10YR 5/8) INTERFINGERED VERY FINE SANDY CLAY (5Y 6/1) with CLAYEY FINE SAND (10YR 5/8) (CL/SC) DRY					
	13						
	14						
	15						
	16	MOTTLED GRAY (5Y 6/1) YELLOWISH BROWN (10YR 5/8) VERY FINE SANDY CLAY (CL/SC)					
	17						
	18						
	19						
	20	Light GRAY (2.5 Y 7/1) SANDY FAT CLAY (CH) DRY					
	21	Light GRAY (2.5 Y 7/1) VERY SANDY (MEDIUM) CLAY (CL) WET					
	22						
	23	REDISH YELLOW (7.5YR 6/8) WELL graded slightly CLAYEY SILTY FINE TO COARSE SAND (SC) with FINE GRAVEL (WET					
	24						
	25	DARK GREENISH GRAY (GLEY 1 4/1) CLAY WITH some FINE SAND (DRY)					
	26						
	27						
	28						

HTW DRILLING LOG

HOLE No. OU6 DPT-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29						
	30						
	31						
	32						
	33						
	34	DARK GREENISH GRAY (GLEY 1 10G 4/1) FINE SAND with GRAVEL (SP)					
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44	GRAYISH GREEN (GLEY 1 5G 5/2) CLAYEY POORLY GRADED COARSE SAND with GRAVEL					
	45						
	46						

869 410

HTW DRILLING LOG

HOLE No. OU6DPT-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46	Boring TERMINATED AT					
	47	46 FT Below ground Surface					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. OU6DPT-1

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ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSER PROJECT NO. 6361-03-0011

WELL NO. OU6 PZ-1 WELL LOCATION By Creek in Weeds

DATE 12-04-03 TIME 0830

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Silica Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" SLOT SIZE 10

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II Portland

MANUFACTURER Keystone Cement

BOREHOLE DIAMETER 10"

MACTEC FIELD REPRESENTATIVE C. Krambis

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 1 gallon

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

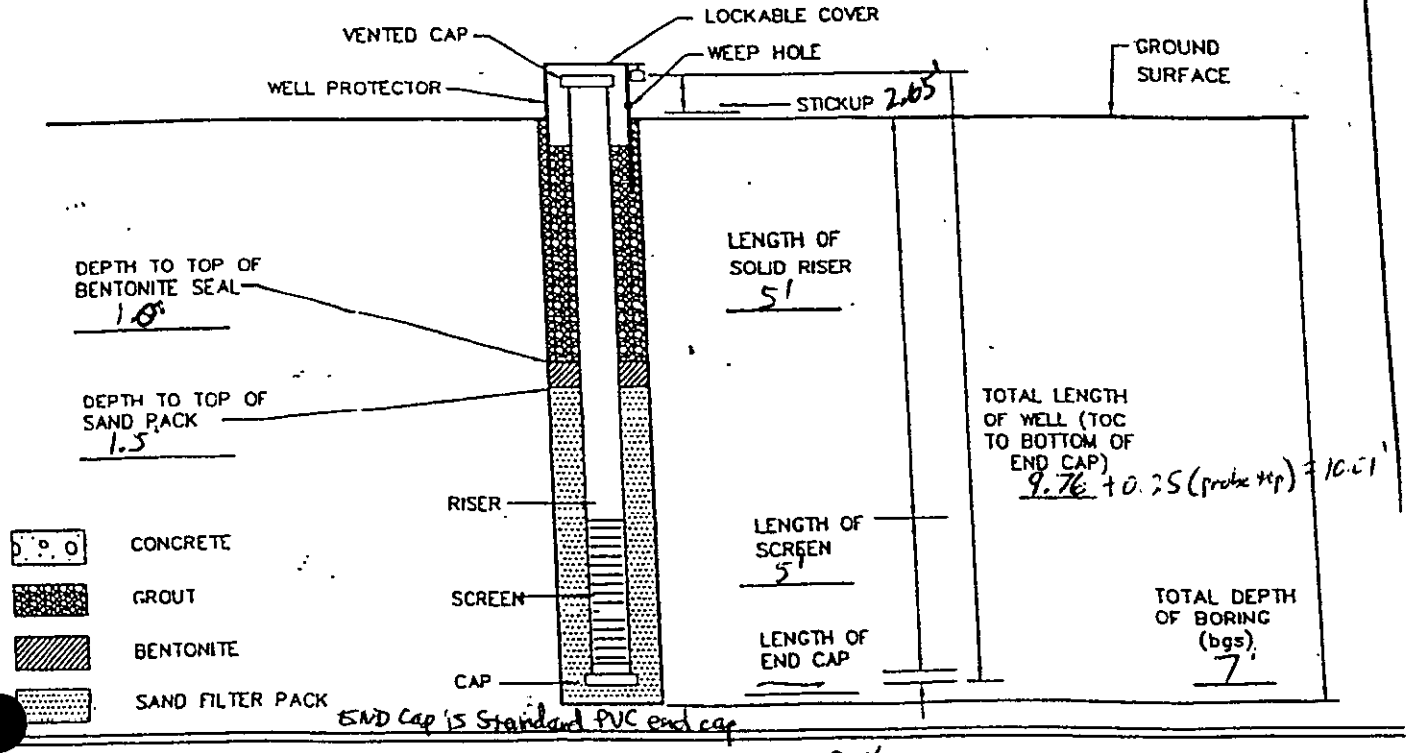
AMOUNT SAND USED 2.75 bags

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) 2.75' bgs 12-04-03 0850

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



END Cap is Standard PVC end cap

QA / QC

DRILLER: Denny INSPECTOR: C. Krambis

DISCREPANCIES: NA CHECKED BY: _____ DATE: _____

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869 412

HTW DRILLING LOG

HOLE No. CCC PZ-1

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 1 SHEETS
3. PROJECT: DSCR	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny, Virgil	6. MANUFACTURER'S DESIGNATION OF DRILL: Mareka MST-600	
SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 1.8" OD barrel; ~~Drill rods (OD)~~ 1.4" OD (1¼"); 140lb. Hammer	9. HOLE LOCATION (SITE): Creek, in woods	
	10. SURFACE ELEVATION: -	
8. WEATHER: Cold, freezing temps., overcast, calm	11. DATE STARTED: 12-04-03	12. DATE COMPLETED: 12-04-03
13. OVERBURDEN THICKNESS: NA	16. DEPTH GROUNDWATER ENCOUNTERED: 2.75' bgs	
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 5.42' BTOC 2hrs. 12-04-03 1030	
15. TOTAL DEPTH OF HOLE: 7' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): -	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
	X	NA	NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NA	-	-	-	-	-	NA

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
	-	X	-	Chi Kraf

25. CHECKED BY:	26. NAME OF INSPECTOR: C. Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0					2,2,6,14 N=8	
	1	CLAY (CL), Sandy, soft, grayish-brown 10YR 5/2, saturated @ 2'					
▽	2	Some w/ subround-round gtz clasts (1-2cm)	NA				12"
	3	NR				22, 12, 10, 4 N=22	
	4	SAND (SC-SP), Clayey, Gravelly, gray, 10YR 5/1, gtz. clasts up to 3cm, well rounded, rounded. wet	NA				14"
	5	CLAY, soft, blocky texture, moist, yellowish brown 10YR 5/6 (CL)				3,3,5,4 N=8	
	6	CLAY, soft, Yellowish Brown 10YR 5/6 Mottled w/ lt. gray 5Y 7/1 Some roots, blocky texture (CL)	2.5ppm				24"
	7	Boring Terminated @ 7.0' bgs					
	8						
	9						
	10						

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental FS — PROJECT NO. 6301-03-0013
WELL NO. OU6 PZ-2 — WELL LOCATION Across Creek in woods
DATE 12-01-03 — TIME 1245

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand — GRADATION #1
FILTER PACK MANUFACTURER DSF

SCREEN MATERIAL PVC
MANUFACTURER DSF
SCREEN DIAMETER 2-in — SLOT SIZE 10

RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2-in

DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4¼ in ID

REMARKS

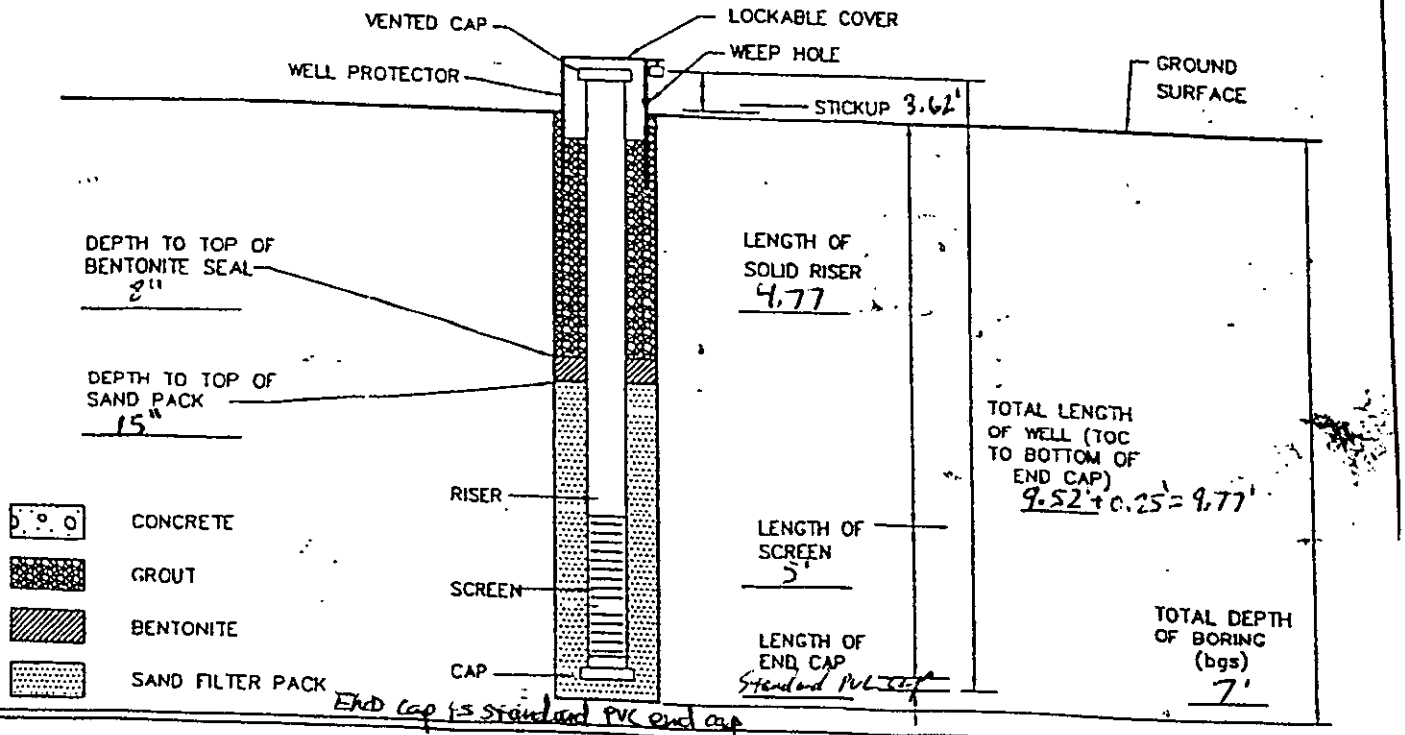
BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II Portland
MANUFACTURER Roanoke

BOREHOLE DIAMETER 10-in
MACTEC FIELD REPRESENTATIVE C. Krambis
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 2 1/gallon
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 3 50 lb bags

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Virgil — INSPECTOR: C. Krambis
DISCREPANCIES: — CHECKED BY: — DATE:

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869 414

HTW DRILLING LOG

HOLE No. OU2 PZ-2

1. COMPANY NAME * MACTEC	2. DRILLING SUBCONTRACTOR Richard Simmons	SHEET OF 1 SHEETS 1
3. PROJECT DSCP Supplemental FS	4. LOCATION (CITY, STATE) Richmond, VA	
5. NAME OF DRILLER Danny	6. MANUFACTURER'S DESIGNATION OF DRILL Maraiki MST 600	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 2 1/8" Drill rods; 1.8" OD barrel; 140 lb hammer	9. HOLE LOCATION (SITE) Woods across Creek	
	10. SURFACE ELEVATION —	
8. WEATHER Freezing Rain	11. DATE STARTED 12-04-03	12. DATE COMPLETED 12-04-03
13. OVERBURDEN THICKNESS —	16. DEPTH GROUNDWATER ENCOUNTERED 4.38 ~~5.5~~ bgs	
14. DEPTH DRILLED INTO ROCK NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED 4.30 bgs 12-04-03 1525 (2.5 hrs)	
15. TOTAL DEPTH OF HOLE 7 ft bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) —	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NA	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
	—	X	—	C. Kramb

25. CHECKED BY:	26. NAME OF INSPECTOR C. Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	CLAY (CL); Silty, soft, v. dark grayish brown 10YR 3/1 w/ some qtz clasts, rounded.				10, 21	
	1	No Recovery —				9 - 11	0' recovery
	2	rock obstructed spoon	—			N=30	not
	3	Hit gravel @ 3' bgs during sampling clasts are 3cm (shell rounded) SAND, gravelly, silty (SM), rounded, fine-vf, lt. brownish-gray 10YR 6/2				23, 19, 20, 20	
	4		—			N=39	0.4' recovery
	5	SAND, Gravelly (SP), Silty, tr sy 10YR 7/1	1.2 ppm			6, 10	
	6	CLAY (CL), 5.6 cohesive, plastic, brownish-Yellow 10YR 6/6				12, 5	1.4' recovery
		~~Clayey Silt~~ (ML) X				N=22	
	7	NR					
		Boring Term. @ 7' bgs					

MRK FORM JUN 89 55 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301.03.0011

WELL NO. OU6 PZ-3 11 WELL LOCATION USGS area / North of Cluster F

DATE 12/03/03 TIME 1600

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC sch. 40

MANUFACTURER DSI

SCREEN DIAMETER 2inch SLOT SIZE 0.010"

RISER MATERIAL PVC sch 40

MANUFACTURER DSI

RISER DIAMETER 2inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 8inch

MACTEC FIELD REPRESENTATIVE Amy Gilaway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 6inches

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

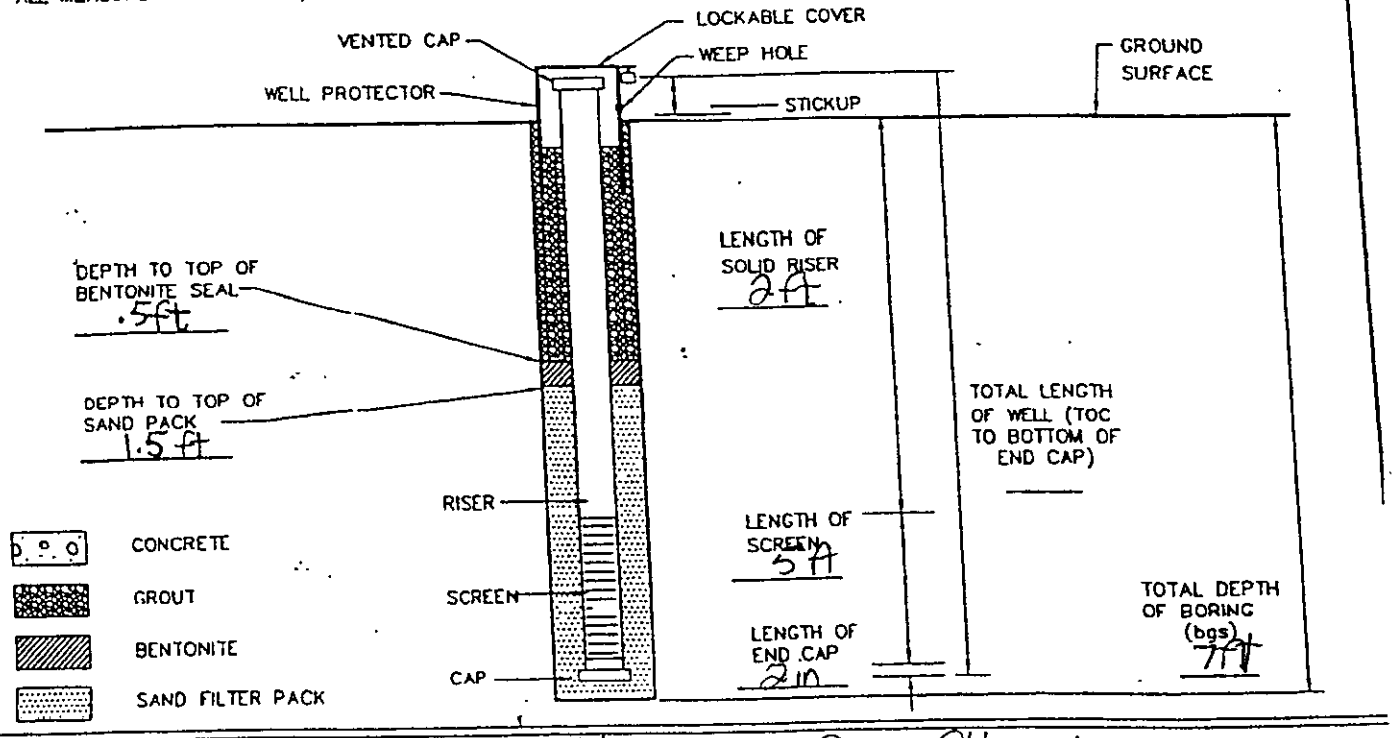
AMOUNT SAND USED 1 3/4 bag ~ 88lbs

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Gilaway

DISCREPANCIES: — CHECKED BY: — DATE: —

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869 416

HTW DRILLING LOG

HOLE No. OU6PZ-3

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental F.S.	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID Hollow Stem Auger, 2' x 2" split spoon sampler barrel	9. HOLE LOCATION (SITE): USGS area / North of cluster F
	10. SURFACE ELEVATION:
8. WEATHER: overcast 37°	11. DATE STARTED: 12/03/03 / 12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: > 7ft	16. DEPTH GROUNDWATER ENCOUNTERED: ~3 ft
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE: 7 ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
OU6PZ-350 (3-7')	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
N/A						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Gallaway

25. CHECKED BY:

26. NAME OF INSPECTOR: Amy Gallaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Brown (7.5YR 5/4)	0.0ppm			2,2	2inch
	2	Slighty silty CLAY CH with some roots				3,2	recovery
	3	Gray (7.5YR 5/1) Moist	0.0ppm	OU6PZ350		5,5	8inch
	4	silty CLAY with some roots CH		(3-7')		3,5	recovery
	5	Some Strong Brown (7.5YR 5/8) mottles Mottled Gray (7.5YR 5/1) Strong Brown (7.5YR 5/8) Moist	0.0ppm			3,5	12inch
	6	Fat CLAY. CH				4,7	recovery
	7	Boring terminated at 7ft bgs					

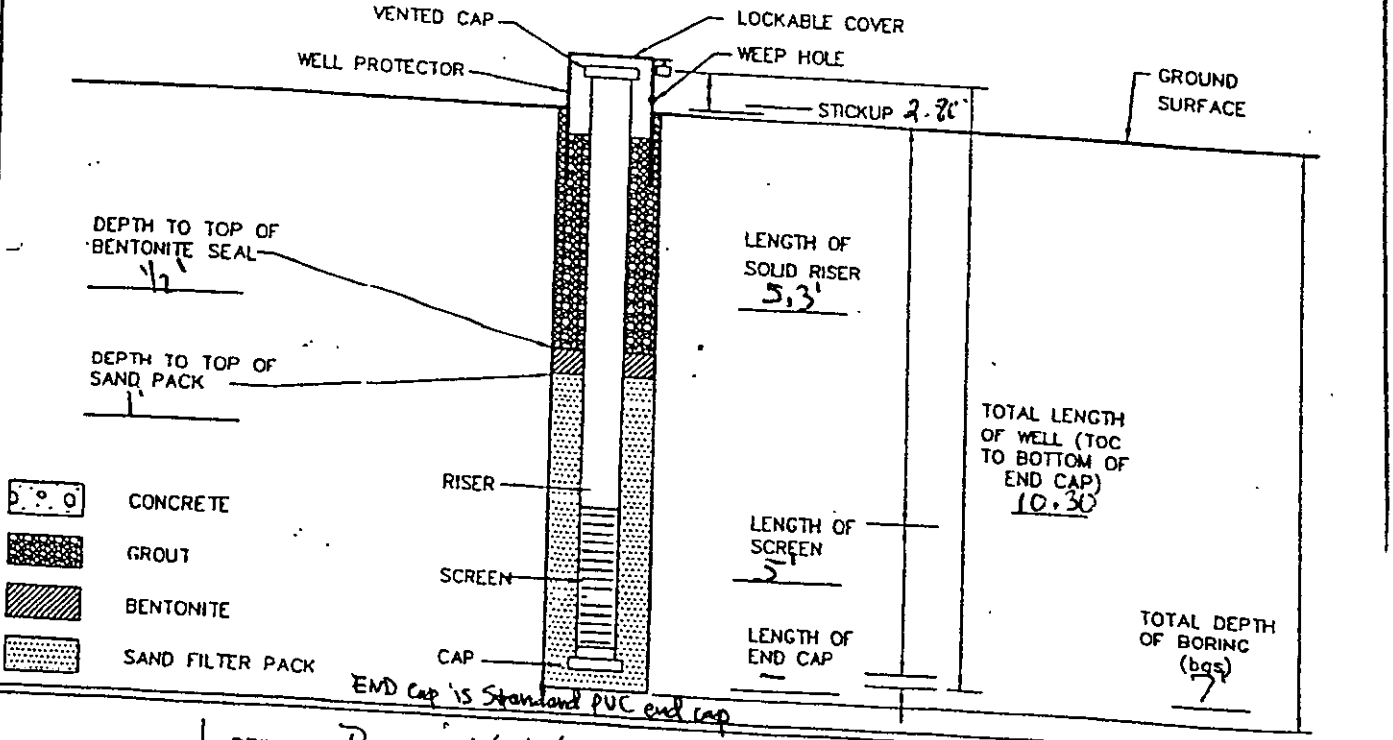
ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental FS
PROJECT NO. 6301-03-0011
WELL NO. OU6 PZ-4
WELL LOCATION Across Creek in Woods
DATE 12-04-03
TIME 1455

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL PVC
MANUFACTURER DSI
SCREEN DIAMETER 2" SLOT SIZE 10
RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2"
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25-in ID
REMARKS

BENTONITE TYPE 3/8" Pellet
MANUFACTURER DSI
CEMENT TYPE Type I/II Portland
MANUFACTURER Roanoke Cement
BOREHOLE DIAMETER 10"
MACTEC FIELD REPRESENTATIVE C. Krambis
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) ~ 1 gallon
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 2 1/2 bags
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Danny & Virgil
INSPECTOR: C. Krambis
DISCREPANCIES:
CHECKED BY: DATE:

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869 418

HTW DRILLING LOG

HOLE No. OUGPZ-4

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Danny ; Virgil	6. MANUFACTURER'S DESIGNATION OF DRILL: Marooka MST-600
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25-in OD HSA; 1 3/3" - Drill rods; 1.8" OD split spoon; 140 lb Hammer	9. HOLE LOCATION (SITE): Across Creek in Woods
	10. SURFACE ELEVATION: —
8. WEATHER: Cold, overcast, freezing rain/snow	11. DATE STARTED: 12-04-03 / 12. DATE COMPLETED: 12-04-03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 4.65' bgs
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 4.70' bTOC @ 0820 12-15-03
15. TOTAL DEPTH OF HOLE: 7' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NA	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
	—	X	—	Chris Krambis

25. CHECKED BY:

26. NAME OF INSPECTOR: Chris Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	CLAY (CL), silty, Yellowish brown 10YR 5/6 w/lg rounded qtz gravel @ 2'				4,5	12" recovery
	2	NR				8,13	
	3	NR — No sample				n=13	
	4	SAND (SM-SC) silty, gravelly, gray 10YR 6/1 — No sample				9,11,10,12 n=21	Post & gravel constructed Screen.
	5	SAND, clayey (SC), gravelly, Yellowish brown 10YR 5/8				8,6,4,5 n=10	6" Recovery
	5.5	CLAY (CL), soft, Yellowish brown 10YR 5/2					
	6	NR					
	7	Boring Terminated @ 7' bgs					
	8						
	9						
	10						

MRK FORM JUN 89 55 | PROJECT NAME & NO. | HOLE No. | HF - Rev. 4

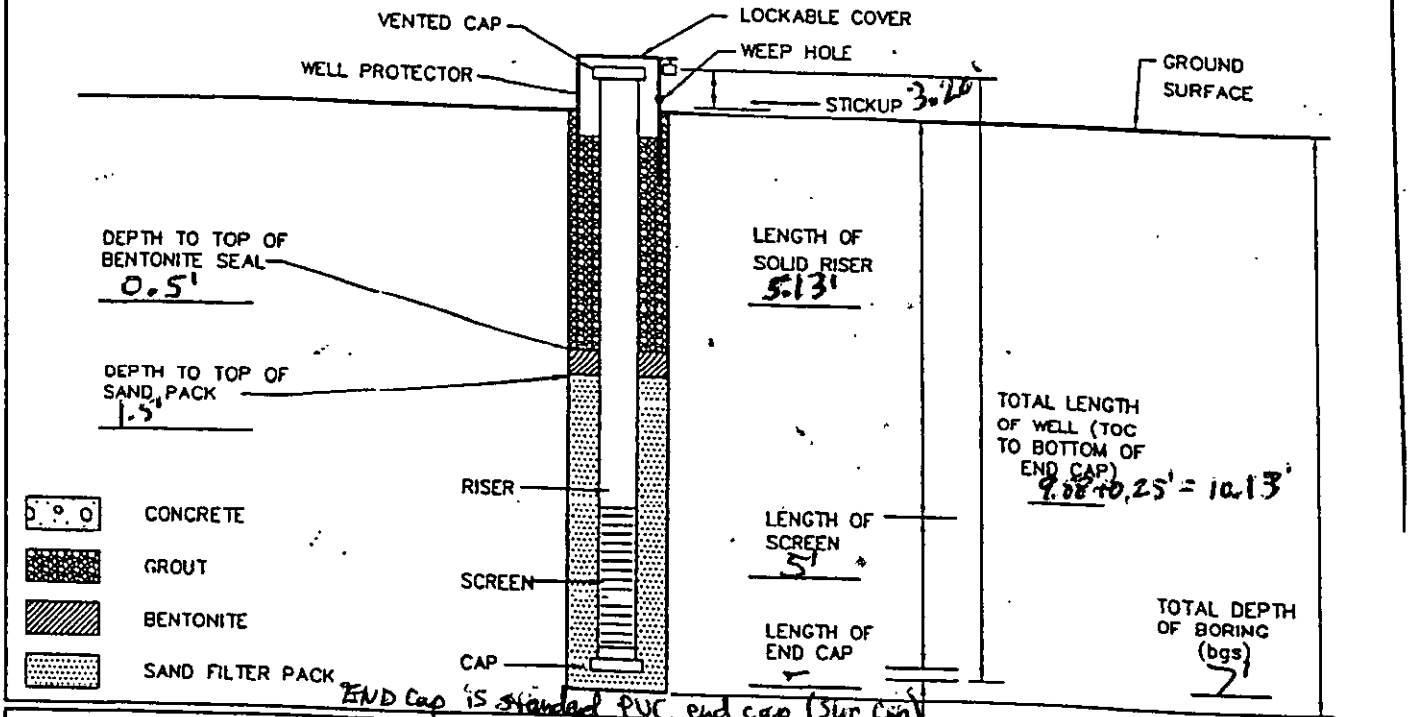
ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental FS — PROJECT NO. 6301-03-0011
WELL NO. 006 PZ-5 — WELL LOCATION Across Creek in Woods
DATE 12-04-03 — TIME 0840

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand — GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL PVC SCH 40
MANUFACTURER DSI
SCREEN DIAMETER 2" — SLOT SIZE 10
RISER MATERIAL PVC SCH40
MANUFACTURER DSI
RISER DIAMETER 2"
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE I/II Portland
MANUFACTURER Roanoke Cement
BOREHOLE DIAMETER 10"
MACTEC FIELD REPRESENTATIVE C. Krumbly
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 2 gallons
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 2 2/3 bags
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Dewey + Virgil — INSPECTOR: C. Krumbly
DISCREPANCIES: — CHECKED BY: — DATE:

P:\design\Standard Details\Well installation diagrams\ATACH 5-1b10.dwg 12/20/2002 3:06pm rolexand

869 420

HTW DRILLING LOG

HOLE No. 006 PZ-5

SHEET 1 OF 1 SHEETS

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
NAME OF DRILLER: Danny & Virgil	6. MANUFACTURER'S DESIGNATION OF DRILL: Marooka MST 600
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 in ID HSA; 12/3 in OD Drill Rods; 1.38" OD split spoon; 140 lb Hammer	9. HOLE LOCATION (SITE): Across Creek in Woods
	10. SURFACE ELEVATION: —
8. WEATHER: Cold, overcast, frozen precip.	11. DATE STARTED: 12-04-03 / 12. DATE COMPLETED: 12-04-03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 0.75' bgs
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 4.38' BTOC
15. TOTAL DEPTH OF HOLE: 7' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
	—	X	—	C. Krumbis

25. CHECKED BY:

26. NAME OF INSPECTOR: C. Krumbis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0						
	1	Silt (ML), Sandy gravelly, rounded qtz Yellowish brown 10YR 5/6, wet				4,7	9" recovery
	2	NR Gravel Gravel layer noted during drilling				19,20 n=26	
	3						
	4	Gravel, silt, clay & sand as matrix Yellowish brown 10YR 5/6 (GM)				24,23 23,34 n=46	16" recovery
	5						
	6	As above				7, 29 23, 50/4"	7" rec.
	7	6.5' bgs CLAY (noted on auger - not recovered in spoon)					
	8	Boring Terminated @ 7' bgs					
	9						
	10						

MRK FORM JUN 89 55

PROJECT NAME & NO.

HOLE No.

HF - Rev. 4/9

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0011

WELL NO. OU6PZ-6A WELL LOCATION NGA

DATE 1-22-04 TIME 1500

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2inch SLOT SIZE 0.010"

RISER MATERIAL sch 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 10 inch

MACTEC FIELD REPRESENTATIVE Amy Calloway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 20lb

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

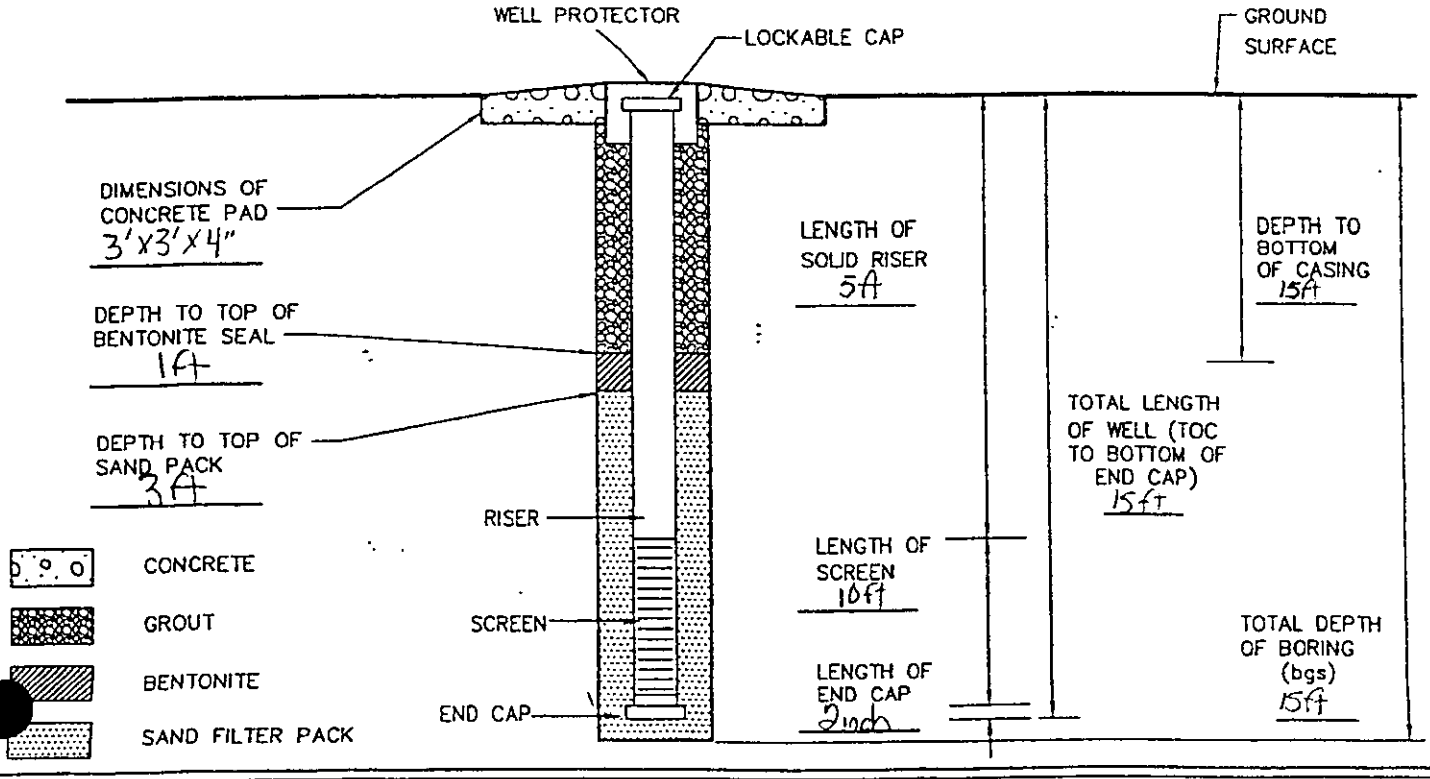
AMOUNT SAND USED 6bgs (50lb each)

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE:
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Calloway

DISCREPANCIES: — CHECKED BY: — DATE: —

869 421

869 422

HTW DRILLING LOG

HOLE No. OU6PZ-6A

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP1600	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" Hollow Stem Auger; 2" x 2" split spoon barrel sampler	9. HOLE LOCATION (SITE): NGA	
	10. SURFACE ELEVATION: —	
8. WEATHER: cloudy 30's	11. DATE STARTED: 1-22-04	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: > 15A	16. DEPTH GROUNDWATER ENCOUNTERED: ~6A	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 15A	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
0			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22 TOTAL CORE RECOVERY %
0						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Calloway

25. CHECKED BY	26. NAME OF INSPECTOR
	Amy Calloway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1						Soil cuttings smell like diesel. PID registers 0.0
	2						
	3						
	4	Loose, Light olive gray (5Y 6/2) Fine grain SAND. Moist SP	0.0			16, 9 8, 5	8/24
	5						
	6						
	7						
	8						
	9	9-9.5 Yellowish Brown (10YR 5/8) Coarse grain SAND. Wet with some clay. SP-SC	0.0			10, 13 19, 22	8/24

869 423

HTW DRILLING LOG

HOLE No. OU6PZ-6A

PROJECT DSCR Supplemental FS | INSPECTOR Amy Gillaway | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	9.5-10 Yellowish Brown (10YR 5/8) SILT with some sand and clay. Moist, micaceous ML					
	11	Firm Mottled Gray (7.5YR 6/1) and Reddish Yellow (7.5YR 6/8)	0.0			2,4	24/24
	12	Fat Clay. Moist. CH				5,8	
	13						
	14						
	15	Terminate Boring at 15ft.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011 | HOLE No. OU6PZ-6A

HF - Rev. 4/94

869 424 UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

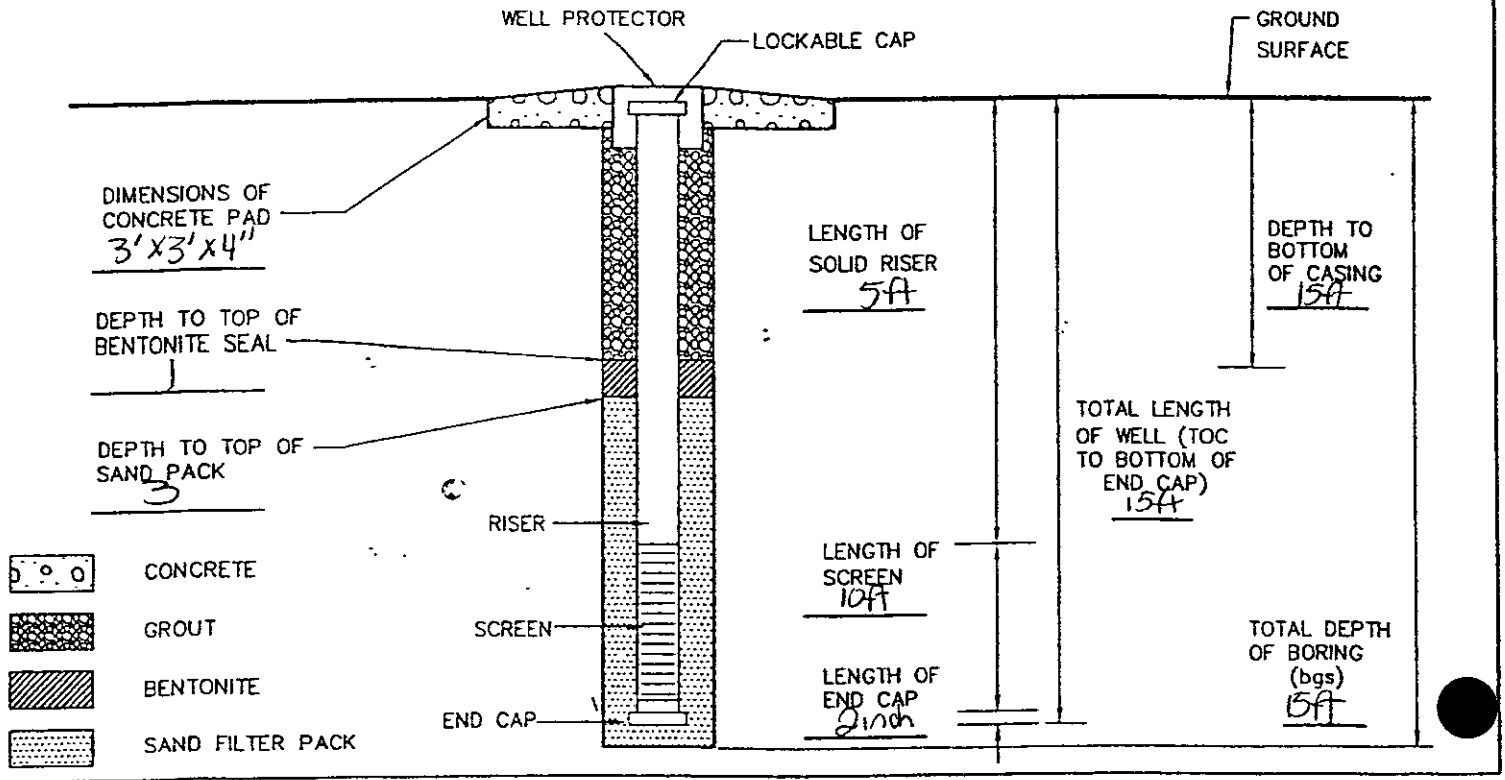
PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0011
WELL NO. OU6PZ-7A WELL LOCATION NGA
DATE 1-22-04 TIME 1330

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL Sch 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2inch SLOT SIZE 0.010"
RISER MATERIAL Sch 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2inch
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 10inch
MACTEC FIELD REPRESENTATIVE Amy Callaway
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 20lb
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 5 bags (50lb each)
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Callaway
DISCREPANCIES: — CHECKED BY: — DATE: —

HTW DRILLING LOG

HOLE No. OU6PZ-7A

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" Hollow Stem Auger; 2'x2" split spoon barrel sampler	9. HOLE LOCATION (SITE): NGA	
	10. SURFACE ELEVATION: —	
8. WEATHER: clear, 30's	11. DATE STARTED: 1-20-04	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: >15ft	16. DEPTH GROUNDWATER ENCOUNTERED: ~4ft	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 15ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
0			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
0						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Callaway

25. CHECKED BY:	26 NAME OF INSPECTOR: Amy Callaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	4–6	Very Soft Gray (2.5Y 6/1) Fat Clay. CH Wet, with some sand and a few pebbles.	0.0			2,2 3,3	12/24
	9	No Recovery				4,5 6,7	0/24

869 426

HTW DRILLING LOG

HOLE No. OW82-7A

PROJECT DSCR Supplemental FS | INSPECTOR Gary Callaway | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	Firm Mottled Grayish Brown (2.5Y 5/2) Dark Reddish Brown (5YR 3/4)	0.0			6,7 7,8	24/24
	12	Fat CLAY. CH Moist					
	13	Stiff Dark Gray (5Y 4/1) Fat CLAY. CH Dry with	0.0			6,9 18,25	24/24
	14	some Grayish Brown (10YR 5/2) Fat Clay lenses. Dry					
	15	Boring terminated at 15 ft.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011 | HOLE No. OW6PZ-7A

HF - Rev. 4/94

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME: DSCR Supplemental FS — PROJECT NO. 6301-03-0011

WELL NO. OU6PZ-8B — WELL LOCATION NGA

DATE 1-21-03 — TIME 0930

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK SAND — GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2inch — SLOT SIZE 0.010"

RISER MATERIAL Sch 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" IDV

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 10inch

MACTEC FIELD REPRESENTATIVE Amy Galloway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 100lb

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

AMOUNT SAND USED 7bgs (50 lb each)

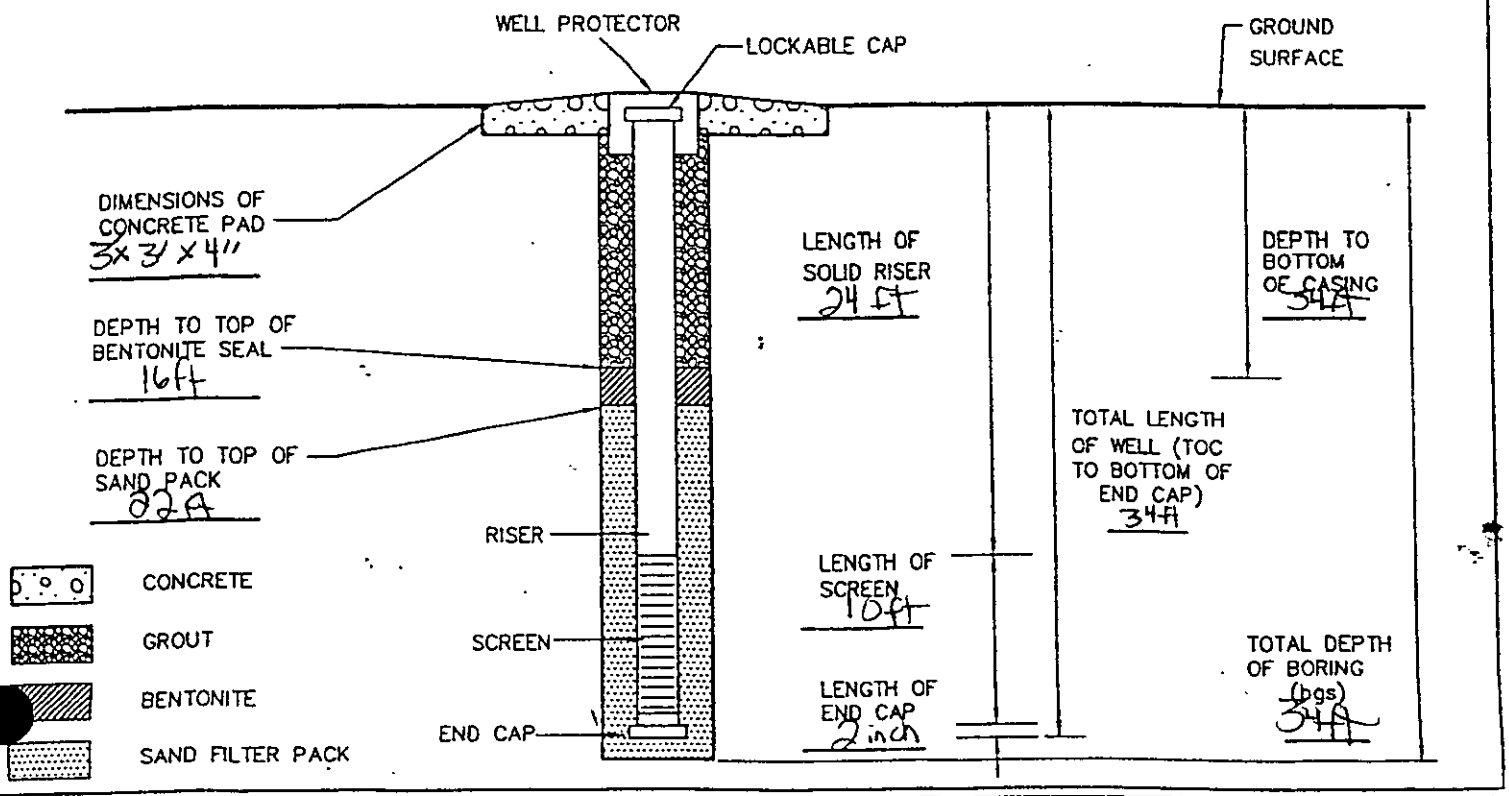
STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

REMARKS —

869 427

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook — INSPECTOR: Amy Galloway

DISCREPANCIES: — CHECKED BY: — DATE: —

869 428

HTW DRILLING LOG

HOLE No. OU6PZ-8B

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 3 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" Hollow Stem Auger; 2" x 2' split spoon barrel sampler	9. HOLE LOCATION (SITE): NGA	
	10. SURFACE ELEVATION: —	
8. WEATHER: Clear, 40's	11. DATE STARTED: 1-21-04	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: >34	16. DEPTH GROUNDWATER ENCOUNTERED: ~4ft	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 34 ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
0			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
0						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Calloway

25. CHECKED BY:	26. NAME OF INSPECTOR
	Amy Calloway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	4–6	Soft, Dark Gray (10YR 4/1) Fat Clay. Wet with some fine sand and some pebbles. CH				4,3 5,22	12/24
	9	Firm, Mottled Light Gray (10YR 7/1) Brownish Yellow (10YR 6/8) Cont.				11,8 7,7	20/24

HTW DRILLING LOG

HOLE No. OU6PZ-8B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Callaway | SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	Fat Clay: CH Moist cont. from page 1					
	12						
	13						
	14	Stiff, Very Dark Greenish Gray (GLEY 2 10BG 3/1) Fat CLAY. CH				15,15	24/24
	15	Dry with some silt.				21,18	
	16	Firm, Very Dark Greenis Gray				3,5	24/24
	17	(GLEY 2 10BG 3/1) Silty Clay				5,7	
	18	Moist CL Soft, Greenish Black (GLEY2				4,5	24/24
	19	10BG 2.5/1) Clayey SILT. Moist micaceous ML				4,4	
	20					4,11	12/24
	21					15,17	
	22						
	23	No Recovery				20,28 30,32	0/24
	24	Greenish Black (GLEY2 10BG 2.5/1)				14,26	24/24
	25	Very fine grain SAND. Dry some clay, micaceous. SP				45/50/4	
	26	Quartz gravel piece				33/50/3	2/24
	27	stuck in sampler tool.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS C301-03-0011 | HOLE No. OU6PZ-8B

HF - Rev. 4/94

869 430

HTW DRILLING LOG

HOLE No. OU6PZ-8B

PROJECT DSCR Supplemental FS | INSPECTOR Gary Galloway | SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	29	Yellowish Brown (10YR 5/6) Clayey coarse grn SAND with pebbles! Moist SP-SC				50/5	3/24
	30						
	31						
	32	No Recovery				39, 50/3	0/24
	33						
	34						
	35	Terminate Boring at 34'.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-6011 | HOLE No. OU6PZ-8B

HF - Rev. 4/94

869 431

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS — PROJECT NO. 6301-63-0011

WELL NO. OU62-98 — WELL LOCATION NGA

DATE 1-22-04 — TIME 1000

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand — GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2inch — SLOT SIZE 0.010"

RISER MATERIAL Sch 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 10inch

MACTEC FIELD REPRESENTATIVE Amy Calloway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 130lb

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

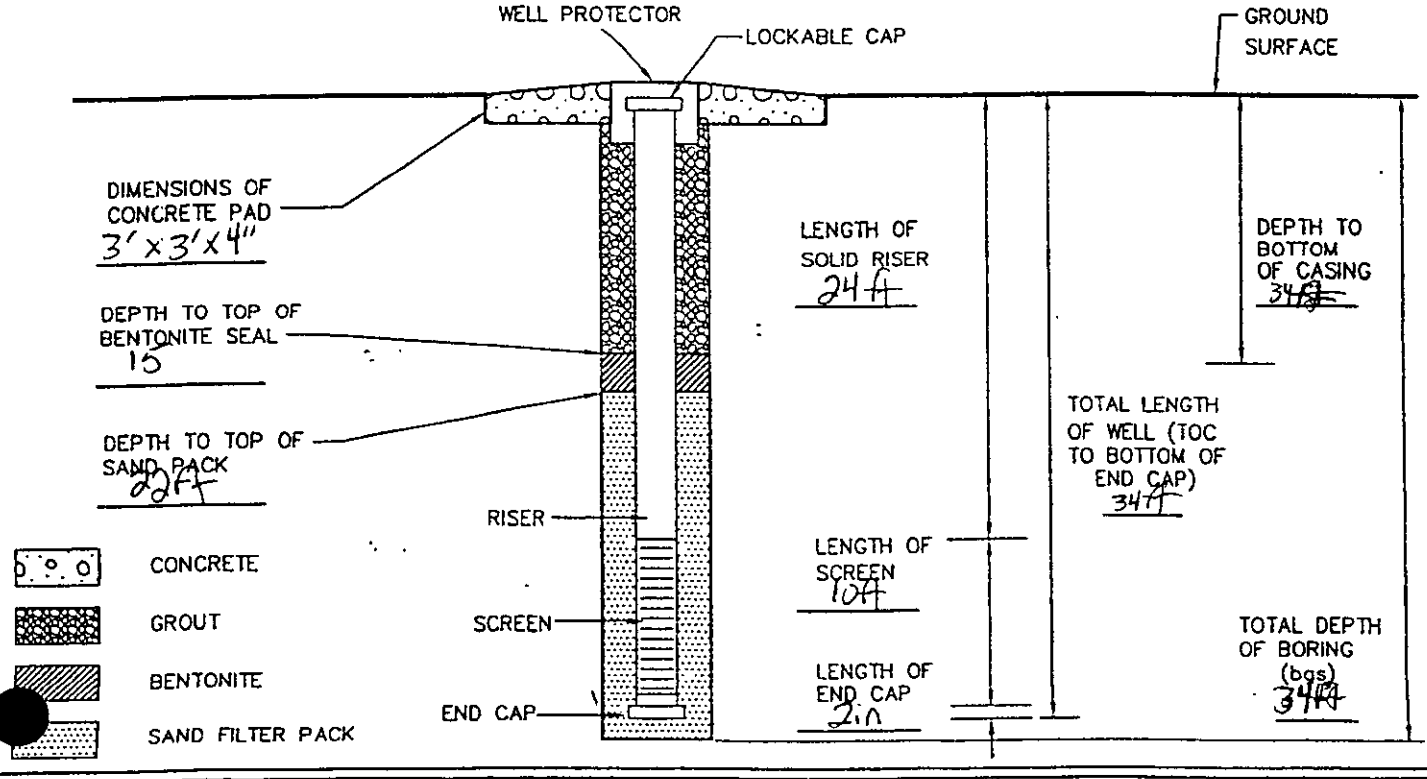
AMOUNT SAND USED 6bags (50lb each)

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook — INSPECTOR: Amy Calloway

DISCREPANCIES: — CHECKED BY: — DATE:

869 432

HTW DRILLING LOG

HOLE No. OU6PZ-9B

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 3 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" Hollow Stem Augers; 2" x 2" split spoon barrel sampler	9. HOLE LOCATION (SITE): NGA	
	10. SURFACE ELEVATION: —	
8. WEATHER: Clear, 30's	11. DATE STARTED: 1-22-04	12 DATE COMPLETED:
13. OVERBURDEN THICKNESS: >34 ft	16. DEPTH GROUNDWATER ENCOUNTERED: ~5 ft	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 34 ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
0			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
0						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Callaway

25. CHECKED BY.	26. NAME OF INSPECTOR: Amy Callaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1						
	2						
	3						
	4	Soft Light Gray (7.5YR 7/1) Slightly Sandy fat CLAY. Moist with some pebbles. CH	0.0			4,4 10,14	14/24
	5						
	6						
	7						
	8						
	9	Soft Thinly Laminated Light Gray (7.5YR 7/1) and Reddish Yellow (7.5YR 6/6) Fat Clay. Moist CH	0.0			2,2 4,4	24/24

MRK FORM JUN 89 55 | PROJECT NAME & NO: DSCR Supplemental FS 6301-03-0011 | HOLE No. OU6PZ-9B

HF - Rev. 4/9

HTW DRILLING LOG

HOLE No. OU68Z-9B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Callaway | SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		see previous page					
	11	11-12.6 - Same	0.0			1,2 3,5	24/24
	12	12.6-13ft Gray (7.5YR 5/1) Fat Clay. Dry CH.					
	13					4,9	Confining Unit
	14		0.0			12,12	24/24
	15	Firm, Greenish Black (GLEY1 5GY 2.5/1) Silty CLAY. Dry. With some pebbles. CH	0.0			4,8 9,10	24/24
	16						
	17	17.-18.5 - Same				5,2	
	18					3,5	24/24
		18.5-19ft - Greenish Black (GLEY1 5GY 2.5/1) Silty CLAY. Dry with lenses of very fine grain SAND. CH	0.0				
	19					1,10	7/24
	20	Firm Greenish Black (GLEY1 5GY 2.5/1) very fine grain SAND Moist SP	0.0			13,15	
	21						
	22						
	23						
	24					50/4	6/24
	25		0.0				
	26						
	27						

869 434

HTW DRILLING LOG

HOLE No. OU6PZ-9B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Callaway | SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	29	No Recovery				50/0	0/0
	30						
	31						
	32						
	33						
	34	Terminate Boring at 34ft bgs.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS C301-03-6011 | HOLE No. OU6PZ-9B

HF - Rev. 4/94

Appendix D-3

OU7 HTW Logs / Monitoring Well / Piezometer Construction Details

869 436 LOWER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0017
WELL NO. MWFTA-30B WELL LOCATION OU7
DATE 12/21/03 - 1/7/03 TIME 0830

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2in SLOT SIZE 0.010"
RISER MATERIAL sch 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2 in
DRILLING TECHNIQUE 4.25" ID HSA; Mud rotary
AUGER/BIT SIZE AND TYPE 4.25ID; 15" bit

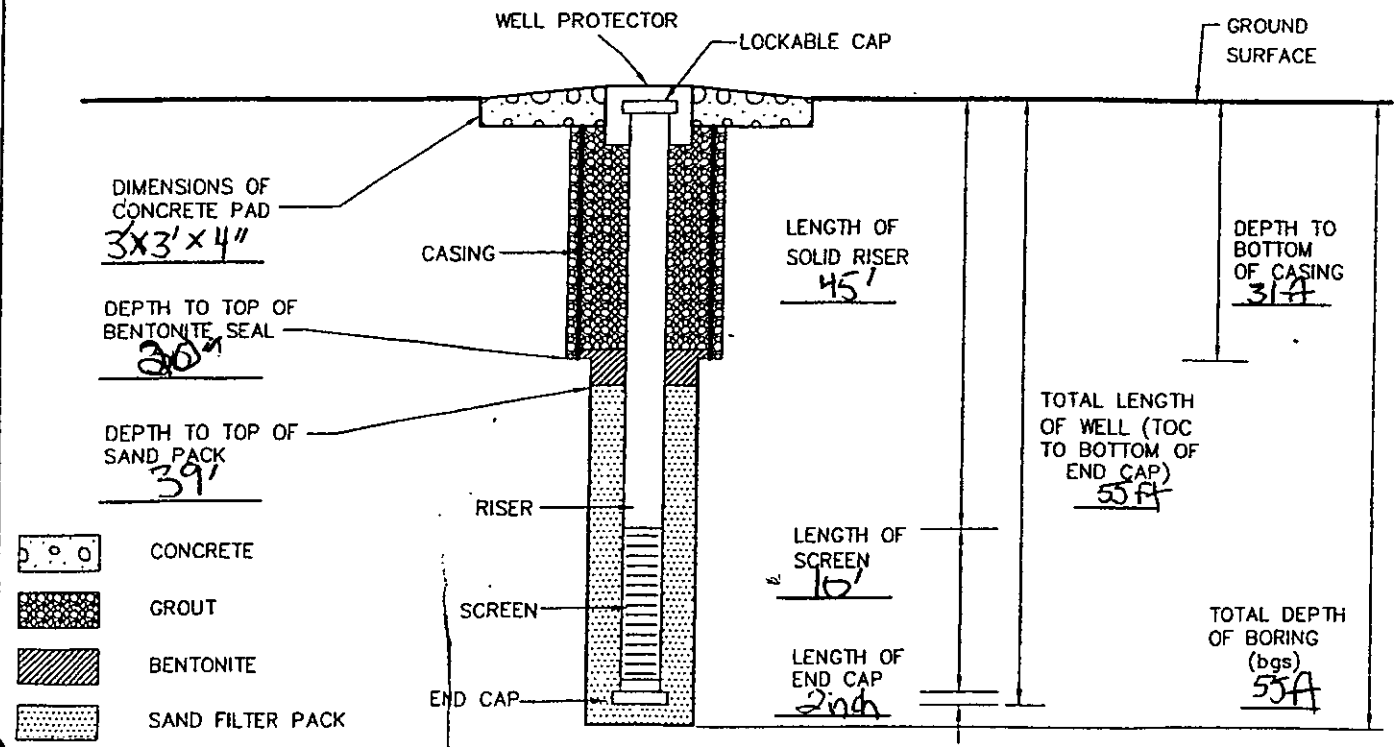
BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke

BOREHOLE DIAMETER 10 inch
MACTEC FIELD REPRESENTATIVE Amy Callaway
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 115lbs
AMOUNT BENTONITE USED (GROUT)
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 9bgs (50lb each)

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Chris Lacko INSPECTOR: Amy Callaway
DISCREPANCIES: CHECKED BY: DATE:

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869 437

HTW DRILLING LOG

HOLE No. MWFTA-30B

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Chris Lacko	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA, 2" OD split spoon sampler barrel, 15" mud rotary bit	9. HOLE LOCATION (SITE): OU7
	10. SURFACE ELEVATION: —
8. WEATHER: Partly cloudy, 30's	11. DATE STARTED: 12/21/03 — 12. DATE COMPLETED: 1/7/03
13. OVERBURDEN THICKNESS: > 35ft	16. DEPTH GROUNDWATER ENCOUNTERED: ~ 9ft
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE: 55ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
—			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Amy Calloway

25. CHECKED BY:

26. NAME OF INSPECTOR: Amy Calloway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	4	Stiff, Strong Brown (7.5YR 5/8) SILT with some pebbles. Dry. to 5.8' ML	0.0			13,9 / 6,13	15/24
	5						
	6	5.8'-6' Dk Gray (7.5YR N4/1) Slightly silty very fine SAND. Dry SP					
	9	Light gray (7.5YR 7/1) Silty, very fine SAND. Micaceous, slightly moist. SP-SM	0.0			13,14 / 17,21	16/24

HTW DRILLING LOG

HOLE No. MWFTA-30B

PROJECT DOCR Supplemental FS | INSPECTOR Amy Callaway | SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	see page ONE					
	12						
	13						
	14	Firm, Light gray (7.5YR 7/1) Silty, fine-to medium grain SAND sp-sm micaceous Moist.	0.0			10,12 16,15	20/24
	15						
	16						
	17						
	18						
	19	Firm, Light Gray (7.5YR7/1) Slightly silty, medium to coarse grain SAND. SP Wet	0.0			22,15 13,24	22/24
	20						
	21						
	22						
	23						
	24	Light Gray (7.5YR7/1) Coarse SAND SP Wet with some clay lenses				8,25	24/24
	25	Light Gray (7.5YR7/1) Clayey SAND SC Wet with gravel.	0.0			37,32	
	26	26-27.2 Dense, Light Gray (7.5YR7/1) Medium to Coarse SAND. Wet SP				34,31	24/24
	27	27.2-28 Gray (7.5YR 6/1) Sandy stiff CLAY. CH Moist	0.0			46,50/5	
	28						

869 439 HTW DRILLING LOG

HOLE No. MWFTA-30B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Callaway | SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29	Gray (7.5 YR 6/1) Sandy Stiff CLAY CH ~~Wet~~ Moist	0.0			16,31	AMC 8/24
	30					41,29	Boring cased to 31ft bgs.
	31					15,21	8/24
	32		0.0			19,22	
	33	Very Stiff, Light Greenish gray (GLEY1 5G 7/1) Fat				21,35	12/24
	34		0.0			26,31	
	35	CLAY. Micaceous Dry some Sand. CH				46,27	14/24
	36	Hard Greenish gray (GLEY1 10GY 6/1) Sandy SILT Dry	0.0			44,50/5	
	37	With some clay, Micaceous ML					
	38	Hard Dark Greenish Gray (GLEY1 5G 4/1) Sandy SILT. With some clay, dry, Micaceous ML	0.0			44,49	14/24
	39					50/4	
	40	No recovery				refusal	
	41						
	42	No recovery				refusal	
	43						
	44	No recovery				refusal	
	45	No recovery				refusal	
	46						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011 | HOLE No. MWFTA-30B

HF — Rev. 5/94

869 440

HTW DRILLING LOG

HOLE No. MWFTH-303

PROJECT OSER Supplemental FS

INSPECTOR Cindy Calloway

SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	47	See previous page					
	48	No recovery				refusal	
	49						
	50						
	51	No recovery				refusal	
	52						
	53						
	54						
	55	No recovery —				refusal	
	56	Terminate Boring at 55 ft. bgs					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. OSER Supplemental FS 6301-03-011

HOLE No. MWFTH-303

HF — Rev. 5/94

869 441

LOWER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS — PROJECT NO. 6301-03-0011
WELL NO. MWFTA-31B — WELL LOCATION CU7
DATE 1/5/04 — TIME 1400

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand — GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2inch — SLOT SIZE 0.010"

RISER MATERIAL sch 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2inch

DRILLING TECHNIQUE 4.25" ID HSA, Mud rotary
AUGER/BIT SIZE AND TYPE 4.25 ID, 15" bit

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke

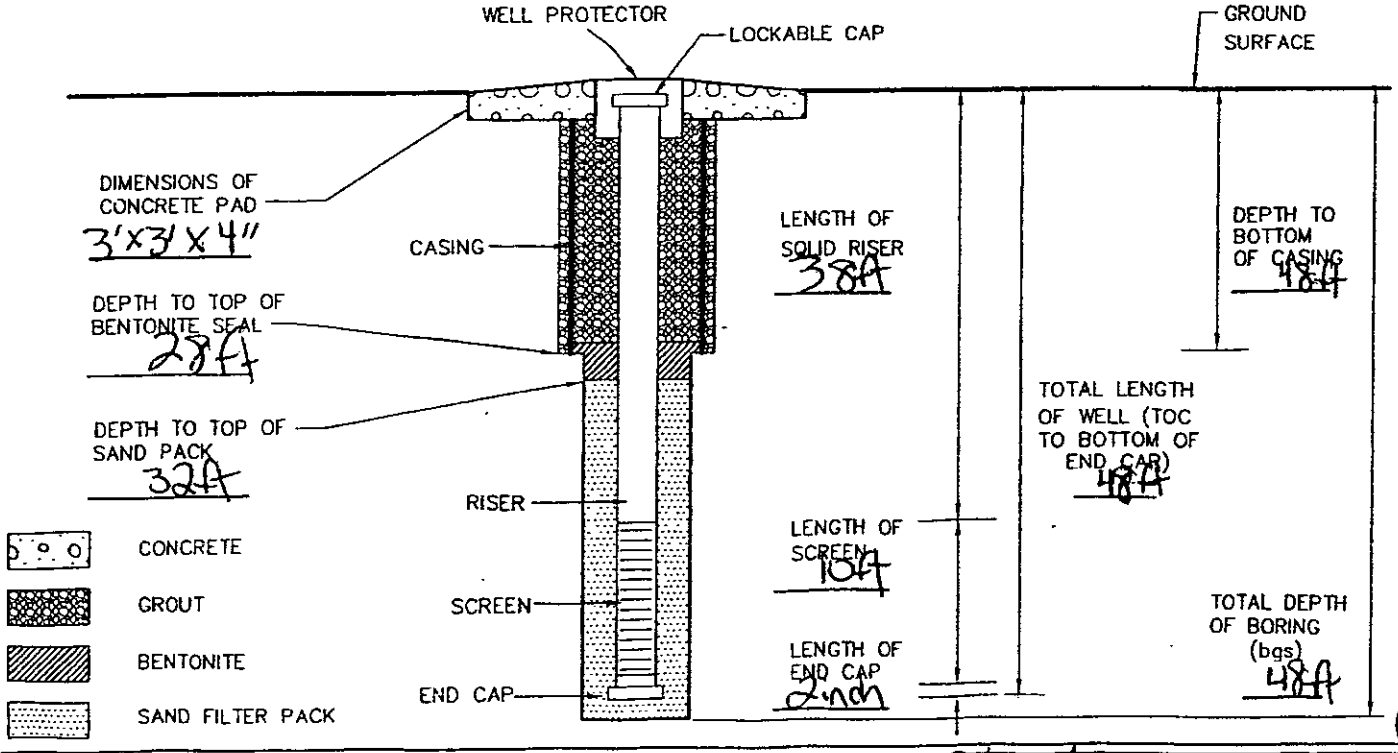
BOREHOLE DIAMETER 10 inch
MACTEC FIELD REPRESENTATIVE Amy Gilaway
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 125lb
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 9bgs (50lb each)

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Lacko — INSPECTOR: Amy Gilaway
DISCREPANCIES: — CHECKED BY: — DATE: —

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869 442

HTW DRILLING LOG

HOLE No. MWFTA-31B

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET OF SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Chris Lacko/Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: ~~CME~~ GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA, 2"x2' split spoon sampler bared 15" mud rotary bit	9. HOLE LOCATION (SITE): 047	
	10. SURFACE ELEVATION: —	
8. WEATHER: light rain, 65°	11. DATE STARTED: 1/05/04	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: > 48 ft	16. DEPTH GROUNDWATER ENCOUNTERED: ~9 ft	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 48 ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
3	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
N						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Amy Gilway

25. CHECKED BY:

26. NAME OF INSPECTOR: Amy Gilway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	4–6	Soft, Light grayish olive (10Y 6/2) to (5GY 6/1) Sandy Clayey, SILT. micaceous DRY MH				4,4 3,3	6/24
	9–10	Firm, Brown (7.5YR 4/2) SP Coarse grain SAND. WET				14,14 10,14	6/24

869 443

HTW DRILLING LOG

HOLE No. MWFTA-31B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Galloway | SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	see page 1					
	12						
	13						
	14	Very Firm Light greenish gray (GLEY1 1/10Y 7/1) Clayey coarse grain Sand. Moist SP-SC				10,16	
	15					25,29	8/24
	16						
	17						
	18						
	19	Dense, Light gray (10YR 7/1) Slightly clayey SAND. Wet with some gravel. SP-SC				40,49	
	20					42,	6/24
	21					50/3	
	22						
	23						
	24	Very Dense White (2.5YR 8/1) Coarse SAND. Wet with some clay and gravel SP				50/6	
	25						
	26						
	27						
	28						

HTW DRILLING LOG

869 444

HOLE No. MWFTA-31B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Galloway | SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	29	Very firm, Greenish Gray (GLEY2 5B6 6/1) Clayey, very fine grn SAND. moist micaceous, SC	0.0			26,27 30,32	
	30						Casing set at 30ft.
	31	Very Stiff, Greenish Gray (GLEY2 5B6 6/1) Sandy CLAY. moist micaceous CL	0.0			14, 18 22,26	
	32						
	33	No Recovery				50/1	
	34	Saprolite Dense, Dark Bluish Gray (GLEY2 5B 4/1) Silty fine grn SAND dry, micaceous with some pebbles				47, 50/4	6/24
	35		0.0				
	36					Push for better recovery	
	37	Same with large gravel	0.0				
	38						
	39						
	40	Same, wet					
	41		0.0				1/24
	42	Saprolite Very Dense, Dark Greenish Gray (GLEY2 10G 4/1) Silty med coarse grn SAND. moist micaceous				37, 50/3	14/24
	43		0.0				
	44						
	45		0.0			50/2	14/24
	46						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011 | HOLE No. MWFTA-31B

HF - Rev. 4/94

869 445

HTW DRILLING LOG

HOLE No. MWFTH31B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Galloway | SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	47			X		50/6	
	48	Boring Terminated at 48ft.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6361-03-011 | HOLE No. MWFTA-31B

HF - Rev. 4/94

HTW DRILLING LOG

869 446

HOLE No. OU7DPT-14-5

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental	4. LOCATION (CITY, STATE): Richmond VA
5. NAME OF DRILLER: DANNY COOK	6. MANUFACTURER'S DESIGNATION OF DRILL: GP-1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 inch ID Auger 2" x 2" Split Barrel Sampler 2" x 3" Split Barrel Sampler 4" x 5" Split Barrel Sampler	9. HOLE LOCATION (SITE): DSCR OU7 South of Pit 1 10. SURFACE ELEVATION: PROVIDED UNDER SEPARATE SHEET
8. WEATHER: SUNNY cold 45°F	11. DATE STARTED: 01/05/03 — 12. DATE COMPLETED: 01/06/03
13. OVERBURDEN THICKNESS: more than 30 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ± 9.00 FT
14. DEPTH DRILLED INTO ROCK: N A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
15. TOTAL DEPTH OF HOLE: 30 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
NONE	—		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
2	✓	✓				

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			GROUTED	[signature]

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A. VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Yellowish Brown (10YR 5/4), very clayey poorly graded fine to medium SAND (SC) with gravel					
	2						
	3						
	4	DENSE, Pale Brown (10YR 6/3) very clayey poorly graded fine to medium SAND with gravel (SC) - Fill Dry				11, 22, 50/3"	14:16
	5						
	6	GRAVEL FINE to COARSE					
	7	Yellowish-Brown (10YR 5/4) clayey poorly graded coarse sand with pebbles (SC) Fill Moist			OU7DPT-14-5 SO (7-10)		9:00
	8						
	9	Yellowish-Brown (10YR 5/4) clayey poorly graded coarse sand (SC)					
	10						

869 447

HTW DRILLING LOG

HOLE No. 007 DPT 14-5

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	VERY DENSE, light GREENISH GRAY (GLEY 1, 10Y 8/1) POORLY GRADED FINE				13, 27, 44	0953
	11	to MEDIUM SAND (SP) WITH AREAS				44	PID READING ON
	12	OF BROWNISH YELLOW (10YR 6/8) STAINS					SOIL SAMPLE
		with STRONG SOLVENT ODOR (WET					9.2 ppm
	13						
	14						
					007DPT-14-5		
	15				SO (14-16)		
	16	VERY DENSE, light GREENISH GRAY					
		(GLEY 1, 10Y 8/1) POORLY GRADED FINE				8, 32, 39	
	17	to MEDIUM SAND (SP) with SPOTS				39	
	18	OF BROWNISH YELLOW (10YR 6/8) STAIN					
		(DAMP - WET)				32, 50/5"	
	19						
	20						
	21					13, 26, 40	
						46	
	22						
		BECOMING MORE GRAVELY					
	23						DESCRIPTION BASED ON DRILLING CONDITIONS
	24	NO RECOVERY				32, 50/2"	
	25						
	26						
		GRAVEL -					MATERIAL SIMILAR
	27	WHITE, VERY CLAYEY COARSE					to SECOND UNIT
		SAND SC/CL (BASED ON MATERIAL					OF LOWER WBU
	28	ON AUGER FLYS) ~~MAR~~ WB					WBU aka
							CEMENTED SAND)

HTW DRILLING LOG

869 448

HOLE No. OUTDPT 14-5

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28					50/1"	
	29						
	30	BORING TERMINATED AT 30 FT BELOW GROUND SURFACE DUE TO DRILLING REFUSAL					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. OUTDPT-145

HF - Rev. 4/94

869 449 UPPER WBU ~~MONITORING WELL~~ MW INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011

WELL NO. OU7PZ-1 WELL LOCATION Jogging TRAIL - KINGSLAND CREEK

DATE 11/17/03 TIME 1400

GROUND SURFACE ELEVATION _____

TOP OF SCREEN ELEVATION _____

REFERENCE POINT ELEVATION _____

TYPE FILTER PACK SAND GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC.

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Augers

AUGER/BIT SIZE AND TYPE 4.25-inch ID

BENTONITE TYPE 3/8 Pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 2 bf

AMOUNT BENTONITE USED (GROUT) _____

AMOUNT CEMENT USED (GROUT) _____

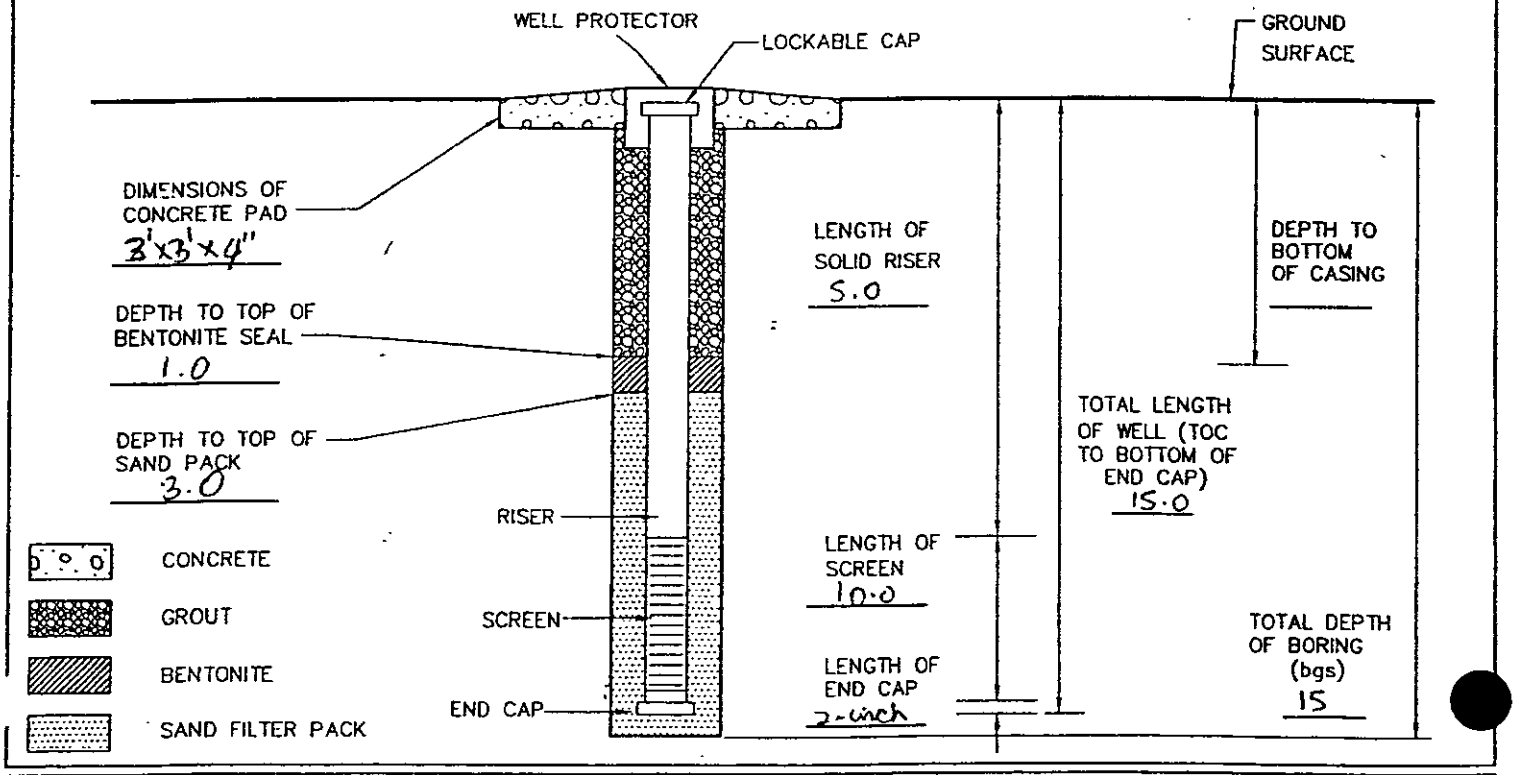
AMOUNT SAND USED 300 Lb

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) _____

REMARKS _____

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Richard Simmons INSPECTOR: M. Vazquez

DISCREPANCIES: _____ CHECKED BY: _____ DATE: _____

HTW DRILLING LOG

869 450

HOLE No. OU7PZ-1

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: RICHARD SIMMONS	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): RICHMOND VA	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25-INCH ID HOLLOW STEM AUGERS; 2-INCH by 2FT SPLIT BARREL SAMPLER	9. HOLE LOCATION (SITE): JOGGING TRAIL – KINGSLAND CREEK	
	10. SURFACE ELEVATION: PROVIDED AS SEPARATE SHEET	
8. WEATHER: SUNNY, COOL	11. DATE STARTED: 11/17/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: MORE THAN 15 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 3.0 FT	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 15.	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
2	X	N/A	N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	M. VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	FILL OLIVE (5Y 5/3) DENSE, SLIGHTLY CLAYEY WELL GRADED FINE TO COARSE SAND WITH GRAVEL	0.0 ppm			14, 16, 15 10	RECOVERY 18"
	2						
	3						
	4	GRAY (2.5Y 5/1) DENSE, WELL GRADED FINE TO COARSE SAND WITH GRAVEL	0.0 ppm	- - -		6, 7, 21	
	5			1370		33	
	6			- - -			
	7						
	8						
	9	GRAYISH OLIVE (10Y-5GY 5/2) HARD, SILTY CLAY	0.0 ppm			17, 27, 22 37	
	10						

869 451

HTW DRILLING LOG

HOLE No. OU7PZ-1

PROJECT: DSCR supplemental FS

INSPECTOR: M. Vazquez

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14	Light Grayish Olive (10Y 5/4 4/2) ~~Grayish olive (10Y 5/4 5/2)~~ HARD, coarse Sandy CLAY				27,36	
	15	with gravel	0.0 ppm	1356		50/2	1351
	16	Boring terminated at 15.0 ft BGS					
	17	Piezometer installed to 19.0 ft BGS					
	18						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. OU7PZ-1

HF - Rev. 4/94

869 452 UPPER WBU ~~MONITORING~~ WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011

WELL NO. 007PZ-2 WELL LOCATION JOGGING TRAIL – KINGSLAND CREEK

DATE 11/17/03 TIME 1600

GROUND SURFACE ELEVATION NA

TOP OF SCREEN ELEVATION NA

REFERENCE POINT ELEVATION PROVIDED ON SEPARATE SHEET

TYPE FILTER PACK SAND GRADATION 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25-inch ID

BENTONITE TYPE 3/8 Pellet

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. VAZQUEZ

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 2-FT

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

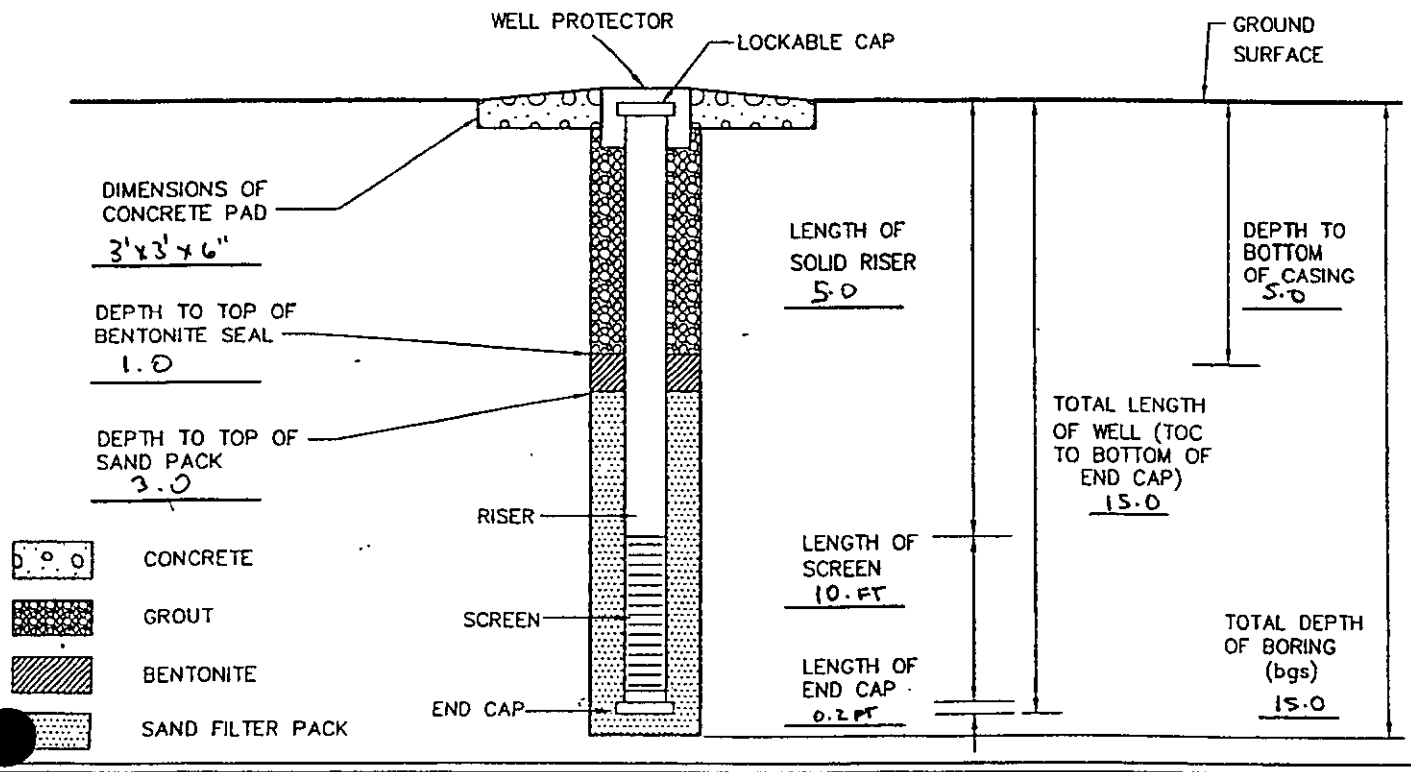
AMOUNT SAND USED —

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Richard Simmons INSPECTOR: M. VAZQUEZ

DISCREPANCIES: CHECKED BY: DATE:

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869 453 MW DRILLING LOG

HOLE No. DU7PZ-2

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): RICHMOND VA
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 ID Hollow Steam Augers; 2-inch, 2 Ft long Split Barrel Sampler	9. HOLE LOCATION (SITE): Jogging Trail - Kingsland Creek
	10. SURFACE ELEVATION: Provided in separated sheet
8. WEATHER: SUNNY, Cool	11. DATE STARTED: 11/17/03 — 12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: >MORE THAN 15 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 3 FT BGS
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE: 15.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
2	X	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Signed A V

25. CHECKED BY:	26. NAME OF INSPECTOR: I. VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		ASPHALT					
	1	Fill - Bricks MEDIUM SAND DARK GRAY (GLEY 1, N4/)	0.0 ppm			39, 17, 7	12 inch Recovery
	2	CLAYEY MEDIUM SAND, POORLY GRADED (SP)				6	
	3						
	4	DARK GRAY (GLEY 1, N4/) Firm clayey poorly graded	0.0 ppm			10, 16	12 inches Recovered
	5	MEDIUM SAND and GRAVEL (SP-SC)				12, 12	
	6						
	7						
	8						
	9						
	10						

HTW DRILLING LOG

HOLE No. 007PZ-2

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vázquez

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	~~GREY (5Y 5/1)~~ LIGHT GREENISH OLIVE (10Y 6/2) DENSE, VERY CLAYEY COARSE SAND. (SC)	0.0 ppm	1		8, 14 50/4	
	12						
	13						
	14	SAME AS ABOVE	0.0 PPM	1		30, 33 35, 50/4	
	15						
	16	BORING TERMINATED AT 15.0 FT BGS					
	17	~~MONITORING~~ PIEZOMETER INSTALLED TO 15.0 FT BGS					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS - 6301-03-0011

HOLE No. 007PZ-2

HF - Rev. 4/94

869 455

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental FS
PROJECT NO. 6201-03-0011
WELL NO. PZ-3
WELL LOCATION 007 Vernon Property
DATE 12-08-03
TIME 1300

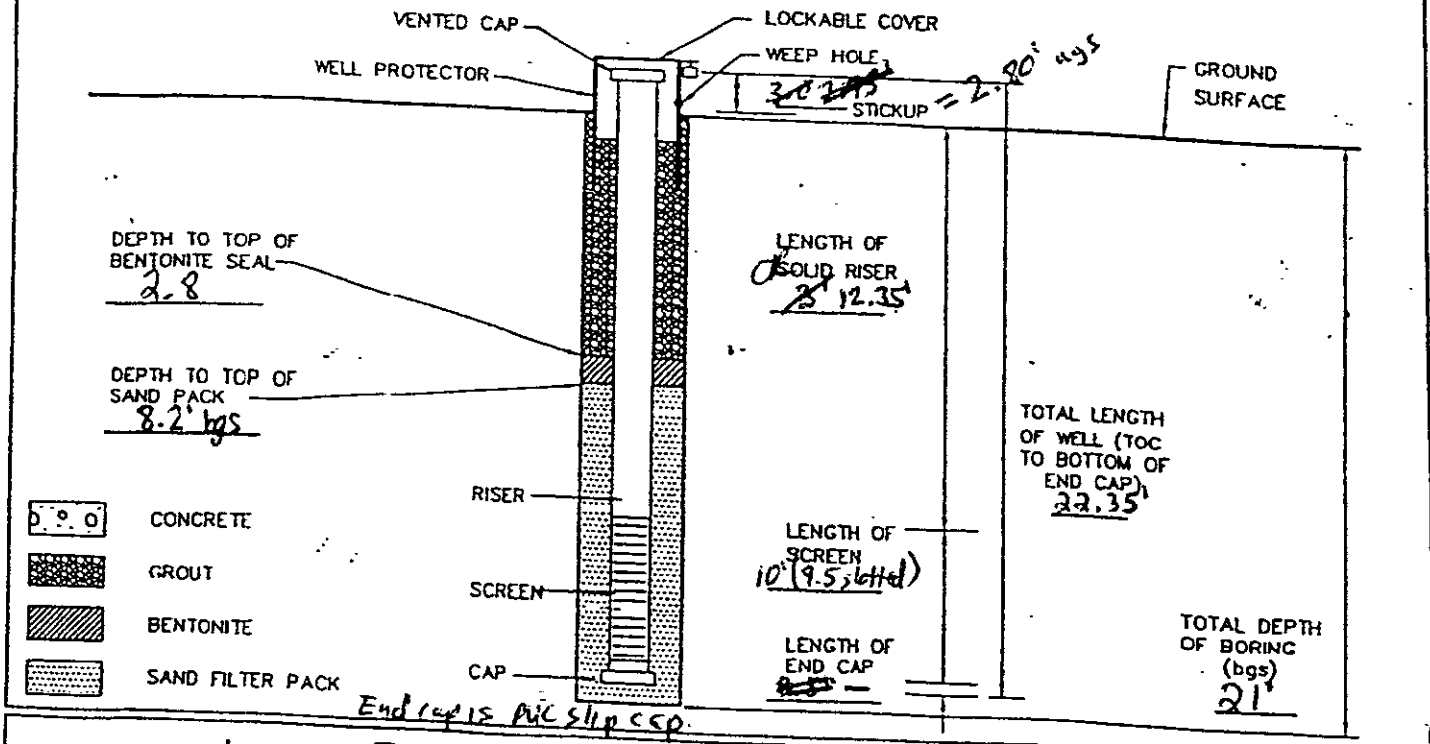
GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Silica Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC
MANUFACTURER DSI
SCREEN DIAMETER 2" SLOT SIZE 10
RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2"
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE DSI 3/8" Pellet
MANUFACTURER DSI
CEMENT TYPE I/II Portland
MANUFACTURER Roanoke cement
BOREHOLE DIAMETER 10"
MACTEC FIELD REPRESENTATIVE C. Kvanbis
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 5 gallons
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 5½ 50lb bags
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny
INSPECTOR: C. Kvanbis
DISCREPANCIES:
CHECKED BY: DATE:

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HTW DRILLING LOG

869 456

HOLE No. 007 PZ-3

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Danny	6. MANUFACTURER'S DESIGNATION OF DRILL: Maraka MST600
SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 1 2/3" OD drill rods; 1.8" OD Split spoons; 140 lbs Hammer	9. HOLE LOCATION (SITE): 007 Vernon Property
	10. SURFACE ELEVATION: —
8. WEATHER: Clear, cold, calm	11. DATE STARTED: 12-08-03 / 12. DATE COMPLETED: 12-08-03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 9 feet bgs
14. DEPTH DRILLED INTO ROCK: —	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 5' BTOC 12/05/03 0750
15. TOTAL DEPTH OF HOLE: 20' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
Goal	—	X	—	

25. CHECKED BY:

26. NAME OF INSPECTOR: C. Krumbir

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	SAND (SP-SM), sl. silty, gravelly, F-M wet, very pale brown 7/3 10YR (Basal cuttings)					
	5	SAND (SP-SM) sl. silty, F-VC, subrounded to rounded qtz, sl. gravelly, wet, moderately loose greenish gray 6/1 10Y Gley2				13, 13 20, 20 N=33	9" recovery
		gravelly throughout noted during drilling					
	15	SAND (SP-SM) silt matrix, gravelly M-VC, light greenish grey 7/1 5GY Saturated	Gley 1	007 PZ-3 (9-20)		50/3" First Run	2"

869 457

HTW DRILLING LOG

HOLE No. 007 PZ-3

PROJECT: DSCR Supplemental FS

INSPECTOR: C Krambis

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	NR.				17, 41, 38, 48 n=79	1st run 8" recovery
		recessional gravel beds encountered during drilling					
	15	SAND(SC) clay matrix, gravelly, micaceous M-C, sub round to round QTZ., 6/1 5GY Gley1 greenish gray semi-consolidated, hard saturated. Clay layer @ 15.5'-15.75'	0.0 ppm		007PZ-3 (9'-20')	22, 41, 38, 50/5" n=79	18" recovery
		Hand drilling soft drilling from 17					
	20	SAND(SC), clay matrix, M-VC sub round QTZ, well rounded gravel, micaceous. V. dense to semi-consolidated, saturated light gray to gray 7/N to 6/N Gley 1 greenish gray 5/1 10GY Gley 1 clay nodule @ 19.5' bgs			007PZ-3 (9'-20')	6, 19, 45 50/5" n=64	12"
		Boring Terminated at 20' bgs Split spoon terminated @ 21' bgs.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS | HOLE No. 007 PZ-3

HF - Rev. 4/9

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental ES — PROJECT NO. 6301-03-0011
WELL NO. 007 PZ-4 — WELL LOCATION 007 Vernon Property
DATE 12/08/03 — TIME 1000

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Silica Sand — GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC
MANUFACTURER DSI
SCREEN DIAMETER 2" — SLOT SIZE 10

RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2"

DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID HSA

REMARKS Intended depth of 20' bgs could not be achieved due to refusal @ 16.5'

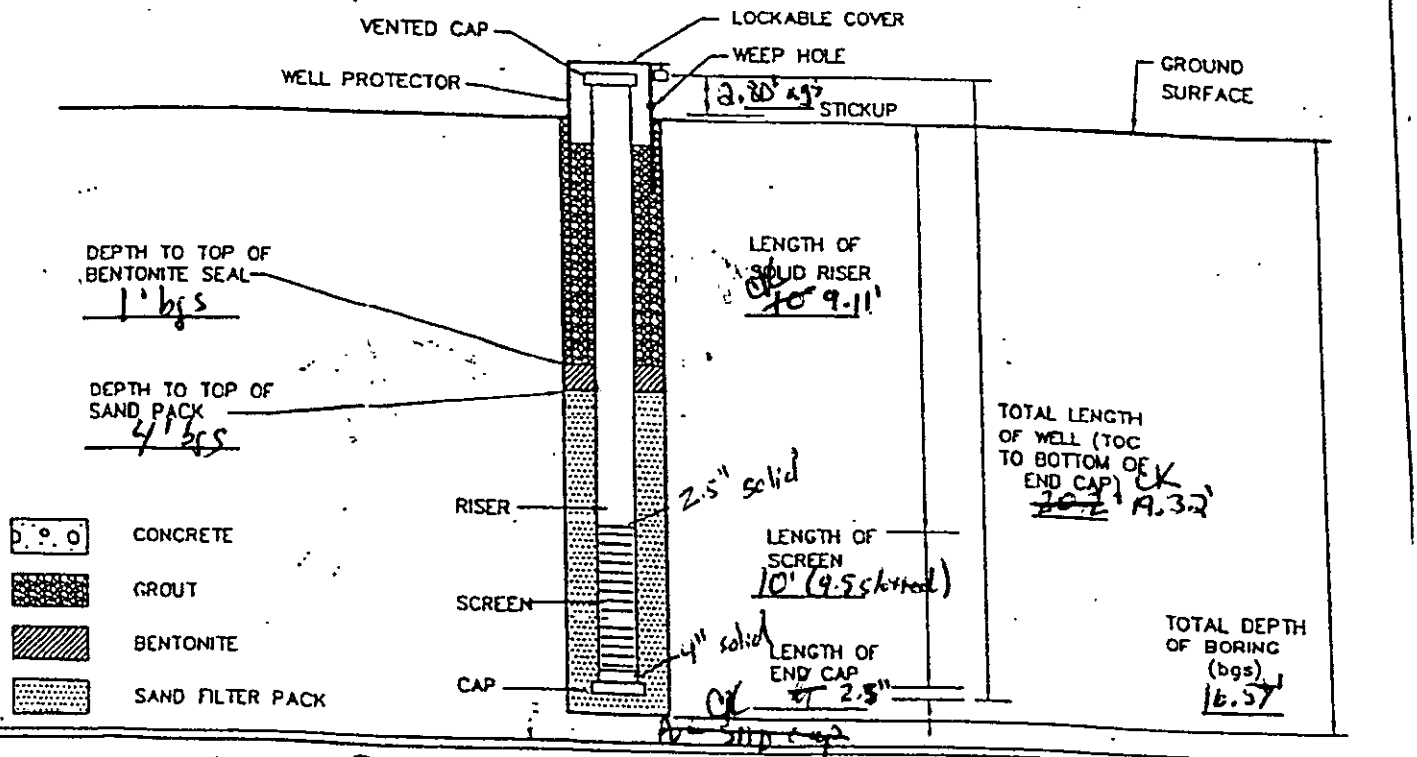
BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE I/II Portland
MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 10"
MACTEC FIELD REPRESENTATIVE C. Kravis
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 5 gallons
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 5 50lb bags

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

(NOT TO SCALE:
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Danny
DISCREPANCIES:
INSPECTOR: C. Kravis
CHECKED BY: DATE:

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869 459

HTW DRILLING LOG

HOLE No. OU7 PZ-4

SHEET 1 OF 3 SHEETS

COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
NAME OF DRILLER: Danny	6. MANUFACTURER'S DESIGNATION OF DRILL: Marooka MST 600
SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 1 3/3" OD drill rods; 1.8" OD split spoons; 140 lb hammer	9. HOLE LOCATION (SITE): OU7 Vernon Property
	10. SURFACE ELEVATION: —
WEATHER: Clear, Cold, calm	11. DATE STARTED: 12/08/03 — 12. DATE COMPLETED: 12/09/03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 3.5' bgs
14. DEPTH DRILLED INTO ROCK: —	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 5.2' BTOC 2.1' bgs 12-09-03 1300
15. TOTAL DEPTH OF HOLE: 16 1/2' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
Good	—	X	—	Chris Krambis

25. CHECKED BY:	26. NAME OF INSPECTOR: Chris Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	SAND(Sm) silty, F-M, subrounded qtz from cuttings, very pale brown					
		Hit hard gravel bed					
	5	~~Could not sample~~ ~~for~~ ~~relevant~~ SAND(SP-Sm), gravelly, slightly silty, F-C, gray brown 5Y 5/2, 10 YR Saturated well rounded qtz clasts up to 2" diameter in cuttings	—	—	—	25, 23 / 17, 19 / N=40	3" recovery
	10						

MRK FORM 55 JUN 89

PROJECT NAME & NO. DSCR Supplemental FS

HOLE No. OU7 PZ-4

HF - Rev. 4/0

HTW DRILLING LOG

HOLE No. OU7 PZ-4

PROJECT: DSCR Supplemental FS

INSPECTOR: C. Krumbein

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		SAND(SP) Clayey, gravelly(GP) greenish gray, 6/1 10G Gley 2		OU7-PZ-4 (10-15)		20,21 22,50/3" n=43	6" recovery
		Water cloud encountered during drilling at this hole					
		easy drilling 12'-					
		Rocky					
	15	SAND(SC), clayey, gravelly, (GP) clay in matrix & nodules, hard greenish-gray 10/1 5GY 6/1 Gley 1 Sand is M-VC subrounded to rounded qtz. Gravel is well rounded qtz.		OU7 PZ-4 (10-15')		17, 50/5"	6" recovery
		Auger & Spoon refusal @ 16½' bgs				50/1"	
		Boring Terminated @ 16½' bgs					
	20						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS | HOLE No. OU7 PZ-4

HF - Rev. 4/94

869 461

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

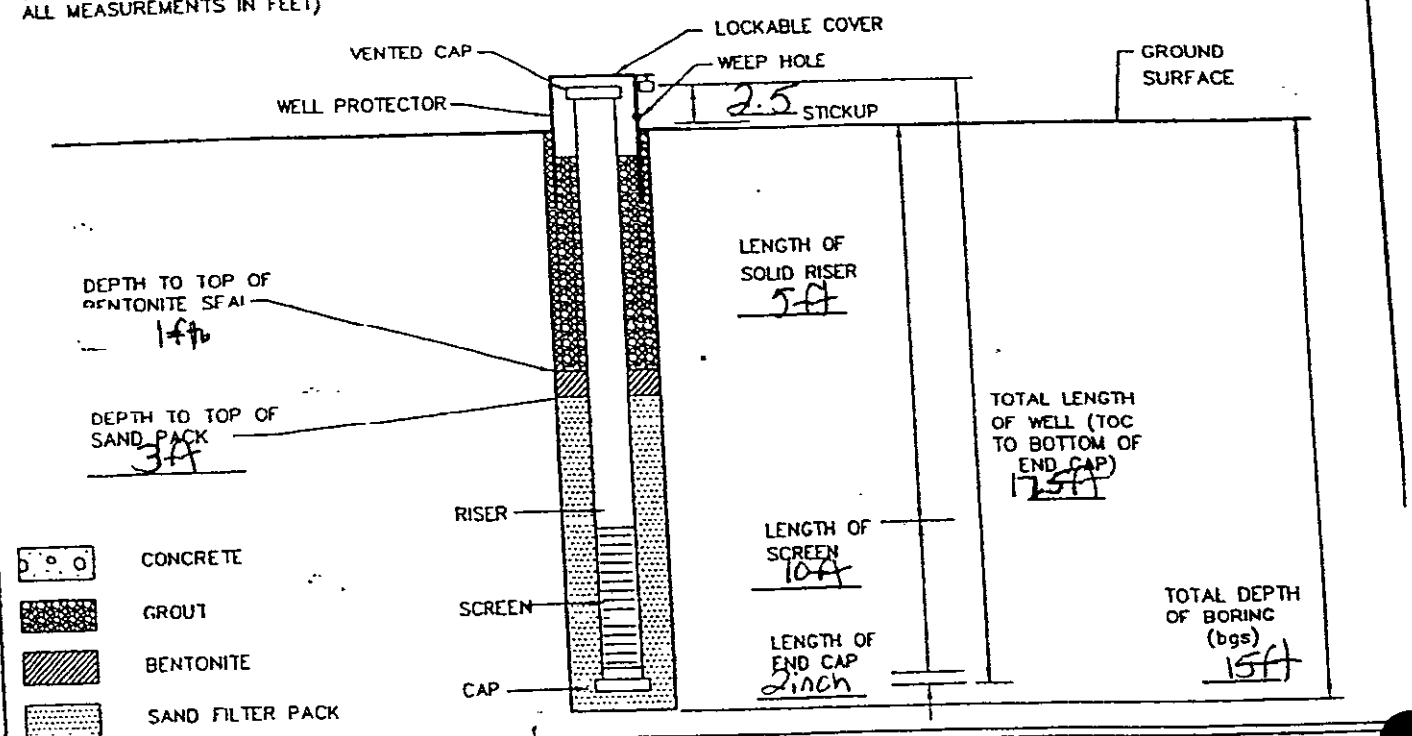
PROJECT NAME DSCR Supplemental F5 PROJECT NO. 6301.05.0011
WELL NO. OUTPZ-5 WELL LOCATION Jogging Trail / Kingsland Creek
DATE 11/18/03 TIME 0800

GROUND SURFACE ELEVATION
TOP OF SCREEN ELEVATION
REFERENCE POINT ELEVATION
TYPE FILTER PACK Sand GRADATION #2
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL PVC sch. 40
MANUFACTURER DSI
SCREEN DIAMETER 2-inch SLOT SIZE 0.01
RISER MATERIAL PVC sch. 40
MANUFACTURER DSI
RISER DIAMETER 2-inch
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25 inch ID

BENTONITE TYPE 3/8 pellets
MANUFACTURER DSI
CEMENT TYPE Portland Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 8-inch
MACTEC FIELD REPRESENTATIVE Amy Gillaway
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 2ft
AMOUNT BENTONITE USED (GROUT) 51b
AMOUNT CEMENT USED (GROUT) 151b
AMOUNT SAND USED 2651b
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE:
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Danny Cook INSPECTOR: Amy Gillaway
DISCREPANCIES: CHECKED BY: DATE:

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HTW DRILLING LOG

869 462 | OUTP2-5

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: B50	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 inch ID Hollow Stem Auger; 2-inch X 2 foot split spoon barrel sampler	9. HOLE LOCATION (SITE): Jogging trail - Kingsland Creek	
	10. SURFACE ELEVATION:	
8. WEATHER: Overcast, 50's	11. DATE STARTED: 11/18/03	12. DATE COMPLETED: 11/21/03
13. OVERBURDEN THICKNESS: > 15 feet	16. DEPTH GROUNDWATER ENCOUNTERED: 2 feet	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 72hrs - 1.39ft	
15. TOTAL DEPTH OF HOLE: 15 feet	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
None						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Callaway

25. CHECKED BY:	26. NAME OF INSPECTOR: Amy Callaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Dark Brown (10YR 3/3) Loose, slighty sandy CLAY with roots CL	0.0 ppm			5,7,7 10	7 inch recovery
	2						
	3						
	4						
	5	very dark grayish Brown (10YR 3/2) Loose, Sandy CLAY. Increasing sand,	0.0 ppm			8,19 19,21	16 inch recovery
	6	with roots. Wet. CL					
		Gray (2.5Y 6/1)					
	7	Firm Clayey well graded fine to coarse SAND with gravel Wet. SC					
	8						
	9						

MRK FORM JUN 89 55 | PROJECT NAME & NO. DSCR Supplemental FS 6301.03.0011 | HOLE NO. OUTP2-5

HF - Rev. 4/9

869 463

HTW DRILLING LOG

HOLE No. OU7PZ-5

PROJECT: DSCR Supplemental FS | INSPECTOR: Amy Galloway | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Light Greenish Gray (GLEY2 7/1) Firm clayey with graded fine to coarse SAND, moist. With gravel SC		OU7PZ-5 (10-12')		19, 32 50/5	6 inch recovery
	11						
	12						
	13						
	14						
	15	Greenish gray (GLEY2 5/1) Hard, wet clayey, gravelly poorly sorted coarse grain SAND. SP-SC				32.46 50/4	12 inch recovery
	16						
	17	Boring terminated at 15ft below grand surface.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301.03.0011 | HOLE No. OU7PZ-5 | HF - Rev. 4/94

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

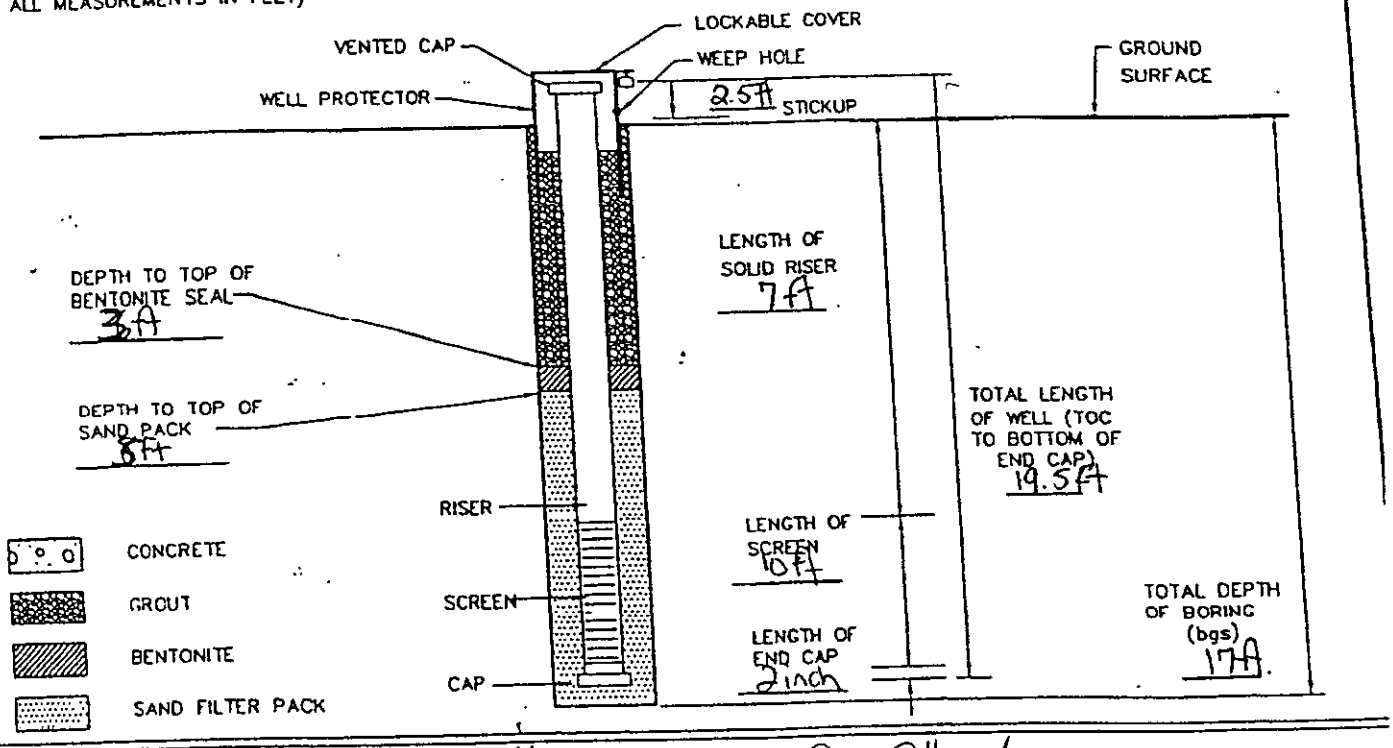
PROJECT NAME PSCR Supplemental F.S
PROJECT NO. 6301.03.0011
WELL NO. OUTPZ-6
WELL LOCATION Jogging Trail / Kingsland Creek
DATE 12/03/03
TIME 0900

GROUND SURFACE ELEVATION
TOP OF SCREEN ELEVATION
REFERENCE POINT ELEVATION
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL Sch. 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2 in SLOT SIZE 0.010"
RISER MATERIAL Sch. 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2 in
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Portland Type I/II
MANUFACTURER
BOREHOLE DIAMETER 8 in.
MACTEC FIELD REPRESENTATIVE Amy Callaway
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 1 5gal bucket
AMOUNT BENTONITE USED (GROUT)
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 5 bgs = 250 lbs
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Danny Cook
INSPECTOR: Amy Callaway
DISCREPANCIES:
CHECKED BY:
DATE:

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869 465

HTW DRILLING LOG

HOLE No. 047PZ-6

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID Hollow Stem Auger; 2"x2" split spoon sampler barrel	9. HOLE LOCATION (SITE): Jogging Trail / Kingsland Creek	
	10. SURFACE ELEVATION:	
8. WEATHER: Clear, 40's	11. DATE STARTED: 12/03/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: >17ft.	16. DEPTH GROUNDWATER ENCOUNTERED: 6 ft.	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 17ft.	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
047PZ-6S0 (16-18')	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
N/A						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Callaway

25. CHECKED BY:	26. NAME OF INSPECTOR
	Amy Callaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	0-6" top soil Very dark gray (10YR 3/1) clayey, med. grain SAND. with roots SP-SC	0.0ppm			2 5	8 inch recovery
	2	6" Yellow red (5YR 4/6) Sandy CLAY. CH				5,6	
	3						
	4						
	5	Red (2.5YR 4/8) Sandy CLAY CH				30,31	20 inch recovery
	6		0.0ppm			29,14	
	7	Reddish Gray (2.5YR 5/1) WET Gravelly, coarse SAND. with some clay. SP					
	8						
	9						
	10						

HTW DRILLING LOG

869 466

HOLE No. 047PZ-6

PROJECT DSCR Supplemental FS

INSPECTOR Amy Calloway

SHEET 2 OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	Greenish Gray (GLEY2 6/1) Damp Clayey, med to coarse grain SAND with some gravel SP-SC	0.0ppm			9,31 50/3"	14 inch recovery
	12			047PZ-6D. (10-18')			
	13	Greenish gray (GLEY2 6/1) Moist Clayey coarse grain SAND with gravel SP-SC	0.0ppm			10,31 39,50/3"	15 inch recovery
	14						
	15	Greenish gray (GLEY2 6/1) Clayey coarse SAND, with gravel Moist SP-SC.	0.0ppm			15,28 44,50	12 inch recovery
	16						
	17	Greenish gray (GLEY2 6/1) Wet clayey coarse grain SAND with gravel. SP-SC	0.0ppm			35 50/3"	6 inch recovery
	18	Refusal at 17ft bgs.					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301.03.0011

HOLE No. 047PZ-6

HF — Rev. 5/94

869 467

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

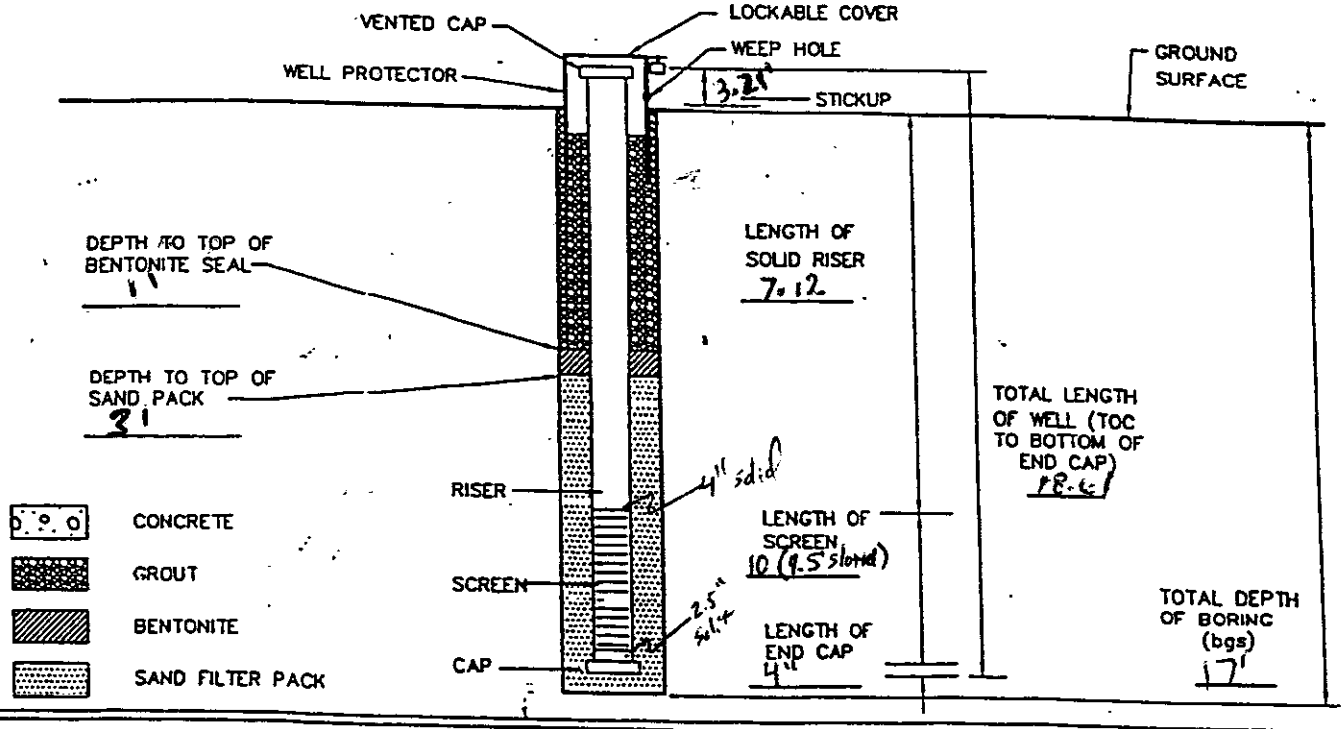
PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0011
WELL NO. 007 PZ-7 WELL LOCATION 007 Vernon Property
DATE 12-10-03 TIME ~~0900~~ 1230

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Silica Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL PVC SCH 40
MANUFACTURER DSI
SCREEN DIAMETER 2" SLOT SIZE 10
RISER MATERIAL PVC SCH 40
MANUFACTURER DSI
RISER DIAMETER 2"
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE I/II Portland
MANUFACTURER Roanoke Cement
BOREHOLE DIAMETER 10"
MACTEC FIELD REPRESENTATIVE C. Krambis
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 2 gallons
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 5 bags
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS Well bridged - redrilled borehole. Still had formation collapse @ top of screen after re-d

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: C. Krambis
DISCREPANCIES: — CHECKED BY: — DATE: —

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HTW DRILLING LOG

869 468

HOLE No. 007 PZ-7

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: Marcotte MST600
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSAs; 1 2/3" OD Drill rods; ~1.8" OD Split Spoon; 140lb Hammer	9. HOLE LOCATION (SITE): 007 Vernon Property
	10. SURFACE ELEVATION: —
8. WEATHER: Clear, cold Calm	11. DATE STARTED: 12-09-03 / 12. DATE COMPLETED: 12-10-03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 3.5' bgs
14. DEPTH DRILLED INTO ROCK: —	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —
15. TOTAL DEPTH OF HOLE: 17'	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
	1	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
Borehole collapsed Had to redrill.	—	X	—	Chi Kramb

25. CHECKED BY:

26. NAME OF INSPECTOR: C Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0						
	5	SAND, Sl. Silty (SP-SM), loose F-M gr2, light olive brown 5/2 2.5Y, Saturated	—	—	—	8,17,35,19	3 add'l Count may be due to rock
		Sandy well rounded gr2 gravel (GP) w/ Sl. silty SAND (as above) matrix.				N=52	14" Recovery
		SAND, Silty (as matrix) (SM), F-C dense, wet, light greenish gray 7/1 5GY Gley 1 some clay nodules	—	007-PZ-7 (8'-15')		35,32,50/4" N=—	4" recovery

869 469

HTW DRILLING LOG

HOLE No. 007 PZ-7

PROJECT: DSCR Supplemental FS

INSPECTOR: C. Krambis

SHEET 1 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Hand drilling - bit refusal					
		As above		007PZ-7 (8-15)		28, 48 50, 50/5" n=98	16" Recovery
		SAND silty, VF, dry, reddish brn 5/1 2.5YR As above c/ well rounded pebbles					
	15	?					
		Boring Terminated @ 17' bgs					
		Auger Refusal					
	20						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

ATTACHMENT 5.1E PIEZOMETER MONITORING WELL INSTALLATION DIAGRAM

PROJECT NAME DSCR Supplemental FS PROJECT NO. 16301-03-0011
WELL NO. OU7 PZ-8 WELL LOCATION OU7 Vernon Property
DATE 12-09-03 TIME 1600

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Silica Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC SCH 40
MANUFACTURER DSI
SCREEN DIAMETER 2" SLOT SIZE 10

RISER MATERIAL PVC SCH40
MANUFACTURER DSI
RISER DIAMETER 2"

DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE I/II Portland
MANUFACTURER Roanoke Cement

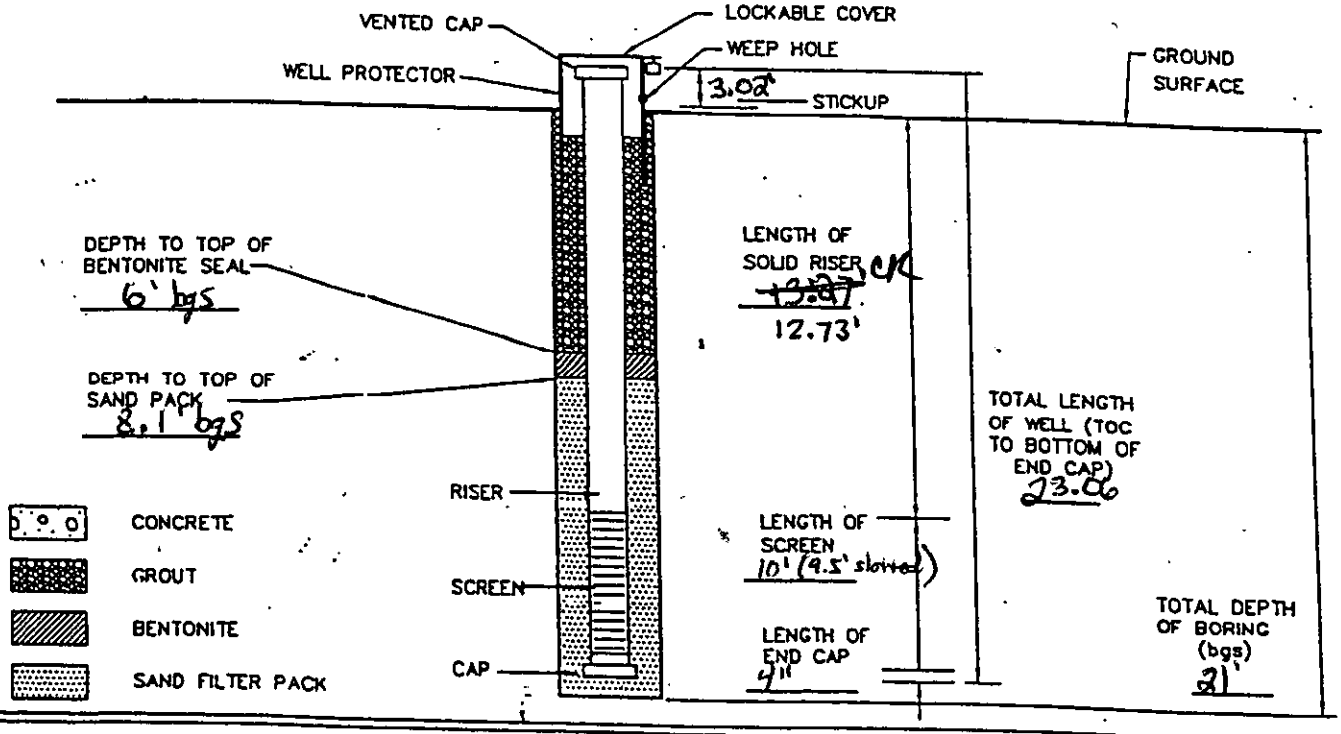
BOREHOLE DIAMETER 10 11
MACTEC FIELD REPRESENTATIVE C Krauss
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 2 gallons
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 5 1/2 50lb bags

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS Bore hole collapse may have occured during installation of Bentonite Seal due to Sandy formation used to raise up to 6 bgs

(NOT TO SCALE:
ALL MEASUREMENTS IN FEET)



QA / QC
DRILLER: Danny Cook INSPECTOR: C. Krauss
DISCREPANCIES: CHECKED BY: DATE:

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869 471

HTW DRILLING LOG

HOLE No. OU7 PZ-8

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
SHEET 1 OF 2 SHEETS	
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: Marooka MST600
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSAs; 1 2/3" OD Drill rods; 1.8" OD Split Spoons; 140 lbs Hammer	9. HOLE LOCATION (SITE): OU7 Vernon Property
	10. SURFACE ELEVATION: —
8. WEATHER: Clear, cold warm	11. DATE STARTED: 12-09-03 / 12. DATE COMPLETED: 12-09-03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 9'
14. DEPTH DRILLED INTO ROCK: —	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 4.71' BTOC
15. TOTAL DEPTH OF HOLE: 21' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
Good	—	X	—	Chris Krambis

25. CHECKED BY:

26. NAME OF INSPECTOR: Chris Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		SAND, silty (SM), F-M, qtz, Brown 7.5YR 4/3, moist from cuttings					
		Easy Drilling					
	5	SAND, silty (matrix) (SM), M-C, qtz subround, moist, light greenish-gray 5/10Y 6/1	0.2 ppm	OU7 PZ-8 (5'-20')	—	2-3-5 N=10	12" recovery
		Easy Drilling					
	10	SAND, silty (as matrix) as above with pebble-size full rounded qtz gravel, saturated, and some clay		OU7 PZ-8 (5'-20')		10,13,15,18 N=28	16" recovery

HTW DRILLING LOG

HOLE No. OU7 PZ-8

PROJECT DSCR Supplemental/FS | INSPECTOR C. Krambis | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	12						
		Some occasional gravel layers from 11' – 12' bgs, otherwise Easy drilling					
	15	SAND, Clayey (SC), clay as matrix, F-M. qtz, some pebble qtz gravel hard, - semi-consolidated, wet 7/1 5GY Gley 1 · light greenish gray Some clay nodules	Micaceous	OU7 PZ-8 (5'-20')	—	50/0" 25,47,4" n=72	5" recovery
	20	SAND, Silty (SM), silt as matrix, quart, F-M qtz, micaceous, gray 5/1 5Y, dense.		OU7 PZ-8 (5'-20')	—	14,28,29,37 n=57	4" recovery
		Boring Terminated @ 21' bgs					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF · Rev. 4/94

869 473

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (STICK-UP COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0011
WELL NO. OU7PZ-9 WELL LOCATION Vernon's Project
DATE 1/9/04 TIME 1300

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2 inch SLOT SIZE 0.010"
RISER MATERIAL Sch. 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2inch
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

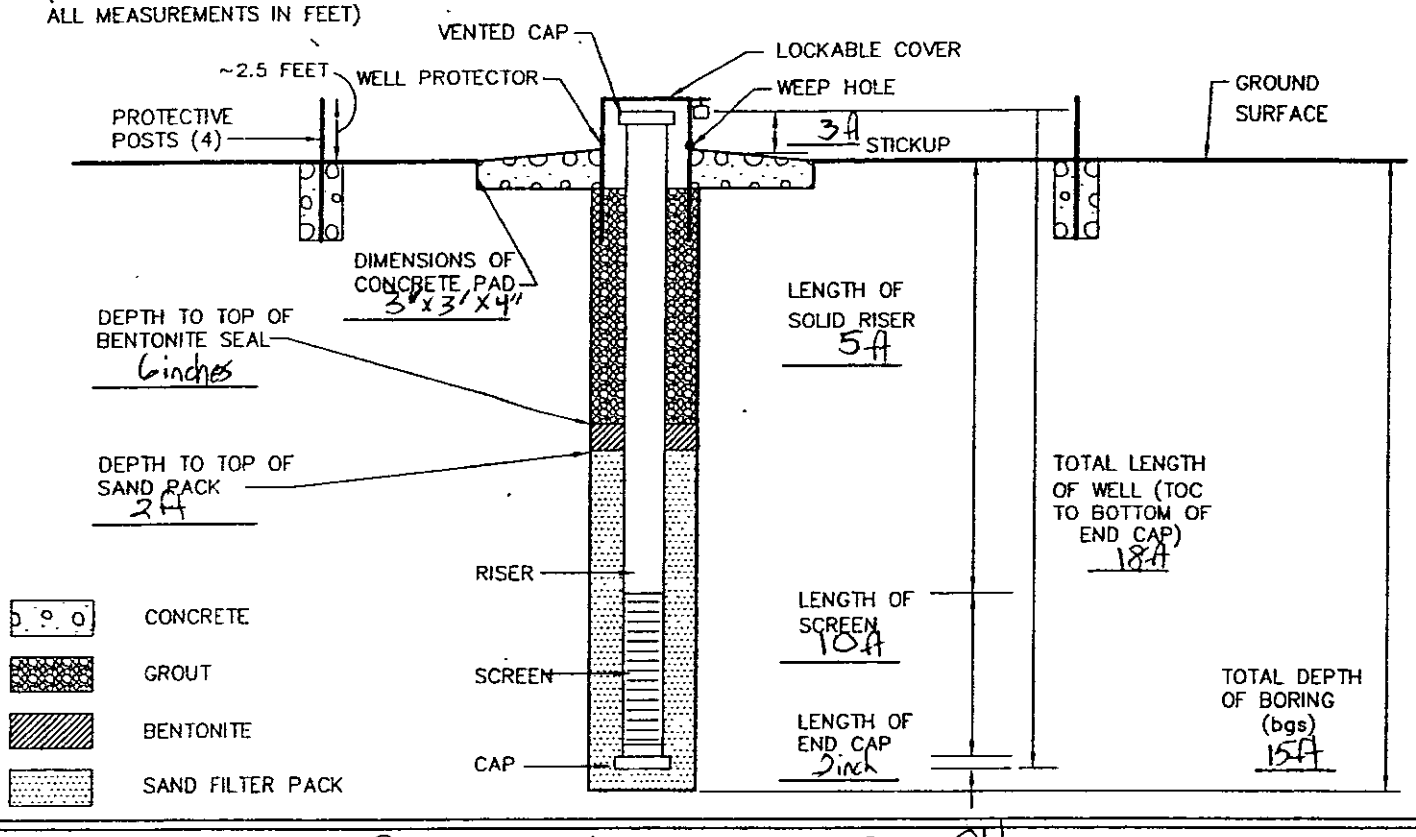
BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke

BOREHOLE DIAMETER 10inch
MACTEC FIELD REPRESENTATIVE Amy Calloway
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 50lbs
AMOUNT BENTONITE USED (GROUT)
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 5bgs = 50lb each

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Calloway
DISCREPANCIES: CHECKED BY: DATE:

HTW DRILLING LOG

HOLE No. OU7PZ-9

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.2" ID Hollow Stem Augers, 2' x 2" split spoon barrel Sampler	9. HOLE LOCATION (SITE): Vernon's property
	10. SURFACE ELEVATION: —
8. WEATHER: Snowy, 30's	11. DATE STARTED: 1/9/04
	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS:	16. DEPTH GROUNDWATER ENCOUNTERED:
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE:	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Amy Callaway

25. CHECKED BY:	26. NAME OF INSPECTOR: Amy Callaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1						
	2						
	3						
	4	Loose, Light Gray (GLEY1 N7/1)				5,7	12/24
	5	clayey SAND. Moist				9,9	
	6	med-coarse grain SPSC					
	7						
	8					8,11	12/24
	9					15,11	
	10						

MRK FORM JUN 89 55

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. OU7PZ-9

HF - Rev. 4/94

869 475

HTW DRILLING LOG

HOLE No. OU7PZ-9

PROJECT DSCR Supplemental FS | INSPECTOR Amy Callaway | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11						
	12					9, 20	18/24
	13	13.5-14- Mottled Pale Yellow (2.5Y 7/3) Strong Brown (7.5YR 5/8) Light Bluish Gray (GLEY2 5B 7/1) Sandy Clay. Dry. CL				26, 30	
	14						
	15	Boring terminated					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011 | HOLE No. OU7PZ-9 HF Rev. 4/94

Appendix D-4

OU13 HTW Log / Monitoring Well Construction Details

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301.03.0011

WELL NO. MWPAH-1 WELL LOCATION 0413

DATE 11/19/03 TIME 0930

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC sch.40

MANUFACTURER DSI

SCREEN DIAMETER 2inch SLOT SIZE 0.01

RISER MATERIAL PVC sch.40

MANUFACTURER DSI

RISER DIAMETER 2inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25 inch ID

BENTONITE TYPE 3/8 pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE Amy Calloway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 2ft.

AMOUNT BENTONITE USED (GROUT) 15lb

AMOUNT CEMENT USED (GROUT) 94lb

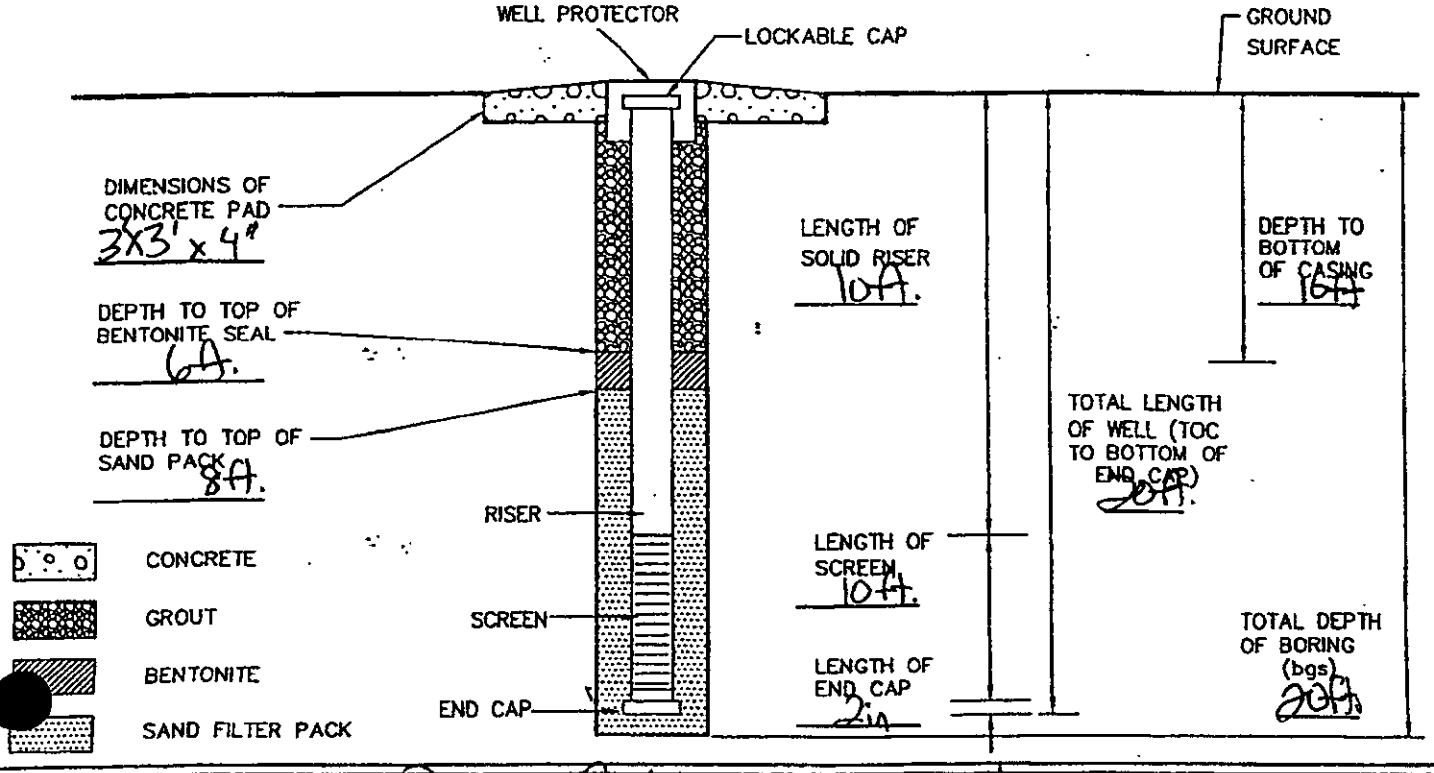
AMOUNT SAND USED 6 bg = 300 lbs

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Calloway

DISCREPANCIES: CHECKED BY: DATE:

869 477

869 478

HTW DRILLING LOG

HOLE No. MWPAH-1
SHEET OF SHEETS

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simms
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA.
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GUSPECK 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 inch ID Hollow Stem Auger; 3-inch X 2ft split spoon barrel sampler	9. HOLE LOCATION (SITE): OUB RMO restricted area
	10. SURFACE ELEVATION: —
8. WEATHER: Overcast, 60's	11. DATE STARTED: 11/19/03 — 12. DATE COMPLETED: 11/20/03
13. OVERBURDEN THICKNESS: > 20ft	16. DEPTH GROUNDWATER ENCOUNTERED: 4-5 feet
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 5.84 bgs - 48 hours
15. TOTAL DEPTH OF HOLE: 20ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
3			PAH			

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Amy Callaway

25. CHECKED BY:

26. NAME OF INSPECTOR: Amy Callaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Yellowish red (5YR 4/6) ~~clayey~~ gravelly, poorly graded, ~~fine~~ coarse grain SAND with gravel SP-SC, FILL	8.3 ppm		MW-PAH-ISO (0-2)	~~2~~ 17, 50/5	
	2	Red (2.5YR 4/6) ~~Fill, V. clayey~~ poorly graded, fine to medium grain SAND. FILL with pieces of brick SC	7.9 ppm		MW-PAH-ISO (2-4)	11,6 3,4	
	4	Reddish Gray (2.5YR 5/1) Wet, fine to medium grain Sandy GRAVEL. GP-GM	0.9 ppm		MW-PAH-ISO (4-6) MW-PAH-DUP1	32,50 46,20	
	6						
	7						
	8						
	9						
	10						

HTW DRILLING LOG

HOLE No. MWPAH-1

PROJECT DSCR Supplemental FS | INSPECTOR Cary Calloway | SHEET OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Light greenish gray (GLEY1 7/1) wet, slightly clayey, medium to coarse grain SAND, poorly graded. SP	0.0 ppm		~~25,25c~~	29,20 ~~35,29~~	12 inch recovery
	11				~~35,39~~		
	12						
	13						
	14						
	15	Greenish gray (GLEY1 6/1) clayey, wet, medium to coarse grain SAND. poorly graded increasing clay content.	0.0 ppm	~~0.0 QAQC~~		10,28 41,50	12 inch recovery
	16						
	17						
	18						
	19	Greenish Gray (GLEY1 6/1) Moist very clayey, medium to coarse grain SAND. Poorly graded.	0.0 ppm	MWPAH-1SO (19-21')		21,38 40,48	16 in recovery
	20						
	21	Boring terminated at 20 feet below ground surface.					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301.03.0011 | HOLE No. MWPAH-1

HF - Rev. 4/94

Appendix D-5

CSM HTW Logs / Monitoring Well / Piezometer Construction Details

869 481

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011

WELL NO. CSMMW-1A WELL LOCATION BETWEEN WH 10 AND WH 11

DATE 11/21/03 TIME 10:38

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK SAND GRADATION 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Holow STEAM Augen

AUGER/BIT SIZE AND TYPE

REMARKS

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 pounds

AMOUNT BENTONITE USED (GROUT)

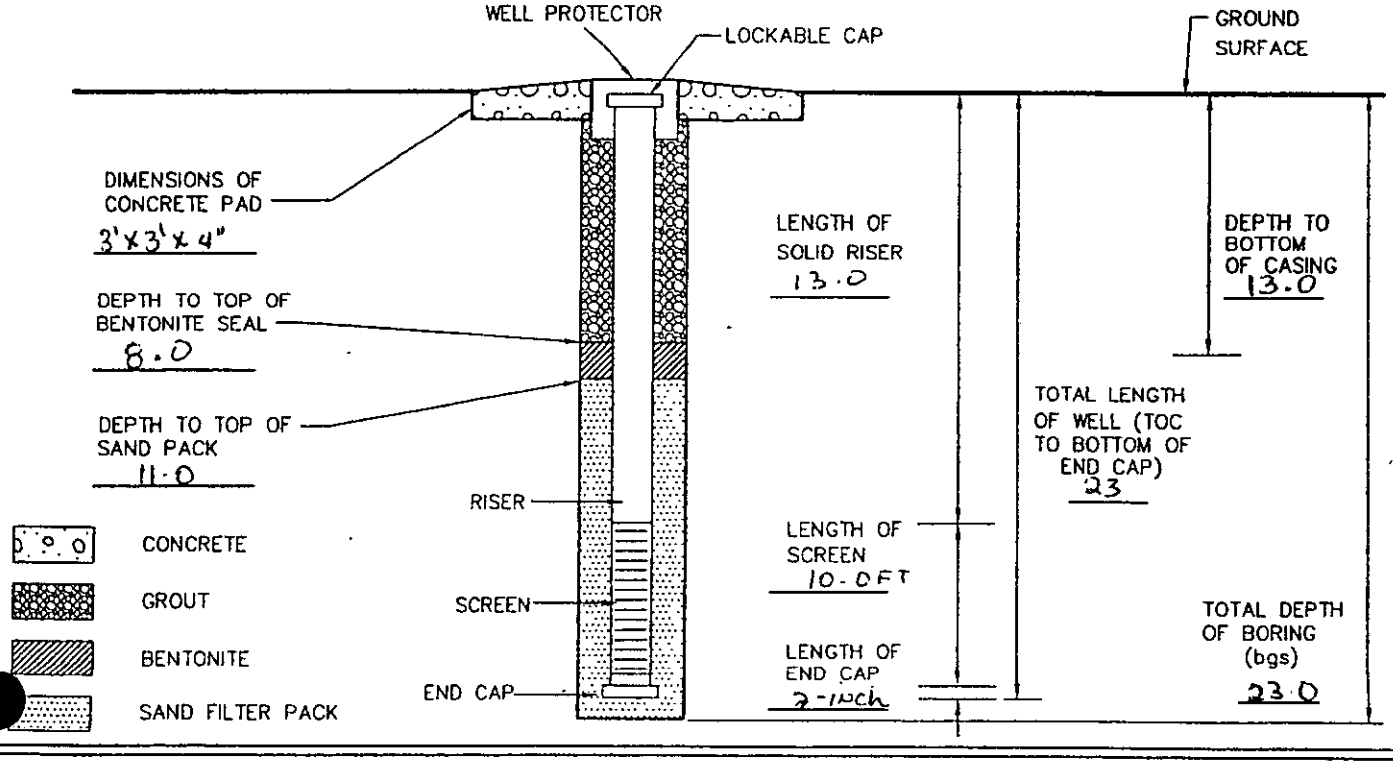
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Inco INSPECTOR: M. Vazquez

DISCREPANCIES: CHECKED BY: DATE:

869 482

Lower

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301-03-0011

WELL NO. CSmmw-1B WELL LOCATION Between WH 10 and WH 11

DATE 11/20/03 TIME 0800

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION 20/40

FILTER PACK MANUFACTURER OSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER OSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.010inch

RISER MATERIAL Sch. 40 PVC

MANUFACTURER OSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25"ID

REMARKS Well installed as nest with CSmmw-1C

BENTONITE TYPE 3/8" pellets

MANUFACTURER OSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) —

AMOUNT BENTONITE USED (GROUT) —

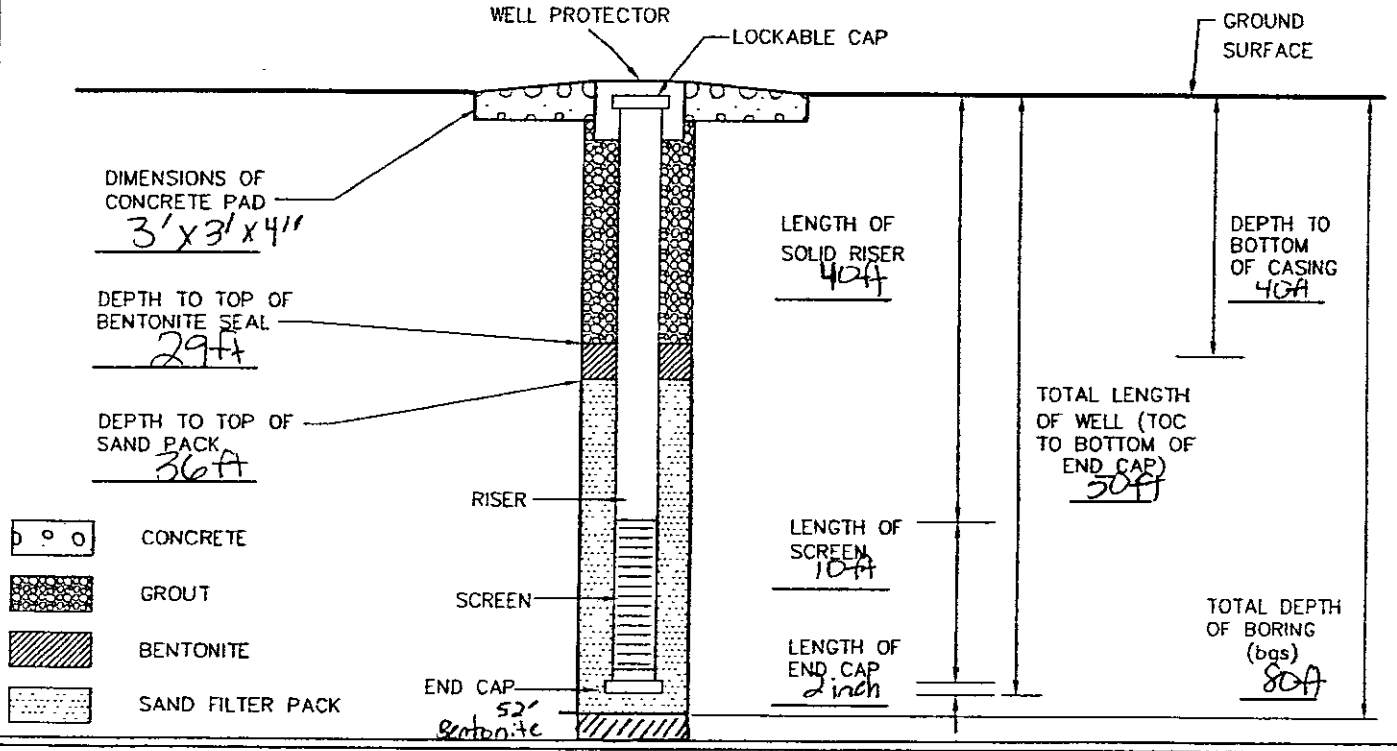
AMOUNT CEMENT USED (GROUT) —

AMOUNT SAND USED —

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez

DISCREPANCIES: — CHECKED BY: — DATE: —

Saprolite

869 483

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301-03-0011

WELL NO. CSMMW-1C WELL LOCATION Between WH 10 and WH 11

DATE 11/20/03 TIME 0800

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.010 inch

RISER MATERIAL Sch. 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS Well installed as nest with CSMMW-4B

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL)

AMOUNT BENTONITE USED (GROUT)

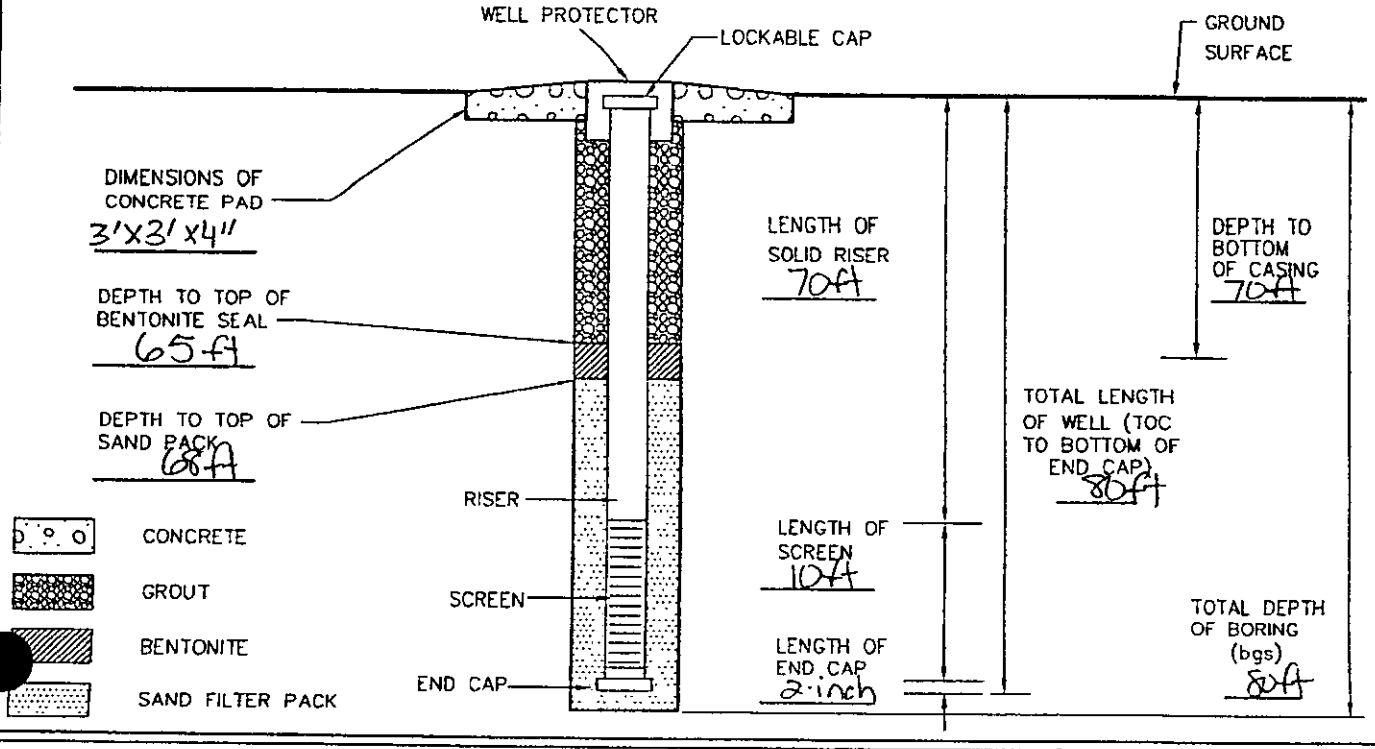
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez

DISCREPANCIES: CHECKED BY: DATE:

869 484

HTW DRILLING LOG

HOLE No. CSMMW-1

1. COMPANY NAME: MACTEC ENGINEERING & CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): Richmond VA	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 9.25-inch ID Hollow Stem Augers; 2-inch x 2 Ft split Barrel Sampler	9. HOLE LOCATION (SITE): Between WH 10 and WH 11	
	10. SURFACE ELEVATION	
8. WEATHER: cool Cloudy	11. DATE STARTED: 11/19/03	12. DATE COMPLETED
13. OVERBURDEN THICKNESS	16. DEPTH GROUNDWATER ENCOUNTERED	
14. DEPTH DRILLED INTO ROCK	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR

25. CHECKED BY:	26. NAME OF INSPECTOR

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	COARSE GRAVEL with SAND (Fill)					
	2						
	3	Strong Brown (7.5YR 5/8) Slightly Clayey poorly graded medium to coarse SAND with gravel - Description from cuttings. (SP-SC)					
	4	NO RECOVERY				5,2,2 4	12 44
	5						
	6						
	7						
	8						
	9						24" Recovery
	10	STIFF, MOTTLED Light RED (2.5YR 6/8) Pinkish gray (7.5YR 7/2) SILTY CLAY with some GRAVEL (CL)				5,3,5,5	12 55 WATER 10'

HTW DRILLING LOG

HOLE No. CSMMW-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14	DENSE, Pinkish White (7.5YR 8/2) SILTY POORLY GRADED MED. to COARSE SAND (SP)				M 15, 24 30	1300 RECOVERY 24 inch
	15						
	16						1310 24" RECOVERY
	17		MW (CSMMW-1A	MW CSMMW-1A			
				CSMMW-1 (16-17)			11/20/03
	18	VERY DENSE, PINKISH WHITE (7.5YR 8/2) SILTY POORLY GRADED MED TO COARSE SAND AND GRAVEL (SP)/(GP)	0.0 Background				14, 26, 26
	19		0.0 BZ				24 24" RECOVERY
	20	Firm, Reddish Yellow (7.5 YR 6/8) SILTY POORLY GRADED MED SAND AND GRAVEL (SP / GP)					7, 15, 15, 14
	21						9" RECOVERY
	22	~~VERY~~ STIFF, ~~YELLOWISH BROWN~~ Brownish Yellow (10YR 6/8) SILTY CLAY (CL) DAMP	0.1 Background 0.0 BZ				6, 6, 11, 16
	23						
	24						4, 7, 9, 10
	25						
	26	STIFF, DARK greenish gray (GLEY 1 5GY 4/1) FAT CLAY (CH) DRY					4468
	27		0.0 Background 0.0 BZ				
	28						

HTW DRILLING LOG

HOLE No. CSMMW-1

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VÁZQUEZ

SHEET 3 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS ppm	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	29	VERY STIFF, DARK GREENISH GRAY (CLEY 1 5GY 4/1 FAT CLAY (CH) DRY				7,9,12,11	24" RECOVERED
	30		0.0 BACKGROUND			7,7,10,14	24" RECOVERED
	31		0.0 BZ				
	32					5,6,9,12	24" RECOVERED
	33						
	34					7,10,11,12	24" RECOVERED
	35						
	36						1047
	37	~~DENSE~~ LOOSE, VERY DARK GREENISH				7,9,12,22	24" RECOVERY
	38	GRAY (5GY 3/1, GLEY 1) POORLY GRADED FINE SAND (SP) MOIST					SA 1055
	39	(DAMP)				17,18,38 50/4"	24" RECOVERY
	40						S 1110
	41		0.0 BACK 0.0 BZ	CSMMW-1B (40'-42')		10,16,30 50	20" RECOVERY
	42						
	43						
	44						
	45	SAME AS ABOVE WITH SOME PEBBLES.				2,16,24 50/4	1137 RECOVERY 24"
	46						

HTW DRILLING LOG

HOLE No. CSMMW-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 4 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS PPM d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	Brn GRAVEL VERY DENSE, GRAY (GLEY 1 N5/) Poorly graded FINE to MEDIUM SAND (SP) WET with some PEBBLES.	0.2 Background			24,55	11:50 Recovered 11"
	50		0.2 BZ				S
	51						
	52						SA
	53						
	54					25,50/5"	1203 11"-Recovery
	55						BS
	56						
	57						B
	58						BS
	59	NO RECOVERY	Background 0.2			50/3"	1216
	60		BZ = 0.2				
	61						
	62						
	63						
	64						

HTW DRILLING LOG

HOLE No. CSMMW-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Jazquez

SHEET 5 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS PPM	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	64	VERY DENSE, PALE GREEN (GLEY 1 5G 4/2) CLAYEY POORLY				22,50/5	1235
	65	graded MEDIUM to Coarse SAND (SC) MOIST					10" RECOVERY
	66	SAPROLITE					B
	67						
	68						SA
	69	weathered Rock described as:	0.0 Background				
	70	grayish green (GLEY 1 5G 5/2) CLAYEY SAND	0.0 BZ	CSMMW-1C (70-71)		27,50 50/2"	1245 S
	71						
	72						
	73						
	74						
	75						
	76						
	77						
	78						
	79						
	80	BORING TERMINATED AT 80.0 FT BGS					S

MRK FORM JUN 89 55-2 | PROJECT NAME & NO: DSCR Supplemental FS 6301-03-0011 | HOLE No. CSMMW-1 | HF - Rev. 4/94

(a) LOWER

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME USER Supplemental FS — PROJECT NO. 6367-03-004

WELL NO. CMS MW-2B — WELL LOCATION Fire Department Bldg. 201 (Auburn Cheney Rd & Road G)

DATE 12-03-03 — TIME 0960

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Silica Sand — GRADATION #1

FILTER PACK MANUFACTURER DSI (Drillers Services, Inc.)

SCREEN MATERIAL PVC SCH 40

MANUFACTURER DSI

SCREEN DIAMETER 2-in ID — SLOT SIZE 10

RISER MATERIAL PVC SCH 40

MANUFACTURER DSI

RISER DIAMETER 2-in ID

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25-in ID

REMARKS Bit cuts a nominal 10 in borehole

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI Shur-Pel

CEMENT TYPE Type I/II Portland

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 10-in

MACTEC FIELD REPRESENTATIVE CK ; MV

DRILLING CONTRACTOR Simmons

AMOUNT BENTONITE USED (SEAL) 4 gallons

AMOUNT BENTONITE USED (GROUT) —

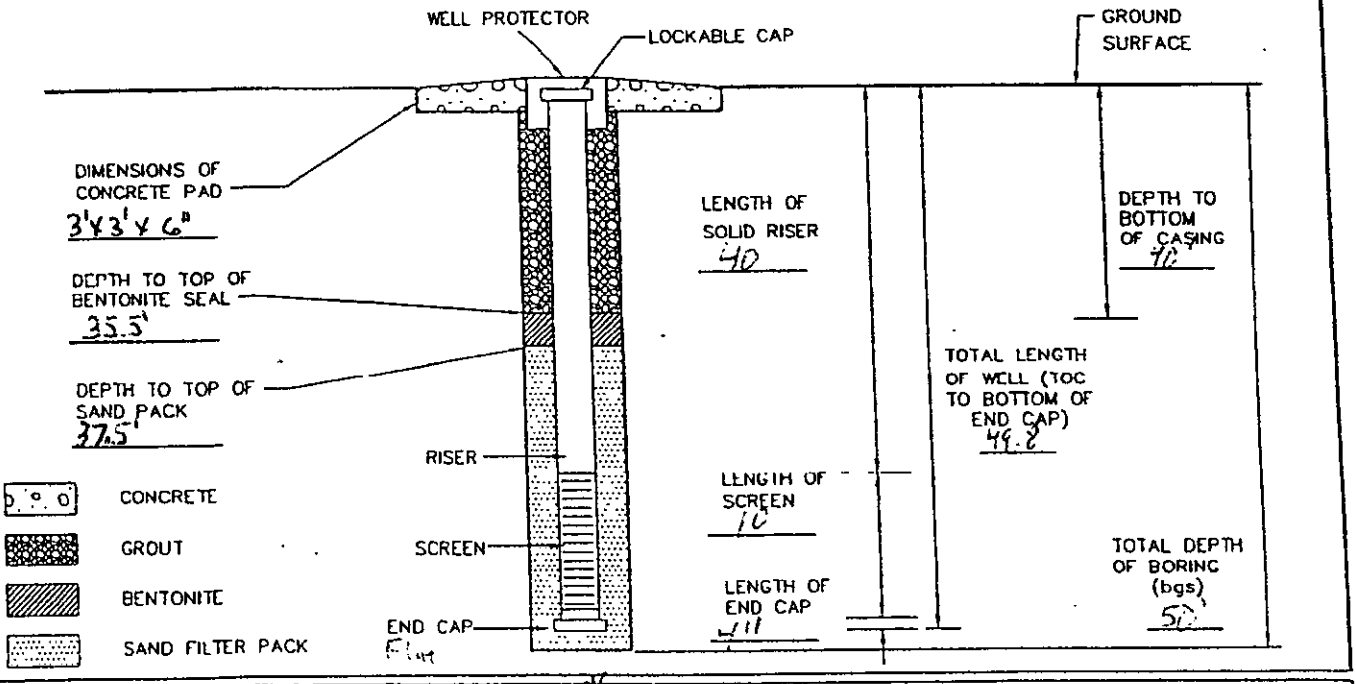
AMOUNT CEMENT USED (GROUT) —

AMOUNT SAND USED 5 1/2 50 lb bags

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) 36.30 bgs 12-05-03 0730

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Simmons Drilling — INSPECTOR: C Krambis

DISCREPANCIES: None — CHECKED BY: _____ — DATE: _____

J:\design\Standard Details\Well installation diagrams\ATACH 5-1b8.dwg 12/23/2002 10:38am taladsto

869 490

HTW DRILLING LOG

HOLE No. CSMMW-2

SHEET 1 OF 4 SHEETS

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: RICHARD SIMMONS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): RICHMOND VA
5. NAME OF DRILLER: CHRIS LACKO	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 8 4.25 INCH ID HOLLOW STEM AUGERS	9. HOLE LOCATION (SITE): FRONT OF FIRE DEPARTMENT
	10. SURFACE ELEVATION: PROVIDED UNDER SEPARATE SHEET
8. WEATHER: SUNNY ± 45°F	11. DATE STARTED: 12/02/03 — 12. DATE COMPLETED: 12/9/03
13. OVERBURDEN THICKNESS: MORE THAN 51 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ± 12.0 FT BGS
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
15. TOTAL DEPTH OF HOLE: 50.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	✓		NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		Miguel A V

25. CHECKED BY:	26. NAME OF INSPECTOR
	M. VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS ppm	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	FILL - GRAVEL AND FINE SAND				9-10-12-15	24" RECOVERY
	1						
	2	VERY STIFF, STRONG BROWN (7.5YR 5/8) SLIGHTLY SILTY CLAY (CL) DRY					
	3						
	4	DENSE, RED (10R 4/8) SILTY CLAYEY POORLY GRADED MED to COARSE SAND (SC) DRY	0.0 Background mw 0/0 2.0 BZ			15-19-28-28	24" RECOVER
	5						
	6						
	7						
	8						
	9	FIRM, LIGHT GRAY (10YR 7/1) FINE SANDY SILTY CLAY (CL) (MOIST)				2,4,4,8	24" RECOVERY
	10						

HTW DRILLING LOG

HOLE No. CSMMW-2

PROJECT: DSCR Supplemental FS | INSPECTOR: M. Vazquez | SHEET 2 OF 34 (MW) SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11						
	12						
	13						
	14	FIRM, STRONG BROWN (7.5YR 5/8) SILTY WELL GRADED FINE TO COARSE	0.0 Backgro			9-10-11-13	20" Recovery
	15	SAND with gravel (SW) SATURATED	0.0 B2 0.0 Borehole				
	16						
	17						
	18						
	19	FIRM, STRONG BROWN (7.5YR 5/8 GRAVELLY WELL GRADED FINE TO				4, 11, 13, 19	20" RECOVERY
	20	COARSE SAND (SW) SATURATED					
	21		0.0 Background 0.0 B2 0.0 Borehole			8, 8, 11, 10	
	22	VERY STIFF, YELLOWISH RED (5YR 5/8) CLAY (CH) (WET)					
	23					6, 13, 12, 13	
	24	VERY STIFF, MOTTLED PINKISH WHITE (7.5YR 8/2) REDDISH YELLOW (7.5YR 7/8) FINE LAMINATED CLAY CH (DRY)					
	25					7, 9, 13, 13	
	26						
	27	HARD, DARK GRAY (GLEY 1 N4/)				5, 8, 15	
	28	CLAY (CH) (DRY)				22	

869 492

HTW DRILLING LOG

HOLE No. CSMMW-2

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 43 mw OF 84 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29					4,9,13,18	
	30						
	31					6,9,16,19	
	32						
	33	BECOMING WITH SOME FINE SAND				7,10,14 16	
	34						
	35	STIFF, VERY DARK GRAY (GLEY 1 N3/) FINE SANDY CLAY (CL)				5,6,8,8	
	36						
	37					11, 22,39 43	
	38	VERY DENSE, VERY DARK GRAY GLEY 1 N3/ FINE POORLY GRADED SAND (SP) MOIST					
	39					11,13,19 50/4"	
	40	DAMP					
	41						
	42						
	43						
	44	VERY DENSE, GRAY (GLEY 1 N6/) POORLY GRADED SILTY MEDIUM TO COARSE SAND WITH GRAVEL (SP)		CSMMW-2 (38-51)		15, 31 50/5"	
	45						
	46						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR SUPPLEMENTAL FS 6301-03-0011 | HOLE No. CSMMW-2

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMMW-2

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 3 (MW) OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49						
	50	Borehole terminated at 50.0ft below ground surface				30-50/4"	
	51						
	52						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-2

HF - Rev. 4/94

869 494

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301-03-0011
WELL NO. CSMMW-3A WELL LOCATION South of the DORV North Entrance
DATE 12/11/03 TIME 0745

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2-inch SLOT SIZE 0.010"

RISER MATERIAL sch. 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke

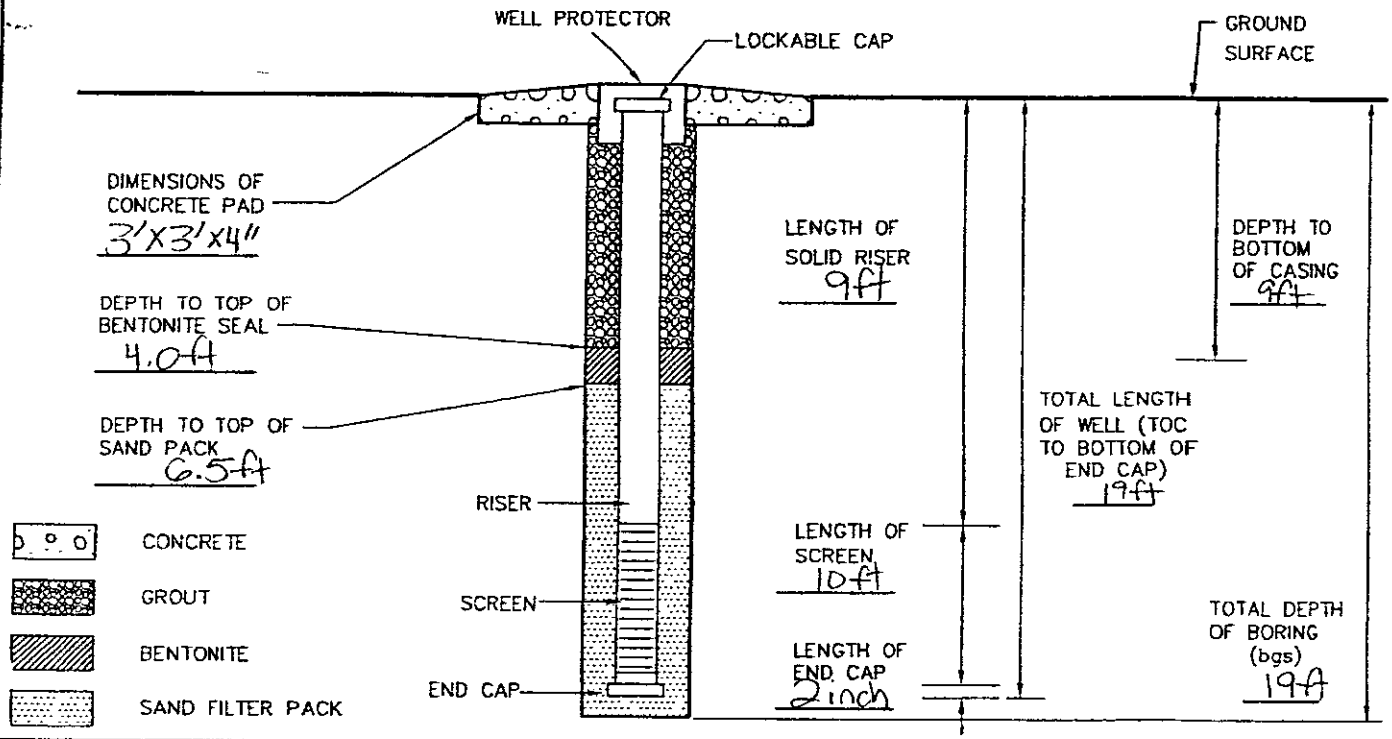
BOREHOLE DIAMETER 8-inch
MACTEC FIELD REPRESENTATIVE M. Vazquez
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) —
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED —

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez
DISCREPANCIES: — CHECKED BY: — DATE: —

Lower

869 495

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301.03.0011

WELL NO. CSMMW-3B WELL LOCATION South of the ORV North Entrance

DATE 12/5/03 TIME 1424

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION # 1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.010"

RISER MATERIAL sch 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS Well installed as nest with CSMMW-3C.

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) —

AMOUNT BENTONITE USED (GROUT) —

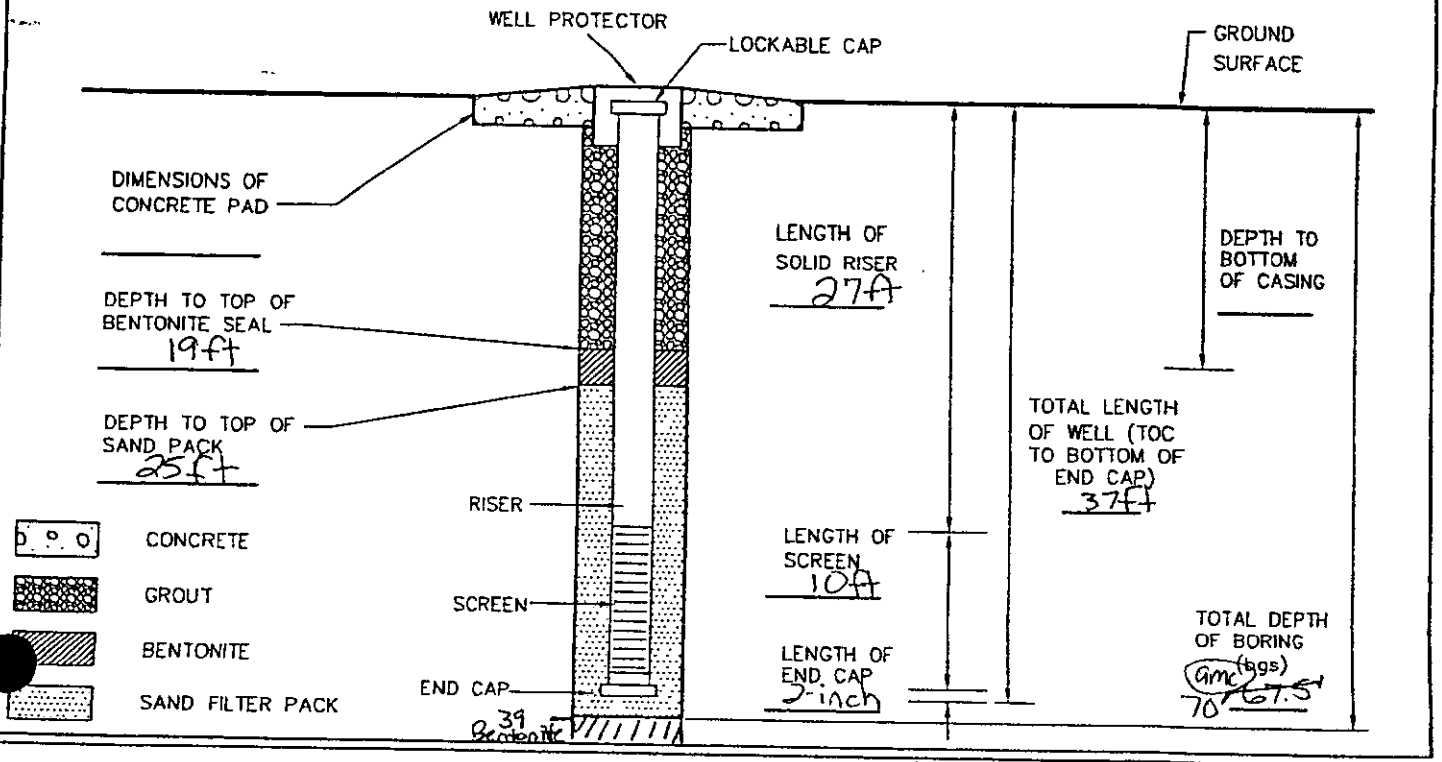
AMOUNT CEMENT USED (GROUT) —

AMOUNT SAND USED —

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez

DISCREPANCIES: — CHECKED BY: — DATE: —

869 496

Saprolite

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME ~~CSMMW-3B DSCR~~ PROJECT NO. 6301-030011

WELL NO. CSMMW-3C WELL LOCATION South of the DORV North Entrance

DATE 12/5/03 TIME 1200

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.010 inch

RISER MATERIAL Sch. 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" IB

REMARKS Well installed as nest with CSMMW-3B.

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) —

AMOUNT BENTONITE USED (GROUT) —

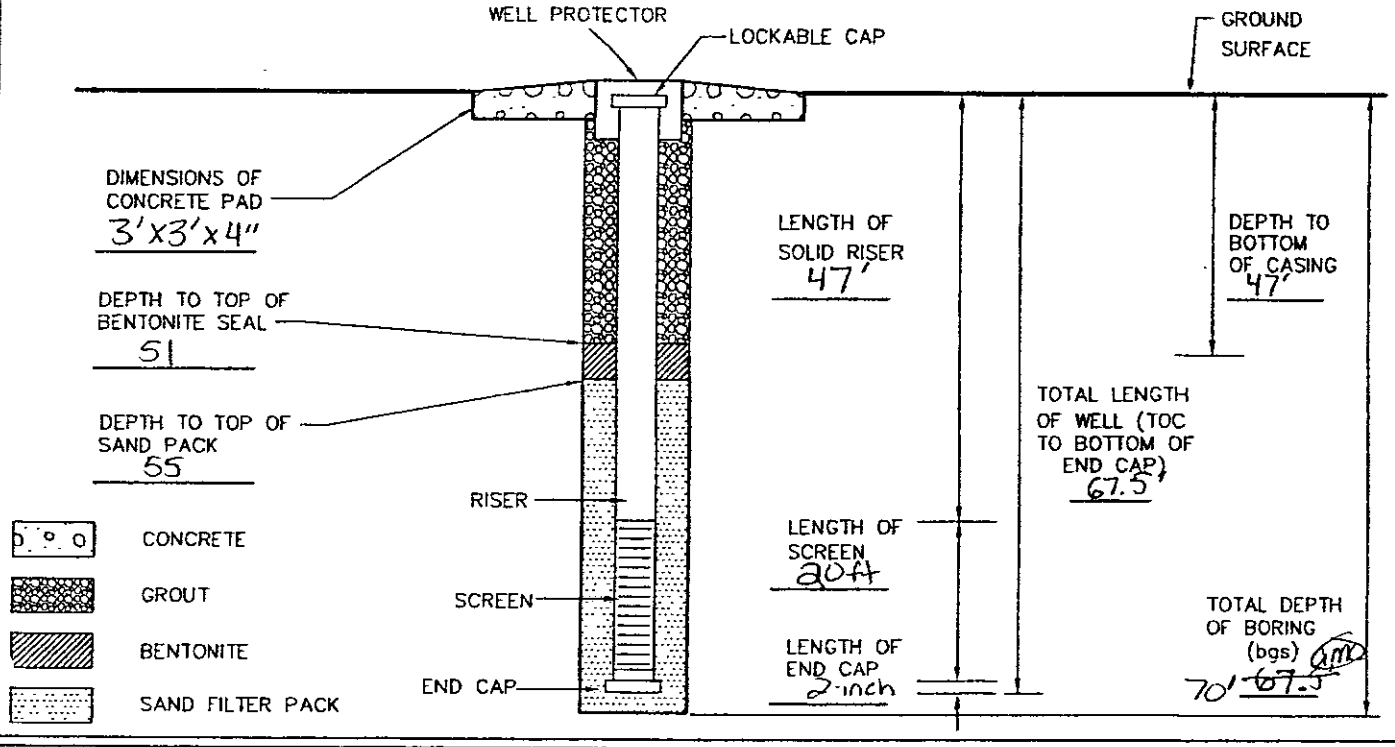
AMOUNT CEMENT USED (GROUT) —

AMOUNT SAND USED —

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez

DISCREPANCIES: — CHECKED BY: — DATE: —

HTW DRILLING LOG

869 497

HOLE No. CSM MW-3

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons
SHEET: OF 1 SHEETS	
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Chris	6. MANUFACTURER'S DESIGNATION OF DRILL
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: HSA; 4.25-in ID; 2-in barrel (1.8" OD) 2.4' long; 3-in barrel for CBR	9. HOLE LOCATION (SITE): Guard Shack
	10. SURFACE ELEVATION: —
8. WEATHER: Cold, overcast, breezy	11. DATE STARTED: 12-03-03
	12. DATE COMPLETED
13. OVERBURDEN THICKNESS: More than 70 FT	16. DEPTH GROUNDWATER ENCOUNTERED: —
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE: 70 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
	Split-Spoon	CBR	

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
			AMIBA			

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR

25. CHECKED BY:	26. NAME OF INSPECTOR: C Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	Fill, gravel, sand				24-20 11-19 n=37	90%
	1	CLAY (CL), sandy, well rounded gtz gravel @ 1-1.5', some carbonaceous material, V. Stiff red 2.5YR 4/6-4/8					
	5	~~Sand (SM), silty, olive gy 5Y 5/2~~ As above to 5' CK				8-13	
		SAND (SM), silty, olive gy 5Y 5/2				15-14 n=28	90%
	10	CLAY (SC) sandy, cohesive, v stiffy lt. gy 5Y 7/1 (From 8-8.5 fill from above.)			1	7-14 25-31 n=39	12"

869 498

HTW DRILLING LOG

HOLE No. CSm MW-3

PROJECT PSCR Supplemental FS | INSPECTOR C. Krambis / M. Vazquez | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	CLAY (CL), Sandy, Fine, lt-gy as above w/ well rounded qtz gravel up to 10 mm		CSm MW-3 SO (10-11')	1	16-34 38-40 n=72	15" recovery (5 CBR)
▽	15	SAND (SC) Clayey, rounded fine qtz gravel, mod. loose, shell frags (fine-gr) Olive Yellow 2.5Y 6/6 - 6/8				2-3 7-15 n=10	19" recovery SS
		NR (NO RECOVERY)		CSm MW-3 SO (20-22')	2	12-11 4-5 n=15	CBR #2 9" recovery 3 CBRs avg
	30	SAND (SC), Clayey & gravelly V. loose, Strong Brown 7.5YR 5/8				2,8- 20,31 N=28	9" rec
		NR					
		SAND (SC), silty & clayey w/ gravel as above					
		SAND (SC) silty, clayey & gravelly gravel is well rounded qtz up to 5 cm, Strong brown 7.5YR 5/8				12,50- 50/5"	Refusal @ 23.5'
		NR				19,32- 45, 50/5" n=77	12" rec
	45	SAND, V dense, silty, F-M. qtz, Mixed orange & white blending, occas SS and well rounded qtz gravel up to 3 cm					
		NR				5-16 50/4"	6" rec
		As above					
		~~Refusal @ 27.4' MW~~					

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. CSm MW-3 Supplemental FS 6501-03-0011 | HOLE No. CSmmw-3

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CMS MW-3

PROJECT DSCR Supplemental FS | INSPECTOR C Krambis / M. Vazquez | SHEET OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	25	SAND (SP) - FM, gravelly, dense, QTZ, Silty (conglomerate) yellowish red 5YR 5/6, poss. Feldspathic, Most of QTZ are rounded				8, 43, 50/5" n=93	6" REC
		29.25 R					
	30	As above but Strong Brown 7.5YR 4/6 Clasts are rounded				30, 50 50/3" n=100	12" Rec
		~~Refusal @ 31.3~~ MW					
		SAND (SM) Silty, clayey w/ well rounded QTZ clasts (2cm) Strong brown 7.5YR 5/8				15, 50, 50, 50/3" n=100	14" Rec
		R @ 33.75' b.g.					
		SAND (SM), Silty, gravelly, well rounded QTZ clasts, weathered feldspars, rare small large clasts in between 4" Strong brown 7.5YR 5/8				23, 50/3"	16" Rec
	35	~~Refusal @ 34.8'~~ MW					
		SAND, F-C, gravelly, silty (SM-GM) QTZ. clasts are rounded Reddish-Yellow 7.5YR 6/8				21, 23, 41, 50/4" n=64	20" Rec
		~~Refusal @ 37.7' b.g.s~~ MW					
						45, 50/5	
	40	VERY DENSE, WHITE (10YR 8/1) Poorly graded SILTY COARSE SAND and Gravel MW FP SP CP GD DRY				15, 49 50/3	
	45					4, 25 50, 50/3	

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 63801-03+0011 | HOLE No. CSM MW-3

HF - Rev. 4/94

869 500

HTW DRILLING LOG

HOLE No. SMMW-3

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET: OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	VERY DENSE, WHITE (10YR8/1) POORLY GRADED SILTY MEDIUM				32, 50/3	9" RECOVERY
	50	COARSE SAND AND FINE GRAVEL SP/GP - DAMP					
	51						
	52	Partially WEATHERED ROCK DESCRIBED AS SAPROLITE,					
	53	Light greenish gray, micaceous					
	54	WELL GRADED silty FINE to COARSE				50, 50/3"	
	55	SAND (SM) Moist					
	56						
	57	REFUSAL AT 57.0 FT. Switch					
	58	FROM Hollow STEAM Auger to					
	59	Rotary drilling.					
	60						
	61						
	62						
	63						
	64						

MRK FORM JUN 89 55-2

PROJECT NAME & NO: DSCR SUPPLEMENTAL FS USCI-03-0011

HOLE No. CSMMW-3

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMMW-3

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET: OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	64						
	65						
	66						
	67						
		BORING CAVE IN FROM 67 TO 70 FT BGS					
	68						
	69						
	70	BORING TERMINATED AT 70 FT BELOW GROUND SURFACE					TWO MONITORING WELLS WERE INSTALLED IN THE SAME HOLE CSMMW-3B and CSMMW-3C

869 502 UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-0011

WELL NO. ~~Diff PZ + CMS MW-16~~ WELL LOCATION CSM MW-4B Jogging Trail

DATE 12-05-03 TIME 1730

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Silica Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" SLOT SIZE 10

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellet

MANUFACTURER DSI

CEMENT TYPE I/II Portland

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 10"

MACTEC FIELD REPRESENTATIVE C. Krambis

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 5 ~~5~~ 50 lbs

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

AMOUNT SAND USED 6 50 lb bags

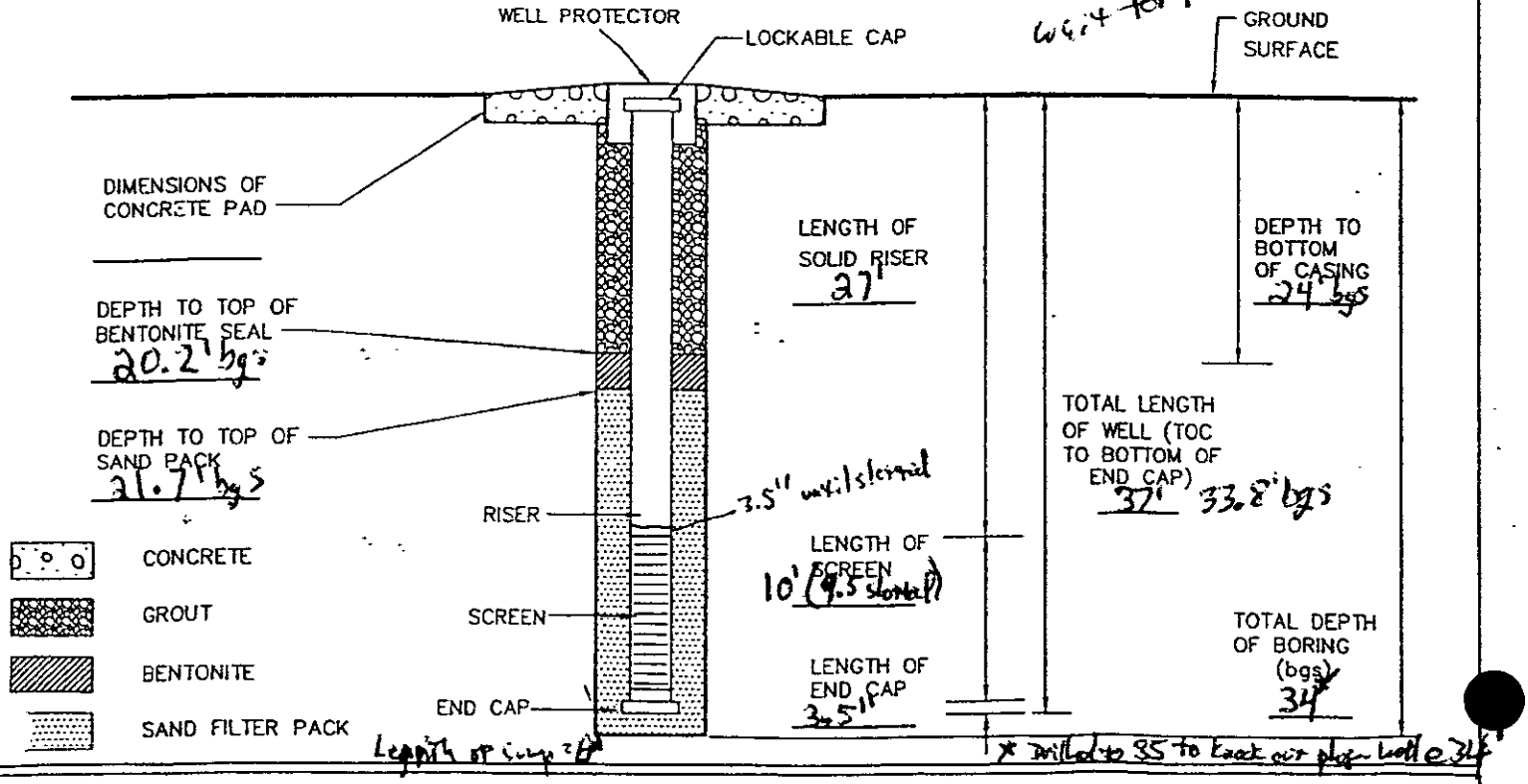
STATIC WATER LEVEL (>24 hrs after dev) —

MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)

9327 "away" wait for green



QA / QC

DRILLER: Danny INSPECTOR: C. Krambis

DISCREPANCIES: — CHECKED BY: — DATE: —

HTW DRILLING LOG

869 503

HOLE No. CSM-4B (CSMW-16)

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET OF 1 3 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
NAME OF DRILLER: Danny	6. MANUFACTURER'S DESIGNATION OF DRILL	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 1 3/3" OD Drill rods; 1.8" OD split Spoon; 140 lbs Hammer	9. HOLE LOCATION (SITE): CSM DPT-16 off jogging trail	
	10. SURFACE ELEVATION: —	
8. WEATHER: Cold, Rain	11. DATE STARTED: 12-05-03	12. DATE COMPLETED: 12-05-03
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: 19' bgs	
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 35' bgs	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	X	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
—	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
	—	X	—	Chr Kal

25. CHECKED BY:	26. NAME OF INSPECTOR: C. Krambis

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	CLAY (CL) Sandy, Yellowish brown 10YR 5/6 sl. moist					
		from cuttings					
		Gravel Bed gt 1" well rounded pebbles - from cuttings & drilling					
		CLAY (CL), Stiff, Strong brown, moist 7.5YR 5/6-5/8 mottled w/ Lt Brwn 5Y 7/2, Sandy;				30, 19, 19, 16 n=48	24" recovery
	5	gravel @ 5-5½' well rounded qtz clasts up to 1" (GP)					
		CLAY (CL) stiff Strong brown 7.5YR 5/8, moist					
		Gravel beds					
		SAND (SM) vf-f, Si/Cl, Yellowish brown 10YR 6/4 moist				3, 9 39 27	8" rec n=39
	10						

869 504

ok

HTW DRILLING LOG

HOLE No. CSM MW-4B ~~CMS MW-16~~

PROJECT: DSCR Supplemental FS | INSPECTOR: C. Kramsis | SHEET: OF 2 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Gravel @ 10' - blocked spoon NR					
		1" of recovery, showed silty SAND (SM) as in 9-10' interval. w/ carbonaceous material (coal)-like chunks blocked spoon					10, 11, 10, 15 n=21
		As above SAND (SM) VF-F, silty, micaceous V. Pale brown 10YR 8/2 moist				rec 21"	1, 4, 9, 16 2
	15	As above				7, 11, 19, 26 n=37	23" recovery
		SILT, (ML), sandy pale brown 10YR 6/3 ~~SAND (SM), silty, VF-M, VFB~~ Yellowish brown 10YR 5/8					
		SAND (SM) VF-C, silt matrix, micaceous, moist White to V. Pale brown 10YR 8/1-8/2 Mottled of brownish Yellow 10YR 6/6 NR				15, 27 36, 36 n=63	12" rec
▽ =	20	As above but saturated NR				5, 15 19, 22 n=34	14" rec
		SAND (SM), gravelly, silt matrix F-VC color as above				15, 26 30, 53 n=56	16"
		As above				10, 27 36, 65	12"
	25	Core twisted off				3, 6 40, 52	2"
		~~sandy clay, gravel to bit~~ As above Ht. 5Y 7/1					12"

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

869 505

HTW DRILLING LOG

HOLE No. CSM MW-4B ~~CSM MW-4B~~ CK

PROJECT DSCR Supplemental FS | INSPECTOR C. Krambis | SHEET OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
						8, 21	
						46, 50	
		SAND (SM), silt matrix, sl. gravelly, F-VC, GY2					
	30	color as above				5-12	6"
						36-48	
		AS above				12, 50/3"	
		NR					16"
	35	Boring Terminated @ 35' bgs					
	40						
	45						

869 506

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS — PROJECT NO. 6301-07-0011

WELL NO. CSM MW-5A — WELL LOCATION WH-6 T.P.2

DATE 12-08-03 — TIME 1240

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Silica Sand — GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" — SLOT SIZE 10

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE I/II Portland

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 10 inch

MACTEC FIELD REPRESENTATIVE C Krambis

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 5 gallons

AMOUNT BENTONITE USED (GROUT) —

AMOUNT CEMENT USED (GROUT) —

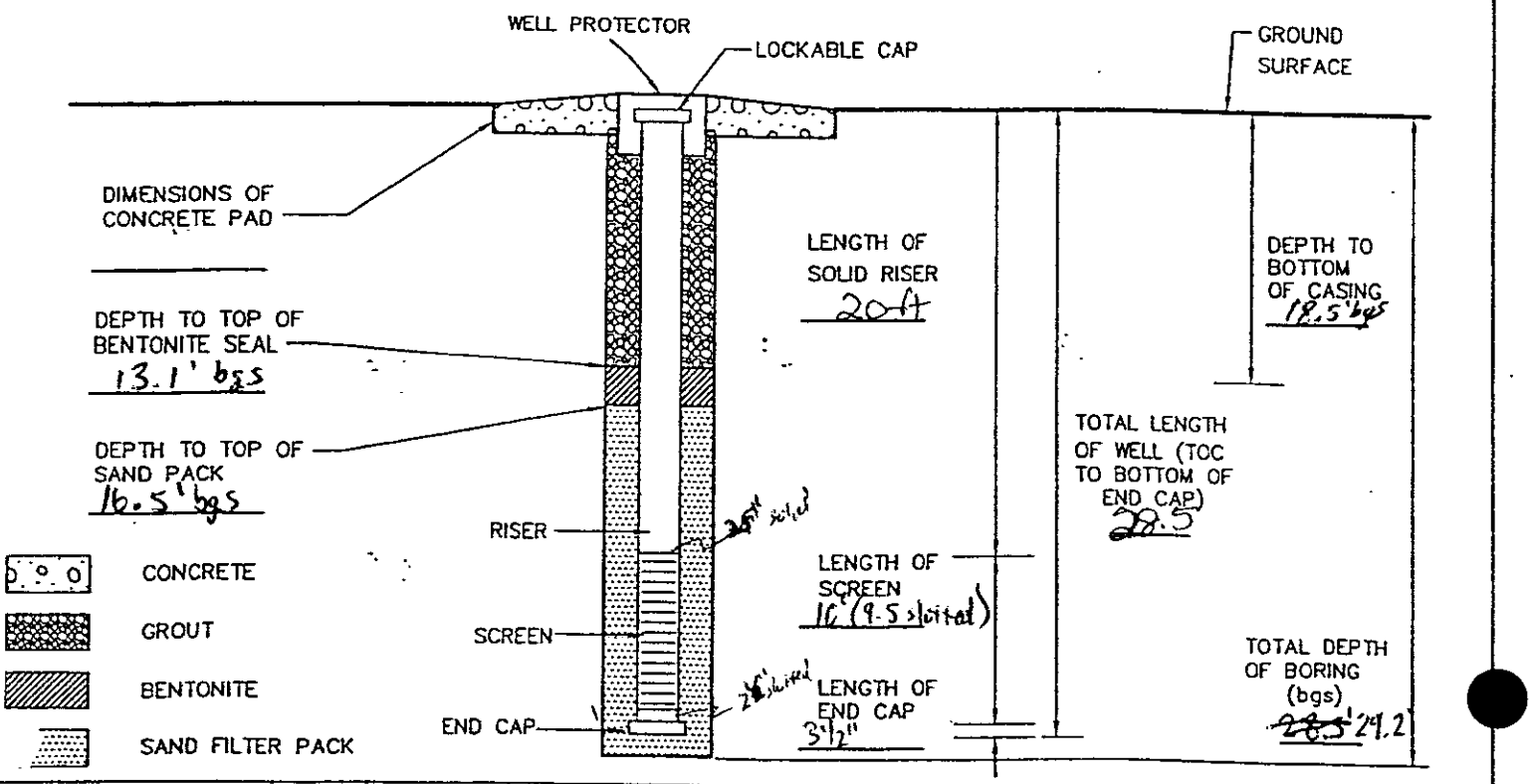
AMOUNT SAND USED 6.5 50lb bags

STATIC WATER LEVEL (>24 hrs after dev) —

MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny — INSPECTOR: C. Krambis

DISCREPANCIES: — CHECKED BY: — DATE: —

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6361-03-001

WELL NO. CSM MW-5B WELL LOCATION WH-6 T.P. 2

DATE 12-08-03 TIME 0930

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Silica Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" SLOT SIZE 10

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE I/II Portland

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 10 inch

MACTEC FIELD REPRESENTATIVE C Krawiec

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL)

AMOUNT BENTONITE USED (GROUT)

AMOUNT CEMENT USED (GROUT)

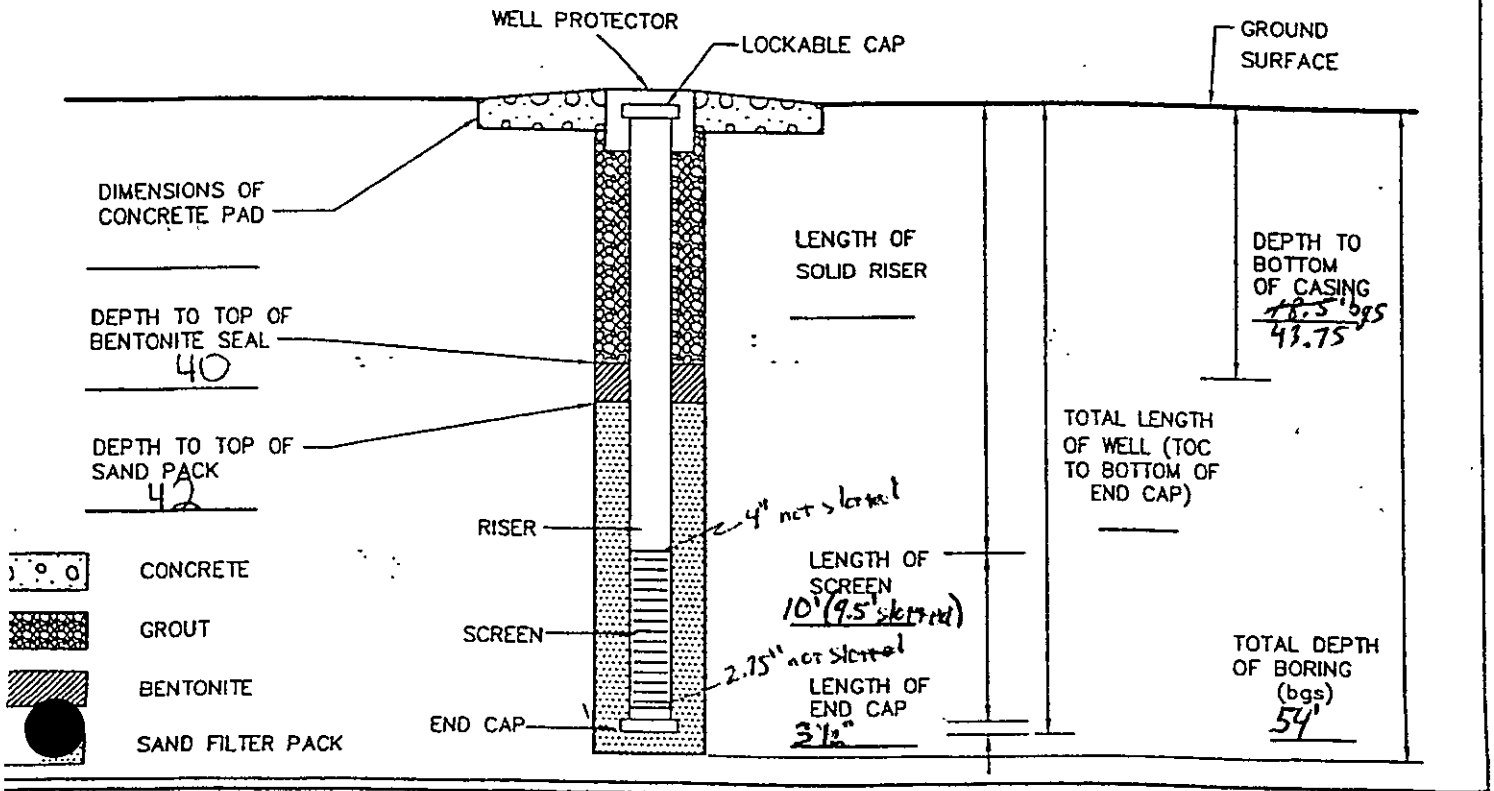
AMOUNT SAND USED

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny INSPECTOR: C. Krawiec

DISCREPANCIES: CHECKED BY: DATE:

869 508

HTW DRILLING LOG

HOLE No. CSM MW-5

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET OF 1, 4 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000 (Gus Pech Mfg. Co, Inc)	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 12/3" OD rods; 1:3" OD split spoons; 140 lb Hammer	9. HOLE LOCATION (SITE): WH-6. TP. 2 DDRV	
	10. SURFACE ELEVATION: —	
8. WEATHER: Cold, windy, cloudy	11. DATE STARTED: 12/06/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: —	16. DEPTH GROUNDWATER ENCOUNTERED: ~9ft	
14. DEPTH DRILLED INTO ROCK: —	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
	1	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
	—	—	—	—	—	—

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
	—	X	—	C. Krumbs

25. CHECKED BY:	26. NAME OF INSPECTOR: C. Krumbs

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0						
	5	SAND (SP) F-VC, rounded, gravelly, loose, reddish Yellow 7.5YR 6/8 Dry				11, 20, 24, 12 N=44	24" recovery
	10	As above, wet @ 10'				7, 8, 5, 10 N=13	18" recovery

MRK FORM JUN 89 55 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/9-

HTW DRILLING LOG

HOLE No. CSM MW-5

PROJECT: DSCR Supplemental FS | INSPECTOR: C. Krainbi> | SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Gravelly SAND (SP) see sheet 1					
	15	SAND (SM) silty w/some gravel F-M, saturated, loose reddish-yellow as noted				H, 12, 15, 12 n=33	13" rec
	20	CLAY silty, sandy (CL) reddish yellow as above	0.3 ppm	CSM MW-5A (19-26)		11, 15, 11, 10 n=26	20"
		SAND (SP) C-VC, gravelly white, well rounded grs clasts.					
		SAND - most washed out of spoon				25, 25 18, 18 n=43	
	25	Sloughed (mixed) CLAY (CL) silty, yellowish-brown 10YR5/3 Mottled/Gray 7.5YR7/1 wet		CSM MW-5A (19-26)		9, 14 25, 28 n=39	12"
		As above Most of spoon (top 20") appeared as gravelly sand wash down from above. Bottom sample				9, 12, 6, 7 n=13	24"

Sample collected 12-07-93 from CSM MW-5A boring

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No. | HF - Rev. 4/94

24'-26' recalled from "A" well boring on 12-07-93; 0.6ppm
18-19-18-9, n=37; 12" recovery (24'-25'): SAND (SP) M-VC, gravelly, v. loose, saturated, rounded to well rounded grs, reddish brown 10YR 5/4

869 510

HTW DRILLING LOG

HOLE No. CSM MW-5

PROJECT DSCR Supplemental FS | INSPECTOR C. Krambis | SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		Entire spoon filled w/ washed down gravelly sand ↓ NR	Redsample had ~6" recovery CLAY(CL) silty, v. soft (n=9) yellowish red 5YR 5/8 the remainder of spoon had slough. Clay was wet			7,12 12,15 n=24	12" spoon all slough
						3,5,4,7	2nd spoon ~6" n=9
	30	CLAY(CL), soft, sticky, sl. plastic, some silt reddish yellow, 5YR 6/8 mottled w/ tr. gray 5YR 7/1. a sand laminae (F-M) lense @ 30.3' bgs F-M yellow pinkish white 7.5YR 8/2 to reddish yellow 7.5YR 7/6 cemented ~1" thick wet				5,10, 14,13 n=24	6" recovery
		CLAY (CL), soft, v. cohesive, sticky, some silt, sl plastic brownish yellow 10YR 6/8, wet Mottled w/ gray 10YR 6/1				6,6,10,16 n=16	24" recovery
		Same but dark grey 5Y 4/1 fissle appearance, some sand VF-F rnd, stiffer					
		CLAY(CL) as above w/ black nodules or carbonaceous material. moist				9,11,16,24 n=25	24" recovery
		AS above, w/ occasional sub rounded to rounded qtz gravel clasts, STIFF, wet				6,9,10,14 n=19	24" recovery
		sandy lense @ 37.5', M-C, black 2.5/N Gley1, saturated					
		CLAY as above to				8,10,19,16 n=29	12" recovery
	40	SAND(SP-SM) Sl. silty, VF-M, dense, black as above w/ carbonaceous material, moist				13,8,20,43 n=28	9" recovery
		As above w/ well rounded qtz. gravel. V. weard layer near auger refusal					
	45					50/5"	

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSM MW-5

PROJECT DSCR Supplemental FS | INSPECTOR C. Krambis | SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		SILT (ML-GM), gravelly & sandy dark greenish gray 4/1 5G Gley1 gravel is well rounded gtz. up to 1.5"	0.5 ppm	CSM MW-5B (47-55)		35, 32 45, 35 N=77	sample should be representative 16" rec.
	50	NO Samples				50/5" 50/5"	Oil ~~Sample should be representative~~ No Recovery Spoon Empty
		Easy Drilling — some biting due to gravel					
	55	SAND (SC) clayey, F-C gtz clay is matrix, Sand is gtz v. dense, mottled 7/N Gley1 No Samples 1st attempt	~~0.5 ppm~~ at 119 ppm	CSM MW-5B (47-55)		50/5½" 2nd run 29"	1st run: NO Recovery
		Auger Boring Terminated @ 54' bgs Split spoon refusal @ 55' bgs					
	60						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

869 512

(or) LOWER

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental RS — PROJECT NO. 6301-03-0011

WELL NO. CSM MW-6B — WELL LOCATION DDRV Between WH12 and WH9

DATE 12/09/03 — TIME 1300

GROUND SURFACE ELEVATION Provided on Separate Sheet

TOP OF SCREEN ELEVATION N/A

REFERENCE POINT ELEVATION N/A

TYPE FILTER PACK SAND — GRADATION #1 SAND 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch — SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25 inch ID Auger

REMARKS

BENTONITE TYPE 3/8 Pellet

MANUFACTURER DSI

CEMENT TYPE Portland type II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 pounds

AMOUNT BENTONITE USED (GROUT)

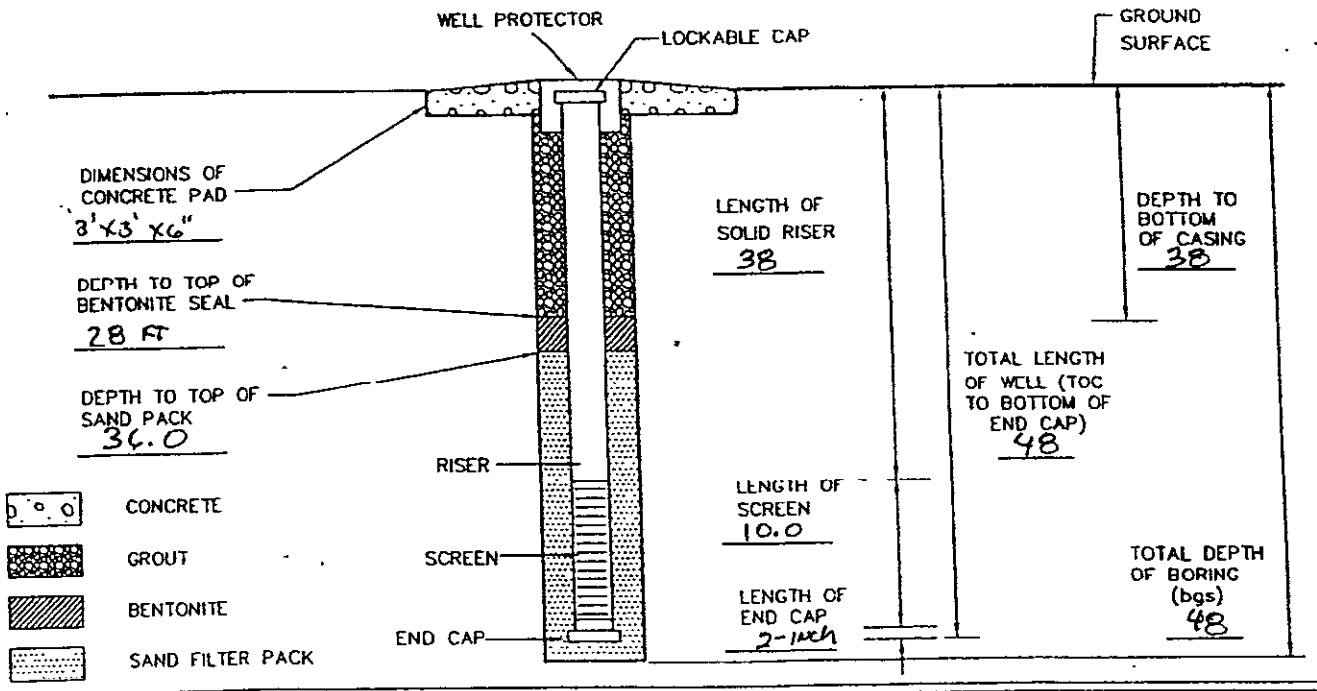
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 350 LB (no)

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: — INSPECTOR:

DISCREPANCIES: — CHECKED BY: — DATE:

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HTW DRILLING LOG

869 513

HOLE NO. CSMMW-06

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 4 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond VA	
5. NAME OF DRILLER: Chris	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch x 2 FT Split Barrel Sampler; 4.25 inch ID Hollow Stem Auger	9. HOLE LOCATION (SITE): Between MW WH 12 and WH 9	
	10. SURFACE ELEVATION	
8. WEATHER: Sunny Cold ± 30° F	11. DATE STARTED: 12/9/03	12. DATE COMPLETED
13. OVERBURDEN THICKNESS: More than 50 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 9.0 FT BGS	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 48.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	✓		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		Miguel A V

25. CHECKED BY:	26. NAME OF INSPECTOR
	Miguel A Vazquez

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS ppm	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Fill - Medium to Coarse Gravel					
	2	String Brown (7.5YR 5/6 Coarse Sand	1.1 Hole Background 0.8 BZ 0.8			19, 22, 34 45	Kerosene Odor
	3						
	4	Very Dense, String Brown (7.5YR 5/6) silty Coarse Sand (SP) with Gravel. Dry ~~Kerosene was~~ ~~what appears~~					~~SP~~ SS What appeared to be Kerosene was observed on the Auger Plug.
	5						
	6						
	7						
	8						
	9						
	10	Very Dense, Strong Brown (7.5YR 5/6) Coarse Sand (Poorly graded)					

869 514

HTW DRILLING LOG

HOLE No. CSM MW-6

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 2 OF 4 SHEETS

ELEV a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	ANG FINE TO MEDIUM GRAVEL (SP-GP) WET				2,3,4,5	0845
	11					4,5	
	12						
	13					WH 9,9,6,5	
	14	FIRM, STRONG BROWN (7.5YR 5/6) POORLY GRADED, MEDIUM TO COARSE SAND AND GRAVEL (SP-GP) (SATURATED)				9,9,6,5	
	15						
	16					8,10,24	
	17					26	
	18					9,7,16	
	19		0.6 Background			34	
	20	NORECOVERY (MATERIAL VERY FLUID)				69,10,6	
	21						
	22	VERY STIFF, YELLOWISH BROWN (10YR 5/8) GRAVELLY CLAY (CL)				7,8,11,13	
	23						
	24	VERY STIFF, BLUISH GRAY (GLEY 2 5PB 5/1) FAT CLAY (CH) DRY	0.6			5,6,9,13	10 10 RECOVERY 24"
	25						
	26	SAME AS ABOVE				7,9,8,14	
	27						
	28						

HTW DRILLING LOG

HOLE No. CSMMW-6

PROJECT: DSCR Supplemental

INSPECTOR: M. Vazquez

SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	SAME AS ABOVE	0.7 Background			6,7,8,9	10 2C
	29		BZ 0.7				
	30	STIFF, Bluish gray (GLAY 2 5PB5/1) FAT CLAY (DRY)				4,6,8,10	1035
	31						
	32					5,5,7,8	
	33	BECOMING SLIGHTLY SANDY (MOIST)					
	34						
		DENSE, GREENISH BLACK (GLEY 1 5GY 2.5/1 POORLY GRADED CLAYEY FINE SAND (SC) (DRY-MOIST)				5,9,12 24	
	35						
	36						
	37	BECOMING (MOIST - DAMP)				18,12,22 34	
	38			CSMMW-6 SO (38-46)		12,18,32 45	1135
	39						
	40						
	41	VERY DENSE, GREENISH BLACK (GLEY 1 5GY 2.5/1 POORLY GRADED GRAVELLY FINE SAND (SP) SATURATED (WP)					
	42						
	43						
	44					38,40 45,50	1142
	45	VERY DENSE, GREENISH GRAY (GLEY 1 10GY 4/1) SILTY FINE TO MED SAND (SP) with ~~BOOM~~ with GRAVEL DAMP		CSMMW-6 SO (38-46)			
	46						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-6

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMMW-6

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS PPM	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48	VERY DENSE, greenish gray (GLEY 1 10GY 6/1) SILTY FINE TO MED SAND (SP) WET	Background 0.8 ppm BZ = 0.8			25, 45 50/5"	
	49						
	50	Boring terminated to 48 FT Below ground SURFACE. sampling terminated at 49.5 FT Below ground SURFACE					
	51						
	52						
	53						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-6

HF - Rev. 4/94

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011

WELL NO. CSMMW-7 AB (AMC) WELL LOCATION DDRV

DATE 12/10/03 TIME 1515

GROUND SURFACE ELEVATION Provided in separate Sheet

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK SAND GRADATION 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25-inch ID

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE Portland type I/II

MANUFACTURER Rapidle Cement

BOREHOLE DIAMETER 8 inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 pound

AMOUNT BENTONITE USED (GROUT) 1 pound

AMOUNT CEMENT USED (GROUT)

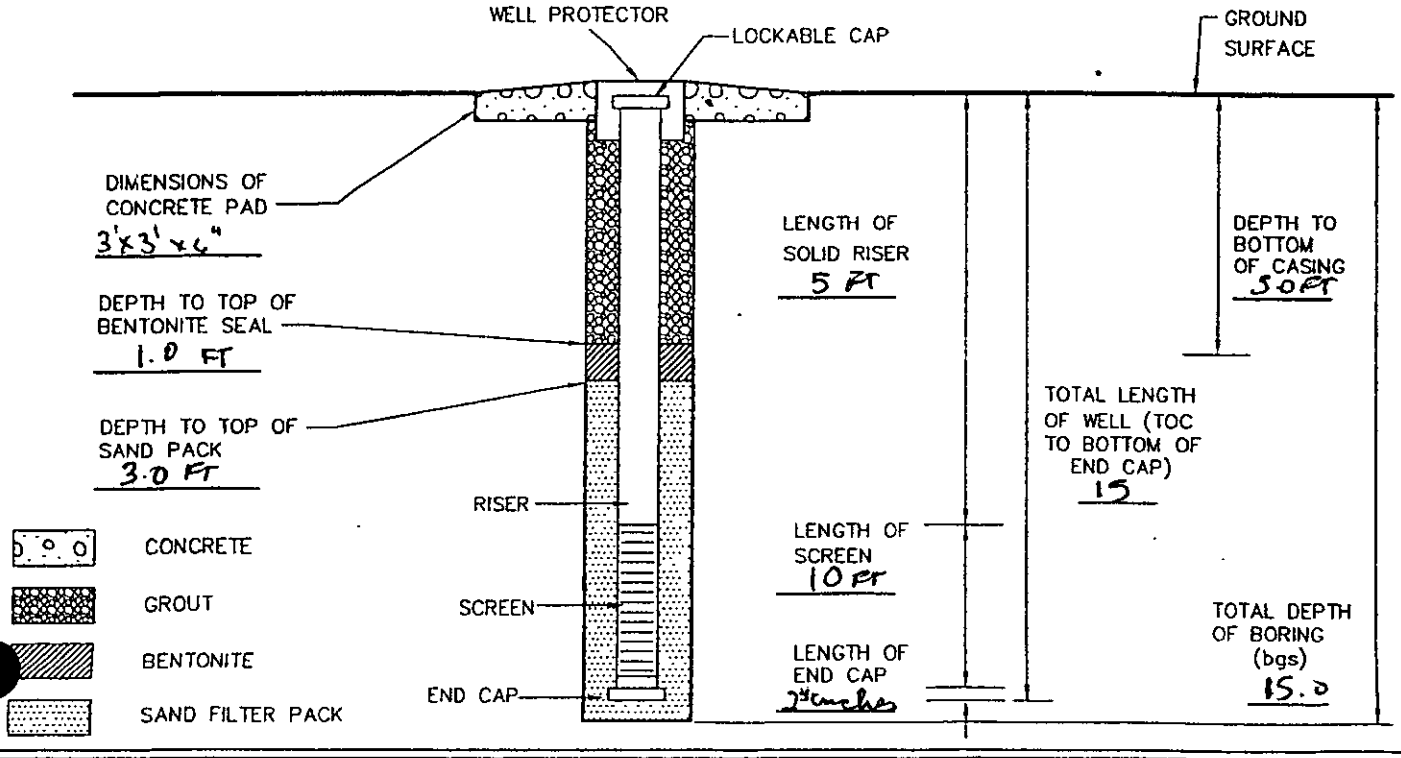
AMOUNT SAND USED 350 pounds

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Lacko INSPECTOR: M Vazquez

DISCREPANCIES: CHECKED BY: DATE: 12

869 518

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS — PROJECT NO. 6301-03-0038

WELL NO. EMCSUMW-7C — WELL LOCATION DDRV

DATE 12/10/03 — TIME 1245

GROUND SURFACE ELEVATION Provided in Separate Sheet

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK SAND — GRADATION 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch — SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25 inch

REMARKS

BENTONITE TYPE 3/8 Pelet

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Rochache Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 POUNDS

AMOUNT BENTONITE USED (GROUT) 1 POUND

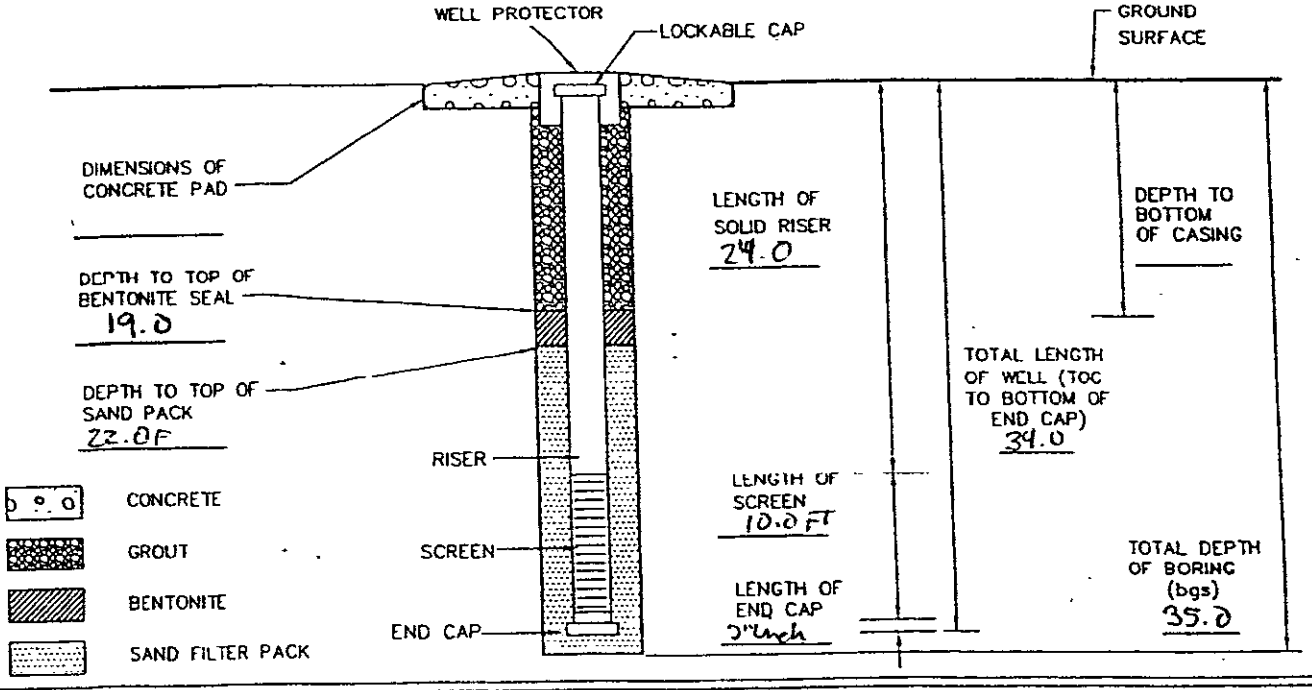
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 350 pounds

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Lacho — INSPECTOR: M. Vazquez

DISCREPANCIES: — CHECKED BY: — DATE:

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869 519

HTW DRILLING LOG

HOLE No. CSMMW-7

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 3 OF 3 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS 6301-03-0011	4. LOCATION (CITY, STATE): Richmond VA	
5. NAME OF DRILLER: Chris	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: ~~4"x2" NW~~ 5'x4" ESM CME Sampler; 4.25 inch ID Hollow Stem Augers	9. HOLE LOCATION (SITE): DDRV	
	10. SURFACE ELEVATION: Provided on Separate Sheet	
8. WEATHER: Rainy/Cold	11. DATE STARTED: 12/10/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than 35 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 5 FT BGS	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 35 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
2	✓		

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
3	✓	✓	AMIDA	TOC	ARSENIC	N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		Miguel Avazduc

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL AVAZDUC

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Fill - Black Clayey Sand with Rocks					0925 24" Recovery
	2	Fill - Gray Slightly Clayey Poorly Graded Sand with gravel and Rocks		G	CSMMW-7 SO(2-4)		
	3						
	4						
	5	Rocks					
	6						
	7						
	8	Grayish green (GLEY 1 5G 5/2) Clayey Poorly Graded Coarse Sand with Fine Gravel (SP-SC) (Wet)					
	9						
	10	Material is consistent with material of the lower WBU)					

869 520

HTW DRILLING LOG

HOLE No. CSMMW 7-

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13			CSMMW-7 SB(12'-15')			
	14						
	15						
	16						
	17						
	18						
	19						
	20	Weathered Rock (Saprolite)					
	21	DESCRIBED AS: Very dark grayish green (GLEY 1 5G 3/2)					
	22	Poorly graded silty FINE to MED SAND (SP-SM)					
	23	FRACTURE OBSERVED AT 22 FT. (MOIST) with MICA					
	24						
	25						
	26			CSMMW-7 SB(25-30)			
	27						
	28						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-7

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMMW-7

PROJECT: DSCR Supplemental

INSPECTOR: M. VAZQUEZ

SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	VERY DARK grayish GREEN (GLEY 1 5G 3/2) poorly graded SILTY FINE to MEDIUM SAND (SP-SM) (Saprolite					
	29						
	30						
	31						
	32						
	33						
	34						
	35	Boring terminated at 35.0 FT BELOW ground SURFACE.					
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						
	46						

869 522

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (STICK-UP COMPLETION)

PROJECT NAME PSCR Supplemental FS PROJECT NO. 6391-03-0011
WELL NO. CSMMW-8A WELL LOCATION Behind Apartments
DATE 1-20-03 TIME 1206

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

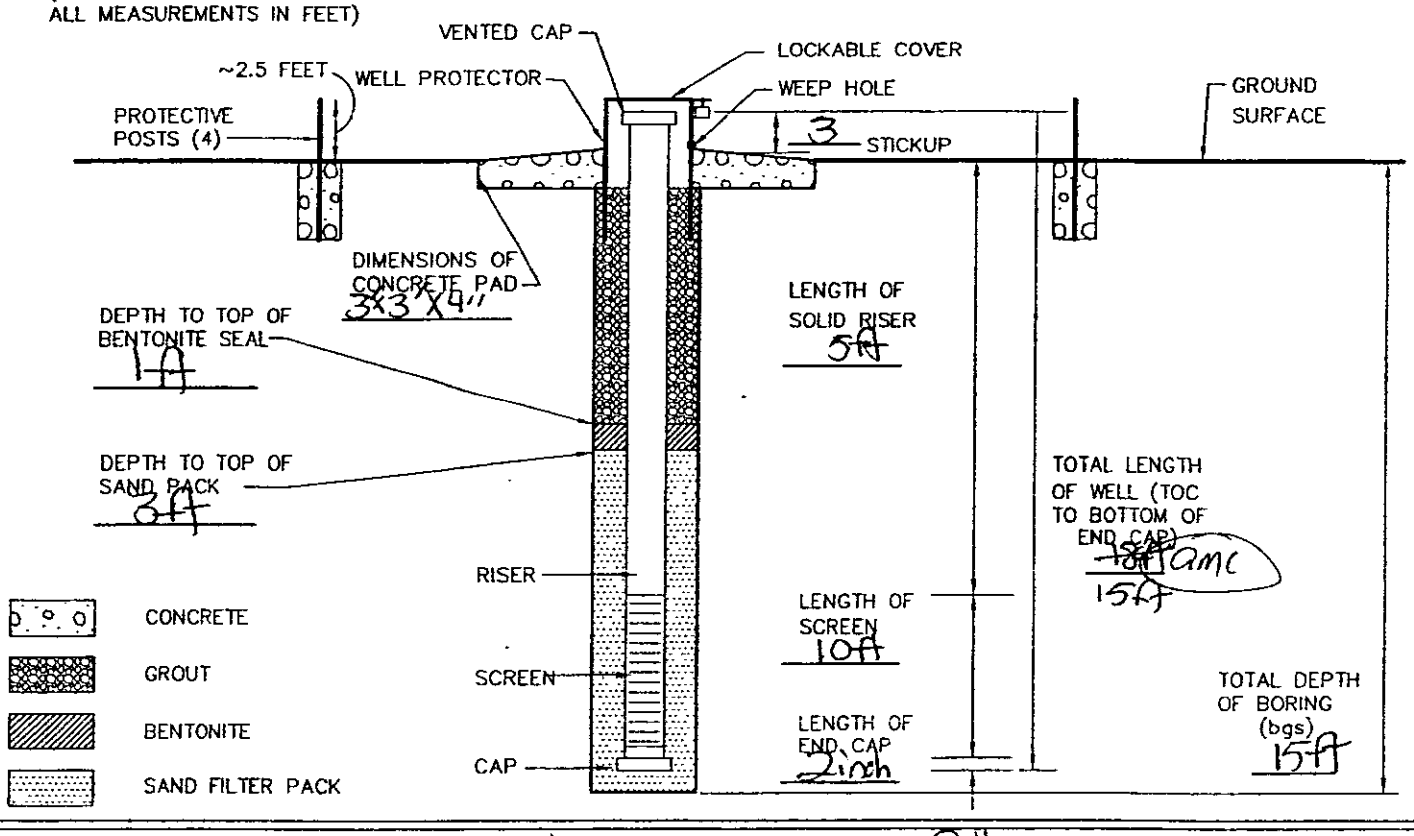
SCREEN MATERIAL sch.40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2inch SLOT SIZE 0.010"
RISER MATERIAL sch.40 PVC
MANUFACTURER DSI
RISER DIAMETER 2inch
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 10 inch
MACTEC FIELD REPRESENTATIVE Amy Gillaway
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 15lbs
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 5bgs
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Gillaway
DISCREPANCIES: — CHECKED BY: — DATE: —

869 523

HTW DRILLING LOG

HOLE No. CSMMW-8A

1. COMPANY NAME: ACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 1 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 660	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" Hollowstem Augers; 2" x 2' split spoon; barrel sampler	9. HOLE LOCATION (SITE): Behind apartments	
	10. SURFACE ELEVATION: —	
8. WEATHER: clear 40's	11. DATE STARTED: 1-20-03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: > 42ft	16. DEPTH GROUNDWATER ENCOUNTERED: ~10ft bgs	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 15ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
0			N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
0						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Amy Calloway

25. CHECKED BY:	26. NAME OF INSPECTOR: Amy Calloway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		see CSMMW-8B drillinglog					

MRK FORM JUN 89 55

PROJECT NAME & NO: DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-8A

HF - Rev. 4/94

869 524

Lower/UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (STICK-UP COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6304.03.0011
WELL NO. CSMMW-8B WELL LOCATION Behind apartments
DATE 12/15/03 TIME 1500

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch. 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2in SLOT SIZE .010"
RISER MATERIAL sch. 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2in
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Type 1/11 Portland
MANUFACTURER Roanoke Cement

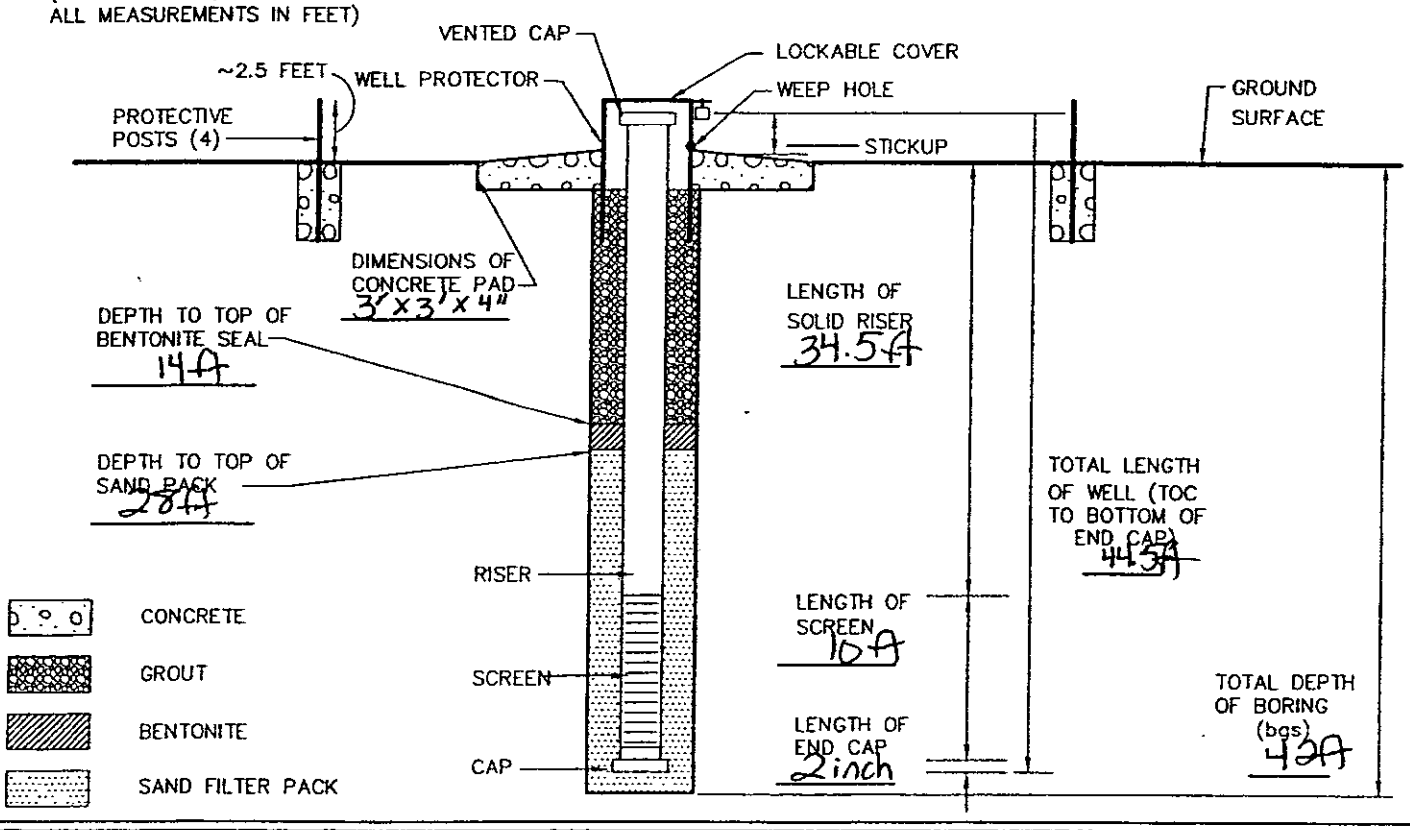
BOREHOLE DIAMETER 8 inch
MACTEC FIELD REPRESENTATIVE Amy Gilway
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 125lb
AMOUNT BENTONITE USED (GROUT)
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 6bgs = 300lbs

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Amy Galloway
DISCREPANCIES: CHECKED BY: DATE:

HTW DRILLING LOG

HOLE No. CSM MW-8B

1. COMPANY NAME MACTEC	2. DRILLING SUBCONTRACTOR Richard Simmons
SHEET OF 1 SHEETS 3	
3. PROJECT DSCR Supplemental FS	4. LOCATION (CITY, STATE) Richmond, VA
5. NAME OF DRILLER Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL CME 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID Hollow Stem Augers; 3" x 2' split spoon barrel; Sampler for 4-6' analytical sample, 3" x 2' split spoon barrel	9. HOLE LOCATION (SITE) Behind apartments in field
	10. SURFACE ELEVATION
8. WEATHER sunny, 50°	11. DATE STARTED 12/15/03 — 12. DATE COMPLETED
13. OVERBURDEN THICKNESS > 42 ft	16. DEPTH GROUNDWATER ENCOUNTERED ~9 ft bgs
14. DEPTH DRILLED INTO ROCK N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE 42 ft	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSM MW-8BSO (37-41')	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
CSMOPT-17SO (4-6')			PAH's			N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		X		Amy Gilaway

25. CHECKED BY:

26. NAME OF INSPECTOR Amy Gilaway

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1						
	2						
	3						
	4	Mottled Dark red (2.5YR 3/6), strong Brown (7.5YR 5/6) Gray (7.5YR 6/1) Gravelly, sandy CLAY. CL	0.0		CSMOPT 17SO (4-6')	14, 45 46, 48	20 inch recovery
	5						
	6						
	7						
	8						
	9	Wet Brown (7.5YR 4/2) clayey, fine to med. gr. SAND SC	0.0			14, 24 28, 7	5 inch recovery
	10						

869 526

HTW DRILLING LOG

HOLE No. CSM MW-8B

PROJECT DSCR Supplemental FS | INSPECTOR Gary Galloway | SHEET OF 2 SHEETS 3

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX. No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	See previous page					
	11	Reddish Yellow (7.5YR 6/8) Fat CLAY. CH	0.0			7,8	24 inch
	12					9,13	recovery
	13	Layered Reddish Yellow (7.5YR 6/8)					
	14	Light Gray (7.5YR 7/1) fat CLAY CH	0.0			7,11 12,10	24 inch recovery
	15	Greenish Gray (GLEY1 5/1)				7,9	24 inch
	16	Fat CLAY. CH.	0.0			12,11	recovery
	17					6,9	24 inch
	18	Same as above	0.0			10,10	recovery
	19					8,10	24 inch
	20	Same as above	0.0			16,21	recovery
	21						
	22	Same as above	0.0			9,12 25,24	24 inch recovery
	23	Dark Gray (GLEY1 4/)					
	24	Fat Clay. CH	0.0			14,19 30,21	24 inch recovery
	25					10,13	24 inch
	26	Same as above	0.0			13,19	recovery
	27					8,11	24 inch
		Same as above	0.0			47,50/2	recovery
	28						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301.03.8011 | HOLE No. CSM MW-8B

nr - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMMW-8B

PROJECT DSCR Supplemental FS | INSPECTOR Amy Galaway | SHEET 3 OF 3 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29	Last two inches of sample have angular gravel pieces and some sand 29-30.4 - Greenish gray (GLEY1 5/1) Fat CLAY, wet. CH	0.0			12,13 16,17	24 inch recovery
	30	30.4-31 Greenish Black (GLEY1 2.5/1) Some clay, dry. SILT with some gravel. dry. ML				8 18,43	
	31	Greenish Black (GLEY1 2.5/1)	0.0			50/1	14 inch recovery
	32	Slightly Sandy SILT with some clay and gravel. Dry ML					
	33						
	34	No recovery				refusal	No recovery
	35						
	36	No recovery				50/3	No recovery
	37	Greenish gray (GLEY1 6/1)		CSM MW8B		44,	
	38	wet, Slightly clayey coarse grain SAND. Moist with some gravel. SP	0.0	S0 (37-41)		50/4	8 inch recovery
	39	Greenish gray (GLEY6/1) Slightly clayey, micaceous, moist				26, 44	12 inch
	40	Coarse grain SAND. with some gravel. SP	0.0			50/3	recovery
	41						
	42	No recovery				refusal	No recovery
	43	Boring Terminated at 42.4 bgs.					

869 528

Upper

~~LOWER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. _____

WELL NO. CSMMW-9a WELL LOCATION 1st St and Road G

DATE 12/18/03 TIME 1000

GROUND SURFACE ELEVATION _____

TOP OF SCREEN ELEVATION _____

REFERENCE POINT ELEVATION _____

TYPE FILTER PACK #1 Sand GRADATION _____

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch 40 PVC

MANUFACTURER _____

SCREEN DIAMETER 2" SLOT SIZE 10

RISER MATERIAL Sch. 40 PVC

MANUFACTURER _____

RISER DIAMETER 2"

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS Sheet 3 of 3 (cluster well)

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type 2

MANUFACTURER Roanoke Concrete

BOREHOLE DIAMETER 8"

MACTEC FIELD REPRESENTATIVE Kevin Tautkus

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 lbs

AMOUNT BENTONITE USED (GROUT) _____

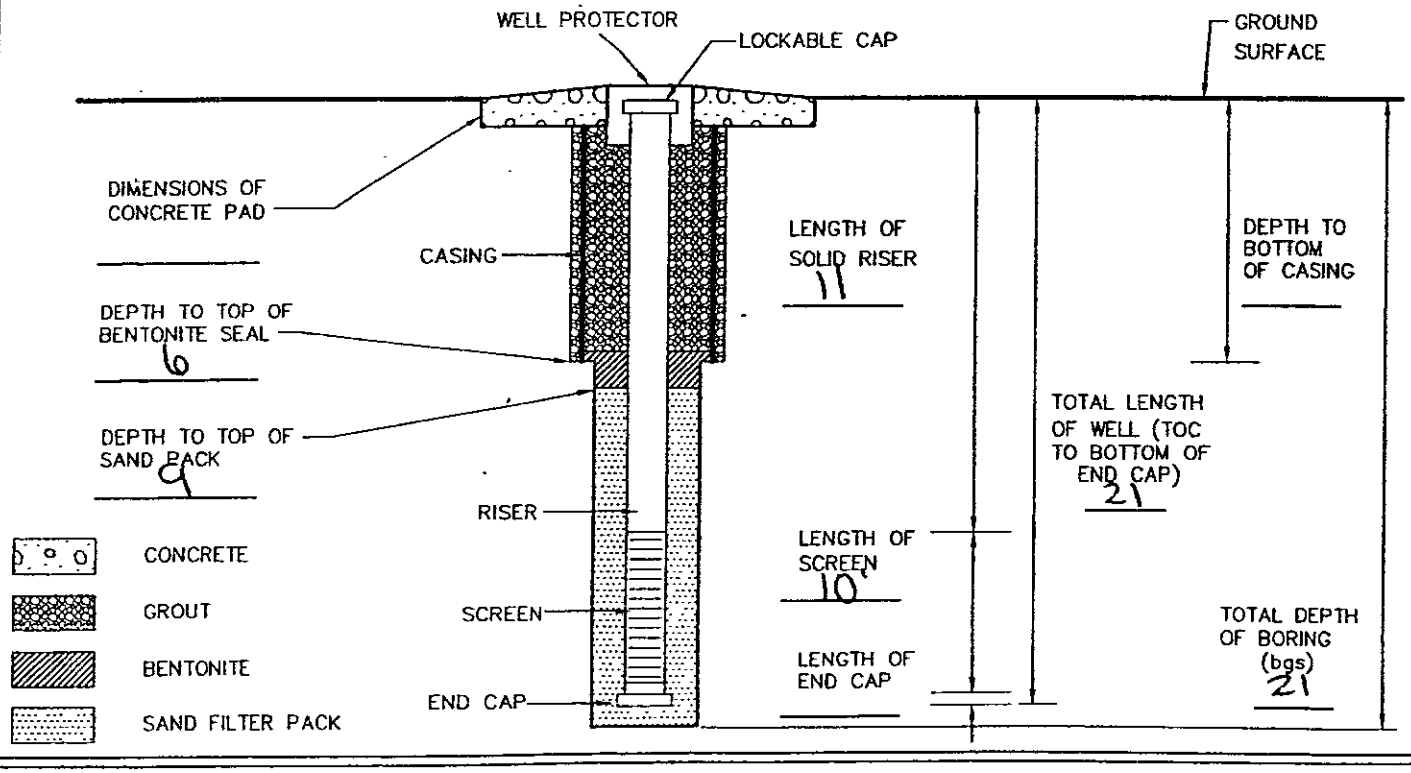
AMOUNT CEMENT USED (GROUT) _____

AMOUNT SAND USED 7 x 50 lbs.

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) _____

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Dan Cook INSPECTOR: _____

DISCREPANCIES: _____ CHECKED BY: _____ DATE: _____

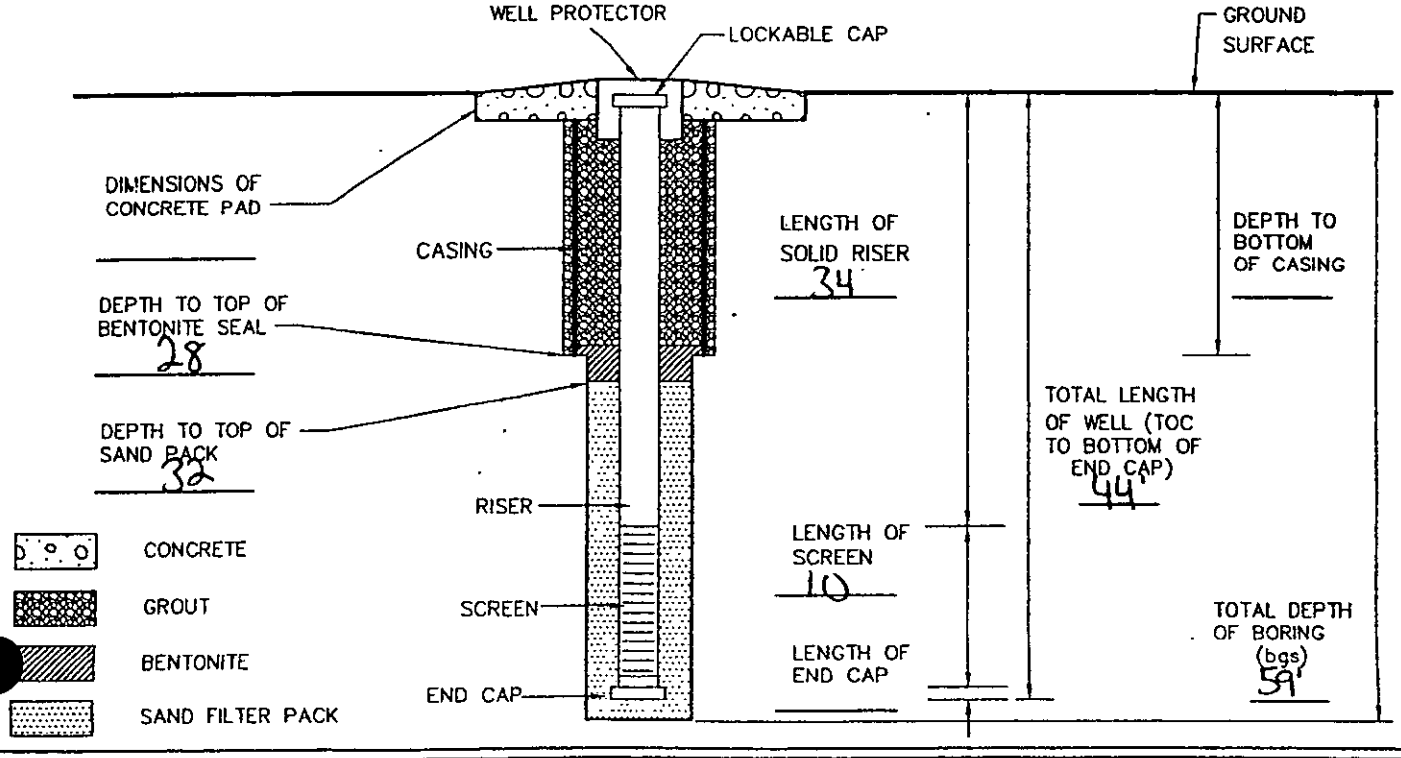
LOWER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental RS PROJECT NO. _____
WELL NO. CSmmw-9b WELL LOCATION 1st St + Road G
DATE 12/17/03 TIME _____

GROUND SURFACE ELEVATION _____
TOP OF SCREEN ELEVATION _____
REFERENCE POINT ELEVATION _____
TYPE FILTER PACK #1 Sand GRADATION _____
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL Sch-40 PVC
MANUFACTURER _____
SCREEN DIAMETER 2" SLOT SIZE 10
RISER MATERIAL Sch 40 PVC
MANUFACTURER _____
RISER DIAMETER 2"
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25 ID HSA
REMARKS ~~Pg~~ Sheet 2 of 3 (cluster well)

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Portland Type 2
MANUFACTURER Roanoke Concrete
BOREHOLE DIAMETER 8"
MACTEC FIELD REPRESENTATIVE Kevin Tauthus
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL) 50 lbs
AMOUNT BENTONITE USED (GROUT) 25 lbs
AMOUNT CEMENT USED (GROUT) 6 x 94 lbs
AMOUNT SAND USED 6 x 50 lbs
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) _____

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Dan Cook INSPECTOR: K. Tauthus
DISCREPANCIES: None CHECKED BY: _____ DATE: _____

869 530

Saprolite ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS — PROJECT NO. —

WELL NO. CSMMW-9C — WELL LOCATION 1st St + Road G

DATE 12/16/03 — TIME —

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK #1 Sand — GRADATION —

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER —

SCREEN DIAMETER 2" — SLOT SIZE 10

RISER MATERIAL Sch. 40 PVC

MANUFACTURER —

RISER DIAMETER 2"

DRILLING TECHNIQUE HSA

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS Sheet 1 of 3 (cluster well)

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type 2

MANUFACTURER Roanoke Concrete

BOREHOLE DIAMETER 8"

MACTEC FIELD REPRESENTATIVE Kevin Tauthus

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 lbs

AMOUNT BENTONITE USED (GROUT) 25 lbs

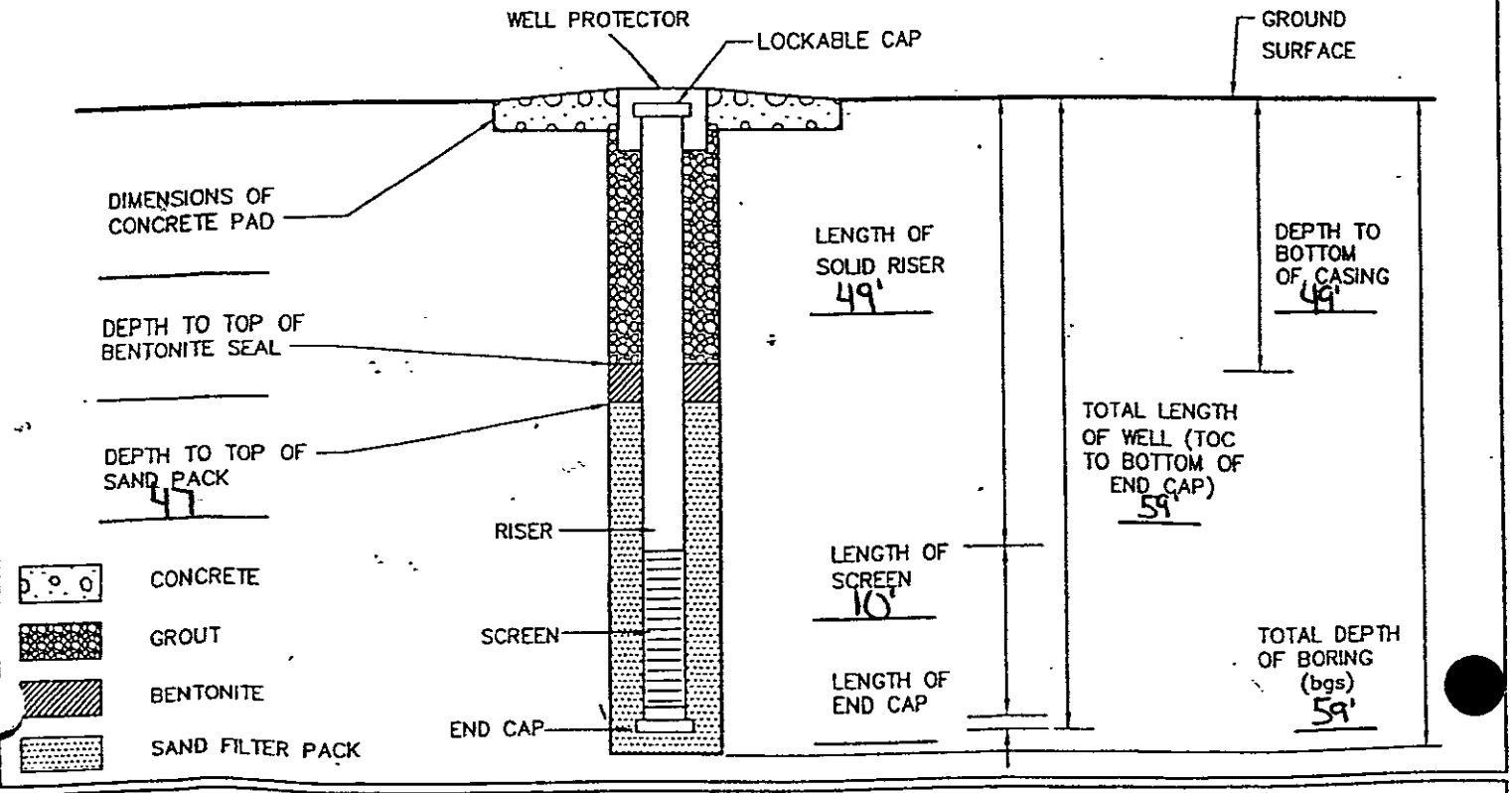
AMOUNT CEMENT USED (GROUT) 6 x 94 lbs

AMOUNT SAND USED 6 x 50 lbs

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Don Cook — INSPECTOR: Kevin Tauthus

DISCREPANCIES: None — CHECKED BY: — DATE: —

869 531

HTW DRILLING LOG

HOLE No. CSMMW-9 cluster

SHEET 1 OF 4 SHEETS

1. COMPANY NAME: MACTEC E&C	2. DRILLING SUBCONTRACTOR: Richard Simmons
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER: Dan Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 ID HSA; 2"x2' split-spoon sampler	9. HOLE LOCATION (SITE): Southern edge of parking lot @ 1st St + Road G
	10. SURFACE ELEVATION:
8. WEATHER: Cloudy, 50's	11. DATE STARTED: 12/16/03 — 12. DATE COMPLETED: 12/17/03
13. OVERBURDEN THICKNESS: 59'	16. DEPTH GROUNDWATER ENCOUNTERED:
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
15. TOTAL DEPTH OF HOLE: 59'	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSMMW-9a, 9b, 9c		3	0

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
CSMDPT-5 @ 50 (0-6) (6-8')			PEST	PCB's		

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		3		Kevin Tauthus

25. CHECKED BY:	26. NAME OF INSPECTOR
	Kevin TautKus

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	Grass, topsoil					
	1	Clayey Silt, 5YR 5/8 yellowish red, moist					
	2						
	3						
	4		Q			13,13, 15,19	24/24" rec.
	5						
	6						
	7						
	8	Sand w/ some gravel, 7.5YR 7/8 reddish yellow, moist, some silt					
	9		Q			9,8, 16,15	20/24" rec.
	10						

869 532

HTW DRILLING LOG

HOLE No. CSMMW-9 cluster

PROJECT DSCR Supplemental FS

INSPECTOR

SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE BEFORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	Recovery REMARKS h
	11						
	12						
	13	Silty Clay w/some Sand,			23,10, 12,18	23,10, 12,13	4/24" rec.
	14	very moist, 7.5YR5/8 Strong brown, very stiff	∅				
	15					9,8.	16/24" rec
		same, stiff	∅			7,11	
	16						
	17					4,3,	
	18					5,5	24/24"
		Silty Clay, 10YR 3/1	∅				
	19	v. dark gray, moist, CL, w/ trace sand	∅			5,5,	
		Clay, 10YR3/1, moist				8,12	
	20	CH, stiff					
	21					7,15,	
		Same, hard	∅			18,25	
	22						
	23					6,9,	
		same, very stiff	∅			15,41	12/24"
	24						
	25					6,7,	
		Same, hard	∅			40,50	
	26						
	27						
	28						

HTW DRILLING LOG

HOLE No. CSMMW9

PROJECT: DSCR Supplemental FS

INSPECTOR:

SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	Recovery REMARKS h
	27	Dark gray Clay (CH),	Ø			9, 9,	24/24"
	28	Same as above; very stiff				14, 25	
	29					6, 7,	24/24"
	30	Same, very stiff.	Ø			13, 25	
	31	Same, hard	Ø			7, 13,	24/24
	32					34, 50/4	
	33	Same, except some sand	Ø			10, 16,	24/24
	34	in bottom 6" (34.5-35')				30, 42	
	35	Very stiff, dark gray	Ø			6, 9,	12/24
	36	10YR3/1, Sandy Clay (CH)				13, 18	
	37	moist				10, 24,	24/24
	38					50/5	
	39	hard, greenish black	Ø				
	40	GLEY 2.5/1, Sand clay (CL) moist				18, 28	24/24
	41	hard, greenish black 2.5/1, Clayey silt (ML) w/ sand, moist	Ø			46, 50/5	
	42	hard, greenish black 2.5/1, Sandy Silt (ML), moist	Ø			30, 30	24/24
	43					50/4	
	44	hard, Same as above	Ø			35, 50/5	20/24
	45						

869 534

HTW DRILLING LOG

HOLE No. CSMMW1-9

PROJECT DSCR Supplemental FS

INSPECTOR

SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	Recovery REMARKS h
	46	Hard, GLEY1 3/5g dk. greenish gray, Silty Sand (SP) w/ some gravel, moist	Ø			50/6	12/24
	47						
	48	Hard, GLEY1 5/5g greenish gray, Sand (SP), moist	Ø			30, 50/5	8/24
	49						
	50	Hard, same, w/ some gravel	Ø			50/5	8/24
	51						
	52	Hard same as above	Ø			50/4	4/24
	53						
	54	Same	Ø			50/5	NR
	55						
	56	hard, same	Ø			15, 50/4	6/24
	57						
	58	hard, same	Ø			39, 50/3	8/24
	59						
	60	EOB @ 59'					
	61						
	62						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS

HOLE No. CSMMW-9

HF - Rev. 4/94

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSOR Supplemental B — PROJECT NO. 6301-03-0011
WELL NO. CSMMW-10A" — WELL LOCATION Entrance to DDRV
DATE 12/20/03 — TIME 0930

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK Sand — GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch. 40 PVC
MANUFACTURER DSI
SCREEN DIAMETER 2" — SLOT SIZE 0.010"

RISER MATERIAL sch 40 PVC
MANUFACTURER DSI
RISER DIAMETER 2"

DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID

BENTONITE TYPE 3/8" pellets
MANUFACTURER DSI
CEMENT TYPE Typ I/II Portland
MANUFACTURER Roanoke Cement

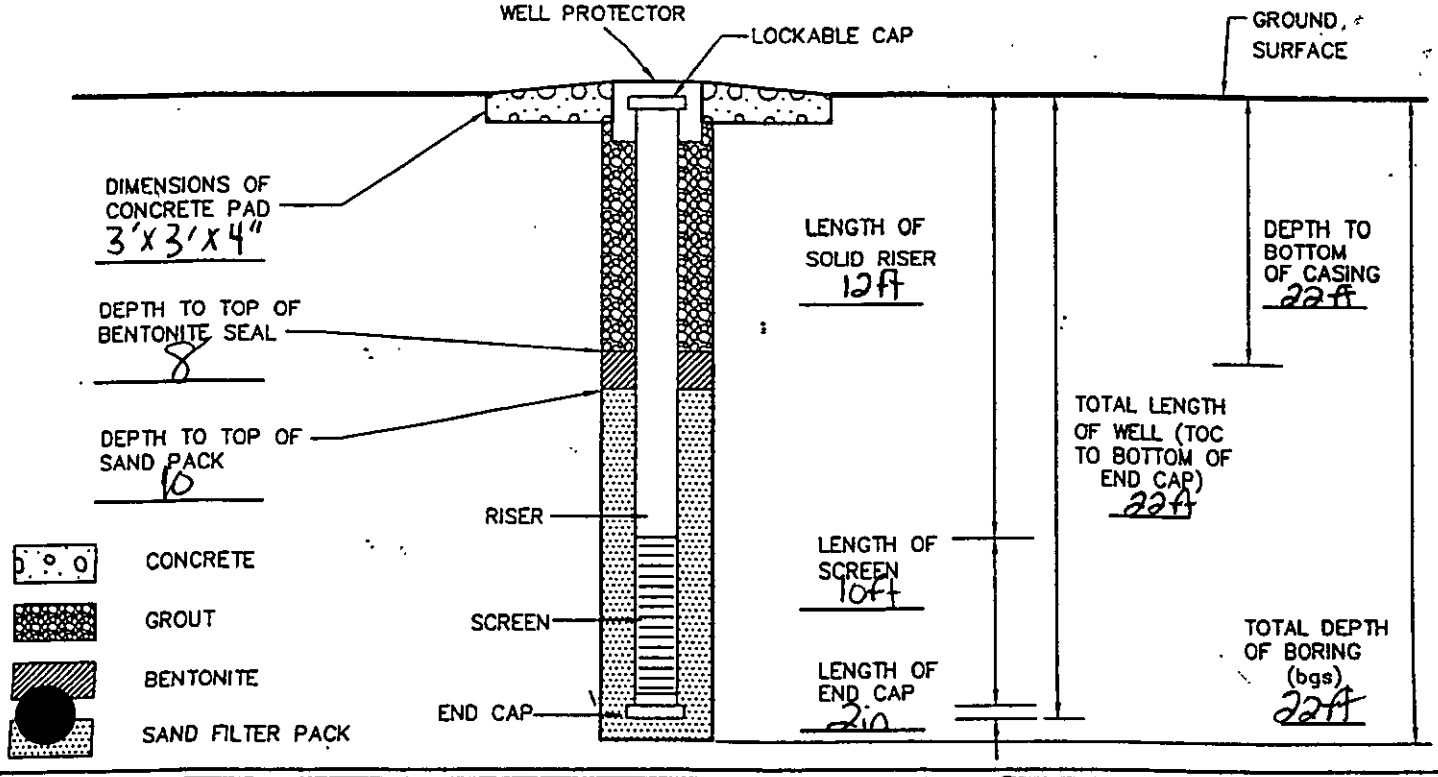
BOREHOLE DIAMETER 8"
MACTEC FIELD REPRESENTATIVE Amy Gilaway
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 45lbs
AMOUNT BENTONITE USED (GROUT) —
AMOUNT CEMENT USED (GROUT) —
AMOUNT SAND USED 3 1/2 bgs = 175 lbs

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time) —

REMARKS —

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook — INSPECTOR: Amy Gilaway
DISCREPANCIES: — CHECKED BY: — DATE: —

869 535

869 536 lower

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301-03-0011

WELL NO. CSMMW-10B WELL LOCATION Entrance to DDRV

DATE 12/19/03 TIME 1635

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.010"

RISER MATERIAL Sch. 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS Well installed as nest with CSMMW-10C

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE A. Calloway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL)

AMOUNT BENTONITE USED (GROUT)

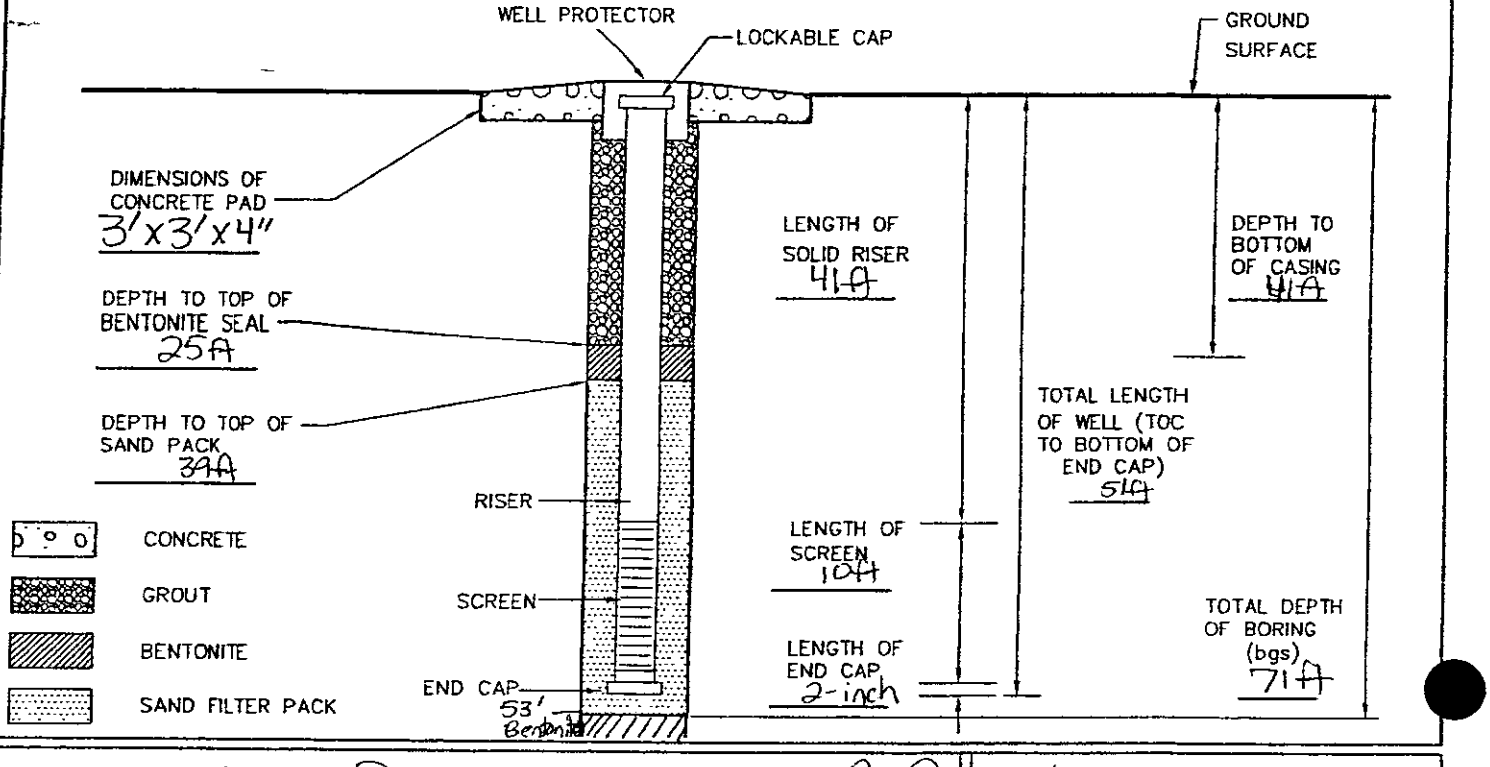
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 250 lbs

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny INSPECTOR: A. Calloway

DISCREPANCIES: CHECKED BY: DATE:

J:\design\Standard Details\Well installation diagrams\ATACH 5-1b8.dwg 10/04/2004 4:37pm rakrand

saprolite

869 537

ATTACHMENT 5.1B ~~UPPER~~ WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME OSCR PROJECT NO. 6301-03-0011

WELL NO. CSMMW-10C WELL LOCATION Entrance to DDRV

DATE 12/19/03 TIME 1635

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL sch. 40 PVC

MANUFACTURER OSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.010"

RISER MATERIAL sch. 40 PVC

MANUFACTURER OSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS Well installed as nest with CSMMW-10B

BENTONITE TYPE 3/8" pellets

MANUFACTURER DSI

CEMENT TYPE Type I/II

MANUFACTURER Roanoke

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE A. Calloway

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL)

AMOUNT BENTONITE USED (GROUT)

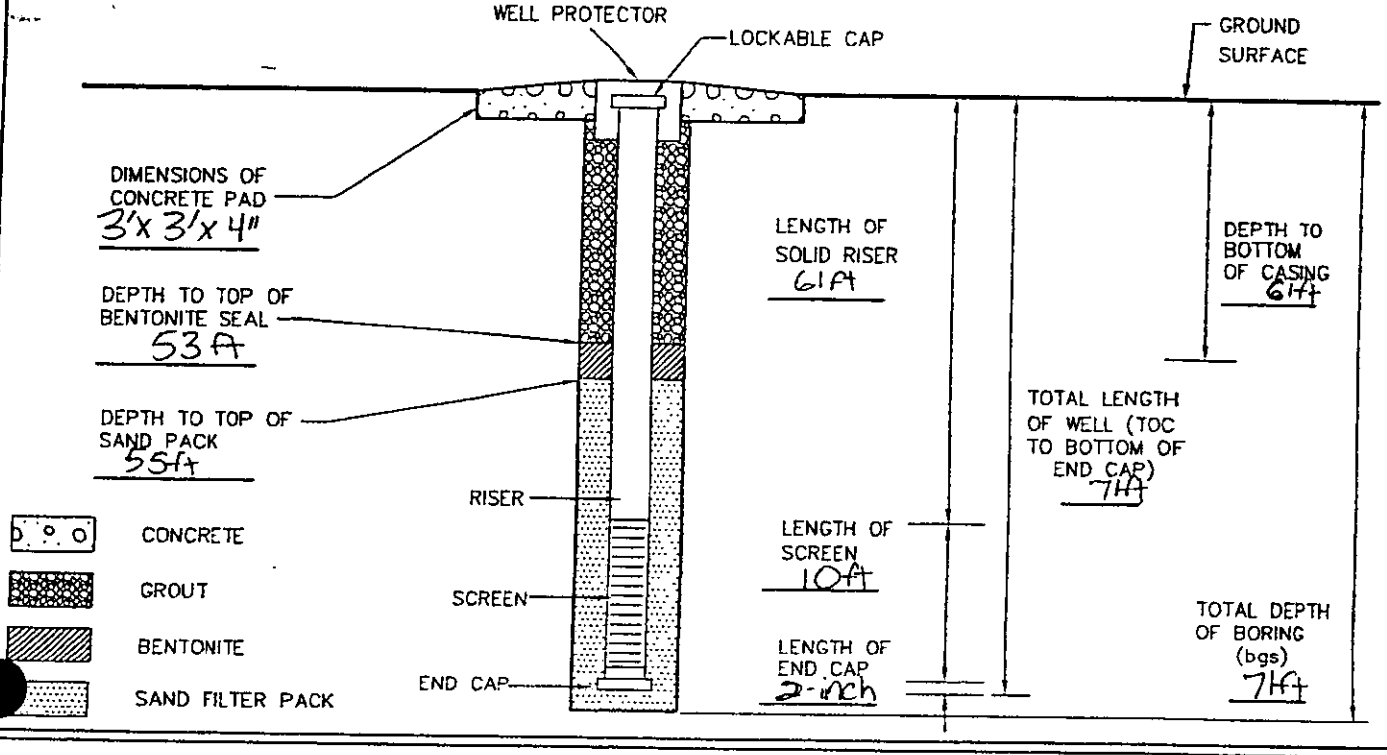
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 300lbs

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: INSPECTOR:

DISCREPANCIES: CHECKED BY: DATE:

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869 538

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: ~~Richard Simmons~~ KT Dan Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID HSA; 2"x2' Split-Spoon sampler	9. HOLE LOCATION (SITE): 2nd St. + Road G	
	10. SURFACE ELEVATION	
8. WEATHER: P. Cloudy, low 40's, breezy	11. DATE STARTED: 12/18/03	12. DATE COMPLETED
13. OVERBURDEN THICKNESS	16. DEPTH GROUNDWATER ENCOUNTERED	
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES: NA			
21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR		
		3		Kevin Tauthus		
25. CHECKED BY:			26. NAME OF INSPECTOR: Kevin Tauthus			

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		Grass + Topsoil					
	1	Firm, 7.5YR4/6 Strong brown Silty clay w/ sand, moist (CL)					
	2						
	3	Very stiff, 7.5YR6/6 reddish yellow; Sandy Clay (CL), moist	Q			7,7, 12,14	20/24
	4						
	5						
	6						
	7						
	8	Very stiff, 7.5YR5/8 Strong brown, Clayey, Sand (SC) w/ gravel, Very moist.				7,9, 12,13	
	9						

HTW DRILLING LOG

869 539

HOLE No. CSMMW-10C

PROJECT: DSCR Supplemental FS

INSPECTOR: Kevin Tautkus

SHEET OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	Recovery REMARKS h
	10						
	11						
	12						
	13	Very Firm, 10YR 7/6 yellow, gravelly sand (SP), wet	∅	Upper WBU		7,5, 13,12	20/24
	14						
	15	Very firm, same as above	∅			5,12, 15,18	24/24
	16						
	17	Firm, same	∅			10,5 15,18	20/20
	18						
	19	Dense, 10YR7/6 yellow, Sand (SP) w/ trace gravel wet, med grained	∅			25,23 23,21	24/24
	20						
	21	Very stiff, 10YR5/8 Yellowish brown, Clay (CH) moist	∅			8,9, 11,11	20/24
	22						
	23					6,8; 8,9	NR
	24						
	25	Stiff, intermixed 10YR5/8 yellowish brown and lt. gray, Clay (EH), moist	∅			4,6, 8,8	24/24
	26						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS

HOLE No. CSM MW-10C

HF - Rev. 4/94

869 540

HTW DRILLING LOG

HOLE No. CSM-MW-10C

PROJECT DSCR Supplemental FS | INSPECTOR K. Tautkus/Cindy Calaway | SHEET 3 OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		see page 2					
	27	Stiff, GLEY 1 3/10Y dk. greenish gray, CLAY (CH), moist	X			5,4 8,18	24/24
	28						
	29	very stiff, same as above					
	30		X			11,8 12,16	24/24
	31						
	32	No Recovery				22,19 22,22	NR
	33						
	34	Stiff (CH) CLAY, same as above.	X			5,5 4,8	24/24
	35						
	36	very stiff, 2.5/1 greenish black silty clay (CL) w/very fine sand moist	X			6,10 11,15	24/24
	37						
	38	Black (GLEY 1N2.5/) Silty very fine SAND, sp-sm moist	0.0			4,1 3,16	5/24
	39						
	40	Black (GLEY1N2.5/) Silty, very fine SAND sp-sm, moist	0.0			15,39 50/5	6/24
	41						
	42		0.0			28 50/5	8/24
	43						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011 | HOLE NO. CSMMW-10C

HF - Rev. 4/94

HTW DRILLING LOG

869 541

HOLE No. GSM MW-10C

PROJECT OSR Supplemental FS

INSPECTOR Amy Allaway

SHEET OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	44						
	45						
	46						
	47						
	48	No recovery				50/3	0/24
	49						
	50						
	51						
	52						
	53						
	54						
	55	Coarse, Greenish Gray (5GY 6/1) Slightly clayey, coarse grain SAND SP wet with some pebbles.				8,18	5/24
	56					50/5	
	57						
	58						
	59						
	60						
	61						

869 542

HTW DRILLING LOG

HOLE No. CSMMW-10C

PROJECT DSCR Supplemental FS | INSPECTOR Amy Allaway | SHEET OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	62	Dense Dark Greenish Gray (GLEY 2 10G 4/1) clayey, coarse grain SAND. Moist, large piece of quartz, some pebbles. SP				23,31	
	63					37 50/3	6/24
	64						
	65						
	66						
	67						
	68						
	69	No Recovery				45,29	0/24
	70					50/1	
	71	Refusal with auger					
	72	Refusal with sampler				Refusal	
	73						
	74						
	75						
	76						
	77						
	78						
	79						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR Supplemental FS 630403-0011 | HOLE No. CSMMW-10C | HF - Rev. 4/

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. _____

WELL NO. CSMMW-11B WELL LOCATION DDRU

DATE 12/20/03 TIME 1604

GROUND SURFACE ELEVATION N/A

TOP OF SCREEN ELEVATION N/A

REFERENCE POINT ELEVATION N/A

TYPE FILTER PACK SAND GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-INCH SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-INCH

DRILLING TECHNIQUE Hollow Stem Augers

AUGER/BIT SIZE AND TYPE 4.25-INCH ID

REMARKS _____

BENTONITE TYPE 3/8 Pellet

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 50 POUND

AMOUNT BENTONITE USED (GROUT) 5 pound

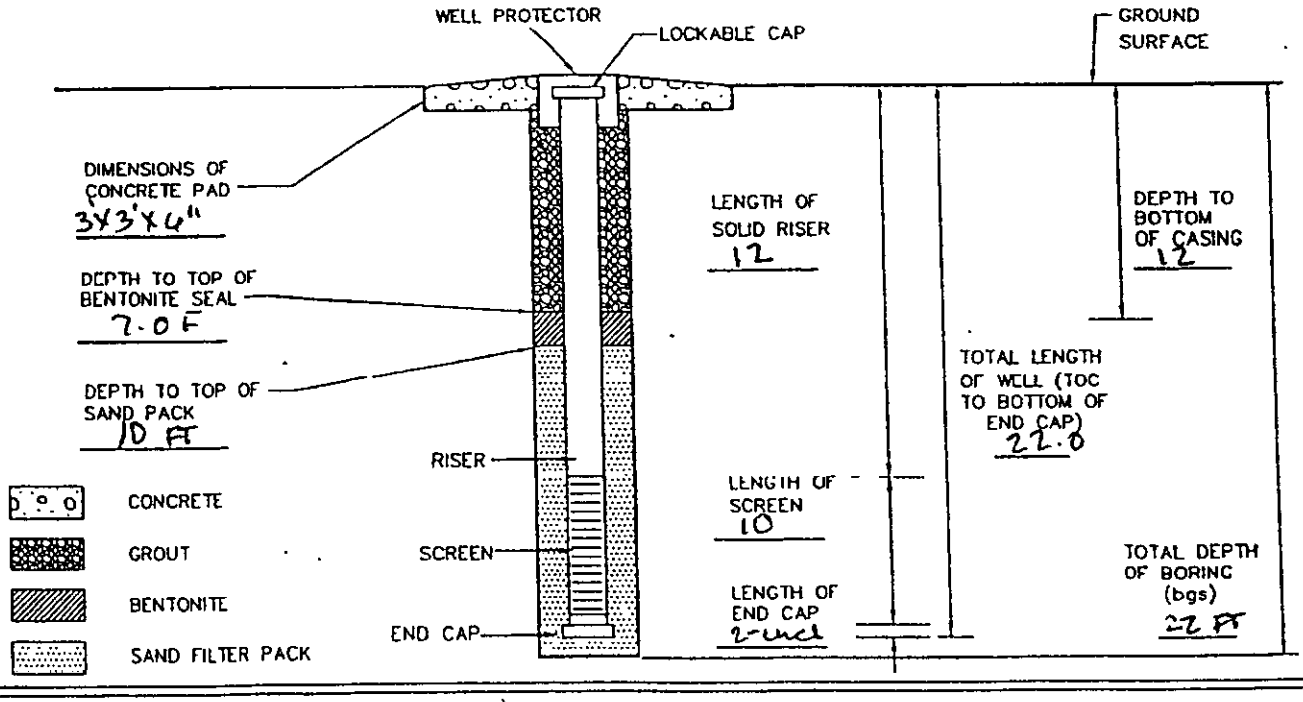
AMOUNT CEMENT USED (GROUT) _____

AMOUNT SAND USED 350 POUND

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time) _____

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Lacko INSPECTOR: M. Vazquez

DISCREPANCIES: _____ CHECKED BY: _____ DATE: _____

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869 544

ATTACHMENT 5.1B UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR Supplemental FS PROJECT NO. 6301-03-001
WELL NO. CSMMW-11~~B~~C WELL LOCATION DDRV
DATE 12/20/03 TIME 1400

GROUND SURFACE ELEVATION N/A
TOP OF SCREEN ELEVATION N/A
REFERENCE POINT ELEVATION N/A
TYPE FILTER PACK SAND GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC
MANUFACTURER DSI
SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Augers
AUGER/BIT SIZE AND TYPE 4.25-inch ID

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Portland Type I/II
MANUFACTURER DSI

BOREHOLE DIAMETER 8-inch
MACTEC FIELD REPRESENTATIVE M. Vazquez
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 150 pound
AMOUNT BENTONITE USED (GROUT) 3 pound

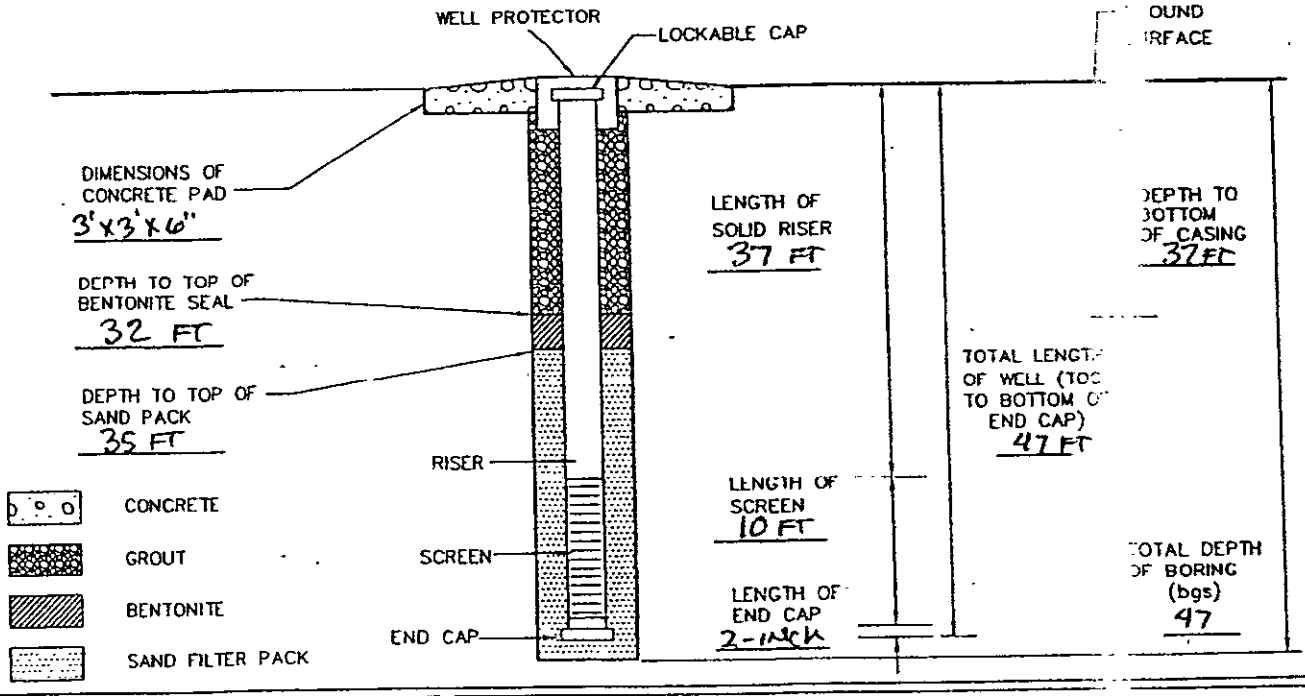
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 350 pound

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Lacko INSPECTOR: M. Vazquez
DISCREPANCIES: CHECKED BY. DATE:

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HTW DRILLING LOG

869 545

HOLE No. CSMMW-11

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 4 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): RICHMOND VA	
5. NAME OF DRILLER: Chris Lacko	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-INCH SPLIT BARREL SAMPLER; 3-INCH SPLIT BARREL W/ LH; 13/20=3 RING CME 5' SAMPLER; 4.25" ID HOLLOW STEM AUGER	9. HOLE LOCATION (SITE): DSCR/DDRV	
	10. SURFACE ELEVATION	
8. WEATHER: Partially Cloudy / Cold (27°F)	11. DATE STARTED: ~~12/19/03~~ 12/20/03	12. DATE COMPLETED
13. OVERBURDEN THICKNESS	16. DEPTH GROUNDWATER ENCOUNTERED	
14. DEPTH DRILLED INTO ROCK	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
2	✓		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
4	✓	✓				N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
				Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	M. VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		ASPHALT			CSMDPT-10 SO(0-6")		
	1	FILL SANDY GRAVEL					
		DARK OLIVE GRAY (5GY 3/2) SPB 4/1)					
	2	MEDIUM SANDY CLAY - (DRY) (CL)					
		MOTTLED LIGHT GRAY (5GY 7/1 N7/)					
	3	REDISH YELLOW (7.5YR 6/8) VERY CLAYEY COARSE SAND WITH GRAVEL (SC) DRY					
	4						0-12.5
		VERY PALE BROWN (10YR 8/2 MOTTED YELLOW (10YR 7/8) SANDY					
	5	SILT WITH GRAVEL FROM 4-5 FT BGS) (ML)					
	6						
	7						
	8						
		REDISH YELLOW (7.5YR 6/8)		MW (CSMMW-11)	CSMMW-11 SO (8-11)		
	9	VERY CLAYEY POORLY GRADED MEDIUM TO COARSE SAND ~~with~~ and gravel (SC/GC) (WET AT 11 FT BGS)					
	10				MOD CSMDPT-10 SO (10-12)		

869 546

HTW DRILLING LOG

HOLE No. CSMMW-11

PROJECT: DSCR Supplemental FS

INSPECTOR: M Vazquez

SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10				CSMBPT-10 SO (10-12)		
	11						
	12						
	13						
	14	Yellowish RED (5YR 5/8) MOTTLED VERY PALE BROWN (10YR 7/4) silty, clayey					
	15	VERY GRAVELY POORLY GRADED					
	16	MEDIUM to COARSE SAND (SP-SM)		CSMMW-11 SO (15-20)			
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24	DENSE, YELLOWISH RED (5YR 5/8) MOTTLED					
	25	VERY PALE BROWN (10YR 7/4) SILTY				9, 12, 19	
	26	FINE GRAVELY POORLY GRADED MEDIUM to COARSE SAND (SP-SM) DAMP.				32	
	27					11, 18, 24	11:38
	28					28	

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-11

HF — Rev.

HTW DRILLING LOG

HOLE No. CSM MW-11

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	DENSE, Yellowish RED (5YR 5/8) MOTTLED VERY PALE BROWN (10YR 7/4) CLAYEY SILTY FINE GRAVELLY POORLY GRADED MEDIUM to COARSE SAND (SP-SM) - DAMP.				9, 15, 22	
	29					24	
	30						
	31	DENSE, PALE YELLOW (5Y 8/3) VERY CLAYEY POORLY GRADED COARSE SAND (SC) (MATERIAL MAY CONTAIN some GRAVEL) similar to low WOH (CEMENTED SAND) MATERIAL - DAMP				7, 21, 25,	11:55
	32					34	
	33					22, 22, 21	
	34	SAPROLITE, GRAYISH GREEN (GLEY 1 5G 5/2) SILTY FINE TO MEDIUM POORLY GRADED SAND - DRY				24	
	35					12, 21, 22	
	36					29	
	37						
	38						
	39			CSM MW-11 SO (39-44)	CSMMW-11 SO (39-44)		
	40						12:45
	41						
	42						
	43						
	44						
	45						
	46						

MRK FORM JUN 89 55-2

PROJECT NAME & NO.: DSCR Supplemental FS 6301-03-0011

HOLE No.: CSM MW-11

HF — Rev. 5/94

869 548

HTW DRILLING LOG

HOLE No. CSM MW-12

SHEET 4 OF 4 SHEETS

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47	Boring terminated to 47 FT BELOW GROUND SURFACE.					
	48						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSM MW-12

HF — Rev. 5/94

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011
WELL NO. CSMMW-12A WELL LOCATION DDRV
DATE 12/21/03 TIME 1600

GROUND SURFACE ELEVATION —
TOP OF SCREEN ELEVATION —
REFERENCE POINT ELEVATION —
TYPE FILTER PACK SAND GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC
MANUFACTURER DSI
SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow STEAM Auger
AUGER/BIT SIZE AND TYPE 4.25-INCH ID

BENTONITE TYPE 3/8 PELET
MANUFACTURER DSI
CEMENT TYPE Portland Type I/II
MANUFACTURER ROANOKE CEMENT

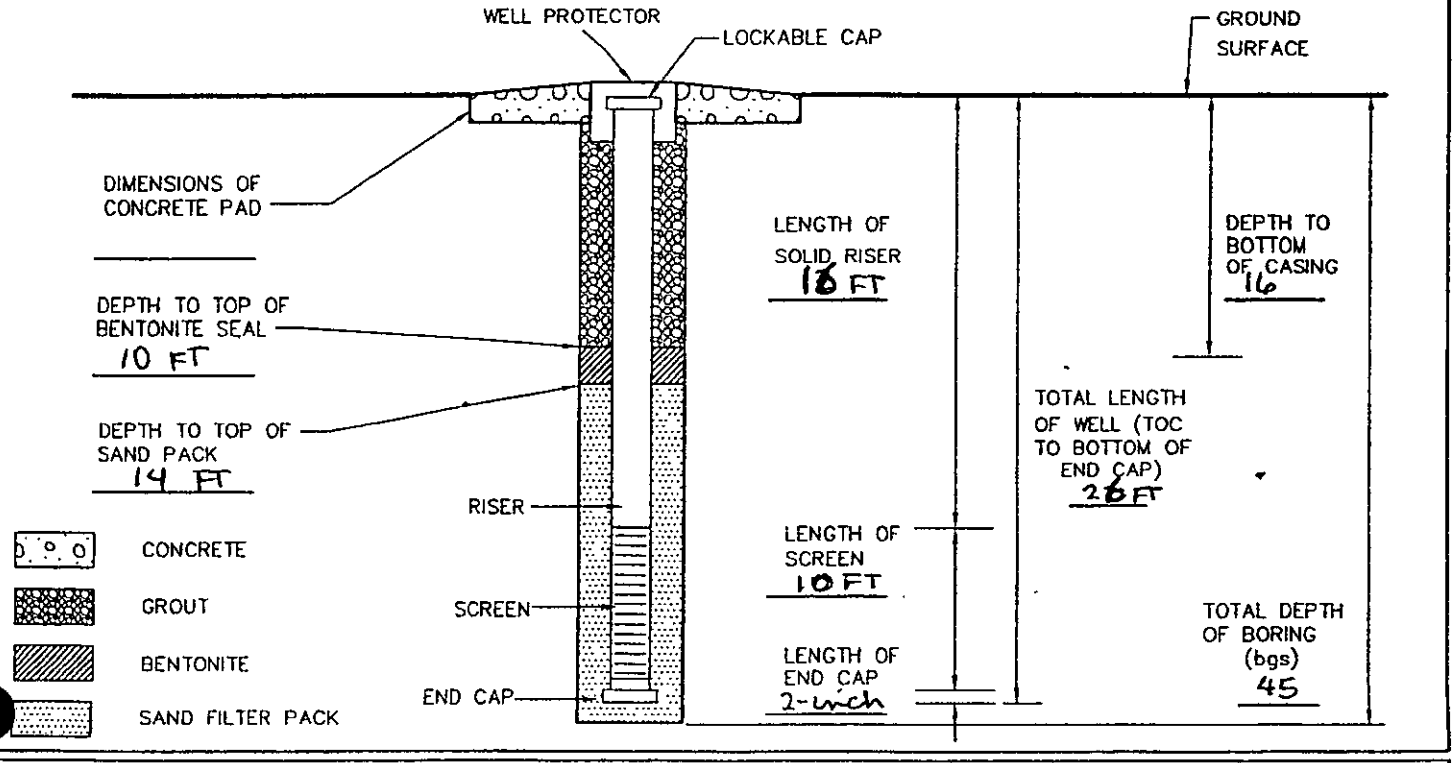
BOREHOLE DIAMETER 8-inch
MACTEC FIELD REPRESENTATIVE M. VAZQUEZ
DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 150 Pound
AMOUNT BENTONITE USED (GROUT) 5 pound
AMOUNT CEMENT USED (GROUT) 200 pound
AMOUNT SAND USED 350 Pounds

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS Borehole Plug with Betonite from 45' to 27 FT Bgs

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: DANNY Cook INSPECTOR: M. VAZQUEZ
DISCREPANCIES: CHECKED BY: DATE:

869 550 UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011

WELL NO. CSMMW-12B WELL LOCATION DDEV

DATE 01/12/04 TIME 1300

GROUND SURFACE ELEVATION N/A

TOP OF SCREEN ELEVATION N/A

REFERENCE POINT ELEVATION Provided on Separate Sheet

TYPE FILTER PACK SAND GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC

MANUFACTURER DSI

SCREEN DIAMETER 2-INCH SLOT SIZE 0.01

RISER MATERIAL PVC

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25-INCH ID

BENTONITE TYPE 3/8 Pellets

MANUFACTURER DSI

CEMENT TYPE Portland TYPE I/II

MANUFACTURER ROANOKE Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. VAZQUEZ

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 150 LB

AMOUNT BENTONITE USED (GROUT) 20 LB

AMOUNT CEMENT USED (GROUT)

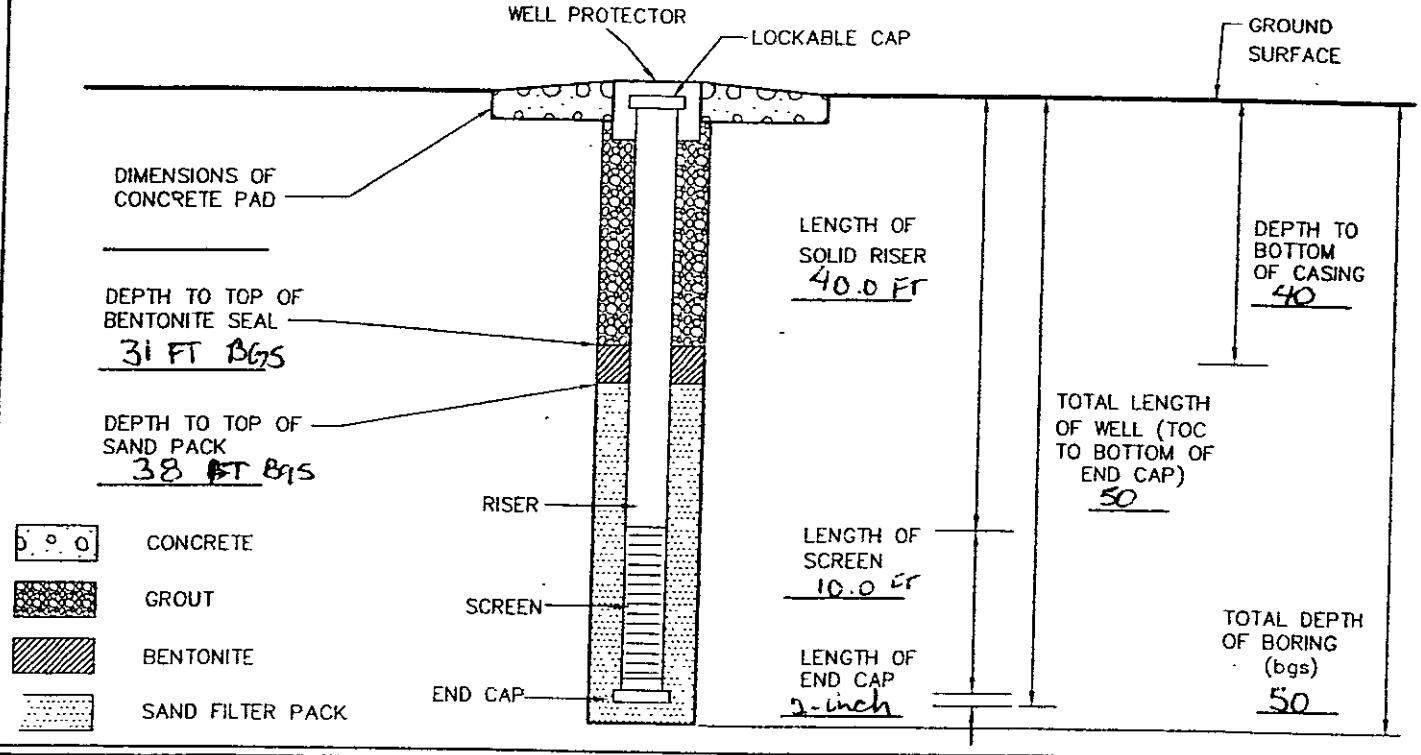
AMOUNT SAND USED 450 LB

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Lache INSPECTOR: M. VAZQUEZ

DISCREPANCIES: CHECKED BY: DATE:

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL FS PROJECT NO. 6301-03-0011
WELL NO. CSMMW-12C WELL LOCATION DDRV
DATE 01/12/04 TIME

GROUND SURFACE ELEVATION NA
TOP OF SCREEN ELEVATION NA
REFERENCE POINT ELEVATION PROVIDE IN SEPARATE SHEET
TYPE FILTER PACK SAND GRADATION #1
FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC
MANUFACTURER DST
SCREEN DIAMETER 2-INCH SLOT SIZE 0.01

RISER MATERIAL PVC
MANUFACTURER DSI
RISER DIAMETER 2-INCH

DRILLING TECHNIQUE HOLLOW STEM AUGER
AUGER/BIT SIZE AND TYPE 4.25-INCH ID

BENTONITE TYPE 3/8 PELLETS
MANUFACTURER DSI
CEMENT TYPE PORTLAND TYPE I/II
MANUFACTURER ROANOKE CEMENT

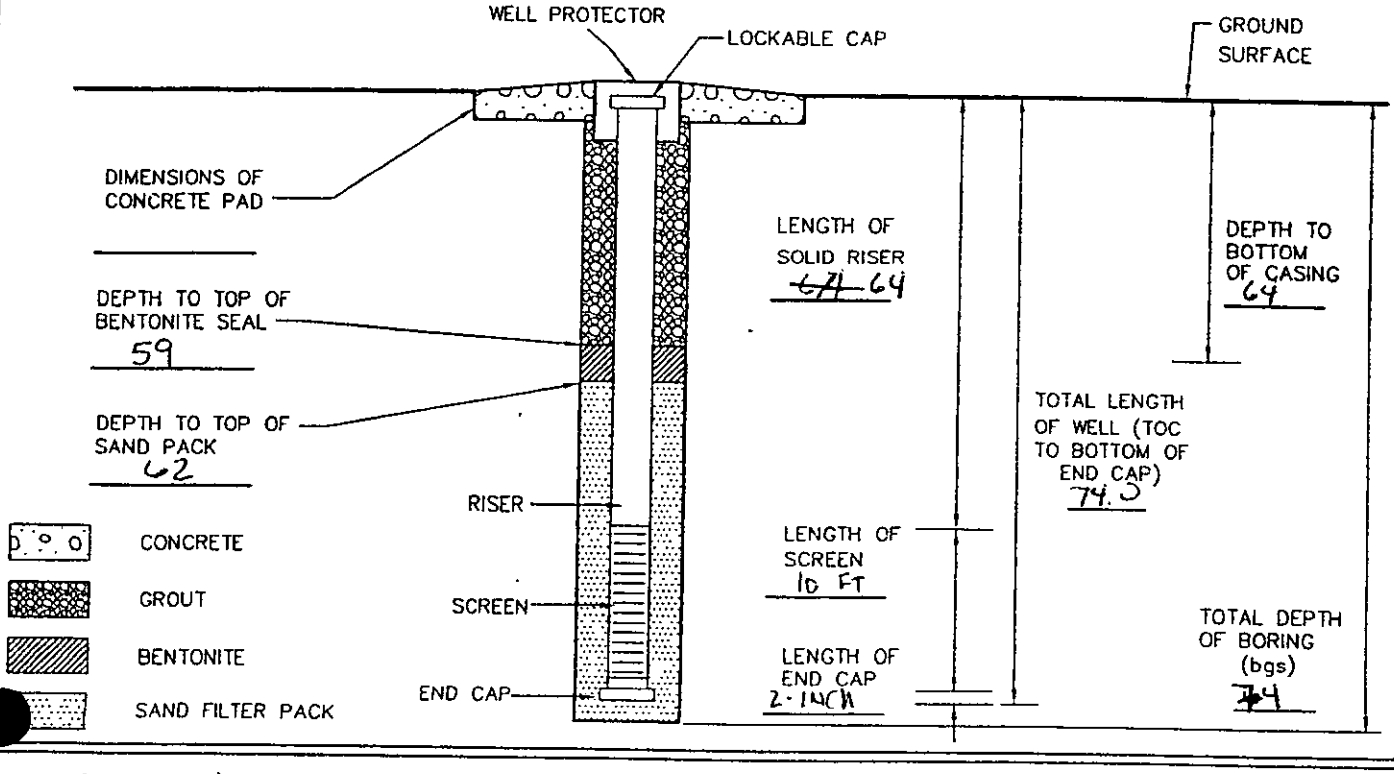
BOREHOLE DIAMETER 5-INCH
MACTEC FIELD REPRESENTATIVE M. VAZQUEZ
DRILLING CONTRACTOR RICHARD SIMMONS

AMOUNT BENTONITE USED (SEAL) 50 POUND
AMOUNT BENTONITE USED (GROUT)
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 350 LB

STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris Iacho INSPECTOR: M. VAZQUEZ
DISCREPANCIES: CHECKED BY: DATE:

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869 552

C5MMW-12

1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET 1 OF 5 SHEETS
MACTEC ENGINEERING AND CONSULTING	Richard Simmons	

3. PROJECT	4. LOCATION (CITY, STATE)
DSCR Supplemental 6301-03-0011	Richmond VA
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
DANNY	GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2" split Barrel Sampler, 3" split Barrel Sampler, 5' long sampler, 4.25" ID Hollow Stem Auger	9. HOLE LOCATION (SITE): DDRV
	10. SURFACE ELEVATION: To be provided under separate sheet
8. WEATHER: Sunny, Cold 30°F	11. DATE STARTED: 12/21/03 — 12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than ~~60~~ 100 74 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ~~± 9 FT BGS~~ ± 11.0 FT BGS
14. DEPTH DRILLED INTO ROCK: N A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
3	✓		

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
~~3~~ 4	✓	✓	AMBA			

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
NESTED WELLS B,C		✓		Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	Miguel A Vazquez

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		ASPHALT (4")					
		CONCRETE (8")					
	1	FIRM, BROWN (7.5YR 5/2) POORLY GRADED SILTY FINE SAND (SM) DRY				6,7,8,10	
	2						
	3						
	4	RED (2.5YR 5/8), SANDY CLAY (CL) WITH LENSES OF COARSE SAND (FILL) DRY - MOIST				Pushed	
	5						
	6	BROWN (7.5YR 5/2) POORLY GRADED CLAYEY MED SAND (SM) MOIST				Pushed	
	7						
	8						
	9	FIRM, YELLOWISH BROWN (10YR 5/6) CLAYEY POORLY GRADED COARSE SAND (SM) - WET				3,3,4,4	GW ± 11 FT BGS
	10						

HTW DRILLING LOG

HOLE No. CSMMW-12

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 2 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14						
	15	BROWNISH YELLOW (10YR 6/8) WELL GRADED FINE TO COARSE SAND AND GRAVEL (SW/GP)		CSMMW-12 SO (15-20)	CSMMW-12 SO (15-20)		
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24	DENSE, PINK (7.5YR 7/3) well graded FINE TO COARSE SAND with GRAVEL (SW/GP) (SW) WET				22,17,14	
	25					20	
	26						
	27	STIFF, Brownish Yellow (10YR 6/8) FINE LAMINATED SILTY CLAY (CL) DRY				5,8,7,12	
	28						

869 554

HTW DRILLING LOG

HOLE No. CSMMW-12

PROJECT: DSCR supplemental

INSPECTOR: M Vazquez

SHEET 3 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28					6,7,9,16	
	29	VERY STIFF, DARK GREENISH GRAY (GLEY 1 5GY 4/1) FAT CLAY (CH) DRY					
	30					9,12,14	
	31					14	
	32						
	33	VERY STIFF, DARK GREENISH GRAY (GLEY 1 5G 4/1) SANDY CLAY (CH) Moist				5,7,10,11	
	34						
	35					7,7,5,11	
	36	DENSE, GREENISH BLACK (GLEY 1 10GY 2.5/1) SILTY POORLY GRADED VERY FINE SAND (Moist)				4,18,22	
	37					44	
	38						
	39			CSMMW-12 50 (39-45)	CSMMW-12 SC (39-45')		
	40						
	41						
	42						
	43						
	44						
	45	DENSE, GREENISH BLACK (GLEY 1 10GY 2.5/1) SILTY CEMENTED GRADED VERY FINE SAND (SP-SM) WET					
	46						

HTW DRILLING LOG

HOLE No. CSMMW-12

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 3 to 4 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46	GREENISH-GRAY (5GY 1/10G 6/1) POORLY GRADED SILTY FINE to MEDIUM SAND (SP), VERY DENSE				13,23,27	
	47					50/3	
	48					15,36,35 SC	
	49						
	50						
	51						
	52						
	53	DENSE, GREENISH GRAY (GLEY1 10G 6/1) CLAYEY POORLY GRADED MEDIUM SAND WITH SOME GRAVEL (SC) DAMP				50	
	54						
	55						
	56						
	57						
	58	VERY DENSE, GRAY (5Y 5/1) CLAYEY POORLY GRADED MEDIUM to COARSE SAND (SC) with LENSES OF SILTY CLAY (DRY)				25,39,39 44	
	59						
	60						
	61						
	62	GRAYISH GREEN (GLEY1 5G 5/2) MICACEOUS, SILTY POORLY GRADED COARSE SAND (SP) MOIST (SAPROLITE)		CSMMW-12 SD (62-64)	CSMMW-12 SD (62-64)		
	63						
	64						

869 556

HTW DRILLING LOG

HOLE No. CSMMW-12

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 5 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	64						
	65						
	66						
	67						
	68						
	69						
	70						
	71						
	72						
	73						
	74	BORING TERMINATED AT 74 FT BELOW GROUND SURFACE					
	75						
	76						
	77						
	78						
	79						
	80						
	81						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMMW-12

HF - Rev. 4/94

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME OSCR
PROJECT NO. 6301.03.0011
WELL NO. CSMP2-1
WELL LOCATION DORV Between WH98 & WH66
DATE 11/18/03
START TIME

GROUND SURFACE ELEVATION —
REFERENCE POINT ELEVATION —
MACTEC FIELD REPRESENTATIVE M. Vazquez
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER OSI
SCREEN MATERIAL 100 mesh
MANUFACTURER Solinst
TUBING DIAMETER 1.7" OD
DRILLING TECHNIQUE Hollow Stem Auger
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS Continuous Multichannel Tubing

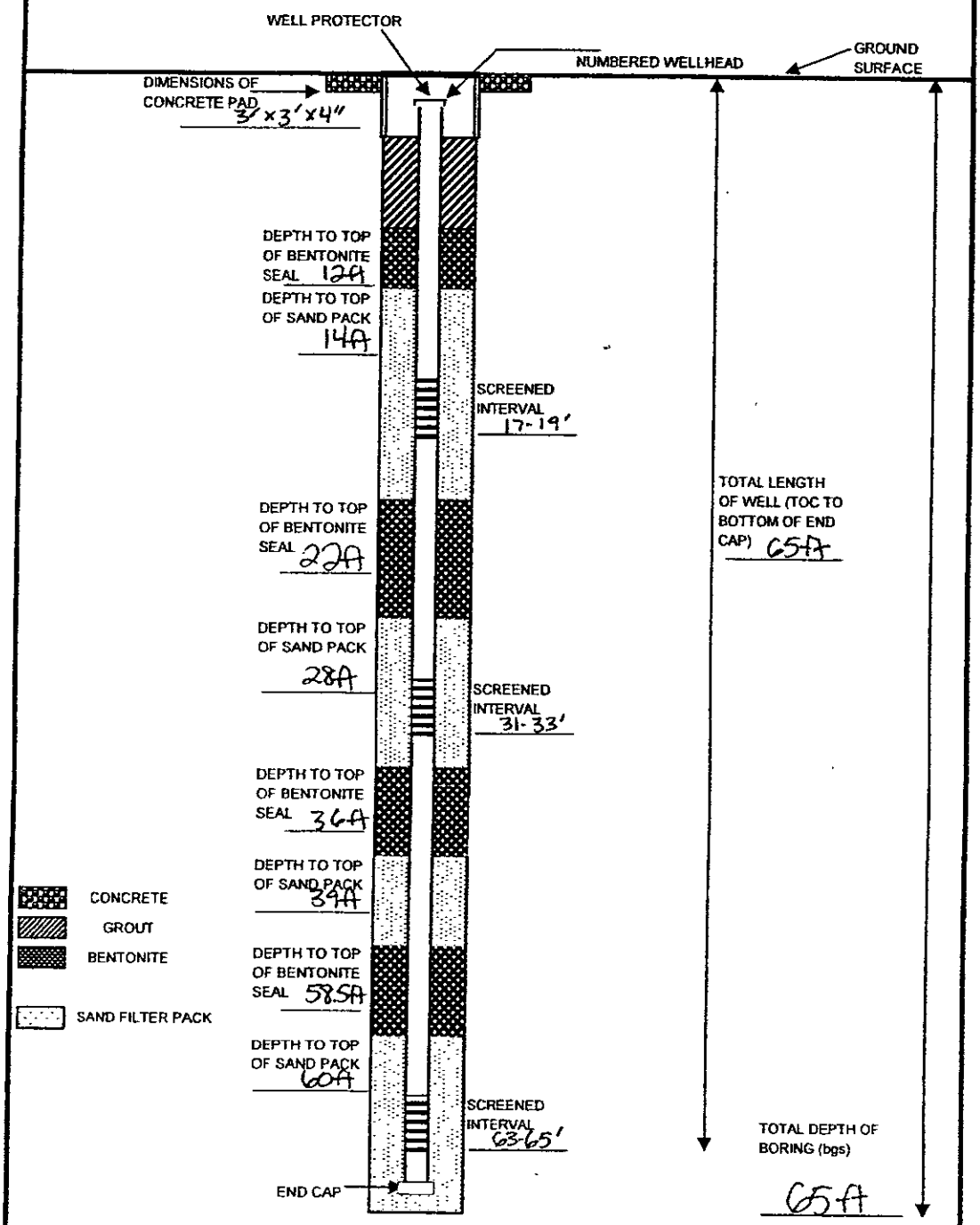
BENTONITE TYPE 3/8" pellets
MANUFACTURER OSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 8-inch
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL)
AMOUNT BENTONITE USED (GROUT)
UPPER WBU a
LOWER WBU B
SAPROLITE WBU C
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED 14 bags
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

869 558

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

WELL NO. CSMPZ-1

(NOT TO SCALE: ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR M. Vazquez

DISCREPANCIES _____ CHECKED BY _____ DATE _____

HTW DRILLING LOG

HOLE No. CSMPZ-1

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons
SHEET 1 OF 5 SHEETS	
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 inch ID Hollow Stem Augers; 2-inch x 2FT Split Barrel Sampler	9. HOLE LOCATION (SITE): DDRV between WH 98 and WH 66
	10. SURFACE ELEVATION: Provided in separate sheet.
8. WEATHER: Rainy cold	11. DATE STARTED: 11/18/03 — 12. DATE COMPLETED: 11/21/03
13. OVERBURDEN THICKNESS: More than 65 FT BGS	16. DEPTH GROUNDWATER ENCOUNTERED: ± 9.5 FT
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE: 65 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
3	✓		NONE

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	Miguel A Vazquez

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		CONCRETE					
	1	RED HARD, RED (10R 4/8) slightly SANDY CLAYEY SILT (MH) (DRY)	Background 0.1 BZ 0.1			7, 14, 22 28	0810 Recovery 24 inch
	2						
	3						
	4	DENSE, DARK GREENISH GRAY (GLEY 1 5G 4/1) MICACEOUS MED to COARSE SAND (SP)				13, 20, 29, 24	0816 Recovery 24 inch
	5	VERY HARD, RED (10R 4/8) slightly SANDY CLAYEY SILT (MH) DRY					
	6						
	7						
	8						
	9	VERY STIFF, MOTTLED RED (10R 4/8) REDDISH YELLOW (7.5YR 7/8) CLAYEY FINE SANDY SILT (MH) DAMP	Background 0.3 BZ = 0.3			7, 8, 9, 9	0822 Recovery 24 inch

869 560

HTW DRILLING LOG

HOLE No. CSMP2-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 2 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14						0829
	15			(14-16) CSMP2-1A 1		7,9,10 12	RECOVERY 18 inches
	16	FIRM, STRONG BROWN (7.5YR 5/8) SILTY POORLY GRADED FINE SAND WET (SM)					
	17						
	18						
	19		Background 0.5 BZ 0.5			5,6,6,6	0833 RECOVER 24 inch
	20	STIFF, MOTTLED REDISH YELLOW (7.5YR 5/8, LIGHT GREENISH GRAY (GLEY 2 5BG7/1) SILTY CLAY (CL)					
	21						0844
	22	VERY STIFF, DARK GREENISH GRAY (GLEY 1 10GY 4/1) FAT CLAY (OH) (CH)				5,8,10 16	RECOVERY 24 inch
	23		Background 0.5 BZ = 0.5				
	24					10,15,18 23	0850 RECOVER 24 inch
	25					4,3,5 10	0853 RECOVERY 24 inch
	26						
	27	VERY FIRM, VERY DARK GREENISH GRAY CLAYEY POORLY GRADED VERY FINE SAND (SC) (Moist)				3,5,8,9	0900
	28						

HTW DRILLING LOG

HOLE No. CSMPZ-1

PROJECT: DSCR Supplemental FS

INSPECTOR: M Vazquez

SHEET 3 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29	DENSE, VERY DARK greenish gray Clayey Poorly graded VERY FINE SAND (SC) Moist	Background 0.3 BZ = 0.3	CSMPZ-1B (29-31)		4,10,16 21	0906 RECOVERY 24 inches
	30						
	31						0912 RECOVERY
	32	WET, (SC)					
	33						
	34	NO RECOVERY	Background 0.5 BZ = 0.5			50/0"	0926 50/0
	35						
	36						
	37						
	38						
*	39	VERY DENSE, MOTTLED light bluish gray (GLEY 2 10B 8/1)				24,50/5"	0937
	40	YELLOWISH RED (5YR 5/8) clayey					
	41	POORLY graded COARSE SAND with gravel (SP-SC)					
	42						
	43						
	44	VERY DENSE MOTTLED light bluish gray (GLEY 2 10B 8/1),	Background 0.5 BZ = 0.5			15,40,44 50/5"	0946 RECOVERY 12"
	45	YELLOWISH RED (5YR 5/8) CLAYEY POORLY GRADED COARSE SAND WITH GRAVEL (SP-SC)					WET
	46						

869 562

HTW DRILLING LOG

HOLE No. CSMPZ-1

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 4 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	VERY DENSE, MOTTLED Light Olive gray (GLEY2 10B 6/1) Yellowish RED (5YR 5/6) Clayey Poorly graded COARSE SAND with gravel (SP-SC) DRY				30, 50/6"	1015 RECOVERY 12 inches
	50						
	51						
	52						
	53					42, 50/5	1024 RECOVERY
	54	SAME AS ABOVE (SP-SC)					
	55						
	56						
	57						
	58						
	59					13, 17 24, 30	1040
	60	SAPROLITE - GREENISH GRAY (GLEY2 10G 5/1) MOTTLED GREENISH gray (GLEY2, 10G 6/1) Light greenish gray (GLEY2 10G 7/1) Silty CLAYEY FINE TO COARSE SAND (SW-SM)		1 CSMPZ-1C (59-61)			
	61						
	62						
	63						
	64						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No. CSMPZ-1

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMPZ-1

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 5 OF 6 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	64						
	65	BORING TERMINATED AT 65.0 FT BGS. A CONTINUOUS MULTICHANNEL TUBING (CMT) WAS INSTALLED TO 65.0 FT.					
	66						

MRK FORM JUN 89 55-2

PROJECT NAME & NO: DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No. CSMPZ-1

HF - Rev. 4/94

869 564

Lower WBU Piezometer

ATTACHMENT 5.1B ~~UPPER WBU MONITORING WELL~~ INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR CSM — PROJECT NO. 6301-03-0011

WELL NO. CSMPZ-2B — WELL LOCATION DDRV FRONT OF WH 66

DATE 11/15/03 — TIME

GROUND SURFACE ELEVATION

TOP OF SCREEN ELEVATION

REFERENCE POINT ELEVATION

TYPE FILTER PACK SAND — GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC sch 40

MANUFACTURER DSI

SCREEN DIAMETER 2 inch — SLOT SIZE 0.01

RISER MATERIAL PVC sch 40

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25 ID

REMARKS

BENTONITE TYPE 3/8 Pellets

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 5 gallon Bucket

AMOUNT BENTONITE USED (GROUT)

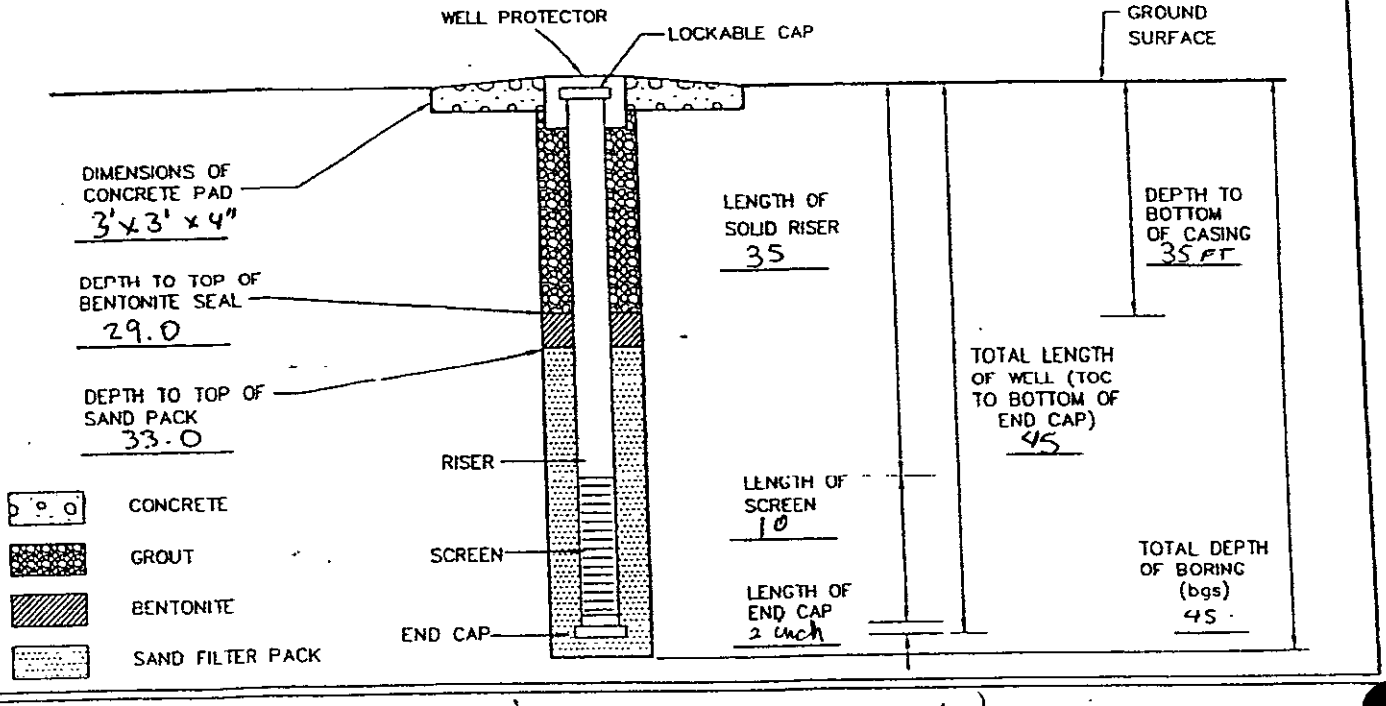
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 375 Pound

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER:

INSPECTOR: M. Vazquez MV

DISCREPANCIES:

CHECKED BY.

DATE:

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HTW DRILLING LOG

HOLE No. CSMPZ-2B

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: RICHARD SIMMONS
SHEET: OF 1 SHEETS	
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): Richmond VA
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: GP-1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25-INCH ID AUGERS; 2-INCH OD split spoon SAMPLER; 2FT LONG.	9. HOLE LOCATION (SITE): OUB AREA - FRONT OF WH 6C
	10. SURFACE ELEVATION: Provided in separate sheet
8. WEATHER: Cloudy, Cold	11. DATE STARTED: 11/15/03 — 12. DATE COMPLETED: 11/17/03
13. OVERBURDEN THICKNESS: MORE THAN 59.0 FT ~~BGS~~ MW	16. DEPTH GROUNDWATER ENCOUNTERED: —
14. DEPTH DRILLED INTO ROCK: N/A.	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 33.00 FT 11/18/03 0819
15. TOTAL DEPTH OF HOLE: 45 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NONE

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
2	2	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
	N/A					

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			piezometer	Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		FOR SUBSURFACE DESCRIPTION REFERES to BORING log CSMPZ-2C					

MRK FORM JUN 89 55

PROJECT NAME & NO.: CONCEPTUAL SITE MODEL-DSCR 4301-03-0011

HOLE No. CSMPZ-2B

HF - Rev. 4/94

869 566

LOWER PIEZOMETER

ATTACHMENT 5.1B ~~UPPER~~ WBU ~~MONITORING WELL~~ INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR CSM — PROJECT NO. 6301-03-0011

WELL NO. CSMPZ-2C — WELL LOCATION DSCR 008

DATE 11/14/03 — TIME

GROUND SURFACE ELEVATION

TOP OF SCREEN ELEVATION

REFERENCE POINT ELEVATION

TYPE FILTER PACK SAND — GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC sch 40

MANUFACTURER DSI

SCREEN DIAMETER 2-inch — SLOT SIZE 0.01

RISER MATERIAL PVC sch 40

MANUFACTURER DSI

RISER DIAMETER 2-inch ID

DRILLING TECHNIQUE Hollow STEAm Auger

AUGER/BIT SIZE AND TYPE 4.25 ID Augers

BENTONITE TYPE 3/8 Pellet

MANUFACTURER PSI

CEMENT TYPE Portland type I/II

MANUFACTURER Ronoke Cement

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 3 1/4 5 gallon Buckets

AMOUNT BENTONITE USED (GROUT)

AMOUNT CEMENT USED (GROUT)

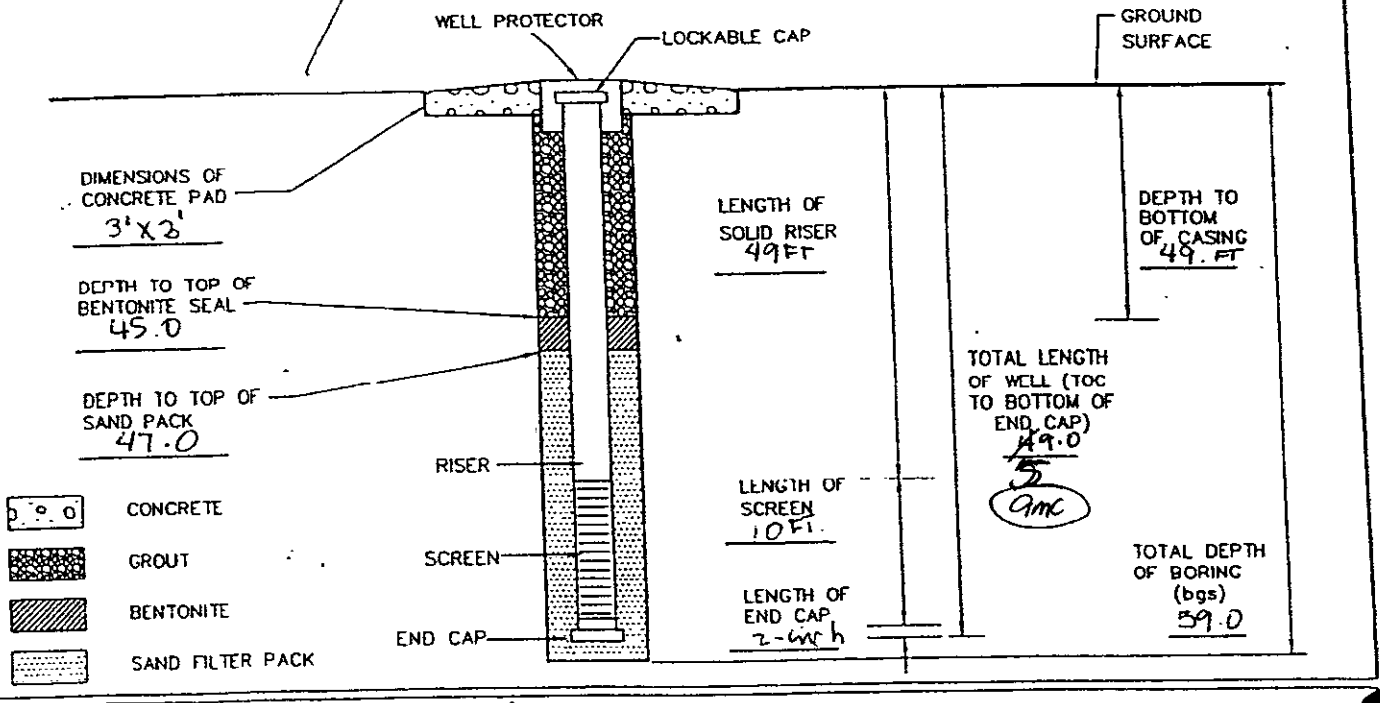
AMOUNT SAND USED 350 pounds

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Richard Simmons — INSPECTOR: M. Vazquez

DISCREPANCIES: — CHECKED BY: — DATE:

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HTW DRILLING LOG

HOLE No. CSMPZ-2C

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons
SHEET OF 1 SHEETS 4	
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: GP-1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 inch ID Augers; 2-inch OD split spoon sampler; 2FT long.	9. HOLE LOCATION (SITE): OU8 AREA - Front of WH 66
	10. SURFACE ELEVATION: ~~MW~~ PROVIDED IN SEPARATE SHEET
8. WEATHER: SUNNY Cold	11. DATE STARTED: 11/14/03 — 12. DATE COMPLETED: 11/17/03
13. OVERBURDEN THICKNESS: ~~MW~~ ▶ more than 59.0FT ~~BGS~~ MW	16. DEPTH GROUNDWATER ENCOUNTERED: 17.0 FT
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: 25.19 FT 11/18/03 MW-2755089
15. TOTAL DEPTH OF HOLE: 59.0	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
2	~~MW~~ # 2	—	—

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
	N/A	N/A				N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			Piezometer	Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	TOP SOIL FILL - CLAYEY FINE SAND w/ fn GRAVEL				5, 15, 13 18	RECOVER 18"
	2	HARD, RED (2.5 YR 4/8), CLAYEY FINE SANDY SILT with GRAVEL (MH)					
	3						
	4	STIFF, Bluish gray (GLEY 2 5PB5/1)				5, 5, 5, 4	RECOVERY 20"
	5	CLAYEY SILT (WET) (ORGANIC) (MH)					
	6						
	7						
	8						
	9	V. STIFF, Bluish gray (GLEY 2 5PB5/1) FAT CLAY with SOME SAND (CH)				7, 10, 12 15	
	10						

869 568

HTW DRILLING LOG

HOLE No. CSMPZ-2C

PROJECT: DSCR CSM | INSPECTOR: M. VAZQUEZ | SHEET: OF 2 SHEETS 4

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11	MOTTLED RED (10R 4/8), BLUISH GRAY (GLEY 2 5PB 5/1), YELLOWISH BROWN (5YR 10YR 5/8) SILTY CLAY (CL) DRY (VERY STIFF)					
	12						
	13						
	14	MOTTLED RED (10R 4/8) BLUISH GRAY (GLEY 2 5PB 5/1) YELLOWISH BROWN (10YR 5/8) & SANDY CLAYEY SILT WITH LENSES OF FINE SAND. (MH) (DRY); HARD	Background 0.1 BZ - 0.1 Borehole 0.1			8,14,19 22	RECOVERY 24"
	15						
	16						
	17						
	18						
	19	NO RECOVERY (WET)					
	20						
	21	VERY DENSE, STRONG BROWN (7.5YR 5/8) POORLY GRADED, MD MEDIUM TO COARSE SAND WITH AND FINE GRAVEL (SP) (DAMP)				16,45,46 39	RECOVERY 24"
	22						
	23	(LENSES) SILTS OF ELASTIC SILT (WET)				47,26, 8,7	RECOVERY 24"
	24						
	25						
	26	STIFF, YELLOW MOTTLED BLUISH GRAY (GLEY 2 5PB 5/1) SILTY CLAY (CL) DRY				3,4,4,7	RECOVERY 24"
	27		27.5				

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. DSCR SUPPLEMENTAL FS Job # 6301-03-2011 | HOLE No. CSMPZ-2C | HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMPZ-2C

PROJECT: DSCR CSM

INSPECTOR: M. VAZQUEZ

SHEET: OF 3 SHEETS 4

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	VERY STIFF, DARK GREENISH GRAY (GLEY 1 4/1) FAT CLAY (CH) DRY				5,10,17	RECOVERY 24 inch
	29					6,8,14,15	RECOVERY 24 inch
	30						
	31					5,6,9,11	RECOVERY 24"
	32	BECOMING MORE SANDY (CH)					
	33					6,6,10,16	RECOVERY 24"
	34	WATER LOST					
		GREENISH BLACK (GLEY 1 2.5GY 2.5/1) CLAYEY POORLY GRADED FINE SAND (DRY)					
	35					5,8,12,12	RECOVERY 18"
	36	WET		1 8oz			
	37						
	38	SATURATED, GREENISH BLACK GLEY 1, 5GY 2.5/1 GRAVELLY POORLY GRADED FINE SAND		1 8oz		10,11,10 20	RECOVERY 18"
	39		37				
		VERY DENSE, STRONG BROWN (7.5YR 5/6 FINE SAND WITH GRAVEL WITH LENSES OF RED (10R 4/8) FINE SAND AND GRAVEL (SP) (DRY)				20, 50/5	RECOVERY 9"
	40						
	41						
	42						
	43						
	44						
		SAPROLITE – WHITE (2.5Y 8/1) SILTY POORLY GRADED COARSE SAND (SP-SM) DAMP				28, 32, 50/5"	RECOVERY 20"
	45			1 8oz			
	46						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS Job# 6301-03-0011

HOLE No. CSMPZ-2C

HF - Rev. 4/94

869 570

HTW DRILLING LOG

HOLE No. CSMPZ-2C

PROJECT DSCR CSM

INSPECTOR M. VAZQUEZ

SHEET OF 4 SHEETS 4

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	47						
	48						
	49	NO RECOVERY				18,49,48 50/4	NO RECOVERY
	50						
	51						
	52						
	53						
	54	White (2.5 Y 8/1) SILTY				4,10,30 43	RECOVERY 18"
	55	POORLY GRADED COARSE SAND (SP-MS) DAMP.					
	56						
	57						
	58						
	59	BORING TERMINATED AT 59.0 FT BGS.					

MRK FORM JUN 85 55-2

PROJECT NAME & NO. DSCR Supplemental PS

HOLE No. CSMPZ-2C

HF - Rev. 4/94

869 571

Piezometer

UPPER WBU ~~MONITORING WELL~~ INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301-03-0011

WELL NO. CSMP2-3 WELL LOCATION U of Area 50

DATE 11/16/03 TIME

GROUND SURFACE ELEVATION

TOP OF SCREEN ELEVATION

REFERENCE POINT ELEVATION

TYPE FILTER PACK SAND GRADATION #2

FILTER PACK MANUFACTURER D.S.E

SCREEN MATERIAL Schedule 40 PVC

MANUFACTURER D.S.E

SCREEN DIAMETER 2" SLOT SIZE .010"

RISER MATERIAL Schedule 40 PVC

MANUFACTURER D.S.E

RISER DIAMETER 2"

DRILLING TECHNIQUE HS Auger

AUGER/BIT SIZE AND TYPE 4.25" I.D. HS Augers

BENTONITE TYPE 3/8" Pellets (Shur Pel)

MANUFACTURER D.S.E

CEMENT TYPE Portland Type I/II

MANUFACTURER Roanoke Cement

BOREHOLE DIAMETER 9"

MACTEC FIELD REPRESENTATIVE Morrison / Calloway

DRILLING CONTRACTOR Simmons Drilling.

AMOUNT BENTONITE USED (SEAL) 1 5 gal. Bucket

AMOUNT BENTONITE USED (GROUT)

AMOUNT CEMENT USED (GROUT)

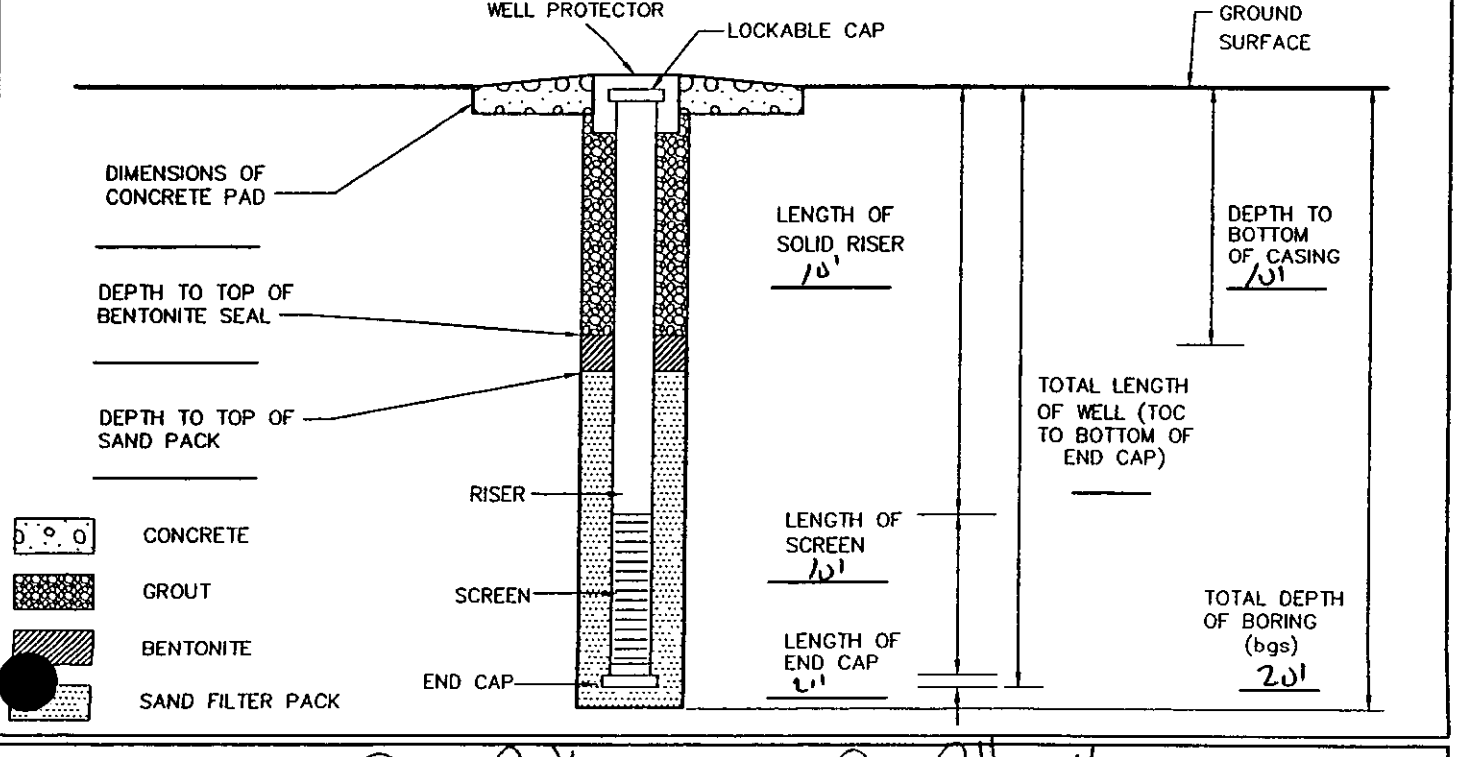
AMOUNT SAND USED 6 bags

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook INSPECTOR: Gary Calloway

DISCREPANCIES: CHECKED BY: DATE:

869 572

HTW DRILLING LOG

HOLE No. CSMP2-3

SHEET 1 OF 2 SHEETS 3

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simms Drilling
3. PROJECT: DSCR-Supp. F.S.	4. LOCATION (CITY, STATE): Richmond VA
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: Gus Pech
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" I.D. HS Auger; 2"x2' Split Spoon	9. HOLE LOCATION (SITE): OU-6 near Gate Shack Inb Adv.
	10. SURFACE ELEVATION:
8. WEATHER: Overcast 45°	11. DATE STARTED: 11/16/03 — 12. DATE COMPLETED: 11/16/03
13. OVERBURDEN THICKNESS:	16. DEPTH GROUNDWATER ENCOUNTERED:
14. DEPTH DRILLED INTO ROCK:	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
15. TOTAL DEPTH OF HOLE: 20 Ft.	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSMP2-350(			

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR

25. CHECKED BY:	26. NAME OF INSPECTOR

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS VOC's	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	Brown (7.5YR 5/2) Firm, CLAY CH with few small pebbles				2,7	13 inche recovery
	2	Firm Red (2.5YR 4/6) silty CLAY CL				11,9	
	3						
	4						
	5	Yellowish Red (5YR 4/6) Slightly sand CLAY CL, moist				2,5 8,4	16 inch recovery
	6						
	7						
	8						
	9						
	10						

MRK FORM JUN 89 55 | PROJECT NAME & NO | HOLE No.

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMP2-3

PROJECT DSCR-Supplemental FS | INSPECTOR | SHEET 3 OF 3 SHEETS 3

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Gray (5YR 5/1) Moist, sandy silty CLAY CL				3,4,13 8	24 inch recovery
	11	Gray (5YR 6/1) Moist clayey coarse to fine grain SAND SC					
	12	Gray (5YR 6/1) Moist slightly clayey medium grain SAND with some gravels-SC				4,7 10,7	7 inch recovery
	13						
	14	Strong Brown (7.5YR5/8) Wet slightly silty coarse grain SAND with some pebbles SP				5,7 6,8	12 inch recovery
	15						
	16	Strong Brown (7.5YR5/8) Wet slightly silty, increasing clay coarse grain SAND with some pebbles				3,5 4,7	18 inch recovery
	17	Strong Brown (7.5YR5/8) Wet slightly clayey SILT MH					
	18	Light Gray (2.5Y7/1) and Strong Brown (7.5YR5/8) sandy CLAY, moist CL				6,9 11,18	24 inch recovery
	19	(GLEY1 N/1) Dark gray CLAYCH					
	20						
	21						
	22						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

869 574 UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR PROJECT NO. 6301-03-0011

WELL NO. CSM PZ-4 WELL LOCATION OU-6 - NEAR PARKING SPACE #27 BY HILLSIDE

DATE 11/15/03 TIME 1300

GROUND SURFACE ELEVATION

TOP OF SCREEN ELEVATION

REFERENCE POINT ELEVATION

TYPE FILTER PACK SAND GRADATION #2

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL SCHEDULE 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" SLOT SIZE .010"

RISER MATERIAL SCHEDULE 40 PVC.

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE HS AUGER

AUGER/BIT SIZE AND TYPE 4-1/2" I.D.

BENTONITE TYPE 3/8" PELLETS PELLETS

MANUFACTURER DSI

CEMENT TYPE PORTLAND TYPE I/II

MANUFACTURER ROANOKE CEMENT

BOREHOLE DIAMETER 8"

MACTEC FIELD REPRESENTATIVE J. MORRISON

DRILLING CONTRACTOR SIMMONS DRILLING

AMOUNT BENTONITE USED (SEAL) 1-5GAL BUCKET

AMOUNT BENTONITE USED (GROUT)

AMOUNT CEMENT USED (GROUT)

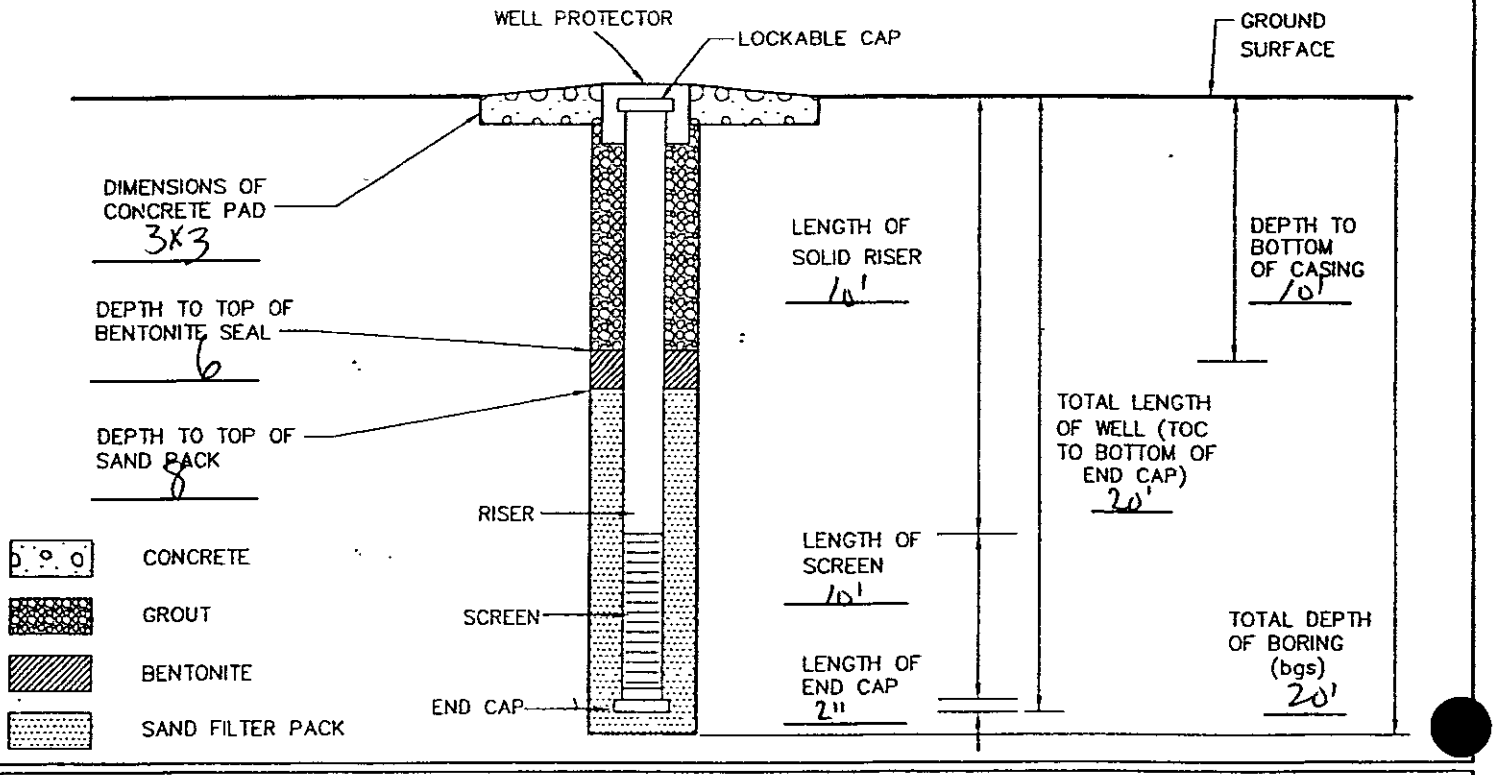
AMOUNT SAND USED

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: INSPECTOR:

DISCREPANCIES: CHECKED BY: DATE:

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HTW DRILLING LOG

869 575

HOLE No. CSM PZ-4

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons Drilling	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR - Supp. F.S.	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Manny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: Gus Pech GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" I.D. HS Augers; 2"x2' Split Spoon	9. HOLE LOCATION (SITE): OU-6	
	10. SURFACE ELEVATION: Provided on separate sheet	
8. WEATHER: Overcast, 45-50°	11. DATE STARTED: 11/15/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS:	16. DEPTH GROUNDWATER ENCOUNTERED: 11'	
14. DEPTH DRILLED INTO ROCK: None Thru. 20 FT	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 20	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSMPZ-4S0(12-14')	✓		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		

25. CHECKED BY:	26. NAME OF INSPECTOR: James M. Murrin

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS USCS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	0-6" Asphalt & Base Material					
	1	Clayey Sand, Fine To Medium Grained, Red (2.5YR 4/6)	SP			1,10 14,10	19" Recovery
	2						
	3						
	4						
	5					6,6	20" Recovery
	6	Saa. To 6.5' Tan Clay Yellowish Brown (10YR 5/6)	SP CH			5,6	
	7						
	8						
	9						
	10						

869 576

HTW DRILLING LOG

HOLE No. CSMP2-4

PROJECT NSCR- Supp. Es.

INSPECTOR

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	S.A.A. To 10.8' Then Clay, Soft, Bluish Gray (5GY 5.2 6/1 10B) To 11.7' Then	CH			2,3	16" Recovery
	11	Coarse Sandy Clay w/ Gravel Bluish Gray As Above	SC			5,5	Lote 11'
	12	S.A.A. To 13.1' Then Sand,				2,3	18" Recovery
	13	Coarse Grained, Reddish Yellow (5YR 6/6)	SP			6,8	
	14					10,8	10" Recovery
	15	S.A.A.	SP			9,5	
	16	Gravelly Sand, Coarse Grained, Yellowish Red (5YR 5/8) To 17.0'	SP			5,4,	22"
	17	Then Clay, Yellowish Red (5YR 5/8)	SC			6,6	Recovery
	19	Clay, Blownish Yellow (10YR 6/8)	CH			6,6	22"
	19	To 19.4' Then Clay, Fat, Dark Greenish Gray (5GY 4/1 10GY)	CH			9,16	Recovery
	20						

869-577

PROJECT NAME: PSCR Supplemental FS — PROJECT NO.: 6301.03:0011

WELL NO.: CSM PZ-5 — WELL LOCATION: OU-6 SW of water treatment plant

DATE: 11/15/03 — TIME:

GROUND SURFACE ELEVATION: —

TOP OF SCREEN ELEVATION: —

REFERENCE POINT ELEVATION: —

TYPE FILTER PACK: Sand — GRADATION: #2

FILTER PACK MANUFACTURER: DSI

SCREEN MATERIAL: Sch. 40 PVC

MANUFACTURER: DSI

SCREEN DIAMETER: 2" — SLOT SIZE: 0.010"

RISER MATERIAL: Sch. 40 PVC

MANUFACTURER: DSI

RISER DIAMETER: 2"

DRILLING TECHNIQUE: Hollow Stem Auger

AUGER/BIT SIZE AND TYPE: 4.25" ID

BENTONITE TYPE: 3/8" Pellets

MANUFACTURER: DSI

CEMENT TYPE: Portland Type I/II

MANUFACTURER: Roanoke Cement

BOREHOLE DIAMETER: 8"

MACTEC FIELD REPRESENTATIVE: J. Morrison

DRILLING CONTRACTOR: Richard S. Simmons Drilling

AMOUNT BENTONITE USED (SEAL): 1 Bucket (5gal)

AMOUNT BENTONITE USED (GROUT): 25lb

AMOUNT CEMENT USED (GROUT): 94lb

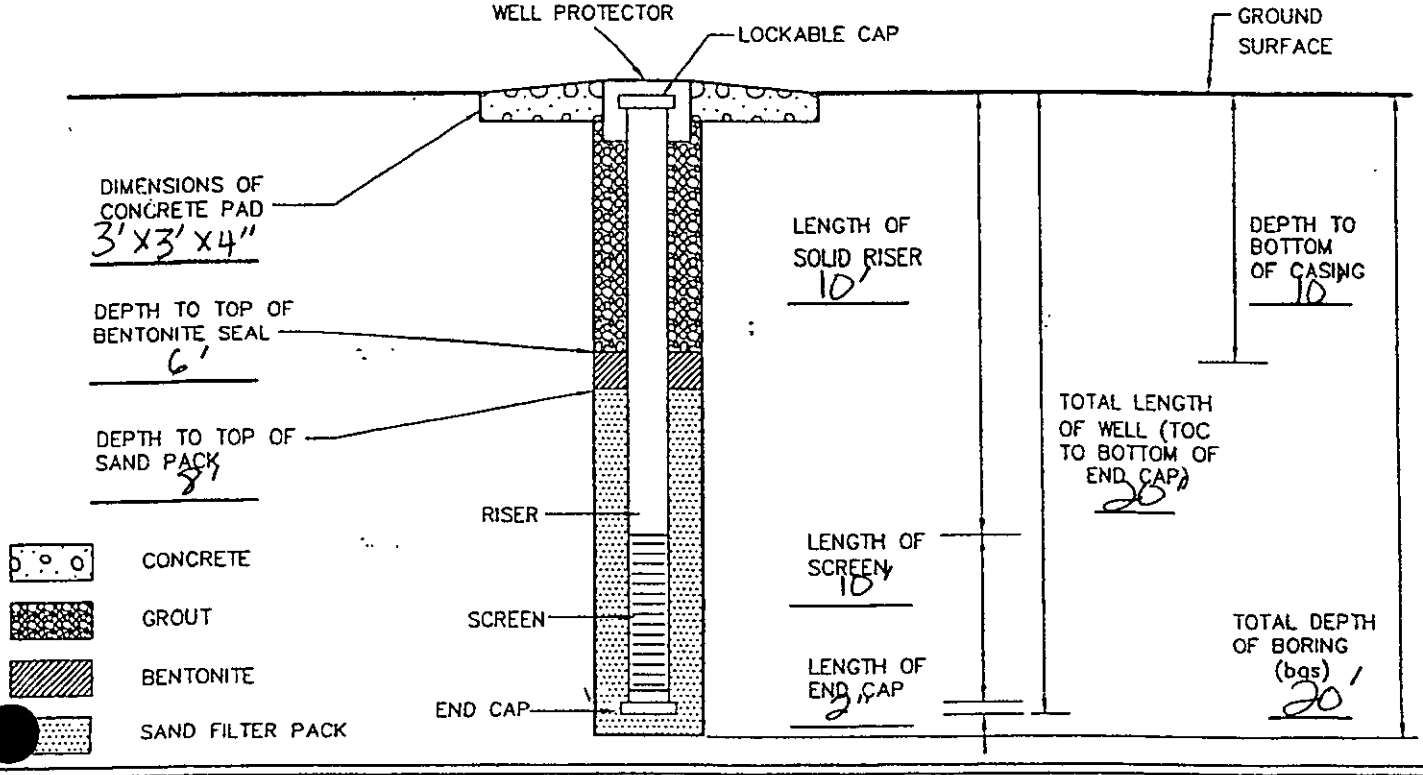
AMOUNT SAND USED: 7bgs

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time):

REMARKS:

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Danny Cook — INSPECTOR: Jim Morrison

DISCREPANCIES: — CHECKED BY: — DATE:

869 578

HTW DRILLING LOG

HOLE No. CSMPZ-5

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons Drilling	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond, VA	
5. NAME OF DRILLER: Danny Cook	6. MANUFACTURER'S DESIGNATION OF DRILL: CME-6	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" ID Hollow Stem Auger; 2' x 2" split spoon Barrel Sampler	9. HOLE LOCATION (SITE): SW of water treatment plant	
	10. SURFACE ELEVATION: —	
8. WEATHER: Overcast, 40°	11. DATE STARTED: 11/15/03	12. DATE COMPLETED: 11/17/03
13. OVERBURDEN THICKNESS: > 20'	16. DEPTH GROUNDWATER ENCOUNTERED: ~10.8'	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 20'	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSMPZ-550(10-12)	X		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
N/A						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			Piezometer	

25. CHECKED BY:	26. NAME OF INSPECTOR
	Jim Morrison

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	0-3" grass/topsoil				12,15	16" recovery
	1	3" - 1.8' silty SAND, yellowish red (5YR 4-6) fine grained SAND to 1.8' SM				20,13	
	2	1.8' - 2' - gravelly SAND, very dark brown (7.5YR 2.5-2) SP					
	3						
	4						
	5	Silty CLAY, yellowish red (5YR 4-6), some fine sand SC				7,6	12" recovery
	6					4,3	
	7						
	8						
	9						
	10						

HTW DRILLING LOG

HOLE No. CSMP2-5

PROJECT DSCR Supplemental FS | INSPECTOR Jim Morrison | SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	Sandy CLAY dark reddish brown SC (5YR3-3) fine to med. sand to 10.6'		CSMP2-55a (10-12')		12, 8	20" recovery
	11	then Silty SAND, fine to coarse grained Red (2.5YR 5-8), wet SM				6, 6	
	12	Silty SAND, fine to coarse grained red (2.5YR 5-8), wet SM				5,4	12" recovery
	13	Gravelly SAND, fine to coarse grained. Yellowish red (5YR5-8) SP				5, 6	
	14	gravelly SAND, fine to coarse grained. Yellowish red (5YR5-8) to 14.7' SP				19,10	
	15	CLAY, strong brown (7.5YR5-6) to 15' (CH) Clayey SAND, med grained, v. pale brown (10YR 8-3) to 15.6' SP	(CH)			7,7	18" recovery
	16	CLAY, yellowish red (5YR 5-6) CH					
	17	Sandy CLAY, fine grained sand Brownish yellow (10YR 6/6) CH				3, 3	10" recovery
	18	Clayey SAND, med. to coarse grained. Yellowish red (5YR5/6) to 19.3' SP				6,5	
	19	fat CLAY, dark greenish				10,17	12"
	20	gray (GLEY1 4/1) CH				18,19	recovery
		Boring Terminated @ 20'					

869 580

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME PSCR PROJECT NO. 6361-03-0011

WELL NO. CSMP2-6 WELL LOCATION WU-6

DATE 11/14/03 TIME 1310

GROUND SURFACE ELEVATION NA

TOP OF SCREEN ELEVATION NA

REFERENCE POINT ELEVATION NA

TYPE FILTER PACK SAND GRADATION #2

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL SCHM 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" SLOT SIZE .010-INCH

RISER MATERIAL SCHM 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE HS AUGER

AUGER/BIT SIZE AND TYPE 4.25" I.D.

BENTONITE TYPE 3/8" PELLETS

MANUFACTURER DSI

CEMENT TYPE PORTLAND

MANUFACTURER

BOREHOLE DIAMETER 8-INCH

MACTEC FIELD REPRESENTATIVE J. MORRISON

DRILLING CONTRACTOR SIMCO DRILLING

AMOUNT BENTONITE USED (SEAL) 1 BUCKET

AMOUNT BENTONITE USED (GROUT)

AMOUNT CEMENT USED (GROUT)

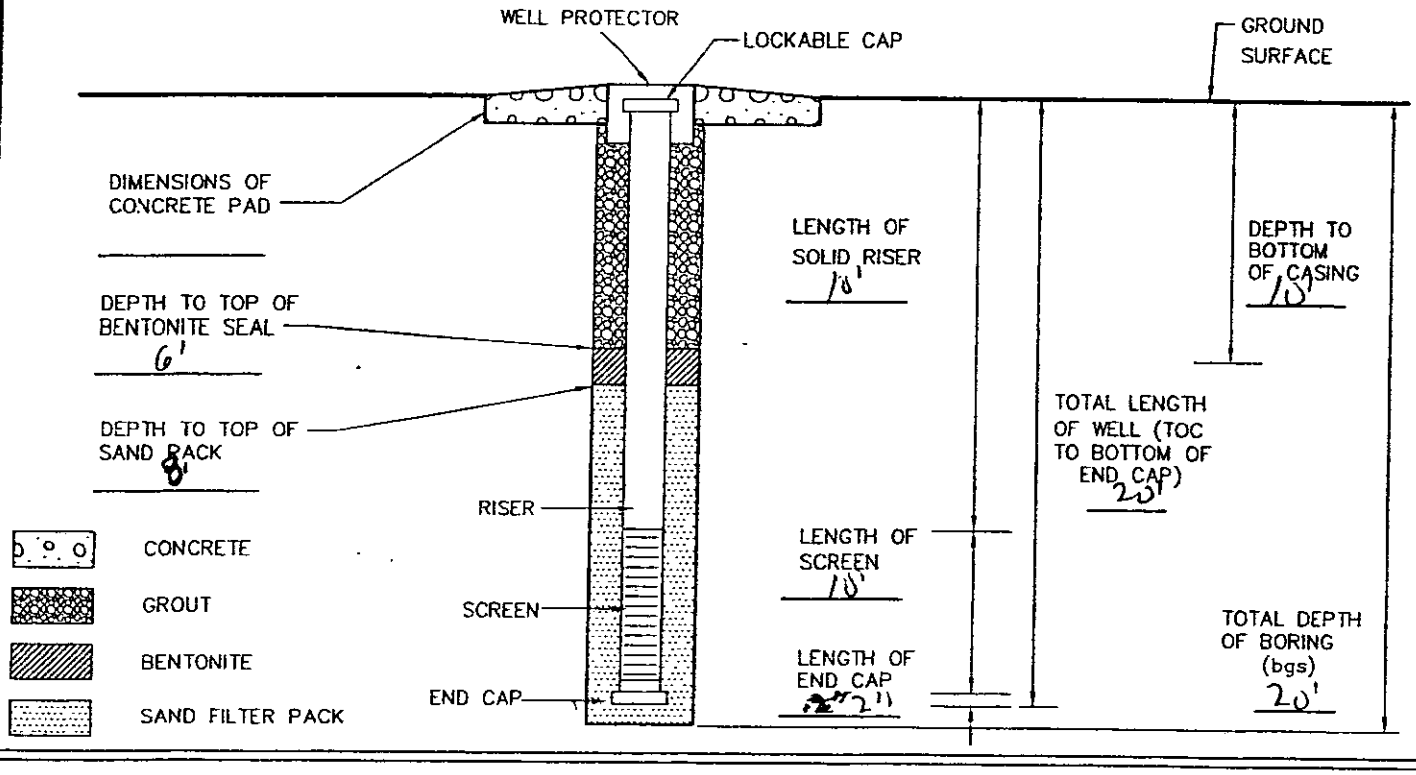
AMOUNT SAND USED 6 BAGS

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: INSPECTOR:

DISCREPANCIES: CHECKED BY: DATE:

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869 581

HTW DRILLING LOG

HOLE No. CSMPZ-6 (A2 6m)

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Simmons Milling	SHEET OF 1 SHEETS 2
3. PROJECT: NSCR-6301-03-0011	4. LOCATION (CITY, STATE): Richmond Virginia	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: Gus Pech	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" I.D. HS Augers; 2" x 2' Split Spoon	9. HOLE LOCATION (SITE): OU-6 - Near NE corner of NGA Fence	
	10. SURFACE ELEVATION: Provided on separate sheet	
8. WEATHER: Clear, Breezy 45°	11. DATE STARTED: 11/14/03	12. DATE COMPLETED
13. OVERBURDEN THICKNESS: More than 20 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 11'	
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 20'	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSMP2-6 SD(12-16')	✓		NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						NA

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		

25. CHECKED BY:	26. NAME OF INSPECTOR
	Jim Morrison

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	0-0.25' Top Soil (TS)	USCS			6,17	9" Recovery
	1	Clayey Sand, Fine to med grained,	SP			17,23	
	2	Yellowish Red (5YR 4/6)					
	3						
	4						
	5	Sandy clay, fine to medium				4,5	16"
	6	Sand, Brown (10YR4-3)	CL			5,5	Recovery
	7						
	8						
	9						
	10						

869 582

HTW DRILLING LOG

HOLE No. CSMP2-6

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: JIM MORRISON

SHEET 2 OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	FINE SAND GRAY (10YR 6/1) with some clay to 11.8 FT BGS THEN SAND MEDIUM TO COARSE SAND					
	11	GRAVEL YELLOWISH BROWN (10YR5/8)					
	12	S.A.A. with some gravel					
	13						
	14	SAND, COARSE GRAVEL Brownish Yellow (10YR 6/8)					
	15						
	16	CLAY STRONG BROWN (7.5YR 5/8)					
	17						
	18	Clay, Yellowish Brown (10YR 5/8)					
	19	with gravel to 19.2 FT BGS					
	20	THEN Clay Dark Bluish Gray (GLEY 2 5G 4/1)					
	21	Boring terminated to 20.0 FT BELOW GROUND SURFACE					

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMP2-6

HF - Rev. 4/94

Piezometer (amc)

869 583

ATTACHMENT 5.1B UPPER WBU ~~MONITORING WELL~~ INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME OSCR PROJECT NO. 6301.03.6011

WELL NO. CSMPZ-7 WELL LOCATION South CSMPZ-5

DATE 11/14/03 TIME

GROUND SURFACE ELEVATION —

TOP OF SCREEN ELEVATION —

REFERENCE POINT ELEVATION —

TYPE FILTER PACK Sand GRADATION #1

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL Sch. 40 PVC

MANUFACTURER DSI

SCREEN DIAMETER 2" SLOT SIZE 0.010inch

RISER MATERIAL Sch. 40 PVC

MANUFACTURER DSI

RISER DIAMETER 2"

DRILLING TECHNIQUE Hollow Stem Auger

AUGER/BIT SIZE AND TYPE 4.25" ID

REMARKS

BENTONITE TYPE 3/8" Pellets

MANUFACTURER DSI

CEMENT TYPE

MANUFACTURER

BOREHOLE DIAMETER 8-inch

MACTEC FIELD REPRESENTATIVE Jim Morrison

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 1 bucket

AMOUNT BENTONITE USED (GROUT)

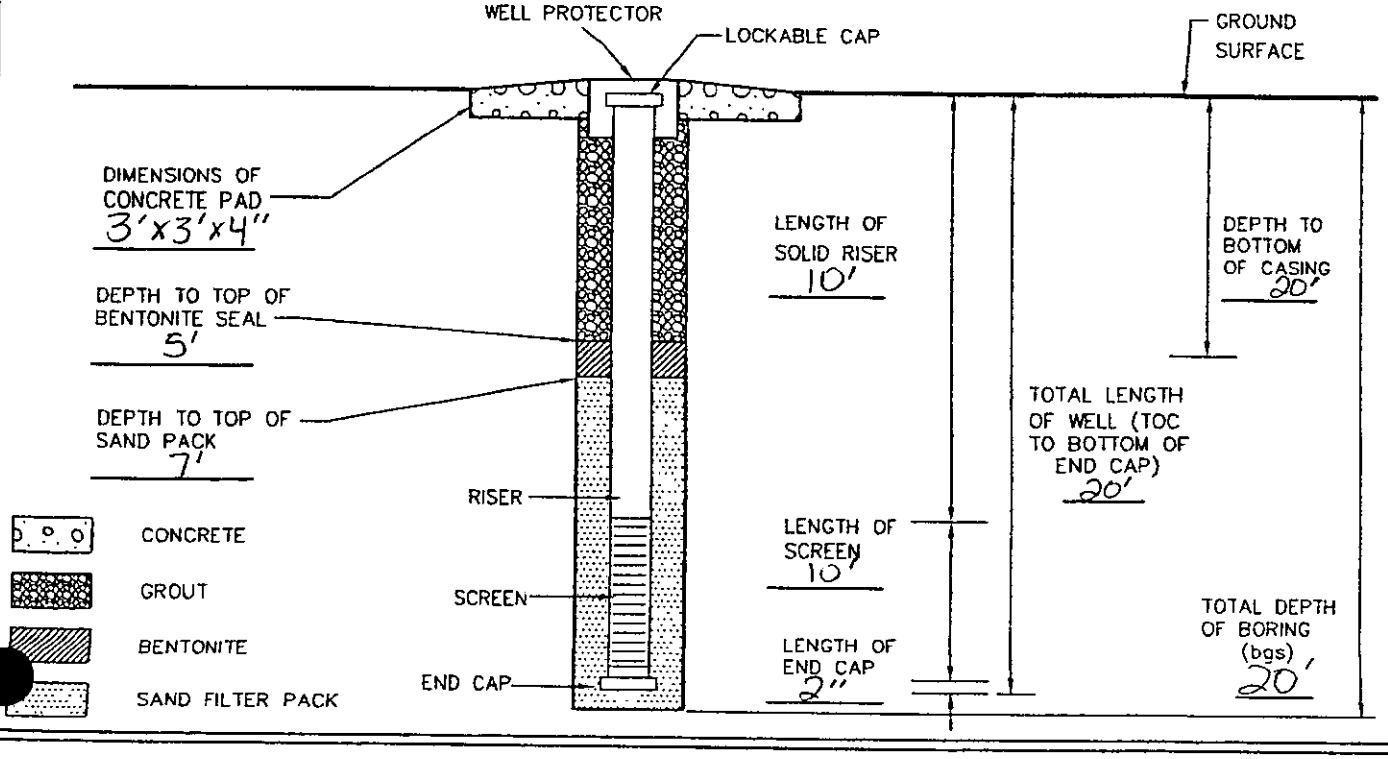
AMOUNT CEMENT USED (GROUT)

AMOUNT SAND USED 6.5 Bags

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: INSPECTOR:

DISCREPANCIES: CHECKED BY: DATE:

869 584

HTW DRILLING LOG

HOLE No. CSMP2-7

1. COMPANY NAME: MACTEC	2. DRILLING SUBCONTRACTOR: Richard Simmons Drilling
3. PROJECT: DSCR	4. LOCATION (CITY, STATE): Richmond, VA
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: 605 Rich
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25" I.A. Augers; 2" x 2' Split Spoon	9. HOLE LOCATION (SITE): OU-6 - MIP Area 5
	10. SURFACE ELEVATION:
8. WEATHER: Clear, 40°	11. DATE STARTED: 11/14/03
	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than 20 ft	16. DEPTH GROUNDWATER ENCOUNTERED: 9'
14. DEPTH DRILLED INTO ROCK: NA	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
15. TOTAL DEPTH OF HOLE: 20'	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
CSMP2-7S0(14-16')	✓		NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						NA

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		

25. CHECKED BY:	26. NAME OF INSPECTOR

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING ~~RESULTS~~ USCS	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	0-1" Top Soil/Grass				7,7	16" Recovery
	1	1"-2'- Sandy Clay, Reddish Brown (5YR 4-3), Fine To Medium Grained.	SC			9,7	
	2						
	3						
	4						
	5	Clayey Sand, Reddish Brown (2.5YR 4-4), Fine To Medium Grained	SP			1,1	4" Recovery
	6					4,4	
	7						
	8						
	9						
	10						

HTW DRILLING LOG

HOLE No. CSMPZ-7

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: Jim Morrison

SHEET 2 OF ___ SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	~~FIELD SCREENING RESULTS~~ USCS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10	CLAY, GRAY (10YR 5/1) TO 11.5 FT BGS TO ~~SAND~~ MD FINE TO MEDIUM SANDY CLAY	CH			4,7,6,8	18" RECOVERY
	11		SC				
	12	CLAYEY SAND, GRAY (10YR 5/1)				4,4,4,4	20" RECOVERY
	13	FINE TO MEDIUM GRAVEL TO 13.2 FT THEN SAND COARSE GRAVEL DARK YELLOWISH BROWN (10YR 4/6)	SM/SP				
	14	S.A.A TO 15.3 FT BGS THEN CLAY STRONG BROWN (7.5YR 5/8)	SM/SP			5,7,4,4	18" RECOVERY
	15		CH				
	16	CLAY, YELLOWISH BROWN (10YR 5/8)				7,8,4,8	24" RECOVERY
	17		CH				
	18	SAME TO 18.9 FT BGS THEN CLAY BLUISH GRAY (GLEY 2 5PB 9				4,5,6,11	20" RECOVERY
	19		CH				
	20	BORING TERMINATED @ 20.0 FT BELOW GROUND SURFACE.					
	21						

869 586

UPPER WBU MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR SUPPLEMENTAL RS PROJECT NO. 6301-03-0011

WELL NO. CSMW2-8 WELL LOCATION OUC AREA 50

DATE 11/13/03 TIME

GROUND SURFACE ELEVATION

TOP OF SCREEN ELEVATION

REFERENCE POINT ELEVATION

TYPE FILTER PACK SAND GRADATION 20/40

FILTER PACK MANUFACTURER DSI

SCREEN MATERIAL PVC sch 40

MANUFACTURER DSI

SCREEN DIAMETER 2-inch SLOT SIZE 0.01

RISER MATERIAL PVC Sch 40

MANUFACTURER DSI

RISER DIAMETER 2-inch

DRILLING TECHNIQUE Hollow STEAM Auger

AUGER/BIT SIZE AND TYPE

BENTONITE TYPE 3/8 Pellet

MANUFACTURER DSI

CEMENT TYPE Portland Type I/II

MANUFACTURER Ponoke Cement

BOREHOLE DIAMETER 8 inch

MACTEC FIELD REPRESENTATIVE M. Vazquez

DRILLING CONTRACTOR Richard Simmons

AMOUNT BENTONITE USED (SEAL) 5 gallon Bucket

AMOUNT BENTONITE USED (GROUT)

AMOUNT CEMENT USED (GROUT)

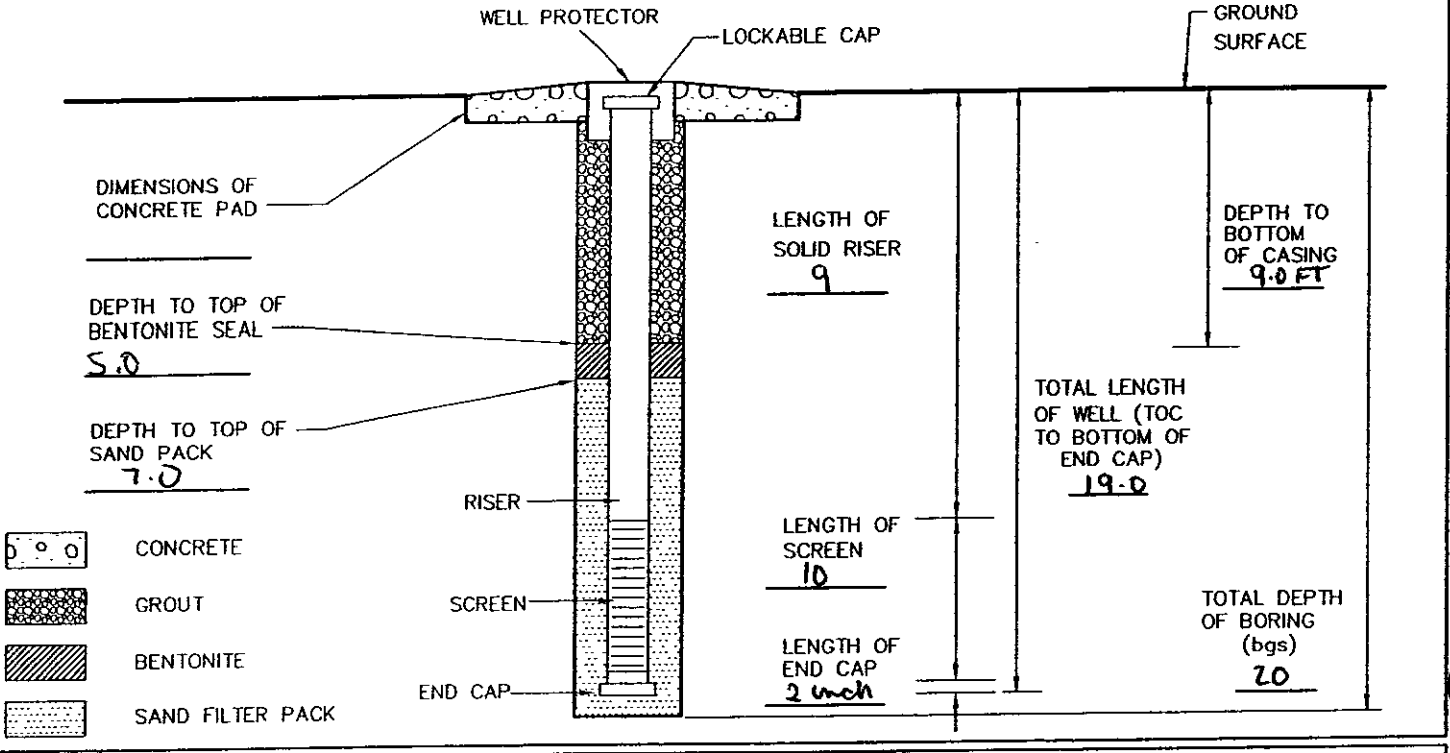
AMOUNT SAND USED

STATIC WATER LEVEL (>24 hrs after dev)

MEASURED ON (Date/Time)

REMARKS

(NOT TO SCALE;
ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: INSPECTOR:

DISCREPANCIES: CHECKED BY: DATE:

HTW DRILLING LOG

HOLE No. CSMPZ-8

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 2 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond VA	
5. NAME OF DRILLER:	6. MANUFACTURER'S DESIGNATION OF DRILL: GUS PGCH	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25-inch ID Auger; 2 ft 2-inch OD Spoon	9. HOLE LOCATION (SITE): DU6	
	10. SURFACE ELEVATION:	
8. WEATHER: Sunny, Windy Cool	11. DATE STARTED: 11/13/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than 20 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ± 8. FT	
14. DEPTH DRILLED INTO ROCK: NA.	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
15. TOTAL DEPTH OF HOLE: 20.0 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
		✓		Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	TOP SOIL 0-0.25					
	1	1 RED (2.5YR 4/8) CLAYEY POORLY graded MEDIUM SAND DRY - (SP-SC) DRY				10,10 8,9	20" RECOVERY
	2						
	3						
	4	1 RED (2.5YR 4/6) silty CLAY WITH SOME FINE SAND DRY				7,7 10,10	18 inch Recovery
	5						
	6						
	7						
	8	Color change to DARK GRAY (10YR 4/1)					
	9	1 DARK GRAY (10YR 4/1 SLIGHTLY FINE SANDY SILTY CLAY DAMP (CH)				7,7,85	18 inch Recovery

869 588

HTW DRILLING LOG

HOLE No. CSMPZ8

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET: OF 2 SHEETS 2

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11						
	12						
	13						
	14	Bluish gray (GLEY 2 5PB 6/1)				4,4,8	2 inch
	15	SILTY Poorly graded Coarse SAND WET. (SP-SM)				6.	Recovery
	16						
	17						
	18						
	19	MOTTLED Light-Bluish gray (GLEY 2 5PB 9/1) and Brownish				4,5,8	20 inch
	20	Yellow (10YR 6/8 Fat CLAY (CH)				13	Recovery
	21	DARK Bluish Gray (GLEY 2 5PB 4/1) CLAY (CH)					
	22	Boring terminated @ at 20.0FT. monitoring Well installed to 19.0FT					
	23						
	24						
	25						
	26						
	27						

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR
PROJECT NO. 6301-03-001
WELL NO. CSMPZ-9
WELL LOCATION Across from PX BLDG Close to Georgia Rd.
DATE 12-7-03
START TIME

GROUND SURFACE ELEVATION —
REFERENCE POINT ELEVATION —
MACTEC FIELD REPRESENTATIVE M. Vazquez
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL 100 mesh
MANUFACTURER Solinst
TUBING DIAMETER 1.7" OD
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS Continuous Multichannel Tubing

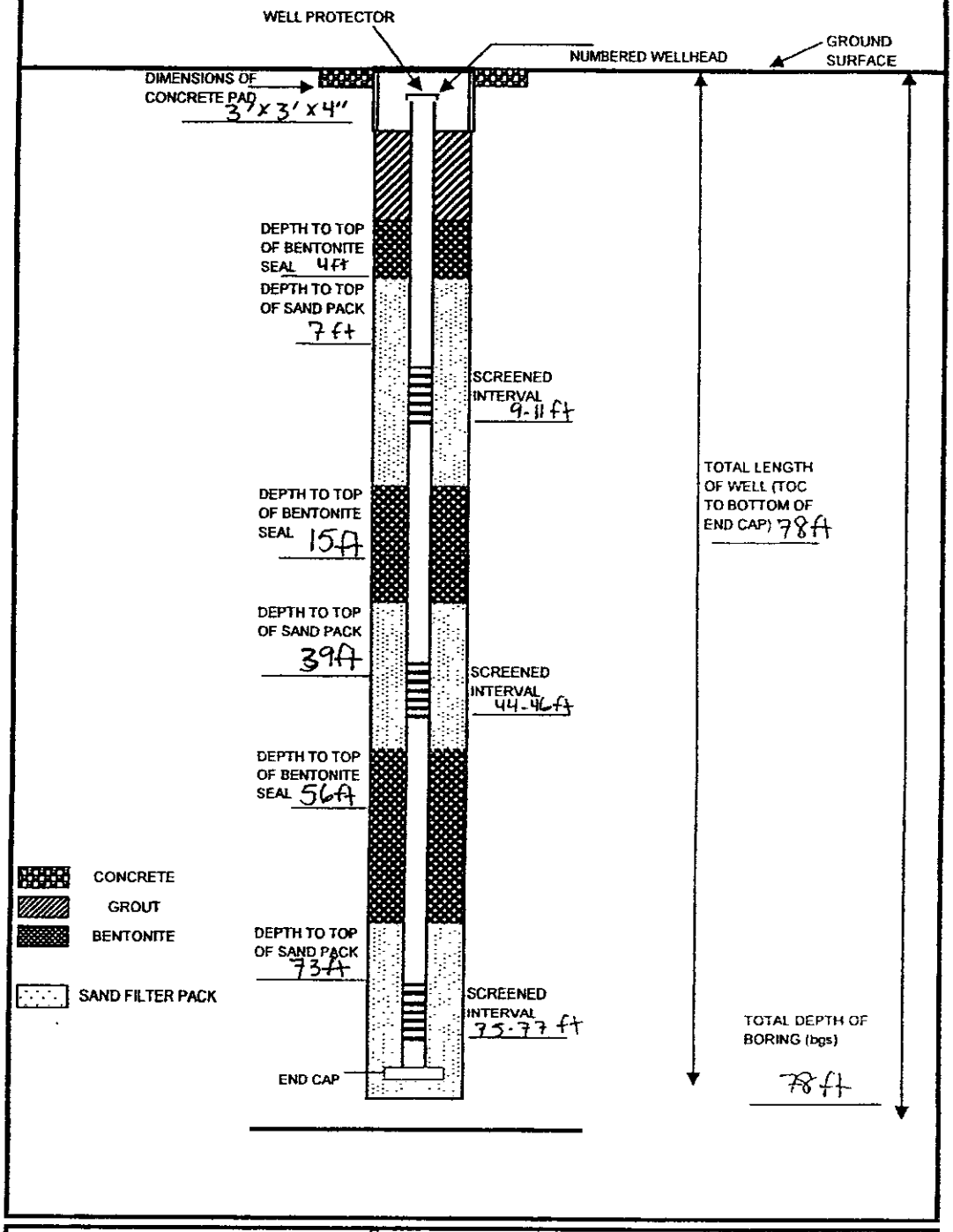
BENTONITE TYPE 3/8" pellets
MANUFACTURER OSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 8-inch
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL)
AMOUNT BENTONITE USED (GROUT)
UPPER WBU A - chamber 1
LOWER WBU B - chamber 6
SAPROLITE WBU C - chamber 5
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

869 590

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

WELL NO. CSMPZ-9

(NOT TO SCALE: ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez

DISCREPANCIES: _____ CHECKED BY: _____ DATE: _____

HTW DRILLING LOG

869 591

HOLE No. CSMP2-9

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: RICHARD SIMMONS	SHEET 1 OF 5 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): Richmond VA	
5. NAME OF DRILLER: Chris Lacko	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 100	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch x 2 ft split spoon Sampler; 4.25 ID Hollow Stem Auger	9. HOLE LOCATION (SITE): ACROSS PX BUILDING close to Congress Rd	
	10. SURFACE ELEVATION: Provide UNDER SEPARATE SHEET	
8. WEATHER: Cold Cloudy	11. DATE STARTED: 12/6/03	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than 79 ft.	16. DEPTH GROUNDWATER ENCOUNTERED: 1st water 8'	
14. DEPTH DRILLED INTO ROCK: N/A.	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
~~CSMP-2-9~~ NA 3	✓		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						NA

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			Solinst	Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	ASPHALT					
		BACK FILL - COARSE SAND AND GRAVEL					
	1	STRONG BROWN (7.5YR 5/8) CLAYEY WELL GRADED FINE TO COARSE SAND (SW) WITH GRAVEL DRY					
	2						
	3						
	4	LOOSE, STRONG BROWN (7.5YR 5/8)	0.0 PPM			3,5,5,5	24" RECOVER
	5	SLIGHTLY CLAYEY POORLY GRADED MEDIUM TO COARSE SAND (SP) WITH GRAVEL DRY					
	6						
	7						
	8						
	9	FIRM, STRONG BROWN (7.5YR 5/6)	0.0 PPM	CSMP2-9 SO (9-11)		9,14,7	0915 24" RECOVER
	10	SILTY POORLY GRADED, FINE TO MED SAND (SP) WET					

869 592

HTW DRILLING LOG

HOLE No. CSMP2-9

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 2 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14	SAME AS ABOVE				6,8,10,8	
	15						
	16	BLUISH GRAY (GLEY2 5PB 5/1) CLAY (WET) (CH)					
	17						
	18	VERY STIFF, (GLEY2 5PB 5/1) BLUISH GRAY FAT CLAY DRY (CH)				6,10,11 13	
	19						
	20					7,10,8,9	
	21						
	22						
	23					BW 6,9,10,14	0934
	24						
	25					5,6,12, 15	
	26						
	27					8,9,13 15	
	28						

A

HTW DRILLING LOG

HOLE No. CSMP2-9

PROJECT: DSCR Supplemental FS | INSPECTOR: M. Vazquez | SHEET 3 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29					7,10,12 15	1003 20" Recovery
	30						
	31					7,9,12 14	24 inch Recovery
	32						
	33					7,12,50 50/1	18" Recovery
	34	VERY HARD, Bluish gray (GLEY 2 5PB5/1) FAT CLAY (CH)					
	35						24" Recovery
	36					10,14,10 16	
	37	FIRM to DENSE, Bluish Black (GLEY 2 5PB 2.5/1) CLAYEY POORLY GRADED FINE TO MEDIUM SAND WITH GRAVEL (MOIST) (SC). AT 37.5 PIECE OF Black Rock (BASALTIC OR ANDESITIC). ROCK FRAGMENTS TO 39.5 FT BGS (DRY)				46,50/3"	9" Recovery
	38						
	39					50,50/2"	10:58
	40						
	41	VERY DENSE, grayish green (GLEY 1 5G 5/2) with POORLY graded MEDIUM SAND with GRAVEL (FINE) and Rock Fragments (SP) moist				50,50/2"	11:15 3" Recovery
	42						
	43						
	44	VERY DENSE, grayish green (GLEY 1 5G 5/2) POORLY graded CLAYEY MED to COARSE SAND with GRAVEL (SP-SM) (DAMP)		CSMPZ-9 (44-46)		29,50 50/3"	11:34
	45						
	46						

B

869 594

HTW DRILLING LOG

HOLE No. CSMP2-9

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 4 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	VERY DENSE, greyish green (5GY 1 (5G5/2) clayey poorly graded med to coarse SAND (SP-SC) - cemented with GRAVEL MOIST-DAMP				42, 50/5	12:43 6" RECOVER
	50						
	51						
	52						
	53						
	54	SAME AS ABOVE				50, 50/3"	6" RECOVER
	55						
	56						
	57						
	58						
	59						
	60						
	61	SAME AS ABOVE				50/5"	5" RECOVER
	62						
	63						
	64						

HTW DRILLING LOG

HOLE No. CSMPZ-4

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 5 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	64	VERY DENSE, GREENISH GRAY (GLEY 1 5G 5/1) VERY CLAYEY WELL GRADED SAND AND GRAVEL (GP/GW). DAMP				50, 5½"	4" RECOVER
	65						
	66						
	67						
	68						
	69	NO RECOVERY				5½"	16 10
	70						
	71						
	72						
	73						
	74	WEATHERED ROCK (SAPROLITE) GREENISH GRAY (GLEY 2 10GY/1) SILTY POORLY GRADED FINE TO MED SAND (SM)		CSMPZ-9 SO (74-77)		42 50/5"	16 37
	75						
	76					50/6	
	77						
	78						
	79	BORING TERMINATED AT 79 FT BELOW GROUND SURFACE.					
	80						
	81						

C

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No. CSMPZ-9

HF - Rev. 4/94

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME OSER
PROJECT NO. 6301.03.0011
WELL NO. OSMPZ-10
WELL LOCATION Front Building 32
DATE 11.16.03
START TIME

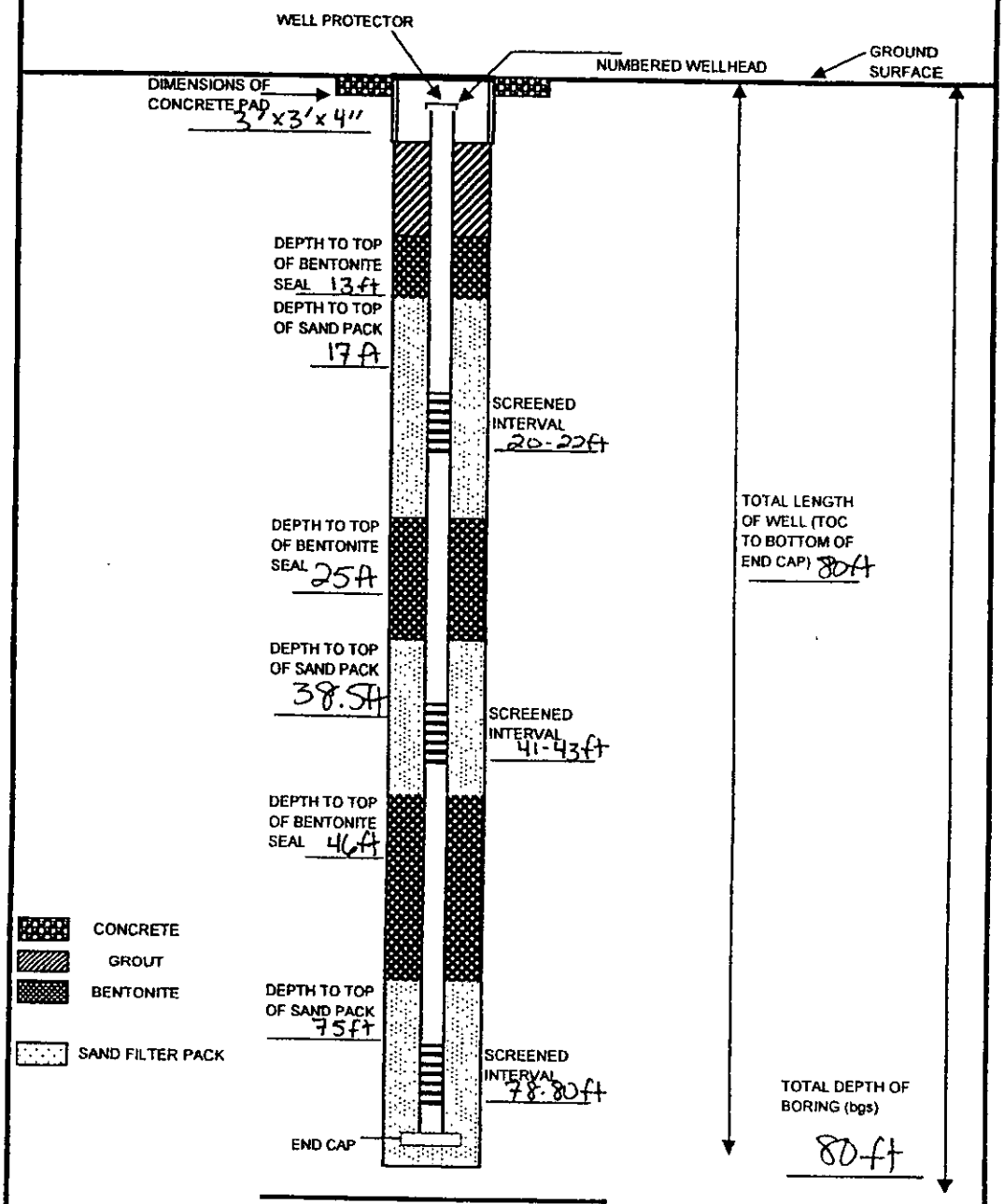
GROUND SURFACE ELEVATION —
REFERENCE POINT ELEVATION —
MACTEC FIELD REPRESENTATIVE M. Vazquez
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL 100 mesh
MANUFACTURER Solinst
TUBING DIAMETER 1.7" OD
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS Continuous Multichannel Tubing

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 8-inch
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL)
AMOUNT BENTONITE USED (GROUT)
UPPER WBU A
LOWER WBU B
SAPROLITE WBU C
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

WELL NO. CSMPZ-10

(NOT TO SCALE: ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR M. Vazquez

DISCREPANCIES _____ CHECKED BY: _____ DATE: _____

869 598

HTW DRILLING LOG

HOLE No. CSMP2-10C

1. COMPANY NAME: MACTEC Engineering and Consulting	2. DRILLING SUBCONTRACTOR: Richard Simmons
SHEET OF 1 SHEETS	
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond VA
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 2-inch x 2 Ft long split spoon; 4.25 inch ID Hollow Stem Auger	9. HOLE LOCATION (SITE): DSCR Front Building 32
	10. SURFACE ELEVATION
8. WEATHER: Cloudy 63°F	11. DATE STARTED: 11/15/03 — 12. DATE COMPLETED
13. OVERBURDEN THICKNESS	16. DEPTH GROUNDWATER ENCOUNTERED
14. DEPTH DRILLED INTO ROCK	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
15. TOTAL DEPTH OF HOLE	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR

25. CHECKED BY:	26. NAME OF INSPECTOR

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
		Asphalt					
	1–2	Very stiff, mottled strong brown (7.5YR 5/8); red (2.5YR 5/8) slightly sandy clayey silt (MH) dry				6, 10, 14 21	Recovery 2 ft
	3						
	4–6	Very stiff, yellowish brown (10YR 5/6) sandy clay (CL) dry; very stiff, mottled red (2.5YR 5/8) strong brown (7.5YR 5/8) sandy clay (CL) dry				7, 10, 14 19	Recovery 2 ft
	7–8						
	9–10	Very stiff, mottled red (2.5YR 5/8) light gray (5YR 7/1) silty clay (CL)				8, 10, 14 24	Recovery 2 ft

HTW DRILLING LOG

HOLE No. CSMP2-10C

PROJECT: DSCR supplemental FS

INSPECTOR: M. Vázquez

SHEET: OF 2 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	11						
	12						
	13						
	14	FIRM, light gray (2.5Y 7/1) FINE SANDY Clay (CL) DAMP.				7, 7, 7	RECOVER 2 FT
	15					9	
	16						
	17						
	18						
	19	DENSE, BRownish Yellow (10YR 6/8) CLAYEY GRAVELLY POOR SORTED MEDIUM to COARSE SAND (SP-SC) (WET)				42, 27	RECOVERY 18 1/2 INCH
	20					16, 10	
	21					7, 16, 22	RECOVERY 4 INCH
	22					16	
	23					3, 4, 4	RECOVERY 2 FT
	24	STIFF, BROWNISH YELLOW (10YR 6/6) CLAY (CH) DAMP				5	
	25					3, 3, 4, 6	RECOVERY 2 FT
	26	STIFF, GRAY (GLEY 1, N5/) FAT CLAY (CH) DRY				4, 5, 7, 12	RECOVERY 2 FT
	27						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

869 600

HTW DRILLING LOG

HOLE No. CSMPZ-10C

PROJECT | INSPECTOR | SHEET . OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	29	DRY				5,6,11,14	RECOVERY 2 FT
	30						
	31	STIFF, GRAY (GLEY 1 N5/) FAT CLAY (CH) DRY - with some					
	32	FINE SAND.				4,6,10 13	RECOVER 2 FT
	33						
	34	SAME AS ABOVE				5,7,9 13	RECOVER 2 FT
	35						
	36						
	37					5,5,7	
	38					10	
	39	FIRM, VERY DARK greenish gray (GLEY 2, 5BG 3/1) VERY Clayey Poorly ~~Sorted~~ Graded FINES				38,37	
	40	SAND (SC) DRY				19,10	
	41	FIRM, VERY DARK greenish		CSMPZ-10B		3,4,6	
	42	gray (GLEY 2, 5BG 3/1) SILTY POORLY GRADED FINE SAND				15	
	43	with gravel (SP-SM) Moist					
	44	VERY DENSE, VERY DARK greenish				17,30	
	45	gray (GLEY 2, 5BG 3/1) Silty Poorly graded FINE SAND with gravel (SP-SM) Moist.				38,50	

MRK FORM JUN 89 55-2 | PROJECT NAME & NO | HOLE No.

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMPZ-10C

PROJECT | INSPECTOR | SHEET OF SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	47						
	48						
	49	VERY DENSE, greenish gray ~~silt~~ MS (GLEY1, 5G5/1) SILTY poorly sorted FINE SAND with PEBBLES (SM) DRY				24, 50/4	RECOVER 6-inch
	50						
	51						
	52						
	53						
	54	NO RECOVERY				41, 50/4"	
	55						
	56						
	57						
	58						
	59	VERY DENSE, greenish gray graded (GLEY1, 5G5/1) poorly sorted medium to COARSE SAND with PEBBLES, (SM) DAMP				50, 10/4	
	60						
	61						
	62						
	63						

MRK FORM JUN 89 55-2 | PROJECT NAME & NO. | HOLE No.

HF - Rev. 4/94

869 602

HTW DRILLING LOG

HOLE No. CSMP2-10C

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 5 OF 5 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	64					40, 50/5"	
	65						
	66						
	67						
	68						
	69	VERY DENSE, GREENISH GRAY (GLEY 1, 5GY 5/1) POORLY GRADED COARSE SAND WITH PEBBLES (SM) WET				50, 50/2	
	70						
	71						
	72						
	73						
	74					50/5"	
	75						
	76						
	77						
	78					10/16	
	79	WET				50/3.1	
	80						
	81						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR SUPPLEMENTAL FS 4361-03-0011

HOLE No. CSM P2-10

HF - Rev. 4/94

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME OSCR
PROJECT NO. 6301-03-0011
WELL NO. CSMPZ-13
WELL LOCATION DDRV North of WH62
DATE 1-22-04
START TIME

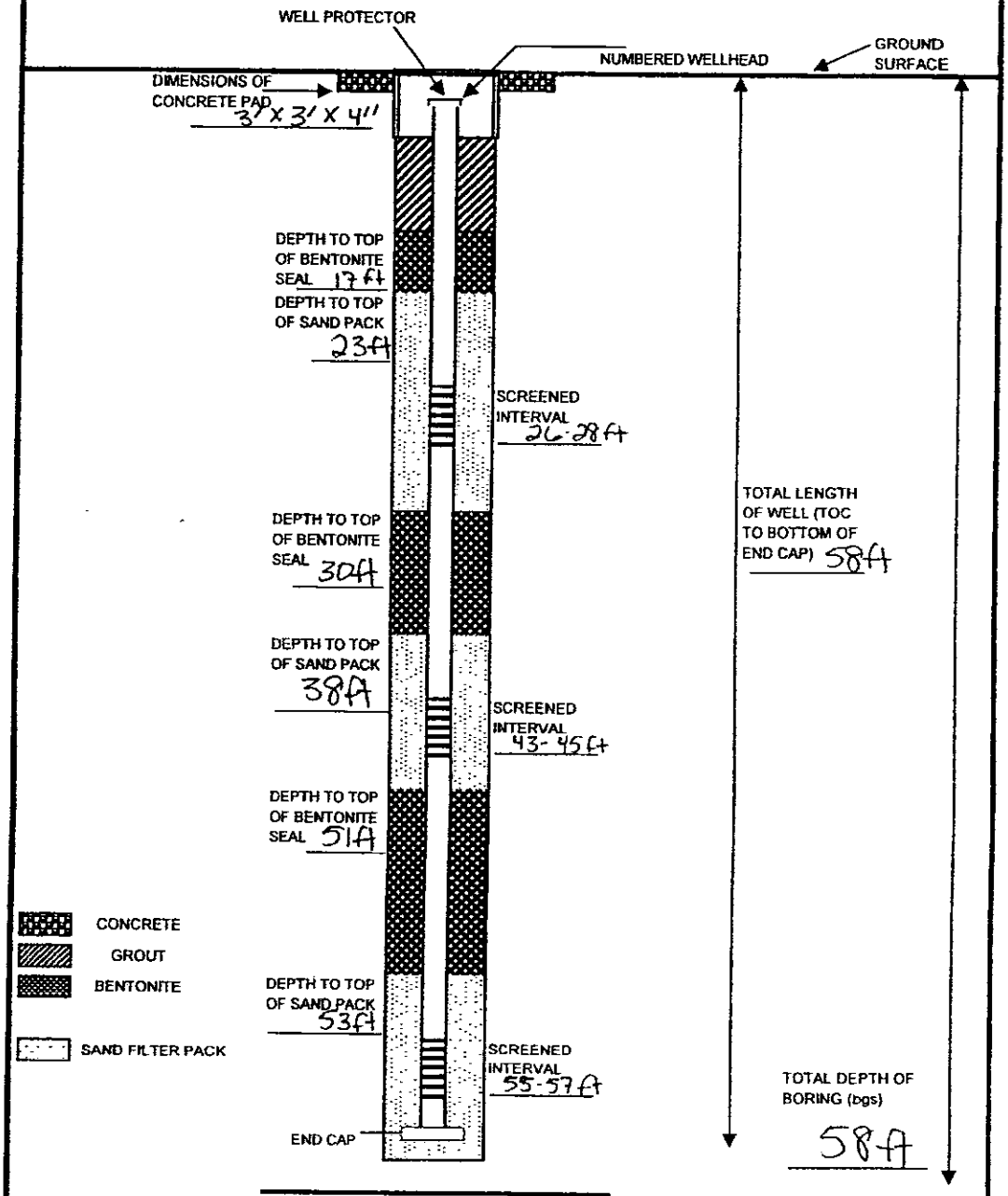
GROUND SURFACE ELEVATION —
REFERENCE POINT ELEVATION —
MACTEC FIELD REPRESENTATIVE M. Vazquez
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL 100 mesh
MANUFACTURER Solinst
TUBING DIAMETER 1.7" OD
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS Continuous Multichannel Tubing

BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Type I/II
MANUFACTURER Roanoke
BOREHOLE DIAMETER 8-inch
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL)
AMOUNT BENTONITE USED (GROUT)
UPPER WBU A chamber 1
LOWER WBU B chamber 2
SAPROLITE WBU C chamber 3
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

WELL NO. CSMPZ-13

(NOT TO SCALE. ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER Chris INSPECTOR: M. Vazquez

DISCREPANCIES: _____ CHECKED BY _____ DATE: _____

HTW DRILLING LOG

869 605

HOLE No. CSMPZ-13

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons	SHEET 1 OF 4 SHEETS
3. PROJECT: DSCR Supplemental FS	4. LOCATION (CITY, STATE): Richmond VA	
5. NAME OF DRILLER: Chris Cocko	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25-INCH ID Hollow STEM Auger; 2-inch split Barrel Sampler	9. HOLE LOCATION (SITE): DRV North of WH 62	
	10. SURFACE ELEVATION	
8. WEATHER: SUNNY Cold 27°F	11. DATE STARTED: 01/21/04	12. DATE COMPLETED
13. OVERBURDEN THICKNESS: More than 58 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 11.5 FT BGS	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 58 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
NONE			NA

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						NA

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			SCHNST MUTH CHAMBER WELL	Miguel A Vazquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	Miguel A Vazquez

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	0	~~ASPHALT~~ CONCRETE					
	1						
	2	YELLOWISH BROWN (10YR5/4) SILTY CLAY (CL)					
	3						
	4	VERY STIFF, YELLOWISH BROWN (10YR5/6) MOTTLED RED (10R4/6) CLAYEY-SILT (MH) DRY				9,14,19	
	5						
	6						
	7						
	8						
	9	VERY STIFF, RED (10R5/8) MOTTLED BROWNISH YELLOW (10YR6/6) CLAYEY				4,9,9,16	
	10	SILT (MH) DAMP					

869 606

HTW DRILLING LOG

HOLE No. CSMPZ-13

PROJECT: DSCR Supplemental FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						▽ ILS AT 865
	12						
	13						
	14	FIRM, YELLOWISH RED (5YR 5/6) SILTY POORLY GRADED FINE SAND (SP-SM) WET				5,6,5,3	
	15						
	16						
	17						
	18						
	19	VERY DENSE, BROWNISH YELLOW (10YR 5/6) SILTY POORLY GRADED COARSE SAND WITH LENSES OF SANDY GRAVEL (SP/GP) WET				26, 50/5"	
	20						
	21					2,8,9,15	
	22						
	23						
	24					6,19,28	
	25					20	
	26					12,13	
	27					9,13	
	28						

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 6301-03-0011

HOLE No. CSMPZ-13

HF - Rev. 4/94

HTW DRILLING LOG

HOLE No. CSMPZ-13

PROJECT: DSCR Supplemental CS

INSPECTOR: M. VAZQUEZ

SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	DARK YELLOWISH BROWN (10YR 4/6) SANDY GRAVEL (GP) WET				12, 50/5"	
	29						
	30					12, 21, 50 5"	
	31	VERY DENSE, MOTTLED VERY PALE BROWN (10YR 8/3), YELLOWISH RED (5YR 5/6) WELL GRADED FINE TO COARSE SAND WITH GRAVEL (SW) DAMP				↓	
	32						
	33	HARD, MOTTLED VERY PALE BROWN (10YR 8/3, YELLOWISH RED (5YR 5/6) GRAVELY SANDY SILT (ML) DRY					
	34					32, 50/5"	
	35	VERY DENSE RED (2.5YR 5/6) GRAVELLY POORLY GRADED COARSE SAND (SP/GP) DRY				13, 34, 32 38	
	36						← 36
	37	GREENISH GRAY (CLAY) 5GY 6/1 CLAY (CH)					
	38	VERY DENSE, VERY PALE BROWN (10YR 8/3) SILTY POORLY GRADED FINE TO MEDIUM SAND WITH GRAVEL (SP)				33, 40, 32, 35	
	39						
	40	BECOMES MOTTLED VERY PALE BROWN (10YR 8/3) AND REDDISH YELLOW (5YR 6/6) MOIST				39, 39 40, 40	
	41						— 41
	42						— 42'
	43						43 43 LW
	44						44 LW
	45	VERY DENSE, YELLOWISH BROWN (10YR 5/6) SILTY POORLY GRADED SAND WITH GRAVEL (SP) (MOIST — DAMP)				15, 48 50/5"	45 45 LW
	46						46

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR Supplemental FS 4301-03-001

HOLE No CSMPZ-13

HF - Rev. 4/94

869 608

HTW DRILLING LOG

HOLE No. CSMPZ-13

PROJECT: DSCR Supplemental FS

INSPECTOR: M. Vazquez

SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	VERY DENSE, DARK YELLOWISH BROWN (10YR 3/6) WELL GRADED FINE TO COARSE SAND WITH GRAVEL (DAMP) (SW)				15, 50/4"	
	50						
	51						51
	52						
	53						53
	54	VERY DENSE, MOTTLED WHITE (GLEY 1 N8/) VERY DARK GREENISH GRAY (GLEY 1 10GY 3/1) MICACEOUS CLAYEY, POORLY GRADED FINE TO MED SAND (SP) (SAPROLITE)				39, 50	
	55						55
	56						
	57						57
	58	BORING TERMINATED AT 58 FT BELOW GROUND SURFACE.					
	59						
	60						
	61						
	62						
	63						
	64						

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME DSCR
PROJECT NO. 6301.03.0011
WELL NO. CSMW2-14
WELL LOCATION DDRV West WH 78
DATE 1.8.04
START TIME

GROUND SURFACE ELEVATION —
REFERENCE POINT ELEVATION —
MACTEC FIELD REPRESENTATIVE M. Vazquez
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER DSI
SCREEN MATERIAL 60 mesh
MANUFACTURER Solinst
TUBING DIAMETER 1.7" OD
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS Continuous Multichannel Tubing

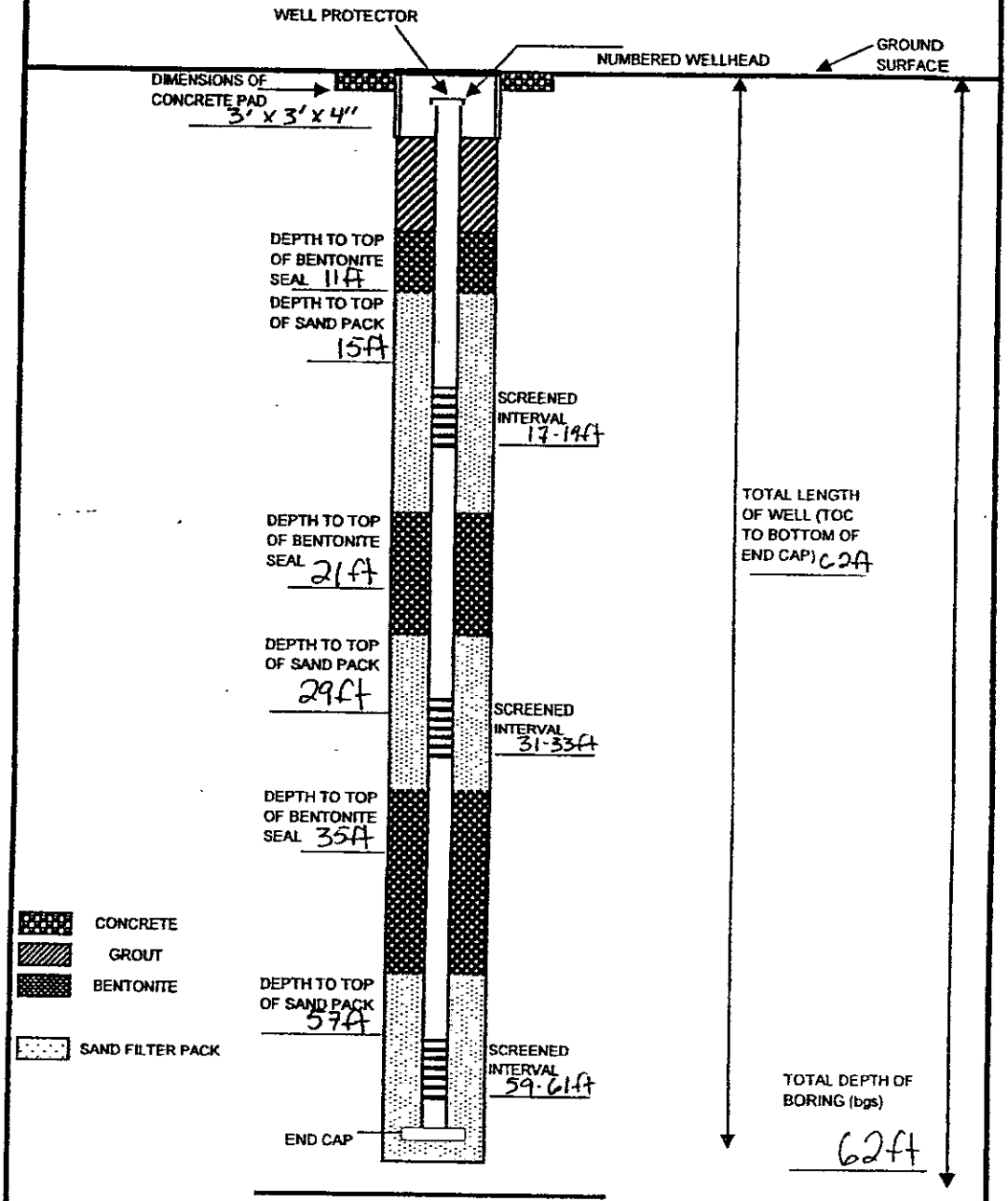
BENTONITE TYPE 3/8" Pellets
MANUFACTURER DSI
CEMENT TYPE Type I / II
MANUFACTURER DSI
BOREHOLE DIAMETER 8-inch
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL)
AMOUNT BENTONITE USED (GROUT)
UPPER WBU A
LOWER WBU B
SAPROLITE WBU C
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

869 610

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

WELL NO. CSMPZ-14

(NOT TO SCALE: ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Chris INSPECTOR: M. Vazquez

DISCREPANCIES _____ CHECKED BY: _____ DATE: _____

HTW DRILLING LOG

HOLE No. CSMDPT-14

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: RICHARD SIMMONS	SHEET 1 OF 4 SHEETS
3. PROJECT: DSCR SUPPLEMENTAL FS 6301-03-0011	4. LOCATION (CITY, STATE): RICHMOND VA	
5. NAME OF DRILLER: CHRIS IACKO	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 4.25 INCH ID HOLLOW STEM AUGERS; 2"X2" SPLIT BARREL SAMPLER	9. HOLE LOCATION (SITE): DDRV WEST WH 78	
	10. SURFACE ELEVATION: NOT PROVIDED ON SEPARATE SHEET	
8. WEATHER: PARTIALLY CLOUDY ± 30°F	11. DATE STARTED: 01/07/04	12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: MORE THAN 62 FT	16. DEPTH GROUNDWATER ENCOUNTERED: 11 FT BGS	
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
15. TOTAL DEPTH OF HOLE: 62.0 FT BGS	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
3	✓		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
MULTICHAMBER PIEZOMETER (SIXINTS)			MULTY CHAMBER PIEZOMETER	

25. CHECKED BY:	26. NAME OF INSPECTOR
	MIGUEL A VAZQUEZ

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1	FILL - GRAVEL					
	2						
	3						
	4	STIFF, RED (10R5/6) CLAYEY SILT (ML) DRY	0'2 62			8,11,9,10	0'1 6
	5		0'3 BKGRND.				
	6						
	7						
	8						
	9	STIFF, MOTTLED RED (10R5/6) AND YELLOW (7.5YR8/6) SANDY SILT (ML) MOIST	DEPTH 0'2 62 0'3 BKGRND			2,3,6,10	7'25
	10						

869 612

HTW DRILLING LOG

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

HOLE No.: CSMDPT-14

SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						DEPTH TO WATER TABLE APPROXIMATELY 11.5FT
	12						▽
	13						
	14	FIRM, YELLOWISH BROWN (10YR 5/4) SILTY POORLY GRADED FINE TO MEDIUM SAND (SP) WITH GRAVEL (WET)		CSMDPT-14 50 (14-21)		2, 2, 10, 16	
	15						
	16						
	17						
	18						SCREEN SECTION
	19	YELLOWISH BROWN (10YR 5/6) SILTY POORLY GRADED FINE TO MEDIUM SAND (SP) BECOMING MORE GRAVELLY (WET)					
	20					50/5"	
	21						
	22	VERY STIFF, YELLOWISH BROWN (10YR 5/8) SLIGHTLY FINE SANDY SILTY CLAY (CL/ML) (MOIST - DRY)				4, 7, 9, 19	
	23						
	24					14, 14, 12, 16	1036
	25	VERY STIFF, DARK GREENISH GRAY (GLEY 2 10G 4/1) SLIGHTLY FINE SANDY CLAY WITH SOME FINE GRAVEL (CH) DRY					
	26					7, 6, 10, 11	1045
	27						
	28						

MRK FORM JUN 89 55-2

PROJECT NAME & NO.: DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No.: CSMDPT-14

HTW DRILLING LOG

PROJECT: DSCR SUPPLEMENTAL FS
INSPECTOR: M VAZQUEZ
HOLE No.: CSMDPT-14
SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28	VERY FIRM, GREENISH BLACK (5GY 2 10G 2.5/1) SILTY POORLY GRADED VERY FINE SAND (SP) MOIST			CSMDPT-14 SO (28-32)	8,9,14,12	
	29						
	30	DENSE, MOTTLED BROWNISH YELLOW (10YR 6/6) YELLOW (10YR 8/6) WELL GRADED FINE to COARSE SAND (SW) DAMP				13,14,31,50/5"	11 15
	31						
	32						SCREEN SECTION SO SO
	33						
	34	VERY DENSE, WHITE (10YR 8/1) with ~~spots~~ REDDISH YELLOW (5YR 6/8) spots WELL GRADED FINE to COARSE SAND with FINE GRAVEL (SW) - MOIST					
	35					5,24,45 49	.1128
	36						
	37						
	38						
	39	DENSE, WHITE (10YR 8/1) SILTY WELL GRADED FINE to COARSE SAND with FINE to MEDIUM GRAVEL (SW) MOIST)					
	40					17,28,22 20	
	41						
	42						
	43						
	44	DENSE, WHITE (10YR 8/1) CLAYEY SILTY WELL GRADED FINE to COARSE SAND with FINE AND COARSE GRAVEL (SW) - DAMP				7,13,30 35	
	45						
	46						

869 614

HTW DRILLING LOG

PROJECT	INSPECTOR	HOLE No.
DSCR Supplemental FS	M. Vazquez	CSM DPT-14
		SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS (ppm) d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	VERY DENSE, white (10YR 8/1) CLAYEY GRAVELLY COARSE SAND (SP) WEAKLY CEMENTED (CLAY CEMENTED - CDAMP				48,50,50	
	50					50/4	
	51						
	52						
	53						
	54	NO RECOVERY				50/3"	
	55						
	56						
	57						
	58						
	59	SAPROLITE - MOTTLED VERY PALE GRAY (GLEY 1 N8/) light gray (GLEY 1 N8/ MICACEOUS SILTY FINE SAND with SOME ROCK FRAGMENTS (MOIS					
	60						SCREEN SECTION
	61						
	62	BORING TERMINATED AT 32.0 FT BELOW GROUND SURFACE.					

MRK FORM JUN 89 55-2	PROJECT NAME & NO.	HOLE No.
	DSCR SUPPLEMENTAL FS 6301-03-0011	CSM DPT-14

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

PROJECT NAME OSCR
PROJECT NO. 6301-03-0011
WELL NO CSMPZ-15
WELL LOCATION ODRV N Building WH63
DATE 1-21-04
START TIME

GROUND SURFACE ELEVATION —
REFERENCE POINT ELEVATION —
MACTEC FIELD REPRESENTATIVE M. Vazquez
TYPE FILTER PACK Sand GRADATION #1
FILTER PACK MANUFACTURER OSI
SCREEN MATERIAL 100 mesh
MANUFACTURER Solinst
TUBING DIAMETER 1.7" OD
DRILLING TECHNIQUE HSA
AUGER/BIT SIZE AND TYPE 4.25" ID
REMARKS Continuous Multichannel Tubing

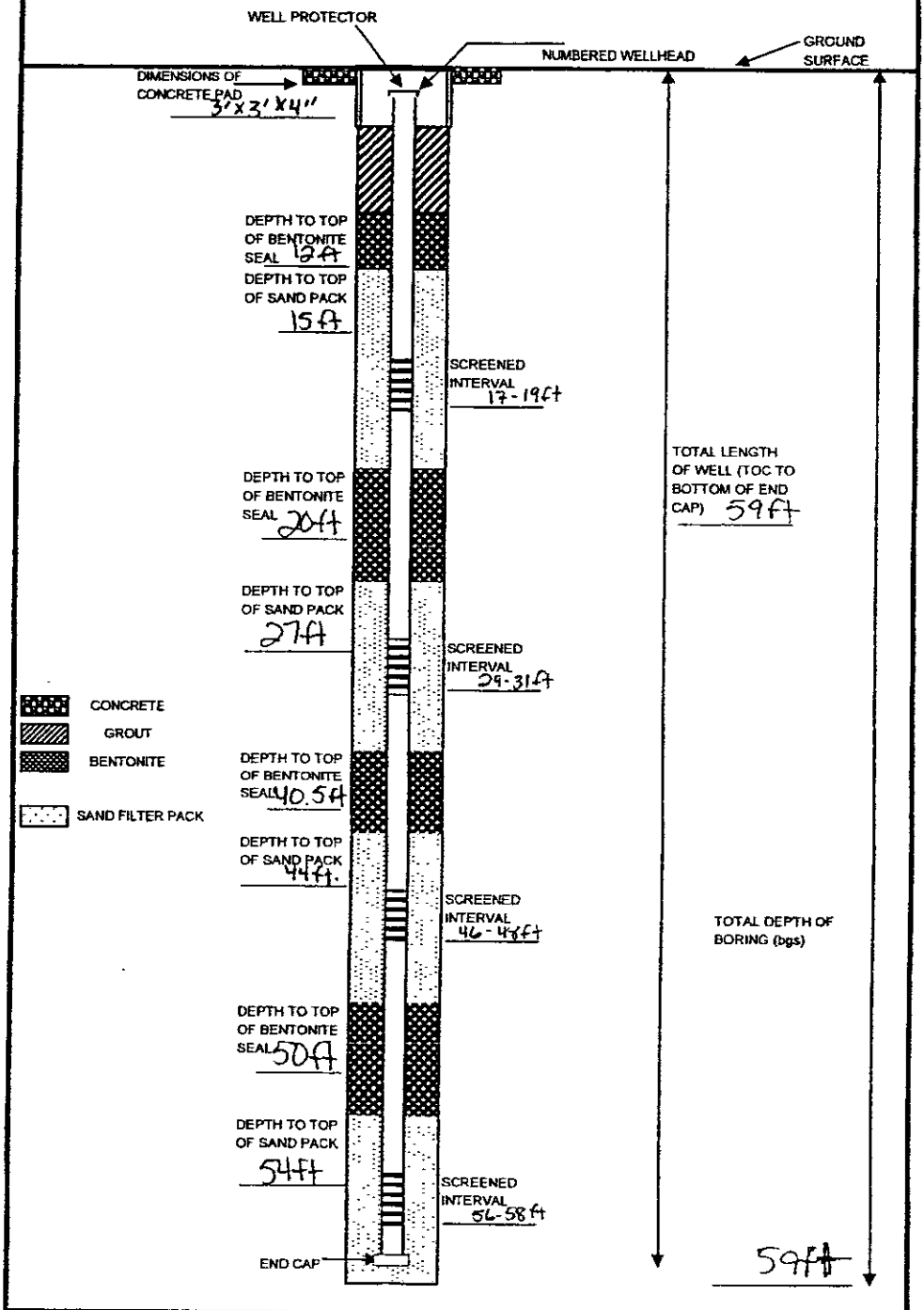
BENTONITE TYPE 3/8" pellets
MANUFACTURER OSI
CEMENT TYPE Type I/II
MANUFACTURER OSI
BOREHOLE DIAMETER 8-inch
DRILLING CONTRACTOR Richard Simmons
AMOUNT BENTONITE USED (SEAL)
AMOUNT BENTONITE USED (GROUT)
UPPER WBU A chamber 1
LOWER WBU B1*1 chamber 2
INTERMEDIATE WBU B2*1 chamber 3
SAPROLITE WBU C chamber 4
AMOUNT CEMENT USED (GROUT)
AMOUNT SAND USED
STATIC WATER LEVEL (>24 hrs after dev)
MEASURED ON (Date/Time)

869 616

MONITORING WELL INSTALLATION DIAGRAM (FLUSH MOUNT COMPLETION)

WELL NO. CSMPZ-15

(NOT TO SCALE. ALL MEASUREMENTS IN FEET)



QA / QC

DRILLER: Ohnis INSPECTOR: M. Vazquez

DISCREPANCIES _____ CHECKED BY _____ DATE: _____

HTW DRILLING LOG

869 617

HOLE No. CSMPZ-15

1. COMPANY NAME: MACTEC ENGINEERING AND CONSULTING	2. DRILLING SUBCONTRACTOR: Richard Simmons
SHEET 1 OF 4 SHEETS	
3. PROJECT: DSCR SUPPLEMENTAL FS	4. LOCATION (CITY, STATE): Richmond VA
5. NAME OF DRILLER: Chris Lacko	6. MANUFACTURER'S DESIGNATION OF DRILL: GP 1000
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 9.25-INCH ID Hollow Stem Augers; 2-INCH x 2 FT split Sampler	9. HOLE LOCATION (SITE): DDRV North Building WH 63
	10. SURFACE ELEVATION: Provided on Separate Sheet
8. WEATHER: Sunny Cold ± 25°F	11. DATE STARTED: 1/20/04 — 12. DATE COMPLETED:
13. OVERBURDEN THICKNESS: More than 59 FT	16. DEPTH GROUNDWATER ENCOUNTERED: ± 9.0 FT BGS
14. DEPTH DRILLED INTO ROCK: N/A	17. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
15. TOTAL DEPTH OF HOLE: 59.0 FT	18. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

19. GEOTECHNICAL SAMPLES (#)	DISTURBED	UNDISTURBED	20. TOTAL NUMBER OF CORE BOXES
1	✓		N/A

21. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	22. TOTAL CORE RECOVERY %
NONE						N/A

23. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	24. SIGNATURE OF INSPECTOR
			Soilnst Multi Level Well	Miguel A Vázquez

25. CHECKED BY:	26. NAME OF INSPECTOR
	Miguel A Vázquez

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	1						
	2						
	3						
	4					10,18,19	
	5	HARD, RED (10R 5/8) SANDY SILT (ML) moist				22	
	6						
	7						
	8						
	9	STIFF, MOTTLED RED (10R 5/8), REDDISH YELLOW slightly SANDY SILT (ML) WET				5,5,8,9	
	10						

MRK FORM JUN 89 55

PROJECT NAME & NO.: DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No.: CSMPZ-

HF - Rev. 4/9

869 618

HTW DRILLING LOG

HOLE No. CSMPZ-15

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 2 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	10						
	11						
	12						
	13						
	14	(7.5YR 5/6) LOOSE, STRONG BROWN, SILTY POORLY GRADED FINE TO MEDIUM SAND (SM) WET				3,3,5,6	
	15						
	16						
	17						17
	18						
	19	DENSE, REDDISH YELLOW (5YR 6/6) WELL GRADED FINE TO COARSE SAND with GRAVEL (SW) WET				17,24,25	19
	20					17	
	21	REDDISH YELLOW (7.5YR 6/8) SILTY CLAY (CL) DAMP					
	22	VERY STIFF, FINE LAMINATED REDDISH YELLOW (7.5YR 6/8 SILTY CLAY (CL) DRY				10,9,8,28	
	23	HARD, BROWNISH YELLOW (10YR 6/6) SILTY CLAY with GRAVEL (CL)				7,14,17	
	24					23	
	25	STIFF, DARK GREENISH GRAY (GLEY 2 5/5GY 4/1) SANDY CLAY (CL) DRY				3,5,6,9	
	26						
	27	DARK GREENISH GRAY (GLEY 2 5/5GY 4/1 SAND AND GRAVEL (SP/GP) (WET)				32,50,50/5	
	28						

869 619

HTW DRILLING LOG

HOLE No. CSMPZ-15

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 3 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	28						
	29	DENSE, white (5Y 8/1) SILTY POORLY GRADED FINE TO MEDIUM SAND WITH GRAVEL (SP)				19, 25, 21	29
	30					50/4	B
	31						31
	32						
	33						
	34	VERY DENSE, white MOTTLED RED 2.5YR 5/8 POORLY GRADED (MEDIUM TO COARSE SAND WITH GRAVEL (SP)				15, 24, 35	
	35					50/4"	
	36						
	37						
	38						
	39	NO RECOVERY, ~~RED (2.5YR 5/8) POORLY GRADED (MEDIUM TO COARSE SAND WITH GRAVEL (MW))~~				7, 38, 37	
	40					36	
	41						
	42						
	43						
	44	NO RECOVERY				40, 50/2"	
	45						
	46						

869 620

HTW DRILLING LOG

HOLE No. CSMPZ-15

PROJECT: DSCR SUPPLEMENTAL FS

INSPECTOR: M. VAZQUEZ

SHEET 4 OF 4 SHEETS

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX No. e	ANALYTICAL SAMPLE No. f	BLOW COUNTS g	REMARKS h
	46						
	47						
	48						
	49	GREENish GRAY (10Y 5/1) GRAVELLY SAND (SP/GP) WET				50/3"	
	50						
	51						
	52						
	53						
	54	SAPROLITE — GRAYISH GREEN (GLEY1 5G 5/2) Micaceous silty poorly graded COARSE SAND (SP) DAMP				50/3"	
	55						
	56						
	57						
	58						
	59						
	60	Boring terminated at 59 FT Below ground Surface					
	61						
	62						
	63						
	64						

CS — C — BT

MRK FORM JUN 89 55-2

PROJECT NAME & NO. DSCR SUPPLEMENTAL FS 6301-03-0011

HOLE No. CSMPZ-15

HF - Rev. 4/94

APPENDIX E

GEOPHYSICAL REPORT

GEOPHYSICAL SURVEY – SUPPLEMENTAL FEASIBILITY STUDY AT DEFENSE SUPPLY CENTER RICHMOND RICHMOND, VIRGINIA

Prepared for:

Air Force Center for Environmental Excellence
3300 Sidney Brooks
Brooks City-Base, Texas 78235

Prepared by:

MACTEC Engineering and Consulting, Inc.
3200 Town Point Drive
Suite 100
Kennesaw, Georgia 30144

Task Order 21
Contract No. F41624-03-D-8606

July 2005
Revision 0

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LIST OF ACRONYMS

2-D	Two-Dimensional Resistivity
bgs	Below Ground Surface
DNAPL	Dense Non-aqueous Phase Liquid
DSCR	Defense Supply Center Richmond
EM	Electromagnetic induction
ft/sec	feet per second
FTA	Fire Training Area
GPR	Ground-probing Radar
IP	Induced Polarization
MACTEC	MACTEC Engineering and Consulting, Inc.
MHz	Megahertz
msl	Mean Sea Level
NGA	National Guard Area
OU	Operable Unit
SFS	Supplemental Feasibility Study
USEPA	United States Environmental Protection Agency

E1.0 INTRODUCTION

This report serves to document and present the findings of geophysical surveys completed at the Defense Supply Center Richmond (DSCR) located in Richmond, Virginia. These geophysical data collection activities were completed in support of the Supplemental Feasibility Study (SFS) Field Investigation. The Supplemental FS is being completed by MACTEC Engineering and Consulting, Inc. under the Air Force Center for Environmental Excellence contract number F41624-03-D-8606.

Geophysical surveying was completed from August 18 through August 26, 2003 for the purposes of supporting the objectives of supplemental FS investigation work at the Area 50 Landfill (Area 50) and the National Guard Area (NGA) at Operable Unit (OU) 6, and in the vicinity of former Fire Training Area (FTA) pits OU 7 (MACTEC, 2003).

The following types of geophysical surveys were completed at the site:

- GEM-2 Electromagnetic (EM) Induction surveys
- Ground-probing radar (GPR) profiling
- Two-Dimensional (2-D) Resistivity and Induced Polarization (IP) profiling
- Seismic Refraction Profiling

Geophex Limited of Raleigh, North Carolina, provided geophysical surveying services. MACTEC personnel provided survey oversight and assistance with data collection activities and interpretation of geophysical data.

The remainder of this report consists of the following sections. Section 2 discusses the purpose and rationale for geophysical surveys at the site. General survey methodology and descriptions of the geophysical techniques employed at the site are also presented in Section 2. Section 3 provides results of geophysical surveys completed at Area 50 and the NGA. Section 4 provides results of geophysical surveys completed at OU 7. Attachment A provides Geophex Limited's geophysical data package and summary of techniques.

E2.0 PURPOSE AND METHODOLOGY

The following sections discuss the purpose of geophysical surveying. The survey methodology, approach, and geophysical techniques employed at the site are also described. Conceptual information on geophysical techniques employed at the site is discussed in greater detail in Attachment A.

E2.1 PURPOSE

Additional data collection was required to refine the site conceptual model at Area 50 and the NGA and OU 7 (MACTEC, 2003). The objectives of geophysical surveying were to determine to the extent practical the following conditions:

E2.1.1 Area 50 and NGA

- Define the lateral and vertical extent of fill material at Area 50 and the NGA
- Provide evidence for the presence or absence of dense non-aqueous phase liquids (DNAPLs) in subsurface soils
- Determine the depth to bedrock beneath the site to locate low points in the bedrock surface

E2.1.2 OU 7

- Define the lateral and vertical extent of former FTA Pits 1, 2, and 3
- Provide evidence for the presence or absence of DNAPLs in subsurface soils
- Determine the depth to bedrock underlying the site to locate low points in the bedrock surface

E2.2 METHODOLOGY

In order to complete the data objectives mentioned previously, MACTEC designed a geophysical program and subsurface sampling program to refine the site conceptual models (MACTEC, 2003). Geophysical data were used to guide the placement of subsurface sampling locations to further characterize interpreted subsurface anomalies attributable to fill material. Geophysical data as well as subsurface sampling of soil and groundwater will be used to select and design remedial alternatives.

The geophysical methods employed at the site and the rationale for their use is presented in Table 2-1. These surveys were generally completed in order of listing (Table 2-1).

The following paragraphs describe the general geophysical survey approach and each geophysical technique employed at the site. Between the two OUs, the total approximate survey quantities of collected data include:

- 12 acres of EM induction data
- 7,000 feet of GPR data
- 2,100 feet of 2-D resistivity data
- 1,200 feet of IP data and,
- 6,200 feet of seismic refraction data.

E2.3 GEOPHYSICAL SURVEY APPROACH

The geophysical surveying approach consisted of four general steps listed in Table 2-2. The geophysical approach was designed to first locate subsurface anomalies on the ground using electromagnetic techniques. Subsurface EM anomalies interpreted to be attributable to fill material and FTA pit activities were further characterized. Selected GPR profiling and 2-D resistivity/IP profiling was completed to further characterize the depth of observed EM anomalies. Lastly, seismic refraction profiling was completed in the immediate vicinity of and hydraulically downgradient of observed EM anomalies or known source areas to determine the depth of bedrock. Seismic refraction profiling was used to locate low areas of the bedrock surface.

E2.4 GEM-2 ELECTROMAGNETIC INDUCTION SURVEY

EM surveys were performed to evaluate the potential presence of subsurface fill materials. EM data were collected using a handheld GEM-2 broadband electromagnetic sensor. A transmitter coil emits an electromagnetic field that induces eddy currents in the earth below the instrument. A receiver coil intercepts both the primary and the secondary electromagnetic fields created by eddy current loops, producing an output voltage corrected for the primary field and the coil geometry and spacing (Telford et al., 1976). The output voltage is linearly related to subsurface conductivity. The reading represents the weighted cumulative sum (or quadrature sum) of the conductivity variations from the surface to the effective depth of the instrument.

EM data were collected simultaneously at five frequencies (330, 1,170, 3,930, 13,590, and 47,010 hertz [Hz]). Survey transects were completed in an east-west orientation. Transects in Area 50 and the NGA were generally spaced 20 feet apart; 10-foot spacing was completed in areas requiring greater detail. Transects in the OU 7 former FTA pit area were spaced 5 feet apart. EM data was logged every 0.5 second along each survey line.

EM data were downloaded to a laptop computer in the field. Each data point was assigned x,y coordinates using standard dead reckoning procedures, using WinGem software (v. 2.0, Geophex, Ltd.). EM data were then exported for gridding and contouring using Oasis Montaj[c] software (V. 5.1, Geosoft, Inc.). Positioning data were rotated to NAD 1983 Virginia State Planar South using GPS data collected with a Trimble PRO XL submeter GPS system.

GEM-2 EM data are reported in parts per million of the induced field or ppm. These data are also referred to as the quadrature sum portion of the EM data set. This is not to be confused with parts per million as it pertains to chemical data. False EM anomalies may be caused by the presence of aboveground man-made structures such as fencing, guardrails, metallic buildings, overhead power lines, and metallic surface debris.

E2.5 GROUND-PROBING RADAR SURVEY

Selected GPR profiling was completed to further characterize the depth of observed EM anomalies. GPR is another electromagnetic technique where short pulses of high-frequency radio waves (ranging between 10 megahertz [MHz] to 1,000 MHz) are focused into the ground surface via a shielded antenna or transducer. The transducer is pulled along the ground surface at a steady pace (0.25 to 0.5 mile per hour). The transducer receives reflected radio wave energy and the processing unit records. Radio wave energy is typically reflected from materials possessing significantly different electrical permittivity (or electrical properties), such as between a sandy soil and a buried iron pipe. A continuous profile of the subsurface is obtained, displayed and often interpreted in the field. GPR profiling is generally most successful in dry, sandy materials. GPR data can be compromised by near-surface, high-conductivity deposits such as clays or in brackish type environments (USEPA, 1993).

GPR data were collected using a RAMAC X3M radar control unit in conjunction with a 250 MHz antenna, both manufactured by MALÅ GeoScience. GPR data were collected and processed using

GroundVision software (V. 1.3.6, MALÅ GeoScience). Line length was recorded by an integrated survey wheel attached to the antenna.

GPR data attained good resolution to approximately 4 to 6 feet below ground surface (bgs) at the survey locations. This depth of penetration was sufficient to map shallow FTA pits at OU 7 but was insufficient to profile the bottom of fill material at Area 50. Test profiles were collected using a lower frequency (100 MHz) antenna; however, the 250 MHz data acquisition was chosen as the 100 MHz antenna achieved only marginally better penetration with significantly less resolution.

E2.6 TWO-DIMENSIONAL RESISTIVITY AND INDUCED POLARIZATION SURVEY

Two-dimensional resistivity and IP profiling was completed to further characterize the depth of observed EM anomalies. Two-dimensional resistivity surveying is used to detect variations in subsurface electrical resistivity. The electrical resistivity of the earth is related to various geologic parameters such as mineralogy, fluid content, and degree of water saturation. IP surveys are used to determine zones of the subsurface that can be electrically polarized (i.e., zones that have the ability to hold a charge and behave like a capacitor). IP data were collected to profile for the potential presence of DNAPL in subsurface soils.

Two-dimensional resistivity and IP data were collected using an Advanced Geosciences Inc. SuperSting R8 IP Earth 2-D Resistivity/Induced Polarization Meter, equipped with a 56-electrode cable configuration. Electrodes were connected to a stainless steel stake with a rubber band and planted in the ground. Prior to data acquisition, a contact resistance check was conducted to verify that each electrode was ready to acquire data. To reduce contact resistances, electrodes were treated with saltwater prior to the test and data acquisition. Resistivity data were acquired using a dipole-dipole geometry with a 5-meter electrode spacing for Line 1, a 1.5-meter spacing for Line 2, and a 2-meter spacing for Lines 3 and 4. IP data were also collected using a dipole-dipole geometry using a 1.5-meter spacing for Line 1 and a 2-meter spacing for Lines 2 and 3. Data were transferred from the SuperSting to an off-site personal computer. Each profile was edited and processed with RES2DINV© software (Geoelectric Imaging, Inc.). Following inversion or data processing, data were imported to Oasis Montaj© software (Geosoft, Inc.) for gridding and display.

E2.7 SEISMIC REFRACTION SURVEY

Seismic refraction profiling was completed in the immediate vicinity of and downgradient of observed EM anomalies or known source areas to determine the depth of bedrock. Seismic refraction profiling was used to locate low areas of the bedrock surface. Seismic refraction is typically a preferred method in top of bedrock investigations because a significant difference in velocity usually exists between overburden type deposits and bedrock. Overburden deposit velocities can range between 2,000 and 5,000 feet per second (ft/sec) and bedrock velocities can be upwards of 7,500 to 15,000 ft/sec. Competent bedrock is typically defined at a velocity of 7,500 ft/sec.

Seismic refraction data were collected using between 20 and 48 channels (geophones) recorded using Geonics GEODE 24-Channel Seismographs. The geophone spacing for Lines 1, 2, and 3 was 15 feet. All other refraction lines used a geophone spacing of 10 feet. Overall line lengths and geophone spacing were determined by the space available along the data collection locations. Energy was introduced into the ground at between 8 and 11 shotpoints on each line. The energy source used most often was a truck-mounted, spring-actuated hammer (SAH), stacked 5 to 10 times at each shotpoint. At shotpoints where vehicle access was limited, a 12-pound sledgehammer was used and stacked 10 to 20 times at each shotpoint. Data were recorded on a laptop computer using Seismodule Controller software (V. 8.18, Geometrics Inc.). First break arrival times were picked using SeisOpt Picker software (V. 1.5, Optim Software). Shot and geophone geometries were combined with the first arrival times and processed using SeisOpt@2D software (V. 3.5, Optim Software). The velocity model results were transferred to ASCII "XYZ" files, and imported into Oasis Montaj© software (Geosoft, Inc.) for gridding and presentation.

E3.0 AREA 50 AND NGA SURVEY RESULTS

The following section presents the results of the geophysical surveys completed at Area 50 and the NGA. Selected geophysical results are brought forward from Attachment A for presentation. Attachment A of Appendix B contains the entire geophysical data set collected at Area 50 and the NGA.

Figure 3-1 illustrates the lateral extent of geophysical surveys completed at Area 50 and the NGA. The red rectangular areas show the lateral extent of EM surveying completed with the GEM-2. Selected GPR lines completed over elevated EM anomalies are labeled P26 through P42 and are depicted in orange. Two-dimensional resistivity profiles completed over selected EM anomalies are labeled Lines 3 and 4 and are shown in green. IP profiles labeled Line 2 and Line 3 are shown in magenta. Seismic refraction lines completed to map the top of the bedrock surface are shown in blue as Lines 4 through 10 and Line 12.

E3.1 AREA 50 RESULTS

Figure 3-2 shows quadrature sum data collected during the GEM-2 EM survey. Elevated EM response values or quadrature sum data (parts per million of the induced field) are shown in yellow through green (EM response values in excess of approximately 6000 parts per million of the induced field). In the absence of surface metallic objects, elevated EM response values are suspected to represent buried fill material, assorted metallic objects, and in some instances subsurface utilities. Two areas of suspected fill appear on Figure 3-2. The northern area of fill encompasses approximately 1.1 acres (approximately 48,000 square feet). The southern area of suspected fill encompasses another 1.6 acres (approximately 69,000 square feet). The total interpreted area of fill at Area 50 appears to encompass approximately 2.7 acres or 117,000 square feet).

The effects of surface metallic objects are evident in the EM data set. Security fencing lining the eastern, western and southern portions of the area surveyed appears as elevated EM response anomalies bounding the edges of the survey area. Also, an east to west trending EM response anomaly that traverses the northern portion of the northern fill area is due to the presence of security fencing. A subtle linear EM response anomaly trends east to west in the area immediately south of the footprint of the helipad. Given its proximity to the helipad, this linear trending anomaly may be due to the possible presence of buried electrical lines associated with the helipad lighting system.

Based on an analysis of the EM data, GPR profiles P26 through P36 were completed to verify the edge of interpreted fill as determined from EM data and to profile the bottom of interpreted fill. GPR profile line P27 (Figure 3-1) is shown in Figure 3-3 and is representative of the GPR data collected at Area 50 (Appendix C in Attachment A). GPR profile line P27 was completed in a north to south fashion through both interpreted areas of fill. Many near-surface diffractions and reflectors are observed along the profile line and appear to be indicative of disturbed ground. The edges of fill interpreted in EM data are difficult to determine from GPR data collected over Area 50. This is most likely due to historical reworking of the subsurface soils and emplacement of fill. As discussed previously in Section 2 of this appendix, the effectiveness of GPR data was limited due to the radio wave energy being attenuated or absorbed at depths ranging from 4 to 6 feet bgs.

Following analysis of EM data and GPR data, 2-D resistivity/IP profile lines were completed over interpreted areas of fill at Area 50 (Figure 3-2) to profile the bottom of the fill. Figure 3-4 presents the results of 2-D resistivity Line 3 completed through the northern fill area. Figure 3-5 shows the results of IP Line 2 also completed through the northern fill area. Figures 3-6 and 3-7 present the results of 2-D resistivity Line 4 and IP Line 3, respectively. These profile lines were completed in the southern fill area of Area 50.

Figure 3-4 shows a cross-sectional view of resistivity through the interpreted northern fill area (Figure 3-2) as profiled along resistivity Line 3. An area of low resistivity (or conversely, high conductivity) extends from southwest to northeast 120 feet to 265 feet (145 feet long) along the survey line and to depths ranging up to 21 feet bgs (approximately 100 feet above mean sea level [msl]). The location of this area of low resistivity compares well with the footprint of fill (Figure 3-2) as identified in the EM survey. An area of high resistivity (or low conductivity) is observed below the area of fill. This feature extends from the beginning of the resistivity profile Line 3 to approximately 220 feet along the survey line and ranges in depth from 6.5 feet to 22 feet bgs. The thickness of this higher resistivity feature ranges from 13 feet to 41 feet and increases to the northeast. The feature may represent a more sandy-type geologic deposit or a sandy fill material used to re-grade the area as the facility was being constructed.

A cross-sectional view of IP data collected along Line 2 is shown in Figure 3-5. These data were collected along the same profile as resistivity Line 3. Areas of elevated chargeability along IP Line 2 extend southwest to northeast from approximately 118 feet to 268 feet (150 feet long) and to depths ranging up to 17 feet bgs. These data compare well with the interpreted footprint of fill (green areas)

shown in Figure 3-2 and the area of low resistivity profiled in resistivity Line 3 (Figure 3-4). Elevated chargeability does not appear to extend below the bottom of interpreted fill. IP data does not suggest the presence of residual DNAPL contaminated soils over the area profiled.

Figure 3-6 shows a cross-sectional view of subsurface resistivity along Line 4. Areas exhibiting higher resistivity values are observed in the near surface and deep along the profile line. Near-surface grading materials may be composed of more sandy soils. Higher resistivity is observed deeper in the section southwest to northeast from 130 feet to 200 feet along Line 4 at approximately 50 to 55 feet bgs (approximately 60 to 65 feet above msl) and is most likely due to the presence of competent bedrock. The elevation of bedrock observed along Line 4 compares well with seismic refraction data collected over this area (Section 3.3 of Appendix B). Areas of lower resistivity are observed throughout much of the profile line. This may represent more silty sand deposits at depth than profiled along resistivity Line 3 completed to the north. The vertical extent of fill also is not observed along this profile line. It may be that the subsurface soils in this area exhibit similar resistivity as the interpreted fill.

IP data collected along IP Line 3 is shown in Figure 3-7, along the same profile as resistivity Line 4. Areas of elevated chargeability along IP Line 3 extend southwest to northeast from approximately 125 feet to 170 feet at depths ranging from approximately 20 feet to 60 feet bgs. Another less extensive area of elevated chargeability is centered at approximately 85 feet along IP Line 3 and occurs at approximately 27 feet bgs (approximately 95 feet above msl).

E3.2 NGA

Figure 3-8 shows EM data collected over the northern portion of the NGA. Three areas of exhibiting elevated EM response values (parts per million of the induced field) are observed over the area surveyed. In the absence of surface metallic objects, elevated EM response values are suspected to represent potential buried fill material associated with the rerouting of nearby No Name Creek. The elevated EM anomalies are outlined in Figure 3-8 and are labeled as NGA-1, NGA-2, and NGA-3.

EM response anomaly NGA-1 is located in the central portion of the area surveyed. NGA-1 is approximately 18 feet wide by 85 feet long, encompassing an approximately 1,550-square-foot area. GPR profile lines P39, P42, and P43 (Attachment A, Appendix C) do not indicate an obvious area of fill or a shallow pit, nor does a subsurface utility line appear to be responsible for this conductivity anomaly.

EM anomaly NGA-2 is located in the northern portion of the area surveyed. NGA-2 is approximately 18 feet by 25 feet and encompasses an approximate 415-square-foot area. GPR radar profile P43 (Attachment A, Appendix C) was completed over NGA-2. GPR data do not indicate the presence of a shallow pit or a subsurface utility or structure.

NGA-3 is located in the southeastern portion of the survey area. NGA-3 appears to be 20 feet by 60 feet and encompasses an approximate 1,050-square-foot area. GPR profile P38 (Attachment A, Appendix C) does not indicate the presence of a shallow pit or subsurface utility or structure in this area. A nearby storm sewer grate may be responsible for the elevated conductivity response in this area. A 4- to 6-inch PVC line was observed traversing to the northwest in the grate.

E3.3 INTERPRETED TOP OF BEDROCK SURFACE - AREA 50 AND THE NGA

The location of seismic refraction profiles are shown in Figure 3-1. Individual seismic refraction profiles and first arrival time of primary and refracted sound waves are presented in Appendix B of Attachment A.

The interpreted top of the bedrock surface (presented as elevation) is shown in Figure 3-9. This map represents the 7,500 feet per second velocity surface and was developed from the eight seismic refraction lines shown on Figure 3-1 and presented in Appendix B of Attachment A. This velocity is typically indicative of the presence of competent bedrock. Compared to historical drilling logs of AEHA-22B (on the western end of seismic refraction Line 6) and AEHA-24B (approximately 15 feet north of seismic refraction Line 6) (Figure 3-1), the interpreted top of bedrock in Figure 3-9 correlates to decomposed bedrock.

Based on the seismic refraction data, the bedrock surface below Area 50 and the NGA appears to range from approximately 40 to 84 feet bgs. An interpreted bedrock "high" appears in the northeastern quadrant of the investigation area based on data collected along seismic refraction Line 5; however, the historical drilling log (Figure 3-1) of well AEHA-19B, which is approximately 75 feet north of Line 5, does not indicate the presence of bedrock, but rather white clay at approximately 34 to 37 feet bgs. The interpreted top of bedrock appears to slope towards the south and southeast, trending deeper towards the residential area to the southeast.

E4.0 OU 7 RESULTS AND RECOMMENDATIONS

The following section presents the results of the geophysical surveys completed at OU 7. Selected geophysical results considered most germane to interpretive discussion are brought forward from Attachment A for presentation. Attachment A of Appendix B contains the geophysical data collected at OU 7.

Figure 4-1 illustrates the lateral extent of geophysical surveys completed at OU 7. The red rectangular areas show the lateral extent of EM surveying completed with the GEM-2. The EM survey was intended to encompass the suspected locations of former FTA Pits 1, 2, and 3. Due to the presence of fencing and metallic dumpsters staged in the area of Pit 3, EM surveying could not be completed is this area. Selected GPR profile lines labeled P1 through P13 and P15 through P21 are depicted in orange. Two dimensional resistivity profiles are shown in green and labeled Line 1 and Line 2. One IP line was completed and is shown in magenta as Line 1. Seismic refraction lines completed to map the top of the bedrock surface are shown in blue as Lines 1 through 3 and Line 11. Note that 2-D resistivity Line 1 was completed in lieu of a seismic refraction line in the Kingsland Creek floodplain. Limited access prohibited the use of the spring actuated hammer as an energy source; therefore, 2-D resistivity was used to evaluate the depth to bedrock in this area.

Figure 4-2 shows EM data collected during the GEM-2 EM survey. Elevated EM response values (parts per million) are shown in yellowish green through green. In the absence of surface metallic objects or other aboveground features, elevated EM response values are interpreted to represent areas of conductive fill and, in some instances, subsurface utilities. Based on historical aerial photo analysis, the suspected location of former FTA Pits 1, 2, and 3 are shown superimposed on Figure 4-2. The historical location of these pits was interpreted from analysis of aerial photographs. As previously discussed in Section 2 of Appendix B, the purpose of EM surveying was to better define the location of the former FTA pits.

E4.1 FORMER FTA PIT 1

Elevated EM response values were observed within the immediate vicinity of the suspected location of former FTA Pit 1. The lateral extent of Pit 1 is clearly shown by the elliptical area of elevated EM response (greater than 2,700 parts per million of the induced field) conductivity values just northeast of the pit's suspected location. Former FTA Pit 1 EM data indicate an anomaly roughly 46 to 60 feet in

diameter and encompassing approximately 2,200 square feet. The location of the FTA Pit 1 anomaly as interpreted from the EM response is shown on Figure 4-2.

Following completion of the EM survey and analysis of the results, GPR profiles P5 through P7 (Figure 4-1 and Appendix C of Attachment A) were completed over the interpreted location of former FTA Pit 1. Figure 4-3 shows GPR data completed from profile Line P7. GPR data show a subtle curvilinear signature that corresponds to the footprint of the interpreted location of Pit 1 as defined by EM data. The subtle curvilinear feature extends from approximately 22 feet to 67 feet (approximately 45 feet wide) along the survey line and extends to a depth of approximately 2.5 feet bgs.

Based on the findings of the EM and GPR surveys, 2-D resistivity Line 2 and IP Line 3 were completed through the interpreted footprints of the former FTA Pits 1 and 2 areas (Figure 4-1). Figures 4-4 and 4-5 show cross-sectional views of resistivity and chargeability through these areas, respectively. The interpreted location of Pit 1 is located between 345 feet and 405 feet along 2-D resistivity Line 2 and IP Line 3. Shallow resistivity data (approximately 0 to 5 feet bgs) in the area of Pit 1 (Figure 4-4) show values up to 100 Ohm-m and does not show an obvious pit.

Deeper resistivity data presented in Figure 4-4 appear to show a more resistive unit extending from approximately 5 to 20 feet bgs (or from 90 to 75 feet above msl). Based on the resistivity data, the more resistive material may indicate the presence of a predominantly sandy geologic unit. The more resistive unit extends deeper west to east at approximately 220 to 280 feet along 2-D resistivity Line 2 and again at approximately 325 feet and 355 feet. This unit is underlain by a less resistive unit beginning at approximately 25 feet bgs or 75 feet in elevation. The resistivity data suggests that the less resistive unit may contain a greater silt or clay content than the overlying unit.

IP data presented in Figure 4-5 shows two areas of elevated chargeability in the vicinity of Pit 1. These areas of elevated chargeability are located west to east at approximately 325 feet and 355 feet along IP Line 1 and begin at approximately 15 to 20 feet bgs (approximately 80 feet above msl). These areas of elevated chargeability appear to extend into the less resistive geologic unit (more silty or clayey unit). These two areas of elevated chargeability may represent areas of potentially impacted soils associated with former FTA pit activities.

E4.2 FORMER FTA PIT 2

Elevated EM response values were observed to the west of the suspected location of Pit 2. EM data show two areas of elevated EM response may be attributable to the presence of Pit 2. For the purpose of this investigation, they are denoted as Pit 2A and 2B on Figure 4-2.

The anomaly designated as Pit 2A is irregular in shape, exhibiting approximate dimensions of 100 feet long and up to 65 feet wide. This anomaly encompasses an area of approximately 4,400 square feet, is roughly circular, and is approximately 35 feet in diameter. The anomaly designated as Pit 2B encompasses an area of approximately 2,000 square feet. This anomaly is located northeast of the north-south running guardrail and is closer to the suspected location of Pit 2.

The effects of surface metallic objects are evident in EM data collected in the vicinity of Pit 2 and the western portion of the area surveyed. Security fencing lining the eastern portion of the former tank berm bounds the western extreme of the area surveyed. North to south and east to west trending EM anomalies in the western half of the area surveyed are attributable to a subsurface sewer line and guardrails. The southern area of EM surveying was completed to investigate an area of elevated groundwater contamination results. Elevated conductivity observed in this area is attributable to aboveground soil and rock piles and large metallic storage bins staged in the area.

Following analysis of EM data, GPR profile lines P1 through P4 and P8 through P10 were completed over the interpreted areas of Pit 2. Figure 4-6 shows GPR profile line P8 completed through the Pit 2A area. A subtle shallow reflector extends west to east from approximately 25 to 90 feet along the profile and extends to approximately 1.7 to 2 feet bgs.

Based on the findings of the EM and GPR surveys, 2-D resistivity Line 2 and IP Line 3 were completed through the interpreted footprints of the former FTA Pits 1 and 2 areas (Figure 4-1). Figures 4-4 and 4-5 show cross-sectional views of resistivity and chargeability through Pits 1 and 2, respectively. The highest EM response values observed in Pit 2A correspond well with a shallow resistivity low observed extending west to east from approximately 120 feet to 140 feet along 2-D resistivity Line 2 (Figure 4-4) to approximately 4 feet bgs.

Figure 4-4 shows a layer of high resistivity extending from approximately 5 to 20 feet bgs. The high resistive unit extends deeper west to east from approximately 220 to 280 feet and from 325 feet and

355 feet along 2-D resistivity Line 2. This area of higher resistivity may represent a sandy geologic unit. This more resistive unit is underlain by a less resistive unit or a siltier or clayey geologic unit beginning at approximately 25 feet bgs.

IP data presented in Figure 4-5 shows two areas of elevated chargeability in the vicinity of the Pit 2A and 2B EM anomalies. Areas of elevated chargeability within the immediate vicinity of the Pit 2A and 2B EM anomalies (Figure 4-5) are located at approximately 65 feet, 150 feet and 245 feet west to east along IP Line 1 and begin at approximately 15 to 20 feet bgs. These areas of elevated chargeability appear to extend into the less resistive geologic unit (more silty or clayey unit). The areas of elevated chargeability may represent potentially impacted soils associated with former FTA pit activities.

E4.3 FORMER FTA PIT 3

As previously discussed, EM data were adversely affected within the fenced area of the tank berm or suspected location of former FTA Pit 3. Three GPR profiles were completed over the suspected location of Pit 3 (Figure 4-1 and Appendix C in Attachment A). GPR profile P12 (Figure 4-7) shows an approximately 30-foot-wide, shallow (2.5 feet bgs), disturbed soil area immediately adjacent to the foot of the easternmost berm wall (Figure 4-1). This anomaly is subtle in nature and may be due in part to excavation activities associated with the construction of the tank berm.

E4.4 INTERPRETED TOP OF BEDROCK SURFACE

The location of seismic refraction profiles are shown in Figure 4-1. Individual seismic refraction profiles and first arrival time of primary and refracted sound waves are presented in Appendix B of Attachment A. As stated previously, 2-D resistivity Line 1 was completed in the Kingsland Creek floodplain to profile the top of bedrock due to difficult access issues.

Based on seismic refraction data and 2-D resistivity data, the interpreted top of the bedrock surface (presented as elevation) is shown in Figure 4-8. This map represents the 7,500-foot-per-second velocity surface. This is generally an acceptable velocity for use when limited bedrock drilling data are available. This velocity is typically indicative of the presence of competent bedrock. Using a resistivity value of over 200 Ohm-m to represent competent bedrock for resistivity Line 1 (Attachment A of Appendix B), suggests that bedrock is much deeper than 50 feet bgs. However, this interpretation is not consistent with

the depth at which saprolite was encountered (approximately 40 feet bgs) in monitoring well MWFTA-14 (Figure 4-1). Therefore, the use of resistivity data to interpret the top of bedrock is uncertain.

Based on the seismic refraction data, the interpreted bedrock surface below OU 7 ranges from approximately 45 to 75 feet bgs. This is generally consistent with saprolite/bedrock data from boring logs of monitoring wells installed in the area. The interpreted top of bedrock appears to slope towards the southeast, trending deeper towards Kingsland Creek.

E5.0 REFERENCES

MACTEC, 2003. *Draft Supplemental Remedial Investigation Work Plan*, Defense Supply Center, Richmond, August, 2003.

Telford, W. M, Geldart, L. P., Sheriff, R. E., and Keys, D. A., 1976. *Applied Geophysics*, Cambridge University Press, Cambridge, England, 860 pages.

United States Environmental Protection Agency, 1993. *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide.* September, 1993, 304 pages.

TABLES

TABLE E2-1

SUMMARY OF GEOPHYSICAL SURVEY RATIONALE
Supplemental FS Field Investigation
Defense Supply Center Richmond
Richmond, Virginia

Geophysical Method	Rationale Area 50 Landfill/NGA	Rationale OU 7
GEM2 Electromagnetic (EM) Induction Survey	• Grid survey to map the lateral extent of fill at Area 50 • Grid survey to map possible fill material in the northern portion of the NGA	• Grid survey to define the location and lateral extent of former FTA Pits 1, and 2.
Ground-probing Radar	• Vertical profiling of selected EM anomalies, determine the depth of fill	• Vertical profiling of EM anomalies attributable to former FTA Pits 1, and 2, determine the depth of pits. • Vertical profiling of the suspected area of Pit 3.
2 Dimensional Resistivity and Induced Polarization	• Vertical profiling to determine depth of fill at Area 50 Vertical profiling to provided evidence for the presence or absence of DNAPL in subsurface soils	• Vertical profiling to determine depth of former FTA pits • Vertical profiling to provided evidence for the presence or absence of DNAPL in soils beneath former FTA pits • Determine the depth of bedrock
Seismic Refraction	• Vertical profiling to determine the top of the bedrock surface underlying the site	• Vertical profiling to determine the top of the bedrock surface underlying the site

PREPARED/DATE: _____
CHECKED/DATE _____

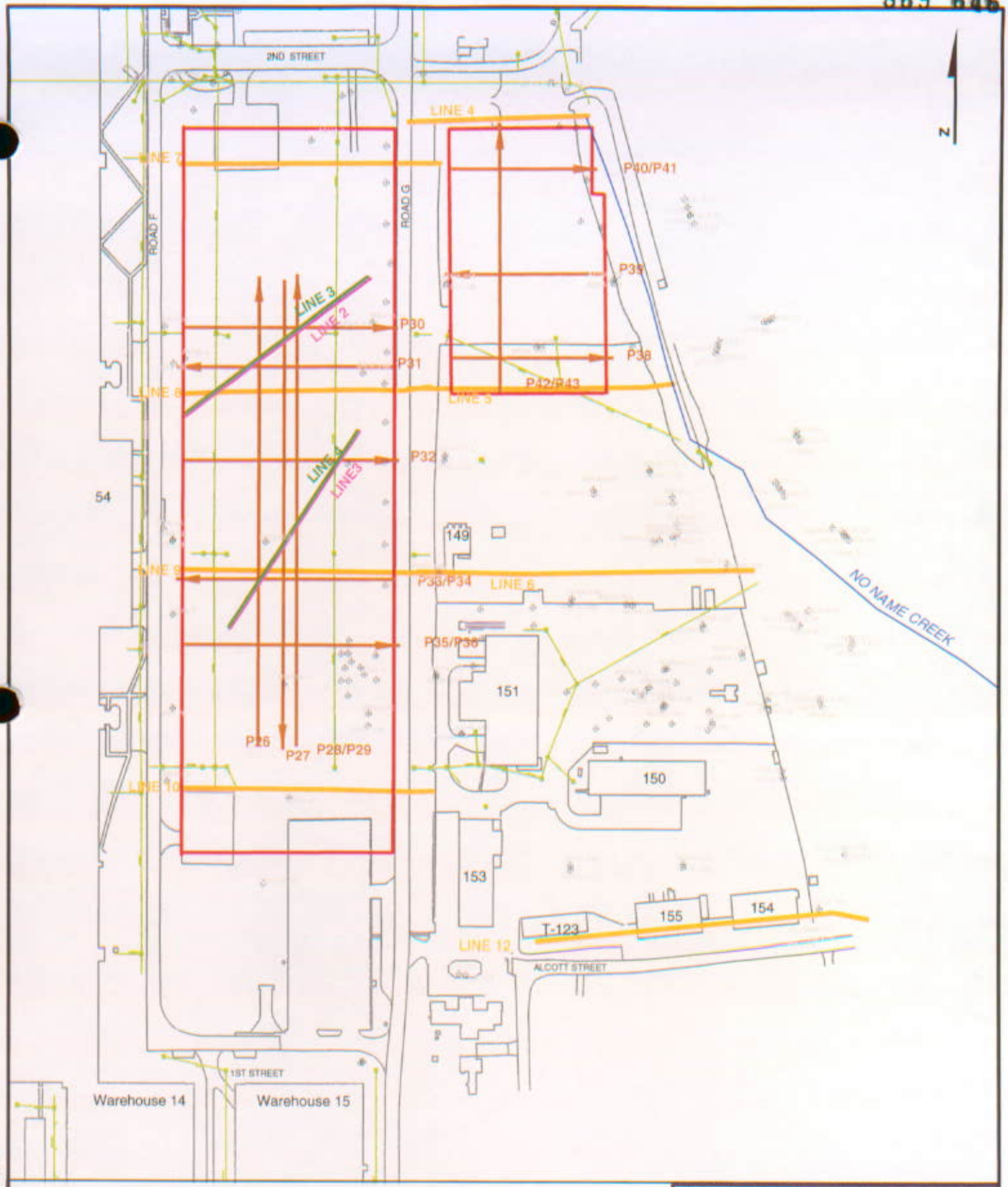
TABLE E2-2

SUMMARY OF GEOPHYSICAL SURVEY APPROACH
Supplemental FS Field Investigation
Defense Supply Center Richmond
Richmond, Virginia

Step	Approach Elements
Step 1	• Establish a reference grid for EM surveys over the suspected fill areas and former fire training area pits
Step 2	• Complete GEM2 EM Induction survey mapping • Complete a field analysis of EM data, review data for areas of elevated conductivity
Step 3	• Locate GPR profile lines and 2-D Resistivity/IP lines over areas exhibiting elevated conductivity attributable to disposal and fire training activities. • Complete GPR profile lines over selected conductivity anomalies • Complete 2-D Resistivity and IP profiling through interpreted source areas
Step 4	• Establish seismic refraction survey lines through mapped source areas and downgradient locations • Complete seismic refraction survey profiling

PREPARED/DATE: _____
CHECKED/DATE _____

FIGURES



0 100 200 400 600 800 Feet

LEGEND

- SEISMIC REFRACTION LINE
- EM DATA
- IP LINE
- RESISTIVITY LINE
- GPR PROFILES
- SEWER LOCATION
- DSCR BUILDING IDENTIFICATION
- MONITORING WELL

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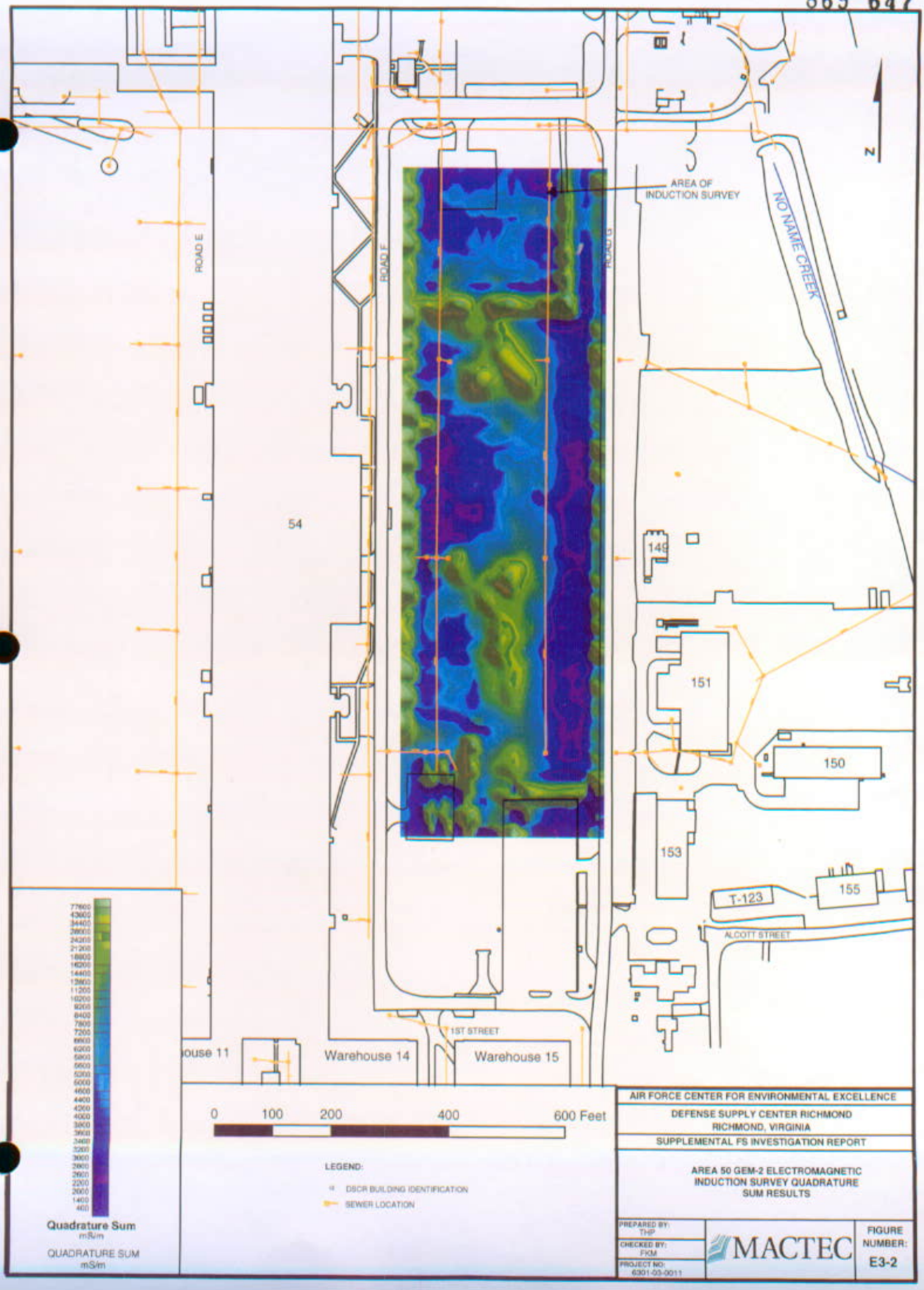
LOCATION OF GEOPHYSICAL SURVEYS -
AREA 50 AND THE NATIONAL GUARD AREA

PREPARED BY: THP CHECKED BY: FKM PROJECT NO: 6301-03-0011	MACTEC	FIGURE NUMBER: E3-1

P:\gis\Projects\dsc\newsite_E\fig3-1_cism.mxd



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AREA 50 GEM-2 ELECTROMAGNETIC INDUCTION SURVEY QUADRATURE SUM RESULTS

PREPARED BY: THP CHECKED BY: FKM PROJECT NO: 6301-03-0011	MACTEC	FIGURE NUMBER: E3-2

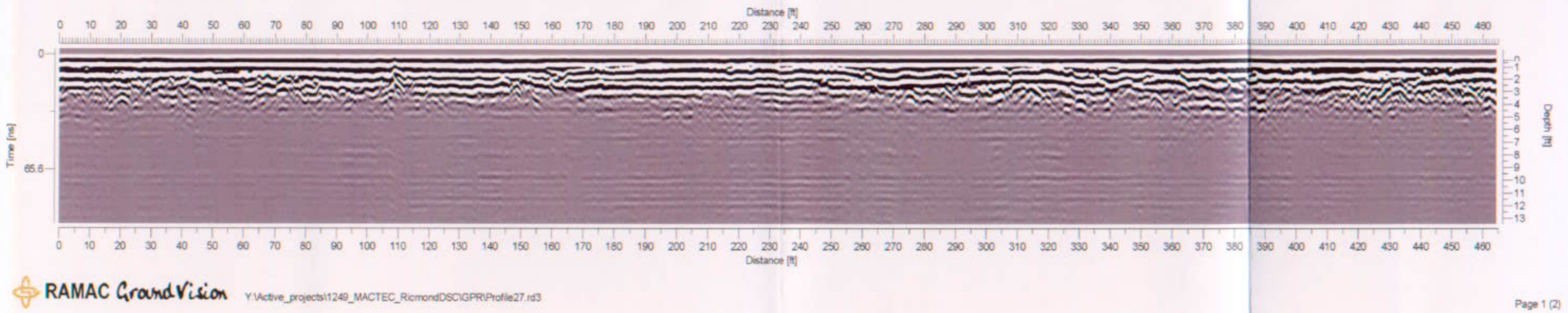


Figure E3-3 Area 50 Representative GPR Profile

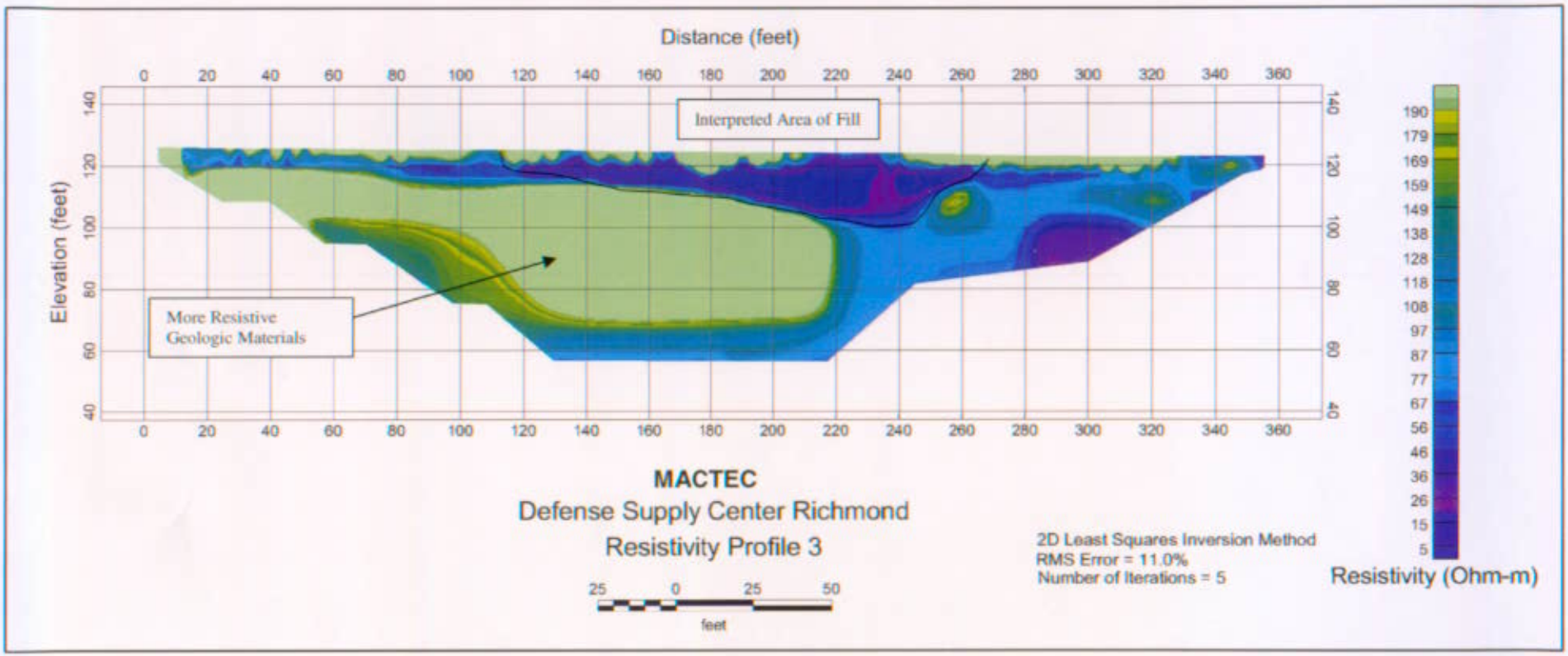


Figure E3-4 Area 50 2-D Resistivity Profile Line 3 Results

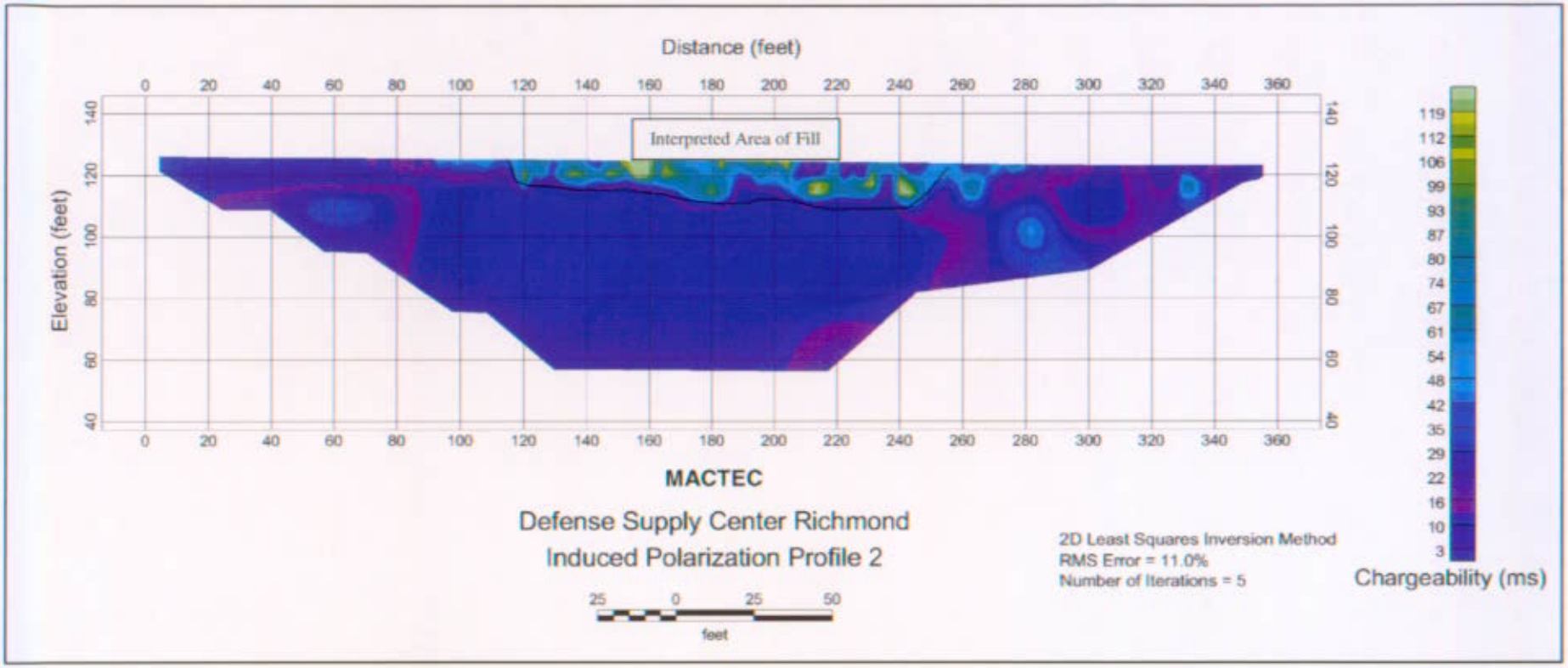
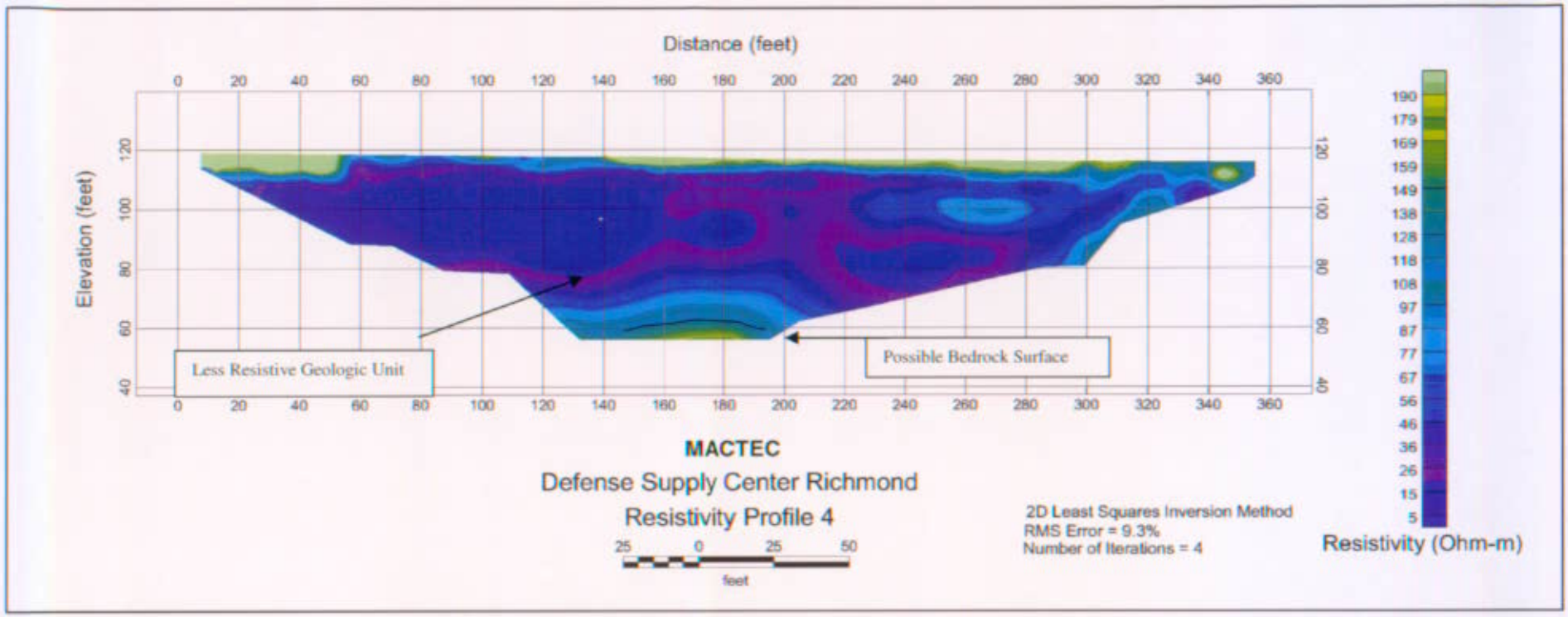


Figure E3-5 Area 50 Induced Polarization Profile Line 2 Results



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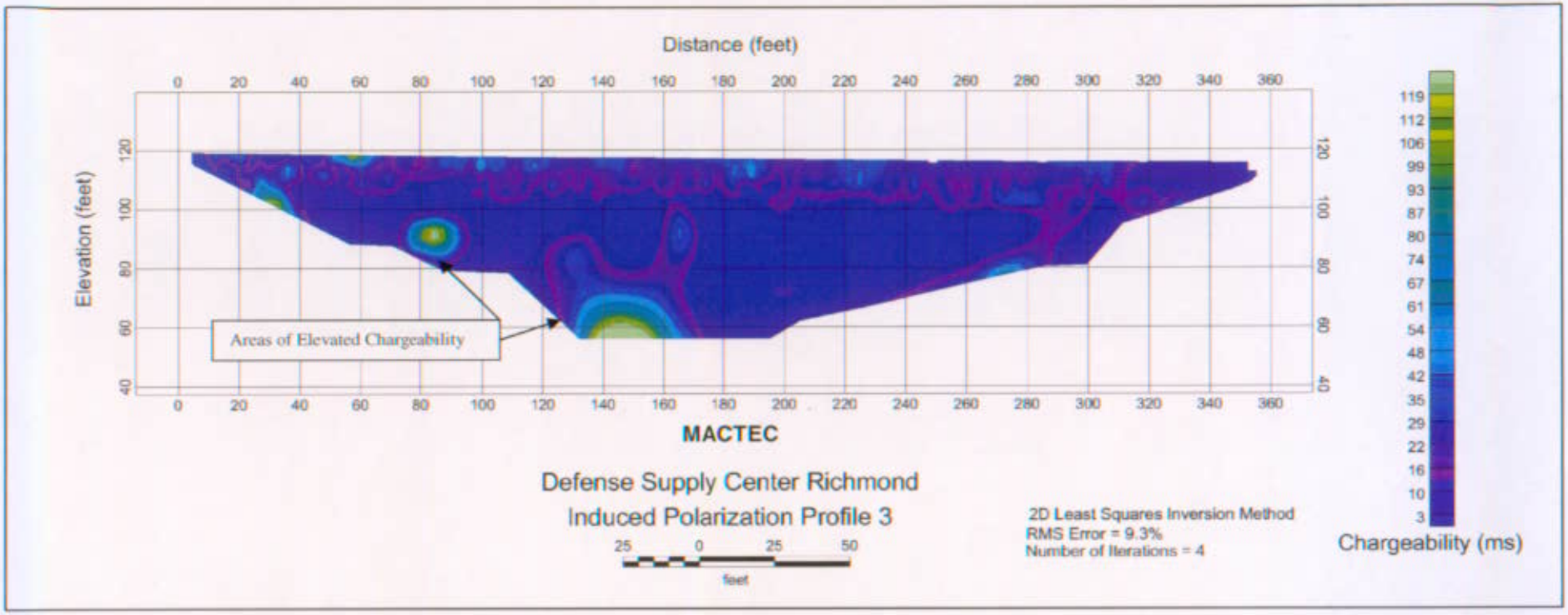
2 **Figure E3-6 Area 50 2-D Resistivity Profile Line 4 Results**



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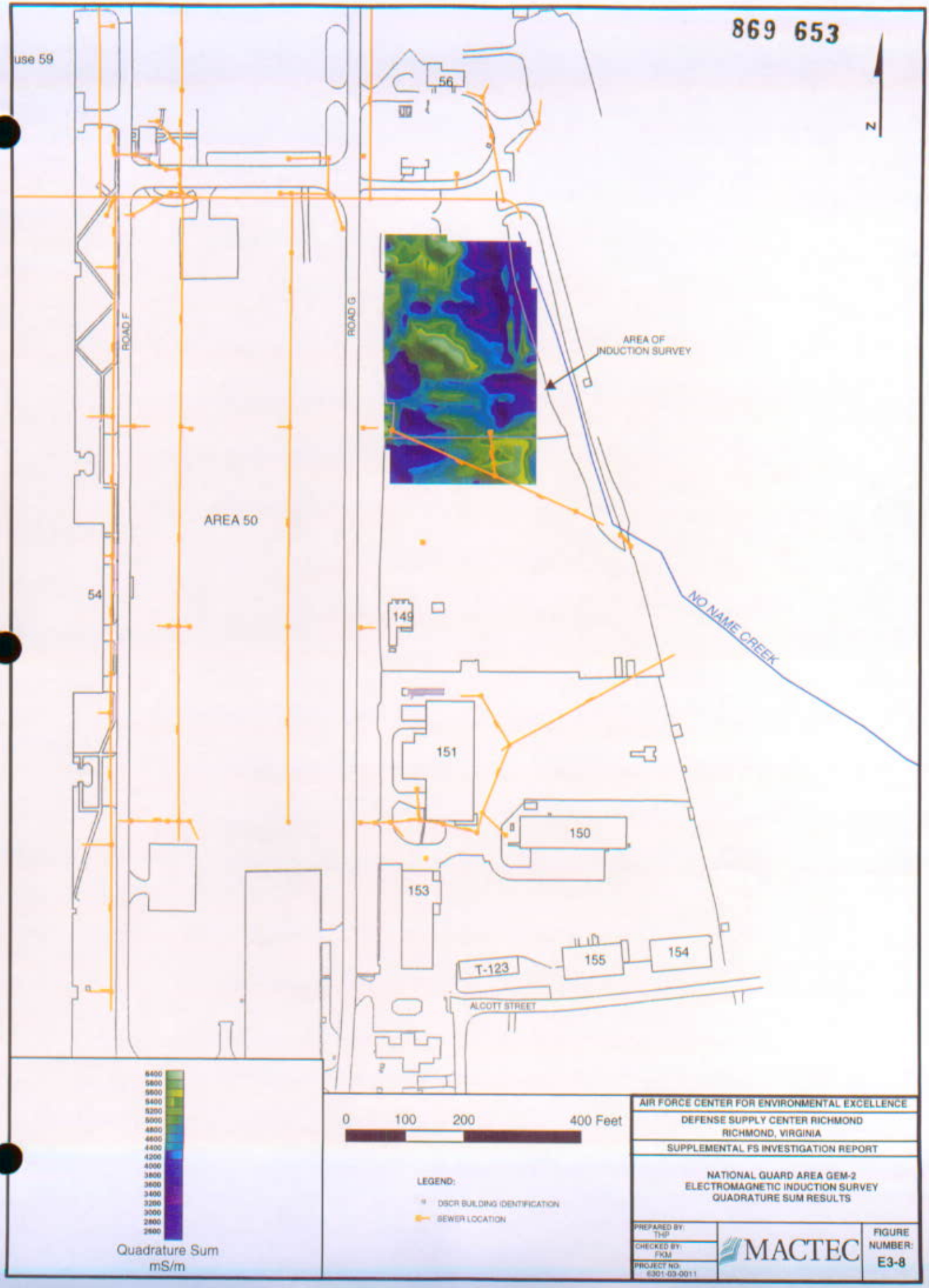
2 **Figure E3-7 Area 50 Induced Polarization Profile Line 3 Results**

869 653



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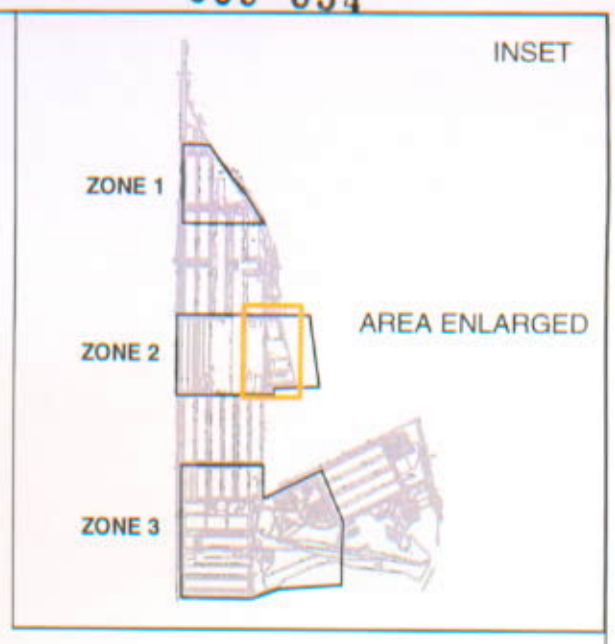
NATIONAL GUARD AREA GEM-2
ELECTROMAGNETIC INDUCTION SURVEY
QUADRATURE SUM RESULTS

PREPARED BY: THP	MACTEC	FIGURE NUMBER: E3-8
CHECKED BY: FKM		
PROJECT NO: 6301-03-0011		

869 654



56

AEHA-15B
AEHA-20B
AEHA-18B
AEHA-7
AEHA-19B
EW-L5
DMW-9B
DMW-34B
EW-L4
AEHA-21B
AEHA-17B
AEHA-26B
EW-L3
DMW-8B
DMW-8E
AEHA-22B
AEHA-30B
EW-L2
AEHA-24B
AEHA-25B
AEHA-27B
AEHA-31B
EW-L1
AEHA-6
AEHA-23B
DMW-7B
DMW-28B
DMW-28E
AEHA-28B
AEHA-29B
AEHA-14B
AEHA-32B
AEHA-15B
AEHA-34B
AEHA-33B
AEHA-13B
AEHA-12B

USGS-E2
USGS-E1
USGS-E3
USGS-I3
USGS-I2
USGS-I1
USGS-D2
USGS-D3
USGS-D1
LAWMW-Q
USGS-O2
USGS-O1
USGS-O3
USGS-H2
USGS-H1
USGS-H3
USGS-C2
USGS-C1
USGS-C3
USGS-N2
USGS-N3
USGS-N1
USGS-BR2
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USGS-A1
USGS-A3
USGS-L2
USGS-L3
USGS-L1
USGS-K2
USGS-K1
USGS-K3
USGS-J1
USGS-J2
USGS-J3
USGS-P1
USGS-P2
USGS-P3

Warehouse 14
Warehouse 15

68
66
64
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32
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28

BEDROCK ELEVATION (FEET, MSL)

0 100 200 300 400 Feet

Legend

- STORM SEWER
- EXTRACTION WELL
- ⊕ SELECT MONITORING WELL LOCATIONS
- DSCR BOUNDARY

NOTE:
TOP OF BEDROCK INTERPRETED AS SEISMIC VELOCITY OF 7500 FT/SEC

N

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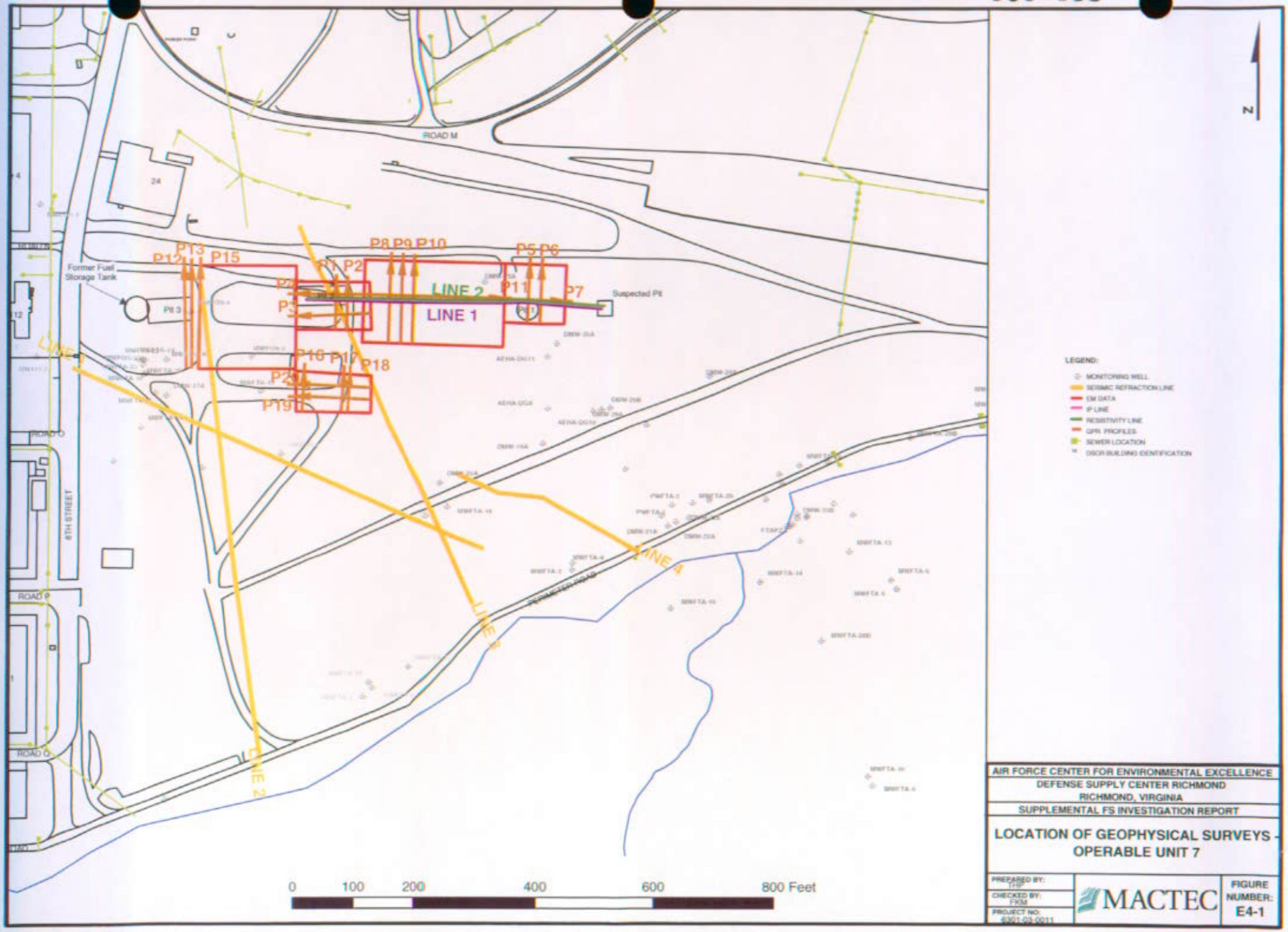
BEDROCK ELEVATIONS INTERPRETED FROM SEISMIC REFRACTION DATA
OU 6 AREA OF ZONE 2

PREPARED BY:		FIGURE NUMBER:
THP	MACTEC	E3-9
CHECKED BY: FKM		
PROJECT NO: 6301-03-0011		



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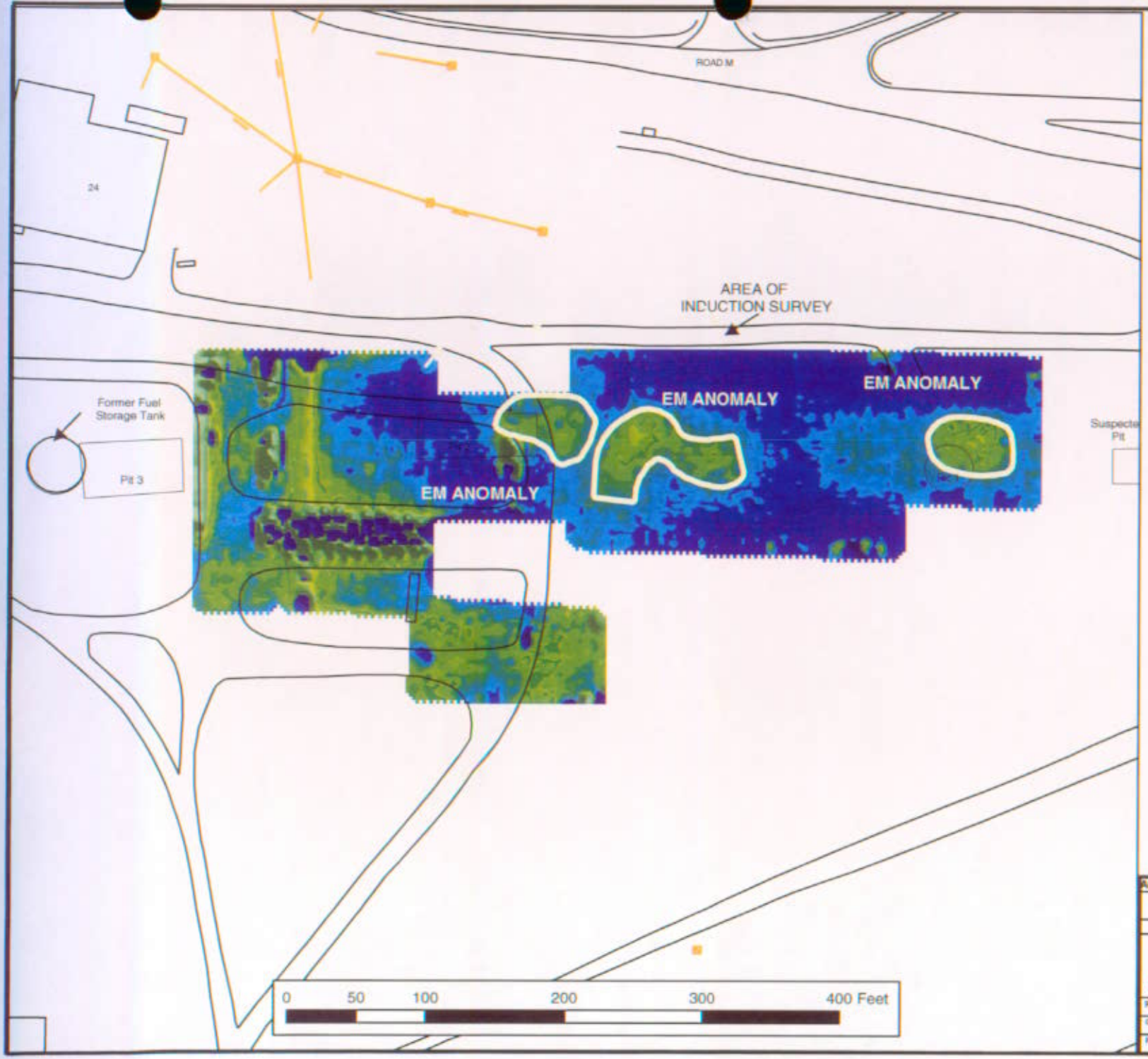
LOCATION OF GEOPHYSICAL SURVEYS - OPERABLE UNIT 7

PREPARED BY: LHP
CHECKED BY: FKM
PROJECT NO: 6301-03-0011

MACTEC

FIGURE NUMBER: E4-1



N

12400
5800
4400
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
-1200

QUADRATURE SUM
mS/m

LEGEND:

DSCR BUILDING IDENTIFICATION
SEWER LOCATION
INTERPRETED EM ANOMALY

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DEFENSE SUPPLY CENTER RICHMOND
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SUPPLEMENTAL FS INVESTIGATION REPORT

OPERABLE UNIT 7 GEM-2 ELECTROMAGNETIC INDUCTION SURVEY QUADRATURE SUM RESULTS

PREPARED BY: THP
CHECKED BY: FKM
PROJECT NO: 5001-02-0011

MACTEC

FIGURE NUMBER: E4-2

959 656

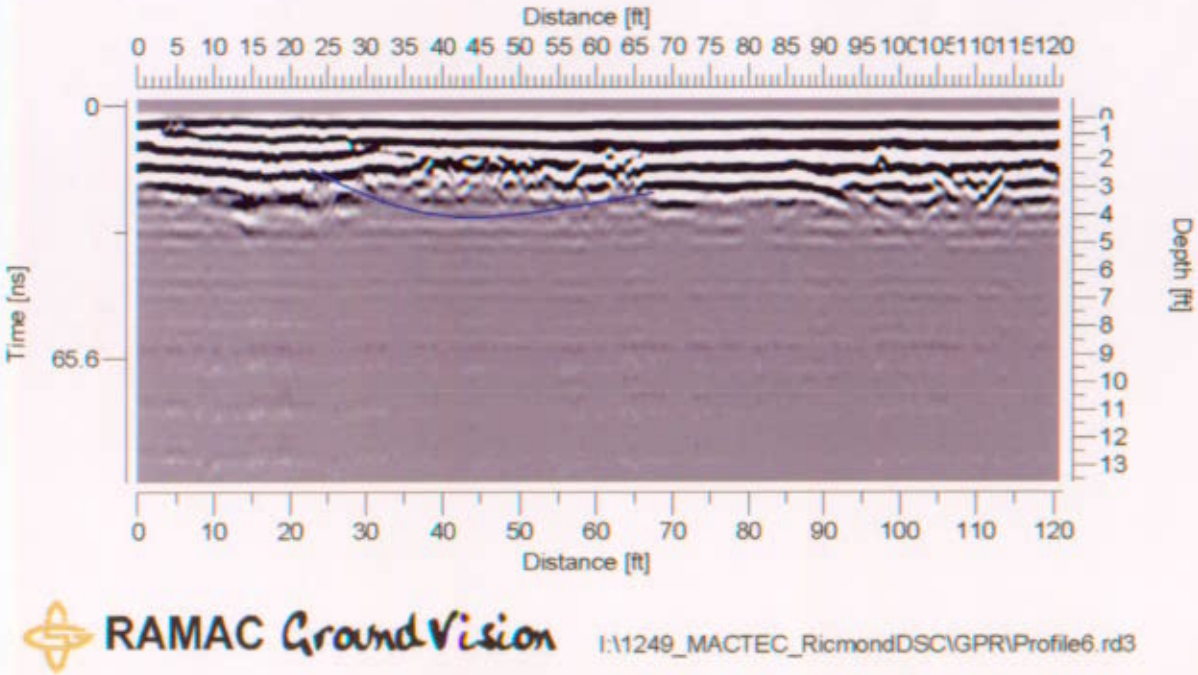


Figure E4-3. Operable Unit 7 Representative GPR Profile Over Pit 1 EM Anomaly. Note subtle curvilinear signature (in blue) extends from 22 feet to 67 feet along the line and extends to approximately 2.5 feet bgs.

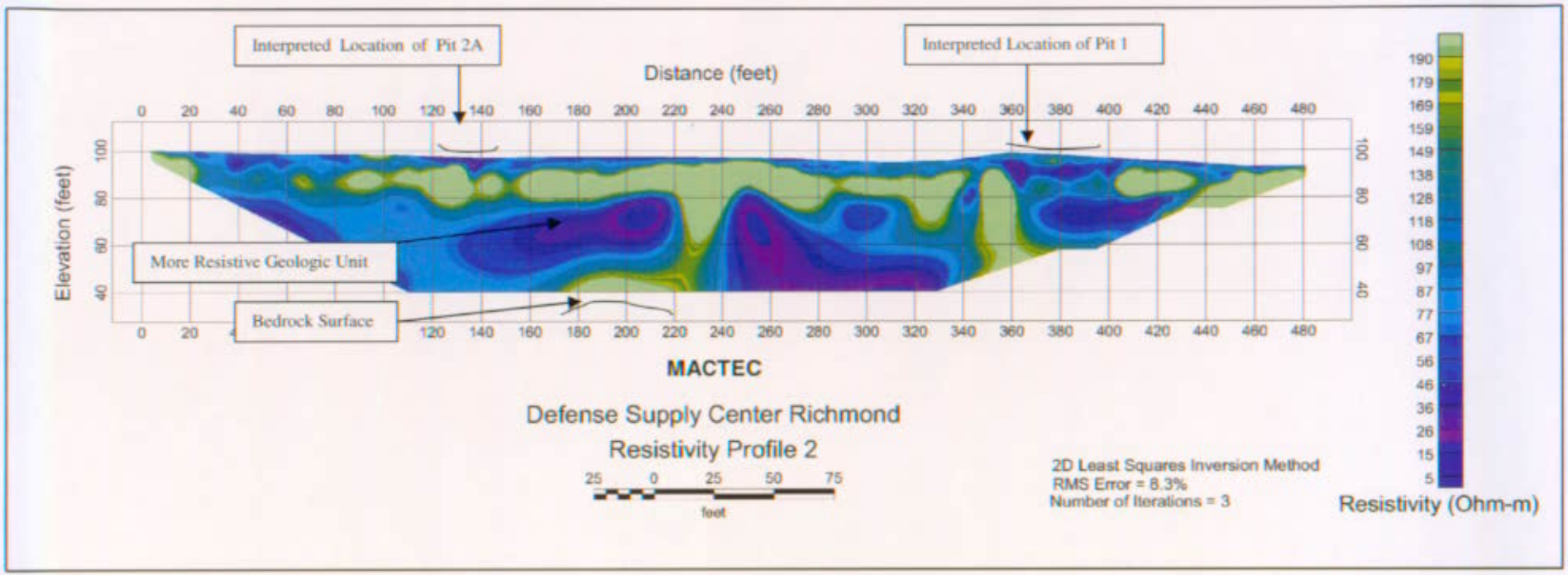
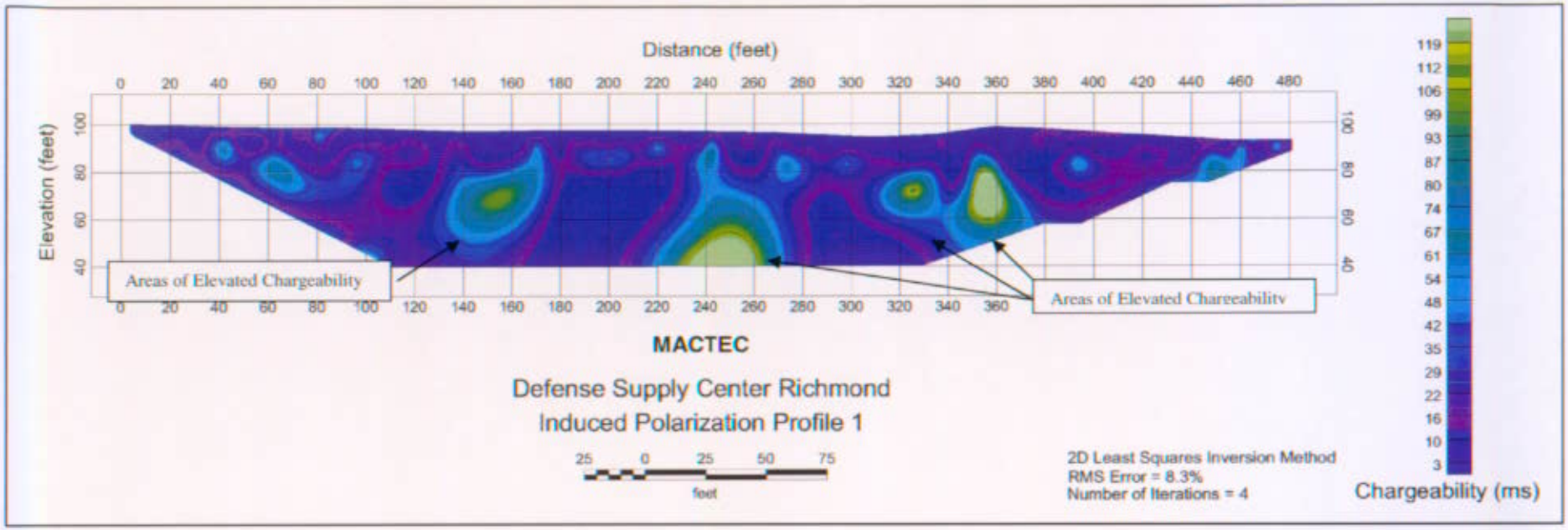


Figure E4-4 Operable Unit 7 2-D Resistivity Profile Line 2 Results



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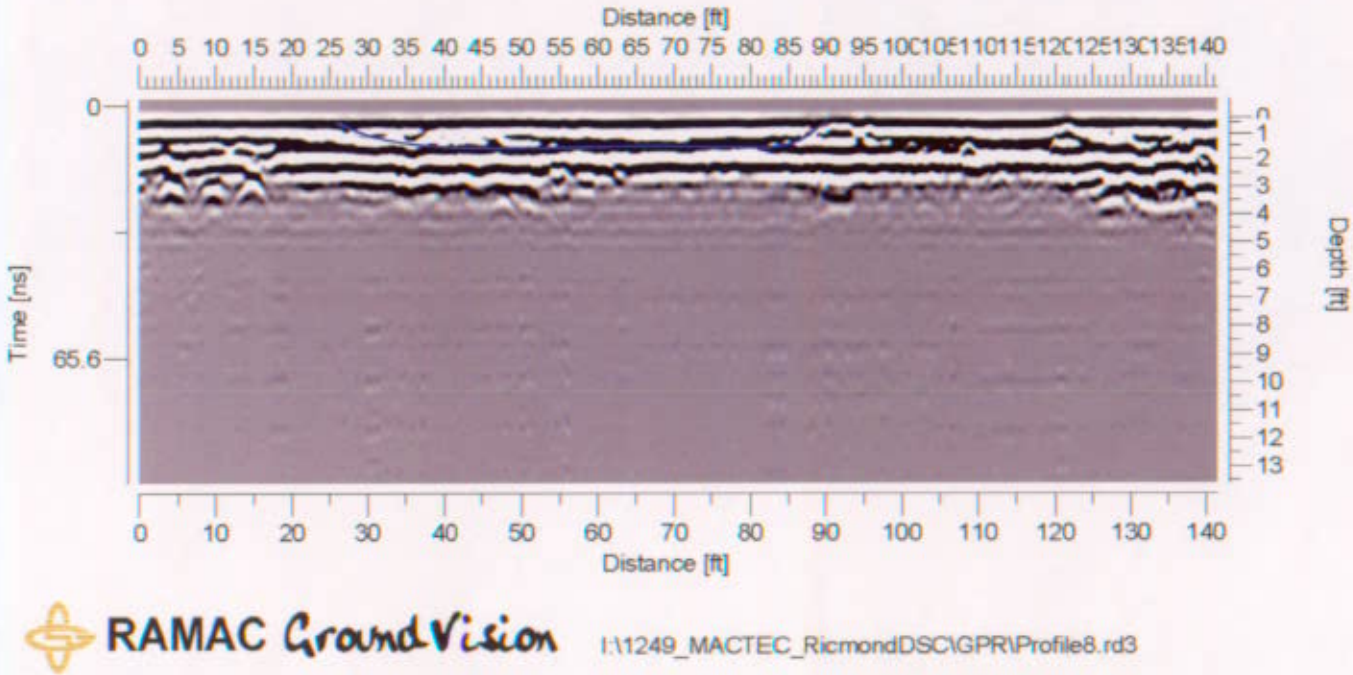
2 **Figure E4-5 Operable Unit 7 Induced Polarization Profile Line 1 Results**



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2 **Figure E4-6** **Operable Unit 7 Representative GPR Profile Over Pit 2A. Note subtle shallow reflector denoted in blue extending from 25**
3 **feet to 90 along the survey line.**

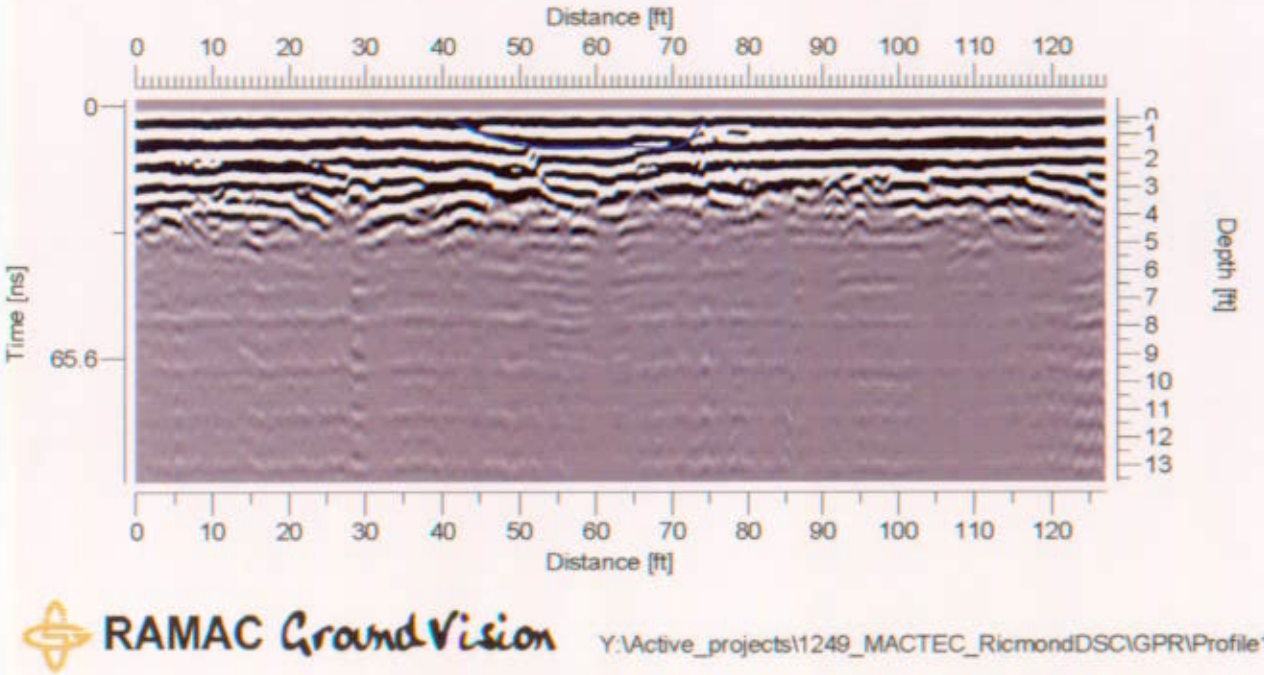
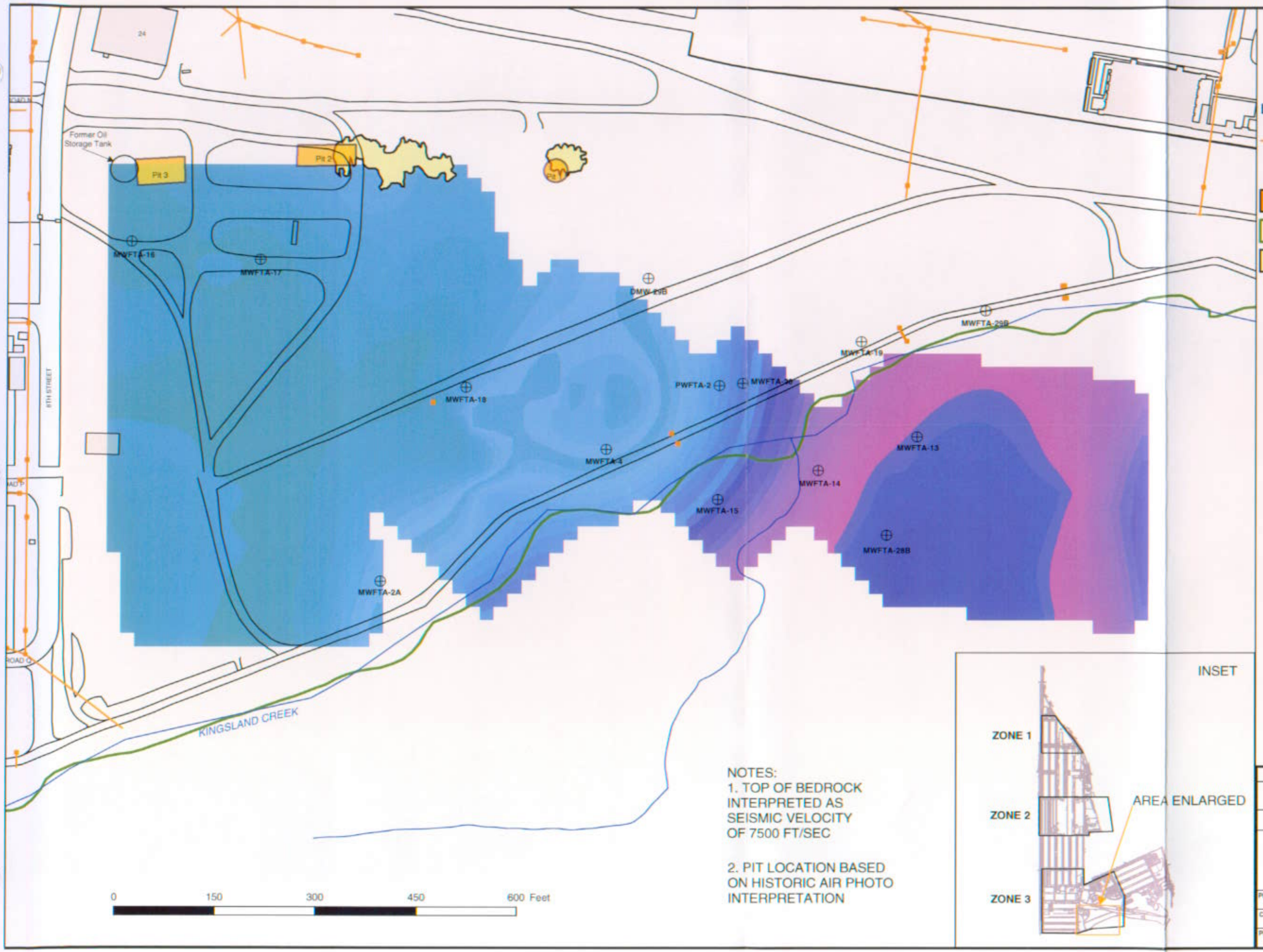


Figure E4-7 Operable Unit 7 Representative GPR Profile Over Pit 3. Note shallow reflector denoted in blue extending from 43 feet to 75 along the line to a depth of approximately 2 feet bgs.



NOTES:
1. TOP OF BEDROCK INTERPRETED AS SEISMIC VELOCITY OF 7500 FT/SEC

2. PIT LOCATION BASED ON HISTORIC AIR PHOTO INTERPRETATION

INSET

Legend

N

- STORM SEWER
- SELECT MONITORING WELL LOCATIONS
- HISTORIC PIT LOCATION
- DSCR BOUNDARY
- GEOPHYSICAL ANOMALY

64 62 60 58 56 54 52 50 48 46 44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10 -12 -14 -16 -18 -20 -22 -24

BEDROCK ELEVATION (FEET, MSL)

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SUPPLEMENTAL FS INVESTIGATION REPORT

BEDROCK ELEVATION INTERPRETED FROM SEISMIC REFRACTION DATA
OU 7 AREA OF ZONE 3

PREPARED BY: THP CHECKED BY: FKM PROJECT NO: 6301-03-0011	MACTEC	FIGURE NUMBER: E4-8

ATTACHMENT A

GEOPHEX LIMITED'S GEOPHYSICAL REPORT

Geophysical Investigation at the Defense Supply Center Richmond Richmond, VA

Geophex Job No. 1249

Submitted to:

MACTEC Engineering and Consulting Inc.
3200 Town Point Drive NW, Suite 100
Kennesaw, GA 30144

Headquarters

Geophex, Ltd.
605 Mercury Street
Raleigh, NC 27603-2343

Tel: (919) 839-8515
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Website: www.geophex.com
Email: geophex@geophex.com

November 2003

Table of Contents

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List of Acronyms

2D Res	Two dimensional DC resistivity
AGI	Advanced Geosciences, Inc.
Conus	Continental United States
CORS	Continuously Operating Reference Station
csv	Comma Separated Variable
DC	Direct Current
DSCR	Defense Supply Center Richmond
EM	Electromagnetic
ft	Feet
GPR	Ground Probing (Penetrating) Radar
GPS	Global Positioning System
IP	Induced electric polarization
MHz	Megahertz
ms	Millisecond
NAPL	Nonaqueous phase liquid
ns	Nanosecond
ppm	Parts per million
SAH	Spring Actuated Hammer seismic source

List of Definitions[1]

chargeability (*M*): One of several units of induced polarization in the time domain. **1.** The ratio of initial decay voltage (or secondary voltage) to primary voltage. **2.** The dimensionless induced-polarization parameter of a material in which there is an induced-current dipole moment per unit volume *P* energized by a current density. **3.** The fractional change in resistance measured on a decay curve, as a function of time.

conductivity: The ability of a material to conduct electrical current. In isotropic material, the reciprocal of resistivity. Sometimes called **specific conductance**. Units are siemens per meter.

dipole-dipole array: Inline electrode array used in induced polarization, electrical, and electromagnetic surveying, where both current and potential-measuring electrodes are closely spaced.

electromagnetic method (EM method): _i lek, tro¯ mag net' ik_ A method in which the magnetic and/or electric fields associated with artificially generated subsurface currents are measured. In general, electromagnetic methods are considered to be those in which the electric and magnetic fields in the earth satisfy the diffusion equation (which ignores displacement currents) but not Laplace's equation (which ignores induction effects) nor the wave equation (which includes displacement currents). One normally excludes methods such as *GPR* that use microwave or higher frequencies (and which consequently have little effective penetration) and methods that use dc or very low frequencies where induction effects are not important (resistivity and IP methods). **Natural field methods** (such as Afmag and magnetotellurics) employ natural energy as the source; **controlled source electromagnetis methods** (CSEM) (such as loop-loop techniques) require a man-made source.

first break: The first recorded signal attributable to seismic-wave travel from a known source. First breaks on reflection records are used for information about the weathering. An initial compression usually shows as a downkick (SEG polarity standard). First-break times are used in static corrections and in headwave interpretation.
first-break intercept

geophone: The instrument used to transform seismic energy into an electrical voltage; a **seismometer, seis, detector, receiver, jug, bug**, or **pickup**. Geophones ordinarily respond to only one component of the ground's displacement, velocity, or acceleration that is involved in the passage of a seismic wave. Three mutually orthogonal phones are used to record all three components. Most land geophones are of the moving-coil type. A coil is suspended by springs in a magnetic field (the magnet may be integral with the case of the instrument). A seismic wave moves the case and the magnet, but the coil remains relatively stationary because of its inertia. The relative movement of a magnetic field with respect to the coil generates a voltage across the coil, the voltage being proportional to the relative velocity of the coil with respect to the magnet (when above the natural frequency of the geophone). Below the natural frequency, the output (for input of constant velocity of magnet motion) is proportional to frequency and hence to the acceleration involved in the seismic wave passage.

[1] Sheriff, Robert E. *Encyclopedic Dictionary of Applied Geophysics.* Tulsa, Oklahoma : Society of Exploration Geophysicists, 2002.

geophone array: The use of areal, linear, or (occasionally) vertical patterns with more than one geophone per channel. Used to discriminate against events with certain apparent wavelengths.

geophone cable: Insulated cable to which geophone groups are connected.

geophone interval: **1.** The distance between adjacent geophones within a group. **2.** Sometimes used for **group interval**, the separation between the centers of adjacent geophone groups.

head wave: A wave characterized by entering and leaving a high-velocity medium at the critical angle. Also called a **refraction, Meisner, Mintrop, von Schmidt, conical wave.**

induced polarization (IP): **1.** An exploration method involving measurement of the slow decay of voltage in the ground following the cessation of an excitation current pulse **(time-domain method)** or low-frequency (below 100 Hz) variations of earth impedance **(frequency-domain** or **overvoltage method).** Most of the stored energy involved with IP is chemical, involving variations in the mobility of ions (*membrane polarization* or the **normal IP effect)** and variations because of the change from ionic to electronic conduction where metallic minerals are present **(electrode polarization, induced potential**, or **interfacial polarization**); the latter is usually the larger effect. Various electrode configurations are used, especially the dipole-dipole array. **2.** The production of a double layer of charge at mineral interfaces or of changes in such double layers as a result of applied electric or magnetic fields.

in-phase: **1.** The condition in which two waves of the same frequency have the same phase. **2.** Electrical signal with the same phase angle as that of the exciting signal or comparison signal.

magnetic susceptibility: A measure of the degree to which a substance may be magnetized; the ratio k or k' of the magnetization **M** or **I** to the magnetizing force **H** that is responsible for it: $k\mathbf{H}=\mathbf{M}$ in the SI system, $k'\mathbf{H}=\mathbf{I}$ in the cgs system. The susceptibility is dimensionless but of different magnitude in the two systems: $k=4\pi k'$. The susceptibility is related to the magnetic permeability μ: $k=\mu-1$, $k'=(\mu-1)/4\pi$.
Susceptibility in cgs units is sometimes measured in units of 10^{-6} (''micro-cgs''). Rock susceptibility usually ranges from 0 to 0.01 cgs units (0 to 10,000 micro-cgs) and it is often proportional to the fraction of magnetite present.

ohm-meter: A unit of resistivity, also written ohm-meter2/meter; the resistance of a meter cube to the flow of current between opposite faces. Reciprocal of mho/m

P-wave: An elastic body wave in which particle motion is in the direction of propagation. The type of seismic wave assumed in conventional seismic exploration. Also called **primary wave** (undae primae), **compressional wave, longitudinal wave, push-pull wave, pressure wave, dilatational wave, rarefaction wave,** and **irrotational wave.** In an isotropic homogeneous solid, the P-wave velocity *VP* can be expressed in terms of the elastic constants and the density.

quadrature: 90° out of phase. The **quadrature component** of a signal is the out-of-phase component; the part of an induced signal which is out-of-phase with the generating signal.

refraction survey: 1. A program to map geologic structure by using head waves. Head waves involve energy that enters a high-velocity medium (refractor) near the critical angle and travels in the high-velocity medium nearly parallel to the refractor surface. The objective is to determine the arrival times of the head waves to map the depth to the refractors in which they travel.

refractor: A layer of higher velocity than overlying layers through which a *head wave* _q.v._ can travel. To be useful for mapping, refractors must be (a) sufficiently thick (greater than 1/10 of a wavelength) for a head wave to carry energy over an applicable distance, (b) sufficiently extensive that the same refractor is mappable over an appreciable area, (c) sufficiently distinctive in velocity that the head wave can be distinguished from the waves carried in other layers, and (d) not be ''hidden'' by a shallower refractor of higher velocity.

source point (SP): 1. The location where seismic energy is released, such as by an explosive shot, an air gun release, a weight drop, a vibroseis excitation, etc. Where patterns of sources are used, usually refers to the center of the pattern. 2. The area surrounding the source point.

takeout: A connection point to a multiconductor cable where geophones or geophone flyers can be connected. Takeouts are usually polarized to reduce the likelihood of making the connection backwards.

Executive Summary

From August 18 to August 26, 2003, Geophex Ltd. performed geophysical surveys at the Defense Supply Center in Richmond, Virginia. Geophex was contracted to execute Option A of Mactec's RFP 551076, to collect Seismic Refraction and Ground Probing Radar (GPR) data. The purpose of these surveys was to delineate the lateral extent of a suspected landfill in Area 50 and to determine the location of suspected fire training pits in OU7 using GPR, and to map the top of bedrock at both places using seismic refraction.

Option B of the same RFP added Electromagnetic Induction (EM) and Resistivity/Induced Polarization data collection methods to the scope of work. Based on previous work near Richmond, Virginia, Geophex mobilized to the site with equipment to perform Option B data collection if necessary.

On-site processing and analysis of preliminary GPR data revealed that it would provide minimal results toward the project goals. After consultation with Mactec personnel, preliminary EM data were collected. The EM data were clearly superior at laterally defining suspected fire training pits and landfill areas. Based on the EM results, a determination was made in the field to change the scope of geophysical data collection. EM data were collected over suspected target areas in Area 50, the National Guard Area, and OU7. Targeted resistivity and induced polarization profiles were collected to define the vertical extent of, and the possible presence of NAPL within, anomalies defined by the EM data. Seismic refraction data were collected as proposed.

At Mactec's request, Geophex has not provided interpretive results. Included in this deliverable is a letter report and data package containing both electronic and hard copies of the geophysical data collected at the site.

1.0 Introduction

From August 18 through August 26, Geophex personnel performed Electromagnetic Induction (EM), Seismic Refraction, Two-Dimensional DC Resistivity (Resistivity or 2D Res), Induced Polarization (IP), and Ground Probing Radar (GPR) surveys at the Defense Supply Center Richmond (DSCR), Virginia (Figure 1). The purpose of these surveys was to determine depth to bedrock and to delineate subsurface anomalies to aid environmental investigations at the site. Over 12 acres of EM data, 6200 feet of seismic refraction data along 12 survey lines, 2100 feet of resistivity data along four survey lines, 1200 feet of IP data along three survey lines, and 7000 feet of GPR data along 36 profiles were collected.

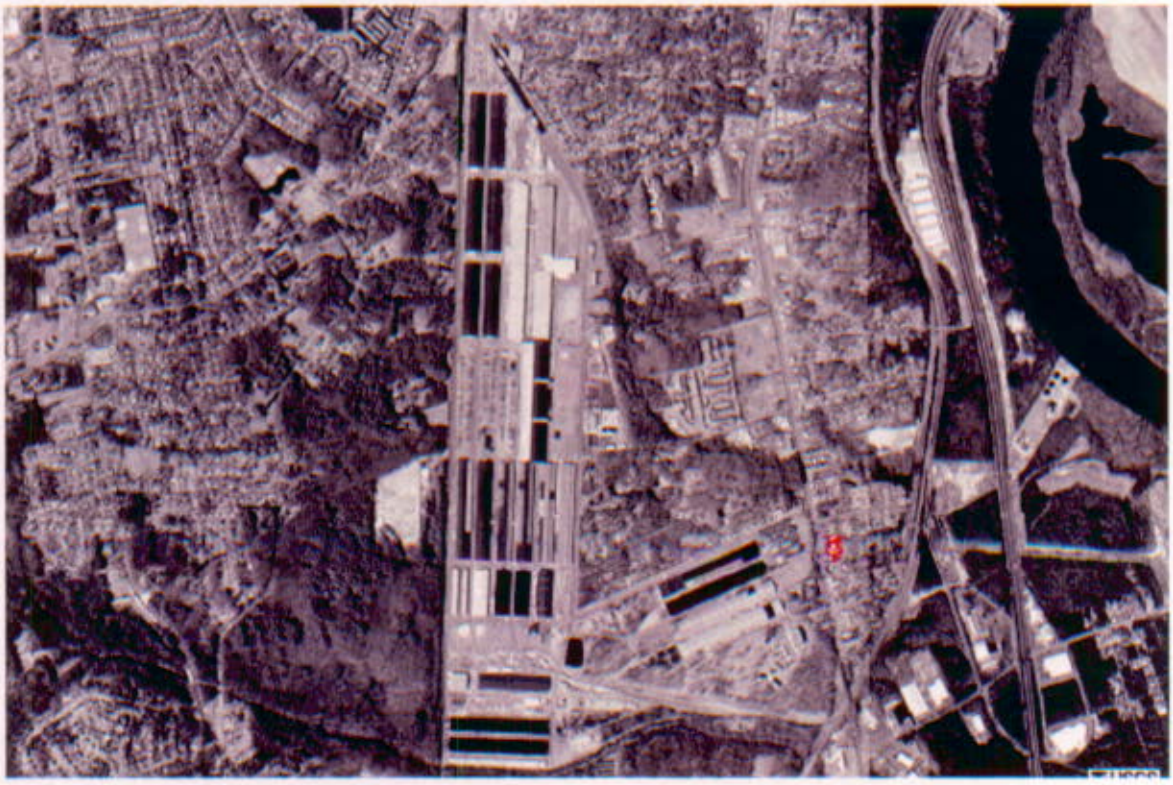


Figure 1. Aerial photograph of the Defense Supply Center Richmond, VA

Tables 1 through 3 provide a summary of the geophysical survey line designations and locations, and Figures 2 and 3 map the survey locations for each method. GPR profiles are designated as P1 through P43 in Figures 2 and 3. Note: Profiles 14, 21-25, and 37 were voided in the field.

Table 1. Geophysical survey line summary table for the National Guard Area

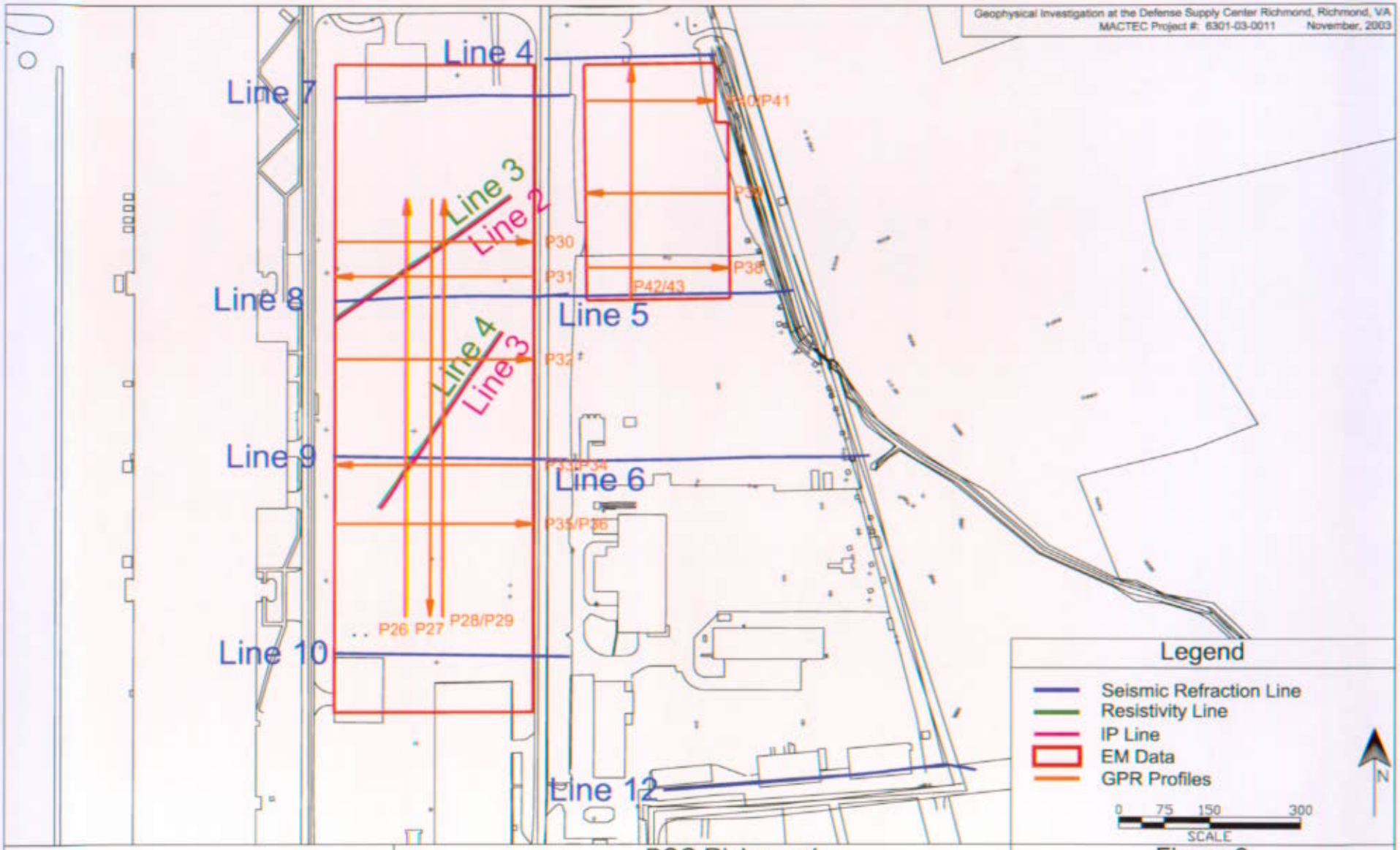
Seismic Refraction	GPR
Line 4 NG Area	Profile P38
Line 5 NG Area	Profile P39
Line 6 NG Area	Profile P40 & P41
Line 12 NG Area	Profile P42 & 43

Table 2. Geophysical survey line summary table for Area 50

Seismic Refraction	GPR	Resistivity	IP
Line 7	Profile P26	Line 3	Line 2
Line 8	Profile P27	Line 4	Line 3
Line 9	Profile P28 & P29		
Line 10	Profile P30		
	Profile P31		
	Profile P32		
	Profile P33 & P34		
	Profile P35 & 36		

Table 3. Geophysical survey line summary table for Area OU7

Seismic Refraction	GPR	Resistivity	IP
Line 1	Profile P1	Line 1	Line 1
Line 2	Profile P2	Line 2	
Line 3	Profile P3		
Line 11	Profile P4		
	Profile P5		
	Profile P6		
	Profile P7		
	Profile P8		
	Profile P9		
	Profile P10		
	Profile P11		
	Profile P12		
	Profile P13		
	Profile P16		
	Profile P17		
	Profile P18		
	Profile P19		
	Profile P20		



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DSC Richmond
Area 50/National Guard Area

Page 3

Figure 2

Job #: 1249	Date: 10/2003
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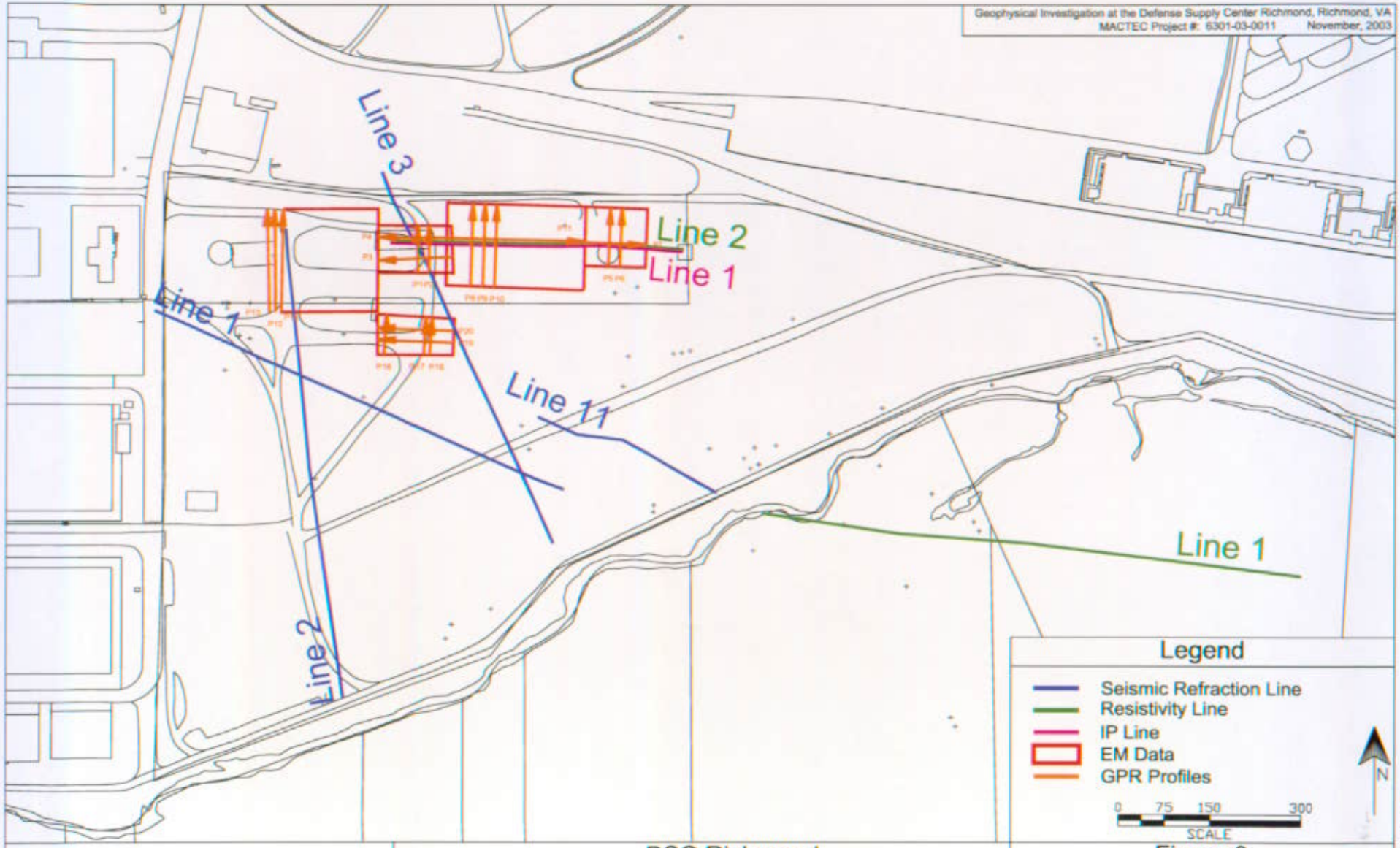
Geophysical Investigation at the Defense Supply Center Richmond, Richmond, VA
MACTEC Project #: 6301-03-0011 November, 2003
Line 3
Line 2
Line 1
Line 1
Line 11
Line 2
Line 1
Legend
Seismic Refraction Line
Resistivity Line
IP Line
EM Data
GPR Profiles
N
0 75 150 300
SCALE
Geophex
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DSC Richmond
Area OU7
Page 4
Figure 3
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
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2.0 Methods

2.1 Electromagnetic Induction

The EM method involves exciting the ground material with a primary, time-varying, electromagnetic field of one or more frequencies, and recording perturbations of the normal field that result from secondary eddy currents induced in conducting bodies at or beneath the surface. The primary field is typically established, in practice, by passing an alternating current through a small coil (the transmitter coil). The intensity of the induced eddy currents in the subsurface is a function of the ground conductivity and is measured by the receiver coil.

The electromagnetic induction method can be used to target different depths of interest. The effective depth of exploration can be varied by changing either: 1) the spacing between transmitter and receiver coils, or 2) the frequency of the transmitted field. The first method is known as *geometrical sounding* and involves recording data using several transmitter-receiver coil intervals at a fixed location; the depth of exploration increases with the coil spacing. The second method is known as *frequency sounding* and involves changing the transmitter frequency, but keeping the transmitter-receiver coil constant (Figure 4). The depth of exploration is inversely proportional to the square root of the frequency: a low frequency signal travels far through a conductive earth and, thus, sees deep structures, while a high frequency signal can travel only a short distance and, thus, sees only shallow structures.

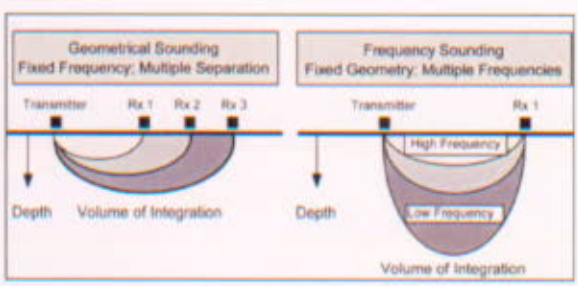


Figure 4. Electromagnetic methods for depth sounding

EM data were collected using a GEM-2 (manufactured by Geophex) handheld, broadband electromagnetic sensor (Figures 5 and 6). The GEM-2 has one transmitter coil and one receiver coil spaced 5.5 feet apart; it also contains a third "bucking coil" that removes the primary field from the receiver coil (Figure 5). The GEM-2 is a *frequency sounding* instrument, capable of recording up to 10 different frequencies simultaneously (both in-phase and quadrature data for each frequency).

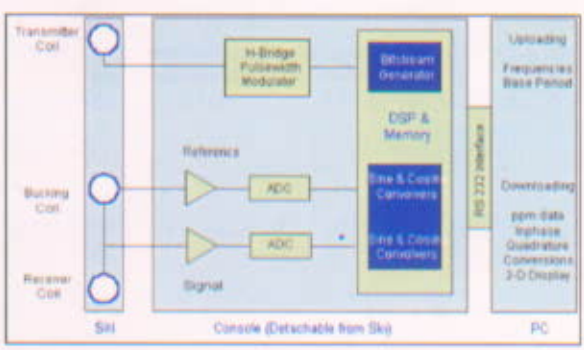


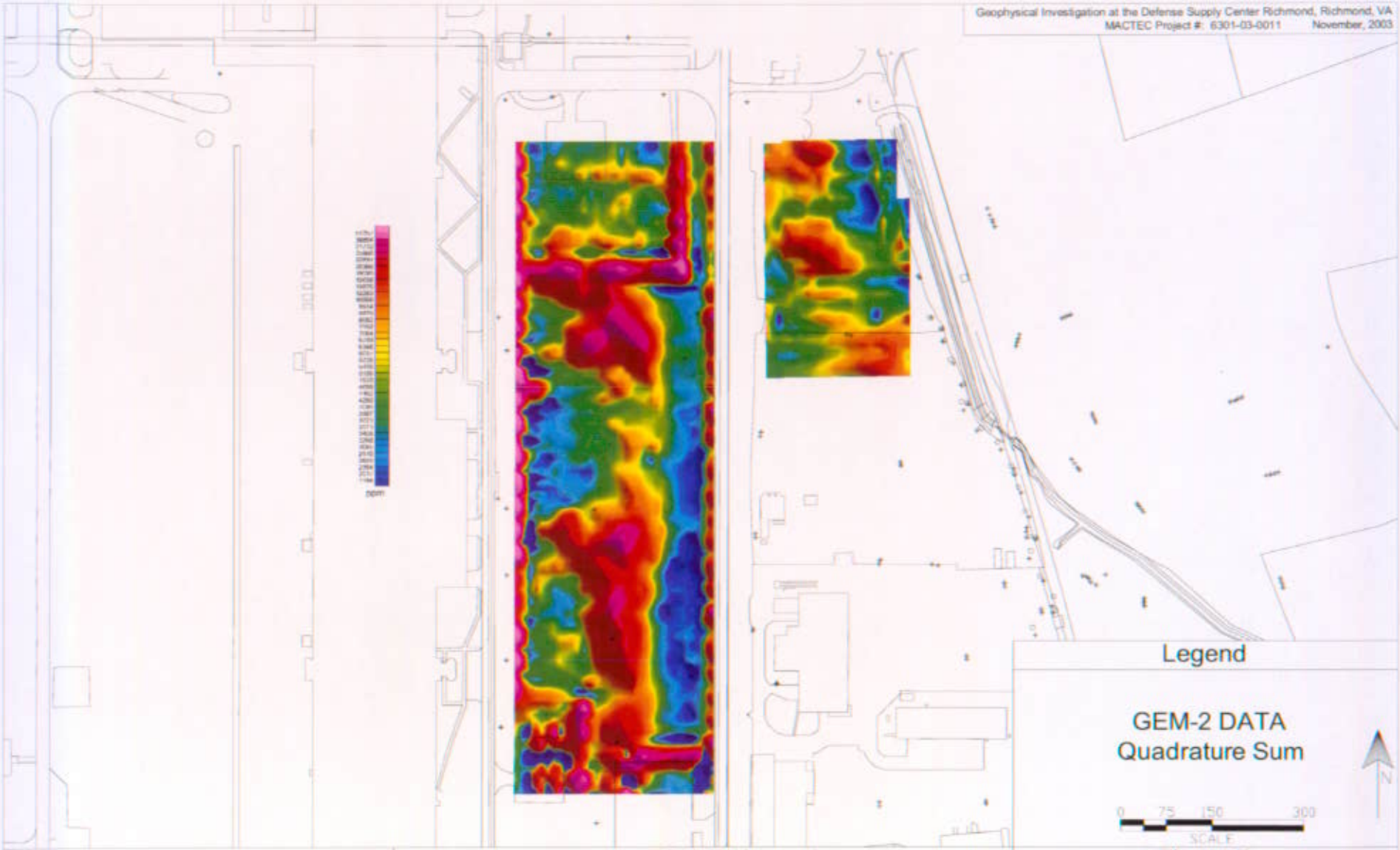
Figure 5. GEM-2 electronic block diagram

Figure 6. GEM-2 electromagnetic sensor

Geophex recorded five frequencies (330, 1170, 3930, 13590, and 47010 Hz) during the survey at the DSCR. We selected these frequencies based on our past experience at similar sites. In the survey areas to the south (Area OU7), EM data were collected along tracklines spaced 5 feet apart. Survey grids in Area 50 and the National Guard Area were collected along tracklines spaced 20 feet apart.

The EM data were downloaded to a laptop computer in the field. The in-phase and quadrature data points for each frequency were assigned x,y coordinates using standard dead reckoning procedures, by Geophex's WinGem software (v. 2.0, Geophex, Ltd.). The WinGem software computes three additional values: quadrature sum (Qsum), total conductivity, and magnetic susceptibility. The located data were then exported to an EXCEL csv file for gridding and contouring using Oasis Montaj© software (V. 5.1, Geosoft Inc.).

The quadrature sum (Qsum) EM data was selected as best at mapping subsurface features and is shown with the site map overlaid in Figures 7 and 8. In-phase and quadrature components for all five frequencies, as well as magnetic susceptibility and total conductivity plots are displayed in Appendix A. In-phase and quadrature data reported in units of ppm (the response of the induced, or secondary, field in part per million)



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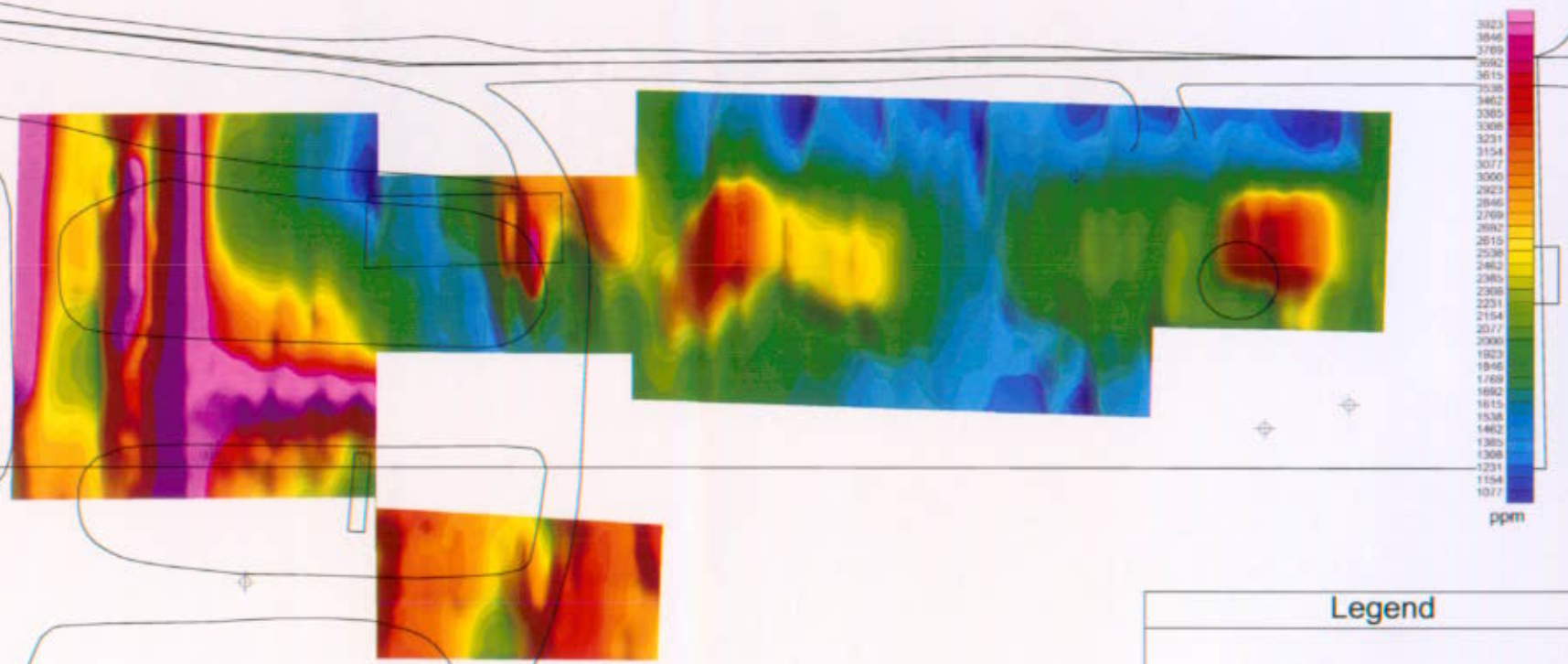
DSC Richmond
Area 50/National Guard Area

Figure 7

Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

Geophysical Investigation at the Defense Supply Center Richmond, Richmond, VA
MACTEC Project #: 6301-03-0011 November, 2003



Legend

GEM-2 DATA
Quadrature Sum

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DSC Richmond
Area OU7

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Figure 8

Job #: 1249	Date: 10/2003
Scale: 1"=50ft	Drawn By: CDL

2.2 Resistivity and Induced Polarization

Two-dimensional DC resistivity (Resistivity or 2D Res) and Induced Polarization (IP) data were collected using an AGI SuperSting R8 IP Earth Resistivity/IP Meter, with a 56-electrode cable (Figure 9). Electrodes were connected to a stainless steel stake with a rubber band and planted in the ground (Figure 10). Prior to acquiring data, a contact resistance check was conducted to verify each electrode was ready to acquire data. To reduce contact resistances, electrodes were treated with salt water prior to the resistance test and data acquisition.

Figure 9. AGI SuperSting R8IP Resistivity Meter

Figure 10. SuperSting electrode attached to stake

Resistivity data were acquired using a dipole-dipole geometry with a 5-meter electrode spacing for Line 1, a 1.5-meter spacing for Line 2, and a 2-meter spacing for Lines 3 and 4. Lines 1 and 2 were located in Area OU7, and Lines 3 and 4 were located in Area 50.

Resistivity data map variations in subsurface electrical resistivity. The electrical resistivity of any portion of the earth is related to various geologic parameters such as mineralogy, fluid content, and degree of water saturation. In environmental surveys with relatively shallow water tables, resistivity values are governed primarily by soil water content. Low electrical resistivity values correspond to high *in situ* bulk porosity and permeability, rather than to lithology directly. For example, a dry (above the water table), well-sorted sand will be highly resistive while the same sand below the water table will have a high bulk porosity and may represent a permeability pathway (if conditions allow) and have a low or very low resistivity.

IP data were also collected using a dipole-dipole geometry using a 1.5-meter spacing for Line 1, and a 2-meter spacing for Lines 2 and 3. IP Line 1 was located in Area OU7 and was coincident with 2D Res Line 2. IP Lines 2 and 3 were located in Area 50 and were coincident with 2D Res Lines 3 and 4, respectively.

IP maps zones of the subsurface that can be electrically polarized (i.e. zones that have the ability to hold a charge and behave like a capacitor). Electrical conduction of most rocks and unconsolidated sediments is essentially electrolytic, by the transport of ions through interstitial water in pores. Traditionally, this method is used to detect ore bodies in mineral exploration since intergranular contacts contain "chargeable" metallic ions associated with massive sulfide deposits. In environmental geophysics, it is unlikely that most IP anomalies represent the presence of intergranular metallic ions.

Our experience has led to the working hypothesis that environmental scale IP anomalies may be associated NAPL contaminants. These IP anomalies are caused by a modified membrane polarization effect. Membrane polarization usually results in rocks/sediments that contain some clay particles as part of the overall matrix. Under an electrical current, these clay particles have a slight net negative charge that attracts the positive ions from the electrolyte present in the pores (usually water). As a result of this polarized distribution of ions the electrical current flow is impeded. Once the current flow is turned off, the positive ions redistribute themselves to return to an equilibrium position. The collection of IP data involves the introduction of an electrical current into the ground that is then switched off. A voltage decay curve is measured as the soil returns to equilibrium. Elevated pore space polarization under an applied electric field results from the presence of NAPL contamination constricting available pore space to interstitial pore water, even in the presence of small amounts of clay particles.

Data were transferred from the SuperSting to a PC off site. Each profile was edited and processed with RES2DINV© software (Geoelectric Imaging, Inc.). Data processing consists of: 1) entering the elevations, 2) editing of any outlying data points, 3) combining individual acquisition deployments for long profile lines, 4) a final inversion with RES2DINV©, 5) inversion results are transferred to ASCII "XYZ" files, and 6) these files are imported into Oasis Montaj© software (Geosoft, Inc.) for gridding and display.

Processed Resistivity/IP profiles are shown in Figures 11 to 17.

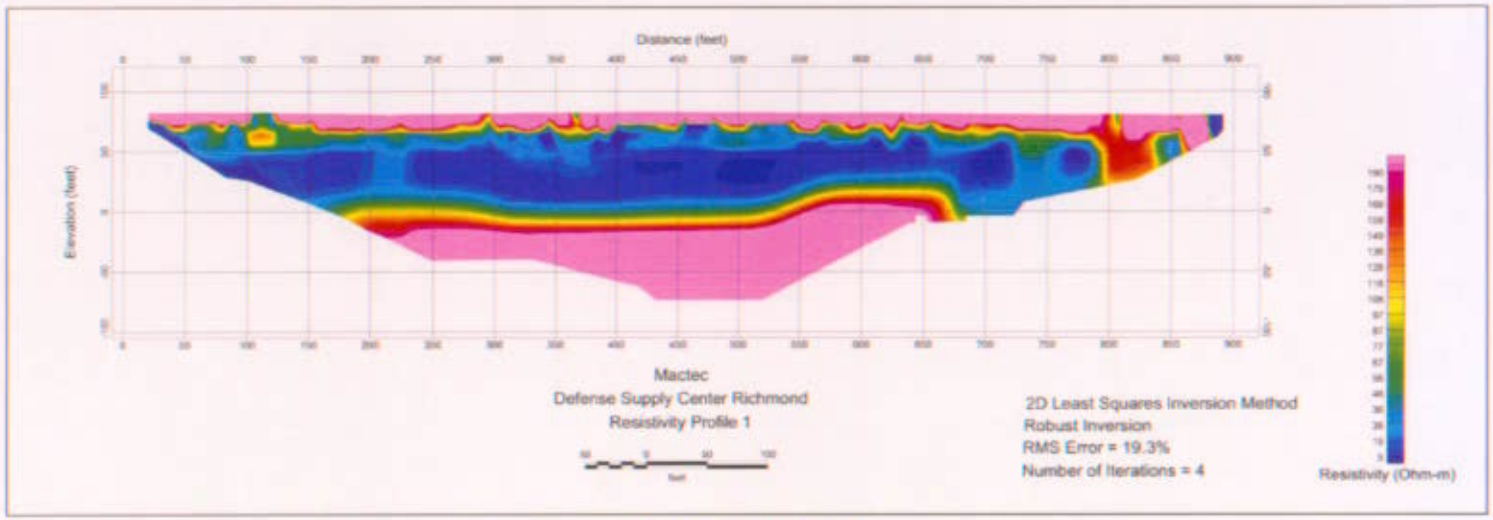


Figure 11. Resistivity Profile 1

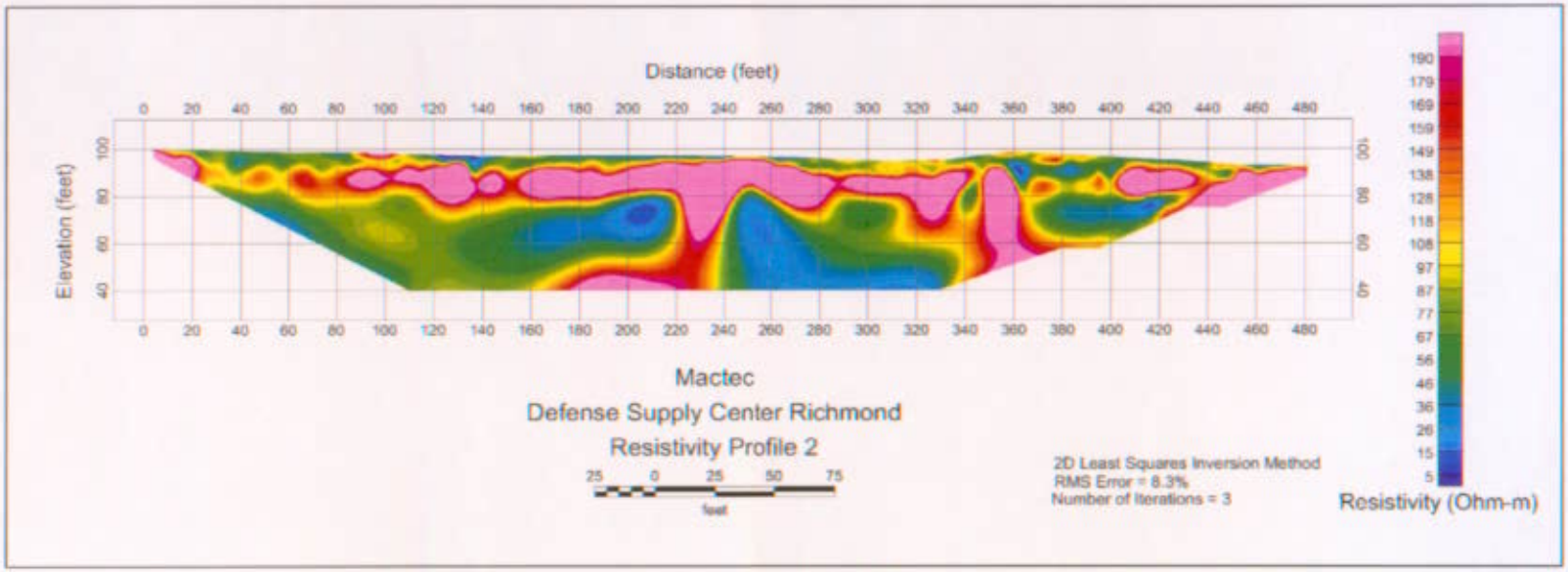


Figure 12. Resistivity Profile 2

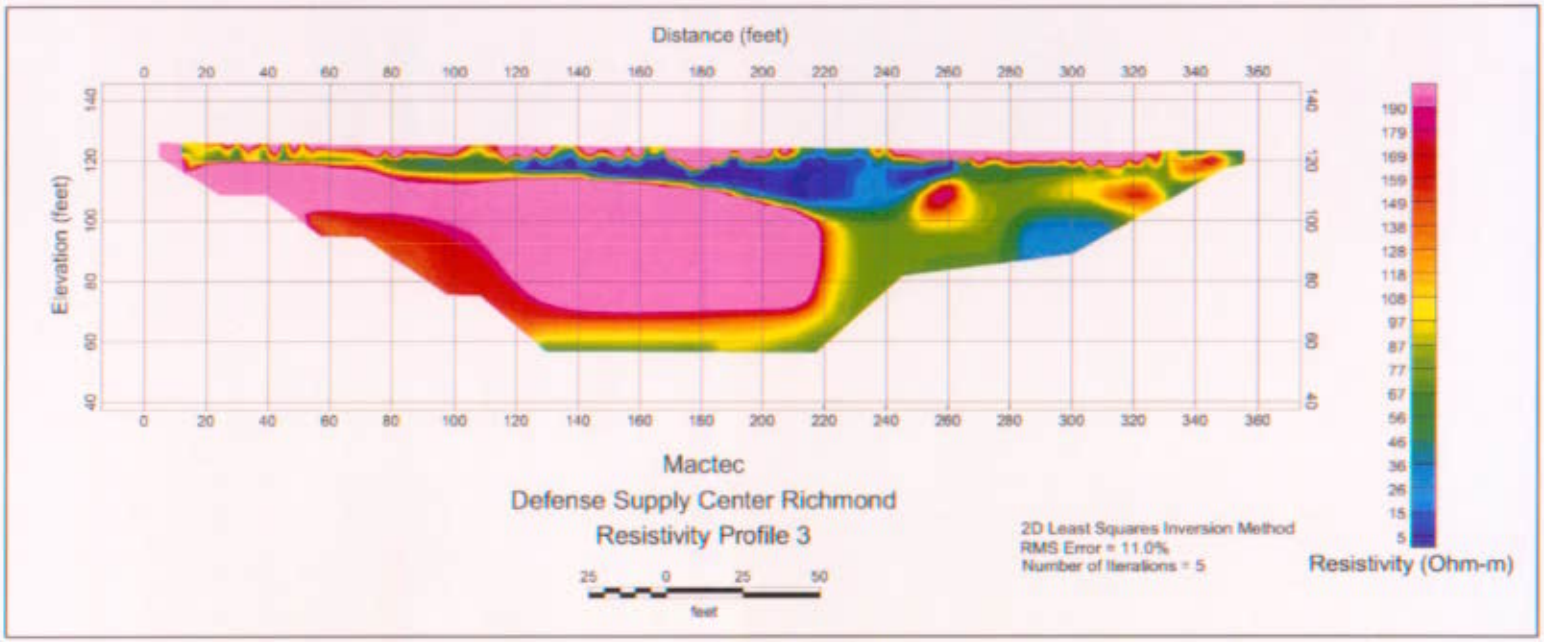


Figure 13. Resistivity Profile 3

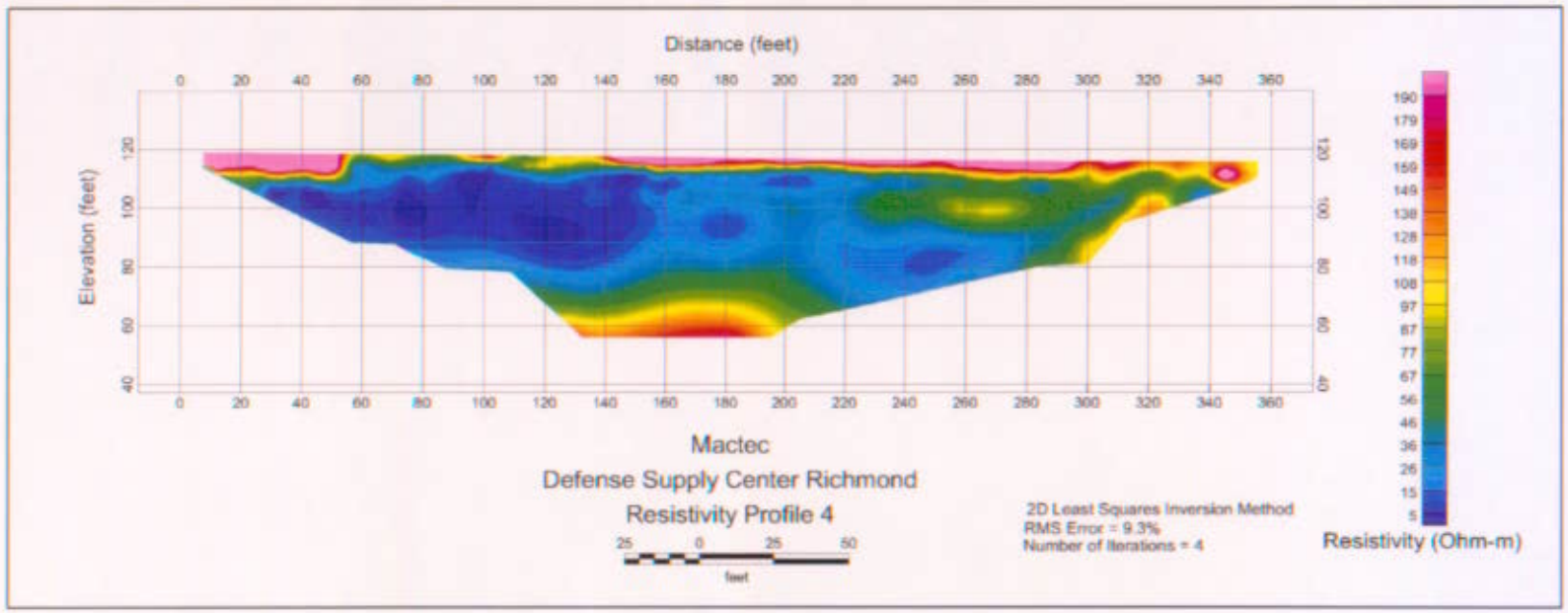


Figure 14. Resistivity Profile 4

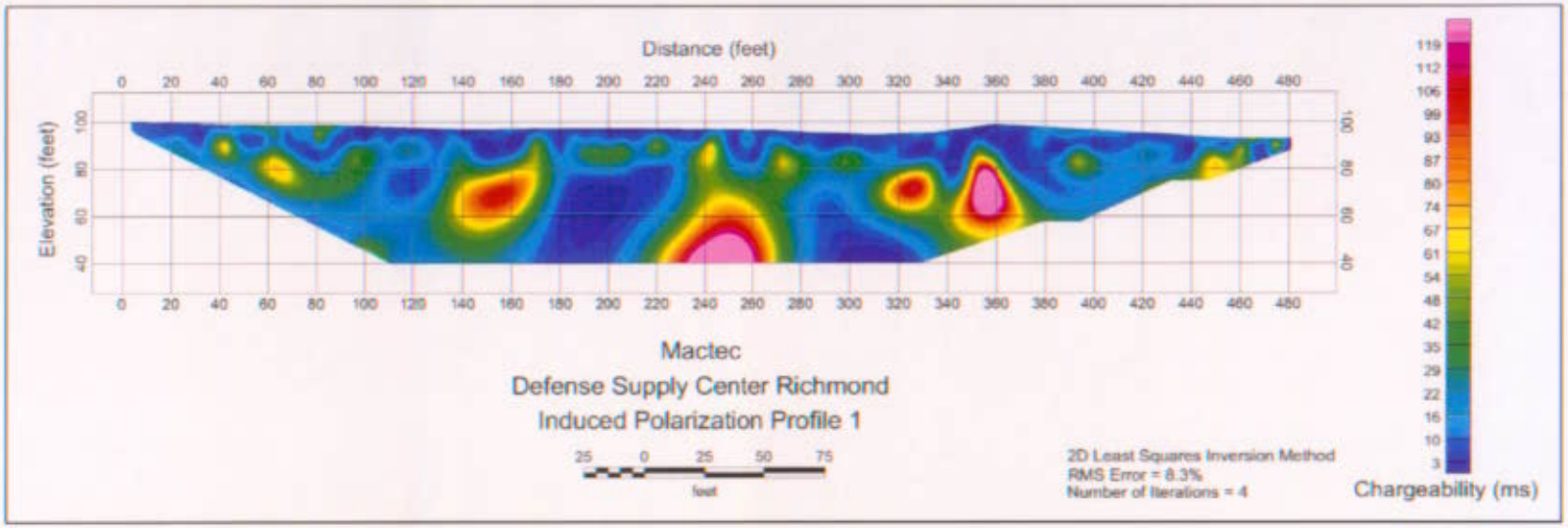


Figure 15. Induced Polarization Profile 1

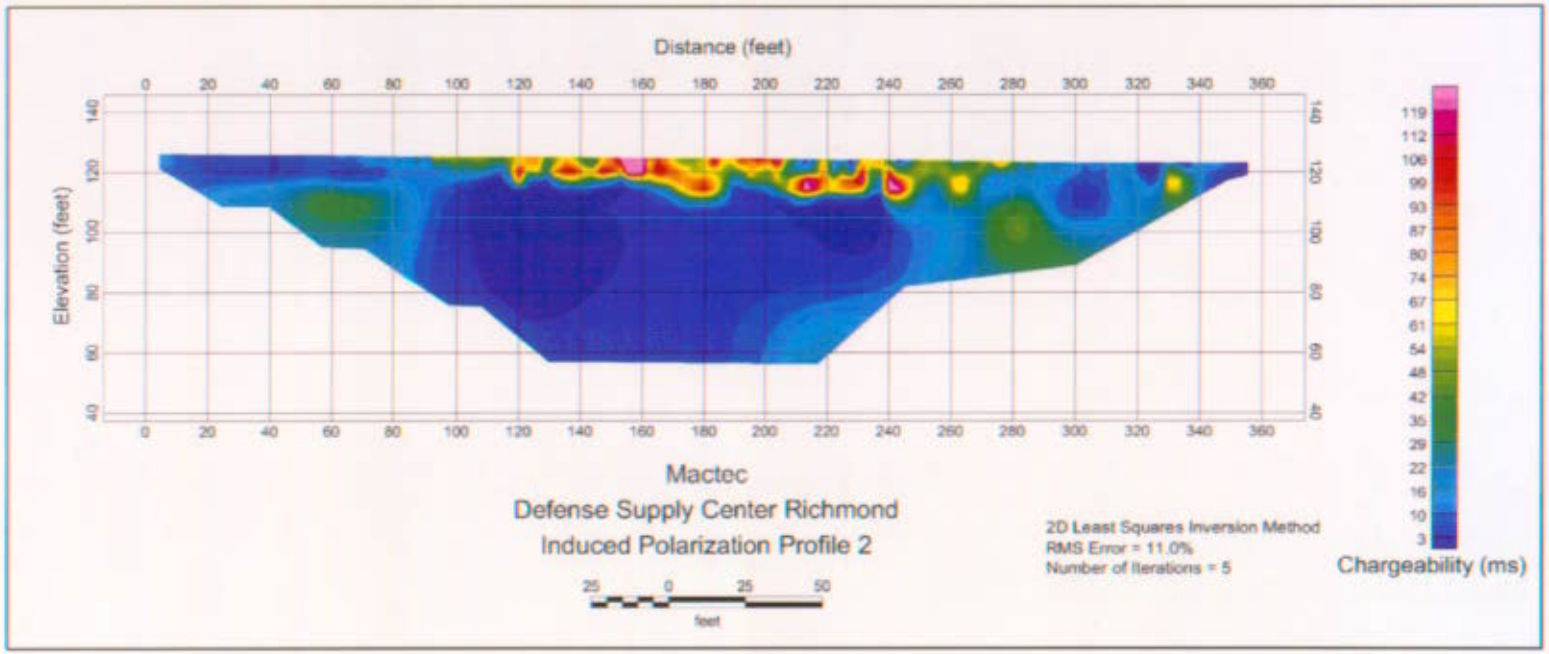


Figure 16. Induced Polarization Profile 2

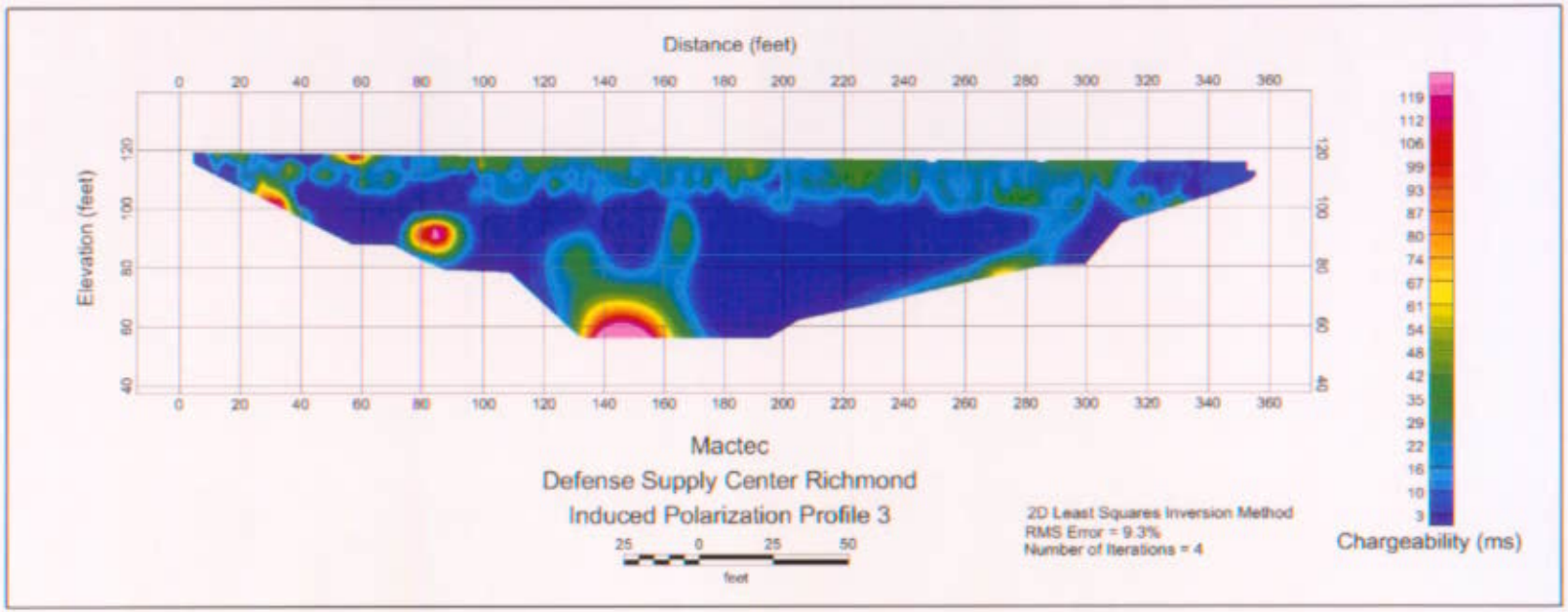


Figure 17. Induced Polarization Profile 3

2.3 Seismic Refraction

Seismic refraction data were collected using between 20 and 48 channels with a three-geophone array at each geophone cable takeout (Figure 18). GEODE 24-Channel Seismograph(s), manufactured by Geometrics Inc (Figures 19) were used as the recording instrument. The geophone interval for Lines 1, 2, and 3 was 15 feet. All other refraction lines used a geophone interval of 10 feet. Overall line lengths and geophone intervals were determined by the space available at the data collection locations. Energy was imparted into the ground at between 8 and 11 source points on each line. The energy source used was primarily a truck mounted spring actuated hammer (SAH), stacked 5 to 10 times at each source point (Figure 20). At source points that the SAH could not access, a 12 lb sledgehammer was used, stacked 10 to 20 times. Data were recorded on a laptop computer using Geometrics' Seismodule Controller software (v. 8.18) (Figure 21). First break times were picked using SeisOpt Picker software (v. 1.5, Optim Software). Source and geophone geometries were combined with the first arrival times and processed using SeisOpt@2D software (v. 3.5, Optim Software). The velocity model results were transferred to ASCII "XYZ" files, and imported into Oasis Montaj© software (Geosoft, Inc.) for gridding and display.

Figure 18. A three-geophone array was used at each takeout

Figure 19. Geode 24-channel seismograph

Figure 20. Truck mounted spring actuated hammer seismic energy source

Figure 21. PC controlled refraction data collection

Generally, seismic refraction data was of good to excellent quality. Arrival times were minimally complicated at a few shot locations due to mechanical vibrations (e.g. large air conditioning compressors and the water treatment plant). Figure 22 shows an example of a typical refraction wiggle trace recorded during this project.

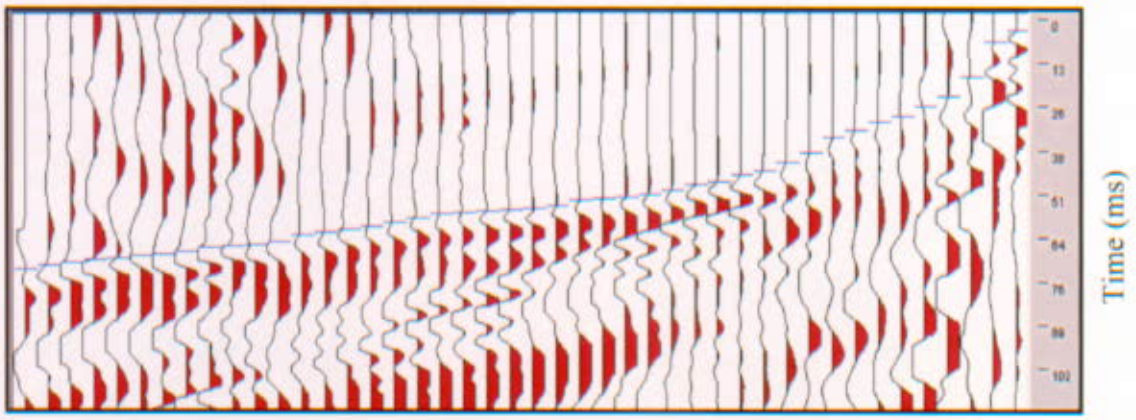


Figure 22. One of the refraction shot records along Refraction Line 1with first break picks marked in blue

The underlying bedrock at the DSCR is granite. In the absence of drill data, Geophex selected a seismic velocity of 7500 ft/s as representative of the top of granite bedrock. This value is a conservative estimate based on the ripping data reported by Caterpillar, Inc (see Figure 23). In the processed refraction profiles shown in Figures 24 to 35 this 7500 ft/s boundary is clearly marked.

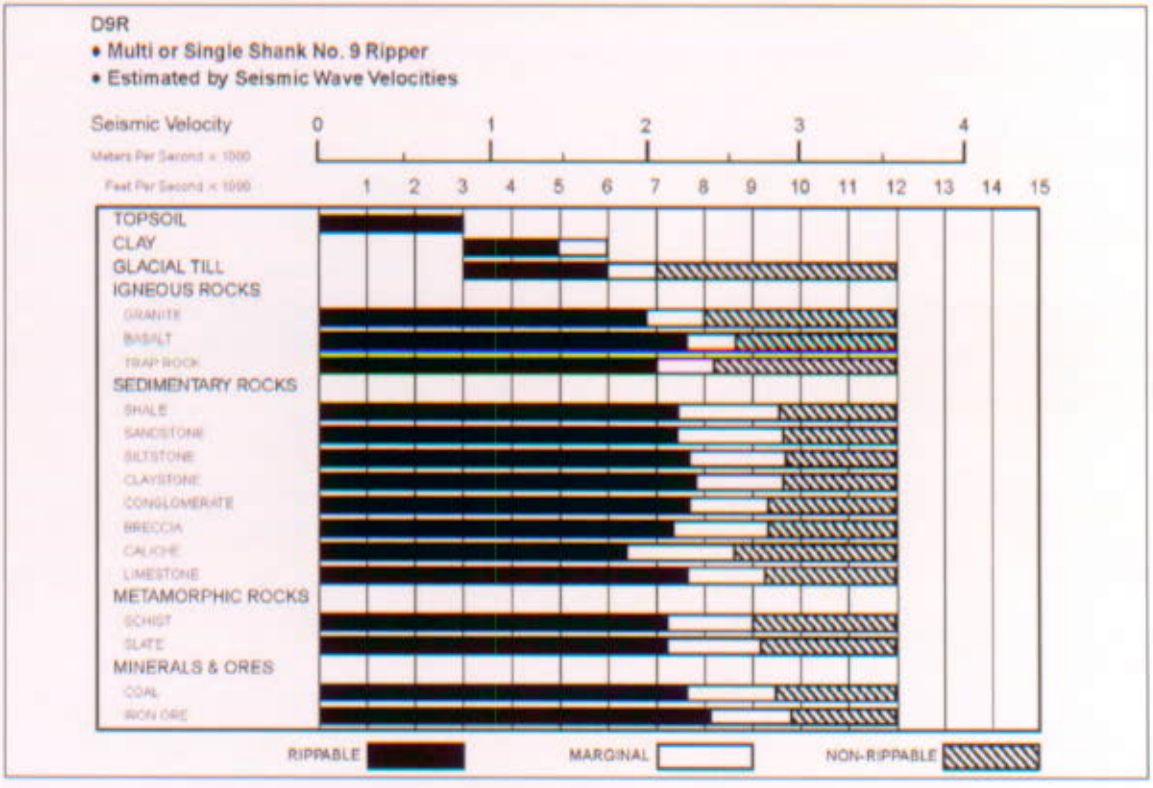


Figure 23. Ripping chart based on seismic velocity, from *Caterpillar Performance Handbook* 31st ed., Peoria, IL : Caterpillar Inc., 2000, p. 1-63.

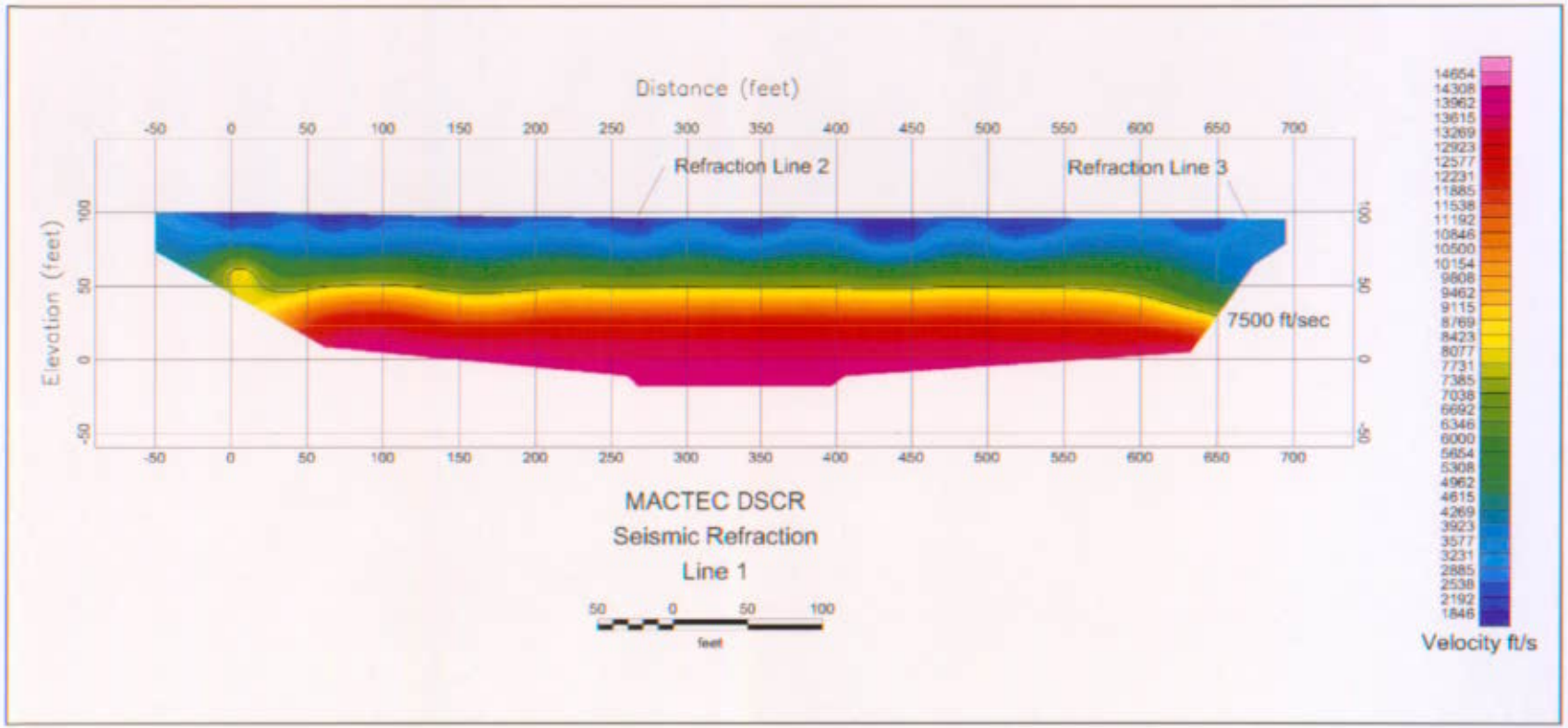


Figure 24. Seismic Refraction Profile 1

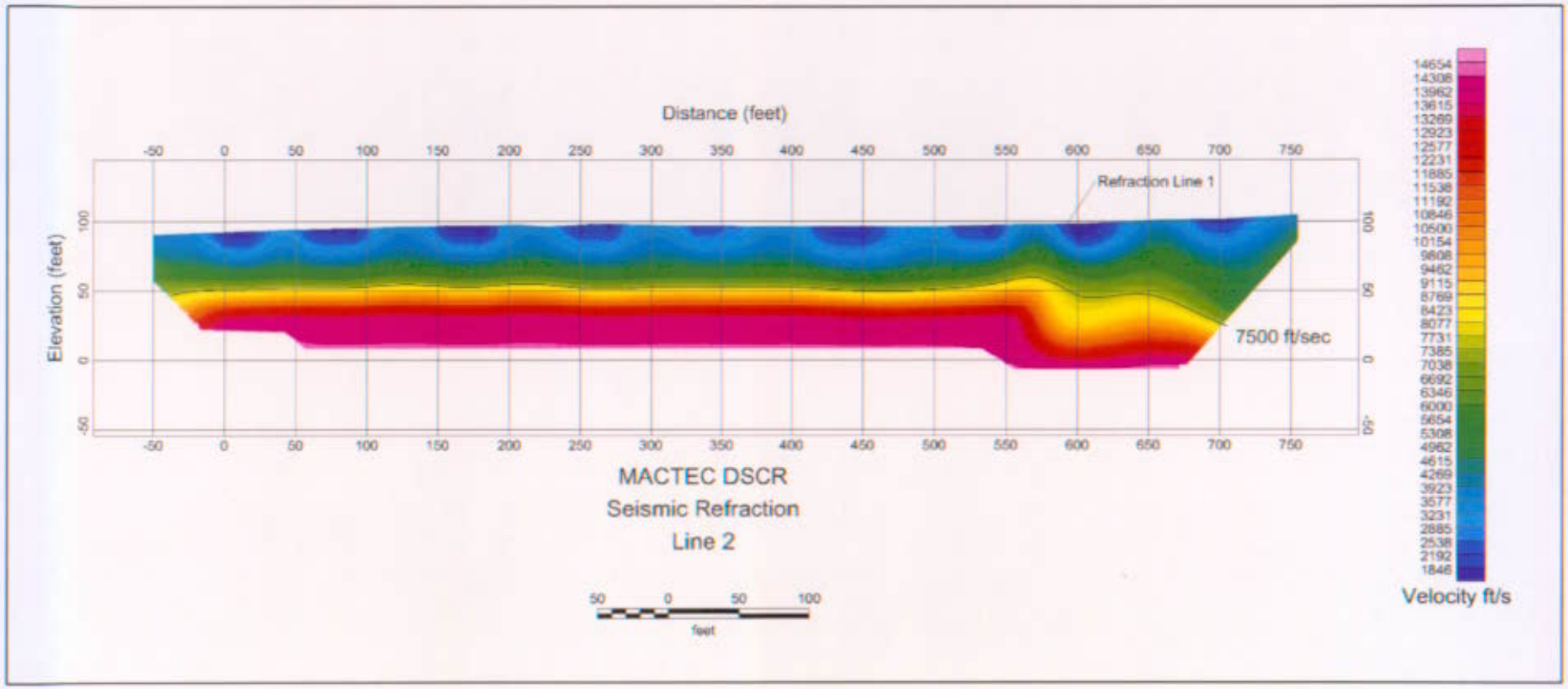


Figure 25. Seismic Refraction Profile 2

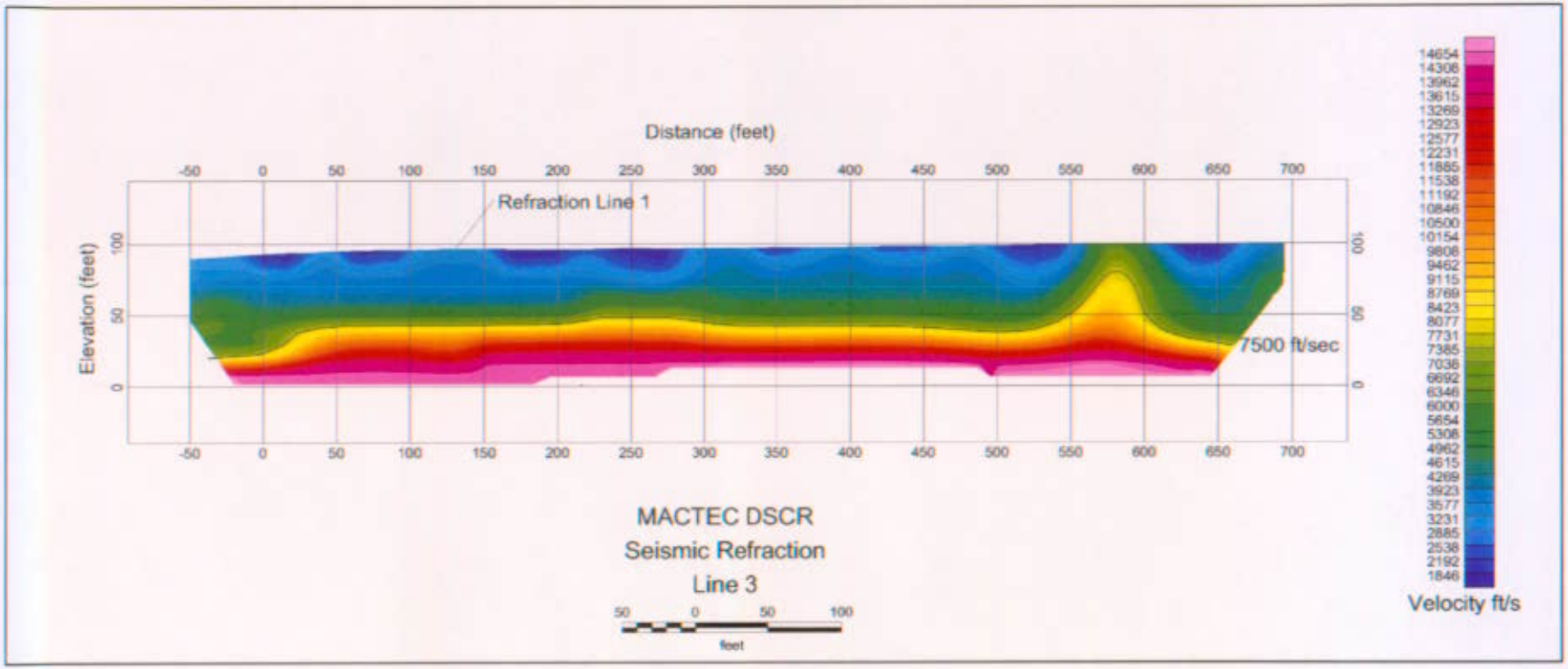


Figure 26. Seismic Refraction Profile 3

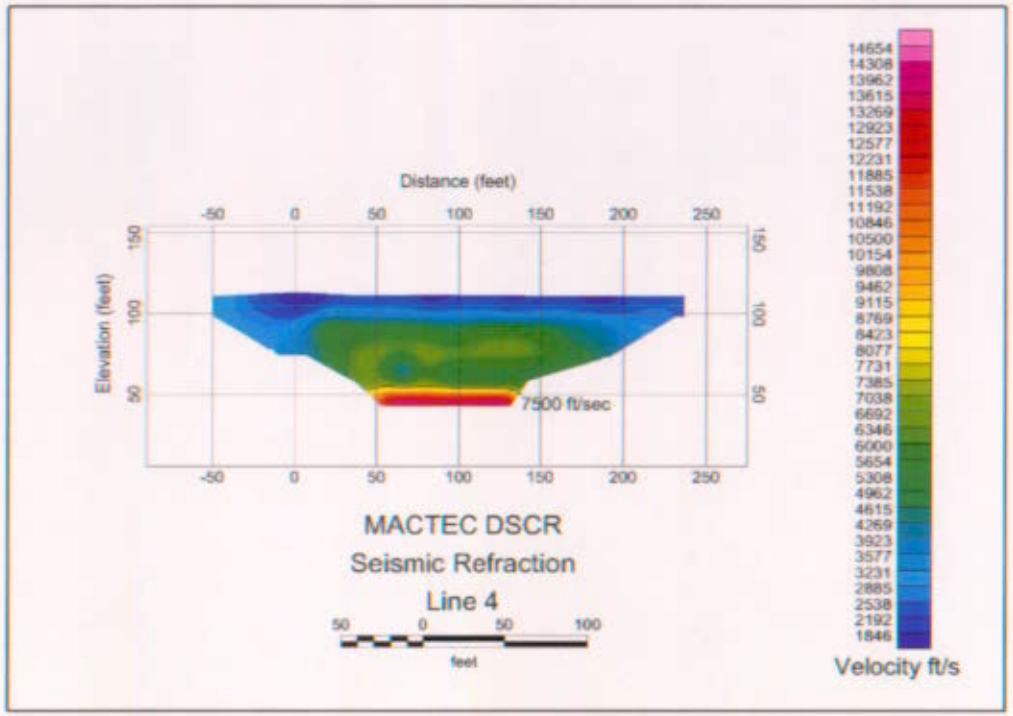


Figure 27. Seismic Refraction Profile 4

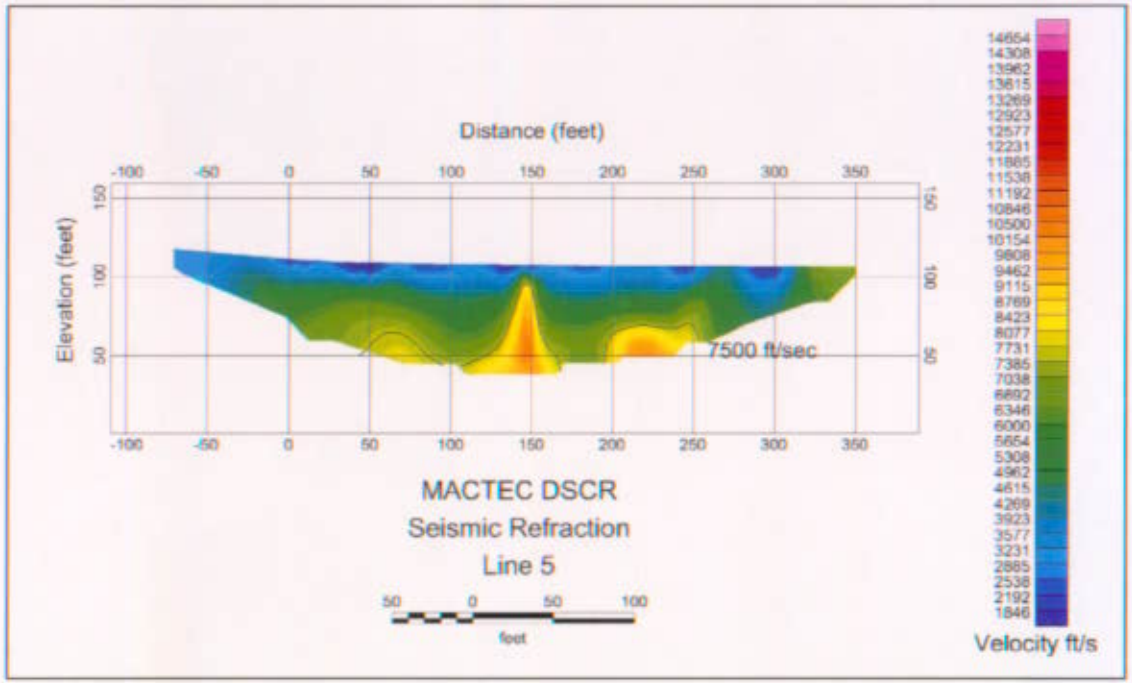


Figure 28. Seismic Refraction Profile 5

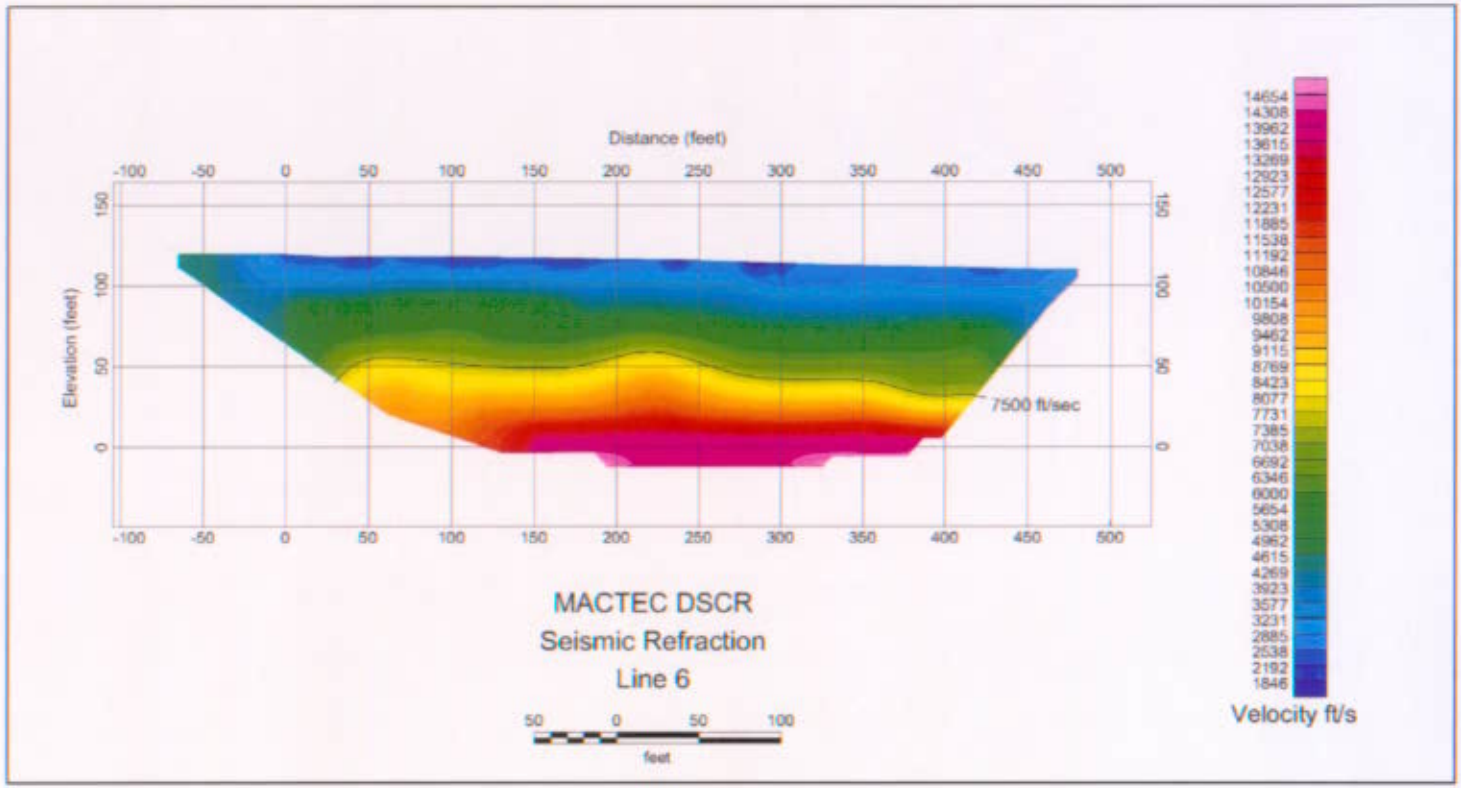


Figure 29. Seismic Refraction Profile 6

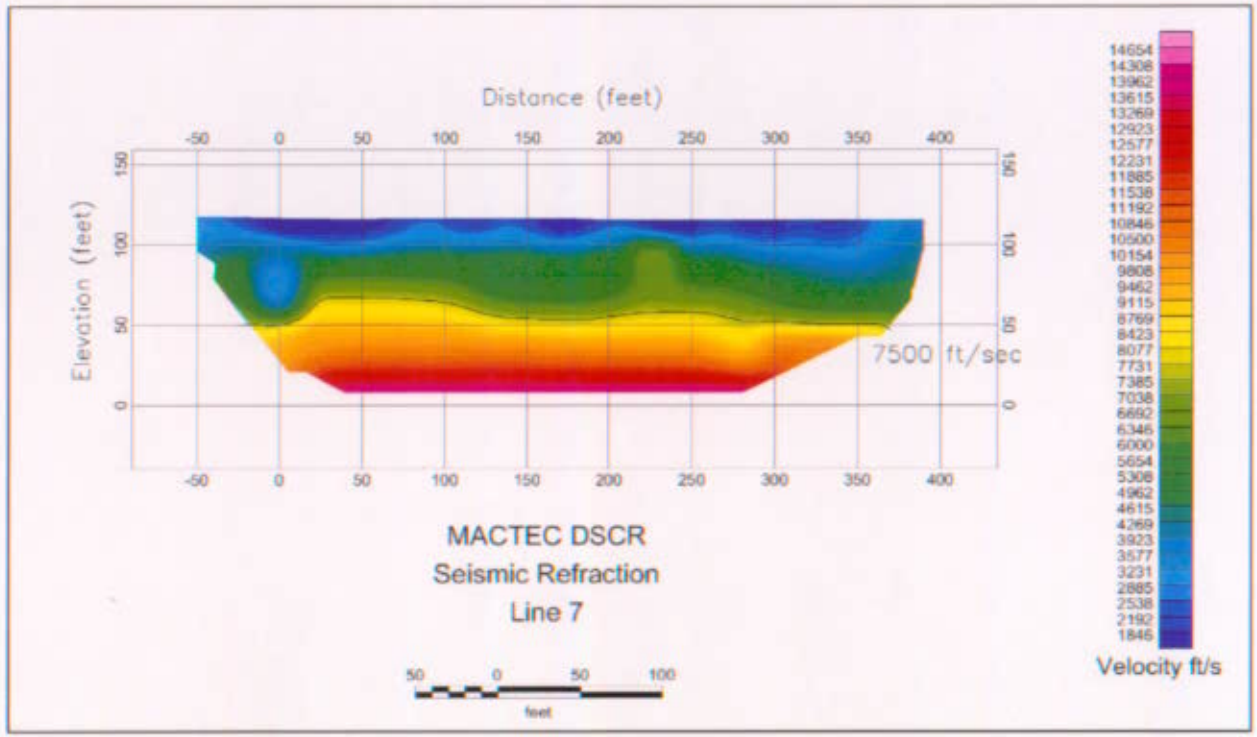


Figure 30. Seismic Refraction Profile 7

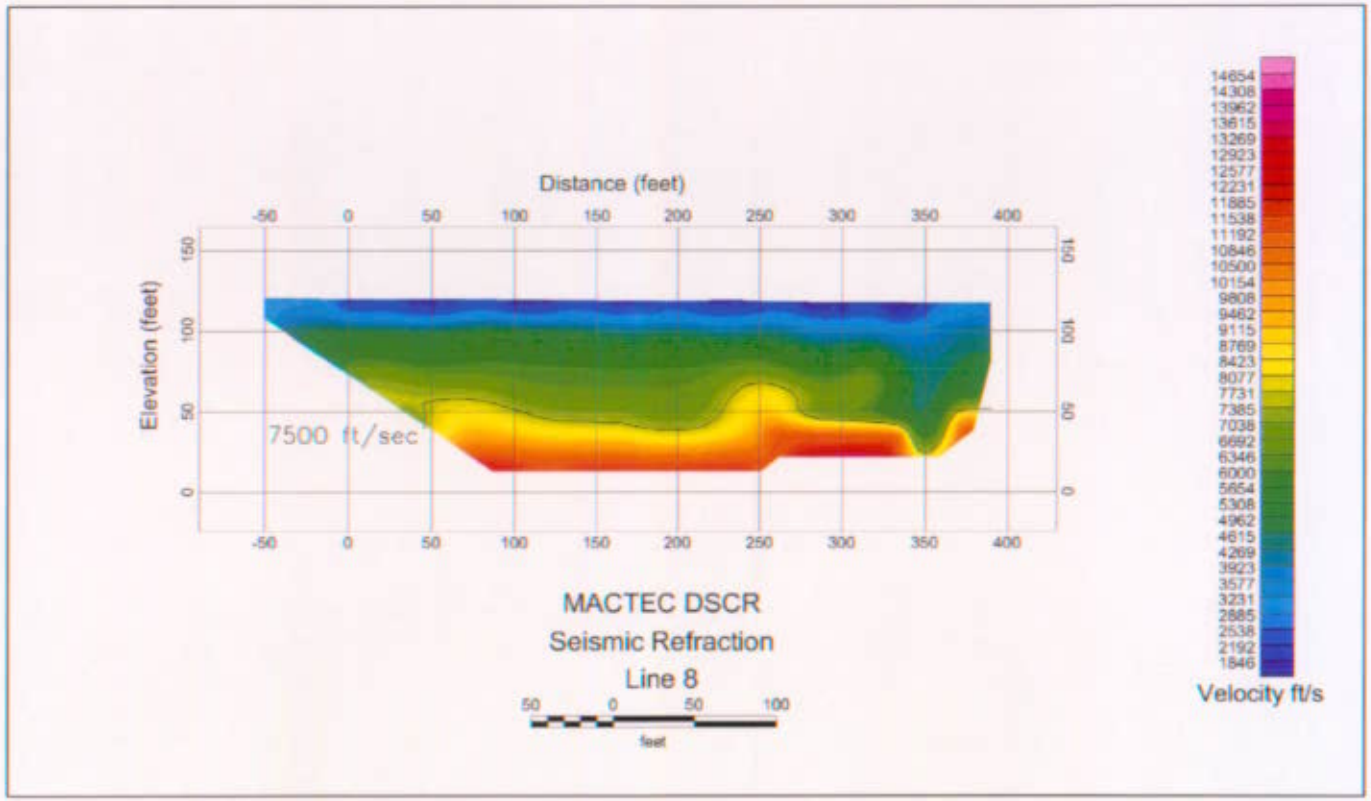


Figure 31. Seismic Refraction Profile 8

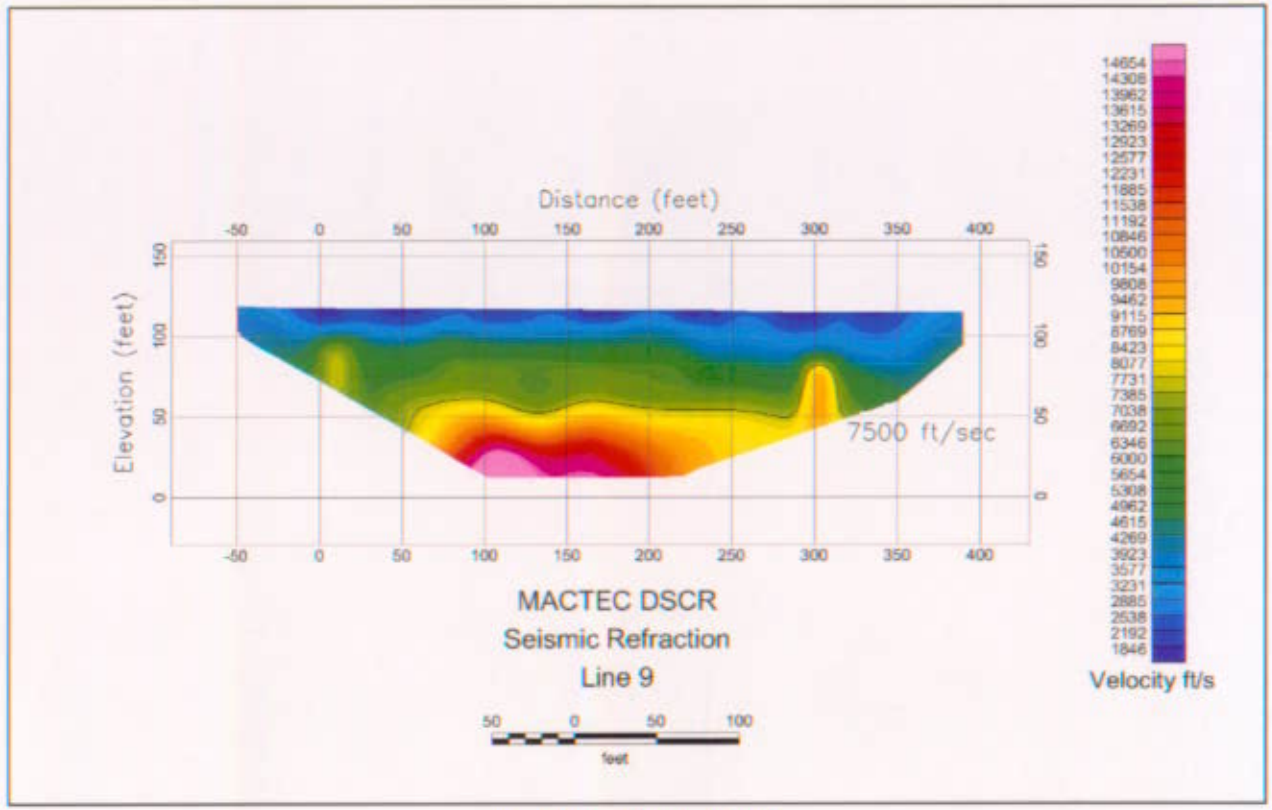


Figure 32. Seismic Refraction Profile 9

669 698

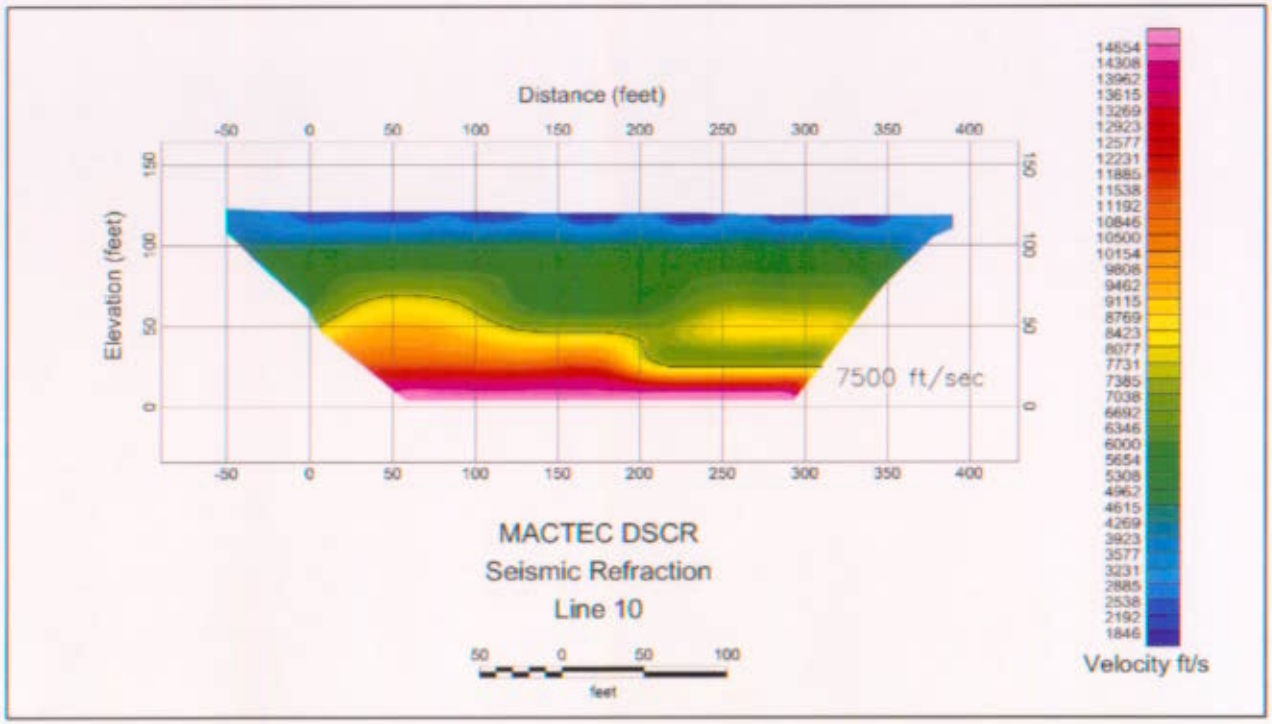


Figure 33. Seismic Refraction Profile 10

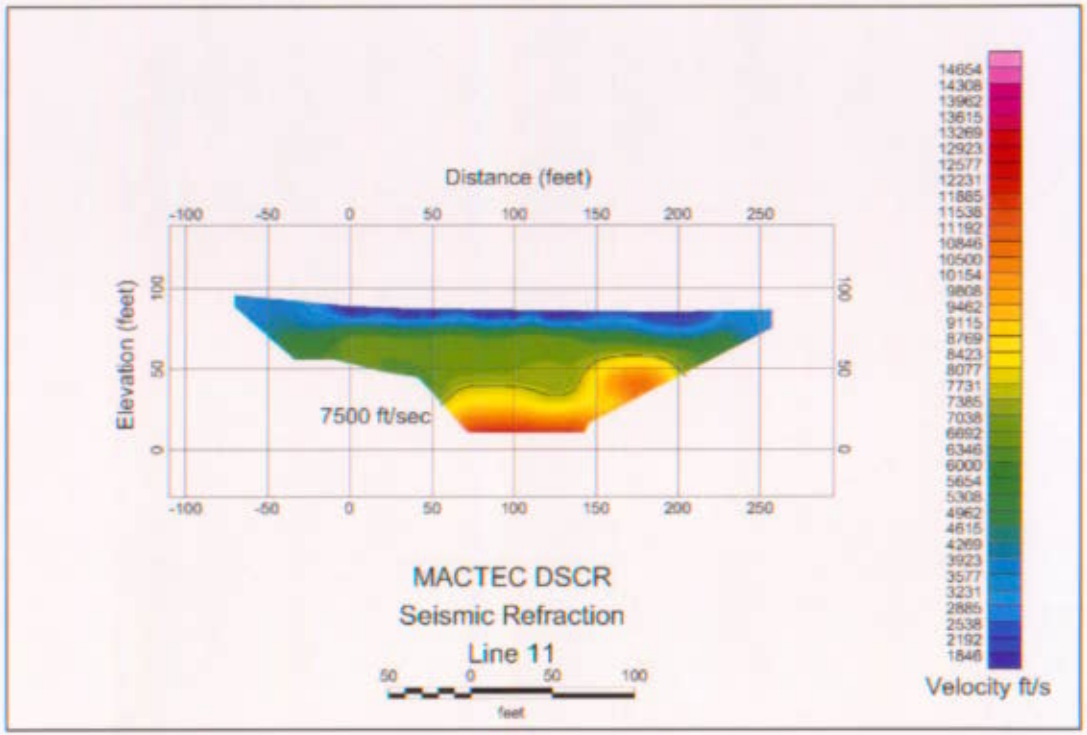


Figure 34. Seismic Refraction Profile 11

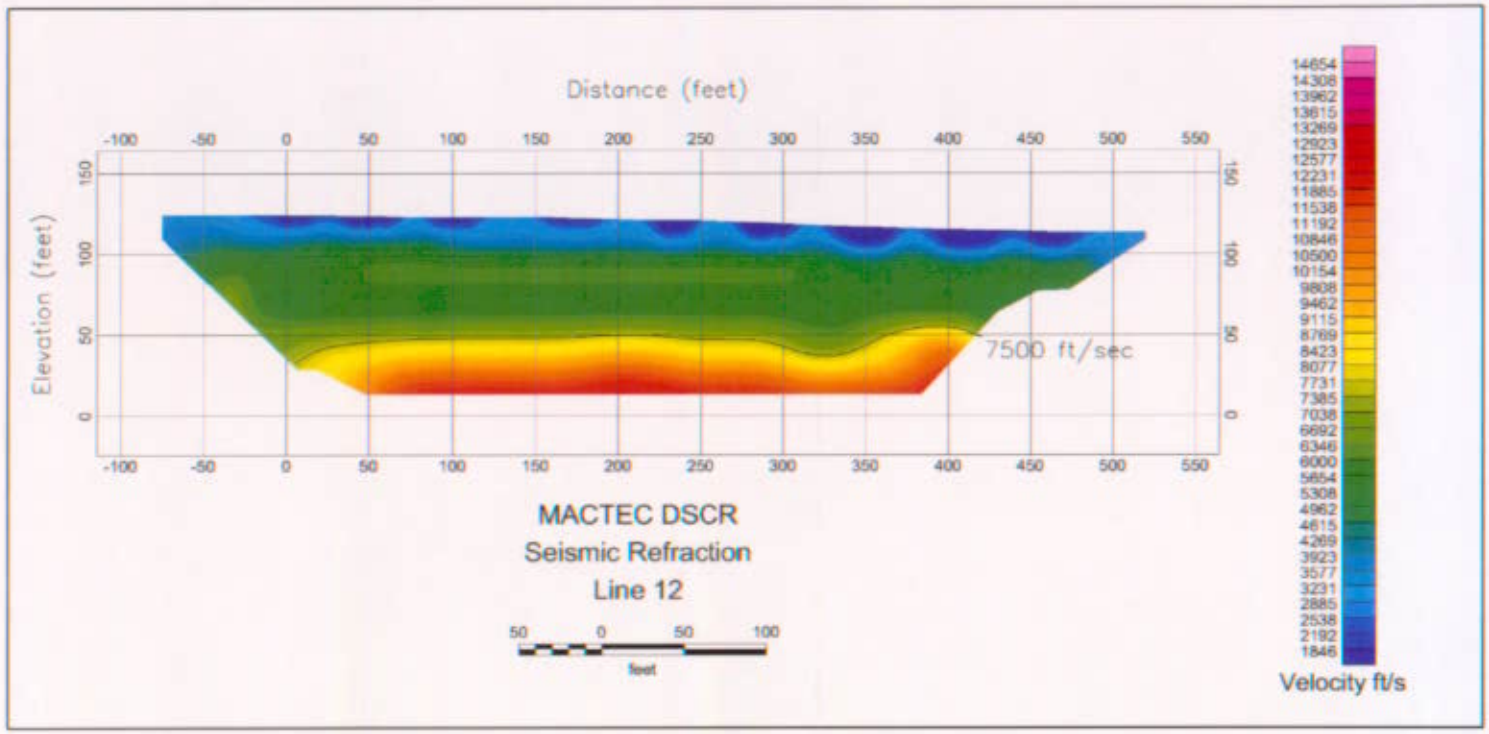


Figure 35. Seismic Refraction Profile 12

2.4 Ground Probing Radar

GPR data were collected using a RAMAC X3M radar control unit in conjunction with a 250 MHz antenna, both manufactured by MALÅ GeoScience (Figure 36). GPR data were collected and processed using GroundVision software (v. 1.3.6, MALÅ GeoScience). Line length is recorded by an integrated survey attached to the antenna.

Figure 36. GPR data acquisition, 250 MHz antenna

Geophex collected GPR data over 43 individual profiles. These profiles are designated P1 through P43 in Figures 2 and 3. Profile numbers 15, 21 through 25, and 37 were voided in the field and are not shown in Figures 2 and 3 or Appendix C. An example of the GPR data is shown in Figure 37. In general, GPR data attained good resolution to approximately 6 feet depth. Test profiles were collected using a lower frequency (100MHz) antenna. 250 MHz data acquisition was chosen as the 100MHz antenna achieved only marginally better penetration with significantly less resolution. Digital GPR data were forwarded to MACTEC (Mr. Scott Calkin) for analysis.

Appendix C contains a single plate showing relevant GPR profiles collected at the site.

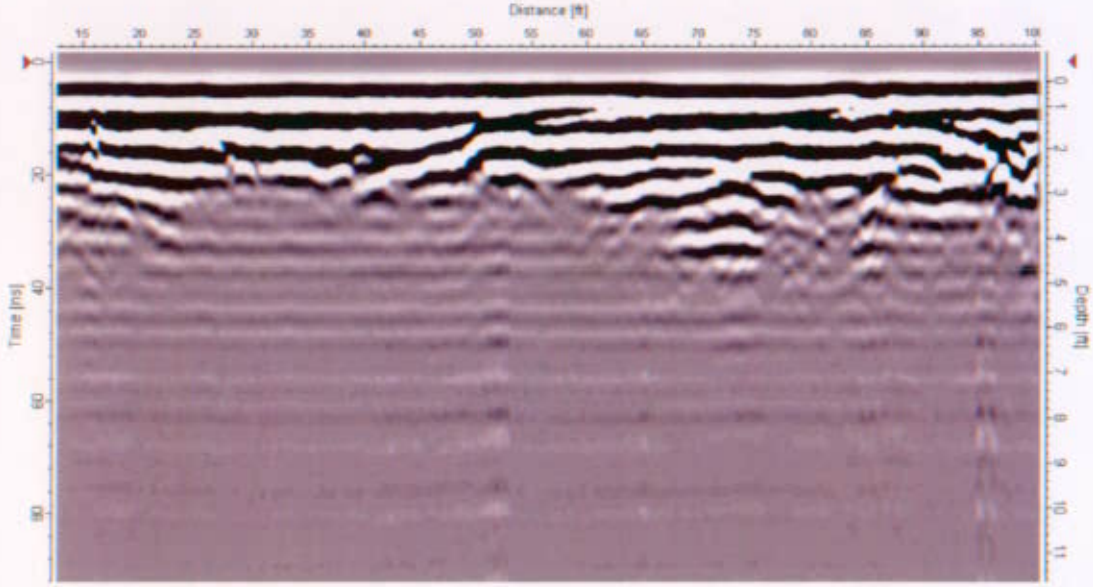


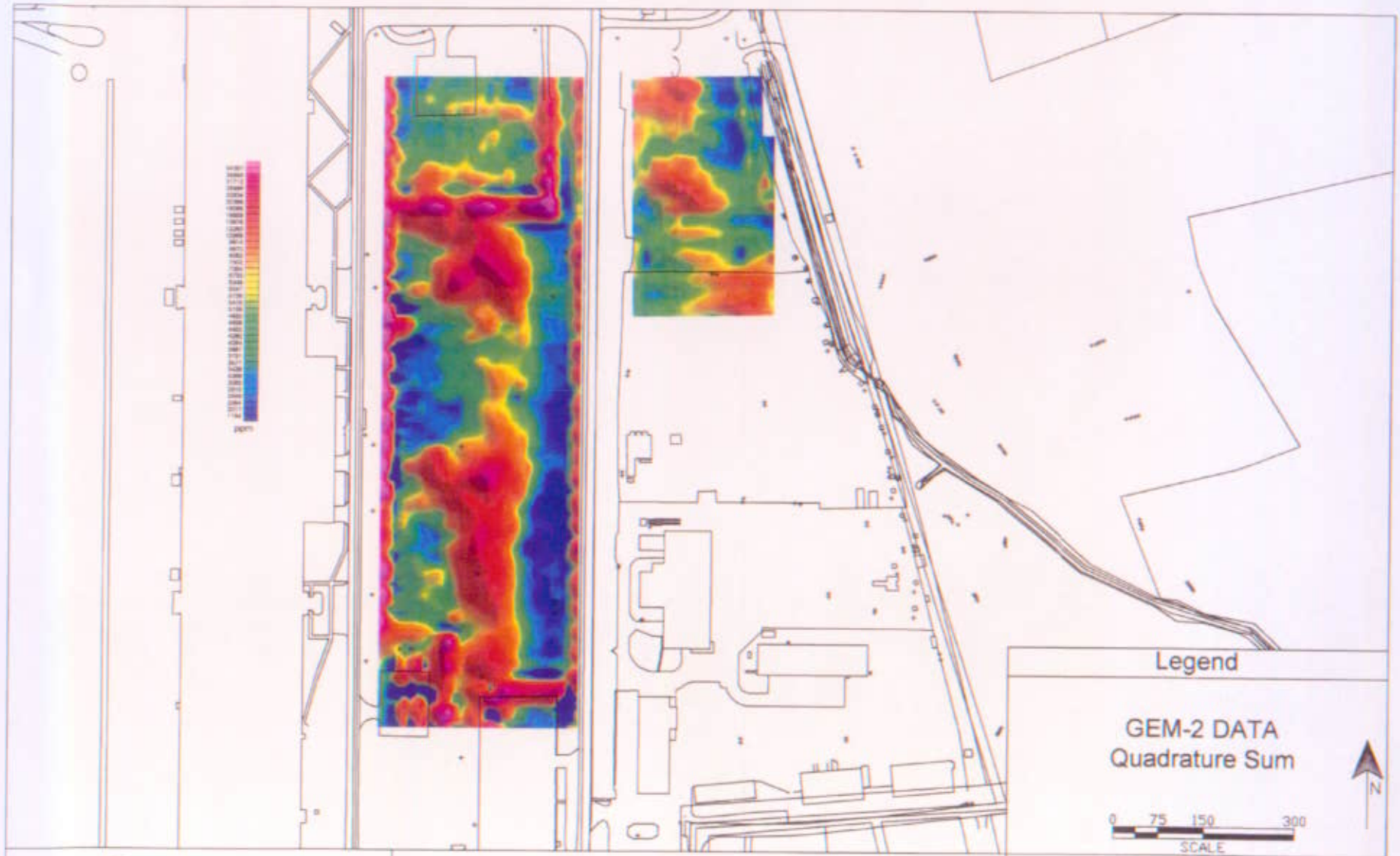
Figure 37. Example GPR profile

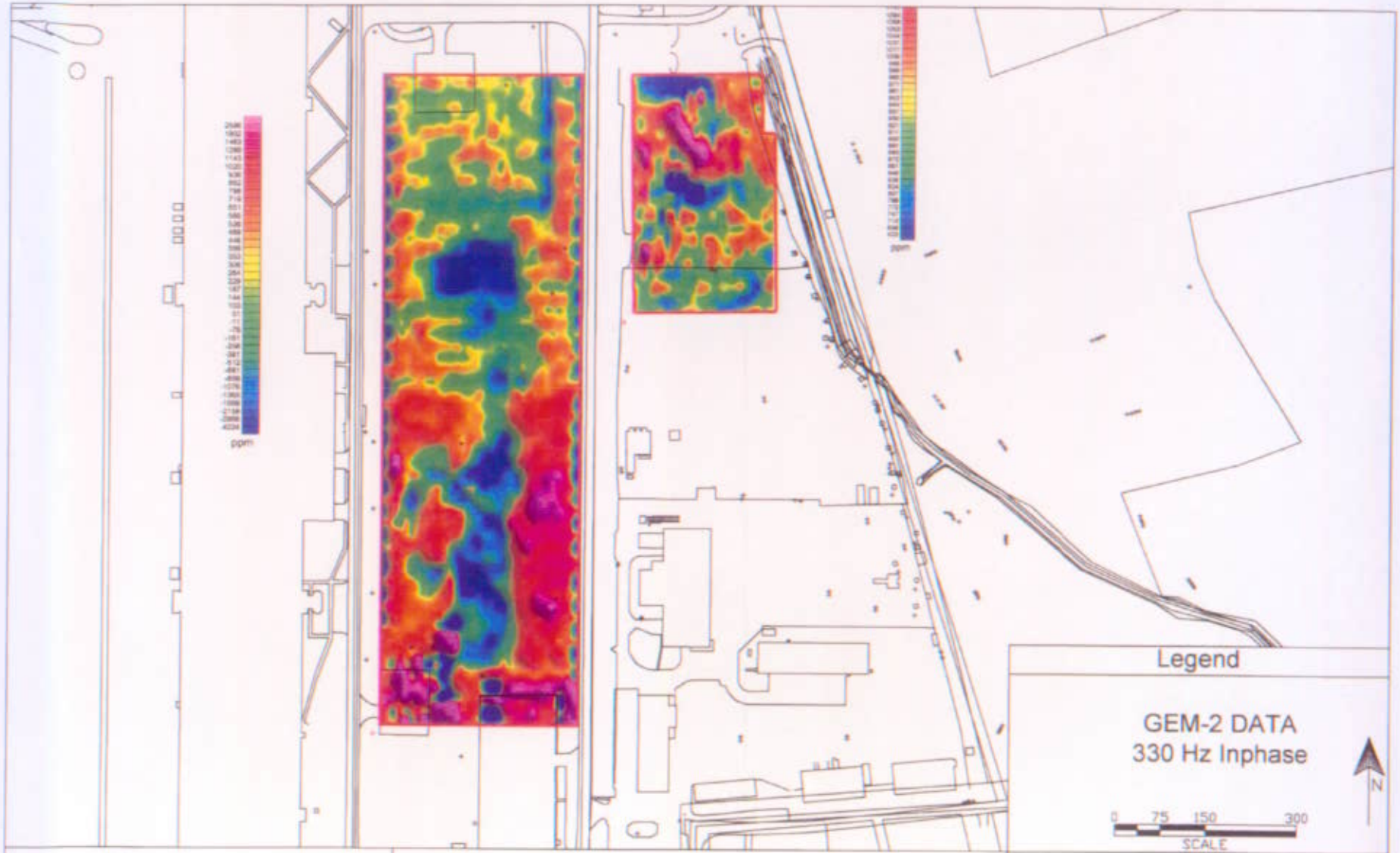
2.5 Surveying/Locations

All geophysical survey grids and profiles were surveyed using a Trimble Pro XR Global Positioning System (GPS). GPS data were post processed using Trimble Pathfinder Office (v. 2.90). All data was rectified to Virginia State Plane (South) Coordinates (NAD 1983, Conus) using the Richmond, VA, 1 CORS base station. GPS elevations were measured from mean sea level using defined Geoid 99 (Conus). Relative elevations along seismic refraction lines and Resistivity /IP lines were recorded in the field using a hand level. These elevations were corrected to sea level by comparing GPS elevations to top of casing and ground surface elevations from existing drill logs, provided by Mactec.

Appendix A

EM DATA

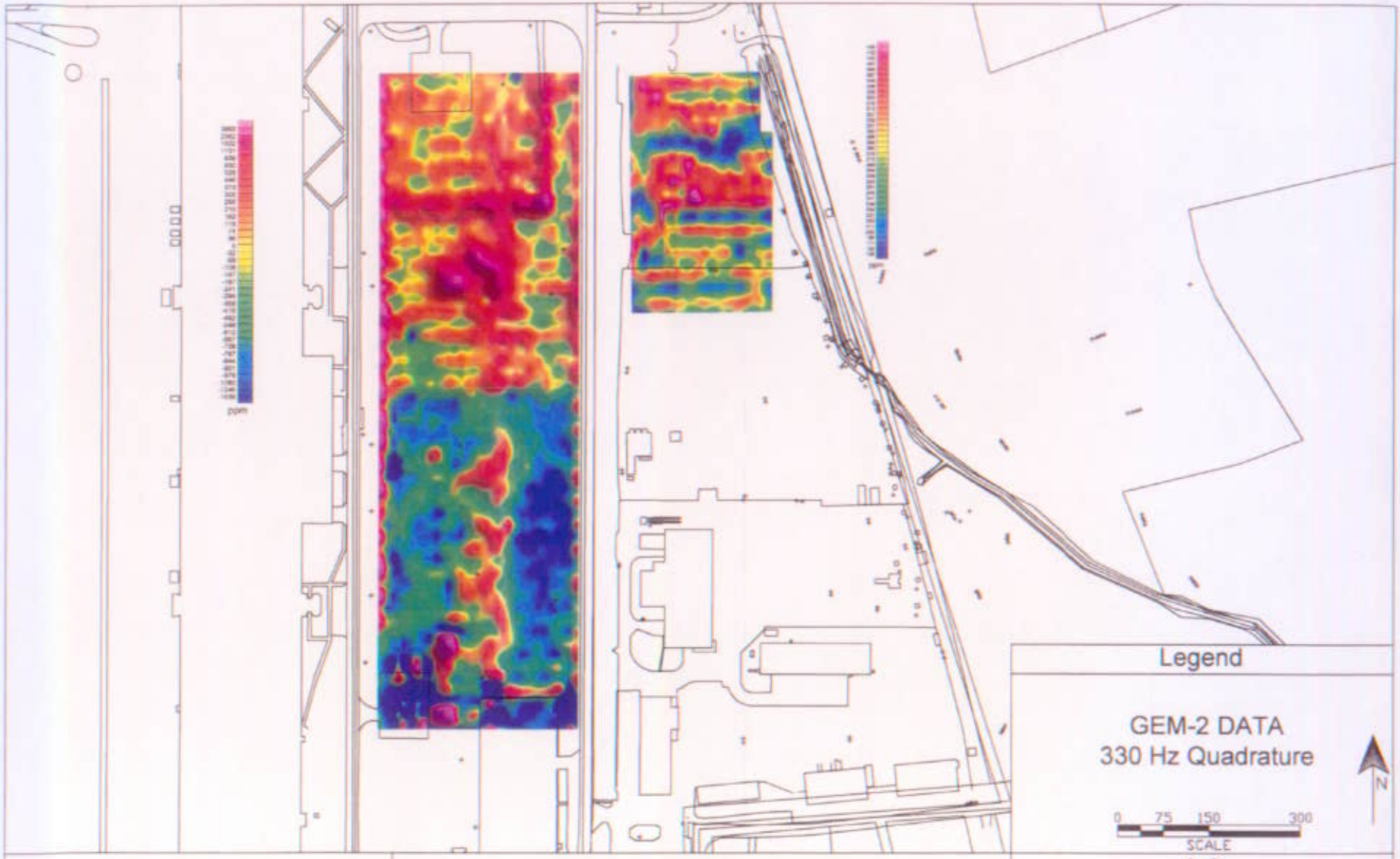

ppm
Legend
GEM-2 DATA
Quadrature Sum
N
0 75 150 300
SCALE
Geophex
-terrum et mare exploramus-
DSC Richmond
Area 50/National Guard Area
A-1
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL



Geophex
-terram et mare explinamus-

DSC Richmond
Area 50/National Guard Area

A-2	
Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

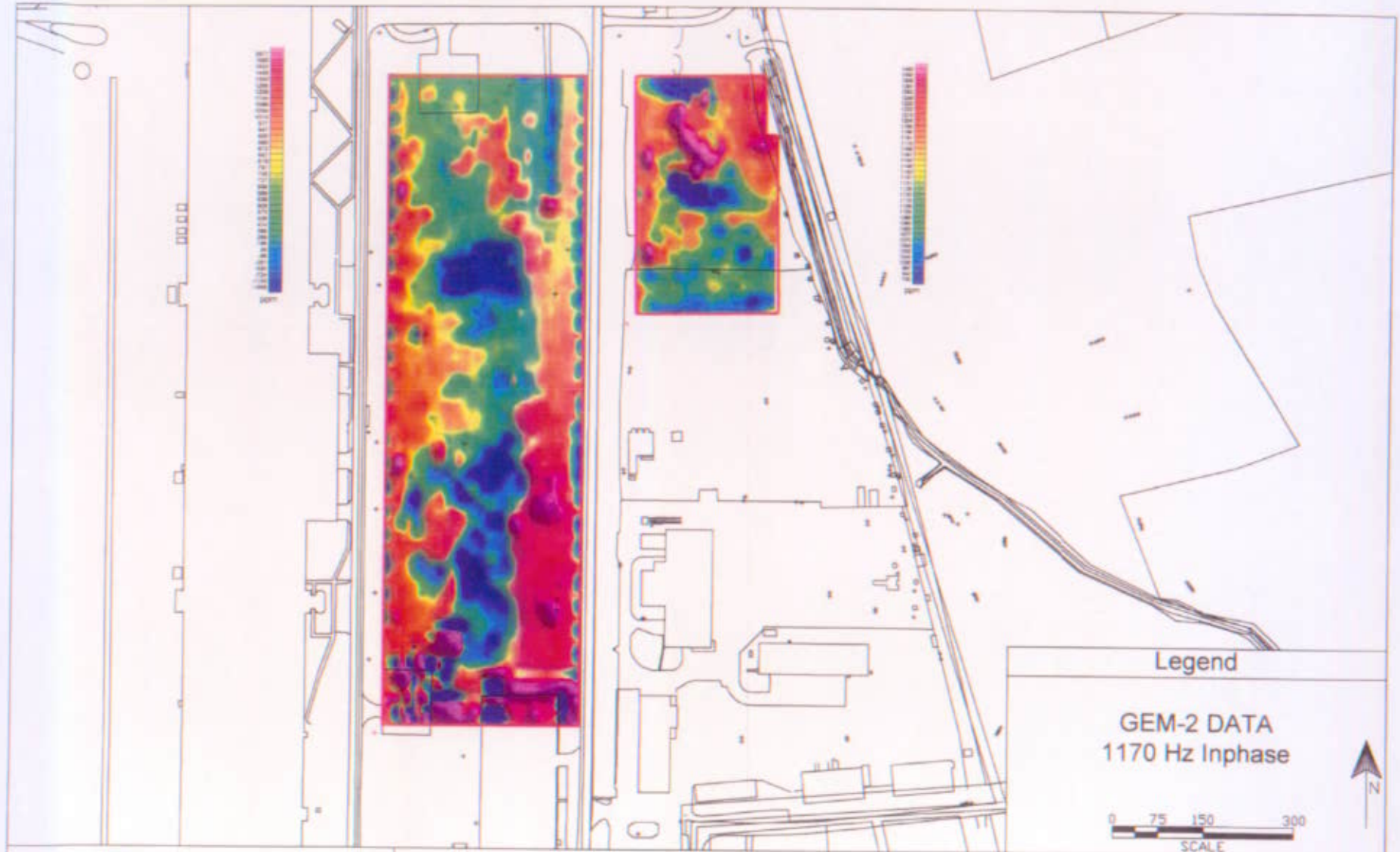


Geophex
-terrain et mare explorama-

DSC Richmond
Area 50/National Guard Area

A-3

Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

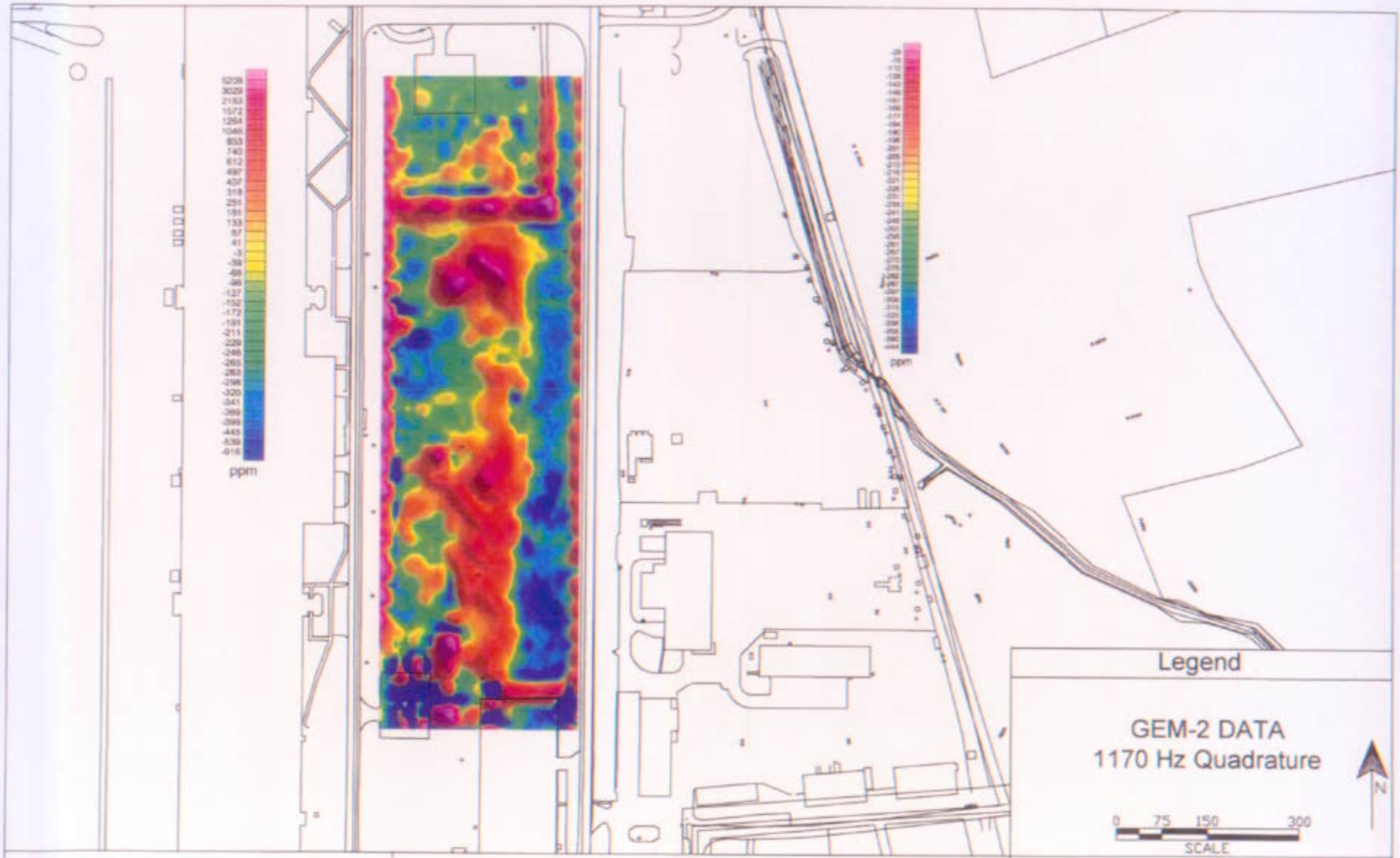


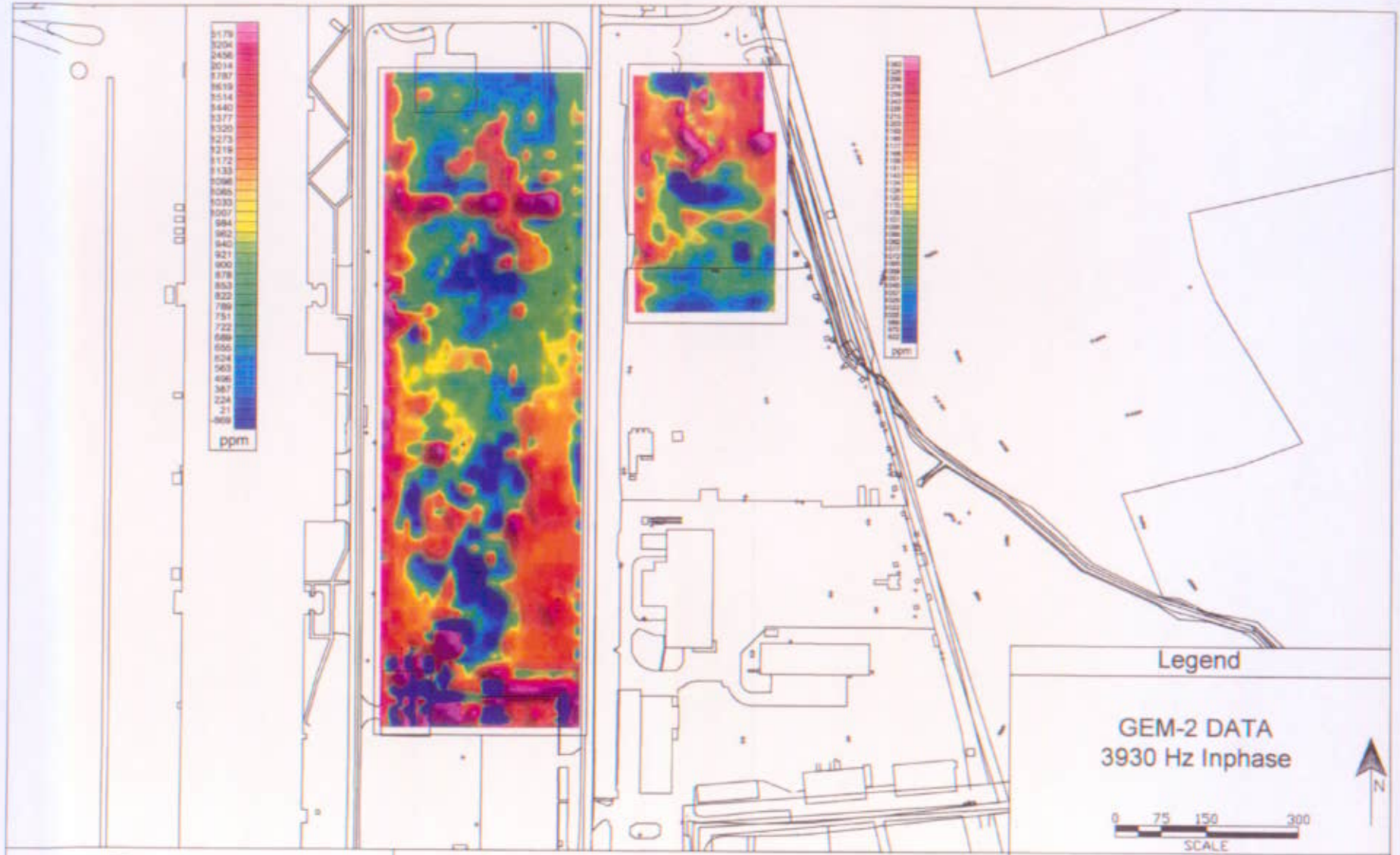
Geophex
-terram et mare exploramus-

DSC Richmond
Area 50/National Guard Area

A-4

Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL


ppm
ppm
Legend
GEM-2 DATA
1170 Hz Quadrature
N
0 75 150 300
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area 50/National Guard Area
A-5
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL



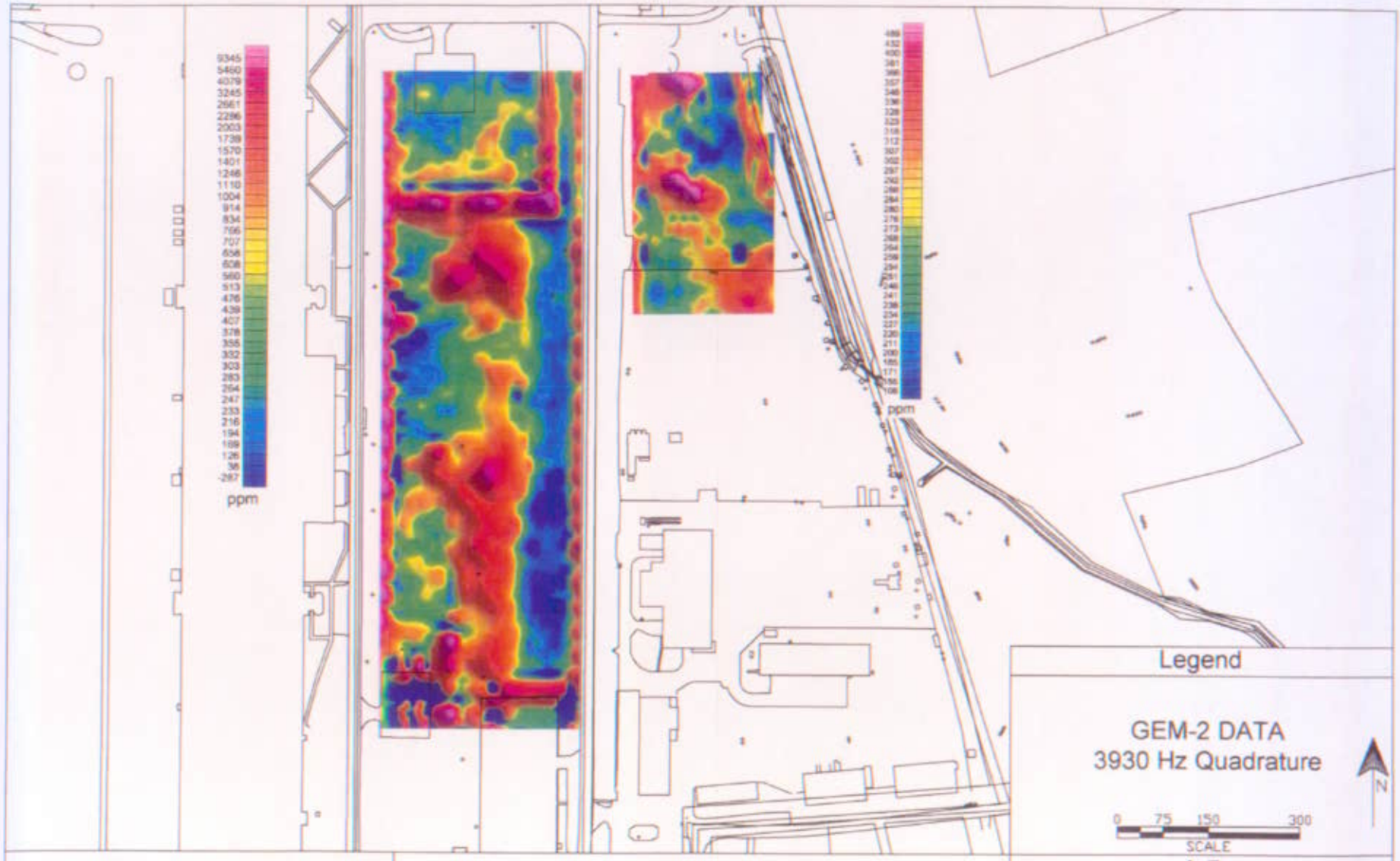
Geophex
-terram et mare exploramus-

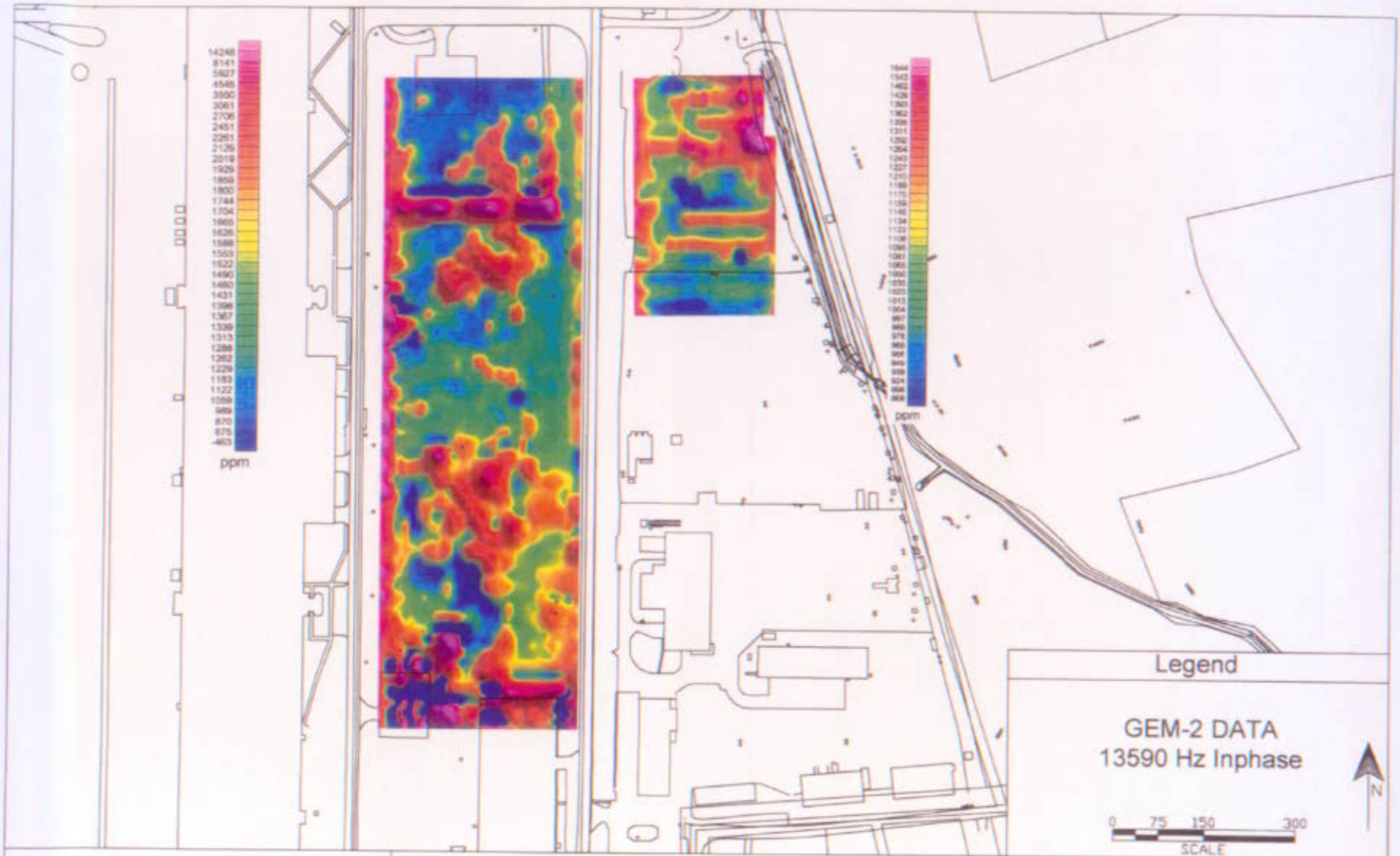
DSC Richmond
Area 50/National Guard Area

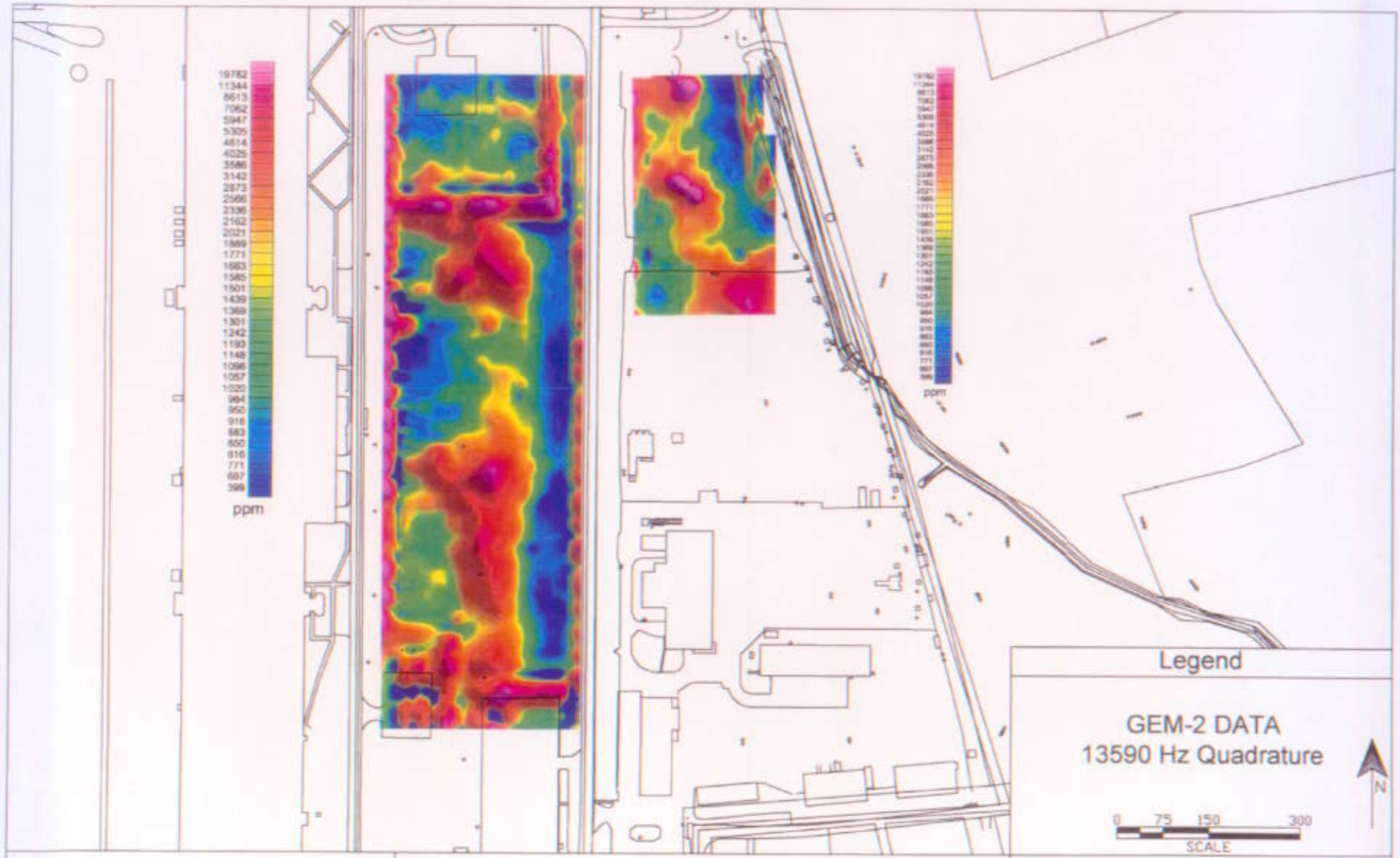
A-6

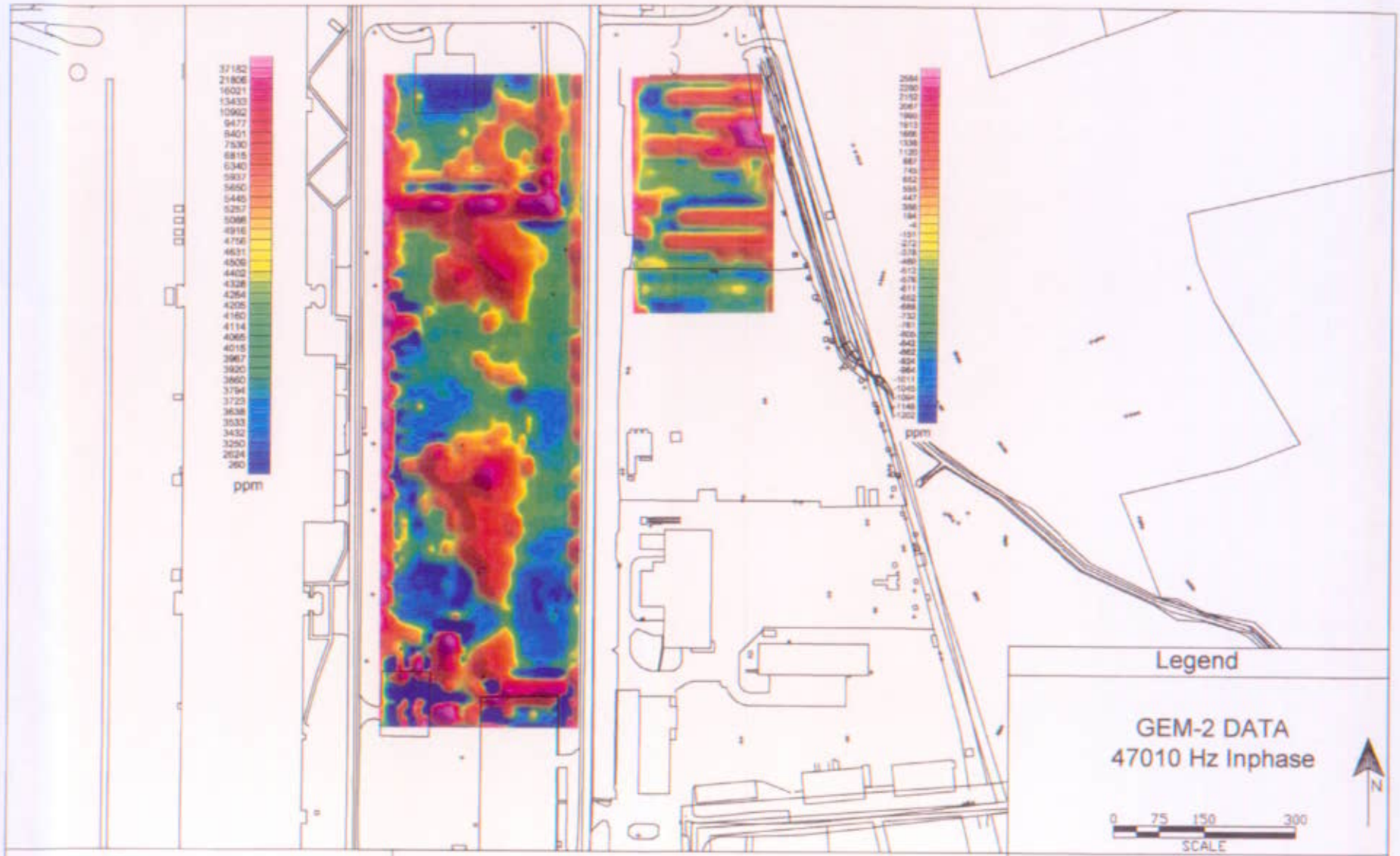
Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

869 712


9345
5460
4379
3245
2561
2286
2003
1739
1570
1401
1246
1110
1004
914
834
766
707
658
608
560
513
476
439
407
378
355
332
303
283
264
247
233
216
194
169
126
36
-287
ppm
ppm
Legend
GEM-2 DATA
3930 Hz Quadrature
N
0 75 150 300
SCALE
Geophex
-terrain et more explorateur-
DSC Richmond
Area 50/National Guard Area
A-7
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL


14248
8141
5927
4545
3550
3061
2706
2451
2251
2129
2019
1929
1859
1800
1744
1704
1665
1626
1588
1553
1522
1490
1460
1431
1396
1367
1339
1313
1288
1262
1229
1183
1122
1059
989
870
875
-463
ppm
ppm
Legend
GEM-2 DATA
13590 Hz Inphase
N
0 75 150 300
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area 50/National Guard Area
A-8
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL


19782
11344
6613
7052
5947
5305
4614
4025
3586
3142
2873
2566
2336
2162
2021
1869
1771
1663
1585
1501
1439
1369
1301
1242
1193
1148
1098
1057
1020
994
950
916
883
850
816
771
687
399
ppm
ppm
Legend
GEM-2 DATA
13590 Hz Quadrature
N
0 75 150 300
SCALE
Geophex
-terrum et mare exploramus-
DSC Richmond
Area 50/National Guard Area
A-9
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL


37162
21806
16021
13433
10992
9477
8401
7530
6815
6340
5937
5650
5445
5257
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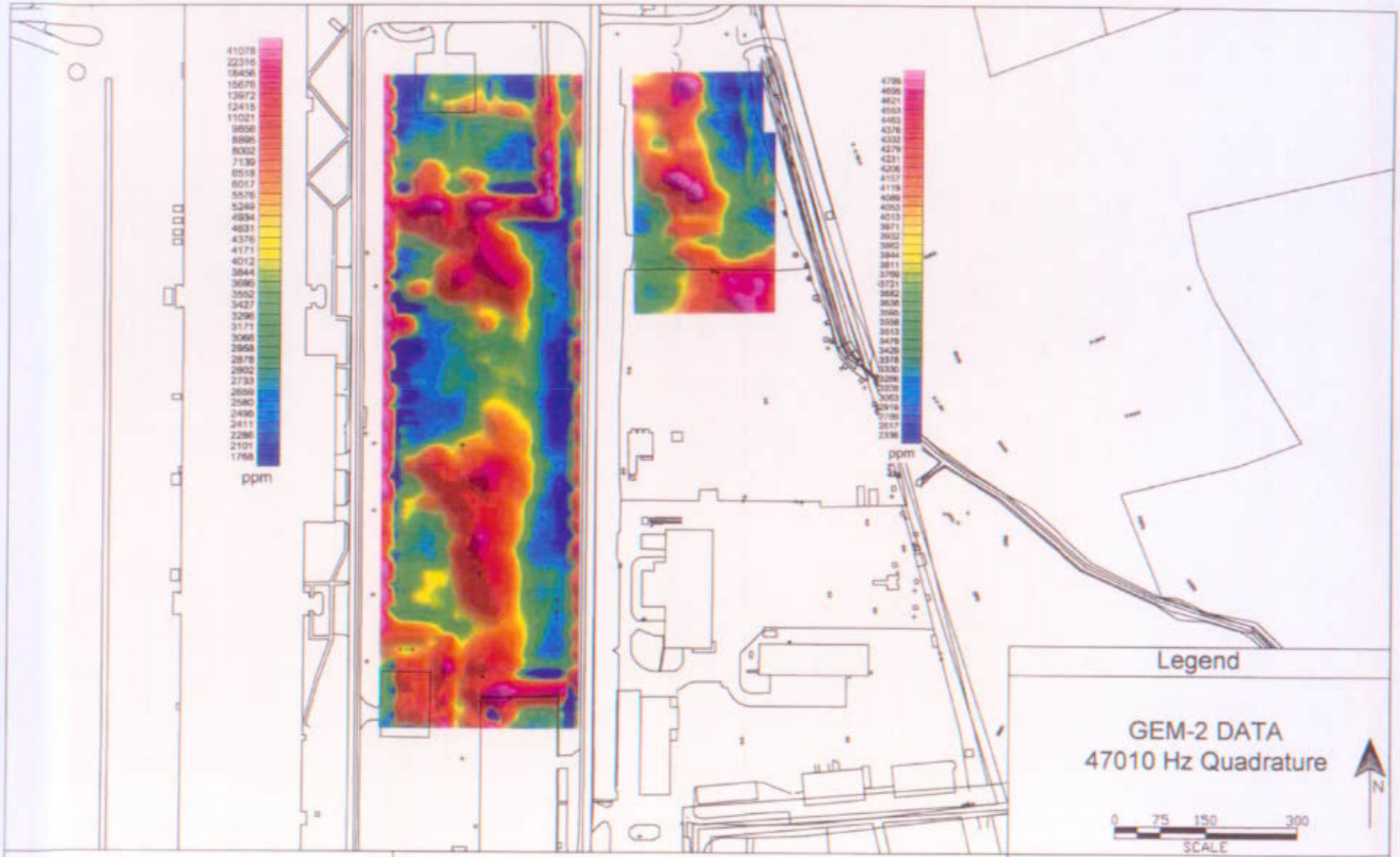
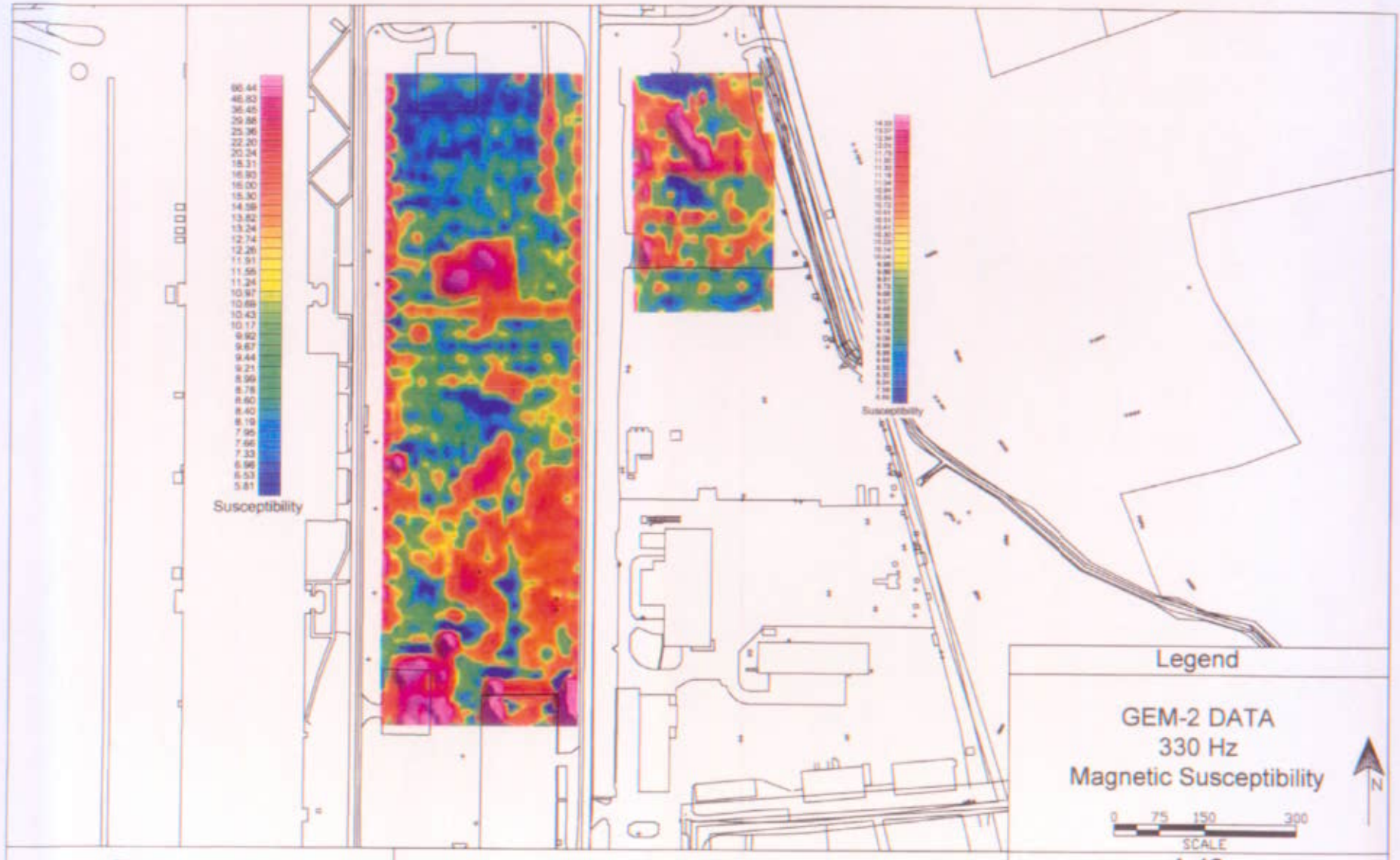
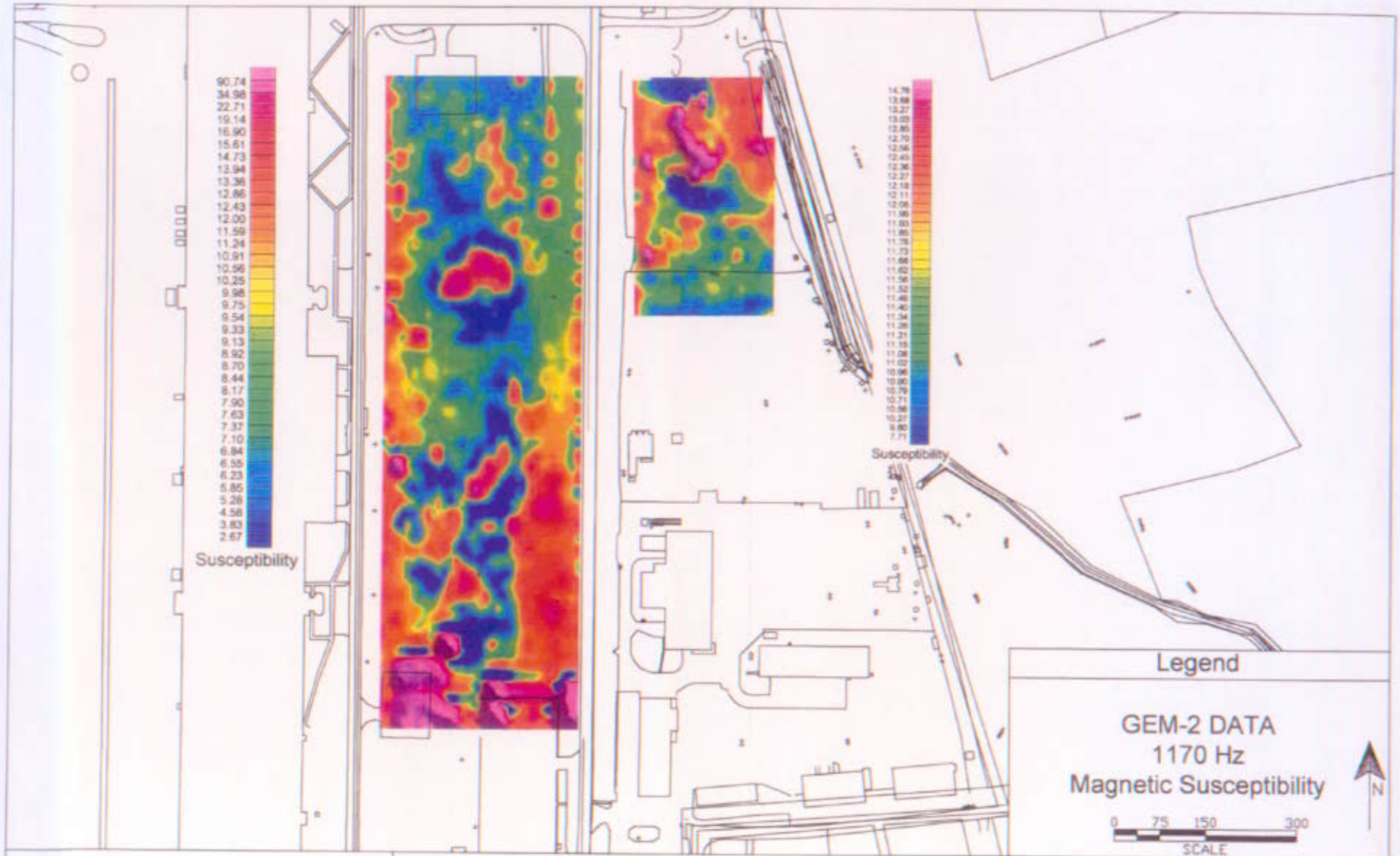
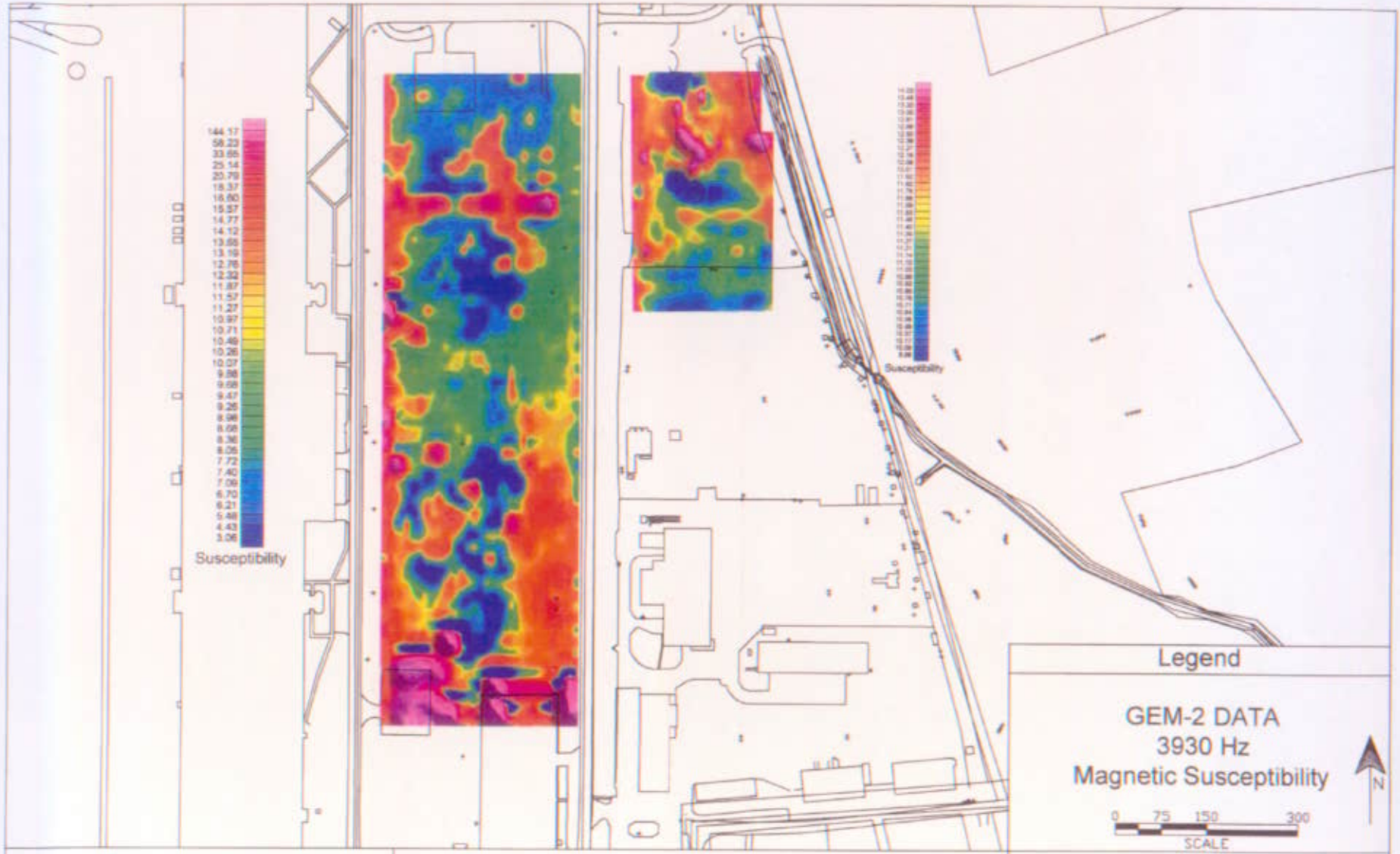
4916
4756
4631
4509
4402
4328
4254
4205
4160
4114
4065
4015
3967
3920
3860
3794
3723
3638
3533
3432
3250
2524
260
ppm
ppm
Legend
GEM-2 DATA
47010 Hz Inphase
N
0 75 150 300
SCALE
Geophex
-stream of more explorations-
DSC Richmond
Area 50/National Guard Area
A-10
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL

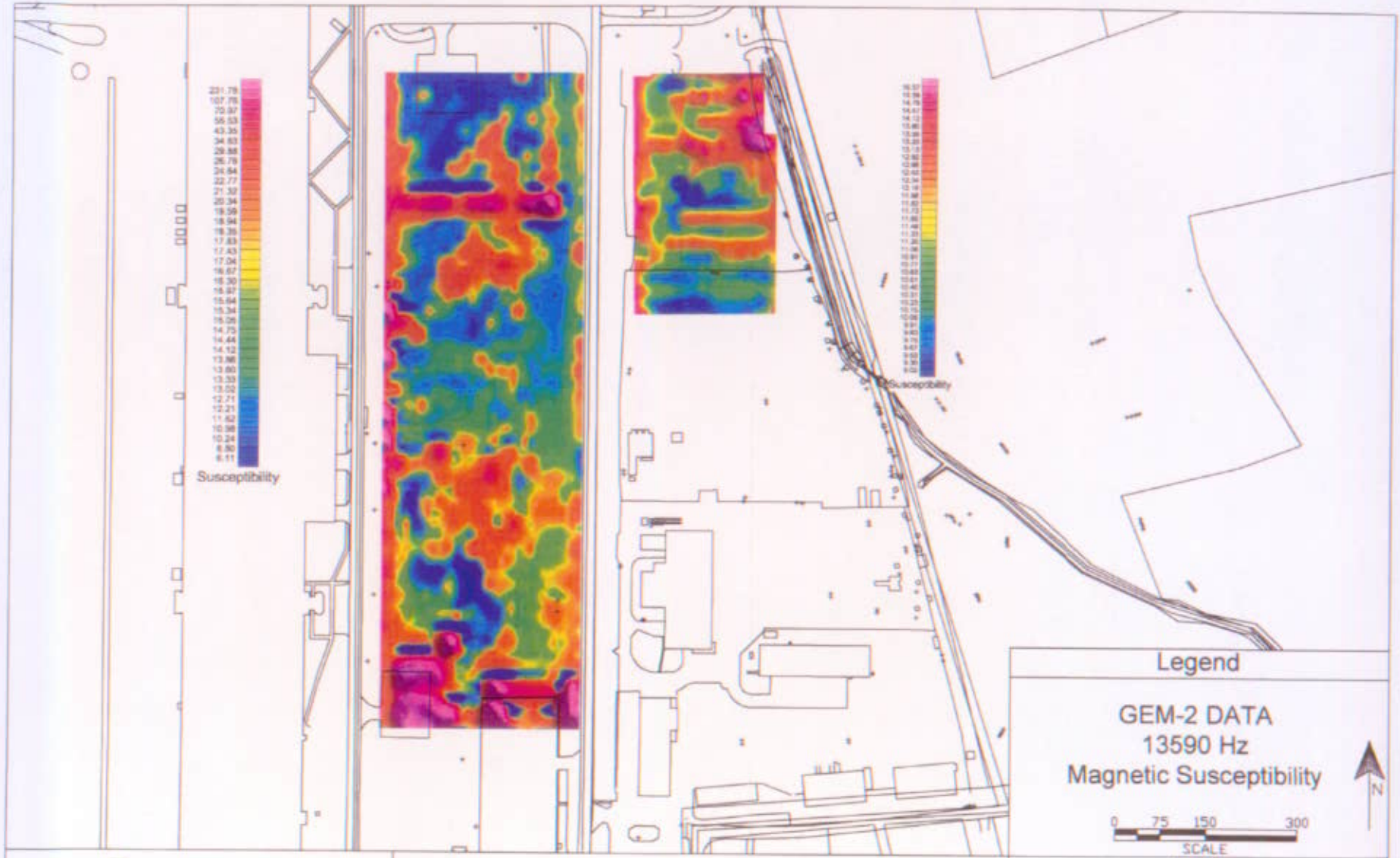

ppm
ppm
Legend
GEM-2 DATA
47010 Hz Quadrature
N
0 75 150 300
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area 50/National Guard Area
A-11
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL

869 717


Susceptibility
Susceptibility
Legend
GEM-2 DATA
330 Hz
Magnetic Susceptibility
N
0 75 150 300
SCALE
Geophex
DSC Richmond
Area 50/National Guard Area
A-12
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL


90.74
34.98
22.71
19.14
16.90
15.61
14.73
13.94
13.36
12.86
12.43
12.00
11.59
11.24
10.91
10.56
10.25
9.98
9.75
9.54
9.33
9.13
8.92
8.70
8.44
8.17
7.90
7.63
7.37
7.10
6.84
6.55
6.23
5.85
5.28
4.58
3.83
2.67
Susceptibility
Susceptibility
Legend
GEM-2 DATA
1170 Hz
Magnetic Susceptibility
0 75 150 300
SCALE
N
Geophex
DSC Richmond
Area 50/National Guard Area
A-13
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL


144.17
58.23
33.65
25.14
20.79
18.37
16.80
15.57
14.77
14.12
13.66
13.19
12.76
12.32
11.87
11.57
11.27
10.97
10.71
10.49
10.26
10.07
9.88
9.68
9.47
9.25
8.98
8.68
8.36
8.05
7.72
7.40
7.09
6.70
6.21
5.48
4.43
3.06
Susceptibility
Susceptibility
Legend
GEM-2 DATA
3930 Hz
Magnetic Susceptibility
N
0 75 150 300
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area 50/National Guard Area
A-14
Job #: 1249
Date: 10/2003
Scale: 1"=150ft
Drawn By: CDL



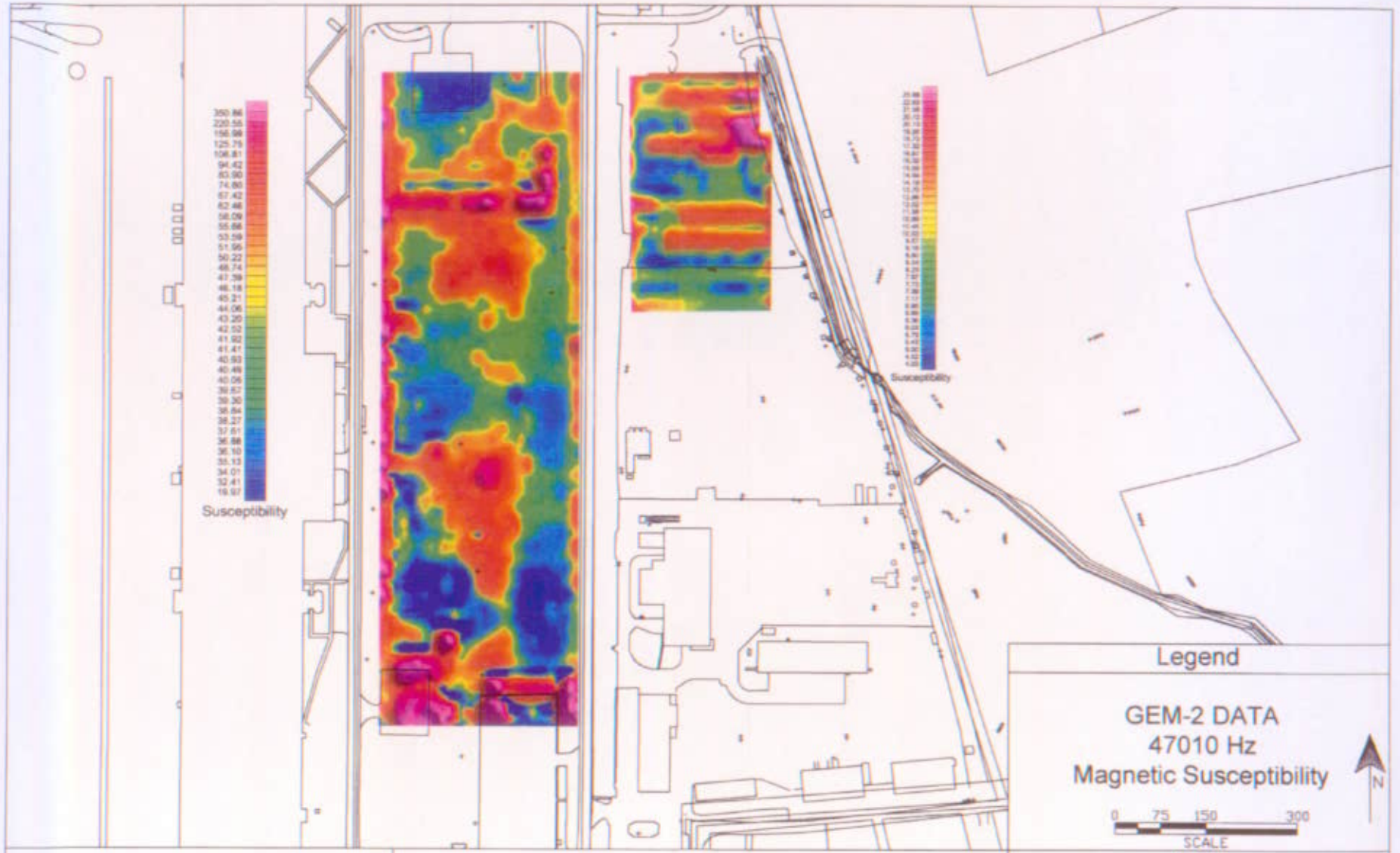
Geophex
-terrum et mare explorans-

DSC Richmond
Area 50/National Guard Area

A-15

Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

869 721



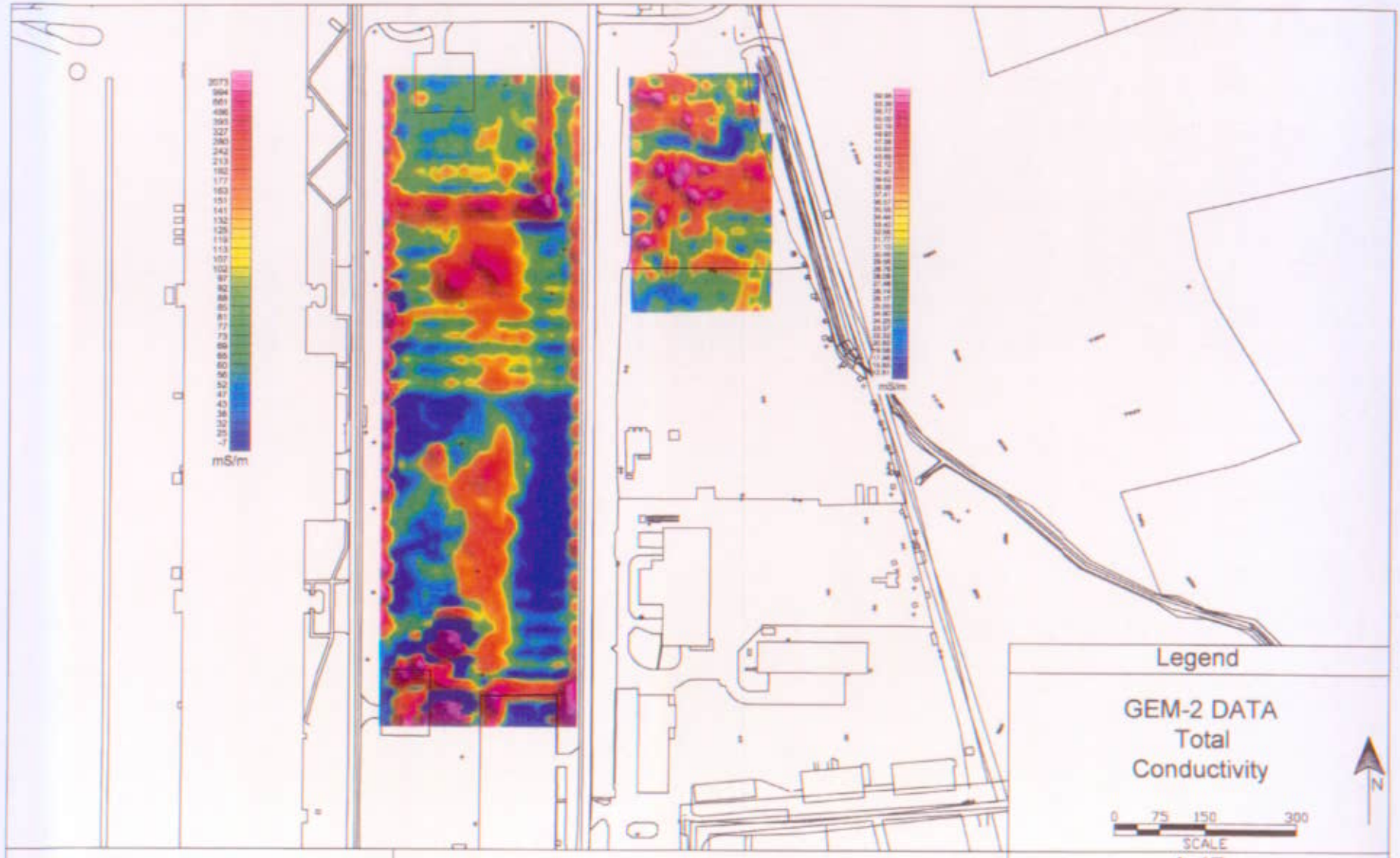
Geophex
-terram et mare exploramus-

DSC Richmond
Area 50/National Guard Area

A-16

Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

869 722

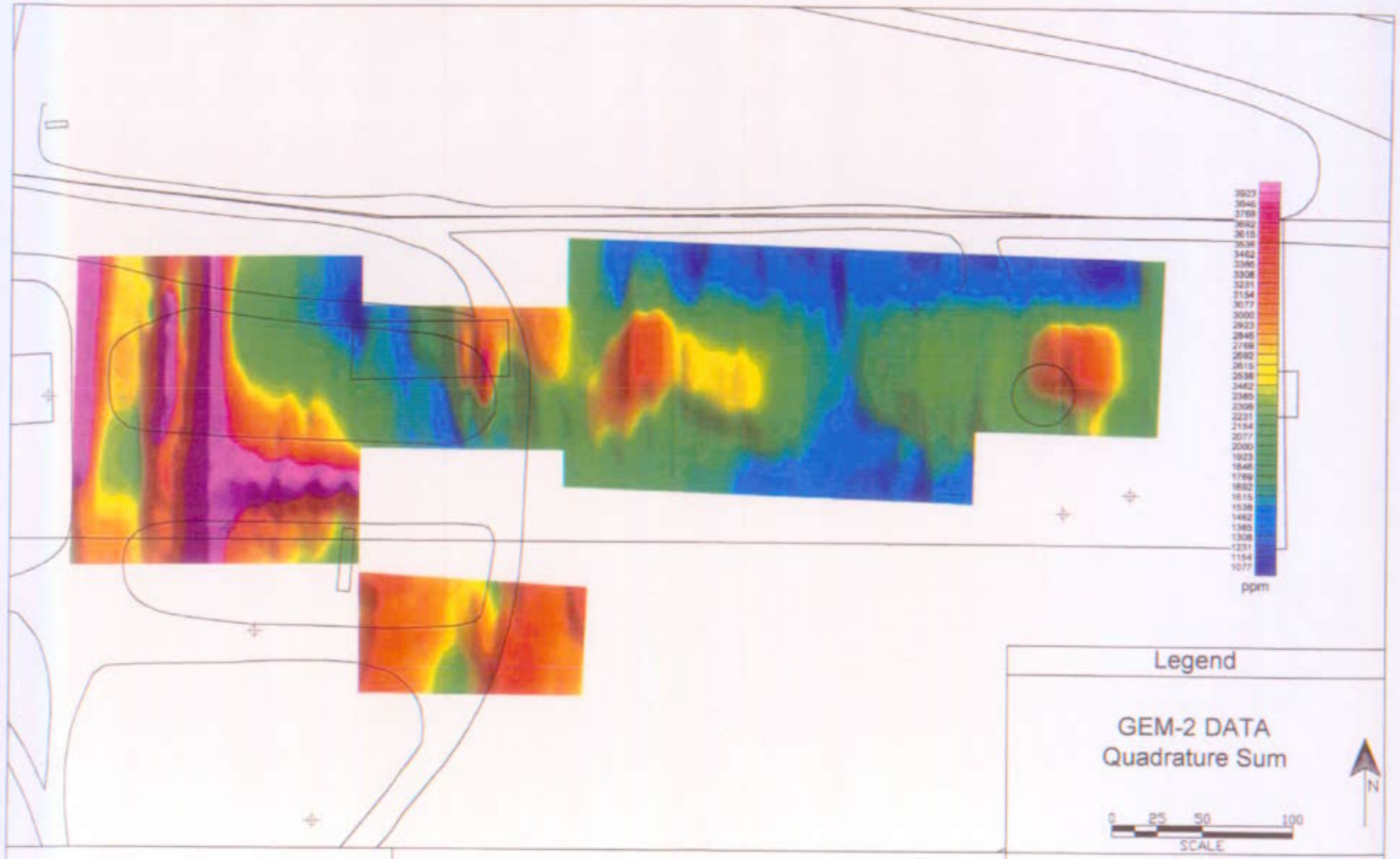


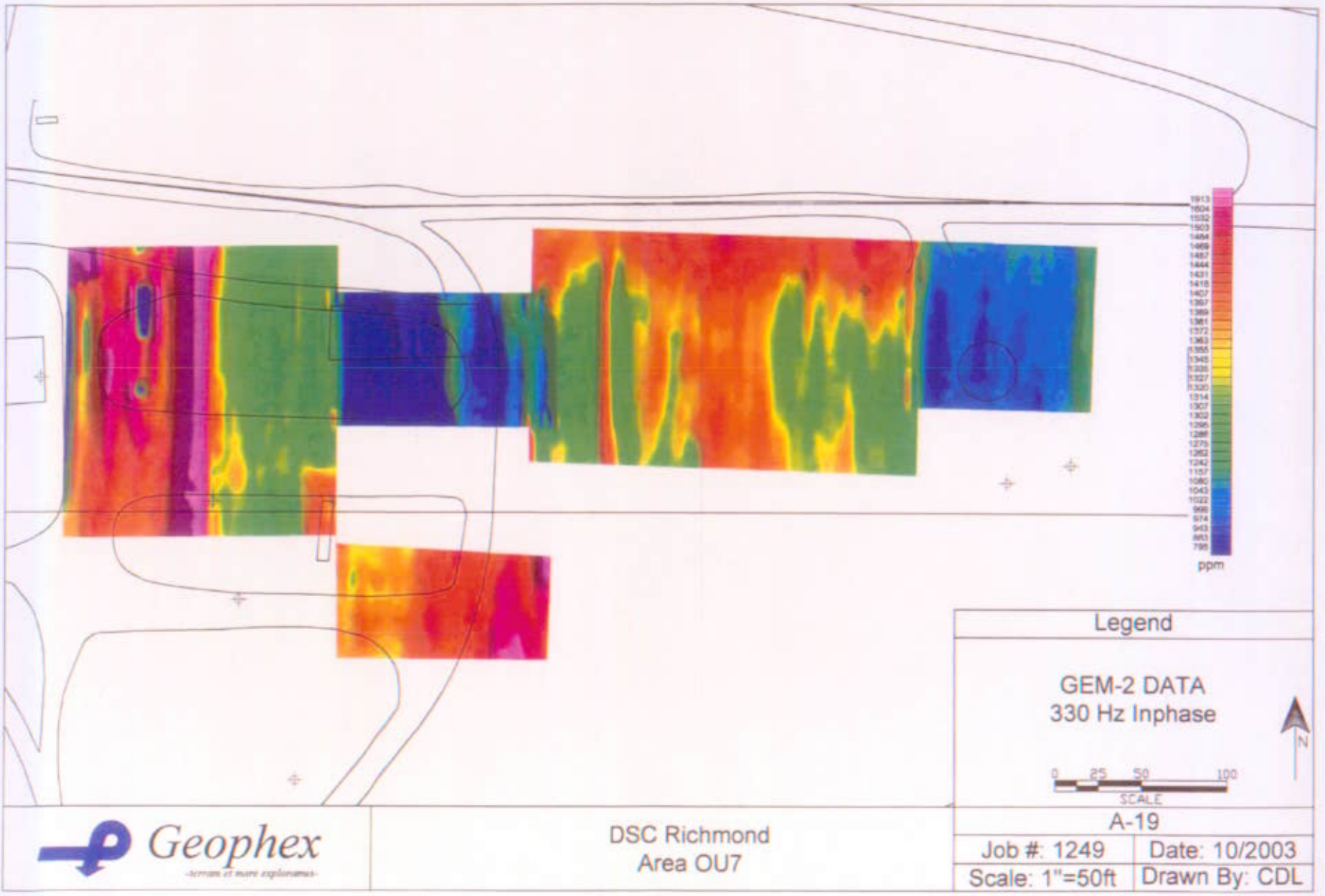
Geophex

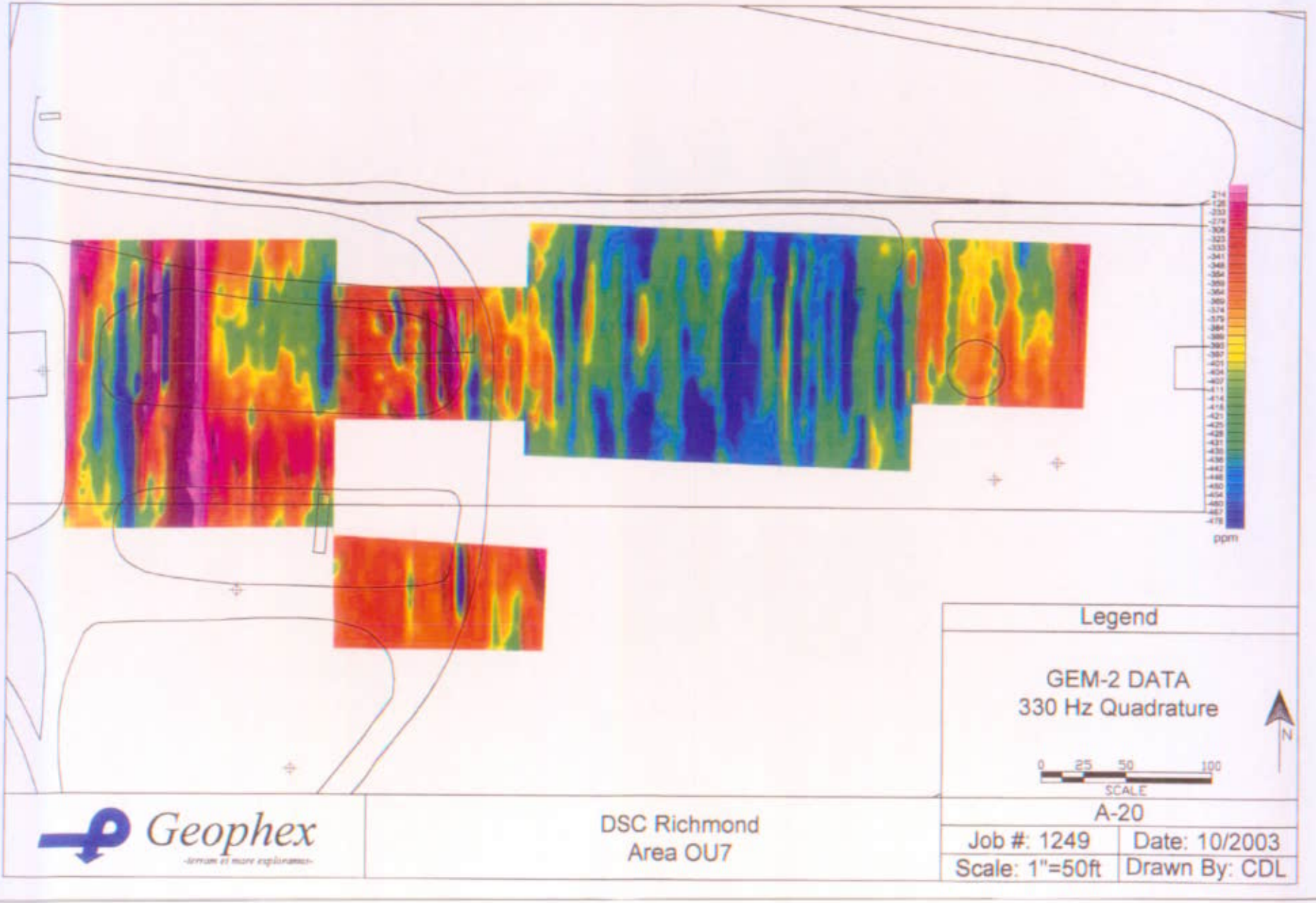
DSC Richmond
Area 50/National Guard Area

A-17

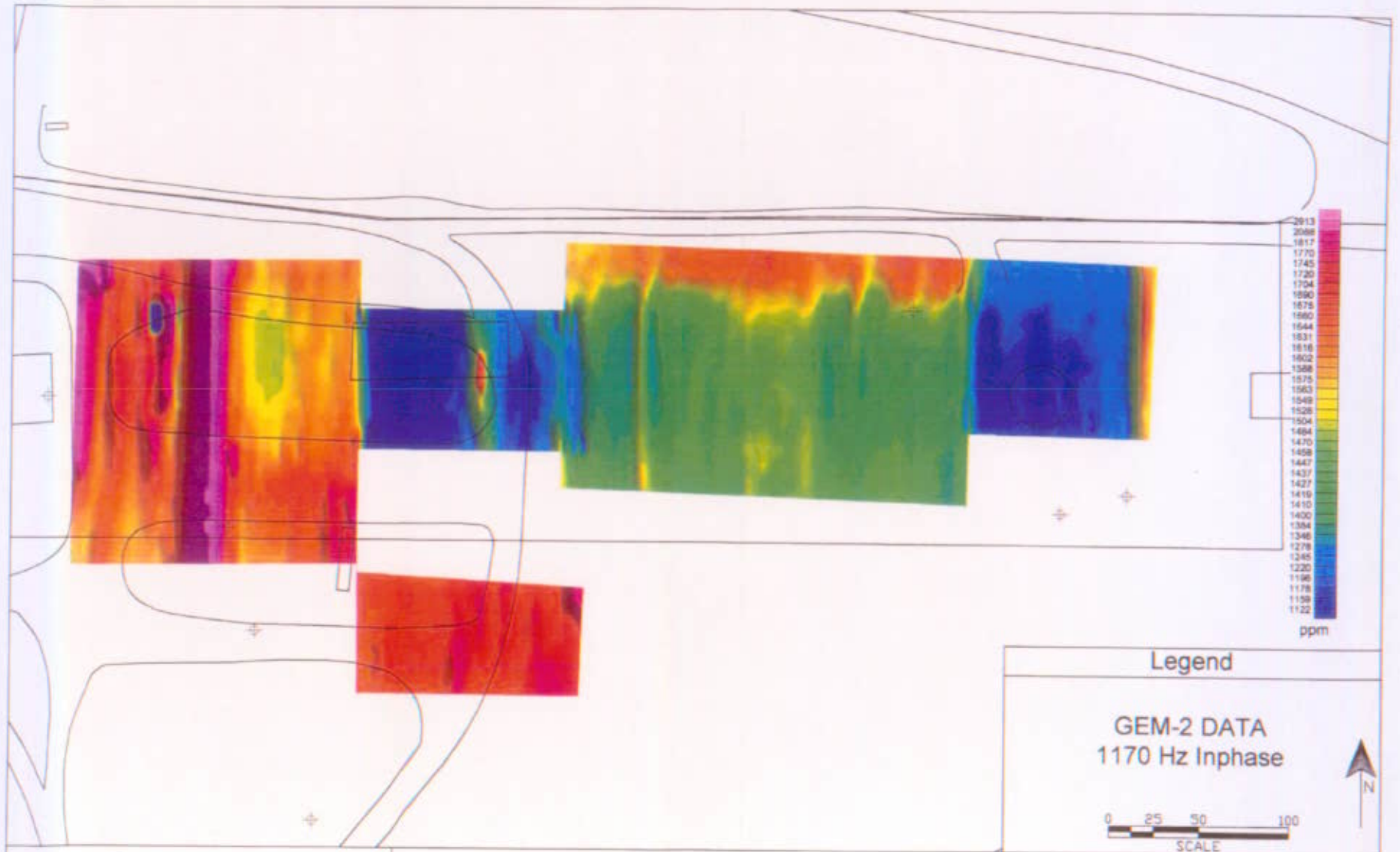
Job #: 1249	Date: 10/2003
Scale: 1"=150ft	Drawn By: CDL

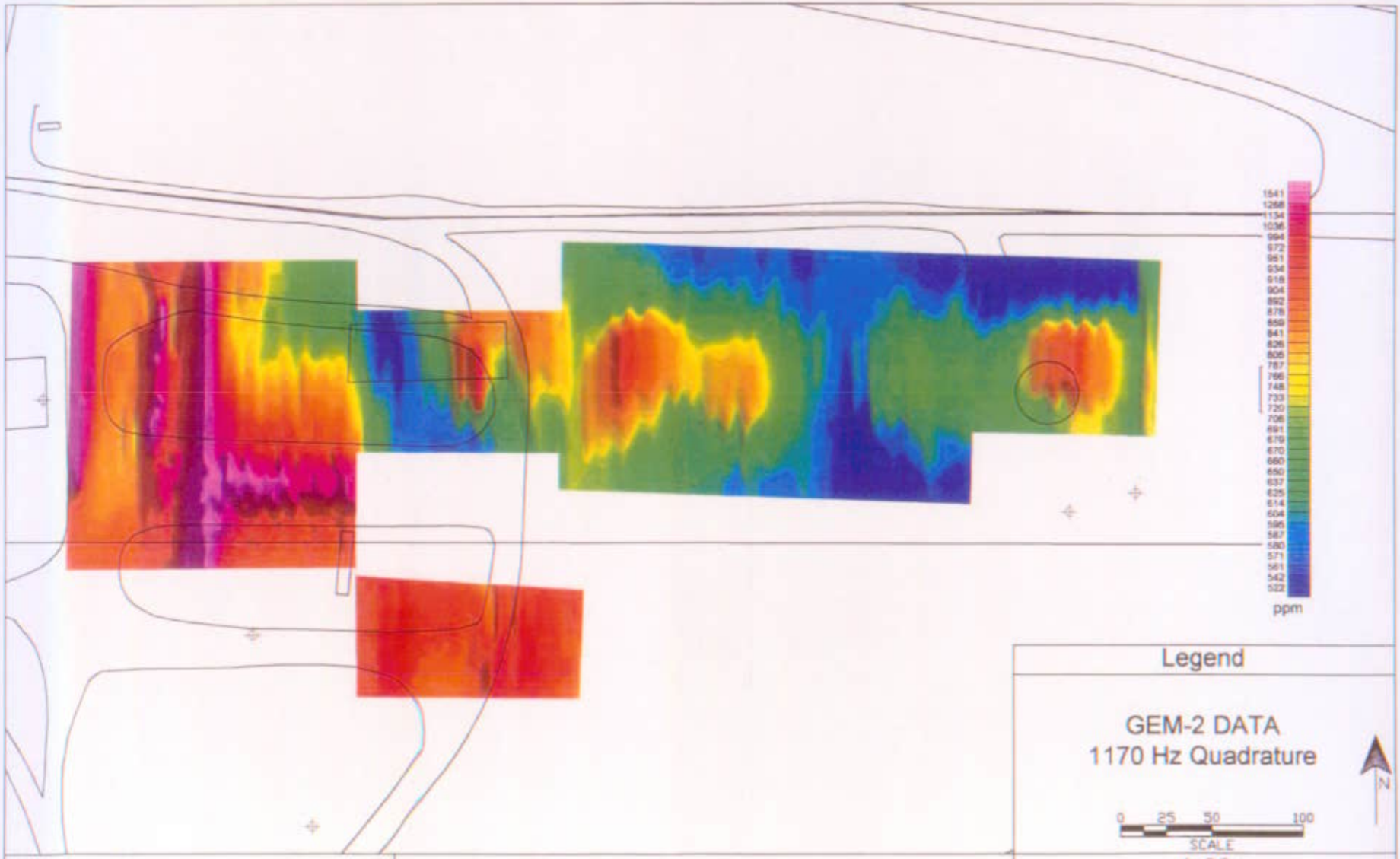

3923
3846
3769
3692
3615
3538
3462
3385
3308
3231
3154
3077
3000
2923
2846
2769
2692
2615
2538
2462
2385
2308
2231
2154
2077
2000
1923
1846
1769
1692
1615
1538
1462
1385
1308
1231
1154
1077
ppm
Legend
GEM-2 DATA
Quadrature Sum
N
0
25
50
100
SCALE
Geophex
-terrain et mine explosives-
DSC Richmond
Area OU7
A-18
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL


ppm
Legend
GEM-2 DATA
330 Hz Inphase
N
0 25 50 100
SCALE
Geophex
DSC Richmond
Area OU7
A-19
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL


ppm
Legend
GEM-2 DATA
330 Hz Quadrature
N
0 25 50 100
SCALE
Geophex
DSC Richmond
Area OU7
A-20
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL

869 726


2913
2088
1817
1770
1745
1720
1704
1690
1675
1660
1644
1631
1616
1602
1588
1575
1563
1549
1528
1504
1484
1470
1458
1447
1437
1427
1419
1410
1400
1384
1346
1278
1245
1220
1196
1178
1159
1122
ppm
Legend
GEM-2 DATA
1170 Hz Inphase
N
0 25 50 100
SCALE
Geophex
terrain et mare explorateurs
DSC Richmond
Area OU7
A-21
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL

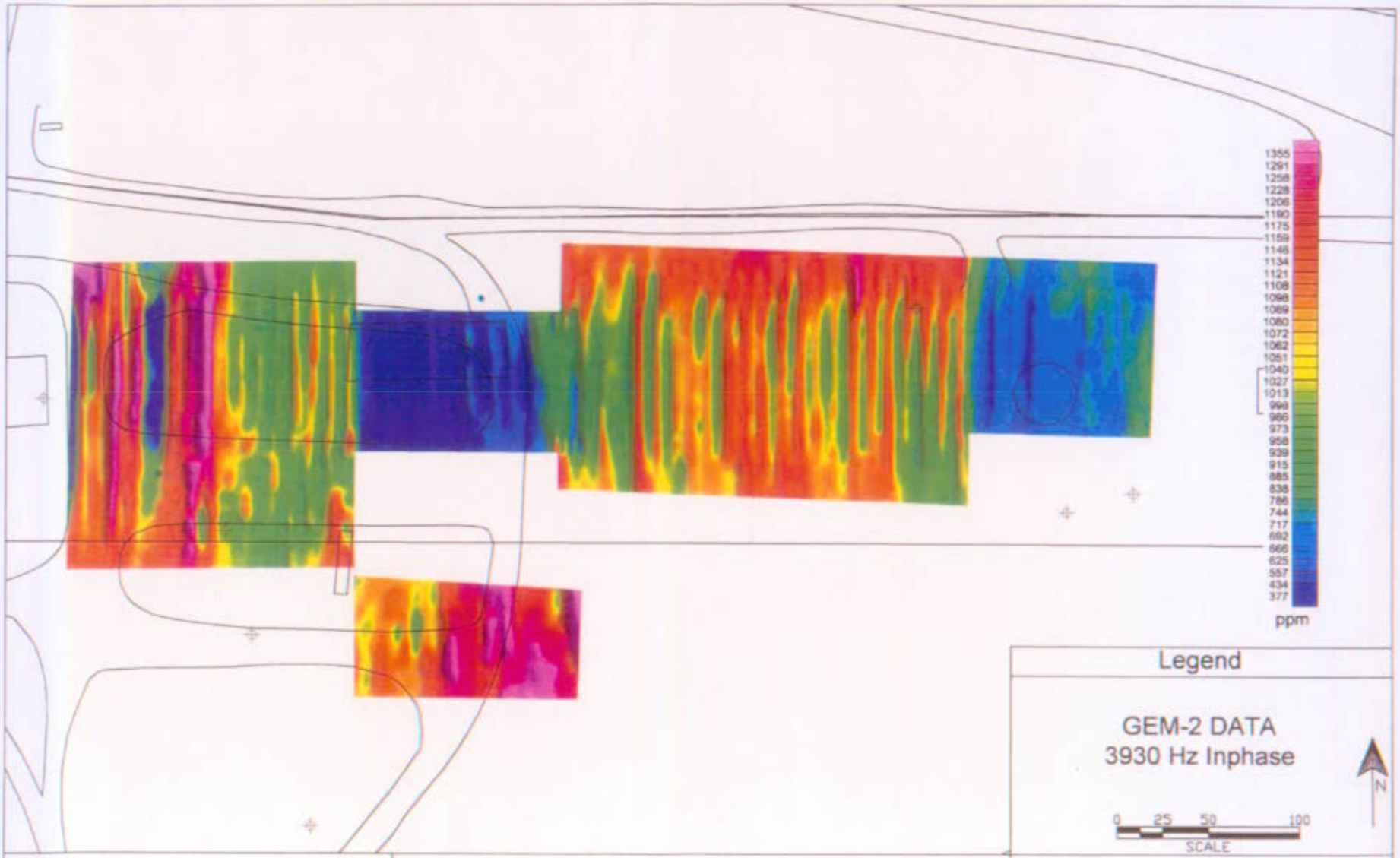


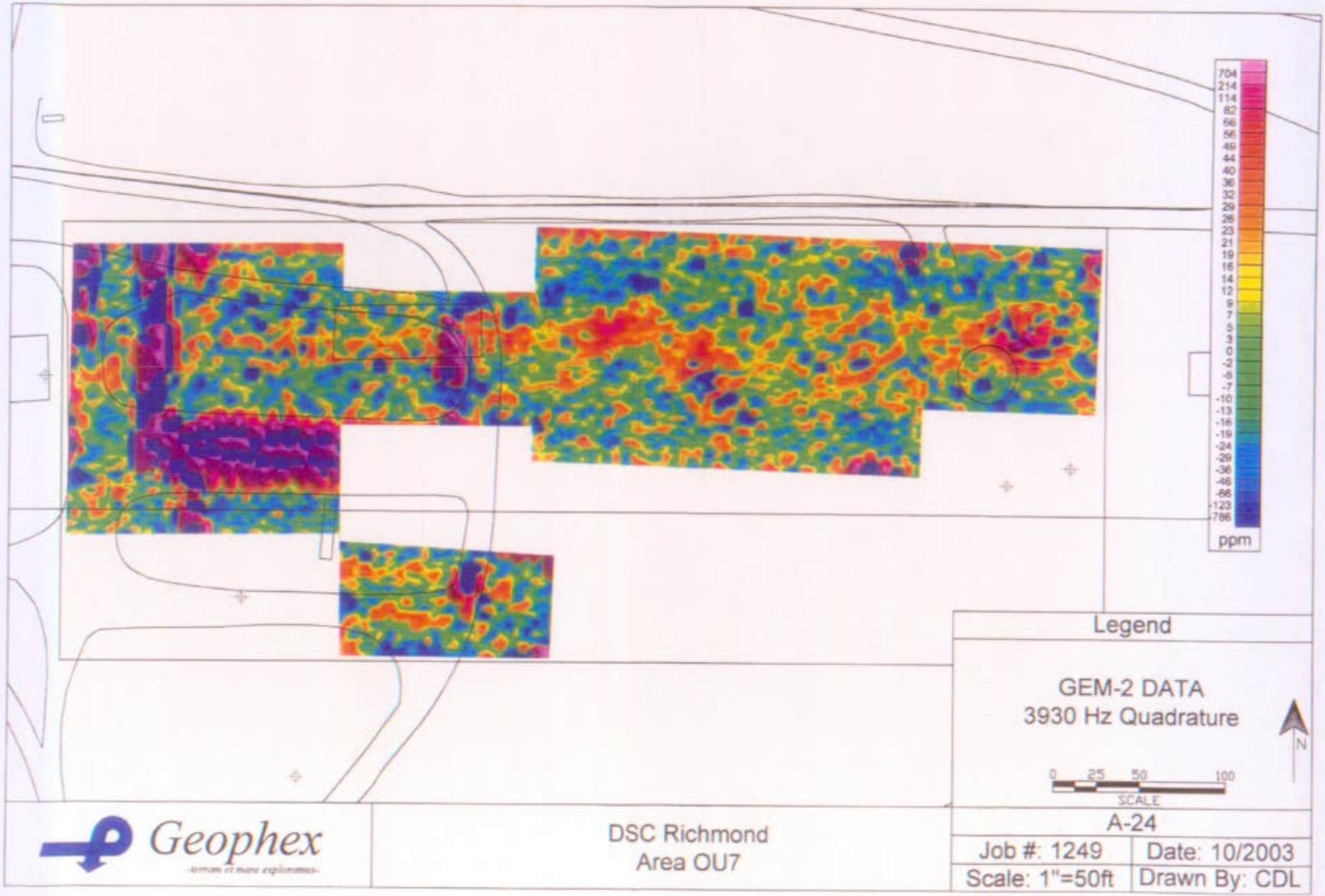
Geophex
-terrain et mare exploramus-

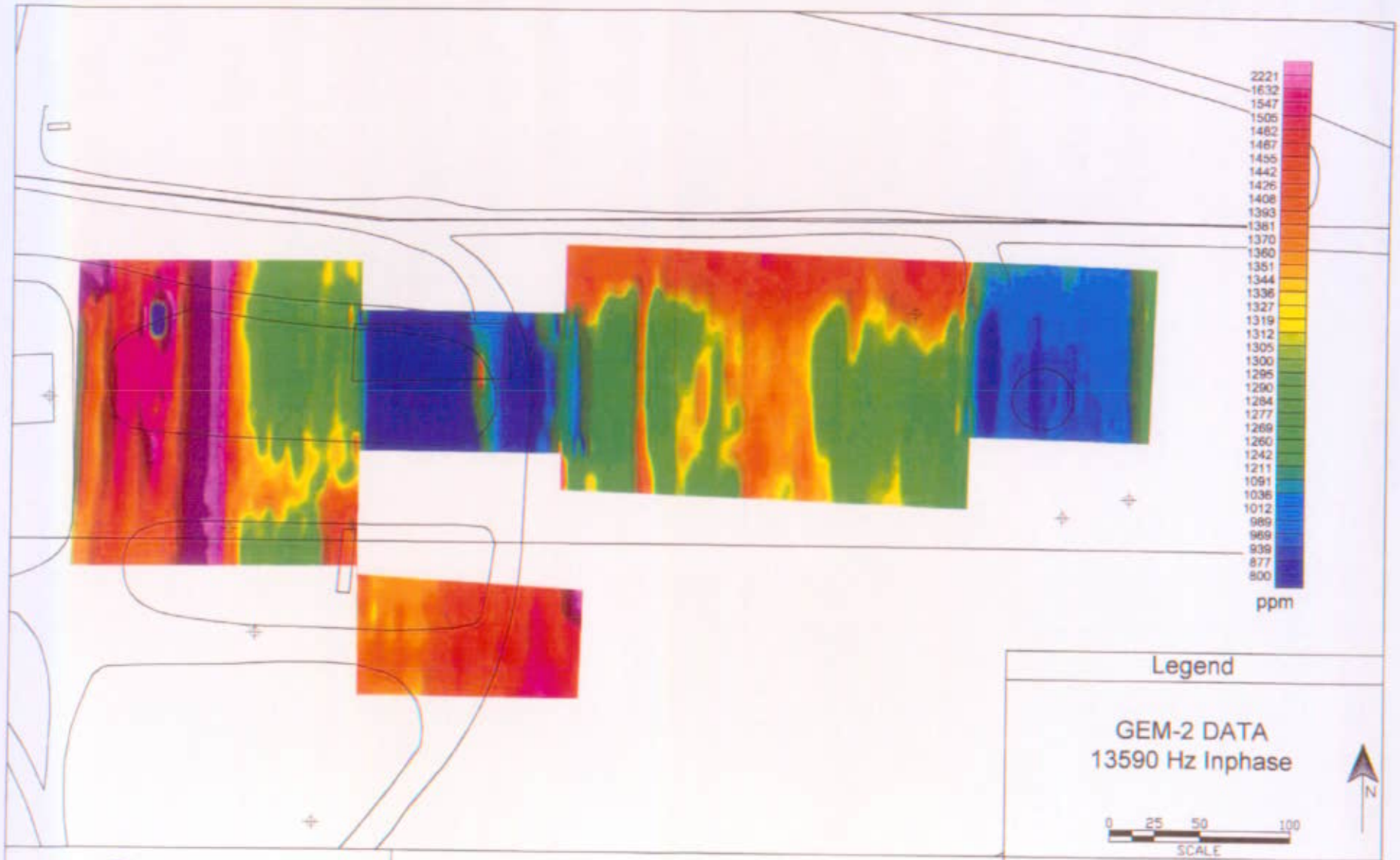
DSC Richmond
Area OU7

A-22

Job #: 1249	Date: 10/2003
Scale: 1"=50ft	Drawn By: CDL


1355
1291
1258
1228
1206
1190
1175
1159
1146
1134
1121
1108
1098
1089
1080
1072
1062
1051
1040
1027
1013
998
986
973
958
939
915
885
838
786
744
717
692
666
625
557
434
377
ppm
Legend
GEM-2 DATA
3930 Hz Inphase
N
0 25 50 100
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area OU7
A-23
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL


704
214
114
82
68
56
49
44
40
36
32
29
26
23
21
19
16
14
12
9
7
5
3
0
-2
-5
-7
-10
-13
-16
-19
-24
-29
-36
-46
-66
-123
-786
ppm
Legend
GEM-2 DATA
3930 Hz Quadrature
N
0 25 50 100
SCALE
Geophex
DSC Richmond
Area OU7
A-24
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL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1632
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1467
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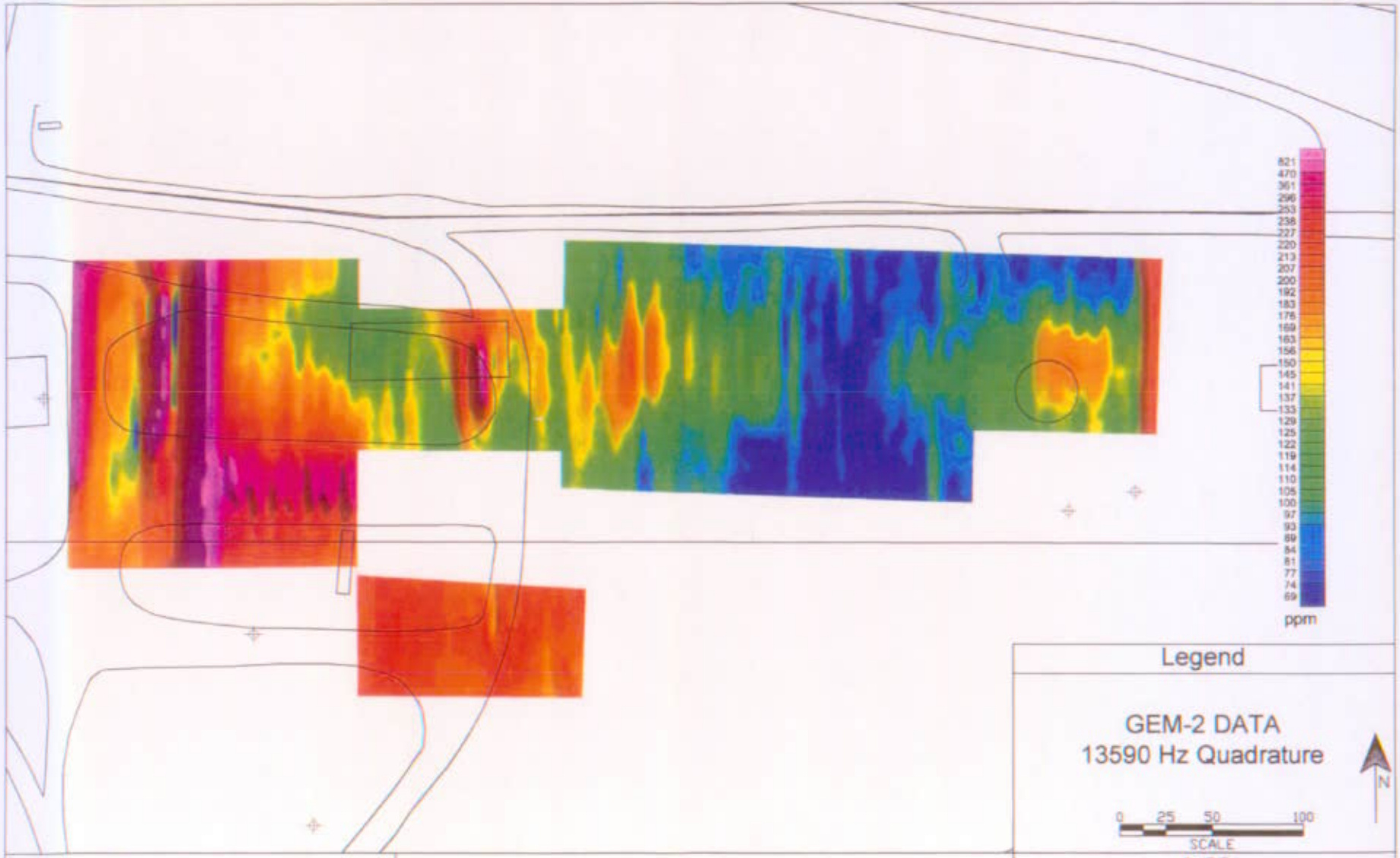
1408
1393
1381
1370
1360
1351
1344
1336
1327
1319
1312
1305
1300
1295
1290
1284
1277
1269
1260
1242
1211
1091
1036
1012
989
969
939
877
800
ppm
Legend
GEM-2 DATA
13590 Hz Inphase
N
0 25 50 100
SCALE
Geophex
DSC Richmond
Area OU7
A-25
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL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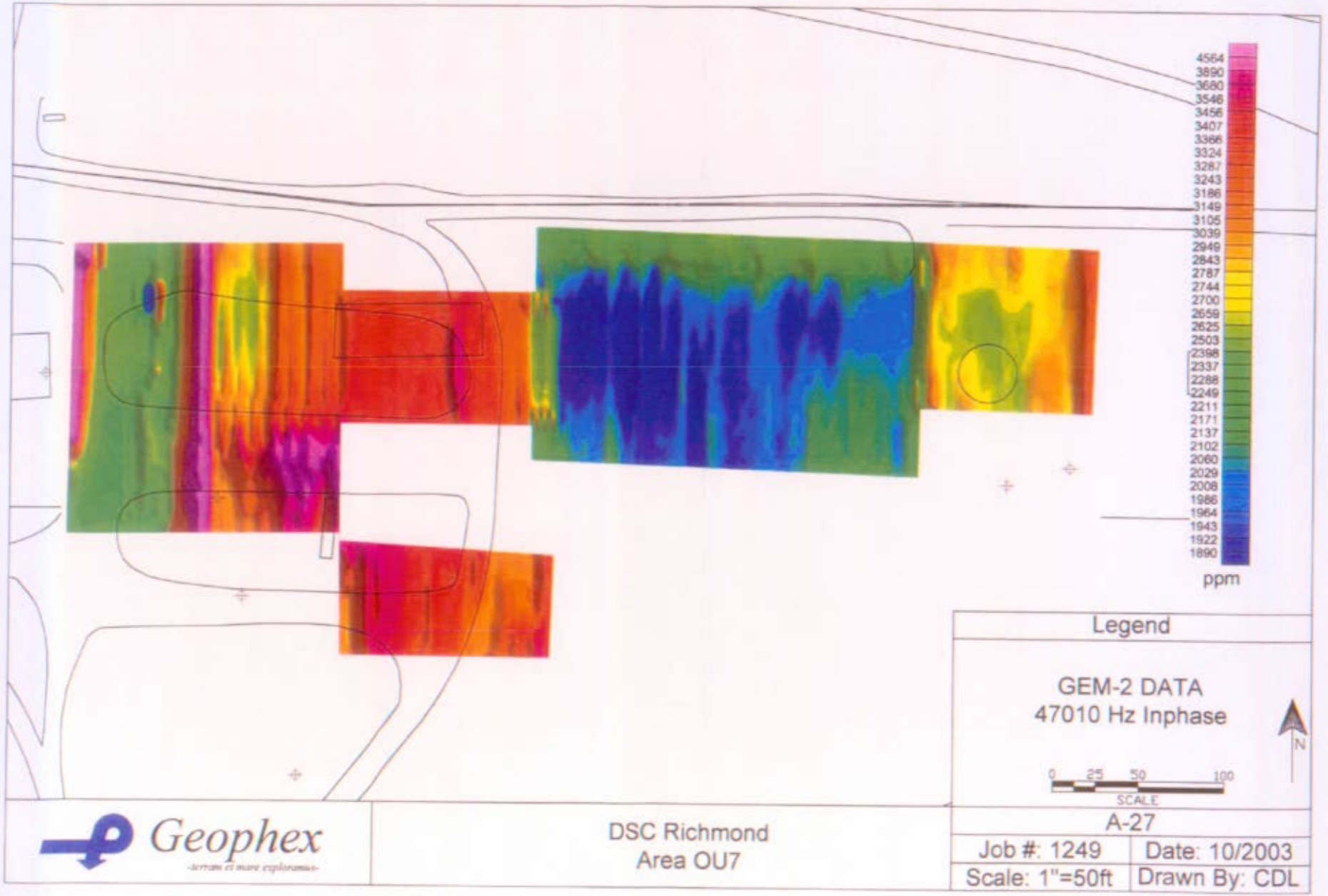
470
361
296
253
238
227
220
213
207
200
192
183
178
169
163
156
150
145
141
137
133
129
125
122
119
114
110
105
100
97
93
89
84
81
77
74
69
ppm
Legend
GEM-2 DATA
13590 Hz Quadrature
N
0 25 50 100
SCALE
Geophex
-terrain et mare explorarus-
DSC Richmond
Area OU7
A-26
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL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3890
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3546
3456
3407
3366
3324
3287
3243
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3149
3105
3039
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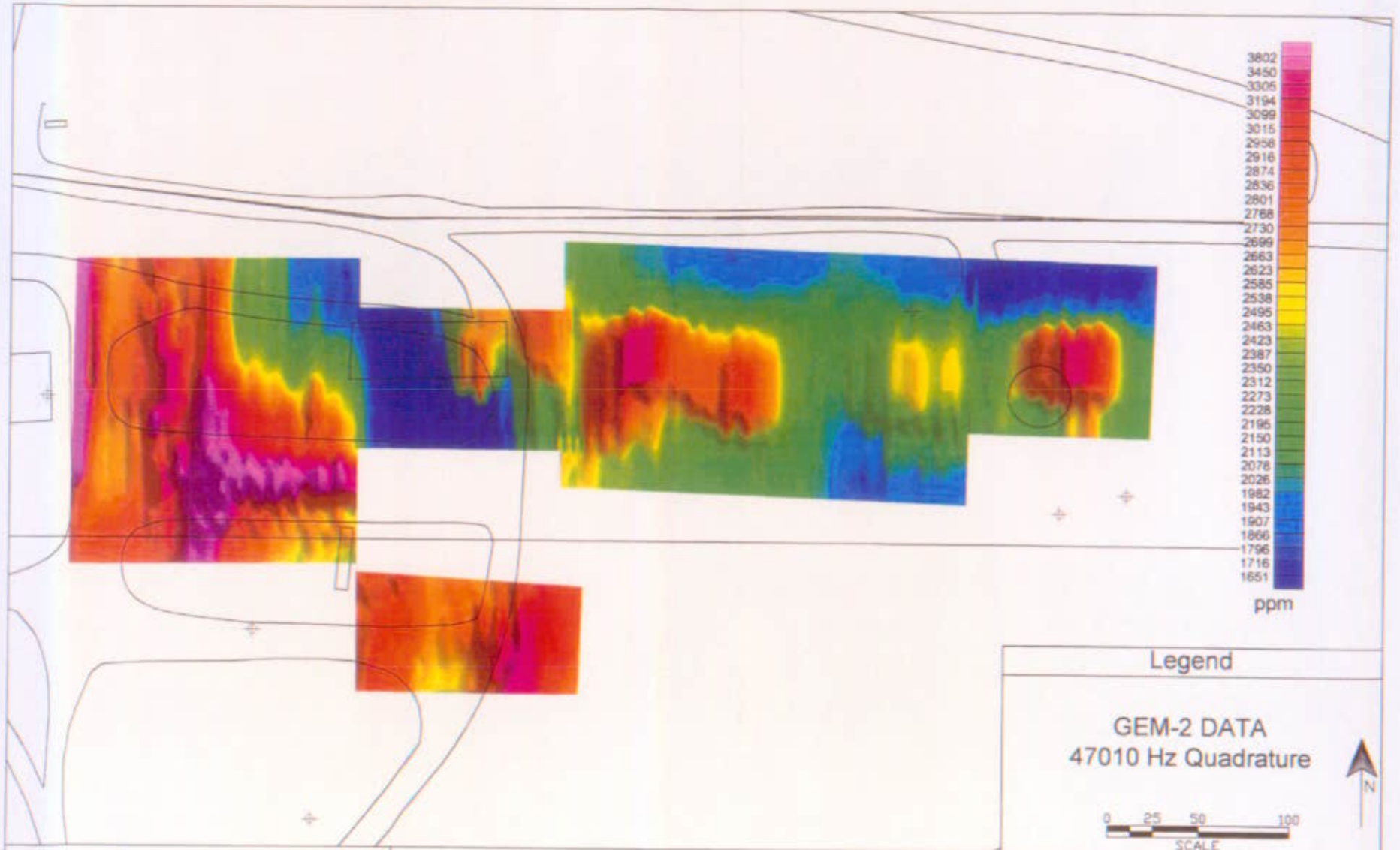
2787
2744
2700
2659
2625
2503
2398
2337
2288
2249
2211
2171
2137
2102
2060
2029
2008
1986
1964
1943
1922
1890
ppm
Legend
GEM-2 DATA
47010 Hz Inphase
N
0 25 50 100
SCALE
Geophex
DSC Richmond
Area OU7
A-27
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL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3305
3194
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3015
2958
2916
2874
2836
2801
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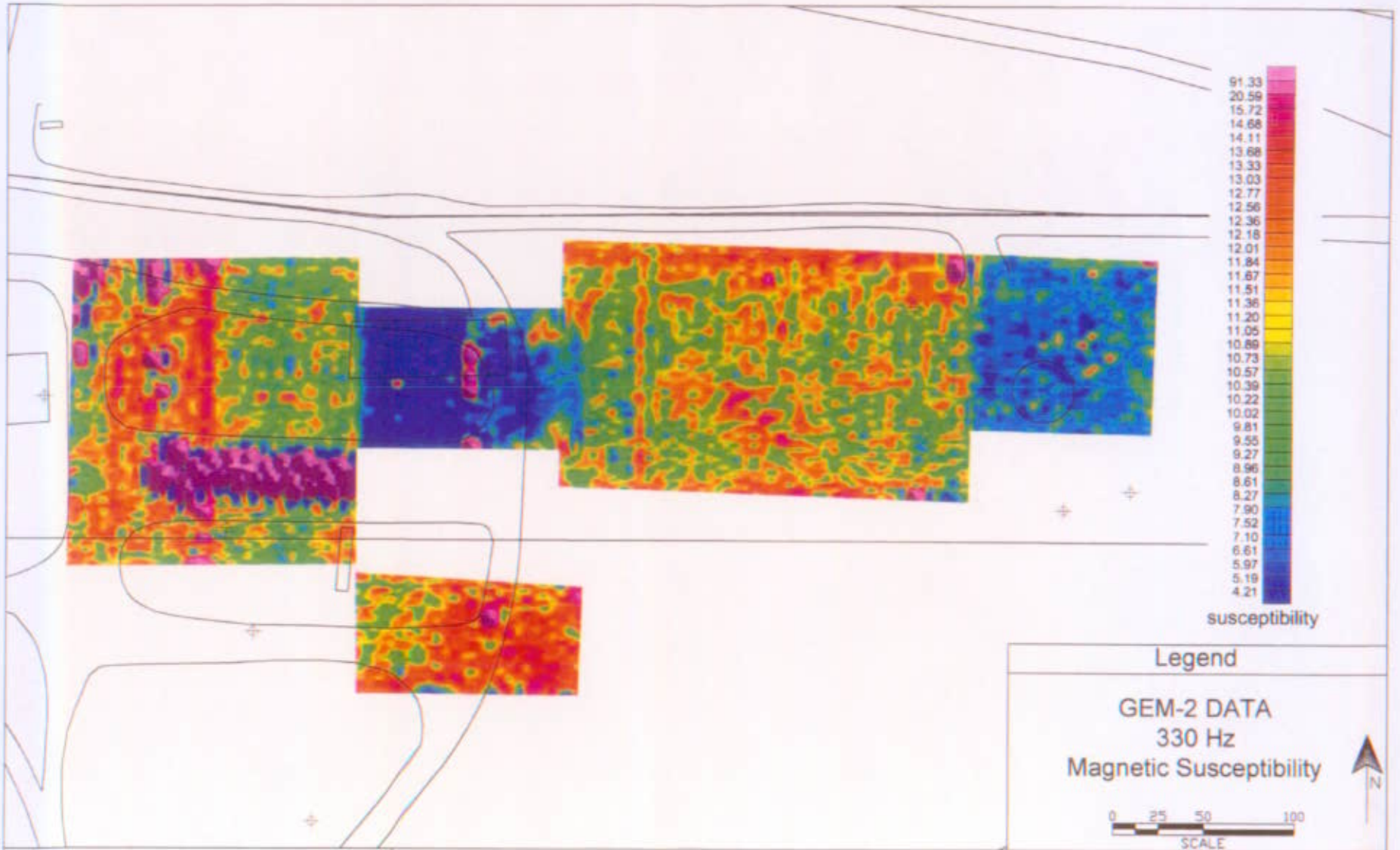
2730
2699
2663
2623
2585
2538
2495
2463
2423
2387
2350
2312
2273
2228
2196
2150
2113
2078
2026
1982
1943
1907
1866
1796
1716
1651
ppm
Legend
GEM-2 DATA
47010 Hz Quadrature
N
0 25 50 100
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area OU7
A-28
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL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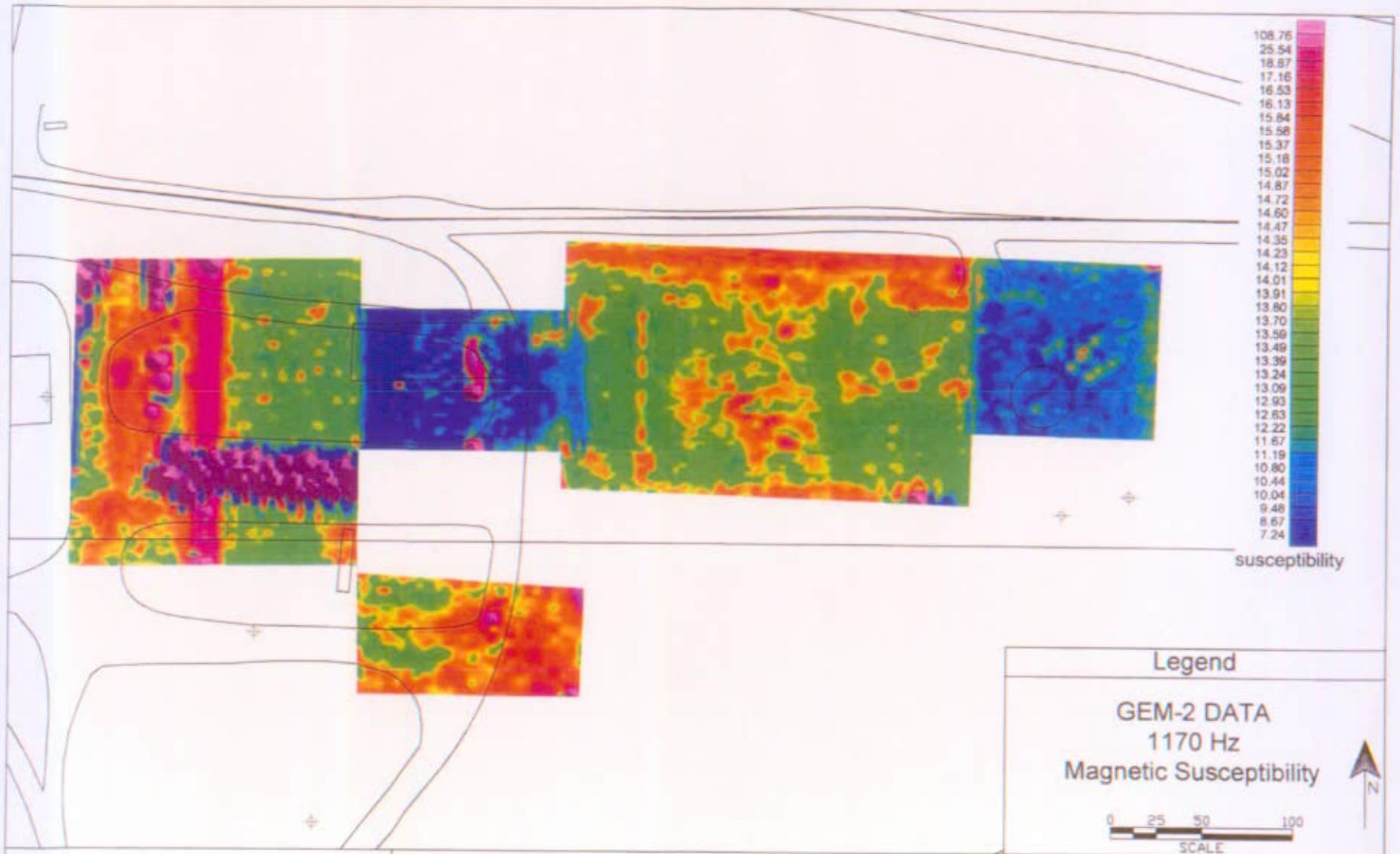
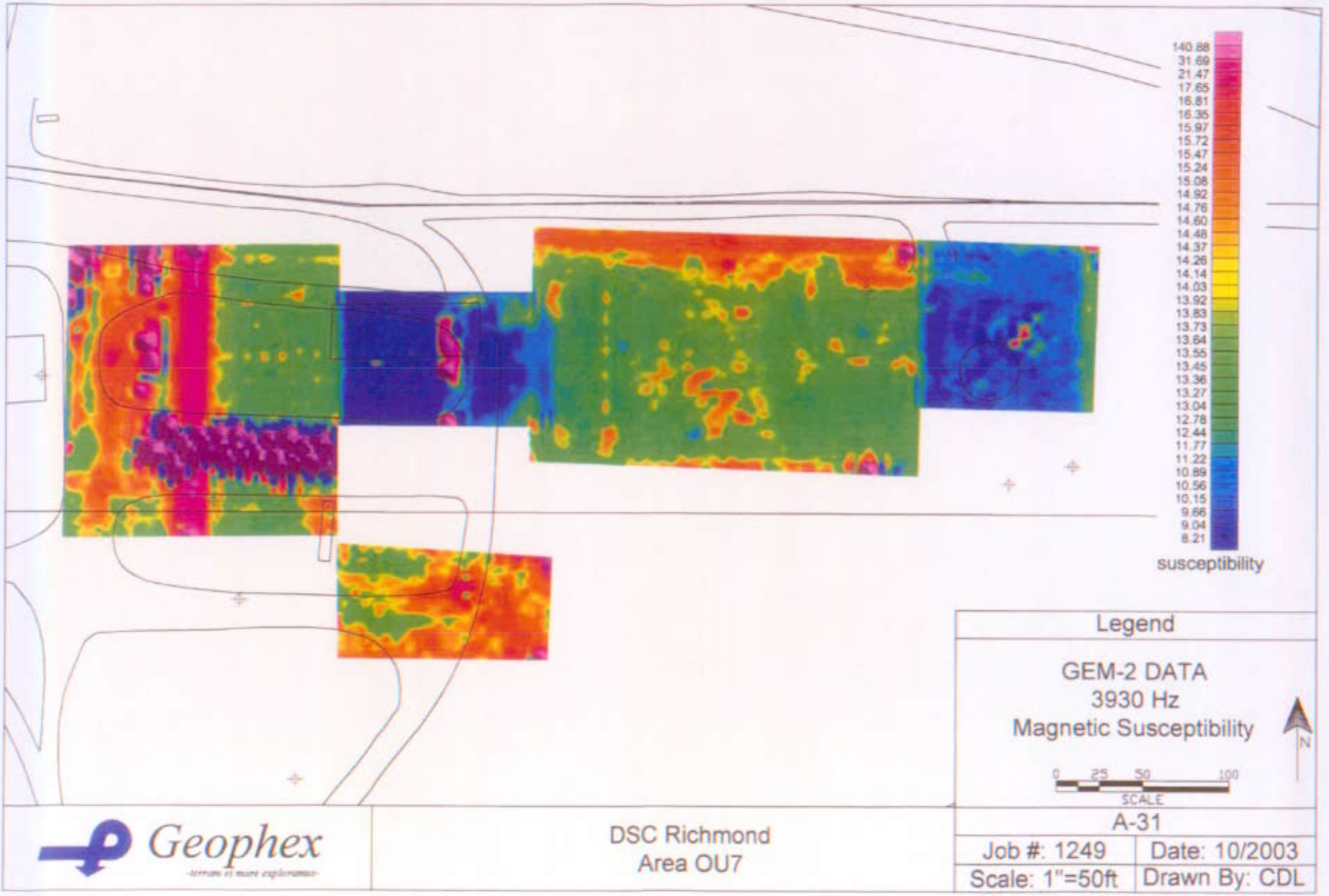
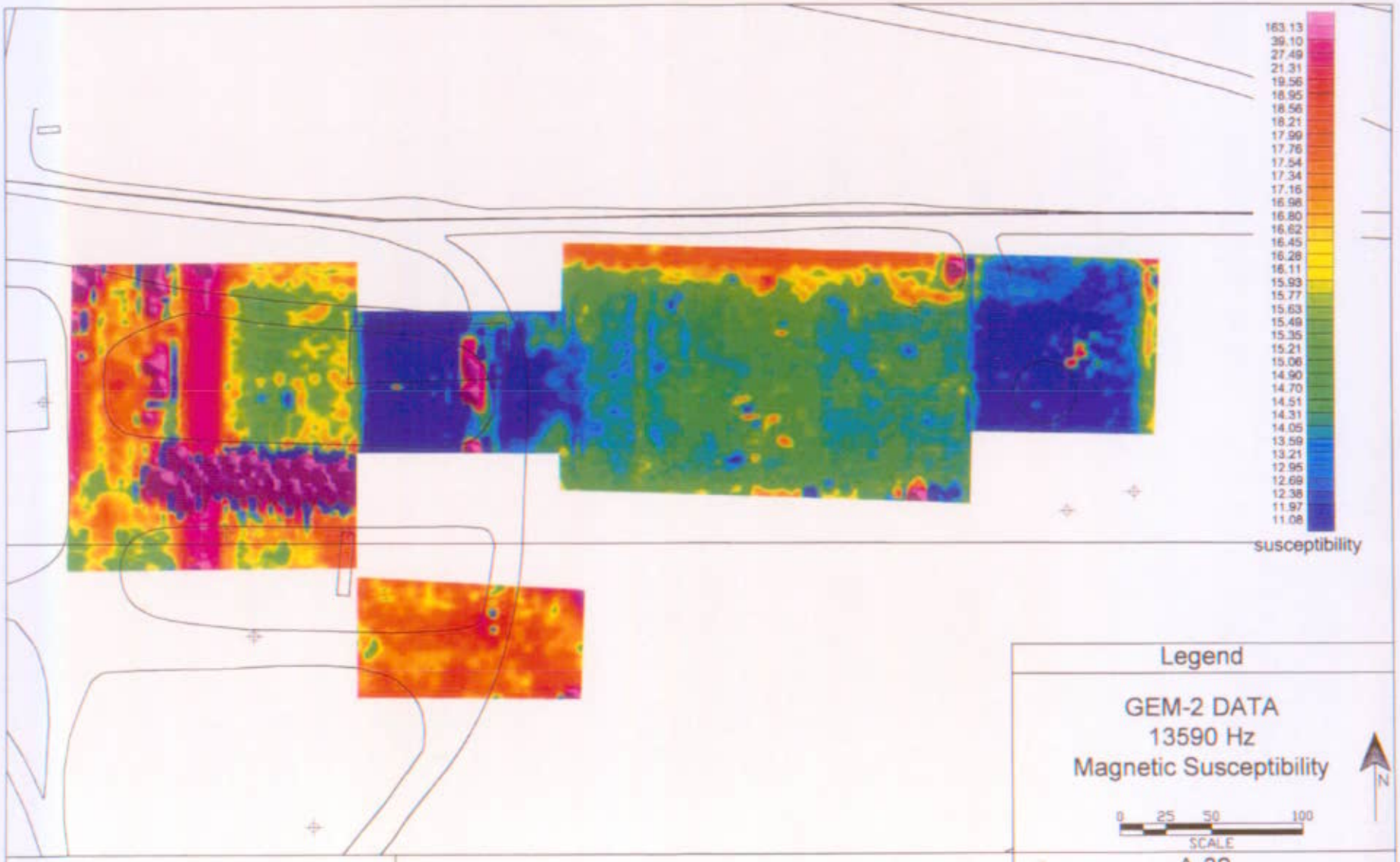
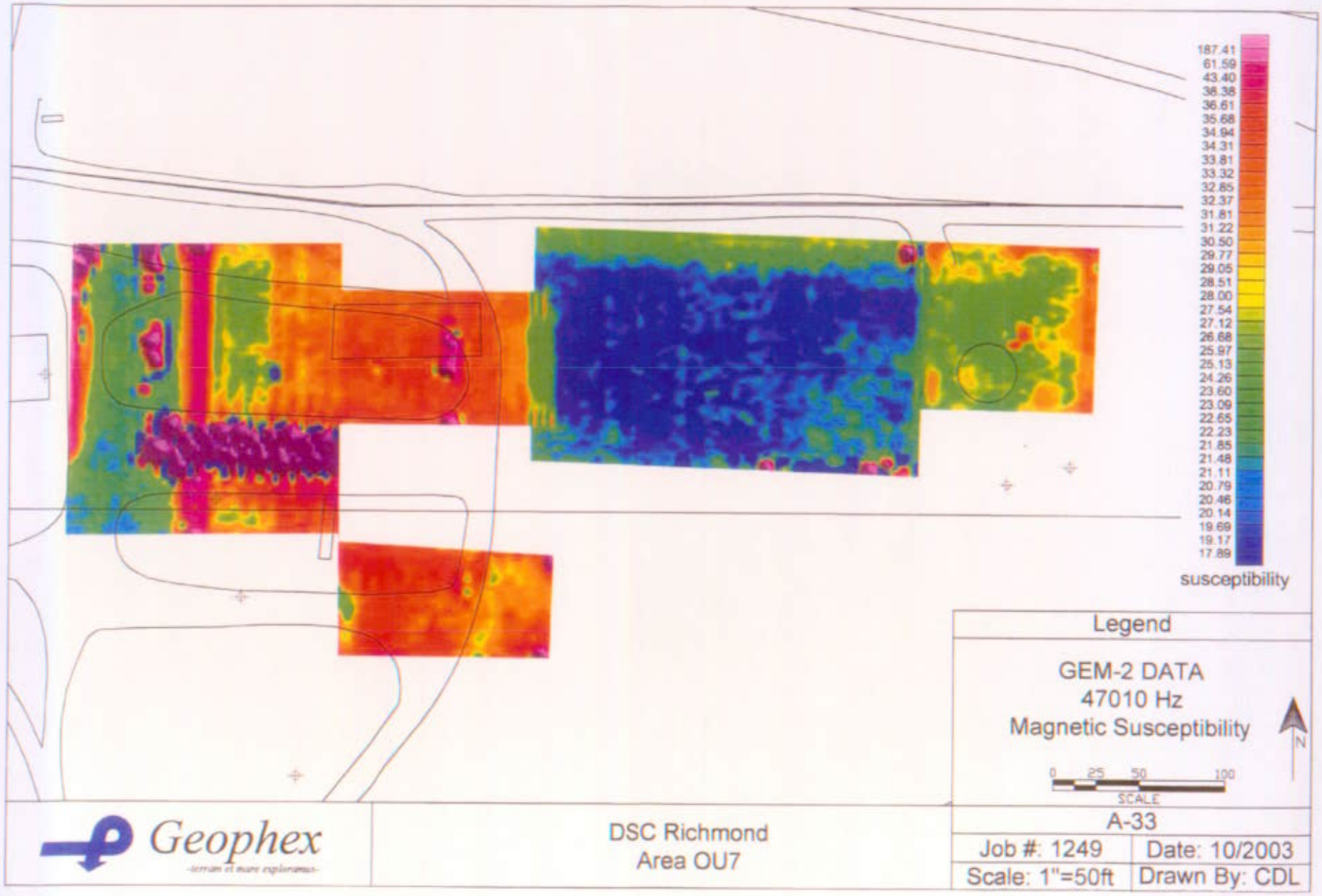
15.72
14.68
14.11
13.68
13.33
13.03
12.77
12.56
12.36
12.18
12.01
11.84
11.67
11.51
11.36
11.20
11.05
10.89
10.73
10.57
10.39
10.22
10.02
9.81
9.55
9.27
8.96
8.61
8.27
7.90
7.52
7.10
6.61
5.97
5.19
4.21
susceptibility
Legend
GEM-2 DATA
330 Hz
Magnetic Susceptibility
N
0 25 50 100
SCALE
Geophex
DSC Richmond
Area OU7
A-29
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL


108.76
25.54
18.87
17.16
16.53
16.13
15.84
15.58
15.37
15.18
15.02
14.87
14.72
14.60
14.47
14.35
14.23
14.12
14.01
13.91
13.80
13.70
13.59
13.49
13.39
13.24
13.09
12.93
12.63
12.22
11.67
11.19
10.80
10.44
10.04
9.48
8.67
7.24
susceptibility
Legend
GEM-2 DATA
1170 Hz
Magnetic Susceptibility
N
0 25 50 100
SCALE
Geophex
-terrain et more explained-
DSC Richmond
Area OU7
A-30
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL


140.88
31.69
21.47
17.65
16.81
16.35
15.97
15.72
15.47
15.24
15.08
14.92
14.76
14.60
14.48
14.37
14.26
14.14
14.03
13.92
13.83
13.73
13.64
13.55
13.45
13.36
13.27
13.04
12.78
12.44
11.77
11.22
10.89
10.56
10.15
9.66
9.04
8.21
susceptibility
Legend
GEM-2 DATA
3930 Hz
Magnetic Susceptibility
N
0
25
50
100
SCALE
Geophex
-terrain et more exploratus-
DSC Richmond
Area OU7
A-31
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL


163.13
39.10
27.49
21.31
19.56
18.95
18.56
18.21
17.99
17.76
17.54
17.34
17.16
16.98
16.80
16.62
16.45
16.28
16.11
15.93
15.77
15.63
15.49
15.35
15.21
15.06
14.90
14.70
14.51
14.31
14.05
13.59
13.21
12.95
12.69
12.38
11.97
11.08
susceptibility
Legend
GEM-2 DATA
13590 Hz
Magnetic Susceptibility
N
0 25 50 100
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area OU7
A-32
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL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61.59
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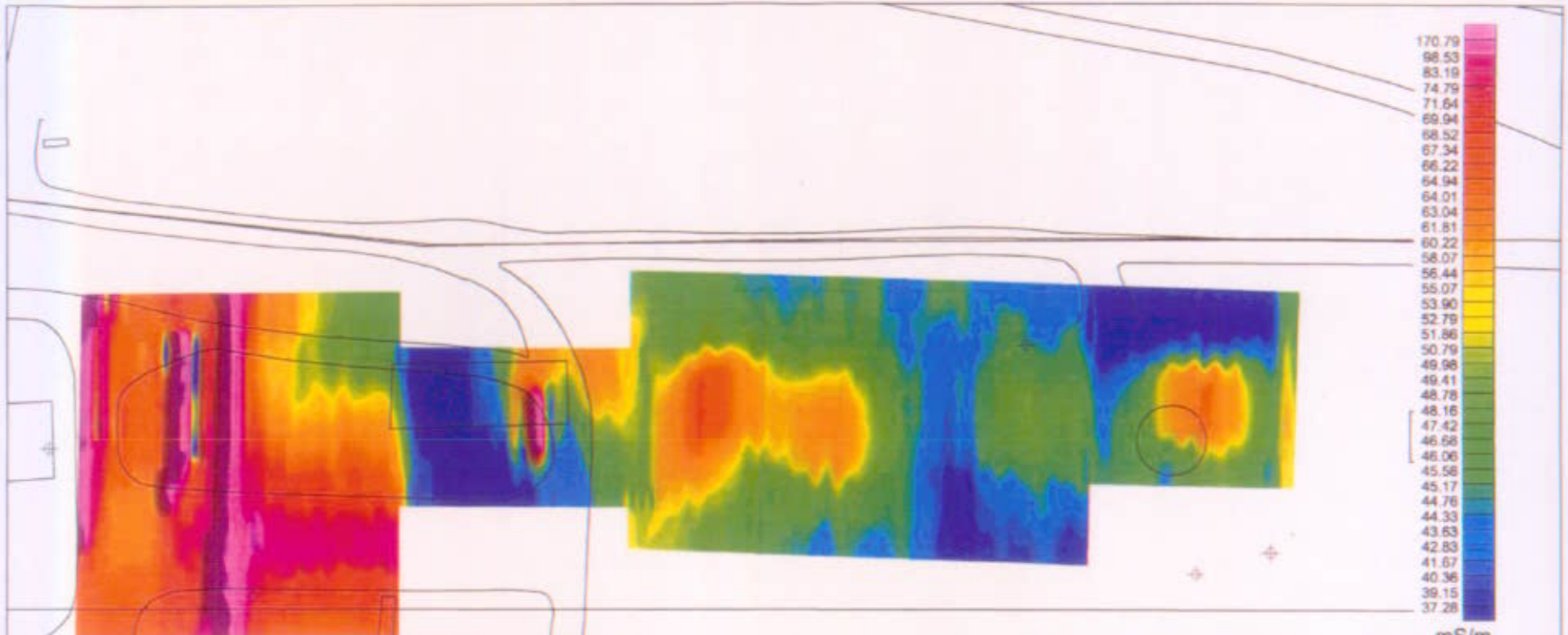
38.38
36.61
35.68
34.94
34.31
33.81
33.32
32.85
32.37
31.81
31.22
30.50
29.77
29.05
28.51
28.00
27.54
27.12
26.68
25.97
25.13
24.26
23.60
23.09
22.65
22.23
21.85
21.48
21.11
20.79
20.46
20.14
19.69
19.17
17.89
susceptibility
Legend
GEM-2 DATA
47010 Hz
Magnetic Susceptibility
N
0 25 50 100
SCALE
Geophex
-terram et mare exploramus-
DSC Richmond
Area OU7
A-33
Job #: 1249
Date: 10/2003
Scale: 1"=50ft
Drawn By: CDL



Legend

GEM-2 DATA
Total
Conductivity

0 25 50 100
SCALE

N

Geophex
-terrain et mure explorateur-

DSC Richmond
Area OU7

A-34

Job #: 1249	Date: 10/2003
Scale: 1"=50ft	Drawn By: CDL

869 740

Appendix B

REFRACTION DATA

Refraction Line 1 Arrival Times																					
Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)		
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9		Shot 10			
-0.0049	0.0079	-0.0049	0.0059	-0.0049	0.0329	-0.0049	0.0428	-0.0049	0.053	-0.0049	0.0587	-0.0049	0.0641	-0.0049	0.0665	-0.0049	0.0751	-0.0049	0.0809		
14.98676	0.0284	14.98676	0.0145	14.98676	0.0296	14.98676	0.0415	14.98676	0.0509	14.98676	0.0579	14.98676	0.0637	14.98676	0.0657	14.98676	0.0739	14.98676	0.0796		
29.98377	0.0329	29.98377	0.0235	29.98377	0.0255	29.98377	0.0403	29.98377	0.0501	29.98377	0.0575	29.98377	0.0632	29.98377	0.0645	29.98377	0.0731	29.98377	0.0792		
44.97843	0.0354	44.97843	0.0264	44.97843	0.0214	44.97843	0.0387	44.97843	0.0481	44.97843	0.0563	44.97843	0.0624	44.97843	0.0637	44.97843	0.0723	44.97843	0.0772		
59.97543	0.0374	59.97543	0.0292	59.97543	0.0169	59.97543	0.037	59.97543	0.046	59.97543	0.055	59.97543	0.062	59.97543	0.0628	59.97543	0.0718	59.97543	0.0768		
74.9751	0.0387	74.9751	0.0329	74.9751	0.005	74.9751	0.0341	74.9751	0.044	74.9751	0.0538	74.9751	0.0608	74.9751	0.0624	74.9751	0.071	74.9751	0.0759		
89.9751	0.0415	89.9751	0.035	89.9751	0.0182	89.9751	0.0296	89.9751	0.0436	89.9751	0.0534	89.9751	0.0604	89.9751	0.062	89.9751	0.0706	89.9751	0.0755		
104.9721	0.0428	104.9721	0.037	104.9721	0.0227	104.9721	0.0268	104.9721	0.0415	104.9721	0.053	104.9721	0.06	104.9721	0.0612	104.9721	0.0698	104.9721	0.0739		
119.9668	0.0432	119.9668	0.0378	119.9668	0.0243	119.9668	0.0247	119.9668	0.0391	119.9668	0.0518	119.9668	0.0596	119.9668	0.06	119.9668	0.0688	119.9668	0.0731		
134.9584	0.0436	134.9584	0.0403	134.9584	0.028	134.9584	0.0214	134.9584	0.0382	134.9584	0.0509	134.9584	0.0587	134.9584	0.0591	134.9584	0.0682	134.9584	0.0723		
149.9571	0.0456	149.9571	0.044	149.9571	0.0305	149.9571	0.019	149.9571	0.0366	149.9571	0.0505	149.9571	0.0579	149.9571	0.0587	149.9571	0.0678	149.9571	0.0718		
164.9558	0.0473	164.9558	0.0448	164.9558	0.0346	164.9558	0.0055	164.9558	0.035	164.9558	0.0497	164.9558	0.0567	164.9558	0.0583	164.9558	0.0669	164.9558	0.0714		
179.9544	0.0481	179.9544	0.0452	179.9544	0.0362	179.9544	0.0141	179.9544	0.0309	179.9544	0.0464	179.9544	0.055	179.9544	0.0567	179.9544	0.0649	179.9544	0.0706		
194.9541	0.0501	194.9541	0.046	194.9541	0.0378	194.9541	0.0186	194.9541	0.0255	194.9541	0.0444	194.9541	0.0546	194.9541	0.0555	194.9541	0.0641	194.9541	0.0698		
209.9541	0.0509	209.9541	0.0477	209.9541	0.0403	209.9541	0.0239	209.9541	0.0231	209.9541	0.0411	209.9541	0.053	209.9541	0.0546	209.9541	0.0632	209.9541	0.0682		
224.9511	0.0518	224.9511	0.0493	224.9511	0.0415	224.9511	0.0284	224.9511	0.0198	224.9511	0.0382	224.9511	0.0518	224.9511	0.053	224.9511	0.0624	224.9511	0.0678		
239.9498	0.0538	239.9498	0.0505	239.9498	0.0428	239.9498	0.0313	239.9498	0.0145	239.9498	0.0362	239.9498	0.0505	239.9498	0.0526	239.9498	0.0612	239.9498	0.0665		
254.9484	0.0542	254.9484	0.0505	254.9484	0.0444	254.9484	0.0329	254.9484	0.0067	254.9484	0.0329	254.9484	0.0473	254.9484	0.0509	254.9484	0.06	254.9484	0.0649		
269.9481	0.055	269.9481	0.0514	269.9481	0.0452	269.9481	0.0354	269.9481	0.0124	269.9481	0.0305	269.9481	0.046	269.9481	0.0501	269.9481	0.0587	269.9481	0.0641		
284.9481	0.0559	284.9481	0.0538	284.9481	0.0464	284.9481	0.0374	284.9481	0.0198	284.9481	0.0255	284.9481	0.0444	284.9481	0.0485	284.9481	0.0583	284.9481	0.0632		
299.9467	0.0567	299.9467	0.055	299.9467	0.0477	299.9467	0.0407	299.9467	0.028	299.9467	0.0194	299.9467	0.0419	299.9467	0.0481	299.9467	0.0579	299.9467	0.0628		
314.9454	0.0583	314.9454	0.0555	314.9454	0.0489	314.9454	0.0419	314.9454	0.0288	314.9454	0.0157	314.9454	0.0403	314.9454	0.0473	314.9454	0.0575	314.9454	0.062		
329.9441	0.0608	329.9441	0.0583	329.9441	0.0514	329.9441	0.0456	329.9441	0.0321	329.9441	0.0104	329.9441	0.0374	329.9441	0.0468	329.9441	0.0571	329.9441	0.0618		
344.9438	0.0612	344.9438	0.0587	344.9438	0.053	344.9438	0.0468	344.9438	0.0346	344.9438	0.0063	344.9438	0.035	344.9438	0.0456	344.9438	0.0563	344.9438	0.0612		
359.9354	0.0616	359.9354	0.0591	359.9354	0.0538	359.9354	0.0485	359.9354	0.037	359.9354	0.0137	359.9354	0.0325	359.9354	0.0428	359.9354	0.0546	359.9354	0.0604		
374.9341	0.0637	374.9341	0.0596	374.9341	0.0542	374.9341	0.0493	374.9341	0.0395	374.9341	0.019	374.9341	0.0276	374.9341	0.0411	374.9341	0.0542	374.9341	0.0596		
389.9287	0.0645	389.9287	0.0604	389.9287	0.055	389.9287	0.0505	389.9287	0.0411	389.9287	0.0223	389.9287	0.0235	389.9287	0.0399	389.9287	0.0538	389.9287	0.0591		
404.9258	0.0657	404.9258	0.0608	404.9258	0.0555	404.9258	0.0518	404.9258	0.0428	404.9258	0.0251	404.9258	0.021	404.9258	0.0362	404.9258	0.053	404.9258	0.0579		
419.9228	0.0661	419.9228	0.0616	419.9228	0.0559	419.9228	0.0526	419.9228	0.0444	419.9228	0.0309	419.9228	0.0182	419.9228	0.0346	419.9228	0.0518	419.9228	0.0571		
434.9174	0.0665	434.9174	0.0624	434.9174	0.0567	434.9174	0.0534	434.9174	0.046	434.9174	0.0358	434.9174	0.0104	434.9174	0.0317	434.9174	0.0501	434.9174	0.0567		
449.9054	0.0673	449.9054	0.0632	449.9054	0.0575	449.9054	0.0538	449.9054	0.0485	449.9054	0.0403	449.9054	0.0165	449.9054	0.0309	449.9054	0.0493	449.9054	0.0559		
464.9024	0.0682	464.9024	0.0637	464.9024	0.0587	464.9024	0.0546	464.9024	0.0497	464.9024	0.0411	464.9024	0.0202	464.9024	0.0288	464.9024	0.0473	464.9024	0.055		
479.9024	0.0698	479.9024	0.0649	479.9024	0.0604	479.9024	0.055	479.9024	0.0509	479.9024	0.0428	479.9024	0.0259	479.9024	0.0259	479.9024	0.046	479.9024	0.0538		
494.9021	0.0714	494.9021	0.0673	494.9021	0.0612	494.9021	0.0575	494.9021	0.0518	494.9021	0.0456	494.9021	0.0321	494.9021	0.0227	494.9021	0.0436	494.9021	0.0514		
509.8991	0.0723	509.8991	0.0682	509.8991	0.062	509.8991	0.0579	509.8991	0.0522	509.8991	0.0464	509.8991	0.0346	509.8991	0.0132	509.8991	0.0407	509.8991	0.0501		
524.8961	0.0727	524.8961	0.0678	524.8961	0.0624	524.8961	0.0583	524.8961	0.0526	524.8961	0.0473	524.8961	0.0362	524.8961	0.0059	524.8961	0.0362	524.8961	0.0456		
539.8961	0.0735	539.8961	0.0682	539.8961	0.0628	539.8961	0.0591	539.8961	0.0534	539.8961	0.0481	539.8961	0.0382	539.8961	0.0091	539.8961	0.0341	539.8961	0.0428		
554.8958	0.0739	554.8958	0.069	554.8958	0.0641	554.8958	0.0608	554.8958	0.0546	554.8958	0.0505	554.8958	0.0423	554.8958	0.0173	554.8958	0.0317	554.8958	0.0411		
569.8837	0.0751	569.8837	0.0706	569.8837	0.0653	569.8837	0.062	569.8837	0.0559	569.8837	0.0518	569.8837	0.044	569.8837	0.0243	569.8837	0.03	569.8837	0.0403		
584.8834	0.0759	584.8834	0.0718	584.8834	0.0657	584.8834	0.0624	584.8834	0.0567	584.8834	0.0522	584.8834	0.0452	584.8834	0.0276	584.8834	0.0272	584.8834	0.0382		
599.8834	0.0772	599.8834	0.0731	599.8834	0.0665	599.8834	0.0628	599.8834	0.0583	599.8834	0.0538	599.8834	0.0485	599.8834	0.0317	599.8834	0.0243	599.8834	0.0346		
614.8831	0.0784	614.8831	0.0735	614.8831	0.069	614.8831	0.0637	614.8831	0.0587	614.8831	0.0546	614.8831	0.0501	614.8831	0.0325	614.8831	0.0186	614.8831	0.0325		
629.8828	0.0788	629.8828	0.0739	629.8828	0.0694	629.8828	0.0649	629.8828	0.06	629.8828	0.0555	629.8828	0.0514	629.8828	0.0337	629.8828	0.0083	629.8828	0.0305		
644.8798	0.0792	644.8798	0.0743	644.8798	0.0698	644.8798	0.0657	644.8798	0.0608	644.8798	0.0563	644.8798	0.053	644.8798	0.0354	644.8798	0.005	644.8798	0.0108		
																					B-1

Refraction Line 2 Arrival Times

Dist. (ft) Shot 1	Arrival (s)	Dist. (ft) Shot 2	Arrival (s)	Dist. (ft) Shot 3	Arrival (s)	Dist. (ft) Shot 4	Arrival (s)	Dist. (ft) Shot 5	Arrival (s)	Dist. (ft) Shot 6	Arrival (s)	Dist. (ft) Shot 7	Arrival (s)	Dist. (ft) Shot 8	Arrival (s)	Dist. (ft) Shot 9	Arrival (s)	Dist. (ft) Shot 10	Arrival (s)	Dist. (ft) Shot 11	Arrival (s)
-0.04002	0.0202	-0.04002	0.0034	-0.04002	0.0259	-0.04002	0.0387	-0.04002	0.0452	-0.04002	0.0501	-0.04002	0.0571	-0.04002	0.062	-0.04002	0.0689	-0.04002	0.0743	-0.04002	0.0755
14.95165	0.0231	14.95165	0.0149	14.95165	0.021	14.95165	0.0374	14.95165	0.0448	14.95165	0.0497	14.95165	0.0567	14.95165	0.0612	14.95165	0.0661	14.95165	0.0735	14.95165	0.0751
29.94331	0.0259	29.94331	0.0173	29.94331	0.0198	29.94331	0.0366	29.94331	0.044	29.94331	0.0489	29.94331	0.0559	29.94331	0.0608	29.94331	0.0657	29.94331	0.0731	29.94331	0.0743
44.93498	0.0284	44.93498	0.0194	44.93498	0.0182	44.93498	0.0354	44.93498	0.0432	44.93498	0.0481	44.93498	0.0548	44.93498	0.0604	44.93498	0.0653	44.93498	0.0723	44.93498	0.0731
59.93364	0.0309	59.93364	0.0231	59.93364	0.0098	59.93364	0.0329	59.93364	0.0432	59.93364	0.0477	59.93364	0.0542	59.93364	0.0596	59.93364	0.0649	59.93364	0.0714	59.93364	0.0727
74.92531	0.0325	74.92531	0.0255	74.92531	0.0046	74.92531	0.03	74.92531	0.0423	74.92531	0.0468	74.92531	0.0534	74.92531	0.0591	74.92531	0.0641	74.92531	0.0706	74.92531	0.0723
89.92231	0.0333	89.92231	0.0276	89.92231	0.0112	89.92231	0.0259	89.92231	0.0399	89.92231	0.046	89.92231	0.0518	89.92231	0.0583	89.92231	0.0632	89.92231	0.0686	89.92231	0.0698
104.917	0.0337	104.917	0.03	104.917	0.0132	104.917	0.0239	104.917	0.0366	104.917	0.0423	104.917	0.0497	104.917	0.0559	104.917	0.062	104.917	0.0678	104.917	0.069
119.9086	0.0359	119.9086	0.0325	119.9086	0.021	119.9086	0.0227	119.9086	0.0354	119.9086	0.0415	119.9086	0.0489	119.9086	0.0546	119.9086	0.0604	119.9086	0.0669	119.9086	0.0682
134.9056	0.0366	134.9056	0.0341	134.9056	0.0259	134.9056	0.0132	134.9056	0.0333	134.9056	0.0411	134.9056	0.0481	134.9056	0.0542	134.9056	0.0596	134.9056	0.0665	134.9056	0.0678
149.9003	0.0382	149.9003	0.0354	149.9003	0.0305	149.9003	0.0071	149.9003	0.0317	149.9003	0.0407	149.9003	0.0477	149.9003	0.0542	149.9003	0.0591	149.9003	0.0657	149.9003	0.0673
164.899	0.0399	164.899	0.0387	164.899	0.0333	164.899	0.0063	164.899	0.0276	164.899	0.0403	164.899	0.0473	164.899	0.0534	164.899	0.0587	164.899	0.0649	164.899	0.0689
179.896	0.0419	179.896	0.0407	179.896	0.035	179.896	0.012	179.896	0.0214	179.896	0.0399	179.896	0.0468	179.896	0.053	179.896	0.0583	179.896	0.0645	179.896	0.0685
194.8956	0.0444	194.8956	0.0428	194.8956	0.0382	194.8956	0.0169	194.8956	0.0165	194.8956	0.0395	194.8956	0.0464	194.8956	0.0526	194.8956	0.0579	194.8956	0.0641	194.8956	0.0661
209.8926	0.0456	209.8926	0.044	209.8926	0.0407	209.8926	0.0202	209.8926	0.0137	209.8926	0.0382	209.8926	0.046	209.8926	0.0522	209.8926	0.0575	209.8926	0.0637	209.8926	0.0657
224.8593	0.0464	224.8593	0.0452	224.8593	0.0415	224.8593	0.0243	224.8593	0.0108	224.8593	0.037	224.8593	0.0452	224.8593	0.0518	224.8593	0.0571	224.8593	0.0632	224.8593	0.0653
239.8509	0.0473	239.8509	0.046	239.8509	0.0423	239.8509	0.0264	239.8509	0.0071	239.8509	0.0341	239.8509	0.0444	239.8509	0.0509	239.8509	0.0559	239.8509	0.0624	239.8509	0.0637
254.8389	0.0464	254.8389	0.0452	254.8389	0.0428	254.8389	0.0296	254.8389	0.005	254.8389	0.0305	254.8389	0.0407	254.8389	0.0481	254.8389	0.0538	254.8389	0.0604	254.8389	0.0616
269.8359	0.0468	269.8359	0.0452	269.8359	0.0432	269.8359	0.0325	269.8359	0.0096	269.8359	0.0264	269.8359	0.0391	269.8359	0.046	269.8359	0.0518	269.8359	0.0591	269.8359	0.0608
284.8356	0.0473	284.8356	0.046	284.8356	0.0436	284.8356	0.0346	284.8356	0.0128	284.8356	0.0239	284.8356	0.0378	284.8356	0.0452	284.8356	0.0501	284.8356	0.0579	284.8356	0.0604
299.8273	0.0493	299.8273	0.0473	299.8273	0.0448	299.8273	0.0366	299.8273	0.0177	299.8273	0.0227	299.8273	0.0366	299.8273	0.0448	299.8273	0.0509	299.8273	0.0575	299.8273	0.0596
314.8242	0.0497	314.8242	0.0489	314.8242	0.0456	314.8242	0.0391	314.8242	0.0251	314.8242	0.0206	314.8242	0.0358	314.8242	0.044	314.8242	0.0501	314.8242	0.0571	314.8242	0.0587
329.8229	0.0509	329.8229	0.0501	329.8229	0.0464	329.8229	0.0407	329.8229	0.0272	329.8229	0.0079	329.8229	0.0341	329.8229	0.0436	329.8229	0.0497	329.8229	0.0563	329.8229	0.0583
344.8216	0.0514	344.8216	0.0501	344.8216	0.0468	344.8216	0.0411	344.8216	0.0284	344.8216	0.003	344.8216	0.0313	344.8216	0.0419	344.8216	0.0468	344.8216	0.0555	344.8216	0.0567
359.8213	0.0518	359.8213	0.0501	359.8213	0.0477	359.8213	0.0419	359.8213	0.0321	359.8213	0.0063	359.8213	0.0288	359.8213	0.0399	359.8213	0.0464	359.8213	0.055	359.8213	0.0563
374.8199	0.0534	374.8199	0.0514	374.8199	0.0489	374.8199	0.0436	374.8199	0.0346	374.8199	0.0124	374.8199	0.0259	374.8199	0.0387	374.8199	0.046	374.8199	0.0542	374.8199	0.0559
389.8186	0.0538	389.8186	0.0526	389.8186	0.0505	389.8186	0.0452	389.8186	0.037	389.8186	0.0223	389.8186	0.0194	389.8186	0.037	389.8186	0.0456	389.8186	0.0534	389.8186	0.0546
404.8156	0.0548	404.8156	0.0538	404.8156	0.0518	404.8156	0.0456	404.8156	0.0395	404.8156	0.0243	404.8156	0.0153	404.8156	0.035	404.8156	0.0452	404.8156	0.0526	404.8156	0.0542
419.8143	0.055	419.8143	0.0542	419.8143	0.0518	419.8143	0.0456	419.8143	0.0399	419.8143	0.0272	419.8143	0.0083	419.8143	0.0321	419.8143	0.0448	419.8143	0.0518	419.8143	0.0538
434.8139	0.0567	434.8139	0.0555	434.8139	0.053	434.8139	0.0468	434.8139	0.0407	434.8139	0.0296	434.8139	0.0038	434.8139	0.0296	434.8139	0.0432	434.8139	0.0509	434.8139	0.0534
449.8139	0.0579	449.8139	0.0563	449.8139	0.0538	449.8139	0.0481	449.8139	0.0428	449.8139	0.0333	449.8139	0.0091	449.8139	0.0227	449.8139	0.0415	449.8139	0.0505	449.8139	0.053
464.8139	0.0587	464.8139	0.0571	464.8139	0.0555	464.8139	0.0493	464.8139	0.0432	464.8139	0.0366	464.8139	0.0149	464.8139	0.0149	464.8139	0.0387	464.8139	0.0497	464.8139	0.0518
479.8109	0.06	479.8109	0.0583	479.8109	0.0563	479.8109	0.0501	479.8109	0.0444	479.8109	0.0378	479.8109	0.0223	479.8109	0.0112	479.8109	0.037	479.8109	0.0485	479.8109	0.0505
494.8106	0.0612	494.8106	0.0587	494.8106	0.0579	494.8106	0.0514	494.8106	0.0456	494.8106	0.0399	494.8106	0.0264	494.8106	0.0083	494.8106	0.035	494.8106	0.0468	494.8106	0.0493
509.8102	0.062	509.8102	0.0596	509.8102	0.0587	509.8102	0.0518	509.8102	0.0464	509.8102	0.0407	509.8102	0.0284	509.8102	0.0059	509.8102	0.0325	509.8102	0.046	509.8102	0.0481
524.8073	0.062	524.8073	0.0604	524.8073	0.0591	524.8073	0.0526	524.8073	0.0473	524.8073	0.0415	524.8073	0.03	524.8073	0.0018	524.8073	0.03	524.8073	0.0448	524.8073	0.046
539.8043	0.0624	539.8043	0.0612	539.8043	0.06	539.8043	0.0534	539.8043	0.0477	539.8043	0.0423	539.8043	0.0321	539.8043	0.0096	539.8043	0.0268	539.8043	0.0423	539.8043	0.0448
554.799	0.0632	554.799	0.062	554.799	0.0604	554.799	0.0546	554.799	0.0481	554.799	0.0432	554.799	0.0346	554.799	0.0149	554.799	0.0235	554.799	0.0403	554.799	0.0428
569.799	0.0649	569.799	0.0632	569.799	0.0616	569.799	0.0559	569.799	0.0497	569.799	0.0452	569.799	0.0374	569.799	0.0206	569.799	0.021	569.799	0.0387	569.799	0.0428
584.7906	0.0661	584.7906	0.0641	584.7906	0.0628	584.7906	0.0571	584.7906	0.0514	584.7906	0.0464	584.7906	0.0407	584.7906	0.0243	584.7906	0.019	584.7906	0.037	584.7906	0.0415
599.7906	0.0673	599.7906	0.0649	599.7906	0.0637	599.7906	0.0583	599.7906	0.0522	599.7906	0.0477	599.7906	0.0423	599.7906	0.0284	599.7906	0.0128	599.7906	0.0346	599.7906	0.0407
614.7786	0.0678	614.7786	0.0657	614.7786	0.0645	614.7786	0.0587	614.7786	0.0526	614.7786	0.0481	614.7786	0.0428	614.7786	0.03	614.7786	0.0026	614.7786	0.0296	614.7786	0.0374
629.7622	0.0682	629.7622	0.0665	629.7622	0.0649	629.7622	0.0591	629.7622	0.0534	629.7622	0.0489	629.7622	0.044	629.7622	0.0337	629.7622	0.0067	629.7622	0.0268	629.7622	0.035
644.7409	0.069	644.7409	0.0669	644.7409	0.0657	644.7409	0.0604	644.7409	0.0546	644.7409	0.0505	644.7409	0.046	644.7409	0.0366	644.7409	0.0132	644.7409	0.021	644.7409	0.0337
659.7245	0.0714	659.7245	0.069	659.7245	0.0682	659.7245	0.0624	659.7245	0.0563	659.7245	0.0518	659.7245	0.0481	659.7245	0.0391	659.7245	0.0202	659.7245	0.0194	659.7245	0.0325
674.7216	0.0735	674.7216	0.0714	674.7216	0.0686	674.7216	0.0637	674.7216	0.0583	674.7216	0.0538	674.7216	0.0505	674.7216	0.0419	674.7216	0.0223	674.7216	0.0141	674.7216	0.03
689.7202	0.0739	689.7202	0.0723	689.7202	0.0702	689.7202	0.0645	689.7202	0.0591	689.7202	0.0542	689.7202	0.0514	689.7202	0.0432	689.7202	0.0239	689.7202	0.0096	689.7202	0.0239
704.7189	0.0739	704.7189	0.0727	704.7189	0.071	704.7189	0.0649	704.7189	0.06	704.7189	0.0546	704.7189	0.0522	704.7189	0.044	704.7189	0.03	704.7189	0.0046	704.7189	0.0218

Refraction Line 3 Arrival Times

Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9		Shot 10	
-0.10251	0.0108	-0.10251	0.0026	-0.10251	0.0288	-0.10251	0.0444	-0.10251	0.0563	-0.10251	0.0587	-0.10251	0.0673	-0.10251	0.0723	-0.10251	0.0747	-0.10251	0.0509
14.88549	0.0227	14.88549	0.0145	14.88549	0.0247	14.88549	0.0423	14.88549	0.0555	14.88549	0.0583	14.88549	0.0665	14.88549	0.0714	14.88549	0.0739	14.88549	0.0501
29.87349	0.0264	29.87349	0.0194	29.87349	0.0223	29.87349	0.0407	29.87349	0.055	29.87349	0.0575	29.87349	0.0657	29.87349	0.0706	29.87349	0.0735	29.87349	0.0497
44.85714	0.0284	44.85714	0.0243	44.85714	0.0165	44.85714	0.0391	44.85714	0.0542	44.85714	0.0571	44.85714	0.0649	44.85714	0.0702	44.85714	0.0727	44.85714	0.0489
59.84881	0.0305	59.84881	0.0276	59.84881	0.0096	59.84881	0.0362	59.84881	0.053	59.84881	0.0559	59.84881	0.0637	59.84881	0.0694	59.84881	0.0718	59.84881	0.0464
74.84581	0.0325	74.84581	0.0305	74.84581	0.0026	74.84581	0.0341	74.84581	0.0526	74.84581	0.055	74.84581	0.0637	74.84581	0.069	74.84581	0.0714	74.84581	0.0456
89.84547	0.035	89.84547	0.0329	89.84547	0.0079	89.84547	0.0313	89.84547	0.0522	89.84547	0.0542	89.84547	0.0616	89.84547	0.0688	89.84547	0.071	89.84547	0.0436
104.8441	0.0366	104.8441	0.0346	104.8441	0.0132	104.8441	0.0292	104.8441	0.0514	104.8441	0.053	104.8441	0.0612	104.8441	0.0661	104.8441	0.0686	104.8441	0.0395
119.8388	0.0399	119.8388	0.0378	119.8388	0.0198	119.8388	0.0276	119.8388	0.0509	119.8388	0.0534	119.8388	0.0608	119.8388	0.0678	119.8388	0.0702	119.8388	0.0391
134.8388	0.0436	134.8388	0.0403	134.8388	0.0239	134.8388	0.0218	134.8388	0.0501	134.8388	0.053	134.8388	0.06	134.8388	0.0688	134.8388	0.0694	134.8388	0.0387
149.8385	0.046	149.8385	0.0423	149.8385	0.0268	149.8385	0.0182	149.8385	0.0501	149.8385	0.0522	149.8385	0.0591	149.8385	0.0661	149.8385	0.069	149.8385	0.0362
164.8381	0.0484	164.8381	0.0444	164.8381	0.0288	164.8381	0.0104	164.8381	0.0477	164.8381	0.0501	164.8381	0.0579	164.8381	0.0657	164.8381	0.0685	164.8381	0.0329
179.8368	0.0468	179.8368	0.0452	179.8368	0.0337	179.8368	0.0026	179.8368	0.0444	179.8368	0.0485	179.8368	0.0567	179.8368	0.0628	179.8368	0.0641	179.8368	0.0296
194.8355	0.0473	194.8355	0.046	194.8355	0.0354	194.8355	0.0112	194.8355	0.0411	194.8355	0.0468	194.8355	0.0546	194.8355	0.0608	194.8355	0.0632	194.8355	0.0255
209.8325	0.0497	209.8325	0.0489	209.8325	0.0387	209.8325	0.0153	209.8325	0.0399	209.8325	0.0464	209.8325	0.055	209.8325	0.0604	209.8325	0.0628	209.8325	0.0243
224.8271	0.0501	224.8271	0.0501	224.8271	0.0407	224.8271	0.0243	224.8271	0.037	224.8271	0.0452	224.8271	0.0538	224.8271	0.0591	224.8271	0.0612	224.8271	0.021
239.8241	0.0505	239.8241	0.0505	239.8241	0.0428	239.8241	0.0264	239.8241	0.0354	239.8241	0.0444	239.8241	0.0526	239.8241	0.0579	239.8241	0.0604	239.8241	0.0104
254.8228	0.0514	254.8228	0.0514	254.8228	0.0448	254.8228	0.0296	254.8228	0.0329	254.8228	0.0419	254.8228	0.0518	254.8228	0.0571	254.8228	0.0591	254.8228	0.0018
269.8145	0.0526	269.8145	0.0518	269.8145	0.0464	269.8145	0.0325	269.8145	0.0305	269.8145	0.0403	269.8145	0.0505	269.8145	0.0563	269.8145	0.0587	269.8145	0.0108
284.8141	0.0534	284.8141	0.053	284.8141	0.0485	284.8141	0.0346	284.8141	0.0284	284.8141	0.0382	284.8141	0.0505	284.8141	0.0559	284.8141	0.0579	284.8141	0.0214
299.8128	0.0538	299.8128	0.0538	299.8128	0.0493	299.8128	0.0362	299.8128	0.0255	299.8128	0.0341	299.8128	0.0481	299.8128	0.0538	299.8128	0.0571	299.8128	0.0235
314.8125	0.0542	314.8125	0.0542	314.8125	0.0497	314.8125	0.0378	314.8125	0.0235	314.8125	0.0321	314.8125	0.0468	314.8125	0.0526	314.8125	0.0559	314.8125	0.0259
329.8095	0.0555	329.8095	0.055	329.8095	0.0505	329.8095	0.0407	329.8095	0.0186	329.8095	0.0305	329.8095	0.0464	329.8095	0.0522	329.8095	0.055	329.8095	0.0296
344.8091	0.0559	344.8091	0.0563	344.8091	0.0509	344.8091	0.0415	344.8091	0.0096	344.8091	0.0276	344.8091	0.0444	344.8091	0.0509	344.8091	0.053	344.8091	0.0313
359.8091	0.0571	359.8091	0.0567	359.8091	0.0526	359.8091	0.0436	359.8091	0.0014	359.8091	0.0251	359.8091	0.0419	359.8091	0.0505	359.8091	0.0526	359.8091	0.0333
374.8078	0.0579	374.8078	0.0579	374.8078	0.0538	374.8078	0.046	374.8078	0.0055	374.8078	0.0239	374.8078	0.0407	374.8078	0.0501	374.8078	0.0522	374.8078	0.0358
389.8065	0.0591	389.8065	0.0591	389.8065	0.0555	389.8065	0.0481	389.8065	0.0161	389.8065	0.0198	389.8065	0.0391	389.8065	0.0497	389.8065	0.0514	389.8065	0.0399
404.8051	0.0596	404.8051	0.06	404.8051	0.0559	404.8051	0.0489	404.8051	0.0206	404.8051	0.0165	404.8051	0.0366	404.8051	0.0481	404.8051	0.0497	404.8051	0.0415
419.8038	0.06	419.8038	0.0604	419.8038	0.0563	419.8038	0.0501	419.8038	0.0231	419.8038	0.0071	419.8038	0.0329	419.8038	0.0464	419.8038	0.0489	419.8038	0.0436
434.8008	0.0604	434.8008	0.0612	434.8008	0.0555	434.8008	0.0493	434.8008	0.0255	434.8008	0.0014	434.8008	0.0296	434.8008	0.0448	434.8008	0.0464	434.8008	0.0444
449.7995	0.0624	449.7995	0.0632	449.7995	0.0587	449.7995	0.0509	449.7995	0.0292	449.7995	0.0071	449.7995	0.0264	449.7995	0.0452	449.7995	0.0473	449.7995	0.046
464.7995	0.0637	464.7995	0.0637	464.7995	0.06	464.7995	0.0522	464.7995	0.0329	464.7995	0.0137	464.7995	0.0251	464.7995	0.0432	464.7995	0.0456	464.7995	0.0477
479.7981	0.0649	479.7981	0.0653	479.7981	0.0612	479.7981	0.0542	479.7981	0.0358	479.7981	0.0186	479.7981	0.0227	479.7981	0.0419	479.7981	0.0452	479.7981	0.0497
494.7978	0.0653	494.7978	0.0661	494.7978	0.062	494.7978	0.055	494.7978	0.037	494.7978	0.0251	494.7978	0.0169	494.7978	0.0395	494.7978	0.0444	494.7978	0.0505
509.7948	0.0669	509.7948	0.0669	509.7948	0.0628	509.7948	0.0563	509.7948	0.0403	509.7948	0.0255	509.7948	0.0091	509.7948	0.037	509.7948	0.0436	509.7948	0.0518
524.7864	0.0678	524.7864	0.0678	524.7864	0.0632	524.7864	0.0575	524.7864	0.0423	524.7864	0.0288	524.7864	0.0018	524.7864	0.0346	524.7864	0.0411	524.7864	0.0526
539.7781	0.0682	539.7781	0.0686	539.7781	0.0637	539.7781	0.0579	539.7781	0.0444	539.7781	0.0305	539.7781	0.0091	539.7781	0.0305	539.7781	0.0378	539.7781	0.053
554.7768	0.0686	554.7768	0.069	554.7768	0.0649	554.7768	0.0587	554.7768	0.0464	554.7768	0.0333	554.7768	0.0173	554.7768	0.0284	554.7768	0.0362	554.7768	0.0538
569.7768	0.069	569.7768	0.0698	569.7768	0.0653	569.7768	0.0596	569.7768	0.0468	569.7768	0.0354	569.7768	0.0202	569.7768	0.0259	569.7768	0.0329	569.7768	0.0542
584.7715	0.0702	584.7715	0.0706	584.7715	0.0669	584.7715	0.06	584.7715	0.0477	584.7715	0.0382	584.7715	0.0243	584.7715	0.0243	584.7715	0.0313	584.7715	0.0555
599.7595	0.0718	599.7595	0.0723	599.7595	0.0673	599.7595	0.0612	599.7595	0.0489	599.7595	0.0411	599.7595	0.0284	599.7595	0.0227	599.7595	0.0292	599.7595	0.0575
614.7595	0.0723	614.7595	0.0727	614.7595	0.0678	614.7595	0.0624	614.7595	0.0497	614.7595	0.0423	614.7595	0.0309	614.7595	0.0182	614.7595	0.0255	614.7595	0.0579
629.7581	0.0727	629.7581	0.0723	629.7581	0.0686	629.7581	0.0628	629.7581	0.0501	629.7581	0.044	629.7581	0.0329	629.7581	0.012	629.7581	0.0235	629.7581	0.0583
644.7578	0.0731	644.7578	0.0727	644.7578	0.069	644.7578	0.0632	644.7578	0.0505	644.7578	0.0452	644.7578	0.0346	644.7578	0.0022	644.7578	0.0198	644.7578	0.0591

Refraction Line 4 Arrival Times

Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7	
-0.05293	0.0083	-0.05293	0.0231	-0.05293	0.0325	-0.05293	0.0395	-0.05293	0.0497	-0.05293	0.0571	-0.05293	0.028
9.934564	0.0145	9.934564	0.0218	9.934564	0.0313	9.934564	0.0387	9.934564	0.0485	9.934564	0.0567	9.934564	0.03
19.92206	0.0214	19.92206	0.0173	19.92206	0.028	19.92206	0.0366	19.92206	0.0452	19.92206	0.0538	19.92206	0.0317
29.90955	0.0239	29.90955	0.0108	29.90955	0.0255	29.90955	0.0337	29.90955	0.0428	29.90955	0.0522	29.90955	0.0325
39.89704	0.0268	39.89704	0.0046	39.89704	0.0218	39.89704	0.0317	39.89704	0.0407	39.89704	0.0501	39.89704	0.0337
49.89696	0.028	49.89696	0.0014	49.89696	0.0206	49.89696	0.03	49.89696	0.0387	49.89696	0.0493	49.89696	0.0358
59.89688	0.0305	59.89688	0.0055	59.89688	0.0177	59.89688	0.0284	59.89688	0.0382	59.89688	0.0477	59.89688	0.037
69.89681	0.0329	69.89681	0.0096	69.89681	0.0116	69.89681	0.0276	69.89681	0.0374	69.89681	0.0473	69.89681	0.0407
79.89672	0.0346	79.89672	0.0177	79.89672	0.0087	79.89672	0.0264	79.89672	0.0362	79.89672	0.046	79.89672	0.0423
89.89665	0.0354	89.89665	0.019	89.89665	0.0022	89.89665	0.0231	89.89665	0.035	89.89665	0.0444	89.89665	0.0448
99.89632	0.0378	99.89632	0.0198	99.89632	0.0059	99.89632	0.0223	99.89632	0.0329	99.89632	0.0423	99.89632	0.0456
109.896	0.0399	109.896	0.0243	109.896	0.0161	109.896	0.0173	109.896	0.0296	109.896	0.0399	109.896	0.0468
119.8957	0.0407	119.8957	0.0264	119.8957	0.019	119.8957	0.0096	119.8957	0.0288	119.8957	0.0391	119.8957	0.0481
129.8954	0.0415	129.8954	0.0272	129.8954	0.0223	129.8954	0.0079	129.8954	0.0276	129.8954	0.0378	129.8954	0.0497
139.895	0.0456	139.895	0.0288	139.895	0.0247	139.895	0.0026	139.895	0.0268	139.895	0.0358	139.895	0.0514
149.895	0.0464	149.895	0.0317	149.895	0.0272	149.895	0.0059	149.895	0.0235	149.895	0.0341	149.895	0.0534
159.8949	0.0473	159.8949	0.0337	159.8949	0.028	159.8949	0.0124	159.8949	0.0194	159.8949	0.0329	159.8949	0.0546
169.8948	0.0485	169.8948	0.0354	169.8948	0.03	169.8948	0.0153	169.8948	0.0108	169.8948	0.0309	169.8948	0.055
179.8947	0.0505	179.8947	0.037	179.8947	0.0317	179.8947	0.0218	179.8947	0.0087	179.8947	0.028	179.8947	0.0567
189.8946	0.0522	189.8946	0.0378	189.8946	0.0333	189.8946	0.0259	189.8946	0.0026	189.8946	0.0255	189.8946	0.0587

Refraction Line 6 Arrival Times

Shot 1		Shot 2		Dist. (ft) Shot 3	Arrival (s)	Dist. (ft) Shot 4	Arrival (s)	Dist. (ft) Shot 5	Arrival (s)	Dist. (ft) Shot 6	Arrival (s)	Dist. (ft) Shot 7	Arrival (s)	Dist. (ft) Shot 8	Arrival (s)	Dist. (ft) Shot 9	Arrival (s)
-0.33107	0.0239	-0.33107	0.0018	-0.33107	0.0182	-0.33107	0.0235	-0.33107	0.0329	-0.33107	0.0415	-0.33107	0.0489	-0.33107	0.0542	-0.33107	0.0542
9.65788	0.0259	9.65788	0.0059	9.65788	0.0141	9.65788	0.0223	9.65788	0.0321	9.65788	0.0407	9.65788	0.0485	9.65788	0.0534	9.65788	0.0534
19.64636	0.028	19.64636	0.0096	19.64636	0.0112	19.64636	0.0206	19.64636	0.0309	19.64636	0.0391	19.64636	0.0477	19.64636	0.053	19.64636	0.053
29.63483	0.0305	29.63483	0.0128	29.63483	0.0055	29.63483	0.019	29.63483	0.0288	29.63483	0.0378	29.63483	0.0468	29.63483	0.0522	29.63483	0.0522
39.62378	0.0321	39.62378	0.0149	39.62378	0.0026	39.62378	0.0169	39.62378	0.0276	39.62378	0.0358	39.62378	0.0456	39.62378	0.0514	39.62378	0.0514
49.62136	0.035	49.62136	0.0173	49.62136	0.0083	49.62136	0.0145	49.62136	0.0259	49.62136	0.0337	49.62136	0.0444	49.62136	0.0509	49.62136	0.0509
59.61894	0.0366	59.61894	0.0194	59.61894	0.01	59.61894	0.0116	59.61894	0.0239	59.61894	0.0325	59.61894	0.0428	59.61894	0.0505	59.61894	0.0505
69.61652	0.0378	69.61652	0.0202	69.61652	0.0116	69.61652	0.0091	69.61652	0.0227	69.61652	0.0309	69.61652	0.0411	69.61652	0.0501	69.61652	0.0501
79.6141	0.0391	79.6141	0.0227	79.6141	0.0157	79.6141	0.0046	79.6141	0.0206	79.6141	0.0296	79.6141	0.0399	79.6141	0.0497	79.6141	0.0497
89.61167	0.0403	89.61167	0.0239	89.61167	0.0177	89.61167	0.0018	89.61167	0.0173	89.61167	0.028	89.61167	0.0378	89.61167	0.0481	89.61167	0.0481
99.61135	0.0428	99.61135	0.0268	99.61135	0.0194	99.61135	0.0042	99.61135	0.0157	99.61135	0.0272	99.61135	0.0362	99.61135	0.0477	99.61135	0.0477
109.611	0.0444	109.611	0.028	109.611	0.0218	109.611	0.0071	109.611	0.0153	109.611	0.0259	109.611	0.035	109.611	0.0464	109.611	0.0464
119.6107	0.0464	119.6107	0.0288	119.6107	0.0235	119.6107	0.0141	119.6107	0.0118	119.6107	0.0235	119.6107	0.0333	119.6107	0.0452	119.6107	0.0452
129.6104	0.0485	129.6104	0.0321	129.6104	0.0255	129.6104	0.0153	129.6104	0.0067	129.6104	0.0218	129.6104	0.0321	129.6104	0.044	129.6104	0.044
139.6101	0.0497	139.6101	0.0333	139.6101	0.028	139.6101	0.0177	139.6101	0.0034	139.6101	0.0186	139.6101	0.0305	139.6101	0.0432	139.6101	0.0432
149.6091	0.0509	149.6091	0.0346	149.6091	0.0288	149.6091	0.0194	149.6091	0.0071	149.6091	0.0161	149.6091	0.0288	149.6091	0.0423	149.6091	0.0423
159.6081	0.053	159.6081	0.0366	159.6081	0.0313	159.6081	0.0218	159.6081	0.0112	159.6081	0.0145	159.6081	0.0272	159.6081	0.0415	159.6081	0.0415
169.6071	0.0534	169.6071	0.0382	169.6071	0.0325	169.6071	0.0243	169.6071	0.0137	169.6071	0.0091	169.6071	0.0251	169.6071	0.0382	169.6071	0.0382
179.6062	0.0542	179.6062	0.0399	179.6062	0.0346	179.6062	0.0264	179.6062	0.0153	179.6062	0.0046	179.6062	0.0227	179.6062	0.0354	179.6062	0.0354
189.6052	0.055	189.6052	0.0407	189.6052	0.0358	189.6052	0.0276	189.6052	0.0173	189.6052	0.0026	189.6052	0.0186	189.6052	0.0341	189.6052	0.0341
239.6051	0.0608	239.6051	0.0452	239.6051	0.0407	239.6051	0.0313	239.6051	0.0198	239.6051	0.0194	239.6051	0.0022	239.6051	0.0227	239.6051	0.0227
249.605	0.0618	249.605	0.0464	249.605	0.0428	249.605	0.0329	249.605	0.0218	249.605	0.0227	249.605	0.0059	249.605	0.0194	249.605	0.0194
259.605	0.0628	259.605	0.0481	259.605	0.0448	259.605	0.035	259.605	0.0235	259.605	0.0243	259.605	0.0096	259.605	0.0173	259.605	0.0173
269.6049	0.0637	269.6049	0.0489	269.6049	0.0464	269.6049	0.037	269.6049	0.0255	269.6049	0.0259	269.6049	0.012	269.6049	0.0137	269.6049	0.0137
279.6049	0.0649	279.6049	0.0501	279.6049	0.0477	279.6049	0.0399	279.6049	0.0276	279.6049	0.0272	279.6049	0.0153	279.6049	0.0104	279.6049	0.0104
289.6048	0.0665	289.6048	0.0514	289.6048	0.0485	289.6048	0.0411	289.6048	0.0296	289.6048	0.0284	289.6048	0.0177	289.6048	0.0071	289.6048	0.0071
299.6047	0.0673	299.6047	0.0522	299.6047	0.0497	299.6047	0.0432	299.6047	0.0321	299.6047	0.03	299.6047	0.0202	299.6047	0.0026	299.6047	0.0026

Refraction Line 6 Arrival Times

Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9		Shot 10	
0	0.0243	0	0.0014	0	0.0194	0	0.0321	0	0.0448	0	0.0534	0	0.0591	0	0.0628	0	0.0682	0	0.0698
9.983742	0.0268	9.983742	0.0046	9.983742	0.0182	9.983742	0.0305	9.983742	0.0436	9.983742	0.0522	9.983742	0.0587	9.983742	0.0624	9.983742	0.0669	9.983742	0.069
19.96805	0.0284	19.96805	0.012	19.96805	0 0157	19.96805	0.0292	19.96805	0.0419	19.96805	0.0509	19.96805	0.0579	19.96805	0.062	19.96805	0.0665	19.96805	0.0682
29.95179	0.0321	29.95179	0 0145	29.95179	0.0124	29.95179	0.0276	29.95179	0.0407	29.95179	0.0497	29.95179	0.0575	29.95179	0.0616	29.95179	0.0661	29.95179	0.0686
39 95171	0.0333	39.95171	0.0186	39.95171	0.0091	39.95171	0.0264	39.95171	0.0387	39.95171	0.0485	39.95171	0.0575	39.95171	0.0612	39.95171	0.0657	39.95171	0.0682
49.95163	0.0362	49.95163	0.0202	49.95163	0.0018	49.95163	0.0239	49.95163	0.0366	49.95163	0.0473	49.95163	0.0555	49.95163	0.0604	49.95163	0.0657	49.95163	0.0678
59.95155	0.0382	59.95155	0 0231	59.95155	0.0038	59.95155	0.0214	59.95155	0.0354	59.95155	0.046	59.95155	0.0546	59.95155	0.0596	59.95155	0.0649	59.95155	0.0682
69.95147	0.0403	69.95147	0.0251	69.95147	0.0128	69.95147	0.0198	69.95147	0.0337	69.95147	0.0448	69.95147	0.0538	69.95147	0.0587	69.95147	0.0645	69.95147	0.0678
79.95139	0.0419	79.95139	0.0264	79.95139	0.0161	79.95139	0.0161	79.95139	0.0321	79.95139	0.0436	79.95139	0.0526	79.95139	0.0579	79.95139	0.0641	79.95139	0.0673
89.95089	0.0452	89.95089	0.0296	89.95089	0.0194	89.95089	0.0141	89.95089	0.0305	89.95089	0.0419	89.95089	0.0509	89.95089	0.0575	89.95089	0.0637	89.95089	0.0665
99.95039	0.046	99.95039	0.0313	99.95039	0.0227	99.95039	0.0096	99.95039	0.028	99.95039	0.0399	99.95039	0.0497	99.95039	0.0567	99.95039	0.0624	99.95039	0.0661
109.9499	0.0477	109.9499	0.0333	109.9499	0.0247	109.9499	0.0014	109.9499	0.0251	109.9499	0.0387	109.9499	0.0485	109.9499	0.0555	109.9499	0.0612	109.9499	0.0657
119.9494	0.0497	119.9494	0.035	119.9494	0.0272	119.9494	0.0063	119.9494	0.0231	119.9494	0.0374	119.9494	0.0473	119.9494	0.0546	119.9494	0.0608	119.9494	0.0649
129.9489	0.0518	129.9489	0.0378	129.9489	0.0292	129.9489	0.0145	129.9489	0.0202	129.9489	0.0366	129.9489	0.0468	129.9489	0.0542	129.9489	0.06	129.9489	0.0641
139.9479	0.0526	139.9479	0.0387	139.9479	0.0305	139.9479	0.0165	139.9479	0.0177	139.9479	0.0333	139.9479	0.0444	139.9479	0.0522	139.9479	0.0587	139.9479	0.0632
149.9469	0.0542	149.9469	0.0403	149.9469	0.0325	149.9469	0.019	149.9469	0.0145	149.9469	0.0317	149.9469	0.0432	149.9469	0.0522	149.9469	0.0579	149.9469	0.0624
159.946	0.0567	159.946	0.0428	159.946	0.0341	159.946	0.0214	159.946	0.01	159.946	0.0296	159.946	0.0419	159.946	0.0514	159.946	0.0575	159.946	0.0616
169.945	0.0579	169.945	0.0444	169.945	0.0378	169.945	0.0251	169.945	0.0018	169 945	0.0239	169.945	0.0407	169.945	0.0497	169.945	0.0563	169.945	0.0604
179.944	0.0587	179.944	0.046	179.944	0.0391	179.944	0.03	179.944	0.0108	179.944	0.0231	179.944	0.0387	179.944	0.0485	179.944	0.055	179.944	0.0596
189.9352	0.0596	189.9352	0.0477	189.9352	0.0411	189.9352	0.0313	189.9352	0.0145	189.9352	0.0165	189.9352	0.0325	189.9352	0.0473	189.9352	0.0542	189.9352	0.0579
239.9332	0 0628	239.9332	0.055	239.9332	0.0493	239.9332	0.0399	239.9332	0.019	239.9332	0.0059	239.9332	0.0243	239.9332	0.0419	239.9332	0.0534	239.9332	0.055
249.9244	0.0645	249.9244	0.0563	249.9244	0.0505	249.9244	0.0419	249.9244	0.0325	249.9244	0.0145	249.9244	0.019	249.9244	0.0382	249.9244	0.0518	249.9244	0.0546
259.9156	0.0669	259.9156	0.0575	259.9156	0.0518	259.9156	0.0444	259.9156	0.0366	259.9156	0.0177	259.9156	0.0157	259.9156	0.0337	259.9156	0.0501	259.9156	0.0542
269.9067	0.0673	269.9067	0.0583	269.9067	0.0525	269.9067	0.0456	269.9067	0.0403	269.9067	0.0202	269.9067	0.0128	269.9067	0.03	269.9067	0.0493	269.9067	0.053
279.9022	0.0678	279.9022	0.0591	279.9022	0.0538	279.9022	0.0468	279.9022	0.0411	279.9022	0.0235	279.9022	0.0108	279.9022	0.0288	279.9022	0.0485	279.9022	0.0526
289.8977	0.0678	289.8977	0.06	289.8977	0.0546	289.8977	0.0477	289.8977	0.0432	289.8977	0.0259	289.8977	0.0046	289.8977	0.0259	289.8977	0.0464	289.8977	0.0518
299 8932	0.0686	299.8932	0.0608	299.8932	0.0555	299.8932	0.0489	299.8932	0.0444	299.8932	0.0284	299.8932	0.0096	299.8932	0.0231	299.8932	0.0452	299.8932	0.0505
309.8887	0.0694	309.8887	0.0616	309.8887	0.0575	309.8887	0.0501	309.8887	0.0452	309.8887	0.0317	309.8887	0.0128	309.8887	0.0173	309.8887	0.0423	309.8887	0.0501
319.8842	0.0702	319.8842	0.062	319.8842	0.0583	319.8842	0.0505	319.8842	0.0464	319.8842	0.0358	319.8842	0.0149	319.8842	0.0137	319.8842	0.0407	319.8842	0.0493
329.8811	0 0706	329.8811	0.0624	329.8811	0.0587	329.8811	0.0526	329.8811	0.0473	329 8811	0.0391	329.8811	0.0169	329.8811	0.0083	329.8811	0.0391	329.8811	0.0481
339.878	0.071	339.878	0.0628	339.878	0.0596	339.878	0.053	339.878	0.0493	339.878	0.0399	339.878	0.0194	339.878	0.0042	339.878	0.037	339.878	0.046
349.8748	0.0714	349.8748	0.0632	349.8748	0.06	349.8748	0.0538	349.8748	0.0501	349.8748	0.0411	349.8748	0.0239	349.8748	0.0038	349.8748	0.0317	349.8748	0.044
359.8717	0 0718	359.8717	0.0637	359.8717	0.0608	359.8717	0 0546	359.8717	0.0505	359.8717	0.0432	359.8717	0.0264	359.8717	0.0034	359.8717	0.0292	359.8717	0.0415
369.8686	0.0723	369.8686	0.0641	369.8686	0.0616	369.8686	0.055	369.8686	0.0509	369.8686	0.0444	369.8686	0.0284	369.8686	0.0067	369.8686	0.0239	369.8686	0.0403
379.8655	0.0731	379.8655	0.0645	379.8655	0.062	379.8655	0.0567	379.8655	0.0528	379.8655	0.046	379.8655	0.0325	379.8655	0.0108	379.8655	0.0214	379.8655	0.0395
389.8631	0.0735	389.8631	0.0649	389.8631	0.0624	389.8631	0.0575	389.8631	0.053	389.8631	0.0477	389.8631	0.0358	389.8631	0.0153	389.8631	0.0157	389.8631	0.0374
399.8606	0.0743	399.8606	0.0657	399.8606	0 0632	399.8606	0.0587	399.8606	0.0534	399.8606	0.0485	399.8606	0.0387	399.8606	0.0198	399.8606	0.0116	399.8606	0.0358
409.8582	0 0747	409.8582	0.0661	409.8582	0.0637	409.8582	0.0591	409.8582	0.0542	409.8582	0 0505	409.8582	0.0415	409.8582	0.0247	409.8582	0.0075	409.8582	0.0337
419.8558	0.0751	419.8558	0.0665	419.8558	0.0653	419.8558	0.06	419.8558	0.0559	419.8558	0.0509	419.8558	0.0448	419.8558	0.0296	419.8558	0.0042	419.8558	0.0325
429.8534	0.0755	429.8534	0.0669	429.8534	0.0661	429.8534	0.0604	429.8534	0 0567	429.8534	0.0518	429.8534	0.0464	429.8534	0.0341	429.8534	0.0034	429.8534	0.0298

Refraction Line 7 Arrival Times																				
Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)			
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9				
-0.010001	0.0169	-0.010001	0 0022	-0.010001	0.0526	-0.010001	0.0407	-0.010001	0.0485	-0.010001	0.055	-0.010001	0.0587	-0.010001	0.0637	-0.010001	0.0649			
9.987579	0.0202	9.987579	0.0165	9.987579	0.0444	9.987579	0.0391	9.987579	0.046	9.987579	0.0542	9.987579	0.0579	9.987579	0.0628	9.987579	0.0637			
19.98493	0.0296	19.98493	0.0235	19.98493	0.0309	19.98493	0.0346	19.98493	0.0448	19.98493	0.0538	19.98493	0.0567	19.98493	0.0628	19.98493	0.0628			
29.98251	0.0321	29.98251	0.0247	29.98251	0.0231	29.98251	0.0313	29.98251	0.0415	29.98251	0.0518	29 98251	0.0563	29.98251	0.0608	29.98251	0.0616			
39.97987	0.0337	39.97987	0.0272	39.97987	0.0096	39.97987	0.028	39.97987	0.0403	39.97987	0.0505	39.97987	0.0555	39.97987	0.0604	39.97987	0.0608			
49.97955	0.0346	49.97955	0.0284	49.97955	0.0042	49.97955	0.0235	49.97955	0.0382	49.97955	0.0485	49.97955	0.0526	49.97955	0.0591	49.97955	0.0596			
59.97923	0.0358	59.97923	0.0305	59.97923	0.0079	59.97923	0.0194	59.97923	0 0358	59.97923	0.046	59.97923	0.0518	59.97923	0.0579	59.97923	0.0583			
69.97891	0 037	69.97891	0.0321	69.97891	0.0124	69.97891	0.0132	69.97891	0.0341	69.97891	0.0452	69.97891	0.0505	69.97891	0.0567	69.97891	0.0579			
79.97858	0.0387	79.97858	0.0337	79.97858	0.0202	79.97858	0.0112	79.97858	0.0321	79.97858	0.0419	79.97858	0.0501	79.97858	0.0563	79.97858	0.0571			
89.97827	0.0399	89.97827	0.035	89.97827	0.0231	89.97827	0.0063	89.97827	0.0305	89.97827	0.0411	89.97827	0.0489	89.97827	0.0555	89.97827	0.0563			
99.97827	0.0423	99.97827	0.0366	99.97827	0.0264	99.97827	0.0042	99.97827	0.0284	99.97827	0.0403	99.97827	0.0477	99.97827	0.055	99.97827	0.0559			
109.9783	0.0436	109.9783	0.0382	109.9783	0.0284	109.9783	0.0022	109.9783	0.0272	109.9783	0.0387	109.9783	0.0477	109.9783	0.0546	109.9783	0.055			
119.9783	0.0452	119 9783	0.0407	119.9783	0.03	119.9783	0.0071	119.9783	0.0251	119.9783	0.0366	119.9783	0.0468	119.9783	0.0542	119.9783	0.0546			
129.9783	0.0473	129.9783	0 0436	129.9783	0.0309	129.9783	0.01	129.9783	0.0227	129.9783	0.0354	129.9783	0.0456	129.9783	0.0534	129.9783	0.0542			
139.9783	0.0485	139.9783	0.0448	139.9783	0.0317	139.9783	0.0141	139.9783	0.0186	139.9783	0.0333	139.9783	0.0432	139.9783	0.0522	139.9783	0.0534			
149.9781	0 0501	149.9781	0.0464	149.9781	0.035	149.9781	0.0186	149.9781	0.0108	149.9781	0.0321	149.9781	0.0423	149.9781	0.0522	149.9781	0.053			
159.9779	0 0505	159.9779	0.0473	159.9779	0.0358	159.9779	0.0243	159.9779	0.0079	159.9779	0.0298	159.9779	0.0399	159.9779	0.0497	159.9779	0.0522			
169.9777	0.0509	169.9777	0.0501	169.9777	0.0378	169.9777	0.0272	169.9777	0.003	169.9777	0.0276	169.9777	0.0395	169.9777	0.0489	169.9777	0.0514			
179.9776	0.0518	179.9776	0.0518	179 9776	0.0399	179.9776	0.0313	179.9776	0.0104	179.9776	0.0243	179.9776	0.0378	179.9776	0.0473	179.9776	0.0505			
189 9774	0.053	189.9774	0.053	189.9774	0.0415	189.9774	0.0329	189.9774	0.0198	189.9774	0.0104	189.9774	0.0366	189.9774	0.0456	189.9774	0.0497			
239 9637	0.0546	239.9637	0.0563	239.9637	0.0489	239.9637	0.0403	239.9637	0.0313	239.9637	0.0141	239.9637	0.0317	239.9637	0.0374	239.9637	0.0448			
249.9637	0.0555	249 9637	0.0567	249.9637	0.0497	249.9637	0.0419	249.9637	0.0333	249.9637	0.0202	249.9637	0.0284	249.9637	0.0362	249.9637	0.0428			
259.9637	0.0559	259.9637	0.0571	259.9637	0.0501	259.9637	0.0436	259.9637	0.0341	259.9637	0.0235	259.9637	0 0223	259.9637	0.0329	259.9637	0.0403			
269.9637	0.0575	269.9637	0.0579	269.9637	0.0509	269.9637	0.0448	269.9637	0.0362	269.9637	0.0268	269.9637	0.0145	269 9637	0.0313	269.9637	0.0391			
279 9637	0.0579	279.9637	0.0583	279.9637	0.0514	279.9637	0.046	279.9637	0.0374	279.9637	0.0284	279.9637	0.0075	279.9637	0.0296	279.9637	0.0366			
289.9637	0.0583	289.9637	0.0587	289.9637	0.0518	289.9637	0.0481	289.9637	0.0391	289.9637	0.0296	289.9637	0.0014	289.9637	0.0284	289.9637	0.035			
299.9637	0.0587	299.9637	0.06	299.9637	0 053	299.9637	0.0497	299.9637	0.0411	299.9637	0.0309	299.9637	0.0075	299.9637	0.0264	299.9637	0.0341			
309.9637	0.06	309.9637	0.0608	309.9637	0.0542	309 9637	0.0509	309.9637	0.0436	309.9637	0.0329	309.9637	0.0128	309.9637	0.0186	309.9637	0.0317			
319.9637	0.0604	319.9637	0.0616	319.9637	0 0546	319.9637	0.0518	319.9637	0.0444	319.9637	0.035	319.9637	0.021	319.9637	0.0141	319.9637	0.0292			
329.9637	0.0612	329.9637	0.0628	329.9637	0.0559	329.9637	0.053	329.9637	0.0477	329.9637	0 0378	329.9637	0.0251	329.9637	0.0067	329.9637	0.0272			
339.9637	0.0616	339.9637	0.0632	339.9637	0 0571	339.9637	0.055	339.9637	0.0493	339.9637	0.0403	339.9637	0.0276	339.9637	0.0018	339.9637	0.0255			

Refraction Line 8 Arrival Times

Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9	
-0.010001	0.021	-0.010001	0.0018	-0.010001	0.0239	-0.010001	0.0337	-0.010001	0.0456	-0.010001	0.0538	-0.010001	0.0579	-0.010001	0.062	-0.010001	0.0628
9.989874	0.0243	9.989874	0.0055	9.989874	0.0206	9.989874	0.0321	9.989874	0.0432	9.989874	0.0522	9.989874	0.0575	9.989874	0.0604	9.989874	0.0624
19.98975	0.0268	19.98975	0.0087	19.98975	0.019	19.98975	0.0313	19.98975	0.0419	19.98975	0.0518	19.98975	0.0567	19.98975	0.06	19.98975	0.0624
29.98962	0.028	29.98962	0.0108	29.98962	0.0153	29.98962	0.0284	29.98962	0.0403	29.98962	0.0505	29.98962	0.0559	29.98962	0.0596	29.98962	0.062
39.9895	0.03	39.9895	0.0186	39.9895	0.01	39.9895	0.0259	39.9895	0.0378	39.9895	0.0485	39.9895	0.0555	39.9895	0.0587	39.9895	0.0612
49.9895	0.0325	49.9895	0.0227	49.9895	0.0063	49.9895	0.0251	49.9895	0.0366	49.9895	0.0477	49.9895	0.055	49.9895	0.0583	49.9895	0.0604
59.9895	0.0346	59.9895	0.0255	59.9895	0.0083	59.9895	0.0223	59.9895	0.0346	59.9895	0.046	59.9895	0.0542	59.9895	0.0579	59.9895	0.06
69.9895	0.0362	69.9895	0.0268	69.9895	0.012	69.9895	0.0194	69.9895	0.0333	69.9895	0.0448	69.9895	0.053	69.9895	0.0575	69.9895	0.0596
79.9895	0.0374	79.9895	0.028	79.9895	0.0141	79.9895	0.0165	79.9895	0.0313	79.9895	0.0419	79.9895	0.0509	79.9895	0.0563	79.9895	0.0579
89.9895	0.0382	89.9895	0.0305	89.9895	0.0194	89.9895	0.0149	89.9895	0.0284	89.9895	0.0403	89.9895	0.0497	89.9895	0.0559	89.9895	0.0575
99.98878	0.0407	99.98878	0.0329	99.98878	0.0223	99.98878	0.0083	99.98878	0.0264	99.98878	0.0382	99.98878	0.0485	99.98878	0.0546	99.98878	0.0571
109.9881	0.0419	109.9881	0.0337	109.9881	0.0243	109.9881	0.0034	109.9881	0.0255	109.9881	0.037	109.9881	0.0468	109.9881	0.0542	109.9881	0.0567
119.9873	0.044	119.9873	0.0362	119.9873	0.0255	119.9873	0.0091	119.9873	0.0227	119.9873	0.0354	119.9873	0.046	119.9873	0.0534	119.9873	0.0563
129.9866	0.0464	129.9866	0.0387	129.9866	0.028	129.9866	0.0149	129.9866	0.0157	129.9866	0.0341	129.9866	0.044	129.9866	0.0526	129.9866	0.0559
139.9859	0.0473	139.9859	0.0399	139.9859	0.0296	139.9859	0.0186	139.9859	0.0112	139.9859	0.0325	139.9859	0.0423	139.9859	0.0514	139.9859	0.0555
149.9857	0.0485	149.9857	0.0407	149.9857	0.0321	149.9857	0.0206	149.9857	0.01	149.9857	0.0292	149.9857	0.0407	149.9857	0.0489	149.9857	0.0542
159.9855	0.0489	159.9855	0.0432	159.9855	0.0337	159.9855	0.0235	159.9855	0.0083	159.9855	0.028	159.9855	0.0391	159.9855	0.0489	159.9855	0.0538
169.9854	0.0497	169.9854	0.0448	169.9854	0.0354	169.9854	0.0251	169.9854	0.0059	169.9854	0.0255	169.9854	0.0368	169.9854	0.0464	169.9854	0.0518
179.9852	0.0509	179.9852	0.0464	179.9852	0.0374	179.9852	0.0272	179.9852	0.0075	179.9852	0.0235	179.9852	0.035	179.9852	0.044	179.9852	0.0501
189.985	0.0514	189.985	0.0481	189.985	0.0387	189.985	0.028	189.985	0.0104	189.985	0.0202	189.985	0.0333	189.985	0.0432	189.985	0.0489
199.9847	0.0526	199.9847	0.0493	199.9847	0.0411	199.9847	0.0313	199.9847	0.0128	199.9847	0.0165	199.9847	0.0321	199.9847	0.0415	199.9847	0.0473
209.9844	0.0534	209.9844	0.0501	209.9844	0.0432	209.9844	0.0325	209.9844	0.0161	209.9844	0.0137	209.9844	0.03	209.9844	0.0407	209.9844	0.0456
219.984	0.0538	219.984	0.0514	219.984	0.0452	219.984	0.0346	219.984	0.0214	219.984	0.0087	219.984	0.0288	219.984	0.0399	219.984	0.0444
229.9837	0.055	229.9837	0.053	229.9837	0.0468	229.9837	0.0362	229.9837	0.0264	229.9837	0.005	229.9837	0.0235	229.9837	0.0378	229.9837	0.0436
239.9834	0.0555	239.9834	0.0534	239.9834	0.0489	239.9834	0.0387	239.9834	0.028	239.9834	0.0087	239.9834	0.0223	239.9834	0.0366	239.9834	0.0411
249.9795	0.0567	249.9795	0.0546	249.9795	0.0509	249.9795	0.0407	249.9795	0.0309	249.9795	0.0153	249.9795	0.0214	249.9795	0.035	249.9795	0.0403
259.9756	0.0575	259.9756	0.055	259.9756	0.0522	259.9756	0.0428	259.9756	0.0325	259.9756	0.0202	259.9756	0.0202	259.9756	0.0329	259.9756	0.0391
269.9716	0.0583	269.9716	0.0567	269.9716	0.0534	269.9716	0.044	269.9716	0.0346	269.9716	0.0243	269.9716	0.0149	269.9716	0.0317	269.9716	0.0366
279.9677	0.0591	279.9677	0.0571	279.9677	0.0538	279.9677	0.0452	279.9677	0.0358	279.9677	0.0264	279.9677	0.0075	279.9677	0.0284	279.9677	0.0346
289.9638	0.0604	289.9638	0.0587	289.9638	0.055	289.9638	0.0468	289.9638	0.037	289.9638	0.0272	289.9638	0.0014	289.9638	0.0272	289.9638	0.0341
299.9638	0.0612	299.9638	0.0591	299.9638	0.0559	299.9638	0.0485	299.9638	0.0399	299.9638	0.0309	299.9638	0.0071	299.9638	0.0235	299.9638	0.0321
309.9638	0.062	309.9638	0.0596	309.9638	0.0567	309.9638	0.0501	309.9638	0.0415	309.9638	0.0325	309.9638	0.0128	309.9638	0.0186	309.9638	0.0296
319.9638	0.0628	319.9638	0.06	319.9638	0.0575	319.9638	0.0518	319.9638	0.0432	319.9638	0.0341	319.9638	0.019	319.9638	0.0137	319.9638	0.028
329.9638	0.0637	329.9638	0.0604	329.9638	0.0587	329.9638	0.0538	329.9638	0.0448	329.9638	0.0362	329.9638	0.0231	329.9638	0.0071	329.9638	0.0214
339.9638	0.0641	339.9638	0.0608	339.9638	0.0596	339.9638	0.055	339.9638	0.0464	339.9638	0.0378	339.9638	0.0272	339.9638	0.0048	339.9638	0.0104

Refraction Line 9 Arrival Times

Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9	
-0.022505	0.0223	-0.022505	0.0059	-0.022505	0.0206	-0.022505	0.0341	-0.022505	0.0452	-0.022505	0.0514	-0.022505	0.0641	-0.022505	0.0616	-0.022505	0.0632
9.97737	0.0243	9.97737	0.0091	9.97737	0.0198	9.97737	0.0313	9.97737	0.0423	9.97737	0.0505	9.97737	0.0624	9.97737	0.0612	9.97737	0.062
19.97725	0.0255	19.97725	0.0141	19.97725	0.0157	19.97725	0.0284	19.97725	0.0395	19.97725	0.0493	19.97725	0.0612	19.97725	0.06	19.97725	0.0616
29.97712	0.028	29.97712	0.0165	29.97712	0.0145	29.97712	0.0268	29.97712	0.0382	29.97712	0.0485	29.97712	0.06	29.97712	0.0591	29.97712	0.0612
39.97699	0.03	39.97699	0.019	39.97699	0.0087	39.97699	0.0255	39.97699	0.0374	39.97699	0.0473	39.97699	0.0587	39.97699	0.0583	39.97699	0.0608
49.97699	0.0309	49.97699	0.0218	49.97699	0.0059	49.97699	0.0235	49.97699	0.035	49.97699	0.0464	49.97699	0.0571	49.97699	0.0579	49.97699	0.0604
59.97699	0.0325	59.97699	0.0243	59.97699	0.0108	59.97699	0.021	59.97699	0.0325	59.97699	0.0444	59.97699	0.0563	59.97699	0.0575	59.97699	0.0596
69.977	0.0354	69.977	0.0272	69.977	0.0153	69.977	0.0182	69.977	0.0309	69.977	0.0428	69.977	0.0538	69.977	0.0571	69.977	0.0591
79.977	0.0366	79.977	0.0288	79.977	0.0173	79.977	0.0157	79.977	0.0284	79.977	0.0407	79.977	0.0526	79.977	0.0563	79.977	0.0583
89.977	0.0387	89.977	0.0317	89.977	0.019	89.977	0.0132	89.977	0.0264	89.977	0.0399	89.977	0.0514	89.977	0.0555	89.977	0.0575
99.975	0.0403	99.975	0.0337	99.975	0.0214	99.975	0.0087	99.975	0.0243	99.975	0.0387	99.975	0.0501	99.975	0.0546	99.975	0.0567
109.973	0.0423	109.973	0.035	109.973	0.0239	109.973	0.0046	109.973	0.021	109.973	0.037	109.973	0.0485	109.973	0.0542	109.973	0.0563
119.971	0.0436	119.971	0.0358	119.971	0.0268	119.971	0.0079	119.971	0.0177	119.971	0.0341	119.971	0.0468	119.971	0.0534	119.971	0.0546
129.969	0.0452	129.969	0.0374	129.969	0.0284	129.969	0.0186	129.969	0.0169	129.969	0.0329	129.969	0.044	129.969	0.0526	129.969	0.0542
139.9689	0.0464	139.9689	0.0403	139.9689	0.03	139.9689	0.0198	139.9689	0.0141	139.9689	0.0305	139.9689	0.0419	139.9689	0.0514	139.9689	0.0538
149.9689	0.0481	149.9689	0.0407	149.9689	0.0321	149.9689	0.0218	149.9689	0.0108	149.9689	0.028	149.9689	0.0407	149.9689	0.0501	149.9689	0.053
159.9688	0.0489	159.9688	0.0423	159.9688	0.0341	159.9688	0.0231	159.9688	0.0079	159.9688	0.0259	159.9688	0.0399	159.9688	0.0485	159.9688	0.0526
169.9688	0.0493	169.9688	0.0432	169.9688	0.0354	169.9688	0.0251	169.9688	0.0059	169.9688	0.0235	169.9688	0.0366	169.9688	0.046	169.9688	0.0514
179.9687	0.0497	179.9687	0.0448	179.9687	0.0366	179.9687	0.0268	179.9687	0.0083	179.9687	0.0218	179.9687	0.0346	179.9687	0.0448	179.9687	0.0505
189.9687	0.0509	189.9687	0.0468	189.9687	0.0382	189.9687	0.0292	189.9687	0.0112	189.9687	0.0206	189.9687	0.0333	189.9687	0.0432	189.9687	0.0497
199.9686	0.0518	199.9686	0.0485	199.9686	0.0399	199.9686	0.0309	199.9686	0.0149	199.9686	0.0161	199.9686	0.0317	199.9686	0.0419	199.9686	0.0489
209.9686	0.0534	209.9686	0.0501	209.9686	0.0419	209.9686	0.0333	209.9686	0.0202	209.9686	0.0104	209.9686	0.0309	209.9686	0.0411	209.9686	0.0481
219.9686	0.0542	219.9686	0.0509	219.9686	0.0448	219.9686	0.0362	219.9686	0.0239	219.9686	0.0063	219.9686	0.0296	219.9686	0.0407	219.9686	0.0477
229.9686	0.0555	229.9686	0.0522	229.9686	0.046	229.9686	0.0374	229.9686	0.0268	229.9686	0.0042	229.9686	0.0255	229.9686	0.0387	229.9686	0.046
239.9686	0.0559	239.9686	0.0526	239.9686	0.0477	239.9686	0.0382	239.9686	0.0288	239.9686	0.0071	239.9686	0.0251	239.9686	0.037	239.9686	0.0448
249.9646	0.0567	249.9646	0.0542	249.9646	0.0497	249.9646	0.0419	249.9646	0.0325	249.9646	0.012	249.9646	0.0231	249.9646	0.0354	249.9646	0.0436
259.9607	0.0575	259.9607	0.055	259.9607	0.0509	259.9607	0.0436	259.9607	0.0341	259.9607	0.0169	259.9607	0.019	259.9607	0.0337	259.9607	0.0411
269.9568	0.0579	269.9568	0.0559	269.9568	0.0518	269.9568	0.0456	269.9568	0.0354	269.9568	0.0202	269.9568	0.0124	269.9568	0.0321	269.9568	0.0382
279.9529	0.0583	279.9529	0.0563	279.9529	0.0526	279.9529	0.0468	279.9529	0.037	279.9529	0.0239	279.9529	0.0067	279.9529	0.0268	279.9529	0.037
289.9489	0.0591	289.9489	0.0567	289.9489	0.0534	289.9489	0.0493	289.9489	0.0391	289.9489	0.0264	289.9489	0.0046	289.9489	0.0264	289.9489	0.0354
299.9489	0.06	299.9489	0.0575	299.9489	0.0542	299.9489	0.0505	299.9489	0.0403	299.9489	0.0288	299.9489	0.0075	299.9489	0.0231	299.9489	0.0333
309.9489	0.0608	309.9489	0.0583	309.9489	0.0546	309.9489	0.0518	309.9489	0.0423	309.9489	0.0321	309.9489	0.0124	309.9489	0.0198	309.9489	0.0321
319.9489	0.0616	319.9489	0.0591	319.9489	0.055	319.9489	0.0526	319.9489	0.0436	319.9489	0.0333	319.9489	0.0182	319.9489	0.0137	319.9489	0.0292
329.9489	0.0624	329.9489	0.06	329.9489	0.0555	329.9489	0.0534	329.9489	0.0448	329.9489	0.0346	329.9489	0.0223	329.9489	0.0063	329.9489	0.0268
339.9489	0.0641	339.9489	0.0604	339.9489	0.0567	339.9489	0.055	339.9489	0.0468	339.9489	0.037	339.9489	0.0276	339.9489	0.0018	339.9489	0.0243

Refraction Line 10 Arrival Times																				
Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)			
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9				
-0.022505	0 0198	-0.022505	0.003	-0.022505	0.0243	-0.022505	0.0333	-0.022505	0.0448	-0.022505	0.053	-0.022505	0.0542	-0.022505	0.0604	-0.022505	0.0632			
9.97737	0.0235	9.97737	0.0071	9.97737	0.0198	9.97737	0.0313	9.97737	0.0432	9.97737	0.0522	9.97737	0.053	9.97737	0.0596	9.97737	0.0624			
19.97725	0.0247	19.97725	0.0145	19.97725	0.0169	19.97725	0.0292	19.97725	0.0411	19.97725	0.0509	19.97725	0.0522	19.97725	0.0587	19.97725	0.0616			
29.97712	0.0268	29.97712	0.0181	29.97712	0.0137	29.97712	0.0272	29.97712	0.0391	29.97712	0.0501	29.97712	0.0514	29.97712	0.0583	29.97712	0.062			
39.97699	0.0284	39.97699	0.019	39.97699	0.0075	39.97699	0.0247	39.97699	0.0378	39.97699	0.0497	39.97699	0.0505	39.97699	0.0579	39.97699	0.0608			
49.97699	0.0309	49.97699	0.0218	49.97699	0.0042	49.97699	0.0231	49.97699	0.0366	49.97699	0.0481	49 97699	0.0501	49.97699	0.0575	49.97699	0.06			
59.97699	0.0321	59.97699	0.0243	59.97699	0.0091	59.97699	0.021	59.97699	0.0337	59.97699	0.0444	59.97699	0.0493	59.97699	0.0571	59.97699	0.0596			
69 977	0.0346	69.977	0.0259	69.977	0.0145	69.977	0.0202	69.977	0.0325	69.977	0.0444	69.977	0.0485	69.977	0.0567	69.977	0.0591			
79.977	0.037	79.977	0.0288	79.977	0.0177	79.977	0.0182	79.977	0.0305	79.977	0.0423	79.977	0.0477	79.977	0.0559	79.977	0.0583			
89.977	0.0391	89.977	0 0305	89.977	0.0198	89.977	0.0145	89.977	0.0288	89.977	0.0411	89 977	0.0473	89.977	0.0555	89.977	0.0579			
99.97572	0.0399	99.97572	0.0321	99.97572	0.021	99.97572	0 0087	99.97572	0.0259	99.97572	0.0374	99.97572	0.0456	99.97572	0.0542	99.97572	0.0571			
109.9744	0.0419	109.9744	0.0337	109.9744	0.0227	109.9744	0.0042	109.9744	0.0231	109 9744	0.0366	109.9744	0.044	109.9744	0.0538	109.9744	0.0571			
119.9732	0.0436	119.9732	0.0358	119.9732	0.0251	119.9732	0.0079	119.9732	0.021	119.9732	0.0358	119.9732	0 0432	119.9732	0 053	119.9732	0.0567			
129.9719	0.0456	129.9719	0.0366	129.9719	0.0268	129.9719	0.0145	129.9719	0.0198	129.9719	0.0321	129.9719	0.0415	129.9719	0.0522	129.9719	0.0559			
139.9706	0.0452	139.9706	0.0378	139 9706	0.0288	139.9706	0.0161	139.9706	0.0165	139.9706	0.0296	139.9706	0.0387	139.9706	0.0485	139.9706	0.0542			
149.9705	0.0484	149.9705	0.0407	149.9705	0.0313	149.9705	0.0186	149.9705	0.0145	149.9705	0.028	149.9705	0.0374	149.9705	0.0481	149.9705	0.0538			
159.9704	0 0485	159.9704	0.0428	159.9704	0.0337	159.9704	0.0223	159.9704	0.0083	159.9704	0.0272	159.9704	0.0354	159.9704	0.046	159.9704	0.0534			
169.9704	0.0497	169.9704	0.044	169.9704	0.0358	169.9704	0.0235	169.9704	0.0059	169.9704	0.0259	169.9704	0.0341	169.9704	0.0452	169.9704	0.0526			
179.9703	0.0505	179.9703	0.0484	179.9703	0.0395	179.9703	0.0276	179.9703	0.0096	179.9703	0.0251	179.9703	0.0333	179.9703	0.0448	179.9703	0.0518			
189.9702	0.0522	189.9702	0.0485	189.9702	0 0411	189.9702	0.0292	189.9702	0.0153	189.9702	0.0231	189.9702	0.0317	189.9702	0.0432	189.9702	0.0501			
199.9702	0.0526	199.9702	0.0493	199.9702	0.0419	199.9702	0.0305	199.9702	0.019	199.9702	0.0177	199.9702	0.028	199.9702	0.0411	199.9702	0.0473			
209.9702	0.0522	209.9702	0.0497	209.9702	0.0428	209.9702	0.0321	209.9702	0.0214	209.9702	0.0141	209.9702	0.0251	209.9702	0.0378	209.9702	0.0456			
219.9701	0.0526	219.9701	0.0501	219.9701	0.0436	219.9701	0.0329	219 9701	0.0231	219.9701	0.0083	219.9701	0.0235	219.9701	0.0358	219.9701	0.0436			
229.9701	0.0538	229.9701	0.0514	229.9701	0.0456	229.9701	0.0362	229.9701	0.0247	229 9701	0.0055	229.9701	0.0223	229.9701	0.035	229.9701	0.0428			
239 9701	0.0546	239.9701	0.0522	239.9701	0.0468	239.9701	0.0374	239.9701	0.0264	239.9701	0.0108	239.9701	0.021	239.9701	0.0325	239.9701	0.0407			
249.9662	0.055	249.9662	0.0526	249.9662	0.0481	249.9662	0.0387	249 9662	0.028	249.9662	0.0157	249.9662	0.0182	249.9662	0.0305	249.9662	0.0382			
259 9623	0.0563	259.9623	0.053	259.9623	0.0497	259.9623	0.0407	259.9623	0.0305	259.9623	0.0186	259.9623	0.0149	259.9623	0.0284	259.9623	0.0362			
269.9583	0 0559	269.9583	0.0534	269.9583	0.0505	269.9583	0.0415	269.9583	0.0325	269.9583	0.0214	269.9583	0.0104	269.9583	0.0255	269.9583	0.0329			
279.9544	0.0559	279 9544	0.0538	279 9544	0.0505	279.9544	0.0428	279.9544	0.0333	279.9544	0.0227	279.9544	0.0063	279.9544	0.0231	279.9544	0.0309			
289.9505	0 0567	289.9505	0.0542	289.9505	0.0509	289.9505	0.0444	289.9505	0.035	289 9505	0.0247	289.9505	0.0038	289.9505	0.0214	289.9505	0.028			
299.9505	0.0575	299.9505	0.0546	299.9505	0.0514	299.9505	0.0456	299.9505	0.0362	299.9505	0.0284	299.9505	0.0063	299.9505	0.0186	299.9505	0.0264			
309.9505	0 0583	309.9505	0.0555	309.9505	0.0522	309.9505	0.0473	309.9505	0.0378	309.9505	0.0288	309.9505	0.0104	309.9505	0.0165	309.9505	0.0243			
319.9505	0.06	319.9505	0.0575	319.9505	0 0538	319.9505	0.0505	319.9505	0.0407	319.9505	0.0321	319.9505	0.0145	319.9505	0.0145	319.9505	0.0227			
329.9505	0.0612	329.9505	0.0583	329.9505	0.0546	329.9505	0.0518	329.9505	0.0428	329.9505	0.0341	329.9505	0.0173	329.9505	0.0087	329.9505	0.0214			
339.9505	0 0628	339.9505	0 0596	339.9505	0.055	339.9505	0.0538	339.9505	0.0452	339.9505	0.0362	339.9505	0.0218	339.9505	0.0014	339.9505	0.0194			

Refraction Line 11 Arrival Times

Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8	
-0.321381	0.0456	-0.321381	0.0231	-0.321381	0.0014	-0.321381	0.0198	-0.321381	0.0276	-0.321381	0.0325	-0.321381	0.0411	-0.321381	0.0448
9.667093	0.0448	9.667093	0.0255	9.667093	0.0145	9.667093	0.0173	9.667093	0.0251	9.667093	0.0309	9.667093	0.0395	9.667093	0.044
19.65604	0.0444	19.65604	0.0276	19.65604	0.0169	19.65604	0.0149	19.65604	0.0231	19.65604	0.0292	19.65604	0.0374	19.65604	0.0423
29.64499	0.044	29.64499	0.0284	29.64499	0.0177	29.64499	0.0091	29.64499	0.021	29.64499	0.028	29.64499	0.0358	29.64499	0.0411
39.63347	0.0432	39.63347	0.0305	39.63347	0.0202	39.63347	0.0014	39.63347	0.0206	39.63347	0.0276	39.63347	0.0348	39.63347	0.0407
49.63314	0.0415	49.63314	0.0313	49.63314	0.0218	49.63314	0.0096	49.63314	0.0198	49.63314	0.0255	49.63314	0.0321	49.63314	0.0382
59.63282	0.0407	59.63282	0.0325	59.63282	0.0231	59.63282	0.0153	59.63282	0.0182	59.63282	0.0239	59.63282	0.0313	59.63282	0.037
69.63251	0.0387	69.63251	0.0333	69.63251	0.0243	69.63251	0.0169	69.63251	0.0149	69.63251	0.0218	69.63251	0.0292	69.63251	0.035
79.63219	0.0378	79.63219	0.0366	79.63219	0.0272	79.63219	0.0202	79.63219	0.0108	79.63219	0.0202	79.63219	0.0284	79.63219	0.0341
89.63187	0.0366	89.63187	0.0378	89.63187	0.0284	89.63187	0.021	89.63187	0.0014	89.63187	0.0198	89.63187	0.0276	89.63187	0.0329
99.62987	0.0346	99.62987	0.0387	99.62987	0.0296	99.62987	0.0214	99.62987	0.0108	99.62987	0.0177	99.62987	0.0255	99.62987	0.0317
109.6279	0.0317	109.6279	0.0395	109.6279	0.03	109.6279	0.0223	109.6279	0.0141	109.6279	0.0149	109.6279	0.0231	109.6279	0.0284
119.6259	0.0309	119.6259	0.0415	119.6259	0.0317	119.6259	0.0239	119.6259	0.0165	119.6259	0.0128	119.6259	0.0227	119.6259	0.0272
129.6239	0.0292	129.6239	0.0436	129.6239	0.0325	129.6239	0.0272	129.6239	0.0194	129.6239	0.0014	129.6239	0.0214	129.6239	0.0268
139.6231	0.0284	139.6231	0.0452	139.6231	0.0337	139.6231	0.0284	139.6231	0.0206	139.6231	0.0145	139.6231	0.0198	139.6231	0.0251
149.6225	0.0276	149.6225	0.0464	149.6225	0.037	149.6225	0.03	149.6225	0.0227	149.6225	0.0161	149.6225	0.0186	149.6225	0.0235
159.6218	0.0264	159.6218	0.0473	159.6218	0.0382	159.6218	0.0325	159.6218	0.0239	159.6218	0.0186	159.6218	0.0169	159.6218	0.0227
169.6211	0.0247	169.6211	0.0481	169.6211	0.0403	169.6211	0.0333	169.6211	0.0264	169.6211	0.0206	169.6211	0.0157	169.6211	0.0218
179.6205	0.0239	179.6205	0.0501	179.6205	0.0428	179.6205	0.0341	179.6205	0.028	179.6205	0.0218	179.6205	0.0087	179.6205	0.0198
189.6198	0.0223	189.6198	0.0509	189.6198	0.0444	189.6198	0.0362	189.6198	0.03	189.6198	0.0235	189.6198	0.0014	189.6198	0.019
199.6187	0.0198	199.6187	0.0509	199.6187	0.0452	199.6187	0.037	199.6187	0.0305	199.6187	0.0243	199.6187	0.0096	199.6187	0.01
209.6175	0.0182	209.6175	0.0518	209.6175	0.046	209.6175	0.0382	209.6175	0.0313	209.6175	0.0251	209.6175	0.0149	209.6175	0.0014

Refraction Line 12 Arrival Times																					
Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)	Dist. (ft)	Arrival (s)
Shot 1		Shot 2		Shot 3		Shot 4		Shot 5		Shot 6		Shot 7		Shot 8		Shot 9		Shot 10		Shot 11	
-0.001667	0.0255	-0.001667	0.005	-0.001667	0.0206	-0.001667	0.0288	-0.001667	0.044	-0.001667	0.0534	-0.001667	0.0641	-0.001667	0.0723	-0.001667	0.0686	-0.001667	0.071	-0.001667	0.0792
9.997613	0.0276	9.997613	0.01	9.997613	0.0186	9.997613	0.028	9.997613	0.0432	9.997613	0.0514	9.997613	0.0624	9.997613	0.0714	9.997613	0.0678	9.997613	0.0698	9.997613	0.0784
19.99689	0.0292	19.99689	0.0128	19.99689	0.0165	19.99689	0.0259	19.99689	0.0407	19.99689	0.0501	19.99689	0.0608	19.99689	0.0702	19.99689	0.0665	19.99689	0.069	19.99689	0.0776
29.99617	0.0325	29.99617	0.0149	29.99617	0.0145	29.99617	0.0235	29.99617	0.0387	29.99617	0.0481	29.99617	0.0591	29.99617	0.0686	29.99617	0.0657	29.99617	0.0682	29.99617	0.0768
39.99545	0.0337	39.99545	0.0177	39.99545	0.0112	39.99545	0.0214	39.99545	0.0366	39.99545	0.046	39.99545	0.0567	39.99545	0.0661	39.99545	0.0653	39.99545	0.0678	39.99545	0.0759
49.99473	0.037	49.99473	0.0202	49.99473	0.0026	49.99473	0.019	49.99473	0.035	49.99473	0.0448	49.99473	0.055	49.99473	0.0645	49.99473	0.0649	49.99473	0.0673	49.99473	0.0751
59.99375	0.0387	59.99375	0.0218	59.99375	0.0104	59.99375	0.0169	59.99375	0.0337	59.99375	0.0436	59.99375	0.0538	59.99375	0.0637	59.99375	0.0645	59.99375	0.0669	59.99375	0.0743
69.99278	0.0395	69.99278	0.0235	69.99278	0.0137	69.99278	0.0149	69.99278	0.0313	69.99278	0.0419	69.99278	0.0522	69.99278	0.0628	69.99278	0.0637	69.99278	0.0661	69.99278	0.0739
79.99179	0.0415	79.99179	0.0247	79.99179	0.0157	79.99179	0.0132	79.99179	0.0284	79.99179	0.0407	79.99179	0.0501	79.99179	0.0612	79.99179	0.0628	79.99179	0.0653	79.99179	0.0731
89.99081	0.0428	89.99081	0.0284	89.99081	0.0182	89.99081	0.0096	89.99081	0.0268	89.99081	0.0387	89.99081	0.0485	89.99081	0.0596	89.99081	0.0624	89.99081	0.0645	89.99081	0.0727
99.98983	0.046	99.98983	0.0305	99.98983	0.0202	99.98983	0.0014	99.98983	0.0255	99.98983	0.0366	99.98983	0.0464	99.98983	0.0579	99.98983	0.0616	99.98983	0.0641	99.98983	0.0718
109.9898	0.0468	109.9898	0.0317	109.9898	0.0218	109.9898	0.0104	109.9898	0.0239	109.9898	0.035	109.9898	0.0448	109.9898	0.0567	109.9898	0.0612	109.9898	0.0637	109.9898	0.0714
119.9898	0.0481	119.9898	0.0333	119.9898	0.0239	119.9898	0.0145	119.9898	0.0218	119.9898	0.0321	119.9898	0.0428	119.9898	0.055	119.9898	0.0608	119.9898	0.0632	119.9898	0.071
129.9898	0.0497	129.9898	0.0358	129.9898	0.0276	129.9898	0.0165	129.9898	0.0194	129.9898	0.03	129.9898	0.0415	129.9898	0.0534	129.9898	0.0596	129.9898	0.0628	129.9898	0.0698
139.9898	0.0522	139.9898	0.0387	139.9898	0.0292	139.9898	0.0198	139.9898	0.0186	139.9898	0.028	139.9898	0.0403	139.9898	0.0526	139.9898	0.0608	139.9898	0.0624	139.9898	0.0694
149.9898	0.053	149.9898	0.0407	149.9898	0.0321	149.9898	0.0214	149.9898	0.0149	149.9898	0.0259	149.9898	0.0387	149.9898	0.0518	149.9898	0.0596	149.9898	0.062	149.9898	0.0673
159.9897	0.0534	159.9897	0.0419	159.9897	0.0333	159.9897	0.0239	159.9897	0.0075	159.9897	0.0251	159.9897	0.0362	159.9897	0.0501	159.9897	0.0587	159.9897	0.0616	159.9897	0.0669
169.9846	0.0538	169.9846	0.0436	169.9846	0.035	169.9846	0.0259	169.9846	0.0022	169.9846	0.0235	169.9846	0.0329	169.9846	0.0489	169.9846	0.0571	169.9846	0.0608	169.9846	0.0661
179.9795	0.0546	179.9795	0.0448	179.9795	0.037	179.9795	0.028	179.9795	0.0104	179.9795	0.0202	179.9795	0.0313	179.9795	0.0473	179.9795	0.0555	179.9795	0.0604	179.9795	0.0657
189.9747	0.0571	189.9747	0.0477	189.9747	0.0395	189.9747	0.0305	189.9747	0.0149	189.9747	0.0182	189.9747	0.0305	189.9747	0.046	189.9747	0.0548	189.9747	0.0596	189.9747	0.0649
199.9696	0.0583	199.9696	0.0489	199.9696	0.0415	199.9696	0.0325	199.9696	0.0182	199.9696	0.0161	199.9696	0.0272	199.9696	0.0448	199.9696	0.0526	199.9696	0.0583	199.9696	0.0645
209.9644	0.0591	209.9644	0.0509	209.9644	0.0444	209.9644	0.0366	209.9644	0.0202	209.9644	0.0137	209.9644	0.0247	209.9644	0.0423	209.9644	0.0514	209.9644	0.0575	209.9644	0.0637
239.9627	0.0596	239.9627	0.0538	239.9627	0.0481	239.9627	0.0403	239.9627	0.0255	239.9627	0.0112	239.9627	0.021	239.9627	0.0395	239.9627	0.0489	239.9627	0.0555	239.9627	0.0632
249.9576	0.0608	249.9576	0.0546	249.9576	0.0501	249.9576	0.0419	249.9576	0.0296	249.9576	0.0145	249.9576	0.0194	249.9576	0.037	249.9576	0.0464	249.9576	0.0542	249.9576	0.0612
259.9525	0.0612	259.9525	0.0555	259.9525	0.0514	259.9525	0.0436	259.9525	0.0321	259.9525	0.0173	259.9525	0.0157	259.9525	0.0354	259.9525	0.0444	259.9525	0.0522	259.9525	0.0604
269.9477	0.062	269.9477	0.0567	269.9477	0.053	269.9477	0.0456	269.9477	0.0346	269.9477	0.0202	269.9477	0.0128	269.9477	0.0313	269.9477	0.0432	269.9477	0.0501	269.9477	0.0591
279.9426	0.0624	279.9426	0.0575	279.9426	0.0542	279.9426	0.0468	279.9426	0.0362	279.9426	0.0214	279.9426	0.0112	279.9426	0.0284	279.9426	0.0411	279.9426	0.0489	279.9426	0.0579
289.9374	0.0632	289.9374	0.0587	289.9374	0.055	289.9374	0.0489	289.9374	0.0378	289.9374	0.0251	289.9374	0.0018	289.9374	0.0264	289.9374	0.0395	289.9374	0.0477	289.9374	0.0567
299.9259	0.0641	299.9259	0.0596	299.9259	0.0567	299.9259	0.0505	299.9259	0.0399	299.9259	0.0268	299.9259	0.012	299.9259	0.0231	299.9259	0.0378	299.9259	0.0464	299.9259	0.0555
309.9144	0.0649	309.9144	0.06	309.9144	0.0575	309.9144	0.0526	309.9144	0.0411	309.9144	0.0288	309.9144	0.0169	309.9144	0.0198	309.9144	0.0362	309.9144	0.0452	309.9144	0.0542
319.9029	0.0657	319.9029	0.0604	319.9029	0.0583	319.9029	0.0538	319.9029	0.0423	319.9029	0.0317	319.9029	0.0198	319.9029	0.0177	319.9029	0.0346	319.9029	0.0436	319.9029	0.053
329.8914	0.0669	329.8914	0.0608	329.8914	0.0587	329.8914	0.055	329.8914	0.0444	329.8914	0.0333	329.8914	0.0223	329.8914	0.0132	329.8914	0.0325	329.8914	0.0407	329.8914	0.0514
339.8798	0.0678	339.8798	0.0612	339.8798	0.0591	339.8798	0.0559	339.8798	0.046	339.8798	0.035	339.8798	0.0235	339.8798	0.0108	339.8798	0.0309	339.8798	0.0387	339.8798	0.0501
349.8753	0.0682	349.8753	0.0616	349.8753	0.0591	349.8753	0.0563	349.8753	0.0468	349.8753	0.0366	349.8753	0.0251	349.8753	0.0014	349.8753	0.0288	349.8753	0.0374	349.8753	0.0485
359.8708	0.069	359.8708	0.0628	359.8708	0.0596	359.8708	0.0567	359.8708	0.0477	359.8708	0.0391	359.8708	0.0305	359.8708	0.0118	359.8708	0.0255	359.8708	0.0354	359.8708	0.0473
369.8663	0.0694	369.8663	0.0641	369.8663	0.0612	369.8663	0.0583	369.8663	0.0501	369.8663	0.0415	369.8663	0.0333	369.8663	0.0141	369.8663	0.0231	369.8663	0.0337	369.8663	0.0456
379.8618	0.0698	379.8618	0.0649	379.8618	0.0624	379.8618	0.0587	379.8618	0.0526	379.8618	0.0436	379.8618	0.0358	379.8618	0.0186	379.8618	0.0214	379.8618	0.0321	379.8618	0.044
389.8573	0.0702	389.8573	0.0657	389.8573	0.0628	389.8573	0.0596	389.8573	0.0538	389.8573	0.0452	389.8573	0.037	389.8573	0.0218	389.8573	0.0182	389.8573	0.03	389.8573	0.0423
399.8549	0.0706	399.8549	0.0661	399.8549	0.0632	399.8549	0.0608	399.8549	0.0555	399.8549	0.0464	399.8549	0.0387	399.8549	0.0247	399.8549	0.0104	399.8549	0.0284	399.8549	0.0403
409.8525	0.071	409.8525	0.0669	409.8525	0.0641	409.8525	0.0612	409.8525	0.0571	409.8525	0.0477	409.8525	0.0403	409.8525	0.0264	409.8525	0.0018	409.8525	0.0264	409.8525	0.0382
419.8501	0.0714	419.8501	0.0673	419.8501	0.0649	419.8501	0.0616	419.8501	0.0587	419.8501	0.0493	419.8501	0.0411	419.8501	0.0276	419.8501	0.0116	419.8501	0.0243	419.8501	0.0362
429.8476	0.0718	429.8476	0.0678	429.8476	0.0653	429.8476	0.0624	429.8476	0.0591	429.8476	0.0514	429.8476	0.0428	429.8476	0.03	429.8476	0.0161	429.8476	0.021	429.8476	0.0337
439.8452	0.0727	439.8452	0.0682	439.8452	0.0657	439.8452	0.0632	439.8452	0.0596	439.8452	0.0522	439.8452	0.0436	439.8452	0.0313	439.8452	0.0194	439.8452	0.0182	439.8452	0.0321
449.8407	0.0731	449.8407	0.0686	449.8407	0.0661	449.8407	0.0637	449.8407	0.06	449.8407	0.0534	449.8407	0.0444	449.8407	0.0333	449.8407	0.0239	449.8407	0.0157	449.8407	0.0309
459.8362	0.0739	459.8362	0.069	459.8362	0.0665	459.8362	0.0641	459.8362	0.0604	459.8362	0.0542	459.8362	0.0452	459.8362	0.035	459.8362	0.0313	459.8362	0.0108	459.8362	0.0292
469.8317	0.0743	469.8317	0.0686	469.8317	0.0669	469.8317	0.0645	469.8317	0.0608	469.8317	0.055	469.8317	0.046	469.8317	0.037	469.8317	0.0415	469.8317	0.0034	469.8317	0.0276

Appendix C

GPR DATA

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Appendix C

GPR Data

Geophysical Investigation at the Defense Supply Center Richmond for MACTEC Engineering and Consultants

Note: Profiles 14, 21, 22, 23, 24, & 37 are void and not presented

Geophex, Ltd.

FINAL PAGE

ADMINISTRATIVE RECORD

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