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QUARRY DETECTION MONITORING WELLS COMPLETION REPORT WP-166

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

SEPTEMBER 1991

REV. 0

U.S. Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

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Page 1 of 1

Weldon Spring Site Remedial Action Project
Contract No. DE-AC05-86OR21548

PLAN TITLE: Quarry Detection Monitoring Wells Completion
Report WP-166

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Weldon Spring Site Remedial Action Project

Quarry Detection Monitoring Wells Completion Report WP-166

Revision 0

September 1991

Prepared by

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and
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for the

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations Office
Under Contract DE-AC05-86OR21548

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1 INTRODUCTION

1.1 Purpose

The purpose of this report is to document the activities undertaken during implementation of Work Package 166, Quarry Detection Monitoring Wells. The subcontract specifications should be consulted for specific details regarding this work effort.

1.2 Overview

On January 2, 1991, Geotechnology, a subcontractor, began the work for Work Package 166 (WP-166) which involved the abandonment of MW-1025, and the installation and development of monitoring wells MW-1029, MW-1030, MW-1031, MW-1032, MW-1033, and MW-1034 all of which are located near the Weldon Spring quarry. Refer to Figure 1-1 for monitoring well locations. This work provided additional characterization needed for the quarry and replaced MW-1025 with MW-1034 because MW-1025 would have been impacted by the Highway 94 relocation effort. Geotechnology personnel present during this work included Dale Meyer, Superintendent/Senior Driller; Andy Limmer, Geologist; Scott Hildabrandt, Senior Driller's Assistant; and Paul Guerrin, Driller's Assistant. The Construction Engineer was Vernon Taylor of the Construction Management & Operations (CM&O) Department with field representation provided by Craig Jones and Richard Spurgeon of the Environmental, Safety and Health (ES&H) Department. Data for completed well abandonment, well installation, well development, and boring logs for all monitoring wells installed for WP-166 are in Weldon Spring Site Remedial Action Project (WSSRAP) Quality Assurance (QA) and ES&H files, and are also included in appendix A of this report.

● QUARRY MONITORING WELL

0 250 500 FT
0 76.2 152.4 M

SCALE

WP-166 MONITORING WELL LOCATIONS

FIGURE 1

REPORT NO.:		EXHIBIT NO.:	
ORIGINATOR		DATE	
CSJ		8/91	
DRAWN BY:		GLN	

2 ABANDONMENT

2.1 Monitoring Well-1025

On January 2 and 3, 1991, monitoring well MW-1025 was abandoned according to State and Federal Regulations and ES&H Procedure 4.4.4s. Only 25 ft of the original riser (stainless steel) was extracted intact. However, a total depth of 56 ft was drilled, including drilling approximately 12 ft into bedrock as indicated by the previous log for this well. The boring was overdrilled using 10 in. augers (original hole was 8.5 in.) and then grouted to the ground surface using Volclay grout as specified.

The primary problem encountered during the abandonment occurred when the drill bit severed the casing at a depth of approximately 25 ft and was no longer centered on the well casing. The driller continued with drilling operations; however, he was not able to realign the drill bit over the well casing as fragments of stainless steel casing were present in the cuttings. The driller continued 12 ft into the bedrock, and then grouted the hole from a total depth of 56 ft below ground surface to the surface. Cuttings were allowed to be spread in the surrounding area as stated in the specifications; however, the well materials were screened from the cuttings and were disposed of by Geotechnology in accordance with the subcontract specifications.

3 DRILLING

The six boreholes for well installation were drilled using a truck mounted CME 75 drilling rig with 6 1/4 in. ID hollow stem augers, NX size wireline core barrels, 2 in. OD split spoons, and a 6 in. hammer bit. A total of 465.0 ft were drilled for the six wells using approved drilling methods for both overburden materials and bedrock. Typically, 2 ft split spoon samples were collected continuously from 0 ft to 10 ft and then every 5 ft thereafter unless otherwise specified until bedrock was encountered. When core drilling in bedrock, the continuous wireline system was utilized using 10 ft runs. Once a total depth was determined, the hole was reamed with the hammer bit. Specifics for each boring drilled are provided below.

3.1 Monitoring Well-1029

The borehole used for installation of MW-1029 is located on the rim of the quarry near the north gate. This borehole was drilled from January 14 through January 17, 1991.

For the most part, silts, clays, and silt/clay mixtures were present from the ground surface to 29.5 ft. As specified, no environmental samples were collected for analysis. From 29.5 ft to 34.5 ft, highly weathered Kimmswick limestone was encountered followed by an additional 65 ft of highly fractured (both vertically and horizontally) Kimmswick limestone to a depth of 99.5 ft below the ground surface (bgs). Circulation was lost at an approximate depth of 45 ft and was never regained. This was consistent with the fractures and vugs identified within the core samples. At 98 ft below the ground surface, water was encountered within the Kimmswick Limestone. The core samples of the Kimmswick Limestone were typically hard, gray, and fossiliferous and contained solution features such as vugs and stylolites. Also, the rock quality of the Kimmswick core samples was typically 50% and less. At approximately 99.5 ft below the surface, rocks of the Decorah Group were encountered. The Decorah Group, typically a gray limestone with shale partings, was highly to slightly weathered with iron staining and fractures present. A 10 in. shale layer was encountered at 108 ft bgs; however, this shale bed was the only parting present within the 11 ft of the Decorah sampled. Water was encountered at 98 ft, and the hole was terminated at 110.5 ft. All core samples were scanned for radioactivity, and all samples were released as clean except for the clay layer encountered at 108 ft bgs which indicated approximately 200 to 250 counts per minute (6-7 times background). All soil cuttings and soil samples were

containerized in four drums and disposed of in the contaminated stockpile located in the inner quarry. After all material was emptied from the drums, the drums were decontaminated and scanned prior to their release from the inner quarry.

3.2 Monitoring Well-1030

From January 22 through January 24, 1991, a borehole was drilled for MW-1030 on the southwest rim within the inner quarry fence.

Mostly silts and clays were encountered to depths of 50 ft below the ground surface. Soil samples were collected from 0 ft to 10 ft and from 30 ft to 36 ft below the ground surface. Portions of these samples were analyzed for environmental contaminants. Sampling parameters included the entire Hazardous Substance List, nitroaromatics, natural uranium, Th-230, and Th-232. Bedrock encountered from 50 ft to 95 ft below the ground surface was cored using the wireline method. Kimmswick Limestone was encountered between 50 ft and 80 ft below the ground surface. Many solution features including stylolites and vugs were present as were many horizontal and vertical fractures. Rocks of the Decorah Group were encountered 80 ft below the surface, consisting of fresh limestone with only a few shale partings, the thickest being less than 1 ft. Groundwater was present approximately 87 ft below the ground surface. All cuttings produced were placed in drums and disposed of within the inner quarry, as described in Section 3.1 for MW-1029 borehole. No major difficulties were encountered when drilling this borehole.

3.3 Monitoring Well-1031

The borehole for monitoring well MW-1031, located north of the Femme Osage Slough with the existing well cluster MW-1013 and MW-1014, was drilled on January 28 and 29, 1991.

Twenty feet of soil consisting of mostly silty clays with two very thin sand layers encountered above the bedrock was sampled and analyzed for uranium, Th-230, Th-232 and nitroaromatics. The bedrock encountered at 20 ft bgs was cored to a total depth of 56.5 ft using the wireline method. The Decorah Group was encountered from 20 ft to 35 ft below the ground surface and the Platin Limestone was encountered from 35 ft to 56.6 ft below the ground surface. Groundwater was present at a depth of approximately 14 ft below the ground surface; however, this borehole was drilled for monitoring groundwater within the

Plattin. Therefore, the borehole was terminated at 56.5 ft, approximately 21 ft into the Plattin. Groundwater located well above the Plattin was cased to prevent mixing. Cuttings generated from the borehole were drummed and disposed of within the inner quarry in the same manner as for MW-1029. No major difficulties were encountered during drilling operations for this borehole.

3.4 Monitoring Well-1032

The borehole for monitoring well MW-1032 is located north of the slough with the existing well cluster MW-1008 and MW-1009. This borehole was drilled on January 31, and February 1, 1991.

Silty clay with one small sand lens was encountered to 12 ft below the ground surface. The 12 ft of soil was sampled and analyzed for uranium, Th-230, Th-232, nitroaromatics, and the total Hazardous Substance List. The bedrock encountered from 12 ft to 30 ft known as the Decorah Group consisted of highly fractured limestone with a shale parting. Groundwater was present at 8 ft below the ground surface; however, this borehole was drilled to monitor the Decorah Group, therefore the borehole was terminated at 30 ft, approximately 18 ft into the Decorah. The soils in the surrounding area are known to contain low levels of radiological contamination, therefore, the rig was scanned prior to its departure. No contamination on the rig was detected prior to its departure. Also, all cuttings generated during drilling operations were disposed of within the inner quarry as described for MW-1029. No major difficulties were encountered during the drilling of this borehole.

3.5 Monitoring Well-1033

The borehole for monitoring well MW-1033, located south of the slough with well cluster MW-1019 and MW-1020, was drilled on February 13 and 14, 1991.

Silty clays were encountered to approximately 15 ft with fine sand present to 20 ft below the ground surface. This 20 ft of material was sampled and analyzed for uranium, Th-230, Th-232, and nitroaromatics. Well graded sands and gravels were encountered from 20 ft to 82.5 ft below the ground surface. This material was not sampled. Bedrock encountered from 82.5 to 97.5 ft is known as the Plattin Limestone and consisted primarily of fresh grey

limestone with stylolites. The formation appeared very tight with few fractures noted. Although it was very difficult to determine if groundwater was present within the Plattin, the borehole was terminated 15 ft within the bedrock as specified in the specifications. It should be noted that groundwater was present at a depth of 20 ft below the ground surface (within the alluvium). Cuttings generated during this operation were spread on the surface near the borehole location as specified.

One major difficulty was encountered during drilling this borehole. Heaving sands began to give the driller many problems at a depth of approximately 22 ft below the ground surface. To correct this problem, several hundred gallons of water obtained from the St. Charles County Water Treatment Plant were pumped into the borehole to create a settling effect. No other major problems were encountered during this operation.

3.6 Monitoring Well-1034

The borehole used for monitoring well MW-1034 is located approximately 100 ft due north of MW-1025 and was drilled from January 3 to January 11, 1991.

This borehole replaced MW-1025 and took several days to drill due to inclement weather. Silty clay with very few sand lenses was encountered to a depth of approximately 55 ft. Samples were collected from 0 ft to 5 ft and 40 ft to 45 ft below the ground surface and analyzed for uranium, nitroaromatics, and the total Hazardous Substance List. Bedrock encountered from 55 ft to 75 ft below the ground surface consisted of fossiliferous, grey limestone. The Kimmswick Limestone was identified as the layer from 55 ft to approximately 70 ft below the ground surface, while the remaining 5 ft was identified as the Decorah Group. Groundwater was encountered at approximately 60 ft; therefore, the borehole was terminated at 75 ft below the ground surface. Cuttings generated at this location were spread on the surface near the borehole as specified. No major difficulties were encountered at this location.

4 WELL INSTALLATION

All well casing and screen materials were made of 316L stainless steel with a locking steel protective surface casing (4 in. square) centered over the top of the well casing. Pads were constructed of ready mix concrete and were approximately 2.5 ft x 2.5 ft square with posts (6 in. diameter) installed surrounding the wells for protection. Refer to the specifications for the protective casing and pad diagrams.

4.1 Monitoring Well-1029

On January 18 through 21, 1991, monitoring well MW-1029 was installed within the Decorah Group. The screened interval for the well was between 110.5 ft and 100.5 ft below the ground surface (bgs). The sand pack was placed to 95 ft bgs and the seal (bentonite 3/4 in. pellets) to 91.5 ft bgs. The sand pack consisted of WB-40 Meramac sand. The remainder of the hole was backfilled with Volclay grout using a tremie pipe. Approximately twice the amount of volclay grout anticipated was used indicating that voids or fractures around the well absorbed the grout.

4.2 Monitoring Well-1030

From January 24 through 28, 1991, monitoring well MW-1030 was installed within the Decorah Group. The screened interval for the well was between 90 ft and 80 ft below the ground surface. The sand pack (WB-40 Meramac sand) was placed from the bottom of the borehole (95 ft bgs) to 72 ft bgs with a 4 ft seal of bentonite 3/4 in. pellets above the sand pack to 68 ft below the surface. The remainder of the hole was backfilled with Volclay grout using a tremie pipe.

4.3 Monitoring Well-1031

On January 29, 1991, monitoring well MW-1031 was installed within the Platin Limestone. The screened interval for the well was between 53 ft and 43 ft below the ground surface. The sand pack (WB-40 Meramac sand) was placed from the bottom of the borehole (56.5 ft bgs) to 39.5 ft bgs with a 3.5 ft seal (bentonite 3/4 in. pellets) above the sand pack. The remainder of the hole was backfilled with Volclay grout using a tremie pipe.

4.4 Monitoring Well-1032

On February 1, 1991, monitoring well MW-1032 was installed within the Decorah Group. The screened interval for the well was between 29 ft and 19 ft below ground surface. The sand pack (WB-40 Meramac sand) was placed from the bottom of the borehole (30 ft bgs) to 17 ft bgs with a 3 ft seal (bentonite 3/4 in. pellets) above the sand pack. The remainder of the hole was backfilled with Volclay grout using a tremie pipe.

4.5 Monitoring Well-1033

On February 20, 1991, monitoring well MW-1033 was installed within the Platin Limestone. The screened interval for the well was between 97.5 ft and 87.5 ft below the ground surface. The sand pack (WB-40) was placed from the bottom of the borehole (97.5 ft bgs) to 85 ft bgs with a 4 ft seal (bentonite 3/4 in. pellets) above the sand pack. The remainder of the hole was backfilled with Volclay grout using a tremie pipe.

4.6 Monitoring Well-1034

On January 10, 1991, monitoring well MW-1034 was installed across the Kimmswick-Decorah contact. The screened interval for the well was between 74 ft and 64 ft below ground surface. The sand pack (WB-40) was placed from the bottom of the borehole (75 ft bgs) to 58 ft bgs with a 3 ft seal (bentonite 3/4 in. pellets) above the sand pack. The remainder of the hole was backfilled with Volclay grout using a tremie pipe.

5 WELL DEVELOPMENT

Well development was performed on each of the wells drilled. Development did not commence until a minimum of 48 hrs after well installation to ensure that the grout column and concrete pad were completely set up. All wells were bailed dry 10 times because the volume of water required for removal could not be removed due to the slow recharge of the bedrock formations. However, the wells were developed until the following conditions were met as set forth in the specifications: (1) three conductivity measurements within plus or minus 20%; (2) three pH measurements within plus or minus 0.2 standard units; and (3) three temperature measurements within $\pm 1^{\circ}\text{C}$.

6 SITE RESTORATION

Site restoration was performed only at monitoring well locations MW-1031, MW-1032, and MW-1034. MW-1029 and MW-1030 are located within the inner quarry on the rim and MW-1033 is located adjacent to crops and did not require seeding. Monitoring well locations MW-1031, MW-1032 and MW-1034 were graded to conform to natural ground elevations and seeded with a winter seed mix in sufficient quantity to ensure dense growth. All locations were cleaned to remove trash and debris and restored as per specifications.

7 DECONTAMINATION

All coring, sampling, augering, and drilling equipment and all tools were decontaminated by hot water cleaning between each borehole/monitoring well location. This operation was performed within the lower inner quarry to contain all fluids generated, with the exception of decontamination after installation of MW-1034. Decontamination at the site of MW-1034 was allowed as this well was a replacement for MW-1025. Decontamination operations for this work package were performed in accordance with the specifications.

8 ANALYTICAL RESULTS

Analytical parameters for soil samples collected for all boreholes except MW-1029 were analyzed for uranium, thorium, cyanide, nitroaromatics, and all Hazardous Substance List parameters including volatiles, semivolatiles, pesticides, polychlorinated biphenyls (PCBs) and metals. No soil samples were collected at MW-1029 as per specifications.

Uranium results for all boreholes sampled were at background levels with the exception of MW-1031 and MW-1032. Uranium results for MW-1031 were only slightly above background; results for MW-1032 were as high as 67 pCi/g. Thorium results for all boreholes sampled were at or near background levels.

Nitroaromatics and cyanide were not detected in any of the samples collected. Volatile and semivolatile organics were not detected in the soil samples collected from the boreholes, with the exception of common lab contaminants such as methylene chloride, toluene, acetone, and phthalates.

All metals results were either within their natural background ranges or below the detection limit of the instrument. PCB's were not detected within any of the boreholes. Pesticides detected (aldrin and methoxychlor) within MW-1034 near the surface may be attributed to previous spraying of pesticides on the Highway 94 right-of-way.

In conclusion, the analytical results show that only uranium was detected in significant quantities; all other results were below the detection limit, very near the detection limit, or within natural background ranges.

APPENDIX A
Completed Borehole, Well Installation,
Development and Abandonment Log Forms

MK-FERGUSON
A MORRISON MUDSEN COMPANY

EXHIBIT 4.4.4.1

WELL PLUGGING AND ABANDONMENT LOG FORM

DATE OF ABANDONMENT 01/02/90/01/03/90

ORIGINAL WELL DATA:

WELL LOCATION DESIGNATION MW-1025
SURVEY COORDINATES OF WELL _____
SCREENED OR OPEN HOLE? screened
TOTAL DEPTH OF BOREHOLE 80.2'
TOTAL DEPTH OF WELL 80.2'
LENGTH OF FILTER PACK 22.2'
DEPTH TO BED ROCK (IF APPROPRIATE) 44.3'
BOREHOLE DIAMETER 8.5'
WELL PIPE DIAMETER 2.0"
LENGTH OF GROUT COLUMN 58.0' (inclds 3' seal)
TOP OF FILTER PACK ELEVATION 58.0' bgl
COMMENTS using 10" OD HS augers

DRILLING AND PLUGGING INFORMATION

WELL CASING EXTRACTED: ☒ YES ☐ NO
EXTRACTION METHOD: ☐ PULLED ☒ DRILLED but only 25' of 80'
DEPTH DRILLED 56' FEET
COMPLETE REMOVAL ACHIEVED YES ☐ NO ☒
IF PARTIAL EXTRACTION, EXPLAIN: Drilled to 35' bgl,
noticed SS in cuttings, pulled 25' of SS casing --
cut through casing, tried to center SS casing, but
couldn't as casing was outside of augers--terminated *
GROUT TYPE USED (MIX) _____

VOLUME USED (DESCRIBE ZONES OF LESS) _____
250 gallons (9)-50 lb. bags volclay grout, initiator
used

SKETCH GROUTING PROFILE: _____
PROBLEMS (BIT DEVIATION, ETC.) _____

*drilling @ 56; 12' mto bedrock

SUBCONTRACTOR NAME: Geotechnology

CE SIGNATURE: _____

DATE: 1/3/91

FEET DEPTH

PLEASE DESCRIBE THE PROFILE OF ALL PORTIONS OF THE PLUGGED COLUMN INCLUDING:
REMAINING WELL PIPE & FILTER PACK, AND VARIOUS GROUT TYPES USED. ALSO ANY DEVIATIONS OF BIT DURING DRILLING

WELDON SPRING SITE REMEDIAL ACTION PROJECT

WELL COMPLETION RECORD

WELL NUMBER MW-1029 DATE INSTALLED 18 Jan 91

PMC REPRESENTATIVE Craig S. Jones DRILLER Dale Meyer

COMMENTS Grout @ 41' Fri 18 Jan 91, Grout down @ 60' Mon 21 Jan 91

PMC REPRESENTATIVE SIGNATURE Craig S. Jones DATE 03-08-91

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 1 OF 4

WELL ID: QY LOCATION ID: MW-1029

WELL COORDINATES (FT.):
 E

GROUND ELEVATION (FT. MSL):

DRILLING METHOD: HSA 6 1/4" id, NQ 2" id

DRILLING CONTR.: Geotechnology, Inc.

DATE STARTED: 14 Jan 91

DATE COMPLETED: 17 Jan 91

FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-15-91	1630	98.0' bgl

LOCATION DESCRIPTION Near quarry fence and monitoring devices

SITE CONDITION Snow and ice on ground
~ 40°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
	0-2	5"		0-0-1-1		4" ice 1" brown silty clay - CL
	2-4	18"		1-3-5-5		Stiff brown silty clay - CL
5	4-6	24"		2-2-3-4		M. stiff brown silty clay - CL
	6-8	24"		2-2-2-3		Brown silty clay - CL
	8-10	24"		1-2-2-2		Soft brown silty clay - CL
10						
15	14.5-16.5	24"		2-2-3-4		M. stiff brown silty clay - CL
20	19-5-21-5	24"		2-2-3-5		Brown silty clay - CL
25	24.5-26.5	6"		9-15-8-5		4" reddish brown clay, some silt to chert and limestone gravel and fragments
	29.5-					Highly weathered limestone, sand, gravel, trace clay
30	31.5	12"		5-6-18-23		

COMMENTS: No samples taken at MW-1029 as per specs!

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 2 OF 4

WELL ID: QY LOCATION ID: MW-1029

WELL COORDINATES (FT.): E

GROUND ELEVATION (FT. MSL):

DRILLING METHOD: HSA 6 1/4"; NO 2" id

DRILLING CONTR.: Geotechnology Svc Inc

DATE STARTED: 14 Jan 91

DATE COMPLETED: 17 Jan 91

FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-15-91	1630	98.0' bgl

LOCATION DESCRIPTION Near fence and small electrical conduit

SITE CONDITION Snow and ice on ground 40°F

DEPTH	SAMPLE INTERVAL	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
						Highly weathered lms; sand, gravel, clay
35	34.5-35.2	6"		26-32-50/3		Limestone hard, white, few vugs, slightly to moderately weathered, fossiliferous (siliceous) some chert dark gray and brown. Good H ₂ O return. Slightly stylolitic, aphenitic
		100%				
40						
	44.3					Limestone hard, gray, aphenitic, stylolitic Fresh to slightly weathered, some calcite present @ 46.5' Few fossils, arenaceous. No H ₂ O return
45		100%				
	48.8					Limestone hard, gray aphenitic, stylolitic, Fresh to slightly weathered,
50	49.5	100%				No H ₂ O return
55		100%				Limestone hard, gray, stylolitic, fossiliferous, slightly weathered
	59.4					No H ₂ O return

COMMENTS: Auger refused @ 35, began 1st run @ 35.2

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 3 OF 4

SITE ID: QY LOCATION ID: MW-1029
 SITE COORDINATES (FT.): _____
 _____ E _____
 GROUND ELEVATION (FT. MSL): _____
 DRILLING METHOD: HSA 6½" id; NQ 2" id
 DRILLING CONTR.: Geotechnology, Inc.
 DATE STARTED: 14 Jan 91
 DATE COMPLETED: 17 Jan 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-15-91	1630	98.0' bgl
	4	

LOCATION DESCRIPTION Near quarry fence and air monitors

SITE CONDITION Snow and ice on ground, cloudy, 40°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
	59.4					<u>Limestone hard, gray, slightly to moderately weathered, stylolitic, few pits and vugs with calcite crystals, No H₂O return Small void @ 69'</u>
- 65		9.5'				
		95%				
- 70	69.4					
- 75		9.2'				<u>Limestone hard, gray, moderately weathered, stylolitic, vertical fracture with weathering. Some voids, many chert inclusions below 66', aphenitic No H₂O return</u>
		95%				
- 80	79.4					
		7.3'				<u>Limestone hard, gray, aphenitic, stylolitic, fresh to slightly weathered voids from 79.4-82'. Some chert, fossiliferous, no H₂O return</u>
		73%				
- 85						
90	89.4					

COMMENTS: _____

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 4 OF 4

WELL ID: QY LOCATION ID: MW-1029

WELL COORDINATES (FT.): _____

_____ E _____

GROUND ELEVATION (FT. MSL): _____

DILLING METHOD: BSA 6 1/2" id; NQ 2" id

DILLING CONTR.: Geotechnology, Inc.

DATE STARTED: 14 Jan 91

DATE COMPLETED: 17 Jan 91

FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-15-91	1630	98.0' bgl

LOCATION DESCRIPTION Inside quarry gate near monitoring devices

SITE CONDITION Snow on ground, raining, 35°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
	89.4					Limestone <u>hard</u> , gray, aphenitic, fresh to moderately weathered below 97'. Stylolitic, some chert inclusions, highly fossiliferous. No H ₂ O return
		100%				
95						
100	99.4					Limestone <u>hard</u> , gray, aphenitic, highly to slightly weathered, argillaceous below 106'. Shale layer 10" thick @ 108' (top of decorah) No H ₂ O return
	99.4					
105		100%				
110	109.4					Limestone <u>hard</u> , gray, fresh, aphenitic, highly fossiliferous, argillaceous No H ₂ O return
		100%				
	112					
115						
120						

xx

COMMENTS: Boring terminated @ 112.0'. Schrammed to 117.5'. Hole slumped and re-schrammed to 117.5'. Next morning 18 Jan Friday hole open to 111.5'.

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELL DEVELOPMENT FORM

PAGE 1 OF 2

WELL NUMBER MW-1029 DATE 06 Feb 91

FIELD PERSONNEL Scott Hilderbrand/Paul Guerrein/A. Limmer

STATIC WATER LEVEL 92' bgl 02-06-91 TOTAL DEPTH 110'

WELL VOLUME (CASING AND FILTER PACK) -----

DEVELOPMENT METHOD(S) 2" stainless steel bailer by hand

BEGINNING TIME 1445

INITIAL WATER CONDITIONS cloudy

RECHARGE RATE very, very slow

END TIME 1540

TOTAL VOLUME REMOVED 48 GALS.

TOTAL WELL VOLUMES REMOVED n/a GALS.

FINAL TURBIDITY MEASUREMENT n/a NTU

FINAL WATER LEVEL ----- FINAL DEPTH -----

COMMENTS -see attached (bailed well dry 10 times)

-water clear during development and @ end of development

PMC REPRESENTATIVE SIGNATURE DATE 03-08-91

- 1) 06 Feb 91
water level @ 92'
7.52 pH, 10°C, 700 umohs
dry after 8 gal removed
- 2) 07 Feb 91
water level @ 100.5'
6.95 pH, 10°C, 730 umohs
dry after 4 gal removed
- 3) 08 Feb 91
water level @ 101'
6.80 pH, 9°C, 870 umohs
dry after 2.5 gal removed
- 4) 11 Feb 91
water level @ 94'
7.35 pH, 10°C, 950 umohs
dry after 5 gal removed
- 5) 12 Feb 91
water level @ 103'
7.30 pH, 10°C, 990 umohs
dry after 3 gal removed
- 6) 14 Feb 91
water level @ 95'
7.30 pH, 9°C, 1060 umohs
dry after 4.5 gal removed
- 7) 21 Feb 91
water level @ 95'
6.94 pH, 16°C, 810 umohs
dry after 8 gal removed
- 8) 26 Feb 91
water level @ 93.5'
7.35 pH, 9°C, 1000 umohs
dry after 5.5 gal removed
- 9) 28 Feb 91
water level @ 100'
7.79 pH, 10°C, 870 umohs
dry after 5.5 gal removed
- 10) 01 Mar 91
water level @ 105'
7.90 pH, 10°C, 870 umohs
dry after 2 gal removed

110' well

WELDON SPRING SITE REMEDIAL ACTION PROJECT

WELL COMPLETION RECORD

WELL NUMBER MW-1030 DATE INSTALLED 24 Jan 91

PMC REPRESENTATIVE Craig S. Jones DRILLER Dale Meyer

COMMENTS 1' plug 90-91'
4' sand below plug

PMC REPRESENTATIVE SIGNATURE Craig S. Jones DATE 03-08-91

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 1 OF 4

SITE ID: QY LOCATION ID: MW-1030
 SITE COORDINATES (FT.): _____
 _____ E _____
 GROUND ELEVATION (FT. MSL): _____
 DRILLING METHOD: HSA 6 1/2" id; NX 2" id
 DRILLING CONTR.: Geotechnology, Inc.
 DATE STARTED: 22 Jan 91
 DATE COMPLETED: 24 Jan 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-28-91	0930	87.0 bgl

LOCATION DESCRIPTION Quarry @ SE corner of fence, wooded

SITE CONDITION icy, slight slope 30°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
						2" top soil
	0-2	8"		3-2-2-3		M. stiff brown silty clay - CL
	2-4	18"		2-4-6-6		Stiff brown silty clay - CL
- 5	4-6	24"		3-4-4-6		Stiff brown silty clay - CL
	6-8	24"	3001	2-3-3-3		M. stiff brown silty clay - CL
	8-10	26"		1-3-4-5		Stiff brown silty clay - CL
- 10						
- 15	14-16	24"		2-4-5-7		Stiff brown silt with v. fine sand - ML
- 20	19-21	24"		3-6-8-9		V. stiff brown silt with v. fine sand and some clay below 19' - ML
- 25	24-26	24"		2-7-10-11		v. stiff brown, v. silty clay, trace organics, tr. sand - CL - ML
30	30-32	24"		3-4-6-6		stiff reddish brown silty clay - CL

COMMENTS: Natural Uranium/Thorium samples were topped off with cuttings.
Not enough soil in split spoons.

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 2 OF 4

WELL ID: 0Y LOCATION ID: MW-1030
 WELL COORDINATES (FT.): E
 BOUND ELEVATION (FT. MSL):
 DRILLING METHOD: HSA 6 1/2" id; NX 2" id
 DRILLING CONTR.: Geotechnology, Inc.
 DATE STARTED: 22 Jan 91
 DATE COMPLETED: 24 Jan 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-28-91	0930	87.0' bgl

LOCATION DESCRIPTION wooded, quarry @ SE corner of fence
 SITE CONDITION icy, slight slope, 30°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
	30-32	24"		3-4-6-6		stiff reddish brown silty clay - CL
	32-34	24"	3002	3-3-6-12		v. stiff reddish brown silty clay to 33.2' reddish brown clay and gravel - CL to CH
35	34-36	12"		3-4-9-9		v. stiff reddish brown clay with silt and chert gravel and fragments - CH
40	40-42	24"		4-8-10-13		v. stiff reddish brown clay with chert gravel and fragments - CH
	42-44			9-18-13-7		v. stiff reddish brown clay with limestone gravel - CH
45						
50	51					Limestone hard, white, finely crystalline, stylolitic, few fossils, siliceous, slightly weathered to moderately weathered with small voids @ 58' to 60.3' void @ 58.8' to 60.3' some brown clay in shoe of sample barrel, possible clayseam.
55		7.8'				
		85%				
60	60.3					

COMMENTS: Auger refusal @ 50'. Run 1 started @ 51'1". Void @ 58.8'-60.3'

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 3 OF 4

TEST ID: QY LOCATION ID: MW-1030

TEST COORDINATES (FT.): _____

_____ E _____

GROUND ELEVATION (FT. MSL): _____

DILLING METHOD: HSA 6 1/2" id; NX 2" id

DILLING CONTR.: Geotechnology, Inc.

DATE STARTED: 22 Jan 91

DATE COMPLETED: 24 Jan 91

FIELD GEOLOGIST/ENGINEER: _____

GROUNDWATER LEVELS

DATE	TIME	DEPTH (FT.)
01-28-91	0930	87.0 bgl

LOCATION DESCRIPTION wooded, in quarry @ SE corner of fence

SITE CONDITION icy, slight slope 36°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	Z VALUE	VISUAL CLASSIFICATION
60	60.3					clay seam, brown stiff sandy with rock fragments from 59.0' to 60.6'
						clay to 61'
		11.3				clay to 61'
		100%				
65						Limestone hard, white
						aphenitic, stylolitic, moderately
						weathered to highly weathered with
						voids and vugs - siliceous
70	70.3					
		9'				Limestone hard, white, aphenitic,
		100%				moderately weathered with small vugs and
75						voids. Calcite crystals in vugs @ 75.6'.
						Becoming argillaceous below 77'.
						Fossiliferous below 77.5'. Small dark
						argillaceous band @ 78' with stylolite
						conflict. 2" gray clay @ 79.1'. 79.3' to
	79.3					79.5' shale gray, fissile, soft, fresh,
		100%				79.5'-79.6' very argillaceous limestone
80	80.8	1.5				dark gray, moderately hard, 79.6'-79.8'
						shaley limestone, soft, dark gray, some
		46%				fissility, 79.8'-80' argillaceous lime-
		2.3				stone embedded with fissile shale, shaley
		46%				limestone and clay ending @ 80.6'-80.8'
85	85.5					white limestone discolored brown.
						Shale @ 80.8'-80.9' brown, fresh,
		5.0				Limestone white, hard, fossiliferous,
		100%				fresh to slightly weathered small brown
						clay
90	90.8					

COMMENTS: Recovered clay from end of first run in second run barrel.

PAGE 4 OF 4

FIELD GEOLOGIST/ENGINEER: A. Limmer

SITE CONDITION snow on ground, slight
slope, 40°F

COMMENTS: Schrammed to 95' set well @ 90'.

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELL DEVELOPMENT FORM

PAGE 1 OF 2

WELL NUMBER MW-1030 DATE 07 Feb 91

FIELD PERSONNEL Scott Hilderbrand/Paul Guerrein/A. Limmer/Dale Meyer

STATIC WATER LEVEL 85' bgl 02-07-91 TOTAL DEPTH 90'

WELL VOLUME (CASING AND FILTER PACK) ----

DEVELOPMENT METHOD(S) bailer

BEGINNING TIME 1020

INITIAL WATER CONDITIONS cloudy

RECHARGE RATE very, very slow

END TIME n/a

TOTAL VOLUME REMOVED 8.25 GALS.

TOTAL WELL VOLUMES REMOVED n/a GALS.

FINAL TURBIDITY MEASUREMENT n/a NTU

FINAL WATER LEVEL ---- FINAL DEPTH ----

COMMENTS -see attachment (bailed well dry 10 times)

-water clear @ end of development

PMC REPRESENTATIVE SIGNATURE Craig H. Jones DATE 03-08-91

- 1) 07 Feb 91
water level @ 85'
7.50 pH, 9°C, 1280 umohs
dry after 1.5 gal removed
- 2) 08 Feb 91
water level @ 88.5'
6.91 pH, 9°C, 1480 umohs
dry after 1 gal removed
- 3) 11 Feb 91
water level @ 88.5'
7.05 pH, 10°C, 1340 umohs
dry after 3/4 gal removed
- 4) 12 Feb 91
water level @ 89'
6.97 pH, 9°C, 1490 umohs
dry after 1/2 gal removed
- 5) 14 Feb 91
water level @ 88.5'
6.78 pH, 9°C, 1480 umohs
dry after 1 gal removed
- 6) 21 Feb 91
water level @ 87'
6.62 pH, 15°C, 1118 umohs
dry after 1 gal removed
- 7) 25 Feb 91
water level @ 87.5'
7.10 pH, 12°C, 1240 umohs
dry after 1 gal removed
- 8) 27 Feb 91
water level @ 87.5'
7.65 pH, 11°C, 1110 umohs
dry after 1 gal removed
- 9) 28 Feb 91
water level @ 88'
7.85 pH, 12°C, 1070 umohs
dry after 1/2 gal removed
- 10) 01 Mar 91
water level @ 88.5'
7.80 pH, 12°C, 1100 umohs
dry after 1/2 gal removed

90' well

WELDON SPRING SITE REMEDIAL ACTION PROJECT

WELL COMPLETION RECORD

WELL NUMBER MW-1031 DATE INSTALLED 29 Jan 91

PMC REPRESENTATIVE Craig S. Jones DRILLER Dale Meyer

COMMENTS _____

PMC REPRESENTATIVE SIGNATURE Craig S. Jones DATE 03-08-91

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 1 OF 2

SITE ID: SLOUGH LOCATION ID: MW-1031
 SITE COORDINATES (FT.): _____
 _____ E _____
 GROUND ELEVATION (FT. MSL): _____
 DRILLING METHOD: HSA 6 1/2" NX 2" id
 DRILLING CONTR.: Geotechnology, Inc.
 DATE STARTED: 28 Jan 91
 DATE COMPLETED: 29 Jan 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-28-91	1130	14.0'

LOCATION DESCRIPTION wooded

SITE CONDITION muddy, sunny, 25°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
3101	0-2	18"		3-2-12		brown silty clay
3102	2-4	24"		1-2-1-1		brown silty sand - SM
3103	4-6	24"		0-2-2-1		brown silty clay with organics - CL
3104	6-8	24"		0-0-1-2		brown silty clay with organics some sand - CL
3105	8-10	24"		1-1-1-2		brown silty clay to 9.5' gray clay w/sand
10	10-12	24"		0-2-3-1		gray clay - CH
3106	12-14	24"		0-1-1-1		gray clay - CH
3107	14-16	24"		0-2-3-5		gray clay with silt to 15.8', gray silt and sand
3108	16-18	10"		4-6-19-50		gray silty clay to 17', limestone gravel and fragments
3109	18-20	13"		30-20-50/3"		sand and gravel to 18.5', limestone gravel
20	20.8					
25		100%				
	29.8					

Limestone hard, white, microcrystalline
 fresh, small shale layer @ 26'
 Decorah

COMMENTS: Water @ 14' AR @ 20.5'

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 2 OF 2

WELL ID: SLOUGH LOCATION ID: MW-1031

N E COORDINATES (FT.): _____

_____ E _____

GROUND ELEVATION (FT. MSL): _____

DILLING METHOD: HSA 6 1/2"; NX 2" id

DILLING CONTR.: Geotechnology, Inc.

DATE STARTED: 28 Jan 91

DATE COMPLETED: 29 Jan 91

FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-28-91	1130	14.0'
	4	

LOCATION DESCRIPTION wooded

SITE CONDITION cleared by dozer.

sunny

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
30	29.8					Limestone hard, white and gray, fresh, argillaceous large hornblende, and calcite inclusion @ 31.5 microcrystalline
35		100%				plattin @ 35'
40	39.8					Limestone hard, white, gray banding, fresh, slightly stylolitic, microcrystalline, argillaceous
	39.8					
45		100%				
50	49.8					Limestone hard; white and gray, fresh, stylolitic, microcrystalline, argillaceous
		100%				
55	59.8					

COMMENTS: Well set @ 43 to 53'.

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELL DEVELOPMENT FORM

PAGE 1 OF 2

WELL NUMBER MW-1031 DATE 07 Feb 91

FIELD PERSONNEL Dale Meyer/Paul Guerrein/Scott Hilderbrand/A. Limmer

STATIC WATER LEVEL 10' bgl 02-07-91 TOTAL DEPTH 53'

WELL VOLUME (CASING AND FILTER PACK) -----

DEVELOPMENT METHOD(S) 2" pvc bailer by hand

BEGINNING TIME -----

INITIAL WATER CONDITIONS cloudy

RECHARGE RATE very, very slow

END TIME -----

TOTAL VOLUME REMOVED 47 GALS.

TOTAL WELL VOLUMES REMOVED n/a GALS.

FINAL TURBIDITY MEASUREMENT n/a NTU

FINAL WATER LEVEL ----- FINAL DEPTH -----

COMMENTS -see attached (well bailed dry 10 times)

-water clear @ end of development

PMC REPRESENTATIVE SIGNATURE DATE 03-08-91

- 1) 07 Feb 91
water level @ 10'
6.88 pH, 10°C, 1070 umohs
dry after 15 gal removed
- 2) 08 Feb 91
water level @ 49'
no tests
dry after 2.5 gal removed
- 3) 11 Feb 91
water level @ 46'
7.25 pH, 10°C, 950 umohs
dry after 4 gal removed
- 4) 12 Feb 91
water level @ 49'
7.07 pH, 10°C, 880 umohs
dry after 2.5 gal removed
- 5) 14 Feb 91
water level @ 47'
7.11 pH, 9°C, 990 umohs
dry after 2.5 gal removed
- 6) 22 Feb 91
water level @ 30'
7.35 pH, 9°C, 880 umohs
dry after 9.5 gal removed
- 7) 26 Feb 91
water level @ 37'
7.70 pH, 11°C, 740 umohs
dry after 2.5 gal removed
- 8) 27 Feb 91
water level @ 49'
7.43 pH, 10°C, 720 umohs
dry after 2.5 gal removed
- 9) 28 Feb 91
water level @ 49'
8.05 pH, 10°C, 650 umohs
dry after 2.5 gal removed
- 10) 01 Mar 91
water level @ 49.5'
7.83 pH, 10°C, 680 umohs
dry after 1 gal removed

53' well

WELDON SPRING SITE REMEDIAL ACTION PROJECT

WELL COMPLETION RECORD

WELL NUMBER MW-1032 DATE INSTALLED 01 Feb 91

PMC REPRESENTATIVE Craig S. Jones DRILLER Dale Meyer

COMMENTS _____

PMC REPRESENTATIVE SIGNATURE Craig S. Jones DATE 03-08-91

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 1 OF 1

WELL ID: SLOUGH LOCATION ID: MW-1032

WELL COORDINATES (FT.): _____

_____ E _____

GROUND ELEVATION (FT. MSL): _____

DRILLING METHOD: HSA 6 1/2" id

DRILLING CONTR.: Geotechnology

DATE STARTED: 31 Jan 91

DATE COMPLETED: 04 Feb 91

FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-31-91	1130	8.0'

LOCATION DESCRIPTION wooded

SITE CONDITION frozen ground, cleared
with dozer 25°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
3201	0-2	8"		3-2-2-3		8" top soil dark brown to soft brownish gray silty clay
	2-4	18"		0-1-2-1		soft brown silty clay with organics - CL
3202 5	4-6	24"		0-1-1-1		soft brown silty clay to gray silty clay with sand - CL
3203	6-8	24"		0-0-0-0		v. soft gray silty clay, trace sand - CL
3204	8-10	18"		0-0-0-1		v. soft gray silty clay trace sand to 8.3' loose gray sand some clay-CL to SC
10	10-12	12"		0-1-1-2		v. loose gray clay sand and organics to 11.8' brown fine and med sand-SC/OL to SP
	12-12	1"		50/1"		stiff yellowish brown clay and limestone fragments
15	14					
		50%				
	17.8					Limestone hard, gray, microcrystalline, highly fractured and broken, possibly mechanical break. Good H ₂ O return fracture or void @ 17.5' ²
20						
		100%				
25						Limestone hard, white, microcrystalline, highly fractured and argillaceous to 18.2' some green clay. 4" gray shale @ 19' very argillaceous limestone green and gray to 21' gray argillaceous limestone some discoloration, stylolitic, 3" clay seam @ 25'. Vug filled with calcite crystals @ 27.3'
	27.8					
		100%				
30	30					Limestone hard, white, microcrystalline, fresh, argillaceous some discoloration

COMMENTS: water @ 8', AR @ 14'

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELL DEVELOPMENT FORM

PAGE 1 OF 2

WELL NUMBER MW-1032 DATE 07 Feb 91

FIELD PERSONNEL Dale Meyer/Scott Hilderbrand/A. Limmer

STATIC WATER LEVEL 4' bgl 02-07-91 TOTAL DEPTH 30'

WELL VOLUME (CASING AND FILTER PACK) -----

DEVELOPMENT METHOD(S) 2" pvc bailer by hand

BEGINNING TIME -----

INITIAL WATER CONDITIONS clear in first bailer, cloudy after

RECHARGE RATE slow

END TIME -----

TOTAL VOLUME REMOVED 68.5 GALS.

TOTAL WELL VOLUMES REMOVED n/a GALS.

FINAL TURBIDITY MEASUREMENT n/a NTU

FINAL WATER LEVEL ----- FINAL DEPTH -----

COMMENTS -see attached (well bailed dry 10 times)

-water clear @ end of development

PMC REPRESENTATIVE SIGNATURE DATE 03-08-91

- 1) 07 Feb 91
water level @ 4'
6.89 pH, 10°C, 1030 umohs
dry after 8 gal removed
- 2) 08 Feb 91
water level @ 8'
7.05 pH, 9°C, 1340 umohs
dry after 7.5 gal removed
- 3) 11 Feb 91
water level @ 6'
7.25 pH, 9°C, 1270 umohs
dry after 7.5 gal removed
- 4) 12 Feb 91
water level @ 7'
6.80 pH, 9°C, 1160 umohs
dry after 8 gal removed
- 5) 14 Feb 91
water level @ 6'
7.45 pH, 8°C, 1340 umohs
dry after 8 gal removed
- 6) 22 Feb 91
water level @ 5.5'
7.25 pH, 9°C, 1240 umohs
dry after 8 gal removed
- 7) 26 Feb 91
water level @ 7'
7.40 pH, 9°C, 1170 umohs
dry after 5.5 gal removed
- 8) 27 Feb 91
water level @ 11'
7.24 pH, 10°C, 1210 umohs
dry after 6.0 gal removed
- 9) 28 Feb 91
water level @ 11'
7.73 pH, 10°C, 1000 umohs
dry after 5 gal removed
- 10) 01 Mar 91
water level @ 9'
7.50 pH, 10°C, 1100 umohs
dry after 5 gal removed

30' well

WELDON SPRING SITE REMEDIAL ACTION PROJECT

WELL COMPLETION RECORD

WELL NUMBER MW-1033 DATE INSTALLED 20 Feb 91

PMC REPRESENTATIVE Craig S. Jones DRILLER Dale Meyer

COMMENTS Casing to have another riser added to it before protective casing installed.

PMC REPRESENTATIVE SIGNATURE Craig S. Jones DATE 03-08-91

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 1 OF 4

WELL ID: SLOUGH LOCATION ID: MW-1033
 WELL COORDINATES (FT.): _____
 _____ E _____
 GROUND ELEVATION (FT. MSL): _____
 DRILLING METHOD: HSA 6 1/2" id
 DRILLING CONTR.: Geotechnology
 DATE STARTED: 13 Feb 91
 DATE COMPLETED: 20 Feb 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
02-13-91	1330	20.0
	4	

LOCATION DESCRIPTION S of slough

SITE CONDITION open field

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
	0-2	8"		2-2-3-4		dk. brown silty clay - CL
	2-4	12"		1-3-3-3		m. stiff brown silty clay - CL/CH
301	4-6	18"		1-2-2-3		m. stiff brown clay with silt to silty clay, some organics - CH to CL
5	6-8	24"		1-2-2-3		m. stiff brown silty clay - CL
302	8-10	24"		2-3-4-5		stiff brown clay - Ch
10	10-12	30"		1-3-3-5		m. stiff brown and gray clay - CH
303	12-14	30"		2-2-2-2		soft brownish gray clay trace sand to silty clay trace sand-CH to CL with sand layers
15	14-16	24"		2-5-7-7		m. dense sandy clay to silty sand, fine brown SC-SM
304	16-18	12"		2-3-3-3		loose brown fine silty sand to fine sand - SM-SP
305	18-20	18"		1-3-3-7		m. dense brown fine sand to gray clayey sand - SP-SC
20	20-22	12"		1-2-4-4		m. dense gray fine sand - SP
25						
30						

COMMENTS: Hit water @ 20'. Stopped sampling @ 22'. Sand heaving up into augers.
Checked every five feet after, fine gray and brown sand still heaving into
augers. Hit gravel @ 65'.

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 2 OF 4

ITE ID: SLOUGH LOCATION ID: MW-1033
 ITE COORDINATES (FT.): _____
 _____ E _____
 ROUND ELEVATION (FT. MSL): _____
 RILLING METHOD: HSA 6 1/2" id
 RILLING CONTR.: Geotechnology
 DATE STARTED: 13 Feb 91
 DATE COMPLETED: 20 Feb 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
02-13-91	1330	20.0'

LOCATION DESCRIPTION S. of slough

SITE CONDITION open field

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
35						
40						
45						
50						
55						

COMMENTS: _____

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 3 OF 4

WELL ID: SLOUGH LOCATION ID: MW-1033
 WELL COORDINATES (FT.): _____
 _____ E _____
 GROUND ELEVATION (FT. MSL): _____
 DRILLING METHOD: HSA 6 1/2" id
 DRILLING CONTR.: Geotechnology
 DATE STARTED: 13 Feb 91
 DATE COMPLETED: 20 Feb 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
02-13-91	1330	20.0'

LOCATION DESCRIPTION S. of slough

SITE CONDITION open field

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
65	65-67	2"		7-11-10-13		gray fine sand to multicolored fine gravel - SP/GP
70						
75						
80	81.8					Gravel to 82.5' Limestone hard, white and gray, aphenitic, stylolitic, fresh @ 82.5'
85		100%				Plattin
90						

COMMENTS: Hit refusal @ 82.5'.

PAGE. 4 OF 4

DATE COMPLETED: _____
FIELD GEOLOGIST/ENGINEER: A. Limmer

SITE CONDITION open field

COMMENTS: _____

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELL DEVELOPMENT FORM

PAGE 1 OF 2

WELL NUMBER MW-1033 DATE 07 Mar 91

FIELD PERSONNEL Paul Guerrein/A. Limmer

STATIC WATER LEVEL 2' of water in hole TOTAL DEPTH 97' bgl

WELL VOLUME (CASING AND FILTER PACK) -----

DEVELOPMENT METHOD(S) 2"pvc bailer by hand

BEGINNING TIME -----

INITIAL WATER CONDITIONS cloudy

RECHARGE RATE very, very slow

END TIME -----

TOTAL VOLUME REMOVED 28 GALS.

TOTAL WELL VOLUMES REMOVED ----- GALS.

FINAL TURBIDITY MEASUREMENT n/a NTU

FINAL WATER LEVEL 2' of water in hole FINAL DEPTH ----

COMMENTS -bailed well 10 times

-water clear @ end of development

PMC REPRESENTATIVE SIGNATURE DATE 03-08-91

- 1) 22 Feb 91
water level @ 17'
8.55 pH, 11°C, 490 umohs
dry after 22 gal removed
- 2) 25 Feb 91
water level @ 95'
8.45 pH, 10°C, 640 umohs
dry after 2 gal removed
- 3) 26 Feb 91
water level @ 96'
8.41 pH, 10°C, 620 umohs
dry after 1/2 gal removed
- 4) 27 Feb 91
water level @ 96'
8.15 pH, 10°C, 720 umohs
dry after 1/2 gal removed
- 5) 28 Feb 91
water level @ 96'
8.33 pH, 13°C, 730 umohs
dry after 1/2 gal removed
- 6) 01 Mar 91
water level @ 96'
8.52 pH, 10°C, 660 umohs
dry after 1/2 gal removed
- 7) 04 Mar 91
water level @ 96'
7.22 pH, 11°C, 650 umohs
dry after 1/2 gal removed
- 8) 05 Mar 91
water level @ 96'
7.17 pH, 12°C, 810 umohs
dry after 1/2 gal removed
- 9) 06 Mar 91
water level @ 96'
7.29 pH, 11°C, 890 umohs
dry after 1/2 gal removed
- 10) 07 Mar 91
water level @ 96'
7.65 pH, 11°C, 820 umohs
dry after 1/2 gal removed

97' well

WELDON SPRING SITE REMEDIAL ACTION PROJECT

WELL COMPLETION RECORD

WELL NUMBER MW-1034 DATE INSTALLED 10 Jan 91

PMC REPRESENTATIVE Craig S. Jones DRILLER Dale Meyer

COMMENTS _____

PMC REPRESENTATIVE SIGNATURE Craig S. Jones DATE 03-08-91

PAGE 1 OF 3

FIELD GEOLOGIST/ENGINEER: A. Limmer

4

SITE CONDITION: snow on ground, sunny
30°F

COMMENTS: _____

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 2 OF 3

WELL ID: QY LOCATION ID: MW-1034
 WELL COORDINATES (FT.): E
 GROUND ELEVATION (FT. MSL): HSA 6 1/2" ID; NX 2" ID
 DRILLING METHOD: Geotechnology
 DRILLING CONTR.: 03 Jan 91
 DATE STARTED: 09 Jan 91
 DATE COMPLETED: A. Limmer
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-07-90	0900	60.2' bgl

LOCATION DESCRIPTION wooded

SITE CONDITION snow on ground, sunny
28-30°F

DEPTH	SAMPLE INTERV.	SAMPLE RECOV.	CPM (OPT.)	BLOWS PER 6 IN.	Z VALUE	VISUAL CLASSIFICATION
30	29-31	24"		4-5-5-6		
35	34	24"		3-10-9-12		brown v. fine sand some silt to 35'
	36					lt. brown v. fine sand - SP
40	39	24"		3-6-4-5		brown silt and sand with clay -SM/ML
	3402	24"		3-4-4-5		brown v. fine sandy silt to 42' brown
						v. fine sandy clay to 42.7' lt. brown v.
		24"		3-2-3-3		fine sand -CL/SM to CL/SC to SP
45	45					brown silty clay with v. fine sand to
						44.2' brown silty clay -CL/CH
						oversaturated from 44 to 44.5'
50	49	24"		2-4-5-6		tan and gray clay with silt and Mg nodules
	51					trace Fe staining - CH
55	54	16"		2-25-27-50	3"	reddish brown clay with vertical yellow
	56					sand partings (highly weathered lms
						residue) -CH to 54.5' white sand and
						lms fragments to yellow highly weathered
						lms.
60						

COMMENTS: Red head broke @ 1550. Removed 15' of augers and spun cuttings up.
AL @ 57.5 began coring @ 59.5'.

WELDON SPRING SITE REMEDIAL ACTION PROJECT BOREHOLE LOG

PAGE 3 OF 3

SITE ID: QY LOCATION ID: MW-1034
 SITE COORDINATES (FT.): _____
 _____ E _____
 GROUND ELEVATION (FT. MSL): _____
 DRILLING METHOD: HSA 6 1/2" id; NX 2" id
 DRILLING CONTR.: Geotechnology
 DATE STARTED: 03 Jan 91
 DATE COMPLETED: 09 Jan 91
 FIELD GEOLOGIST/ENGINEER: A. Limmer

GROUNDWATER LEVELS		
DATE	TIME	DEPTH (FT.)
01-07-91	0900	60.2' bgl

LOCATION DESCRIPTION wooded
 SITE CONDITION snow and ice on ground
sunny with clouds, 20°F

DEPTH	SAMPLE INTERV.	SAMPLE RECUV.	CPM (OPT.)	BLOWS PER 6 IN.	N VALUE	VISUAL CLASSIFICATION
60	59.5					No H ₂ O return. Limestone hard, gray, slightly fossiliferous finely crystalline, large vugs to 52.5' with Fe staining. Fe staining to 64'. Limestone gray and white, argillaceous, hard, aphenitic, few small clay seams. 0.05' shale @ 67.6 fissile.
65		100%				poor H ₂ O return Limestone hard, gray and white, aphenitic qreneaceous, fossiliferous
70	69.5					poor H ₂ O return Limestone hard, gray and white, aphenitic qreneaceous, fossiliferous
75	74.7					poor H ₂ O return Limestone hard, gray and white, aphenitic qreneaceous, fossiliferous

COMMENTS: Boring terminated @ 74.7' (core)
Reamed to 75'.

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELL DEVELOPMENT FORM

PAGE 1 OF 2

WELL NUMBER MW-1034 DATE 06 Feb 91

FIELD PERSONNEL Paul Guerrein/Scott Hilderbrand/A. Limmer

STATIC WATER LEVEL 57' bgl 02-06-91 TOTAL DEPTH 75'

WELL VOLUME (CASING AND FILTER PACK) _____

DEVELOPMENT METHOD(S) 2" stainless steel bailer by hand

BEGINNING TIME ----

INITIAL WATER CONDITIONS cloudy

RECHARGE RATE very, very slow

END TIME -----

TOTAL VOLUME REMOVED 47 GALS.

TOTAL WELL VOLUMES REMOVED n/a GALS.

FINAL TURBIDITY MEASUREMENT n/a NTU

FINAL WATER LEVEL ----- FINAL DEPTH -----

COMMENTS -see attached (well bailed dry 10 times)

-water clear @ end of development

PMC REPRESENTATIVE SIGNATURE DATE 03-08-91

- 1) 06 Feb 91
water level @ 57'
7.30 pH, 10°C, 770 umohs
dry after 7 gal removed
 - 07 Feb 91
water level @ 68'
did not bail or test
 - 2) 08 Feb 91
water level @ 66'
7.05 pH, 9°C, 870 umohs
dry after 3.5 gal removed
 - 3) 11 Feb 91
waterlevel @ 63'
7.25 pH, 10°C, 800 umohs
dry after 5.5 gal removed
 - 12 Feb 91
water level @ 68'
did not bail or test
 - 4) 14 Feb 91
water level @ 61.5
6.87 pH, 9°C, 840 umohs
dry after 6.5 gal removed
 - 5) 21 Feb 91
water level @ 58'
7.17 pH, 14°C, 580 umohs
dry after 7 gal removed
 - 6) 26 Feb 91
water level @ 61'
7.30 pH, 12°C, 730 umohs
dry after 7 gal removed
 - 7) 27 Feb 91
water level @ 69'
7.53 pH, 11°C, 870 umohs
dry after 4.5 gal removed
 - 8) 28 Feb 91
water level @ 64'
7.95 pH, 11°C, 870 umohs
dry after 4 gal removed
 - 9) 28 Feb 91
water level @ 70'
8.25 pH, 12°C, 670 umohs
dry after 1 gal removed
 - 10) 01 Mar 91
water level @ 70'
8.22 pH, 11 °C, 720 umohs
dry after 1 gal removed
- 75' well

END

**DATE
FILMED**

01 / 21 / 92