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PROJECT SPECIFIC PLAN FOR ADDITIONAL MONITORING WELL INSTALLATION AND WELL ABANDONMENT MAY 1993

06/15/93

DOE-FN/EPA
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ADDENDUM

4480

PROJECT SPECIFIC PLAN

for

ADDITIONAL MONITORING WELL INSTALLATION

and

WELL ABANDONMENT

WBS No. 50.03.22

Draft Addendum to the
Remedial Investigation/Feasibility Study
Work Plan

Prepared by

Fernald Environmental Restoration Management Corporation

Prepared for

U.S. Department of Energy
Fernald Field Office

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TABLE OF CONTENTS

List of Figures iv

List of Tables v

1.0 INTRODUCTION 1

2.0 PREVIOUS INVESTIGATIONS 1

3.0 GROUNDWATER MONITORING WELLS AND BACKGROUND DATA 2

3.1 GLACIAL OVERBURDEN WELLS 2

3.1.1 Well 11067 Northwest of Sewage Treatment Plant 3

3.1.2 Proposed Type 1 Wells In West Pilot Plant Area 13

3.1.3 Replacement Wells for the Plant 1 Pad Area 15

3.1.4 Replacement Wells Within the Production Area 15

3.1.5 New Well 11064 North of the Inactive Flyash Pile 18

3.1.6 Replacement Wells Within the Waste Pit Area 18

3.1.7 New Wells at the Stormwater Retention Basin 21

3.2 GREAT MIAMI AQUIFER WELLS 23

3.2.1 New Well 21063 Southeast of Homeowner Well 13 23

3.2.2 New Well 21064 North of the Inactive Flyash Pile 26

3.2.3 New Well 21065 West of the Stormwater Retention Basin 26

3.2.4 Type 2 Well Installation Procedure-Special Considerations 27

3.2.5 Well 3084 Abandonment and Replacement 27

3.2.6 New Well 41066 East of the KC-2 Warehouse 28

3.3 OBJECTIVES SUMMARY 32

3.4 ANALYTICAL PROGRAM 32

TABLE OF CONTENTS
(Continued)

4.0 ORGANIZATION AND RESPONSIBILITIES 32

4.1 FIELD ACTIVITIES 34

4.2 QUALITY ASSURANCE AND QUALITY CONTROL 35

5.0 HEALTH AND SAFETY CONSIDERATIONS 35

5.1 TASK SPECIFIC PLANS 36

5.2 RADIOLOGICAL MONITORING AND CONTROLS 36

5.3 NONRADIOLOGICAL MONITORING AND CONTROLS 37

6.0 QUALITY ASSURANCE AND QUALITY CONTROL 37

6.1 FIELD AND LABORATORY QUALITY CONTROL SAMPLES 38

6.2 TRAINING 38

7.0 FIELD ACTIVITY GUIDELINES 38

7.1 WASTE DISPOSITION 39

7.1.1 Soil Cores and Cuttings 40

7.1.2 Purge Water 40

7.1.3 Contact Wastes 41

7.1.4 Decontamination Solutions 41

8.0 FIELD SAMPLING SCHEME 41

8.1 SAMPLE TEAM ORGANIZATION 41

8.2. RESPONSIBILITIES OF TEAM MEMBERS 41

8.3 SAMPLING SCHEDULE 42

APPENDIX A - TARGET ANALYTE LISTS A-1

LIST OF FIGURES

Figure		Page
3-1	Sewage Treatment Plant with Soil Sampling, Boring/Well, and Proposed Locations	4
3-2	East-West Cross-Section Beneath Sewage Treatment Plant	5
3-3	Potentiometric Map of Perched Groundwater in the Glacial Overburden; Sewage Treatment Plant Area	6
3-4	Proposed Type 1 Well in the West Pilot Plant Area	14
3-5	Proposed Locations of Replacement Wells Within the Plant 1 Area	16
3-6	Proposed Location of Replacement Well 11075	17
3-7	Well Location Map North of the South Field	19
3-8	Location Map of Replacement Wells in the Waste Pit Area	20
3-9	Maximum Total Uranium in Type 2 Wells (μg/L)	24
3-10	Well Location Map Near Homeowner Well 13	25
3-11	Well 67 Potential Groundwater Plume Analysis	30

LIST OF TABLES

Table		Page
3-1	Sewage Treatment Plant Soil Analyses in pCi/g	7-8
3-2	Sewage Treatment Plant Soil Analyses by Boring	10
3-3	Sewage Treatment Plant Perched Groundwater Radiological Analyses in pCi/L	11
3-4	Sewage Treatment Plant Perched Groundwater Chemical Analyses in pCi/L	12
3-5	Waste Pit Area Well Depths	21
3-6	Estimation of Groundwater Flow Direction from Well 67	31
3-7	Groundwater and Plume Migration from Well 67	31
3-8	Summary Objectives for New Well Installation	33
3-9	Summary List of Samples by Media	34
7-1	Well Installation Procedures	40

1.0 INTRODUCTION

This Project Specific Plan (PSP) has been developed in response to the identification of remedial investigation data needs in the groundwater monitoring at the Fernald Environmental Management Project (FEMP), and contains individual specifications for the installation of new groundwater monitoring wells in the Great Miami Aquifer and in the perched groundwater zones of the glacial overburden. This PSP has been developed under the specifications of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ) by CERCLA/RCRA Unit 5 (CRU5) staff.

Well numbers in the Fernald Environmental Management Project (FEMP) have been expanded to five digits from four, and as a result, the well identification nomenclature has been modified. This PSP uses the new nomenclature in which a 1,000-Series well is now a Type 1, 2000-Series is a Type 2, etc. Under this PSP, sixteen Type 1 wells, three Type 2 wells, and one Type 4 well, will be installed. Six existing Type 1 wells and one Type 3 well will be plugged and abandoned.

The controlling deadline for the activities in this PSP is August 1, 1993. All data from these field activities must be available for data validation by August 1 for inclusion in the Operable Unit (OU) 5 Remedial Investigation (RI) report. The objective is to install the wells and collect groundwater samples that can be used in the site characterization, groundwater modeling, and risk assessments for the OU 5 RI report. All field operations and data handling procedures will be consistent with the specifications in the FEMP SCQ.

2.0 PREVIOUS INVESTIGATIONS

This PSP specifies the installation of replacement wells for damaged and/or defective wells which are located in areas where additional data are needed to support the RI report. In addition, several new wells are proposed in order to fill data needs identified as a result of a thorough review of available well data.

The majority of the existing data stemmed from the initial March 1988 RI/FS Work Plan and its addenda. Work plan addenda calling for additional monitoring well installations are listed below as Document Change Requests (DCRs) that modified the initial March 1988 Work Plan:

- 24-Well Program, DCR 14, March 23, 1989
- 10-Well Program, DCR 21, February 27, 1989

- 31-Well Program, DCR 38, March 23, 1990
- Production and Additional Suspect Area Work Plan, DCR 33, October 13, 1989
- Addendum for Six Additional Wells Along Paddys Run, DCR 43, June 8, 1990
- Additional Monitoring Well Program, DCR 44, June 26, 1990
- Paddys Run South Seepage Investigation, DCR 52, August 3, 1990
- Eight Additional Groundwater Monitoring Wells, DCR 54, August 3, 1990
- Additional Monitoring Well 3032, DCR 56, September 19, 1990
- Section 3.5, Add-on to the Production and Additional Suspect Areas Work Plan, DCR 63 March 11, 1991
- Additional Wells for Operable Unit 5, DCR 71, October 10, 1991

3.0 GROUNDWATER MONITORING WELLS AND BACKGROUND DATA

Section 3.1 discusses the glacial overburden wells and Section 3.2 discusses the Great Miami Aquifer wells to be installed. Soil samples for total uranium and total thorium will be collected from the glacial overburden at each location on FEMP property. All wells will be developed and sampled for radiological, HSL inorganic, volatile and semivolatile organics, and general water chemistry. Target Analyte Lists (TAL) specifying individual analytes for soil and water samples and quality control sampling are included in Appendix A.

3.1 GLACIAL OVERBURDEN WELLS

Sections 3.1.1 through 3.1.7 provide the rationale for installing the 16 new Type 1 wells. All Type 1 wells in this PSP will be 4-inch stainless steel wells. Soil samples will be collected continuously using split spoon samplers in each glacial overburden boring according to the sequence used in the "Production and Additional Suspect Area" Work Plan Addendum (DCR 33). As part of this effort, soil samples will be retained for total uranium and total thorium analysis (TAL 50.03.22B in Appendix A) at depths of 0.0 to 0.5, 2.0 to 2.5, 5.0 to 5.5 feet and at 5-foot intervals thereafter. These samples will be sent to the FERMCO laboratory for analysis.

After completion and development, each of the 16 new Type 1 wells will be sampled for radiological, HSL inorganic, volatile and semivolatile organics, and general water chemistry as specified in TAL 50.03.22A (Appendix A).

3.1.1 Well 11067 Northwest of Sewage Treatment Plant

The Sewage Treatment Plant is located within a fenced area along the eastern boundary of the FEMP, and is the eastern most part of the production facility. As shown in Figure 3-1, Manhole 175 and a solid waste incinerator are located within the fence surrounding the Sewage Treatment Plant. Manhole 175 is located near the southwest corner of the area and the incinerator is located in the northwest corner of the area. The incinerator operated from November 1954 through December 1979, and was then replaced by a solid waste incinerator operating within the former production area at Building 39. The Sewage Treatment Plant presently receives and treats wastewater from the laundry and sanitary sewage system, and the discharge water from the biodenitrification system. The treated water is discharged to the Great Miami River through Manhole 175, which also receives treated effluent from the General Sump, overflow from the Clearwell during periods of excessive rainfall, and the discharge water from the Stormwater Retention Basin.

Six wells have been installed in the glacial overburden within the Sewage Treatment Plant fenced area, with an additional two borings on the west and north sides of the area as shown in Figure 3-1. The glacial overburden stratigraphy beneath the area (Figure 3-2) consists of approximately 25 feet of glacial till with interspersed silt and sand lenses. It is hypothesized that color variations of the clay units within the glacial overburden are due to weathering/oxidation differences rather than depositional differences. The gray clays represent unweathered clay and a general lack of perched groundwater flow within the unit. The color change to yellows and browns is the result of iron being oxidized by infiltration of surface water. Therefore, the presence of yellow or brown clay below gray clay suggests that perched water is moving laterally within the unit.

The upper 15 to 20 feet of glacial overburden underlying the Sewage Treatment Plant is mainly composed of yellow-brown clay with silt and sand lenses. This unit, as a whole, is considered the water-bearing unit within the glacial overburden beneath the Sewage Treatment Plant. Water levels taken in the wells indicate flow to the west-northwest (Figure 3-3).

Investigations conducted in the Sewage Treatment Plant area under the RI/FS study from 1988 through 1990 consisted of a surface soil sampling program and a well/boring program with subsurface soil and groundwater sampling. Figure 3-1 shows the locations of the borings and Table 3-1 contains the

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FIGURE 3-1
SEWAGE TREATMENT PLANT WITH SOIL SAMPLING, BORING/WELL, AND PROPOSED LOCATIONS

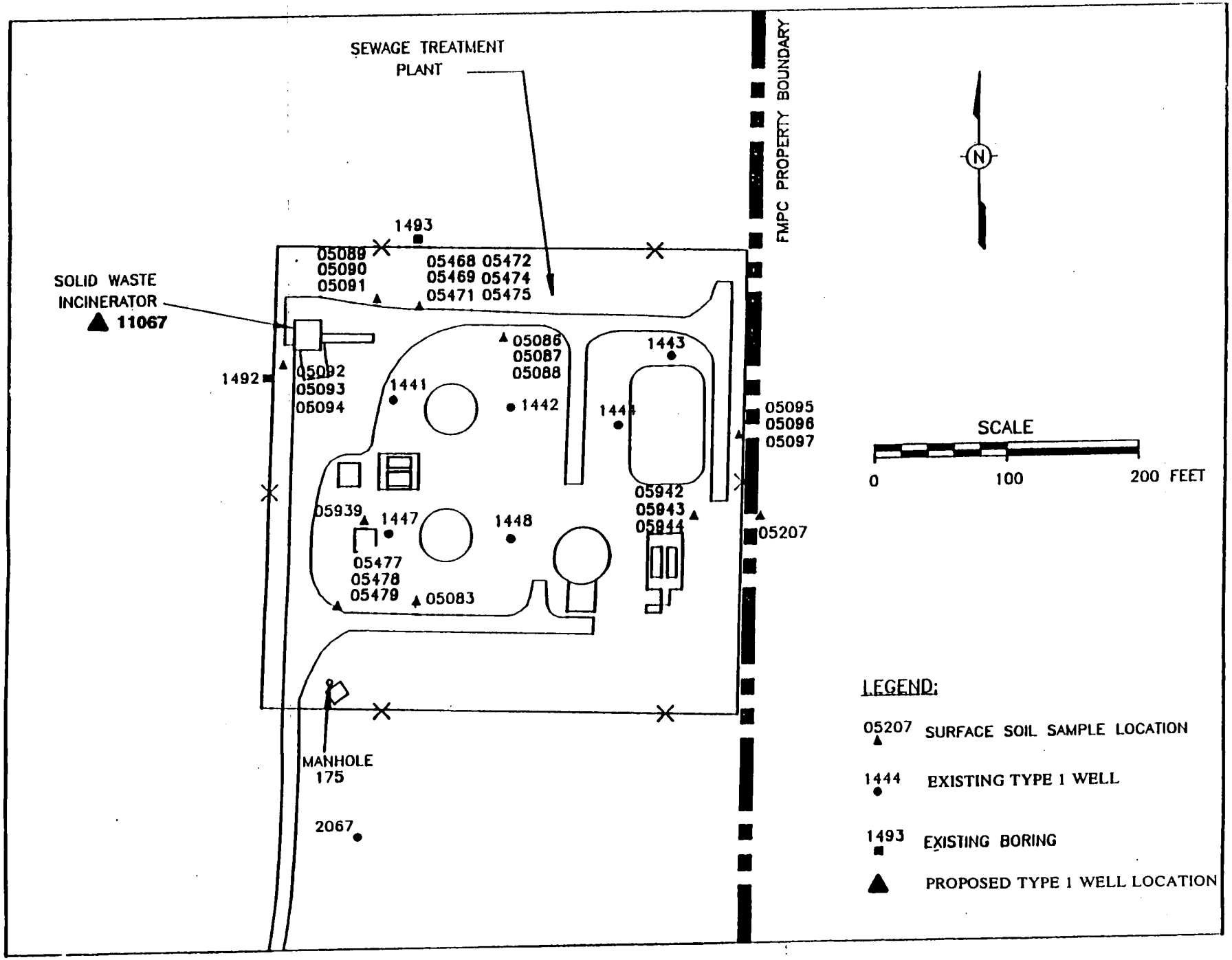

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FIGURE 3-2
EAST-WEST CROSS-SECTION BENEATH SEWAGE TREATMENT PLANT

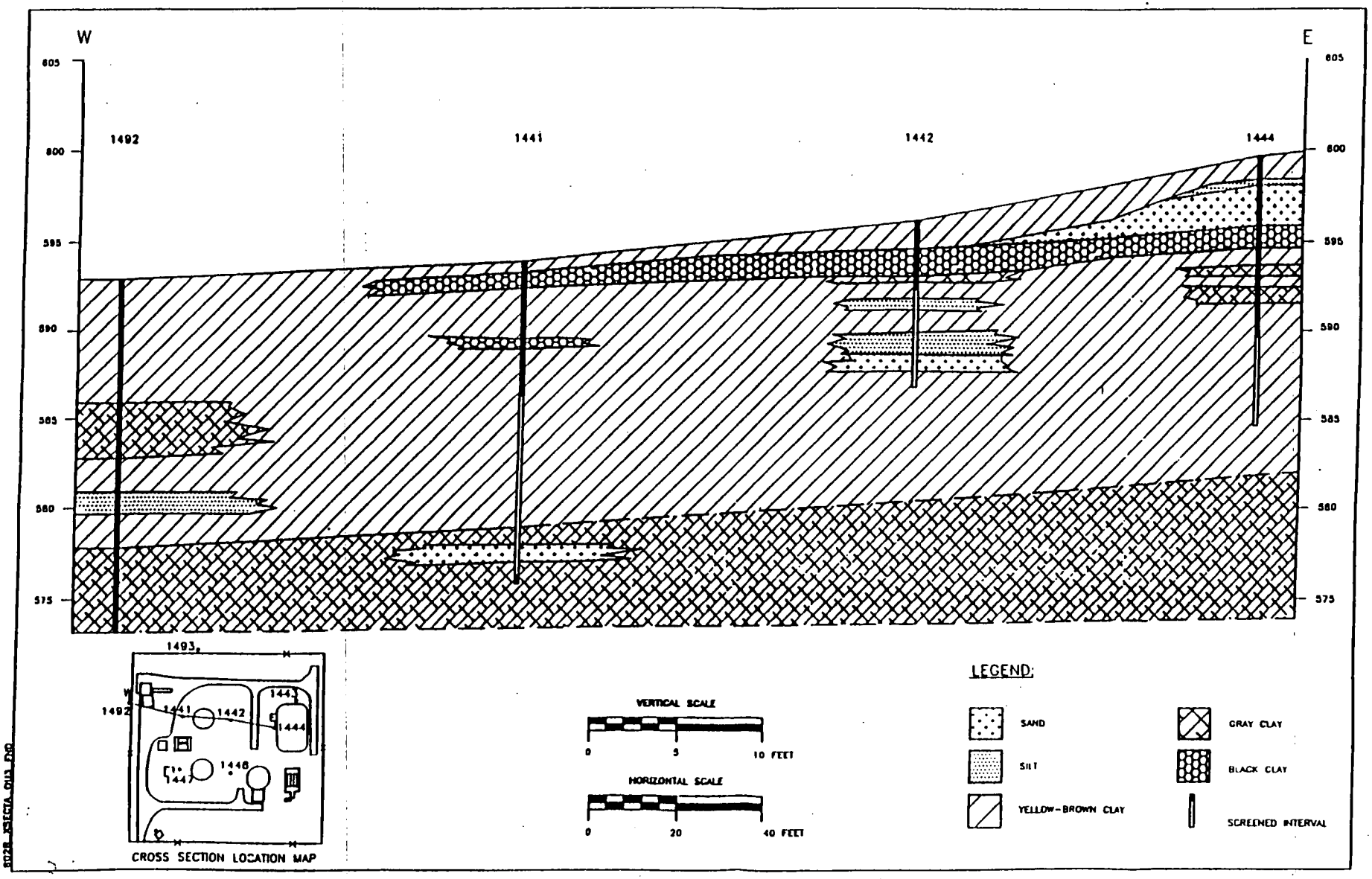


FIGURE 3-3
POTENTIOMETRIC MAP OF PERCHED GROUNDWATER IN THE GLACIAL OVERBURDEN; SEWAGE TREATMENT PLANT AREA

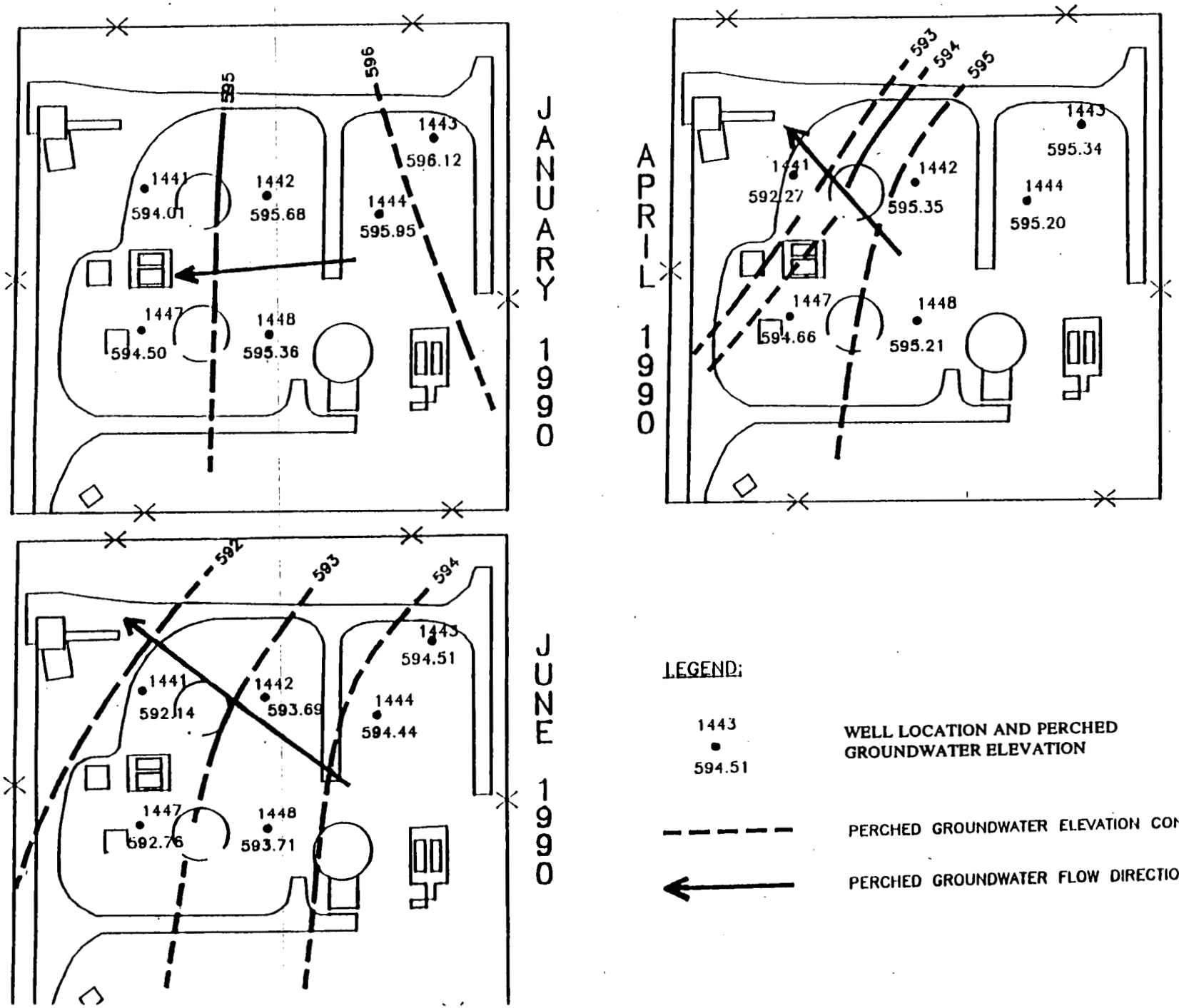


TABLE 3-1
SEWAGE TREATMENT PLANT SOIL ANALYSES IN pCi/g

Data presented by sample number and depth in inches. NA indicates not analyzed. (<) indicates not present above the detection limit of the analytical instrument.

Radiological Parameters	05083 0-2	05086 0-2	05087 2-4	05088 4-6	05089 0-2	05090 2-4	05091 4-6	05092 0-2	05093 2-4
Cesium 137	0.5	1.1	1.1	0.4	0.7	0.7	0.3	<1.7	0.6
Plutonium 238	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Plutonium 239/240	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	1.1	<0.6
Radium 226	5.0	1.8	1.6	1.4	5.5	6.4	1.9	<3.2	<1.3
Radium 228	<0.9	2.5	2.2	1.7	5.1	3.9	1.9	12.2	5.7
Strontium 90	<0.5	<0.5	1.8	0.8	0.8	0.5	1.0	1.9	1.2
Technetium 99	<5.3	<5.5	1.0	<0.9	<5.5	4.3	2.0	14.4	12.8
Thorium 228	4.7	1.8	2.0	1.4	3.6	3.3	1.5	10.2	10.2
Thorium 230	13.2	3.9	7.7	4.9	31.4	28.7	7.0	58.9	50.5
Thorium 232	1.5	2.3	2.2	1.4	3.8	3.9	1.4	11.3	14.0
Uranium 234	11.8	341.0	228.0	116.0	1010.0	2913.0	543.0	10977.0	7591.0
Uranium 235/236	<0.9	16.4	15.4	6.9	123.0	98.0	26.4	1730.0	372.0
Uranium 238	13.6	259.0	186.0	98.0	2376.0	3100.0	560.0	25670.0	7771.0
Total Uranium[a]	NA	NA	587.0	250.0	NA	6240.0	1660.0	NA	23000.0

Radiological Parameters	05094 4-6	05095 0-2	05096 2-4	05097 4-6	05207 0-2	05468 0-6	Duplicate 05469 0-6	05471 6-12	Duplicate 05472 6-12
Cesium 137	<0.4	1.1	<0.6	<0.4	0.3	0.3	0.3	0.3	0.2
Plutonium 238	<0.6	<0.6	<0.6	<0.6	<0.6	1.4	1.5	2.4	<0.6
Plutonium 239/240	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Radium 226	2.1	57.4	188.0	67.0	2.5	4.9	4.3	3.0	2.7
Radium 228	6.9	<1.8	<2.6	<1.7	1.2	18.0	16.9	8.5	7.2
Strontium 90	0.7	<0.5	0.6	<0.5	<0.5	1.8	1.4	0.7	<0.5
Technetium 99	6.1	<5.2	<0.9	<0.9	2.1	13.0	9.1	7.4	4.3
Thorium 228	3.4	5.1	1.3	1.3	1.0	17.6	24.8	8.2	5.7
Thorium 230	8.3	102.0	325.0	87.0	6.5	755.0	806.0	460.0	359.0
Thorium 232	4.8	6.6	2.2	1.5	1.1	30.8	61.9	12.0	6.1
Uranium 234	2160.0	165.0	312.0	98.0	12.8	1644.0	1110.0	960.0	602.0
Uranium 235/236	82.0	13.4	14.9	3.5	0.8	134.0	95.3	54.9	37.8
Uranium 238	2006.0	187.0	328.0	101.0	13.5	1941.0	1445.0	1124.0	771.0
Total Uranium[a]	5380.0	NA	1140.0	294.0	NA	5030.0	4180.0	2260.0	2240.0

[a] Results reported in μg/g

TABLE 3-1 (Cont'd)
SEWAGE TREATMENT PLANT SOIL ANALYSES IN pCi/g

Data presented by sample number and depth in inches. NA indicates not analyzed; (<) indicates not present above the detection limit of the analytical instrument.

Radiological Parameters	05474 12-18	Duplicate 05475 12-18	05477 0-6	05478 6-12	05479 12-18	05939 0-6	05942 0-6	05943 6-12	05944 12-18
Cesium 137	0.3	<0.2	0.7	<0.2	<0.2	<0.2	0.6	<0.2	<0.2
Plutonium 238	<0.6	1.7	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Plutonium 239/240	<0.6	<0.6	1.5	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Radium 226	1.4	3.4	2.4	2.1	2.2	1.2	2.3	0.9	1.0
Radium 228	1.2	4.3	1.0	0.8	1.1	0.6	1.1	0.8	1.3
Strontium 90	0.7	1.2	0.6	<0.5	<0.5	1.1	1.0	0.8	3.9
Technetium 99	1.2	4.4	228.0	56.9	44.2	1.5	3.5	<0.9	<0.9
Thorium 238	2.0	6.4	1.1	1.3	1.2	0.7	1.1	0.8	1.1
Thorium 230	11.3	385.0	8.2	5.2	4.4	1.8	5.5	1.5	2.2
Thorium 232	1.8	7.8	2.9	0.9	1.0	0.6	0.8	0.9	1.2
Uranium 234	345.0	660.0	1627.0	808.0	516.0	3.7	44.8	NA	NA
Uranium 235/236	17.6	38.6	143.0	41.5	23.3	<0.6	1.9	NA	NA
Uranium 238	389.0	720.0	1477.0	790.0	500.0	4.1	42.5	NA	NA
Total Uranium [a]	1070.0	1420.0	4210.0	1570.0	976.0	12.0	159.0	25.0	31.0

[a] Results reported in $\mu g/g$

analytical results indicating radiological contamination, principally by uranium in the surface soils. Elevated concentrations of thorium and radium, as well as plutonium, strontium, and technetium, were also present at scattered locations. As the locations and analytical results show, uranium and other radionuclides tend to concentrate within the upper two feet of the subsurface soil, and the highest concentrations were found near the incinerator in the northwest corner of the Sewage Treatment Plant area. The subsurface soil sampling results for radiological parameters (see Table 3-2) indicates declining concentrations with depth with three notable exceptions: 244.4 μg/g total uranium at 2 to 3.5 feet in Well 1444; 214 μg/g total uranium at 14.5 to 15.5 feet in boring 1492; and 43.2 pCi/g technetium-99 at 2 to 3.5 feet in Well 1441.

Perched groundwater analyses shown in Table 3-3 indicate that the highest total uranium concentrations are in Wells 1442 and 1447. An anomalous total uranium value of 6400 μg/L was reported for Well 1441 in May 1990. This value was inconsistent with the isotopic values reported for the same sample. The total uranium value reported for the sample taken from Well 1441 in July 1990 was 58.7 μg/L. In addition to wells 1442 and 1447, wells 1441 and 1444 showed elevated concentrations of technetium-99, ranging from 344 to 3185 pCi/L in May 1990.

The perched groundwater samples collected in May 1990 from each well were also analyzed for full Hazardous Substance List (HSL) parameters. Table 3-4 presents the significant detected quantities. The predominant volatile organic compound detected was 1,2-dichloroethylene (1,2-DCE) with a maximum concentration of 92 μg/L in Well 1444, and lower concentrations in the plume which extends to the northwest to Well 1441. It appears that the 1,2-DCE source is on the eastern side of the area and the plume is moving northwest.

Both the water table data and the distribution of radionuclide and chemical contaminants indicate that the perched groundwater flow direction is to the west-northwest. The source of radionuclide contamination appears to be in the vicinity of the incinerator. The uranium surface soil contamination locations roughly overlay the perched uranium groundwater plume with little groundwater uranium plume movement. Proposed Well 11067 will be drilled to an approximate depth of 20 feet within the weathered/oxidized glacial overburden west-northwest of the Sewage Treatment Plant area (Figure 3-1). This location should confirm the groundwater flow direction and be downgradient of any contamination migrating from the Sewage Treatment Plant area.

TABLE 3-2
SEWAGE TREATMENT PLANT SOIL ANALYSES BY BORING

NA indicates not analyzed; (<) indicates not present above the detection limit of the analytical instrument.

Parameter and Depth (Feet)	Boring Numbers							
	1441	1442	1443	1444	1447	1448	1492	1493
Total Uranium (μg/g)								
0.0-1.0	87.4	63.1	68.3	19.3	29.8	62.8	162.0	322.0
2.0-3.5	10.0	9.2	17.9	224.4	7.4	5.8	31.0	8.0
5.0-6.5	22.9	6.9	49.5	69.6	2.6	7.0	7.0	8.0
10.0-11.0	22.7	NA	53.0	4.7	NA	8.6	45.0	9.0
14.5-15.5	3.8	NA	37.9	2.3	NA	3.0	214.0	6.0
Total Thorium (μg/L)								
0.0-1.0	14.8	10.3	9.6	8.8	6.5	7.6	NA	NA
2.0-3.5	9.2	10.8	12.1	29.0	5.7	10.6	NA	NA
5.0-6.5	12.2	7.5	10.1	15.2	6.4	7.2	NA	NA
10.0-11.0	9.0	NA	11.3	8.2	NA	6.7	NA	NA
14.5-15.5	5.7	NA	8.2	6.8	NA	5.5	NA	NA
Strontium-90 (pCi/g)								
0.0-1.0	0.6	0.7	7.7	2.4	4.9	2.7	NA	NA
2.0-3.5	8.1	7.5	9.3	0.6	4.2	6.6	NA	NA
5.0-6.5	5.9	4.7	7.1	1.7	5.0	<0.5	NA	NA
10.0-11.0	8.2	NA	10.1	2.0	NA	<0.5	NA	NA
14.5-15.5	2.1	NA	1.3	1.7	NA	1.3	NA	NA
Technetium-99 (pCi/g)								
0.0-1.0	20.3	13.1	11.3	<0.9	1.8	5.4	NA	NA
2.0-3.5	43.2	2.8	<1.1	3.6	3.0	<0.9	NA	NA
5.0-6.5	4.9	3.2	3.6	<0.9	<0.9	<0.9	NA	NA
10.0-11.0	2.9	NA	<0.9	<0.9	NA	<0.9	NA	NA
14.5-15.5	<0.9	NA	<0.9	<0.9	NA	<0.9	NA	NA

TABLE 3-3
SEWAGE TREATMENT PLANT PERCHED GROUNDWATER RADIOLOGICAL ANALYSES IN pCi/L

Data presented by well number and sample date. NA indicates not analyzed; (<) indicates not present above the detection limit of the analytical instrument.

Radiological Parameters	1441 05/16/90	1441 07/17/90	1442 05/20/90	1442 05/18/90	1442 07/18/90	1443 05/21/90	1443 05/21/90	1443 07/18/90
Radium-226	1.2	NA	3.2	<1.0	NA	4.5	1.0	NA
Technetium-99	385.0	NA	344.0	401.0	NA	<30.0	<30.0	NA
Thorium-228	<1.0	NA	<1.0	<1.0	NA	3.4	<1.0	NA
Thorium-230	<1.0	NA	<1.0	<1.0	NA	2.8	<1.0	NA
Thorium-232	<1.0	NA	<1.0	<1.0	NA	2.2	<1.0	NA
Total Thorium	<4.6	NA	2.8	<1.7	NA	20.2	<1.7	NA
Uranium-234	3.8	NA	70.4	84.8	NA	19.2	<1.0	NA
Uranium-235/236	<1.0	NA	3.8	22.3	NA	0.9	<1.0	NA
Uranium-238	3.6	NA	74.9	89.2	NA	18.3	<1.0	NA
Total Uranium [a]	6400.0	58.7	181.0	116.0	191.0	43.6	16.8	15.2

Radiological Parameters	1444 05/09/90	1444 07/17/90	1447 06/02/90	1447 06/02/90	1447 07/17/90	1448 05/18/90	1448 05/18/90
Radium-226	<1.0	NA	1.5	<1.0	NA	1.2	NA
Technetium-99	3185.0	NA	NA	1069.0	NA	<30.0	NA
Thorium-228	<1.0	NA	4.2	1.8	NA	<1.0	NA
Thorium-230	<1.0	NA	10.5	3.3	NA	<1.0	NA
Thorium-232	<1.0	NA	3.3	1.3	NA	<1.0	NA
Total Thorium	<2.7	NA	29.9	11.6	NA	<5.2	NA
Uranium-234	5.3	NA	219.0	194.0	NA	8.1	NA
Uranium-235/236	<1.0	NA	14.0	15.0	NA	1.9	NA
Uranium-238	4.3	NA	227.0	211.0	NA	4.3	NA
Total Uranium [a]	23.6	13.3	871.0	975.0	350.0	13.7	12.8

[a] Results reported in μg/L.

TABLE 3-4
SEWAGE TREATMENT PLANT PERCHED GROUNDWATER CHEMICAL ANALYSES IN pCi/L

Data presented by well number and sample date. Dashes indicate no detection. NA indicates not analyzed; (<) indicates not present above the detection limit of the analytical instrument.

Constituents (μg/L)	1441 5/16/90	1442 5/18/90	1442 5/20/90	1443 5/21/90	1444 5/9/90	1447 6/2/90	1448 5/18/90
Inorganic Constituents							
Cadmium	6.5	5.9	NA	8.6	8.7	4.8	7.8
Calcium	110000.0	103000.0	NA	103000.0	119000.0	151000.0	100000.0
Magnesium	42500.0	40200.0	NA	52700.0	59900.0	37800.0	49600.0
Molybdenum	11.4	<10.0	NA	11.8	<10.0	<10.0	16.8
Nickel	37.2	27.0	NA	33.8	21.7	20.7	29.4
Silver	15.2	18.5	NA	18.5	19.7	21.8	18.4
Sodium	55800.0	42800.0	NA	11300.0	66000.0	74100.0	27300.0
Volatile Organic Constituents							
2-Butanone	---	---	---	---	---	---	17.0
1,1-Dichloroethylene	1.0	1.0	1.0	---	4.0	---	---
1,2-Dichloroethylene	10.0	43.0	45.0	---	92.0	---	---
1,1,1-Trichloroethane	4.0	---	---	---	---	---	---
Carbon disulfide	---	---	---	2.0	2.0	2.0	2.0
Tetrachloroethene	5.0	8.0	8.0	---	2.0	---	---
Trichlorethene	6.0	6.0	6.0	---	4.0	---	---
Vinyl chloride	---	---	---	---	6.0	---	---

3.1.2 Proposed Type 1 Wells in West Pilot Plant Area

Recent glacial overburden characterization has identified the presence of a relatively extensive sand/silty sand lens within the glacial overburden between the K-65 Silos and the Pilot Plant area (Figure 3-4). This sand/silty sand lens is known to contain perched groundwater. The sand/silty sand lens outcrops along the strike of a drainage ditch which flows from an area west of the Pilot Plant to Paddys Run as shown in Figure 3-4. On February 5, 1993, a "site walk" was conducted along the drainage ditch, resulting in the identification of several seeps along the length of the drainage ditch. The identification of the seeps substantiated the hypothesis that perched water from the sand/silty sand lens underlying the area is discharging into the drainage ditch. A PSP titled "Pilot Plant Drainage Ditch Seepage and Surface Water Background Investigation" has been written to address seep water quality entering this drainage ditch. However, the quality of the perched groundwater within the sand/silty sand lens has not been fully characterized, and represents a data need in the RI/FS groundwater characterization for the RI report.

Perched groundwater within the southwest quadrant of the Production Area is contaminated with uranium as shown in Figure 3-4. Almost the entire Plant 2/3 area is underlaid by perched groundwater exhibiting total uranium concentrations greater than 100 μg/L. The western extent of the perched groundwater contamination needs to be determined. At present, there are no monitoring wells directly west of the Pilot Plant area within the western portion of this relatively extensive sand/silty sand lens in the glacial overburden. Figure 3-4 also shows perched groundwater elevations within the sand/silty sand lens during March 1992. The general perched groundwater flow direction and discharge within the glacial overburden in this area is interpreted to be in the direction of the Pilot Plant Drainage Ditch.

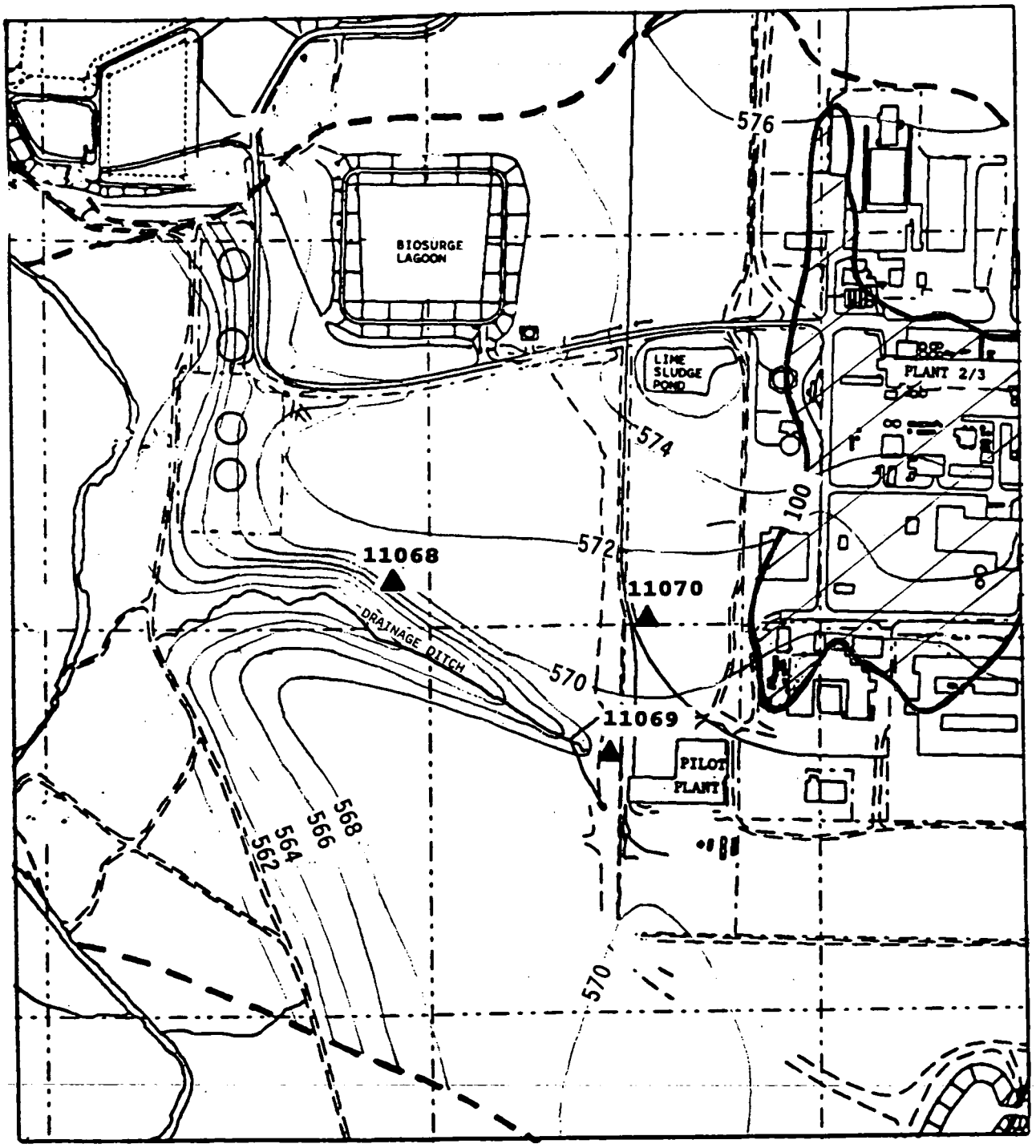
Flow of groundwater within the glacial overburden depends on the continuity of sand and gravel lenses and their porosity and permeability. The sand/silty sand lens probably has the most influence on perched groundwater flow. Therefore, to further characterize the area west of the Pilot Plant, the following information is needed:

- Perched groundwater elevation within the sand/silty sand lens,
- Sand/silty sand lens thickness and lithologic properties, and
- Additional monitoring points to evaluate perched groundwater contamination.

Monitoring Wells 11068, 11069 and 11070 will be installed so they fully penetrate the sand/silty sand lens at the locations shown in Figure 3-4. Wells 11069 and 11070 will be installed just west of the Pilot

4488

FIGURE 3-4
PROPOSED TYPE 1 WELL IN THE WEST PILOT PLANT AREA



LEGEND:

574 GENERALIZED WATER ELEVATION CONTOUR OF GLACIAL OVERBURDEN GROUNDWATER (contour interval = 2 feet)

PROPOSED TYPE 1 WELL LOCATION

100 TOTAL URANIUM CONCENTRATION WITHIN THE GLACIAL OVERBURDEN ≥ 100 PPB

APPROXIMATE BOUNDARY OF GLACIAL OVERBURDEN SAND LENS

19

Plant area to further define the western extent of the contamination. Well 11068 will be installed further west, just north of the drainage ditch to provide groundwater elevation and water quality data.

3.1.3 Replacement Wells for the Plant 1 Pad Area

Wells 1337, 1341 and 1347 located adjacent to the west side of the Plant 1 Pad (Figure 3-5) have been plugged and abandoned. This action was necessary due to the general upgrading of the Plant 1 Storage Pad. The wells will be replaced to fulfill the data requirements of the OU 5 Work Plan Addendum "Investigation of Potential Soil and Groundwater Contamination in the Plant 1 Pad Area." Wells 11071, 11072 and 11073, as shown in Figure 3-5, will be installed to replace the abandoned wells. Perched groundwater flow is generally to the southwest within the glacial overburden of this area. Figure 3-5 includes average groundwater data elevation contours for Type 1 wells in the area where 20 or more water table readings are available. As the water table contours indicate, the replacement wells will be downgradient of the Plant 1 Pad with respect to perched groundwater flow. Samples from the proposed wells will further characterize the western extent of uranium contamination in the Plant 1 Pad area. Samples from Monitoring Well 1010, located just west of Plant 1, have shown relatively low uranium concentrations in the past. The proposed replacement wells will act as indicators of possible westward migration of contamination within the glacial overburden groundwater.

3.1.4 Replacement Wells Within the Production Area

Well 1350, shown along the southeast side of the area depicted in Figure 3-5, has been damaged by site traffic. As a result, representative samples can no longer be obtained from this well. In order to fulfill the data requirements of the OU 5 Work Plan Addendum "Investigation of Potential Soil and Groundwater Contamination Resulting from the K-65 Slurry Line and Clearwell Line" (DOE, 1992), Well 11074 will be installed as shown in Figure 3-5 to serve as a replacement for Well 1350. Well 11074 will be located further west of the road to reduce the possibility of damage occurring due to site traffic. If the new well cannot be located further west of the road, then guard posts or fencing will be installed around the well to protect it.

Flush-mount Well 1174 located on the southeast side of the Heavy Equipment Building and shown in Figure 3-6 has also been damaged by site traffic. Representative samples can no longer be obtained from this well because of the damage. In order to fulfill the data requirements of the OU 5 Work Plan Addendum "Investigation of Perched Groundwater Contamination in the Southeast Quadrant of the

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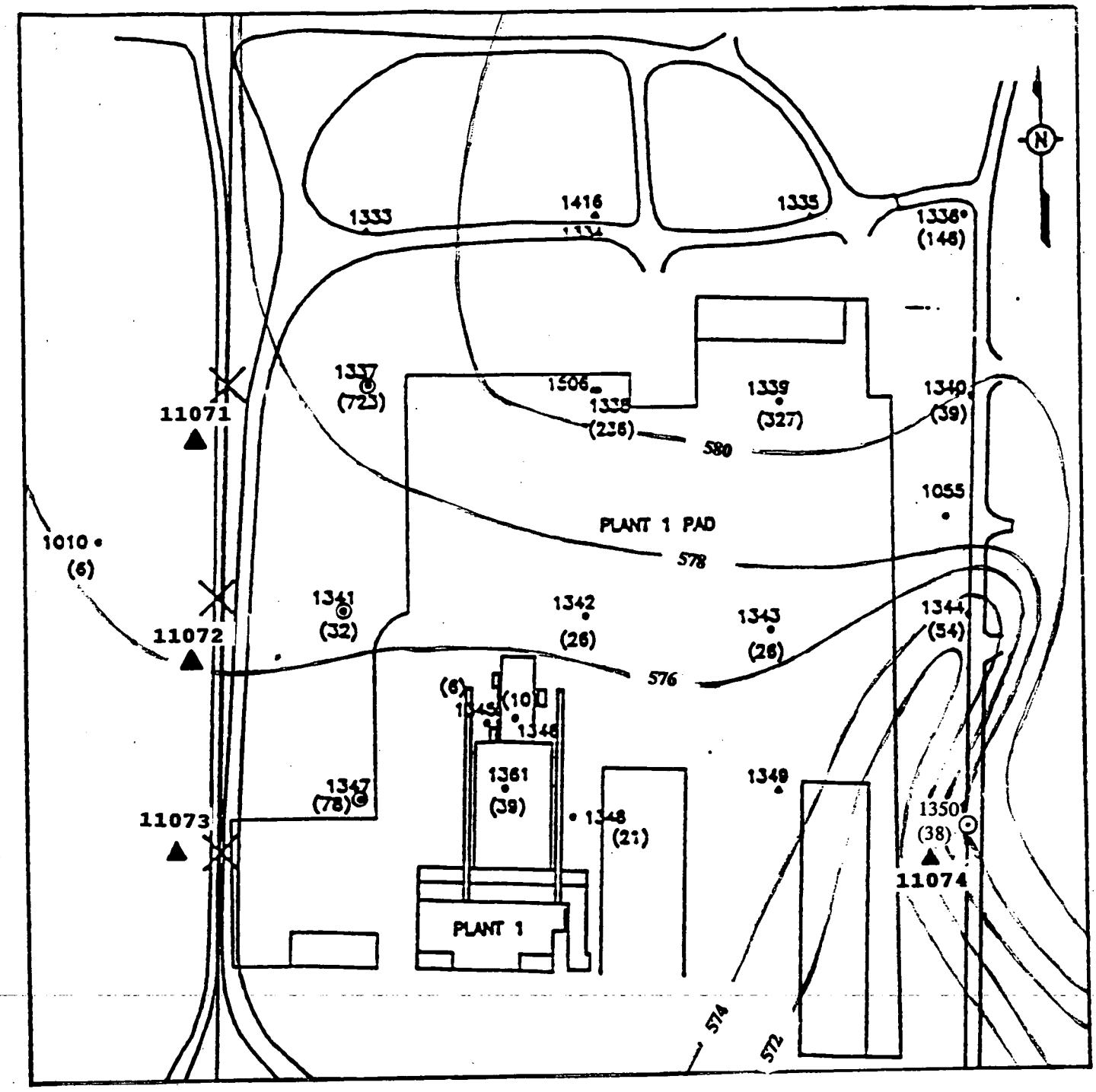
FIGURE 3-5
PROPOSED LOCATIONS OF REPLACEMENT WELLS WITHIN THE PLANT 1 AREA



LEGEND:

(21) AVERAGE TOTAL URANIUM CONCENTRATION (μG/L) IN PERCHED GROUNDWATER

▲ BORING LOCATION

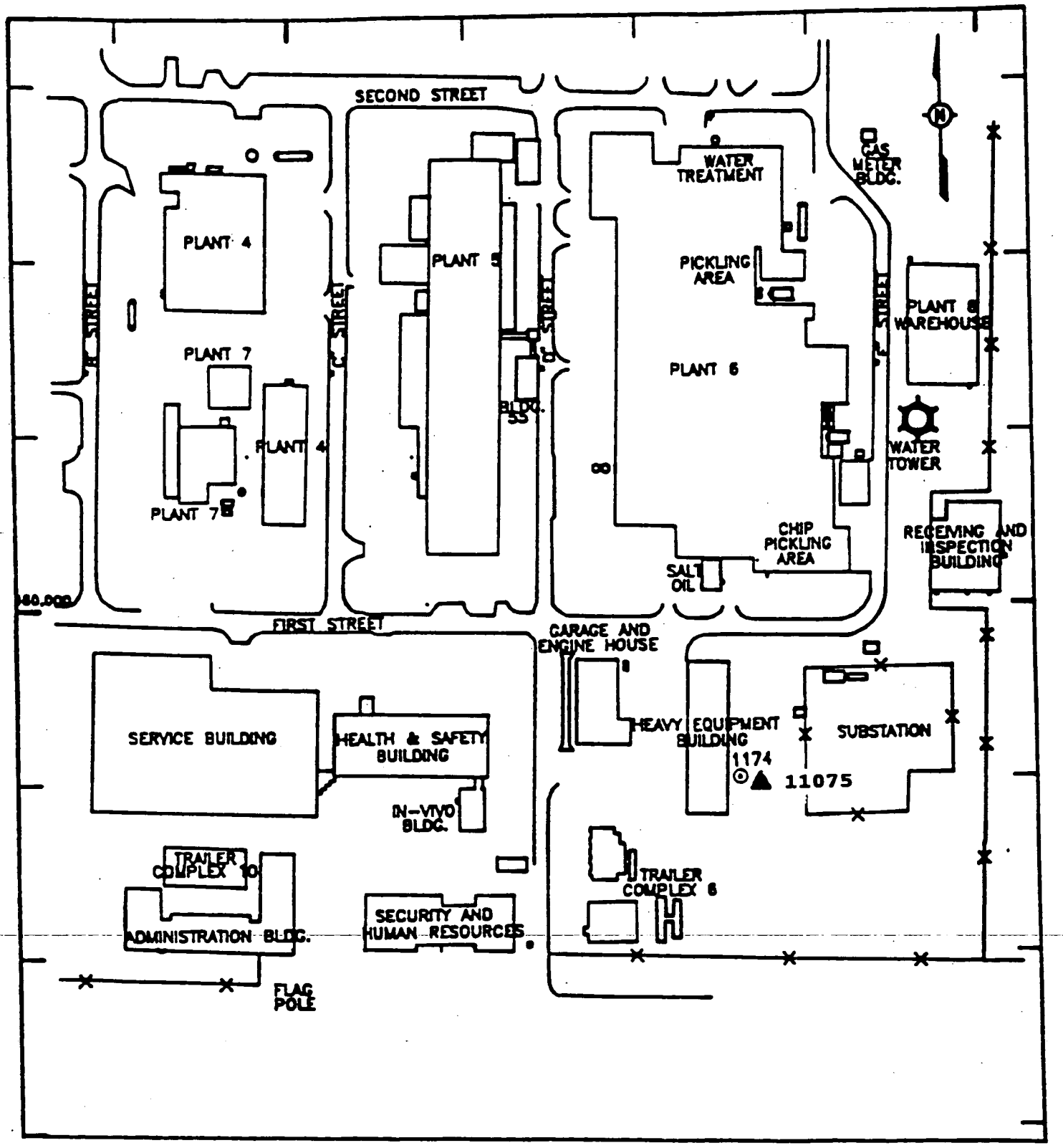
⊙ DAMAGED/PLUGGED AND ABANDONED WELL

▲ PROPOSED WELL LOCATION

576 AVERAGE PERCHED GROUNDWATER ELEVATION CONTOUR

DRAFT

FIGURE 3-6
PROPOSED LOCATION OF REPLACEMENT WELL 11075



LEGEND:

▲ PROPOSED TYPE 1 WELL LOCATION

⊙ DAMAGED MONITORING WELL

Production Area," replacement Well 11075 will be installed at the location shown in Figure 3-6. The new well will not be installed as a flush-mount. Guard rails and/or fencing will be installed around the well to protect against possible damage from future site activities.

Wells 1350 and 1174 are to be plugged and abandoned following the procedures in Section 5 and Appendix J of the SCQ. These wells will be drilled out to their total depth prior to filling the boring.

3.1.5 New Well 11064 North of the Inactive Flyash Pile

The area north of the Inactive Flyash Pile has little data regarding the subsurface environment. Elevated uranium contamination has been found on the north side of the Inactive Flyash Pile in the glacial overburden in monitoring Well 1046 (Figure 3-7). However, this was an isolated occurrence with 203 μg/L uranium being found on April 13, 1988.

Well 11064, which will be located north of the Inactive Flyash Pile (Figure 3-7), will test for contamination in the glacial overburden in this area. Well 11064 will be drilled as part of a well cluster with Well 21064 which will be discussed in Section 3.2.2. The location and thickness of glacio-fluvial deposits in this area will be determined by Well 21064, filling a data need for this area.

3.1.6 Replacement Wells Within the Waste Pit Area

Four Type 1 wells have been identified as having anomalous water level depths in relation to other Type 1 wells in the Waste Pit Area or have little or no water. The wells are Well 1004, located on the west berm of Pit 3; Well 1030, located north of the Biodenitrification Surge Lagoon; Well 1037, located northeast of Waste Pit 6 and east of the Solid Waste Landfill; and Well 1072, located north of the K-65 Silos (Figure 3-8). All of these wells were completed in 1988 within two feet or less of the Great Miami Aquifer. The anomalous low water levels and/or paucity of water suggest that these wells possibly have faulty bentonite seals, or that the two feet of till is insufficient to form a seal at the base of the glacial overburden.

Wells are needed at these locations for the RI/FS monitoring well network, therefore, they will be replaced with new wells installed within 15 feet of the original RI/FS well. Table 3-5 list the maximum

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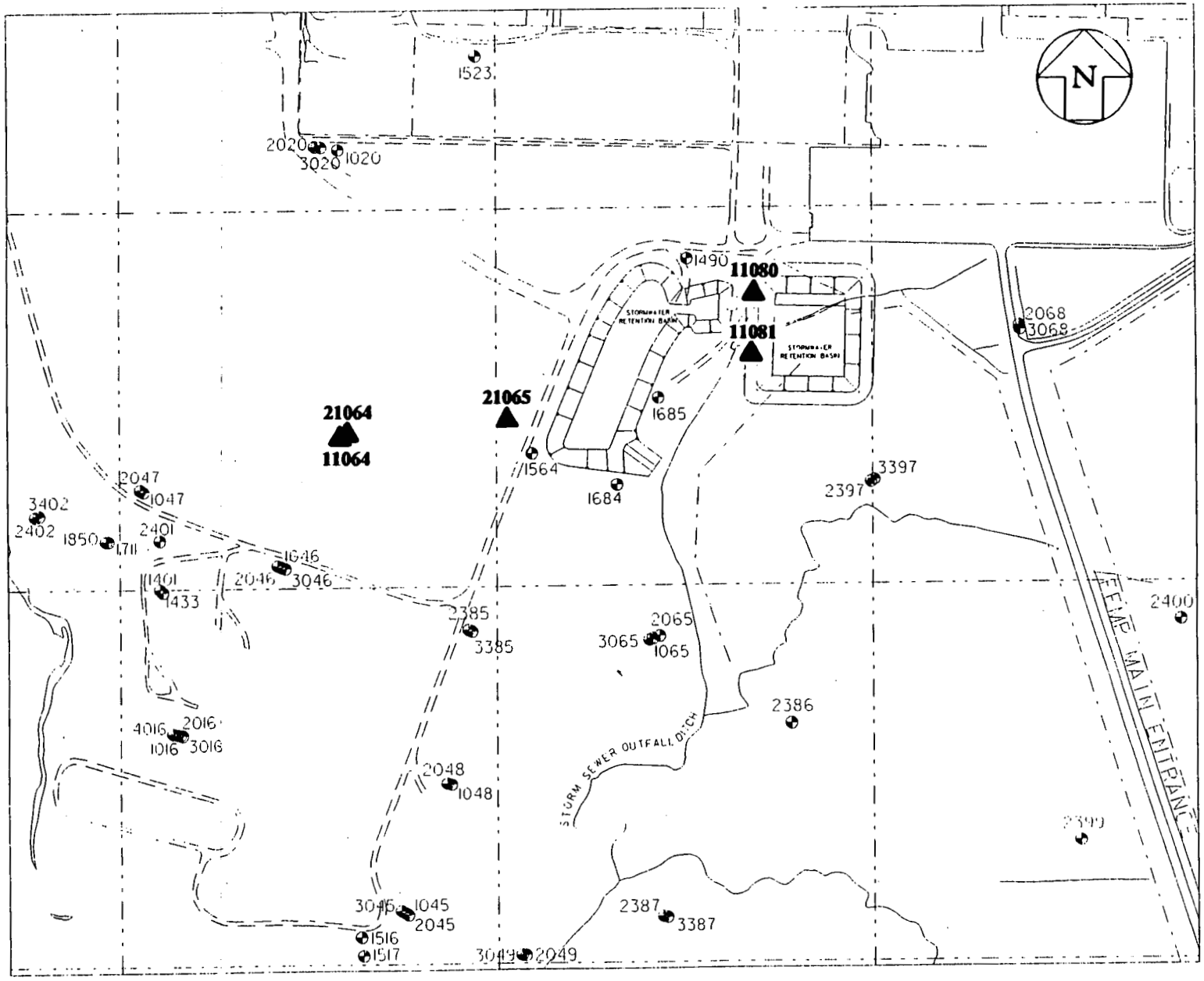
FIGURE 3-7
WELL LOCATION MAP NORTH OF THE SOUTH FIELD



LEGEND

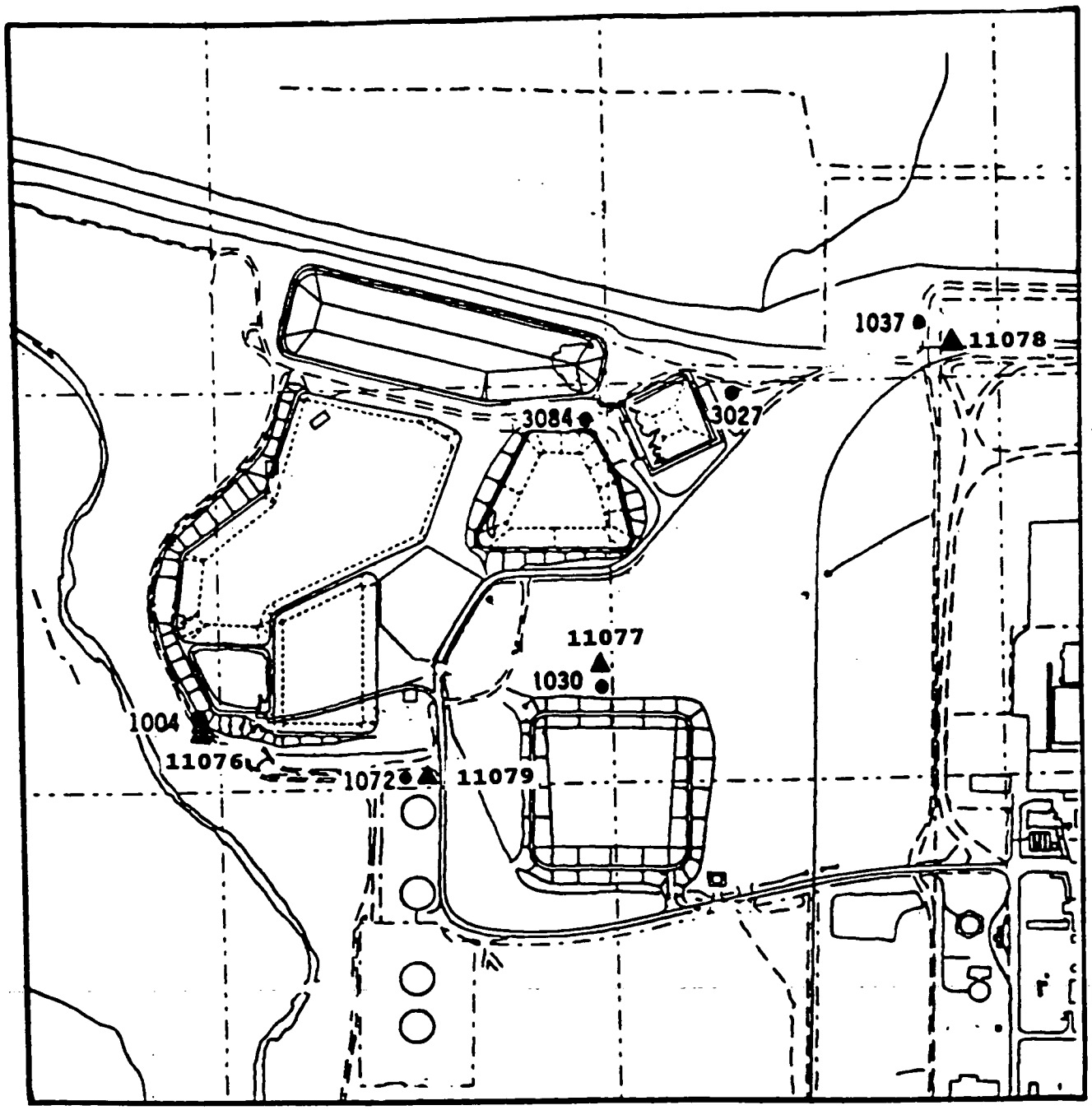
2049 WELL NUMBER

PROPOSED NEW

200' 0' 200' 400' 600'

SCALE: 1" = 400'-0"

FIGURE 3-8
LOCATION MAP OF REPLACEMENT WELLS IN THE WASTE PIT AREA



LEGEND:

▲ PROPOSED WELL LOCATION

● DAMAGED MONITORING WELL

TABLE 3-5
WASTE PIT AREA WELL DEPTHS

ORIGINAL WELLS			REPLACEMENT WELLS	
WELL NUMBER	BORING DEPTH (ft)	WELL DEPTH (ft)	NEW WELL NUMBER	PROPOSED MAXIMUM BORING DEPTH (ft)
1004	31	31	11076	21.5
1030	50	30	11077	21.5
1037	41.5	41.5	11078	32.5
1072	50	31.14	11079	22.75

depth of each of the replacement wells. These depths are specified to minimize the possibility of installing new wells too close to the top of the Great Miami Aquifer. It is possible that none of these borings will encounter perched water. If the boring has reached the depth specified in Table 3-5 and has not encountered a water bearing zone, the boring will be left open with the augers in place for a minimum of 24 hours from the time total depth was reached. If after 24 hours no water has accumulated in the boring, it will be plugged and abandoned. If after 24 hours water has accumulated to a depth of at least two feet in the boring, a well screen will be set and the well will be completed. The length and placement depth of the screen will be determined by the CRU5 RI/FS Project Manager after reviewing the boring records and drilling data.

Wells 1004, 1030, 1037 and 1072 are to be plugged and abandoned as specified in Section 5 and Appendix J of the SCQ. As part of the abandonment procedure, each well will be drilled out to the original depth of the boring shown in Table 3-5 and plugged over its entire length.

3.1.7 New Wells at the Stormwater Retention Basin

As part of the original construction of the FEMP, an 18-inch diameter drain line was installed in the bed of a tributary to the Storm Sewer Outfall Ditch. The drain removes water from the area under the east end of Plant 8 and carries it to the vicinity of the Stormwater Retention Basin. The Stormwater Retention Basin construction plans called for the termination of the 18-inch line to be inside the basin with a flap

valve to prevent back flow into the 18-inch line. During construction of the east basin, it was discovered that there are so many leaky joints in the 18-inch line, that the line would not hold enough pressure to open the flap valve. The final construction of the east basin allows the discharge from the leaks in the 18-inch drain to enter the adjacent french drain designed to de-water the glacial overburden around the east basin. The water from the 18-inch drain flows south along the west side of the east basin in the french drain to a collection sump from which it is periodically pumped into the basin.

It is assumed that the perched groundwater in the 18-inch drain is contaminated since it drains the area under Plant 8 where contamination is known to exist. There are no access points into the 18-inch drain which could be used for sampling to determine the level of contamination. Since the french drain around the east basin was designed to be in good communication with the glacial overburden, it is quite possible that contaminated water from the 18-inch drain line is leaking from the french drain into the glacial overburden. A field inspection in May 1993 indicated that there is a very minor amount of seepage coming through the concrete wall forming the east side of the former storm sewer discharge structure. This seepage is originating from the berm that forms the west side of the east basin where the collection sump is located.

In order to determine if contaminated groundwater is being discharged into the environment, two Type 1 wells will be installed adjacent to the east retention basin as shown in Figure 3-7. Well 11080 will be installed in the vicinity of the end of the 18-inch line and in the french drain. This well will provide samples that will assess the water quality in the area at the end of the 18-inch drain. Well 11081 will be installed near the western edge of the west berm of the east basin between the sump and the former discharge structure. This well will provide a sampling point to determine if there is contaminated perched groundwater adjacent to the east basin. A sample will also be collected from the sump where the french drain discharges at the time the two wells are sampled to determine if there is a change in groundwater quality between the new well 11080 and the sump.

If contamination is found in either or both of these wells, further investigation may be required to determine if the contamination is reaching the Great Miami Aquifer. Also, if the water coming from the drain line is contaminated as will be determined by the sample from Well 11080, a removal action may have to be developed and implemented to control this water.

3.2 GREAT MIAMI AQUIFER WELLS

Wells will be installed at three locations in the Great Miami Aquifer to better define the boundaries of the uranium plume shown in Figure 3-9. This figure shows the maximum total uranium value ever detected in wells in the south field and southern FEMP area. Sections 3.2.1 through 3.2.4 describe wells that will refine the definition of this plume. Section 3.2.5 describes the abandonment procedure for Well 3084 and Section 3.2.6 provides the plan for a Type 4 well to be placed downgradient of the KC-2 Warehouse.

After completion and development, each of the Type 2 and the Type 4 wells will be sampled for radiological, HSL inorganic, volatile and semivolatile organics, and general water chemistry as specified in TAL 50.03.22A (Appendix A).

3.2.1 New Well 21063 Southeast of Homeowner Well 13

Routine environmental monitoring samples from Homeowner Well 13, located immediately southwest of the FEMP main entrance, have indicated rising concentrations of uranium in the well since the summer of 1991. Homeowner Well 13 is downgradient of the Storm Sewer Outfall Ditch which is believed to have been a major pathway for uranium migration from the former production area to the Great Miami Aquifer. Figure 3-10 shows the location of the homeowner well, the proposed new well, and the location of existing monitoring wells in the area.

The groundwater flow directions change in this area seasonally as was determined in DCR 71 in 1991. When there has been sufficient precipitation to cause flow in Paddys Run, the groundwater gradient is approximately due east from the outfall ditch. When Paddys Run is dry, the gradient shifts to a more southerly direction. Contamination entering the aquifer from either Paddys Run or the Storm Sewer Outfall Ditch moves east and south depending on the season. This oscillation in the direction of groundwater flow has resulted in an overall arcuate contamination migration path.

Monitoring wells were installed at locations 387, 398 and 166 to detect the eastern boundary of the plume and to provide water level data. The wells at location 398 have not detected contamination; however, contamination has been detected in the wells at location 069 as shown in Figure 3-10. Further to the south, wells at location 093 have not detected contamination. Because of the increasing concentrations of uranium in Homeowner Well 13, Well 2166 was installed between locations 069 and 398 to more

FIGURE 3-9
MAXIMUM TOTAL URANIUM IN TYPE 2 WELLS (μg/L)

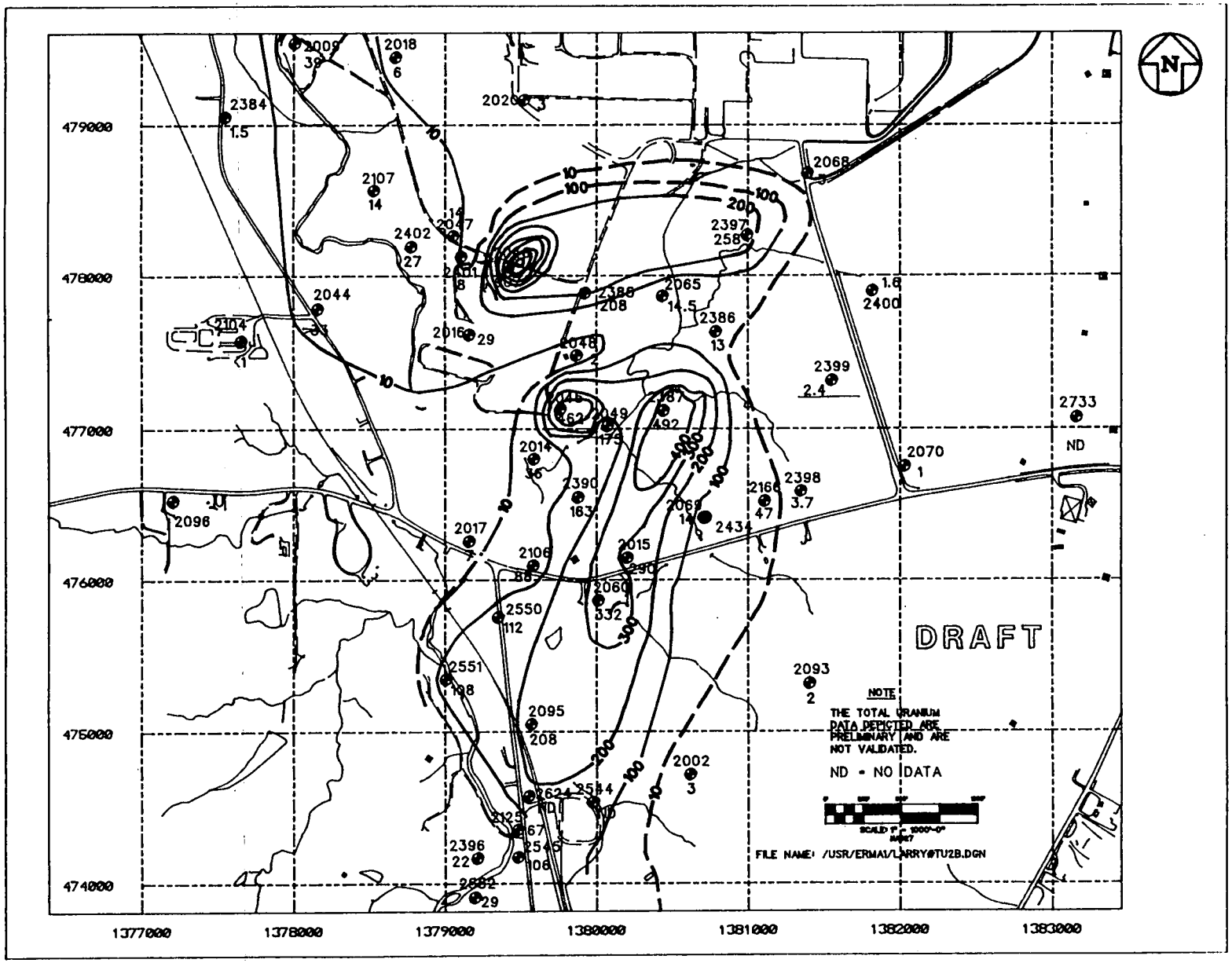
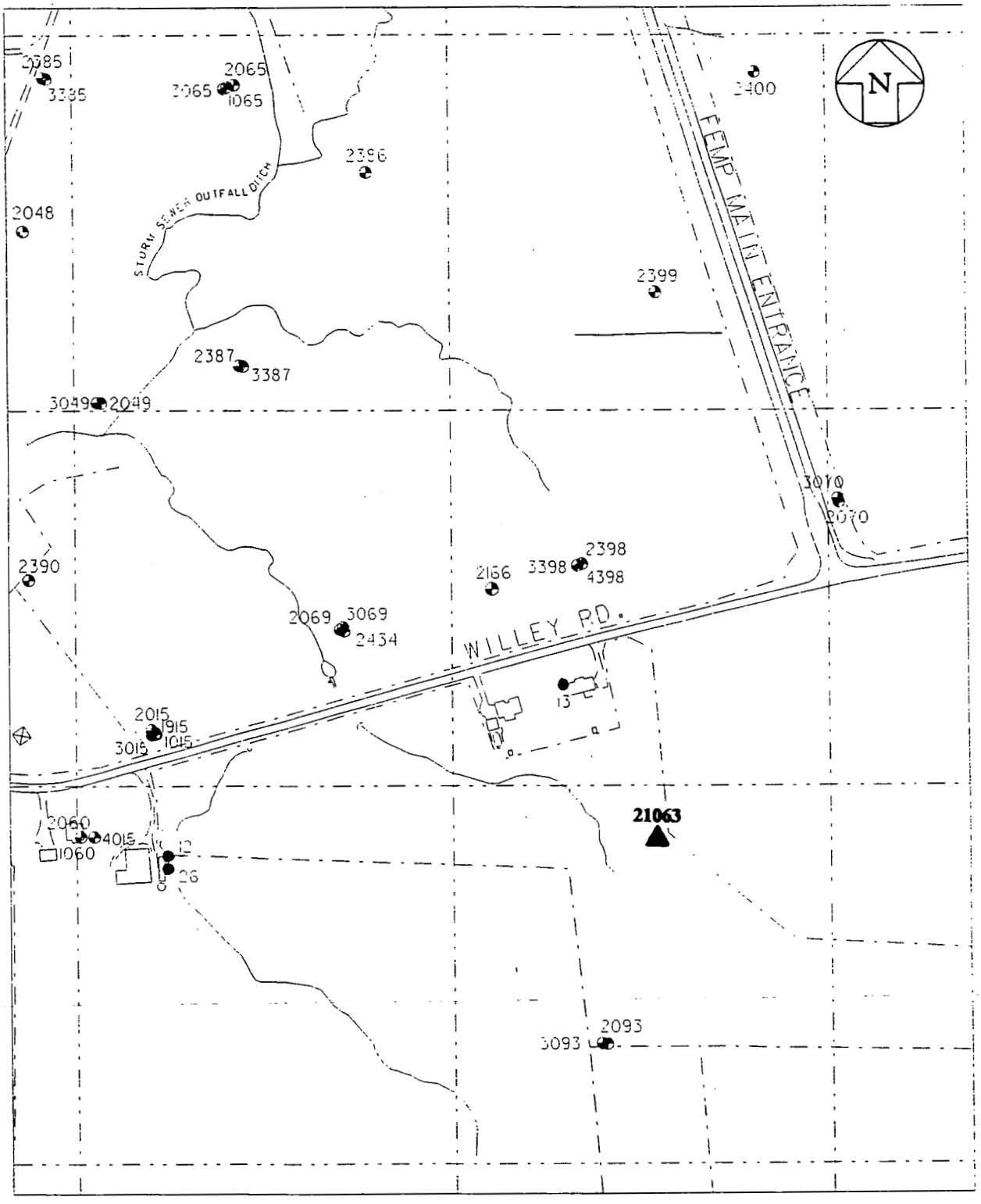


FIGURE 3-10
WELL LOCATION MAP NEAR HOMEOWNER WELL 13



LEGEND

2049 WELL NUMBER

PROPOSED NEW WELL LOCATION

HOMEOWNER WELL

200' 0' 200' 400' 600'

SCALE: 1" = 400'-0"
NAD27

closely define the eastern edge of the uranium plume. Because the well pairs at locations 398, 070 and 093 have not detected contamination, the boundary of the plume impacting Homeowner Well 13 is located within the triangle defined by these locations.

The occurrence of uranium in Homeowner Well 13 in 1991 provides a data point for measuring the rate of migration of the uranium plume in this area. When uranium is detected in the Well 21063 or Well 2093, there will be a direct measurement of the plume migration rate from Homeowner Well 13.

3.2.2 New Well 21064 North of the Inactive Flyash Pile

The highest uranium concentrations detected in groundwater samples from the Great Miami Aquifer outside the waste storage area have been found in Well 2046, located on the north side of the Inactive Flyash Pile (see Figure 3-7). Based on water table maps and particle tracking, it appears that the migration of uranium in this area is from the Inactive Flyash Pile toward the east northeast. The northern edge of this plume has not been defined; therefore, a new well will be installed, approximately one third of the way north of Well 2046 toward Well 2020 as shown in Figure 3-7.

Well 21064 will provide data to refine the definition of the north side of the plume. This refinement will be used in the development of remedial alternatives. This well will be drilled as a cluster well in conjunction with Well 11064 discussed in Section 3.1.5 of this PSP.

3.2.3 New Well 21065 West of the Stormwater Retention Basin

Up to 258 μg/L per liter of total uranium have been detected in Well 2397, located to the east and downgradient from the Stormwater Retention Basin and the Storm Sewer Outfall Ditch (see Figure 3-10). Well 21065 will be installed as an upgradient monitoring well for the Stormwater Retention Basin, and analytical results from this location will be used to assist in determining the source of the uranium detected in Well 2397.

The Type 1 wells in the area were installed to monitor the perched groundwater around the west basin of the Stormwater Retention Basin before the RI/FS began, and there is little analytical data on soil contamination in the area. Well 21065 will be sampled using the procedure for a Type 1 well through the glacial overburden to provide soil data. Samples will be collected at 0 to 0.5, 2.0 to 2.5, 5.0 to 5.5 feet and at 5-foot intervals to the bottom of the glacial overburden for total uranium and total thorium analysis (TAL 50.03.22B in Appendix A) at the FERMCO laboratory.

3.2.4 Type 2 Well Installation Procedure-Special Considerations

Wells 21063, 21064 and 21065 will be installed at the locations shown in Figures 3-7 and 3-10 using cable tool drilling methods as described in the SCQ, Appendix J, with the addition of Hydropunch Sampling. Sampling with the Hydropunch Sampler during the installation of Well 2166 indicated that the uranium plume may be located between the standard Type 2 and Type 3 well depths. In each of the three new well locations, it is important that the well screen be placed at the depth of the uranium plume. To achieve this goal, the well installation procedure will include sampling with the Hydropunch to determine the appropriate depth for placement of the well screen.

The selection of the screen depth will be based on the results from samples collected with the Hydropunch sampling tool. Beginning at 10 feet below the water table, the Hydropunch will be used to collect groundwater samples at 10-foot intervals to a total depth equivalent to the elevation of a Type 3 well screen, or an elevation of about 450 feet, or until the clay interbed is encountered. Samples collected with the Hydropunch will be analyzed at the on-site FERMCO laboratory for total uranium. The screen depth will be set at the depth where the maximum uranium levels are found with the Hydropunch and when that maximum level is significantly higher than samples from other internals. If no uranium is detected above the background level of approximately 1 μg/L in any samples, then 15 feet of well screen will be set at the water table with 10 feet of screen extending below the water table. The final decision as to the depth of the screen will be made by the CRU5 RI/FS Project Manager.

Wells 21063 and 21065 will require a detailed lithologic description of the subsurface because they are the first wells at those locations. The glacial overburden will be continuously sampled with a split spoon sampler and all samples described on the appropriate SCQ forms. Split spoon samples will be collected for lithologic descriptions at 5-foot intervals in the outwash sands of the Great Miami Aquifer.

3.2.5 Well 3084 Abandonment and Replacement

Monitoring Well 3084 was installed in 1987 in the initial stage of the RI for the FEMP. Groundwater samples from this well have shown anomalous high results three to four orders of magnitude greater than sampling results from other wells in the area. In 1992, a down-hole television survey of Well 3084 detected a casing leak at a joint 10 to 15 feet below the ground surface. One apparent consequence of this leak is that samples from this Type 3 well have been contaminated by shallow, perched groundwater

requirements to stop any further cross contamination. As part of the abandonment procedure, a casing will be driven to the base of the glacial overburden to prevent cross contamination from perched groundwater as the casing in Well 3084 is removed and the hole is grouted.

Proposed RCRA Well 3027, along with other wells currently planned for the RCRA program, will replace the monitoring function of Well 3084. The proposed location for Well 3027 is on the east side of Waste Pit 6 (Figure 3-8). Data from Well 3027 will be used to evaluate the water quality in the aquifer downgradient from Well 3084. Additional RCRA wells to be installed in the waste storage area will also serve the function of Well 3084; therefore, a direct replacement well is not required.

3.2.6 New Well 41066 East of the KC-2 Warehouse

The purpose of this well is to determine whether a contaminant plume exists at the Type 4 level of the Great Miami Aquifer. Unlike the other wells in this program, which are designed to detect a broad plume, this well must detect a very localized plume from a point source. The process of selecting the well location, therefore, requires a different approach. The well must be installed in a location where the probability is very high that if the plume is present, the well will intersect the contamination. The possibility of installing the well in a location where it will miss the plume must be minimized.

In October 1992, a well was discovered within the KC-2 Warehouse which is located on the northeastern side of the former production area. Well installation records indicate that this is Well 67 which was installed in 1951 as an aquifer test well and is 218 feet deep, equivalent to a Type 4 well. Well 67 was sampled in January 1993 and found to contain approximately 40 feet of unknown sediment. Samples collected from the material blocking the well at 178 feet indicate contamination is present in the well. There is communication with the aquifer, however, since water levels recover slowly whenever water is removed from the well. Well 67 is to be plugged and abandoned under a removal action.

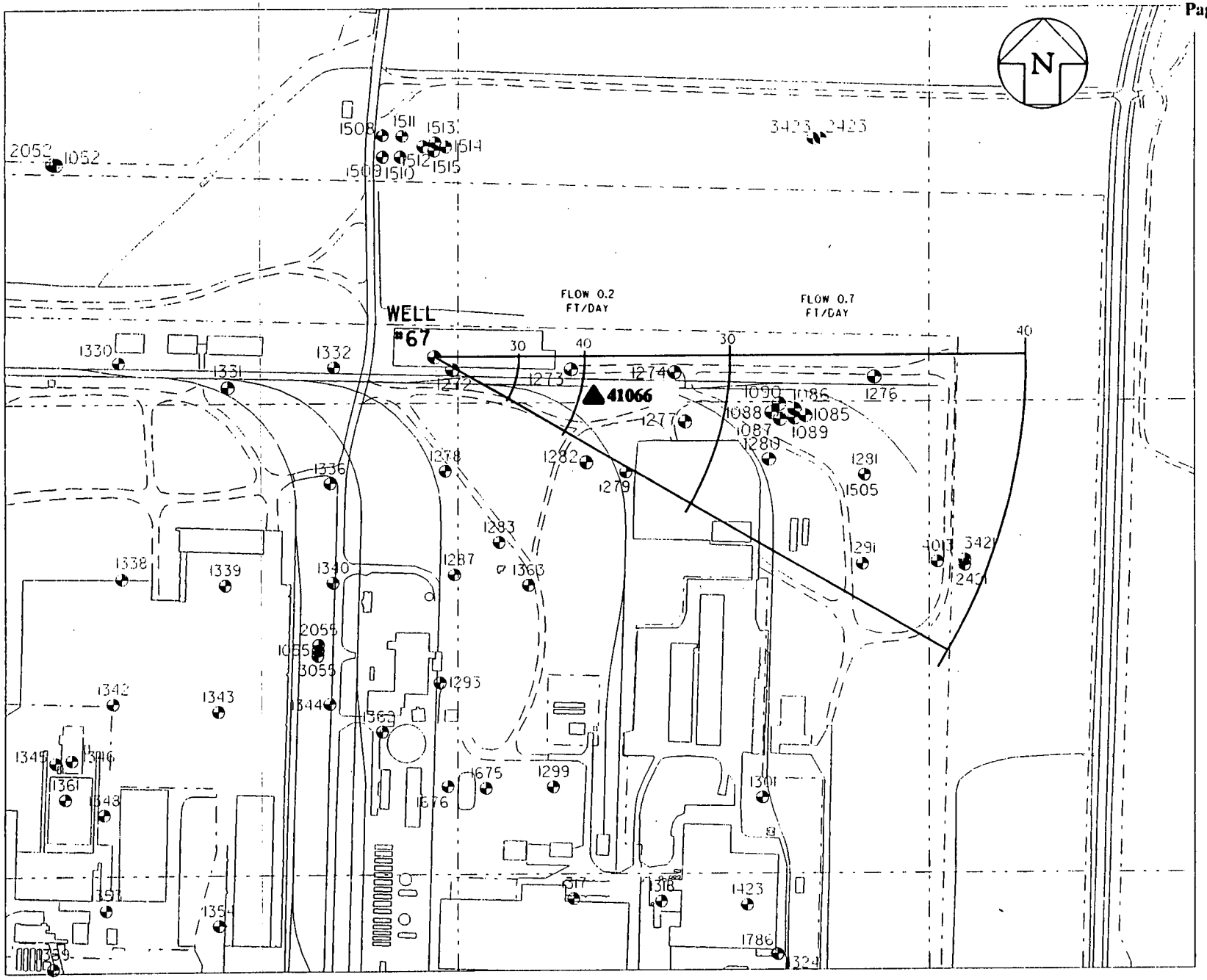
The objective here is to install and sample a well in a location that has a high probability of detecting a groundwater contamination plume that could be emanating from Well 67. There is no clear evidence to indicate how long it has been since material was initially placed in the well. There is also no data to indicate what volumes or concentrations of contaminants that may have been placed in Well 67. Based on the data from recent sampling attempts in Well 67, it is assumed that there is a plume of contamination that has been released from the well.

Figure 3-11 shows the location of the KC-2 Warehouse, Well 67, and the nearby downgradient wells and borings. Monitoring Well 4013, located approximately 1100 feet southeast of Well 67, is the only well in the area deep enough to detect a plume in the lowest part of the aquifer. Preliminary total uranium data from Well 4013 indicate levels are generally 5 μg/L or lower; however, one sample indicated a level of 86 μg/L. It is possible, however, that the 86 μg/L value in June of 1989 could have been the result of vertical migration from Well 3013 which, due to a casing failure, was acting as a vertical pathway for the downward migration of perched groundwater.

The KC-2 Warehouse is located over a portion of the Great Miami Aquifer that is affected by both the zone of influence of the Southwest Ohio Water Company (SOWC) collector wells and seasonal recharge from Paddys Run. Table 3-6 is a comparison of the monthly flow directions for groundwater under the KC-2 Warehouse area. The flow direction was estimated for each month from January 1988 through April 1990 from water table maps. As is shown in Table 3-6, the dominant direction of flow is to the east and east-southeast, which is toward the SOWC wells. SOWC Collector Well 1 is approximately 8,000 feet southeast of the KC-2 Warehouse and on the other side of the Great Miami River. SOWC Collector Well 2 is approximately 7,600 feet slightly south of due east from the KC-2 Warehouse and on the FEMP side of the river.

Table 3-7 shows a range of distances over which the contamination is likely to have traveled assuming a general east-southeast groundwater flow direction, using flow rates of 0.2 and 0.7 feet per day and a retardation factor of 12. These values are consistent with the groundwater model for the Great Miami Aquifer under this portion of the FEMP. However, these values have some uncertainty, so the data in Table 3-7 are used as approximate values only.

Four arcs have been drawn in Figure 3-11 that depict possible locations for the leading edge of the plume using data from Table 3-7 for the 30- and 40-year migration periods. These arcs, therefore, depict the maximum and minimum distances that a plume is likely to have migrated. Based on the data plotted in Figure 3-11, it is reasonable to place Well 41066 within the area bounded on the west by the 40-year front at a 0.2ft/day flow, and on the east by the 30-year front for a flow of 0.7 ft/day. The well will be placed to the east-southeast of Well 67. The distance the plume may have traveled is sensitive to both the flow velocity and the retardation factor. As is shown in Figure 3-11, if the maximum travel velocity is used, the contamination occasionally detected in Well 4013 may have originated in Well 67. Well 4013



LEGEND

2049 WELL NUMBER

▲ PROPOSED NEW WELL LOCATION

150' 0' 150' 300' 450'

SCALE: 1" = 300'-0"
NAD27

FIGURE 3-11
WELL 67 POTENTIAL GROUNDWATER PLUME ANALYSIS

TABLE 3-6
ESTIMATION OF GROUNDWATER FLOW DIRECTION FROM WELL 67

Direction	Frequency	Percent
Northeast	3	11
East Northeast	3	11
East	10	36
East southeast	8	28
Southeast	4	14
Total	28	100

TABLE 3-7
GROUNDWATER AND PLUME MIGRATION FROM WELL 67

Groundwater Flow 0.2 ft/day	Groundwater Movement in Feet	Plume Movement in Feet
40 Years	2922	243
35 Years	2556	213
30 Years	2191	183
Groundwater Flow 0.7 ft/day		
40 Years	10,227	1,270
35 Years	8,949	746
30 Years	7,670	639

seems to be in an almost ideal location to detect such a plume; however, alternate sources exist for the uranium detected in samples from Well 4013.

Well 41066 will be installed using procedures in Section 5 of the SCQ. In addition to normal well installation sampling, the Hydropunch sampling tool will be used starting at the depth of the clay interbed, or the equivalent depth of a Type 3 well, to collect water samples at 10-foot intervals until bedrock is reached. These samples will be analyzed at the FERMCO laboratory for total uranium on a rapid turn-around schedule. The results of these samples will be used to determine the exact location for placement of the well screen. If all Hydropunch samples are at background levels, the screen will be placed 10 feet above bedrock. The final decision on the placement of the screen will be made by the OU 5 RI/FS Project Manager.

Since this is a new well location, the glacial overburden will be continuously sampled with a split spoon sampler and described on the appropriate SCQ form. Samples will be collected from 0.0 to 0.5, 2.0 to 2.5, 5.0 to 5.5 feet and at 5-foot intervals through the glacial overburden for total uranium and total thorium analysis at the FERMCO laboratory. Lithologic samples will be collected and described at 5-foot intervals in the Great Miami Aquifer.

3.3 OBJECTIVES SUMMARY

The data will be used for the determination of the extent of groundwater contamination in the glacial overburden and the Great Miami Aquifer. This data will be used for site characterization and risk assessment in the RI Report for OU 5. Table 3-8 is a summary of the objectives for the installation and sampling of these wells. Table 3-9 is a summary of the type and number of samples to be taken.

3.4 ANALYTICAL PROGRAM

The required radiological and non-radiological analytical tests to be conducted for this characterization are listed in the Target Analyte Lists in Appendix A. Sample container, preservation, and holding time requirements for solid and liquid matrix samples are prescribed in the SCQ.

4.0 ORGANIZATION AND RESPONSIBILITIES

This PSP has been developed by CRU5 to fulfill data needs for the OU 5 RI. The CRU5 RI/FS Project Manager has full responsibility and authority for the content and specifications in this PSP. Any changes

TABLE 3-8
SUMMARY OBJECTIVES FOR NEW WELL INSTALLATION

Activities	Install 16 Type 1 groundwater monitoring wells: seven new and nine replacement wells. Install three Type 2 and one Type 4 groundwater monitoring wells. Collect soil samples during drilling and groundwater samples after completion and development from each of the wells. Plug and abandon six existing Type 1 wells. Plug and abandon Well 3084.
Objectives	**GLACIAL OVERBURDEN:** Refine perched groundwater flow pattern in the Sewage Treatment Plant area. Further define the extent of perched groundwater contamination and flow direction within the sand/silty sand lens west of the Pilot Plant and Plant 1 Pad. Further characterize the stratigraphy at all well locations and provide a more detailed suite of soil and groundwater analyses at locations where wells are replaced. Determine if perched groundwater is contaminated in the vicinity of the Stormwater Retention Basin. Establish initial groundwater quality parameters for each of the new wells. **GREAT MIAMI AQUIFER:** Fill data needs to define the extent of the groundwater contamination plume in the Great Miami Aquifer. Determine if a groundwater contamination plume exists in the vicinity of the KC-2 Warehouse. Establish initial groundwater quality parameters for each of the new wells.
Prioritized data uses	Determine the level of groundwater contamination in the glacial overburden and Great Miami Aquifer at the new well location . Determine the total uranium and total thorium concentrations in soil in the glacial overburden. Provide data for the OU 5 RI, risk assessment, and modeling efforts. Provide long-term monitoring points for water levels and water quality within the glacial overburden and the Great Miami Aquifer.
Appropriate Analytical Levels	PID field screening: ASL A; radiological field screening: ASL A; total uranium and total thorium: ASL B; isotopic radiological: ASL C; standard HSL: ASL C; general chemistry: ASL B; field blanks and rinsate samples: ASL C. Ten percent of ASL C analyses require ASL D documentation.
Constituents of Concern	HSL inorganic, volatile, semivolatile organics, radionuclide, and general chemistry, TAL 50.03..22A and B in Appendix A.
Required detection limits	As specified in the SCQ, drinking water standards, MCLs, and preliminary remediation goals for radionuclides.
Critical samples	Results from Hydropunch samples will be used to pick the screen depth. Samples used to determine plume boundaries, interpret migration rates, model calibration, and risk assessments.

TABLE 3-9
SUMMARY LIST OF SAMPLES BY MEDIA

Sample Type		Glacial Overburden	Great Miami Aquifer	Total
Soil[a]	Type 1 Wells	84		84
	Type 2, 4 Wells	17		17
	Rinsates[a]	13	4	17
	Sub Total	114	4	118
Groundwater[c]	Filtered	14	4	18
	Unfiltered	14	4	18
Duplicate[c]	Filtered	2	1	3
	Unfiltered	2	1	3
Hydropunch[d]		24		24
Field Blank[c]		1	1	2
Rinsate[c]		1	1	2
Trip Blanks[e]		4	2	6
	Sub Total	62	14	76
Total		176	18	194

[a] TAL 50.03.22B in Appendix A
[c] TAL 50.03.22A in Appendix A
[d] TAL 50.03.22E in Appendix A
[e] TAL 50.03.22C in Appendix A

to the activities specified in this PSP must have the approval of the CRU5 RI/FS Project Manager prior to implementation. It is the CRU5 RI/FS Project Manager's responsibility to secure any off-FEMP property access permits required for the completion of this PSP.

4.1 FIELD ACTIVITIES

Field activities are to be conducted by the FEMP Site Characterization Group using SCQ-approved work procedures and sampling procedures specified in Section 5 and Appendix J of the SCQ for well installation. Groundwater sampling will be conducted using the procedures covered in Section 6 and Appendix K of the SCQ. The Site Characterization staff have the responsibility for adhering to the SCQ and Section 5 (Health and Safety Considerations) and Section 6 (QA/QC) of this PSP. The Site Characterization staff will assign unique sample numbers for all samples collected. Field activities

include: sample handling, preservation, shipment and notification of the laboratories, and management of subcontracted drilling and geologic services.

At the completion of field activities associated with each well, a task completion report will be prepared by the SC/DM and submitted to the CRU5 RI/FS Project Manager, which includes copies of all field forms, data sheets, and activity logs, as well as a written summary of the field activities noting any variances from either this PSP or SCQ procedures. Appropriate SCQ forms (D-1 through D-13), Appendix B of the SCQ, must also be completed for data validation and submitted to the FEMP laboratory as part of the field activity.

4.2 QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

The FERMCO QA department will assure that the contents of this PSP conform to the requirements of the SCQ. The FERMCO QC department will monitor field activities to assure that all work conducted in the execution of this PSP conforms to the appropriate standards specified in the SCQ.

5.0 HEALTH AND SAFETY CONSIDERATIONS

Effective health and safety programs for any activity are based on an effective training program. All involved personnel will receive adequate training prior to implementation of the field work. This training will make all employees aware of all physical, radiological, and chemical hazards which may be encountered during the execution of this project.

All FEMP employees and subcontractor personnel who will be performing field work during this project are required to have completed all OSHA-mandated 1910.120 Hazardous Waste Site Worker training. In addition, all applicable annual refresher training will have been taken by the individuals. The DOE regulations at the FEMP require a series of site specific training courses. These courses are designed to augment OSHA-required training and provide additional training specific to the hazards which exist at the FEMP. For health and safety considerations, field personnel participating in the performance of this project will be trained according to the FEMP SCQ and this PSP. In summary, employee awareness and clearly delineated lines of authority and responsibility have been designed to provide for effective health- and safety-related knowledge specific to each activity.

5.1 TASK SPECIFIC PLANS

All aspects of this PSP will be performed in accordance with all existing applicable DOE, U.S. EPA, Occupational Safety and Health Administration (OSHA), and State of Ohio health and safety regulations. Additionally, all practices will be managed in accordance with commonly-accepted practices used in the hazardous wastes industry.

Prior to the implementation of field work, which is to involve drilling, trenching or soil boring, a "Penetration Permit" is issued. Before a Penetration Permit is obtained, the area of concern is investigated and compared against the site database for underground utilities in the area. No drilling, trenching or soil borings will be performed without a valid Penetration Permit being obtained prior to actual performance of the field work.

Each field activity to be performed must have a separate task specific health and safety plan. Task specific health and safety plans have been prepared for the work described in this PSP in accordance with the FEMP Site Health and Safety Plan. For each project task and sub-task, health and safety technician coverage is provided by the assignment of a technician to monitor the field crew's activities.

Project specific health and safety plans address the hazards typically encountered by personnel when performing the specified field work. Proper equipment to be used for health and safety monitoring and personnel protection are specified. Criteria for the selection of monitoring equipment and protective clothing are detailed. Each member of the field crew is required to participate in a health and safety training session, which is specific to each field project, prior to performance of the field work.

In addition to the task specific health and safety plans, formal approval of the field activities specified in this PSP will be obtained prior to the implementation of field work.

5.2 RADIOLOGICAL MONITORING AND CONTROLS

Radiological monitoring for this PSP will be performed using existing institutional controls commonly utilized at the FEMP. For those areas of the FEMP which are under existing institutional radiological controls, any employee who will be entering such areas is required to possess and wear a Thermal Luminescent Detector (TLD) to monitor for exposure to radiological contamination. In addition, each employee is required to participate in a regularly-scheduled urine analysis program which is designed to monitor for radiological exposure.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, Radiation Worker Permits are necessary and will be obtained prior to the field work being performed in those areas. A radiological technician will be assigned to each field crew who is performing any activities in an area which could be expected or result in site workers being exposed to levels of radiological contamination exceeding DOE limitations.

Ingress and egress of personnel, equipment and vehicles to and from radiologically-controlled areas will be monitored with "real time" radiation detection instrumentation. Monitoring results, which exceed FEMP-determined exposure guidelines, will be further evaluated as to the possible source(s). Measures necessary to remediate radiological contamination sources will be implemented. Such measures may include, but are not limited to, personnel training, decontamination, employee exposure monitoring, increased personnel monitoring, personnel protective equipment, and sampling of suspect materials encountered.

If the responsible radiological technician assigned to the field activities being performed identifies a real or potential condition which could or will result in an unsafe condition, then that person has the authority to cease field operations until such time as the unsafe condition has been corrected.

5.3 NONRADIOLOGICAL MONITORING AND CONTROLS

Monitoring of potential health and safety problems associated with nonradiological hazards are evaluated by a health and safety technician. Also, all field crews are responsible for hazard awareness and recognition. Task specific training is designed to enhance the performance of all field work using good and safe work practices.

Evaluating the potential for personnel exposure to organic contaminants will be achieved mainly through the use of an HNu P-101 Photoionization Detector or equivalent instrument. Other equipment which could potentially be used include: Drager tubes, oxygen meters, and combustible gas indicators.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

The primary objectives of the QA and QC sections of this plan relate to the collection of field information and data which are sufficient to accurately characterize groundwater and perched groundwater contamination in the Great Miami Aquifer and glacial overburden, respectively. Specific objectives of this field sampling effort will be designed, organized and implemented in a manner which will optimize

the collection of information which meets predetermined data quality objectives. To ensure that information is gathered in such a manner that data quality objectives are met, quality control measures will be used to determine conformance with overall OU 5 RI/FS program objectives.

6.1 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field quality control samples will be taken to evaluate the possibility that some controllable practice, such as decontamination or sampling technique, may be responsible for introducing bias in project analytical results. Four types of QC samples will be collected: sampling equipment rinsates, field blanks, trip blanks, and duplicate samples. QC for groundwater samples will consist of one duplicate for every 10 samples collected and one field blank will be prepared for each 20 samples collected (TAL 50.03.22A, Appendix A). Trip blanks for HSL volatile organic compounds (TAL 50.03.22C, Appendix A) will be prepared for each sample shipment containing VOC. During soil sampling, rinsate samples will be collected at a rate of one in 20 washings and analyzed for the radiological parameters in TAL 50.03.22B (Appendix A).

6.2 TRAINING

To verify compliance with the SCQ and project-specific requirements, the CRU 5 RI/FS Project Manager or representatives and designated QA personnel will conduct audits and surveillances. The United States Environmental Protection Agency (U.S. EPA) may obtain audit results of activities covered by the SCQ upon written request to the Department of Energy, Fernald Field Office (DOE-FN). They may also conduct external audits of FEMP activities covered by the 1991 Amended Consent Agreement.

As a minimum, audits shall consist of evaluation of the QA program and procedures, effectiveness of implementation, and review of associated project documentation and final reports. Auditing shall be performed in accordance with DOE guidelines, the SCQ, and applicable PSPs.

Surveillances shall consist of monitoring/observing on-going project activity and work areas to verify item and activity conformance to specified requirements. Project surveillance activities will be scheduled, planned and documented (see SCQ, Section 12, for further details).

7.0 FIELD ACTIVITY GUIDELINES

This section presents a generalized description of the field activities to be implemented in order to provide the additional contaminant nature and extent information necessary for RI/FS purposes. Field activities

will consist of subsoil and groundwater sampling. This will be accomplished by the installation of a series of monitoring wells and the collection of groundwater samples. The information derived from the field investigation will provide information to further define the nature and extent of contamination in the glacial overburden and the Great Miami Aquifer.

All procedures for drilling and sample collection through sample shipment, monitor well completion and development, waste generation and decontamination, will be performed in accordance with directives established in the SCQ, except for specifically-defined exceptions stated in the PSP.

Each of the new wells will be developed in accordance with procedures set forth in the SCQ. After the wells have been properly developed, they will be purged and sampled. The analyses will be conducted by a designated and approved laboratory using procedures which meet the data quality standards for the specified analytical packages. Groundwater sampling field procedures, sampling handling/shipment, and decontamination procedures will be performed in accordance to Appendix K of the SCQ. Well installation procedures are listed in Table 7-1.

During the installation of all Type 1 wells and Wells 21021 and 41066, soil samples will be collected at 0.0 to 0.5, 2.0 to 2.5, 5.0 to 5.5 foot depths and at 5-foot intervals to the bottom of the boring or at the base of the glacial overburden for total uranium and total thorium analysis. These analyses will be done at the FERMCO laboratory.

7.1 WASTE DISPOSITION

The following wastes will be generated during characterization activities:

- Core and cuttings
- Purge water
- Contact wastes
- Equipment decontamination solutions

The following subsections provide the proposed disposition methodology for each type of waste generated.

TABLE 7-1 WELL INSTALLATION PROCEDURES	
Administrative Procedures	**Reference Document**
Chain of Custody	SCQ Volume I, Section 7.1
Corrective Action	SCQ Volume I, Section 15.2
Daily Logs	Section 5.1, Appendix J, Subsection J.4.1
Variances	Section 15.4
Field Procedures	
General Drilling Practices	SCQ, Section 5.2.1, Appendix J, Subsection J.4.2
Subsurface Soil Sampling	SCQ, Appendix K, Subsection K.5.3
Monitoring Well Design, Installation, and Abandonment	SCQ, Section 5.2.2, Appendix J, Subsection J.4.3 and EM-GW-004
Well Development	SCQ, Section 5.2.3, Appendix J, Subsection J.4.4
Field Screening of Samples for Radioactive Contamination	SCQ, Appendix K, Subsection K.5.3.2
Decontamination	SCQ, Appendix K, Subsection K.11
Field Storage and Shipment of Samples	SCQ, Appendix K, Subsection K.10
Sample Handling Procedures	
Classification, Preservation, Transportation, and Shipment of FEMP RI/FS Samples	ASI/IT RI/FS Fernald Project Policy and Procedures Manual, FPP-601 and SCQ, Appendix A, Table 6.1

7.1.1 Soil Cores and Cuttings

Unused soil cores and cuttings from drilling monitor wells will be placed in clean 55-gallon drums, labelled according to project, contents and location, and sent to the designated waste interim storage location for future characterization, disposition and disposal.

7.1.2 Purge Water

Groundwater purged form the wells will be contained and transported to the FEMP General Sump for proper disposal. If historic data for a well indicate the purge water is potentially a RCRA waste, the purge water will be drummed at the well and sampled to determine the proper method of disposal.

7.1.3 Contact Wastes

Contact wastes, such as personal protective equipment (PPE) and rags or wipes (paper towels, Chemwipes, etc.),will be placed in plastic bags or 55-gallon drums and transported to the FEMP for appropriate disposition. Contact waste handling and disposition is discussed in the SCQ, Appendix K.

7.1.4 Decontamination Solutions

Equipment decontamination solutions will be transferred to U.S. Department of Transportation (DOT)-approved bung-type, 55-gallon drums, labeled as "Decontamination Solutions." The drums will be placed on wooden pallets, underlaid by diked Herculite sheeting to prevent contaminant migration resulting from spills or leaks. Upon completion of field activities for each characterization phase, the drummed decontamination solutions will be transported to the FEMP for storage and appropriate disposal.

8.0 FIELD SAMPLING SCHEME

Sampling for this project will be performed by the Site Characterization/Data Management Department (SC/DM) of the FERMCO Environmental Management Division. Due to the nature, objectives and programmatic requirements of this project, actual sampling locations and parameter selection is determined by FERMCO personnel of Operable Unit 5, specifically, the RI/FS Project Manager.

8.1 SAMPLE TEAM ORGANIZATION

Well installation crews will be directly supervised by the SC/DM Field Operations Manager. Sampling will be accomplished by two-person field crews, consisting of a geologist/engineer and a sampling technician. Sample Management Office staff will be utilized to provide an interface between the sampling crews and the FEMP or contract laboratory to be used for sample analysis.

8.2 RESPONSIBILITIES OF TEAM MEMBERS

The Field Operations Manager is responsible for the coordination and effective use of all personnel on site and for proper maintenance of the record of all field activities. In addition, the Field Operations Manager is responsible for field quality control including issuance and tracking of measurement and test equipment.

Field sampling personnel are responsible for the collection of the samples in accordance with the approved PSP. All activities associated with the execution of sampling are to be documented on the appropriate Field Activity Daily Logs (FADLs) which are to be completed by the sampling technicians

for each sampling location. These technicians are also responsible for ensuring that the proper sampling equipment is available, in serviceable condition, and properly decontaminated between each sampling point. Field sampling personnel are responsible for sample labelling, handling, and completion of a Chain of Custody/Request for Analysis (CC/RFA) form prior to submittal of the samples to the Sample Management Office.

The Sample Management Office staff will interface with the FEMP or contract laboratory, and are responsible for ensuring that proper sampling containers, preservatives, and sampling coolers are available and in serviceable condition. They are also responsible for logging in all collected samples, delivering the samples to the FEMP laboratory or sending the samples, with accompanying paperwork, to the appropriate contract laboratory.

8.3 SAMPLING SCHEDULE

In general, sampling will be performed concurrent with other investigative activities; however, it is imperative that sample results be available for validation by August 1, 1993. All field work must be completed in May and June to meet this schedule.

Soil sampling will be conducted during well installation. Groundwater sampling will consist of Hydropunch sampling during Type 2 and Type 4 well installation, and sampling of all new monitoring wells installed under this PSP. New monitoring wells will be sampled upon completion of well development.

APPENDIX A
TARGET ANALYTE LISTS

ADDITIONAL MONITORING WELL INSTALLATION AND ABANDONMENT

GROUNDWATER SAMPLES AND RINSATES

TAL 50.03.22 A

FEMP RI/FS - HSL - ANALYTICAL PARAMETERS

	INORGANICS *	Pay Item
1	Aluminum	143**
2	Antimony	
3	Arsenic	
4	Barium	
5	Beryllium	
6	Cadmium	
7	Calcium	
8	Chromium (Total)	
9	Cobalt	
10	Copper	
11	Cyanide	
12	Iron	
13	Lead	
14	Magnesium	
15	Manganese	
16	Mercury	
17	Molybdenum	
18	Nickel	
19	Potassium	
20	Selenium	
21	Silicon	
22	Silver	
23	Sodium	
24	Thallium	
25	Vanadium	
26	Zinc	

	VOLATILE ORGANICS	
1	1,1-Dichloroethane	47
2	1,1-Dichloroethene	
3	1,1,1-Trichloroethane	
4	1,1,2-Trichloroethane	
5	1,1,2,2-Tetrachloroethane	
6	1,2-Dichloroethane	
7	1,2-Dichloroethene (total)	
8	1,2-Dichloroethylene	
9	1,2-Dichloropropane	
10	2-Butanone	
11	2-Hexanone	
12	4-Methyl-2-pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis-1,3-Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans-1,3-Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

	SEMIVOLATILE ORGANICS	Pay Item
1	1,2-Dichlorobenzene	52
2	1,2,4-Trichlorobenzene	
3	1,3-Dichlorobenzene	
4	1,4-Dichlorobenzene	
5	2-Chloronaphthalene	
6	2-Chlorophenol	
7	2-Methylnaphthalene	
8	2-Methylphenol	
9	2-Nitroaniline	
10	2-Nitrophenol	
11	2,4-Dichlorophenol	
12	2,4-Dimethylphenol	
13	2,4-Dinitrophenol	
14	2,4-Dinitrotoluene	
15	2,4,5-Trichlorophenol	
16	2,4,6-Trichlorophenol	
17	2,6-Dinitrotoluene	
18	3-Nitroaniline	
19	3,3'-Dichlorobenzidine	
20	4-Bromophenyl phenylether	
21	4-Chloro-3-methylphenol	
22	4-Chloroaniline	
23	4-Chlorophenyl-phenyl ether	
24	4-Methylphenol	
25	4-Nitroaniline	
26	4-Nitrophenol	
27	4,6-Dinitro-2-methylphenol	
28	Acenaphthene	
29	Acenaphthylene	
30	Anthracene	
31	Benzoic acid	
32	Benzo(a)anthracene	
33	Benzo(a)pyrene	
34	Benzo(b)fluoranthene	
35	Benzo(g,h,i)perylene	
36	Benzo(k)fluoranthene	
37	Benzyl alcohol	
38	bis(2-Chloroethoxy)methane	
39	bis(2-Chloroethyl)ether	
40	bis(2-Chloroisopropyl) ether	
41	bis(2-Ethylhexyl)phthalate	
42	Butyl benzyl phthalate	
43	Carbazole	
44	Chrysene	
45	Dibenzofuran	
46	Dibenzo(a,h)anthracene	
47	Diethylphthalate	
48	Dimethylphthalate	
49	Di-n-butyl phthalate	
50	Di-n-octyl phthalate	
51	Fluoranthene	
52	Fluorene	
53	Hexachlorobenzene	
54	Hexachlorobutadiene	
55	Hexachlorocyclopentadiene	
56	Hexachloroethane	
57	Indeno(1,2,3-cd)pyrene	
58	Isophorone	
59	Naphthalene	
60	Nitrobenzene	
61	N-Nitroso-di-n-propylamine	
62	N-Nitrosodiphenylamine	
63	Pentachlorophenol	
64	Phenanthrene	
65	Phenol	
66	Pyrene	

FEMP RI/FS - FULL RADIOLOGICAL - ANALYTICAL PARAMETERS

	RADIOLOGICAL *	Pay Item
1	Cesium 137	56
2	Neptunium 237	
3	Plutonium 238	
4	Plutonium 239/240	
5	Radium 226	
6	Radium 228	
7	Ruthenium 106	
8	Strontium 90	
9	Technetium 99	
10	Thorium 228	
11	Thorium 230	
12	Thorium 232	
13	Total Thorium	
14	Total Uranium	
15	Uranium 234	
16	Uranium 235/236	
17	Uranium 238	

	MISC. RADIOLOGICAL	
1	Gross alpha	19
2	Gross beta	

FEMP RI/FS - GENERAL GROUNDWATER QUALITY - ANALYTICAL PARAMETERS

	GENERAL CHEMISTRY	
1	Ammonia	143**
2	Chloride	
3	Fluoride	
4	Nitrate	
5	Phenols	
6	Phosphorus (total)	
7	Sulfate	
8	Sulfide	
9	Total Organic Carbon (TOC)	
10	Total Organic Halogens (TOX)	
11	Total Organic Nitrogen (TON)	

	MISC. GENERAL CHEMISTRY	
1	Alkalinity	134

*** HSL Inorganics and Full Radiological analysis is to be performed on both filtered and non-filtered samples.**
**** HSL Inorganics and General Chemistry parameters are one combined pay item (Pay Item 143).**

ADDITIONAL MONITORING WELL INSTALLATION AND ABANDONMENT

SOIL SAMPLES AND RINSATES TO BE ANALYZED AT THE ON-SITE LABORATORY

TAL 50.03.22 B

FEMP RI/FS – LIMITED RADIOLOGICAL – ANALYTICAL PARAMETERS

	RADIOLOGICAL	Pay Item
1	Total Thorium	116
2	Total Uranium	121

ADDITIONAL MONITORING WELL INSTALLATION AND ABANDONMENT

TRIP BLANKS

TAL 50.03.22 C

FEMP RI/FS – LIMITED HSL (VOCs) – ANALYTICAL PARAMETERS

	VOLATILE ORGANICS	Pay Item
1	1,1-Dichloroethane	47
2	1,1-Dichloroethene	
3	1,1,1-Trichloroethane	
4	1,1,2-Trichloroethane	
5	1,1,2,2-Tetrachloroethane	
6	1,2-Dichloroethane	
7	1,2-Dichloroethene (total)	
8	1,2-Dichloroethylene	
9	1,2-Dichloropropane	
10	2-Butanone	
11	2-Hexanone	
12	4-Methyl-2-pentanone	
13	Acetone	
14	Benzene	
15	Bromodichloromethane	
16	Bromoform	
17	Bromomethane	
18	Carbon disulfide	
19	Carbon tetrachloride	
20	Chlorobenzene	
21	Chloroethane	
22	Chloroform	
23	Chloromethane	
24	cis-1,3-Dichloropropene	
25	Dibromochloromethane	
26	Ethylbenzene	
27	Methylene chloride	
28	Styrene	
29	Tetrachloroethene	
30	Toluene	
31	Total xylenes	
32	trans-1,3-Dichloropropene	
33	Trichloroethene	
34	Vinyl acetate	
35	Vinyl chloride	

ADDITIONAL MONITORING WELL INSTALLATION AND ABANDONMENT

GROUNDWATER SAMPLES TO BE ANALYZED AT THE ON-SITE LABORATORY

TAL 50.03.22 E

FEMP RI/FS - LIMITED RADIOLOGICAL - ANALYTICAL PARAMETERS

	RADIOLOGICAL	Pay Item
1	Total Uranium	121