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PROJECT SPECIFIC PLAN FOR THE INSTALLATION OF THE SOUTH FIELD EXTRACTION SYSTEM

05/19/95

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

OPERABLE UNIT 5

PROJECT-SPECIFIC PLAN FOR THE INSTALLATION OF THE SOUTH FIELD EXTRACTION SYSTEM

MAY 1995

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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DRAFT

Department of Energy
Fernald Environmental Management Project
P. O. Box 538705
Cincinnati, Ohio 45253-8705
(513) 648-3155

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MAY 19 1995

DOE-0976-95

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - 5HRE-8J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

PROJECT SPECIFIC PLAN AND FUNCTIONAL REQUIREMENTS AND DESIGN BASIS DOCUMENT FOR THE INSTALLATION OF THE SOUTH FIELD GROUNDWATER EXTRACTION SYSTEM

The purpose of this letter is to transmit, for your review and approval, the Project Specific Plan (PSP) and Functional Requirements and Design Basis Document for the installation of eight groundwater recovery wells in the vicinity of the South field at the Fernald Environmental Management Project (FEMP). The restoration and protection of the Great Miami Aquifer is one of the highest priorities at the FEMP. Since funds are available under the remaining Fiscal Year 1995 (FY 95) budget to proceed with construction of an initial phase of the $160 million, 28-well aquifer restoration system outlined in the Operable Unit 5 (OU5) Feasibility Study (FS), the Department of Energy, Fernald Area Office (DOE-FN) would like to proceed as quickly as possible.

This initial phase of the groundwater remediation will focus on the area of the aquifer that exhibits the highest uranium concentrations and accompanying longest remediation time. The locations of the proposed wells have been evaluated in the groundwater modeling simulations conducted for the OU5 FS, and are ideal for this "early start" initiative. Additionally, the well locations, attendant piping and utility plans will accommodate groundwater reinjection, should the U.S. Environmental Protection Agency (U.S. EPA), Ohio Environmental Protection Agency (OEPA), and DOE-FN collectively determine that reinjection is a necessary course of action.

The enclosed PSP for the installation of the South Field extraction system outlines the requirements and activities necessary to install eight new recovery wells, and to convert the FEMP's existing pumping test well for inclusion as a recovery well. DOE-FN recognizes that the activities outlined in the PSP are proposed in advance of the required schedules for OU5's Remedial Design and Remedial Action (RD/RA) as required by the Amended Consent Agreement, and that the U.S. EPA and OEPA are only approving the installation of this initial phase of the system at this time. A follow-up plan as a component of the formal RD/RA process (outlining interim operations and discharge requirements) will be developed and transmitted to the U.S. EPA and OEPA for review and approval prior to the proposed South Field system beginning operation.

In the event that funding is found to be unavailable to expedite the installation of these eight wells, the program would be completed later as an element of the formal RD/RA process for OU5 under the terms of the Amended Consent Agreement.

As a companion to the PSP, the Title I South Field Extraction System Functional Requirements and Design Basis document is enclosed. This document is a necessary first step in the development of a procurement package for obtaining a construction contractor, and outlines the engineering basis for the recovery wells, piping network, utilities plan, and tie-ins to the existing South Plume system. We have included the functional requirements document in order to provide supporting information for your review of the PSP.

The FEMP would like to implement this PSP this summer, following approval by both the U.S. EPA and OEPA. To this end, DOE-FN would like to schedule a meeting for late May, or early June, to discuss the PSP and resolve any outstanding issues the agencies may have.

If you have any questions, please contact Robert Janke at (513) 648-3124 or Kathi Nickel at (513) 648-3166.

Sincerely,

Johnny Reising

for Jack R. Craig
Fernald Remedial Action
Project Manager

FN:RJJanke

Enclosures: As Stated

cc w/encs:

K. H. Chaney, EM-423/GTN
L. Griffin, EM-423/GTN
D. R. Kozlowski, EM-423/GTN
B. Barwick, USEPA-V 5HRE-8
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J. Kwasniewski, OEPA-Columbus
P. Harris, OEPA-Dayton
M. Proffitt, OEPA-Dayton
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D. J. Carr, FERMCO/52-5
AR Coordinator, FERMCO

cc w/o encs:

M. Yates, FERMCO/9

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OPERABLE UNIT 5

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1.0 INTRODUCTION

This document presents the project specific plan (PSP) for the installation of eight Great Miami Aquifer groundwater extraction wells, pipelines and supporting equipment in the vicinity of the South Field area at the Fernald Environmental Management Project (FEMP), referred to in this plan as the South Field extraction system. A test well recently installed to support an aquifer pumping test will be converted to an extraction well to provide a nine-well South Field extraction system. Piping will be designed so that a 10th well could be added to the northeast corner of the system at a later date. The nine wells represent approximately one third of the baseline-case extraction well system evaluated in the Operable Unit 5 Feasibility Study (FS) (DOE 1995a, see Section F.7, Figure F.7-40) and proposed as part of the preferred remedy in the Operable Unit 5 Proposed Plan (DOE 1995b). These two documents were approved by the U.S. Environmental Protection Agency (EPA) on April 20, 1995 and Proposed Plan was issued for public comment on May 1, 1995. The installation of the wells is being expedited in response to the availability of Fiscal Year (FY) 1995 funds that can be used to gain an "early start" on the implementation of remedial actions for Operable Unit 5.

The wells will be situated around the South Field area, primarily along the storm sewer outfall ditch. This area was selected to accelerate the implementation of the preferred remedy for remediation of the Great Miami Aquifer because it contains the highest concentrations of uranium detected in the aquifer (up to 2100 parts per billion [ppb]) and represents the area with the longest potential remediation time.

The South Field extraction system will be comprised of 12-inch diameter stainless steel extraction wells, vertical turbine pumps, valve houses, an access roadway, electrical service, instrumentation, and approximately 5500 feet of buried high density polyethylene (HDPE) discharge piping (Figure 1-1).

The wellfield piping will be arranged in a two-header system with each well capable of discharging (through valving arrangements) to either header. Each well will have the capability to discharge to a header designated for treatment (i.e., the advanced wastewater treatment [AWWT] facility, South Plume interim treatment [SPIT] system, or the interim AWWT [IAWWT] units) or to a header directing flows to the Great Miami River.

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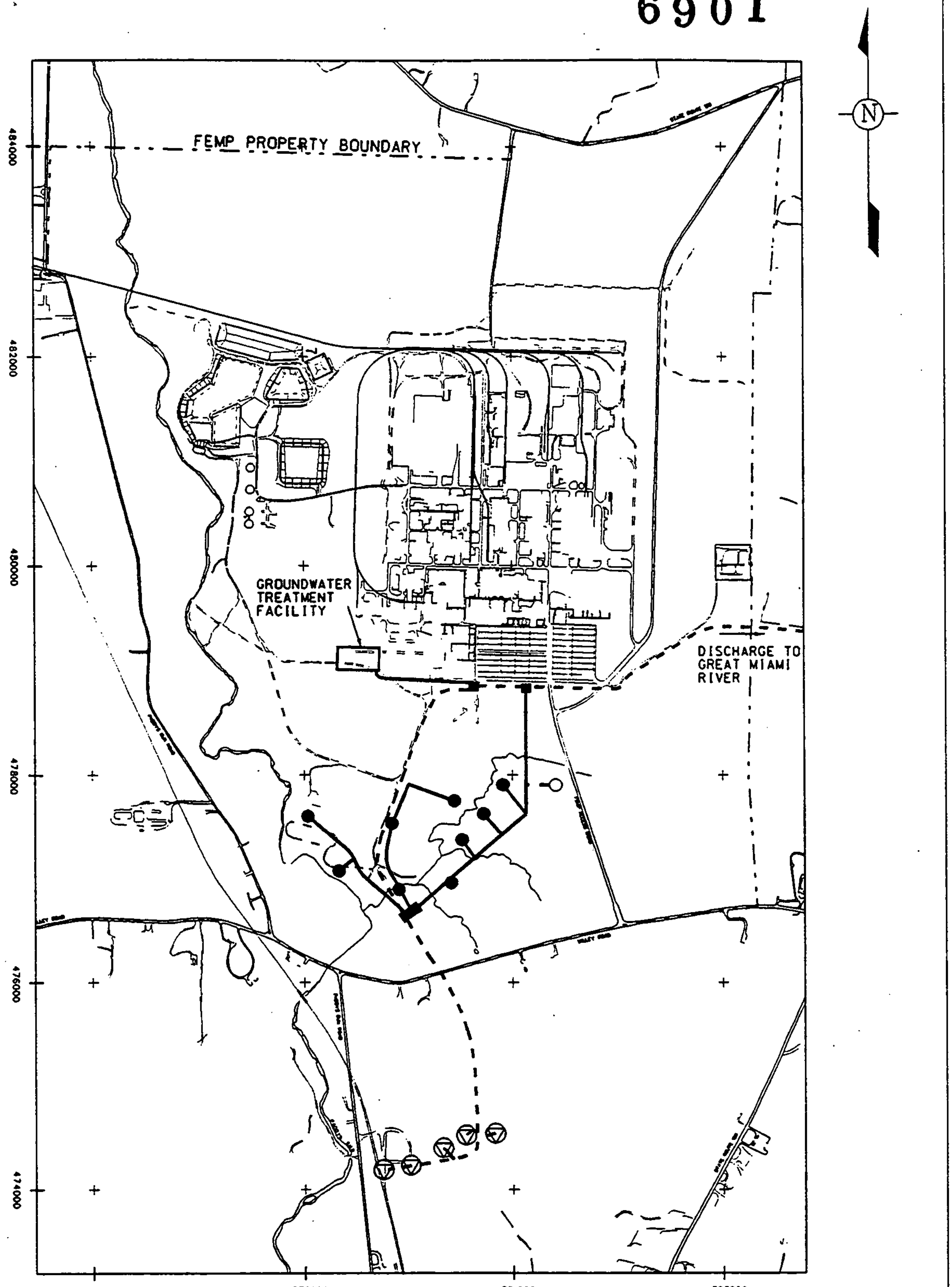

LEGEND:

- ● SOUTH FIELD EXTRACTION WELL
- ⊽ SOUTH PLUME EXTRACTION WELL
- ■ VALVE HOUSE
- ○ CONTINGENCY WELL
- - - - - EXISTING PIPELINE
- ——— PROPOSED PIPELINE

SCALE

0 750 1500 3000 FEET

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FIGURE 1-1. SOUTH FIELD EXTRACTION SYSTEM DESIGN

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A valve house will be constructed in the area where the wellfield headers cross the South Plume force main. Connections will be made between the force main and the wellfield headers so that the existing South Plume force main leaving the new valve house will carry the flow designated for treatment at AWWT, SPIT, and IAWWT and a newly installed wellfield header will carry flow designated for discharge to the Great Miami River.

The new wellfield header carrying flow for discharge to the Great Miami River will tie into the existing discharge force main between the east storm water retention basin and the south access road. The effluent from the South Plume system will be diverted at the new South Field valve house, combined with other flows and discharged to the Great Miami River. Additional details are provided in Section 4.2.

1.1 RESTORATION OBJECTIVES

The Proposed Plan for Operable Unit 5 has identified restoration of the Great Miami Aquifer to full beneficial use, including use as a drinking water source, as the primary remedial action objective for the aquifer. This objective applies uniformly to all affected areas of the aquifer (both on- and off-property) that contain FEMP-related contaminants.

Consistent with this objective, Safe Drinking Water Act proposed and final maximum contaminant levels (MCLs) have been adopted as final remediation levels (FRLs) for FEMP-related contaminants in the Great Miami Aquifer. For those FEMP-related contaminants that do not have an established MCL under the Safe Drinking Water Act, a concentration equivalent to an incremental lifetime cancer risk (ILCR) of 10^{-5} for carcinogens or a hazard index (HI) = 1 for noncarcinogens would be used as the FRL. The FRLs will be tracked throughout all affected areas of the aquifer and will be the basis for determining when the Great Miami Aquifer restoration objectives have been met.

These objectives apply to the preferred approach for restoring the Great Miami Aquifer, as presented in the Operable Unit 5 Proposed Plan and discussed below.

1.2 PREFERRED APPROACH FOR RESTORING THE GREAT MIAMI AQUIFER

The Proposed Plan for Operable Unit 5 has identified groundwater extraction and treatment as the preferred approach for restoring the Great Miami Aquifer. The FS concluded that a 28-well base-case extraction system pumping at a maximum of 4000 gallons per minute (gpm) would be sufficient to restore the aquifer in an estimated 27-year time frame. Groundwater extracted from the aquifer would be treated as necessary to meet discharge requirements for release to the Great Miami River. Portions of the recovered groundwater exhibiting the highest concentrations of contaminants would be treated through the existing treatment facilities and a future expansion of the AWWT facility. The uranium concentration in the effluent discharged to the Great Miami River would not exceed the proposed MCL of 20 ppb, and the maximum discharge of uranium to the river would not exceed 600 pounds per year. Contaminated groundwater would be treated to the design capacity of the AWWT facility, and more highly contaminated groundwater would be preferentially treated before treatment would be expended on less contaminated water.

The 28-well base-case extraction system evaluated in the FS revealed that conventional groundwater extraction and treatment technologies could satisfactorily restore the aquifer within the 27-year restoration period, which was identified through groundwater modeling simulations of restoration performance. As noted in the Proposed Plan, the process of restoring the aquifer is chiefly controlled by the chemical interactions that occur between the contaminants and the sand and gravel matrix composing the aquifer system. This process is complex and leads to significant uncertainty in the ability to precisely simulate and predict the performance of groundwater recovery operations. As part of the preferred alternative, the FEMP would continue to evaluate the benefits of applying emerging or innovative technologies to enhance contaminant recovery from the aquifer. These technologies could include the possible reinjection of groundwater less than 20 ppb into the aquifer as a means of speeding the contaminant flushing process.

The FEMP's evaluation of enhancement technologies will be incorporated into the remedial design process and, as necessary, into the periodic reviews of system operational effectiveness conducted during actual remediation. This is consistent with the performance evaluation strategies outlined in EPA's General Methods for Remedial Operation Performance Evaluations for Pump-and-Treat Remediation. As envisioned in this guidance, efforts to promote system performance, assess technological advances, and improve system economics and efficiency should be extended throughout the life of the remedial action.

The FEMP is performing additional modeling simulations of the reinjection process and is planning to conduct a field-scale demonstration of the technology in FY 1996. If the need to apply reinjection or other enhancement technologies is deemed appropriate in the future, approval by EPA or Ohio EPA (OEPA) would be obtained before implementation.

1.3 RELATIONSHIP BETWEEN THE SOUTH FIELD EXTRACTION SYSTEM AND THE PREFERRED ALTERNATIVE IDENTIFIED IN THE PROPOSED PLAN

The wells to be installed under the South Field extraction system and the converted pumping test well are a subset of the extraction wells identified for the preferred alternative in the Operable Unit 5 Proposed Plan. They are being installed as a first-phase effort to accelerate implementation of the Operable Unit 5 remedy in the area of the aquifer exhibiting the highest uranium concentrations and the longest potential remediation time. The well locations were evaluated through the modeling simulations and performance evaluations conducted during the Operable Unit 5 FS. Placement of the wells at these locations will effectively capture the uranium plume in this area.

A commitment to completing 9 of the 28 proposed extraction wells now will not jeopardize the FEMP's ability to accommodate the remaining wells or the potential for application of reinjection technologies at a later date, should reinjection be identified by DOE and EPA as a necessary enhancement technology. The necessary piping and utilities plans take into consideration the future expansion of the system.

1.4 PROJECT CONSTRAINTS

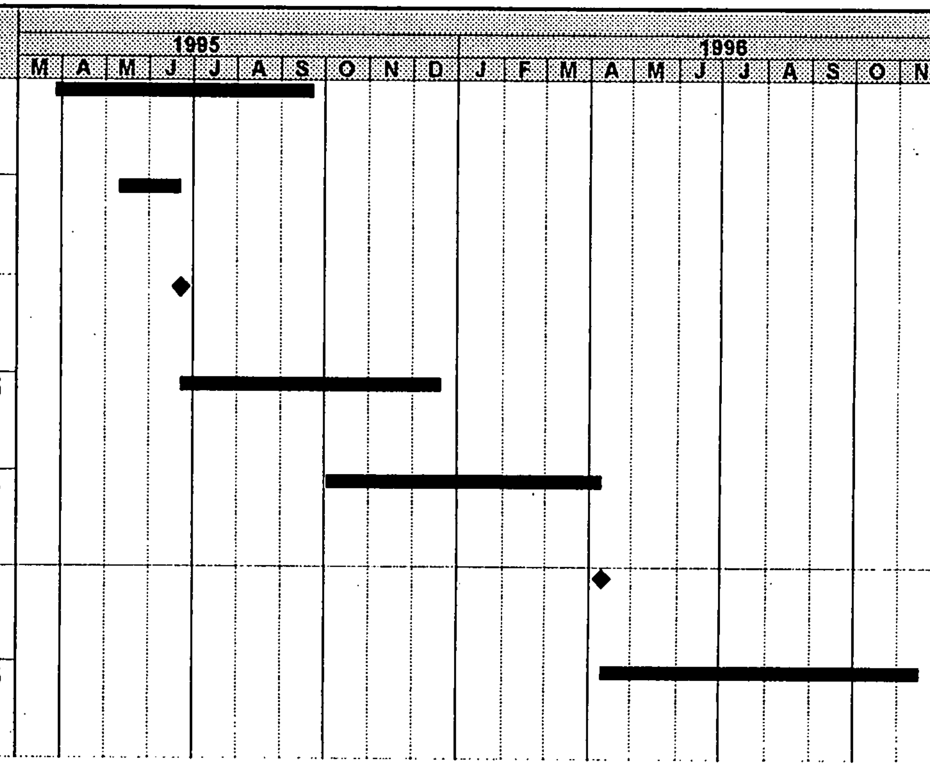
The installation of the South Field extraction system is being proposed as an early start on aquifer restoration activities. The project is being proposed at this time to most appropriately use available funding for the early completion of planned groundwater extraction systems. It is recognized that the installation of the system is in advance of required Amended Consent Agreement schedules for remedial design and remedial action for Operable Unit 5.

Implementation of the project is subject to funding availability. While efforts are being made to secure the necessary funding to expedite completion of the project, in the event funding is deemed unavailable the project will be delayed or cancelled. Should funding not be available to expedite the installation of the nine-well extraction system, installation of the system would be completed as a part of remedial actions for Operable Unit 5 under the terms of the Amended Consent Agreement.

Figure 1-2 presents a preliminary schedule for the installation of the South Field extraction system. On the basis of this schedule, the systems would be expected to be available for operation on or before November 17, 1996. Efforts are underway to accelerate critical path items, such as construction contractor procurement, to expedite the overall project schedules. During the course of the project, documentation and/or design packages will be submitted to EPA for review. The following are the project deliverables anticipated to be submitted to EPA:

• Functional Requirements and Design Basis	5/19/95
• South Field Pumping Test Report	7/17/95
• 90 Percent Design Documentation	8/11/95
• Certified-for-Construction Design Drawings	10/2/95
• Well Completion Logs	1/15/96
• Operations Plan	1/15/96
• Status Reports	Monthly with Amended Consent Agreement report

Activity Description	Early Start	Early Finish
Design South Field Extraction System	27MAR95	21SEP95
Procure - Wellfield Contractor	11MAY95	22JUN95
Award - Wellfield Installation		22JUN95
Install - Wellfield Extraction System	23JUN95	20DEC95
Procure - Pipeline System Contractor	02OCT95	08APR96
Award - Pipeline System Installation		08APR96
Install - Pipeline System	09APR96	15NOV96



FERMCO
Proposed Schedule
South Field Extraction System

FIGURE 1-2. FERMCO PROPOSED SCHEDULE FOR SOUTH FIELD EXTRACTION SYSTEM

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The Operations Plan identified above would be submitted to develop a common operational philosophy between DOE and EPA regarding the extraction system . The plan would describe the current treatment capabilities of the FEMP, the characteristics of the discharges to the Great Miami River, and the anticipated impacts operation of the South Field extraction system would have on these discharges. Upon final approval by EPA, the Operations Plan would establish the operating constraints for the system.

1.5 ORGANIZATION OF PROJECT-SPECIFIC PLAN

This PSP has been prepared in accordance with the requirements of the Sitewide CERCLA Quality Assurance Plan and is comprised of nine sections. The sections and their contents are as follows:

Section 1.0 Introduction - Includes a discussion of the purpose of the PSP, an overview of project objectives and scope, and the plan organization.

Section 2.0 Management and Organization - Includes a brief description of the organization of the project and the responsibilities of the key personnel or organizations.

Section 3.0 Background - Includes brief background information on the geologic, hydrogeologic and water quality conditions in the study area and on related existing extraction and treatment systems at the FEMP.

Section 4.0 Description of Project Activities - Includes a discussion on the design and placement of the well system, installation of the piping and support systems, well development activities, performance monitoring and the collection and analysis of samples to support well installation.

Section 5.0 Decision Points and Contingencies - Includes a discussion of key decision points and required flexibilities necessary to the project during well drilling and installation.

Section 6.0 Data Management And Analysis - Includes a brief discussion on the management of project data.

Section 7.0 Health and Safety - Establishes that a task specific health and safety plan will be issued and followed to support project activities.

Section 8.0 Quality Assurance/Quality Control - Includes a brief discussion on the overall quality assurance/quality control requirements for the project.

Section 9.0 References - Provides a listing of information referenced by the PSP.

2.0 MANAGEMENT AND ORGANIZATION

This section identifies the roles and responsibilities of key management and technical personnel associated with the completion of the South Field extraction system. The Amended Consent Agreement places ultimate project management responsibility with the DOE and the EPA. Additionally, the OEPA is participating in the cleanup process at the FEMP.

Figure 2-1 identifies the relationship among the regulators, DOE administrative and program management organizations, stakeholders, and the Fernald Environmental Management Corporation (FERMCO) and its subcontractors. Figure 2-2 depicts the flow of project communications that are in place for this project. The DOE Operable Unit 5 Team Leader will provide the overall programmatic direction for the accomplishment of the activities described in this PSP.

The FERMCO organization consists of project organizations, support divisions, and service departments. The support divisions provide discipline-specific personnel to staff the project organizations on a matrix basis. Service organizations provide resources and support to the project organizations on an as-needed basis.

Parsons is a subcontractor to the DOE providing a range of services to the FEMP including design engineering. Parsons will be responsible for the completion of all design-associated activities on this project.

It is envisioned that well drilling and construction activities necessary to complete the project will be provided by subcontractors to FERMCO. Following completion of necessary design activities, procurement packages will be issued for bid to qualified subcontractors. Following award, the selected contractor will be responsible for completing the project well-drilling or construction activities in accordance with issued design drawings and/or specifications.

Descriptions of some of the key technical responsibilities of project personnel or organizations are provided below.

The DOE Operable Unit 5 Team Leader is responsible for:

- Providing program direction and oversight to the completion of project activities
- Acting as the point of contact within DOE and for the regulators and stakeholders for all communications concerning this project.

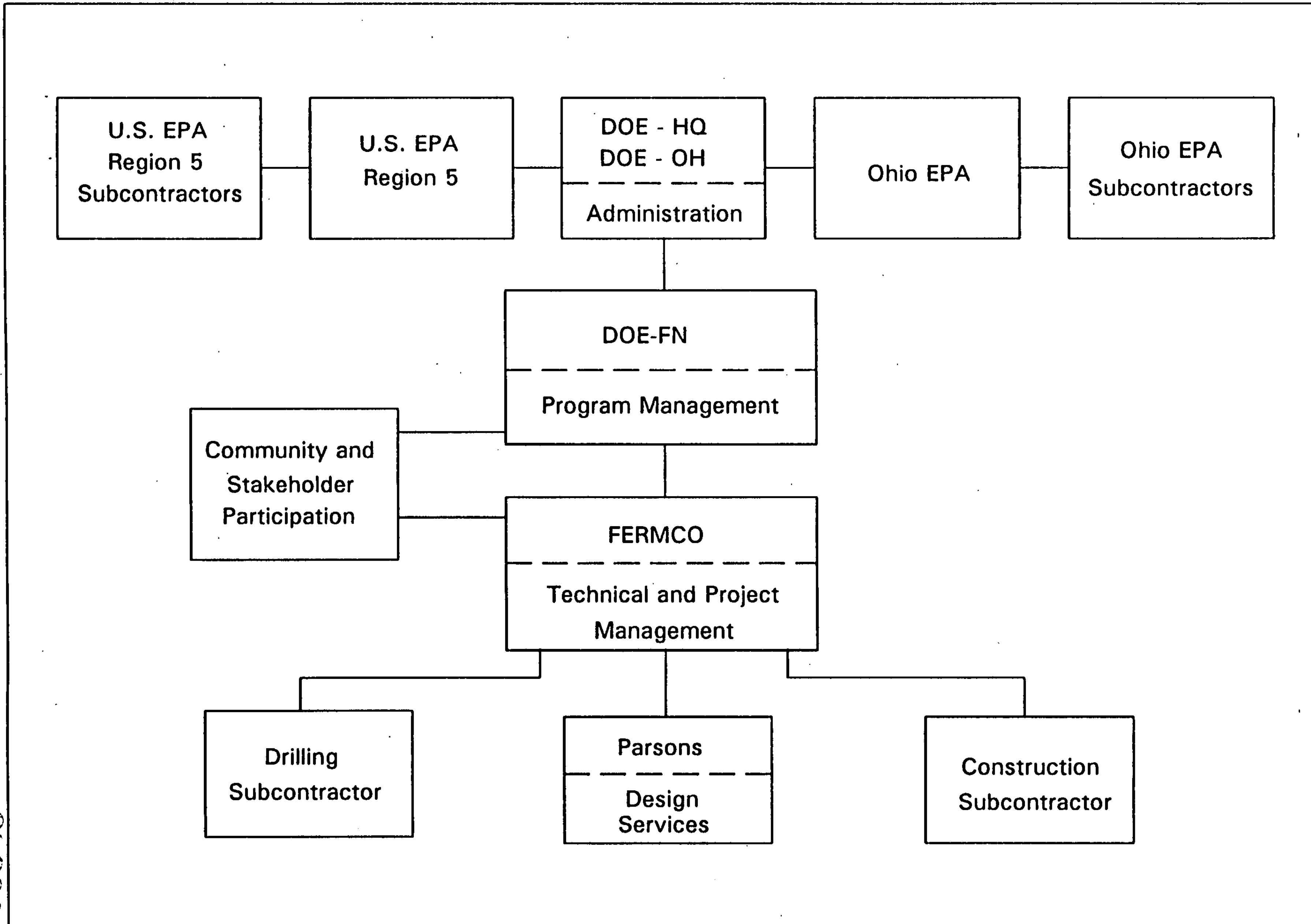

FIGURE 2-1. PROJECT ADMINISTRATIVE RELATIONSHIPS

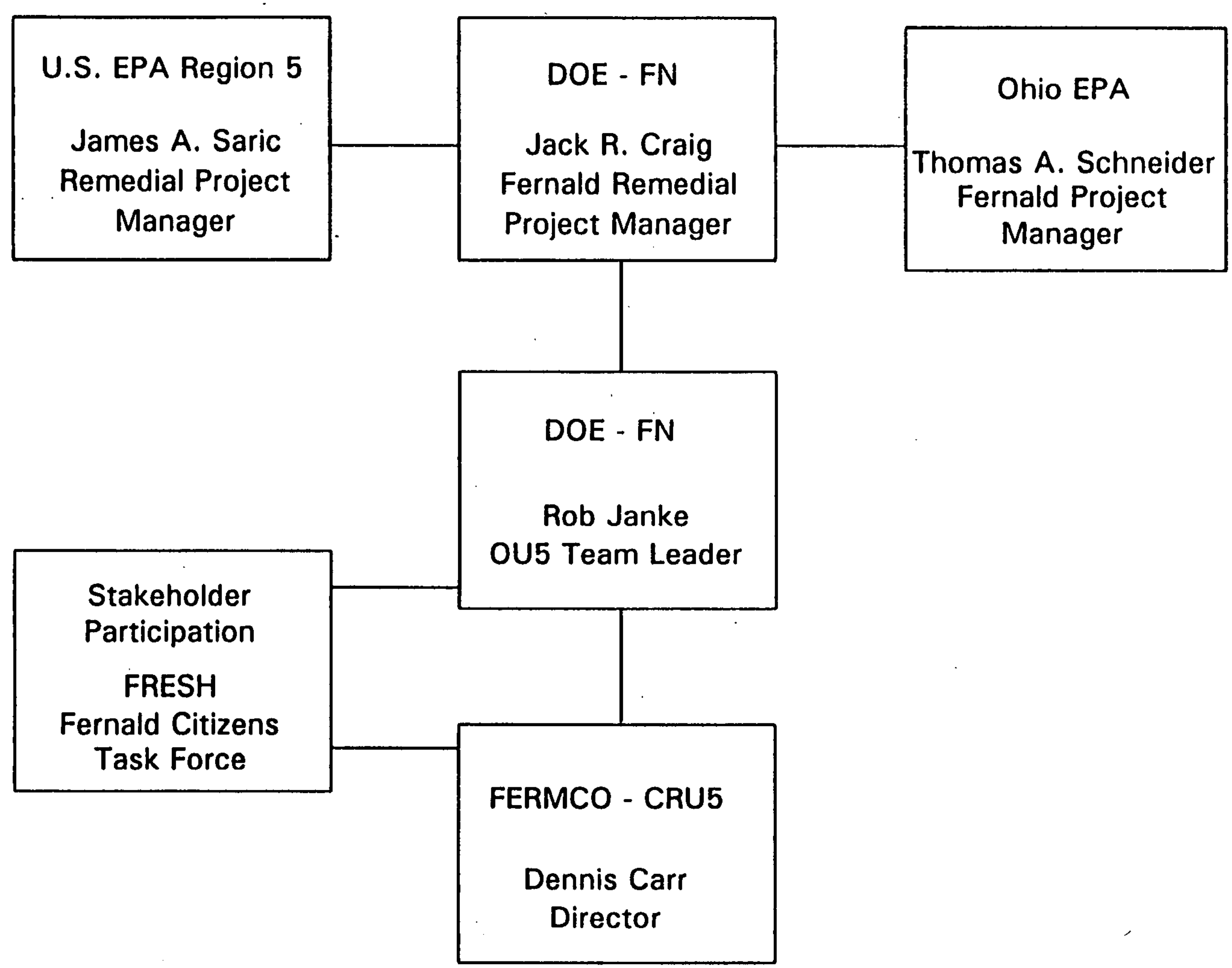

FIGURE 2-2. PROJECT COMMUNICATIONS FLOW CHART

The FERMCO Operable Unit 5 Director is responsible for:

- Providing overall project management and technical guidance to the FERMCO team
- Ensuring the necessary resources are allocated to the project for the efficient and safe completion of project activities
- Overseeing and auditing project activities to ensure that the project is being performed efficiently and in accordance with all regulatory requirements and commitments, DOE Orders, site policies and procedures, and safe working practices.

The FERMCO Project Manager is responsible for:

- The safe and prompt completion of project design and construction activities
- Oversight and programmatic direction of system startup and operation
- Providing a technical lead for the design of the system to ensure it attains project objectives
- Providing management oversight of the design and construction subcontractors to ensure project objectives are safely and efficiently attained
- Establishing and maintaining the project scope, schedule and cost baseline
- Reporting to the DOE Operable Unit 5 Team Leader and FERMCO Operable Unit 5 Director on the status of project activities and on the identification of any problems encountered in the accomplishment of the project objective
- Obtaining the necessary funding to complete the project.

The FERMCO Lead Geologist is responsible for:

- Reporting to the FERMCO Project Manager on the progress of drilling activities
- Documenting the geology of each boring
- Being present whenever a borehole is advanced, casing and screen is being installed, and during well-development activities
- Generating subsurface logs for each boring, generating a complete and accurate daily log of project activities, and preparing lithologic logs in the field
- Documenting lithology and depositional features.

The drilling subcontractor is responsible for:

- On-site operations of each drilling rig
- Completion of well installation
- Well development.

Parsons is responsible for:

- Completion of the engineering design of the project.

The construction subcontractor is responsible for:

- Completion of construction activities for the project including the installation of pumping and piping systems, utility tie-ins, and tie-ins to existing FEMP piping and treatment systems.

3.0 BACKGROUND

3.1 HYDROGEOLOGY OF THE DRILLING AREA

The hydrogeology of the drilling area has been characterized in detail in the Operable Unit 5 Remedial Investigation (RI) Report (DOE 1995c). The new extraction wells are to be located in the southwest corner of the FEMP property (Figure 3-1). This area is situated over the New Haven Trough, a large buried valley whose axis roughly extends in a northeast - southwest orientation (Figures 3-2 and 3-3). The New Haven Trough is bounded by Ordovician-age shale and limestone bedrock along the floor and walls. The trough was carved into the bedrock during the Pleistocene and subsequently filled with approximately 150 to 190 feet of sand and gravel in what was most probably a braided stream environment. Glacial processes during Wisconsin time deposited up to 60 feet of clay-rich glacial overburden over the sand and gravel outwash deposits.

The depth to bedrock in the drilling area varies from approximately 165 feet to 195 feet. Approximately 3 to 12 feet of brown clay and 6 to 11 feet of gray clay exists in the glacial overburden. A semiconfining clay layer divides the aquifer into an upper and lower zone. The clay layer is not present at all of the locations (Figure 3-4).

Several years of water elevation data exists for the drilling area. Data collected in 1993 reveals that flow is either to the east or southeast depending on the seasonal influence of recharge from Paddys Run. The water table under the drilling area dips to the east in January and April (when water levels are high due to recharge from Paddys Run) and to the southeast in July and October (when water levels are low and Paddys Run is dry except during and immediately following significant precipitation). Quarterly water table maps for 1993 are provided in Attachment A. Data collected from Wells 2387, 3387, 2049, 3049, and 2390, and 3390 indicate that seasonally the water table rises and falls approximately 7 feet; from a low of approximately 518 feet above mean sea level (amsl) to 525 feet amsl. Hydrographs are provided in Attachment A.

3.2 WATER QUALITY OF THE DRILLING AREA

Water quality in the Great Miami Aquifer within the drilling area has been characterized in detail in the Operable Unit 5 RI Report (DOE 1995c). The predominant contaminant of concern for the area is uranium. Unfiltered samples collected from Type 2 wells in 1993 indicate that total uranium concentrations in the drilling area range up to 2070 ppb (DOE 1995c, Plate E-77). This

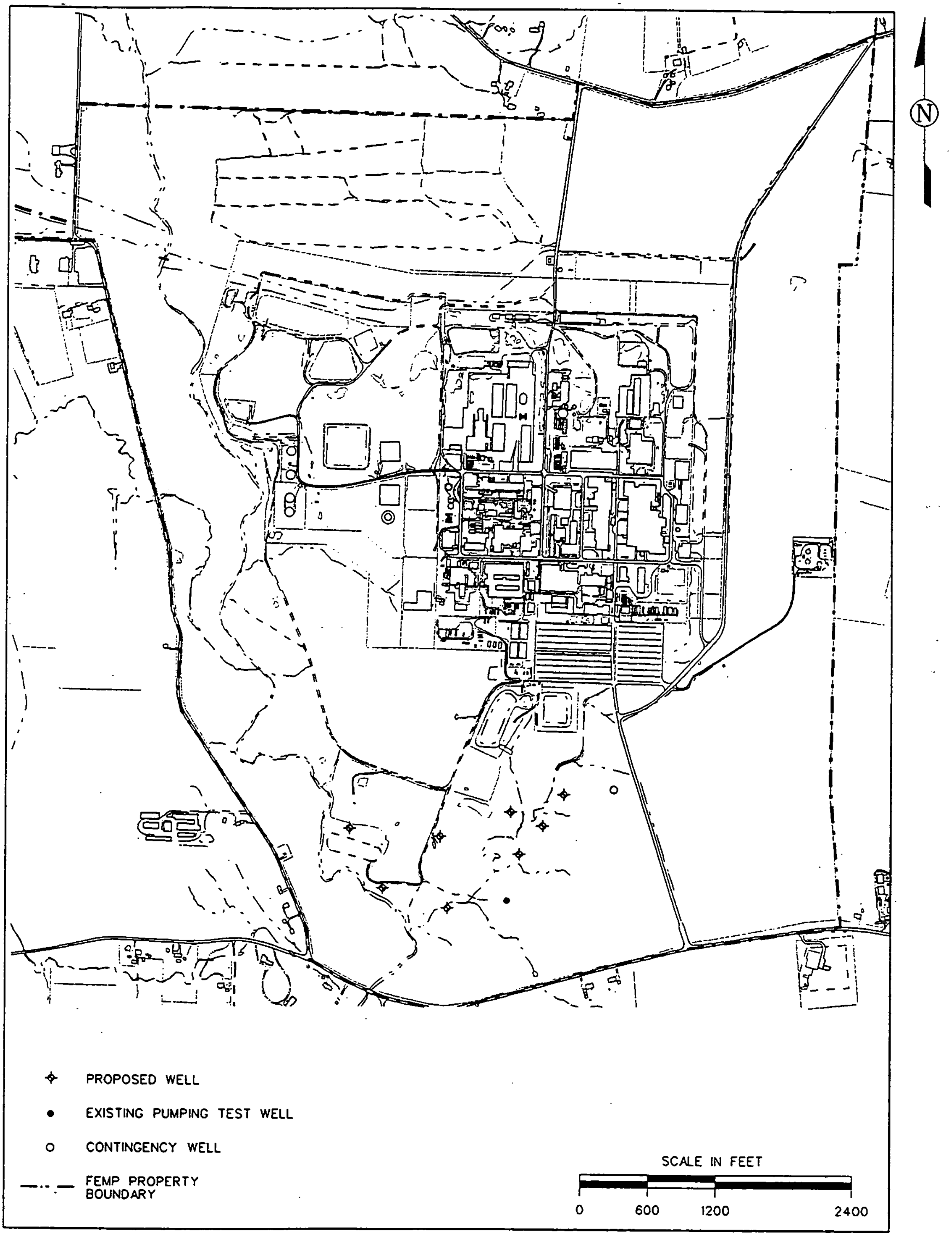

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FIGURE 3-1.
LOCATION OF RECOVERY WELLS

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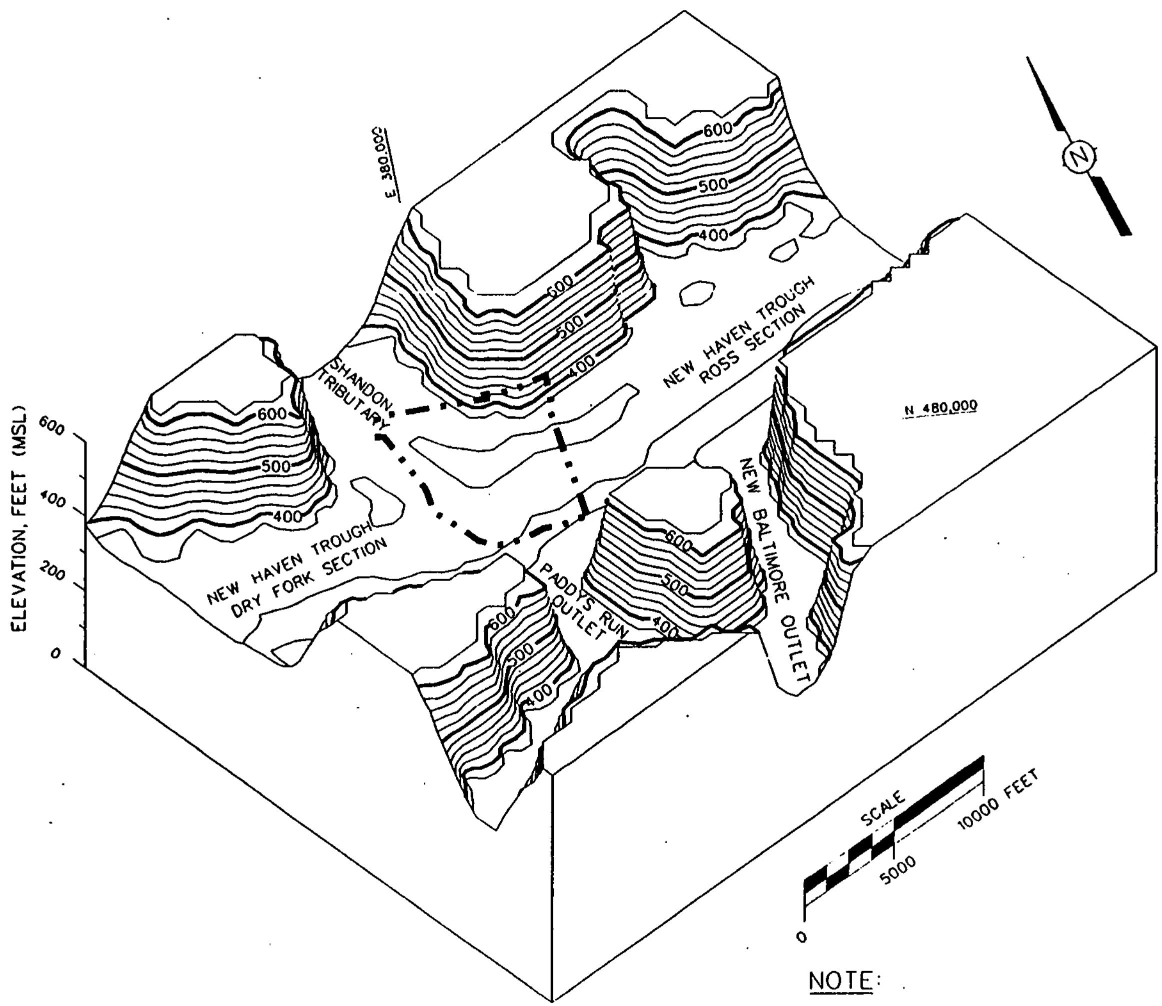

NOTE:
VERTICAL EXAGGERATION
= 20X

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LEGEND:
400 CONTOUR
— · · — FEMP BOUNDARY

FINAL

/USR/ERMA3/FMPC/IDX/A146.DGN FER DUS RIDATA 6-10-94 STATE PLANAR COORDINATE SYSTEM 1927 FIGURE 2-3 3-DIMENSIONAL BEDROCK CONFIGURATION

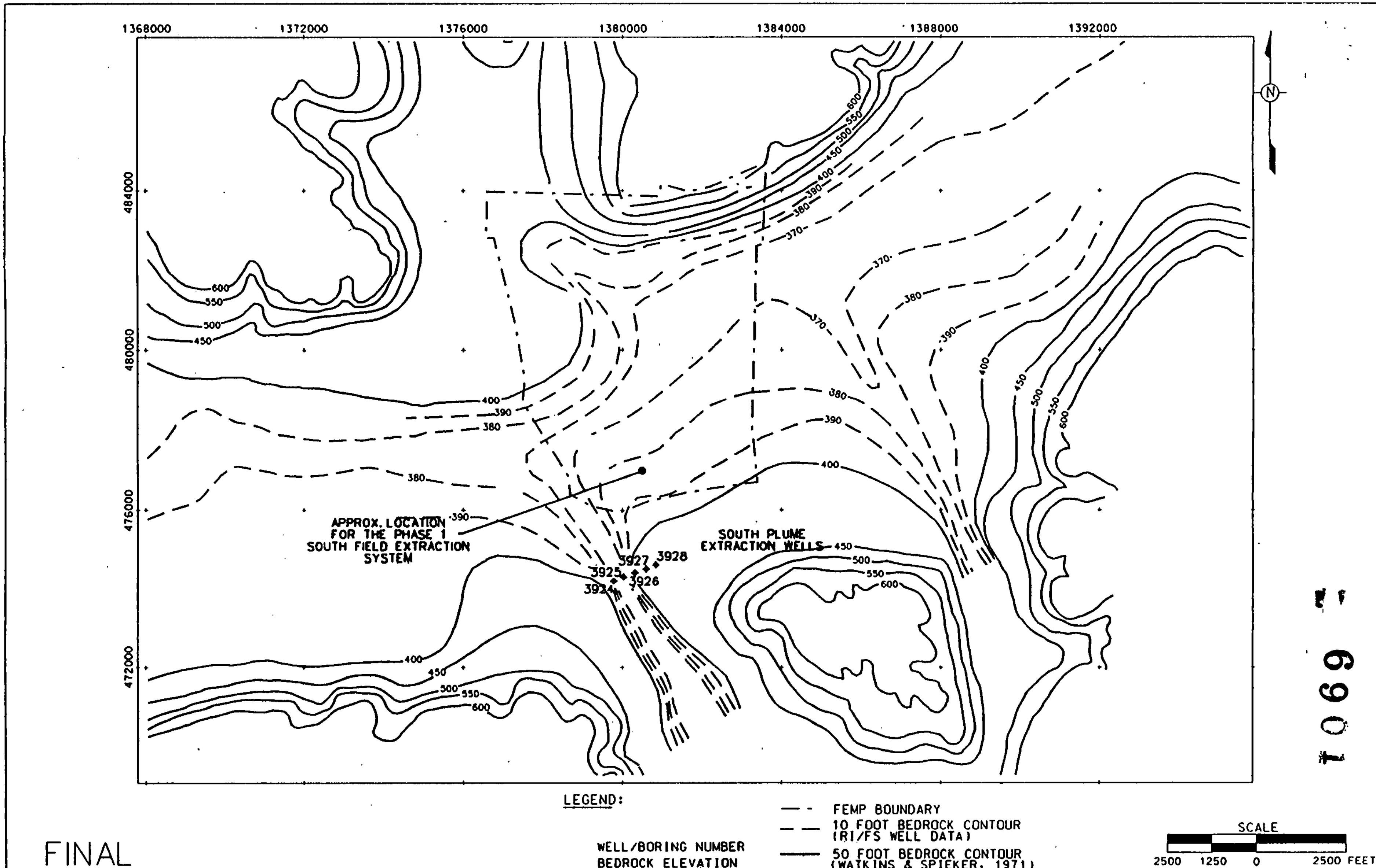
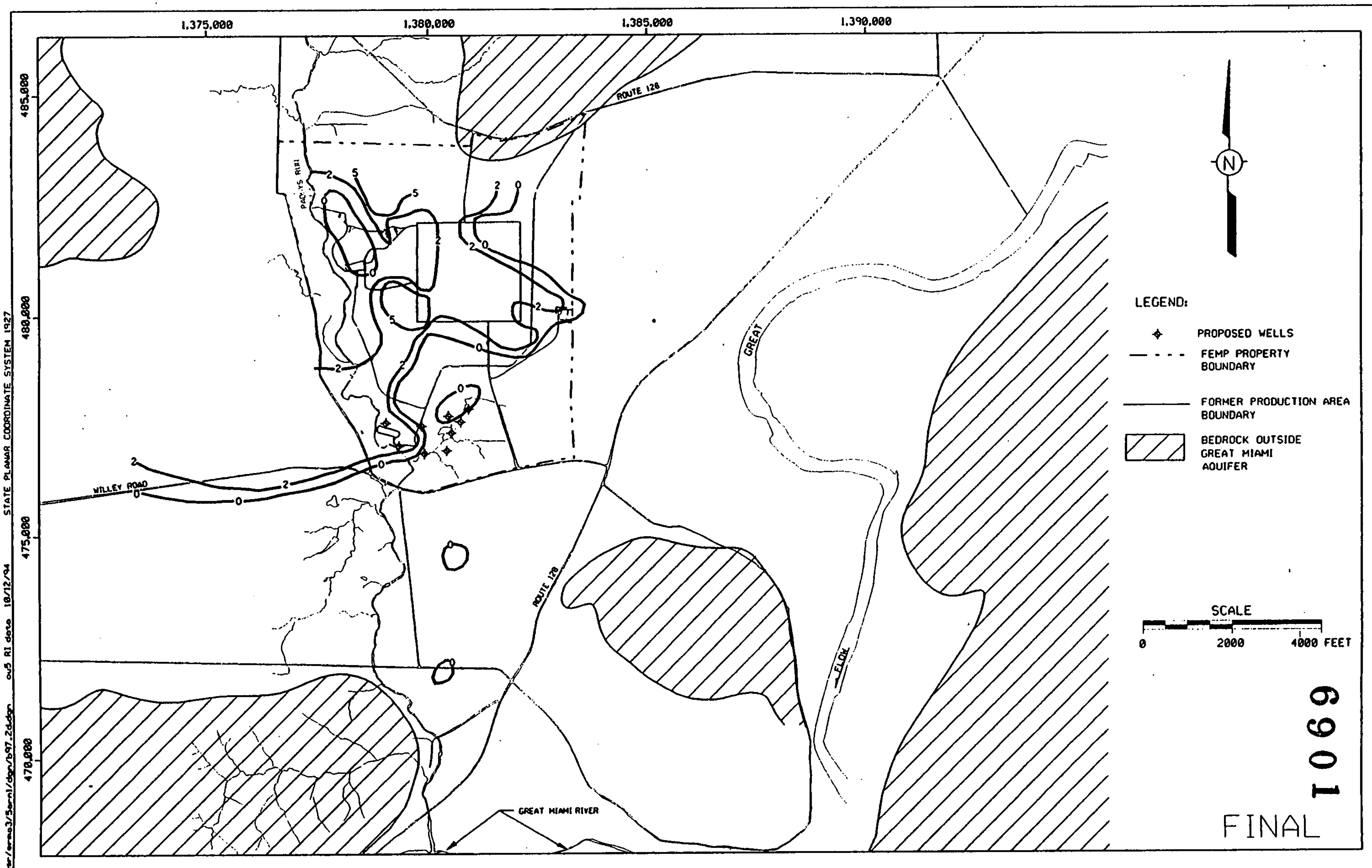


FIGURE 3-3. BEDROCK TOPOGRAPHIC SURFACE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ROUTE 128
WILLEY ROAD
GREAT
FLOW
GREAT MIAMI RIVER
N
LEGEND:
PROPOSED WELLS
FEMP PROPERTY BOUNDARY
FORMER PRODUCTION AREA BOUNDARY
BEDROCK OUTSIDE GREAT MIAMI AQUIFER
SCALE
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concentration was found in Well 2945 which monitors water quality beneath the inactive flyash pile, a part of Operable Unit 2. Unfiltered samples collected from Type 3 wells (approximately 50 to 60 feet beneath the water table) indicate that total uranium concentrations range up to 110 ppb (DOE 1995c, Plate E-78). The preferred approach for restoring the Great Miami Aquifer described in section 1.2 addresses uranium contamination greater than 20 ppb at all depths. At the existing pumping test well (see Figure 3-1), uranium concentrations greater than 20 ppb are limited to the upper 20 feet of the aquifer.

3.3 EXISTING GROUNDWATER EXTRACTION AND TREATMENT

Groundwater is currently being extracted, at a rate of 1400 gpm, from the Great Miami Aquifer from extraction wells located near the southern end of the South Plume as part of a removal action. These extraction wells will be combined with an additional 23 wells as part of the preferred approach to restore the aquifer. Portions of the water being pumped from the South Plume are being treated for uranium removal by the site wastewater treatment facilities before discharge to the Great Miami River. Groundwater being pumped from the South Plume flows through a 20-inch HDPE pipeline to the South Plume valve house. Here portions of the groundwater (200 - 1300 gpm) are diverted to various wastewater treatment facilities before discharge to the Great Miami River. Use of existing treatment facilities and piping to implement the preferred remedy will help minimize costs.

4.0 PROJECT WORK ACTIVITIES

This section presents details on the installation of the extraction wells and the associated testing programs. The following controls, among others, will be implemented during the installation of the wells:

- Project health and safety plan will be followed
- Physical barriers will be positioned around work areas to prevent unauthorized access
- Protective clothing and respiratory protection will be provided for workers, as required
- Administrative controls will be instituted to prevent wind erosion, dust generation, and storm water runoff control (i.e., plastic sheeting).

4.1 WELL PLACEMENT AND DESIGN

For the purpose of this initial phase of the groundwater remediation system for the South Field, eight new extraction wells will be installed on FEMP property. Each new well location will be drilled and sampled to bedrock using a rotosonic drill rig. The sampling hole will be backfilled and overdrilled using a 20-inch cable tool or air rotary rig to a depth of approximately 100 feet to provide for the installation of the recovery well. All drilling and well-completion activities will be performed in accordance with requirements contained in the Sitewide CERCLA Quality Assurance Project Plan (SCQ) (DOE 1993). Table 4-1 lists the guidelines that will be followed for well drilling, well installation, sampling, and testing.

A surveyor's stake with a highly visible ribbon tied around the top will be driven into the ground at each drilling location and location numbers will be written on each stake. The staked locations will be surveyed vertically and horizontally to the nearest 0.1 foot and approved by a State of Ohio-licensed surveyor.

The extraction wells will be drilled and installed in two steps. The wells will first be cored and sampled to bedrock using a 6-inch rotosonic drilling tool. Groundwater and soil samples will be collected every 10 feet and submitted to the FEMP lab for total uranium and sieve analysis. The rotosonic casing will be pulled back to the water table and the formation will be allowed to collapse back into the hole. The driller will pull the casing out of the hole very slowly and verify that the hole is collapsing by taking a depth measurement every 10 to 20 feet. If blue clay is present in the hole, bentonite will be tremied into the collapsing hole, from the bottom of the hole to a depth approximately 5 feet above the top of the clay. Above the water table the hole will not readily collapse. A mixture of sand and bentonite will be tremied into the hole up to the surface to temporarily abandon the hole until a cable tool or air rotary rig can be moved in to overdrill a 20-inch hole. Using a mixture of sand and bentonite, rather than pure bentonite, will cut down on some of the mess during the redrilling process. This technique was used during the drilling of Extraction Well 31550; fifteen 50-pound bags of bentonite were mixed with 300 pounds of sand and placed in the borehole from the water table to the surface. A similar ratio of sand and bentonite will be used for the wells installed under this PSP.

During step two, a 20-inch hole will be drilled to completion depth (approximately 100 feet) using a cable tool or air rotary rig (needed because a rotosonic drilling rig cannot cut a 20-inch diameter hole). The 20-inch hole will accommodate both a 12-inch internal diameter (ID) casing and a 2-inch ID PVC piezometer outside of the casing but within the boring.

The recovery wells will be constructed of 12-inch ID stainless steel. A 2-inch ID stainless steel stilling pipe will be installed inside of the screen and a 2-inch ID PVC observation well will be installed outside of the screen, but within the borehole, to assess screen efficiency. The 2-inch stilling pipe inside of the screen will have a 5-foot screen. The base of the 5-foot screen will be located at the same elevation as the base of the recovery well screen. The 2-inch PVC well located outside of the screen but within the borehole will also have a 5-foot screen, whose base will also be located at an elevation that corresponds to the base of the recovery well screen (Figure 4-1).

Table 4-1
SCQ WELL INSTALLATION GUIDELINES
(DOE 1993a)

Guidelines	Reference
Administrative	
Chain-of-custody	Section 7.1
Corrective action	Section 15.2
Daily logs	Section 5.1 and Appendix J, Subsection J.4.1
Variances	Section 15.4
Field	
General drilling practices	Section 5.2.1 and Appendix J, Subsection J.4.2
Subsurface soil sampling	Appendix K, Subsection K.5.3
Monitoring well/piezometer design, installation and abandonment	Section 5.2.2, Appendix Subsection J.4.3, EM-GW-004 *
Well development	Section 5.2.3 and Appendix J, Subsection J.4.4
Field screening of samples for radioactive contamination	Appendix K, Subsection K.5.3.2
Decontamination	Appendix K, Subsection K.11
Field storage and shipment of samples	Appendix K, Subsection K.10
Sampling of cores	
Documenting cores	
Laboratory Tests	
Grain-size analysis	ASTM D 422

* Well abandonment will also follow the procedure listed in the *WEMCO Environmental Monitoring Procedures Manual, Rev. 28 (June 16, 1992)*

000025

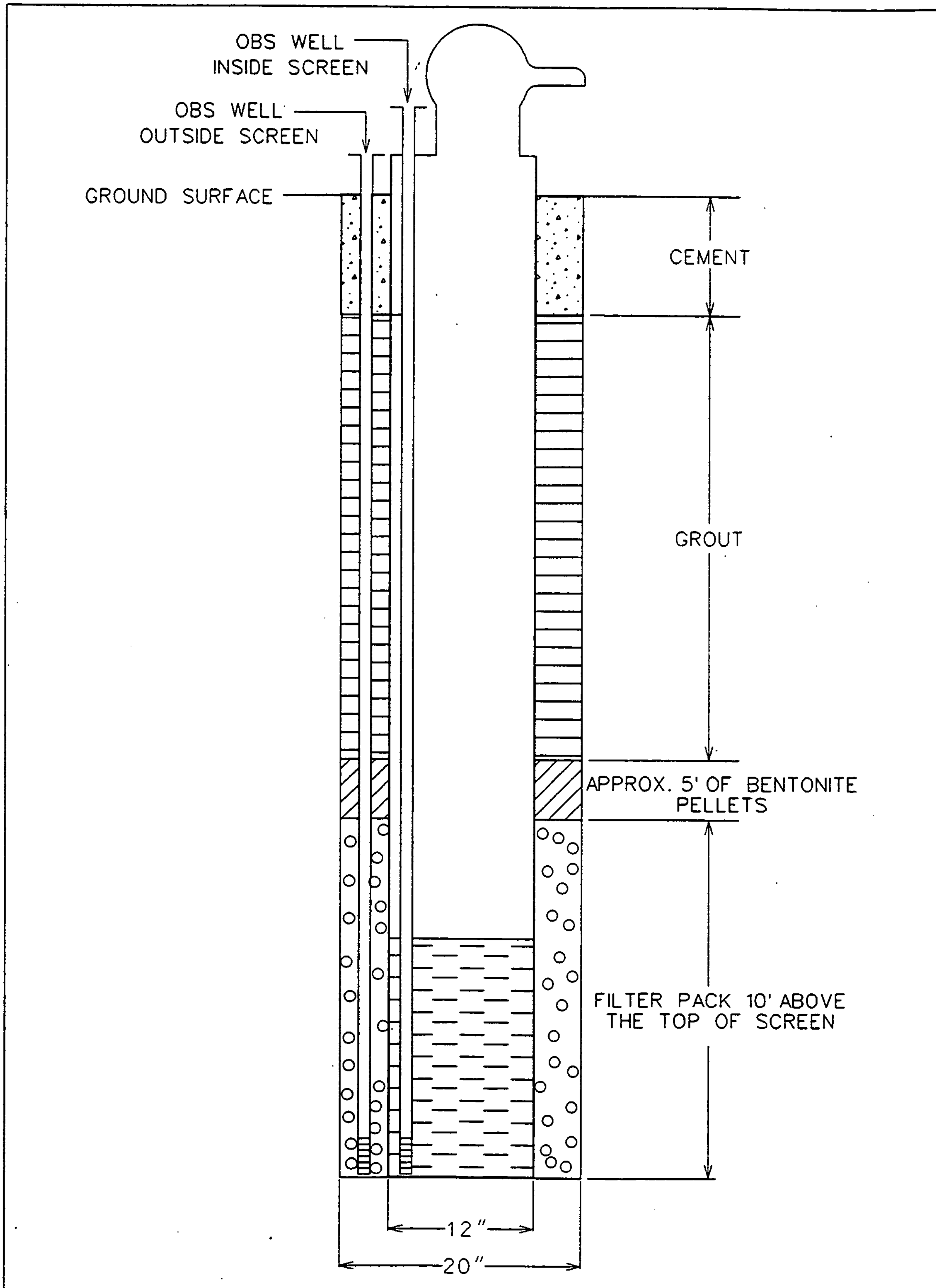

FIGURE 4-1.
EXTRACTION WELL DESIGN

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The extraction wells will be screened across a 20-40 foot interval, with the top of the screen located 5-8 feet below the lowest recorded seasonal water level for the area. The actual length will be determined using water quality data collected during the rotosonic drilling. The objective will be to place the screen in the portion of the plume that contains greater than 20 ppb of total uranium. The slot size and final completion method will be selected based upon sieve analysis results. It is anticipated that the wells will be completed using a filter pack and a 12-inch ID, continuous 60-slot stainless steel screen. Completion will be conducted in accordance with the SCQ (DOE 1993).

4.2 SUPPORT FEATURES AND SYSTEM SPECIFICATIONS

The uranium-contaminated groundwater will be transported to either the FEMP's wastewater treatment facilities or directly discharged to the Great Miami River. The system achieves this objective using an arrangement of pumps, pipelines, valves, and associated instrumentation. Figure 4-2 depicts a simplified line diagram of the proposed system.

The extraction wells will have vertical turbine, aboveground discharge pumps located within wellhouses. The wellhouses will be designed to protect the extraction pumps and their associated instrumentation and aboveground piping and valving. Each extraction well unit will have a sample port and the ability to divert effluent to either the well treatment header tie-in or the well discharge force main. This flow diversion will occur within the respective wellhouse using locally operated valves to isolate the discharge path.

The treatment force main is the existing 20-inch HDPE pipeline used for the South Plume Removal Action. The treatment force main will direct flow into the South Plume valve house, where it will be directed toward either the AWWT, the SPIT, or the IAWWT facilities.
The new discharge main will run northeasterly from the new South Field valve house and combine with other site flows in the existing 24-inch HDPE outfall force main before discharge. Valving will be provided at this tie-in point for isolation capability.

The South Plume effluent will follow its existing flow path into the new South Field valve house where the South Plume force main will have connections with both the treatment and the discharge force mains. These connections will be valved to allow flow to be diverted into either path depending on available treatment capacity.

See Figure 4-3 for a preliminary civil site plan of the proposed system.

All new buried piping will be HDPE with fused joints; aboveground piping will be carbon steel with welded joints and flanged connections either heat traced or located within valve or wellhouses. The

*ILLUS\OU-5\PO-126\WELL HOUSE.EPS

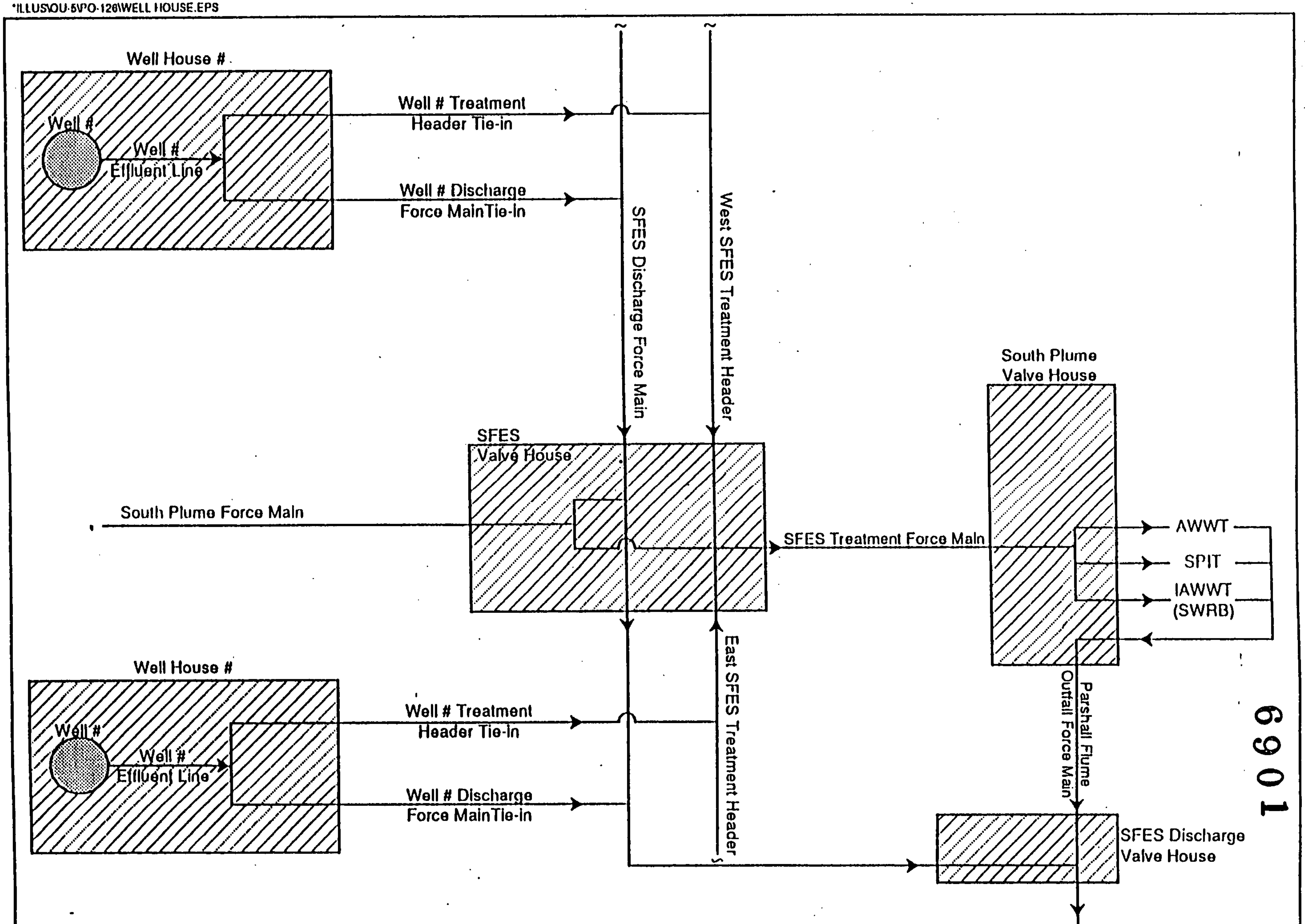

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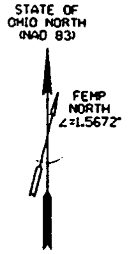
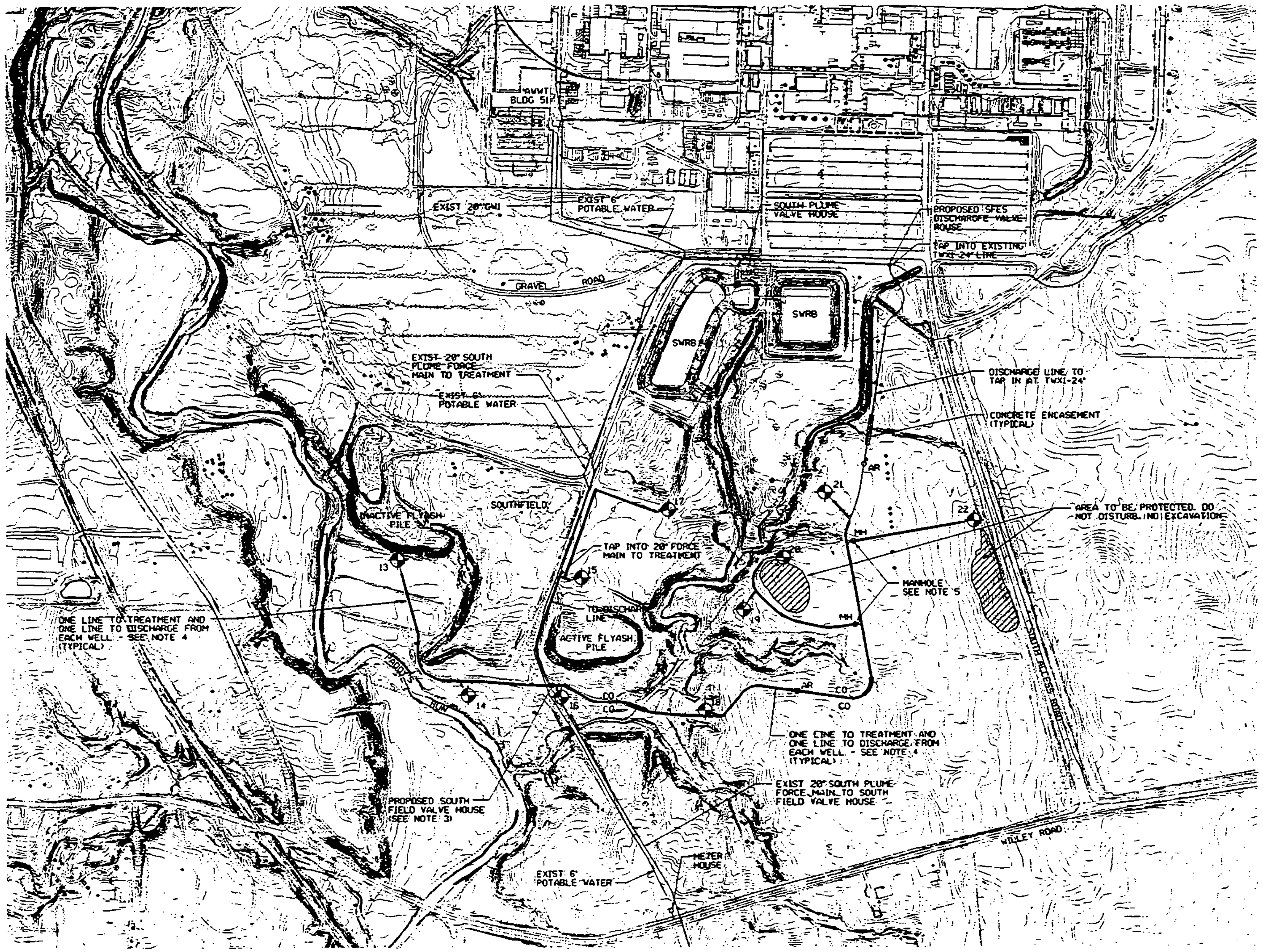
FIGURE 4-2. SIMPLIFIED LINE DIAGRAM OF THE PROPOSED SYSTEM





NOTE: WELL NO. 22 AND PIPELINE ARE CONTINGENT.

FIGURE 4-3. SITE PLAN OF THE PROPOSED SYSTEM

NOTES

1. EXISTING CONDITONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM DOCUMENTS LISTED BELOW:

   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. ACTUAL LOCATION OF THE WELL HOUSE WILL BE CLOSER TO THE WELL HEAD THAN SHOWN.
3. GROUNDWATER WILL BE SENT TO TREATMENT BY THE EXISTING SOUTH PLUME LINE, GW1-20"-01. THE EXISTING 20" LINE SOUTH OF THE PROPOSED SOUTH FIELD VALVE HOUSE WILL BE DIVERTED TO EITHER DISCHARGE OR TREATMENT IN VALVE HOUSE.
4. SIZES OF PIPELINES WILL RANGE FROM 4" TO 20" DIAMETER. MATERIAL WILL BE HDPE. FINAL PIPE SIZES, CLEAN OUT, MANHOLES AND VALVE LOCATIONS WILL BE DETERMINED IN TITLE II DESIGN.
5. MANHOLES COULD CONTAIN CLEANOUT PORTS, ISOLATION VALVES, AND CHECK VALVES. ARRANGEMENT OF EACH MANHOLE WILL BE DETERMINED IN TITLE II DESIGN.

6901

LEGEND

EXISTING		PROPOSED
	AIR RELEASE CHAMBER	○AR
	BUILDING	
	CLEANOUT MANHOLE	CO
	EXTRACTION AND WELL HOUSE	
	MAJOR CONTOUR	
	MINOR CONTOUR	
	MANHOLE	○MH
	PIPELINE	
	SITE BOUNDARY	

PRELIMINARY
NOT FOR CONSTRUCTION

REV. NO.	ISSUE OR REVISION PURPOSE - DESCRIPTION	A-E	FERMCO	DATE
0	ISSUED FOR FR & DBD			

UNITED STATES
DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

THIS DRAWING PREPARED BY
PARSONS
THE RALPH M. PARSONS CO. - PARSONS MAIN, INC. - ENGINEERING-SCIENCE, INC.
CINCINNATI, OHIO

PROJECT NAME
GROUNDWATER REMEDIATION
TITLE I/II DESIGN

DRAWING TITLE
CIVIL
SITE PLAN
SOUTH FIELD EXTRACTION SYSTEM

000029

DRAWN BY	DATE	LEAD ENGINEER	DATE	CHECKED BY	DATE
R. ESPARZA	04-04-95				

PLANT/BLDG NO.	FLOOR	SCALE	CLASS
		1"=200'	

SUBMITTED FOR APPROVAL / FERMCO CRU APPROVAL

PREPARED UNDER PARSONS PROJECT ORDER NUMBER	DOE PROJECT NO.	FEMP PROJECT NO.	DRAWING INDEX CODE NO.	SHEET NO.	REV. NO.
CRU5/P0126		WBS 1.1.1.1.5.3 00-90701	95X-5900-G-00192	G0001	0

South Field extraction well system will be remotely monitored at the AWWT control room for flow and pump discharge pressure at each well and wellfield header operating pressures, but flow and pump discharge will be controlled at the valve houses. Pumps will be the vertical turbine type. Flow rates will vary between 100 to 450 gpm depending on the location of the well. Pumping will be sequenced throughout the life of the project as outlined in the Operable Unit 5 FS (DOE 1995a, Section F.7).

4.3 SAMPLING, SAMPLE HANDLING AND SHIPPING

A rotosonic drilling method was chosen for sample collection because it efficiently provides a continuous sample or core. Such a sample is necessary to detect and document depositional features such as cross bedding, fining up and down sequences, etc. An understanding of the depositional features will aid in optimizing the cleanup of the Great Miami Aquifer. A sample matrix and sampling instructions are provided in Attachments B and C respectively.

The sampling program will consist of the following:

- A continuous rotosonic core will be collected from each boring to bedrock.

- The rotosonic core will be described in the field by a geologist (Munsell color, USCS soil classification, textural description, and depositional features) before any extraction of samples. A lithologic log will be completed that will also record depositional features such as cross bedding. The entire core will be photographed.

- Groundwater samples will be collected (pumped) from each well every 10 feet, beginning at the water table. The groundwater samples will be submitted to the FEMP lab for total uranium analysis (analytical support level [ASL] B). The groundwater sampling device will consist of a friction packer and wellpoint. Concentration data measured from the groundwater samples will be used to construct a uranium contamination profile of the drilling area. The groundwater total uranium concentrations will be matched against soil uranium concentrations to estimate a soil-to-water total uranium partitioning coefficient (K_d).

- Soil samples will be extracted from the rotosonic core every 10 feet (beginning at the water table) to correspond to the depth of the groundwater sampling. The soil samples will be tested for total uranium at the FEMP lab (ASL B). Total uranium concentrations in soil will be matched against total uranium concentrations in the groundwater to estimate a total uranium K_d.

- Desorption batch tests will be conducted using soil samples collected from areas of the plume where groundwater uranium concentrations are greater than 20 ppb. Groundwater from the Great Miami Aquifer which is not contaminated with uranium will be used during the batch tests as the leaching agent. The desorption batch tests will be conducted for a minimum of 16 days and results will be used to further refine in situ K_d estimates made by matching uranium concentrations in groundwater to soil as described above.

- Soil samples will be extracted from the rotosonic core (every 10 feet outside of the proposed screened depth) beginning at the top of the Great Miami Aquifer and submitted to the FEMP lab for sieve analysis (ASTM D 422, ASL B). Results of the sieve analysis will be used to make grain-size determinations and USCS soil classifications.

- Soil samples will be extracted from the core (every 5 feet) across the proposed screen interval and submitted to the FEMP lab for sieve analysis (ASTM D 422, ASL B). Results will be used to make grain-size determinations and USCS soil classifications. Results will aid in the selection of a final screen size and completion method.

- The remaining core will be saved in core boxes and archived for future use.

The installation of the extraction wells will disturb soil in the uncontrolled area of the site, most of which had been used for cattle grazing. Portions of the area have previously been sampled (i.e., South Plume Force Main and Advanced Wastewater Treatment Project) and the soil was determined to be nonhazardous under the Resource Conservation and Recovery Act.

The management of waste (if any) from this project will be controlled by Site Standard Operating Procedure (SSOP)-0044, Management of Soils, Debris, and Waste from a Project, and Removal Action 17, Improved Storage of Soil and Debris. All waste (if any) generated from this project will be monitored for radioactivity before final disposition.

Immediately following collection of a sample, a sampling technician will survey each sample with a Geiger Muller frisker and an alpha meter and the readings recorded and reported to the Lead Geologist. Immediately following containerization, each sample will be labeled and sealed with custody tape; boxes containing archived core will not be custody taped. A unique sample number will be assigned to each collected sample being submitted to the FEMP lab and samples will be logged and scheduled into the site Fernald analytical computerized tracking system. Each sample submitted to the FEMP lab will be affixed with a label containing, at a minimum, the unique sample number, WBS number, location number, sample matrix, depth interval sampled, collection time, sampler's initials, geotechnical or analytical parameters, and field screening results. The custody tape will be initialed and dated by the sampler.

Sample custody procedures outlined in the SCQ will be adhered to throughout the sample handling process from field collection to shipment of the samples to the laboratory. An analysis request/custody record will be used to document collection of data, chain-of-custody and geotechnical parameters requested for each sample.

In addition to the custody records, a sample collection log will be completed which summarizes all samples collected from a single borehole. All field work will be documented in detail daily using the field activity log. All field documentation will be completed by the Lead Geologist.

Sample custody seals will be examined and verified by FEMP sample processing laboratory personnel before acceptance of the samples. The field screening results will be clearly displayed on the sample label and the analysis request/custody record. Sample packaging will be in accordance with the SCQ, Section K.10. Final sample handling, screening, storage, and shipping activities will be completed by the FEMP sample processing laboratory.

All equipment used during this investigation will be operated and calibrated according to the manufacturer's specifications. Written logs of equipment calibration are maintained by the FEMP personnel responsible for performing the instrument calibrations.

Excess groundwater generated during the sampling process will be sent to a collection tank at the drill investigation-site. Water will be trucked to the storm water retention basin and disposed of in a manner consistent with the site aqueous investigation derived waste (IDW) policy. Cuttings generated during the drilling operation will be handled in accordance with procedures outlined in Removal Action 17.

Drill cuttings generated during the installation of the extraction wells will be deposited on the ground surface near the respective drilling locations and managed in accordance with the Operable Unit 5 interim IDW policy (for drill cuttings). Subsurface analytical data collected from rotosonic cores at locations where the extraction wells will be installed provide the basis for the comparative determination between boring and ground surface contaminant concentrations. Soil with concentrations of uranium greater than surface concentrations will be drummed consistent with the IDW policy.

4.4 WELL DEVELOPMENT

Surging techniques (surge blocks) and pumping will be used to develop the wells. Fines will be removed from the borehole as often as possible (Driscoll 1986). Development will continue until the turbidity of the water is clear, the nephelometric turbidity unit (NTU) reading has stabilized to five NTUs or less, and pH, specific conductance, temperature, and dissolved oxygen readings have stabilized. This development method is subject to change pending results of the sieve analysis. If a large amount of fines are present in the area, an alternate development method may be preferred. Surging techniques are recommended in the FEMP SCQ for high-yield aquifers such as the Great Miami Aquifer. Field readings and data will be documented by site restoration services technicians.

A temporary line will be constructed to transmit development water to either the South Plume force main or the storm water retention basin depending upon the location of the well being developed. Given the size of these wells, development could take up to three days and includes both surging and pumping. Approximately 324,000 gallons of groundwater will be pumped at each well during development (600 gpm, 3 hours per day, 3 days). The actual mass of uranium removed at each well during development will vary depending upon the concentration of uranium present at each particular well.

Groundwater quality data collected for the RI indicates that the recovery wells will be located in areas of the Great Miami Aquifer that have total uranium concentrations ranging up to approximately 950 ppb. Well 31550 is the existing pumping test well being converted to an extraction well for the South Field extraction system. During development of Well 31550, the total uranium concentration of the pumped groundwater, as measured at the well head, was only 26.3 percent of the groundwater concentration measured just below the water table of the aquifer. This dilution is attributed to mixing of the groundwater which takes place during pumping. A similar dilution is anticipated for development of the other extraction wells. During development the maximum total uranium concentration of the pumped groundwater, as measured at the wellhead, is estimated to be 250 ppb. Calculations indicate that during development, pumping groundwater with a total uranium concentration of 250 ppb will result in a discharge of less than 20 ppb total uranium to the Great Miami River. The concentration of total uranium discharged to the river was determined by mixing the pumped groundwater from the well being developed with the discharge water being pumped from the South Plume recovery wells and treating 30 percent of the total flow down to 5 ppb before releasing it to the Great Miami River. Calculations are provided in Attachment D. The mass of total uranium discharged to the river will be approximately 1.3 pounds of uranium. Because 250 ppb represents what should be the highest concentration of total uranium to be pumped during development of the recovery wells, the total uranium concentration discharged to the Great Miami River during the development of the other extraction wells should be less than 20 ppb. If all eight wells have a pumped total uranium concentration of 250 ppb during development, approximately 10 pounds of uranium will be released to the river.

Water quality data collected during the drilling process will be used to calculate an estimated mass of uranium removed during development. The mass calculations will be used to plan wastewater treatment such that uranium concentrations in the wastewater discharged to the Great Miami River are as low as can be achieved. Water samples will be collected from the pumped water during the development process. These samples will be submitted to the FEMP lab for total uranium analysis (ASL B) so that the actual concentration can be recorded.

4.5 PERFORMANCE MONITORING

The effectiveness of the recovery wells in achieving remediation goals will be monitored and evaluated throughout the life of the extraction system. Specifics concerning the monitoring will be addressed in the Remedial Action Work Plan.

4.6 CULTURAL RESOURCES

A cultural resource and archaeological survey will be completed at each drilling location and along the path of the proposed pipelines to determine the presence of any historic properties within the area of potential effect. If it is determined that historic properties are present and will be effected, appropriate avoidance and/or mitigation steps will be undertaken.

5.0 DECISION POINTS AND CONTINGENCIES

A small degree of flexibility needs to be maintained to address new information learned through the drilling and installation of the wells. As data is collected during well drilling and well completion (soil samples and sieve analysis data), decision points will be reached where contingencies may need to be considered. These decision points and possible contingencies are outlined below:

1) Interpretation of rotosonic cores collected from the wells can be used to assess how effectively the design deals with vertical textural variability caused by depositional features (e.g., cross bedding, fining up or down sequences, etc.).

   Just as horizontal hydraulic conductivity varies spatially in a horizontal plane (see Section 3.1), the distribution of hydraulic conductivity can also change with depth. This is expected in a braided stream deposit. Textural pathways can create preferential flow pathways that have relatively higher hydraulic conductivities than the surrounding sand and gravel. Contaminants move through the pathways of least resistance. The proposed position or length of some or all of the screens may need to be altered to address actual subsurface textural features.

2) Vertical profiles of uranium contamination, made from measurements taken of groundwater samples collected during drilling of the rotosonic core, will be used to adjust the proposed depth and length of the extraction well screen.

6.0 DATA MANAGEMENT AND ANALYSIS

Data collected during the investigation will be managed during and following the field activities to ensure accurate records are maintained. Data and field documentation generated during the investigation will be checked to ensure compliance with the data quality objectives for the project.

As specified in Section 5.1 of the SCQ, sampling teams will describe daily activities on the field activity log so the sampling team can reconstruct significant activities that occurred during the work day without reliance on memory. The lead geologist will complete lithologic logs for each boring as specified in Section J.4.1.2 of the SCQ and sample collection logs will be completed according to instructions specified in Appendix B.

To ensure the appropriate documentation was completed during field activities, field documentation will be checked for completeness and accuracy.

Total uranium data for sediment and groundwater samples, measured in the FEMP lab, will be entered into the FEMP site-wide environmental database. Manual, double keyed data entry will be performed and the entered data will be compared to the original data sheets; corrections will be initialed and dated, and made as necessary. Hard-copy documents are kept in permanent storage in the project files, filed under WBS 50.05.32, and the electronic database is archived in a neutral ASCII file format.

As-built drawings will be completed following project construction activities. Current and up-to-date system as-built drawings will be maintained for the operational life of the system.

7.0 HEALTH AND SAFETY

A project-specific health and safety plan will be developed to support all field activities including well installations and development, and the installation and startup of the piping and supporting systems.

8.0 QUALITY ASSURANCE/QUALITY CONTROL

All work will be conducted in accordance with the requirements of the overall quality assurance program at the FEMP. Drilling, sampling, well installation, pumping test activities, and laboratory testing will be assigned the proper quality level. Site Policy and Procedure Number FMPC-711 provides guidelines for matching quality program requirements to quality levels. Specific quality items will be reviewed by FERMCO staff to verify that the quality requirements are adequate and consistent with the assigned quality level. Field quality control will be consistent with guidance provided in the SCQ (DOE 1993).

9.0 REFERENCES

Driscoll, F. G., 1986, Groundwater and Wells, 2nd Edition, Johnsons Division, St. Paul, MN.

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U.S. Department of Energy, 1995a, "Feasibility Study Report for Operable Unit 5," Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Department of Energy, 1995b, "Proposed Plan for Operable Unit 5," Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Department of Energy, 1995c, "Remedial Investigation Report for Operable Unit 5," Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

ATTACHMENT A

WATER LEVEL DATA

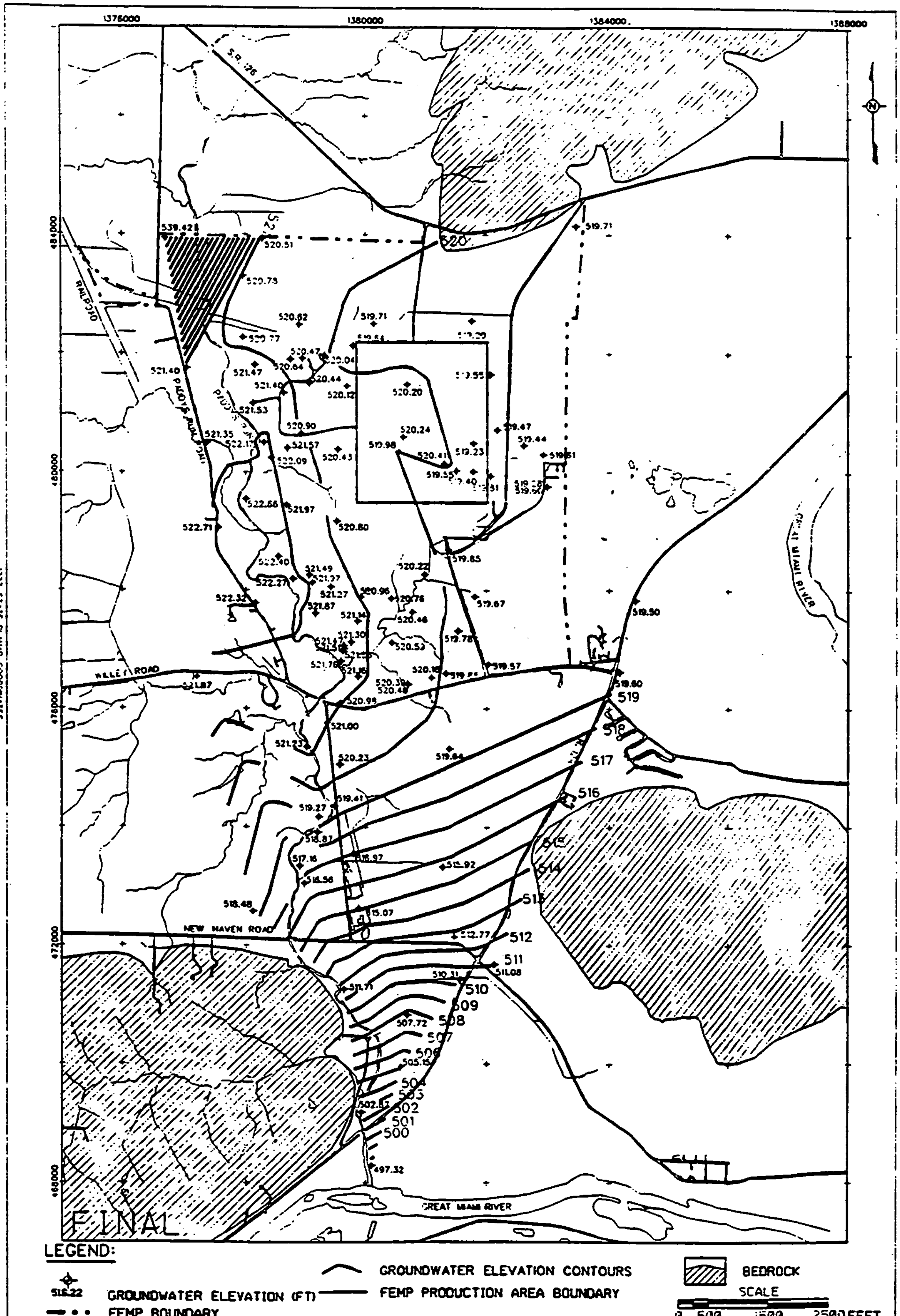

FIGURE A-1. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JANUARY 1993

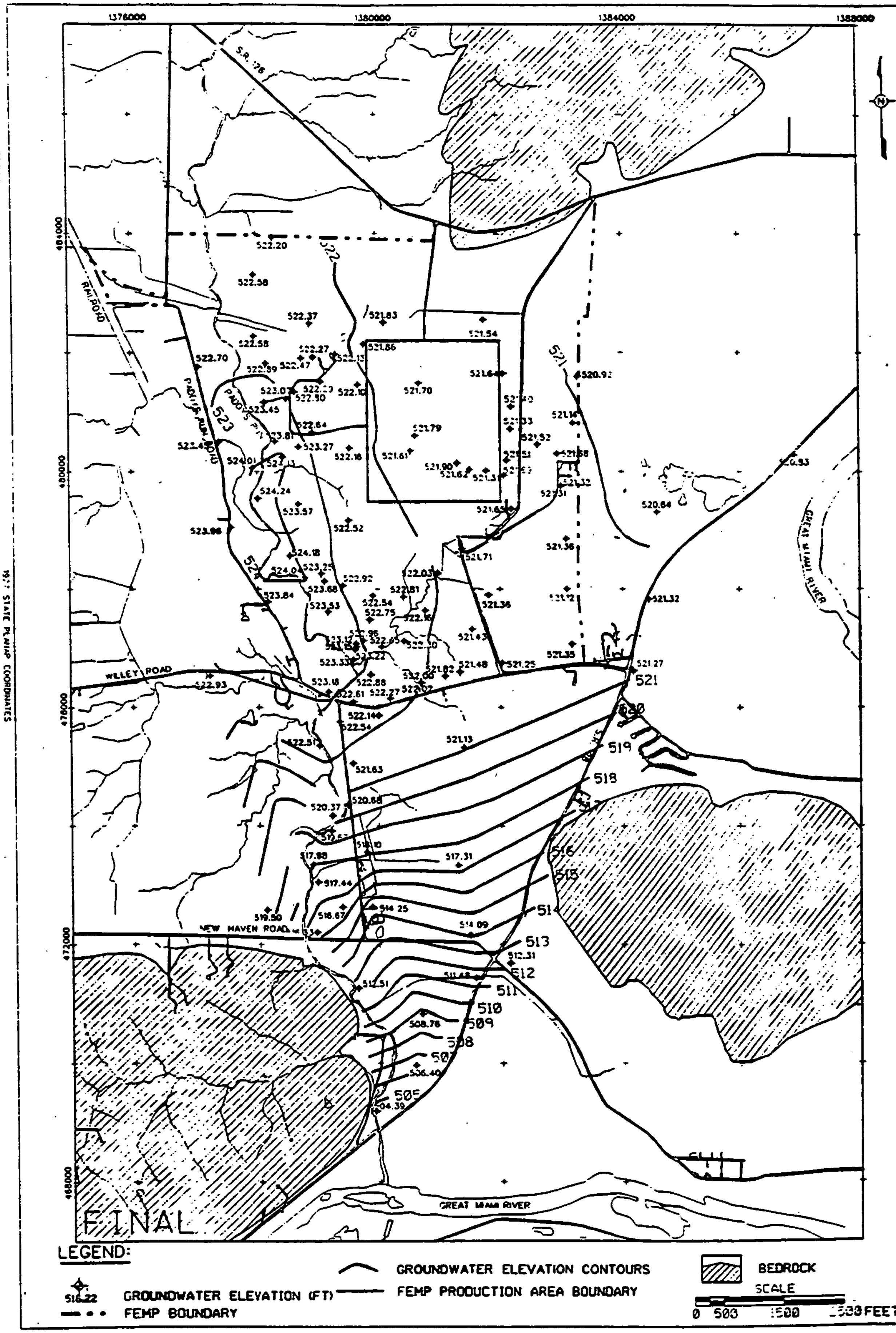

FIGURE A-2. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, APRIL 1993

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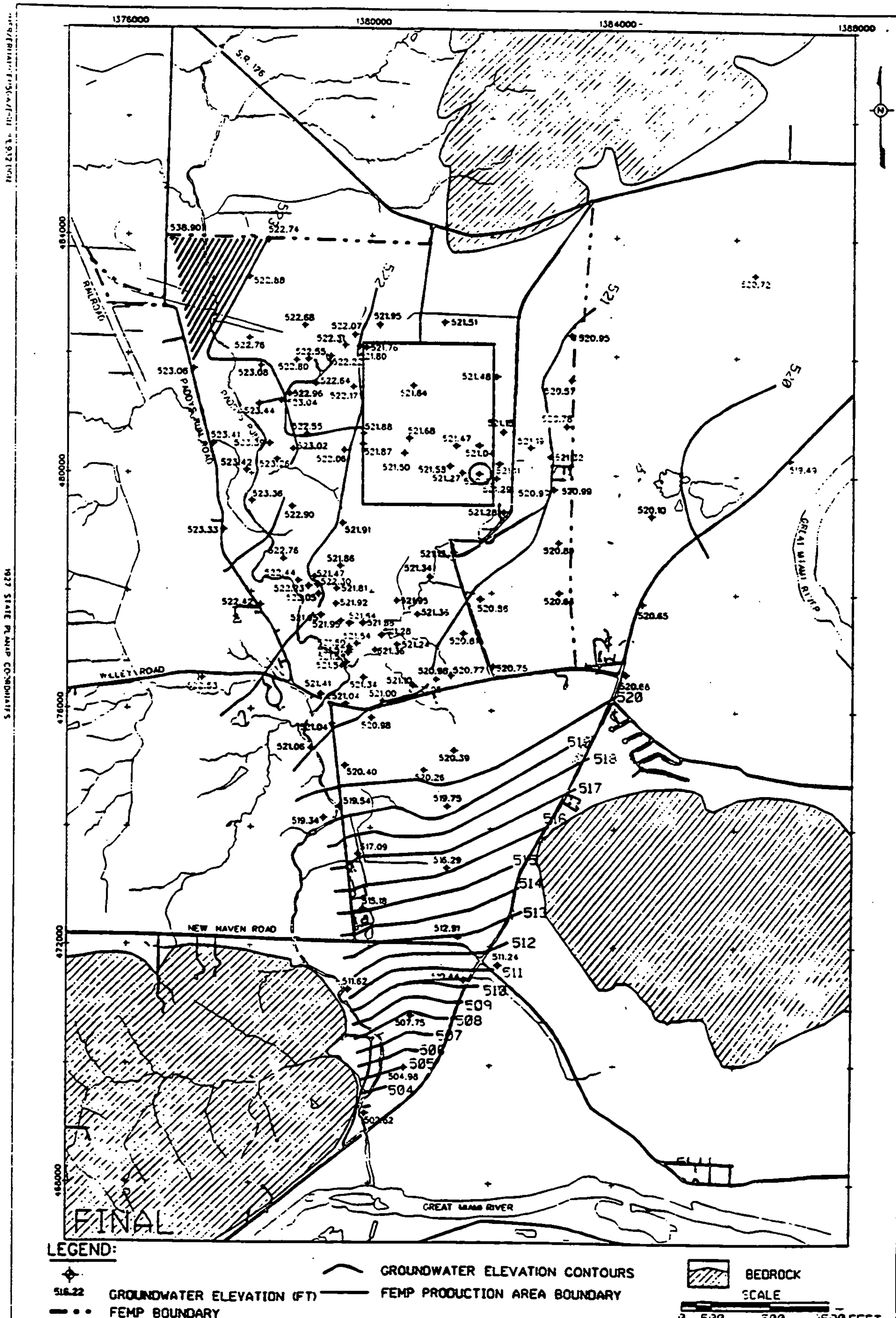

FIGURE A-3. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JULY 1993

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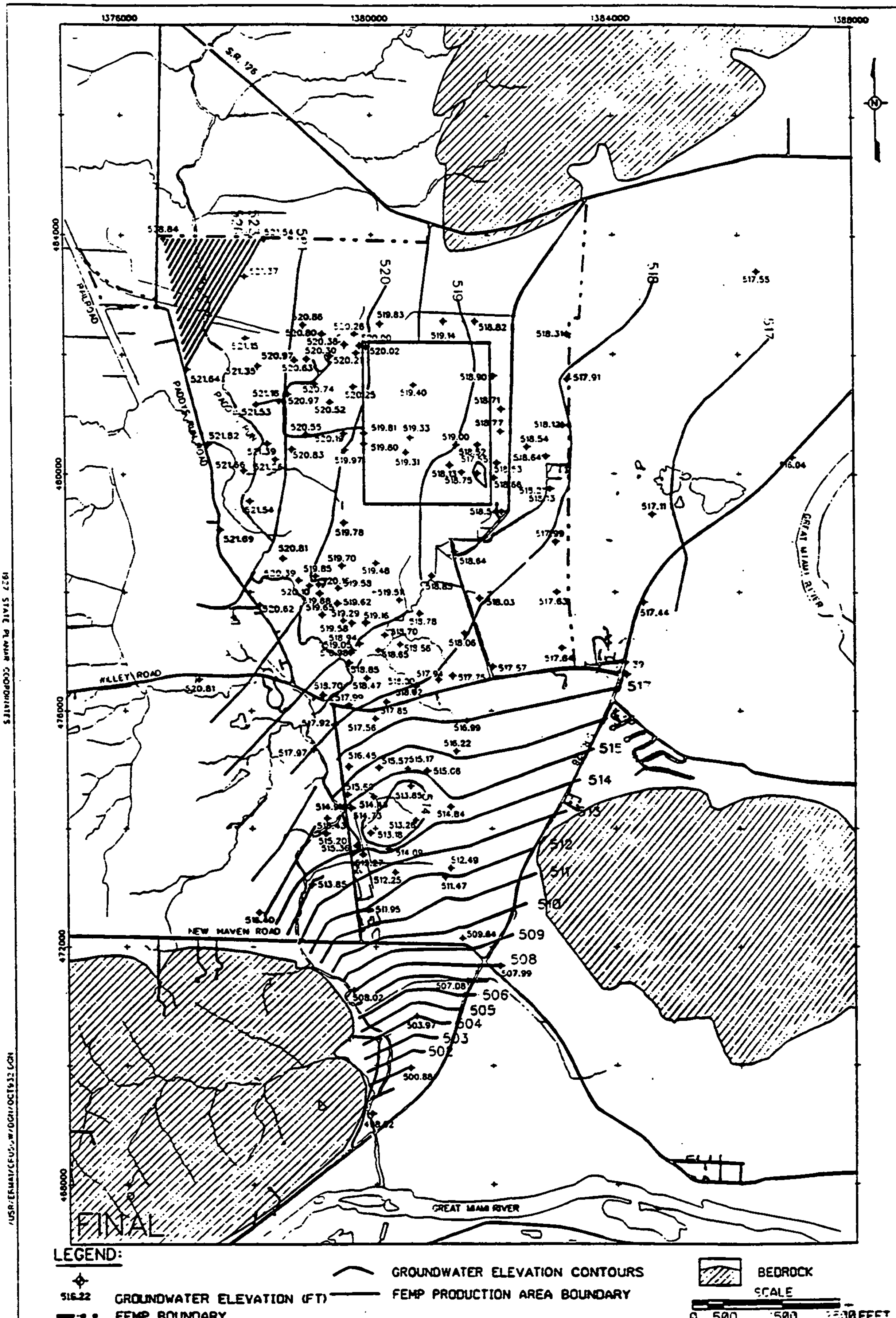

FIGURE A-4. GROUNDWATER ELEVATIONS, TYPE 2 WELLS, OCTOBER 1993

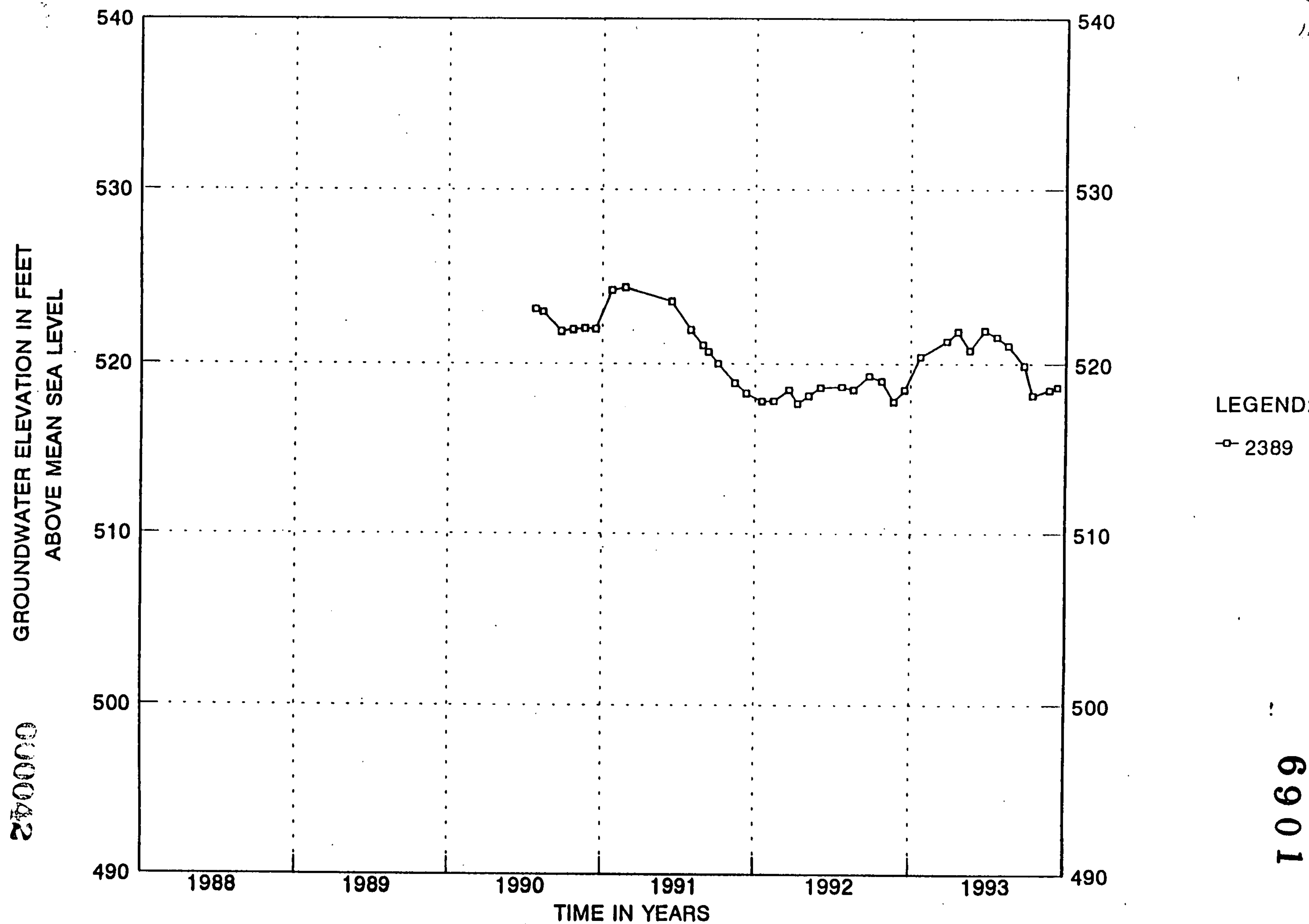

FIGURE A-5 HYDROGRAPH FOR WELL 2389

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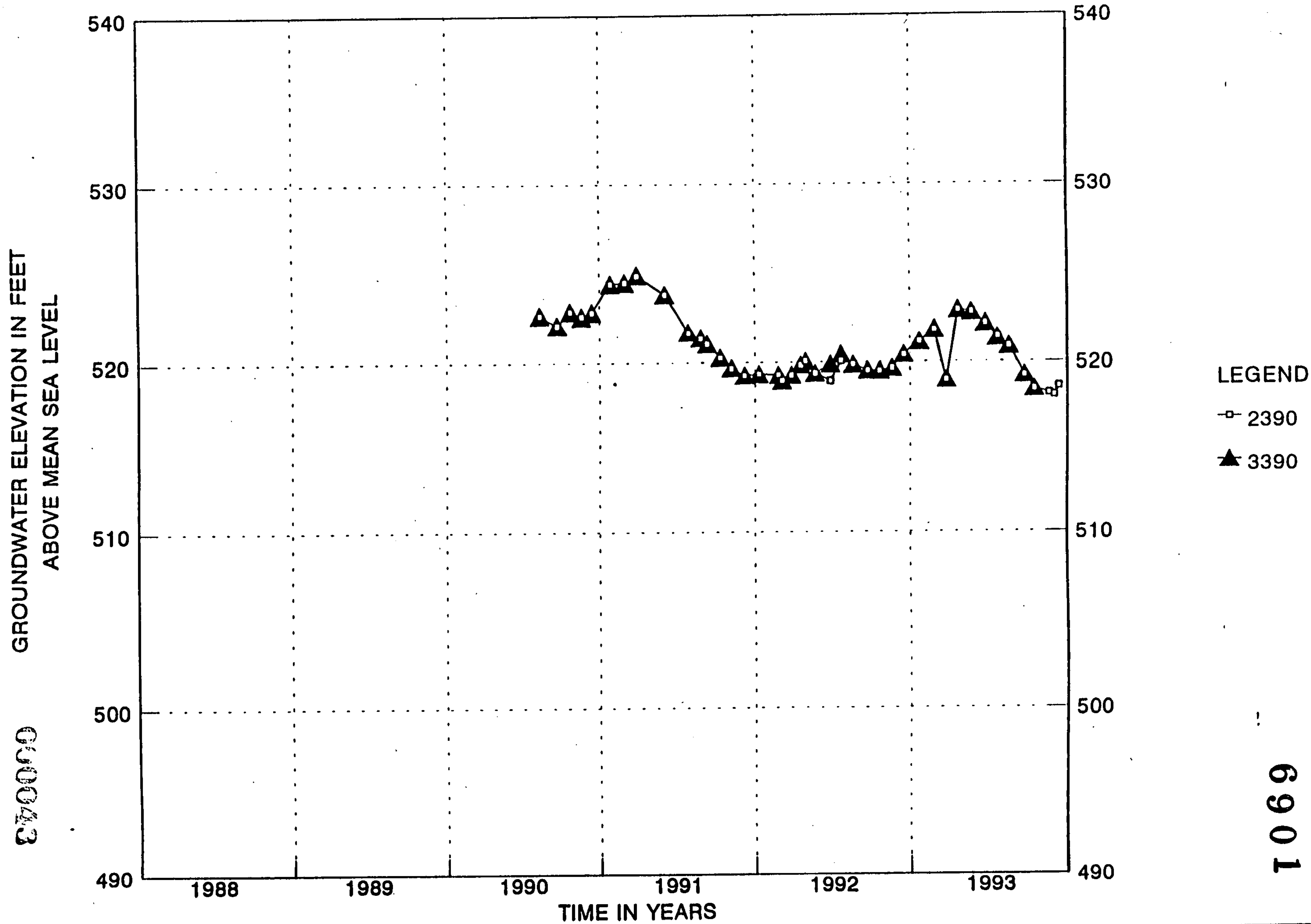

GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
540
530
520
510
500
490
1988
1989
1990
1991
1992
1993
TIME IN YEARS
LEGEND:
2390
3390

000043

6901

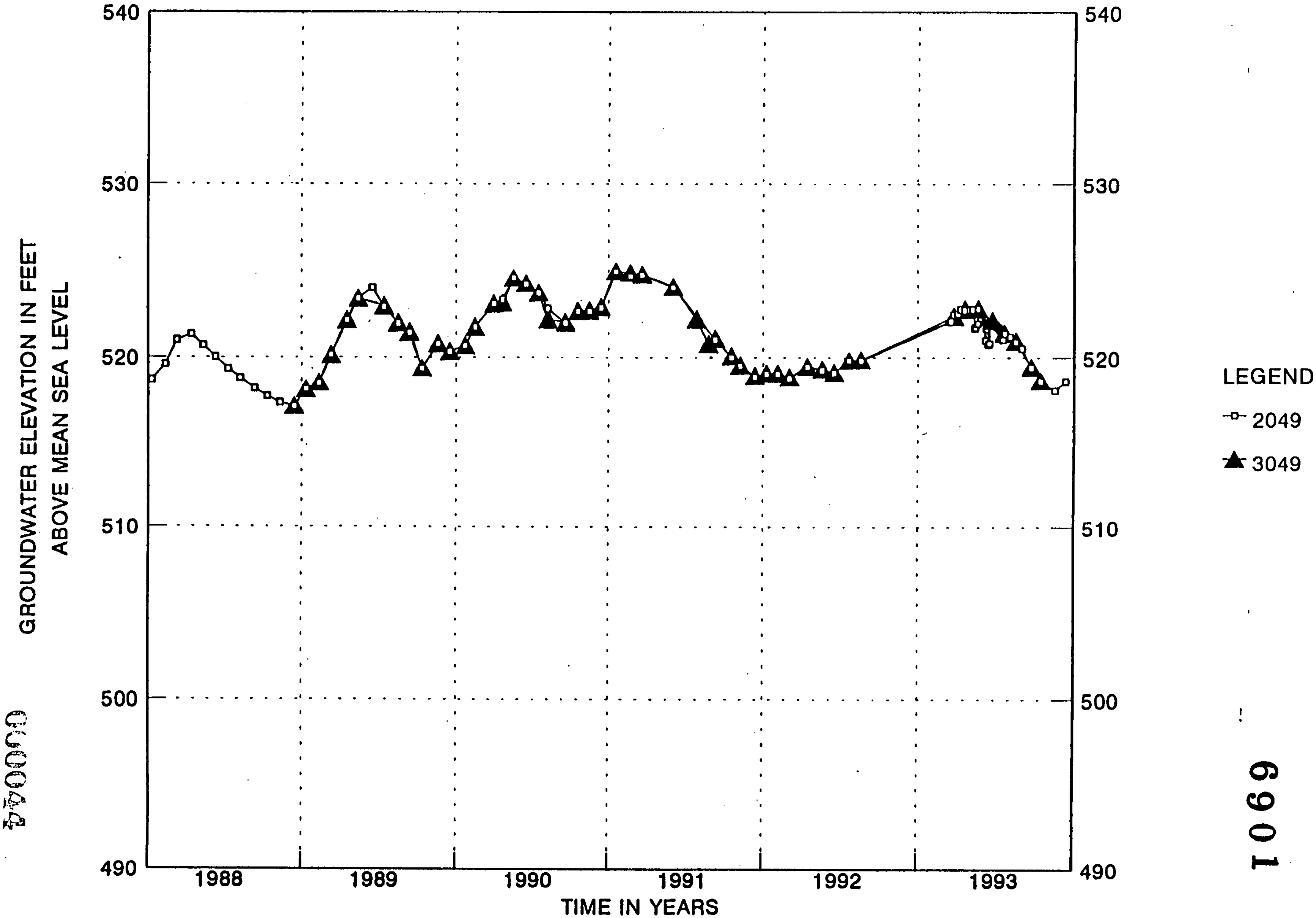

FIGURE A-7 HYDROGRAPH FOR WELL CLUSTER 049

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ATTACHMENT B

SAMPLING MATRIX

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ATTACHMENT B

South Field Extraction System Sampling Matrix

Analyte	No. of Samples	Frequency	Matrix	Lab/Field	Turnaround Time
Uranium-total	85 77 samples 4 duplicates 4 field blanks	Every 10 ft	Groundwater	Lab (on site)	1 week
Uranium-total	85 77 samples 4 duplicates 4 field blanks	Every 10 ft	Soil	Lab (on site)	1 week
Uranium-total K_d desorption batch test	Approximately 40 samples	Every 5 ft in selected intervals of plume	Groundwater /soil	Lab (on site)	16 days
Sieve analysis for grain size	106	Every 10 ft	Soil	Lab (on site)	ASAP
Sieve analysis for screen size selection	14	Every 5 ft	Soil	Lab (on site)	ASAP
Turbidity pH Specific conductance Temperature Dissolve oxygen	Indeterminate	Until turbidity = < 5 NTU	Groundwater	Field	N/A

ATTACHMENT C

SAMPLING INSTRUCTIONS

ATTACHMENT C

SAMPLING INSTRUCTIONS FOR THE EIGHT WELLS IN THE SOUTH FIELD EXTRACTION SYSTEM

DRILLING GUIDELINES

Collecting Samples:

- Groundwater and soil samples will be collected beginning at the water table and every 10 feet thereafter to the total depth of the borehole.
- Sieve samples will be collected every 10 feet, starting at the top of the Great Miami Aquifer, excluding the proposed screened interval. Sieve samples will be collected every 5 feet starting at the top and down through the entire proposed screened interval.

CORE WORK

- Screen core for volatiles after extraction from the rotosonic casing
- Move core into trailer or temporarily store it under the trailer
- Cut open the core sleeve
- Screen the core for radionuclides using the pancake frisker
- Photograph the core
- Describe the lithology/depositional features; record on the soil classification log
- Archive core per site procedures.

ATTACHMENT D

CALCULATION OF THE CONCENTRATION OF TOTAL URANIUM DISCHARGED TO THE GREAT MIAMI RIVER DUE TO WELL DEVELOPMENT

ATTACHMENT D

Calculation of the concentration of total uranium released to the Great Miami River due to the development of a recovery well with a total uranium concentration of 250 ppb in the pumped groundwater is as follows. The groundwater pumped from the well during development is mixed with groundwater being pumped from the South Plume recovery wells. Thirty percent of the combined flow is treated to 5 ppb before being released to the Great Miami River.

Input to calculations:

- Development will take 3 days or 72 hours
- During development the well will be pumped at 600 gpm for 3 hours a day for 3 days or 9 hours (540 minutes) total.
- Groundwater pumped from the South Plume recovery wells will move through the force main at a rate of 1400 gpm and a concentration of 18 ppb.
- During 72 hours an additional 1.642×10^6 gallons of water from other flow streams will be treated to 5 ppb of total uranium and be available for mixing into the flow stream being discharged to the Great Miami River.

South Plume Recovery Wells
1400 gpm @ 18 ppb for 72 hours

Development of Well
600 gpm @ 250 ppb for 9 hours

↓

Combined Volume[a]
6.372×10^6 gallons @ 29.8 ppb

↓ ↓

70% untreated
4.460×10^6 gallons
@ 29.8 ppb

30% treated to
1.912×10^6 gallons
@ 5 ppb

Other treated flow
1.642×10^6 gallons
@ 5 ppb

↓ ↓ ↓

↓

18.8 ppb total uranium released to Great Miami River[b]

[a]Combined volume and concentration before treatment

$$\frac{[(6.048x10^6\ gal)(18\ ppb)]+[(3.24x10^5\ gal)(250\ ppb)]}{6.372x10^6\ gal} = \frac{(1.089x10^8\ gal\ x\ ppb)+(8.100x10^7\ gal\ x\ ppb)}{6.372x10^6\ gal} = 29.8\ ppb$$

[b]30% (6.372×10^6 gallons) = 1.912×10^6 gallons
70% (6.372×10^6 gallons) = 4.460×10^6 gallons

Total volume at 5 ppb concentration = 1.912×10^6 gallons + 1.642×10^6 gallons = 3.554×10^6 gallons

$$\frac{[(3.554x10^6\ gal)(5\ ppb)]+[(4.460x10^6\ gal)(29.8\ ppb)]}{8.014x10^6 gal} = \frac{(1.777x10^7\ gal\ x\ ppb)+(1.329x10^8\ gal\ x\ ppb)}{8.014x10^6\ gal} = 18.8\ ppb$$