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OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) TREATABILITY STUDY WORK PLAN DRAFT JUNE 1994

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OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) TREATABILITY STUDY WORK PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

JUNE 1994

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

DRAFT

FOREWORD

The U.S. Department of Energy has completed and transmitted this work plan for the Operable Unit 1 Dewatering Excavation Evaluation Program (DEEP) under the terms of Section XII.D.1 and D.2 of the Amended Consent Agreement (ACA) between the DOE and the U.S. Environmental Protection Agency. This work plan provides the framework for an additional treatability study for Operable Unit 1 at the Fernald Environmental Management Project (FEMP). As such, this work plan is a secondary document under the terms of the ACA.

This work plan identifies tests that will be performed to support post-remedy-selection remedial design/remedial action of Operable Unit 1. This work plan meets the substantive requirements of the EPA's Guide for Conducting Treatability Studies under CERCLA (CERCLA 1992). The work plan format focuses on each of the technologies for materials handling evaluations, with additional information that supports all the technologies provided in Section 6. In addition, five attachments provide supplementary information.

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LIST OF ACRONYMS

AC	alternating current
ASTM	American Society for Testing and Materials
BDN	Biodenitrification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CL	low-plasticity clays
CPT	cone penetrometer test
CRU3	CERCLA-RCRA Unit 3
cy	cubic yards
DC	direct current
DEEP	Dewatering Excavation Evaluation Program
DOE	U.S. Department of Energy
EM	electromagnetic
E-O	electro-osmosis
EPA	U.S. Environmental Protection Agency
ETS	Effluent Treatment System
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Management Company of Ohio
FFCA	Federal Facilities Compliance Agreement
FS	feasibility study
ft	feet
GS	General Sump
GMR	Great Miami River
KWHR	horizontal kilowatt-hour(s)
MH	high-plasticity silts
ML	low-plasticity silts
MSDS	Material Safety Data Sheet
NESHAP	National Emission Standards for Hazardous Air Pollutants
NP	non-plastic silts
NPDES	National Pollutant Discharge Elimination System

LIST OF ACRONYMS
(Continued)

OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
PID	photoionization detector
PPE	personal protective equipment
PSP	project specific plan
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SCQ	Site-wide CERCLA Quality Assurance Plan
SM	silty sands
SPT	standard penetration test
SSOP	Standard Site Operating Procedures
UAP	uranyl ammonium phosphate
USCS	United Soil Classification System
USEPA	U.S. Environmental Protection Agency
V	vertical

SECTION 1
DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) PROJECT DESCRIPTION

1.1 SITE DESCRIPTION

This work plan describes the objectives and scope of work for the Dewatering Excavation Evaluation Program (DEEP) to be conducted at the U.S. Department of Energy (DOE) Fernald Environmental Management Project (FEMP) located near Cincinnati, Ohio. The study supports remedial design/remedial action (RD/RA) for Operable Unit 1, the Waste Storage Area. The FEMP is a government-owned former uranium-processing plant that was placed on the National Priority List in 1989. Environmental remediation is underway in accordance with the 1991 Amended Consent Agreement between the DOE and the U.S. Environmental Protection Agency (EPA).

Operable Unit 1 is one of five FEMP operable units. Figure 1-1 shows the location of Operable Unit 1. It consists of Waste Pits 1 through 6, the Clearwell, the Burn Pit, miscellaneous structures/facilities, and environmental media within the Operable Unit 1 boundary. Figure 1-2 identifies the waste pits. Radioactive waste, consisting of naturally occurring radionuclides generated from uranium ore processing and various chemicals, are stored in Operable Unit 1.

1.2 GENERAL PROJECT DESCRIPTION

Currently, the Preferred Remedial Alternative for Operable Unit 1 is based upon dry mechanical excavation, front shovel and truck hauling, at Waste Pits 1, 2, 3, 4, 6, and the Burn Pit, and slurrying waste from Waste Pit 5 and the Clearwell to a thickener for dewatering. All excavated wastes will then be stockpiled and dried to remove free liquid before shipping it off site to a disposal facility.

The Dewatering Excavation Evaluation Program (DEEP) was developed to:

- Provide data and observational information that will be used to optimize and refine plans for removing waste form the waste pits by using the safest, fastest, and most economical excavation techniques.

Data collected from this project will be evaluated for use in developing the RD/RA work plan for Operable Unit 1. Table 1-1 identifies the tests to be performed during the DEEP. Sections 2-5 provide detailed information on each test.

Waste Pits 1, 2 and 3 were selected for the DEEP. The other waste pits were excluded for the following reasons:

- Waste Pit 4 is classified as a hazardous waste management unit (HWMU) under the Resource Conservation and Recovery Act (RCRA).
- Waste Pit 5 is already included in a treatability study under Minimum Additive Waste Stabilization (MAWS) program.
- Waste Pit 6 will be the subject of a separate waste removal pilot study.
- Clearwell contents are similar to the slurry in Waste Pit 5.
- Burn Pit - no additional "new" data would be expected.

1.3 DEEP DATA QUALITY OBJECTIVES (DQOs)

The FEMP Data Quality Objectives (DQO) process, as identified by the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ), guided preparation of this work plan. A brief discussion of the process follows here; a detailed discussion of geotechnical DQOs, as specifically mandated by the SCQ, is provided in Section 2 of this work plan.

1.3.1 Identify the Decisions to Be Made that Affect the Situation

The purpose of DEEP is to identify applicable excavation techniques to remove waste pit material and to determine how to optimize and refine these techniques.

1.3.2 Identify Inputs that Affect the Decision

The following techniques will be tested in the following order:

- Wet excavations and waste reslurry and pumping tests will be performed first.
- Dewatering, to include well comparison and pumping tests, will be performed next in areas adjacent to the wet excavations to ensure similar waste material consistency.
- Dry excavations, to include dry trench excavation and ramp excavation, will then be performed to determine the success of the dewatering effort.

- In addition, geotechnical testing will be utilized to identify the geotechnical properties of pit content samples before and after dewatering.

1.3.3 Define the Boundaries of the Situation

The "boundaries of the situation" are:

- The heterogeneity of the waste pit contents
- The need for each test to remain independent of other tests
- The physical features of Waste Pits 1, 2, and 3, as described in section

1.3.4 Develop a Logic that Applies to the Decision

The logic of the DEEP testing is as follows:

- Geotechnical testing
- Wet excavation
- Dewatering
- Dry excavation

All testing will be conducted in accordance with standard procedures as identified by the American Society for Testing and Materials (ASTM), and those identified in the FEMP SCQ and task-specific procedures. In addition, testing activities will be conducted in accordance with the DEEP Sampling and Analysis Plan.

Each test represents an excavation method that has potential to be suitable for remediating the waste pits. Each method will be tested according to the procedures identified in this work plan; data collected will be compiled in reports that will be used to support selection of excavation methods during remedial design/remedial action (RD/RA).

1.3.5 Establish Constraints on the Uncertainty of the Decision

The following constraints affect the uncertainty of the decision:

- The data collected related to waste pit material (shear strength, pore pressure, moisture content, etc.) during the DEEP investigation will support the Operable Unit 1 RD/RA. Waste material characteristics observed during DEEP testing will provide data to support selection of excavation method(s) to be used in waste pit remediation. Data variability is anticipated, due to the heterogenous nature of waste pit contents. Excavation method(s) that are suitable for one waste pit, or a portion of a waste pit, may not be suitable for another.

- The impacts (on schedule and on materials handling) of weather-related delays due to heavy rains, snow, ice, and freezing temperatures can be determined if such conditions occur during DEEP testing. For example, heavy rains have the potential to create a need to dewater again or to re-excavate waste pit material.

- The constancy of data gathered could be hampered if there is a high frequency of unplanned field decisions (i.e., drilling decisions that must be made if impenetrable materials are encountered during boring; excavation decisions that result should slope factors be deemed inadequate to support excavation equipment) that must be made by the field operations lead or the lead geologist.

1.3.6 Optimize a Design for Obtaining Quality Data and Summary

The design optimization is as specified in the procedures discussions in Section 2, 3, 4, and 5 of this work plan.

1.4 WASTE PIT DESCRIPTIONS AND CHARACTERIZATION

Geotechnical and analytical data that has been collected, reported, and interpreted is included in the Operable Unit 1 Draft Final Remedial Investigation (RI) Report (DOE 1994) and the Operable Unit 1 Treatability Study Report (DOE 1993). Table 1-2 provides a summary of the thickness and volumes of the liners, caps, and waste in Waste Pits 1, 2, and 3. Contaminants of concern (and associated action levels) identified in Operable Unit 1 are listed in the DEEP Health and Safety Plan, Attachment A to this work plan.

1.4.1 Waste Pit 1

According to the RI Report (DOE 1994a), the majority of materials placed in Waste Pit 1 were dry solids including general sump sludge, depleted slag, trailer cake, depleted residues, graphite and ceramics, thorium waste, and uranyl ammonium phosphate (UAP) filtrate. A photograph taken in mid-1959 shows part of Waste Pit 1 covered, with drums visible along the eastern edge of the waste pit. The open portion was shown filled with water.

Typical water levels range from approximately 3 to 3.5 feet below ground surface. Sieve tests from the RI showed six samples with fines (percent passing a #200 sieve) ranging from 71 to 92 percent (dry weight basis). The fines from the Atterberg limit tests were reported as non-plastic (NP). The material was classified as low plasticity silt (ML) according to the Unified Soil Classification System (USCS).

The Operable Unit 1 Treatability Study Report classifies the material as homogeneous, non-plastic silt. Fines ranged from 70 to 91 percent, sands from 9 to 27 percent, and a trace of gravel (3 percent). The samples had moisture contents ranging from 20 to 39 percent and were characterized as having slight cohesion, and low dry strength.

Magnetic anomalies were indicated across 60 percent of the waste pit. Anomaly maps were published in the RI. Sharp magnetic highs and lows in the southeastern quarter indicate a substantial volume of buried ferrous metal or other magnetically susceptible debris at relatively shallow depths. Magnetic anomalies in the northern and western edge indicate smaller volumes of buried ferrous debris at greater depths.

1.4.2 Waste Pit 2

The material placed in Waste Pit 2 consisted of general sump sludge, depleted slag, trailer cake, UAP filtrate, depleted residues, and graphite/ceramics. The material in Waste Pit 2 were relatively coarser than the material placed in Waste Pit 1.

Typical water levels range from approximately 1 to 1.5 feet below ground surface. Sieve tests from the RI had seven samples with fines (percent passing a #200 sieve) ranging from 29 to 72 percent (dry weight basis). The fines from the Atterberg limit tests were reported as non-plastic (NP). Samples were classified as sandy silt and silt with sand (ML), sandy elastic silt (MH), and silty sand with gravel (SM) according to the USCS. Moisture contents of the ML and MH material ranged from about 120 to 317 percent; the SM and SC material ranged from about 21 to 33 percent. Measured specific gravities ranged from approximately 2.20 to 2.83. The Treatability Study Report described the material as low-plasticity clays, high-plasticity silts, and silty sand (USCS Classifications CL, MH and ML). Four samples were tested: one sample was a silty sand with 44 percent fines, 55 percent sands and 1 percent gravel; two samples were sandy lean clays (CL) with 66 to 74 percent fines, 22 to 26 percent sand, and 4 to 8 percent gravel; the fourth sample was a high plasticity silt with 67 percent fines (percent passing a #200 sieve), 28 percent sand and 5 percent gravel. In general, each report confirmed the other report findings. Magnetic anomalies were noted across 35 percent of Waste Pit 2.

1.4.3 Waste Pit 3

The material placed in Waste Pit 3 consisted of general sump sludge, raffinate, trailer cake, slag leach, water treatment sludge, and thorium wastes.

Typical water levels ranged from approximately 2 and 4.5 feet below ground surface. The RI Report contained data from grain size analyses, specific gravity tests, moisture content tests, and Atterberg limit tests. Based on five sieve tests, fines (percent passing a #200 sieve) ranged from approximately 43 to 63 percent, sand sizes from 37 to 56 percent, and gravel sizes from 0.1 to 1.3 percent. The fines from two samples had Atterberg limit tests which were reported as NP. The samples were classified as elastic silts (MH), silty sands (SM), sandy elastic silt (MH), and sandy silt (ML). The materials with MH fines had moisture contents ranging from 55 to 139 percent. Measured specific gravities ranged from approximately 2.19 to 2.84. Magnetic anomalies were indicated across more than 40 percent of the waste pit. Electromagnetic (EM) conductivity anomalies, indicating solid materials of high electrical conductivity, were not present in the Waste Pit 3 survey. Rather, the conductivities increased toward the center of the waste pit and probably result from either flyash, high dissolved solids in the waste pit leachate, or both.

TABLE 1-1.

OPERABLE UNIT 1 DEWATERING EXCAVATION EVALUATION PROGRAM (DEEP) GENERAL DESCRIPTION AND IMPLEMENTATION SEQUENCE

Test[a]	Description/Comments
1. Soil Borings, Sampling and Geotechnical Testing for SPT and CPT	● SPT and continuous sampling during well drilling for geotechnical laboratory testing. ● SPT at each trench for CPT correlation. ● Two SPT at each de-watering site. ● Geotechnical index and physical properties testing.
2. Wet Excavations and Slurry Pumping	● Excavate trenches with a backhoe. ● 7 trenches - 2 in Waste Pit 1, 2 in Waste Pit 2, and 3 in Waste Pit 3. Collect bulk sample from each location. ● Re-slurry waste, pump and evaluate settling rates. ● Three slurry tests, one each in Pit 1, 2, and 3.
3. Dewatering	● Evaluate three well types (large diameter wells, sand packed well points, and driven well points). ● Evaluate well spacing (3 wells in each waste pit). ● Yield testing of well points and large-diameter wells. ● Install remaining wells and well points. ● Pump wells without vacuum. ● Pump wells with vacuum. ● Pump wells with E-O.
4. Dry Excavation	● Trenches and ramp excavation. ● Collect bulk samples from each location.

SPT = Standard Penetration Test
CPT = Cone Penetrometer Test
E-O = Electro-Osmosis

[a]Supporting slug tests are performed at existing leachate wells in Waste Pits 1, 2, and 3, a total of 9 locations will be evaluated. (See Attachment E.)

TABLE 1-2.
MATERIAL VOLUME CALCULATION RESULTS FOR WASTE PITS 1, 2 AND 3

WASTE PIT 1

Material		Thickness(ft)	Volume (yd^3)	Volume (m^3)
Cover		0.5	1,700	
Waste		18 (maximum)	48,500	37,083
Low Permeability Material		11 (maximum)	18,200	
	Total	29.5 (maximum)	68,400	

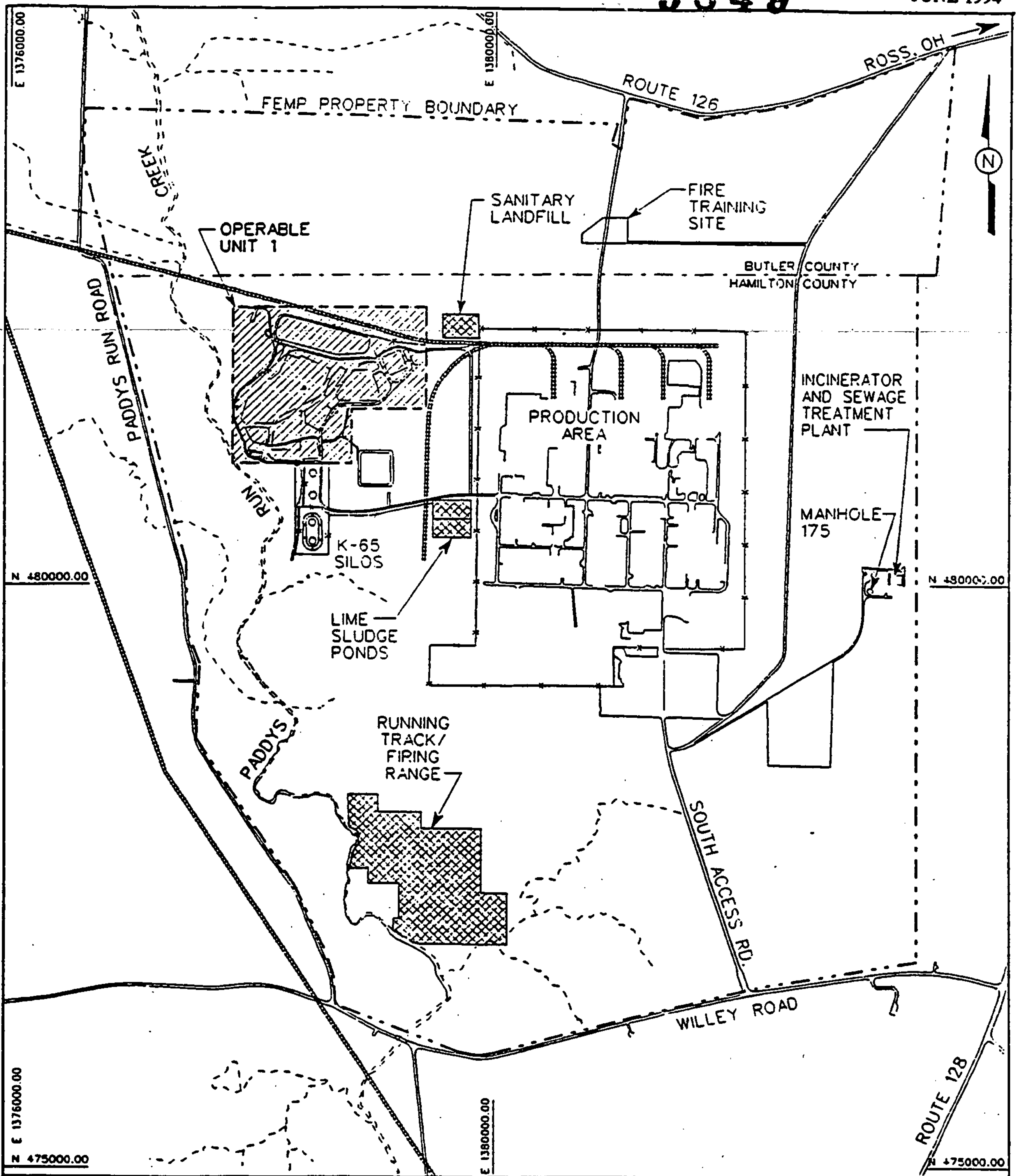
WASTE PIT 2

Material		Depth (ft)	Volume (yd^3)	Volume (m^3)
Cover		1 to 4	4,200	
Waste		15 ± 1	24,200	18,503
Low Permeability Material		4.5 (approx.)	9,000	
	Total	23.5 (maximum)	37,400	

WASTE PIT 3

Material		Depth (ft)	Volume (yd^3)	Volume (m^3)
Cover		14 (maximum)	93,700	
Waste		27 (maximum)	204,100	156,055
Low Permeability Material		1 (approx.)	9,700	
	Total	42 (maximum)	307,500	

SOURCE: Draft Final Remedial Investigation Report for Operable Unit 1, February 1994.



NOTE:

1. OPERABLE UNIT 3 INCLUDES ALL BUILDINGS, PIPELINES, AND ABOVE-GROUND STRUCTURES IN THE PRODUCTION AREA. OPERABLE UNIT 5 INCLUDES GROUNDWATER, SURFACE WATER, SOILS, FLORA AND FAUNA, IN THE REGIONAL AREA AS WELL AS THE PRODUCTION AREA.

SCALE:

0 1200 FEET

LEGEND:

—x—x—	FENCE LINE
—···—	DRAINAGE WAY
▬▬▬	CSX RAIL LINE
— — —	OPERABLE UNIT 1 OUTLINE
—·—·—	FEMP PROPERTY BOUNDARY
▨	OPERABLE UNIT 1
▩	OPERABLE UNIT 2
☐	OPERABLE UNIT 4

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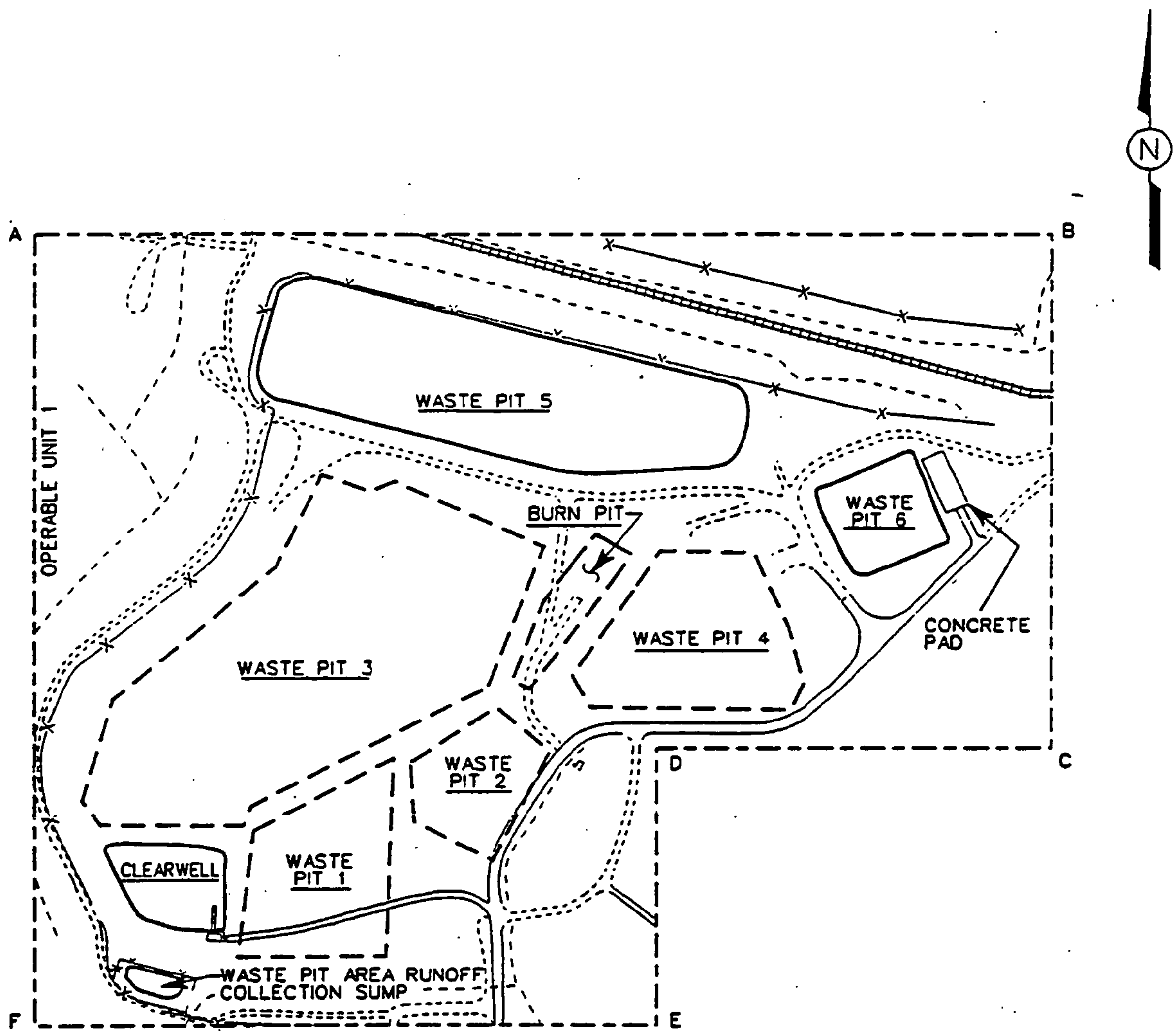
FIGURE 1-1. LOCATION OF OPERABLE UNIT 1 WITHIN THE FEMP



NOTES:

1. PITS 1, 2, 3 AND THE BURN PIT ARE COVERED WITH SOIL CAPS AND VEGETATED.
2. PIT 4 HAS AN INTERIM CAP.
3. PITS 5, 6 AND CLEARWELL ARE WATER COVERED
4. COORDINATES SHOWN ARE OHIO STATE PLANAR COORDINATES, ADJUSTED PER THE NORTH AMERICAN DATUM (NAD) OF 1983.

OU1 STATE PLANAR COORDINATES		
POINT	NORTHING	EASTING
A	482364	1377824
B	482364	1379432
C	481499	1379432
D	481499	1378812
E	481033	1378812
F	481033	1377824

LEGEND:

- —X—X— FENCE LINE
- DRAINAGE WAY
- CSX RAIL LINE
- PAVED ROADWAY
- GRAVEL ROADWAY
- OPERABLE UNIT 1 OUTLINE
- COVERED PIT OUTLINE
- OPEN PIT OUTLINE

SCALE:
0 300 FEET

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FIGURE 1-2. OPERABLE UNIT 1 SITE MAP

SECTION 2
GEOTECHNICAL TESTING

This section describes the geotechnical testing to be performed as part of the Dewatering Excavation Evaluation Program (DEEP). Geotechnical testing includes soil borings and cone penetrometer tests. This section provides information about each type of testing, as wells associated residuals management and modifications to the site Sampling and Analysis Plan (SAP). A discussion of data quality objectives (DQOs) is also provided.

2.1 GEOTECHNICAL TESTING DATA QUALITY OBJECTIVES

In accordance with the Fernald Environmental Management Project (FEMP) Sitewide CERCLA Quality Assurance Project Plan (SCQ) the following test describes the data quality objectives process for DEEP geotechnical tests.

2.1.1 Identify the Decisions to be Made that Affect the Situation

As stated in Section 1.3.1, the purpose of DEEP is to identify applicable excavation techniques to remove waste pit material and determine how to optimize and refine these excavation techniques.

2.1.2 Identify Inputs that Affect the Situation

The following DEEP geotechnical testing is expected to provide additional waste pit material physical property characteristics. Geotechnical tests results will be utilized to decide which dewatering and excavation methods are safest, most economical, fastest, and consistent with the preferred Remedial Alternative as identified in the Operable Unit 1 Proposed Plan (DOE 1994b).

The results of the geotechnical analyses will be in the following areas:

- The relative difficulty of dewatering waste pit material
- Permeability of the waste pit material
- Specific gravity of the waste pit material
- Moisture content of the waste pit material
- Atterburg limits of the waste pit material
- Grain size distribution of the waste pit material
- Foundation stability information of the waste pit material
- Waste strength through the Standard Penetration Test

The limitations of the inputs are:

- The acceptability of the data generated
- The actual field observations

2.1.3 Define the Boundaries of the Situation

The boundaries of the situation are defined in two ways: (1) the physical features of the waste pits (refer to Section 1); and (2) the suitability of boring installation-derived field investigation and laboratory analytical results of waste material physical properties. The heterogeneity of the waste pit contents was a key consideration in selecting the number and locations of the DEEP sampling points. Points were chosen to provide a maximum amount of data from a minimum amount of sampling locations. Sampling points were selected to minimize disturbance to know magnetic anomalies in the pits.

2.1.4 Develop a Logic that Applies to the Decision

Prior to surface excavation, DEEP project investigations, including "wet" and "dry" trench excavations, dewatering operations, and ramp construction, geotechnical data specific to the investigation locations will be needed. A boring for each of the seven "wet" trench excavation sites has been determined appropriate: two each in Waste Pits 1 and 2, and three in Waste Pit 3, has been determined adequate to provide the required information. In addition, one boring each at or near the center of the "dry" trench excavation location in Waste Pit 1 and the center of the ramp in Waste Pit 3, will provide sufficient information for that part of the project. In total, nine borings will be conducted prior to execution of waste pit trenching or dewatering operations.

In addition, two borings for each dry excavation shall be performed during dewatering, then one boring shall be performed at the end of dewatering for each dry excavation. Thus, six borings total shall be performed during and after the two dry excavations. The borings will be performed at least 5 feet form each other in the approximate center of the excavations.

Geotechnical data collected during earlier studies of the waste pits for the Final Treatability Study for Operable Unit 1 has been considered in the selection of the proposed trench excavation locations, the ramp construction location, preliminary boring locations, and depths. Locations of known or suspect drilling problem areas have been evaluated, and will be avoided. Surface surveying of proposed boring drilling locations, and the approximate depth of waste pit liner depths have been determined.

Estimated boring depths, sampling intervals, and sample types are outlined in attached Table 2-1. The geotechnical tests to be conducted on the samples are listed in Table 2-2.

Boring installation and sampling proposed will be performed in accordance with existing American Society for Testing and Materials (ASTM) standards, and FERMCO standard operating procedures. All activities associated with the field portion of this investigation will be performed in accordance with the SCQ. This field work will comply with all other applicable FEMP requirements.

2.1.5 Establish Constraints on the Uncertainty of the Decision

The behavior of waste pit material during the investigation will influence design of the remedial option selected for the waste pits. For example:

- If drilling or sampling refusal occurs prior to reaching the pre-determined depth, the geologist will select a new boring location at least five feet from any existing boring location, and commence drilling again. A boring must be completed for every trench or de-watering location. During drilling two types of samples shall be collected in an alternating sequence, these being: split-barrel samples and thin-walled tubes samples.

- If waste pit material densities, obstacles, or hazardous conditions preclude obtaining piston samples, split-barrel samples will be collected continuously.

- If, during the course of the field investigation, drilling is difficult or impossible due to unanticipated obstacles encountered in the subsurface, a resulting delay in the collection of required samples and other physical property information will result. The ramifications of project schedule slippage would cause detrimental to the CRU1 remediation process to proceed at risk.

- If samples can not be recovered by normal sampling methods, alternative sampling methods will be used.

2.1.6 Optimize a Design for Obtaining Quality Data and Summary

Geotechnical samples shall be collected and reported on as identified in Sections 2.2 and 2.3 of this work plan.

2.2 SOIL BORINGS

2.2.1 Soil Borings Test Description and Objectives

Fifteen borings will be drilled in Waste Pits 1, 2, and 3. Figure 2-1 depicts proposed boring locations, the general layout of the soil-covered waste pits, and nearby access roads. Samples will be collected for geotechnical laboratory testing and will consist of split-barrel samples and thin-walled samples taken at selected intervals in coordination with Standard Penetration Test (SPT) testing. Borings will be installed in multiple phases that may be days to weeks apart to satisfy a project objective of determining geotechnical material properties before, during, and after planned dewatering activities.

Standard Penetration Tests (SPT) will be performed prior to every excavation, and before and during the full-scale dewatering tests begin in Waste Pits 1 and 3. SPT will supply data about the nature of the waste strata and strengths. The SPT strength data will yield information on the viability of the waste to hold certain types of equipment and excavation slopes for excavation planning. The strata knowledge will yield strength information at known depths. The geotechnical tests that will be performed from the SPT samples will also provide information on the properties of the waste for excavation and process purposes, i.e. tri-axial shear will yield the shear strength for slope stability, moisture contents of the waste will yield information in the dewatering and drying designs, sieve tests will yield information for material classification and crusher/shredder designs. SPT that are performed during and after dewater will yield information on the effectiveness of the dewatering, i.e. through an increase in strength of the material and a reduction in moisture.

2.2.2 Soil Borings Experimental Design and Procedures

2.2.2.1 Boring Locations and Anticipated Depths

Boring diameter shall be of a large enough diameter to allow for an adequate amount of sample to be collected. They will range in depth from 15 to 35 feet. They will penetrate from 2 to 10 feet of compacted cap materials, will extend into waste materials, and terminate at least 5 feet above the waste pit bottom liner. Borings will be installed and geotechnical sampling will be performed in accordance with FERMCO Site Characterization Department Standard Operating Procedure SCDM FO 001, entitled "Sampling of Solids with a Split-Barrel or Thin-Walled Tube."

Seven borings will be advanced at the proposed wet trench excavations; two each in the Waste Pits 1 and 2, and three in Waste Pit 3. Two borings will be at or near the centers of the proposed Waste Pit 1 and Waste Pit 3 dewatering test areas, for a total of nine borings prior to trenching or dewatering. During dewatering, two borings will be performed each in Pit 1 and 3 at different times to measure the material strength from dewatering. After the dewatering phase is complete, a final boring per Pit 1 and 3 will be performed. Table 2-1 summarizes boring locations, anticipated depths, sample types, and sample intervals.

Prior to soil boring activities, locations will be surveyed to establish the surface elevation at each borehole location so that all borings can be terminated 5 feet above the top of the waste pit liner at that location. Pit cross-section information published in the Draft Final Remedial Investigation Report for Operable Unit 1, such as lithological logs from the Characterization Investigation Study (CIS) and boring logs and other data from RI/FS sampling, will aid in identifying liner depth. In addition, samples recovered from split-barrel samples will be examined at 1 1/2-foot intervals; samples recovered from thin-walled tubes will be examined at 2 1/2-foot intervals

2.2.2.2 Boring Operations and Sampling Procedures

The borings will be of such diameter to allow sufficient sample to be collected. Site procedures, identified in the Sampling and Analysis Plan, will be used. Cuttings from boring operations will be placed on plastic sheeting and subsequently returned to the excavation site. The entire hole will be backfilled with voclay grout upon completion of each boring. Grouting of completed boreholes will conform to Ohio Administrative Code (OAC) 3745-09-10. Following completion and backfilling of the borehole, an identification stake will be placed at the borehole so that follow up "as built" surveying can be completed.

Several soil sampling methods will be used to explore subsurface materials because much of the material to be sampled is anticipated to be saturated (part of which is semi-liquid consistency). A variety of sample collection techniques, such as a piston sampler, SPT split-barrel sampler, and a split-barrel sampler with a liner and basket or flap valve retainer, will be required. Other methods may also be used, if needed. All methods must be approved by the lead geologist prior to implementation. The focus will be collection of a testable sample. Table 2-1 identifies the anticipated sampling methods and intervals.

Split-Barrel Sampling. Samples will be recovered in accordance with the Standard Method for Penetration Test (SPT) and Split-Barrel Sampling of Soils (ASTM D 1586). The sample will be visually classified and recorded; a portion will be saved for further laboratory testing. All split-barrel samples shall be field screened for radiological and organic constituents and shall be identified in the field log book.

Thin-Walled Tube Samples. In addition to the standard split-barrel sampling procedures, relatively undisturbed 3-inch-diameter thin-walled sample tubes (ASTM D 1587) will also be obtained for laboratory testing. The thin-walled tubes will be pushed a minimum of 30 inches into the undisturbed material below the augers. A Dennison sampler or similar piston sampler is recommended for site conditions.

The tubes will be carefully removed from the borehole and inspected by the lead geologist. The sample tubes will then be cut into approximate 6-inch sections, labeled accordingly, at the direction of the geologist, and prepared for transport. Both ends of each tube section will be capped and taped to protect the sample. Tube sections will be packaged in special shipping containers designed to maintain the sample orientation and to prevent shock or vibration during transit. The samples should be protected against freezing or excessive temperatures. All samples will be collected, handled, and shipped to the geotechnical laboratory in accordance with site requirements .

The daily log, including a log of each borehole, sample type, intervals, blow count, material type, and general comments about the borehole advancement process, shall be maintained by the lead geologist. All geotechnical laboratory reports will be consistent with the reporting requirements specified in the ASTM test procedures listed in Table 2-2. Subsurface boring logs shall be generated for each boring. Visual classification of the materials will be performed in the field in accordance with ASTM D 2488.

2.2.3 Soil Borings Data Collection, Analysis, Interpretation, and Reporting

Soil borings will be utilized to determine the geotechnical properties of materials sampled from each boring before and after dewatering activities. To provide specific in situ information for use in the investigation of dewatering, boring samples which provide accurate physical descriptions and physical property information are essential. The pit waste boring and sampling program will provide the necessary comparative data for establishing baseline waste geotechnical conditions within each pit. Due to the heterogeneity of waste pit materials and the existence of analytical results from previous sampling programs in Waste Pits 1, 2, and 3, sampling to identify the chemical nature of the pit wastes will not be performed.

During soil boring, at the specified intervals split-barrel (split-spoon) and thin-walled (Shelby) tube sampling will be conducted. Field-generated documentation associated with soil borings will include:

- Field activity logs
- Lithologic logs (to include visual classification of materials)
- Sample collection logs
- Standard penetration test (SPT) information
- Field screening results for radiological and organic constituents

Soil boring samples will be analyzed to provide the following geotechnical information in reports:

- Grain-size analysis
- Atterburg limits
- Moisture content
- Specific gravity
- Triaxial shear strength test
- Unit weight test
- Standard Proctor compaction test

Table 2-3 provides the purpose each of the above analyses are being performed. Reported data will include the geologist's daily log (to include a log of each borehole, sample type, intervals, blow count, material type, and general comments), subsurface boring logs , the results of field screening for radiological and organic constituents, and geotechnical laboratory reports.

2.2.4 Soil Borings Equipment

- Truck, platform, or trailer mounted mechanical or hydraulic drill rig with hollow stem auger capabilities
- Split-barrel sampler
- Thin-walled tube sampler
- Photoionization detector (PID)
- Radiation meter

2.3 CONE PENETROMETER TESTING

2.3.1 Cone Penetrometer Test Description and Objectives

Cone penetrometer tests (CPT) will be performed in Waste Pits 1, 2, and 3 to obtain geotechnical information on the wastes to be excavated by mechanical equipment. An electric penetrometer fitted with a piezocone shall be used to measure tip resistance, side friction, inclination, load, and pore pressure. All ground penetrations will stop at a minimum distance of 5 feet above the estimated depth of the top of the pit liner. Testing will take place throughout the pits, as well as in the approximate area of the dewatering wells. Testing will provide a continuous record of penetration resistance and pore pressure versus depth for each testing location. All CPTs will be performed according to ASTM D 3441-86 procedures and equipment specifications unless otherwise stated in Section 4 of this work plan.

Data obtained, such as waste strength, and pore pressure, will be correlated with the SPT information. Samples taken from the borings will have index properties, shear strength, and compaction tests. These tests will provide data for well designs, material classifications, permeabilities, waste strata, slope stability, optimum moisture content and maximum dry density. Maximum dry density and optimum moisture contents will provide design information that will allow the mechanical equipment to be driven over the waste safely.

The CPT advantage is that it is faster and more economical to the SPT, however, SPTs will be performed in the area of the CPTs to correlate the CPT data with that is actually found and tested in laboratory conditions (SPT samples).

2.3.2 Cone Penetrometer Experimental Design and Procedures

Cone penetrometer tests (CPT) will be performed in Waste Pits 1, 2, and 3 to obtain geotechnical information on the wastes to be excavated by mechanical equipment. All ground penetrations will stop at a minimum distance of 5 feet above the estimated depth of the top of the waste pit liner. Testing will take place throughout the waste pits, as well as in the approximate area of the dewatering wells. Testing will provide a continuous record of penetration resistance and pore pressure versus depth for each testing location. All CPT holes shall be abandoned with volclay grout to the surface. Following grouting, an identification stake will be placed at the location so that follow up "as built" surveying can be completed. Locations of the CPTs are shown in Figure 2-1.

Phasing of CPTs in the Waste Pits: SCAPS Phasing of the CPTs will depend on the availability of the equipment furnished by the U.S. Department of Energy (DOE) Demonstration Project. CPTs scheduled for August 15 - August 19, 1994, in the waste pits, will be performed by DOE in conjunction with the DEEP.

CPT Procedures: Testing procedures shall be in accordance with ASTM D 3441-86, Sections 4, 5, and 6. The rate of penetration shall be at 4 feet/minute (10 millimeters/second) plus or minus 1 foot/minute (7.5 millimeters/second). The penetrometer shall be electric with a piezocone.

Calibration: Instrument calibration shall be performed in the field. The results will be recorded in the field log.

Data Requirements: Data requirements shall be in accordance with ASTM D 3443-86, Section 7. The minimum depth interval between sensor data readings shall be 1 inch and data shall be reported at the same interval. Data shall be provided as continuous plots of tip bearing, sleeve friction and pore pressure in pounds per square inch and tons per square foot versus depth in feet. Inclination of the probe during penetration shall also be identified.

2.3.3 Cone Penetrometer Testing Data Collection, Analysis, Interpretation, and Reporting

Data shall be provided as continuous plots of tipbearing, sleeve friction, and pore pressure in pounds per square inch and tons per square foot versus depth in feet. Inclination of the probe during penetration shall also be identified.

Data processed shall include generation of continuous plot of friction ratio and pore pressure ratio versus depth in feet. Strip chart data shall also be provided. Data related to physical probe dimensions used in calculations and any filtering or averaging used in the analysis shall also be reported.

A tabulation of the data presented or the continuous plot shall be provided at 6 inch intervals. Interpreted information, such as equivalent SPT blowcount N, equivalent drained friction angle for sands, equivalent relating density of sands, equivalent undrained strength of clays, and equivalent soil behavior type, shall also be provided on the same tabulation. The method by which these interpreted data are developed shall also be reported. Data analysis information shall be available in the field during dewatering at the dewatering sites. A continuous record of penetration resistance and pore pressure versus depth will be documented for each CPT location.

2.3.4 Cone Penetrometer Testing Equipment

Cone Penetrometer equipment and supplies will be provided by DOE SCAPS Demonstration Project.

2.4 MODIFICATION OF EXISTING SITE SAMPLING AND ANALYSIS PLAN

This section describes how the existing Site Sampling and Analysis Plan (SAP) will be modified to address the specific geotechnical testing to be performed during the DEEP. An estimated 265 feet of borings will be taken, comprised of 69 split-barrel samples and 58 thin-walled tube samples.

Sample Identification: Test borings have been assigned an alphanumeric identification number. Each sample from the borings will be assigned a unique sample number. Each section of a single thin-walled tube will be given the same sample number with additional alphabetic and depth designations which will locate the position of the section in relation to the whole thin-walled tube. Additional borings and samples will be numbered using a similar method.

Sample Containers: Samples will be placed in the appropriate containers for further handling and transport for shipment off site. Split-barrel samples will be placed in moisture-proof jars. The jars will then be placed in partitioned boxes for off-site shipment, as necessary.

After the sample tubes are cut into sections, the ends of each section will be tightly sealed to prevent disturbance and moisture loss. The thin-walled tube sections will then be packaged upright in specially designed containers for further transport and shipment. The sample tubes will be packed to minimize vibration and shock during transport. Final preparation of shipping containers will be performed by the FERMCO Sample Processing Laboratory.

Sample Labels: Sample jars, sample tubes, boxes, and shipping containers will be permanently labeled and/or marked with the appropriate descriptive information. Sample labels at a minimum shall include project number and site, boring number, sample number, date of sampling, depth of top and bottom of sample, number of blows for each 6 inches, and recovery. Additional labeling and marking may be necessary for potentially hazardous or radioactive samples.

Sample Handling: Samples obtained during field investigations require careful handling, packaging, and shipping. Disturbance and loss of moisture from the undisturbed samples may have serious effects on the properties of the materials; therefore, every precaution will be taken in handling the samples. Precautions will be taken to protect samples against exposure, freezing, excessive temperature changes, and moisture loss. Additional handling, packaging, and shipping requirements may be necessary if potentially hazardous or radioactive samples are encountered during the investigations. If required, FERMCO will perform these additional activities. Table 2-3 lists the procedures for field storage and shipment of samples obtained during the investigation.

EPA requires that remedial actions at Federal Facilities taken under Sections 104, 106, or 120 of CERCLA comply with the CERCLA Off-Site Rule (40 CFR 300.440). Under the Off-Site Rule, CERCLA waste samples that are being characterized do not have to meet the full requirements of the rule. The CERCLA waste samples may be returned to the site if the FEMP agrees to assume responsibility for the management of the samples.

Sample Shipment: Samples (tubes and jar samples) collected during the subsurface exploration will be shipped to an off-site/on-site geotechnical laboratory for analysis. Transportation of samples will be accomplished in a manner designed to protect the integrity of the sample (ASTM D 4220) and to prevent any detrimental effects from the potentially hazardous nature of the samples. All samples shall be preserved, packaged, and transported in accordance with the Sitewide CERCLA Quality Assurance Project Plan (SCQ). Custody of sample containers shall remain with FERMCO for shipment, document preparation, packaging, and final preparation for shipment to the geotechnical laboratory or to the FEMP Sample Processing Laboratory. Upon completion of geotechnical laboratory testing, the geotechnical laboratory will ship the sample material to FERMCO for final disposition.

Sample Archives: Selected samples, as specified by the lead geologist that are not sent to the geotechnical laboratory for testing, will be archived in the FEMP Sample Archives. Archiving of samples will be coordinated through the FEMP Sample Processing Laboratory.

Chain-of-Custody: Sample chain-of-custody procedures will be followed during all field and laboratory activities in accordance with the SCQ.

Geotechnical Laboratory Test Plan: Samples of pit materials collected during drilling and SPT will be shipped to an off-site geotechnical laboratory for testing. The testing will consist of classification tests, shear strength tests, and compaction tests. The general purpose and procedure for each type of geotechnical test is summarized in Table 2-3.

The majority of geotechnical tests will be performed on sample material from relatively undisturbed thin-walled samples obtained from boreholes within the covered pits. Bulk samples will be required for compaction testing. This sample material will come from the un-dewatered trench excavations. The anticipated laboratory tests for the waste pit test dewatering and excavation project are presented in Table 2-2. The actual samples selected for particular tests will be determined based on the conditions encountered in the field and sample characteristics. All triaxial shear tests shall include tests of three specimens at different confining pressures. Standard Proctor compaction tests will be performed at five point tests. The laboratory testing is anticipated to take 4 to 6 weeks upon initial receipt of samples from the site.

2.5 GEOTECHNICAL TESTING RESIDUAL WASTE MANAGEMENT

2.5.1 Boring Cuttings

Soil boring cuttings will be placed on plastic sheeting and covered until they are used as backfill at trench excavations.

2.5.2 Waste Returned From Analytical Laboratories

Contact waste will be managed as described in Section 2.5.3. Waste being returned from laboratories will be archived and stored with the dried material awaiting the Pit 6 Drying Study. Sampling of the waste entails geotechnical sampling only; therefore, no additives will be added to the material that could alter the chemical composition of the waste thus rendering it a RCRA hazardous waste.

2.5.3 Contact Waste and Personal Protective Equipment (PPE)

Contact waste is categorized as personal protective equipment (PPE), gloves, wipes, plastic, etc. generated during a sampling event that may be contaminated as a result of coming in contact with the sampled material. Contact waste generated during the DEEP will be collected in a plastic bag and sealed with tape. The bag will be labeled with the name and phone number of the project supervisor and the name of the person placing the bag in the dumpster. The bag will be placed in the CRU3 RI/FS-designated locked dumpster. No Material Evaluation Form will be generated. The trash in the dumpster will go to the trash baler, where it will be compacted and boxed for transport from the site as low-level radioactive waste. Grossly contaminated PPE will be placed in a container and stored with the dried material awaiting the Pit 6 Drying Study.

TABLE 2-1
ESTIMATE OF SAMPLE DEPTHS AND INTERVAL WITH NUMBER OF EACH TYPE PER BORING

Boring No.[2]	Estimated Depth (ft)	Sampling Interval[4]	Split-Barrel Samples	Thin-walled Tube Samples
G1-101[1]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-102	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-103[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-104[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-105[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-106[3]	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-201	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-202	15	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	4	3
G1-301	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8

TABLE 2-1
ESTIMATE OF SAMPLE DEPTHS AND INTERVAL WITH NUMBER OF EACH TYPE PER BORING (CONTINUED)

Boring No.[2]	Estimated Depth (ft)	Sampling Interval[4]	Split-Barrel Samples	Thin-walled Tube Samples
G1-302	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-303	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-304[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-305[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-306[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
G1-307[3]	35	Continuous sampling; alternate between 1.5 ft. split-barrel and 2.5 ft. piston samplers	9	8
Totals	365		95	80

Notes:
(1) Boring Identification key: G1-101; G = Geotechnical Boring, 1 = Pit 1, 01 = Boring 1.
(2) See Figure 2-1 for location of borings.
(3) Borings G1-103, G1-104, G1-105, and G1-106 will be one before two during, and one after dewatering. Five foot separation should be maintained between borings.

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TABLE 2-2
SUMMARY OF GEOTECHNICAL LABORATORY TESTING PROCEDURES

TEST METHODS	TITLE
ASTM D 422	Method for Particle-size Analysis of Soils
ASTM D 698	Test Methods for Moisture-Density Relations of Soils Using a 5.5-lb Hammer and 12-in. drop
ASTM D 854	Test Method for Specific Gravity of Soils
ASTM D 2216	Method for the Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate
ASTM D 2487	Test Method for Classification of Soils for Engineering Purposes
ASTM D 2488	Practice for Description and Identification of Soils for Engineering Purposes
ASTM D 4220	Practices for Preserving and Transporting Soil Samples
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4767	Test Method for Consolidated Undrained (CU) Triaxial Compressive Test on Cohesive Soils
EM-100-2-1906 APP.II	Dry Unit Weight
EM-1100-1906 APP. X	Triaxial Compression Testing

TABLE 2-3
TYPES AND PURPOSES OF GEOTECHNICAL TESTS

Type of Geotechnical Test	Purpose
Index Properties Tests: ● grain-size analysis	* The grain size analysis or sieve tests will classify the material as a clay, silt, etc. The grain size distribution curve (from the sieve test) will provide permeability data that will be used in the well design, i.e. fine verses course material will have different well screen sizes and different sand pack gradations.
● Atterberg limits	* The atterberg limits (plastic and liquid limit tests) will provide moisture contents for when the material moves into the plastic (clay) range or liquid range. These values will help to classify the material and provide a contractor information as to how the material behaves at certain moisture contents, i.e. does the material hold when it gets wet or does it tend to slough immediately.
● moisture content	* The moisture content of the waste in-situ will help in the design of the dryer, tell us what state the material is in, i.e. elastic, plastic, or liquid.
● specific gravity	* The specific gravity of the material will be needed for a slurry pump design (high SG material are harder to pump), soil classification (clays average 2.7), and thickener design (higher SG material smaller thickener).

TABLE 2-3
TYPES AND PURPOSES OF GEOTECHNICAL TEST
(CONTINUED)

Type of Geotechnical Test	Purpose
Shear Strength: ● triaxial shear strength test ● unit weight test	* The tri-axial shear test will obtain the total shear strength of the material and the pore water pressure. Since the material is in a saturated condition the effective strength will be used for design purposes which is the total strength minus the pore water pressure. The effective shear strength of the material will be utilized in slope stability calculations. Knowing the maximum slope that the pits can be excavated is crucial to avoiding any slope failures. The laboratory shear strength will also be used to correlate with SPT and CPT data. * The in-situ unit weight is needed to determine the density of the material which will be used for geotechnical calculations for material indexing, i.e. relating the percent solid, liquid, and air of the material.
Compaction: ● Standard Proctor compaction test	* The standard proctor test finds the optimum moisture content and the maximum dry density of a material for compaction purposes. This information will be needed since equipment will be on the waste and the material will have to be compacted to safely place equipment on the waste.

TABLE 2-4
ESTIMATED GEOTECHNICAL LABORATORY TESTING FOR WASTE PIT DEWATERING AND EXCAVATION PROJECT

Boring No. or Trench Location	Boring Type(1)	Grain-size	Atterberg Limits	Moisture Content	Unit Weight	Specific Gravity	Triaxial Comp. (CUw/pp)(3)	Standard Proctor
G1-101(4)	T	2	2	3	2	1	2	
G1-102	T	2	2	3	2	1	2	
G1-103	B	2	2	4	2	2	2	
G1-104	D	1	1	2	2	1	2	
G1-105	D	1	1	2	2	1	2	
G1-106	A	1	1	2	2	1	2	3(2)
G1-201	T	2	2	3	2	1	2	
G1-202	T	2	2	3	2	1	2	
Trenches at Pit 2								2(2)
G1-301	T	2	2	3	2	1	3	
G1-302	T	2	2	3	2	1	3	
G1-303	T	2	2	3	2	1	3	
G1-304	B	3	3	4	3	2	3	
G1-305	D	2	2	3	2	1	3	
G1-306	D	2	2	3	2	1	3	

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Boring No. or Trench Location	Boring Type(1)	Grain-size	Atterberg Limits	Moisture Content	Unit Weight	Specific Gravity	Triaxial Comp. (CUw/pp)(3)	Standard Proctor
G1-307	A	2	2	3	2	1	3	
Excavations at pit 3								4(2)
Totals		28	28	44	31	17	37	9

Notes: (1) Boring Types: T = Boring at trench location
B = Boring at dewatering test site before dewatering
D = Boring at dewatering test site during dewatering
A = Boring at dewatering test site after dewatering
(2) Test on bulk sample collected at a trench location identified in the field by the Field Geologist or Geological Engineer
(3) CUw/pp = Consolidated Undrained triaxial compression with pore pressure measurements
(4) Boring Identification key: G1-101; G = Geotechnical Boring, 1 = Pit 1, 01 = Boring 1

SECTION 3
WET EXCAVATIONS

This section describes the methodology for two wet excavation tests: (1) excavation with no dewatering wells; and (2) a waste reslurry and pumping test.

3.1 WET EXCAVATION

3.1.1 Wet Excavation Test Description and Objectives

Seven wet (not dewatered) trenches will be excavated: two each in Waste Pits 1 and 2, and three in Waste Pit 3. Wet trenches will be excavated where no dewatering wells are planned. This approach is being used to evaluate un-dewatered or natural conditions for the waste or sludge. The proposed wet excavations will evaluate the effectiveness of conventional mechanical equipment, and will provide the basis to evaluate the effectiveness of dewatering from a wet waste to a dry waste. Waste Pit 1 trenches will be excavated first, followed by Waste Pit 3 trenches, then Waste Pit 2 trenches. Individual trenches within each waste pit will be sequenced at the discretion of Dewatering Excavation Evaluation Program (DEEP) project manager or designee. Each trench must be completely backfilled before excavation of another trench can begin. See Figure 3-1 for wet trench locations.

The wet or pre-dewatered excavations will be excavated with side walls as steep as possible. This will provide visual data as to how steep the waste can be excavated. The waste side walls may collapse, thus providing information as to the natural angle of repose. The trenches shall be excavated a maximum of 15 feet deep and an effected top area of 30 by 30 feet. If the trenches are found to be too wet for conventional excavation equipment, to excavate efficiently, then slurrying the waste or conventional equipment with waste dewatering may be concluded to be the more efficient excavation technique. Samples will be taken from the waste stockpile and placed in steel boxes for treatability studies at a later date. Coatings and surfactants will be applied to the waste stockpiles to test each surfactant's ability to contain the waste and to prevent windborne emissions. (See Attachment D.)

3.1.2 Wet Excavation Experimental Design and Procedures

3.1.2.1 Stockpile Area

At each trench location, two lined pads will be used: one to store soil cap material while the other will be used to stockpile waste. The cap in Waste Pit 3 is relatively thick, ranging from 6 to 8 feet thick at proposed trench locations. The caps at Waste Pits 1 and 2 may be less than 2 feet thick, therefore caution will be exercised in removing the cap material and not contaminating it with waste material. All stockpile pads will be graded such that drainage flows back into the trench.

Containment berms for the stock piles will be made with straw bales lined up to form a barrier. The bales will be covered with the 6-mil plastic sheeting, extending over the bales.

3.1.2.2 Excavation

After lining the pad areas and constructing containment berms, the capping can be stripped. Stockpiles shall be covered when excavations are no longer in progress or dust control agents will be applied (see Attachment D, Dusting Suppressant Testing).

Maximum trench depths will be 15 feet. The backhoe will excavate to near-vertical slopes until failure of the trench walls occurs. An assumed slope of 2V to 1H is expected to maintain stability through the cap, and a 1-to-3 vertical to horizontal ratio (1V to 3H) is expected to maintain stability through the waste sludge. Determining actual angles of repose for the cap and waste sludge is one of the objectives of the excavation.

The typical wet trench excavation is shown in Figure 3-1. The wastes in Waste Pits 1 and 2 may support a slope of 1V to 3H. Waste Pit 3 waste is assumed to be very wet; the 1V to 3H slope may not be stable. The 1V to 3H slope is an estimate for the wet waste. If near-vertical slopes can be obtained, then the excavation will progress in that manner. If the walls collapse at near-vertical slopes, then the trench shall be regraded to a stable slope. An estimate of 312 cubic yards (cy) of waste may be retrieved from each trench. Due to the characteristics of the waste, i.e., wet waste, then the excavations will be shallower and the quantities of waste removed will be reduced.

In excavating the trenches, an emphasis will be placed on visual observations of the waste behavior, thus equipment operators will be given direction as to how fast and where to excavate. Field observations will include:

- Angle of repose of the waste
- Amount (depth) of water in the trench

- Waste strata (colors, texture, etc.)
- Approximate trench depth, as determined by the boom length
- Wall stability following contact with equipment
- Waste strength

Excavations will proceed at the discretion of the field operations manager, with no wet excavation remaining open for greater than three days. Equipment used for certain phases of the excavation, i.e. cap removal or waste excavating, will be determined by the field operations lead.

3.1.2.3 Waste Material Archives

A 15 cubic yard (cy) sample shall be taken from each of the three waste pits. Each sample shall be taken from the second trench excavated in each waste pit and placed in a 96-cubic-foot white metal box. The boxes shall be transferred to the best available hard surface for storage. After surveying to ensure no contamination exists above the FEMP Rad-con Control Manual criteria.

3.1.2.4 Reclamation

Following trench excavation and gathering samples for material handling studies, the waste will be backfilled into the trench. The sludge will need to be compacted with the backhoe bucket as it is placed in the trench. When the waste stockpile is backfilled down to the plastic liner, the liner will be disposed of in the trench. Next the cap material will be placed on the waste and compacted with the excavation equipment by driving on the disturbed areas. The disturbed areas will then be seeded and the straw from the hay bales (berm) will be dispersed over the seeded areas. Caution must be used in backfilling the trench such that rubber-tired equipment does not create any slope failures.

3.1.2.5 Equipment Decontamination

When salvageable equipment is no longer needed for the DEEP project, it will be scraped with a shovel to remove excess sludge waste. Gross contamination will be removed on site prior to further decontamination at the FEMP Decontamination Facility where it will be authorized for free release off site.

3.1.2.6 Video Recording

All excavations will be video recorded for a permanent record of visual waste characteristics during excavations.

3.1.3 Wet Excavation Data Collection, Analysis, Interpretation, and Reporting

3.1.3.1 Wet Excavation Data Collection

The following data will be collected during the wet excavation:

- **Angle of Repose in Excavation and Stockpile** - A visual evaluation of the angle of repose of materials exposed in the trench excavation sidewalls and the waste stockpiles will be conducted and recorded.

- **Moisture Content in Situ** - Waste samples will be taken from the excavation and analyzed per American Society for Testing and Materials (ASTM) method 2216, for moisture content.

- **Plate-Bearing Capacity** - A Plate Bearing Capacity test will be performed (and recorded) on the undisturbed waste in the excavation. Three different Plate 3 Bearing Capacity end pressures will be used to simulate the bearing pressure under an excavator's tracks.

- **Dust Generation From Excavation and Stockpile** - The waste stockpile and atmospheric conditions will be monitored to evaluate the potential for dust generation during waste excavation. Visual observation and air sampling will be performed and recorded. Additionally, dust suppressants will be tested for their effectiveness and reliability over the duration of the test.

- **Air Emissions From Excavation and Stockpile** - Prior to, during, and following excavating, portable air monitoring instrumentation will be established both upwind and downwind of the excavation and stockpile area. Air station monitoring will be performed for the presence of particulates, radon, and organic vapors.

- **Water Released From Stockpiled Waste and Ponding of Water in Excavation** - The storage pad beneath the waste stockpiles will be graded to divert any resulting leachate drainage back into the open excavation. Grading will also include the creation of small depressions to allow observation, collection, and controlled release of leachate back into the excavation.

- **Stratigraphy of Cap and Waste** - During excavation, efforts will be made to segregate cap materials from the underlying wastes. This will be accomplished by performing visual observation of the excavated material, and utilizing mechanical and manual separation techniques, if possible. If successful, differentiation of cap material from pit wastes may allow for separate temporary storage of the cap material. This ultimately will provide useful information about the homogenization and segregation of the waste/cap material.

- **Ease of Handling Excavated Waste** - Anticipated and unanticipated difficulties associated with mechanical excavation of the waste will be observed and recorded. Some problems which are anticipated include the following:

  - Stickiness
  - Viscosity
  - Debris interaction
  - Splashing
  - Dust generation
  - Stiffness

- Other information derived from mechanical excavation will be the determination of the efficiency of simple bucket excavation and of the need for liners for the excavation bucket and truck beds.

3.1.3.2 Wet Excavation Data Analysis

The following data analyses will be performed during the wet excavation:

- **Angle of Repose in Excavation and Stockpile** - Angle of repose information will be included in remedial excavation planning to provide safe and achievable excavation grades in the waste, itself. Angles of repose in wet and dewatered waste will be compared to determine if pit dewatering results in slopes that can maintain stability under the variety of waste conditions anticipated.

- **Moisture Content in Situ** - Moisture content of the waste material will be measured at several locations throughout the waste pits. This information will allow a reasonable estimation of the average moisture in the waste pits and of the variations of the moisture content. Changes in moisture content with fluctuations in the water table within the waste pits is critical to the development of waste- drying requirements during the project remedial design phase.

- **Plate-Bearing Capacity** - The analysis of Plate-Bearing Capacity will provide general engineering evaluation information of the capacity of the waste in situ to support excavation and equipment.

- **Dust Generation** - Several dust suppressants will be tested on waste in the pits and in the stockpiles. These suppressants include, but are not limited to:

  - Water
  - Foams
  - Surfactants
  - Latex coatings

All surfactants will be tested and evaluated for suitability based on the following criteria. This information will be used to optimize the excavation sequence. The criteria include:

- Ease of application
- Durability
- Application manpower requirements
- Adhesion to waste
- Performance at various moisture levels
- Performance in different weather conditions
- Minimum effective thickness
- Resistance to sloughing
- Amount of waste generation conditions

All surfactants will be evaluated for composition to determine the potential for leachate generation, and chemical and physical interaction between the waste and the surfactant. Material Safety Data Sheets (MSDS) for each surfactant that requires an MSDS will be used to determine interaction potential and to identify personal protection requirements for application personnel.

3.1.4 Wet Excavation Residuals Management

3.1.4.1 Unused Field Samples

Excess field sample material will be returned to each area of excavation in Waste Pits 1, 2, and 3. These materials will be used to backfill the areas of excavation. Additional backfill will be obtained from other areas within Operable Unit 1 that have been characterized under Removal Action 17: Improved Storage of Soil and Debris.

3.1.4.2 Excavation Waste

Approximately 45 cubic yards (15 cubic yards per pit for Waste Pits 1, 2, and 3) of the excavation waste will be used as feed material for the Waste Pit 6 Drying Study. The dried pit material will be placed in white metal boxes and placed on the best available hard-surfaced facility in a manner that is protective of human health and the environment. The dried material will remain in temporary storage until the Waste Pit 6 Drying Study is implemented.

The remaining portion of excavation waste will be returned to each area of excavation in Waste Pits 1, 2, and 3.

3.1.4.3 Wastewater

Wastewater will be managed as described in Section 4, Dewatering, Residuals Management subsection.

3.1.4.4 Contact Waste and Personal Protective Equipment (PPE)

Contact waste is categorized as personal protective equipment (PPE), gloves, wipes, plastic, etc. generated during a sampling event that may be contaminated as a result of coming in contact with the sampled material. Contact waste generated during the DEEP will be collected in a plastic bag and sealed with tape. The bag will be labeled with the name and phone number of the project supervisor and the name of the person placing the bag in the dumpster. The bag will be placed in the CRU3 RI/FS-designated locked dumpster. No Material Evaluation Form will be generated. The trash in the dumpster will go to the trash baler, where it will be compacted and boxed for transport from the site as low-level radioactive waste. Contaminated PPE will be placed in a container and stored with the dried material awaiting the Pit 6 Drying Study.

3.1.5 Wet Excavation Equipment

Equipment:

- Large backhoe
- Front-end loader or tractor-loader
- Mobile lift platform
- Generator
- Submersible electric sump pump
- Lighting
- Electrical cable
- Video camera
- TV monitor

Supplies:

- 6-mil plastic sheeting for liner
- Light-weight plastic (tarp) for covering waste stockpile
- Timber ties and mats
- Orange plastic hazard fencing and fence posts
- Grass seed
- Straw bales
- Dust control agents and application equipment

3.2 WASTE RESLURRY AND PUMPING TEST

3.2.1 Waste Reslurry and Pumping Test Description and Objectives

A waste reslurrying and pumping test will be performed as part of the wet excavation testing. The test will reslurry the waste, which was slurried before it was placed in the waste pit. The reslurrying and pumping test is designed to evaluate the practicality and cost of excavating the waste by slurry pumping. The test will provide information needed for preliminary design of a waste pumping system. This preliminary design will allow a viability and cost comparison between waste excavation by mechanical methods and slurry excavation with mechanical excavation of residual debris.

The test will consist of lowering a slurry pump into an excavation in the waste pits, slurrying the waste, and pumping it to a holding tank. Moisture content, pulp density, and settling rates of the slurry will be measured to provide critical design information i.e., determine the amount of solids that can be pumped from the trenches and the thickeners required to separate out solids. This information will be collected by visual observation of the slurry/clear water interface and measuring the moisture content of samples taken from each vertical foot of the contents of the tank at specified time intervals. The waste and supernatant will be pumped back into the excavation after the test is complete. Three trenches shall be reslurried, one in each waste pit. Slurrying and pump tests will be performed on the second "wet" trench to be excavated in each waste pit.

3.2.2 Waste Reslurrying and Pumping Test Experimental Design and Procedures

This test will be conducted in each of the three waste pits. A slurry pump will be suspended from the backhoe bucket and lowered into the waste pit trench. The pump will operate from 10 to 50 gallons per minute. The waste will be pumped into a tank (minimum 3,000 gallons). The technician will collect pipe samples from the tank immediately after pumping and at selected intervals during settling.

The test will be conducted in an existing wet excavation during the wet excavation portion of DEEP. The tank will be placed on a plastic liner on a unimat base near the trench. Hoses will be connected to the tank near the top. The hoses will have a sampling tee and valve to allow sample collection during pumping. The tank overflow hose will be directed to the excavation.

The slurry pump assembly will be suspended (at a safe standoff distance) from a backhoe bucket or a crane boom and lowered into the waste pit trench. Water will be added to cover the pump inlet to allow the pump to prime itself. The slurry pump is then started. Water flow will be decreased gradually to achieve a balance with sustained slurry pumping of the wastes. The slurry pump will be raised or lowered, as needed, to achieve desired waste inflow and slurry concentration. Water may be added through jet rings or a water hose for priming and normal operation. The waste will be pumped through a rubber hose into a large translucent tank (3,000 gallons). The waste in the tank will also be sampled to measure the pulp density of the slurry after various settling times. The waste slurry will be sampled at the following intervals: 5, 10, 15, 30, 60, 240, and 1,440 minutes. This information will be used to design the thickening and filtration system. This information will also be collected from laboratory testing, but this field settling test will help to evaluate large-scale field effects such as segregation of debris as the waste is pumped.

The slurry pumping will be monitored and videotaped to record the waste/pump interaction. Samples will be taken at regular intervals to measure pulp density. These samples can be correlated to the videotaped pumping record. These samples will be analyzed at the laboratory for settling rates, particle size distribution, specific gravity of solids and moisture content.

After the tank has been filled with slurry, samples will be taken from various strata within the tank. A top port and side valve ports will be installed in the tank for stratified sampling. After the tank has been filled with waste, strata samples will be taken at regular intervals depending on the settling rate of the slurry. Recommended intervals were listed previously. These intervals may be changed by the field operations lead after initial settling rates have been observed.

The contents of the tank will be pumped back to the excavation after settling is compete (or 24 hours). The tank top will have an opening 36 inches in diameter to insert the pump into the tank to reslurry and pump the material back into the pit. If possible, the waste will be agitated and drained by gravity back into the pit.

Water which separates form the waste in the trench will be pumped with a sump pump to a holding tank for disposal. The trench can be backfilled as with the other wet excavations.

The contents of the tank will be pumped back to the excavation after settling is complete (24 hours). The tank top will have an opening 24 inches in diameter to insert the pump into the tank to reslurry and pump the material back into the waste pit. If possible, the waste will be agitated and drained by gravity back into the waste pit. Water which separates from the waste in the trench will be pumped with the sump pump to a holding tank for disposal.

3.2.3 Waste Reslurrying and Pumping Test Data Collection, Analysis, Interpretation, and Reporting

3.2.3.1 Waste Reslurrying and Pumping Test Data Collection

The following waste slurry-related information will be obtained during this phase of the DEEP:

- Solids content at which the waste is pumpable
- Minimum amount of water to maintain sustained pumping for distinct waste strata
- Jetting water flow rate and pressure
- Slurry pumping flow rate
- Visual and video observations of waste movements in the trench
- Moisture content of the waste prior to pumping
- Moisture content of the slurry during pumping
- Moisture content of slurry at distinct strata in the tank after pumping at selected intervals
- Visual and video observations of waste entering tank during pumping
- Visual observations of the waste settling in the storage tank
- Slurried waste flow ability versus slurry density
- Settling rates and particle size distribution
- Specific gravity of solids

This information will be used to design the pumping, thickening and filtration system. Much of this information can be collected from laboratory testing; however, the field settling test will help to evaluate large-scale field effects, such as segregation of debris as the waste is pumped. Filtration data will be derived from a laboratory test, but the results from this field test will provide input to filter sizing. Enough information should be produced by this test to estimate the costs of slurry excavation relative to mechanical waste excavation.

3.2.4 Waste Reslurrying and Pumping Residuals Management

Waste will be controlled to prevent release to the environment during this test. Waste will be pumped in a sealed line (preferably double walled) to prevent spills. The hose will be attached to the pump and the tank. The ground under the hose will be lined with plastic and graded to drain back into the trench (or double walled pipe/hose will be used.). The venting from the tank will be equipped with a mist eliminator and will be monitored to assure no unacceptable release to the air.

Waste pumped to the tank will be pumped back into the trench when the test is completed. Excess water will be pumped to a tank and treated along with the water from the dewatering wells. Residual sludge in the bottom of the test tank will be vacuumed out with the sites large vacuum truck. The tank will be rinsed out after the test.

3.2.5 Waste Reslurrying and Pumping Test Equipment

Equipment

- Agitator slurry pump (50 gpm) Toyo or equivalent, with jetting water nozzle assembly
- Temporary power supply for pump
- Sling to suspend pump from backhoe or crane
- Slurry hose from pump to tank
- Polypropelene or fiberglass tank (3000 gallons strong enough for specific gravity fluids 1.8) with drain, overflow, vent, 6 side ports, and 3 ft. manway in top (approximately 8 feet diameter 6-7 feet high)
- Wooden platform for tank (unimats)
- Water supply pump with pressure gauge
- Slurry overflow hose
- Plastic liner under tank > 10 mil thick
- Water hose within line flow meter
- Slurry hose from pump to tank (30 to 60 ft)
- Wooden platform for tank (unimats)
- Water hose within line flow meter

SECTION 4
DEWATERING

This section describes dewatering tests to be performed during the Dewatering Excavation Evaluation Program (DEEP).

4.1 TEST DESCRIPTION AND OBJECTIVES

Dewatering the waste in-situ may be economically advantageous over removing the water thermally and may make excavation of the pits easier and safer. To determine if the in-situ dewatering is more economical than removing the water with a dryer, the dewatering system must be defined. To determine if installing a dewatering system will improve excavation conditions, an area of the pits must be dewatered and excavated. The first two phases of the dewatering test respond to the first information gap. The third phase responds to the second information gap.

Dewatering tests will be performed in three phases to support design optimization for the final dewatering test systems. Phase 1, the Comparative Well Test, will be conducted in Waste Pit 1. A driven well point will be compared to a drilled and cased well. Two pumping methods will also be compared. Phase 2 will attempt to confirm (or revise) well spacing distances that will be used in the final test of dewatering systems (Phase 3). Phase 2 will be conducted in Waste Pits 1 and 3. Phase 3 will involve dewatering an area in Waste Pit 1 and an area in Waste Pit 3 to facilitate excavation of a trench in each pit.

Phases 2 and 3 are designed according to the anticipated results of Phases 1 and 2, respectively. If the results are different from those anticipated, then the tests will be modified accordingly by the lead geologist.

Phase 1 - Comparative Well Test - The objectives of Phase 1 are:

- Determine if a driven well point will work in the fine-grained pit wastes
- Determine if there are any installation or development difficulties for the proposed drilled well design (drilled, cased, and sand packed)
- Determine if a surface well point pump will work adequately for a more shallow well and how it compares to a submersible pump
- Determine pumping characteristics for the wells and expected sustainable flows

Data from Phase 1 are expected to confirm (or prompt revisions to) the drilled well design in Phase 2 testing. Data gathered will include flow rate from the well in gallons per minute and total volume of water pumped (in gallons); well water levels in pumping wells and wells used for observation; well or well point discharge line pressure readings; and vacuum readings within the well or well point casing.

Phase 2 - Well Spacing Test - The objectives of Phase 2 well-spacing testing are to determine the effect on the flow rate from vacuum enhancement, E-O enhancement, and E-O and vacuum enhancement used in combination; and to determine if the proposed 20-foot well spacing for Phase 3 will be adequate for dewatering. For the spacing testing, nine wells will be installed in Waste Pit 1 and 16 wells will be installed in Waste Pit 3. Various well combinations will be pumped and observations made to determine the zone of influence of the final well spacing. This phase will collect and document the same type of data as gathered in Phase 1. In addition, total energy use for E-O testing in kilowatt-hours (kWHRs) and direct readouts of power, voltage, and amperage will be recorded.

Phase 3 - Full Installation Dewatering Test - The primary objective of Phase 3 is to dewater selected areas of Waste Pits 1 and 3, to facilitate trenching with minimal interference from groundwater. This phase will include installing the full complement of wells in Waste Pits 1 and 3, then proceeding with dewatering. The best well design and spacing, as determined in Phases 1 and 2, will be installed in Phase 3. These wells will be pumped for several weeks to dewater those areas of the waste pits such that dry or post-dewatered excavations can be performed in the waste pits.

This phase will collect performance data, as follows:

- Variations in the volumetric rate of water removal over time
- Increased in shear strength of the waste as dewatering progresses
- The magnitude and area of influence of sustainable vacuum for the downhole pump configuration versus the surface-based pump configuration, if two configurations are adopted
- Water table elevations over time during pumping
- Vacuum measurements over time, if vacuum techniques are adopted.

4.2 EXPERIMENTAL DESIGN AND PROCEDURES

4.2.1 Surveying

Surveying will be performed to locate the borings, dewatering wells, and piezometers. Additionally, surveying of each waste pit's surface will be used to measure subsidence due to dewatering and excavation.

Subsidence at the surface of each waste pit to be dewatered will be measured in the following manner:

- A grid pattern will be established across each Waste Pit.
- Grid line intersections will be surveyed prior to dewatering and the elevations recorded.
- Following dewatering the grid line intersections will be surveyed and the resulting elevations compared to the pre-dewatering elevations.

4.2.2 Well Construction and Installation Requirements

Waste permeability must not be reduced during well construction and installation. Well borehole advancement methods will be designed to minimize any potential for smearing borehole sidewalls. Installation of the well casing, screen, and sand pack must also be accomplished in a manner that does not reduce the waste permeability at the borehole face. The driven well point will be installed by hammering, pre-augering, or jetting.

4.2.3 Well Development Requirements

Well development for each of the well types will be accomplished by bailing and surging. Resultant wastewater will be collected and sent to the existing Fernald Environmental Management Project (FEMP) wastewater treatment system before being discharged to the Great Miami River in accordance with National Pollutant Discharge Elimination System (NPDES) effluent limits set at manhole 175 (*4001). Development of these wells will be an iterative process, but completion will be terminated once pumped water reaches a "steady state" clarity.

4.2.4 Phase 1 - Dewatering and Testing

4.2.4.1 Phase 1 Dewatering

The comparative well test will be conducted with a line of three wells installed in Waste Pit 1; one driven well point and two drilled wells. The wells will be spaced as shown in the General Arrangement Plan

(Figure 4-1). The two drilled wells will be used in the well spacing test system in Waste Pit 1 during Phase 2.

The designs of the driven well point and the drilled well using a surface well point pump are shown in Figures 4-1 and 4-2. The design of the drilled well using a downhole submersible pump is shown in Figure 4-3. The well design is the same for both, but the pumping systems are different.

Tentative well depths are shown in the figures for each well, based on a well termination depth 5 feet above the top of the liner in Waste Pit 1. These well depths will be confirmed prior to construction, based on surveyed ground surface elevations at each well location and the previously established top-of-liner elevation in Waste Pit 1 (elevation 563$\pm$).

A downhole submersible pump will be installed in one of the drilled wells. The discharge pipe for the pump will pass through an airtight seal in the well casing so a vacuum may be applied to the well. A valve will be provided on the discharge line for control of the discharge rate and a check valve is also included to prevent the system from draining. A fitting and valve at the top of the well is also provided for attachment of the vacuum line (Phase 2). The driven well point and the other drilled well will use a conventional surface-located well point pump (centrifugal and vacuum) for removing water from the wells (see Figures 4-2 and 4-3). The well caps will be sealed to be air tight. A valve will be installed in the drop pipe to control the flow rate out of the well and a check valve will prevent the system from draining into the well.

The drilled well will include a reinforcing bar (rebar) installed in the well sand pack attached to the electro-osmosis (E-O) system wiring. When active, the steel rebar serves as the cathode in the E-O electrical circuit.

4.2.4.2 Phase 1 Testing Procedure

Phase 1 testing and evaluation will occur in three stages. The following testing descriptions and procedures for each stage are subject to field modification by the lead geologist based on interim testing results. In particular, drilled well/well point pumping rates and pumping periods will be subject to adjustment based on field review of data. Residual wastewater generated during Phase 1 testing will be collected in tanks at the waste pit, trucked to the existing FEMP wastewater treatment system (Plant 8), before being discharged to the Great Miami River in accordance with NPDES effluent limit at outfalls *4605 and *4001.

Stage 1 - Stage 1 will evaluate construction and development methods, described in Sections 4.2.2 and 4.2.3, used for installation of the two drilled wells and the one well point. Any resultant construction-related well design changes will be incorporated into the Phase 2 well design and testing.

Stage 2 - Stage 2 will evaluate the performance of the single well point pumped with a well point pump. Flows, if any, will be noted and pumping will continue until the lead geologist is satisfied that no significant sustained flow can be attained. If flows are observed, well point flow will be adjusted to provide a uniform, sustainable flow from the well point. During the well point pumping, observations will be made in the two non-functioning wells to monitor any changes in water level and vacuum levels.

Stage 3 - Stage 3 testing will compare the pumping systems used for the two drilled wells and will establish tentative pumping rates for the Phase 2 testing. One well will use a down-hole submersible pump and the other will use a surface well point pump. With the shallow depth of the Waste Pit 1 wells (approximately 15 feet), both pumping systems are expected to work satisfactorily, although the well with the submersible pump is expected to offer an advantage in vacuum application (part of Phase 2 testing). The vacuum system used with the submersible pump is separate from the pump, so the vacuum applied to the well is constant, even if the pump is pumping water. Alternatively, with the well point pump, the pump and vacuum are combined, so the vacuum decreases when water is being pumped. Vacuum readings from the well casing ports will be collected at the direction of the lead geologist.

Both wells will be pumped starting at very low rates, approximately 0.1-0.25 gallons per minute (gpm); well water levels and durations sustained during pumping will be monitored. If pumping is continuous, pumping rates will be increased in increments of approximately 0.1-0.25 gpm. Pumping rates will continue to be increased until a uniform, sustained flow, with minimal incremental decline in well water level, is observed. Testing should then be continued, in the same manner, beyond the sustainable flow rate, to the rate where the pumping occurs only about 25 percent of the time; that is, the pumping rate is about four times the sustainable flow. All of the flow testing is expected to establish sustainable pumping rates for the Phase 2 testing.

4.2.5 Phase 2 - Dewatering and Testing

Phase 2 was designed based on the anticipated results of Phase 1. It is anticipated that Phase 1 testing will show that the drilled well with the well point pump is the most effective well/pump design for dewatering the shallow wells in Waste Pit 1 and the drilled well with the submersible pump is the best well/pump design for the deeper wells in Waste Pit 3.

4.2.5.1 Phase 2 Dewatering

The well spacing testing will be conducted with three lines of dewatering wells. Dewatering wells will be located in Waste Pits 1 and 3 as identified on the well location plan (Figures 4-4 and 4-5). The long line of wells (DW3-1 through DW3-11) in Waste Pit 3 will be used to test the E-O system and the short line (DW3-20 through DW3-24) will be used to test the vacuum enhancement system. Three of the wells in Waste Pit 1 and 10 of the wells in Waste Pit 3 are placed at the anticipated final well spacing and will become part of the Phase 3 test dewatering system. The additional wells will be installed at half the anticipated final well spacing. Two additional wells will also be at the ends of the long line of wells Pit 3. These additional wells will be used for testing purposes, but are not expected to be pumped in the final dewatering test systems.

The design and material specifications for the dewatering wells using the surface well point pump (Waste Pit 1) are shown in Figure 4-2; those for the drilled wells with submersible pumps (Waste Pit 3) are shown in Figure 4-3. It is anticipated these well designs will be satisfactory, although there may be design revisions that may occur following the well comparative testing (Phase 1 testing) planned prior to this test. Also, if the submersible pump wells are much more effective for application of vacuum, then all wells will use submersible pumps.

The dewatering wells will be drilled and sand packed with 6-inch diameter casings and screens in 16-inch-diameter holes. The dewatering well design will allow for use of either a surface mounted well point pump (with a water pickup drop pipe in the well) or a down hole submersible pump (with water discharge pipe). The well caps and any penetrations through the well casings for piping and electrical wiring will be sealed to be air tight. A valve will be provided in the piping at the top of each well for control of the pumping rate. A check valve will be provided to prevent backflow and draining. All wells will have a fitting and valve for attachment of a vacuum line.

Tentative well depths are shown on the figure for each well, based on a well termination depth 5 feet above the top of the liner in each waste pit to minimize the risk of puncturing the liner. These well depths will be confirmed prior to construction based on surveyed ground surface elevations at each well location and previously established top-of-liner elevations in each waste pit.

A separate cathode (No. 5 rebar) will be installed in the dewatering well sand pack zone as part of the E-O system (see Figures 4-2 and 4-1). The separate cathode allows the use of poly vinyl chloride (PVC) well screen and casing to minimize well installation cost and disposal cost when excavation begins. It is recommended a spare cathode also be installed during initial well construction.

Piezometers - Fourteen piezometers (PZ1-1 through PZ1-5) and (PZ3-1 through PZ3-9) will be installed and used to function as both water table piezometers and as vacuum piezometers. The locations and configuration of the piezometers are identified in Figures 4-4 and 4-5 for Waste Pits 1 and 3, respectively. The design of the piezometers is shown in Figure 4-3. This design allows use of the piezometer for both vacuum and water level measurements.

Each piezometer will be hermetically sealed when the vacuum piezometer function is required. The piezometer will be constructed with a long seal zone to prevent air short circuits from surface to filter pack through any defects in the bentonite well seal.

Each piezometer will have a gauge attached to measure vacuum. Additionally, each will have provisions for determining water level for both open atmospheric conditions and sealed vacuum conditions. Field conditions will take into account vacuum could result in artificial raising of the wells water level due to decreased air pressure.

Depths of the piezometers will also only extend to 5 feet above the waste pit liner (based on the current established liner elevation). Surveyed waste pit surface elevation at each piezometer location will be used to reaffirm estimated well depth prior to piezometer installation.

E-O Systems - The E-O systems for Waste Pits 1 and 3 will be powered by a direct current (DC) generator. The DC-generator controls must provide for a range of operating conditions as resistances in the wastes change with anticipated reduced moisture content. Equipment performance requirements will be based on the Phase 3 full-system configuration; however, the equipment must also satisfactorily meet the reduced need for Phase 2 testing. The E-O system will use a steel rebar, placed within the sand pack of the dewatering well, as the cathode(-) and separate anodes (+) spaced around the wells as shown in Figures 4-4 and 4-5. No. 5 (5/8-inch diameter) steel rebar will be used for the cathodes and anodes. Anodes will be pushed or driven to the same depth as the dewatering wells, maintaining 5 feet of clearance to the top of the waste pit liner. Cathodes will also extend over the depth of the dewatering well as shown in Figures 4-2 and 4-3. Some cathodes will be switched to act as anodes in Phase 3 testing. To eliminate potential problems from cathode deterioration, two cathodes (one as a spare) will be installed.

Preliminary testing of waste resistance will be necessary to assure assumed operating conditions and equipment characteristics are compatible and E-O system operation and dewatering enhancement still seems possible. The waste is heterogenous and the electrical characteristics are unpredictable. Testing will determine if it is possible that E-O can be used, and if the tentative equipment sizing assumptions are reasonable. Presuming E-O testing continues, the spacing testing work would provide additional information to further refine the design and operation of the E-O system for use in the final phase (Phase 3) of dewatering testing.

4.2.5.2 <u>Phase 2 Testing Procedure</u>

Well spacing testing will be performed in two stages. For the first stage of testing, only well pumping will be conducted. The second stage of testing will add the E-O and vacuum systems to enhance dewatering.

The stages will be conducted in a series of steps that will start with only the farthest spaced wells (with 40- to 60-foot spacing) being tested. Additional wells will be pumped to test smaller well spacings (30-, 20- and 10- foot spacings).

During testing, the piezometers associated with each string of spacing testing wells will be used to collect water level data and vacuum data when appropriate. Also, for most of the testing, there will be inactive dewatering wells which will also be used for data collection.

All the following testing descriptions and procedures will be subject to field modification by the lead geologist based on interim testing results. In particular, dewatering well pumping rates and pumping periods will be subject to adjustment based on field review of data.

The E-O enhancement testing is expected to require preliminary testing and field adjustment to optimize well flows for a system that is expected to be continually changing (i.e., reduced waste pit water levels and increased waste resistances).

Stage 1 - No Dewatering Enhancements (Gravity Drainage Only)

Step 1 - Two end wells and a center well in a line of wells in each waste pit will be pumped at a steady state rate to define zone of influence around each line of dewatering wells. In Waste Pit 1 these wells will be spaced at 40 feet. In Waste Pit 3, only the long line of wells will be pumped and the three dewatering wells will be spaced at 60 feet. Water levels in the remaining dewatering wells and the piezometers will be monitored to determine drawdown rates and the zone of influence.

Step 2 - The overall objective of Step 2 is to establish or confirm a well spacing. Assuming the wells in Step 1 were spaced too far apart, Step 2 will pump wells of decreasing distance until optimum well spacing has been achieved.

Stage 2 - E-O and Vacuum Enhancement

The objective of Stage 2 is to determine what improvements and vacuum enhancement may have on dewatering. It is assumed that a 20-foot well spacing and constant pumping rate was established during Stage 1.

E-O testing should be conducted in Waste Pits 1 and 3. Only the long line of wells in Waste Pit 3 shall be tested with E-O. E-O should increase the pumping rates. Depending on the results of the E-O enhancement, the well spacing may be able to be increased to minimize the number of wells, while achieving comparable dewatering flows or total volumes.

Vacuum testing will be conducted in Waste Pit 3 using only the short line of wells, where the separate vacuum system is installed. If the results are insufficient then E-O may be used in conjunction with vacuum enhancement.

Step 1 - With pumping continuing from Stage 1, operating conditions (pumping rates, draw-down levels in surrounding wells, etc.) without E-O and vacuum dewatering enhancements will be recorded.

Step 2 - The E-O system will be activated and adjusted so as to be imparting approximately 0.015 kilowatts per cubic yard (approximately 5 kWHR over a 14-day period) of waste within the zone affected by the E-O system. System operating conditions for voltages and current flows must also be maintained in appropriate bounds.

The vacuum system should be activated and operated to apply maximum possible vacuum in the test wells. The wells not being pumped and the piezometers will be monitored to evaluate the extent of vacuum propagation through the waste.

Step 3 - Based on flow rates and water level data, adjustments to the E-O system operation may be warranted. Depending on continuing results of the E-O and vacuum enhancement tests, dewatering should continue, with adjustment for expected conditions change, until dewatering rates decline, or sufficient data is collected to evaluate each system.

4.2.6 Phase 3 - Full Installation Dewatering Testing

The Phase 3 system is designed with the assumption that the results from Phases 1 and 2 will indicate that the drilled, sand-packed wells spaced at 20 feet apart are the best well design for dewatering the pits and that well point pump is the best pump for the shallow Pit 1 wells and submersible pumps are the best pumps for the deeper Pit 3 wells. It is also assumed that E-O and vacuum enhancements must be used together. If the results of Phases 1 and 2 are different than what has been assumed, the test design for Phase 3 will be modified accordingly.

The third phase of testing will comprise installing the full complement of wells in Waste Pits 1 and 3 and then proceeding with the dewatering. The primary objective of Phase 3 is to dewater selected areas of Waste Pits 1 and 3 to facilitate trenching with minimal interference from groundwater.

The wells will each be installed with full E-O, vacuum and/or dedicated pump capability as determined from Phase 2.

4.2.6.1 Phase 3 Dewatering Wells

Twenty-seven wells will be installed in Waste Pit 3 and 15 wells will be installed in Waste Pit 1. These numbers include 16 Phase 2 wells in Waste Pit 3 and 9 Phase 2 wells in Waste Pit 1. The wells will be configured in Waste Pits 1 and 3 as identified on the well location map (Figure 4-6). These wells represent the location and arrangement of the final test dewatering system. In all cases, wells will be laid out in an approximately square array at a spacing of 20 feet. Anodes used for the E-O system will be evenly spaced between the wells. In all waste pits, anodes will be spaced at 20-foot centers between the wells. Anode spacing is indicated in Figures 4-7 and 4-8.

Unless revised because of results of the previous testing (Phases 1 and 2), the designs and specifications for the wells will be the same as used in the well spacing test (Figures 4-2 and 4-3).

4.2.6.2 Phase 3 Testing Procedure

Once the arrays have been installed the wells will be adjusted for optimal performance and the dewatering period will commence. Although the actual duration for dewatering is not known in advance, a period of 4 to 6 weeks is estimated. This may be modified on the basis of information obtained in Phases 1 and 2.

4.3 DATA COLLECTION, ANALYSIS, INTERPRETATION, AND REPORTING

4.3.1 Data Collection

This test will collect and evaluate the same data as the wet excavation test. The analysis will generally be the same with specific attention to changes in moisture content and shear strength. To provide specific in situ information for use in the investigation of dewatering concepts, pumping and observation wells will be installed within the waste pits. During the installation and completion of these wells, the following field generated documentation will be generated:

- Water Quality Field Collection Report
- Field Activity Logs
- Lithologic Logs
- Sample Collection Logs
- Surface/Groundwater Sample Collection Logs
- Well Completion Logs
- Monitoring Well Development Form
- Standard Penetration Test Information

For Phases 1 and 2, the data to be collected directly from each well and well point include the following:

- Flow rate (in gpm) from the well and total flow in gallons
- Well water levels in both pumping wells and wells used for observation
- Well or well point discharge line pressure readings will be recorded
- Vacuum readings within the well or well point casing will be recorded

In addition, the following other data should also be collected:

- Water level data in designated observation wells
- Vacuum readings within designated observation wells

Field observations will include:

- Optimum well spacing
- Type of wells that work best
- Water flow rates based on daily measurements
- Increase in waste strength as dewatering proceeds.

All dewatering tests will collect components of the following project-related information. The comparative well test will collect the following information:

- **Installation and Development Problems with Each Well Type** - Anticipated problems associated with the installation and development of each well include the following:

- **Drilling** - Penetration, sidewall smearing, surface contamination, etc.

- **Development** - Screen size, screen clogging, sand pack size, sand pack clogging recharge rate, etc.

- **Vacuum in Pumping and Observation Wells** - Vacuum in both the pumping wells and vacuum piezometers will be evaluated to determine the effective radius of groundwater drawdown of the vacuum pumping wells. The ability of the vacuum system to maintain a vacuum will be evaluated, along with the increased well yield due to the vacuum enhancement.

- **Water Levels in Pumping and Observation Wells** - Groundwater levels within the pits will be measured to determine the aquifer drawdown in both pumping and observation wells. This drawdown information in combination with the basic geotechnical properties of the waste can be used to calculate the in situ hydraulic conductivity of the wastes in the immediate vicinity of the pumping wells along with determination of the effectiveness of each well type in the fine-grained pit waste.

- **Energy and Power Use in E-O** - The energy requirements relative to increasing water recovery will be evaluated to determine the feasibility and efficiency of E-O. The cost of E-O will be compared to waste drying to optimize the remedial design.

4.3.2 Data Analysis

Well Yield - This information will be used to design the optimum dewatering well system during remedial design. This information can be used to calculate the hydraulic conductivity of the waste matrix within the immediate vicinity of the wells. The transient drawdown analysis will use the equations shown below:

$$T = QW(u)/4\pi s$$

Where:
T = transmissivity
Q = pumping rate
$W(u)$ = well function of u
s = drawdown

$$S = 4Ttu/r^2$$

Where:
S = storage coefficient
T = transmissivity
t = time
r = distance from pumping well to observation well

$$T = Kb$$

Where:
T = transmissivity
K = hydraulic conductivity
b = aquifer thickness

4.4 EQUIPMENT

4.4.1 Phase 1

For Phase 1, comparative well testing in Waste Pit 1, the following equipment, materials, and test instrumentation will be required:

Equipment:

- One drilled well and appurtenances set up for a surface well point pump
- One driven well point and appurtenances set up for a surface well point pump
- Well point pump and collection piping system
- One drilled well with submersible pump, discharge line and appurtenances
- Alternate Current (A-C) generator power supply system
- Discharge water piping system and discharge tank

Instrumentation:

- Flow meters (rate and total) for both drilled wells and the one well point
- Vacuum gauge for each well and well point casing
- Pressure gauge on discharge pipe from well and well point to the well point pump
- Automatic water level sensor and recorder for both wells and the one well point

4.4.2 Dewatering - Phase 2

For Phase 2, well spacing testing, the following equipment, materials, and test instrumentation are required:

Equipment:

Waste Pit 1

- Nine dewatering wells and appurtenances
- Five combined piezometers
- Well point pump (with gas or diesel engine drive) and collection piping system
- E-O system and power supply
- A-C generator power supply system
- Discharge Water piping system including a discharge tank

Waste Pit 3

- 16 dewatering wells with submersible pumps and appurtenances
- Nine combined piezometers
- Well discharge collection piping system
- Vacuum pump and vacuum piping system
- Electro-osmosis (E-O) system and power supply

- AC generator power supply system
- Discharge water piping system, including a discharge tank

Instrumentation:

Waste Pit 1

- Flow meters (rate and total) for each dewatering well
- Vacuum gauge for each dewatering well casing
- Pressure gauge on discharge pipe from each dewatering well
- Automatic water level sensor and recorder for each dewatering well
- Vacuum gauge on each combined piezometer
- Automatic water level sensor and recorder for each combined piezometer
- Energy use meter (kWHRs) and voltage and current meters for E-O operation

Waste Pit 3

- Flow meters (rate and total) for each dewatering well
- Vacuum gauge for each well casing
- Pressure gauge on discharge pipe from each well
- Automatic water level sensor and recorder for each well
- Vacuum gauge on each combined piezometer
- Automatic water level sensor and recorder for each combined piezometer
- Energy use meter (kwhrs) and voltage and current meters for E-O operation

4.4.3 Dewatering - Phase 3

Equipment:

All equipment (with exception of some of the submersible pumps) exists and is in position from the well spacing test (Phase 2 testing). Submersible pumps and separate vacuum pumps will be used in Waste Pit 3. Waste Pit 1 will use surface-based well point pumps to provide both water pumping and vacuum. It is possible that separate vacuum pumps may be used, depending on the results of Phase 2 testing. Phase 2 will decide whether to use surface-based well point pumps or to use submersible pumps for Pit 1 dewatering. The following equipment is required to perform Phase 3 activities:

Waste Pit 1

- 15 wells (Phase 2 wells plus 6 more) and appurtenances
- Surface well point pump or dedicated submersible pump and collection piping system
- E-O system and power supply
- A-C generator power supply system.
- Well discharge water system.

Waste Pit 3

- 27 wells (Phase 2 wells plus 11 more)with submersible pumps and appurtenances

- Well discharge water system
- Vacuum pump and vacuum piping system
- E-O system and power supply
- A-C generator power supply system
- Well discharge water system

Instrumentation:

For the final dewatering test, the following test instrumentation is required:

Waste Pit 1

- Flow meters (rate and total) for each well
- Vacuum gauge for each well casing
- Pressure gauge on discharge pipe from each well (only if surface pump option is selected for final test)
- Automatic water level sensor and recorder for each well
- Vacuum gauge for each combined piezometer.
- Water level sensor and recorder for each combined piezometer.
- Energy use meter (kWHRs) and voltage and current meters for E-O operation

Waste Pit 3

- Flow meters (rate and total) for each well
- Vacuum gauge for each well casing
- Pressure gauge on discharge pipe from each well
- Automatic water level sensor and recorder for each well
- Vacuum gauge for each combined piezometer.
- Water level sensor and recorder for each combined piezometer.
- Energy use meter (kWHRs) and voltage and current meters for E-O operation

4.5 DEWATERING RESIDUALS MANAGEMENT

4.5.1 Wastewater

The total volume of wastewater to be generated by the project is difficult to quantify, however, current estimates call for approximately 105,000 gallons of water per day to be pumped during the initial three to four days of the project. is estimated to be approximately 105,000 gallons of water per day, to be pumped during the initial three to four days. After start-up operations are complete, it is anticipated the pumping rate will decline to a relatively stable rate of 5,000 gallons per day. Two additional 20,0000 gallon tanks will be installed within the Waste Pit area to supply surge capacity for wastewater produced during initial pumping operations. These tanks will also be used to provide storage capacity once the pumping rate stabilizes.

Figure 4-9 describes the treatment and discharge process that DEEP wastewater will undergo. Wastewater will be pumped for the 20,000 gallon tanks periodically and transferred to the existing Plant 8 treatment system using a 5000 gallon mobile tank truck. Plant 8 has a treatment capacity of 30,000 gallons per day and utilizes lime precipitation, sedimentation, and filtration to remove uranium, heavy metals and fluoride from wastewaters. At Plant 8, the wastewater will be treated to remove uranium and other heavy metals through lime precipitation, sedimentation, and filtration. Treated effluent from Plant 8 will be discharged to the uranium-contaminated side of the General Sump for sampling and eventual transfer to the Biodenitrification (BDN facility)., where it will be combined with other wastewater and discharged to the Bio-Denitrification (BDN) Facility.

The BDN facility consists of the BDN Surge Lagoon (BSL), a High Nitrate Storage Tank (HNT), four BDN Towers, followed by the BDN Effluent Treatment System (NPDES outfall *4605). At the BDN facility, removal of organic constituents will occur through aeration within the BDN Towers and through activated sludge processes at the BDN-Effluent Treatment System (BDN-ETS). After treatment at the BDN-ETS, the wastewater will be discharged through the NPDES-permitted outfall *4605 (BDN-ETS), with ultimate disposition occurring to the Great Miami River (GMR) via outfall *4001 (MH-175).

Wastewater will be treated and discharged through the NPDES-permitted wastewater treatment system to the Great Miami River.

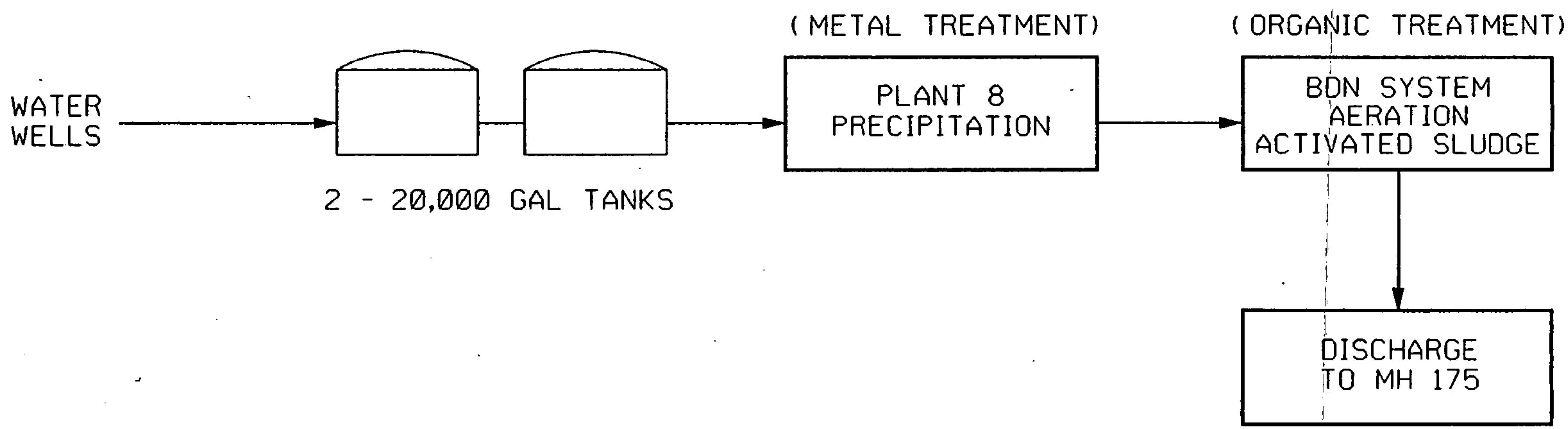


Figure 4-9
DEEP WATER TREATMENT

SECTION 5
DRY EXCAVATION

5.1 DRY EXCAVATION TEST DESCRIPTION AND OBJECTIVES

Dry (post-dewatered) excavation activities include excavation of a dry trench in Waste Pit 1 and excavation of a ramp in Waste Pit 3. The dry trench and ramp will be excavated after the waste has been dewatered using dewatering wells. (The dryness of the waste will depend on the success of the dewatering.) The trench in Waste Pit 1 will be completed and backfilled before the ramp in Waste Pit 3 is started. Dry trench and ramp will be excavated to help characterize the condition for planning the full-scale excavation. Locations for all proposed excavations are provided in Figure 2-1.

The objective of these excavations is to provide data on:

- The degree of success of the waste dewatering program
- Whether tracked equipment can be driven directly on a ramp in Waste Pit 3
- The angle repose for the dewatered waste
- Slope steepness comparisons between the wet (pre-dewatered) excavations and dry (post-dewatered) excavations
- Determine the conditions of the liner material underlying the waste in Waste Pit 3.

Samples will be taken from the waste stockpile and stored appropriately in steel boxes for treatability studies at a later date. Coatings and surfactants will be applied to the waste stockpiles to test each surfactant's ability to contain the waste in avoiding windborne emissions.

5.2 WASTE PIT 1 DRY TRENCH EXCAVATION

5.2.1 Waste Pit 1 Dry Trench Excavation Experimental Design and Procedures

The dry trench excavation in Waste Pit 1 must be excavated so as not to damage the dewatering wells that will continue to be operated around the perimeter of the excavation. The locations of the proposed trench and the surrounding dewatering wells are illustrated in Figure 2-1.

5.2.1.1 Deactivate Inner Wells

The dry trench excavations are centrally located in the midst of an array of dewatering wells. Prior to starting the trench excavation, the inner-wells shall be deactivated. The remaining wells will keep the dewatered area free of inflow from the surrounding pit area. Following deactivation of the inner wells, the pumps with attached wiring, piping, and connections shall be removed and salvaged. Plastic well casings will be left in place and demolished as the excavation proceeds.

5.2.1.2 <u>Stockpile Areas</u>

Stockpile pads shall be sloped to drain back toward the excavation. One or two waste pads may be needed, depending on the slopes that can be obtained in the excavation. The thickness of the cap in Waste Pit 1 is approximately 6 inches to 2 feet. Containment berms will be made with straw bales lined up to form a barrier. The bales will be covered with the 6-mil plastic sheeting.

5.2.1.3 <u>Excavation</u>

After lining the pad areas and constructing containment berms, the capping can be removed. Capping will be stripped down until there is a definite appearance of waste or sludge-like material. Excavation progress will be continually monitored to ensure that contaminated waste or sludge is not mixed with excavated capping. All stockpiled areas shall be covered with plastic sheeting or a dust control agent will be applied (see Attachment D, Dust Suppressant Testing) when excavations are not in progress.

For dry trenching at Waste Pit 1, an attempt should be made to excavate down to 15 feet deep while maintaining near vertical side walls. A small amount of sloughing may occur with the side walls holding at a 1 vertical to 1 horizontal slope. In Waste Pit 1, the waste is deeper than 15 feet, so the excavation will not penetrate into the waste pit liners. The initial attempt to excavate down to 15 feet in waste will depend upon the strength or stability of excavated waste as demonstrated while excavating. If the waste holds at steep slopes, a 14-foot by 28-foot trench shall be the maximum size of excavation. If the side walls immediately collapse, the remaining trench excavation would be carried to a depth of 10 feet or to a depth determined by the field operations managers. In this case, where the waste begins to slough, the trench walls will be laid to a slope that the waste can hold. Since the wall slopes will be flatter in a sloughing condition of the waste, an area no greater than 30 feet by 30 feet will be disturbed.

5.2.1.4 <u>Reclamation</u>

Following trench excavation the waste will be backfilled into the trench. The sludge will need to be compacted with the backhoe bucket as it is placed in the trench. When the waste stockpile is backfilled down to the plastic liner, the liner will be disposed of in the trench. Next the cap material will be placed on the waste and compacted with the excavation equipment by driving on the disturbed areas. The disturbed areas will then be seeded and the straw from the hay bales (berm) will be dispersed over the seeded areas. Caution must be used in backfilling the trench such that rubber tired equipment does not create any slope failures.

5.2.1.5 Equipment Decontamination

When salvageable equipment is no longer needed for the DEEP project, gross decontamination will be performed at the project site, and the equipment will then be transferred to the D&D facility for further decontamination.

5.2.2 Waste Pit 1 Dry Trench Equipment

Equipment:

- Large backhoe
- Front-end loader or tractor-loader
- Mobile lift platform
- Generator
- Submersible electric sump pump
- Lighting
- Electrical cable
- Video camera
- TV monitor

Supplies:

- 6-mil plastic sheeting for liner
- Lightweight plastic (tarp) for covering waste stockpile
- Timber ties and mats
- Orange plastic hazard fencing and fence posts
- Grass seeding
- Straw bales
- Dust control agents and application equipment

5.3 WASTE PIT 3 RAMP EXCAVATION

5.3.1 Waste Pit 3 Ramp Excavation Experimental Design and Procedures

A "full-sized" ramp will be excavated into Waste Pit 3 sludge. The purpose for the ramp excavation is to determine if tracked excavation equipment can be operated on sludge. The proposed ramp excavation is illustrated in Figure 5-1 and is located in the south-east portion of Waste Pit 3, near the Clearwell.

The ramp itself is 20 feet wide which will be excavated at -12°. The ramp will cut through the capping and ostensibly another 3 feet into contaminated sludge. At the bottom, a circular shaped floor will be excavated 30 feet in diameter.

Cap thickness varies; it is thinnest in the southeast part of the excavation and thickens to the northwest. The planned excavation contains 750 cy, consisting of 550 cy of cap and 200 cy of sludge. An attempt will be made to extend the excavation 3 feet down into the sludge where a 30-foot diameter circular pit floor would be excavated. It was presumed that slopes in the overlying clay capping could be carried at 2V to 1H while slopes in the weaker sludge would stand at 1V to 2H. If conditions are favorable to driving tracked equipment on the waste, then the ramp will be excavated an additional 3 to 5 feet into the waste.

The initial excavation will stop along the outside perimeter of the dewatering wells. Observations will be made to evaluate the wastes ability to retain its slope. The excavation will continue in a northwest direction through the perimeter dewatering wells for 50 feet. The plan is to visually observe the equipment's ability to excavate wet waste. The excavation must extend 50 feet such that the excavation is outside of the perimeter wells' radius of influence which is assumed to be 20 feet. The additional quantities for the extension past the dewatering wells is 520 cy cap, 335 cy waste sludge, or 855 cy waste and cap. The waste in the wet area of the ramp is assumed to be stable at a 1V to 3H slope. See Figure 5-2 for ramp extension into undewatered waste.

5.3.1.1 <u>De-activate Inner Wells</u>

The proposed ramp excavation is placed in the midst of 27 dewatering wells. The inner wells will be deactivated before beginning the excavation. Pumps and all attached wiring, piping, and connections shall be removed and salvaged. The remaining peripheral wells will continue to be operated, reducing water inflow to the excavation. After the initial excavation is complete, exterior perimeter wells will be deactivated. All plastic casings will be left in place and demolished as the excavation proceeds.

5.3.1.2 Stockpile Areas

At the ramp excavation, the stockpile pads shall be graded to drain to the excavation. Some grading may be needed to remove vegetation and to smooth the surface prior to laying 6-mil thick plastic sheeting liner.

Containment berms will be made with straw bales lined up to form a barrier. The bales will be covered with the 6-mil plastic sheeting.

5.3.1.3 Excavation

Capping will be trammed up the ramp and dumped at the stockpile area. The ramp is extended down as successive cuts into capping are made. The excavation will extend down 3 feet into waste, revealing its underfoot condition. Then, if waste conditions are favorable for tracked equipment, the ramp excavation will extend an additional 3 to 5 feet into the waste. Waste will be excavated using the tracked loader-excavator. The loader will tram its load up the ramp and out of the excavation and over to a stockpile. A small loader, "Bobcat," may be used to place the waste in the main stockpile.

5.3.1.4 Reclamation

Following the ramp excavation, the waste will be backfilled into the trench. The sludge will need to be compacted with the tractor loader as it is backfilled. When the waste stockpile is backfilled down to the plastic liner, the liner will be disposed of in the excavation. Next, the cap material will be placed on the waste and compacted with the excavation equipment by driving on the disturbed areas. The disturbed areas will then be seeded and the straw from the hay bales (containment berms) will be dispersed over the seeded areas. Caution must be used in backfilling the excavation such that rubber tired equipment does not create any slope failures.

5.3.1.5 Equipment Decontamination

When salvageable equipment is no longer needed for the DEEP project, gross decontamination will be performed at the project site, and the equipment will then be transferred to the D&D facility for further decontamination.

5.3.2 Waste Pit 3 Ramp Excavation Equipment

Equipment:

- Tracked loader-excavator
- Rubber-tired front-end loader
- Large backhoe
- Generator

- Submersible electric sump pump
- Electrical cable
- Video camera
- TV monitor

Supplies:

- 6-mil plastic sheeting for liners
- Lightweight plastic tarp for covering stockpiles
- Orange plastic hazard fencing and fence posts
- Grass seed
- Straw bales
- Dust control agents and application equipment

5.4 DRY EXCAVATION DATA COLLECTION, ANALYSIS, INTERPRETATION, AND REPORTING

Field logs will document observations of the work-in-progress. Field logs will include, but are not limited to:

- Angle of repose of the waste
- Amount (depth) of water in the trench
- Waste strata description (colors, texture, etc.)
- Approximate trench depth, as determined by the boom length
- Wall stability following contact with equipment
- Waste strength

SECTION 6
SUPPORTING DOCUMENTATION

This section includes documentation that supports all the treatment technologies identified in this work plan for the Dewatering Excavation Evaluation Program (DEEP). Included are:

- Data Management
- Health and Safety
- Community Relations
- Management and Staffing
- Schedule
- Reports

6.1 DATA MANAGEMENT

This section describes the procedures for recording observations and raw data in the field or laboratory for the Dewatering Excavation Evaluation Program (DEEP). The data management procedures are designed to ensure that data generated throughout the project are recorded and maintained efficiently, accurately, and in a manner that can be reproduced. All data management procedures are in accordance with the Sitewide CERCLA Quality Assurance Project Plan (SCQ).

Daily logs (preprinted, sequentially numbered forms) will be kept for all project activities. Daily logs will provide a written record of activities and measurements conducted in the field on a given date in compliance with SCQ - Appendix J. Logs that will be utilized during this project include:

- Field Activity Log
- Monitoring Well Development Form
- Well Completion Log
- Sample Collection Log
- Surface Water/Groundwater Sample Collection Log
- Lithologic Log

Data generated from cone penetrometer testing, wet excavation and dewatering testing will be of an observational nature and recorded only on field activity logs. Field personnel will be trained in the correct procedure for visual classification and completion of accurate log forms. Soil borings and geotechnical testing will include activity logs along with appropriate laboratory documentation, as specified in the SCQ and Project-Specific Plan (PSP).

Originals of all field records will be maintained in the project central file with copies provided to the CRU1 Project Manager. Copies will be stored separately from the originals for documentation of work activities in the event the originals are destroyed, lost, or stolen.

6.2 HEALTH AND SAFETY

The Health and Safety Plan for the DEEP is contained in Attachment A. This health and safety plan addresses hazards associated with the DEEP.

6.3 COMMUNITY RELATIONS

Public involvement in the decision-making process is an integral part of remediation of the Fernald site. A site-wide Community Relations Plan has been developed to describe the activities that the U.S. Department of Energy (DOE) will undertake to ensure a full program of public participation. In addition to the community relations activities required under the Comprehensive Environmental Response, Compensation and Liability Act, the Superfund Amendments Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan, the U.S. Department of Energy (DOE) will initiate additional activities to obtain feedback from stakeholders on cleanup alternatives and technologies being considered. These activities will include briefings to key stakeholders at public meetings and workshops, updates in the monthly Fernald newsletter, fact sheets, and other availability and informational sessions.

Copies of this work plan and other materials relevant to Operable Unit 1 are available to the public and are part of the FEMP Administrative Record, located at the following address.

Public Environmental Information Center
10845 Hamilton-Cleves Highway
Harrison, Ohio, 45030
The phone number is (513) 738-0164.

6.4 MANAGEMENT AND STAFFING

This section identifies key management and technical personnel, and defines specific project roles and responsibilities for managing and implementing the Dewatering and Excavation Evaluation Program (DEEP) for Operable Unit 1. The line of authority is presented in the organization chart featured in Figure 6-1. Staff identified in this organization chart are employees of the Fernald Environmental Restoration Management Corporation (FERMCO) and support the DOE, the federal agency responsible for remediating Operable Unit 1 and for the DEEP. The work will be performed by FERMCO employees and subcontractors, as needed. Following are descriptions of the key areas of technical responsibility identified in Figure 6-1.

CERCLA/RCRA Unit (CRU) 1 Director: Responsible for all CRU1 activities including project performance, schedule, budget, and resources. Provides guidance and support to projects. Provides project status information to senior management, client, and regulatory officials.

CRU1 Health & Safety Manager: Responsible for the overall CRU1 Health and Safety Program. Reviews and approves the DEEP Health and Safety Plan. Performs inspections to assure compliance with health and safety requirements.

DEEP Project Manager: Responsible for overall project performance. Reviews project plans, evaluates project against budget and schedule, and coordinates activities with the client.

DEEP Assistant Project Manager: Assist the project manager with project reviews, budgets and schedules. Provides technical oversight of field operations and will direct excavation activities.

Quality Assurance (AQ) Officer: Responsible for establishing and preparing QA requirements for the project. Performs audits and surveillance.

DEEP Health and Safety Officer: Responsible for preparing the project specific health and safety plan. Continually evaluates field activities to assure worker safety. Coordinates field support for rad control, fire safety, industrial hygiene, and construction safety. Conducts project safety meetings.

Field Operations Lead/Lead Geologist: Coordinates field activities, obtains work permits and provides oversight of field personnel; responsible for oversight of geotechnical tests.

Regulatory Compliance Lead: Responsible for the preparation of the Regulatory Compliance Plan and integrating environmental requirements.

Engineering Lead: Responsible for developing project requirements, preparing project-specific work plans, and performing data evaluation.

Safety Analysis Lead: Responsible for coordinating the development of the integrated safety and environmental hazard assessment.

Public Affairs Lead: Responsible for preparing the Community Relations Plan and information releases.

Laboratory Support Lead: Responsible for coordinating sample shipping, laboratory scheduling and laboratory contract management.

Cost and Scheduling Lead: Responsible for preparing project cost updates and evaluations. Updates and tracks project schedules.

6.5 SCHEDULE

As shown in Figure 6-2, the DEEP geotechnical, wet excavation/slurry, and dewatering field work will begin simultaneously. Boring and other support field work will begin approximately two months later, with dry excavation scheduled to begin as the wet excavation/slurry and dewatering field work end. The entire project is scheduled for completion one year after start-up.

6.6 REPORTS

A report will be prepared to document each of the tests identified in this Treatability Work Plan. In accordance with CERCLA guidance for conducting treatability studies, the report will be submitted to:

- USEPA Office of Research and Development
  Risk Reduction Engineering Laboratory Treatability Data Base
  Risk Reduction Engineering Laboratory
  26 West Martin Luther King Drive
  Cincinnati, Ohio 45268

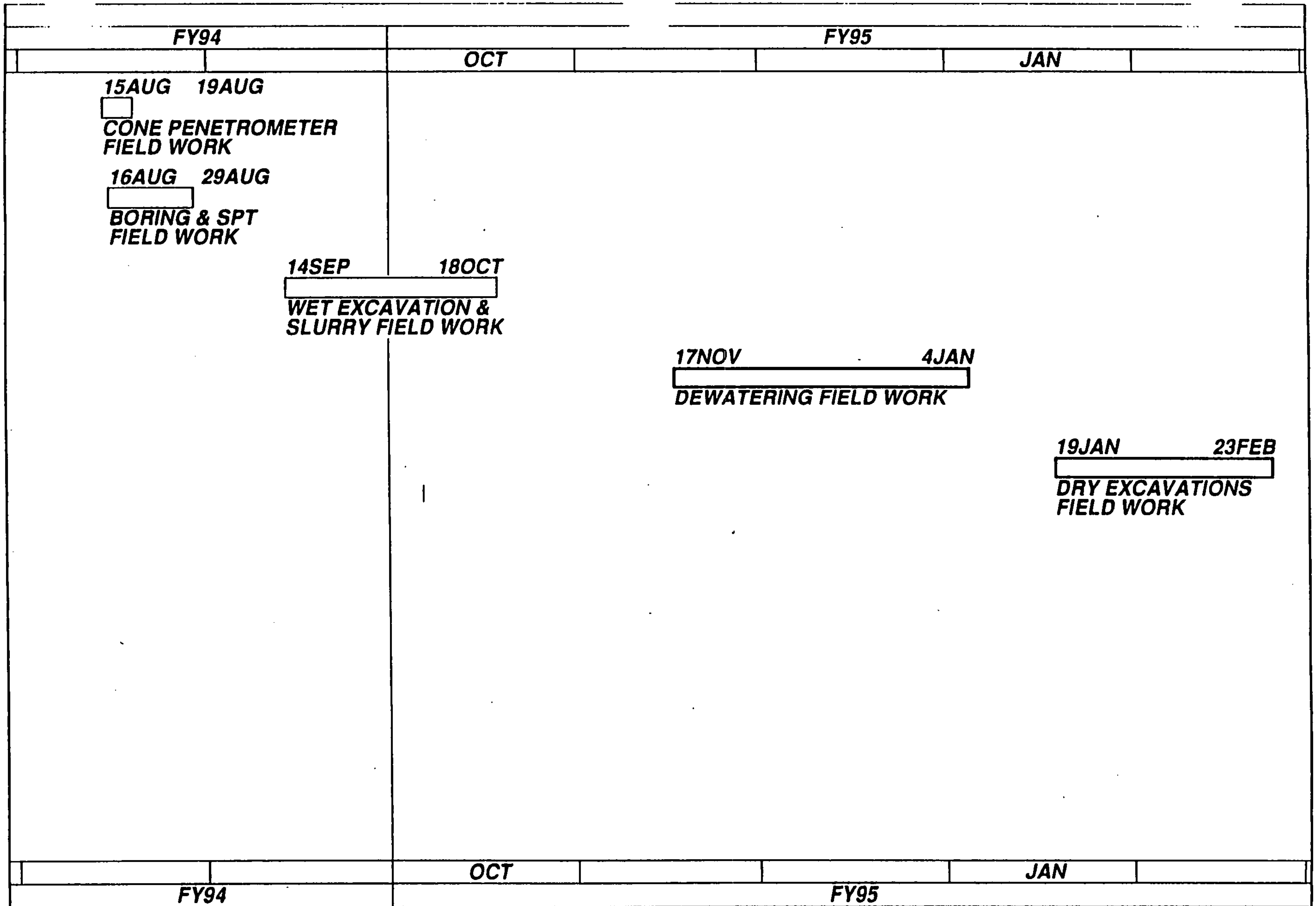


Figure 6-2

Plot Date	14JUN94
Data Date	31MAY94
Project Start	1JAN88
Project Finish	6APR95

(c) Primavera Systems, Inc.

start finish
Activity Bar Early Dates
Critical Activity
Progress Bar
Milestone Flag Activity

Sheet 1 of 1

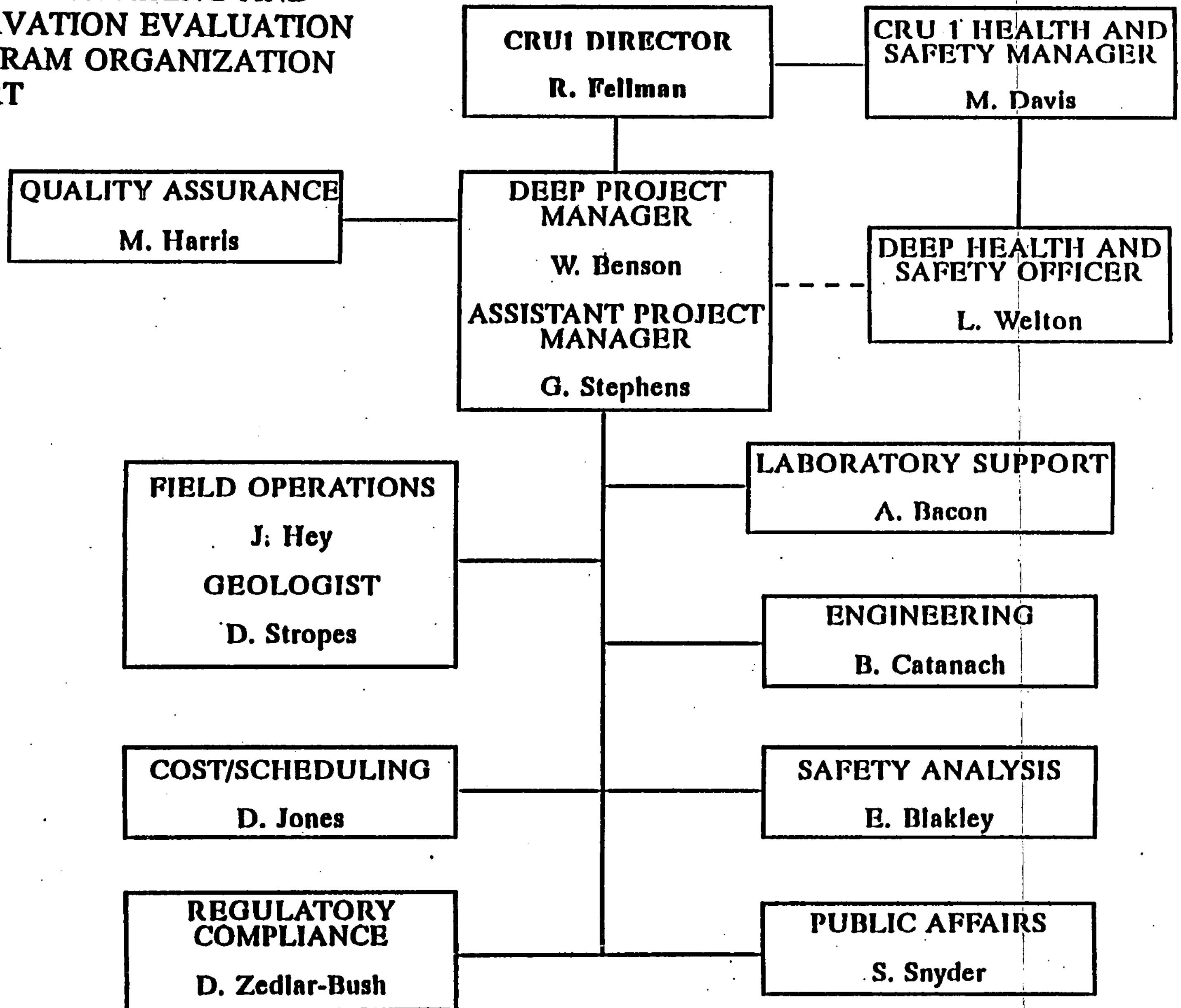
OU 1 FY 94-99 BASELINE

TEDAP (D.E.E.P.) FIELD STUDY

Date	Revision	Checked	Approved

Figure 6-2

CRU1 DEWATERING AND EXCAVATION EVALUATION PROGRAM ORGANIZATION CHART



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ATTACHMENT A

TASK SPECIFIC HEALTH AND SAFETY PLAN FOR: THE DEWATERING AND EXCAVATION EVALUATION PROGRAM(DEEP)

ADDENDUM TO THE CERCLA/RCRA UNIT ONE HEALTH AND SAFETY PLAN: INITIAL PHASE, TREATABILITY STUDY

INTRODUCTION

This task specific Health and Safety Plan is for all field operations being performed for the Dewatering and excavation evaluation program (DEEP), and will specifically address the sampling and test excavations for Waste Pits one (1) through three (3).

Purpose

The purpose of this document is to:

- Fulfill the requirements of 29CFR1910.120 "Hazardous Waste Operations and Emergency Response" (HAZWOPER)
- Provide an understandable and effective tool for use by the field personnel to perform their tasks in the safest and most effective manner.

1.0 Description

1.1 Characterization

For a complete, in-depth description at the FEMP site and the CRU1 area, and the characterization of the Waste Pits, refer to Section 1.1 and 1.2 of the CRU1 Health and Safety Plan. Groundwater quality data is available through the Environmental Safety and Health Division, Environmental Protection Groundwater Monitoring Group for the FEMP DEEP Activities Waste Pit Area Work Plan and screening data on soil samples (radioactivity counts and Volatile Organic Compound scans) can be obtained from the existing FEMP inventory of soil boring logs.

1.2 Work Plan

The Dewatering and Excavation Evaluation Program (DEEP) will be performed in two (2) phases:

1.2.1 Phase One (1) consists of sampling Waste Pits one (1) through three (3). This sampling will first be performed through downhole hydraulic conductivity tests, analysis and modeling in existing borings, then by the installation of additional borings through the use of a truck-mounted hollow-stem auger drill rig.

Sampling points have been pre-determined and were expressly chosen to minimize the possibility of breaching the waste pit liners during the sampling effort. The soil borings will be taken by using six (6) inch augers to reach the target sampling depth. The samples will be collected by lowering a two (2) inch diameter, split spoon sampler into undisturbed waste material.De-watering wells will be installed to de-water the waste. The boreholes used for the sampling and penetration tests will be utilized as de-watering wells.

1.2.3 Phase Two (2) consists of performing test pit excavations in Waste Pits one (1) through three (3). Test trenches will be excavated with dimensions that are approximately 6 to 20 feet wide at the surface and tapering down to approximately 3 feet wide at the bottom, and extend about 30 feet long; with stable ground the ultimate trench depths may range from 15 feet to 20 feet while **up to 85 bcyds** of cap and waste would be removed per waste pit. Based on the aforementioned trench dimensions, the safety precautions and procedures in Section 11.3.2.5 shall be followed when digging, inspecting, or backfilling excavation trenches. Up to 15 cubic yards each of representative Pits one (1) through three (3) waste material will be collected and containerized for use in the Waste Drying Pilot Study.

1.2.4 The purpose of the field activities covered by this task-specific Health and Safety Plan is to supplement existing remedial investigation/remedial design information for inclusion in the Waste Pit Area investigation work plan. The investigation results will be used to select a code for computer modeling to develop a conceptual model for the Waste Pit Area and to provide information on excavating and de-watering properties of the waste.

1.3 Scope of Work

This Task-Specific Health and Safety Plan for the FEMP DEEP Activities Waste Pit Area Work Plan will be used by FERMCO and any subcontractor personnel while conducting field activities as described herein.

The major tasks to be completed under this initial part of the Waste Pit Area investigation program include the following:

1) Establish monitoring well water levels in selected wells in Waste Pits 1, 2, and 3.

2) Perform 9 Falling Head and 9 Rising Head Slug Tests on monitoring wells in Waste Pits 1, 2, and 3.

3) Prepare a comprehensive report that provides a complete analysis of all collected field data and describes the results of the field investigations

4) The trenches will be excavated using a backhoe to assess moisture content, waste and cap stability, and to obtain samples for shear, moisture content, and slump tests. These data are needed to assess the amenability of dry excavation methods in Pits 1, 2, and 3.

5) De-watering wells will be located in each pit and may be either a conventional well point or a large diameter well. The de-watering techniques of electro-osmosis and vaccuum pumping will both be tested. Approximately 70 borings will be required for the de-watering systems. These borings are also to be used for the penetration testing (standard and cone) of the pit contents.

2.0 Work Area

2.1 Work Area Location

The CRU1 work area is located to the west of the main plant in an area known as the Special Waste Storage Area. This area is fenced in on all four sides, with access controlled at the east entrance on Second Street, near the west water tower. The CRU1 Waste Pits are located in the northern two-thirds of the Special Waste Storage Area; The task-specific area for DEEP Activities includes Waste Pits 1, 2, and 3 (See ATTACHMENT A).

2.2 Project Personnel Phone Numbers

- CRU1 Program Director - Bob Fellman 738-6181
- DEEP Project Manager - William Benson 738-6208
- DEEP Field Manager - Greg Stevens 738-6843
- DEEP Health and Safety Representative Larry Welton 648-7346
- CRU1 Health and Safety Manager - Michael Davis 738-6492
- Field Engineering Lead- Brad Catanach 738-6843

2.3 FERMCO CRU1 Management

FERMCO and all subcontractors shall ensure that all personnel entering the work area are in full compliance with all requirements within this plan and all other FEMP Health and Safety requirements. FERMCO management is committed to ensuring that safety is the first priority, ahead of all other issues.

3.0 General Safety Requirements

3.1 Permits and Posting

The areas where the hydraulic investigations, drilling, and trenching activities will occur shall be completely defined from other areas. This will be accomplished with barriers and signs. Entrances into the Waste Pit work locations shall be posted as a restricted area and entry shall be restricted to authorized personnel only. The posting shall include the following information as a minimum:

1) Project name
2) Requirements for entry
3) Name of contact person prior to entry

The work area shall have a defined entrance/exit. All barricades installed shall meet or exceed ESH-1-1000, SPR 2-15 requirements. Barricade or tape/rope barriers shall be tagged to identify who installed it and why it was installed. Radiological postings will be installed in accordance with SP-P-35-025. Controlled areas and hazardous noise areas shall be posted per FERMCO procedures.

For additional guidance see Section 3.1 in CRU1 Health and Safety Plan (HASP)

3.2 Safety Equipment - In addition to the general PPE requirements in Section 3.2 of the CRU1 HASP, the following equipment must be available and used as specified:

3.2.1 Respiratory equipment as specified on the Radiation Work Permit and/or Hazardous Work Permits.

3.2.2 Protective clothing as specified on the Radiation and/or Hazardous Work Permits.

3.3 - 3.8 See CRU1 HASP Sections 3.3 - 3.8

4.0 Site Control - See CRU1 HASP Section 4

5.0 Training and Education

5.1 Required training for entry into the DEEP work areas are as specified in Sections 5.1.3 and 5.1.4 of the CRU1 HASP.

5.2 Required training to perform work in the DEEP work areas are as specified in Section 5.2 of the CRU1 HASP, and in addition will require training as follows:

5.2.1 Personnel performing drilling/boring operations must be trained/certified in proper operation, maintenance, and emergency procedures that pertain to that equipment.

5.2.2 Personnel performing water level measurement and pressure/hydraulic conductivity tests must be trained/certified in the proper operation of the field data recording equipment.

5.3 All personnel who operate construction-type equipment (backhoes, man lifts, etc.) shall be trained accordance with Section 5.3 of the CRU1 HASP.

5.4 - 5.6 See sections 5.4 - 5.6 of the CRU1 HASP.

6.0 Medical Monitoring - See Section 6 of the CRU1 HASP.

7.0 Personal Protective Equipment/Engineering Controls - See Section 7 of the CRU1 HASP and Section 11 of this document.

8.0 Required Monitoring and Action Limits - See Section 8 of the CRU1 HASP and specific requirements on the work permits.

***** See also the relevant tables in ATTACHMENT B at the end of this Health and Safety Addendum.**

9.0 Handling Drums and Containers - See Section 9 of the CRU1 HASP.

10.0 Decontamination - See Section 10 of the CRU1 HASP and specific requirements on the work permits.

11.0 Hazard Assessment and Accident Prevention

11.1 Industrial Hygiene - See Section 11.1 of the CRU1 HASP, in addition: chemical analyses of the waste pits contents indicate that the major Industrial Hygiene concerns are: (See ATTACHMENT C, and table 11.1-1)

11.1.1 Uranium/Lead

11.1.2 Magnesium Fluoride

11.1.3 Arsenic

11.1.4 Asbestos

11.1.5 Hazardous atmospheres resulting from release of unknown waste pit contents

11.1.6 Possible corrosive liquids

11.1.7 Heat/Cold stress

11.1-1 Corrective/Protective Measures

To minimize the possibility of exposure, the following precautions must be adhered to:

- PPE must be in accordance with the Hazardous Chemical Work Permit.
- Waste materials must be kept wet. Clean off contamination to minimize potential for dust generation.
- Have a covered area (Tarp) for a cool down, shaded facility; have drinking water available.
- Use cool vests for heat stress prevention.
- Assure that an emergency eyewash station (15 minute wash) is available if needed.

11.2 Radiological Safety - See Section 11.2 of the CRU1 HASP; in addition:

Radiological analyses of the waste pits contents indicate that the following radio isotopes are of primary concern:

- Uranium and its daughters
- Thorium 232 (limiting isotope)
- Small amounts of various radionuclides (See Table 11.2-1)

11.2-1 Corrective/Protective Measures

External/Internal Radiation Exposures

Although past sampling efforts have indicated minimal radiation doses from Beta-Gamma radiation, the uncertainties surrounding the actual pit contents requires that certain precautions be taken to maintain any external or internal exposures ALARA; these precautions are as follows:

- Full Anti-C's with full-face air-purifying respirator with comb cartridges.
- For personnel taking water or saturated soil samples, the outer set of Anti-C's shall be Saranex or other water-resistant fabric.
- Samples shall be surveyed by a full-time Radiation Safety Technician prior to and during all sample retrieval activities. All sample readings greater than two mrem/hr. at contact must be stored in a restricted area, properly barricaded and posted.
- A Radiation Work Permit will be required and may amend precautions.
- Work all samples wet/damp to minimize particulates.
- Air sampling shall performed in accordance with established procedures. (See CRU1 HASP, Section 8).

11.3 Industrial Safety - See Section 11.3 in CRU1 HASP; in addition:

11.3.1 Job Safety Analyses indicate that the following Industrial Safety issues are of major concern:

11.3.1.1 Manual handling of heavy objects and containers

11.3.1.2 Equipment/Operation & Safety

11.3.1.3 Drilling/Boring operations

11.3.1.4 Excavation activities

11.3.1.5 Operations of heavy equipment on potentially unstable waste pit surfaces

11.3.2 Corrective/Preventive Measures

11.3.2.1 Manual Handling of Heavy Material/Equipment (> 50 lbs)

All tasks that may require manual lifting of heavy objects should be evaluated to determine if a mechanical means can be used. If this is not possible, then two or more personnel must be used to move/lift the objects.

11.3.2.3 Equipment/Operation Safety

The use of the drilling rig and the backhoe require a pre-placement inspection be made prior to movement. Special attention should be given to sub-surface conditions; avoid travel over soft/spongy areas. Watch vehicles closely during move; if any excessive sinking of tires into surface is noted, back off and re-evaluate situation. It may be necessary to use "Unimat", timber, or other materials to spread the load evenly over surface.

11.3.2.4 Drilling/Boring Operations

All drilling/boring operations shall be performed in accordance with all applicable Federal, State, and Local regulation/standards. As a minimum, the following shall be adhered to:

- All drilling equipment and tools shall be inspected by FERMCO Safety and Fire Technicians prior to being allowed to enter the FEMP site. Damaged, defective, or out-of-compliance equipment must be repaired, replaced, or removed.

- No personnel shall climb more than six feet above ground level on the drill mast unless they are protected by a body harness and lanyard, and are tied-off on a structural member of the rig, above their head.

- A minimum of two persons shall be present at the drill rig during all operations. Working alone will not be permitted.

- Before starting daily drilling operations, the drilling crew shall perform an equipment safety inspection which shall include testing of drilling kill switch for proper operation.

- Drillers are the only people allowed within four feet of a rotating auger. All monitoring shall be performed at this distance or when auger is stopped.

- A minimum of five feet clearance shall be maintained on <u>all</u> sides of the drilling rig/outfit. This is necessary for emergency access.

11.3.2.5 Excavation Activities

Due to the inherent instability of land fills, and given the wide variety of buried waste, special consideration must be given to operations requiring excavations in the waste pits.

The possibility of encountering soft, unstable contents is high, therefore, the following precautions must be taken:

- Casual observers will not be allowed closer than Ten feet to the trench edge, unless they are either: (1) adequately tied off; (2) positioned on boom-type man-lift (see below). This distance limitation does not apply to the backhoe operator when the operator is positioned on the machine,

- The Project Manager, supervisors, and equipment operators, as well as observers, shall, when approaching a trench, be alert and on guard for possible pending failure of the trench walls. Imminent failure may be preceded by increasing number, propagation, and widening of tension cracks at the surface; these cracks running more or less parallel to the trench. Imminent failure may also be indicated by accelerating rate of falling or dribbling debris from the inside trench walls, indicating movement of the adjoining soil mass into the trench.

11.3.2.5 Excavation Activities (continued)

- Excavated capping and waste will be separately stowed onto plastic covering laid down for this purpose. Waste material will be stowed no closer than ten feet to the trench edge. Stowage of cap, waste and sludge will be graded so that these materials or drainage therefrom will be contained. Water drained from waste or sludge will be measured and drained back into excavation.

- When digging, the backhoe outriggers will be fully extended. Where poor underfoot conditions are present such that outriggers will sink excessively into soft soils, the operator shall place suitable wood planking or blocking to adequately distribute the load over a sufficiently large area to prevent damage to overlying soils. If poor underfoot conditions are encountered such that the tracked backhoe sinks into the overlying capping, then digging shall stop until "Unimats" or timber is placed so as to prevent soil damage from backhoe tracks.

- Personnel viewing the trench shall use an articulating boom-type man lift with its wheels positioned at a safe distance from the trench.
- The bucket used to excavate should not exceed thirty-six (36) inches in width.

11.3.2.5 Excavation Activities (continued)

- Excavated trenches will be promptly barricaded with appropriate orange plastic fencing. All trenches will be backfilled within one (1) week, and any caving or unstable excavations will be immediately backfilled or sloped to angle of repose. In backfilling trenches, waste and sludge will be placed first followed by capping material. Plastic covering under stowed waste, sludge and capping will be taken up,and placed into the waste pits for burial.

- If an adverse chemical reaction (i.e. fumes, smoke, fire, etc.) is noted, the operator shall, if practical and without endangering himself, immediately backfill sufficient waste or sludge into the trench excavation to douse such adverse chemical reaction. On the other hand, if the operator is in imminent and immediate danger from fumes, smoke or spreading fire, he shall immediately lower the bucket, turn off and vacate the equipment. In either case, the operator shall proceed to notify the project manager who shall, in turn, notify the Health and Safety representative,the AEDO and others as required by the FEMP Site Contingency Plan.
  Re-entry requirements will be determined by the Project Manager and the Health and Safety representative, in consultation with appropriate E,S and H personnel.

11.4 Fire Protection - See CRU1 HASP, Section 11.4

11.5 Decontamination Procedures- See Attachment D

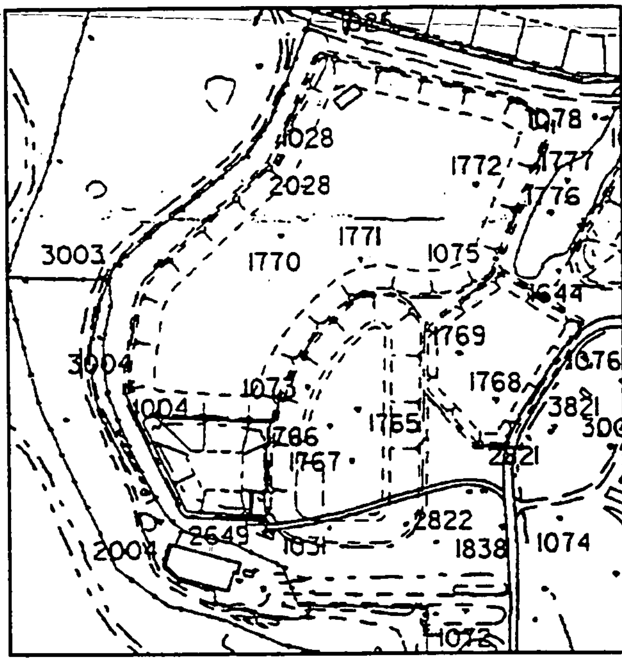
11.6 Natural Occurrences - See CRU1 HASP, Section 11.6

11.7 Environmental ALARA Issues - To minimize the possibility of off-site dispersion radioactive waste materials, the excavations and spoil piles will be controlled by wetting, use of a crusting agent or by use of appropriate tarps. Waste water run-off will be controlled to prevent off-site migration.

12.0 Emergency/Contingency Plans - See CRU1 HASP, Section 12

13.0 Changes/Amendments to this Health and Safety Plan - See CRU1 HASP, Section 13.0

ATTACHMENT A: CRU 1 WASTE PIT AREA TASK SPECIFIC AREA MAP



NOTE: MAP NOT TO SCALE

NORTH APPROXIMATELY ALONG SIDE EDGE OF MAP

ATTACHMENT B: ANALYTICAL TABLES FOR CRU 1 WASTE PIT AREA

Hazard Analysis for Inorganic Contaminants for Pits 1 - 4 from CIS Data									
	Pit1		Pit2		Pit3		Pit4		Lower of TLV / PEL Limits
Inorganic Contaminant	Avg.Concn. (ppm)	Concn/TLV	Avg.Concn. (ppm)	Haz. Ratio Concn/TLV	Avg.Concn. (ppm)	Haz. Ratio Concn/TLV	Avg.Concn. (ppm)	Haz. Ratio Concn/TLV	
Antimony	1.4	3	0.7	1	8.3	17	0.4	1	0.5
Arsenic	6.5	650	5.1	510	1085	108500	1.6	160	0.01
Barium, soluble	255	13	138	10	4673	2170	2408	4816	0.5
Beryllium	1	500	3.8	1900	9.8	4900	3.7	1850	0.002
Cadmium	2.1	42	5.9	118	6.1	122	8.3	166	0.05
CalciumCarbonate	65940	6594	53850	5385	100900	10090	44250	4425	10
Chromium +2+3	18	36	43	86	77	154	34	68	0.5
Cobalt	10	200	140	2800	14	280	26	520	0.05
Copper dusts	50	50	118	118	1081	1081	72	72	1
Lead, inorganic	32	640	84	1680	232	4640	43	860	0.05
Manganese	1361	272	722	144	2716	543	2650	530	5
Mercury, inorganic	0.2	4	0.4	8	1.1	22	0.3	6	0.05
Nickel, soluble	25	25	201	201	156	156	25	25	1
Selenium cpds.		0	3.4	17	26	130		0	0.2
Silver, soluble	9	900	9	900	5	500	114	11400	0.01
Thallium, soluble	0.3	3		0	4	40	3.9	39	0.1
Uranium, soluble *	17,030	340,000	2,940	58,800	3,440	68,840	51,860	1,037,000	0.05
Vanadium as V205	31	620	60	1200	2976	59520	2976	59520	0.05
ZincOxide dust	20	2	884	88	130	13	130	13	10

NOTES: Uranium concentrations are from August 1993 RI/FS sampling data report

ATTACHMENT B: ANALYTICAL TABLES FOR CRU 1 WASTE PIT AREA (CONTINUED)

MONITORING FOR PIT 1

Contaminant	Ave Concn CIS*3	Limit	Action Level	Action	Monitoring Method
Uranium, soluble	17,030 ppm	0.05 mg/m^3	> 0.1 to 1 mg/m^3 > 1 to 10 mg/m^3 > 10 mg/m^3	Full-Face w. Magenta cartridges PAPR *2 w. Magenta cartridges P-D Airline w. Escape Bottle or SCBA	RAM-1 Photometer
Nuisance Dust	----	10 mg/m^3			
Organic Vapors	< 5 ppm for any one compound	Varies	> Detection to 10 ppm > 10 to 25 ppm > 25 ppm	Half-mask w. Magenta & Yellow cartridges Continuous Flow Airline Full-Face P-D Airline w. Escape Bottle or SCBA	MicroTip PhotoIonization Detector

Notes

1: Uranium is the most restrictive and is the governing one for setting the action levels for all dusts excluding asbestos

2: PAPR is an acronym for Powered Air Purifying Respirator

3: CIS is an acronym for Characterization and Investigative Study

4. Uranium sample data come from RI/FS study dated August 1993

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ATTACHMENT B: ANALYTICAL TABLES FOR CRU 1 WASTE PIT AREA (CONTINUED)

MONITORING FOR PIT 2

Contaminant	Ave Concn CIS*3	Limit	Action Level	Action	Monitoring Method
Uranium, soluble	2,940 ppm	0.05 mg/m³	> 0.1 to 1 mg/m³ > 1 to 10 mg/m³ > 10 mg/m³	Full-Face w. Magenta cartridges PAPR *2 w. Magenta cartridges P-D Airline w. Escape Bottle or PD SCBA	RAM-1 Photometer
Cobalt	140 ppm	0.05 mg/m³			
Beryllium	3.8 ppm	0.002 mg/m³			
Lead	84 ppm	0.05 mg/m³			
Vanadium	60 ppm	0.05 mg/m³			
Nuisance Dust	----	10 mg/m³			
Organic Vapors	< 5 ppm for all compounds except for trichloro-ethylene which was 15 ppm	Varies	> Detection to 10 ppm > 10 ppm to 25 ppm > 25 ppm	Full-face w. Magenta & Yellow cartridges Continuous Flow Airline Full-Face P-D Airline w. Escape Bottle or PD SCBA	MicroTip PhotoIonization Meter

Notes

1: Uranium is the most restrictive and is the governing one for setting the action levels for all dusts excluding asbestos
2: PAPR is an acronym for Powered Air Purifying Respirator
3: CIS is an acronym for Characterization and Investigative Study
4. Uranium sample data come from RI/FS study dated August 1993

ATTACHMENT B: ANALYTICAL TABLES FOR CRU 1 WASTE PIT AREA (CONTINUED)

MONITORING FOR PIT 3

Contaminant	Ave Concn CIS*3	Limit	Action Level	Action	Monitoring Method
Arsenic	1085 ppm	0.01 mg/m^3	> 0.02 to 0.3 mg/m^3 > 0.3 to 10 mg/m^3 > 10 mg/m^3	Full-Face w. Magenta cartridges PAPR *2 w. Magenta cartridges SCBA PD Mode	Ram-1 Photometer
Uranium, soluble	3,440 ppm	0.05 mg/m^3			
Vanadium	2,976 ppm	0.05 mg/m^3			
Beryllium	9.8 ppm	0.002 mg/m^3			
Lead, inorganic	232 ppm	0.05 mg/m^3			
Barium, soluble	4,673 ppm	0.5 mg/m^3			
Nuisance Dust	----	10 mg/m^3			
Organic Vapors	< 4 ppm for any one compound	Varies	> Detection to 10 ppm > 10 to 25 ppm > 25 ppm	Full-Face w. Magenta & Yellow cartridges Continuous Flow Airline Full-Face P-D Airline w. Escape Bottle or PD SCBA	MicroTip PhotoIonization Meter

Notes

1: Arsenic is the most restrictive and is the governing one for setting the action levels for all dusts excluding asbestos

2: PAPR is an acronym for Powered Air Purifying Respirator

3: CIS is an acronym for Characterization and Investigative Study

4. Uranium sample data come from RI/FS study dated August 1993

ATTACHMENT C: SUMMARY OF WASTE PIT AREA HEALTH AND SAFETY CONCERNS

11.1.1 Ammonia

Ammonia is an easily detectable pungent gas which is created by protein decomposition or reaction of a strong base with an ammonium salt. Ammonia forms a strong alkali solution in water in mucuous membranes or wet skin and is highly irritating to the eyes, nose, and upper respiratory tract. If irritation is ignored or exposed persons cannot leave the area, skin and eye burns and pulmonary edema may occur.

11.1.2 Arsenic, inorganic

Arsenic is a steel gray metal in its pure form. It is a carcinogen. Soluble trivalent forms such as arsenic trioxide cause skin and mucuous membrane irritation. Arsenic is acutely toxic poison if ingested. Acute inhalation effects are rare and chiefly inflammation. Chronic inhalation effects include perforation of the nasal septum, weight loss, nausea, diarrhea, hair loss, skin discoloration/lesions, and loss of sensation from peripheral nerves.

11.1.3 Asbestos

Asbestos refers to a class of fibrous minerals which were used extensively for insulation and enhancing strength of cements at the FEMP. Loose asbestos dust contains fibers which can cause lung scarring (asbestosis), lung cancer, cancer of the lining of the lungs (mesothelioma), and cancers in other body organs. It has an OSHA TWA exposure limit of 0.2 fibers per cubic centimeter (f/cc) and a 15 minute excursion limit of 1 f/cc.

11.1.4 Beryllium

Beryllium in its pure form is a grayish-white metal. It is able to cause tumors in experimental animals. It is a deadly poison by intravenous route and a suspect human carcinogen. By the inhalation route of entry, it caused weight loss and a lung condition known as berylliosis. It has the lowest OSHA allowable TWA exposure limit for any aerosol contaminant of only 0.002 mg/m^3.

11.1.5 Barium, soluble

Barium is a silver-white malleable metal in its pure form. It is a hazard when ingested or inhaled. Symptoms are vomiting, diarrhea, irregular pulse, and muscular paralysis. Soluble barium has an OSHA TWA exposure limit of 0.5 mg/m^3.

11.1.6 Copper dusts

Copper is a brown malleable metal in its pure form and a variety of blue/green colors when present as salts or oxides. Copper salts act as irritants to the mucous membranes. Inhalation of copper salts can cause irritation of the upper respiratory tract. Inhaled copper oxide fume can cause metal fume fever.

ATTACHMENT C: SUMMARY OF WASTE PIT AREA HEALTH AND SAFETY CONCERNS (CONTINUED)

11.1.7 Fluorides, total

Fluorides at the FEMP are chiefly inorganic forms such as magnesium fluoride and calcium fluoride which are beige or grayish powders. Inorganic fluorides are highly irritating and toxic. Symptoms include nausea, vomiting, abdominal pains, weakness and convulsions. Inorganic fluorides are irritating to the skin and eyes. Chronic fluoride intake causes mottling of dental enamel in teenagers and thickening of bones and cartilage (fluorosis).

11.1.8 Inorganic lead

Lead is a bluish-gray metal when pure. It also can be brightly colored yellow, orange, or yellow when present in its various oxides. Lead is a toxin for the blood forming organs and can cause anemia. It can also cause loss of appetite, insomnia, irritability, and muscle and joint pains. Lead is also listed as a potential human carcinogen of the lungs and kidneys. Routes of entry are inhalation and ingestion. Lead has an OSHA TWA limit of 0.05 mg/m^3.

11.1.9 Nuisance dust

Nuisance dust is a term used by OSHA to describe dusts which are not particularly toxic and therefore are not regulated by their chemical composition. Excessive exposure to even low toxicity dusts can cause lung and upper respiratory tract irritation. OSHA has established a TWA limit of 5 mg/m^3 for respirable nuisance dust.

11.1.10 Organic vapors

Low levels < 10 ppm maximum of a variety of organic compounds have been identified by the Waste Pit Characterization and Investigation study soil sampling. Identified compounds included chlorinated pesticides, chlorinated solvents, polynuclear aromatics, aromatics, ethers, esters, esters, and alcohols.

11.1.11 Uranium

Uranium is a radioactive material, and in its soluble forms, is highly toxic to the kidneys. Soluble uranium compounds such as uranyl nitrate, uranyl fluoride, uranyl acetate, are absorbed through the skin. Non-soluble forms of uranium, such as uranium octaoxide (black oxide), uranium dioxide (brown oxide), uranium tetrafluoride (green salt), and uranium trioxide (orange oxide) are not absorbable through the skin, but constitute a radioactive inhalation hazard to the lungs. It has OSHA TWA limits of 0.05 mg/m^3 for soluble uranium and 0.2 mg/m^3 for insoluble uranium.

ATTACHMENT B

QUALITY ASSURANCE PLAN

ATTACHMENT B
QUALITY ASSURANCE PLAN

B.1 TRAINING

All field personnel involved with the Operable Unit 1 Dewatering Excavation Evaluation Program (DEEP) shall receive project-specific training for applicable activities. Training records shall be maintained by the Fernald Environment Restoration Management Company of Ohio (FERMCO) Training Department and the CRU1 training coordinator.

B.2 DOCUMENT CONTROL

CRU1 shall control the issuance, use, revision and storage of project documentation including:

- Site procedures
- Design specifications
- Design and work drawings
- Nonconformance reports
- Inspection reports
- Test reports
- General work and special process procedures
- Personnel Files
- Training records
- Quality Assurance records
- Surveillances
- Audits
- Other QA records
- Calibration records of test equipment
- Procurement Inspections and documentation

B.3 PROCEDURES

Work related instruction, procedures, and other forms of direction shall be developed, verified, validated and approved by technically competent personnel, and shall be provided to employees doing the work. All environmental sampling activities shall comply with the Site CERCLA Quality Assurance Plan (SCQ). Any activities not covered by the SCQ shall use American Society for Testing and Materials (ASTM) methods for guidance. The Project-Specific Plan shall be reviewed and approved by the appropriate personnel prior to implementation.

B.4 DESIGN

Project management shall outline how design activities are controlled, including:

- Review and approval of design inputs
- Preparation, review, and approval of calculations
- Validation of computer programs/models that support design
- Processing of design changes including field change request and nonconformances.

B.5 PROCUREMENT

Project management shall ensure that purchased items and services meet established requirements and perform as expected per SSOP-0315. Purchased items and services are to be accepted using specified methods (such as source verification, receipt inspection, pre-installation and post-installation tests, and certificates of conformance, or a combination of these methods).

B.6 INDEPENDENT ASSESSMENT

Work activities associated with the DEEP project shall be monitored periodically by Quality Assurance. These independent assessments will monitor work performance, identify non-compliance activities and other abnormal performance and precursors of potential problems, and identify opportunities for improvement.

Independent assessments shall be conducted using criteria that address environmental, safety and health, and remediation requirements, and describe acceptable work performance and promote improvement. They shall include evaluation to determine whether technical requirements, not just procedural compliance, are being met. Assessment findings shall be resolved by management having responsibility in the area assessed.

ATTACHMENT C
PERMIT INFORMATION SUMMARY

ATTACHMENT C
PERMIT INFORMATION SUMMARY
DEWATERING EXCAVATION EVALUATION PROGRAM

C.1 INTRODUCTION

Proposed dewatering and excavation activities will be conducted at the Fernald Environmental Management Project (FEMP) in Hamilton and Butler Counties, Ohio as part of the CERCLA treatability study entitled "Dewatering, Excavation, Evaluation Program (DEEP)." As stated on Page 62 of the U.S. Environmental Protection Agency (USEPA) Guide for Conducting Treatability Studies Under CERCLA, (EPA/540/2-89/058, December, 1989) "Onsite treatability studies under CERCLA may be conducted without any Federal State, or local permits, however, such studies must comply with applicable or relevant and appropriate requirements (ARARs) under Federal and State environmental laws." This waiver is consistent with the requirement specified in CERCLA Section 121(e), 40 CFR 300.400(e), and Paragraph XIII.A of the Amended Consent Agreement signed by USEPA and DOE. As such, the project will be exempt from the requirement to obtain formal permit approval pursuant to CERCLA Section 121(e).

Although DEEP is exempt from normal permitting requirements, Paragraph XIII.B of the Amended Consent Agreement requires the U.S. Department of Energy (DOE) to supply specific information regarding the permits that would have been required for the project in the absence of the CERCLA permitting exemption described above. Pursuant to Paragraph XIII.B the following information is required:

1. Identification of each permit that would be required in absence of the CERCLA 121 (e) permitting exemption described above;

2. Identification of the standards, requirements, criteria, or limitations that would have had to been met to obtain the permits; and

3. Explanation of how the response action will meet the standards, requirements, criteria, or limitations identified in item 2, above.

The following sections of this attachment have been prepared to address these requirements and to provide a detailed description of how substantive permitting requirements for the project will be addressed.

C.2 PROJECT DESCRIPTION

The proposed project involves conducting a series of eight dewatering tests within Waste Pits 1, and 3. Each test is designed to determine the extent to which pit sludge can be dewatered prior to excavation under the Operable Unit 1 Preferred Alternative. These tests include excavating trenches in Waste Pits 1, 2, and 3 to evaluate how well waste and sludge can be dewatered and subsequently excavated. Trenches will be dug before and after dewatering. In addition to trench excavations, well point and large diameter well dewatering systems will be tested. To compare the two well dewatering approaches, a large-diameter well system will be tested in Waste Pit 3, while the well point system will be tested in Waste Pits 1 and 2.

The total volume of wastewater to be produced by the project is difficult to quantify, however, current estimates call for approximately 105,000 gallons of water per day to be pumped during the initial three to four days of the project. After start-up operations are complete, it is anticipated the pumping rate will decline to a relatively stable rate of 5,000 gallons per day. Two additional 20,000-gallon tanks will be installed within the Waste Pit area to supply surge capacity for wastewater produced during initial pumping operations. These tanks will also be used to provide storage capacity once the pumping rate stabilizes.

Wastewater will be pumped for the 20,000-gallon tanks periodically and transferred to the existing Plant 8 treatment system using a 5,000-gallon mobile tank truck. At Plant 8, the wastewater will be treated to remove uranium and other heavy metals through lime precipitation, sedimentation, and filtration. Treated effluent will be discharged to the uranium contaminated side of the General Sump (GS), where it will be combined with other wastewater and discharged to the Bio-denitrification (BDN) Facility.

At the BDN Facility, removal of organic constituents will occur through aeration within the BDN towers and through activated sludge processes at the BDN-Effluent Treatment System (BDN-ETS). After treatment at the BDN-ETS the wastewater will be discharged through NPDES permitted outfall *4605

(BDN-ETS), with ultimate disposition occurring to the Great Miami River via outfall *4001 (Manhole 175).

C.3 INFORMATION REQUIRED BY PARAGRAPH XIII.B OF THE AMENDED CONSENT AGREEMENT

Tables A1 & A2 provide a summary of the permits and notifications that would have been required for the project had it not been exempt from the requirement to obtain formal permit approval under CERCLA Section 121(e). A more detailed explanation of these requirements is provided as follows:

C.3.1 Identification of Each Permit That Would Be Required in Absence of the CERCLA 121(e) Permitting Exemption

State Permits/Notifications

- Ohio Administrative Code (OAC) 3745-31-02 - OEPA PERMITS TO INSTALL

  Pursuant to OAC 3745-31-02, no person shall cause, permit, or allow the installation of a new source of air pollutants without first obtaining a Permit to Install. Because the two (2) 20,000 gallon surge tanks meet the definition of an air contaminant source, a Permit to Install would be required for their installation.

- OAC 3745-35-02 - OEPA PERMITS TO OPERATE

  Pursuant to OAC 3745-35-02, no person may cause, permit, or allow the operation or other use of any air contaminant source without first applying for and obtaining a Permit to Operate. As stated above, the two (2) 20,000 gallon surge tanks are air contaminant sources and therefore, would be subject to the Permit-to-Operate rule.

- NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD

FEMP wastewater discharges to the Great Miami River are regulated under OEPA NPDES Permit No. 1IO00004*DD. Project specific discharges will be subject to NPDES effluent limitations and loading rates at NPDES permitted outfalls *4605 and *4001. In addition, the proposed discharges must comply with the terms and conditions of the FEMP NPDES Permit.

By permit condition, the FEMP must notify OEPA of any activities or changes at the site which have the potential to significantly alter the character of its wastewater stream. A NPDES permit modification may be required if the discharge is deemed significant enough to cause a change in the character of the wastewater stream.

In addition, proposed discharges must also be evaluated to ensure they do not violate Clean Water Act (CWA) Section 307 Toxic notification levels promulgated in 40 CFR 122.42 or OEPA Water Quality Standards for the segment of the GMR into which the FEMP discharges its wastewater.

Federal Permits/Notifications

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES

The NESHAP Subpart H Standard promulgated in 40 CFR Part 61.92 specifies that radiological emissions (except radon-222 and radon-220) from DOE facilities must not cause any member of the general public to receive an effective dose equivalent of more than 10 mrem/year.

Pursuant to 40 CFR 61.07 and 61.96, a permit is required for point sources which could cause an annual effective dose equivalent to the nearest off-site receptor in excess of 0.1 mrem/year. Continuous emission monitoring is required by 40 CFR 61.03 (b) for stacks and vents which have the potential to cause a dose in excess of 0.1 mrem/year to any member of the general public. Monitoring is not required for fugitive emission under the NESHAP Subpart H regulations, however, isotopic emission estimates must be prepared for the project to demonstrate compliance with the NESHAP Subpart H Standard.

Given these requirements, both fugitive and point source emissions must be evaluated to ensure compliance with the 10 mrem/year site standard. Emissions from the 20,000-gallon storage tanks must be evaluated against the 0.1 mrem/year standard to determine permitting and monitoring requirements mandated by 40 CFR 61.07, 61.96 and 61.03. Isotopic emission estimated must be prepared for fugitive emission associated with excavation activities.

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES

Pursuant to the NESHAP Subpart Q Standard promulgated in 40 CFR Part 61.192, radon-222 emissions from Department of Energy facilities must not exceed a flux rate of more that 20 picoCuries per square meter per second. In November, 1991 USEPA and DOE signed the Federal Facility Compliance Agreement (FFCA) for the Control and Abatement of Radon-222 Emissions, in which DOE committed to providing USEPA with estimates of radon flux from potential sources of radon emissions such as the Waste Pits.

C.3.2 Identification of the Standards, Requirements, Criteria, or Limitations that Would Have Had to Have Been Met to Obtain the Permits Identified Above

State Permits/Notifications:

- OAC 3745-31-02 - OEPA PERMITS TO INSTALL

OEPA issues Permits to Install for new sources provided: they do not interfere with the attainment or maintenance of applicable air quality standards; do not result in a violation of any applicable laws; and employ best available technology (BAT) to control emissions. BAT requirements are determined using the methodology prescribed under OEPA's Air Toxic Policy.

- OAC 3745-35-02 - OEPA PERMITS TO OPERATE

OEPA issues Permits to Operate provided: the source is operated in compliance with applicable air pollution control laws; is located or installed in accordance with the terms and conditions of a Permit to Install; and does not violate National Emissions Standards for Hazardous Air Pollutants adopted by the Administrator of OEPA.

- NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD

Wastewater discharges associated with the proposed project must be treated to comply with effluent limits and loading rates at NPDES regulated outfalls *4605 (BDN-ETS) and *4001 (MH-175). In addition, wastewater discharges must comply with the terms and conditions of FEMP NPDES Permit 1IO00004*DD.

By permit condition, the FEMP is required to notify OEPA of any activities or changes at the site which have the potential to significantly alter the character of the FEMP wastewater stream. Given the concentration of many pollutants known to be present in the pit leachate are higher than those identified in our NPDES permit application, the FEMP will be required to notify OEPA about the proposed discharge. To avoid a NPDES permit modification, the FEMP must demonstrate that the proposed discharge will not alter the character of our existing wastewater stream.

In addition, proposed discharges must also be evaluated to ensure they do not violate CWA Section 307 Toxic notification levels promulgated in 40 CFR 122.42 or applicable numeric and narrative water quality standards established for the segment of the GMR into which site discharges occur. Use designations for the GMR and their corresponding water quality criteria are established pursuant to OAC 3745-1-21 and 3745-1-07, respectively.

Federal Permits/Notifications

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES

Pursuant to the NESHAP Subpart H Standard codified in 40 CFR Part 61.92, all activities conducted at the FEMP must not cause a maximum off-site release of more that ten (10) mrem for a given year.

Pursuant to 40 CFR 61.07 and 61.96, a notification is required for point sources which could cause an annual effective dose equivalent to the nearest off-site receptor in excess of 0.1 mrem/year. Continuous emission monitoring is required by 40 CFR 61.03 (b) for stacks and vents which have the potential to cause a dose in excess of 0.1 mrem/year to any member of the general public. The effective dose equivalent is determined pursuant to the methods prescribed in 40 CFR Part 61, Appendix D and USEPA's CAP-88 modeling program. Monitoring is not required for fugitive emission sources, however, project specific isotopic emission estimates must be prepared to demonstrate compliance with the NESHAP Subpart H Standard.

Given these requirements, both fugitive and point source emissions must be evaluated to ensure compliance with the 10 mrem/year site standard. Emissions from the 20,000 gallon storage tanks must be evaluated against the 0.1 mrem/year standard to determine permitting and monitoring requirements mandated by 40 CFR 61.07, 61.96 and 61.03. Isotopic emission estimates must be prepared for fugitive emission associated with excavation activities.

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES

Pursuant to Paragraph 28 of the FFCA for the Control and Abatement of Radon-222 Emission, project specific flux rates must be prepared and approved by USEPA prior to conducting the proposed activities.

C.3.3 Explanation of How the Response Action Will Meet the Standards, Requirements, Criteria, or Limitations Identified in C.3.2 Above
State Permits/Notifications

- OAC 3745-31-02 - OEPA PERMITS TO INSTALL

Permits to Install would be required for the two (2) 20,000 gallon surge tanks in absence of the CERCLA 121(e) permitting exemption. The tanks will be installed such that they do not interfere with the attainment or maintenance of any applicable air quality standards or cause a violation of applicable laws. The tanks will employ submerged fill to meet BAT requirements.

- OAC 3745-35-02 - OEPA PERMITS TO OPERATE

Permits to Operate would be required for both the 20,000 gallon surge tanks identified above. The tanks will be operated in compliance with applicable air pollution control laws and will be installed in accordance with the substantive requirements for Permits to Install. The tanks will be operated such that they do not violate applicable NESHAP Standards.

- NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD

Wastewater associated with the de-watering activities will be pumped directly from the Waste Pit Area of OU-1 to the existing Plant 8 treatment system using a 5000-gallon capacity mobile tank truck. Two additional 20,000-gallon mobile tanks will be available at the Waste Pit location to supply surge capacity for wastewater produced by the project.

After treatment at Plant 8, the wastewater will be discharged to the Biodenitrification Facility for additional treatment. After passing through the BDN towers, the wastewater will be discharged through NPDES permitted outfall *4605 (BDN-ETS) prior to its ultimate disposition to the Great Miami River (GMR) via outfall *4001 (MH-175).

Given that the existing FEMP wastewater treatment system is capable of treating the wastewater to meet NPDES permit limitations and loading rates, a NPDES permit modification will not be required for the project. The FEMP will continue to monitor discharges at NPDES regulated outfalls to ensure the proposed discharge does not violate NPDES permit limitations or OEPA Water Quality Standards for the GMR.

Federal Permits/Notifications

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES

The FEMP will ensure that the DEEP project does not violate the 10 mrem/year site standard by maintaining records of measured and isotope specific emissions from the project. This information will then be used to estimate the DEEP's contribution to off-site dose impacts in the Annual NESHAP Subpart H Compliance Demonstration.

- NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES

Excavation activities associated with the proposed project have the potential to cause a release of radon gas and therefore, are subject to evaluation against the NESHAP Subpart Q Standard. Project specific flux calculations will be prepared for the project. In addition, real-time monitoring for radon emissions will be conducted throughout the course of the project.

TABLE C-1 DEEP PERMIT INFORMATION SUMMARY		
PERMIT THAT WOULD BE REQUIRED	**PERMIT REQUIREMENTS (ARARS)**	**COMPLIANCE PLAN**
STATE PERMITS AND NOTIFICATIONS:		
OAC 3745-31-02 - PERMIT TO INSTALL	Unless exempted by OAC 3745-31-03, no person shall cause, permit, or allow the installation of a new source of air pollutants without first obtaining a Permit to Install. OEPA issues Permits to Install for new sources provide they do not interfere with the attainment or maintenance of applicable air quality standards; do not result in a violation of any applicable laws; and employ best available technology to control emissions.	Permits to Install would be required for the 20,000-gallon surge tanks in absence of the CERCLA 121(e) exemption. The tanks will be installed such that they do not interfere with the attainment or maintenance of any applicable air quality standards or cause a violation of any applicable laws. Best available technology (BAT) will be implemented to control emissions from the tanks and will consist of submerged fill.
OAC 3745-35-02 - PERMIT TO OPERATE	Pursuant to OAC 3745-35-02, no person may cause, permit, or allow the operation or other use of any air contaminate source without first applying for and obtaining a Permit to Operate. OEPA issues Permits to Operate provided the source is operated in compliance with applicable air pollution control laws; is located or installed in accordance with the terms and conditions of a Permit to Install; and does not violate National Emissions Standards for Hazardous Air Pollutants adopted by the Administrator of OEPA.	Permits to Operate would be required for the 20,000-gallon surge tanks identified above. The tanks will be operated in compliance with applicable air pollution control laws and will be installed in accordance with the substantive requirements for Permits to Install. The tanks will be operated such that they do not violate National Emissions Standards for Hazardous Air Pollutants.
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT - OEPA NPDES PERMIT NO. 1IO00004*DD	FEMP wastewater discharges must not cause a violation of effluent limits or loading rate at NPDES permitted outfalls. Discharges must also be conducted in accordance with the terms and conditions of the permit. This includes notification requirements under 40 CFR 122.42 for Clean Water Act Section 307 toxic pollutants.	Wastewater associated with the proposed project will be treated at Plant 8 and the BDN Facility to ensure compliance with effluent limits and loading rates at NPDES permitted outfalls *4605 (BDN-ETS) and *4001 (MH-175).

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TABLE C-2
DEEP PERMIT INFORMATION SUMMARY

PERMIT THAT WOULD BE REQUIRED	PERMIT REQUIREMENTS (ARARS)	COMPLIANCE PLAN
FEDERAL PERMITS AND NOTIFICATIONS:		
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR PART 61, SUBPART H - EMISSIONS OF RADIONUCLIDES OTHER THAN RADON FROM DOE FACILITIES	The NESHAP Subpart H Standard codified in 40 CFR 61.92 specifies that radiological emissions (except radon-222 and radon-220) to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent of 10 mrem/year. Pursuant to 40 CFR 61.07 and 61.96, a permit is required for point sources which could cause an annual effective dose equivalent to the nearest off-site receptor in excess of 0.1 mrem/year. Continuous emission monitoring is required under 40 CFR 61.03 (b) for stacks and vents which have the potential, under normal operating conditions without any emission control devices, to release radionuclides in sufficient quantity to cause an effective dose equivalent of 0.1 mrem/year or greater to any member of the public.	The FEMP will ensure that the DEEP project does not violate the 10 mrem/year site standard by maintaining records of measured or isotopic-specific emissions from the project. This information will then be used to estimate the DEEP's contribution to off-site dose impacts. Emissions from the 20,000-gallon storage tanks will be evaluated to determine permitting and monitoring requirements pursuant to 40 CFR 61.01, 61.97, and 61.03 (b).
NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAP) - 40 CFR 61, SUBPART Q - EMISSIONS OF RADON FROM DEPARTMENT OF ENERGY FACILITIES	Pursuant to the NESHAP Subpart Q Standard promulgated in 40 CFR 61.192, radon-222 emissions from Department of Energy facilities must not exceed a flux rate of more than 20 pCi/m2/sec. As part of the November, 1991 USEPA/DOE Federal Facilities Compliance Agreement (FFCA) for the Control and Abatement of Radon-222 Emissions, the DOE agreed to achieve compliance with the radon flux standards by implementing removal and final remedial actions. DOE also committed to providing the USEPA with estimates of the radon flux from potential radon sources at the site.	Excavation activities associated with the proposed project have the potential to cause a release of radon gas and therefore, are subject to evaluation against the NESHAP Subpart Q Standard. Project-specific flux calculations will be prepared for the project. In addition, real-time monitoring of radon emissions will be conducted throughout the course of the project.

ATTACHMENT D

DUST SUPPRESSANT TESTING

ATTACHMENT D
DUST SUPPRESSANT TESTING

D.1 INTRODUCTION

FERMCO personnel will conduct field tests to evaluate the effectiveness of six commercially available coating agents in controlling the generation of dust during wet and dry excavation activities. The effectiveness of using pit supernatant water for dust control will also be evaluated. These agents, together with the pit water, will be applied to excavation working surface, stockpiles, and roadways. It is anticipated that as a result of this test, two agents will be identified for controlling the generation of dust during excavation activities associated with final remediation of the Waste Pit Area.

D.2 EXECUTION TEST

Excavation activities associated with final remediation of the Waste Pit Area are expected to generate significant amounts of dust which must be controlled. Dust control can be accomplished using coating agents applied directly to excavation working surfaces, stockpiles, and roadways. These agents include hazardous/mixed waste barrier systems (foams or films) and commercial dust suppressants. The use of available pit supernatant water for dust control will also be evaluated.

Prior to initiating excavation activities, commercially-available agents from various vendors will be preliminarily screened for applicability to the field testing activities. Potential vendors include the following:

Aquadyne	Reef Industries
Georgia Pacific Chemical	Johnson March Systems
Witco Corp.	Martin Marietta
Intersystems	Bartlett
Iron Mountain Tech.	Rusmar Foam Tech.
American Cyanamid Co.	3M

The preliminary screening criteria include:

1. Type of equipment required for application (including manpower requirements)
2. Anticipated ease of application
3. Product constituents
   a. material handling requirements
   b. environmental impacts
   c. agents compatibility with waste
4. Storage life of product
5. Duration of effective control
6. Quantitative information (non-visual) on particulate control
7. Effective temperature/humidity ranges for application and service
8. Suitability to thermal treatment (drying and/or incineration)_

Based upon preliminary screening, six agents will be selected for field performance testing. The selected agents will be applied and evaluated at each of the seven wet and the one dry excavation locations. Evaluation is required at both wet and dry excavation locations due to varying moisture conditions.

Specific applications sites at each excavation location include working excavation surfaces, stockpiles, and roadways. Within each specific application site, six test cells will be identified and delineated for application of the selected agents. Each test cell will be approximately 5-feet. The locations of the test cells will be determined in the field by the field team leader. Application of the agents within these cells will occur following excavation activities. Each agent will be applied in accordance with the manufacturers' specifications.

The performance of the applied coatings will then be visually monitored over a 24 hour period. The performance period of the tests may be extended by the field team leader, but will be limited by the duration of the excavation activities themselves. Due to safety concerns, excavation activities have been limited to 72 hours at each excavation site. Longer performance periods may be obtained by applying the selected agents to the restored pit surface following backfilling operations. Agents may be re-applied, as necessary, to areas exhibiting wear or cracking. At the discretion of the field team leader, the selected agents may also be employed during actual excavation operations. Testing under these conditions, however, may be restricted due to site-specific health and safety requirement (i.e. limiting the distances to which personnel may approach excavation boundaries and operating equipment). Since standardized testing procedures for monitoring the performance of these agents in the field have not been identified at this time, performance will be based primarily on visual observations.

It is estimated that each agent will be required to coat an area of approximately 75 square feet within the test cells and an additional 250 square feet during actual excavation operation (if initiated) at each excavation location. Allowing for 10 percent waste, each selected agent would be required to coat approximately 360 square feet per excavation.

Upon the conclusion of excavation activities, the six selected agents will be evaluated against the following criteria:

1. Cost per square feet
2. Ease of application
3. Ease of cleanup
4. Amount and type of waste generated (including disposal requirements)
5. Applicability to the full range of particulate control needs - effectiveness of the selected agents in controlling particulate releases that may be caused by wind, rain, and equipments operation
6. Adhesion to waste
7. Durability and integrity of applied coating

The two most effective agents, as identified during the previously described wet and dry excavation activities, will be utilized for controlling the generation of dust during ramp excavation activities. For estimating purposes, each of the two selected agents will be applied to approximately 1,500 square feet of surface area. Each agent will be re-evaluated against the seven above-identified criteria. Testing will be carried out in a manner similar to that previously described, however, the performance period of the test will be longer due to the longer duration of this excavation activity.

ATTACHMENT E
SLUG TESTING

ATTACHMENT E
SLUG TESTING

This section describes the slug testing to be performed as part of the Dewatering Excavation Evaluation Program (DEEP). The tests are designed to provide the information to evaluate the feasibility of mechanical excavation and an alternative method of removing the waste from the pits, slurrying.

E.1 TEST DESCRIPTION AND OBJECTIVES

Slug tests will be performed on nine existing groundwater monitoring wells in Waste Pits 1, 2, and 3. The slug tests will determine the hydraulic conductivity of a relatively small zone of influence of the waste material surrounding the wells to be tested. Wells included are identified in Table E-1 and shown in Figure 2-1.

TABLE E-1
WELLS TO BE SLUG TESTED

Waste Pit	Wells to be slug tested
1	1073, 1765, 1766
2	1767, 1768, 1769
3	1770, 1771, 1772

Falling and rising head tests will be performed in each of the wells. Water levels in the wells will be measured at least daily for one week prior to and two weeks after slug testing. Slug testing will be performed in accordance with ASTM D 4044-91. Waste permeabilities will be used to construct computer flow models of the waste so that dewatering applications, if needed, can be refined.

E.2 DATA COLLECTION, ANALYSIS, INTERPRETATION, AND REPORTING

The planned path to calculate hydraulic conductivity is the Bouwer-Rice method. The Bouwer-Rice method calculates hydraulic conductivity surrounding a well installed in an unconfined or leaky aquifer. Design characteristics of the waste pits, the unconfined groundwater waste "aquifer" conditions bounded on the top and base by cap and liner materials of suspect integrity, qualifies Bouwer-Rice as the slug test method of choice.

It is recognized that the hydraulic conductivity results may not be representative of the total waste material contained in the waste pits due to the heterogeneous and anisotropic conditions of the waste within the pits. However, much useful information regarding waste permeability characteristics can be inferred if a relatively large number of wells is used.

Bouwer-Rice will also be used for those wells that display a water level above the top of the well screen. Pre-testing measurement of the water level will be performed. Following this, a slug of known dimensions will be introduced into the well, the slug removed, and the resultant water levels measured per unit of time until equilibrium conditions have been achieved in the well.

Removal of the slug will cause a drop in the water level within the well. Measurements of the new liquid level will be taken as this level fluctuates per unit of time until such time as equilibrium conditions return to the well. From this information, the hydraulic conductivity will be calculated. Waste permeabilities will be used to construct computer flow models of the waste so that dewatering applications, if needed, can be refined. These data will be used to obtain a preliminary value for numerical modeling which will be used to assess well spacing.

E.3 RESIDUALS MANAGEMENT

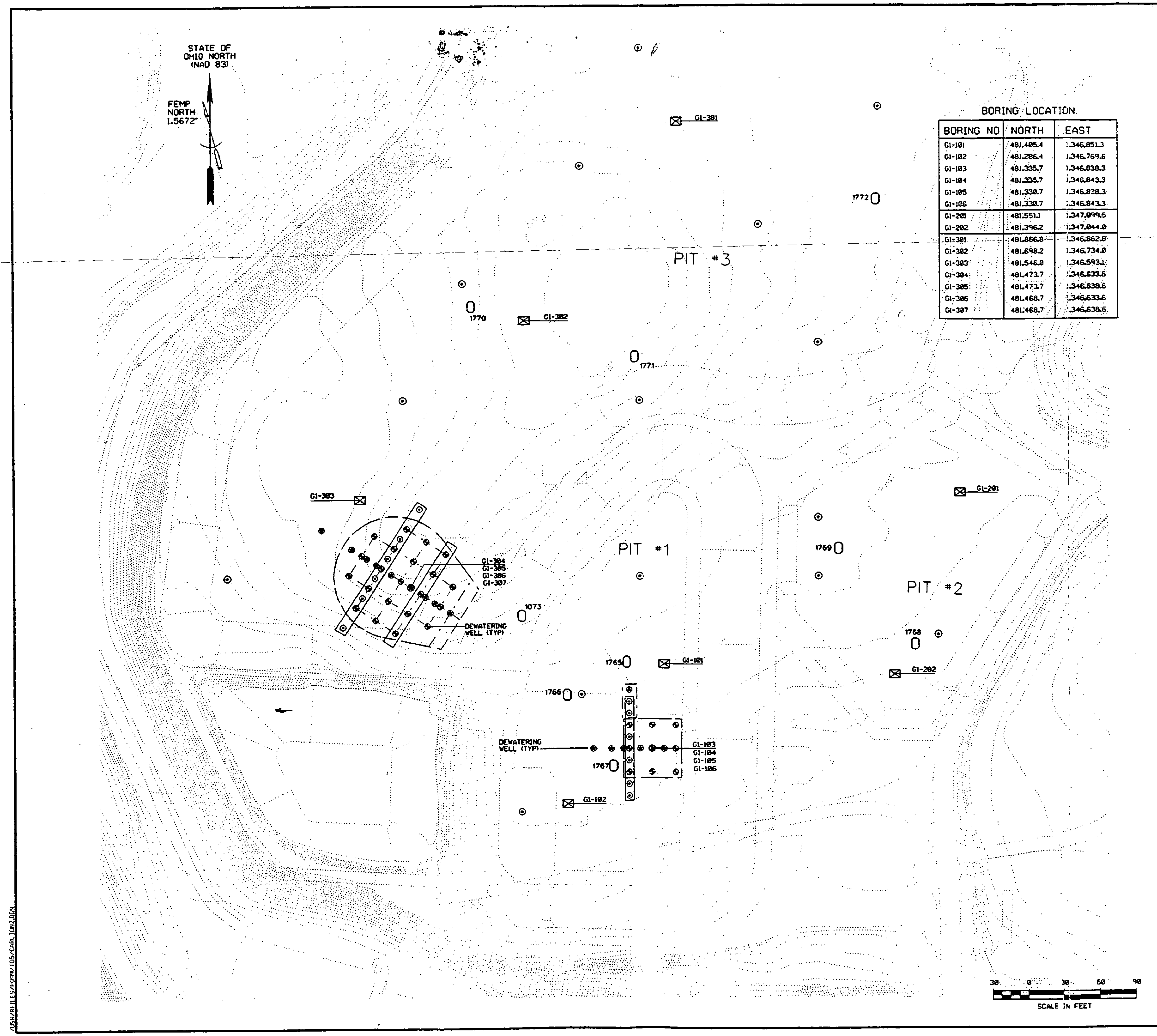
E.3.1 Contact Waste and Personal Protective Equipment (PPE)

Contact waste is categorized as personal protective equipment (PPE), gloves, wipes, plastic, etc. generated during a sampling event, that may be contaminated as a result of coming in contact with the sampled material. Contact waste generated during DEEP will be collected in a plastic bag and sealed with tape. The bag will be labeled with the name and phone number of the project supervisor and the name of the person placing the bag in the dumpster. The bag will be placed in the CRU3 RI/FS-designated locked dumpster. No Material Evaluation Form is generated. The trash in the dumpster will go to the trash baler, where it will be compacted and boxed for transport from the site as low-level radioactive waste. PPE that is contaminated will be placed in a container and stored with the dried material awaiting the Pit 6 Drying Study.

E.4 EQUIPMENT

- Solinst Water Level Indicator (probe and tape)
- Cable Reels and Pressure Transducers (9)
- In Situ Hermit 2000 multichannel data loggers (4, one as backup)
- Slugs: dimensions 2 5/8" outside diameter by 3' (9)

5849



BORING LOCATION

BORING NO	NORTH	EAST
GI-101	481.405.4	1.346.851.3
GI-102	481.286.4	1.346.769.6
GI-103	481.335.7	1.346.838.3
GI-104	481.335.7	1.346.843.3
GI-105	481.330.7	1.346.828.3
GI-106	481.330.7	1.346.843.3
GI-201	481.551.1	1.347.099.5
GI-202	481.396.2	1.347.044.0
GI-301	481.866.8	1.346.862.8
GI-302	481.698.2	1.346.734.0
GI-303	481.546.0	1.346.593.1
GI-304	481.473.7	1.346.633.6
GI-305	481.473.7	1.346.638.6
GI-306	481.468.7	1.346.633.6
GI-307	481.468.7	1.346.638.6

LEACHATE WELL FOR SLUG TESTING

BEFORE, DURING AND AFTER DEWATERING SPT

CONE PENETROMETER TEST (CPT)

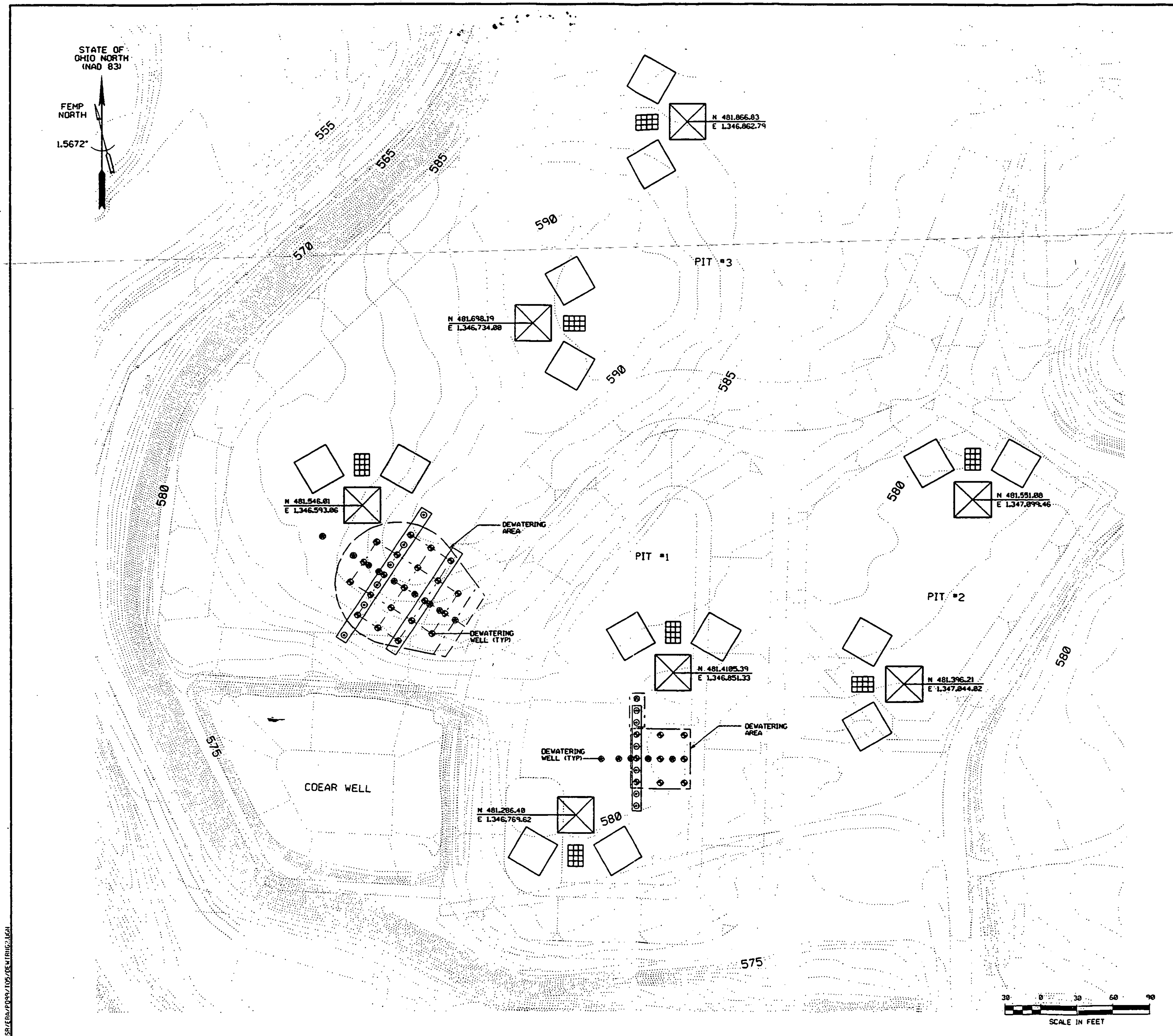
UNDEWATERED TRENCH, SPT AND CPT

DEWATERING TEST AREA, OBSERVATION WELLS AND ZONE OF INTERIM CPT TESTING.
(SEE FIGURE 6-1 FOR LOCATION OF PUMPING WELLS.)

LOCATION MAP
SLUG TEST, BORING WITH SPT, CPT

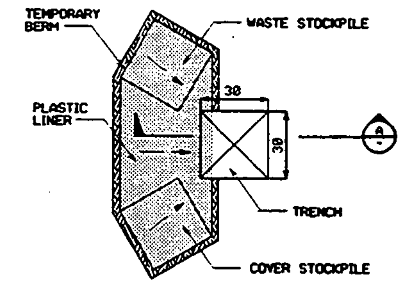
000131

FIGURE 2-1

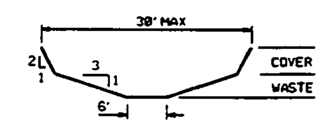


LEGEND

- UNDEWATERED TRENCH
- DEWATERING TEST AREA OBSERVATION WELLS
- PLASTIC LINER
- BACKHOE LOCATION



TYPICAL TRENCH DETAIL



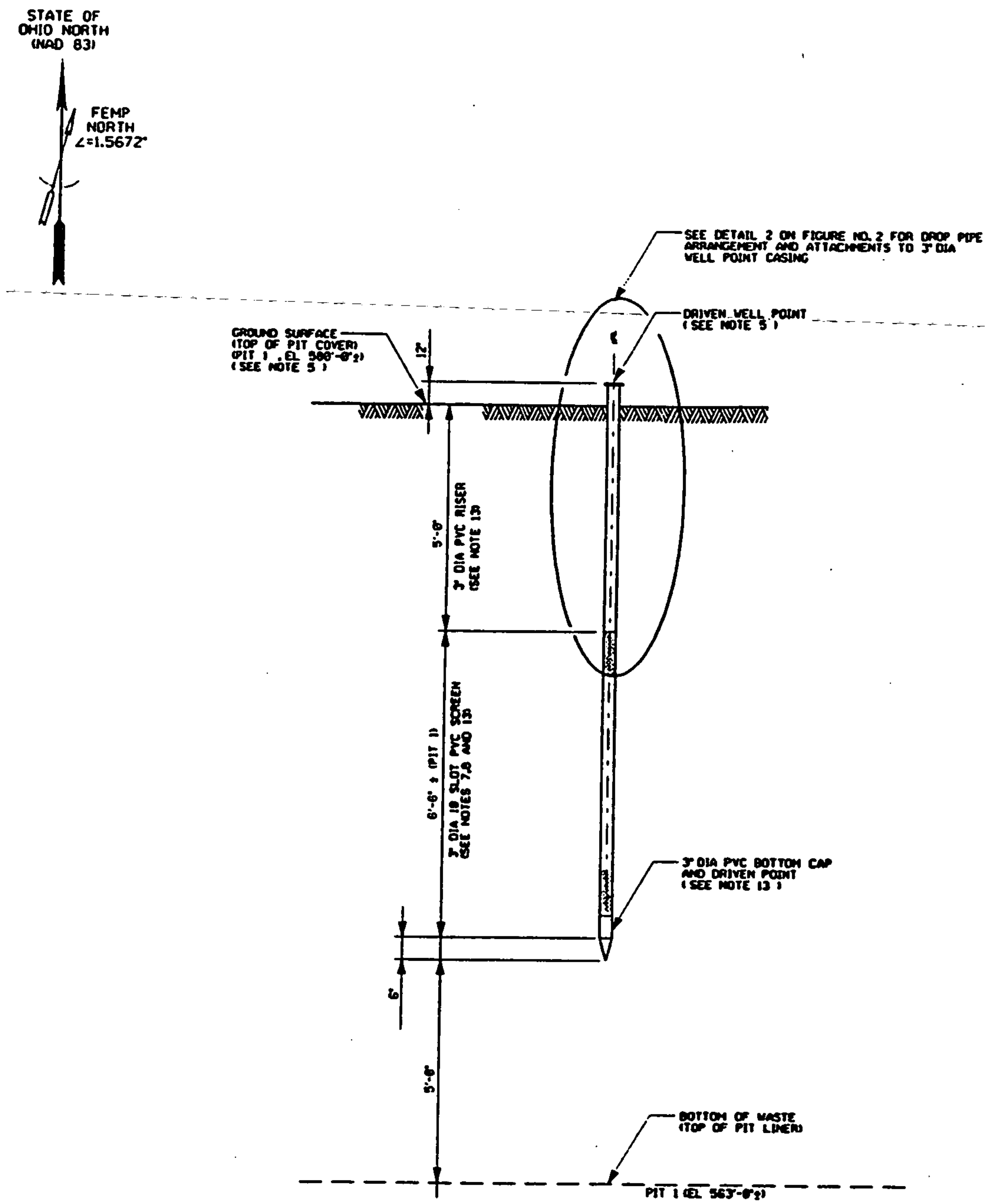
A TYPICAL SECTION
NOT TO SCALE

LOCATION MAP
WET EXCAVATION

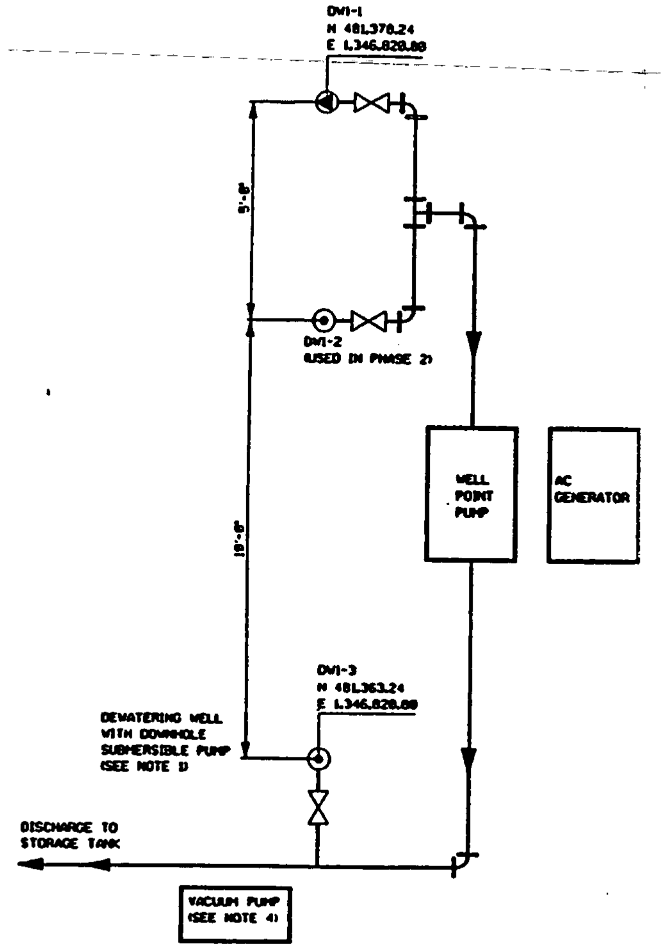
000132

FIGURE 3-1

5849



DRIVEN WELL POINT
DW1-1
(FOR PHASE 1 TESTING)



GENERAL ARRANGEMENT
WELLS, EQUIPMENT, PIPING
(INSTALLATION IN PIT 1)

NOTES

1. SEE FIGURE NO. 3 FOR DESIGN OF DEWATERING WELL WITH DOWN HOLE SUBMERSIBLE PUMP.
2. SEE FIGURE NO. 2 FOR DESIGN OF DEWATERING WELL WITH SURFACE LOCATED WELL POINT PUMP.
3. LOCATE AC GENERATOR AND WELL POINT PUMP AS SHOWN IN FIGURE NO. 7.
4. VACUUM PUMP TO BE USED IN PHASE 3 IF DOWN HOLE PUMP OPTION IS SELECTED.
5. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER CONSTRUCTION.
6. ALL PIPE DIMENSIONS GIVEN IN NOMINAL PIPE SIZE.
7. A 10 SLOT PVC SCREEN USING NO. 8 GLOBAL SAND EQUIVALENT AS A FILTER PACK SHOULD BE SATISFACTORY FOR THIS APPLICATION. ALTERNATIVELY A 20 SLOT PVC SCREEN USING GLOBAL NO. 7 SAND OR EQUIVALENT COULD BE SUBSTITUTED IF ENCRUSTING IS A CONCERN OR IF BLOCKAGES DURING DEVELOPMENT ARE CONSIDERED TO BE A POTENTIAL DRAWBACK.
8. ESTABLISH WELL POINT SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION ; ASSUME PIT-1 WASTE BOTTOM EL 563'-0".
9. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
10. ALL PVC PIPE SHALL BE SCHEDULE 80.
11. WELL SCREEN SHALL BE SIZED FOR A MAXIMUM PUMPING RATE OF 4 GPM PER LINEAL FOOT OF WELL SCREEN.
12. INSTRUMENTATION FOR WELL POINT TO INCLUDE:
    - A. VACUUM GAGE ON WELL CASING
    - B. FLOW RATE AND TOTALIZER ON WELL DISCHARGE
    - C. WATER LEVEL SENSOR AND RECORDER
13. DEPENDING ON WASTE CONDITION AND INSTALLATION METHOD STEEL WELL POINT MAY BE REQUIRED.
14. ALL WELLS INSTALLED WITH TWO ELECTRODES (REBAR) WITHIN WELL FILTER PACK. SECOND ELECTRODE IS A SPARE.

LEGEND

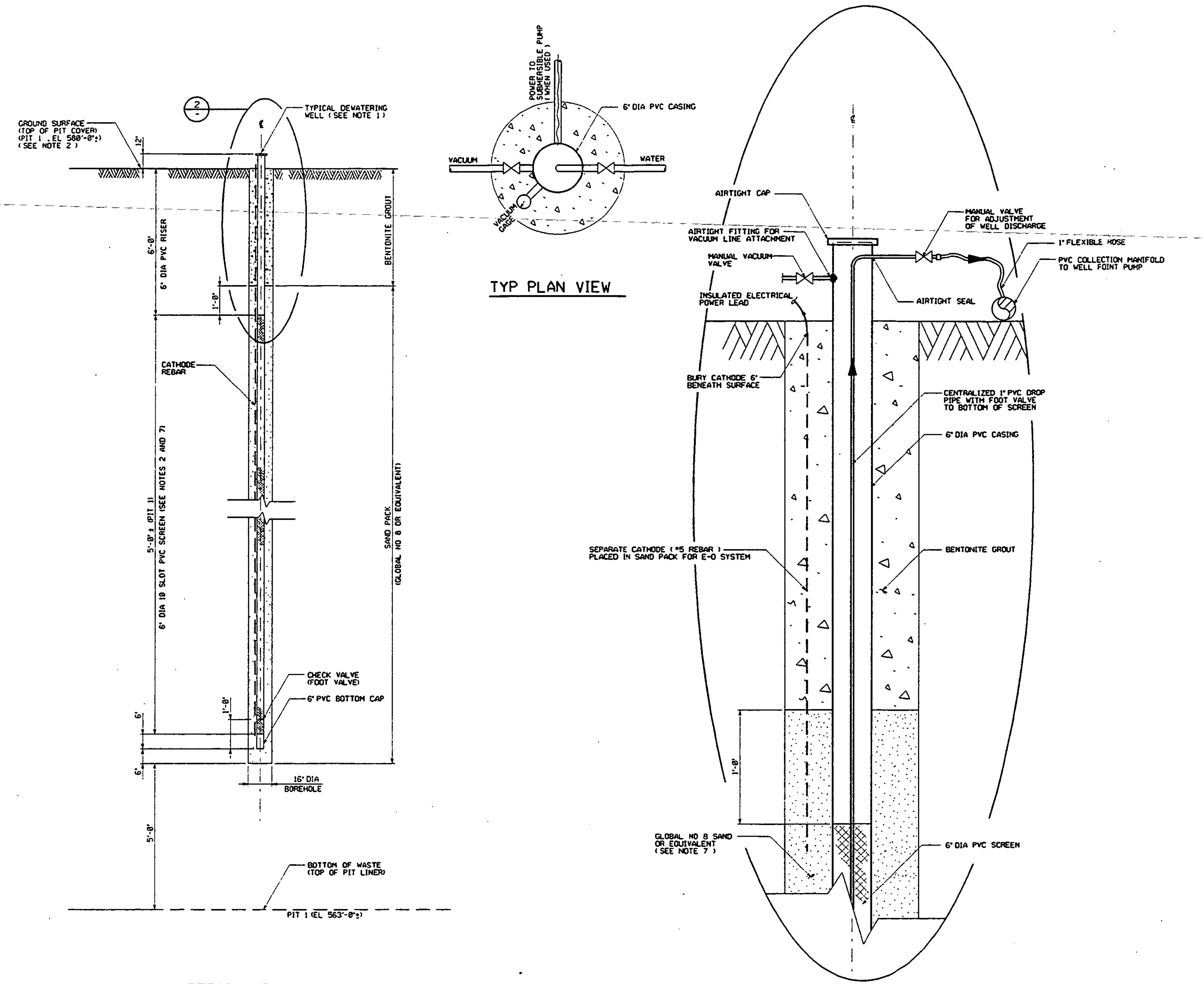
◬	DRIVEN WELL POINT
⊙	WELLS UTILIZED FOR SPACING TEST (PHASE 2)
⋈	THROTTLE / SHUTOFF VALVE
DW1-2	DEWATERING WELL, PIT 1, WELL NO. 2

GENERAL ARRANGEMENT PLAN
PHASE 1 - COMPARATIVE WELL TEST

000133

P019/CRU1

Figure 4-1



DETAIL 1 NTS REF FIGURES NO. 5 & 7

DETAIL 2 NTS

NOTES

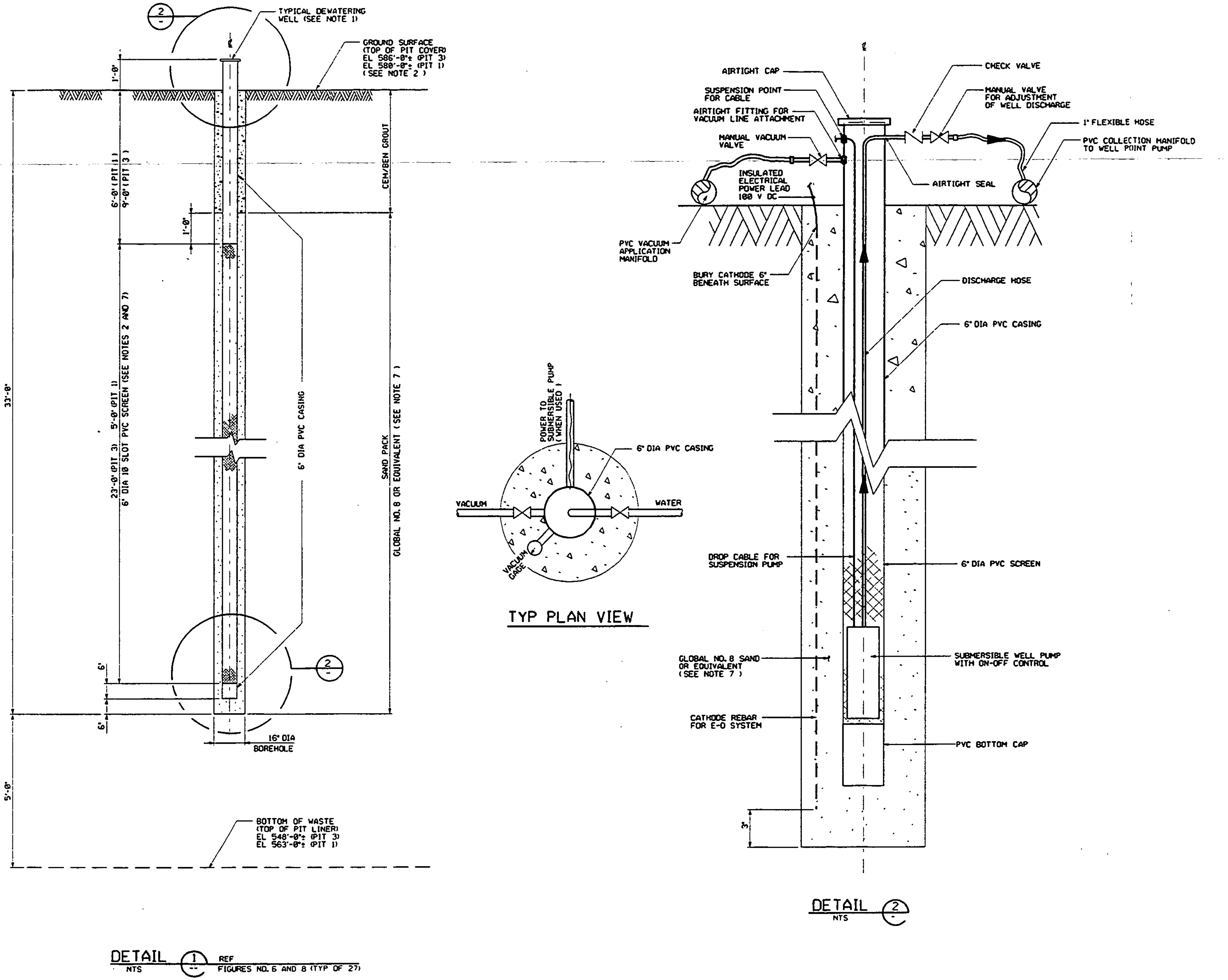
1. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER WELL CONSTRUCTION.
2. ESTABLISH WELL SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION; ASSUME PIT-1 WASTE BOTTOM EL 563'-0".
3. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
4. ALL PVC PIPE SHALL BE SCHEDULE 80.
5. WELL SCREEN SHALL BE SIZED FOR A MAXIMUM PUMPING RATE OF 4 GPM PER LINEAL FOOT OF WELL SCREEN.
6. INSTRUMENTATION FOR WELL TO INCLUDE:
   A. VACUUM GAGE ON WELL CASING
   B. FLOW RATE AND TOTALIZER ON WELL DISCHARGE
   C. WATER LEVEL SENSOR AND RECORDER
7. IF ENCRUSTATION IS CONSIDERED TO BE A POSSIBLE PROBLEM THE SLOT SIZE CAN BE INCREASED UP TO 20 SLOT. IF 20 SLOT IS USED, SAND PACK EQUIVELENT TO GLOBAL NO. 7 SHOULD BE USED.

DEWATERING WELL DESIGN
SURFACE LOCATED WELL POINT PUMP

000134

P019/CRU1

Figure 4-2



NOTES

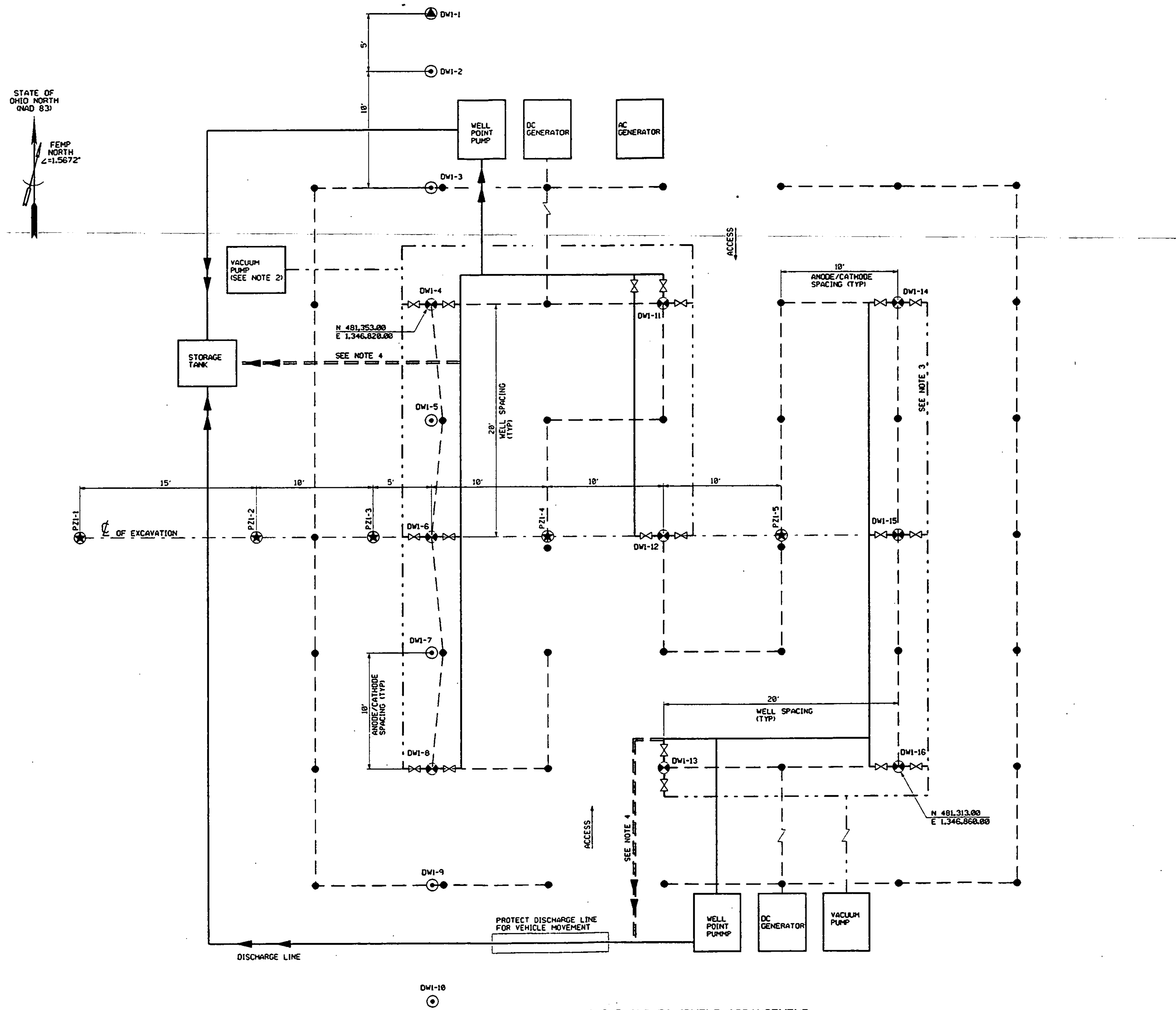
1. WELL LOCATIONS ESTABLISHED/SURVEYED BEFORE AND AFTER WELL CONSTRUCTION.
2. ESTABLISH WELL SCREEN LENGTH BASED ON SURVEYED GROUND ELEVATION AT WELL LOCATION ; ASSUME PIT-3 WASTE BOTTOM EL 548'-0" AND PIT 1 WASTE BOTTOM EL 563'-0".
3. ALL SCREEN AND RISER DIMENSIONS ARE GIVEN IN NOMINAL PIPE SIZE.
4. ALL PVC PIPE SHALL BE SCHEDULE 80.
5. WELL SCREEN BE SIZED FOR A MAXIMUM PUMPING RATE OF 5 GPM PER LINEAL FOOT OF WELL SCREEN.
6. INSTRUMENTATION FOR WELL TO INCLUDE:
   A. VACUUM GAGE ON WELL CASING
   B. FLOW RATE AND TOTALIZER ON WELL DISCHARGE
   C. WATER LEVEL SENSOR AND RECORDER
7. IF ENCRUSTATION IS CONSIDERED TO BE A POSSIBLE PROBLEM THE SLOT SIZE CAN BE INCREASED UP TO 20 SLOT. IF 20 SLOT IS USED, SAND PACK EQUIVALENT TO GLOBAL NO. 7 SHOULD BE USED.

DEWATERING WELL DESIGN
WITH DOWN HOLE SUBMERSIBLE PUMP

000135

P019/CRU1

Figure 4-3



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT

WELL POINT ARRAY - PIT 1

P019/CRU1

NOTES

1. NO. 5 REBAR IS INSTALLED TO THE FULL DEPTH OF EACH WELL. WITHIN THE FILTER PACK ANNULUS OF EACH WELL. THIS REBAR THEN PERFORMS THE FUNCTION OF A CATHODE AT EACH WELL.
2. VACUUM PUMP LOCATION IF DOWN HOLE PUMP IS EVENTUALLY SELECTED FOR PHASE 3 TESTING.
3. VACUUM HEADER SHOWN FOR DOWN HOLE PUMP OPTION IF SELECTED.
4. THIS SECTION OF DISCHARGE HEADER IS REQUIRED ONLY IF DOWN HOLE PUMP OPTION IS SELECTED.

LEGEND

DRIVEN WELL POINT

COMBINED VACUUM AND WATER TABLE PIEZOMETER

WELL (PHASE 3)

WELLS UTILIZED FOR SPACING TEST (PHASE 2)

THROTTLE / SHUTOFF VALVE

ANODE

VACUUM HEADER

INSULATED ELECTRICAL CONDUIT

DISCHARGE HEADER

OPTIONAL SECTION OF DISCHARGE HEADER TO BE INSTALLED IF DOWN HOLE PUMP OPTION IS USED.

DW1-2 DEWATERING WELL, PIT 1, WELL NO. 2

PZ1-1 COMBINED VACUUM AND WATER TABLE PIEZOMETER, PIT 1, NO. 1

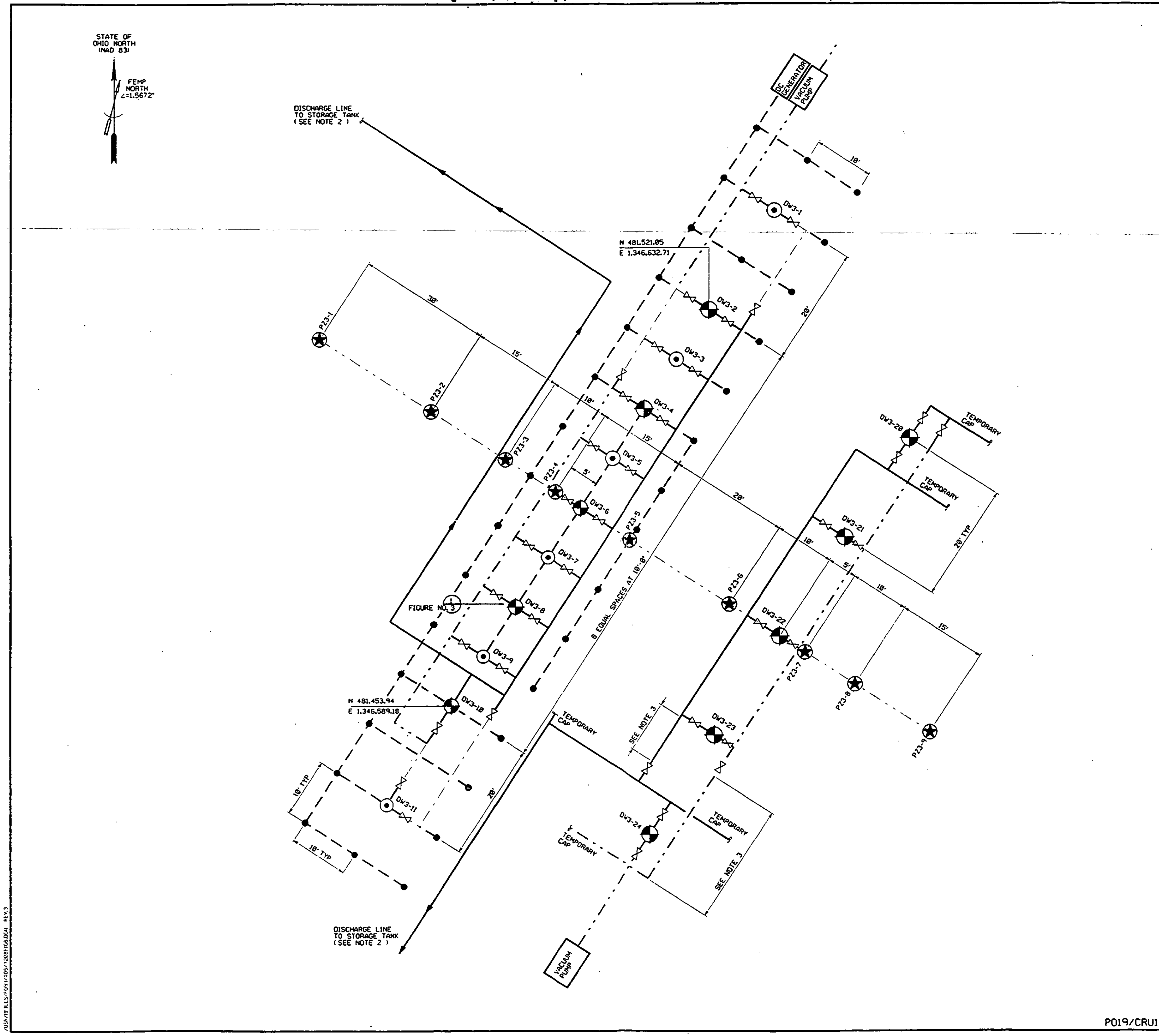
GENERAL ARRANGEMENT PLAN
PHASE 3

FULL INSTALLATION TESTING WELLS.
FOR PIT 1

000136

Figure 4-4

5849



NOTES:

ELECTRICAL NOTES:

1. LOCATE WELL POINT PUMP, E-O DC SUPPLY, AND DATA LOGGER AT APPROXIMATE LOCATIONS SHOWN OUTSIDE OF APPROXIMATE DEWATER ZONE BOUNDARY.
2. FOR GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT, SEE FIGURE NO. 8
3. THIS SECTION TO BE REMOVED WHEN PHASE 2 WORK IS COMPLETE.

LEGEND

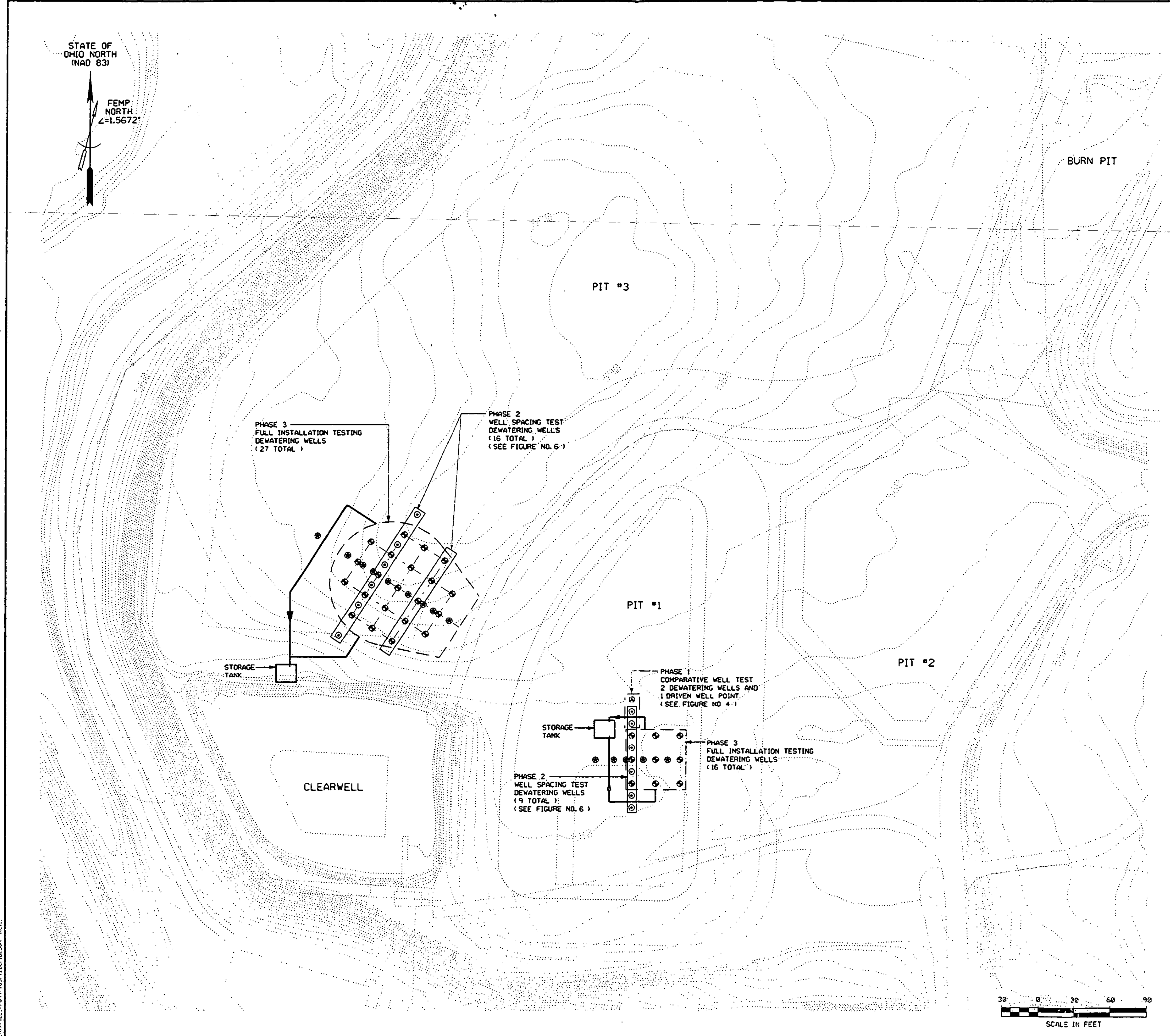
- ⊙ WELL NOT PART OF THE PATTERN EXPECTED FOR THE FINAL DEWATER TESTING SYSTEM (PHASE 3), THEY ARE FOR WELL SPACE TESTING PURPOSES.
- DEWATERING WELLS PART OF PHASE 3 FULL INSTALLATION SYSTEM
- COMBINED VACUUM AND WATER TABLE PIEZOMETER WELLS
- ⋈ THROTTLE / SHUTOFF VALVE
- ● ANODE
- DW DEWATERING WELL
- PZ COMBINATION PIEZOMETER
- — — — INSULATED ELECTRICAL CONDUIT
- — · — SECTIONS OF HEADERS BETWEEN VALVES TO BE REMOVED PRIOR TO PHASE 3.
- — · · — VACUUM HEADER
- ——— DISCHARGE HEADER

GENERAL ARRANGEMENT
PHASE 2

WELL SPACING TEST
FOR PIT 3

000137

Figure 4-5



NOTES:

1. DISCHARGE WATER PIPING SYSTEM IS SIZED FOR EXPECTED FLOW IN PHASE 3 TESTING. A PART OF THE SYSTEM MUST BE IN PLACE FOR PHASE 1 AND 2 TESTING.
2. PIPELINE ROUTING MAYBE ADJUSTED IN FIELD AT DIRECTION OF FERMCO CONSTRUCTION MANAGER.
3. "WET" EXCAVATIONS COMPLETED IN THE TEDAP PROGRAM TESTING SHOULD BE BACKFILLED PRIOR TO LAYING DISCHARGE PIPING OR PIPING SHOULD BE REROUTED TO AVOID EXCAVATION AREAS.
4. DISCHARGE WATER PIPING SYSTEM TO BE LAID ON GROUND SURFACE. PIPELINE TO BE HELD IN PLACE WITH SAND BAGS AT ALL FITTINGS AND VALVES AND AT 20' INTERVALS ALONG THE PIPELINE.
5. SEE FIGURES 7 AND 8 FOR DETAIL OF THE WELL TEST ARRAY DISCHARGE WATER SYSTEM PIPING AT EACH PIT.

LEGEND

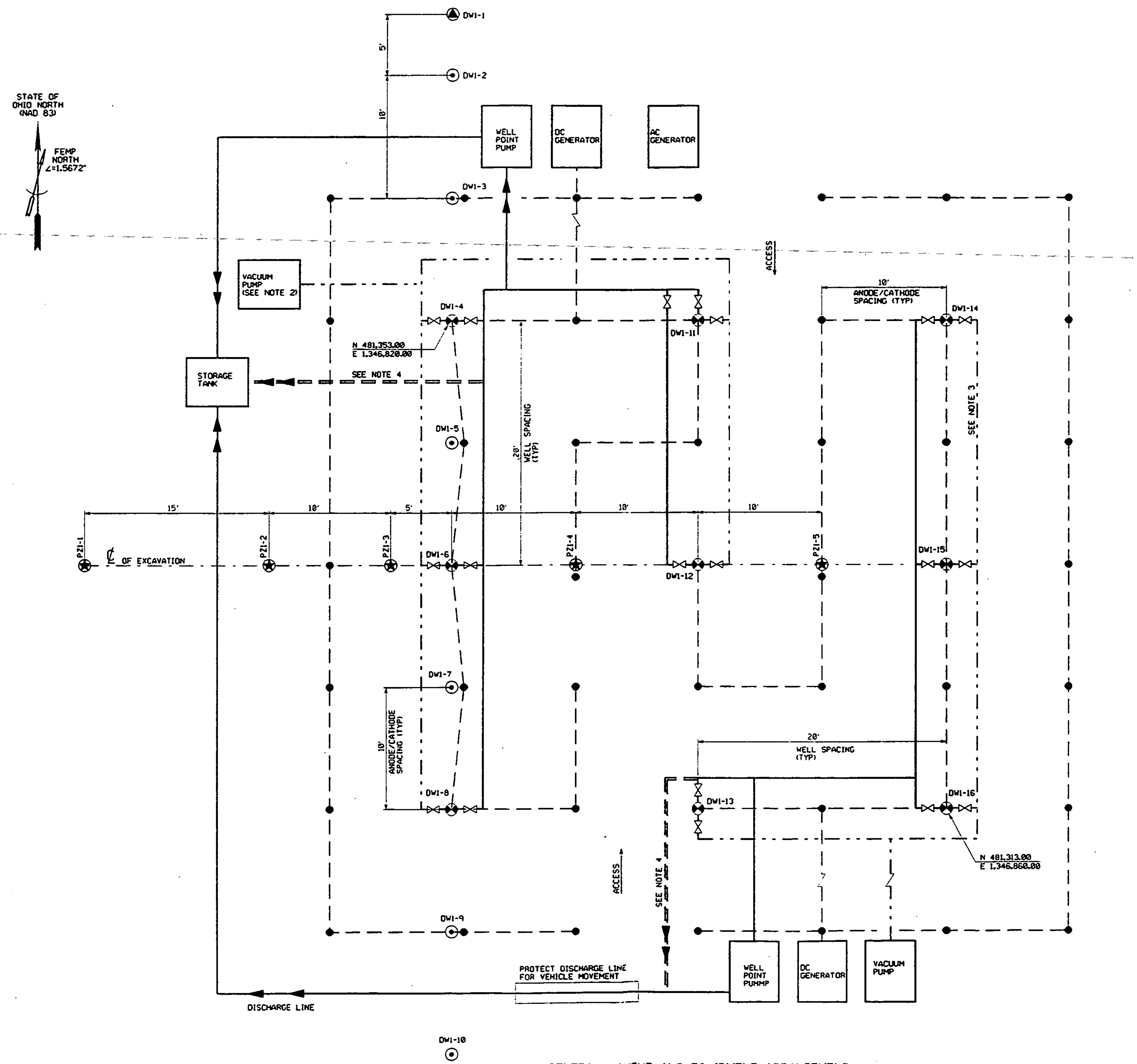
- DEWATERING WELL
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- WELLS UTILIZED FOR SPACING TEST (PHASE 2)
- DRIVEN WELL POINT

GENERAL LOCATION MAP
PHASES 1, 2 AND 3

TESTING SYSTEMS LOCATIONS
IN PITS 1 AND 3

000138

Figure 4-6



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT
WELL POINT ARRAY - PIT 1

NOTES:

1. NO. 5 REBAR IS INSTALLED TO THE FULL DEPTH OF EACH WELL. WITHIN THE FILTER PACK ANNULUS OF EACH WELL. THIS REBAR THEN PERFORMS THE FUNCTION OF A CATHODE AT EACH WELL.
2. VACUUM PUMP LOCATION IF DOWN HOLE PUMP IS EVENTUALLY SELECTED FOR PHASE 3 TESTING.
3. VACUUM HEADER SHOWN FOR DOWN HOLE PUMP OPTION IF SELECTED.
4. THIS SECTION OF DISCHARGE HEADER IS REQUIRED ONLY IF DOWN HOLE PUMP OPTION IS SELECTED.

LEGEND

⊛	DRIVEN WELL POINT
⊛	COMBINED VACUUM AND WATER TABLE PIEZOMETER
⊗	WELL (PHASE 3)
⊙	WELLS UTILIZED FOR SPACING TEST (PHASE 2)
⋈	THROTTLE / SHUTOFF VALVE
●	ANODE
— - - —	VACUUM HEADER
— — —	INSULATED ELECTRICAL CONDUIT
———	DISCHARGE HEADER
═ ═ ═	OPTIONAL SECTION OF DISCHARGE HEADER TO BE INSTALLED IF DOWN HOLE PUMP OPTION IS USED.
DW1-2	DEWATERING WELL, PIT 1, WELL NO. 2
PZ1-1	COMBINED VACUUM AND WATER TABLE PIEZOMETER, PIT 1, NO. 1

GENERAL ARRANGEMENT PLAN
PHASE 3

FULL INSTALLATION TESTING WELLS.
FOR PIT 1

000139

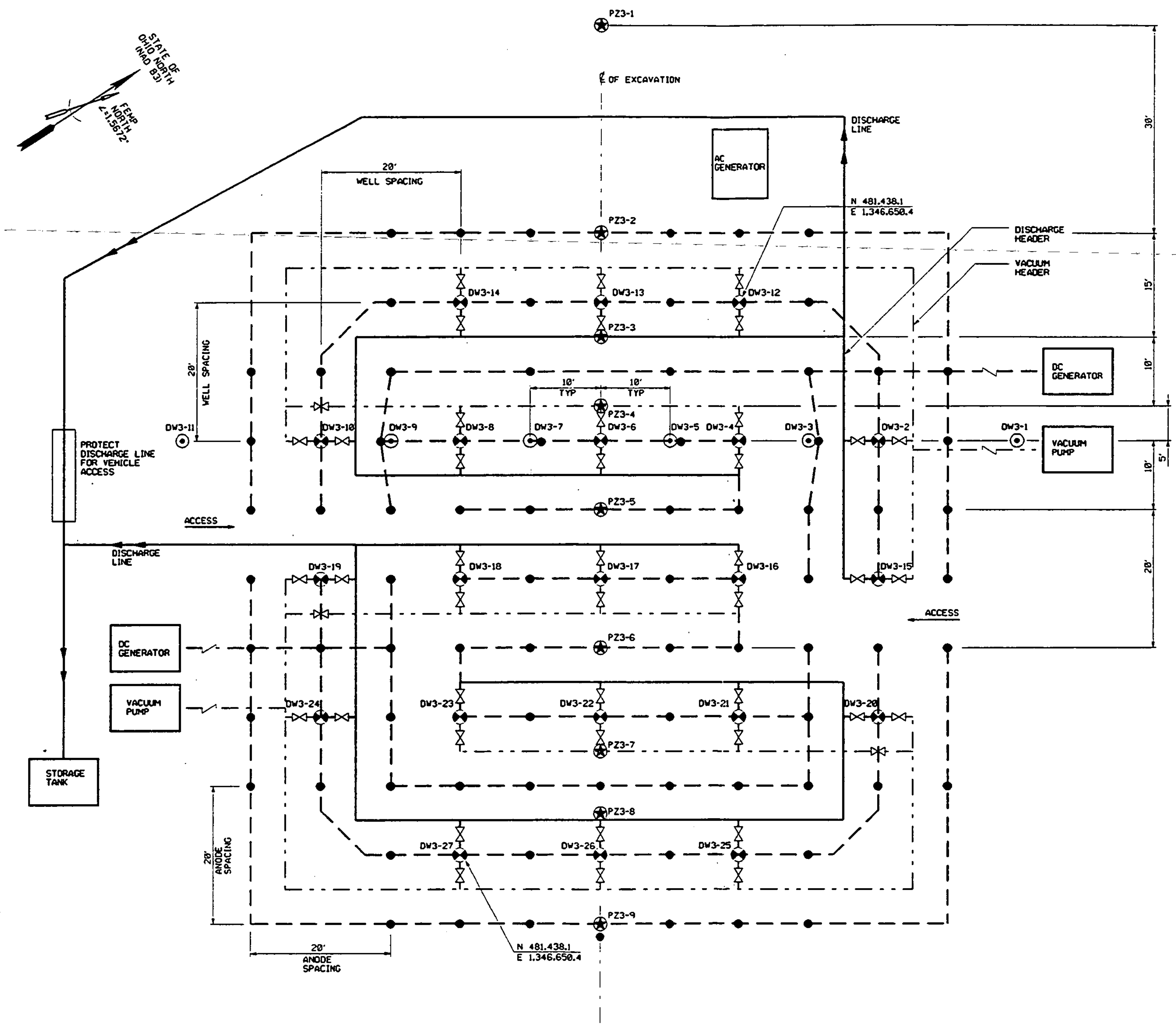
P019/CRU1

Figure 4-7

5849

NOTES

1. WELLS HAVE PVC CASING AND SCREENS.
2. NO. 5 REBAR INSTALLED TO THE SAME DEPTH AS THE WELL AND PLACED IN THE FILTER PACK OF EACH WELL. ACTS AS A CATHODE. ALL WELLS HAVE 2 ELECTRODES EACH INSTALLED WITHIN THE FILTER PACK. THE SECOND ELECTRODE IS A SPARE.



GENERAL LAYOUT AND EQUIPMENT ARRANGEMENT
WELL ARRAY - PIT 3

LEGEND

Symbol	Description
⊙	WELLS UTILIZED FOR SPACING TEST (PHASE 2)
	DEWATERING WELL
	COMBINED VACUUM AND WATER TABLE PIEZOMETER
⋈	THROTTLE / SHUTOFF VALVE
●	ANODE
— —	INSULATED ELECTRICAL CONDUIT
— · —	VACUUM HEADER
——	DISCHARGE HEADER
DW	DEWATERING WELL
PZ3-1	COMBINED VACUUM AND WATER TABLE PIEZOMETER, PIT 3, NO. 1

GENERAL ARRANGEMENT PLAN
PHASE 3

FULL INSTALLATION TESTING
FOR PIT 3

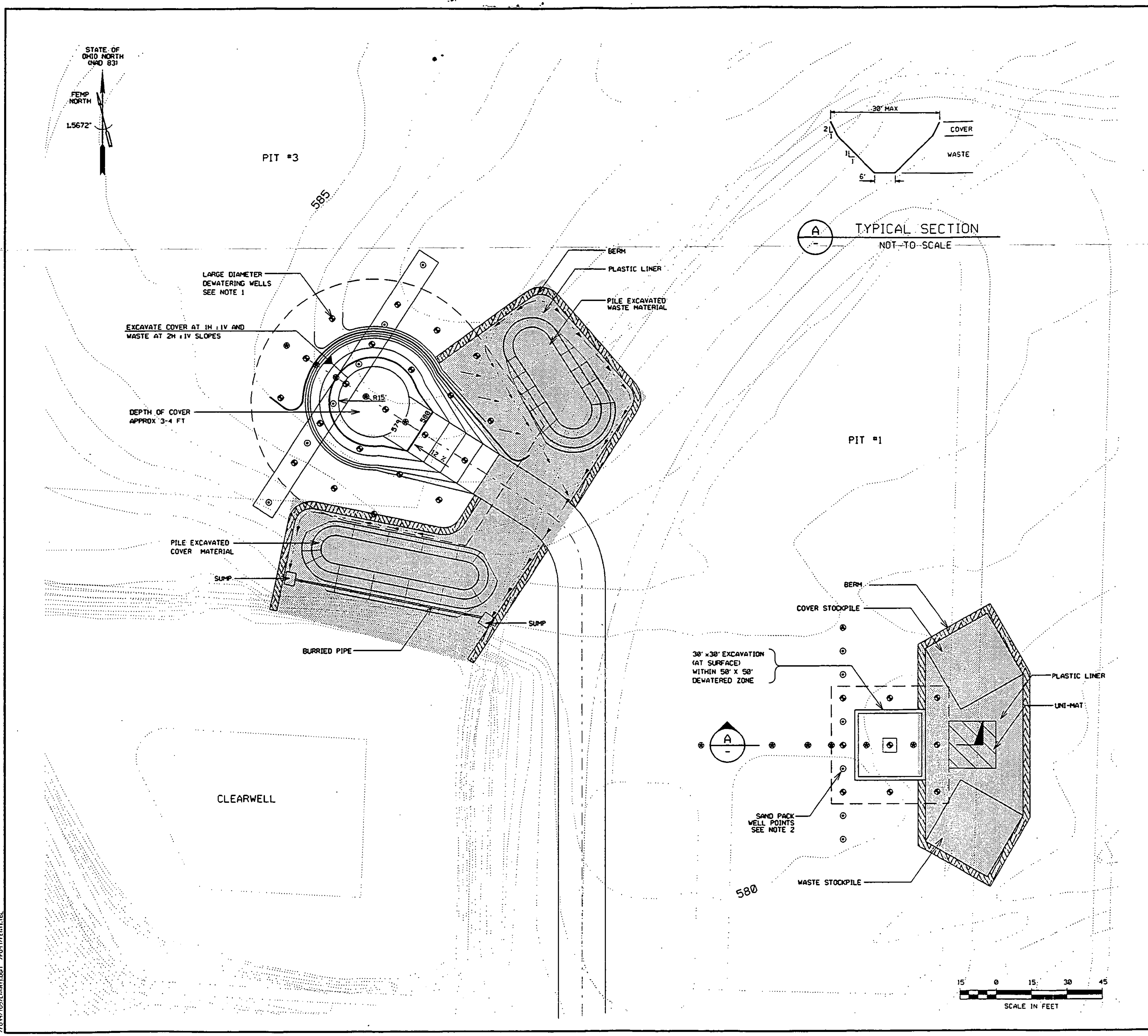
000140

Figure 4-8

P019/CRU1

/USR/FILES/PO19/105/128FIG8.DGN REV.3

1. DEWATERING WELLS WITHIN THE LIMIT OF EXCAVATION SHALL BE REMOVED PRIOR TO THE START OF EXCAVATION.
2. SAND PACK WELL POINTS WITHIN THE LIMIT OF EXCAVATION SHALL BE REMOVED PRIOR TO THE START OF EXCAVATION.



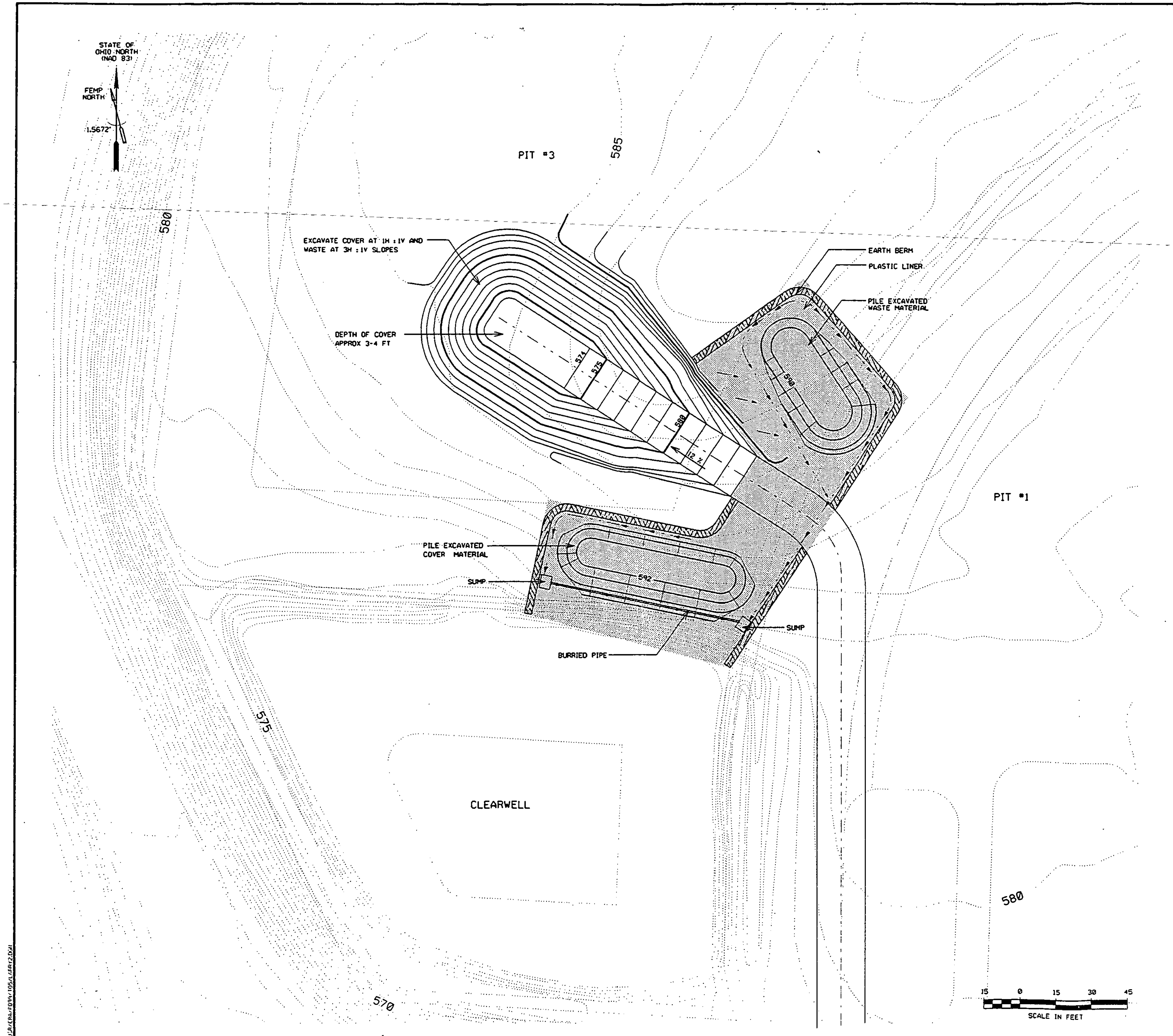
LEGEND

- DEWATERING WELL
- COMBINED VACUUM AND WATER TABLE PIEZOMETER
- WELLS UTILIZED FOR SPACING TEST (PHASE 2)
- DRIVEN WELL POINT
- PLASTIC LINER
- DEWATERING TEST AREA

WASTE PITS 1, & 3
DEWATERING TEST SYSTEMS & DRY EXCAVATION

000141

FIGURE 5-1



5-6849

WASTE PIT 3
RAMP EXTENSION

000142

FIGURE 5-2