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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY MONTHLY TECHNICAL PROGRESS REPORT JULY 1989

08/28/89

DOE-FN 245 REPORT

EPA

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REMEDIAL INVESTIGATION

AND

FEASIBILITY STUDY

MONTHLY TECHNICAL PROGRESS REPORT

JULY 1989

FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

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Attachment to:

5549

FMPC SITEWIDE RI/FS
July 1989
MONTHLY TECHNICAL PROGRESS REPORT

STATUS

General

Progressive actions continued on the FMPC sitewide RI/FS during July 1989. The installation of the remainder of 10 off-site wells remains on hold pending site access.

Discussions with Paddy's Run RI/FS PRP's continued during July and a follow-up meeting is scheduled for late August. A draft agreement to share data from the two RI/FS's is undergoing evaluation and concurrence between the parties. A request for proposal for well installations at the Albright and Wilson facility has also been completed and is awaiting DOE concurrence.

Task 1 - Description of Current Situation

Task 1 Percent Complete: 100%

Task 2 - Remedial Investigation Work Plan Requirements

A meeting was held in Chicago on June 8th with the U.S. EPA and Ohio EPA to review the responses to the comments on the Facility Testing Plan.

Task 2 Percent Complete: 95%

Task 3 - Site Investigation

Transit Survey - Surveying activities continued on establishing the horizontal and vertical coordinates of the completed wells, piezometers, and borings.

Facility Testing - A total of 37 borings, shown in Table 3-1, were drilled during the 20 day week period in July. Piezometers were installed in ten of the 37 borings where ground water was encountered. Within the remaining 27 borings, ground water was not encountered and the borings were properly abandoned by plugging with Volclay grout and surface sealing with a one foot cement cap.

During the drilling of boring 1307, volatile organics were detected. A sample was collected and submitted to the laboratory for analysis. The boring was then plugged and abandoned. An offset boring will be drilled pending the lab results.

2

At boring location 1363 an underground water line was punctured. The rig was moved off location to allow WMCO to assess the situation. The WMCO utility engineer informed ASI that this line has been abandoned and that drilling through the pipe is acceptable. This is the present plan of action.

Buried concrete rubble was encountered at approximately 9.5 feet in boring 1334. After a considerable amount of time and drilling effort, this boring could only be advanced to a depth of 12 feet, the boring was then plugged and abandoned. A replacement boring (#1416) is planned approximately five feet west of boring 1334.

Drilling inside Plant 6 was hampered by underground utility lines. In the vicinity of boring 1162, five attempts at nearby locations were required prior to completion to a depth of 20 feet. The replacement borings: 1162(2), 1413, 1414, and 1415, encountered drainage lines and other pipes at 4 feet, 10 feet, 5 feet, and 4 feet, respectively. Considerable standby time was experienced during this drilling effort as WMCO support was required prior to moving the rig and setting up at each new location.

If drilling proceeds with only minor interruptions, Plant 6 should be completed by mid-August.

The laboratory results from borings 1411 and 1412, located north of Plant 2/3, where suspected volatiles were encountered, indicate the presence of kerosene at concentrations as great as 8,450 mg/m^3. Although not probable, a potential for overexposure of drilling personnel exists. Therefore, drilling in this area will be conducted using full face air purifying respirators equipped with combination organic vapor, acid gas, and high efficiency particulate air (HEPA) cartridges when breathing zone HNu measurements exceed 5 ppm.

<u>Facility Testing Ground Water Sampling</u> - During July, water samples were collected from piezometers installed under the facility testing boring program. Through July 31, 67 piezometers have been sampled by ASI/IT personnel and analyzed for total uranium analysis by the on-site WMCO lab.

TABLE 3-1

FACILITY TESTING BORING PROGRESS
July 1989

Sector	Boring #	Completion Date	Piezometer Installed Y/N	Boring Depth (Ft.)	Well Depth (Ft.)
2	1186	7/01	Y	18.0'	15.5'
4	1321	7/02	N	20.0'	DRY - P&A**
1	*1162	7/02	N	10.0'	P&A
		(2nd attempt & encountered underground drainage pipe)			
4	1289	7/12	N	20.0'	DRY - P&A
4	1282	7/12	N	20.0'	DRY - P&A
1	*1413	7/13	N	4.5'	P&A
(3rd attempt to drill original boring #1162, encountered underground utility line)					
4	1295	7/13	N	20.0'	DRY - P&A
4	1284	7/13	N	20.0'	DRY - P&A
4	1302	7/14	N	20.0'	DRY - P&A
4	1320	7/14	N	20.0'	12'
4	1301	7/14	Y	12.0'	DRY - P&A
4	1314	7/14	N	20.0'	DRY - P&A
4	1300	7/15	N	20.0'	DRY - P&A
1	*1147	7/15	N	20.0'	DRY - P&A
4	1299	7/17	Y	18.0'	18'
4	1298	7/17	N	20.0'	DRY - P&A
	1279	7/17	Y	15.0'	14.4'
1	*1149	7/17	Y	15.5'	15.0'
4	1307	7/18	N	4.5'	P&A
		(Encountered volatiles, well abandoned on lab results)			
4	1287	7/18	Y	15.0'	15.0'
4	1283	7/18	Y	10.5'	10.5'
1	*1414	7/19	N	4.0'	P&A
(4th attempt to drill original boring #1162, encountered underground utility pipe)					
1	*1415	7/24	N	20.0'	DRY -P&A
		(5th & final attempt to drill original boring #1162: successful)			
4	1293	7/25	Y	12.0'	12'

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TABLE 3-1 (Cont'd)

FACILITY TESTING BORING PROGRESS (Cont'd)

July 1989

Sector	Boring #	Completion Date	Piezometer Installed Y/N	Boring Depth (Ft.)	Well Depth (Ft.)
4	*1363	7/25	N	6.0'	P&A
	(Penetrated water line, waiting on instructions from WMCO)				
4	1294	7/26	N	20.0'	DRY - P&A
5	1333	7/27	N	20.0'	DRY - P&A
2	1234	7/27	Y	10.5'	10.5'
4	1296	7/28	N	20.0'	DRY - P&A
1	*1159	7/28	N	20.0'	DRY - P&A
1	*1144	7/29	N	20.0'	DRY - P&A
4	1297	7/29	N	20.0'	DRY - P&A
5	1329	7/30	N	20.0'	DRY - P&A
5	1332	7/30	Y	20.0'	20.0'
5	1330	7/31	N	20.0'	DRY - P&A
1	*1139	7/31	N	20.0'	DRY - P&A
5	1334	7/31	N	12.0'	P&A
	(Concrete rubble encountered at 12 ft., boring abandoned & plugged)				

* Plant 6 Borings
** Plugged and Abandoned

SUMMARY

Total Borings: 37

Piezometer Installations: 10

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Biological Resources - The Acute and Chronic Toxicity and Benthos studies of the FMPC are continuing. The biological resources studies will be correlated to comply with NEPA requirements. Public meeting comments will also be addressed in this correlation. A draft report for internal review is planned for the end of August.

Task 3 Percent Complete: 97%* through Rev 3
62%* post Rev 3

*does not include Facilities Testing

Ground Water Sampling - The sixth quarterly round of ground water sampling was initiated on July 25, 1989. A total of fifteen wells will be sampled during the sixth round. Fourteen of these wells were sampled in July. Per RI/FS Work Plan requirements, two duplicate samples and one rinsate sample will also be collected. Expected completion date for the sixth round sampling is August 2, 1989. Table 3-2 shows specific wells sampled or being sampled, and sample dates for the sixth round. This will conclude all required sampling activities, as required by the RI/FS Work Plan. Any subsequent sampling will be conducted as part of the WMCO monitoring program.

TABLE 3-2
WELLS SAMPLED DURING JULY

Well Number	Date Sampled
2127	7/25
3127	7/25
2045	7/25
2014	7/26
2016	7/26
2048	7/26
2002	7/27
2046	7/28
2047	7/28
2065 (+ duplicate)	7/30
2049	7/30
2006	7/31
2007	7/31
2053 (+ duplicate)	7/31
2055	8/01 (expected)
Equipment Rinsate	8/02 (expected)

WMCO RCRA Ground Water Sampling - No RCRA ground water sampling was conducted during July, 1989. Preparations were initiated to begin the second round of RCRA sampling under Task 9.25. The next round of RCRA ground water sampling is scheduled to commence the week of August 7, 1989.

Sediment Sampling - The fourth and final quarterly round of sediment sampling of the Great Miami River was completed during July with the prescribed seven locations being sampled.

Surface Water - Seeps - Quarterly surface water samples from Paddy's Run were not collected due to the stream's intermittent flow characteristics during the late spring and summer months.

On July 12, Paddy's Run was traversed from approximately 100 meters downstream from the K-65 Silos to the railroad crossing near the northwest corner of the FMPC property. One active seep was observed on the eastern bank at the contact between the gray till and overlying alluvial deposits. A sampling device was constructed and set up at this seep during the afternoon of the 12th. Unfortunately, the flow from the seep was insufficient to collect enough sample for full HSL analyses. By July 17th the seep had completely dried up. Enough water was collected for the following analyses: volatiles, total uranium, metals (filtered), phenols/nitrates and TOC.

This seep location was assigned RI/FS Site number 1422 and was surveyed. The site will be checked for flow on a monthly basis. If flow is observed, then water for additional HSL analyses will be collected at that time.

Task 4 - Site Investigation Analysis

Database - Hardware and software were installed and tested for the first planned remote access into the WMCO VAX. Provision was continued for sustaining users on the time-shared computer in order to avoid disruption in access to the master system.

Data entry continued on the Facilities Testing Program field data, on the current RCRA sampling, and sampling round 5 for the ground water monitoring wells. Data entry for new borings and wells and their survey information was also continued.

Programming was completed on two standard reports and modifications were made for two RCRA reports.

Extensive revisions were made to the Homeowner report. These were delivered on schedule, containing data for sampling rounds 1 - 4.

Programming to generate maps to display data for the Facilities Testing Program was initiated. Programming to update uranium maps for sampling rounds 1 - 4 was completed using the results of the level 1 verification effort. Water table maps were updated and data on additional ground water parameters such as conductivity were entered.

Technical difficulties, including an insufficient number of ports into the WMCO VAX, precluded completion of the planned schedule of leased phone lines that would permit remote access from all prescribed locations. In the interim, remote access will be accomplished via dial-up to the remote access installation at the ASI field office near the site.

Ground Water Modeling - During July, work on the calibration of the three-dimensional solute-transport model at retardation Factors 9 and 12 was completed. Work began on modeling the feasibility of recovering uranium by using extraction wells. Additional modeling was prompted by results from the geochemical program.

Also initiated was work on fitting uranium concentrations calculated by the model to available concentrations measured in the field (calibration). In accordance with the work plan, a longitudinal dispersivity of 100 feet and a transverse dispersivity of 10 was assumed for the model. Model concentrations were adjusted to fit field data by varying source rates and source locations, during various time steps simulated by the model. Formal quality assurance checking of this calibration has not been completed.

Model development using a retardation factor of 1 (no adsorption) has begun. This retardation factor was chosen because preliminary geochemical results indicate the possibility of very little adsorption of uranium. The field data is being fitted by adjusting dispersivities and source rates.

Input files are being created for extraction well modeling that will allow model forecasts 30 years into the future when extraction wells would be operating. These files are being checked and corrected as necessary prior to making routine production runs. Two statistical computer programs were implemented during this period and utilized to check the goodness of fit of model versus field data. One produces various statistical measures of goodness of fit (GEOSTAT), and the other calculates the range of concentration values that are consistent with ones already measured at each monitoring well within the plume.

Risk Assessment:

Operable Units 4 and 6 - The Risk Assessment (RA) for the FMPC RI is proceeding on schedule for Operable Units 4 and 6 for both radiological and chemical contaminants.

The chemical and radiological risk assessments for Operable Unit 4 have been integrated into a single report and submitted for internal review by affected parties at Knoxville. Upon receipt and incorporation of their comments, a draft will be submitted to project management.

Soil sampling of the silo berms and underlying strata is still required to assess the status of potential environmental exposure pathways to off-site receptors that could result from contaminants in soils surrounding the silos. Should these sampling programs validate that these are real pathways for chemical or radiological exposure, these pathways will be evaluated based on procedures contained in the Work Plan.

Preliminary calculations have been performed to estimate the radiological impact on public health if ground water in the south plume is routed to the Great Miami River via the FMPC effluent discharge. The Chemical Risk Assessment Group has retrieved organic and inorganic chemical data for the south plume from the database and transferred these data into Lotus. Summary calculations were performed for well data, QA/QC of spreadsheets, and development and/or modification of exposure scenario calculations for impact.

NEPA - A proposed schedule was prepared for NEPA activities which is integrated with the schedules for each operable unit. Draft sections of the NEPA Integration Plan are undergoing internal review. The Integration Plan will address the level of NEPA documentation required for Fernald RI/FS activities and a method of CERCLA/NEPA integration. A Draft Plan will be submitted to DOE-Fernald in early August. In addition, a review of the existing environmental data sources will be initiated, to identify technical subjects that will require more detailed data, an expanded study area, or more current data for NEPA purposes.

Tasks 5 - Laboratory & Benchscale Studies

Bench-Scale Studies - Resins and other materials necessary for the bench-scale studies were procured. A revised proposal for the bench-scale studies was received from the IT-Knoxville laboratory and a copy was sent to WMCO for review. A partial analysis of a composite sample was completed and indicated a maximum uranium concentration of 27 ug/l. During the month, problems developed with the analytical methodology as related to detection limits, but these have been resolved and the

treatability study is progressing. Initial testing of the composite sample indicates that ion exchange can remove 90 percent of the uranium. Work on the treatability study was delayed during the month, both because of the above-referenced problem and because a purchase order had not been issued. A purchase order has now been issued and both problems have been resolved.

K-65 Silos - Sampling activities were completed for all silos during July. Total sample recovery is unacceptable, requiring further modification prior to the resumption of sampling. Sampling methods and apparatus are undergoing engineering evaluation prior to resumptions of sampling.

Task 6 - RI Reports

Operable Unit 4 - Considerable effort was expended during July to project schedules to reflect the needs of regulatory review cycles and budget constraints. A schedule with appropriate personnel loading has now been attained and is pending final approval by DOE and EPA.

Written responses to two sets of formal questions have been completed during this period. The first was a set of questions prepared for EPA by the AWC Organization. They covered the earlier submission of the (old) Task 12 report. The second was a set that had been submitted by DOE and WMCO dealing with the (new) Task 12 presentation of the Screened Alternatives.

The presentation of the Screened Alternatives for the EPA was made at the July TIE meeting at the Fernald site. This elicited a number of questions and responses beyond the formal prepared materials.

Work is progressing on the Detailed Analysis of the Alternatives, Task 13. The day-to-day activities take place within multi-disciplinary teams assigned to each of the separate Alternatives.

Operable Unit 6 - Ground water elevation data from 1988 and 1989 and ground water quality data from Rounds 1 through 4 were extracted from the data base. Uranium concentration in ground water data from several sources (i.e., Fernald data base, Environmental Monitoring Report (EMR), etc.) were compiled to support ground water modeling and risk assessment efforts.

A report program generator (RPG) output file from the Fernald data base was downloaded to a personal computer and subsequently imported into Lotus. The Lotus file is being modified to produce tables suitable for the Remedial

Investigation (RI) report. The computation and compilation of alkalinity ground water data for Rounds 3 and 4 were completed.

Figures were prepared to present uranium and nitrate concentrations in ground water for Rounds 1 through 5. The preparation of ground water elevation maps for 1988 and 1989 was continued. Isopach and structure contour maps for the major clay interbed of the sand and gravel aquifer and an isopach map of the till were completed. Geologic cross sections of the South Plume area were also completed during July. The preparation of hydrographs for selected wells was initiated. Background data was collected for use in report preparation. Lotus files containing ground water uranium data for the South Plume were used to generate information for the radiological portion of the risk assessment.

Geochemical Program - The July 1989 geochemical program activities included geochemical modeling of ground and surface water, total uranium analysis of stream bed sediment and subsurface soil, and selection material for differential leaching uranium analysis and geotechnical testing.

Seventy-two ground water analyses and three surface water analyses were sent to IT Corporation's Albuquerque office for geochemical modeling. Input files were generated from these data and geochemical modeling is in progress.

Forty-eight samples of Paddy's Run and outfall ditch sediment and subsurface soil has been analyzed for total uranium. One sample from each drainage has been selected for differential leaching uranium analysis.

Thirty-one archived subsurface soil samples have been selected to undergo geochemical testing, and seven subsurface soil samples have been selected for differential leaching uranium analysis.

Task 7 - Program Management and Reports

7.1 Program Management

Section 6.0 of the Workplan, the Project Management Plan, is in the process of being revised for submittal to USEPA in August.

Two information exchange meetings were held with WMCO personnel. At the second of these, the cognizant engineers for each of the activities and operational units were announced by WMCO. These personnel were assigned to allow a more continuous flow of information

between the organizations involved in the site remediation activities.

7.2 Quality Assurance

The quality assurance activities for the month of July 1989 were categorized into general areas.

- Continued effort for closing of open audits, surveillances and nonconformances.
- Field Quality Assurance on field activities through monitoring and surveillances.
- Continued efforts on organizing the project file into task oriented filing systems.
- DOE/WMCO requested to complete review of ASI submitted document change requests.
- Preparation of approved document change requests to controlled copy holders.

7.3 Health and Safety

- All workers continue to be monitored for exposures to chemicals and radioactive materials during RI/FS operations. All monitoring results continue to remain well below recommended action guides and applicable limits.
- The new urine sampling schedule showing urine samples collected from every field employee at the end of each 10-day work period continues to show results less than 5 ug/l of total uranium (WMCO's detection level). No positive results were obtained during July. Over 60 samples were analyzed.
- Health and Safety support has been ongoing for water sampling operations and the Facilities Testing Phase of the RI/FS. Health and Safety coverage is being provided for first and second shifts during Facility Testing operations.
- Work is being done on 2nd shift to permit electrical power to the building to shut down thus ensuring electrical safety.

Task 8 - Community Relations Support

1. The Community Assessment was completed. Briefings on the process and initial results were given to the FMPC

Environmental Safety & Health Advisory Committed, to the TIE and the ERA meetings. ASI conducted about 30 interviews.

2. Follow-up activity from the May 15 Community Meeting:

   - The first draft of the videotape transcription was completed; it will undergo technical review and be completed in August.

   - Information was gathered for the report on the meeting.

3. Work began on the revision of the RI/FS Community Relations Plan.

   - A first draft of objectives and implementation strategies was created and reviewed by the ASI Community Relations Team.

4. A White Paper discussing objectives and recommending an October date for the next RI/FS Community Meeting was initiated.

Task 10 - Feasibility Study Work Plan

The Feasibility Study Work Plan was submitted to the USEPA and OEPA on August 15, 1988. Comments have not been received from either OEPA or USEPA as of July 31, 1989.

Task 10 Percent Complete: 100%

Task 11 - Remedial Technology Alternatives

The Remedial Technology Alternatives Report was submitted to USEPA on December 16, 1988. Comments have not been received from USEPA.

Task 11 Percent Complete: 100%

Task 12 - Initial Screening of Alternatives

Detailed analysis of the screened alternatives continued in July. Eight teams are further defining the priorities of their detailed tasks and revising schedules and man loading to conform with review periods and budget constraints.

Operable Unit 6 - During the month of July, the efforts on the Feasibility Study (FS) for Operable Unit 6 focused on the following main areas:

- Continuation of the bench-scale studies;

- Completion of the documentation of information to effect transition from the information in the "Development of Alternatives (Task 12)" document of December 1988, to the "Screening of Alternatives" information for Operable Unit 6 that was presented to the U.S. Department of Energy (DOE) in May 1988;

- Continuation of work on the detailed analysis of alternatives;

- Presentation of the results of the initial screening of alternatives at a Technical Information Exchange (TIE) meeting with the U.S. Environmental Protection Agency (US EPA) and the Ohio Environmental Protection Agency (OEPA); and

- Discussion of DOE and Westinghouse Materials Company of Ohio (WMCO) comments on the initial screening of alternatives.

The work associated with documenting the transition from the information in the "Development of Alternatives" document submitted in December 1988 to the information used for the initial screening of alternatives for Operable Unit 6 was completed. This documentation will appear in the FS report.

Detailed Analysis of Alternatives - The primary emphasis in the detailed analysis of alternatives during July focused on the following:

- Development of accurate receptor data base in conjunction with RI staff members;

- Development of an alternate data base on concentrations of uranium and other potential contaminants. This was also undertaken in conjunction with RI staff members.

- Initiation of preliminary computer model runs, in conjunction with the modeling staff, on the effects of ground water pumping on uranium concentrations. These data will be used as a basis to establish the details of ground water pumping alternatives.

- Identification of Operable Unit 6 applicable or relevant and appropriate requirements (ARARs).

- Request for and partial receipt of selected information from WMCO for use in the detailed evaluation.

PLANNED ACTIVITIES FOR NEXT MONTH

- Continue sampling to support geochemical study;
- Continue Facilities Testing Program;
- Continue the South Plume FS;
- Prepare data tables for the RI reports;
- Alkalinity data for Rounds 1 through 4 will be added to the Lotus file;
- Alkalinity data computation data summary will be initiated for Round 5 data;
- The uranium concentration data summary will be updated to include individual EMR analysis;
- Ground water elevation and nitrate and uranium concentration maps will be completed;
- Hydrograph preparation for selected wells in the South Plume will be completed;
- Trillinear diagrams and text preparation for the RI reports will be started in August;
- A draft report of the health risk assessment will be completed; and
- Continue ground water modeling to support OU 6 RI/FS.
- Complete OU 6 bench-scale studies;
- Continue detailed analysis of alternatives for OU 4 and OU 6;
- Prepare written responses to DOE and WMCO comments on initial alternative screening; and
- Complete geochemical modeling required to support Operable Unit 6 ground water modeling.

ATTACHMENT 1

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: 1139	COORDINATES:	DATE: 7-30-89
ELEVATION:	GWL: Depth N/A Date/Time	DATE STARTED: Floor Slab Cores 7-2-89 / 7-29-89
ENGINEER/GEOLOGIST: E. Trollinger	Depth N/A Date/Time	DATE COMPLETED: 7-30-89
DRILLING METHODS: Mobile Drill HSA 8 in		PAGE 1 OF 2

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 in)	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Radiation at 3.5 ft. WATER USED DURING DRILL THROUGH PIPES CARRIED WATER IN DRILL DOWN THROUGH SOIL
1				CONCRETE FLOOR SLAB			
				2 PIPES WATER RETURN			
2 (7-30)	15737 1727 7-30	3	6	SOFT, BROWN (10YR 4/4) SILTY CLAY, TRACE OF GRAVEL (.5 in), WET. LOW PLASTICITY.	CL	.5	Hnu = 0.4 ppm
	15738 1727 7-30	4	∅	NO RECOVERY	~~CL~~	~~.5~~	α = 0-10 CPM
3	15739 1727 7-30	6	∅				βγ = 30,000 CPM
	15740 1740 7-30	4	6	STIFF, BROWNISH GRAY (10YR 4/2) CLAY, SOME WHITE SAND, MEDIUM PLASTICITY, WET TO MOIST	CL	1.0	Hnu = 0.4 ppm
4	15741 1740 7-30	6	6	MEDIUM DENSE, BROWN (10YR 5/3) CLAYEY SAND, TRACE OF GRAVEL (.5 in) MOIST TO WET	SC	N/A	α = 0-10 CPM βγ = 32,000 CPM
	15742 1740 7-30	12	2				
5	15743 1745 7-30	2	6	VERY STIFF, DARK GRAYISH BROWN, (10YR 5/2) SANDY CLAY, TRACE OF GRAVEL (.5-.75 in) MOIST. LOW PLASTICITY	CL	2.75	Hnu = 0.2 ppm
	15744 1745 7-30	10	6				α = 0 CPM
6	15745 1745 7-30	13	6			3.0	βγ = 7000-9000 CPM
	15746 1953 7-30	6	6				Hnu = 0.4 ppm
7	15747 1953 7-30	7	4		CL	3.0	α = 0-10 CPM
	15748 1953 7-30	9	∅	NO RECOVERY			βγ = 30,000 CPM 6-6.5 ft 3000 CPM 7 ft.

NOTES: DRILLING Co.:
DRILLER: Dave Newman
HELPER: Chris Colter
MATERIALS USED:
[illegible] bags bentonite [illegible]
25 gals. water
[illegible] cement

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
Hnu = 0.2-0.6 ppm #18
α = 0-10 CPM
βγ = 200-400 CPM
LEL = 0
O_2 = 20%

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FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: 1139	COORDINATES:	DATE: 7-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: Flow Stem Cored 7-2-89
ENGINEER/GEOLOGIST: E. TRUMNEER	Depth Date/Time	DATE COMPLETED: 7-31-89
DRILLING METHODS: MOBILE DRILL HSA 8 in		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 in)	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	15749 1957 7-30	10	6	VERY STIFF, GRAYISH BROWN (10YR 5/3) SANDY CLAY, TRACE OF GRAVEL (.5-.75 in) MOIST. LOW TO MEDIUM PLASTICITY	CL	2.5	Hnu = 0.2 ppm α = 0-10 cpm βγ = 23,000 cpm @ 7.5 FT 3000 cpm @ 5 & 9 FT.
	15750 1957 7-30	13	6				
9	15751 1957 7-30	16	6			3.5	
	15752 2000 7-30	27	6	VERY STIFF TO HARD, GRAY (10YR 4/1) CLAY, TRACE OF COARSE SAND, LOW TO MEDIUM PLASTICITY, MOIST.	CL	4.0	Hnu = 0.2 ppm α = 0 cpm βγ = 900-1000
	15753 2000 7-30	28	6				
10	15754 2000 7-30	30	2				
11	15755 2200 7-30	21	6	DENSE, GRAY, (10YR 4/2) ~~GRAVEL~~ GRAVEL, .5-1.5 in DRY.	GC	N/A	Hnu = 0.2 ppm α = 0 cpm βγ = 2000 cpm
	15756 2200 7-30	19	E	NO RECOVERY		—	
12	15757 2200 7-30	17	E				
	15758 2210 7-30	17	6	HARD, GRAY (10YR 5/1) SANDY CLAY, TRACE OF GRAVEL, MOIST TO DRY, LOW PLASTICITY.	CL	4.0	Hnu = 0.2 ppm α = 0 cpm βγ = 1500-2000 cpm
13	51215 2210 7-30	17	6				
	51216 2200 7-30	29	6				
14	51217 2230 7-30	50	6		CL	3.5	Hnu = 0.2 ppm α = 0 cpm βγ = 1200 cpm
	51218 2230 7-30	45	6				
	51219 2230 7-30	17	6	VERY DENSE, DARK GRAY (10YR 3/1) POORLY GRADED SAND, MOIST.	SP	N/A	

NOTES

DRILLER: Dave Newman
HELPER: Chris Colter

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0-10 cpm
βγ = 600 cpm

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FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1139	COORDINATES:	DATE.	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:	
ENGINEER/GEOLOGIST: E. [illegible]	Depth Date/Time	DATE COMPLETED: 7-31-89	
DRILLING METHODS: Mobile Drill HSA		PAGE 3 OF [illegible]	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15							
16	S1220 2255 7-30	10	6	VERY STIFF GRAY [illegible] CLAY TRACE OF GRAVEL [illegible] MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu = 0.2 ppm α = 0 cpm βγ = 1000 cpm
	S1221 2255 7-30	12	0	NO RECOVERY			
	S1222 2258 7-30	16	0				
17	S1223 2305 7-30	[illegible]	6	VERY STIFF GRAY [illegible] CLAY, TRACE OF COARSE SAND, MEDIUM PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm α = 0 cpm βγ = 500 cpm
	S1224 2305 7-30	9	0	NO RECOVERY			
18	S1225 2305 7-30	12	0				
	S1226 2310 7-30	10	6	VERY STIFF TO STIFF, GRAY, [illegible] 3/1 [illegible] 3/2) CLAY, TRACE OF COARSE SAND AND GRAVEL [illegible], MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu 0.2 ppm α = 0 cpm βγ 400-600 cpm
19	S1227 2310 7-30	10	[illegible]			2.0	
	S1228 2310 7-30	12	[illegible]				
20	S1229 2310 7-30	18	0	NO RECOVERY LARGE ROCK AT 20 FT. (GRAVEL)			Hnu N/A α = N/A βγ = N/A
				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE. BORING DRY AT 20.0 FT SAMPLING DONE AT 20.0 FT NO WATER BEARING ZONE ENCOUNTERED, NO WATER DIVERTED.			

NOTES:

DRILLER: Dave Newman

HELPER: Chris Cotter

INSTRUMENT BACKGROUND

Hnu = 0.2 ppm

α = 0 cpm

βγ = 600 cpm

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INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject [illegible] Sheet No. ____ of ____

Chkd. By ____ Date _____ Proj. No. _____

BORING 139 WAS DRILLED TO A DEPTH OF 200 FT, AND SAMPLED TO A DEPTH OF 100 FT. NO WATER BEARING ZONE WAS ENCOUNTERED DURING DRILLING & SAMPLING. BORING WAS PLUGGED WITH GROUT AND FINISHED WITH CEMENT PAD 14 INCHES THICK.

MATERIALS USED:

1/2 BAG CEMENT
2 BAGS BENTONITE GROUT
1 1/2 BAGS QUARTZ

000020

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1144	COORDINATES:		DATE: 7-28-89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7-28-89
ENGINEER/GEOLOGIST: E. TRUELINGER	Depth	Date/Time	DATE COMPLETED: 7-28-89
DRILLING METHODS: MOBILE DRILL & HSA			PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1				CONCRETE FLOOR SLAB 1.5 FT.			
2	15847 1743 7-28	6	6	VERY STIFF, DARK GRAY, (5Y 3/1) CLAY, TRACE OF SAND, LOW PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm; α = 0-10 cpm; βγ = 2000 cpm (BACKGROUND LOW HIGH)
	15848 1743 7-28	8	6				
3	15849 1743 7-28	7	3				
	15850 1749 7-28	5	6		CL	3.5	Hnu = 0.2 ppm; α = 0 cpm; βγ = 2000 cpm
4	15851 1749 7-28	7	6				
	15852 1749 7-28	12	6				
5	15853 1800 7-28	8	6	VERY STIFF, MOTTLED DARKISH BROWN, (10YR 4/2) TO (10YR 5/1) CLAY, MEDIUM PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm; α = 0 cpm; βγ = 2000 cpm
	15854 1800 7-28	9	6				
6	15855 1800 7-28	12	4				
	15856 1805 7-28	8	6	STIFF, GRAY, (10YR 5/1) CLAY, TRACE OF SILT AT 6.5 FT. LOW PLASTICITY, MOIST.	CL	2.0	Hnu = 0.2 ppm; α = 0 cpm; βγ = 1000-2000 cpm
7	15857 1805 7-28	8	6				
	15858 1805 7-28	5	3				

NOTES: DRILLING CO.:
DRILLER: DAVE NEWMAN
HELPER: CHRIS COLTER

MATERIALS USED:
2 BAGS VELLCAY GROUT
1 BUCKET BENTONITE PELLETS
25 GALL WATER
1/2 CEMENT (TYPE I)

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT., 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0-10 cpm
βγ = 2000 cpm, 10,000 surface
LEL = 0
O_2 = 21.0%

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS	
BORING NUMBER:	COORDINATES:	DATE: 7-23-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-25-89
ENGINEER/GEOLOGIST: E. Trombley	Depth Date/Time	DATE COMPLETED: 7-27-89
DRILLING METHODS: MOBILE DRILL HSA		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	15859 1920 7-25	8	6	VERY STIFF, GRAYISH BROWN (10YR 4/3) CLAY, MEDIUM PLASTICITY, MOIST.	CL	2.75	Hnu = 0.2 ppm, α = 0 cpm, βγ = 1500-2000 cpm
	15860 1920 7-25	9	6				
9	15861 1920 7-25	10	4	NO RECOVERY		-	
	15862 1920 7-25	13	6	STIFF, GRAY (10YR 5/1) GRAVELLY CLAY, MED. PLASTICITY, WET.	CL	2.0	Hnu = 0.2 ppm, α = 0 cpm, βγ = 1500 cpm
10	15863 1920 7-25	10	6	MEDIUM DENSE, YELLOWISH BROWN (10YR 4/3), SILT, SOME CLAY, MOIST.	ML	N/A	
	15864 1920 7-25	10	6	VERY STIFF, YELLOWISH BROWN 10YR 4/4 SANDY CLAY, MOIST.	CL	2.75	
11	15865 2010 7-25	3	6	STIFF, YELLOWISH BROWN (10YR 4/3) SILTY CLAY, TRACE OF GRAVEL (5 in), LOW PLASTICITY, MOIST	CL	2.0	Hnu = 0.2 ppm, α = 0 cpm, βγ = 1500 cpm
	15866 2010 7-25	8	6				
12	15867 2010 7-25	12	0	NO RECOVERY			
13	15868 2015 7-25	7	6	VERY STIFF, DARK GRAY (10YR 3/1) TO LIGHT GRAY 10YR 5/1 CLAY TRACE OF MEDIUM SAND, LOW TO MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu = 0.2 ppm, α = 0 cpm, βγ = 1500-2000 cpm
	51316 2015 7-25	10	6				
	51316 2015 7-25	11	4				
14	51317 2019 7-25	9	6	STIFF, LIGHT GRAY 5Y 3/5 TRACE OF MEDIUM SAND, MEDIUM PLASTICITY MOIST.	CL	1.75	Hnu = 0.2 ppm, α = 0 cpm, βγ = 1000-1500 cpm
	51318 2019 7-25	9	6				
	51319 2019 7-25	10	6				

NOTES.

DRILLER: Doe Newman
HELPER: Chris Cotter

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0 cpm -10 cpm
βγ = 2000 cpm / 100 cm²

DRAFT

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1000	COORDINATES:	DATE: 7-28-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-28-89	
ENGINEER/GEOLOGIST: E. Tollner	Depth Date/Time	DATE COMPLETED: 7-29-89	
DRILLING METHODS: Mobile Drill HSA		PAGE 3 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15							
16	51320 2031 7-28	5	6	STIFF, GRAY (5Y 3/2) CLAY TRACE OF SAND, MEDIUM PLASTICITY, MOIST.	CL	2.0	Hnu = 0.2 ppm α = 0 cpm βγ = 1500-2000 cpm
	51321 2039 7-28	5	6				
	51322 2039 7-28	7	3				
17	51323 2047 7-28	5	6				Hnu = 0.2 ppm α = 0 cpm βγ = 1500 cpm
	51324 2047 7-28	7	6				
18	51325 2047 7-28	9	~~6~~	NO RECOVERY			
19	51326 2100 7-28	10	6	VERY STIFF, GRAY (10YR 5/1) SANDY CLAY, TRACE OF GRAVEL (.5-.75 IN), LOW PLASTICITY, DRY TO MOIST.	CL	3.5	Hnu = 0.2 ppm α = 0 cpm βγ = 1500-2000 cpm
	51327 2100 7-28	10	6				
	51328 2102 7-28	39	6				
20	51329 2100 7-28	27	6	DENSE, GRAYISH BROWN (10YR 4/3) ~~SILTY~~ SILT, TRACE OF GRAVEL (SAND) DRY TO MOIST.	ML	3.5	Hnu = 0.2 ppm α = 0 cpm βγ = 1500 cpm
				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE. AUGER STOPPED AT 20.0 FT. SAMPLING ENDED AT 20.0 FT. NO WATER BEARING ZONE ENCOUNTERED TO TOTAL DEPTH OF 20.0 FT.			

NOTES:

DRILLER: Dave Neumann
HELPER: Chris Cotter.

INSTRUMENT BACKGROUND

Hnu = 0.2 ppm
α = 0-10 cpm
βγ = 1000-2000 AIR
10,000 cpm surface

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. ____ of ____

Chkd. By ____ Date _____ _____ Proj. No. _____

BORING 1144 WAS DRILLED TO A TOTAL DEPTH OF 20.0 FT. WITH SAMPLING ENDING AT 20.0 FT. NO WATER BEARING ZONE ENCOUNTERED THROUGHOUT TOTAL DEPTH. DRILLED AND SAMPLED HOLE WAS PLUGGED USING COLLOID GROUT WITH SMALL BENTONITE PLUG AND CEMENT PLUG TO SURFACE.

MAT'LS USED:

2 BAGS COLLOID GROUT
1/2 SACK CEMENT TYPE I
≈ 25 GALS WATER
1 BUCKET BENTONITE PELLETS.

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1147	COORDINATES:		DATE: 7-14-89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7-13-89
ENGINEER/GEOLOGIST: E. Trollinger	Depth	Date/Time	DATE COMPLETED: 7-15-89
DRILLING METHODS: Mobile Drill HSA 8 in			PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	15913 1730 7-14	6	[illegible]	± FLOOR SLAB, 6 IN - 8 IN, [illegible] CONCRETE [illegible]	[illegible]	[illegible]	H_{NU} = [illegible] ppm
1	15914 1730 7-14	9	6	VERY DARK GRAYISH BROWN (V. STIFF) (10YR 3/2) CLAY, TRACE TO SOME SILT, MOIST.	CL	3.0	α = 0 CPM
	15915 1730 7-14	12	6				$\beta\gamma$ = 400 - 500 CPM
2	15916 1745 7-14	11	5	SAME COMPOSITION AS ABOVE	CL	2.0	H_{NU} = .2 ppm - 1.0 ppm
	15917 1745 7-14	18		NO RECOVERY			α = 0 - 10 CPM
3	15918 1745 7-14	21	6	VERY STIFF, LIGHT OLIVE BROWN (2.5Y 5/4), CLAY, MEDIUM PLASTICITY, MOIST.	CL	2.0	$\beta\gamma$ = 600 CPM
4	15919 1944 7-14	18	4	SAME COMPOSITION AS ABOVE	CL	2.0	H_{NU} = 2.0 - 5.0 ppm
	15920 1944 7-14	7		NO RECOVERY			α = 0 CPM
	15921 1944 7-14	9	6	STIFF, OLIVE BROWN (2.5Y 4/4) CLAY TRACE OF COARSE SAND, MEDIUM PLASTICITY, MOIST.	CL	1.75	$\beta\gamma$ = 600 CPM
5	15922 1919 7-14	12	4	SAME AS ABOVE SAMPLE	CL	1.75	Sample down hole H_{NU} = 5.0 - 20.0 ppm
	15923 1919 7-14	4	6	LOOSE, VERY DARK GRAY (10YR 3/1) SILT, TRACE OF GRAVEL (.5 - .75 IN) MOIST TO DRY.	ML	N/A ~~2.0~~ CF	α = 0 CPM
6	15924 1919 7-14	5	6				$\beta\gamma$ = 400 - 600 CPM
7	15925 1925 7-14	5	5	STIFF, VERY DARK GRAY - OLIVE GRAY (5Y 4/2) CLAY, TRACE OF SILT THROUGHOUT, MEDIUM PLASTICITY, TRACE OF GRAVEL @ 6.5 FT (.5 IN) MOIST TO SLIGHTLY SATURATED	CL	1.5	H_{NU} = 2 - 5 ppm
	15926 1925 7-14	5	6				α = 0 CPM
	15927 1925 7-14	4	6				$\beta\gamma$ = 600 CPM

NOTES: DRILLING CO.:
DRILLER: Dave Newman
HELPER: Chris Colter
MATERIALS USED:
2 BAGS BENTONITE
1/2 BAG CEMENT
1/2 BUCKET BENTONITE PELLETS

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
H_{NU} = 0.4 PPM
α = 0 - 10 CPM
$\beta\gamma$ = 600 - 1100 CPM
LEL = 0
O_2 = 21.2 %

FERNALD
RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: 1147	COORDINATES:	DATE: 7-14-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-13-89
ENGINEER/GEOLOGIST: E. Trahnagel	Depth Date/Time	DATE COMPLETED: 7-15-89
DRILLING METHODS: MOBILE DRILL HSA 8 IN.		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	15928 1936 7-14	6	5	SAME COMPOSITION AS 6.0-7.5 FT.	CL	1.5	H_{max} = .2 - 10 ppm
	15929 1936 7-14	15	6	DENSE, YELLOWISH GRAY - DARK YELLOWISH BROWN (2.5Y 4/2) CLAYEY SILT, TRACE OF GRAVEL (.5 IN.) MOIST TO SLIGHTLY SATURATED	ML	N/A	α = 0 CPM
	15930 1936 7-14	25	6				$\beta\gamma$ = 400-600 CPM
9	15931 1950 7-14	25	3	VERY STIFF, DARK YELLOWISH BROWN (10YR 4/4) CLAY, TRACE OF GRAVEL (.5 IN) MOIST.	CL	2.75	H_{max} = 2 ppm
	15932 1950 7-14	16		NO RECOVERY			α = 0 CPM
10	15933 1950 7-14	10					$\beta\gamma$ = 400-600 CPM
11	15934 2050 7-14	10	6	VERY STIFF, DARK GRAY (10YR 3/1) CLAY, MEDIUM PLASTICITY, TRACE OF GRAVEL (.5-2.0 IN) AND SAND, MOIST.	CL	2.5	H_{max} = 1.2 ppm
	51375 2050 7-14	12	5				α = 0 CPM
12	51376 2050 7-14	50/2in		NO RECOVERY			$\beta\gamma$ = 400-500 CPM
	51377 2100 7-14	13	3	STIFF, BROWN (10YR 4/3) GRAVELLY CLAY, MEDIUM PLASTICITY, MOIST	CL	2.0	H_{max} = 1.0 ppm
13	51378 2100 7-14	15		NO RECOVERY			α = 0 CPM
	51379 2100 7-14	11					$\beta\gamma$ = 400 CPM
14	51380 2105 7-14	9	6	STIFF, GRAYISH BROWN (10YR 5/2) CLAY, TRACE OF GRAVEL (.5-.75 IN) MEDIUM PLASTICITY, MOIST.	CL	2.0	H_{max} = .2 - 1.5 ppm
	51381 2105 7-14	10	6				α = 0 CPM
	51382 2105 7-14	7	3	MEDIUM DENSE, DARK BROWN (10YR 4/3) SILTY SAND, MOIST.	SM	N/A	$\beta\gamma$ = 400 CPM

NOTES:

DRILLER: Dave Newman
HELPER: Chris Colter

INSTRUMENT BACKGROUND
H_{max} = 0.4 ppm
α = 0-10 CPM
$\beta\gamma$ = 600-1100 CPM

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1147	COORDINATES:	DATE: 7-14-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-13-89	
ENGINEER/GEOLOGIST: E. Tollinger	Depth Date/Time	DATE COMPLETED: 7-15-89	
DRILLING METHODS: Mobile Drill HSA 8 in		PAGE 2 OF 3	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15	51383 2219 7-14	3	6	STIFF, DARK GRAY (10YR 5/1) CLAY TRACE OF GRAVEL (.5 IN) MEDIUM PLASTICITY, MOIST.	CL	1.5	Hnu = 1.2 ppm
	51384 2219 7-14	4					α = 0 cpm
16	51385 2219 7-14	7		NO RECOVERY			βγ = 400 cpm
17	51386 2223 7-14	7	6	MEDIUM STIFF, GRAY (2.5Y4/0) CLAY, MEDIUM PLASTICITY, MOIST.	CL	.75	Hnu = 0.8 ppm
	51387 2223 7-14	6	6				α = 0 cpm
18	51388 2223 7-14	7		NO RECOVERY			βγ = 400 cpm
	51389 2235 7-14	5	6	VERY STIFF, DARK GRAY (5Y4/1) CLAY, MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu = 0.4 ppm
19	51390 2235 7-14	7	6				α = 0 cpm
	51391 2235 7-14	13	6				βγ = 400 cpm
20	51392 2245 7-14	21	6	SAME AS 18.0 - 19.5 INTERVAL	CL	2.5	Hnu = 0.4 ppm α = 0 cpm βγ = 400 cpm
				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE * DRILLING & SAMPLING ENDED AT 20.0 FT. NO WATER BEARING ZONE ENCOUNTERED			

NOTES:

DRILLER: Dave Newman
HELPER: Chris Colter

INSTRUMENT BACKGROUND

Hnu = 0.4 ppm
α = 0-10 cpm
βγ = 600-1000 cpm

5549

4/

FERNALD RI/FS

DRY BORING: NO WATER ENCOUNTERED

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. E. Tollinger DATE 7-15-89
PROJECT NO. 602 3.7.1 CHECKED BY W A Hertel DATE 7-20-89
BORING NO. 149
PIEZOMETER NO. N/A DATE OF INSTALLATION 7-13-89 TO 7-15-89

BOREHOLE DRILLING

DRILLING METHOD 8 in HSA	TYPE OF BIT 8 in AUGER TEETH
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM ____ TO ____	SIZE N/A FROM ____ TO ____
FLUID N/A FROM ____ TO ____	SIZE N/A FROM ____ TO ____

PIEZOMETER DESCRIPTION

TYPE N/A	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION ____
PROTECTIVE PIPE O.D. N/A	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT.)		ELEVATION ( )	
TOP OF RISER PIPE	N/A			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	N/A			
BOREHOLE FILL MATERIALS:	CONCRETE PLUG 0.0	1.0 FT		
2 bags GROUT/~~SLURRY~~ VOLCLAY	TOP -1.5 FT	BOTTOM 20.0	TOP	BOTTOM
BENTONITE 1/2 bucket	TOP -1.0 FT.	BOTTOM -1.5 FT	TOP	BOTTOM
SAND	TOP	BOTTOM	TOP	BOTTOM
GRAVEL	TOP	BOTTOM	TOP	BOTTOM
PERFORATED SECTION	TOP	BOTTOM	TOP	BOTTOM
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	20.0 FT			
GWL AFTER INSTALLATION	N/A			

AS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐

REMARKS Concrete plug 0.0 FT TO 1.0 FT
materials used. 1/2 bucket bentonite
1/2 bag cement
2 bags volclay

000028

FERNALD RI/FS

	Field Check	1st Key In	2nd Key In	Hard Copy Verification
Date	7-20-89			
Initial				

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD · RI/FS	
BORING NUMBER: 1149	COORDINATES:	DATE: 7/16/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-15-89
ENGINEER/GEOLOGIST: Charlie E. Trollinger	Depth Date/Time	DATE COMPLETED: 7-17-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN.	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				cement			HNU = 6
				cement			α = 0
1							Bδ = 900
	15957 7-16 1350	6	6	(5y 5/1) gray silty clay some sand, low (very stiff) plasticity, moist	CL	3.0	
				med. dense (10y 5/3) clayey gravel, moist	GC	NA	
1	15958 7-16 1350	6	6	very stiff (2.5y 2/0) black, silty clay, some sand, trace fine to med gravel, low plasticity, moist	CL	2.75	HNU = 6
2	15959 7-16 1350	7	6	stiff SAA	CL	1.25	α = 0
							Bδ = 900
	15960 7-16 1350	9	3	STIFF SAA	CL	1.50	
3	15961 7-16 1450	5	6	medium stiff (5y, 4/1) dark gray silty clay, some sand, low plasticity, moist	CL	.75	HNU = 5
	15962 7-16 1450	6	6	SAA	CL	1.0	α = 0
4							Bδ = 1000-1100
	15963 7-16 1450	9	3	SAA	CL	.75	Attempted 3 times with trap on last try.
15964	~~15965~~ 1500 7-16	CPM 07-16-89 7	6	stiff (5y, 3/2) dark olive gray clay, some silt & sand, med plasticity, moist	CL	1.75	HNU = 5
5							α = 0
15965	~~15966~~ 1500 7-16	CPM 07-16-89 10	6	stiff (5y 4/1) dark gray, silty clay, trace sand, med plasticity, moist	CL	.75	Bδ = 900-1000
15966	~~15967~~ 1500 7-16	CPM 07-16-89 12	4	med. stiff (5y 4/2) olive gray, clay trace sand & silt med plasticity moist	CL	.5	
6							
15967	~~15968~~ 1530	CPM 07-16-89 9	6	med stiff (5y 2.5/1) Black, silty clay, trace sand, low plasticity, moist	CL	.5	HNU = 7
15968	~~15969~~ 7-16 1530	CPM 07-16-89 7	6	med stiff (5y, 3/1) very dark gray clay, trace silt & sand, low plasticity moist	CL	.75	α = 0
7							Bδ = 900-1000
~~15969~~	~~15970~~ 6-16-89 1530	15970 4	6	med stiff (5y, 5/3) olive, silty clay, trace sand, low plasticity, moist	CL	.5	

NOTES: CONTRACTOR: PENNDRILL
RIG: 393
DRILLER: Jim, DAVE
ASSISTANT: Ryle, Chris

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0.0 PPM
α = 0 CPM
Bδ = 1200-1400 CPM
LEL/O2: LEL: 0 ~~PPM~~ % UAH 7-20
O2: 21.0 %

P.4 of 6

FERNALD RI/FS

5549

	Initial	Date
1st Party In		
2nd Party In		
Hard Copy Verification		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS	
BORING NUMBER:	COORDINATES:	DATE: 7-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-15-89
ENGINEER/GEOLOGIST: E. Trollinger	Depth Date/Time	DATE COMPLETED: 7-17-89
DRILLING METHODS: MOBILE DRILL HSA 8 in		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 in)	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	15971 1535 7-16	10	6	MEDIUM STIFF TO STIFF, OLIVE GRAY (5Y 5/2) SILTY CLAY, MEDIUM PLASTICITY, TRACE OF SAND, MOIST.	CL	1.5	H_{mu} = 1-5 ppm α = 0 $\beta\gamma$ = 900-1000 cpm
	15972 1535 7-16	12	6			.5	
9	15973 1535 7-16	15	6			1.75	
	15974 1630 7-16	21	6	STIFF, YELLOWISH BROWN, (10YR 5/6) SILTY CLAY, TRACE OF SAND, LOW PLASTICITY, MOIST.	CL	1.25	H_{mu} = 5 ppm α = 0 $\beta\gamma$ = 800-900 cpm
WATER ZONE @ 100 FT	15975 1630 7-16	14	6			1.75	
10	15976 1630 7-16	10	6	MEDIUM DENSE, OLIVE BROWN (2.5Y 4/4) CLAYEY SAND, TRACE OF FINE GRAVEL, MOIST TO WET	SC	N/A	
11	15977 1758 7-16	2	6	LOOSE, YELLOWISH BROWN (10YR 4/3), CLAYEY SILT, MOIST TO WET.	ML	N/A	H_{mu} = 1.0 ppm α = 0-10 cpm $\beta\gamma$ = 1000 cpm
	15978 1758 7-16	3	3				
12	51415 1758 7-16	7		NO RECOVERY			
	51416 1805 7-16	2	6	STIFF, GRAY (10YR 5/2), SILTY CLAY, TRACE OF FINE GRAVEL, WET.	CL	1.0	H_{mu} = 0.8 ppm α = 0-10 cpm $\beta\gamma$ = 800-900 cpm
13	51417 1805 7-16	3	6	LOOSE, GRAYISH BROWN (10YR 5/3) CLAYEY SILT, WET.	ML	N/A	
	51418 1805 7-16	8	5	STIFF, GRAY (10YR 5/2) CLAY, MOIST TO WET.	CL	2.0	
Base water zone BSA. JAN 7-20	51419 1820 7-16	13	6	STIFF, GRAY (10YR 5/2) CLAY MEDIUM PLASTICITY, MOIST.	CL	2.0	H_{mu} = 0.4 ppm α = 0-10 cpm $\beta\gamma$ = 900 cpm
14	51420 1820 7-16	19	6	MEDIUM DENSE, BROWN (10YR 4/3) SILTY SAND, MOIST.	SM	N/A	
	51421 1820 7-16	19	6	GRAY (10YR 5/2) VERY STIFF CLAY, MEDIUM PLASTICITY MOIST.	CL	2.5	

NOTES:

DRILLER: Dave Newman
HELPER: Chris Carter

INSTRUMENT BACKGROUND
H_{mu} = 0.2 ppm
α = 0-10 cpm
$\beta\gamma$ = 1200 cpm

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1149	COORDINATES:	DATE: 7-16-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-15-89	
ENGINEER/GEOLOGIST: E. Trollinger	Depth Date/Time	DATE COMPLETED: 7-17-89	
DRILLING METHODS: MOBILE DRILL HSA		PAGE 3 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15	51422 1938 7-16	6	6	STIFF GRAY (10YR 4/1), CLAY, MED. PLASTICITY, MOIST.	CL	1.5	Hnu = 0.6 ppm
16	51423 1938 7-16	5		BOTTOM OF BORING AT 15.5 FT. LAST SAMPLE 15.0-15.5 FT.			α = 0-10 CPM
	51424 1938 7-16	3		NO RECOVERY			βγ = 900 CPM
17							
18							
19							
20				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE			

NOTES:

DRILLER: Dave Newman
HELPER: Chris Colter

INSTRUMENT BACKGROUND

Hnu = 0.4 ppm
α = 0 CPM
βγ = 1000-1200 CPM

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. E. Trollinger DATE 7-17-89
PROJECT NO. 6002 3.7.1 CHECKED BY W. Hertel DATE 7-20-89
BORING NO. 1149
PIEZOMETER NO. 1149 DATE OF INSTALLATION 7-17-89

BOREHOLE DRILLING

DRILLING METHOD 8 in HOLLOW STEM AUGER
DRILLING FLUID (S) USED:
FLUID N/A FROM ____ TO ____
FLUID N/A FROM ____ TO ____

TYPE OF BIT AUGER TOOTH
CASING SIZE (S) USED:
SIZE N/A FROM ____ TO ____
SIZE N/A FROM ____ TO ____

PIEZOMETER DESCRIPTION

TYPE MONITORING
DIAMETER OF PERFORATED SECTION 4.0 ID
PERFORATION TYPE:
SLOTS [X] HOLES [ ] ~~SCREEN~~ E.T. [X]
AVERAGE SIZE OF PERFORATIONS 0.020 in
TOTAL PERFORATED AREA ~~5.0 FT.~~ 4.6 FT

RISER PIPE MATERIAL PVC
RISER PIPE DIAMETERS:
O.D. 4.5 in I.D. 4.0 in
LENGTH OF PIPE SECTIONS 1.0 FT, 10 FT.
JOINING METHOD SCREW TYPE, JOINTED FLUSH.

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 2.5 FT.
PROTECTIVE PIPE O.D. 10.5 in

OTHER PROTECTION HINGED U.D. COVER WITH LOCK.

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT.)		ELEVATION ( )	
TOP OF RISER PIPE	11.0 in. ABOVE			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	1.4 FT.			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP	BOTTOM	TOP	BOTTOM
BENTONITE PELLETS	TOP 1.2 FT BELOW	BOTTOM 6.5 FT	TOP	BOTTOM
SAND 10/20	TOP 6.5 FT	BOTTOM 15.0 FT.	TOP	BOTTOM
~~GRAVEL~~ NONE	TOP	BOTTOM	TOP	BOTTOM
PERFORATED SECTION	TOP 10.0 FT	BOTTOM ~~15.0~~ 14.0 FT	TOP	BOTTOM
PIEZOMETER TIP	15.0			
BOTTOM OF BOREHOLE	15.4 FT			
GWL AFTER INSTALLATION	8.0 FT.			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [✓]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [✓]

REMARKS PROTECTIVE CASING PLACED 1.5 in. HIGHER THAN SPEC. OF 12.0 IN. DUE TO SOIL RESISTANCE ARRIVING BOREHOLE TOP.
Water Zone 10.0 to 13.5 Ft. WAH 7-20-89

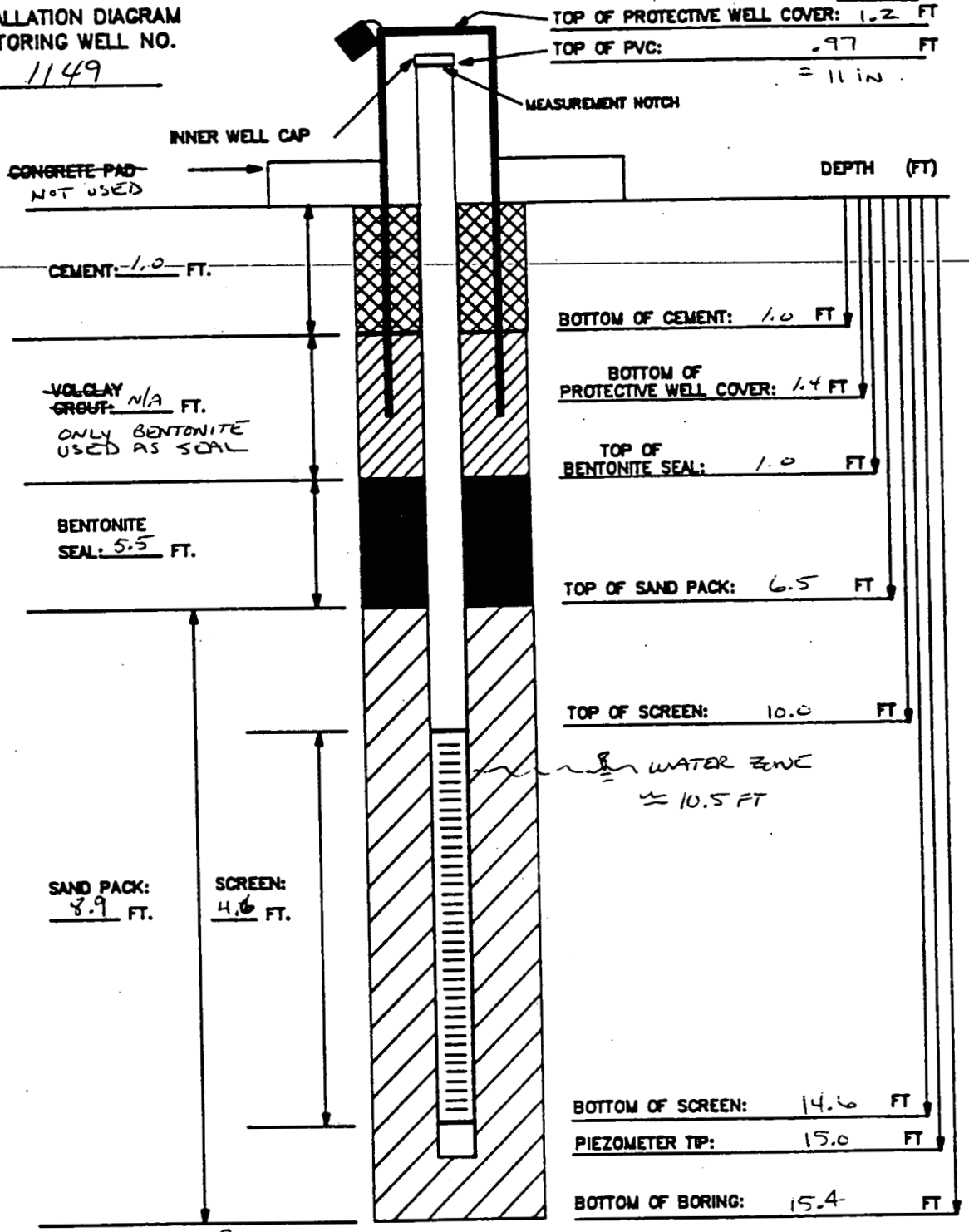
000032

409-11-86

INSTALLATION DATE: 7-17-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1149



BOREHOLE DIAMETER: 8 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 2 BAGS 60 lbs. ea.
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 bag (50 lb)
AMOUNT OF WATER USED: 6 GALS.
OTHER:

NOTES:
1) RISER PIPE IS ~~2~~ 4.0 IN-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS ~~2~~ 4 IN-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: 8.0 FT @ 7-17-89

TASK: 3.7.1

GEOLOGIST/ENGINEER: E. Trollinger

QA QC WAK 7-20-89

FERNALD
RI/FS
5549

Date	8/3/9			
Initial	BCL			
	Data Entry	1st Key In	2nd Key In	Hard Copy Validation

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1159	COORDINATES:	DATE: 7-27-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-27-89	
ENGINEER/GEOLOGIST: E. Trollinger	Depth Date/Time	DATE COMPLETED: 7-28-89	
DRILLING METHODS: MOBILE DRILL HSA 8 in		PAGE 1 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6 in	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CONCRETE FLOOR SLAB			Hnu = 0.2 ppm
1	16177 1905 7-27	2	6	VERY STIFF, DARK gray (10YR 5/1) CLAY TRACE OF COARSE SAND, MEDIUM PLASTICITY, MOIST. ↓	CL	2.75	α = 0 cpm
	16178 1905 7-27	3	6				βγ = 1000 cpm
2	16179 1905 7-27	4	6		CL	3.5	Hnu = 0.2 ppm
	16180 1905 7-27	4	3				α = 0 cpm
							βγ = 800-1000 cpm
3	16181 1905 7-27	6	0	NO RECOVERY			
4	16182 1914 7-27	4	6	VERY STIFF, DARK gray (5Y 3/1) CLAY, TRACE OF COARSE SAND AND GRAVEL (.5 IN), MEDIUM PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm
	16183 1914 7-27	6	6				α = 0 cpm
							βγ = 800 cpm
	16184 1914 7-27	7	0	NO RECOVERY			
5	16185 1920 7-27	5	6	VERY STIFF, GRAY (10YR 4/1) CLAY, TRACE OF COARSE SAND, LOW TO MEDIUM PLASTICITY, MOIST.	CL	2.75	Hnu = 0.2 ppm
	16186 1920 7-27	5	6				α = 0 cpm
							βγ = 800-900 cpm
6	16187 1920 7-27	10	0	NO RECOVERY			
7	16188 1943 7-27	5	6	VERY STIFF, DARK GRAY 5Y (3/1) CLAY, TRACE OF SAND, LOW TO MEDIUM PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm
	16189 1943 7-27	5	6				α = 0 cpm
							βγ = 800 cpm
	16190 1943 7-27	8	4	SOME SILT AT 7.0-7.5 FT. (ML)			

NOTES: DRILLING CO.:
DRILLER: Dave Newman
HELPER: Chris Colter
MATERIALS USED:

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0-10 air / 180-200 suit
βγ = 800-1000 air 1900 surface
LEL = 0
O_2 = 21.6%

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: 1159	COORDINATES:	DATE: 7-22-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-27-89
ENGINEER/GEOLOGIST: E. Trollinger	Depth Date/Time	DATE COMPLETED: 7-28-89
DRILLING METHODS: MOBILE DRILL HSA		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	16191 1947 7-27	9	6	VERY STIFF, GRAYISH BROWN (10YR 4/2) GRAVELLY CLAY, SOME SAND (COARSE), LOW PLASTICITY, MOIST.	CL	2.75	Hnu = 0.2 ppm α = 0 CPM βγ = 800 CPM
	16192 1947 7-27	11	6				
	16193 1947 7-27	14	2				
9	16194 1954 7-27	14	6		CL	3.0	Hnu = 0.2 ppm α = 0 CPM βγ = 600-800 CPM
	16195 1954 7-27	13	6				
10	16196 1954 7-27	21	3.				
11	16197 2100 7-27	3	6	VERY STIFF, GRAYISH BROWN (10YR 4/3) SILTY CLAY, TRACE OF COARSE SAND, LOW TO MEDIUM PLASTICITY, MOIST.	CL	3.5	Hnu = 0.2 ppm α = 0 CPM βγ = 800-1000 CPM
	16198 2100 7-27	5	6				
12	51515 2100 7-27	6	0	NO RECOVERY			
13	51516 2105 7-27	3	6	VERY STIFF, GRAY TO DARK GRAY (10YR 5/2) TO (10YR 5/1) SILTY CLAY, MEDIUM PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm α = 0 CPM βγ = 800-900 CPM
	51517 2105 7-27	6	6				
	51518 2105 7-27	10	2				
14	51519 2113 7-27	6	6	VERY STIFF, GRAY (10YR 4/1) CLAY, TRACE OF COARSE SAND, LOW TO MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu = 0.2 ppm α = 0 CPM βγ = 800-900 CPM
	51520 2113 7-27	6	6				
	51521 2113 7-27	8	4				

NOTES:

DRILLER: Dave Newman
HELPER: Chris Cotter.

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0-10 CPM
βγ = 1000-1200 CPM

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1159	COORDINATES:		DATE: 7-27-85
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7-27-85
ENGINEER/GEOLOGIST: E. Trollinger	Depth	Date/Time	DATE COMPLETED:
DRILLING METHODS: Mobile Drill HSA 8 in			PAGE 3 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15	51522 2145 7-27	4	6	VERY STIFF, GRAYISH BROWN (10YR 4/1) CLAY, MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu = 0.2 ppm
	51523 2145 7-27	5	2				α = 0 cpm
16	51524 2145 7-27	7	0	NO RECOVERY			βγ = 800-900 cpm
17	51525 2150 7-27	7	6	STIFF, GRAY, (10YR 5/1) SANDY CLAY, LOW TO MEDIUM PLASTICITY, MOIST.	CL	2.0	Hnu = 0.2 ppm
	51526 2150 7-27	9	4				α = 0 cpm
18	51527 2150 7-27	14	0	NO RECOVERY			βγ = 800 cpm
	51528 2200 7-27	14	6	STIFF, GRAY, (10YR 4/1) CLAY, TRACE OF GRAVEL (.5 IN - .75 IN) MEDIUM PLASTICITY, MOIST.	CL	2.0	Hnu = 0.2 ppm
19	51529 2200 7-27	16	6				α = 0 cpm
	51530 2200 7-27	31	6				βγ = 800-1000 cpm
20	51531 2200 7-27	32	4		CL	2.0	Hnu = 0.2 ppm α = 0 cpm βγ = 1000 cpm
				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE. DRILLING AND SAMPLING ENDED AT 20.0 FT, NO WATER ENCOUNTERED THROUGHOUT TILL SAMPLED.			

NOTES:

DRILLER: Dave Newman
HELPER: Chris Coffer

INSTRUMENT BACKGROUND

Hnu = 0.2 ppm
α = 0 cpm
βγ = 800-1000 cpm

INTERNATIONAL TECHNOLOGY CORPORATION

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4/4

By _____ Date _____ Subject _____ Sheet No. ____ of ____

Chkd. By ____ Date _____ _____ Proj. No. _____

BORING 1159 (PLANT 6) WAS DRILLED TO A TOTAL DEPTH OF 20.0 FT. WITH NO WATER BEARING ZONE ENCOUNTERED OVER THE TOTAL DEPTH. SAMPLING ENDED AT 20.0 FT. AND BORING WAS PLUGGED WITH VOLCLAY GROUT AND CAPPED WITH A CEMENT PLUG.

PLUG (CEMENT) 0.5 FT. TO 1.0 FT. (BELOW SURFACE)
VOLCLAY FROM 1.5 FT. TO 20.0 FT.
BENTONITE PELLETS 1.0 TO 1.5 FT. below surface

MAT'LS USED:
- VOLCLAY GROUT 2 (50 lb.) bags
- BENTONITE PELLETS 1/2 bucket
- WATER ~25 gals.
- CEMENT 1/2 (90 lb. bag)

000037

108-10-85

5549

FERNALD
RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1162 (1413)	COORDINATES:		DATE: 7-12-87
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7-12-87
ENGINEER/GEOLOGIST: E. Trollinger	Depth	Date/Time	DATE COMPLETED: 7-12-87
DRILLING METHODS: MOBILE DRILL HSA			PAGE 1 OF 2

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6 (IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
Concrete							
1	55121 1800 7-12	5		Concrete slab on floor grade ~6-8" THICK.			H_{nu} = 0.2 ppm
	55122 1800 7-12	6	6	STIFF BROWN 10YR (4/2) SILTY CLAY, LOW PLASTICITY, TRACE OF COARSE SAND, MOIST.	CL	2.5	α = 0-10 cpm
	55123 1800 7-12	12	6				$\beta\gamma$ = 1000-1200 cpm
2	55124 1815 7-12	6	6	BROWN, (10YR 4/3) CLAY, TRACE OF GRAVEL (.5-.75 IN), MOIST TO SLIGHTLY MOIST, MED. PLASTICITY.	CL	1.5	H_{nu} = 0.2 ppm
	55125 1815 7-12	8	6			2.5	α = 0-10 cpm
3	55126 1815 7-12	10	4			3.5	$\beta\gamma$ = 600-900 cpm
	55127 1823 7-12	4	5	BROWN 10YR 5/3 ~~CLAY~~, SILTY CLAY, LOW PL, MOIST.	CL	3.5	H_{nu} = 0.2 ppm
4	55128 1823 7-12	10		NO RECOVERY			α = 0-5 cpm
	55129 1823 7-12	10					$\beta\gamma$ = 600-900 cpm
5	55130			BORING WAS PLUGGED WITH 2 BUCKETS BENTONITE PELLETS AND WATER, THEN SEALED WITH CEMENT PLUG 12 INCHES THICK.			H_{nu} =
	55131						α =
6	55132						$\beta\gamma$ =
7	55133						H_{nu} =
	55134						α =
	55135						$\beta\gamma$ =

NOTES: DRILLING CO.:
DRILLER: Dave Neumann
HELPER: Chris Carter

MATERIALS USED:
1 bag cement
2 buckets pellets bentonite
buckets water

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
H_{nu} = 0.2 ppm
α = 10-20 air 100 cpm Sifta
$\beta\gamma$ = 1500-2500 cpm
LEL = 0
O_2 = 21.0%

INTERNATIONAL TECHNOLOGY CORPORATION

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By _____ Date _____ Subject _____ Sheet No. ____ of ____

Chkd. By ____ Date _____ _____ Proj. No. _____

BORING NUMBER (W-2), 3rd ATTEMPT CHANGE OF NUMBER TO BORING 14-3 WAS SAMPLED TO A DEPTH OF 35 FT AND AUGERS STOPPED AT 4.5 FT. LARGE OBSTACLE, PIPE, WAS ENCOUNTERED AT A DEPTH OF 4.5 TO 5.0 FT. LOCATION WAS ABANDONED AND BOREHOLE WAS PLUGGED WITH BENTONITE PELLETS AND FINISHED WITH A CEMENT PLUG OF 12 INCHES THICK.

MAT'LS USED:

1/2 BAG TYPE I CEMENT

2 BUCKETS BENTONITE PELLETS

≈10 GALS WATER.

000039

108-12-85

FERNALD
RI/FS
5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1162 (1414)	COORDINATES:		DATE:
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: E. Tell	Depth	Date/Time	DATE COMPLETED:
DRILLING METHODS: MOBILE DRILL HSA			PAGE 1 OF 2

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CONCRETE FLOOR SLAB 6 IN THIN			
1	55172 2059 7-17	3	6	VERY STIFF, YELLOWISH BROWN (10YR 4/3) SILTY CLAY, TRACE OF GRAVEL (.5-.75 IN), MOIST.	CL	3.0	HNU = 0.0 PPM α = 0-10 CPM βγ = 500 CPM
	55171 2059 7-17	5	6				
2	55175 2059 7-18	4	3	SAME AS ABOVE	CL	2.5	HNU = 0.0 PPM α = 0-10 CPM βγ = 800-900 CPM
	55177 2059 7-18	12	0	NR. BORING ABORTED DUE TO PIPE AT DEPTH OF ~4.0 FT.			
3				MOVED LOCATION ~2.0 FT EAST OF THIS LOCATION.			
4				DRILL FLUSHED TO THE BOTTOM PORTION AND FINISHED WITH A CEMENT PLUG 12 INCHES THICK.			
5							
6							
7							

NOTES: DRILLING CO.:
DRILLER: Dale Neumann
HELPER: Chris Cutler
MATERIALS USED:
[illegible] bag cement
1 1/2 [illegible]
5 [illegible] water

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
HNU = 0.2 PPM
α = 10-22 CPM
βγ = 1500-2000 CPM
LEL = 0%
O_2 = 20.8%

000046

INTERNATIONAL TECHNOLOGY CORPORATION

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By _____ Date _____ Subject _____ Sheet No. ____ of ____

Chkd. By ____ Date _____ _____ Proj. No. _____

BORING NUMBER [illegible] - 7TH ATTEMPT CHANGED NUMBER TO BORING 1414 WAS SAMPLED TO A DEPTH OF 3.0 FT. WITH AUGERS STOPPED AT 3.5 FT. ANOTHER OBSTACLE HIT AT APPROXIMATELY 4.0 FT., CONCRETE PIPE. LOCATION MOVED 2.0 FT. EAST AND RE-DRILLED. THIS LOCATION WAS PLUGGED WITH BENTONITE AND FINISHED WITH A CONCRETE PLUG 12 INCHES THICK.

MATERIALS USED:

1/2 bag ~~[illegible]~~ cement
1 1/2 buckets bentonite pellets
5 gals water

000041

08-10-85

FERNALD
RI/FS
5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1415 (1162)	COORDINATES:	DATE: 7-19-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-19-89	
ENGINEER/GEOLOGIST: [illegible]	Depth Date/Time	DATE COMPLETED: 7-24-89	
DRILLING METHODS: MOBILE DRILL HSA 8 IN		PAGE 1 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	[illegible]	—	—	INCREASE FLOOR SLAB PAVE COARSE UNDERLINES			H_{NU} = 0.4 ppm
1	55176 1540 7-19	5	6	VERY ST FT, YELLOWISH BROWN (10YR 4/3) SILTY CLAY, LOW TO MEDIUM PLASTICITY, TRACE OF FINE GRAVEL (.5 in), MOIST.	CL	2.5	α = 0-10 CPM $\beta\gamma$ = 500-600 CPM
	55177 1540 7-19	6	6				
2	55178 1540 7-19	13	—	NR 2 ATTEMPTS			H_{NU} = 0.4 ppm α = 0-10 CPM $\beta\gamma$ = 600 CPM
	55179 1540 7-19	15	—				
3	55180 [illegible]	6	4	STIFF, YELLOWISH BROWN (10YR 4/3) CLAY, MEDIUM PLASTICITY, MOIST.	CL	1.5	
4	55181 1554 7-20	6	—	3 ATTEMPTS NO RECOVERY			H_{NU} = 0.4 ppm α = 0-10 CPM $\beta\gamma$ = 600 CPM
	55182 1557 7-19	8					
	55183 1607 7-19	5	6	STIFF, BROWN (10YR 4/3) CLAY MEDIUM PLASTICITY, MOIST	CL	1.5	
5	55184 1707 7-19	9	—	NO RECOVERY 3 ATTEMPTS LARGE OBSTACLE IN HOLE			H_{NU} = 0.4 ppm α = 0-10 CPM $\beta\gamma$ = 500-600 CPM
	55185 1707 7-19	12	4				
6	55186 1741 7-24	9	6	VERY STIFF, GRAYISH BROWN (10YR 4/3) SANDY CLAY, MED. PLASTICITY MOIST	CL	3.0	
	55187 1741 7-24	12	6	SAME SOIL COMPOSITION AS ABOVE.	CL	3.25	H_{NU} = 0.4 ppm α = 0 CPM $\beta\gamma$ = 500 CPM
7	55188 1741 7-24	12	3				
	55189 1742 7-24	9	6	VERY STIFF, GRAYISH BROWN (10YR 4/3) CLAY, TRACE OF GRAVEL (.25-.5 in) MED. PLASTICITY MOIST.	CL	2.5	

NOTES: DRILLING CO.:
DRILLER: [illegible]
HELPER: [illegible]

MATERIALS USED:
BOLCLAY - 2 bags.
WATER 450 gals
BENTONITE - 1 bucket (5 gal)
CHLORIT - 1/2 bag (50 lb)

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
H_{NU} = 0.4 ppm
α = 0-10 CPM
$\beta\gamma$ = 500 CPM
LEL = 0
O_2 = 20.8%

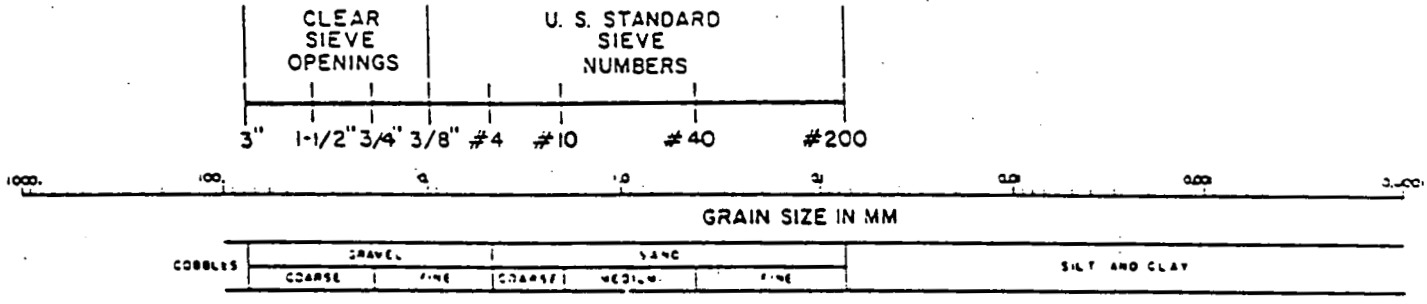
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD
RI/FS
5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: [illegible]	COORDINATES:	DATE: [illegible]
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: [illegible]
ENGINEER/GEOLOGIST: E. Trollinger	Depth Date/Time	DATE COMPLETED: 7-24-89
DRILLING METHODS: Mobile Drill HSA		PAGE [illegible] OF [illegible]

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	55190 1746 7-24	10	6	SAME MATERIAL AS ABOVE	CL	2.5	Hnu = 0.4 ppm
	55191 1746 7-24	11		NO RECOVERY			α = 0 cpm
	55192 1755 7-24	13	6	STIFF, DARK BROWN (10YR 3/2) CLAY, TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	CL	2.0	βγ = 500-550 cpm
9	55193 1755 7-24	16	6	VERY STIFF, BROWN (10YR 4/3) CLAY, TRACE TO SOME GRAVEL 1/4 TO .5 IN), MEDIUM PLASTICITY, MOIST.	CL	3.0	Hnu = 0.4 ppm
	55194 1755 7-24	21	5				α = 0 cpm
10	55195 1900 7-24	3	6	VERY STIFF, GRAYISH BROWN (10YR 4/3) CLAY, TRACE OF GRAVEL MEDIUM PLASTICITY, MOIST	CL	2.75	βγ = 500-600 cpm
11	55196 1900 7-24	10	6	VERY STIFF, GRAY (10YR 5/2) CLAY, MEDIUM PLASTICITY, MOIST	CL	3.5	Hnu = 0.4 ppm
	55197 1900 7-24	11	2				α = 0 cpm
12	55198 1900 7-24	12	6	VERY STIFF, GRAYISH BROWN (10YR 4/2) TO GRAY (10YR 5/2) GRAVELLY CLAY, MEDIUM PLASTICITY, MOIST.	CL	2.5	βγ = 500 cpm
	55199 1900 7-24	14	6	SAME COMPOSITION AS ABOVE	CL	2.5	Hnu = 0.4 ppm
13	55200 1900 7-24	18		NO RECOVERY			α = 0 cpm
	55201 1925 7-24	11	6	VERY STIFF, GRAY (10YR 5/2) CLAY, TRACE OF GRAVEL SIZE MEDIUM PLASTICITY, MOIST	CL	2.5	βγ = 500 cpm
14	55202 1925 7-24	12	6	SAME COMPOSITION AS ABOVE	CL	2.5	Hnu = 0.4 ppm
	55203 1925 7-24	24	6				α = 0 cpm
	55204 1929 7-24	21	6				βγ = 500 cpm

NOTES:

DRILLER: Dave Sorenson
HELPER: Chris Cotter

Hnu Std. = 00222 ppm

INSTRUMENT BACKGROUND
Hnu = 0.4 ppm
α = 0-16 cpm
βγ = 500-650 cpm

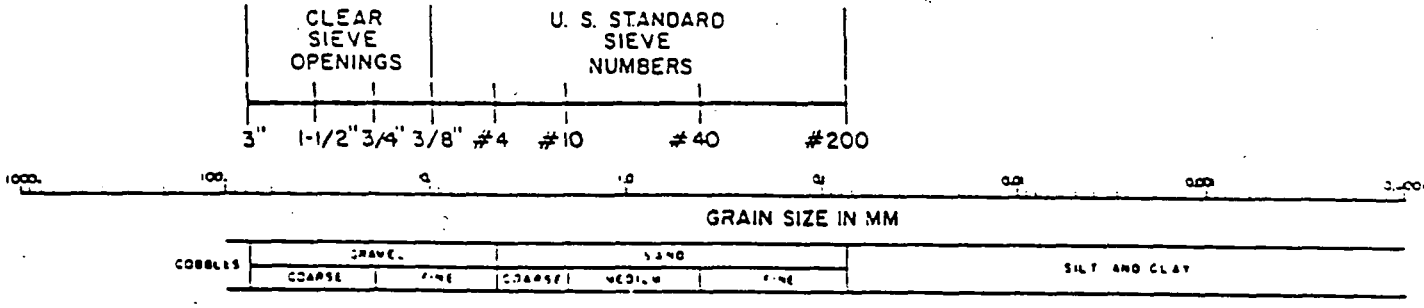
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE.

0220

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: [illegible]	COORDINATES:	DATE: 7-20-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-19-89
ENGINEER/GEOLOGIST: [illegible]	Depth Date/Time	DATE COMPLETED: 7-24-89
DRILLING METHODS: MOBILE DRILL HSA 8 IN		PAGE 3 OF –

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15							
16	55205 1946 7-24	6	6	STIFF, GRAYISH BROWN, (10YR 4/2) CLAY, TRACE OF GRAVEL (5 IN) MEDIUM PLASTICITY, MOIST.	CL	2.0	Hrm = 0.4 ppm α = 0 CPM βγ = 500 CPM
	55206 1946 7-24	6	4				
	55207 1946 7-24	8		NO RECOVERY			
55208 → 17	55208 1952 7-24	13	6	VERY STIFF, GRAY, (10YR 5/1) CLAY, TRACE OF COARSE SAND TO FINE GRAVEL, MEDIUM PLASTICITY, MOIST.	CL	3.5	Hrm = 0.6 ppm α = 0 CPM βγ = 500 CPM
	55209 1952 7-24	18	6				
18	55210 1952 7-24	50/3 in	3				
19	55211 2055 7-24	24	6	HARD, GRAYISH BROWN (10YR 5/3) GRAVELLY CLAY, MOIST, MEDIUM PLASTICITY, VERY HARD AT TOP	CL	4.0	Hrm = 0.4 ppm α = 0 CPM βγ = 500 CPM
	55212 2055 7-24	30	6				
	55213 2055 7-24	32	6				
20	55214 2055 7-24	18	6	SAME AS ABOVE	CL	4.0	Hrm = [illegible] ppm α = 0 CPM βγ = 500 CPM
				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE. + BORING WAS PLUGGED WITH GROUT. NO WATER BEARING ZONE WAS ENCOUNTERED TO DRILLED DEPTH OF 20.0 FT. SAMPLING ENDED AT 20.0 FT.			

NOTES:

DRILLER: DAVE NEWMAN
HELPER: CHRIS COTTER

INSTRUMENT BACKGROUND

Hrm = 0.4 ppm
α = 0-10 CPM
βγ = 500-1000 CPM

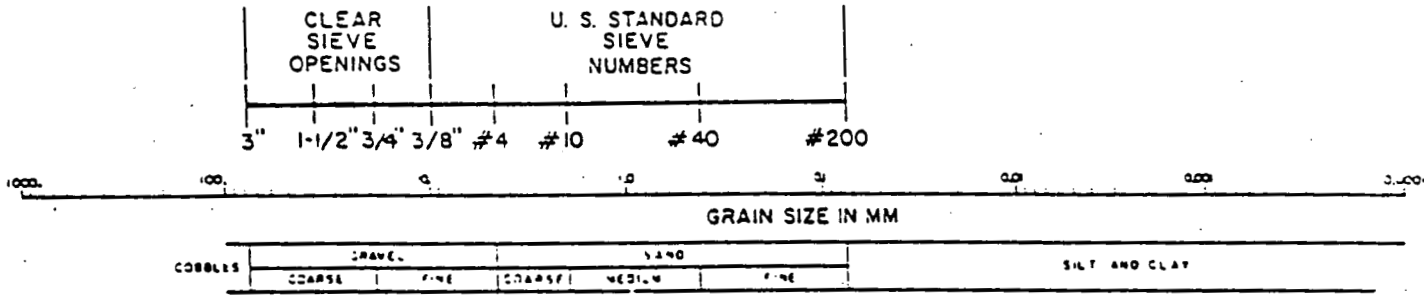
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH-O.D.-SPLIT-BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

5549

INTERNATIONAL TECHNOLOGY CORPORATION

By _____ Date _____ Subject _____ Sheet No. ____ of ____

Chkd. By ____ Date _____ _____ Proj. No. _____

BORING 1415 (5th ATTEMPT ON BORING 1402) WAS DRILLED TO A DEPTH OF 20.0 FT., SAMPLING BASED AT 20.0 FT NO WATER BEARING ZONE ENCOUNTERED TO 20.0 FT

MAT'LS USED:

2 bags VOLCLAY GROUT (50 lbs ea.)

20 gals. WATER

1/2 bucket BENTONITE PELLETS

1/2 bag. CEMENT.

000048

108-12-85

5549

FERNALD RI/FS

	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.2.1	PROJECT NAME: Fernald	
BORING NUMBER: ~~1314~~ 1186	COORDINATES:	DATE: 7/1/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/1/89
ENGINEER/GEOLOGIST: TSD	Depth Date/Time	DATE COMPLETED: 7/1/89
DRILLING METHODS: Hollow Auger		PAGE 1 OF 5

DEPTH (ft)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 in)	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	16661 1008 7-1	14	6	Dense (10YR 4/3) dark brown sand some gravel & clay, dry.	SC	—	HNU = 3 ppm, α = 0 cpm, BG = 120-14 cpm
1.0	16662 1008 7-1	14	6	Hard (2.5Y 5/4) light olive brown silty clay some sand, trace of gravel dry, low plasticity	CL	74.0	
1.5	16663 1008 7-1	11	0	NR	—	—	
2.0	16664 1010 7-1	11	6	Hard (2.5Y 5/4) light olive brown silty clay, some sand, trace of gravel low plasticity, moist	CL	74.0	HNU = 6 ppm, α = 0 cpm, BG = 80-100 cpm
2.5	16665 1010 7-1	8	5	SAA	CL	3.5	
3.0	16666 1010 7-1	8	0	NR	—	—	
3.5	16667 1013 7-1	7	6	Stiff (2.5Y 5/4) light olive brown silty clay some sand, trace of gravel med plasticity, moist	CL	1.75	HNU = 2 ppm, α = 0 cpm, BG = 100 cpm
4.0	16668 1013 7-1	6	2	Soft (5Y 4/1) dark gray silty clay trace of sand & gravel, med plasticity moist	CL	0.5	
4.5	16669 1013 7-1	5	0	NR	—	—	
5.0	16670 1016 7-1	3	6	Stiff (5Y 4/1) dark gray silty clay trace of sand, med. plasticity, moist	CL	2.0	HNU = 4 ppm, α = 0 cpm, BG = 100 cpm
5.5	16671 1016 7-1	2	4	SAA	CL	1.5	
6.0	16672 1016 7-1	3	0	NR	~~CL~~ —	—	
6.5	16673 1024 7-1	3	6	Med. stiff (2.5Y 5/4) light olive brown sandy clay, trace of gravel, med. plasticity moist	CL	0.75	HNU = 1 ppm, α = 0 cpm, BG = 120 cpm
7.0	16674 1024 7-1	5	6	Stiff (2.5Y 4/4) olive brown silty clay trace of sand, med plasticity, moist.	CL	1.75	
	16675 1024 7-1	8	3	Very stiff & SAA	CL	4.0	

NOTES: CONTRACTOR: Penn Drill
Rig: ~~model 80~~ B-53
Driller: ~~Craig Coulter~~ J. Saccini 7/1/89
Assistant: ~~Bill Anderson~~ R. Felty
SAA = Same As Above

SAMPLES collected as per ASTM standard Penetration Test.
Colors identified by Munsell Color Ch
Background Levels: HNU = 0 ppm, α = 0 cpm, BG = 80-120 cpm, LEL = ppm, O_2 = %

000049

5549

FERNALD RI/FS

1st Key In	JAS 8-14-89
2nd Key In	
Hard Copy Verification	

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Fernald	
BORING NUMBER: 1186	COORDINATES:	DATE: 7/1/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/1/89
ENGINEER/GEOLOGIST: TSD	Depth Date/Time	DATE COMPLETED: 7/1/89
DRILLING METHODS: Hollow Auger		PAGE 2 OF 5

DEPTH (ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 in.	RECOVERY (in.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8.0	16676 1041 7-1	7	6	Stiff (2.5Y 6/8) olive yellow (5Y5/1) gray mottled silty clay, trace of sand med plasity moist	CL	1.75	HNU = 1 ppm; α = 0 cpm; βγ = 140-160 cpm
8.5	16677 1041 7-1	7	6	very stiff (2.5Y 6/8) olive yellow (5Y5/1) gray mottled silty clay trace of sand med plasticity moist	CL	3.5	
9.0	16678 1041 7-1	8	1	SAA	CL	2.75	
9.5	16679 1050 7-1	7	6	SAA	CL	2.75	HNU = 0 ppm; α = 1 cpm; βγ = 120-140 cpm
top of water – 9.75' 10.0	16680 1050 7-1	7	6	SAA / very stiff (10YR 5/3) brown sandy silt wet	CL / ML	2.5	
10.5	16681 1050 7-1	9	3	SAA w/ 1" clean fine sand seam	ML	2.25	
11.0	16682 1053 7-1	3	6	Med. stiff (5Y5/2) olive gray silty clay some sand, med. plasticity moist	CL	1.0	HNU = 1 ppm; α = 0 cpm; βγ = 100-120 cpm
11.5	51795 1058 7-1	5	3	stiff / SAA / med. dense (2.5Y 5/4) light olive brown silty fine sand very moist	CL / SM	1.25	
12.0	51796 1058 7-1	7	0	NR	—	—	
12.5	51797 1127 7-1	8	6	Med dense (5Y5/2) olive gray sandy silt, wet	ML	—	HNU = 0 ppm; α = 0 ppm; βγ = 140-120 cpm
13.0	51798 1127 7-1	6	6	med dense (2.5Y 5/4) light olive brown silty sand, wet, w/ 1" clean fine sand at the bottom.	SM	—	
13.5	51799 1127 7-1	11	4	med dense (2.5Y 5/4) light olive brown fine-med. sand, wet.	SP	—	
14.0	51800 1140 7-1	10	6	Dense (2.5Y 4/2) dark grayish brown fine to med. sand some clay, wet	SP	—	HNU = 0 ppm; α = 0 cpm; βγ = 20-100 cpm
14.5	51801 1140 7-1	10	6	SAA	SP	—	
bottom of water – 15'	51802 1140 7-1	12	6	dense (2.5Y 5/4) light olive brown silty sand wet / Dense (2.5Y 5/4) light olive brown fine to med sand some silt, trace of clay wet	SM / SP	— / —	

NOTES: Contractor: Penn Drill
Rig: B-53
Driller: J. Succuni
Assistant: K. Felty

SAA = Same As Above

Samples collected as per ASTM standard penetration test.
Colors identified by Munsell color chart
Background Levels: HNU = 0 ppm
α = 0 cpm
βγ = 180-120 cpm
LEL = ppm
O_2 = %

000050

5549

FERNALD RI/FS

	Initial	Date
1st Key In		
2nd Key In		
Copy		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Fernald		
BORING NUMBER: 1186	COORDINATES:	DATE: 7/1/89	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 7/1/89	
ENGINEER/GEOLOGIST: TSD	Depth / Date/Time	DATE COMPLETED: 7/1/89	
DRILLING METHODS: Hollow Auger		PAGE 3 OF 5	

DEPTH (ft)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 in	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (tsf)	REMARKS
15.5	51803 1212 7-1	6	6	med. stiff (2.5Y5/4) light olive brown silty clay, some sand, med. plasticity, moist. 1988. stiff (2.5Y5/2) grayish brown sandy clay, trace of gravel, moist.	CL / CL	0.75	HNU = 0 ppm
16.0	51804 1212 7-1	9	6	Stiff (2.5Y 5/2) grayish brown sandy clay/clayey sand, trace of gravel, moist.	CL/SC	1.75	α = 0 cpm βγ = 120-140 cpm
16.5	51805 1212 7-1	9	5	SAA	CL/SC	1.75	
17.0	51806 1221 7-1	8	6	Very stiff (2.5Y5/2) grayish brown sandy clay, trace of gravel, med. plasticity, moist.	CL	2.75	HNU = 0 ppm α = 0 cpm βγ = 180-200 cpm
17.5	51807 1221 7-1	10	3	SAA	CL	2.50	
18.0	51808 1221 7-1	11	0	NR	—	—	
18.5				Bottom of Boring @ 18.0 ft.			HNU = ppm α = cpm βγ = cpm
19.0							
19.5							
20.0							HNU = ppm α = cpm βγ = cpm
							HNU = ppm α = cpm βγ = cpm

NOTES: CONTRACTOR: Penn Drill
Rig: B-53
Driller: J. Saccuni
Assistant: K. Felty
SAA = SAME AS ABOVE

Samples collected as per ASTM standard penetration test.
Colors identified by Munsell color char
Background levels: HNU = 0 ppm
α = 0 cpm
βγ = 80-120 cpm
LEL = ppm
O_2 = %

000051

O.F.G.G
5549
FERNALD RI/FS

pg. 4 of 5

PIEZOMETER INSTALLATION SHEET

PROJECT NAME RI/FS Fernald
PROJECT NO. GO2 3.7.1
BORING NO. 1186
PIEZOMETER NO. 1186

FIELD ENG./GEO. T. Samargek DATE 7/1/89
CHECKED BY B.N. DATE 7/2/89
DATE OF INSTALLATION 7/1/89

BOREHOLE DRILLING

DRILLING METHOD 8" Hollow Auger
DRILLING FLUID (S) USED:
FLUID NA FROM NA TO NA
FLUID NA FROM NA TO NA

TYPE OF BIT Auger
CASING SIZE (S) USED:
SIZE NA FROM — TO —
SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer
DIAMETER OF PERFORATED SECTION 2.0in ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.02 in
TOTAL PERFORATED AREA 5.0 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 5.5'-10'-1.7'
JOINING METHOD Screw type - flush Joint Threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5'
PROTECTIVE PIPE O.D. 4 3/8"

OTHER PROTECTION Hinged protective cover with installed

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE	1.7'			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	3.0			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY/cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 8.0	TOP	BOTTOM
SAND	TOP 8.0	BOTTOM 15.5	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP 10.0	BOTTOM 15.0	TOP	BOTTOM
PIEZOMETER TIP	15.5			
BOTTOM OF BOREHOLE	18.0'			
GWL AFTER INSTALLATION	To be taken later			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at 9.75'
Bottom of water bearing zone at 15.0'

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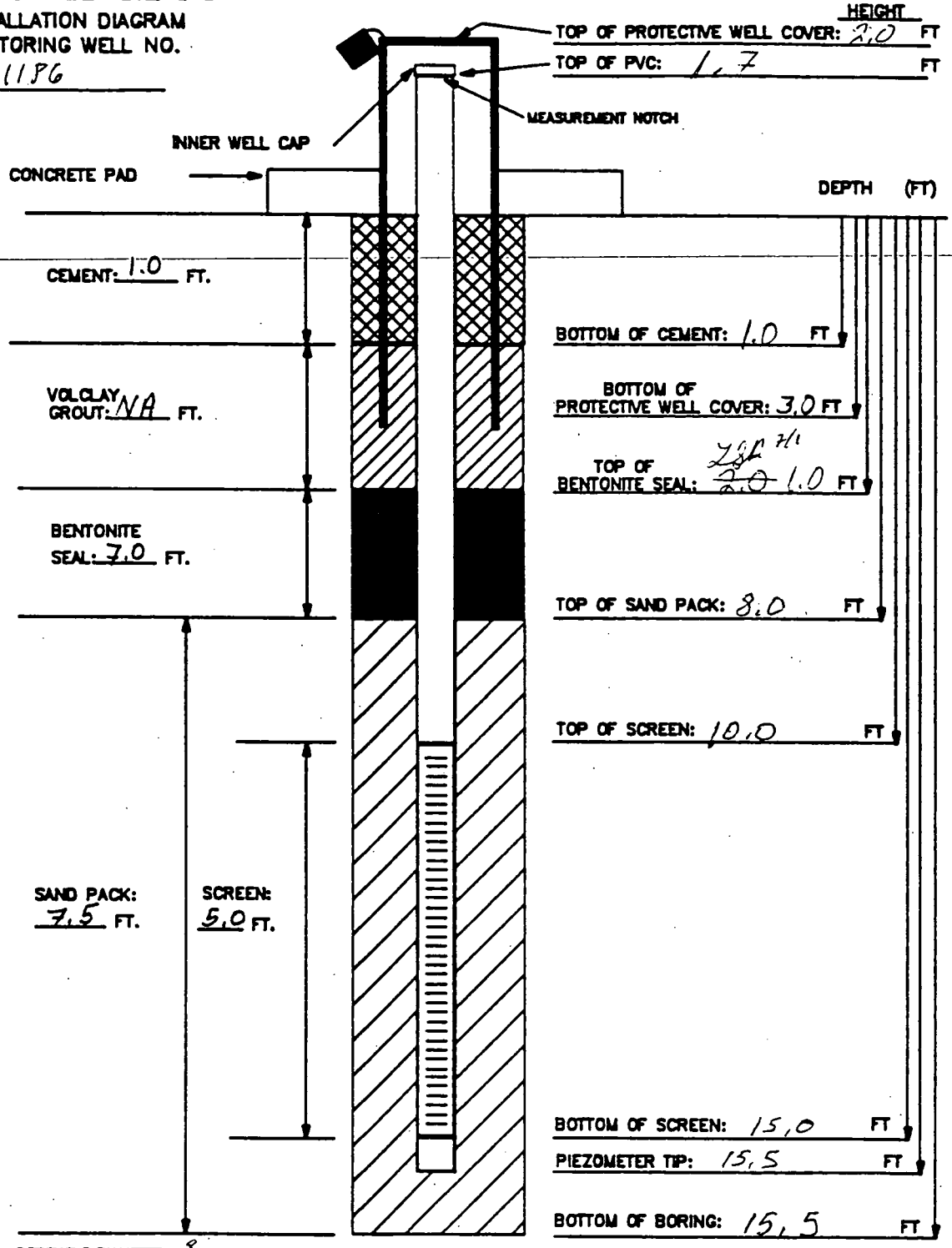
ACG-11-86

INSTALLATION DATE: 7/1/87

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1186



BOREHOLE DIAMETER: 8 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY:
BENTONITE PELLETS (5-GALLON BUCKETS):
BAGS OF VOLCLAY GROUT:
AMOUNT OF CEMENT:
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 3.7.1

GEOLOGIST/ENGINEER: T. Santangelo

FERNALD
RI/FS
5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 37.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1234	COORDINATES:	DATE: 07-27-91
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-21-91
ENGINEER/GEOLOGIST: M. [illegible]	Depth Date/Time	DATE COMPLETED: 07-27-91
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17719 0925 07-27	6	4	MEDIUM DENSE, BROWN (10YR5/4) CLAYEY GRAVEL, GRAVEL RANGING FROM (.25 - .75 IN) DRY	GC	N/A	HNU = 7 PPM α = 0 BZ = 90 100
1	17720 0925 07-27	10	—	NO RECOVERY FROM 0.5-1.0 FT.	—	—	
	17721 0925 07-27	8	—	NO RECOVERY FROM 1.0 -1.5 FT	—	—	SAMPLE # 17719 -3 USA ENTIRE RECOVERED SAMP. USED TO FILL VOA BOTTLE
2	17722 0925 07-27	5	6	STIFF, BROWN (10YR 4/4) SILTY CLAY, TRACE GRAVEL (.25 -1.0), TRACE SAND, DAMP	CL	2.0	HNU = 5-6 PPM α = 0 BZ = 100 120
	17723 0928 07-27	7	—	NO RECOVERY FROM 2.0 -2.5 FT	—	—	
3	17724 0928 07-27	6	—	NO RECOVERY FROM 2.5 -3.5 FT	—	—	
	17725 0932 07-27	8	6	STIFF, OLIVE-BROWN (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25 IN) DAMP	CL	2.0	HNU = 9 PPM α = 0 BZ = 140 160
4	17726 0932 07-27	5	4	A.A	CL	2.0	
	17727 0932 07-27	8	—	NO RECOVERY FROM 4.0 -4.5 FT	—	—	
5	17728 0935 07-27	11	6	STIFF, YELLOW-BROWN (2.5Y 4/4) SILTY CLAY, TRACE GRAVEL (.25 IN) DAMP	CL	2.0	HNU = 4-5 PPM α = 0 BZ = 100 120
	17729 0935 07-27	12	6	A.A	CL	2.0	
6	17730 0935 07-27	11	6	A.A	CL	2.0	
	17731 1032 07-27	5	6	STIFF, YELLOW-BROWN (2.5Y 5/4) SILTY CLAY, TRACE SAND, DAMP	CL	1.0	HNU = 2-3 PPM α = 0 BZ = 100
7	17732 1032 07-27	4	6	A.A	CL	1.0	
	17733 1032 07-27	4	6	A.A	CL	1.0	

NOTES: CONTRACTOR: PENN DRILL
RIG: MOBIE RIG B53
DRILLER: T SACCALI
ASSISTANT: W. FELTY

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
BZ = 100 200 CPM
LEL = 0 PPM
O_2 = 20.6 %

LELO2:

A.A = AS ABOVE

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 37.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1234	COORDINATES:	DATE: 07-27-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-26-89
ENGINEER/GEOLOGIST: M. SMOLINSKI	Depth Date/Time	DATE COMPLETED: 07-27-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17734 1034 07-27	4	6	STIFF, YELLOW-BROWN (2.5Y 5/4) SILTY CLAY DAMP 7.6	CL	2.0	HNU = 4 PPM
	17735 1034 07-27	5	6	MEDIUM DENSE, YELLOW-BROWN (2.5Y 5/4) POORLY GRADED FINE SAND, WET 8.3	SP	N/A	α = 0 CPM BG = 100-120 CPM
9	17736 1034 07-27	8	6	MEDIUM DENSE, YELLOW-BROWN (2.5Y 5/4) SAND SILT MIXTURE, WET	SM	N/A	
	17737 1034 07-27	7	6	MEDIUM DENSE, YELLOW-BROWN (2.5Y 5/4) SAND-SILT MIXTURE, DAMP	SM	N/A	HNU = 4 PPM α = 0 CPM BG = 100-120 CPM
10	17738 1034 07-27	11	6	A.A	SM	N/A	
	52555 1034 07-27	15	6	10.3			
	52556			STIFF, BLUE-GREY (5Y 4/1) SILTY CLAY DAMP	CL	2.0	HNU = α = BG =
11	52557			BOTTOM OF BORING 10.5 FT.			
	52558			PIEZOMETER INSTALLED WITH INTERVAL SCREENED 7.5-10.5 FT.			
12	52559						HNU = α = BG =
	52560						
13	52561						
	52562						HNU = α = BG =
14	52563						
	52564						

NOTES:

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. M Fuscaldo DATE 7/27/89
PROJECT NO. 6023070 CHECKED BY B Dunning DATE 7/29/89
BORING NO. 1234
PIEZOMETER NO. 1234 DATE OF INSTALLATION 7/27/89

BOREHOLE DRILLING

DRILLING METHOD Auger (Hollow Stem)	TYPE OF BIT
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID None FROM N/A TO N/A	SIZE 8" FROM Surface TO 10.5 Ft
FLUID N/A FROM N/A TO N/A	SIZE — FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Groundwater Monitoring Type	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 inch I.D. 2.0 inch
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 90 Ft
AVERAGE SIZE OF PERFORATIONS 0.02 inches	JOINING METHOD Flush Jointed / Threaded
TOTAL PERFORATED AREA 3.0 Ft.	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 Ft.	OTHER PROTECTION Locked / Protective
PROTECTIVE PIPE O.D. 4 3/8 inch	Lid.

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE	+ 2.0 Ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE				
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP —	BOTTOM —
BENTONITE	TOP 1.0 Ft.	BOTTOM 5.0 Ft	TOP	BOTTOM
SAND	TOP 5.0 Ft	BOTTOM 10.5 Ft.	TOP	BOTTOM
GRAVEL	TOP None	BOTTOM None	TOP N/A	BOTTOM N/A
PERFORATED SECTION	TOP 7.5 Ft.	BOTTOM 10.5 Ft	TOP	BOTTOM
PIEZOMETER TIP	10.5 Ft.			
BOTTOM OF BOREHOLE	10.5 Ft			
GWL AFTER INSTALLATION	Will be checked at later Date			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Water Bearing Sand Zone at 8 - 10.3 Ft.
Piezometer will be developed via Flushing/Air Bailing prior to sampling.

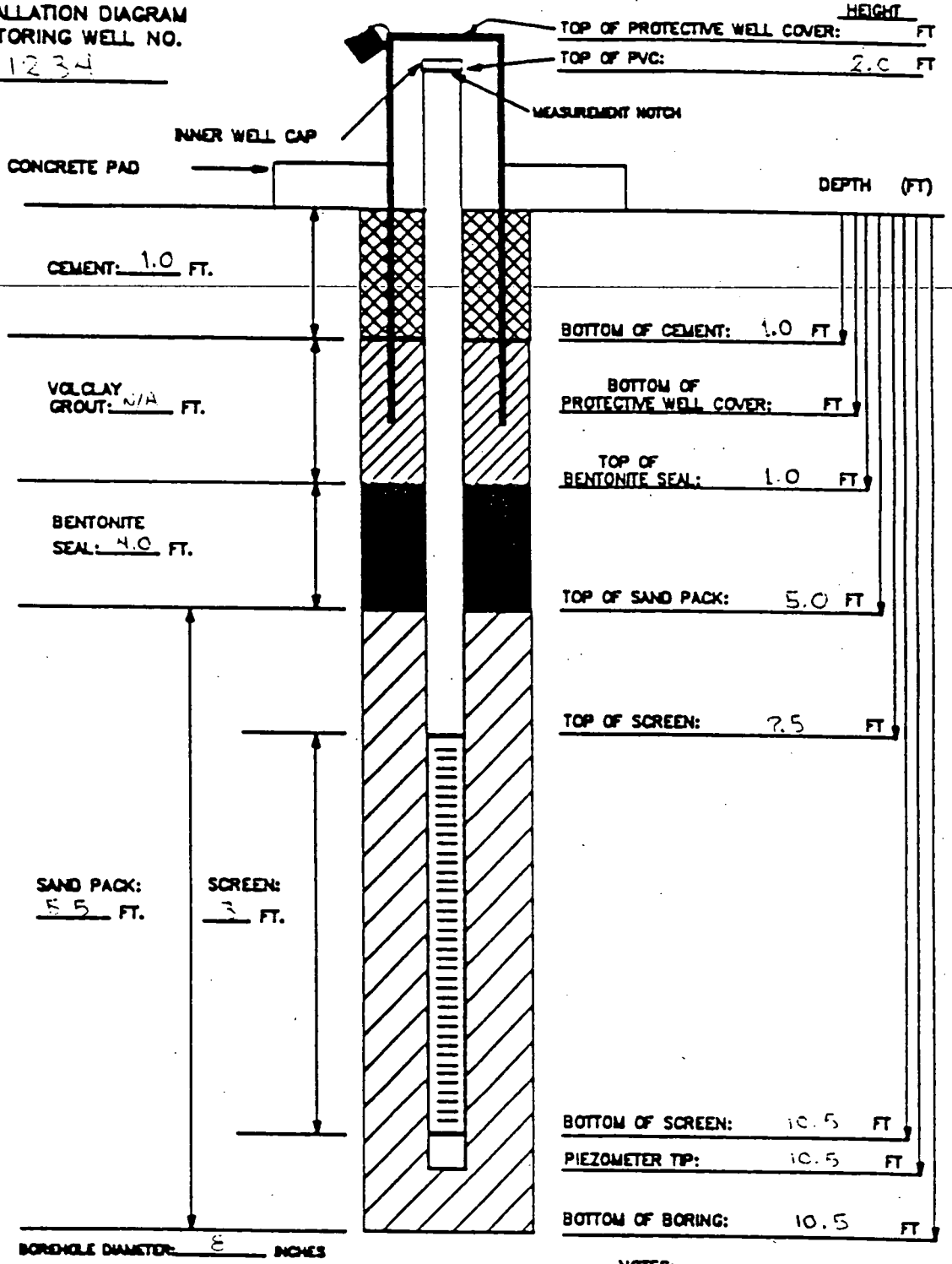
409-11-86

5549

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1234

INSTALLATION DATE: 7/[illegible]



BOREHOLE DIAMETER: 8 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 2 50 lb. bags (10-20 sand)
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: none
AMOUNT OF CEMENT: 1/2 bag (40 lb. bag)
AMOUNT OF WATER USED: 25 gallons
OTHER: none

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 03 07 01

GEOLOGIST/ENGINEER: M Stuart / R Dunning

FERNALD RI/FS

5549

	Date	Initial	
Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1279	COORDINATES:	DATE. 7/17/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/17/89	
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/17/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	18707 0949 7-17	8	6	Pale brown (10 yr 6/3), Clayey silt. Some surface roots + grass. Dry. ~~Some~~ Some sand + gravel. Loose.	ML	N/A	HNU: Bkg. α: Bγ: ↓
1	18708 0949 7-17	8	6				
	18709 0949 7-17	4	UA 4.2	Very Stiff, pale brown to brown to yellowish brown (10 yr 6/3 to 5/3 to 5/8) Silty clay. slightly damp. Trace Sand.	CL	2.25	
	18710 0951 7-17	7	6	Stiff, yellowish brown (10 yr 5/8) clay. Some silt. Some sand (may be surficial.) Damp. Med. Plasticity.	CL	1.75	HNU: Bkg α: Bγ: ↓
2	18711 0951 7-17	7	0				
	18712 0951 7-17	8	0	no recovery	N/A		
3	18713 0953 7-17	7	5	Stiff, brown to yellowish brown, (10 yr 5/3 to 5/8) silty clay. Some sand + fine gravel. Med. Plasticity. Moist	CL	1.0	HNU: Bkg α: Bγ: ↓
	18714 0953 7-17	8	0	~~SAA~~ UA			
4	18715 0953 7-17	12	0	no recovery	N/A		
	18716 0955 7-17	12	0	no recovery due to rock in end of spoon.	N/A		HNU: N/A α: Bγ:
5	18717 0955 7-17	12	0				
	18718 0955 7-17	12	0				
6	18719 1035 7-17	3	6	Very Stiff, yellowish brown (10 yr 5/4 to 5/8) Clay. Some very dark brown silt (10 yr 2/2). Trace sand. Very moist. High plasticity.	CL	2.25	HNU: Bkg α: Bγ: ↓
Possible water zone	18720 1035 7-17	4	6	Stiff, yellowish brown to brown (10 yr 5/3 to 5/6) clayey silt. med.-high plas. wet.	ML	1.0	
7	18721 1035 7-17	6	6	Hard, brown (10 yr 5/3) silty clay. Some very dk. brown (10 yr 2/2) mottling. Trace fine sand. Damp	CL	4.25	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile - B-53
DRILLER: J. Saccani
ASSISTANT: K. Felty
Bγ probe: ASI # 10
α probe: ASI # 6
Helper: D. Nelson.

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bγ : 180 CPM
LEL O2: → LEL: 0 ~~PPM~~ %
→ O2: 20.9%

HNU: HH.18

FERNALD RI/FS

5549

1st Key In: pas 8/10/89
2nd Key In: 8/17/89
Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1279	COORDINATES:	DATE: 7/17/89	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 7/17/89	
ENGINEER/GEOLOGIST: L. Adams	Depth / Date/Time	DATE COMPLETED: 7/17/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4	

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (")	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1037 8	18722 ~~1037~~ 7-17	UA & 8	6	Very stiff to hard, yellowish brown (10yr 5/4) clay some silt. High plasticity. Moist. Some gravel (fine) trace sand.	CL	4.0	HNU = Bkg α = Bδ = ↓
1037	18723 ~~1037~~ 7-17	UA & 15	6	SAA except damp	CL	4.5+	
1037 9	18724 ~~1037~~ 7-17	UA & 12	6	SAA	CL	3.75	
10	18725 1049 7-17	12	6	Soft, yellowish brown (10yr 5/4) silty clay. Med. to high plasticity. Very moist.	CL	0.5	HNU = Bkg α = Bδ = ↓
	18726 1049 7-17	18	6	Very stiff, brown to dark yellowish brown silty clay. (10yr 5/1 to 4/6). Some gravel. Trace sand. Damp. Low plasticity.	CL	3.25	
	18727 1049 7-17	20	6	Hard, SAA w/some coal fragments	CL	4.5+	
11	18728 1057 7-17	7	6	Hard to very stiff, brown to yellowish brown (10yr 5/1 to 10yr 4/4) Silty clay. Some very dk. brown specky stains, some sand. Slightly damp.	CL	4.5+	HNU = Bkg α = Bδ = ↓
	53275 1057 7-17	11	6	Very stiff, gray (10yr 5/1) to brown to dark yellowish brown sandy silty clay. (10yr 5/3 to 4/6) damp	CL	3.5	
12	53276 1057 7-17	11	6	Very stiff gray (10yr 5/1) clay and Dark yellowish brown clayey sand (10yr 4/6). Poorly graded. Moist. (Med. Dense)		3.5	
	53277 1309 7-17	13	6	Very stiff, Brown (10yr 5/1) sandy clay. Some gravel. Med. to high plast. Wet	CL	2.5	HNU = Bkg α = Bδ = ↓
Water zone 13	53278 1309 7-17	9	6	Soft, Brown (10yr 5/3) to gray (10yr 5/3) Silty sandy clay. Some gravel. Wet		NA	
	53279 1309 7-17	9	6	Very stiff, gray (10yr 5/1) clay. Yellowish brown stains in vertical cracks (10yr 4/6). Some gravel. Med. to high plasticity. Damp.	CL	2.5	
14	53280 1311 7-17	8	6	SAA		2.25	HNU = Bkg α = Bδ = ↓
	53281 1311 7-17	12	6		CL	2.75	
	53282 1311 7-17	17	6			2.0	

NOTES:

Total Depth of Borehole ~~18.4~~ 15.0

Water zone 12.5 – 13.0 ft.

FERNALD RI/FS

5549

	Initial	Date
1st Key In	JMT	8/15/89
2nd Key In	JMT	8/15/89
Data Verification		

PIEZOMETER INSTALLATION SHEET

PROJECT NAME ~~X~~ Fernald RIFS FIELD ENG./GEO. L. Adams DATE 7/17/89
PROJECT NO. 602 3.7.1 CHECKED BY W.A. Hertel DATE 7/20/89
BORING NO. 1279
PIEZOMETER NO. 1279 DATE OF INSTALLATION 7/17/89

BOREHOLE DRILLING

DRILLING METHOD Auger (Rotary)
DRILLING FLUID (S) USED: none
FLUID — FROM — TO —
FLUID — FROM — TO —

TYPE OF BIT Auger Bit (8.0 in)
CASING SIZE (S) USED:
SIZE ~~4.25 in~~ 4.25 ID UA FROM 0.0 TO 15.0
SIZE ~~N/A~~ UA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Well
DIAMETER OF PERFORATED SECTION 4 5/8 in.
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.02 in.
TOTAL PERFORATED AREA 4.8 ft

RISER PIPE MATERIAL PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in. I.D. 2.0 in.
LENGTH OF PIPE SECTIONS
JOINING METHOD Flush thread joint screw type

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft.
PROTECTIVE PIPE O.D. 4 5/8 in.

OTHER PROTECTION Locking cap, padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 8.0	TOP	BOTTOM
SAND	TOP 8.0	BOTTOM 14.4	TOP	BOTTOM
GRAVEL	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 9.3	BOTTOM 14.15	TOP	BOTTOM
PIEZOMETER TIP	~~14.0~~ 14.5 UA	14.4 ft		
BOTTOM OF BOREHOLE	15.0			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Water Bearing Zone 12.5-13.0 ft.

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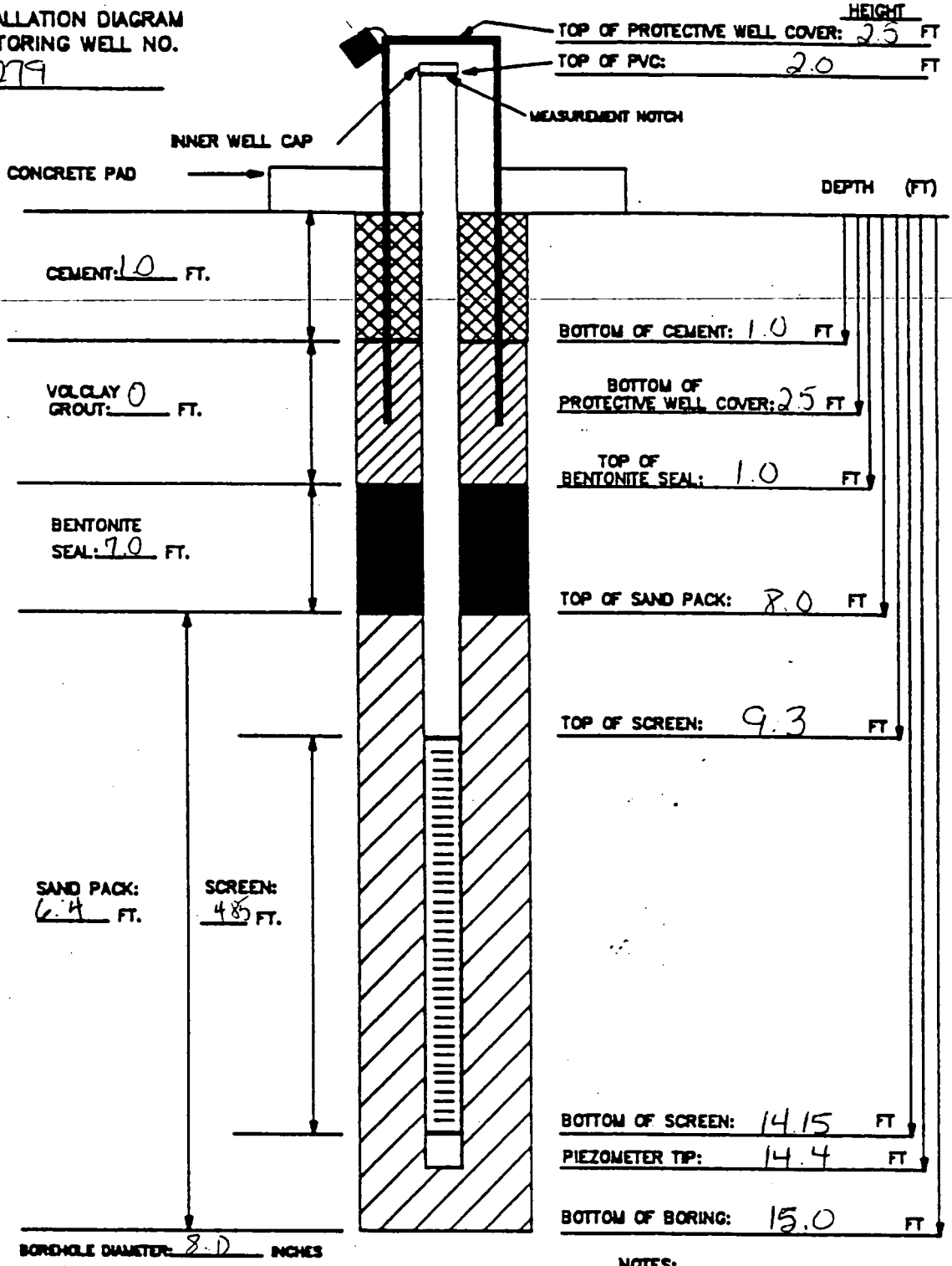
4C9-11-86

5549

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1279

INSTALLATION DATE: 7/17/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 2.5 bgs. 10/20
BENTONITE PELLETS (5-GALLON BUCKETS): 3.0 buckets
BAGS OF VOLCLAY GROUT: none
AMOUNT OF CEMENT:
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: L. Adams

QA/QC [illegible] by WAH

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

Date	7-12	58
Initial	NW	
	Field Check	1st Review	2nd Review	Final Data Validation

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1282	COORDINATES:	DATE: 07/12/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07/12/89	
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/14/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	18773 7-12 1530	6	6	HARD (10YR 5/3) BROWN, SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, DRY. (GRASS AND ROOTS)	CL	>4.5	HNU: 0 ppm α: 0 cpm Bγ: 150-160 cpm
1	18774 7-12 1530	40	6	HARD, (10YR 4/4) DARK YELLOWISH BROWN SILTY CLAY, TRACE OF FINE TO MED. GRAVEL, LOW PLASTICITY, DRY.	CL	>4.5	
	18775 7-12 1530	50/2	0	NR	NA	NA	
2	18776 7-12 1535	8	6	VERY STIFF (10YR 3/3) DRK. BRN, CLAY TRACE OF SILT & SAND, LOW PLASTICITY, SLIGHTY MOIST,	CL	3.0	HNU: 0 ppm α: 0 cpm Bγ: 120-130 cpm
	18777 7-12 1535	9	6	SAA	CL	2.25	
3	18778 7-12 1535	12	2	SAA	CL	2.5	
	18779 7-12 1540	12	6	STIFF, (10YR 4/6) DRK. YELLOWISH BROWN SILTY CLAY, TRACE OF SAND AND FINE GRAVEL MEDIUM PLASTICITY MOIST	CL	1.5	HNU: 0 ppm α: 0 cpm Bγ: 100-110 cpm
4	18780 7-12 1540	16	4	STIFF, SAA	CL	1.25	
	18781 7-12 1540	17	0	NR	NA	NA	
5	18782 1553 7-12	18	5	Hard (2.5YR 5/4) LGT. OLIVE BROWN SILTY CLAY, TRACE OF SAND, FINE TO MED. GRAVEL, SLIGHTY MOIST	CL	>4.5	HNU: 0 ppm α: 0 cpm Bγ: 140-150 cpm
	18783 1553 7-12	4	0	NR	NA	NA	
6	18784 1553 7-12	7	0	NR	NA	NA	(WITH SCREEN)
	18785 1600 7-12	10	6	SOFT, (10YR 5/6) YELLOWISH BROWN, SANDY CLAY, TRACE OF FINE TO MEDIUM GRAVEL, LOW PLASTICITY, SLIGHTLY MOIST	CL	.5	HNU: 0 ppm α: 0 cpm Bγ: 110-120 cpm
7	18786 1600 7-12	12	0	NR	NA	NA	
	18787 1600 7-12	20	0	NR	NA	NA	(WITH SCREEN)

NOTES: CONTRACTOR: PENNDRILL
RIG: N5-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
GEO ASSISTANT: Wendy Budach

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
SAA = SAME AS ABOVE α = 0 CPM
NR = NO RECOVERY Bγ = 100-120 CPM
LELO2: [illegible] @ 7/12/89
O2: 20.6 %

HNU# 00221

000062

FERNALD RI/FS

PAGE 49

1st Key In | 2nd Key In | Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1282	COORDINATES:	DATE: 07/12/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07/12/89	
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/14/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	18788 7-12 1603	18	6	HARD (10YR 5/4) YELLOWISH BROWN, SILTY CLAY, SOME SAND, TRACE OF FINE TO MED. GRAVEL LOW PLASTICITY, MOIST	CL	4.5	HNU = 0 ppm α = 0 cpm Bγ = 150-160 cpm
	18789 7-12 1603	20	6	VERY STIFF, SAA	CL	3.75	
9	18790 7-12 1603	25	80	NR	NA	NA	
10	18791 07-13-89 0828	10	6	STIFF, (10YR 5/4) YELLOWISH BROWN, SILTY CLAY, SOME SAND TRACE OF FINE TO MEDIUM GRAVEL, LOW PLASTICITY, SLIGHTLY MOIST.	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 120-430 cpm
	18792 07-13-89 0828	10	5	VERY STIFF, (10YR 5/3) BROWN, SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	3.5	
	18793 07-13-89 0828	14	0	NR	N/A	NA	
11	18794 07-13-89 0832	18	6	HARD. (10YR 5/4) YELLOWISH BROWN, SILTY CLAY, TRACE OF SAND AND FINE TO MED. GRAVEL LOW PLASTICITY, MOIST	CL	>4.5	HNU = 0 ppm α = 0 cpm Bγ = 40-100 cpm
	53335 07-13-89 0832	20	6	HARD, SAA	CL	4.25	
12	53336 07-13-89 0832	22	6	HARD (5Y N/1) DRK. GREY, SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	>4.5	
13	53337 07-13-89 0846	48	6	HARD, SAA	CL	>4.5	HNU = 0 ppm α = 0 cpm. Bγ = 120-130 cpm
	53338 07-13-89 0846	50/4	6	HARD, SAA	CL	4.25	
	53339 07-13-89 0846		0	NR	NA	NA	
14	53340 07-13-89 1044	4	4	SAA	CL	4.25	HNU = 0 ppm α = 0 cpm Bγ = 120-130 cpm (with screen)
	53341 07-13-89 1044	8	0	NR	NA	NA	
	53342 07-13-89 1044	10	0	NR	NA	NA	

NOTES:

SAA = Same As Above
NR = No Recovery

000063

FERNALD RI/FS 2549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1282	COORDINATES:		DATE: 07/13/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 07/12/89
ENGINEER/GEOLOGIST: C. Grube	Depth	Date/Time	DATE COMPLETED: 07/14/89
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 3 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6"	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53343 07-13-89 1109	6	6	HARD (5Y 4/1) DARK GREY, SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, moist	CL	>4.5	HNU = 0 ppm α = 0 cpm BG = 110-120 cpm
	53344 07-13-89 1109	11	6	HARD SAA	CL	>4.5	
16	53345 07-13-89 1109	13	6	VERY STIFF (5Y 4/1) DRK. GREY, SILTY CLAY, TRACE OF SAND AND FINE TO MEDIUM GRAVEL, MEDIUM PLASTICITY, moist.	CL	2.5	
	53346 07-13-89 1117	18	6	STIFF, SAA	CL	2.0	HNU = 0 ppm α = 0 cpm BG = 100-110 cpm
17	53347 07-13-89 1117	20	6	STIFF, SAA	CL	1.25	
	53348 07-13-89 1117	22	6	STIFF, SAA	CL	1.0	
18	53349 07-13-89 1125	18	6	STIFF SAA	CL	1.0	HNU = 0 ppm α = 0 cpm BG = 120-130 cpm
	53350 07-13-89 1125	20	6	MEDIUM STIFF SAA	CL	.75	
19	53357 07-13-89 1125	32	6	MEDIUM STIFF, SAA	CL	.75	
20	53352 07-13-89 1125	37	6	STIFF. SAA	CL	1.25	HNU = 0 ppm α = 0 cpm BG = 120-130 cpm
			*	Bottom of boring + sampling at 20.0 FT			

NOTES:

SAA = Same As Above
NR = No Recovery

FERNALD RI/FS

5549

4 of 5

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 7/13/89
PROJECT NO. 6023.7 CHECKED BY W.A. Hertel DATE 7/16/89
BORING NO. 1282
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 Hollow Stem Auger	TYPE OF BIT 8.0 Hollow Stem Auger
DRILLING FLUID(S) USED:	CASING SIZE(S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

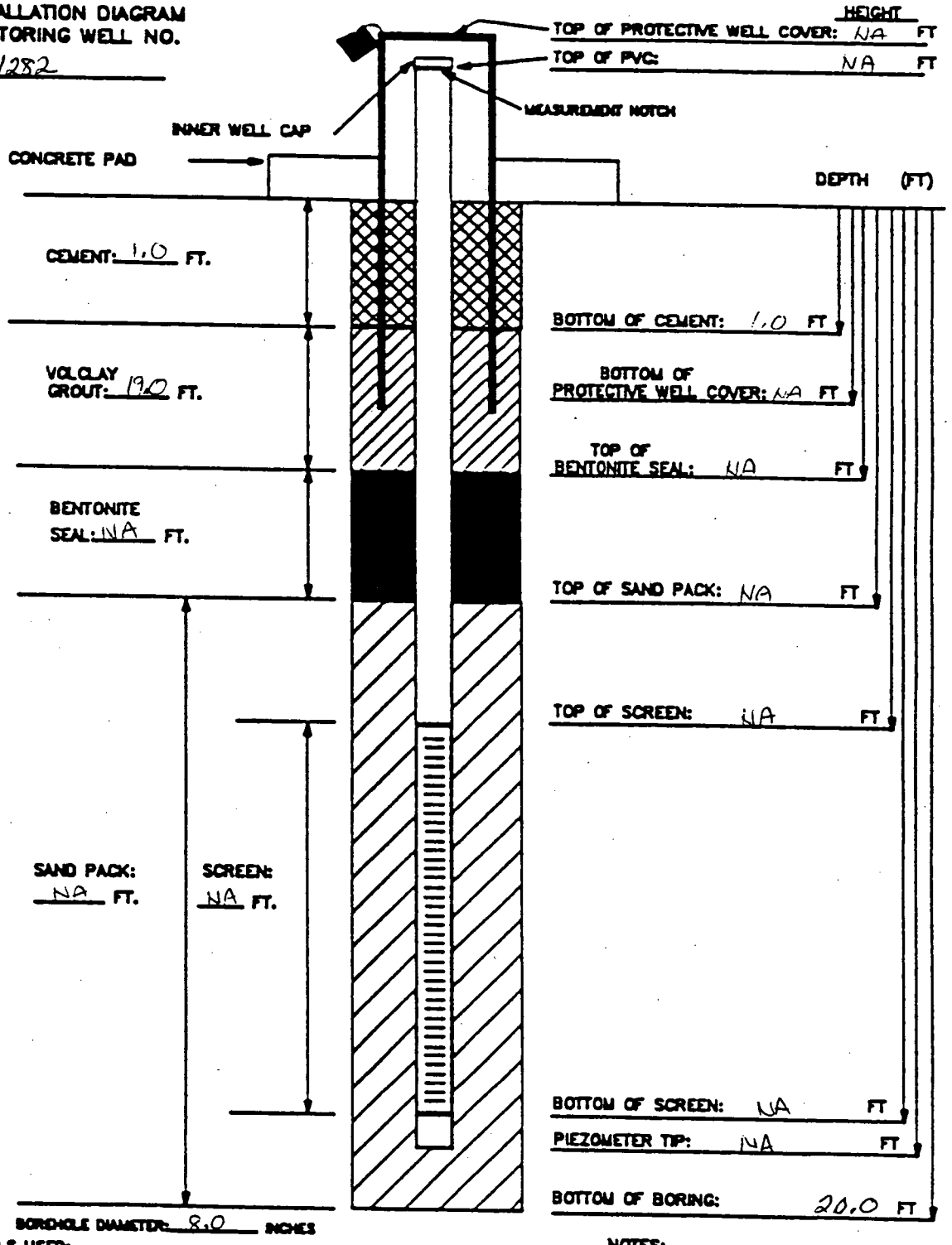
ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS: Cement / Volclay GROUT / ~~SLURRY~~	TOP 0.0 FT / 1.0 FT ~~NA~~	BOTTOM 1.0 FT / 20.0 FT ~~NA~~	TOP	BOTTOM
BENTONITE	TOP NA	BOTTOM NA	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0 FT			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS No water bearing zone encountered - well was plugged on 7-14-89 with Volclay grout and topped with a cement plug

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1282

INSTALLATION DATE: 7-14-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 2 sacks (50#) + 2 bags initiator
AMOUNT OF CEMENT: 1/2 (94#) sack
AMOUNT OF WATER USED: 40 gal.
OTHER: NA

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

FERNALD
RI/FS

5549

Date	7-20			
Initial	WAH			
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1283	COORDINATES:	DATE: 7/18/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/18/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/18/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (ISF)	REMARKS
1	18798 1402 7-18	22	6	Very dense, very dark brown (10yr 2/2) clayey gravelly silt. Some sand, surface gravel frost. dry to damp.	ML	N/A	HNU = Bkg α = Bγ = ↓
	18798 1402 7-18	15	6				
	18799 1402 7-18	39	0	No recovery	N/A		
2	18800 1443 7-18	22	6	Med dense, dark yellowish brown (10yr 4/4) Sand + gravel. Gravel from surface med.-well graded. Gravel to 1.25 in. Some silt. Dry.	GM	N/A	HNU = Bkg α = Bγ = ↓
	18801 1443 7-18	18	3				
	18802 1443 7-18	7	0	No recovery	N/A		
3	18803 1452 7-18	2	6	Stiff, dark ~~brown~~ gray to dark yellowish brown (10yr 4/1) to (10yr 4/6) silty clay. Low to med. plast. Damp Trace gravel.	CL	1.75	HNU = 1ppm α = Bkg Bγ = ↓
4	18804 1452 7-18	4	5			2.0	
	18805 1452 7-18	3	0	No recovery	N/A		
5	18806 1454 7-18	4	6	Stiff to very stiff, gray to yellowish brown (10yr 5/1 to 5/6) Clay. Some sandy clay in upper 6 in. Some spotty dk. brown staining in lower 6 in. Trace gravel. Damp Low to med. plast.	CL	1.75	HNU = 1-2 ppm α = Bkg Bγ = ↓
	18807 1454 7-18	4	6			1.75	
6	18808 1454 7-18	5	6			3.75	
7	18809 1456 7-18	4	6	Stiff to very stiff, dark brown (10yr 4/1) to dark yellowish brown (10yr 4/6) Clay. Some silt in areas. Damp to moist. Med to high plasticity Some gravel toward bottom.	CL	1.75	HNU = Bkg α = Bγ = ↓
	18810 1456 7-18	3	6			3.0	
	18811 1456 7-18	3	6			1.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile B 57
DRILLER: J. Saccani
ASSISTANT: K. Felty
Bγ probe: ASI #10
α probe: ASI #6 Helper. D. Nelson
Hnu: HH 18

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TES
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0-1 CPM
Bγ = 350 CPM
LELO2: → LEL = 0 ~~PPM~~ % WAH 7-20
→ O2 = 20.6 %

462-1

5549
FERNALD
RI/FS

Page 3 of 4

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Fernald RIFS
PROJECT NO. 602 3.7.1
BORING NO. 1283
PIEZOMETER NO. 1283

FIELD ENG./GEO. L. Adams DATE ~~7/12~~ 7/19/8 (A)
CHECKED BY W.A. Hendel DATE 7-20-89
DATE OF INSTALLATION 7/18/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID — FROM — TO —
FLUID — FROM — TO —

TYPE OF BIT 8.0 in. Hollow Stem auger
CASING SIZE (S) USED:
SIZE 4.25 in I.D. FROM 0.0 TO 10.5
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitor Well
DIAMETER OF PERFORATED SECTION 2.0 in I.D.
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.02 in.
TOTAL PERFORATED AREA 4.8 ft.

RISER PIPE MATERIAL PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in. I.D. 2.0 in.
LENGTH OF PIPE SECTIONS .25, 4.8, 8.0 ft.
JOINING METHOD Screw type Flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft.
PROTECTIVE PIPE O.D. 4 5/8 in.

OTHER PROTECTION Hinged locking cover w/padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft.)		ELEVATION ( )	
TOP OF RISER PIPE	1.8 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.9 ft.			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 3.0	TOP	BOTTOM
SAND	TOP ~~10.5~~ 3.0 (A)	BOTTOM 10.5	TOP	BOTTOM
GRAVEL None	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 5.45	BOTTOM 10.25	TOP	BOTTOM
PIEZOMETER TIP	10.5			
BOTTOM OF BOREHOLE	10.5			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Water zone 7.5 - ~~10.0~~ 9.5 (A) ft.

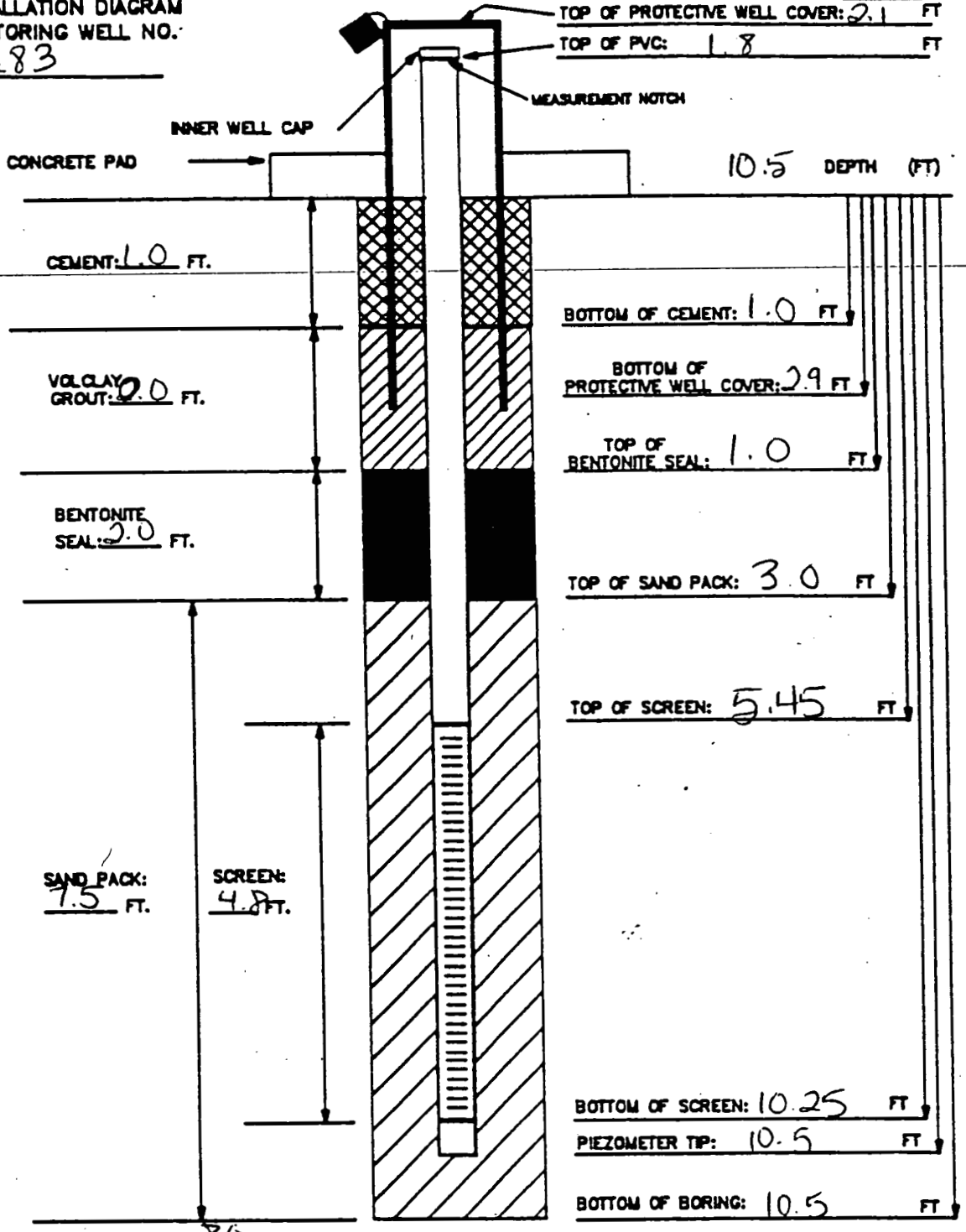
000068

4C3-11-86

INSTALLATION DATE: 7/18/89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1283



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 3½ bgs. 10\20
BENTONITE PELLETS (5-GALLON BUCKETS): 1 bucket
BAGS OF VOLCLAY GROUT: none
AMOUNT OF CEMENT:
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: L. Adams

QA/QC WAH 7-20-89

5049

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

	Date	Initial	
Field Check	7-16-89		
1st Rev'n			
2nd Rev'n			
Final Data Validation			

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 128H	COORDINATES:	DATE: 07-13-89	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 07/13/89	
ENGINEER/GEOLOGIST: C. Grube	Depth / Date/Time	DATE COMPLETED: 07/14/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	18817 1417 07-13-89	4	6	HARD, (10YR 4/4) DRK YELLOWISH BROWN, SANDY CLAY, TRACE OF FINE GRAVEL, ROOTS/GRASS, LOW PLASTICITY, SLIGHTLY MOIST	CL	>4.5	HNU = 0 ppm α = 0 cpm Bγ = 260-270 cpm
	18818 1417 07-13-89	6	5	HARD (10YR 3/3) DARK BROWN, SILTY CLAY, TRACE OF SAND, LOW PLASTICITY, SLIGHTLY MOIST.	CL	>4.5	
1	18819 1417 07-13-89	10	0	NR	NA	NA	
	18820 1420	12	6	HARD, (10YR 5/6) YELLOWISH BROWN; SILTY CLAY, SOME SAND AND FINE GRAVEL, LOW PLASTICITY, SLIGHTLY MOIST	CL	>4.5	HNU = 0 ppm α = 0 cpm. Bγ = 280-290 cpm.
2	18821 1420 07-13-89	13	6	HARD SAA	CL	>4.5	
	18822 1420 07-13-89	13	0	NR	NA	NA	
3	18823 1423 07-13-89	12	6	VERY STIFF, (2.5Y 5/4) LIGHT OLIVE BROWN SILTY CLAY, SOME SAND, TRACE OF FINE TO MED. GRAVEL, LOW PLASTICITY, SLIGHTLY MOIST	CL	3.5	HNU = 0 ppm α = 0 cpm Bγ = 260 cpm.
	18824 1423 07-13-89	16	6	VERY STIFF, (10YR 5/4) YELLOWISH BROWN SILTY CLAY, TRACE OF SAND AND FINE TO MED. GRAVEL, LOW PLASTICITY, MOIST.	CL	3.5	
4	18825 1423 07-13-89	18	3	VERY STIFF, SAA	CL	2.5	
	18826 1504 07-13-89	8	6	HARD (10YR 5/6) YELLOWISH BROWN, SILTY CLAY, SOME SAND, TRACE OF FINE GRAVEL, LOW PLASTICITY, SLIGHTLY MOIST	CL	4.5	HNU = 0 ppm α = 0 cpm Bγ = 290-300 cpm.
5	18827 1504 07-13-89	8	6	VERY STIFF (10YR 5/4) YELLOWISH BROWN SANDY CLAY, SOME SILT, TRACE OF FINE TO MED GRAVEL, LOW PLASTICITY, MOIST.	CL	2.5	
	18828 1504 07-13-89	9	6	STIFF, (2.5Y 5/4) LIGHT OLIVE BROWN, SILTY CLAY, SOME SAND, TRACE OF MED. TO FINE GRAVEL, MED. PLASTICITY, MOIST	CL	2.0	
6	18829 1507 07-13-89	10	4	VERY STIFF, (2.5Y 5/4) LIGHT OLIVE BRN. SILTY CLAY, TRACE OF SAND AND FINE TO MEDIUM GRAVEL, LOW PLASTICITY, MOIST.	CL	2.5	HNU = 0 ppm α = 0 cpm Bγ = 340-350 cpm.
	18830 1507 07-13-89	13	6	VERY STIFF, SAA	CL	2.5	
7	18831 1507 07-13-89	14	~~5~~ 3	VERY STIFF, SAA	CL	2.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: 45-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
GEO ASSISTANT: Wendy Budach

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
~~3980 - 360~~ 260-350 CPM WLB 07.13.89

SAA = Same As Above
NR = No Recovery

LEL: 0% ~~PPM~~ @ 7/13/89
O_2: 20.6%

000070

5549

FERNALD RI/FS

1st Key In | 2nd Key In | Hard Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1284	COORDINATES:	DATE: 07/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07/13/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 07/14/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
TIME 1515	18832 1540 7-13-89	20	6	VERY STIFF (10 YR 5/4) YELLOWISH BROWN. SILTY CLAY, SOME SAND, TRACE OF FINE TO MEDIUM GRAVEL, LOW PLASTICITY, MOIST	CL	3.5	HNU = 0 ppm α = 0 cpm Bγ = 340-350 cpm
8	18833 1540 7-13-89	24	6	VERY STIFF SAA	CL	2.5	
TIME 1515	18834 1540 7-13-89	32	6	VERY STIFF, SAA	CL	3.5	
9	18835 1533 07/13/89	13	6	VERY STIFF, (10YR 5/4) YELLOWISH BROWN, SANDY CLAY, TRACE OF MED. GRAVEL, LOW PLASTICITY, MOIST	CL	3.5	HNU = 0 ppm α = 0 cpm Bγ = 320-340 cpm
10	18836 1533 07/13/89	10	6	SAA STIFF, (5Y 4/1) DK GREY, SILTY CLAY, TRACE OF SAND FINE TO MED GRAVEL, LOW PLASTICITY, MOIST.	CL	1.5	
	18837 1533 07/13/89	11	6	STIFF SAA	CL	1.25	
11	18838 1537 07/13/89	13	6	STIFF, SAA	CL	1.75	HNU = 0 ppm. α = 0 cpm Bγ = 380-390 cpm
	53375 1537 07/13/89	16	6	SAA	CL	1.5	
12	53376 1537 07/13/89	23	2	SAA	CL	2.0	
	53377 1550 07/13/89	18	6	VERY STIFF SAA	CL	2.25	HNU = 0 ppm α = 0 cpm Bγ = 320-330 cpm
13	53378 1550 07/13/89	18	6	VERY STIFF SAA	CL	2.75	
	53379 1550 07/13/89	20	6	STIFF, SAA	CL	1.5	
14	53380 1555 07-13-89	18	6	SAA	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 360-370 cpm
	53381 1555 07-13-89	25	6	SAA	CL	1.5	
	53382 1555 07-13-89	30	6	VERY SAA 7/13/89 DENSE (5Y 4/1) DRK GREY SILTY SAND, TRACE GRAVEL, VERY MOIST	CL SM	1.25 NA	
				STIFF, SAA 14.0-14.5 FT.	CL	1.5	

NOTES:

SAA = Same As Above
NR = No Recovery

000071

5549

FERNALD RI/FS

	Initial	Date
1st Review		
2nd Review		
Final Review		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1284	COORDINATES:	DATE: 07/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/14/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53383 1613 07-13-89	8	5	STIFF, (2.5Y 4/4) OLIVE BROWN, SILTY CLAY TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, MOIST	CL	1.0	HNU = 0 ppm α = 0 cpm BG = 340-350 cpm
16	53384 1613 07-13-89	12	0	NR	NA	NA	
	53385 1613 07-13-89	17	0	NR	NA	NA	
17	53386 1632 07-13-89	11	6	MEDIUM STIFF, (5Y 4/1) DK. GREY, SILTY CLAY SOME SAND, TRACE FINE TO MED. GRAVEL, MED. PLASTICITY, MOIST	CL	.75	HNU = 0 ppm α = 0 cpm BG = 380-390 cpm
	53387 1632 07-13-89	12	6	MED. STIFF SAA	CL	.75	
18	53388 1632 07-13-89	14	6	STIFF SAA	CL	1.25	
	53389 1640 07-13-89	14	6	MED. STIFF, SAA	CL	.5	HNU = 0 ppm α = 0 cpm BG = 360-370 cpm
19	53390 1640 07-13-89	21	6	STIFF SAA	CL	1.0	
	53391 1640	23	6	MED. STIFF, SAA	CL	.75	
20	53392 1640	26	6	MED. STIFF, SAA	CL	.75	HNU = 0 ppm α = 0 cpm BG = 360-370 cpm
			X	Bottom of Boring & Sampling at 20.0 FT			

NOTES:

SAA = Same As Above
NR = No Recovery

000072

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 7-14-89
PROJECT NO. 1.02 3.7 CHECKED BY WA Hented DATE 7/16/89
BORING NO. 1284
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger	TYPE OF BIT ~~NA~~ 8.0 in Hollow Auger CA 7/14/89
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS:	Top 0.0 FT	Bottom 1.0 FT		
Volclay GROUT / ~~SLURRY~~ Cement	TOP 1.0 FT	BOTTOM 20.0 FT	TOP	BOTTOM
BENTONITE	TOP NA	BOTTOM NA	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0 FT			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS No water bearing zone was encountered - well was checked with m-scope not morning - 7/14/89 - it was dry. Well was plugged with volclay grout & topped with a cement plug

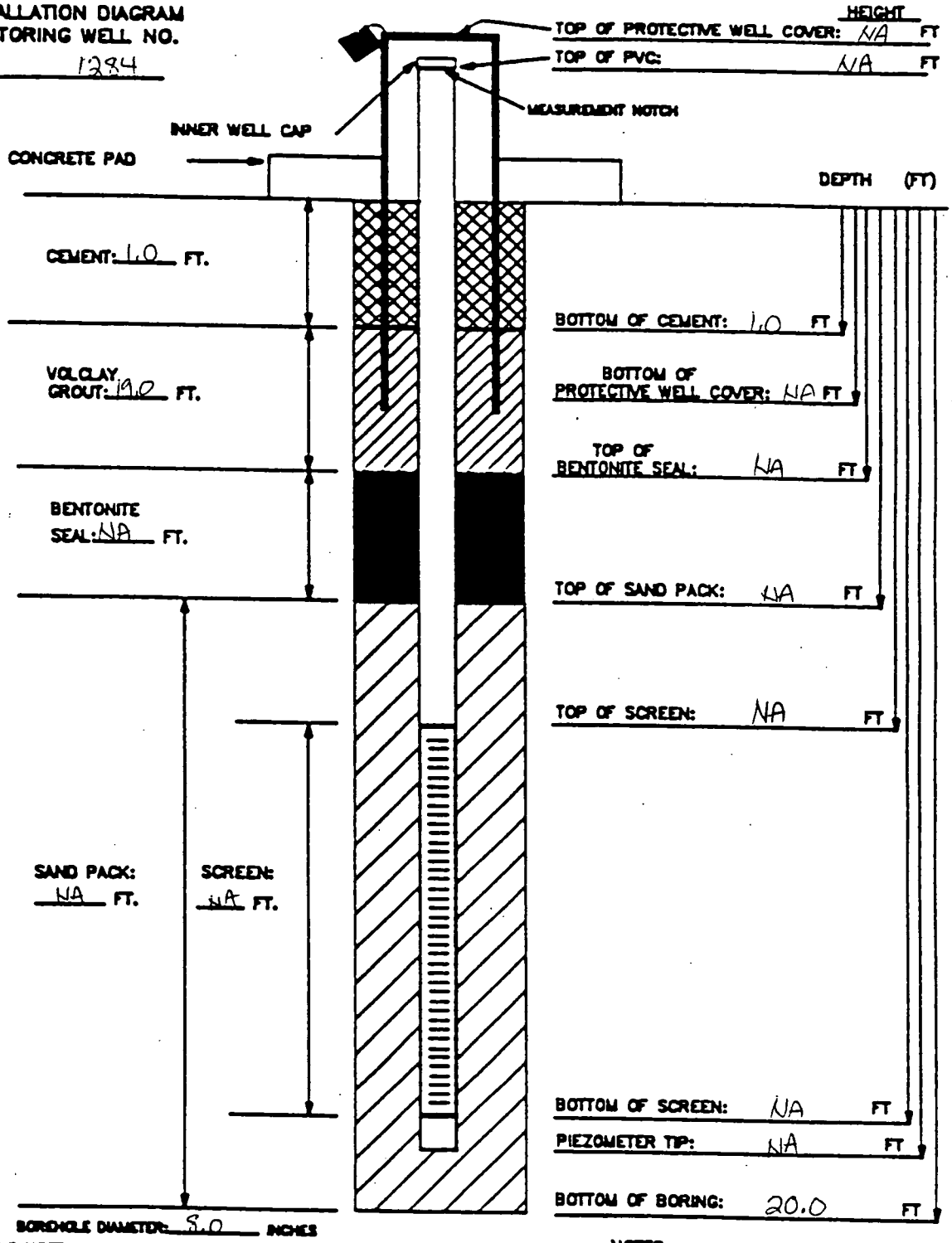
4C9-...-36

01 225549

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1284

INSTALLATION DATE: 7-14-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANTITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 2 (50#) sacks or 2 bags initially
AMOUNT OF CEMENT: 1/2 (94#) sack
AMOUNT OF WATER USED: 40 gal
OTHER: NA

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube.

FERNALD RI/FS

5549

	Date			
	Initial			
	Field Check	1st Key In	2nd Key In	Hard Copy Validation

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1287	COORDINATES:	DATE: 7/17/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/17/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/18/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6/12)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
*	18885 ~~1545~~ 0940 7-18	6	6	Very stiff to hard, very dark brown (10yr 2/2) very silty clay. Some surficial coal chunks surficial roots & grass. Some sand + gravel. damp.	CL	4.5+	HNU: Bkg α: Bβ: ↓
1	18886 ~~1545~~ 0940 7-18	7	6				
	18887 ~~1545~~ 0940 7-18	8	0	SAA fewer roots, no grass, damp.		4.5+	
				no recovery	N/A		
2	18888 ~~1615~~ 1545 7-17	5	6	Very stiff, to hard, very dark grayish brown (10yr 3/2) silty clay. Roots present. Some gravel. Damp	CL	4.5+	HNU: Bkg α: Bβ: ↓
	18889 1545 7-17	7	6	Very stiff, grayish brown to yellowish brown (10yr 5/2 to 5/8) silty clay. Some roots. Trace sand and gravel. Damp.		4.5+	
3	18890 1545 7-17	8	3		CL	3.75	
	18891 1609 7-17	7	6	Very stiff, grayish brown to yellowish brown to gray (10yr 5/2 to 5/8 to 5/1) silty clay. Trace sand, roots, gravel. Some dark brown spotty staining.	CL	2.25	HNU: Bkg α: Bβ: ↓
4	18892 1609 7-17	7	4				
	18893 1609 7-17	8	0	no recovery	N/A		
5	18894 1611 7-17	4	6	SAA but med. stiff, moist.	CL	.5	HNU: Bkg α: Bβ: ↓
	18895 1611 7-17	3	6	SAA becoming sandier, soft.		0	
6	18896 1611 7-17	0	0	Med. stiff, gray to yellowish brown (10yr 5/8 to 5/4) Some sand, very moist. (clay)	CL	.5	
	18897 1621 7-17	5	6	Med. dense, brown (10yr 5/3) silty sand and gravel. well graded. moist.	GM	N/A	HNU: 2 ppm α: Bkg Bβ: Bkg
7	18898 1621 7-17	6	1				
	18899 1621 7-17	10	0	No recovery	N/A		

NOTES: CONTRACTOR: PENNDRILL
RIG: Mobile B-57
DRILLER: J. Saccani
ASSISTANT: Kyle Felty
Helper - D. Nelson

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION T:
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bβ = 110 CPM
LEL/O_2 → LEL: 0%
→ O_2: 20.7% IA

000075

Bβ probe = ASI #10
α probe = ASI #6

Hnu = HH18

SAA = same as above

* - 0.0-1.5 offset due to special analysis samples. This was done 7/18 after we was ...

5540 0066

FERNALD RI/FS

	Initial	
1st Key In	Sad	8/4/89
2nd Key In		
Hard Copy Verification		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1287	COORDINATES:	DATE: 7/17/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/17/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/18/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (")	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
Water bearing zone							
8	18900 1635 7/17	12	6	Med. Dense, brown (10yr 5/3) silty sand and gravel. Some small lenses of clay (≈2.0 in clay). Wet.	SM	N/A	HNU = Bkg α = Bδ = ↓
	18901 1635 7/17	13	6				
9	18902 1635 7/17	13	6	Med. Dense, brown (10yr 5/3) very fine silty sand. Well sorted. Wet.	SM	N/A	
7.5ft ↓	18903 1640 7/17	8	6	SAA except yellowish brown (10yr 5/6) color.	SM	N/A	HNU = Bkg α = Bδ = ↓
10	18904 1640 7/17	12	6				
	53435 1640 7/17	9	3				
14.5ft	53436 0845 7/18	9	5	Med. Dense, silty sand + gravel. Brown to gray (10yr 5/3 to 5/1) Some clay. Some roots. Wet.	GC	N/A	HNU = Bkg. α = Bδ = ↓
11	53437 0845 7/18	8	0				
Water	53438 0845 7/18	7	0	No recovery	N/A		
12	53439 0848 7/18	5	2	SAA. loose. also large piece of gravel.	GC	N/A	HNU = Bkg α = Bδ = ↓
13	53440 0848 7/18	5	0	No recovery	N/A		
	53441 0848 7/18	1	0				
14	53442 0856 7/18	3	6	SAA	GC	N/A	HNU = Bkg α = Bδ = ↓
	53443 0856 7/18	2	6				
	53444 0856 7/18	5	6	Soft, gray (10yr 5/1) Clay. Some gravel, sand. High plasticity. Moist.	CL	.25	

BD 8/11/89

NOTES:

SAA = Same as above

Water bearing zone 7.5 - 14.5 ft.

Total depth of hole - 15.0 ft.

000076

FERNALD RI/FS

5549

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Fernald RIFS
PROJECT NO. 602 3.7.1
BORING NO. 1287
PIEZOMETER NO. 1287

FIELD ENG./GEO. L. Adams DATE 7/18/89
CHECKED BY W A Hertel DATE 7/20/89
DATE OF INSTALLATION 7/18/89

BOREHOLE DRILLING

DRILLING METHOD rotary auger
DRILLING FLUID(S) USED: none
FLUID — FROM — TO —
FLUID — FROM — TO —

TYPE OF BIT Hollow Stem Auger (8 in)
CASING SIZE(S) USED:
SIZE 4.25 in 10 FROM 0.0 TO 15.0
SIZE — FROM — TO —

PIEZOMETER DESCRIPTION

TYPE monitor well
DIAMETER OF PERFORATED SECTION 2.0 in ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.02
TOTAL PERFORATED AREA 9.75 ft

RISER PIPE MATERIAL PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in. I.D. 2.0 in.
LENGTH OF PIPE SECTIONS .25, 9.75, 7.0 ft.
JOINING METHOD Screw type flush jt. threaded.

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH ~~7.0~~ 5.0 ft WA
PROTECTIVE PIPE O.D. 4 5/8 in.

OTHER PROTECTION hinge top w/padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft.)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS: Cement GROUT/SLURRY	TOP ~~2.0~~ 0.0 ft	BOTTOM ~~2.0~~ 1.0 ft	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 3.0	TOP	BOTTOM
SAND	TOP 3.0	BOTTOM 15.0	TOP	BOTTOM
GRAVEL	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP ~~14.75~~ 5.0 ft	BOTTOM 14.75 ft	TOP	BOTTOM
PIEZOMETER TIP	15.0			
BOTTOM OF BOREHOLE	15.0			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS water zone 7.5 - 14.5 ft.

000077

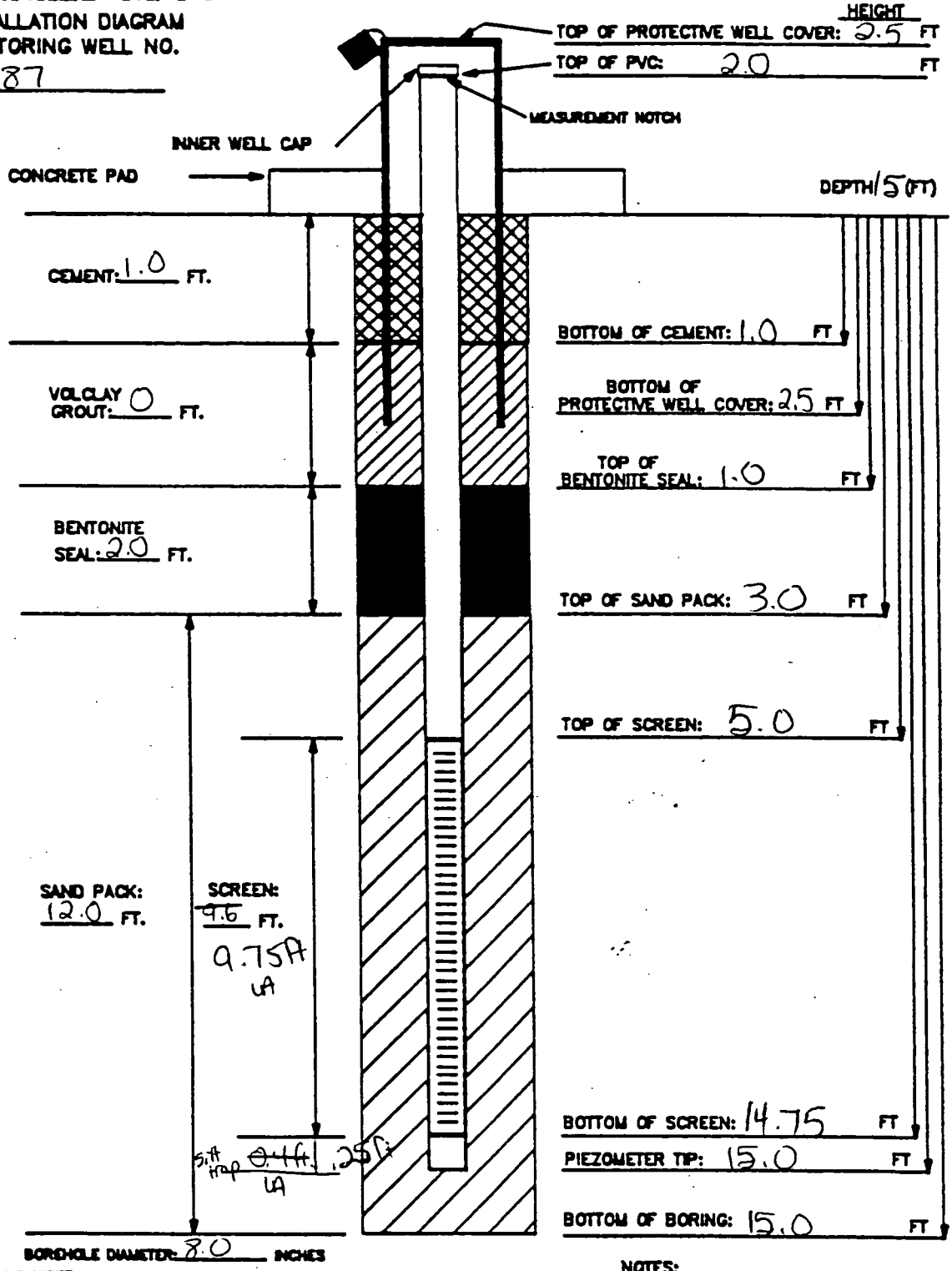
ACS-11-86

P. 22

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1287

INSTALLATION DATE: 7/18/89



MATERIALS USED:
SAND TYPE AND QUANITITY: 2 bags 10/20
BENTONITE PELLETS (5-GALLON BUCKETS): 1 bucket
BAGS OF VOLCLAY GROUT: none
AMOUNT OF CEMENT:
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: L. Adams

Water zone: 7.5 - 14.5 ft.

QA/QC 7-20-89 by WAH

FERNALD RI/FS

field copy & interval measurements off

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1287	COORDINATES:	DATE: 7/17/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/17/89	
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE	OF

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	18883 1545 7-17	4	~~4~~ 6 UA	Very stiff to hard very dark grayish brown (10yr 3/2) silty clay. Roots present. Some gravel. Damp.	~~4.5~~ CL	4.5+	HNU: Bkg α: Bγ: ↓
	18886 1545 7-17	5	6 UA		CL		
1	18888 1545 7-17	7 8	3 UA	Very stiff, grayish brown to yellowish brown (10yr 5/2 to 5/8) silty clay. Some roots. Trace sand, and gravel. Damp.	CL CL	4.5+ 3.75	
1	18889 1609 7-17	7	~~4~~ 6 UA	SAA w/some dk brown spotty staining, less roots. Also has gray (10yr 5/1) coloring.	CL	2.25	HNU: Bkg α: Bγ: ↓
2	18890 1609 7-17	7	4 UA				
	18891 1609 7-17	8	0				
3	1611 7-17	4	6	SAA, moist, ~~soft~~ UA Med. stiff.	CL	.5	HNU: Bkg α: Bγ: ↓
	1611 7-17	3	6	SAA Becoming sandy, soft.		0	
4	1611 7-17	0	~~1~~ 0	Med. stiff, gray (10yr 5/1) to yellowish brown (10yr 5/8) clay. Some sand, very moist		.5	
	1621 7-17	5	6	Med Dense, brown (10yr 5/3) silty sand and gravel, well graded. moist.			HNU: 2 ppm α: Bkg Bγ: ↓
5	1621 7-17	6	1				
	1621 7-17	10	0				
6	1635	12	6	med dense brown (10yr 5/3) silty sand + gravel. Some clay lenses. wet.			HNU: α: Bγ:
water zone	1635	13	6				
7	1635	13	6	med dense, brown (10yr 5/3) very fine silty sand well sorted.			

NOTES: CONTRACTOR: PENNDRILL
RIG:
DRILLER:
ASSISTANT:

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION T.
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU: 0 PPM
α: 0 CPM
Bγ: (10) CPM
LEL/O2: LEL: 0 PPM
O2: 20.7%

FERNALD
RI/FS

field copy
interval measurement off

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	1640	8	6	SAA except yellowish brown (10YR 5/6)			HNU = α = Bδ =
	1640	12	6				
9	1640	9	3				
10							HNU = α = Bδ =
11							HNU = α = Bδ =
12							HNU = α = Bδ =
13							HNU = α = Bδ =
14							HNU = α = Bδ =

NOTES:

000080

5549

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 6023.7	PROJECT NAME: FERNALD RI/FS	DATE: 7/12/89
BORING NUMBER: 1289	COORDINATES:	DATE STARTED: 7/12/89
ELEVATION:	GWL: Depth Date/Time	DATE COMPLETED: 7/13/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	PAGE 1 OF 5
DRILLING METHODS: AUGER (HOLLOW STEM)		

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	18927 0847 7-12	6	6	HARD, (2.5Y 8/4), olive brown, silty clay, trace of sand, low plasticity, slightly moist. GRASS AND ROOTS.	CL	4.5	HNU: 0 ppm, α: UK, Bγ: 800 cpm
	18928 0847 7-12	10	5	VERY STIFF, (2.5Y 8/4/2), DARK GREYISH BROWN, SANDY CLAY, TRACE OF FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	3.5	
1	18929 0847 7-12	11	0	NR	NA	NA	
	18930 0851 7-12	7	6	STIFF, (2.5Y 8/4/2) GREYISH BROWN, SANDY CLAY, LOW PLASTICITY, MOIST.	CL	1.75	HNU: 0 ppm, α: UK, Bγ: 600 cpm
2	18931 0851 7-12	12	12	VERY STIFF, (10YR 5/4) yellowish brown, SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	3.75	
	18932 0851 7-12	19	0	NR	NA	NA	
3	18933 0854 7-12	8	6	VERY STIFF, (10YR 5/4) YELLOWISH BROWN, SILTY CLAY, SOME SAND, TRACE OF FINE GRAVEL, MEDIUM PLASTICITY.	CL	2.25	HNU: 0 ppm, α: UK, Bγ: 600-700 cpm
	18934 0854 7-12	13	6	SAA	CL	1.25	
4	18935 7-12 0854	16	6	SAA	CL	2.25	
	18936 0910 7-12	7	6	HARD, (10YR 5/4) YELLOWISH BROWN, SILTY CLAY, SOME SAND, TRACE OF FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	4.5	HNU: 0 ppm, α: UK, Bγ: 600 cpm
5	18937 0910 7-12	8	6	VERY STIFF, SAA	CL	2.5	
	18938 0910 7-12	12	0	NR	NA	NA	
6	18939 0915 7-12	12	6	VERY STIFF (10YR 5/4) YELLOWISH BROWN SILTY CLAY, TRACE OF SAND, LOW PLASTICITY MOIST	CL	3.0	HNU: 0 ppm, α: UK, Bγ: 700 cpm
	18940 0915 7-12	37	6	VERY STIFF, (10YR 5/4) YELLOWISH BROWN SILTY CLAY, SOME SAND, TRACE OF FINE TO MEDIUM GRAVEL, LOW PLASTICITY, MOIST	CL	3.75	
7	18941 0915 7-12	25	6	VERY STIFF SAA	CL	3.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 45-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
Geo Assistant: Wendy Budach

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 800-1000 CPM
LEL = 0% ~~PPM~~ Bγ 7/14/89
O_2 = 20.6 %

SAA = Same As Above
NR = No Recovery
UK = Unknown – Alphameter arrived late

HNU # 00221

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1289	COORDINATES:	DATE: 7/12/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/12/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/13/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	18942 0942 7-12	27	6	HARD, (5YR 4/1) DARK GREY, SILTY CLAY TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY MOIST	CL	4.25	HNU = 0 ppm α = 0 cpm Bγ = 400 cpm
	18943 0942 7-12	35	6	VERY STIFF, SAA	CL	3.5	
9	18944 0942 7-12	30	8	VERY STIFF, SAA	CL	3.0	
	18945 1003 7-12	8	0	NR	NA	NA	HNU = NA α = NA Bγ = NA
10	18946 7-12 1003	9	0	NR	NA	NA	
	18947 7-12 1003	11	0	NR	NA	NA	
11	18948 7-12 1010	8	6	STIFF (5YR 4/1) DK. GREY TO (2.5YR 5/4) LIGHT OLIVE BROWN, SILTY CLAY, SOME SAND, MED. PLASTICITY, MOIST	CL	1.5	HNU = 0 ppm α = 0 cpm Bγ = 650 cpm
	53475 7-12 1010	13	0	NR	NA	NA	
12	53476 7-12 1010	20	0	NR	NA	NA	
	53477 7-12 1022	15	6	VERY STIFF (5YR 4/1) DARK GREY SILTY CLAY SOME SAND TRACE OF FINE TO MEDIUM GRAVEL, MED. PLASTICITY, MOIST	CL	2.75	HNU = 0 ppm α = 0 cpm Bγ = 450 cpm
13	53478 7-12 1022	30	6	SAA	CL	2.5	
	53479 7-12 1022	30	6	SAA	CL	2.5	
14	53480 7-12 1027	21	6	STIFF, SAA	CL	1.25	HNU = 0 ppm α = 0 cpm Bγ = 400 cpm
	53481 7-12 1027	30	6	STIFF, SAA	CL	1.0	
	53482 7-12 1027	35	6	MEDIUM STIFF, SAA	CL	.75	

NOTES:

SAA = Same As Above
NR = No Recovery

5549

FERNALD RI/FS

	Initial	Date
1st Key In		8-11-89
2nd Key In		
Hard Copy Verification		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1289	COORDINATES:	DATE: 7/12/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/12/89
ENGINEER/GEOLOGIST: C. Gruber	Depth Date/Time	DATE COMPLETED: 7/13/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION (LD 7/12/89)	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15	53483 7-12 1100	5	5	STIFF (5YR 4/1) DK. GREY, SILTY CLAY, SOME SAND, TRACE OF FINE GRAVEL. MEDIUM PLASTICITY, MOIST.	CL	1.0	HNU = 0 ppm α = 0 cpm Bβ = 700 cpm. SCREEN USED IN SPLIT SPOON.
	53484 7-12 1100	7	0	NR	NA	NA	
16	53485 7-12 1100	8	0	NR	NA	NA	
17	53486 7-12 1104	8	6	MEDIUM-STIFF SAA	CL	.75	HNU = 0 ppm α = 0 cpm Bβ = 650 cpm
	53487 7-12 1104	16	6	SAA	CL	.75	
	53488 7-12 1104	20	6	SAA	CL	.75	
18	53489 7-12 1110	8	6	STIFF, SAA	CL	1.25	HNU = 0 ppm α = 0 cpm Bβ = 600 cpm
	53490 7-12 1110	10	6	MED. STIFF SAA	CL	.5 ~~.25~~	
19	53491 7-12 1110	15	6	MED. STIFF SAA	CL	.5 ~~.25~~	
20	53492 7-12 1110	20	6	MED. STIFF SAA	CL	.75	HNU = 0 ppm α = 0 cpm Bβ = 600 cpm
			*	Bottom of boring + sampling at 20.0 FT			

NOTES:

SAA = Same As Above
NR = No Recovery

5549
FERNALD
RI/FS

4 of 5

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
PROJECT NO. 6023.7
BORING NO. 1289
PIEZOMETER NO. NA

FIELD ENG./GEO. C. Grube DATE 7/13/89
CHECKED BY WAHertel DATE 7/16/89
DATE OF INSTALLATION ~~7/13/89~~ ~~7/ /89~~ NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8.0 Hollow Auger
CASING SIZE (S) USED:
SIZE NA FROM — TO —
SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer - NA
DIAMETER OF PERFORATED SECTION 2.0 in ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 in - NA
TOTAL PERFORATED AREA NA

RISER PIPE MATERIAL Schedule 40 PVC - NA
RISER PIPE DIAMETERS:
O.D. 2 5/16 in - NA I.D. 2.0 in - NA
LENGTH OF PIPE SECTIONS NA
JOINING METHOD NA

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT - NA
PROTECTIVE PIPE O.D. 4 3/8 in - NA

OTHER PROTECTION Hinged protective cover with installed padlock - NA

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY/cement	TOP NA	BOTTOM NA	TOP	BOTTOM
BENTONITE	TOP NA	BOTTOM NA	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL - NA	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	NA			
GWL AFTER INSTALLATION	To be taken at a later date - NA			

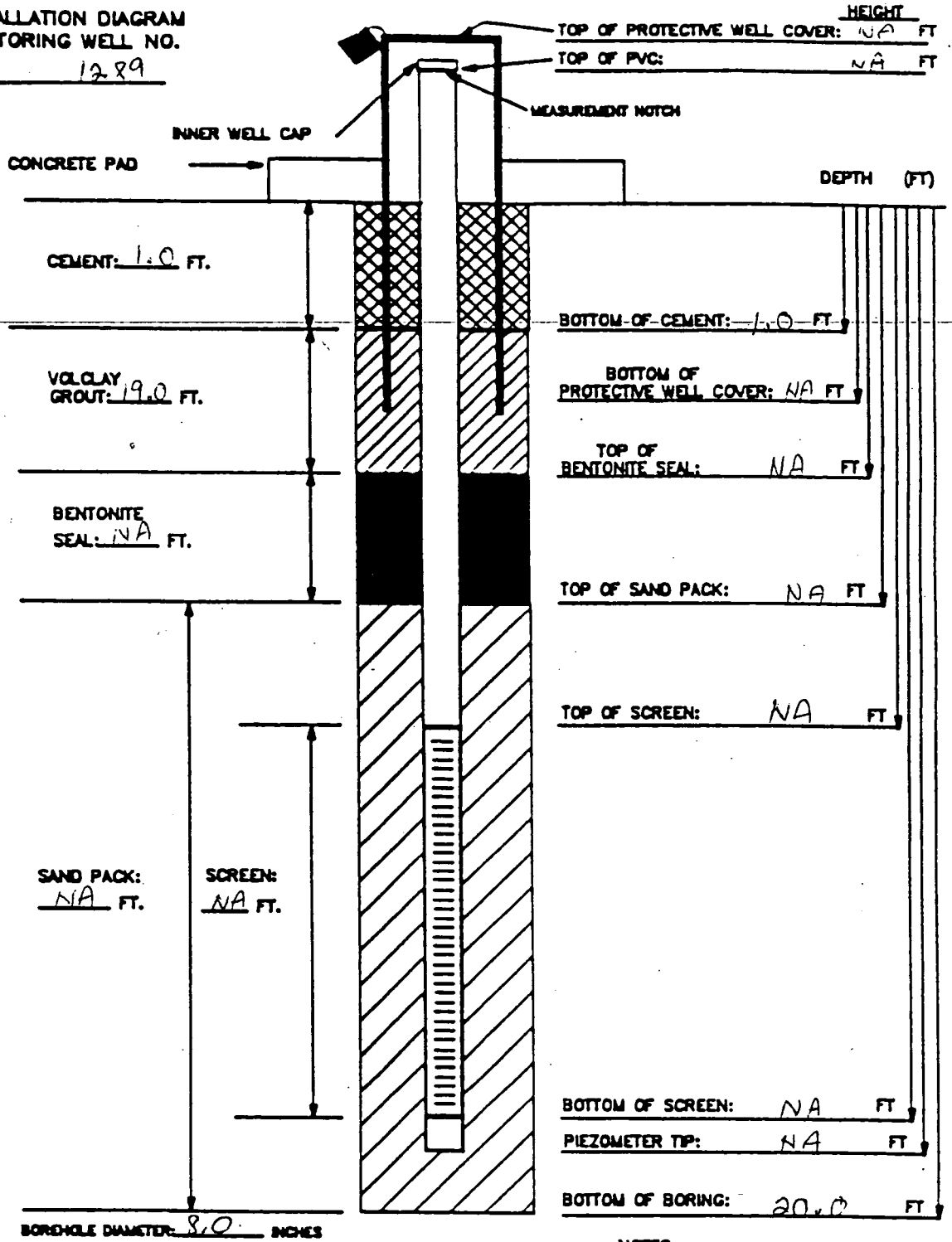
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at - NA
Bottom of water bearing zone at - NA
No water bearing zone encountered - well plugged on 7-13-89 with bentonite from 20.0 FT to 1.0 FT then cement from 1.0 FT to 0.0 FT

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1289

INSTALLATION DATE: 7-13-89



MATERIALS USED:
SAND TYPE AND QUANITITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 2 (50#) sacks, 2 bag initiator
AMOUNT OF CEMENT: 1/2 94# sack
AMOUNT OF WATER USED: 40 gal
OTHER: NA

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

QA/QC WAH 7-16-89

5540

FERNALD RI/FS

Date				
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1293	COORDINATES:	DATE: 7/25/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/25/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/25/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	19015 1000 7-25	5	6	FINE GRAINED COAL, trace clay (10YR 6/4) light yellowish brown moist	NA	NA	HNU = 0 ppm α = 0 ppm Bγ = 70-80 cpm
	19016 1000 7-25	6	6	SAA	NA	NA	
				Med. Dense (10YR 4/6) dark yellowish brown sandy gravel, trace coal, moist	GW	NA	
	19017 1000 7-25	11	0	NR	NA	NA	
2	19018 1005	6	6	Stiff (10YR 5/4) yellowish brown sandy clay, trace coal & fine gravel low plasticity, very moist	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 80-90 cpm
	19019 1005	6	6	SAA	CL	1.0	
3	19020 1005	10	3	Med. Dense (5Y 6/2) light olive gray poorly graded SAND, some fine to med gravel, wet	SP	NA	⟸ WET
4	19021 1009	10	0	NR	NA	NA	HNU = α = Bγ = NA No Recovery with cutter
	19022 1009	6	0	NR	NA	NA	
	19023 1009	6	0	NR	NA	NA	
5	19024 1025	2	6	Stiff, (2.5Y 5/4) light olive brown silty clay, some sand, medium plasticity, very moist	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 80-90 cpm
	19025 1025	4	6	SAA	CL	1.5	
6	19026 1025	5	2	SAA	CL	1.25	
7	19027 1030	5	6	Very Stiff (2.5Y 4/4) olive brown, silty clay, trace sand and fine gravel, low plasticity, moist	CL	2.25	HNU = 0 ppm α = 0 cpm Bγ = 90-100 cpm
	19028 1030	15	6	SAA	CL	2.75	
	19029 1030 7-25	17	0	NR	NA	NA	

NOTES: CONTRACTOR: PENNDRILL
RIG: Model 45-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
Geo-Assistant: Cindy Melling

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 70-100 CPM

SAA = Same As Above
NR = No Recovery

LEL/O2: LEL = 0% ~~PPM~~ @ 7/25/89
O2 = 20.6 %

HNU ~~[illegible]~~ [illegible]

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1293	COORDINATES:	DATE: 7/25/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/25/89
ENGINEER/GEOLOGIST: C. Grove	Depth Date/Time	DATE COMPLETED: 7/25/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 (IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19030 1240 7-25	10	6	Med. Dense (10y-5/6) yellowish brown to (2.5y 3/2) Very Dark grayish brown, trace fine to med gravel wet clayey sand	SC	NA	HNU = 0 ppm α = 0 ppm Bδ = 80-90 cpm
	19031 1340 7-25	11	6	SAA	SC	NA	
9	19032 1340 7-25	11	0	NR	NA	NA	
	19033 1355 7-25	4	6	Med. Dense (10y-5/6) yellowish brown clayey sand, some fine to med gravel wet	SC	NA	HNU = 0 ppm α = 0 ppm Bδ = 90-100 cpm
10	19034 1355 7-25	5	0	NR	NA	NA	
	19035 1355 7-25	5	0	NR	NA	NA	
11	19036 1400 7-25	2	6	Loose (2.5y 4/2) Dark grayish brown clayey sand, trace fine to med gravel wet	SC	NA	HNU = 0 ppm α = 0 ppm Bδ = 120-180 cpm
	53555 1400 7-25	5	6	SAA	SC	NA	
12	53556 1400 7-25	5	3	Stiff (5y 4/1) Dark Gray silty clay some sand, trace fine gravel, med plasticity moist	CL	1.25	
13	53567		~~6~~	Bottom of boring sample at 12.5 ft			HNU = α = Bδ =
	53568						
	53569						
14	53570						HNU = α = Bδ =
	53571						
	53572						

NOTES:

SAA = Same As Above
NR = No Recovery

05549
FERNALD
RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE [illegible]
PROJECT NO. 102-3.7 CHECKED BY DATE
BORING NO. [illegible]
PIEZOMETER NO. [illegible] DATE OF INSTALLATION [illegible]

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger	TYPE OF BIT 8.0 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer	RISER PIPE MATERIAL Schedule [illegible]
DIAMETER OF PERFORATED SECTION [illegible] in	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. [illegible] in I.D. [illegible] in
SLOTS ☑ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS [illegible] FT
AVERAGE SIZE OF PERFORATIONS [illegible] in	JOINING METHOD Flush joint - [illegible] threaded
TOTAL PERFORATED AREA [illegible] FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH [illegible] FT	OTHER PROTECTION [illegible]
PROTECTIVE PIPE O.D. [illegible] in	[illegible]

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	[illegible]			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	[illegible]			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP [illegible]	BOTTOM [illegible]	TOP	BOTTOM
BENTONITE	TOP [illegible]	BOTTOM [illegible]	TOP	BOTTOM
SAND	TOP [illegible]	BOTTOM [illegible]	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP [illegible]	BOTTOM [illegible]	TOP	BOTTOM
PIEZOMETER TIP	[illegible]			
BOTTOM OF BOREHOLE	[illegible]			
GWL AFTER INSTALLATION	[illegible]			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

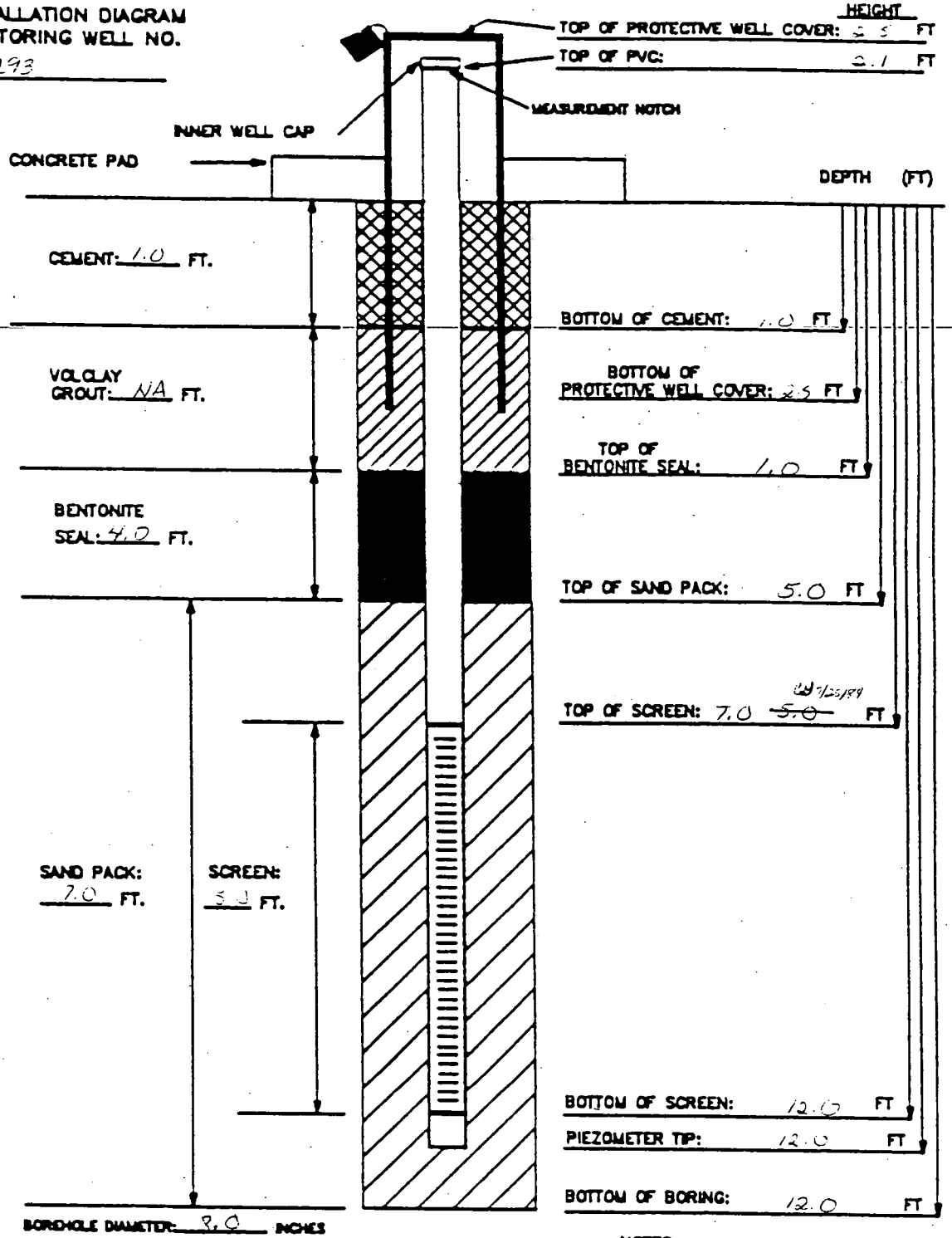
REMARKS Top of water bearing zone at [illegible] FT
Bottom of water bearing zone at [illegible] FT

000088

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1293

INSTALLATION DATE: 7-[illegible]-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 10/20 sand - 4-80 lb sacks
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: NA
AMOUNT OF CEMENT: 1/2 (94 lb) sack
AMOUNT OF WATER USED: 10 gal
OTHER: 5.0 ft Protective Casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 603 3.7.1 GEOLOGIST/ENGINEER: C. Grube

05549

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1294	COORDINATES:	DATE: 7-25-89 / 7-26-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-25-89
ENGINEER/GEOLOGIST: [illegible]	Depth Date/Time	DATE COMPLETED: 7-27-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (")	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	1904C 1611 07-25	4	12	VERY STIFF, BROWN (10YR 4/2), SILTY CLAY, TRACE SAND, TRACE GRAVEL (.25 - 1.0 in) TRACE ORGANIC MATERIAL, DAMP	CL	3.0	HNU = 2-6 PPM * α = 0 CPM Bγ = 160-180 CPM
	1904D 1611 07-25	4		VERY STIFF, BROWN (10YR 4/2) SILTY CLAY, TRACE SAND, DAMP	CL	3.0	
	1904E 1611 07-25	6	—	NO RECOVERY FROM 1.0 - 1.5 FT	—	—	* DISSIPATED USING EXPOSURE TO ATMOSPHERE
2	1904F 1612 07-25	4	14	VERY STIFF, YELLOW BROWN (10YR 4/4) SILTY CLAY, TRACE SAND, TRACE GRAVEL (.25 in) DAMP	CL	3.5	HNU = 2-5 PPM * α = 0 CPM Bγ = 160-180 CPM
	1904G 1612 07-25	7		A.A.	CL	3.5	
3	1904H 1612 07-25	8		A.A.	CL	3.5	* DISSIPATED USING EXPOSURE TO ATMOSPHERE
	1904J 1614 07-25	7	14	A.A.	CL	3.0	HNU = 5-8 PPM * α = 0 CPM Bγ = 160-180 CPM
4	1904K 1614 07-25	8		VERY STIFF, YELLOW BROWN (10YR 5/4) SILTY CLAY, TRACE SAND, TRACE GRAVEL (.25 in) DAMP	CL	3.0	
	1904L 1614 07-25	7		A.A.	CL	3.0	* DISSIPATED USING EXPOSURE TO ATMOSPHERE
5	1904M 1616 07-25	7	16	VERY STIFF, YELLOW BROWN (10YR 5/4) SILTY CLAY, TRACE SAND, TRACE GRAVEL (.25 - 1.0 in) DAMP	CL	3.5	HNU = 2-6 PPM * α = 0 CPM Bγ = 160-180 CPM
	1904N 1616 07-25	8		A.A.	CL	3.5	
6	1904P 1616 07-25	9		A.A.	CL	3.5	* DISSIPATED USING EXPOSURE TO ATMOSPHERE
7	1904Q 0804 7-26	9	17	VERY STIFF, GRAYISH BROWN (10YR 4/3) GRAVELLY CLAY, MOIST, MED. PLASTICITY.	CL	2.5	HNU = 0.2 PPM α = 0 CPM Bγ = 160-180 CPM
	1904R 0804 7-26	11					
	1904S 0804 7-26	15					

NOTES: CONTRACTOR: PENN DRILL
RIG: MOBILE B-53
DRILLER: J. SACCANI
ASSISTANT: W. FELTY
HNU Mod = HH 12
A.A. = AS ABOVE

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 160-180 CPM
LEL/O2: LEL = 0 PPM
O2 = 20.6 %

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 37.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1290	COORDINATES:	DATE: 7-26-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07 27 89
ENGINEER/GEOLOGIST: [illegible]	Depth Date/Time	DATE COMPLETED: 7-27-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	1R055 0809 7-26	6	4	VERY STIFF, GRAYISH BROWN (10YR 4/2) TO YELLOWISH BROWN (10YR 4/4) CLAY, TRACE TO SOME GRAVEL (.5-.75 IN) MEDIUM PLASTICITY, MOIST.	CL	3.0	HNU = 0.2 ppm α = 0 cpm BG = 180 cpm
	1R056 0809 7-26	9	6				
9	1R057 0809 7-26	16	5				
10	1R058 0813 7-26	17	6	VERY STIFF, GRAY, (10YR 5/1) CLAY, TRACE OF GRAVEL, MEDIUM PLASTICITY, MOIST.	CL	2.75	HNU = 0.2 ppm α = 0 cpm BG = 180 200 cpm
	53576 0813 7-26	15	6				
	53576 0813 7-26	16	6				
11	53577 0902 7-26	11	6	VERY STIFF, GRAYISH BROWN (10YR 4/3) TO GRAY (10YR 5/1) CLAY, MEDIUM PLASTICITY, MOIST, TRACE OF GRAVEL (.5 IN)	CL	3.0	HNU = 0.2 ppm α = 0 cpm BG = 190 cpm
	53578 0902 7-26	11	6				
12	53579 0902 7-26	17	6				
13	53580 0905 7-26	10	6	VERY STIFF, GRAY, (10YR 5/2) CLAY TRACE OF GRAVEL (.5 IN), MEDIUM PLASTICITY, MOIST.	CL	3.5	HNU = 0.2 ppm α = 0 cpm BG = 190 cpm
	53581 0905 7-26	12	6				
	53582 0905 7-26	12	0	NO RECOVERY			
14	53583 0910 7-26	11	6	VERY STIFF, GRAY (10YR 4/1) CLAY TRACE OF GRAVEL (.5 - 1.0 IN), MEDIUM PLASTICITY, MOIST.	CL ~~3.0~~ CT	3.0	HNU = 0.2 ppm α = 0 cpm BG = 180 cpm
	53584 0910 7-26	10	6				
	53585 0910 7-26	15	3				

NOTES:

000091

5549

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1294	COORDINATES:	DATE: 7-26-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-25-89
ENGINEER/GEOLOGIST: E. Tallman	Depth Date/Time	DATE COMPLETED: 7-27-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
16	S3586 0944 7-26	20	6	VERY STIFF, GRAYISH BROWN (10YR 4/2) GRAVELLY CLAY, MEDIUM PLASTICITY, MOIST.	CL	2.75	HNU = 0.2 ppm α = 0 cpm BG = 180 cpm
	S3587 0944 7-26	11	4				
	S3588 0944 7-26	12	0	NO RECOVERY			
17	S3589 0950 7-26	11	6	VERY STIFF, GRAY (10YR 4/1) CLAY, TRACE OF GRAVEL (LIMESTONE) (.5-1 IN), MEDIUM PLASTICITY, MOIST.	CL	3.5	HNU = 0.2 ppm α = 0 cpm BG = 180 cpm
	S3590 0950 7-26	12	4				
	S3591 0950 7-26	15	0	NO RECOVERY			
18	S3592 1005 7-26	27	6	VERY STIFF, GRAY, 10YR 4/1 CLAY, TRACE OF GRAVEL (.5-1 IN) SOME COARSE SAND AT 19-19.5 FT., MED PLASTICITY, MOIST.	CL	3.5	HNU = 0.2 ppm α = 0 cpm BG = 160 cpm
19	S3593 1005 7-26	14	6				
	S3594 1005 7-26	17	6				
20	1005 7-26	16	6		CL	3.0	HNU = 0.2 ppm α = 0 cpm BG = 160 cpm
				BORING ENDED AT 20.0 FT. SAMPLING ENDED AT 20.0 FT. NO WATER ZONE ENCOUNTERED.			

NOTES:

BORING 124 WAS COMPLETED ON 7-27-89. BOTTOM OF BORING AT 20.0 FT, SAMPLING ENDED AT 20.0 FT WITH NO WATER BEARING ZONE ENCOUNTERED.

Concrete Plug 0.0 - 1.0 FT.
Bentonite Pellets 1.0 FT. TO 2.0 FT.
VOLCLAY GROUT 2.0 FT. TO 20.0 FT

MATLS USED.

1/2 bag. cement
1/2 bucket bentonite
25 gals WATER
2. bags VOLCLAY GROUT.

0047

FERNALD RI/FS

	Date	Initial	
Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS (FACILITIES TESTING PROGRAM)	
BORING NUMBER: 1295	COORDINATES:	DATE: 7/12/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/12/89
ENGINEER/GEOLOGIST: L. ADAMS	Depth Date/Time	DATE COMPLETED: 7/12/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19059 0855 7-12	11	6	Hard, yellowish brown (10yr 5/4) clay. Some gravel and silt. Some grass and roots from surface. Dry.		4.5+	HNU: 0-2 ppm (BKg) α: 1 Bβ: BKg
	19060 0855 7-12	13	6	SAA except very stiff.	CL	3.0	
1	19061 0855 7-12	21	0	no recovery.		N/A	
	19062 0905 7-12	20	6	Very stiff, mottled gray (10yr 5/1) to yellowish brown (10yr 5/5) clay. Some silt and cobbles. Damp.			HNU: BKg α: 1 Bβ: BKg
2	19063 0905 7-12	15	4	Very stiff yellowish brown clay (10yr 5/4). Some cobbles, trace sand. Damp.	CL	4.0	
	19064 0905 7-12	17	0	no recovery	N/A	N/A	
3	19065 0907 7-12	15	6	Very stiff to hard, yellowish brown (10yr 5/5) clay. Some silt, gravel. Gravel to 0.5 in. Slightly damp.		3.0	HNU: BKg α: 1 Bβ: BKg
	19066 0907 7-12	20	6		CL	4.5	
4	19067 0907 7-12	21	1				
	19068 0911 7-12	20	6	Hard, yellowish brown (10yr 5/4) clay. Some gravel + silt. Some shell material. Med. Plasticity. Slightly damp.		4.5+	HNU: BKg α: 1 Bβ: BKg
5	19069 0911 7-12	21	6		CL	4.5+	
	19070 0911 7-12	21	5				
6	19071 1022 7-12	15	6	Very stiff, dark yellowish brown (10yr 4/4) silty clay. Trace fine gravel. Low Plasticity. Damp.		2.5	HNU: BKg α: 1 cpm Bβ: BKg
	19072 1022 7-12	20	6	Very stiff, yellowish brown (10yr 5/4) silty clay. Some gravel - fine to coarse. Some sand. Gravel to 1.0 in. Low plast. Damp.	CL	3.25	
7	19073 1022 7-12	19	6	Stiff, yellowish brown (10yr 5/4) silty, sandy gravelly clay. Low plast. Damp.		1.5	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile B 53
DRILLER: J. Saccani
ASSISTANT: Wm. Felty
~~Helper~~ Bβ Detector: ASI# 2
α Detector: ASI # 4

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0-2 PPM
α : 0 CPM
Bβ : 220-260 CPM
LEL/O2: → LEL: 0 %
→ O2: 20.7%

SAA = SAME AS ABOVE Hall: HH 18

000094

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1295	COORDINATES:		DATE: 7/12/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7/12/89
ENGINEER/GEOLOGIST: L ADAMS	Depth	Date/Time	DATE COMPLETED: 7/12/89
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 2 OF 85

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19074 1025 7-12	21	6	Stiff yellowish brown (10yr 5/4) Silty Clay, some sand. Med. Plast. Damp.	CL	1.5	HNU = BKG α = BKG Bβ = BKG
	19075 1025 7-12	19	5	Very stiff, mottled yellowish brown (10yr 5/8) to gray (10yr 5/1) clay. Some gravel. Damp.		2.0	
9	19076 1025 7-12	19	0	No recovery		N/A	
10	19077 1030 7-12	14	6	Very stiff, dark gray (10yr 4/1) Slightly mottled clay. Some gravel, some sand. Med. Plasticity, Damp.	CL	2.75	HNU = BKG α = BKG Bβ = BKG
	19078 1030 7-12	14	6			2.25	
	19079 1030 7-12	15	6			3.25	
11	19080 1055 7-12	16	6	Stiff to very stiff, gray (10yr 5/1) gravelly, sandy clay. Med. Plasticity. Damp.	CL	1.5	HNU = BKG α = BKG Bβ = BKG
	53595 1055 7-12	14	4			2.5	
12	53596 1055 7-12	13	0			N/A	
13	53597 1100 7-12	14	6	Very stiff, gray (10yr 5/1) sandy, gravelly clay. Low plasticity, damp. (Gravel to 0.75 in.)	CL	3.5	HNU = BKG α = BKG Bβ = BKG
	53598 1100 7-12	15	6	Very stiff, dark gray (10yr 4/1) Clay. Some sand, some silt. Low-med. plasticity. Slightly damp.		2.75	
	53599 1100 7-12	15	6	SAA		2.0	
14	53600 1116 7-12	9	0	no recovery after 2 attempts		N/A	HNU = ~~BKG~~ CK 7-15-89 α = ~~BKG~~ CK Bβ = ~~BKG~~ CK
	53601 1116 7-12	11	0				
	53602 1116 7-12	12	0				

NOTES:

SAA = SAME AS ABOVE

5549 QFGG

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1295	COORDINATES:	DATE: 7/12/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/12/89
ENGINEER/GEOLOGIST: L. ADAMS	Depth Date/Time	DATE COMPLETED: 7/12/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 35

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53603 1134 7-12	6	6	Very stiff, dark gray (10yr 4/1) gravelly clay. Some sand. Medium plasticity. Damp.	CL	2.5	HNU = BKG α = BKG Bβ = BKG
16	53604 1134 7-12	7	4			2.5	
	53605 1134 7-12	7	0	No recovery	N/A	N/A	
17	53606 1138 7-12	7	6	Very stiff, gray (10yr 5/1) silty clay. Some sand, some gravel. Slightly damp. Low plasticity.	CL	2.25	HNU = BKG α = BKG Bβ = BKG
	53607 1138 7-12	8	6			1.5	
	53608 1138 7-12	9	6	Stiff, gray (10yr 5/1) clay (silty) (gravelly) Some sand. Med. Plasticity, damp.		1.25	
18	53609 1144 7-12	7	6	Med stiff, gray (10yr 5/1) clay. Trace gravel, sand, silt. Med. plasticity, damp.	CL	0.5	HNU = BKG α = BKG Bβ = BKG
19	53610 1144 7-12	12	6			1.5	
	53611 1144 7-12	14	6			1.0	
20	53612 1144 7-12	15	2	SAA	CL	1.0	HNU = BKG α = BKG Bβ = BKG
				Total Depth of Borehole 20.0 Ft.			

NOTES:

SAA = SAME AS ABOVE

Initial Date
JMT 7-27-89

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. ~~L. Sinfield~~ Laurie Adams DATE 7/12/89
PROJECT NO. 602 3.7.1
CHECKED BY W.A. Herfel 7-18-89 DATE ~~7/13/89~~ LA
BORING NO. 1295
PIEZOMETER NO. N/A
DATE OF INSTALLATION (Grouting): 7/13/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED: N/A	CASING SIZE (S) USED: N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE N/A	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS: N/A
PERFORATION TYPE: N/A	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION Cement Plug 1.0–0.0 ft
PROTECTIVE PIPE O.D. N/A	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	N/A		N/A	
GROUND SURFACE	0.0 ft		ft	
BOTTOM OF PROTECTIVE PIPE	N/A		N/A	
BOREHOLE FILL MATERIALS:	Cement: 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 20.0 ft	TOP	BOTTOM
BENTONITE	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
SAND	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
GRAVEL	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PIEZOMETER TIP	N/A		N/A	
BOTTOM OF BOREHOLE	20.0 ft		ft	
GWL AFTER INSTALLATION	Dry - No Groundwater Encountered		N/A	

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐ N/A
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐ N/A

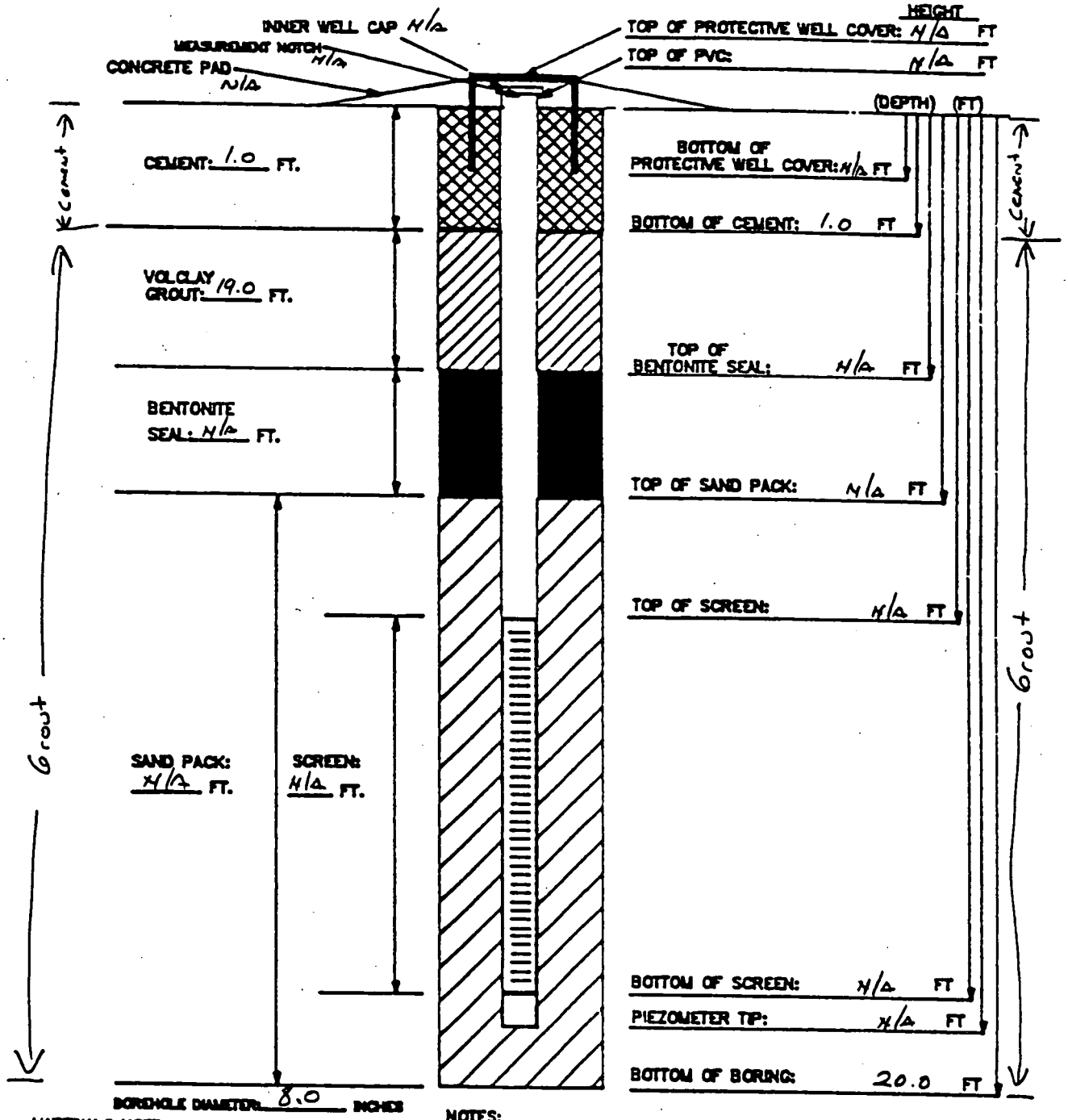
REMARKS Borehole grouted from 20.0 ft to 1.0 ft depth.
Cement plug installed from 1.0 ft to 0.0 ft depth
Borehole was plugged and Abandoned

000097

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1295

INSTALLATION DATE: 7/13/89



MATERIALS USED:

SAND TYPE AND QUANTITY: N/A
BENTONITE PELLETS (5-GALLON BUCKETS): N/A
BAGS OF VOLCLAY GROUT: 1 bag
AMOUNT OF CEMENT: 1/3 sac.
AMOUNT OF WATER USED: 24 gal.
OTHER:

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESIS INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: ~~L. Sanfield~~ LA

WAH QA/QC 7/16/89

L. Adams

0855

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Field Copy.

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1295	COORDINATES:	DATE: 7/12/89	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 7/12/89	
ENGINEER/GEOLOGIST: L. Adams	Depth / Date/Time	DATE COMPLETED:	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE	OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				~~Very stiff~~ LA Hard			
*	19059 0855 7/12/89	11	6	Yellowish brown (10yr 5/4) clay. ~~Med to high plasticity~~ LA. Some gravel, some silt. Dry (some organics/grass etc.)	CL	4.5+	HNU: 0-2 ppm (Bkg) α: Bγ: Bkg
	19060 0855 7/12/89	13	6	SAA except very stiff		3.0	
1	19061 0855 7/12/89	21	0	No recovery		N/A	
	19062 0905	20	6	Very stiff, ~~mottled~~ Gray (10yr 5/1) to yellowish brown (10yr 5/5) Clay. Some silt. ~~So Trace~~ LA Some cobbles, ~~too dry~~ LA Damp			HNU: Bkg α: Bγ: Bkg
2 *	19063 0905	15	4	~~Very stiff~~ yellowish brown (10yr 5/4) Clay. Some cobbles, trace sand, ~~dry~~ LA Damp	CL	4.0	
	19064 0905	17	0	No recovery		N/A	
3	19065 0907	15	6	Very stiff, yellowish brown (10yr 5/5) Clay. Some silt. Some gravel. Gravel to .5 in. Slightly Damp		3.0	HNU: Bkg α: Bγ: Bkg.
	19066 0907	20	6		CL	4.5	
4	19067 0907	21	1	SAA except Hard			
	19068 0911	20	6	~~Very stiff~~ LA Hard, Yellowish brown (10yr 5/4) Clay. Some gravel, some silt. Slightly Damp. Some shell material. Med. Plast.		4.5+	HNU: Bkg α: Bγ: Bkg
5 *	19069 0911	21	6		CL	4.5+	
	19070 0911	21	5				
6	19071 ~~10:55~~ LA 1055	15	6	Very stiff, Dark yellowish brown (10yr 4/4) silty clay. Low Plast. Damp Trace fine gravel		2.5	HNU: Bkg α: 1 cpm Bγ: BKG
	19072 ~~1000~~ LA 1055	20	6	Very stiff, yellowish brown (10yr 5/4) silty Clay. Some gravel - fine to coarse, some sand gravel to 1 in. Damp low plast.		3.25	
7	19073 ~~1005~~ LA 1055	19	6	Stiff, SAA but w/more sand. Sandy gravelly clay		1.5	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobil B53
DRILLER: J. Salcani
ASSISTANT: Wm. Felty

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU: 0-2 PPM
α: — CPM none available
Bγ: 220-260 CPM
LEL: 0 %
O_2: 20.7 %

SAA = Same as above.

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FERNALD RI/FS

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1295	COORDINATES:		DATE: 7/12/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7/12/89
ENGINEER/GEOLOGIST: L. Adams	Depth	Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 2 OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19074 1025	21	6	Stiff yellowish brown (10yr 5/4) silty clay some sand med. plasticity.	CL	2.5	HNU = Bkg α = Bkg Bγ = Bkg
	1025 75	19	5	very stiff, mottled yellowish brown, 10yr 5/4. Damp		2.0	
9	1025 76	19	0	No recovery. Gray (10 yr 5/1) mottled clay. Some gravel in it. No recovery		N/A	
10	1030 77	14	6	very stiff, dark gray (10yr 4/1) slightly mottled clay. Some gravel some sand. Med. Plast. Damp.	CL	2.75	HNU = Bkg α = Bkg Bγ = Bkg
	1030 78	14	6			2.25	
	1030 79	15	6			3.25	
11	1055 80	16	6	Stiff gray (10yr 5/1) gravelly, sandy clay. Med-plast. Damp.	CL	1.5	HNU = Bkg α = Bkg Bγ = Bkg
	53595 1055	14	4			2.5	
12	1055 46	13	0			N/A	
	1100 47	14	6	very stiff, gray (10yr 5/1) sandy, gravelly clay. low plasticity, damp. Gravel to 3/4"	CL	3.5	HNU = Bkg α = Bkg Bγ = Bkg
13	1100 98	15	6	very stiff, Dark gray (10yr 4/1) clay. Some sand, some silt. low-med. plast. slightly damp		2.75	
	1100 99	15	6	SAA		0.0	
14	53600 ~~1105~~ 1116	9	0	No recovery		N/A	HNU = α = Bγ = N/A
	53601 ~~1105~~ 1116	11	0				
	53602 ~~1105~~ 1116	12	0				

NOTES:

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FERNALD RI/FS

Field Copy 5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1295	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
*	53603 1434	6	6	very stiff, dark gray (10yr 4/1) gravelly clay. Med. plastizity. Damp. Some sand.	CL	2.5	HNU = Bkg α = Bkg Bγ = Bkg
	53604	7	4	SAA		2.5	
16	53605	7	0				
	53606 1438	7	6	very stiff, gray (10yr 5/1) silty clay, some sand, some gravel. Slightly damp. low plast.		2.25	HNU = Bkg α = Bkg Bγ = Bkg
17	53607	8	6	Stiff, SAA but w/ more gravel, damp, med. plast.		1.5	
	53608	9	6			1.25	
18	53609 1444	7	6	med stiff, gray (10yr 5/1) clay. Trace gravel, sand, silt. Med. Plastizity. Damp.		.5	HNU = Bkg α = Bγ =
	53610	12	6			1.5	
19	53611		6	SAA		1.0	
	53612	14	2	SAA		1.0	HNU = α = Bγ =
20	~~53613 1444~~	~~15~~	~~18~~	Total Depth 20.0ft			

NOTES:
* WACO

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FERNALD
RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602.03.07	PROJECT NAME: FMPC RI/FS (FACILITY TESTING)		
BORING NUMBER: 1296	COORDINATES:	DATE: 7/27 & 7/28/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/27/89	
ENGINEER/GEOLOGIST: B. Dunning	Depth Date/Time	DATE COMPLETED: 7/28/89	
DRILLING METHODS: Hollow Stem Auger - Split Spoon Sampling		PAGE 1 OF 5	

DEPTH (Ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 In.)	RECOVERY (In.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
.5 1	None 1635 7-27	N/A	12"	CEMENT		N/A	Hnu = 2 α = 100 c.p.m. γβ = 2300 c.p.m.
1.5	19063 0920 7-28	7	21"	Very Stiff Olive gray clay (5Y, 4/2) Moist	CL	2.5	Hnu = 0
2	19084 0920 7-28	9		Stiff Very Dark grayish Brown clay (5Y, 3/2) with a trace of large gravel - Moist		2.0	α = 0-2 γβ = 6-700 c.p.m.
	19085 0920 7-28	11		Stiff Olive Gray Clay (5Y, 5/3) with rust-brown mottling (10YR, 5/6) + gravel slightly moist		1.5	
3	19086 0920 7-28	12					
4	19087 0922 7-28	7	18"		CL	1.5	Hnu = 0 α = 0-2 γβ = 600
	19088 0922 7-28	7					
	19089 0922 7-28	5				1.0	
5	19090 0924 7-28	6	16"	Stiff olive gray clay (5Y, 5/3) becoming decreasingly mottled. Dry	CL	1.5	Hnu = 0 α = 0-2 γβ = 600
	19091 0924 7-28	8					
	19092 0924 7-28	9					
6	19093 0940 7-28	6	18"			2.75	Hnu = 0
7	19094 0940 7-28	8		7.0 Stiff Light olive brown clay - Dry	CL	2.5	α = 0 γβ = 600
	19095 0940 7-28	7		7.2 Sandy Stiff olive gray clay (5Y, 5/3) with rust-brown mottling (10YR, 5/8)	SC CL		

NOTES:
Contractor : Pennsylvania Drilling
Rig : Big Mobile
Driller : Jim Saccani
Drillers Helper : Kyle Felty

Samples described & collected consistent with ASTM standards.
Colors identified using Munsell Soils Color Charts
Site Background Levels : Hnu = 0 ppm
α = 100-160
γβ = 2100-2600
O2 - LEL = 20.5%

000102

402-11-86

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1296	COORDINATES:		DATE: 7/28/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7/27/89
ENGINEER/GEOLOGIST: B.D.	Depth	Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (")	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19096 1012 7-28	6	6"	Very Stiff, Brownish-yellow clay with fine gravel moist but not wet slightly mottled with light olive brown clay. - Moist - slightly damp	2.5	CL	HNU = 0 α = 0 BG = 600
	19097 1012 7-28	9	6"				
9	19098 1012 7-28	14	6"				
	19099 1015 7-28	15	18"	a/a	2.5	CL	HNU = 0 α = 0 BG = 600
10	19100 1015 7-28	20			2.75		
	19101 1015 7-28	21			3.5		
11	19102 1034 7-28	6	18"		3.0		HNU = 0 α = 0 BG = 400-600
	53615 1034 7-28	8		11.5' 11.5 Very stiff, dark gray clay (5Y, 4/1)	2.5		
12	53616 1034 7-28	11					
AV 7/28/89	53617 1034 7-28	7	12"		2.5		HNU = 0 α = 0 BG = 400
13	53618 1036 7-28	11					
	53619 1036 7-28	14	0	No Recovery	NR		
14	53620 1049 7-28	16	18"	Hard, dark gray clay (5Y, 4/1) with gravel < 3% moist - dry	4.5	CL	HNU = 0 α = 0 BG = 600
	53621 1049 7-28	18					
	53622 1049 7-28	15		Very stiff gray clay as above	2.5		

NOTES: SEE PAGE 1 OF 5

FERNALD
RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602.03.07	PROJECT NAME: FMPC RI/FS (Facility Testing)		
BORING NUMBER: 1296	COORDINATES:	DATE: 7/28/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/27/89	
ENGINEER/GEOLOGIST: B. Dunning	Depth Date/Time	DATE COMPLETED: 7/28/89	
DRILLING METHODS: Hollow Stem Auger		PAGE 3 OF 5	

DEPTH (Ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 In.)	RECOVERY (In.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
.5	53623 1100 7-29	6	- NR -	No Recovery			Hum = 0
	53624 1100 7-29	6	- NR -				α = 0
16	53625 1100 7-28	8	6	Very stiff dark gray clay (5Y, 4/1) with decreasing amount of gravel. Moderate plasticity. Moist-Damp	2.5 to 3.0 CL		JB = 600
	53626 1103 7-28	5					Hum = 0
17	53627 1103 7-28	10	18"	Stiff dark gray clay (5Y, 4/1) Moist-Damp generally as above	CL	2.5	α = 0
	53628 1103 7-28	13					JB = 600
18	53629 1110 7-28	18				1.75 to 2.25	Hum = 0
	53630 1110 7-28	18	18"		CL		α = 0
19	53631 1110 7-28	21					JB = 400-500
	53632 1110 7-28	24	6"			1.75	Hum = 0 α = 0 JB = 4-500 c.p.m.
				No Water Bearing Zones Encountered Plugged & Abandoned			

NOTES: See page 1 of 5

402-11-86

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. R. Dunning DATE 7/28/89
PROJECT NO. 60203 07 CHECKED BY _____ DATE _____
BORING NO. 1296
PIEZOMETER NO. — DATE OF INSTALLATION None P&A 7/28/89

BOREHOLE DRILLING

DRILLING METHOD Augering	TYPE OF BIT Auger
DRILLING FLUID(S) USED:	CASING SIZE(S) USED:
FLUID None FROM None TO —	SIZE None FROM N/A TO N/A
FLUID None FROM None TO —	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE None	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION Boring was Plugged
PROTECTIVE PIPE O.D. None	with Volclay grout & Cement Cap. -

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE	N/A			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	N/A			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ CEMENT	TOP 0.00	BOTTOM 1.0 FT.	TOP	BOTTOM
~~BENTONITE~~ Volclay grout	TOP 1.0 FT.	BOTTOM 20.0 FT	TOP	BOTTOM
SAND	TOP N/A	BOTTOM N/A	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	20.0 FT.			
GWL AFTER INSTALLATION	None			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Boring was observed to be void of any water bearing lithology & was plugged & abandoned. -

000105

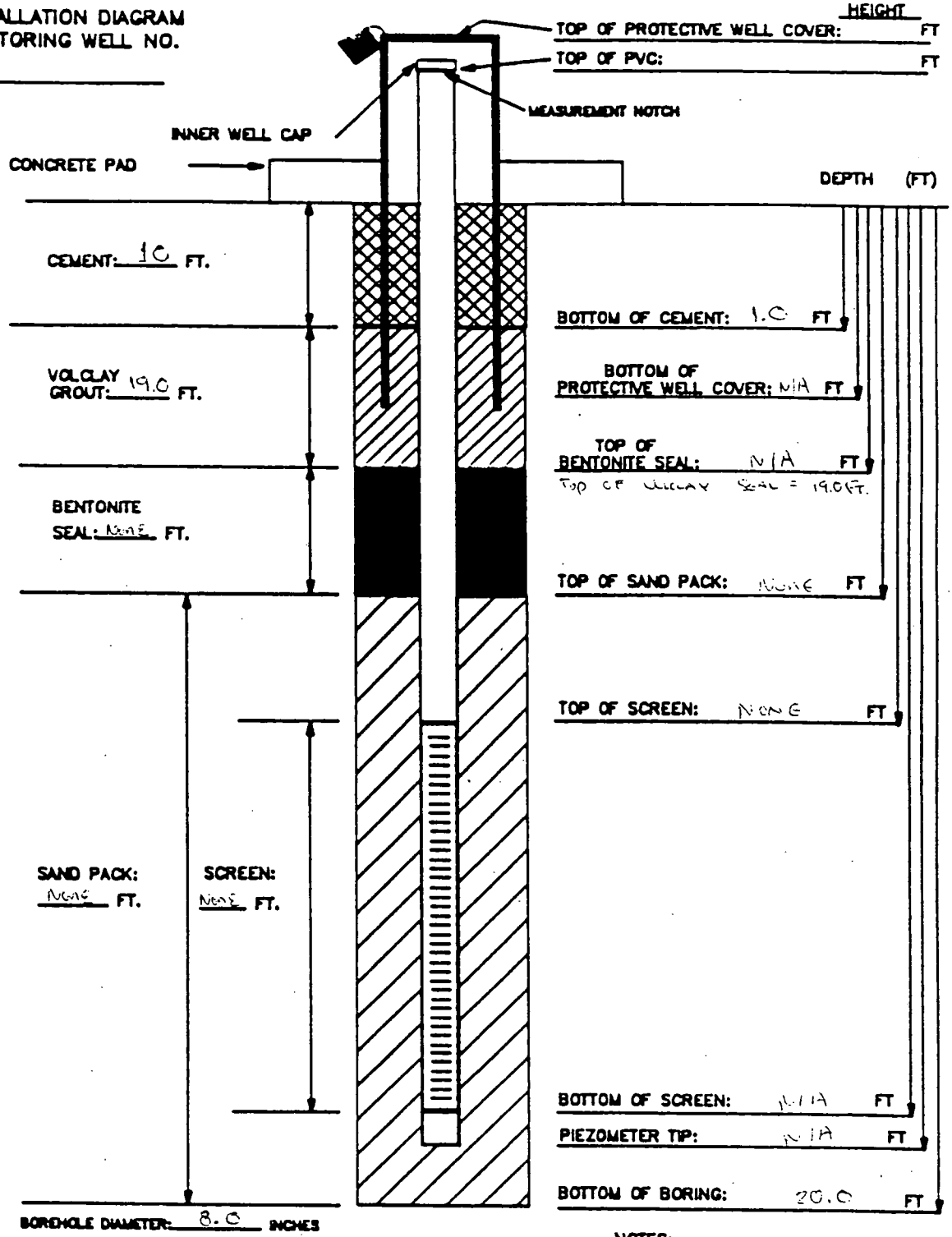
409-11-86

5549

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. _____

INSTALLATION DATE: N/A - DEA 7/29/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANITITY: NONE
BENTONITE PELLETS (5-GALLON BUCKETS): NONE
BAGS OF VOLCLAY GROUT: 2 1/2 40 lb SKS.
AMOUNT OF CEMENT: 1/2 SK.
AMOUNT OF WATER USED: Approximately 60 gallons used to mix volclay
OTHER:

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: NONE

TASK: 3.7.1

GEOLOGIST/ENGINEER: B. Dunning

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME _____ FIELD ENG./GEO. _____ DATE _____
PROJECT NO. _____ CHECKED BY _____ DATE _____
BORING NO. 1419
PIEZOMETER NO. _____ DATE OF INSTALLATION _____

BOREHOLE DRILLING

DRILLING METHOD _____	TYPE OF BIT _____
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID _____ FROM _____ TO _____	SIZE _____ FROM _____ TO _____
FLUID _____ FROM _____ TO _____	SIZE _____ FROM _____ TO _____

PIEZOMETER DESCRIPTION

TYPE _____	RISER PIPE MATERIAL _____
DIAMETER OF PERFORATED SECTION _____	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. _____ I.D. _____
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS _____
AVERAGE SIZE OF PERFORATIONS _____	JOINING METHOD _____
TOTAL PERFORATED AREA _____	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH _____	OTHER PROTECTION _____
PROTECTIVE PIPE O.D. _____	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE				
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE				
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP	BOTTOM	TOP	BOTTOM
BENTONITE	TOP	BOTTOM	TOP	BOTTOM
SAND	TOP	BOTTOM	TOP	BOTTOM
GRAVEL	TOP	BOTTOM	TOP	BOTTOM
PERFORATED SECTION	TOP	BOTTOM	TOP	BOTTOM
PIEZOMETER TIP				
BOTTOM OF BOREHOLE				
GWL AFTER INSTALLATION				

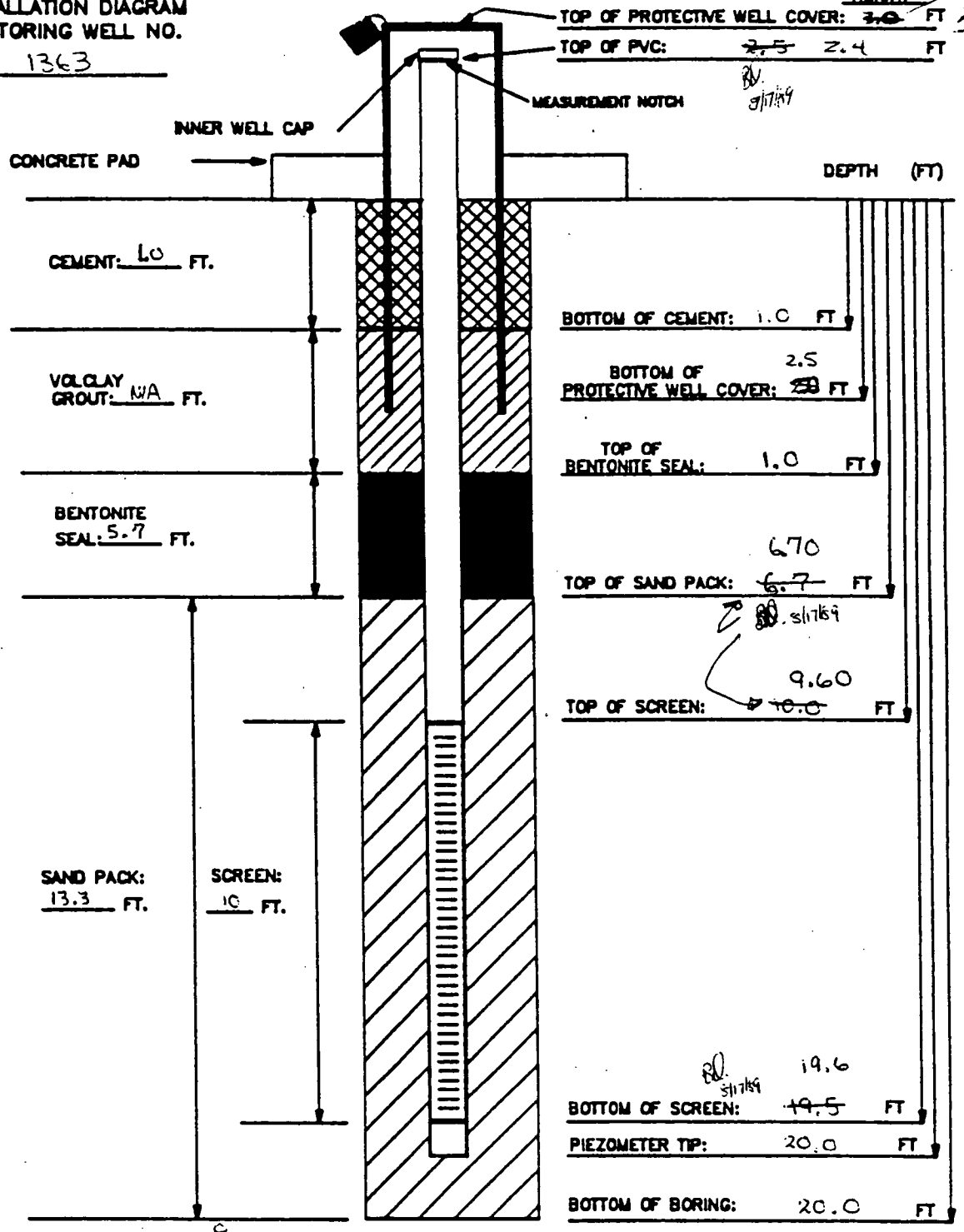
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐
REMARKS _____

5549

INSTALLATION DATE: 5/17/89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1363



BOREHOLE DIAMETER: 8 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 5 bags of 1020 (80 lb. sks)
BENTONITE PELLETS (5-GALLON BUCKETS): 3
BAGS OF VOLCLAY GROUT:
AMOUNT OF CEMENT: ½ bag
AMOUNT OF WATER USED: 10 gallons
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 3.7.1

GEOLOGIST/ENGINEER: B. Dunning M. Slusarski

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1363	COORDINATES:	DATE: 08-17-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 08-16-89
ENGINEER/GEOLOGIST: M. SLOBOSKI	Depth Date/Time	DATE COMPLETED: 08-17-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	54965 1055 08-15	5	6	VERY STIFF, GREY (5Y 5/1) SILTY CLAY, TRACE COARSE GRAVEL (1.0-1.5 IN) DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 100-160 CPM
16	54966 1055 08-15	10	6	VERY STIFF, GREY (5Y 5/1) SILTY CLAY TRACE GRAVEL (.25 IN) DAMP	CL	2.0	
	54967 1055 08-15	11	—	NO RECOVERY 16.0-16.5 FT	—	—	
17	54968 1103 08-15	13	6	VERY STIFF GREY (5Y 5/1) SILTY CLAY, TRACE GRAVEL (.25 IN) DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 100-160 CPM
	54969 1103 08-15	14	6	A.A	CL	2.0	
18	54970 1103 08-15	16	3	A.A	CL	2.0	
	54971 1115 08-15	20	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 100-160 CPM
19	54972 1115 08-15	25	6	A.A	CL	2.0	
	54973 1115 08-15	25	6	A.A	CL	2.0	
20	54974 1115 08-15	27	6	A.A 20.0	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 100-160 CPM
				BOTTOM OF BORING @ 20.0 FT. P&A ON 08-17-89			

NOTES:

A.A = AS ABOVE

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1363	COORDINATES:	DATE: 08-17-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 08-16-89
ENGINEER/GEOLOGIST: M. SLUSARKI	Depth Date/Time	DATE COMPLETED: 08-17-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	50571 0911 08-16	5	6	VERY STIFF, MOTTLED GREY-BROWN (2.5Y 5/2) SILTY CLAY TRACE GRAVEL (.25-.10) DAMP.	CL	2.0	HNU = 0 PPM α = 0 CPM BG: 100-200 CPM
	50572 0911 08-16	10	6	A.A.	CL	2.0	
9	50573 0911 08-16	16	—	NO RECOVERY - 8.5-9.0 FT	—	—	
10	50574 0935 08-16	7	6	VERY STIFF, BROWN (2.5Y 4/4) SILTY CLAY, TRACE COARSE GRAVEL (1.0-1.5 IN) DAMP TRACE COAL.	CL	2.5	HNU = 0 PPM α = 0 CPM BG: 100-160 CPM
	50575 0935 08-16	12	6	A.A	CL	3.0	
	54955 0935 08-16	6	—	NO RECOVERY 10.0-10.5 FT.	—	—	
11	54956 0940 08-16	10	6	VERY STIFF, GREY-BROWN MOTTLED (5Y 5/1 - 2.5Y 4/2) SILTY CLAY, TRACE GRAVEL (.25-.10) DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 80-140 CPM
	54957 0940 08-16	11	6	A.A	CL	2.0	
12	54958 0940 08-16	[illegible]	6	A.A	CL	2.0	
13	54959 0948 08-16	12	6	VERY STIFF, GREY (5Y 5/1) SILTY CLAY, TRACE GRAVEL (.25-.50) DAMP	CL	2.0	HNU = 0 α = 0 BG = 100-160
	54960 0948 08-16	19	6	A.A.	CL	2.0	
	54961 0948 08-16	16	4	A.A	CL	2.0	
14	54962 1046 08-16	1	—	NO RECOVERY 13.5-14.0 FT.	—	—	HNU = — α = — BG = —
	54963 1046 08-16	5	—	NO RECOVERY 14.0-14.5 FT.	—	—	
	54964 1046 08-16	7	—	NO RECOVERY 14.5-15.0 FT	—	—	

NOTES:

A.A = AS ABOVE

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 37.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1265	COORDINATES:	DATE: 08-17-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 08-16-89
ENGINEER/GEOLOGIST: M. Sc[illegible]	Depth Date/Time	DATE COMPLETED: 08-17-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	S0556 0912 08-16	8	6	VERY STIFF, BROWN (2.5Y 5/2) SILTY CLAY, TRACE GRAVEL (.25-.75 IN) TRACE ROOTLETS, TRACE COAL, DRY	CL	2.5	HNU = 0 PPM α = 0 CPM BΓ = 180-260 CPM
	S0557 0912 08-16	17	6	A.A	CL	3.5	
	S0558 0912 08-16	14	—	NO RECOVERY 1.0-1.5 FT	—	—	
2	S0559 0920 08-16	12		VERY STIFF BROWN (2.5Y 5/4) SILTY CLAY, TRACE FINE GRAVEL (.25 IN) TRACE COAL, DRY	CL	3.0	HNU = 0 PPM α = 0 CPM BΓ = 160-260 CPM
	S0560 0920 08-16	11	—	NO RECOVERY 2.0-2.5 FT.	—	—	
3	S0561 0923 08-16	11	—	NO RECOVERY 2.5-3.0 FT	—	—	
4	S0562 0926 08-16	9	6	VERY STIFF, BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL (.25-.50 IN) TRACE SAND, TRACE COAL, DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM BΓ = 100-160 CPM
	S0563 0926 08-16	12	6	A.A	CL	2.5	
	S0564 0926 08-16	~~15~~	—	NO RECOVERY 4.0-4.5 FT.	—	—	
5	S0565 0930 08-16	?	6	VERY STIFF, BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL (.25-1.0 IN) DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM BΓ = 100-160 CPM
	S0566 0930 08-16	12	6	A.A	C	2.5	
6	S0567 0930 08-16	9	—	NO RECOVERY 5.5-6.0 FT	—	—	
7	S0568 0937 08-16	?	6	VERY STIFF, BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL (.25-.50 IN) DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM BΓ = 100-160 CPM
	S0569 0937 08-16	4	6	A.A	CL	2.5	
	S0570 0937 08-16	3	—	NO RECOVERY 7.0-7.5 FT	—	—	

NOTES: CONTRACTOR: PENN DRILL
RIG: CENTRAL MINE 4FC
DRILLER: ~~T. SACCA~~ H. ANDREWS
ASSISTANT: ~~C. ELKWITZ~~ C. ELKWITZ

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
BΓ = 260-300 CPM
LEL/O2: LEL = 0 PPM
O2 = 20.6 %

A.A = AS ABOVE

FERNALD
RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1333	COORDINATES:	DATE: 08-02-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-31-89
ENGINEER/GEOLOGIST: M. SUSMUKI	Depth Date/Time	DATE COMPLETED: 08-02-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 3

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	54363 0948 08-01	5	6	VERY STIFF, OLIVE-GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (LT. SOIL) DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 80-120 CPM
	54364 0948 08-01	6	6	A.A.	CL	2.0	
16	54365 0948 08-01	8	6	A.A.	CL	2.0	
17	54366 0952 08-01	8	6	A.A.	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 60-100 CPM
	54367 0952 08-01	10	6	A.A.	CL	2.0	
	54368 0952 08-01	11	6	A.A.	CL	2.0	
18	54369 1038 08-01	7	6	A.A.	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 60-100 CPM
	54370 1038 08-01	8	6	A.A.	CL	2.0	
19	54371 1038 08-01	10	6	A.A.	CL	2.0	
	54372 1038 08-01	14	6	A.A. 20.0	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 60-100 CPM
20				BOTTOM OF BORING 20.0 FT.			

NOTES: BORING #1333 WAS P&A ON 08-02-89
P&A MATERIALS: 2-50LB BAGS VOLCLAY GROUT FROM (20.0 - 1.0 FT)
1/2-94 LB BAG CEMENT FROM (1.0 - 0.0 FT)

A.A. = AS ABOVE

000112

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1333	COORDINATES:	DATE: 08-02-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-31-89
ENGINEER/GEOLOGIST: M. SCWARSKI	Depth Date/Time	DATE COMPLETED: 08-02-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19910 1647 07-31	10	6	VERY STIFF, GREENISH-BROWN (2.5Y 4/4) SILTY CLAY ~~(.25~~ TRACE GRAVEL (.25 IN) DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM BG = 80-120 CPM
	19911 1647 07-31	25	—	NO RECOVERY 8.0-8.5 FT.	—	—	
9	19912 1647 07-31	22	—	NO RECOVERY 8.5-9.0 FT	—	—	
	19913 1634 07-31	19	6	VERY STIFF, GREENISH-BROWN (2.5Y 4/4) SILTY CLAY, TRACE GRAVEL (.25-.50 IN) DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM BG = 80-120 CPM
10	19916 1634 07-31	21	6	A.A	CL	2.5	
	19915 1634 07-31	22	3	A.A	CL	2.5	
11	19916 0930 08-01	6	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 80-120 CPM
	54355 0930 08-01	14	6	A.A	CL	2.0	
12	54356 0930 08-01	15	6	A.A	CL	2.0	
	54357 0934 08-01	19	~~3~~6	VERY STIFF, GREENISH-BROWN (2.5Y 4/4) SILTY CLAY, SOME SAND, TRACE GRAVEL (.25-.50 IN) DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 80-120 CPM
13	54358 0934 08-01	15	6	VERY STIFF, GREENISH-BROWN (2.5Y 4/4) SILTY CLAY, TRACE GRAVEL (.25-.50 IN) DAMP	CL	2.0	
	54359 0934 08-01	15	6	VERY STIFF, OLIVE-GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25-.50 IN) DAMP	CL	2.0	
14	54360 0939 08-01	11	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 80-120 CPM
	54361 0939 08-01	12	6	A.A	CL	2.0	
	54362 0939 08-01	12	6	A.A	CL	2.0	

NOTES:

A.A. = AS ABOVE

5549
FERNALD
RI/FS

Date	8/3/8			
Initial	BK			
Length Recovery	Depth In	Depth In	Depth In	Length Recovery

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1333	COORDINATES:	DATE: 08-02-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-31-89
ENGINEER/GEOLOGIST: M. SWIMSKI	Depth Date/Time	DATE COMPLETED: 08-02-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19895 1615 07-31	36	6	MEDIUM STIFF, BROWN (10YR 4/3) SILTY CLAY, SOME GRAVEL (.25-1.0 IN) DAMP	CL	1.0	HNU = 0 PPM α = 0 CPM Bγ = 100-180 CPM
1	19896 1615 07-31	48	6	STIFF, BROWN (10YR 4/3) SILTY CLAY SOME GRAVEL (.25-.75 IN) DAMP	CL	2.0	
	19897 1615 07-31	—	—	NO RECOVERY 1.0-1.5 FT	—	—	
2	19898 1623 07-31	3	6	VERY STIFF, BROWN (10YR 4/4) SILTY CLAY, TRACE GRAVEL (.25-1.0 IN) DAMP	CL	3.0	HNU = 0 PPM α = 0 CPM Bγ = 80-120 CPM
	19899 1623 07-31	5	6	A.A.	CL	3.0	
3	19900 1623 07-31	6	—	NO RECOVERY 2.5-3.0 FT	—	—	
	19901 1626 07-31	10	6	VERY STIFF, GREENISH-BROWN (2.5Y 4/4) SILTY CLAY, TRACE GRAVEL (.25 IN) DAMP	CL	3.0	HNU = 0 PPM α = 0 CPM Bγ = 80-120 CPM
4	19902 1626 07-31	11	6	A.A	CL	3.0	
	19903 1626 07-31	12	3	A.A	CL	3.0	
5	19904 1630 07-31	10	6	A.A	CL	2.5	HNU = 0 PPM α = 0 CPM Bγ = 80-100 CPM
	19905 1630 07-31	8	6	A.A	CL	2.5	
6	19906 1630 07-31	7	—	NO RECOVERY 5.5-6.0 FT	—	—	
	19907 1644 07-31	9	3	A.A	CL	2.5	HNU = 0 PPM α = 0 CPM Bγ = 80-100 CPM
7	19908 1644 07-31		—	NO RECOVERY 6.5-7.0 FT	—	—	
	19909 1644 07-31	14	—	NO RECOVERY 7.0-7.5 FT	—	—	

NOTES: CONTRACTOR: PENN DRILL
RIG: MOBILE B-53
DRILLER: J. SACCHI
ASSISTANT: W. FELTY

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 100-180 CPM
LEL = 0 PPM
O_2 = 20.6

A.A = AS ABOVE

LELO2:

000114

#1301 0.0 GL

2 bags sand
2 buck bent.

Cement 1.0 - 0.5

Pellets

9.0

Sand pack

TOP OF SCREEN 7.0

~~TOP OF SCREEN 7.0~~

9.0

BOB 12.0 BOTTOM OF SCREEN

Protect Csg.
2.2 above g.s
2.8 below g.s

#5 9.0 6.0

Top of Sand 5 1/2' Base 12'
Bentonite 1 5 1/2

Silt trap .4
Screen 4.8

BOB 12.0
PT 12.0
TOP 6.8 TOPS 5.5
TOP S 6.0

11.8 5.2

~~BOB 12.0~~
~~PT 11.8~~
~~TOP OF SCREEN 6.0~~
~~TOP of Sand 5.5~~
~~TOP BENT 1.0~~
TOP CEMENT 0.0

12.0
- 5.2
6.8

12.0
5.2
6.8

4.8
.4
5.2

5549

FERNALD RI/FS

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 37.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1301	COORDINATES:	DATE: 7-14-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:	
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF	

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19206 0927 7-14	9	6	Very stiff to hard, gray (10yr 5/1) silty clay some gravel, fossil material, trace sand. Damp.		2.75	HNU = Bkg ~ : BS = ↓
	19207 0927 7-14	11	6			4.0	
9	19208 0927 7-14	15	6			3.75	
	19209 0942	14	6	very stiff. gray (10 yr 6/1) very sandy silty clay. med. to High plasticity wet.		N/A	HNU = ~ : BS :
10	19210 0942	17	6	Very stiff gray (10yr 6/1) silty gravelly clay.		2.5	
	19212 0942	15	6	SAA w/layer med grained sand, well sorted.		4.5+	
11	19212 53714 0958	3	6	Very stiff, gray (10yr 5/1) silty clay. Some fine gravel & sand. Moist med. plasticity - trace med gravel (to .5in)		2.5	HNU ~ BS :
	53715 0958	4	6	SAA.		2.25	
12	53716 0958	7	6	SAA		1.5	
	53717			Total depth of boring 12.0 ft			HNU : ~ : BS :
13	53718						
	53719						
14	53720						HNU : ~ : BS :
	53721						
	53722						

NOTES: Water zone 9'0" - 9'8".

FERNALD RI/FS

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		14 LA
BORING NUMBER: 1301	COORDINATES:		DATE: 7-13-89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: L. Adams	Depth	Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 1 OF

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
10	19191 0857 7-14	14	6	Hard, brown (10yr 5/3) silty clay. Some gravel, trace sand. Some roots. gravel to .75". Slightly damp.		4.5+	HNU: Bkg α: Bkg Bγ: Bkg
	19192 0857 7-14	15	6	Hard, SAA		4.5+	
1	19193 0857 7-14	15	0	no recovery			
1	19194 0900 7-14	7	6	SAA, less gravel, some dark brown spotty staining. Slightly damp	LA ~~4.25~~	4.25	HNU: Bkg α: Bkg Bγ: Bkg
2	19195 0900 7-14	11	6	SAA		4.5+	
	19196 0900 7-14	14	0	no recovery			
3	19197 0901 7-14	14	6	Hard, yellowish brown, (10yr 5/6) silty clay. More color variation, mottling. Trace sand, gravel damp		4.25	HNU: Bkg α: ↓ Bγ: ↓
	19198 0901 7-14	17	6	SAA		4.5	
4	19199 0901 7-14	34	2	SAA, some gravel		4.5	
	19200 0906 7-14	23	6	Hard, yellowish brown (10yr 5/4 to 5/6) silty clay. Dk. brown spotty stains. Some fine gravel to coarse, (1/2 in.) Slightly damp.		4.5+	HNU: Bkg α: ↓ Bγ: ↓
5	19201 0906 7-14	23	6	SAA		4.5+	
	19202 0906 7-14	27	6	SAA		4.5+	
6	19203 0925 7-14	9	6	Hard Brown (10yr 5/3) to dark yellowish brown (10yr 4/5), to gray (10yr 5/1) silty clay. Some gravel + shell material. Damp.		4.5+	HNU: Bkg α: ↓ Bγ: ↓
	19204 0925 7-14	12	6			4.25	
7	19205 0925 7-14	16	2			4.25	

NOTES: CONTRACTOR: PENNDRILL
RIG: Model B-53 ATV
DRILLER: J. Saccani
ASSISTANT: Kyle Felty
Helper: D. Nelson

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = ~~360~~ 380 PPM LA WAH 7-16-89
α : 0 CPM
Bγ : ~~360~~ 380 CPM LA 7/16/89

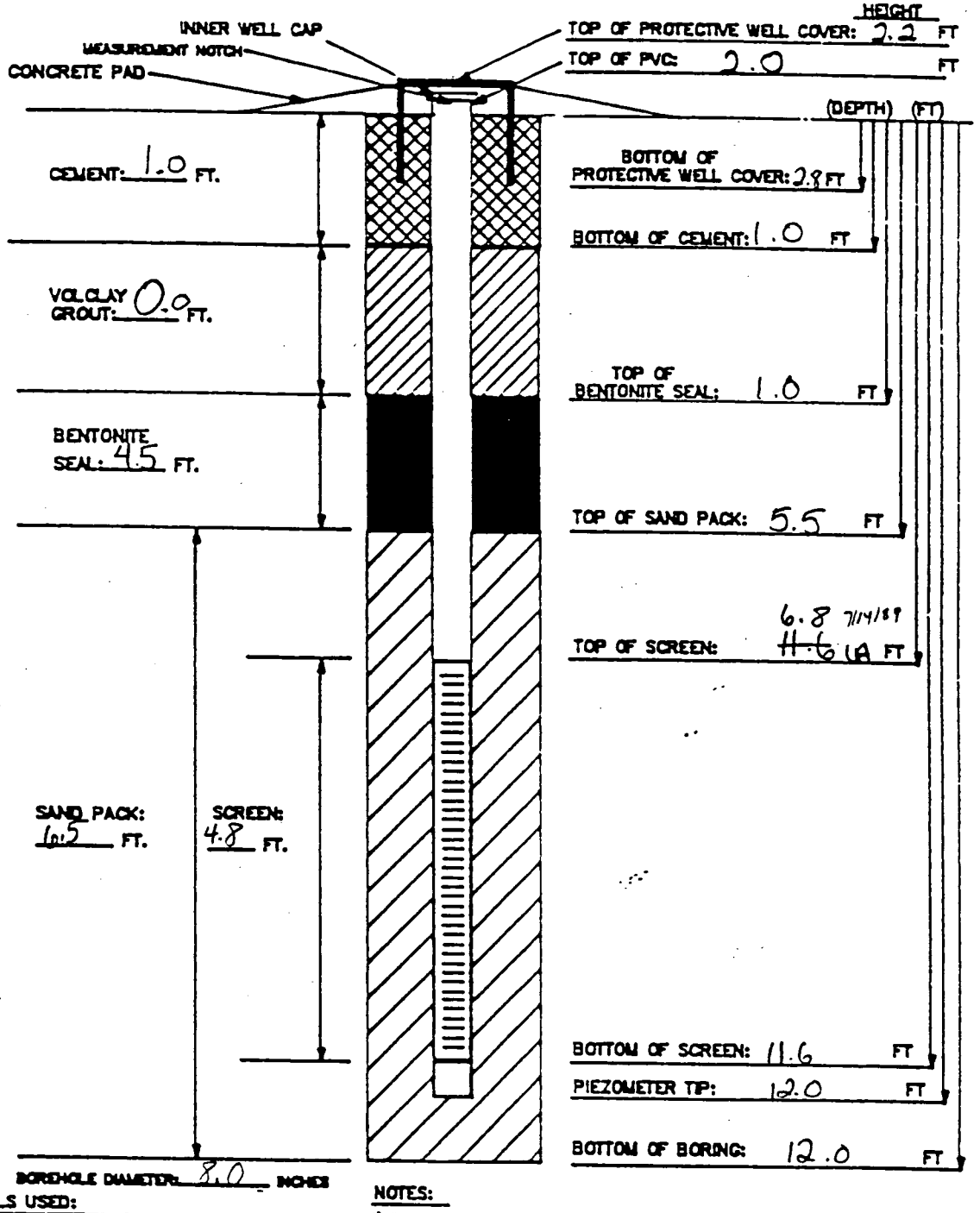
LEL/O2: LEL: PPM
O2: %

BZ probe #2 α #1
Hnu - CO199 Int. Safe.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1301

INSTALLATION DATE: 7/14/89



MATERIALS USED:

SAND TYPE AND QUANTITY: 10/20 sand - 2 sacks
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: NA
AMOUNT OF CEMENT: 1/2 (940) sack
AMOUNT OF WATER USED: 15 gal
OTHER: 5.0 FT protective casing

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESES INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 3.7.1

GEOLOGIST/ENGINEER: L. Adams

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Fernald RIFS
FIELD ENG./GEO. L. Adams DATE 7/14/89
PROJECT NO. 162 3.7.1
CHECKED BY [illegible] DATE 7/16/89
BORING NO. 1301
PIEZOMETER NO. 1301
DATE OF INSTALLATION 7/14/89

BOREHOLE DRILLING

DRILLING METHOD Auger (Rotary)	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED: None	CASING SIZE (S) USED: None
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Well	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID.	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 9.0 FT
AVERAGE SIZE OF PERFORATIONS 0.02 in.	JOINING METHOD Flush threaded jointed
TOTAL PERFORATED AREA 5.0 ft	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH ~~2.2 Ft.~~ 5.0 Ft. [illegible] 7/14/89	OTHER PROTECTION locking cap
PROTECTIVE PIPE O.D. 4 3/8 in.	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (Ft.)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8			
BOREHOLE FILL MATERIALS: Cement:	0.0	1.0		
GROUT/SLURRY	TOP none	BOTTOM none	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 5.5	TOP	BOTTOM
SAND	TOP 5.5	BOTTOM 12.0	TOP	BOTTOM
GRAVEL	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 6.8	BOTTOM 11.6	TOP	BOTTOM
PIEZOMETER TIP	12.0			
BOTTOM OF BOREHOLE	12.0			
GWL AFTER INSTALLATION	To be taken at a later date			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Water bearing zone: 9.0-9.7 Ft

0000
5540 FERNALD
RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1301	COORDINATES:		DATE: 7/14/89
ELEVATION: UA ~~L. Adams~~	GWL: Depth	Date/Time	DATE STARTED: 7/14/89
ENGINEER/GEOLOGIST: L. Adams	Depth	Date/Time	DATE COMPLETED: 7/14/89
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 2 OF ~~2~~ 4

DEPTH (FT)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19206 0927 7-14	9	6	Very stiff to hard, gray (10yr 5/1) silty clay. Some gravel, fossil material, trace sand. Damp.	CL	2.75	HNU = Bkg α : Rδ = ↓
	19207 0927 7-14	11	6			4.0	
	19208 0927 7-14	15	6			3.75	
9 water bearing zone	19209 0942 7-14	14	6	Very soft, gray (10yr 6/1) very sandy, silty clay. Med. to high plasticity. Wet. *	CL	N/A	HNU = Bkg α : Rδ = ↓
	19210 0942 7-14	17	6	Very stiff, gray (10yr 6/1) silty, gravelly clay.		2.5	
10	19211 0942 7-14	15	6	Very stiff, gray (10yr 6/1) silty, gravelly clay. Layer med. grained sand cutting core diagonally. 1 in. wide. Well sorted.		4.5+	
11	19212 0958 7-14	3	6	Very stiff, gray (10yr 5/1) silty clay. Some fine to med. gravel (to 0.5 in) and fine sand. Med. Plasticity. Moist.		2.5	HNU Bkg α : Rδ = ↓
	53715 0958 7-14	4	6			2.25	
12	53716 0958 7-14	7	6			1.5	
13				Total depth of borehole 12.0 Ft.			HNU = ~~Bkg~~ UA α : Rδ = ↓
14							HNU : α : Rδ :

NOTES:
* Water zone: 9.0 - ~~9.8 ft~~.
9.7 Ft UA

000120

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS Facilities Testing		
BORING NUMBER: 1301	COORDINATES:	DATE: 7-14-89	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 7-14-89	
ENGINEER/GEOLOGIST: L. Adams	Depth / Date/Time	DATE COMPLETED: 7-14-89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4	

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	19191 0857 7-14	14	6	Hard, brown (10yr 5/3) silty clay. Some gravel, roots. Trace sand. Gravel size to 0.75 in. Slightly damp.	CL	4.5+	Hnu = Bkg α = Bγ = ↓
	19192 0857 7-14	15	6			4.5+	
	19193 0857 7-14	15	0	no recovery	N/A		
2	19194 0900 7-14	7	6	Hard, brown (10yr 5/3) silty clay. Some dark brown spotty staining. Trace gravel, sand. Slightly damp.	CL	4.25	Hnu = Bkg α = Bγ = ↓
	19195 0900 7-14	11	6			4.5+	
	19196 0900 7-14	14	0	no recovery	N/A		
3	19197 0901 7-14	14	6	Hard, yellowish brown (10yr 5/6) silty clay. Color variation and mottling. Trace sand + gravel. Damp. Gravel content increases toward bottom.	CL	4.25	Hnu = Bkg α = Bγ = ↓
4	19198 0901 7-14	17	6			4.5	
	19199 0901 7-14	34	2			4.5	
5	19200 0906 7-14	23	6	Hard, yellowish brown (10yr 5/4 to 5/6) silty clay. Dark brown spotty stains. Some fine to coarse gravel (to 0.5 in.). Slightly damp.	CL	4.5+	Hnu = Bkg α = Bγ = ↓
19201 VA 7/19/89	19201 0906 7-14	23	6			4.5+	
6	19202 0906 7-14	27	6			4.5+	
7	19203 0925 7-14	9	6	Hard, brown (10yr 5/3) to dark yellowish brown (10yr 4/5) to gray (10yr 5/1) silty clay. Some gravel + shell material. Damp.	CL	4.5+	Hnu = Bkg α = Bγ = ↓
	19204 0925 7-14	12	6			4.25	
	19205 0925 7-14	16	2			4.25	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile B-53 ATV
DRILLER: J. Saccani
ASSISTANT: K. Felty
Helper: D. Nelson
βγ: ASI #2
α: ASI #1

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: Hnu = ~~360~~ ~~380~~ ppm 2
α = ~~0~~ ppm 0
βγ = ~~2~~ ppm 360-380
LELO2: LEL = 0 ppm
O2 = 20.7 %

Hnu: 00199 Intrinsically Safe.

000121

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 14[illegible]	COORDINATES:	DATE: 07-31-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-31-89
ENGINEER/GEOLOGIST: H SLUNERIK	Depth Date/Time	DATE COMPLETED: 08-1-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	SS231 1430 07-31	6	6	STIFF, OLIVE-GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (2.5 YR 5/3), DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM βγ = 100-180 CPM
16	SS232 1430 07-31	8	6	A.A	CL	2.0	
	SS233 1430 07-31	10	6	A.A	CL	2.0	
17	SS234 1421 07-31	11	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM βγ = 100-180 CPM
	SS235 1421 07-31	12	6	A.A	CL	2.0	
	SS236 1421 07-31	12	6	A.A	CL	2.0	
18	SS237 1426 07-31	14	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM βγ = 100-180 CPM
	SS238 1426 07-31	17	6	A.A	CL	2.0	
19	SS239 1426 07-31	12	6	A.A	CL	2.0	
	SS240 1426 07-31	12	6	A.A 20.0 ft	CL	2.0	HNU = 0 PPM α = 0 CPM βγ = 100-180 CPM
20				BOTTOM OF BORING 20.0 FT BOREHOLE P&A 08-01-89			

NOTES: 1 MATERIAL USED DURING P&A [illegible]
2 50 LB BAGS OF BENTONITE CHIPS FROM 20.0 FT TO 1.0 FT
1/2 50 LB BAG OF CEMENT, FROM 1.0 FT TO GRADE
WATER 100 GAL.

A.A = AS ABOVE

P.G.7.
5549

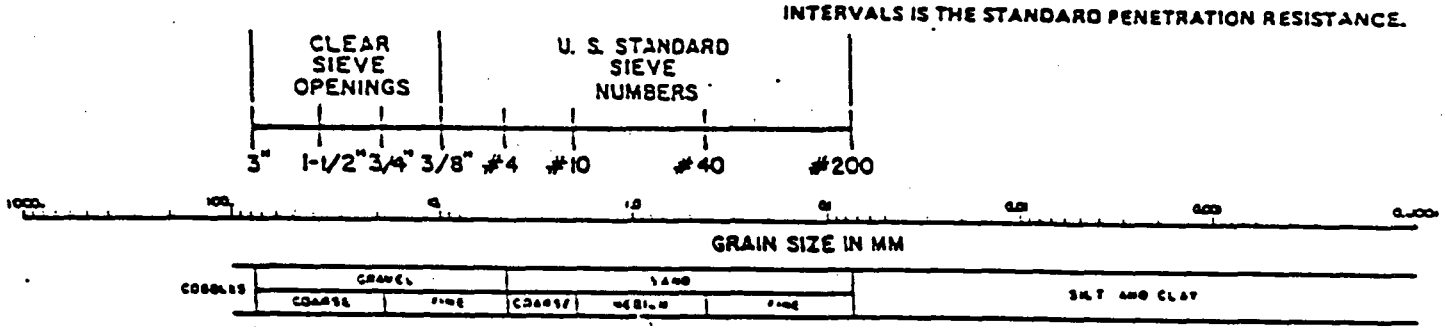
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT.

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 14 16	COORDINATES:	DATE: 07-31-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-31-89
ENGINEER/GEOLOGIST: M SCHARK	Depth Date/Time	DATE COMPLETED: 8-1-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8							HNU = α = BR =
9							HNU = α = BR =
10							
11	55220 1338 07-31	12	6	STIFF, YELLOW-BROWN (2.5Y 5/4) SILTY CLAY, TRACE SAND, TRACE GRAVEL (.25-.75") DAMP	CL	1.5	HNU = 0 PPM α = 0 CPM BR = 80-160 CPM
	55221 1338 07-31	14	6	A.A.	CL	1.5	
12	55222 1338 07-31	11	6	A.A.	CL	1.5	
	55223 1341 07-31	7	6	A.A.	CL	1.5	HNU = 0 PPM α = 0 CPM BR = 100-140 CPM
13	55224 1341 07-31	10	6	STIFF, BLUE-GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25-.50") DAMP	CL	2.0	
	55225 1341 07-31	12	6	A.A.	CL	2.0	
14	55226 1350 07-31	13	6	A.A.	CL	2.0	HNU = 0 PPM α = 0 CPM BR = 80-160 CPM
	55227 1350 07-31	14	6	A.A.	CL	2.0	
	55228 1350 07-31	16	6	A.A.	CL	2.0	

NOTES:

000123

A.A. = AS ABOVE

000124

5549

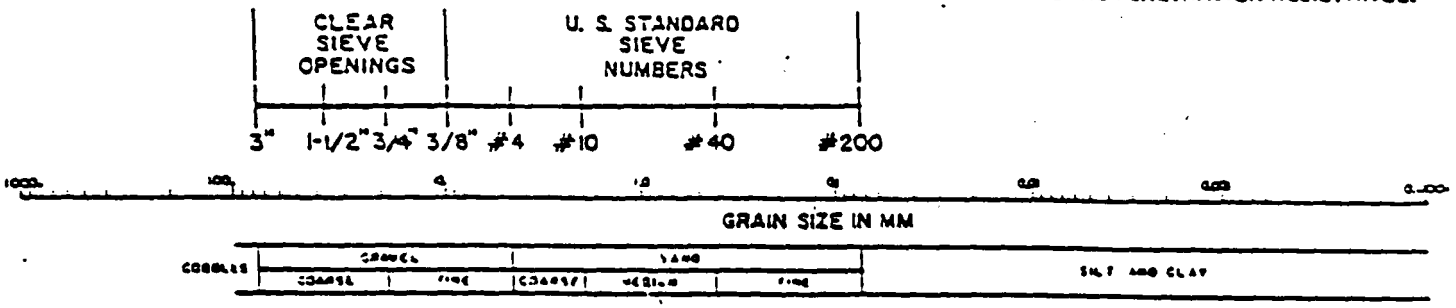
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

Date	8/31/89			
Initial				
	Final Check	1st Rev'n	2nd Rev'n	Final Copy Validation

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1416	COORDINATES:	DATE: 8-1-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-31-89
ENGINEER/GEOLOGIST: H SCHTARSKI	Depth Date/Time	DATE COMPLETED: 8-1-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 1

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (%)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1				VISUAL CLASSIFICATION OF SOILS DESCRIPTION FOR INTERVAL 0.0 - 10.5 FT MAY BE OBTAINED FROM LOG OF BORING # 1334			HNU = α = BG =
1 2				SAMPLE ~~LOG~~ IN BORING # 1416 COMMENCED @ 10.5 FT.			HNU = α = BG =
3				* THIS WAS A REPLACEMENT boring FOR original Boring LOCATION # 1334. COULD NOT DRILL BELOW 12 FT. DUE TO CONCRETE RUBBISH AT ORIGINAL LOCATION 1334. BG 8/3/89			HNU = α = BG =
4							HNU = α = BG =
5 6							HNU = α = BG =
7							HNU = α = BG =

NOTES: CONTRACTOR: PENN DRILL
RIG: MOBILE B-53
DRILLER: J. SICCANI
ASSISTANT: W. FELTY

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
BG = 100-200 CPM
LEL = 0 PPM
O_2 = 20.6 %

LELO$_2$:

000126

5549

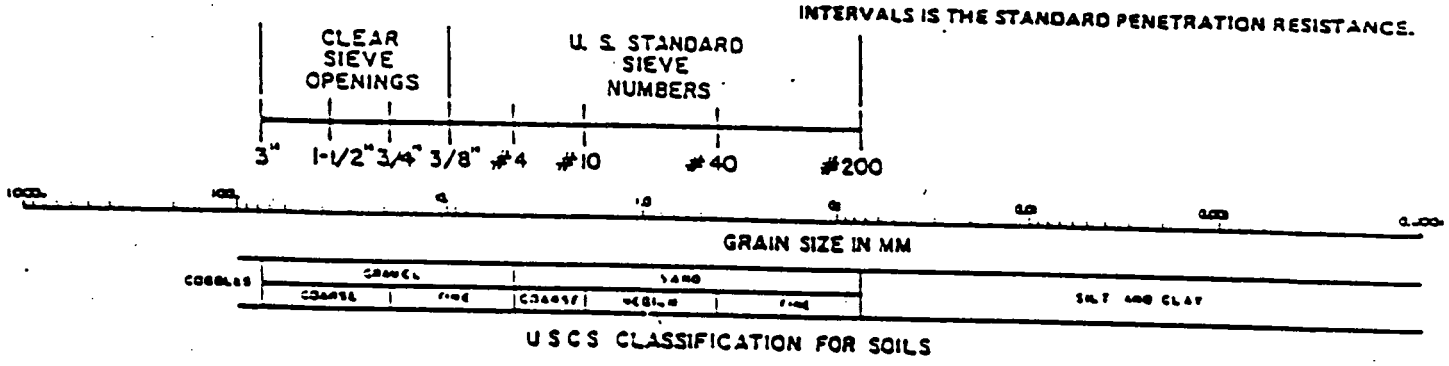
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

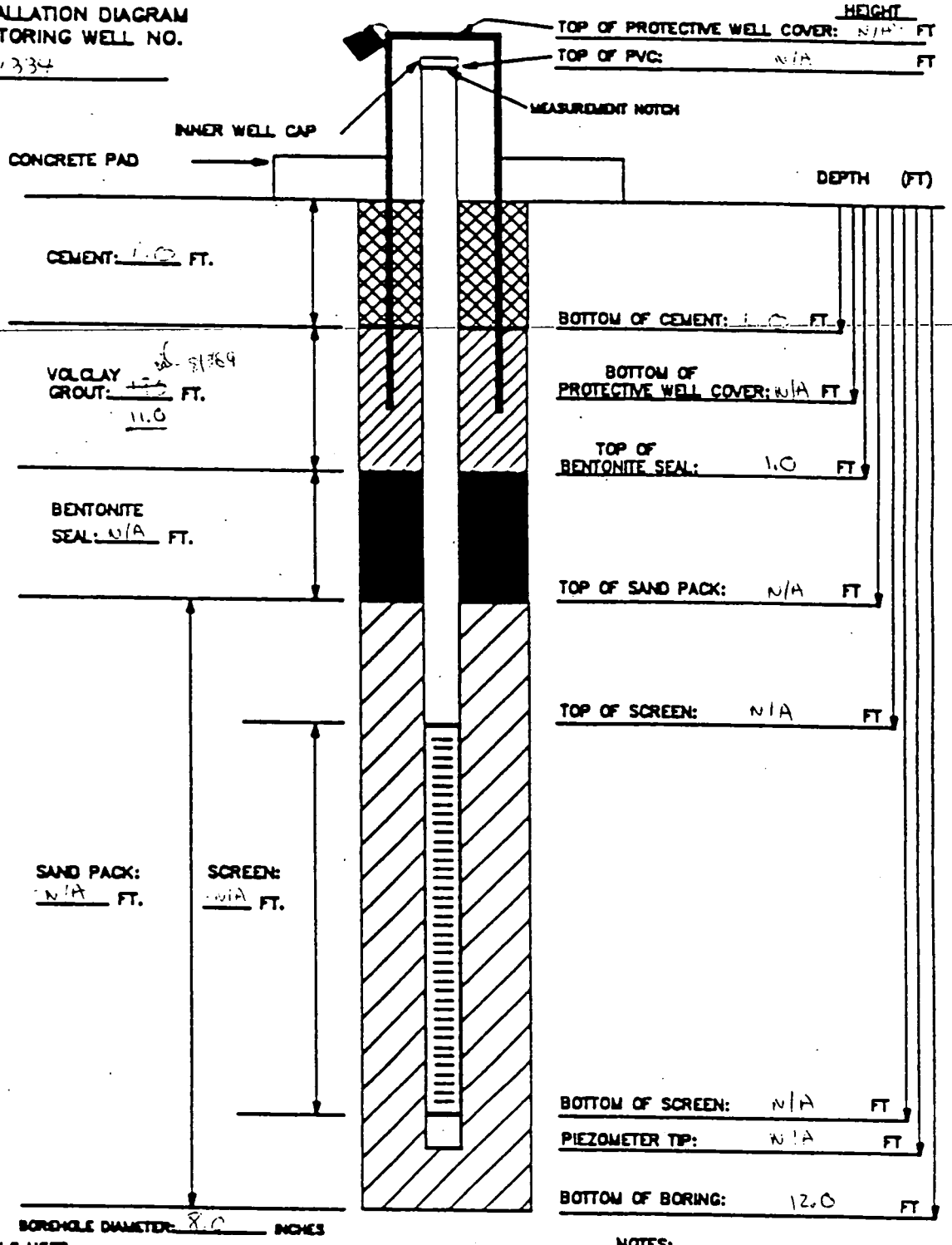
FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTT

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1334

INSTALLATION DATE: N/A



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY:
BENTONITE PELLETS (5-GALLON BUCKETS): 1/2 bucket
BAGS OF VOLCLAY GROUT: 1 40 lb
AMOUNT OF CEMENT: 1/2 (94#) sack
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: GCA 3.7.1 GEOLOGIST/ENGINEER: C. Grube

5549

FERNALD RI/FS

pg. 3 of 4 6/4/8

PIEZOMETER INSTALLATION SHEET

7/31/89

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. [illegible] DATE [illegible]
PROJECT NO. 1023.71 CHECKED BY [illegible] DATE [illegible]
BORING NO. 1334
PIEZOMETER NO. None DATE OF INSTALLATION None 3 & 4

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger	TYPE OF BIT 8 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE N/A	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION N/A
PROTECTIVE PIPE O.D. N/A	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	N/A			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	N/A			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0 FT.	BOTTOM 1.0 FT.	TOP	BOTTOM
~~BENTONITE~~ Volclay Grout	TOP 1.0 FT	BOTTOM 12.0 FT.	TOP	BOTTOM
SAND	TOP N/A	BOTTOM N/A	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	12.0 FT.			
GWL AFTER INSTALLATION	N/A.			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Could not drill below 12 Ft. Due To Concrete rubbish - Boring was abandoned & volclay grouted From 12.0 - 1.0 Ft. - Cement Pad 0-1.0 Ft. Replacement boring # 1416 was located adjacent this abandoned ~~set~~ boring -

000129

409-...-96

55497

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1334	COORDINATES:		DATE: 7/31/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7/31/89
ENGINEER/GEOLOGIST: C. Grube	Depth	Date/Time	DATE COMPLETED: 7/31/89
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19932 1140 7-30	19	6	Med Stiff (2.5y 4/4) olive brown sandy clay, loose, slightly moist. Below (2.5y 4/4) light olive brown clayey sand, slightly moist.	CL / SC	.75 / NA	HNU = .1 α = 5-10 Bγ = 110-120
	19933 1140 7-30	27	6	Very Stiff (10y 5/4) yellowish brown silty clay, some sand, trace med to fine gravel, low plasticity, moist	CL	2.75	
9	19934 1140 7-30	50/2	6	Stiff — SAA	CL	1.0	
	19935 1140 7-30	~~19~~ only 4 in	6	V. Stiff (2.5y 4/4) olive brown. Silty clay some sand trace fine to med gravel low plasticity slightly moist	CL	3.0	HNU = 0 α = 0 Bγ = 100-110
10	19936 1430 7-30	13	3	Stiff (10y 4/6) dark yellowish brown silty clay, trace sand & fine to med gravel, low plasticity, moist	CL		
	19937 1430	50	0	NR	NA	NA	
11	19938 1510 7-30	50/5	4	Stiff (2.5y 4/4) olive brown silty clay, trace fine to med gravel, trace sand low plasticity, slightly moist	CL	1.75	HNU = 0 α = 0 Bγ = 100-110
			0	N/A			
			0				
12							HNU = α = Bγ =
13							
14							HNU = α = Bγ =

NOTES:

Could not drill below 12 ft. due to rubbish ie concrete, etc. - well was plugged and moved. Replacement boring # 14

8/3/89

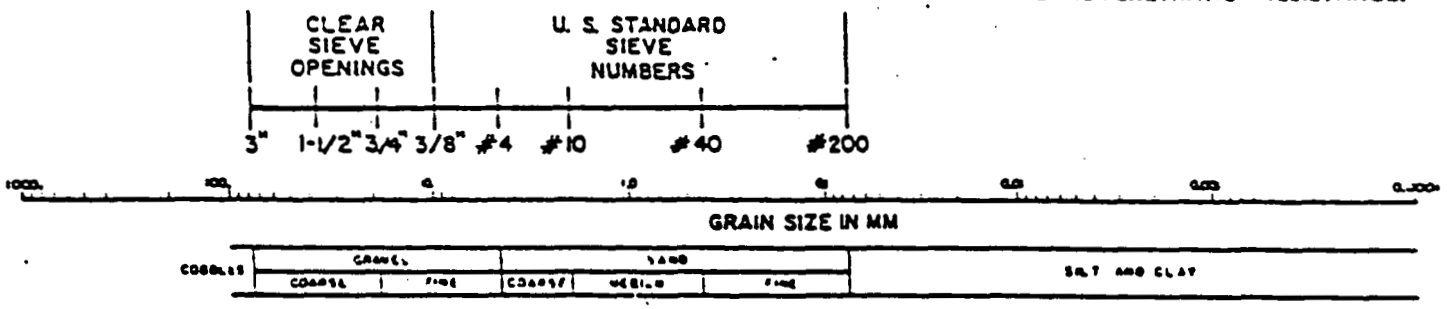
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

5549

Date				
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1334	COORDINATES:	DATE: 7/30/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/30/89
ENGINEER/GEOLOGIST: C Grube	Depth Date/Time	DATE COMPLETED: 7/31/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19917 1010 7-30	9	6	DENSE (10y 5/3) Brown, clayey gravel, some sand, roots, grass, dry	GC	NA	HNU = 720 ppm α = 10 Bδ = 100-110
1	19918 1010 7-30	22	3	SAA	GC	NA	HNU reading not taken on higher scale because substance dissipated too quickly
	19919 1010 7-30	26	0	NR	NA	NA	
1	19920 1020 7-30	12	4	Very Stiff (10y 5/3) Brown, sandy clay trace fine to med gravel, low plasticity, dry	CL	3.0	HNU = 0 α = 0 Bδ = 80-90
2	19921 1020 7-30	6	0	NR	NA	NA	
	19922 1020 7-30	6	0	NR	NA	NA	
3	19923 1025 7-30	10	6	Very Stiff (10y 5/3) Brown sandy clay, trace fine to med gravel, low plasticity, dry Very Stiff (5y 3/2) Dark olive gray clay, trace of sand, low plasticity, moist	CL CL	3.0 3.75	HNU = 0 α = 5-10 Bδ = 120-140
	19924 1025 7-30	16	6	Very Stiff (5y 4/3) olive, gray clay, trace of sand & fine gravel, low plasticity, moist	CL	2.0	
4	19925 1025 7-30	14	3	Stiff (5y 4/3) olive, clay, trace sand, med plasticity, moist	CL	1.5	
	19926 1120 7-30	5	6	MED DENSE (2.5y 4/4) olive brown gravel some sand, low plasticity, dry	GC	NA	HNU = 0 α = 0 Bδ = 70-80
5	19927 1120 7-30	8	6	Stiff (5y 4/3) olive, clay, trace sand & fine to med gravel, med plasticity, moist	CL	1.25	
	19928 1120 7-30	9	0	NR	NA	NA	
6	19929 1130 7-30	16	6	Stiff (2.5y 3/4) olive brown gravelly clay some sand, low plasticity, slightly moist	CL	1.25	HNU = 1 α = 5 Bδ = 90-100
	19930 1130 7-30	13	6	Very Stiff (10y 4/6) dark yellowish brown sandy clay, trace fine to med gravel, low plasticity, moist	CL	2.0	
7	19931 1130 7-30	15	6	Stiff SAA		1.75	

NOTES: CONTRACTOR: PENNDRILL
RIG: Mobel 45-C
DRILLER: Harold Andrews
ASSISTANT: Charlie Ellwood
GeoAssistant: Cindy Malroy

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bδ = 70-90 CPM
LEL = 0%
O_2 = 20.6%

SAA = Same As Above
NR = No Recovery

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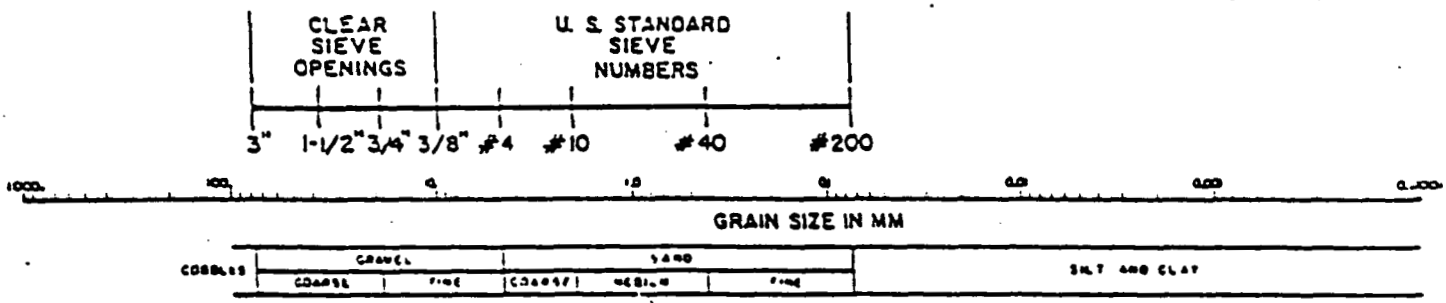
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

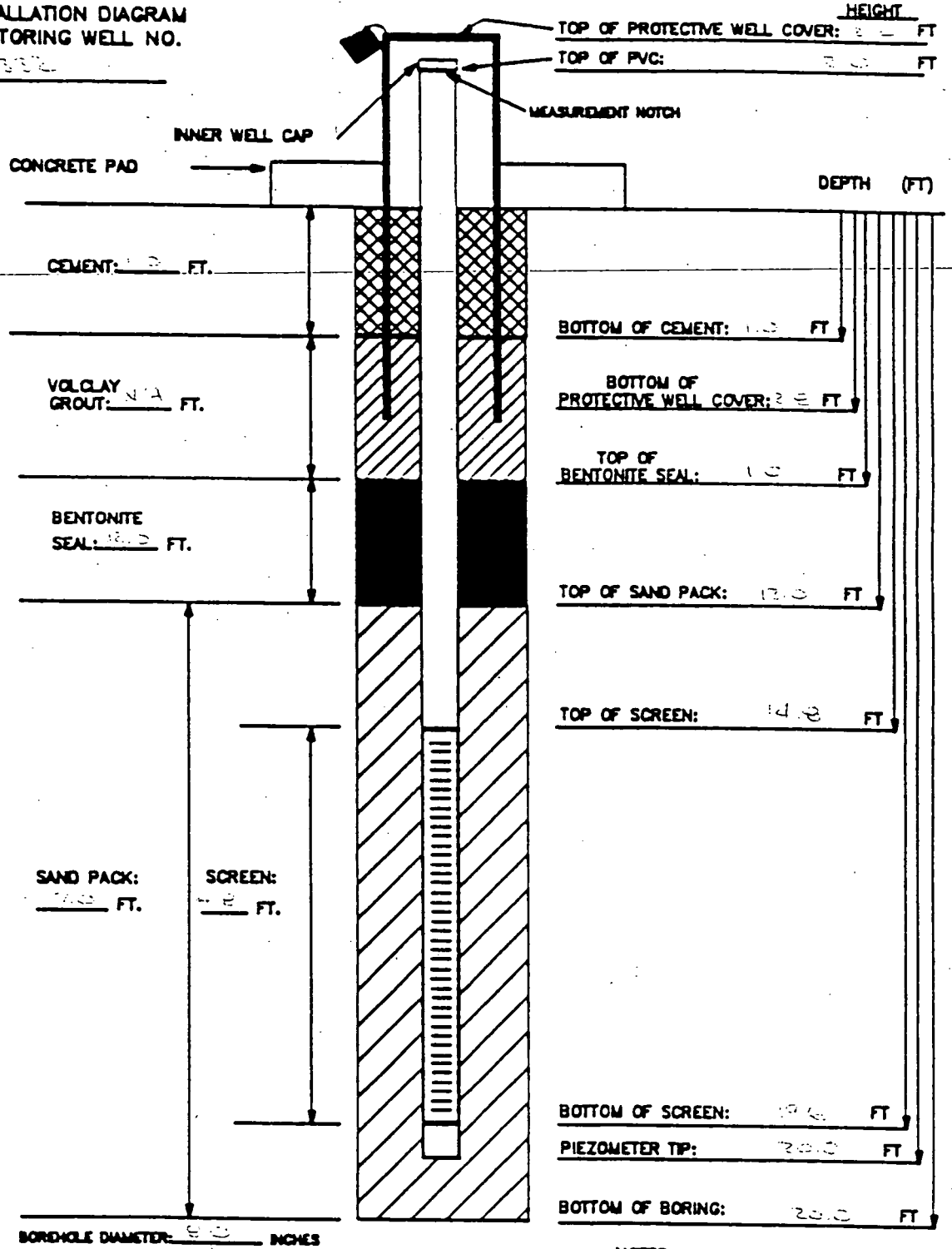
FINE-GRAINED/HIGHLY ORGANIC SOIL

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. [illegible]

INSTALLATION DATE: [illegible]



MATERIALS USED:

SAND TYPE AND QUANTITY: [illegible] BAGS 10-20 SAND
BENTONITE PELLETS (5-GALLON BUCKETS): [illegible] GAL BUCKETS
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: [illegible] BAGS
AMOUNT OF WATER USED: [illegible] GAL
OTHER:

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: [illegible]

GEOLOGIST/ENGINEER: [illegible]

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FERNALD RI/FS FIELD ENG./GEO. [illegible] DATE [illegible]
PROJECT NO. [illegible] CHECKED BY _____ DATE _____
BORING NO. [illegible]
PIEZOMETER NO. [illegible] DATE OF INSTALLATION 07-20-89

BOREHOLE DRILLING

DRILLING METHOD [illegible]	TYPE OF BIT [illegible]
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE 4.25 in ID FROM [illegible] TO [illegible]
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE PIEZOMETER	RISER PIPE MATERIAL PVC
DIAMETER OF PERFORATED SECTION [illegible] in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 7/8 in I.D. [illegible] in
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 4 ea 4.2 ft 10.0 ft [illegible] ft
AVERAGE SIZE OF PERFORATIONS [illegible]	JOINING METHOD SCREW TYPE FLUSH
TOTAL PERFORATED AREA 4.2 ft	JOINT THREADED

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft	OTHER PROTECTION [illegible]
PROTECTIVE PIPE O.D. 4 7/8 in.	w/ padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.2			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8			
BOREHOLE FILL MATERIALS:				
~~GROUT~~/SLURRY CEMENT	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 13.0	TOP	BOTTOM
SAND (10-20)	TOP 13.0	BOTTOM 20.0	TOP	BOTTOM
GRAVEL N/A	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 14.8	BOTTOM 19.6	TOP	BOTTOM
PIEZOMETER TIP	20.0			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒ 000136
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS USED 2 - 40LB BAGS OF 10-20 SAND FROM 13.0 FT TO 20.0 FT
USED 7 - 5 GAL BUCKETS OF BENTONITE PELLETS FROM 1.0 FT TO 13.0 FT
USED 1/2 - BAG OF PORTLAND CEMENT FROM 0.0 FT TO 1.0 FT

5549

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1332	COORDINATES:	DATE: 07-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-30-89
ENGINEER/GEOLOGIST: M. SKUTARSKI	Depth Date/Time	DATE COMPLETED: 7-30-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	S4343 1446 07-30	4	6	STIFF, OLIVE GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25 IN.) DAMP	CL	2.0	HNU = 0 PPM
	S4344 1446 07-30	6	6	A.A	CL	2.0	α = 0 CPM
16	S4345 1446 07-30	16	6	16.3			BG = 100-200 CPM
				MEDIUM DENSE, OLIVE-GRAY (5Y 4/1) SILT SAND MIXTURE, WET	SM	N/A	
	S4346 1452 07-30	11	6	AA	SM	N/A	HNU = 0 PPM
17	S4347 1452 07-30	14	6	MEDIUM DENSE, OLIVE-GREY (5Y 4/1) SILT SAND MIXTURE, TR GRAVEL (.25 IN.) WET	SM	N/A	α = 0 CPM
	S4348 1452 07-30	15	6	MEDIUM DENSE, OLIVE-GRAY (5Y 4/1) SOME SAND, SAND-CLAY MIXTURE, WET	SC	N/A	BG = 100-180 CPM
18	S4349 1458 07-30	6	6	MEDIUM DENSE, OLIVE-GREY (5Y 4/1) POORLY GRADED FINE SAND, WET	SP	N/A	HNU = 0 PPM
	S4350 1458 07-30	6	6	A.A.	SP	N/A	α = 0 CPM
19	S4351 1458 07-30	7	6	19.0 STIFF, OLIVE-GREY (5Y 4/1) SILTY CLAY TRACE GRAVEL (.25 IN.) DAMP	CL	2.0	BG = 100-180 CPM
20	S4352 1458 07-30	8	6	A.A 20.0	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-180 CPM
				BOTTOM OF BORING @ 20 FT.			

NOTES: COMPLETED AS THERMOMETER

A.A. = AS ABOVE

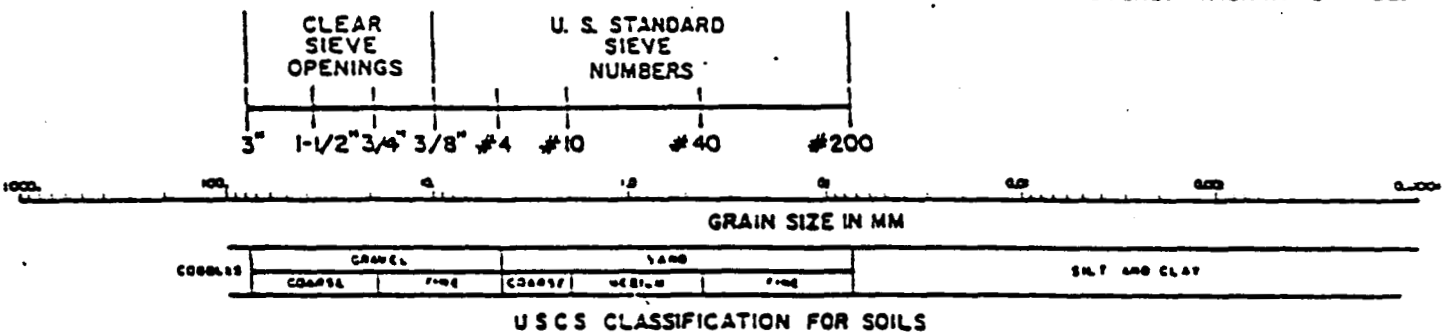
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1372	COORDINATES:	DATE: 07-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-30-89
ENGINEER/GEOLOGIST: M SLUSARSKI	Depth Date/Time	DATE COMPLETED: 7-30-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19828 1420 07-30	6	6	STIFF, OLIVE GREY (5Y 4/1) SILTY CLAY, TRACE SAND, TRACE GRAVEL (<1%), DAMP	CL	2.0	HNU = 0 PPM
	19829 1420 07-30	7	6	A.A	CL	2.0	α = 0 CPM
	19830 1420 07-30	7	—	NO RECOVERY 8.5-9.0 FT	—	—	BG = 100-200 CPM
9	19831 1422 07-30	6	6	STIFF, OLIVE-GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (<1%), DAMP	CL	2.0	HNU = 0 PPM
10	19832 1422 07-30	4	6	A.A	CL	2.0	α = 0 CPM
	19833 1422 07-30	4	—	NO RECOVERY 10.0-10.5	—	—	BG = 100-200 CPM
11	19834 1430 07-30	2	6	STIFF YELLOW-BROWN (10YR 5/1), OLIVE-GREY (5Y 4/1) MOTTLED, SILTY CLAY, TR (<1%-<50%) GRAVEL, DAMP	CL	2.0	HNU = 0 PPM
	54335 1430 07-30	3	—	NO RECOVERY 11.0-11.5	—	—	α = 0 CPM
12	54336 1430 07-30	6	—	NO RECOVERY 11.5-12.0	—	—	BG = 100-180 CPM
13	54337 1432 07-30	6	6	STIFF, LIGHT BROWN (7.5YR 5/1) SILTY CLAY, DAMP	CL	2.0	HNU = 0 PPM
	54338 1432 07-30	7	6	A.A	CL	2.0	α = 0 CPM
	54339 1432 07-30	7	6	A.A	CL	2.0	BG = 100-180 CPM
14	54340 1437 07-30	15	6	VERY STIFF, OLIVE-GREY (5Y 4/1) SILTY CLAY, DAMP	CL	2.5	HNU = 0 PPM
	54341 1437 07-30	14	6	A.A	CL	2.5	α = 0 CPM
	54342 1437 07-30	14	6	A.A	CL	2.5	BG = 100-200 CPM

NOTES:

A.A

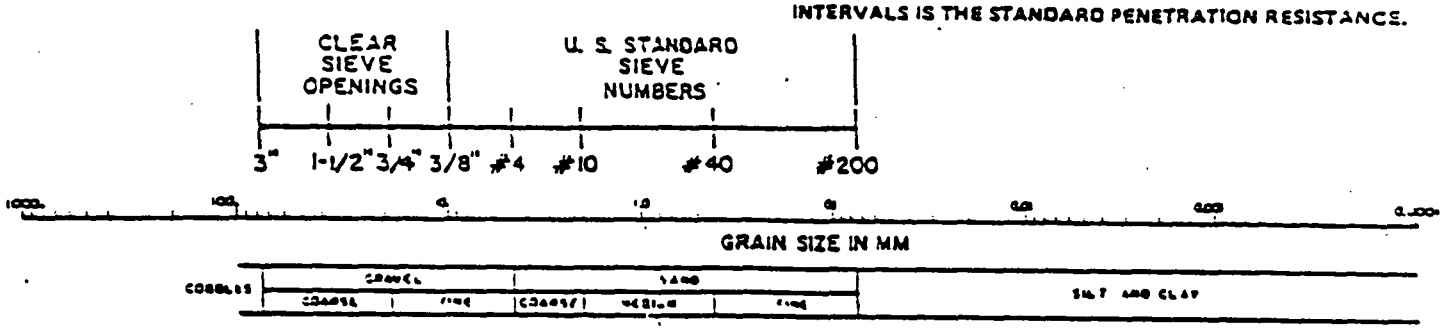
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

554 (1)

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 37.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1332	COORDINATES:	DATE: 07-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-30-89
ENGINEER/GEOLOGIST: M. SCUDARSKI	Depth Date/Time	DATE COMPLETED: 7-30-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (")	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	19873 1340 07-30	10	6	VERY STIFF, BROWN (10YR 5/3) SILTY CLAY, SOME GRAVEL (.25-1.0 IN) DAMP	CL	3.5	HNU = 0 PPM α = 0 CPM Bβ = 180-200 CPM
	19874 1340 07-30	11	6	A.A	CL	3.5	
	19875 1340 07-30	8	—	NO RECOVERY 1.0-1.5 FT	—	—	
2	19876 1343 07-30	8	—	NO RECOVERY 1.5-2.0 FT	—	—	HNU = 0 PPM α = 0 CPM Bβ = 180-200 CPM
	19877 1343 07-30	8	—	NO RECOVERY 2.0-2.5 FT	—	—	
	19878 1343 07-30	5	—	NO RECOVERY 2.5-3.0 FT	—	—	
3	19879 1346 07-30	8	6	STIFF, BROWN (10YR 5/3) SILTY CLAY SOME GRAVEL (.25-.50 IN) DAMP MOTTLED, DK GREY (5Y 4/1)	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 200-240 CPM
4	19880 1346 07-30	10	—	NO RECOVERY 3.5-4.0 FT	—	—	
	19881 1346 07-30	10	—	NO RECOVERY 4.0-4.5 FT	—	—	
5	19882 1350 07-30	9	6	STIFF, OLIVE GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25 IN) DAMP 4.7	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 100-180 CPM
				STIFF, YELLOW-BROWN (10YR 5/1) SILTY CLAY SOME GRAVEL (.25-1.0 IN) DRY 5.0			
	19883 1350 07-30	10	6	STIFF, OLIVE GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25 IN), TRACE GREEN CHATTLING, DAMP	CL	2.0	
6	19884 1350 07-30	13	—	NO RECOVERY 5.5-6.0 FT	—	—	
7	19885 1416 07-30	3	6	STIFF, OLIVE GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25 IN) DAMP	CL	2.0	HNU = 0 PPM α = 0 CPM Bβ = 100-200 CPM
	19886 1416 07-30	4	6	A.A	CL	2.0	
	19887 1416 07-30	6	6	A.A	CL	2.0	

NOTES: CONTRACTOR: PENN DRILL
RIG: MOBILE RIG B-53
DRILLER: J. SACCANI
ASSISTANT: W. FLETY

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bβ = 500-700 CPM
LELO2: LEL = 0 PPM
O2 = 20.6 %

A.A. = AS ABOVE

000142

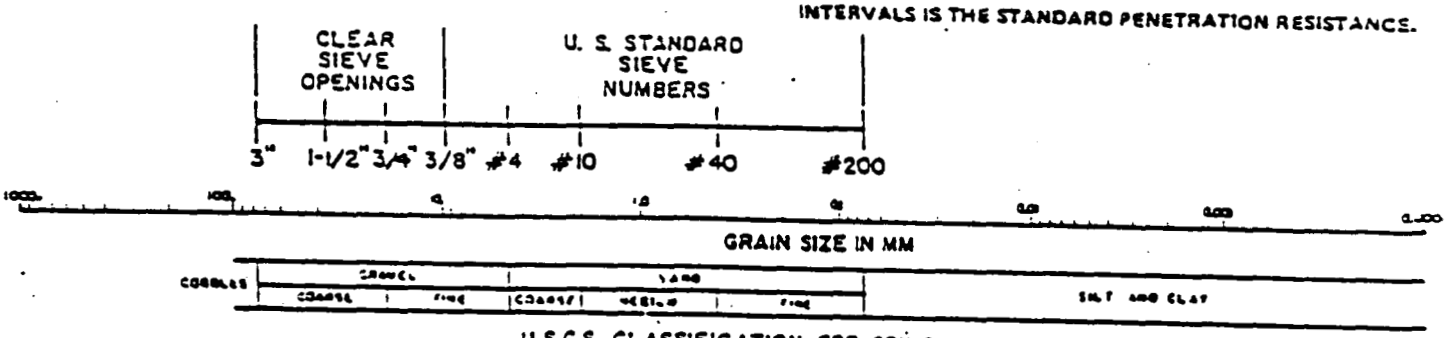
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1330	COORDINATES:	DATE: 07-28-89 / 07-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-27-89
ENGINEER/GEOLOGIST: M. SLOSMIK	Depth Date/Time	DATE COMPLETED: 07-30-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 3

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	S4303 0945 07-30	6	6	VERY STIFF, YELLOW-BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL (.25 - .50 IN) DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM BG = 100-180 CPM
	S4304 0945 07-30	8	6	VERY STIFF, GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25 - .50 IN) DAMP	CL	2.5	
16	S4305 0945 07-30	9	6	A.A	CL	2.5	
	S4306 0949 07-30	9	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-180 CPM
17	S4307 0949 07-30	9	6	A.A	CL	2.0	
	S4308 0949 07-30	10	6	A.A	CL	2.0	
18	S4309 0954 07-30	9	6	A.A	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-180 CPM
	S4310 0954 07-30	10	6	A.A	CL	2.0	
19	S4311 0954 07-30	11	6	A.A	CL	2.0	
	S4312 0954 07-30	12	6	A.A 20.0	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-180 CPM
20				BOTTOM OF BORING 20.0 FT. Plugged and Abandoned 8-3-89			

NOTES:

A.A = AS ABOVE

000144

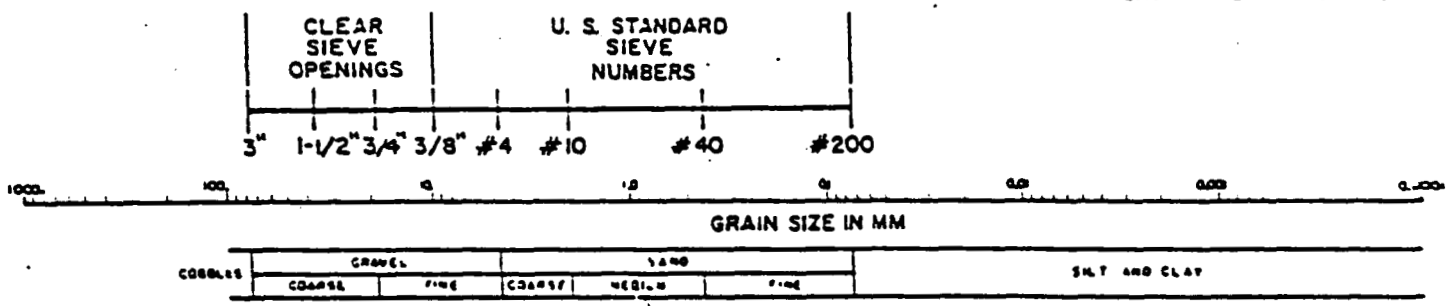
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1330	COORDINATES:	DATE: 07-29-99
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-29-99
ENGINEER/GEOLOGIST: M. SCUBARSKI	Depth Date/Time	DATE COMPLETED: 7-30-99
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19844 1400 07-29	10	6	[illegible]	[illegible]	[illegible]	HNU = [illegible] α = [illegible] BG = [illegible]
	19845 1400 07-29	10	6	STIFF, YELLOW BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL [illegible] DAMP	[illegible]	[illegible]	
	19846 1400 07-29	[illegible]	[illegible]	A.A	[illegible]	[illegible]	
9	19847 1404 07-29	[illegible]	[illegible]	STIFF, YELLOW BROWN [illegible] CLAY	[illegible]	[illegible]	HNU = [illegible] α = [illegible] BG = 100 [illegible]
10	19848 1404 07-29	14	[illegible]	STIFF, YELLOW BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL [illegible] DAMP	[illegible]	[illegible]	
	19849 1404 07-29	16	—	NO RECOVERY [illegible]	—	—	
11	19850 1603 07-29	7	6	VERY STIFF, YELLOW BROWN (2.5Y 5/4) SILTY CLAY, TRACE GRAVEL [illegible] DAMP	[illegible]	[illegible]	HNU = [illegible] α = [illegible] BG = [illegible]
	19851 1603 07-29	9	[illegible]	A.A	[illegible]	[illegible]	
12	19852 1603 07-29	10	6	A.A	[illegible]	[illegible]	
13	19853 1603 07-29	11	[illegible]	A.A	[illegible]	[illegible]	HNU = [illegible] α = [illegible] BG = [illegible]
	19854 1603 07-29	13	[illegible]	A.A	[illegible]	[illegible]	
	19855 1603 07-29	10	[illegible]	A.A	[illegible]	[illegible]	
14	19856 1611 07-29	[illegible]	6	A.A	[illegible]	[illegible]	HNU = [illegible] α = [illegible] BG = [illegible]
	19857 1611 07-29	[illegible]	6	A.A	[illegible]	[illegible]	
	19858 1611 07-29	[illegible]	6	A.A	[illegible]	[illegible]	

NOTES:

A.A = [illegible]

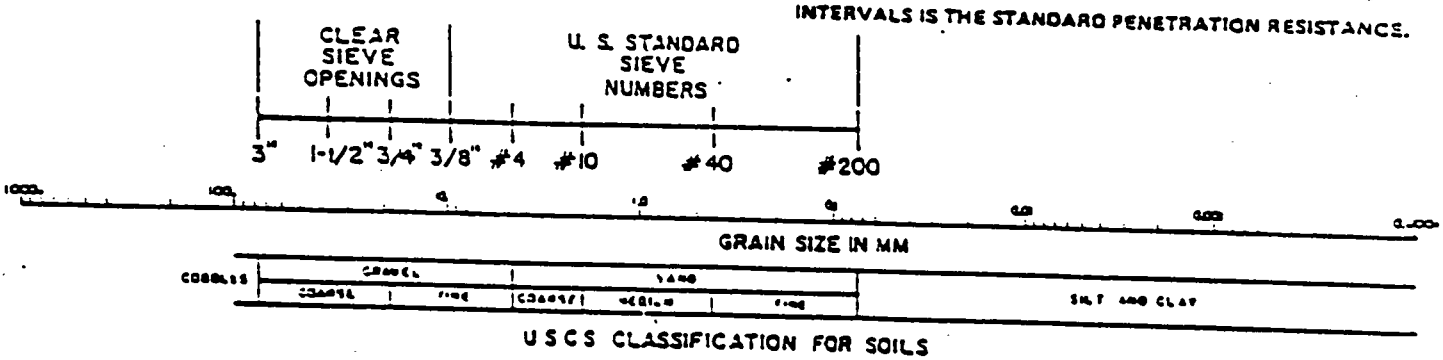
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

5549

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1330	COORDINATES:	DATE: 07-29-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-29-89
ENGINEER/GEOLOGIST: M. SCHWABEL	Depth Date/Time	DATE COMPLETED: 07-30-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (FT)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19829 1405 07-29	19	6	MEDIUM STIFF, BROWN (10YR 4/3) GRAVELLY CLAY, SOME SAND, FINE (1.5-1.0 in) DRY	CL	0.5	HNU = 0 PPM α = 0 CPM BG = 100-140 CPM
	19830 1405 07-29	9	—	NO RECOVERY 0.5-1.0 FT.	—	—	
1	19831 1405 07-29	5	—	NO RECOVERY 1.0-1.5 FT.			
	19832 1410 07-29	13	6	STIFF, BROWN (10YR 4/3) SILTY CLAY, TRACE SAND, TRACE GRAVEL (2-3 FT) DRY	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-140 CPM
2	19833 1410 07-29	9	6	A.A.	CL	2.0	
	19834 1410 07-29	6	—	NO RECOVERY 2.5-3.0 FT.	—	—	
3	19835 1417 07-29	10	6	STIFF, BROWN-GREEN (7.5YR 4/4) SILTY CLAY, TRACE GRAVEL (LESS THAN) DRY	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-140 CPM
	19836 1417 07-29	11	6	A.A.	CL	2.0	
4	19837 1417 07-29	11	—	NO RECOVERY 3.5-4.0 FT.	—	—	
	19838 1419 07-29	6	6	STIFF, OLIVE-GREEN (5Y 3/2) SILTY CLAY, TRACE GRAVEL (LESS THAN) DRY	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-140 CPM
5	19839 14[illegible] 07-29	8	6	A.A.	CL	2.0	
	19840 1419 07-29	10	6	A.A.	CL	2.0	
6	19841 1420 07-29	5	1.0 ft	STIFF, BROWN (7.5YR 4/4) SILTY CLAY, TRACE GRAVEL (LESS THAN) DRY	CL	2.0	HNU = 0 PPM α = 0 CPM BG = 100-140 CPM
	19842 1420 07-29	7	1.0 ft	STIFF, BROWN-GREEN (5Y 4/2) SILTY CLAY, TRACE GRAVEL (LESS THAN) DRY	CL	2.0	
7	19843 1425 07-29	9	1.0 ft	A.A.	CL	2.0	

NOTES: CONTRACTOR: PENN DRILL
RIG: MOBIL B-53
DRILLER: T. SACCANI
ASSISTANT: W. REITY

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
BG = 100-200 CPM

LEL/O2: LEL = 0 PPM
O2 = 20.6 %

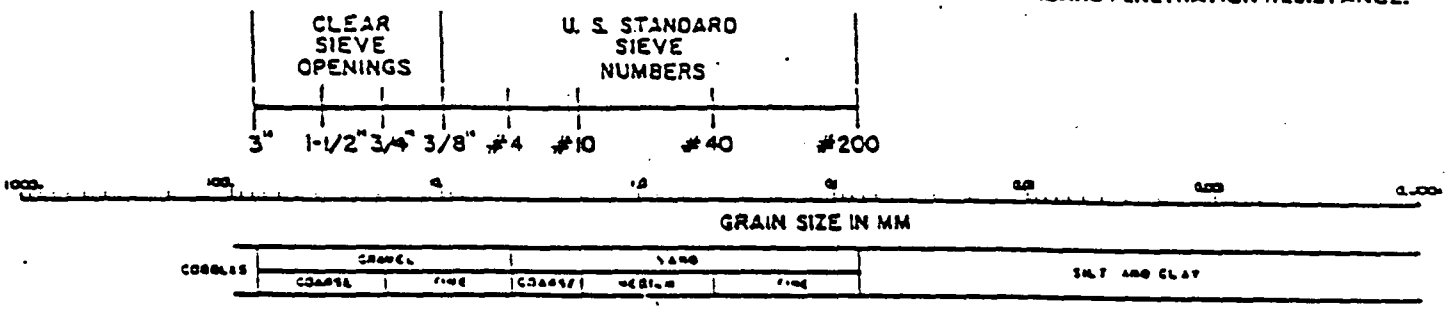
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

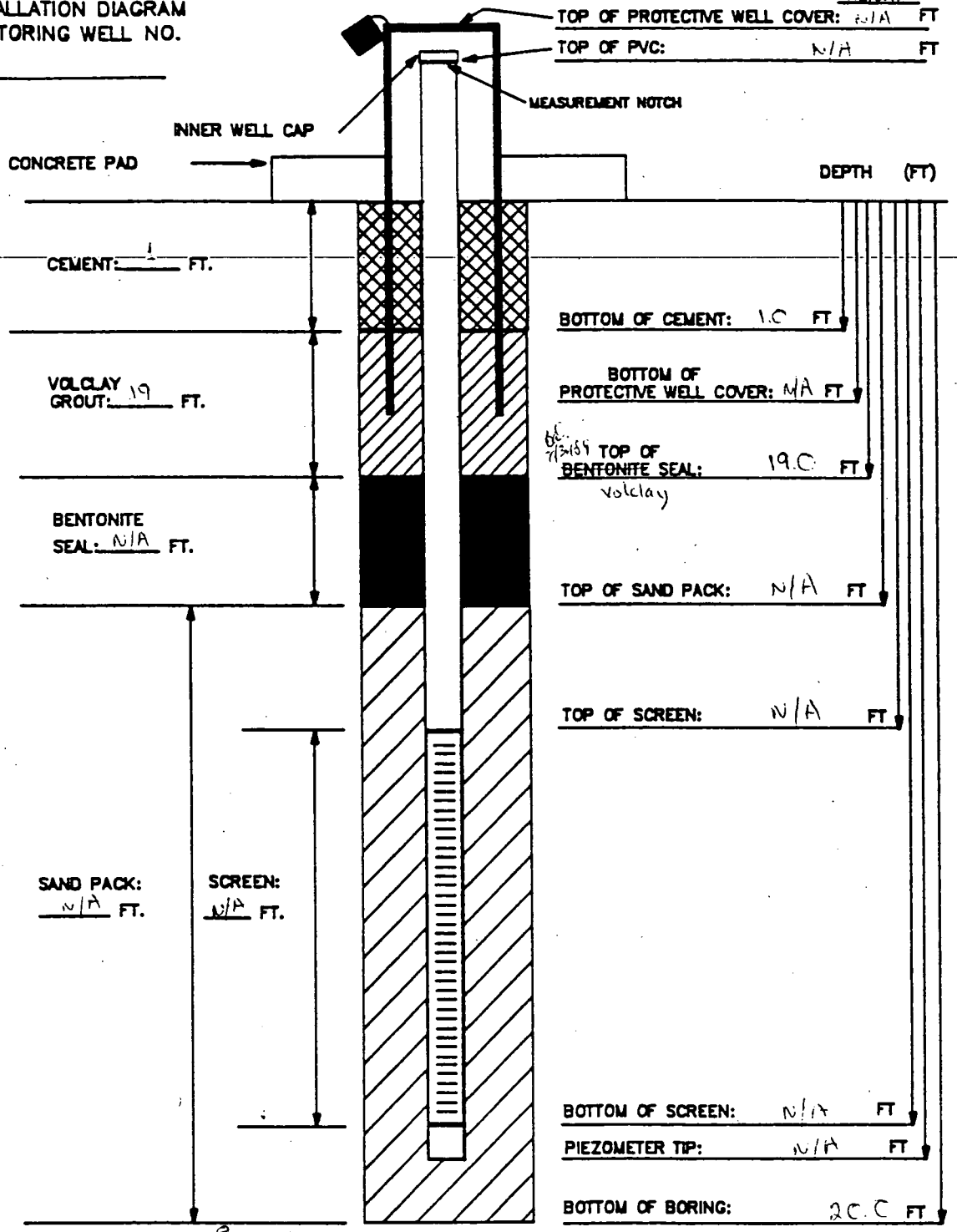
FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

INSTALLATION DATE: 7/30/89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. _____



BOREHOLE DIAMETER: 8 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: N/A
BENTONITE PELLETS (5-GALLON BUCKETS): N/A
BAGS OF VOLCLAY GROUT: 2 50 lb bags
AMOUNT OF CEMENT: 1/2 sk.
AMOUNT OF WATER USED: -
OTHER: -

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 3.7

GEOLOGIST/ENGINEER: B. Dunning M. Sluzarski

FERNALD RI/FS

5549

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. R. Dunning DATE 7/30/89
PROJECT NO. 602.03.07 CHECKED BY DATE
BORING NO. 1329
PIEZOMETER NO. N/A DATE OF INSTALLATION N/A 7/30/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED:
FLUID None FROM None TO —
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger
CASING SIZE (S) USED:
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM TO N/A

PIEZOMETER DESCRIPTION

TYPE None
DIAMETER OF PERFORATED SECTION N/A
PERFORATION TYPE:
SLOTS ☐ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS N/A
TOTAL PERFORATED AREA N/A

RISER PIPE MATERIAL None
RISER PIPE DIAMETERS:
O.D. N/A I.D. N/A
LENGTH OF PIPE SECTIONS N/A
JOINING METHOD N/A

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A
PROTECTIVE PIPE O.D. N/A

OTHER PROTECTION None

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE	N/A			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	N/A			
BOREHOLE FILL MATERIALS:				
BC 7/30/89 ~~GROUT/SLURRY~~ Cement	TOP 0.0 FT.	BOTTOM 1.0 FT.	TOP	BOTTOM
~~BENTONITE~~ Volclay Grout	TOP 1.0 FT.	BOTTOM 20.0 FT.	TOP	BOTTOM
SAND	TOP N/A	BOTTOM N/A	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	20.0 FT.			
GWL AFTER INSTALLATION	N/A			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Boring - Well was left open 24 Hours.
No Water bearing Zones encountered
Boring was Plugged & Abandoned.

000151

409-11-86

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1329	COORDINATES:	DATE: 07-29-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 07-28-89
ENGINEER/GEOLOGIST: M SUMMERS	Depth Date/Time	DATE COMPLETED: 07-30-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 3

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	54283 1010 07-29	SA 16		VERY STIFF, YELLOWISH-BROWN (10YR5/2) SILTY CLAY, TRACE GRAVEL (.25-1.0 IN) DAMP	CL	2.5	HNU = 0 PPM α = 0 CPM Bγ = 80-100 CPM
	54284 1010 07-29	19	18	A.A	CL	2.5	
16	54285 1010 07-29	21		VERY STIFF, GREY (5Y 4/1) SILTY CLAY, TRACE GRAVEL (.25-1 IN) DAMP	CL	2.5	
	54286 1016 07-29	14		A.A	CL	2.5	HNU = 0 PPM α = 0 CPM Bγ = 100-120 CPM
17	54287 1016 07-29	19	18	A.A	CL	2.5	
	54288 1016 07-29	23		A.A	CL	2.5	
18	54289 1025 07-29	19		A.A	CL	2.5	HNU = 0 PPM α = 0 CPM Bγ = 100-120 CPM
	54290 1025 07-29	19	18	A.A	CL	2.5	
19	54291 1025 07-29	25		A.A.	CL	2.5	
	54292 1025 07-29	19	6	A.A. 20.0 FT	CL	2.5	HNU = 0 PPM α = 0 CPM Bγ = 80-100 CPM
20				BOTTOM OF BOREHOLE 20.0 FT WELL / Boring was left open for 24 hrs. No water accumulated. Boring was plugged & Abandoned.			

NOTES:

A.A = As Above

000152

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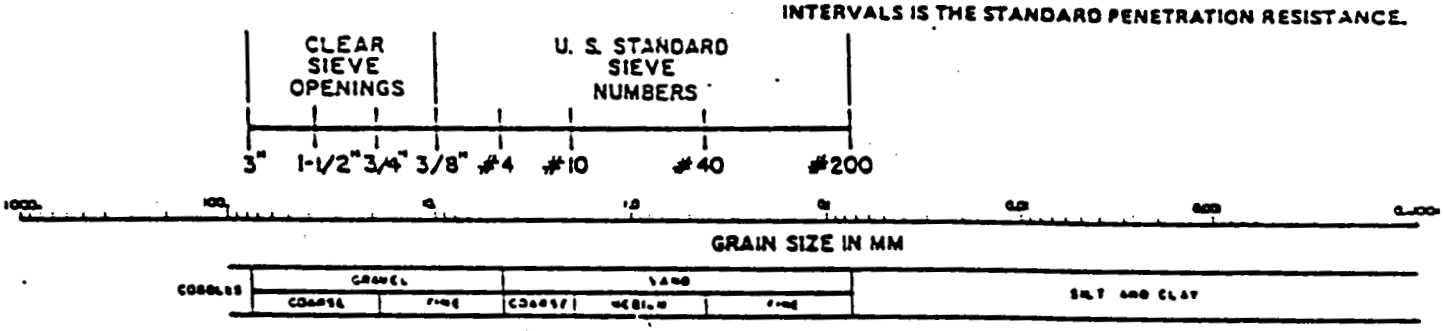
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 02.03.07	PROJECT NAME: FMPC RI/FS (FACILITY TESTING)	
BORING NUMBER: 1329	COORDINATES:	DATE: 7/28/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/28/89
ENGINEER/GEOLOGIST: B. Dunning	Depth Date/Time	DATE COMPLETED: ~~7/29/89~~ 7/30/89
DRILLING METHODS: HOLLOW STEM AUGER - SPLIT SPOON SAMPLING		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN.	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19822 1615 7-28	5	12"	Very STIFF Yellowish Brown Clay (10 YR, 5/8) with a TRACE of gravel DRY	CL	3.5	Hnu = 0 α = 0 βγ = 40-50
	19823 1615 7-28	7					
	19824 1615 7-28	10					
9	19825 1618 7-28	10	18"	HARD grading downward to Very Stiff dark yellowish-brown clay (10YR, 4/6) DRY - Slightly Damp		4.5	Hnu = 0 α = 0 βγ = 40-50
	19826 1618 7-28	15					
10	19827 1618 7-28	17				3.0	
	19828 1640 7-28	10	18"	10.75' 10.75' STIFF Brown Clay (10 YR, 4/3) Slightly moist with moderate plasticity.	CL	1.5	Hnu = 0 α = 0 βγ = 40-50
11	54275 1640 7-28	14					
	54276 1640 7-28	17					
12	54277 1657 7-28	11	18"	12.5' 12.5' HARD Light Olive Brown Clay (2.5 Y, 5/6) with trace of gravel Damp to Dry		4.5	Hnu = 0 α = 0 βγ = 40-50
	54278 1657 7-28	15					
13	54279 1657 7-28	17					
	54280 1700 7-28	20	15"	HARD Clay - As Above Slightly Damp to Dry		4.0	Hnu = 0 α = 0 βγ = 40-50
14	54281 1700 7-28	20					
	54282 1700 7-28	19					
15							

NOTES: SEE Page 1

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402-11-86

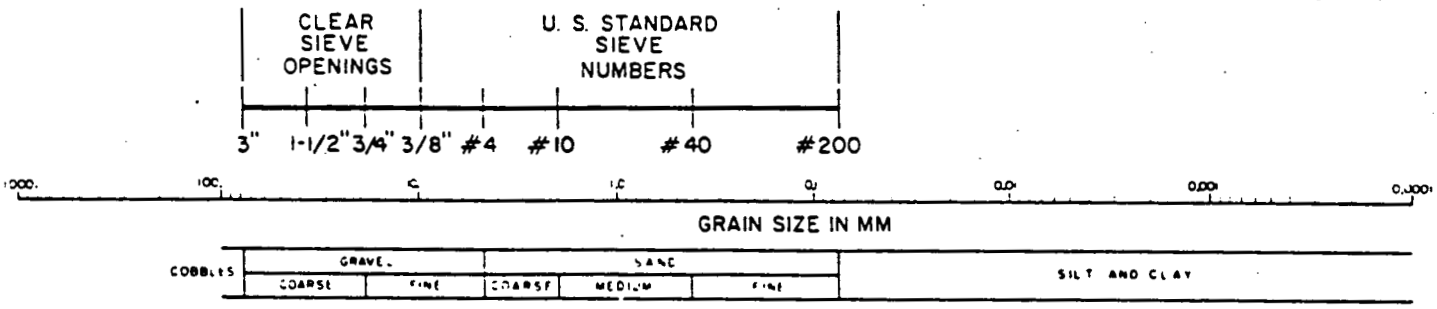
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602.03.07	PROJECT NAME: FMPC RI/FS (Facility Testing)		
BORING NUMBER: 1329	COORDINATES:	DATE: 7/28/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/28/89	
ENGINEER/GEOLOGIST: B. Dunning M. Jusacchi	Depth Date/Time	DATE COMPLETED: ~~7/29/89~~ 7/30/89	
DRILLING METHODS: Hollow Stem Auger - Split Spoon Sampling		PAGE 1 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN.	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	19807 1540 7-28	10	12"	Hard Brown Clay (10 YR, 5/3) Dry	CL	4.5	Hnu = 0 α = 0 γβ = 60-80 c.p.m.
	19808 1540 7-28	16					
1	19809 1540 7-28	10					
2	19810 1542 7-28	7	~~6~~ 7/28/89 ~~9~~ 16"	Very Stiff Dark Brown Clay (10 YR, 5/3) with a trace of gravel Dry	CL	3	Hnu = 0 α = 0 γβ = 60-80
	19811 1542 7-28	7					
3	19812 1542 7-28	9					
4	19813 1544 7-28	6	18"			2.5	Hnu = 0 α = 0 γβ = 80
	19814 1544 7-28	8					
	19815 1544 7-28	8					
5	19816 1546 7-28	7	12" ~~16~~ 7/28/89	Very Stiff Yellowish Brown Clay (10 YR 5/6) Slightly Damp	CL	2.75	Hnu = 0 α = 0 γβ = 60-80
	19817 1546 7-28	9					
	19818 1546 7-28	8					
6	19819 1555 7-28	8	~~6~~ 7/28/89 ~~12~~ 14"	Stiff Yellowish Brown Clay (10 YR, 5/6) Dry		1.75	Hnu = 0 α = 0 γβ = 40-80 c.p.m.
7	19820 1555 7-28	8					
	19821 1555 7-28	8					

NOTES:

Drilling Contractor: Pennsylvania Drilling
Driller: J. Saccini
Driller Helper: W. Felty

All Samples collected & Described via ASTM Standards Colors by Munsell Soil Color Chart.

Background Levels: Hnu = 0
α = 0
γβ = 60-160

000156

402-11-86

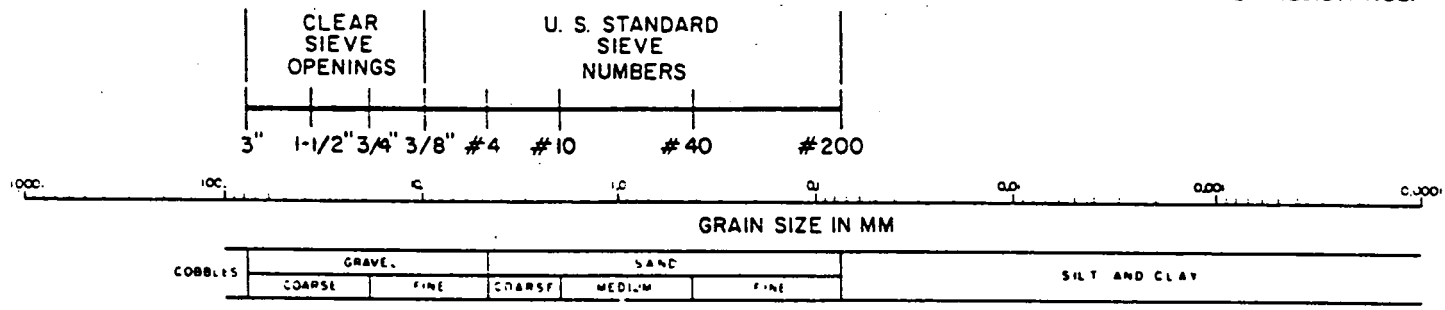
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

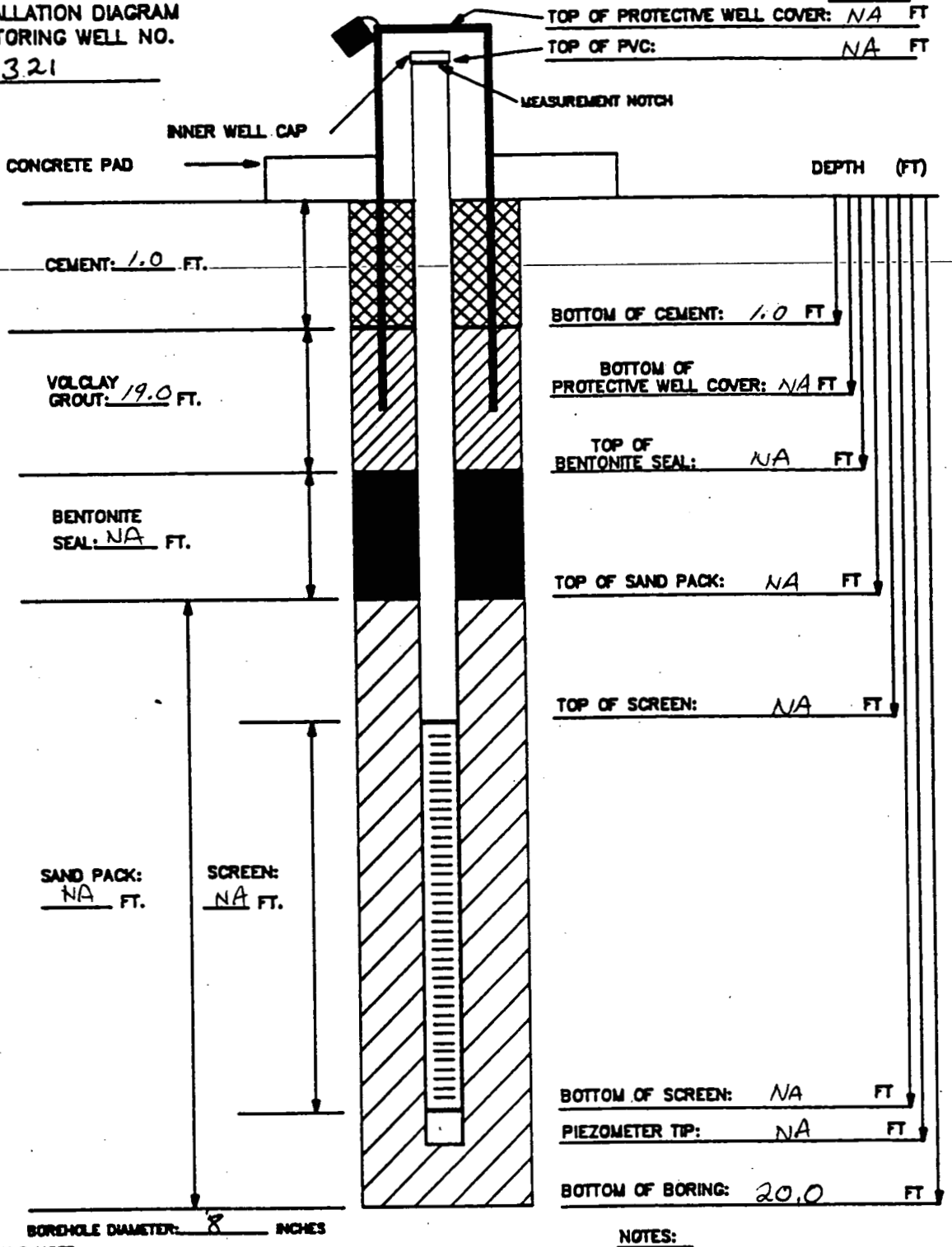
FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

INSTALLATION DATE: _____

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1321



MATERIALS USED:
SAND TYPE AND QUANITITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 3 sacks grout, 3 bags initiator
AMOUNT OF CEMENT: ½ (94#) sack
AMOUNT OF WATER USED: 50 gal
OTHER: NA

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 3.7.1

GEOLOGIST/ENGINEER: T. Sanzangelo

FERNALD RI/FS

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PIEZOMETER INSTALLATION SHEET

PROJECT NAME RI/FS Fernald FIELD ENG./GEO. T. Santangelo DATE 7/1/89
PROJECT NO. 602 3.7.1 CHECKED BY [illegible] DATE 7/3/89
BORING NO. 1321
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS: Voldag GROUT / ~~SLURRY~~ Cement	Top 0.0 TOP 1.0	Bottom 1.0 BOTTOM 20.0	TOP	BOTTOM
BENTONITE	TOP NA	BOTTOM NA	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Well was plugged 7-2-89 — No Water zone encountered

000159

409-11-86

5549

TEST EQUIPMENT LIST

TEST_____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Fernald		
BORING NUMBER: 1321	COORDINATES:		DATE: 7/1/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7/1/89
ENGINEER/GEOLOGIST: TSD	Depth	Date/Time	DATE COMPLETED: 7/1/89
DRILLING METHODS: Hollow Auger			PAGE 3 OF 5

DEPTH (ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 in.)	RECOVERY (in.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (tsf)	REMARKS
15.5	54123 1645 7-1	3	6	STIFF (2.5Y 4/4; olive brown Sandy Clay some gravel	CL	1.25	HNU = 0 ppm
16.0	54124 1645 7-1	4	4	SAA	CL	1.25	α = 0 cpm
				Med. Dense (5Y 5/1) gray clayey sand trace of gravel, moist	SC	—	βγ = 140-160 cpm
16.5	54125 1645 7-1	5	0	NR	—	—	
17.0	54126 1653 7-1	8	6	Med Stiff (10YR 5/1) gray sandy clay trace of gravel, high plasticity, moist.	CL	0.5	HNU = 0 ppm
17.5	54127 1653 7-1	11	6	SAA	CL	0.75	α = 0 cpm
18.0	54128 1653 7-1	12	6	SAA	CL	1.0	βγ = 140-160 cpm
18.5	54129 1705 7-1	8	6	SAA	CL	0.75	HNU = 0 ppm
19.0	54130 1705 7-1	6	6	Soft (10YR 5/1) gray silty clay some sand, high plasticity moist.	CL	0.5	α = 0 cpm
19.5	54131 1705 7-1	7	6	Soft (10YR 5/1) gray silty clay, some sand, high plasticity, moist. trace of gravel	CL	0.25	βγ = 160-180 cpm
20.0	54132 1705 7-1	7	6	SAA	CL	0.75	HNU = ppm
				BOTTOM of Boring & SAMPLING at 20.0 ft.			α = cpm
							βγ = cpm
							HNU = ppm
							α = cpm
							βγ = cpm

NOTES: CONTRACTOR: Penn Drill
Rig: B-53
Driller: J. Saccuni
Assistant: K. Felty

SAA = SAME AS ABOVE

Samples Collected as per ASTM Standard Penetration Test.
Colors Identified by Munsell color char.
Background Levels: HNU = 0 ppm
α = 0 cpm
βγ = 160-240 cpm
LEL = ppm
O_2 = %

5549

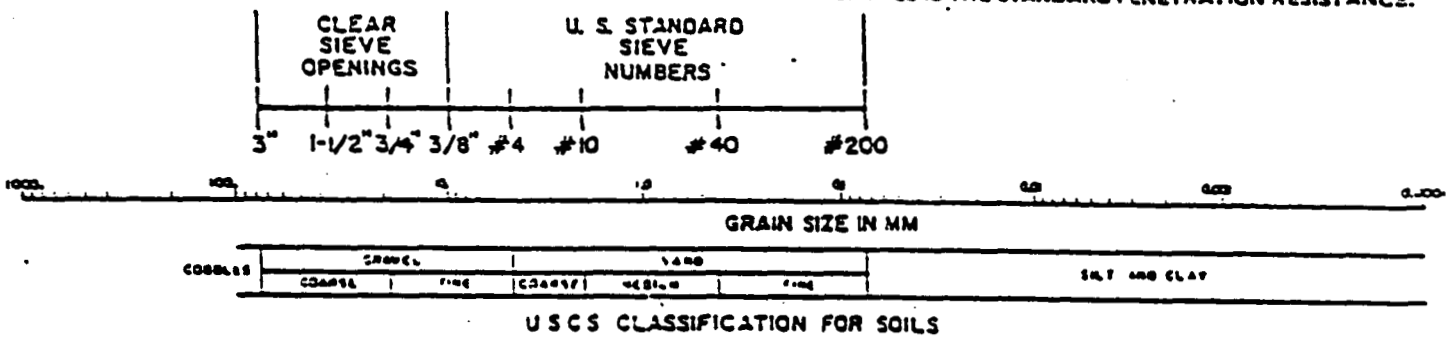
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTT

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Fernald	
BORING NUMBER: 1321	COORDINATES:	DATE: 7/1/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/1/89
ENGINEER/GEOLOGIST: TSD	Depth Date/Time	DATE COMPLETED: 7/1/89
DRILLING METHODS: Hollow Auger		PAGE 2 OF 5

DEPTH (ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 in.)	RECOVERY (in.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8.0	19646 1533 7-1	14	6	very stiff (2.5Y 4/4) olive brown (2.5Y 5/0) gray mottled, sandy clay, some gravel, med plasticity, moist	CL	2.75	HNU = 0 ppm; α = 0 cpm; βγ = 140-160 cpm
8.5	19647 1533 7-1	17	6	SAA	CL	3.0	
9.0	19648 1533 7-1	18	6	very stiff SAA	CL	2.75	
9.5	19649 1557 7-1	14	6	very stiff (10YR 4/1) dark gray silty clay some sand & gravel, med plasticity moist	CL	2.25	HNU = 0 ppm; α = 0 cpm; βγ = 100-180 cpm
10.0	19650 1557 7-1	13	6	stiff SAA	CL	1.5	
10.5	19651 1557 7-1	16	3	SAA	CL	1.5	
11.0	19652 1625 7-1	7	6	med stiff (2.5Y 5/4) light olive brown sandy clay, some gravel, med. plasticity, moist	CL	0.75	HNU = 0 ppm; α = 0 cpm; βγ = 160-190 cpm
11.5	54115 1625 7-1	10	1	SAA	CL	0.75	
12.0	54116 1625 7-1	12	0	NR	—	—	
12.5	54117 1629 7-1	20	6	stiff (5Y 4/1) dark gray sandy clay some gravel, med. plasticity, moist	CL	1.0	HNU = 0 ppm; α = 0 cpm; βγ = 140 cpm
13.0	54118 1629 7-1	11	0	NR	—	—	
13.5	54119 1629 7-1	8	0	NR	—	—	
14.0	54120 1634 7-1	7	6	med. stiff (10YR 4/1) dark gray, silty clay, some sand, trace of gravel, med. plasticity, moist	CL	1.0	HNU = 0 ppm; α = 0 cpm; βγ = 120 cpm
14.5	54121 1634 7-1	8	6	SAA	CL	1.0	
	54122 1634 7-1	11	6	SAA	CL	0.5	

NOTES: Contractor: Penn Drill
Rig. B-53
Driller: J Saccuni
Assistant: K. Felty

SAA = Same As Above

Samples collected as per ASTM standard penetration test.
Colors identified by Munsell color chart.
Background Levels: HNU = 0 ppm
α = 0 cpm
βγ = 160-240 cpm
LEL = ppm
O_2 = %

000163

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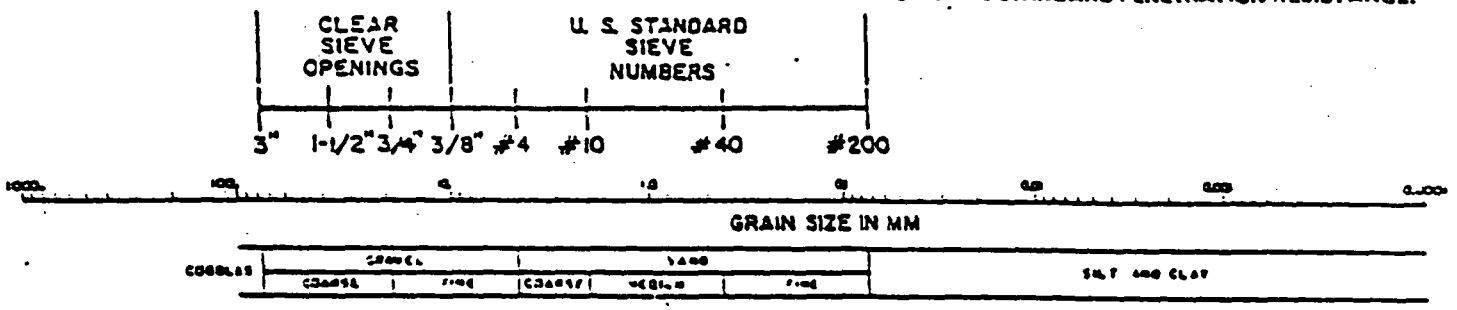
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
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FINE-GRAINED/HIGHLY ORGANIC SOIL.

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Fernald	
BORING NUMBER: 1321	COORDINATES:	DATE: 7/1/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/1/89
ENGINEER/GEOLOGIST: TSD	Depth Date/Time	DATE COMPLETED: 7/2/89
DRILLING METHODS: Hollow Auger		PAGE 1 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 in)	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	19631 1503 7-1	5	6	Hard (2.5Y 4/4) olive brown silty clay some sand, trace of gravel, med plasticity, moist	CL	74.0	HNU = 0 ppm α = 0 cpm Bγ = 140 cpm
1.0	19632 1503 7-1	5	5	SAA		3.0	
1.5	19633 1503 7-1	5	0	NR	—	—	
2.0	19634 1505 7-1	6	6	Stiff (2.5Y 4/4) olive brown silty clay some sand, med plasticity, moist	CL	1.75	HNU = 0 ppm α = 0 cpm Bγ = 140-160 cpm
2.5	19635 1505 7-1	8	3	very stiff SAA	CL	2.5	
3.0	19636 1505 7-1	9	0	NR	—	—	
3.5	19637 1507 7-1	6	3	Stiff SAA	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 140-160 cpm
4.0	19638 1507 7-1	4	0	NR	—	—	
4.5	19639 1507 7-1	5	0	NR	—	—	
5.0	19640 1510 7-1	4	6	Med stiff (2.5Y 5/4) light olive brown silty clay some sand & gravel, med. plasticity, moist	CL	0.75	HNU = 0 ppm α = 0 cpm Bγ = 160-180 cpm
5.5	19641 1510 7-1	4	6	Med stiff (2.5Y 5/4) grayish brown silty clay some sand, med. plasticity, moist.	CL	1.0	
6.0	19642 1510 7-1	4	1	med stiff (10YR 5/3) brown sandy clay some gravel, med plasticity, moist	CL	0.75	
6.5	19643 1530 7-1	8	6	Hard (10YR 4/6) dark yellowish brown silty clay, some sand, trace of gravel low plasticity, moist	CL	74.0	HNU = 0 ppm α = 0 cpm Bγ = 180-200 cpm
7.0	19644 1530 7-1	9	6	SAA	CL	74.0	
	19645 1530 7-1	12	2	SAA	CL	74.0	

NOTES: CONTRACTOR: Pear Drill
Rig: B-53
Driller: J. Saccuni
Assistant: K. Felty
SAA = Same As Above

SAMPLES collected as per ASTM Standard Penetration Test.
Colors identified by Munsell Color Ch
Background Levels: HNU = 0 ppm
α = 0 cpm
Bγ = 160-240 cpm
LEL = ppm
O_2 = - %

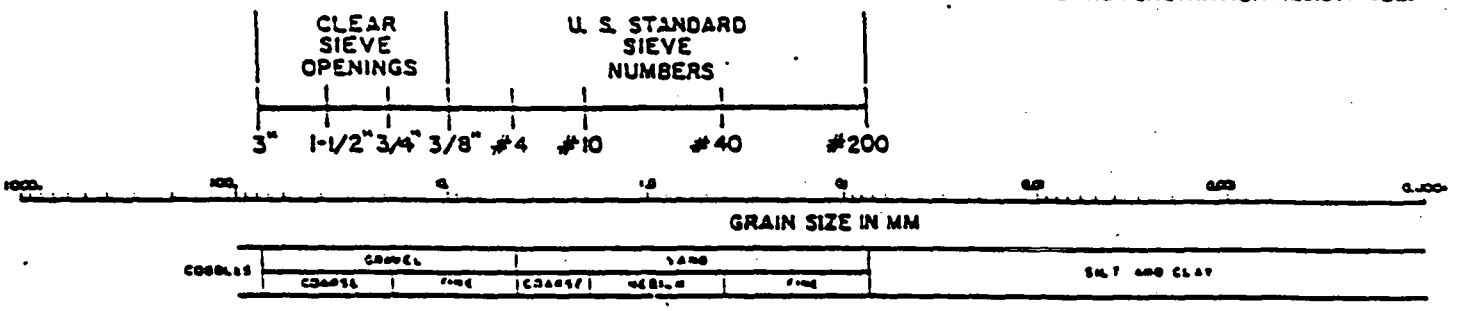
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602- 3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: See Page 1 of 5		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
13.0	54103 1350 W/120	10	6	SAA		4.5+	HNU= Bkg ppm
15.5	54104 1350 7-13	10	6 in.			2.25	α= Bkg cpm BΓ= Bkg cpm
16.0	54105 1350 7-13	10	6			1.75 TSF	
16.5	54106 1352 7-13	9	6	SAA moist med - high plast. less silt		3.25	HNU=Bkg ppm α= cpm
17.0	54107 1352 7-13	10	6 in.	less gravel, less sand → last 6 in.		2.0	BΓ= cpm
17.5	54108 1352 7-13	12	0			TSF	
18.0	54109 1359 7-13	15	6	SAA damp		1.5	HNU= ppm α= cpm
18.5	54110 1359 7-13	22	6 in			1.0	BΓ= cpm
19.0	54111 1359 7-13	20	6			1.5	
19.5	54112 1359 7-13	19	6	SAA some fossil fragments damp		1.75 TSF	HNU= ppm α= cpm BΓ= cpm
20.0				some areas of dry sand & gravel (yellowish brown 10yr5/4)			

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:
} See page 1 of 5

Background

	HNU=	ppm
Air	α=	cpm
Air	BΓ=	cpm
gnd	α=	cpm
gnd	BΓ=	cpm

NR= No Recovery, No Sample Taken

ACZ-11-88

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: See Page 1 of 5		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0	54103 1350 WM20	10	6	SAA		4.5+	HNU = Bkg ppm
15.5	54104 1350 7-13	10	6 IN.			2.25	α = Bkg cpm βγ = Bkg cpm
16.0	54105 1350 7-13	10	6			1.75 TSF	
16.5	54106 1352 7-13	9	6	SAA moist med - high plast. less silt		3.25	HNU = Bkg ppm α = cpm
17.0	54107 1352 7-13	10	6 IN.	less gravel, less sand → last 6 in.		2.0	βγ = cpm
17.5	54108 1352 7-13	12	0			TSF	
18.0	54109 1351 7-13	15	6	SAA damp		1.5	HNU = ppm α = cpm
18.5	54110 1351 7-13	22	6 IN			1.0	βγ = cpm
19.0	54111 1351 7-13	20	6			1.5	
19.5	54112 1351 7-13	19	6	SAA some fossil fragments damp		1.75 TSF	HNU = ppm α = cpm βγ = cpm
20.0				some areas of dry sand & gravel (yellowish brown 10yr5/4)			

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU #:
} See page 1 of 5

Background

	HNU =	ppm
Air	α =	cpm
Air	βγ =	cpm
gnd	α =	cpm
gnd	βγ =	cpm

NR = No Recovery, No Sample Taken

ACZ-11-86

CONSISTENCY OF COHESIVE SOILS

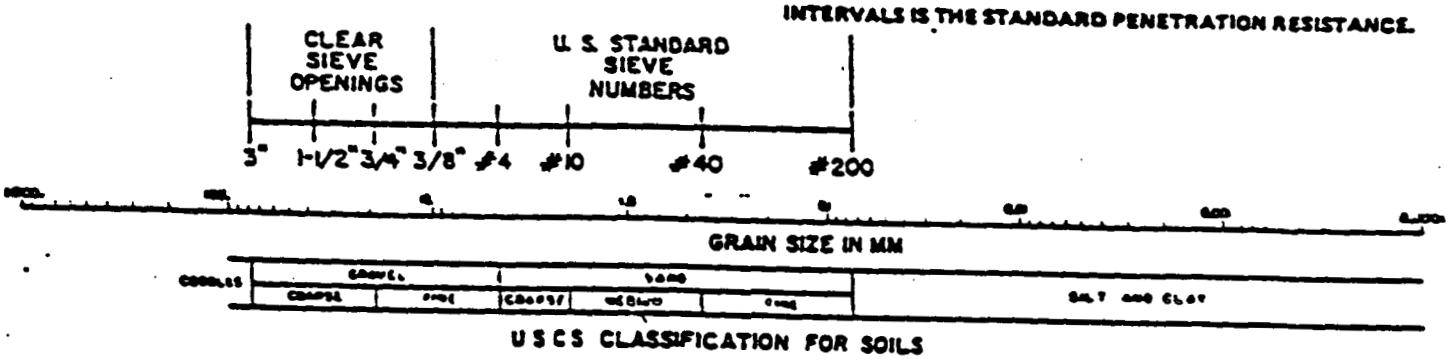
CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

000169

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

5549

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	1046 19624 7-13	13	~~18~~ UA 6	Hard, gray (10yr 5/1) clay. Trace sand. Some rock cuttings from above - silty. Slightly damp.		4.5+	HNU = Bkg α = Bδ = ↓
	1046 19625 7-13	18	~~19~~ UA 6	SAA		4.5+	
9	1046 19626 7-13	23	~~21~~ 6 OA	SAA		4.5+	
	1052 19627 7-13	18	~~6~~ UA 6	SAA		4.5+	HNU = Bkg α = Bδ = ↓
10	1052 19628 7-13	18	6			4.5+	
	1052 19629 7-13	21	6			4.5+	
11	1115 19630 7-13	~~6~~ UA 2	0	no recovery after 2 attempts due to boulder.			HNU = α = Bδ =
	54095 1113 ~~1463~~ UA 7-13	~~6~~ UA 23	0				
12	54096 1113 7-13	~~6~~ UA 16	0				
	54097 1140 7-13	7	6	Hard, gray (10yr 5/1) clay. Trace sand, some gravel. Some wood fragments. Some gravel from above rock. Damp.	~~4.5~~ UA	4.5	HNU = Bkg α = Bδ = ↓
13	54098 1140 7-13	10	6			3.5	
	54099 1140 7-13	12	6			2.5	
14	54100 1340 7-13	9	6	SAA except no wood. Gravel to .75 in. Damp.	4.5		HNU = Bkg α = Bδ = ↓
	54101 1340 7-13	9	6		3.75		
	54102 1340 7-13	10	2		3.0		

NOTES:

000170

FERNALD RI/FS

5549
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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6"-2")	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	0948 19609 7-13	10	6	Dk brown clay (10 yr 3/3) Some grass & roots damp			HNU: 0
	0948 19610 7-13	14	6	Brown gravelly clay (10yr 5/3). Some shell frags. silty, some roots. Gravel to .5 in. Dry			α: 0
1	0948 19611 7-13	14	1				Bγ: 350
2	0951 19612 7-13	12	6	Hard, yellowish brown (10yr 5/6) to gray 10yr 6/1) clay. Silty. Some gravel (to .5 in) Trace sand. Slightly damp.		4.5+	HNU: Bkg
	0951 19613 7-13	16	6			4.5+	α: ↓
	0951 19614 7-13	15	0				Bγ:
3	0955 19615 7-13	19	6	SAA	4.5+		HNU: Bkg
	0955 19616 7-13	23	6	Gravel in clay matrix (2 in) Matrix yellowish brown (10yr 5/6) Gravel angular 1.5 in.			α: ↓
4	0955 19617 7-13	27	6	Clay (10yr 5/6) yellowish brown w/clusters of gravel as above well graded gravel all thru clay coarse to fine some fine sand & silt. slightly damp	4.5+		Bγ:
	1021 19618 7-13	19	6	Hard, SAA some fossil material.	4.5+		HNU: Bkg
5	1021 19619 7-13	31	1				α: ↓
	1021 19620 7-13		0	Boulder in way, not able to sample 5.5 - 5.8			Bγ:
6	1043 19621 7-13	19	6	Hard yellowish brown (10yr 5/4) clay. Some fine gravel, trace sand. Slightly damp	4.5+		HNU: Bkg
	1043 19622 7-13	22	6	SAA, no sand & gravel gradually changing to gray (10yr 5/1) clay. Trace sand. Slightly damp.	4.5+		α: ↓
7	1043 19623 7-13	25	6		4.5+		Bγ:

NOTES: CONTRACTOR: PENNDRILL
RIG: Mobile
DRILLER: J. Saccani
ASSISTANT: K. Felty

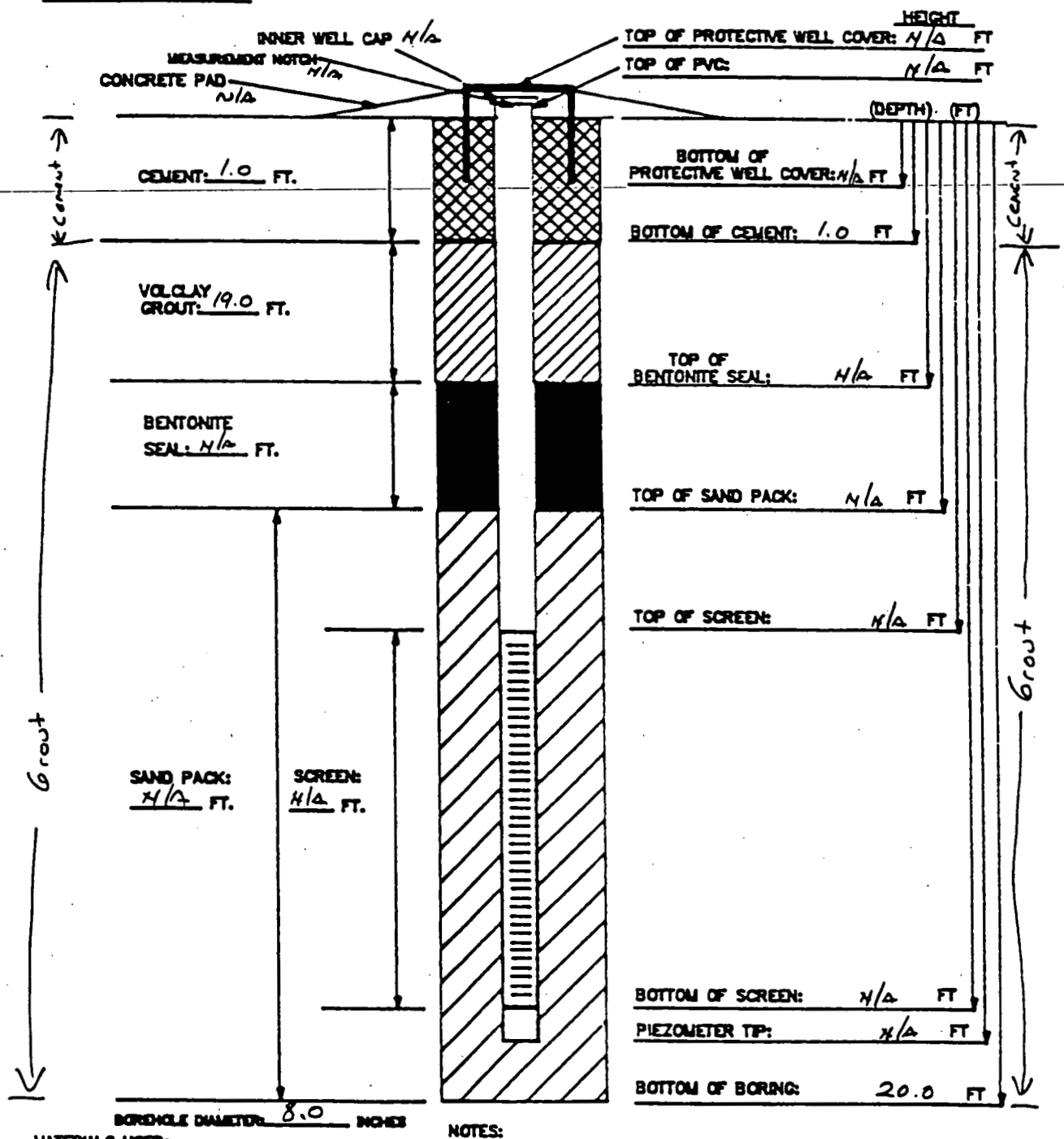
SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bγ : 350-510 CPM
LEL: 0% LA
O_2: 20.6%

000171

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1320

INSTALLATION DATE: 7/14/89



MATERIALS USED:
SAND TYPE AND QUANTITY: N/A
BENTONITE PELLETS (5-GALLON BUCKETS): N/A
BAGS OF VOLCLAY GROUT:
AMOUNT OF CEMENT:
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESES INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: ~~L. Sinfield~~

WAH QA/QC 7-16-89

L. Adams

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. ~~L. Sinfield~~ L. Adams
DATE 7/14/89
PROJECT NO. 602 3.7.1
CHECKED BY W.A. Hertel
DATE 7/16/89
BORING NO. 1320
PIEZOMETER NO. N/A
DATE OF INSTALLATION (Grouting): 7/14/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE N/A
DIAMETER OF PERFORATED SECTION N/A
PERFORATION TYPE: N/A
SLOTS ☐ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS N/A
TOTAL PERFORATED AREA N/A
RISER PIPE MATERIAL N/A
RISER PIPE DIAMETERS: N/A
O.D. N/A I.D. N/A
LENGTH OF PIPE SECTIONS N/A
JOINING METHOD N/A

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A
PROTECTIVE PIPE O.D. N/A
OTHER PROTECTION Cement Plug 1.0-0.0 ft

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	N/A		N/A	
GROUND SURFACE	0.0 ft		ft	
BOTTOM OF PROTECTIVE PIPE	N/A		N/A	
BOREHOLE FILL MATERIALS:	Cement: 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 20.0 ft	TOP	BOTTOM
BENTONITE	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
SAND	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
GRAVEL	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PIEZOMETER TIP	N/A		N/A	
BOTTOM OF BOREHOLE	20.0 ft		ft	
GWL AFTER INSTALLATION	Dry - No Ground Water Encountered		N/A	

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐ N/A
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐ N/A

REMARKS Borehole grouted from 20.0 ft to 1.0 ft depth.
Cement plug installed from 1.0 ft to 0.0 ft depth
Borehole was plugged and Abandoned

000173

TEST EQUIPMENT LIST

TEST_____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	(FACILITIES TESTING PROGRAM)
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. SINFIELD	Depth Date/Time	DATE COMPLETED: 7/13/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1350 54103 7-13	10	6	SAA		4.5+	HNU: BKG α: BG: ↓
	1350 54104 7-13	10	6			2.25	
16	1350 54105 7-13	10	6			1.75	
	1352 54106 7-13	9	6	Very stiff, gray (10yr 5/1) clay. Trace gravel, sand, silt. Med. to high plasticity. Moist.	CL	3.25	HNU: BKG α: BG: ↓
17	1352 54107 7-13	10	6			2.0	
	1352 54108 7-13	12	0	no recovery			
18	1359 54109 7-13	15	6	SAA, damp.		1.5	HNU: BKG α: BG: ↓
	1359 54110 7-13	22	6			1.0	
19	1359 54111 7-13	20	6			1.5	
	1359 54112 7-13	19	6	SAA, some fossil fragments, damp. some areas of dry sand and gravel (yellowish brown (10yr 3/4)).		1.75	HNU: BKG α: BG: ↓
20				Total depth of borehole 20.0 Ft.			

NOTES: SAA = SAME AS ABOVE

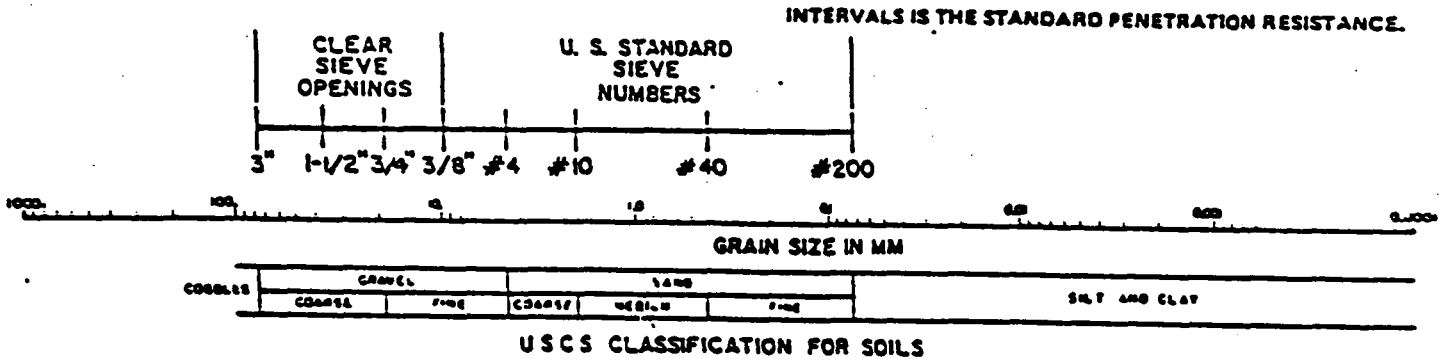
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT.

FERNALD RI/FS

0549

1st Review		
2nd Review		
Hard Copy Verification		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. ADAMS	Depth Date/Time	DATE COMPLETED: 7/13/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	1046 19624 7-13	13	6	Hard, gray (10yr 5/1) clay. ~~Trace~~ LA ~~Sandy~~ LA Silty. Some rock cuttings from above boulder. Trace sand. Slightly damp.		4.5+	HNU = BKg α : Bδ : ↓
	1046 19625 7-13	18	6			4.5+	
9	1046 19626 7-13	23	6			4.5+	
	1052 19627 7-13	18	6	SAA		4.5+	HNU = BKg α : Bδ : ↓
10	1052 19628 7-13	18	6			4.5+	
	1052 19629 7-13	21	6			4.5+	
11	1115 19630 7-13	26	0	no recovery after 2 attempts.	N/A	N/A	HNU α Bδ :
	1115 54095 7-13	23	0				
12	1115 54096 7-13	16	0				
	1140 54097 7-13	7	6	Hard, ~~gray~~ ~~very stiff~~ (10yr 5/1) Clay. Some gravel, wood fragments. Damp. Trace sand. Some rock cuttings from above boulder still present.		4.5	HNU = BKg α : Bδ : ↓
13	1140 54098 7-13	10	6			3.5	
	1140 54099 7-13	12	6			2.5	
14	1340 54100 7-13	9	6	SAA, except no wood frags. present. Gravel to 0.75 in.		4.5	HNU = BKg α : Bδ : ↓
	1340 54101 7-13	9	6			3.75	
	1340 54102 7-13	10	2			3.0	

NOTES:

SAA = SAME AS ABOVE

000177

FERNALD RI/FS

5549

Date	7/19/89			
Initial	CJM			
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS (FACILITIES TESTING PROGRAM)	
BORING NUMBER: 1320	COORDINATES:	DATE: 7/13/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/13/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/13/89 7/14
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	0948 19609 7-13	10	6	Hard, dark brown clay (10yr 3/3) Some surface grass + roots. Damp.	CL	4.5	HNU = 0 α = 0 βγ = 350
1	0948 19610 7-13	14	6	Hard, brown (10yr 5/3) gravelly, silty clay. Some shell fragments and roots. Gravel to 0.5 in. Dry.	CL		
	0948 19611 7-13	14	1				
2	0951 19612 7-13	12	6	Hard, yellowish brown (10yr 5/6) to gray (10yr 5/6) silty clay. Some gravel (to 0.5 in.) Trace sand. Slightly damp.	CL	4.5+	HNU = BKg α = ↓ βγ =
	0951 19613 7-13	16	6			4.5+	
	0951 19614 7-13	15	0				
3	0955 19615 7-13	19	6	* SAA	CL	4.5+	HNU = BKg α = ↓ βγ =
	0955 19616 7-13	23	6	Hard, yellowish brown (10yr 5/6) clayey gravel color is clay matrix. Gravel is angular to 1.5 in.	GC	N/A	
4	0955 19617 7-13	27	6			4.5+	
	1021 19618 7-13	19	6	Hard, yellowish brown clay (10yr 5/6) with clusters well graded gravel throughout. Some fine grained sand + silt. Slightly damp.	CL	4.5+	HNU = BKg α = ↓ βγ =
5	1021 19619 7-13	31	1	SAA, some fossil fragments present.	CL		
	1021 19620 7-13		0	Auger + sample spoon hit boulder unable to sample 5.5'-5.8'.	N/A		
6	1043 19621 7-13	19	6	Hard, yellowish brown (10yr 5/4) clay. Some fine gravel, trace sand. Slightly damp.	CL	4.5+	HNU = BKg α = ↓ βγ =
	1043 19622 7-13	22	6	Hard, yellowish brown (10yr 5/4) to gray (10yr 5/1) clay. Trace sand. Slightly damp.	CL	4.5+	
7	1043 19623 7-13	25	6			4.5+	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile
DRILLER: J. Saccani
ASSISTANT: K. Felty
βγ Detector: ASI #2
α Detector: ASI #4
HNU: Hnzco HH 18

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
βγ = 350-370 CPM

LEL/O2: LEL = 0 %
O2 = 20.7 %

000178

* SAA = Same as above

5549

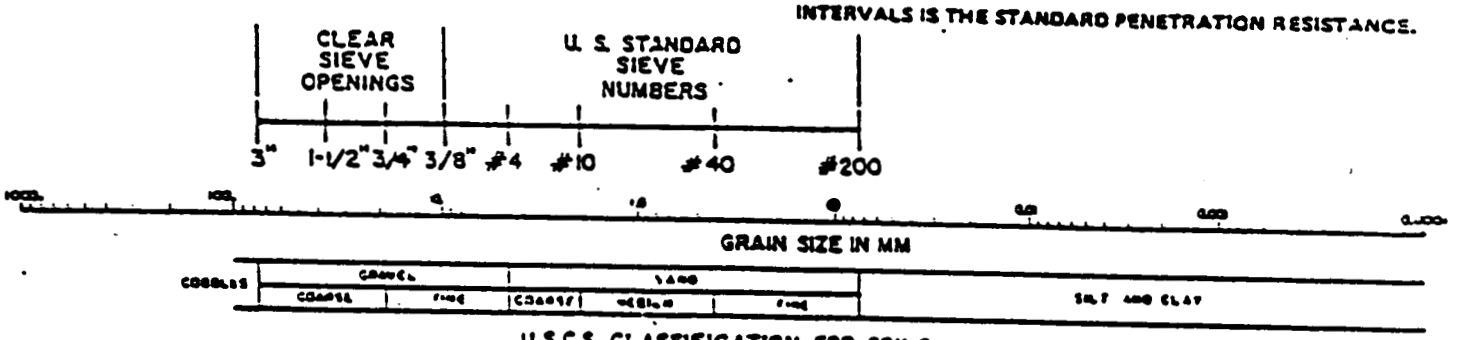
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

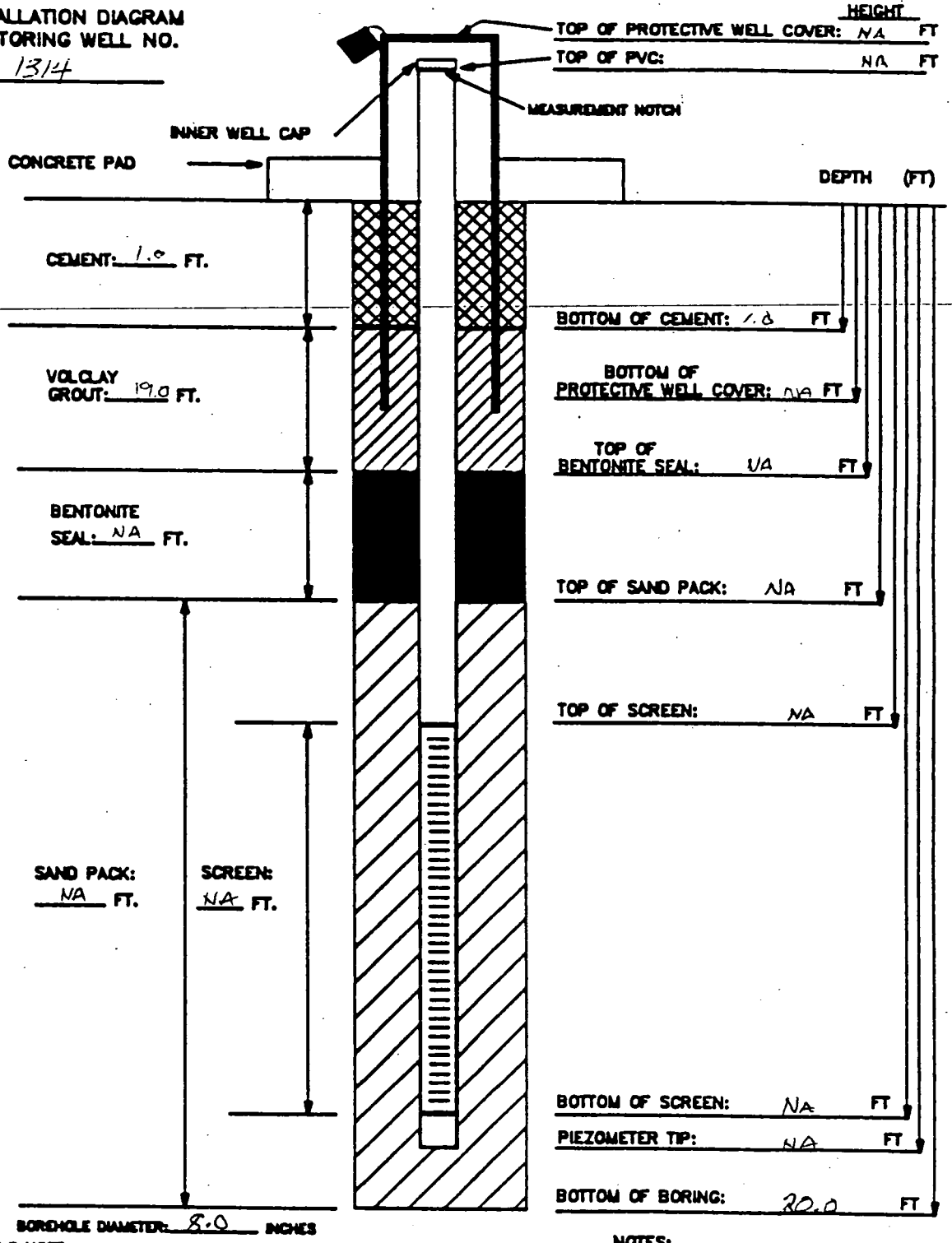
FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1314

INSTALLATION DATE: 7-16-87



MATERIALS USED:

SAND TYPE AND QUANTITY: 10/20 sand – NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: ~~NA~~ CH 7/4/89 2 (50#) sacks, 2 bags [illegible]
AMOUNT OF CEMENT: 1/2 (94#) sack
AMOUNT OF WATER USED: 40 gal
OTHER: 5.0 FT protective casing – NA

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

5549

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1297	COORDINATES:	DATE: 7/28/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/28/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/29/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	NA 7-28	—	NA	Asphalt Cement	NA	NA	HNU = 0 ppm α = 0 cpm Bγ = 450-460 cpm
	NA 7-28	—	NA	Cement	NA	NA	
1	19105 7-28 1120	2	6	Loose (10y-5/4) yellowish brown clayey gravel some sand very moist due to surface water Very stiff (10y-5/4) yellowish brown sandy clay trace fine gravel, low plasticity, moist	GC CL	NA 2.75	
1	19106 7-28 1120	3	6	Stiff (5y-3/1) very dark gray clay, trace fine gravel medium plasticity moist Very stiff (10y-5/4) dark yellowish brown silty clay, trace sand & fine gravel, low plasticity, moist	CL CL	1.75 2.0	HNU = 0 ppm α = 0 cpm Bγ = 450-460 cpm
2	19107 7-28 1120	4	0	NR	NA	NA	
	19108 7-28 1120	6	0	NR	NA	NA	
3	19109 7-28 1125	10	3	Very stiff (10y-5/4) yellowish brown sandy clay, some med. gravel, med plasticity, moist	CL	2.75	HNU = 0 ppm α = 0 cpm Bγ = 700-750 cpm
	19110 7-28 1125	10	0	NR	NA	NA	
4	19111 7-28 1125	13	0	NR	NA	NA	
	19112 7-28 1430	4	6	Very stiff (2.5y 5/4) light olive brown silty clay, some sand, trace fine to med gravel, low plasticity, moist	CL	3.0	HNU = 0 ppm α = 5 cpm Bγ = 950-1000 cpm
5	19113 7-28 1430	5	2	Very stiff SAA	CL	3.0	
	19114 7-28 1430	6	0	NR	NA	NA	
6	19115 7-28 1445	12	6	Stiff (2.5y 4/4) olive brown clay trace sand & fine gravel, low plasticity, moist	CL	1.25	HNU = 0 ppm α = 0 cpm Bγ = 900-930 cpm
	19116 7-28 1445	12	6	Stiff (2.5y 4/4) olive brown silty clay, trace sand & fine to med gravel, low plasticity, moist	CL	1.5	
7	19117 7-28 1445	10	0	NR	NA	NA	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 45-C
DRILLER: Harold Andrews
ASSISTANT: Charlie Elkowitz

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART.
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = [illegible] CPM
LEL = 0% ~~PPM~~ CH 7/27/87
O_2 = [illegible] %

SAA = Same As Above
NR = No Recovery

LELO2:

1-NU-00199

5549

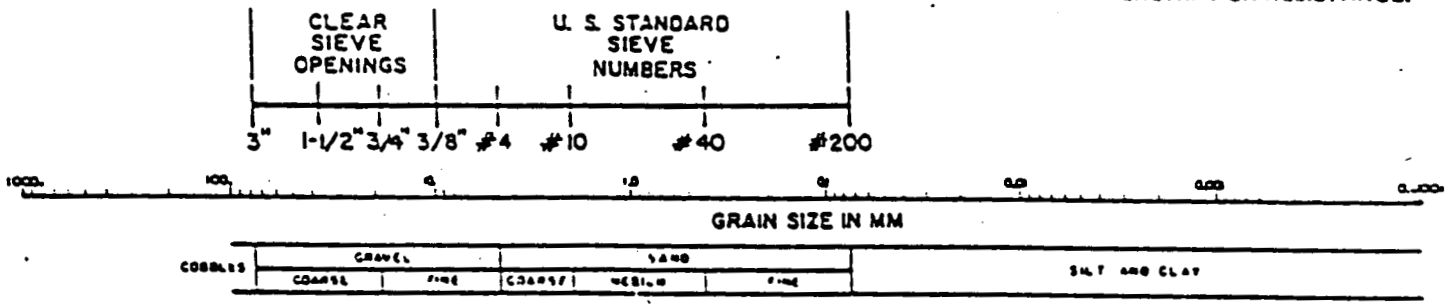
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1297	COORDINATES:	DATE: 7/28/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/28/89
ENGINEER/GEOLOGIST: C Grube	Depth Date/Time	DATE COMPLETED: 7/29/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19113 7-28 1455	27	6	Very stiff (2.5y 5/4) [illegible] clay some sand, trace fine gravel to med gravel low plasticity, moist	CL	2.25	HNU = 0 ppm α = 5-10 cpm Bγ = 900-950 cpm
	19119 7-28 1455	32	6	Very stiff SAA	CL	3.5	
9	19120 7-28 1455	31	6	Hard (2.5y 4/4) olive brown silty clay trace sand & fine to med gravel low plasticity moist	CL	4.5	
	19121 1600 7-28	5	6	Very stiff (5y 4/1) Dark gray silty clay trace sand & fine to med gravel, low plasticity, moist	CL	3.75	HNU = 0 ppm α = 5-10 cpm Bγ = 950-900 cpm
10	19122 1600 7-28	0	0	NR	NA	NA	
	19123 1600 7-28	10	0	NR	NA	NA	
11	19124 1601 7-28	15	6	Very stiff (5y 4/1) Dark gray silty clay, trace of sand & fine to med gravel, low plasticity, moist	CL	2.75	HNU = 0 ppm α = 5 cpm Bγ = 750-800 cpm
	53635 1605 7-28	12	6	HARD SAA	CL	4.0	
12	53636 1605 7-28	13	6	HARD SAA	CL	4.5	
	53637 1615 7-28	19	6	HARD SAA	CL	4.25	HNU = 0 ppm α = 0 cpm Bγ = 750-800 cpm
13	53638 1615 7-28	16	6	Dense (5y 4/1) Dark gray [illegible] sand, trace clay, moist. Very stiff (5y 4/1) Dark gray silty clay, some sand, trace fine to med gravel, low plasticity, moist	SP CL	NA 3.25	
	53639 1615 7-28	15	6	SAA	CL	3.25	
14	53640 0915 7-29	5	5	Very stiff SAA	CL	3.0	HNU = 0 ppm α = 0 cpm Bγ = 800-820 cpm
	53641 0915 7-29	5	0	NR	NA	NA	
	53642 0915 7-29	6	0	NR	NA	NA	

NOTES:

SAA = Same As Above
NR = No Recovery

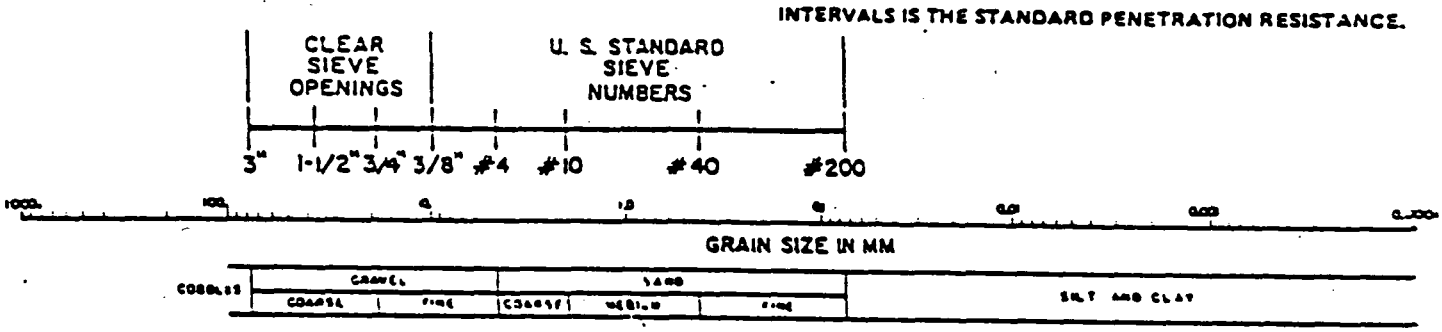
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1297	COORDINATES:	DATE: 7/27/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/23/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/29/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53643 0925 7-29	15	6	Med Stiff (5Y 4/1) Dark gray silty clay trace sand & fine to coarse gravel in a plastic matrix, moist	CI	.75	HNU = 0 ppm α = 5 cpm Bβ = 750-800 cpm
16	53644 0925 7-29	13	6	Stiff SAA	CI	1.5	
	53645 0925 7-29	17	0	NR	NA	NA	
17	53646 0945 7-29	19	6	Stiff SAA	CI	2.0	HNU = 0 ppm α = 5-10 cpm Bβ = 800-820 cpm
	53647 0945 7-29	20	6	Stiff. SAA	CI	1.0	
18	53648 0945 7-29	22	4	Stiff SAA	CI	2.0	
	53649 07-29 0955	13	6	Med Stiff SAA	CI	.75	HNU = 0 ppm α = 0 cpm Bβ = 950-970 cpm
19	53650 07-29 0955	14	6	Med Stiff SAA	CI	.75	
	53651 07-29 0955	18	6	Stiff SAA	CI	1.0	
20	53652 07-29 0955	22	6	Stiff SAA	CI	1.5	HNU = 0 ppm α = 0 cpm Bβ = 950-970 cpm
				Bottom of Boring & Sampling at 20.0 FT			

NOTES:

SAA = Same As Above
NR = No Recovery

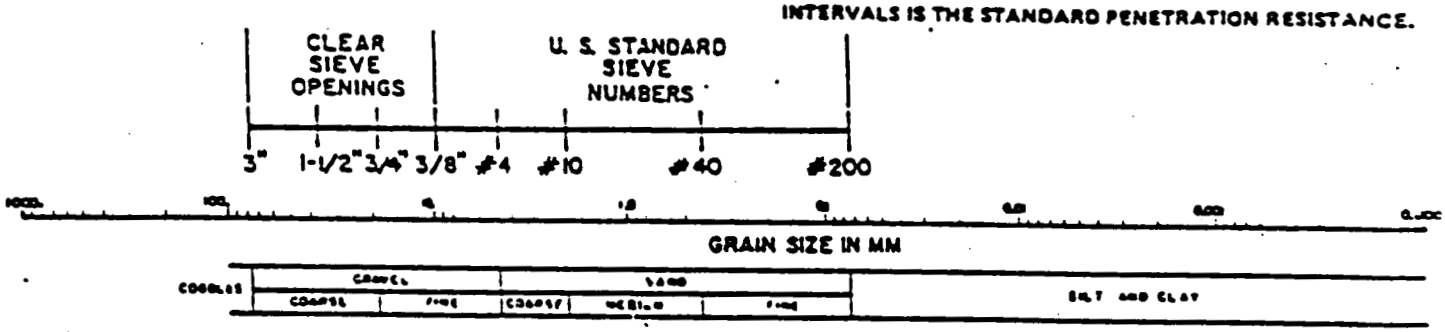
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. [illegible] DATE 7/29/89
PROJECT NO. 602 3.7.1 CHECKED BY _____ DATE _____
BORING NO. 1397
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger	TYPE OF BIT 8.0 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM – TO –	SIZE NA FROM – TO –
FLUID NA FROM – TO –	SIZE NA FROM – TO –

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS: Volclay GROUT / ~~SLURRY~~ Cement	TOP 0.0 TOP 1.0	BOTTOM 1.0 BOTTOM 20.0	TOP	BOTTOM
BENTONITE	TOP NA	BOTTOM NA	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS No water bearing zone encountered - boring was plugged with Volclay grout and capped with cement

4C9-[illegible]-86

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

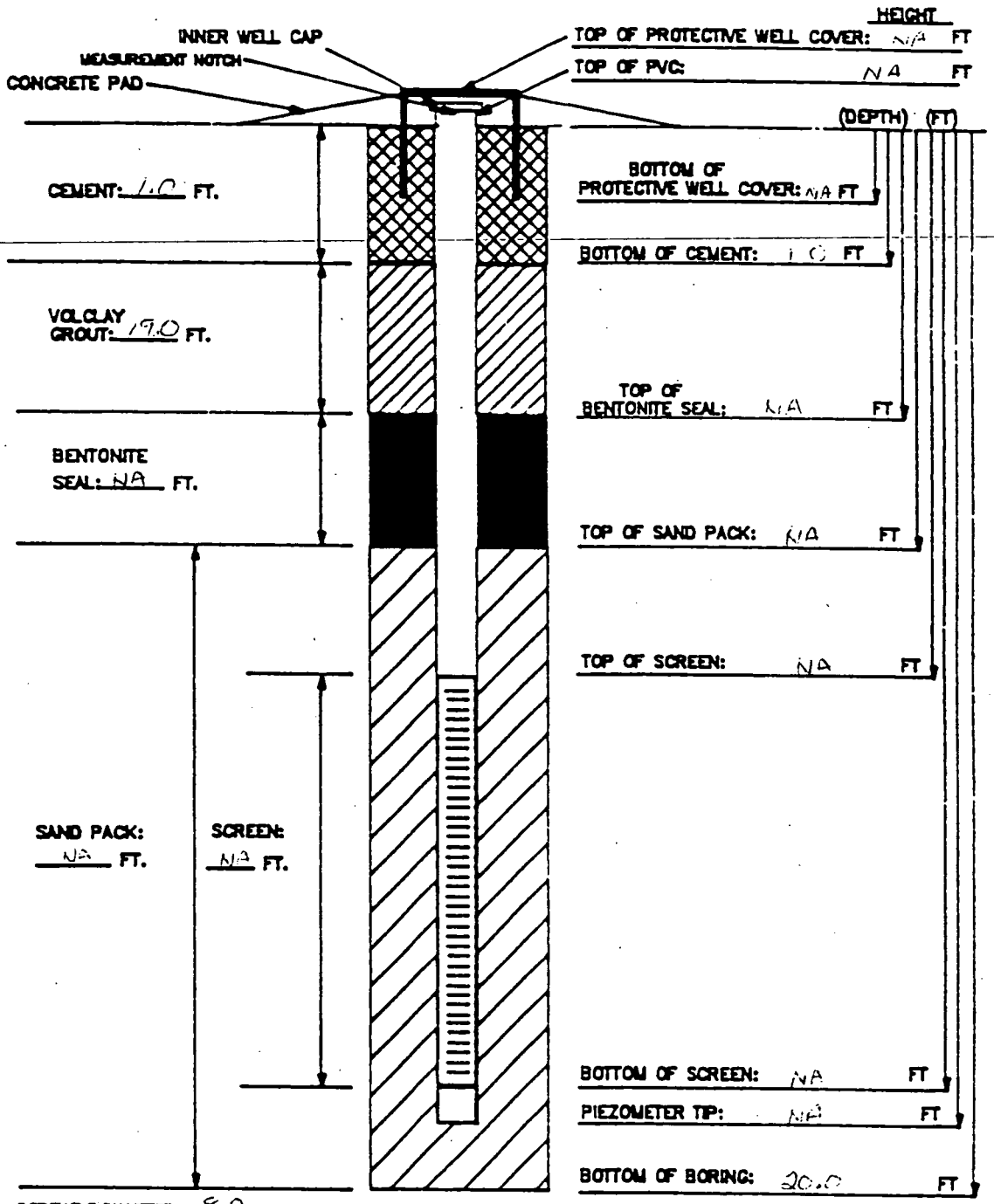
NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1297

INSTALLATION DATE: 7/29/92



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 2 (50 #) sacks - 2 bag inventory
AMOUNT OF CEMENT: ½ (94 #) sack
AMOUNT OF WATER USED: 50 gal
OTHER: NA

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESES INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 002 3.7.1 GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1298	COORDINATES:	DATE: 7/16/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/16/89	
ENGINEER/GEOLOGIST: L. Adams / C. Grob	Depth Date/Time	DATE COMPLETED: 7/18/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	19125 ~~0409~~ 7-16	10	6	Hard, brown to dark yellowish brown (10yr 5/3 to 4/6) mottled silty clay. Dk. brown spotty staining. Surface gravel + surface coal present. Some sand + gravel present. Gravel to 1.0 in. Slightly damp.	CL	4.5+	HNU: Bkg
	19126 ~~0409~~ 7-16	10	6			4.0	α: ↓
	19127 ~~0409~~ 7-16	11	0	no recovery			Bγ:
2	19128 1616 7-16	14	6	SAA, slightly more sand present.	CL	2.5	HNU = 1 ppm
	19129 1616 7-16	15	6			4.5+	α: Bkg
	19130 1616 7-16	16	3				Bγ: 140 cpm
3	19131 1619 7-16	14	6	Hard, yellowish brown (10yr 5/4) silty clay. Some gravel. Trace sand. Slightly damp.	CL	4.5+	HNU: Bkg
	19132 1619 7-16	18	6			4.5+	α:
4	19133 1619 7-16	18	6			4.5	Bγ: ↓
5	19134 1650 7-16	4	6	Very stiff to hard, brown (10yr 5/3) silty clay. Trace fine gravel. Low plasticity. Slightly damp.	CL	3.0	HNU: Bkg
	19135 1650 7-16	6	6			4.0	α:
	19136 1650 7-16	8	6			4.5+	Bγ: ↓
6	19137 1652 1655	8	6	Very stiff, brown (10yr 5/3) to dark yellowish brown (10yr 4/6) silty clay. Some gravel present. Some dk. brown spotty staining. Low plasticity. Damp.	CL	3.5	HNU: Bkg
7	19138 1652 1655	12	6			3.0	α:
	19139 1652 1655	12	6			3.25	Bγ: ↓

NOTES: CONTRACTOR: PENNDRILL
RIG: Model 45-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
α probe # 6
β probe # 10

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bγ : 80-100 CPM
LEL/O2: LEL: 0% ~~PPM~~ 7/17/89
O2: 20.6 %

000190

5549

Initials	Date
1st Key In	6.14.89
2nd Key In	
Hard Copy	

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1298	COORDINATES:	DATE: 7/17/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/16/89
ENGINEER/GEOLOGIST: C Lorube	Depth Date/Time	DATE COMPLETED: 7/18/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53663 1040	8	6	Med. Stiff (10yr, 5/4) yellowish brown silty clay, some sand, trace fine to med gravel low plasticity, moist	CL	1.0	HNU = 0 α = 0 Bβ = 50-60 *
16	53664 1040	10	2	Med Stiff SAA	CL	.75	
	53665 1040	14	0	NR	NA	NA	
17	53666 1046	7	0	NR	NA	NA	HNU = α = Bβ = } NA
	53667 1046	18	0	NR	NA	NA	
	53668 1046	29	0	NR	NA	NA	
18	53669 1056	37	6	Med Stiff (5y, 4/1) Dark gray silty clay, trace sand & fine gravel med plasticity, moist	CL	.5	HNU = 0 α = 0 Bβ = 70-80
19	53670 1056	50/4	6	Med Stiff SAA	CL	.75	
	53671 1056		0	NR	NA	NA	
20	53672 1056		0	NR	NA	NA	HNU = α = Bβ = } NA
				Bottom of Boring & Sampling at 20 ft			

NOTES:

SAA = SAME AS ABOVE

NR = No Recovery

* ALL HNU READINGS IN PPM
ALL α,Bβ readings in cpm

000191

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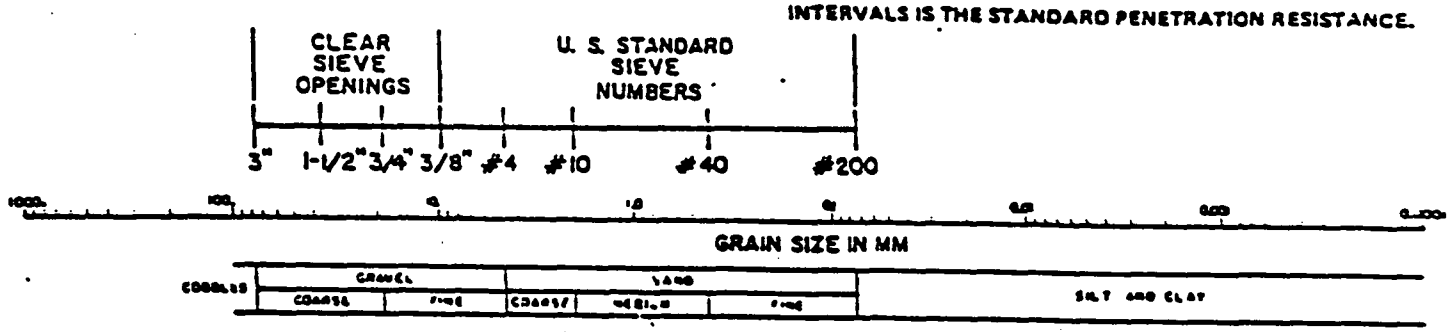
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

5549 4 of 5

Initial	Date

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. CGrube DATE 7/18/89
PROJECT NO. 602 3.7 CHECKED BY WA Herdel DATE 7/20/89
BORING NO. 1298
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger	TYPE OF BIT 8.0 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS:	Top 0.0	Bottom 1.0		
Volclay GROUT / ~~SLURRY~~ cement	TOP 1.0	BOTTOM 20.0	TOP	BOTTOM
BENTONITE	TOP — NA	BOTTOM —	TOP	BOTTOM
SAND	TOP — NA	BOTTOM —	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS No water bearing zone encountered — well plugged on 7/18/89 with volclay grout from 20.0 FT to 1.0 FT, and cement from 1.0 FT to 0.0 FT

000193

4C9-···36

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

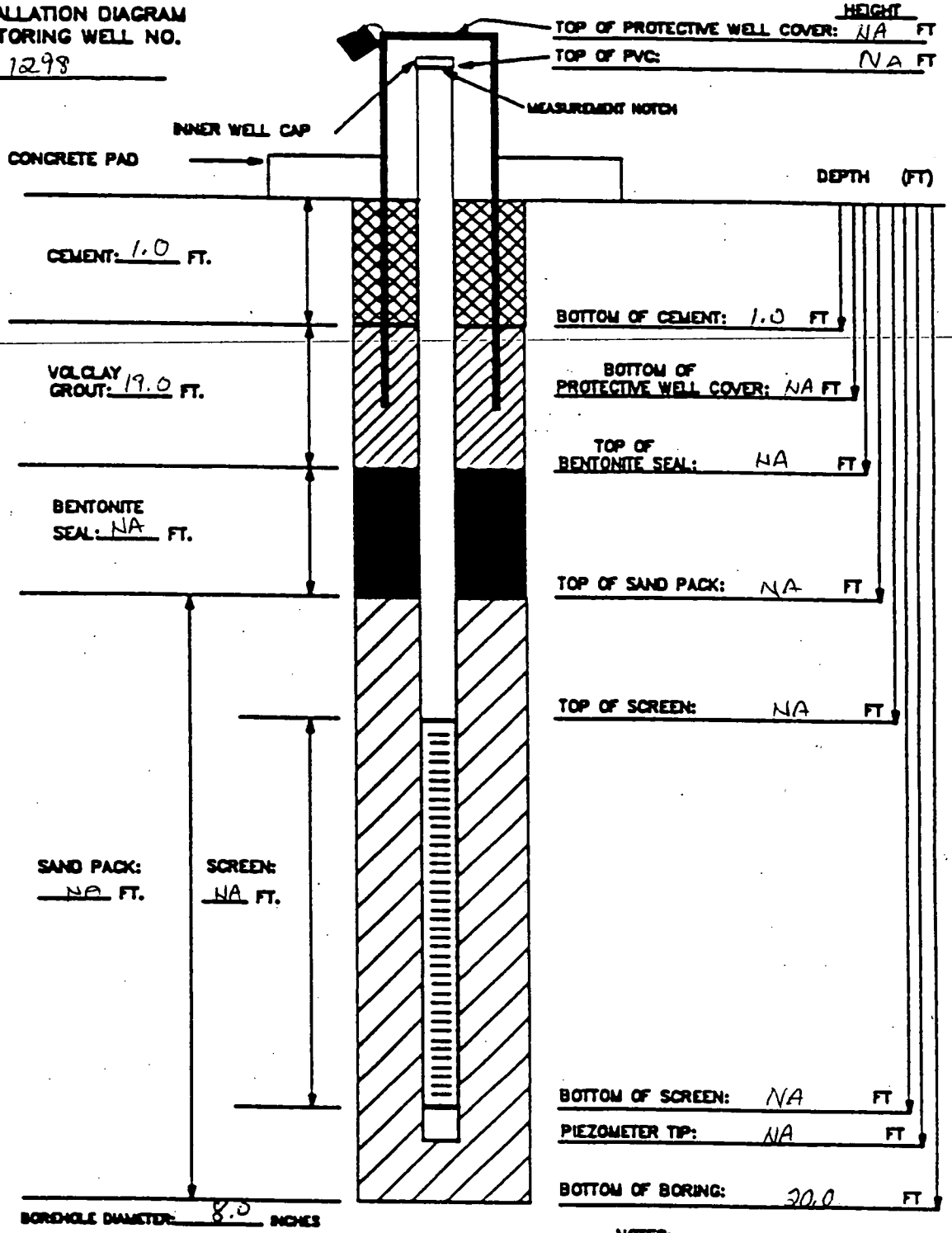
NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1298

INSTALLATION DATE: 7-18-89



MATERIALS USED:
SAND TYPE AND QUANTITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 2 (50#) sacks, 2 bags on hand
AMOUNT OF CEMENT: 1/2 sack (94#)
AMOUNT OF WATER USED: 40 gal
OTHER: NA

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7 GEOLOGIST/ENGINEER: C. Grube

QA/QC WAH 7-20-89

FERNALD RI/FS

5549

	Date	7-26-89		
	Initial	JH		
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1299	COORDINATES:	DATE: 7/16/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/16/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19147 0930 7-16	5	6	Hard, mottled brown (10yr 4/4) to (10yr 3/3) to yellowish brown silty clay. Surface grass, roots. Trace fine gravel. Damp.	CL	4.5+	HNU: Bkg α: Bβ: ↓
	19148 0930 7-16	6	0	no recovery			
1	19149 0930 7-16	6	0	no recovery	N/A		
	19150 0933 7-16	5	6	Very stiff, SAA		3.5	HNU: Bkg α: Bβ: ↓
2	19151 0933 7-16	5	2	Very stiff, brown (10yr 5/3) to dark yellowish brown (10yr 4/6) silty clay. Some dark brown spotty staining, low to med. plasticity, damp.	CL	2.0	
	19152 0933 7-16	7	0	no recovery	N/A		
3	19153 0935 7-16	3	6	Soft to stiff, SAA but with some gray (10yr 5/1), and some roots. High plasticity, very moist.		>.25	HNU: Bkg α: Bβ: ↓
	19154 0935 7-16	4	3	SAA, slightly damp, low plasticity.	CL	1.5	
4	19155 0935 7-16	6	0	no recovery	N/A		
	19156 0946 7-16	4	6	Hard, brown (10yr 5/3) silty clay. Some dk. brown spotty staining. Some gravel (to 0.5 in.) damp. low plasticity.		4.5+	HNU: Bkg α: Bβ: ↓
5	19157 0946 7-16	10	6		CL	4.5+	
	19158 0946 7-16	11	3			4.5+	
6	19159 0950 7-16	14	6	Very stiff & very dark grayish brown (10yr 3/2) silty clay. Some roots. Trace sand + fine gravel. Slightly damp.	CL	3.5	HNU: Bkg α: 2-3 cpm Bβ: Bkg
	19160 0950 7-16	16	6	Hard, brown (10yr 5/3) to yellowish brown (10yr 5/6) silty clay. Trace gravel. Slightly damp.	CL	4.5+	
7	19161 0950 7-16	17	6	SAA	CL	3.0	

NOTES: CONTRACTOR: PENNDRILL
RIG:
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
Bβ Probe: ASI# 2
α Probe: ASI# 1
HNU: HH 18

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TE
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bβ : 320-340 CPM
LEL/O2: LEL: 0% ~~%~~
O2: 20.7%

SAA = SAME AS ABOVE

FERNALD RI/FS

5549

	Initial	Date
1st Key In		
2nd Key In		
Hard Copy Verification		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1299	COORDINATES:	DATE: 7/16/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/16/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19162 0955 7-16	19	6	Very stiff, gray (10yr 6/1) to dark yellowish brown (10yr 4/6) silty clay. Slightly damp. Low plasticity.	CL	2.75	HNU = Bkg α = BZ = ↓
	19163 0955 7-16	22	6			3.75	
9	19164 0955 7-16	23	6			2.75	
10	19165 1006 7-16	3	0	No recovery	N/A	N/A	HNU = α = BZ =
	19166 1006 7-16	5	0				
	19167 1006 7-16	7	0				
11	19168 1009 7-16	7	6	Stiff, gray (10yr 5/1) silty clay. low-med. plasticity. Damp. Trace gravel, sand.	CL	1.75	HNU = Bkg α = BZ = ↓
	53675 1009 7-16	11	6			2.0	
12	53676 1009 7-16	13	6			2.0	
13	53677 1014 7-16	18	6	Stiff to very stiff, gray (10yr 5/1) silty clay. Some gravel. Trace sand. Moist. Med. plast.	CL	2.5	HNU = Bkg α = BZ = ↓
	53678 1014 7-16	20	6			1.75	
	53679 1014 7-16	23	6			2.0	
14	53680 1019 7-16	18	6	Stiff, gray (10yr 5/1) silty clay. Trace gravel and sand. Some surface material (dark silty clay w/some roots) present.	CL	1.5	HNU = Bkg α = BZ = ↓
	53681 1019 7-16	19	6			1.25	
	53682 1019 7-16	20	6			1.25	

NOTES:

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FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1299	COORDINATES:	DATE: 7/16/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/16/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
wet interval possible water zone	53683 1331 7-16	5	0	no recovery	N/A		HNU = Bkg α = Bkg BS = * probe not functioning properly
	53684 1331 7-16	7	0	* sample spoon very wet			
16	53685 1331 7-16	8	6	Med. stiff. gray (10yr 5/1) silty, sandy clay. Some gravel. Med. to high plasticity. wet (gravel to 0.75 in)	CL	.75	
	53686 1342 7-16	5	6	SAA		.75	HNU = Bkg α = ↓ BS = *
17	53687 1342 7-16	10	6		CL	.75	
	53688 1342 7-16	12	6			1.75	
18	53689 7-16			Total Depth of borehole 18.0 ft.			HNU = α = BS = N/A
	53690 7-16						
19	53691 7-16						
	53692 7-16						HNU = α = BS = N/A
20							

000198

NOTES:

There was no recovery 15.0-16.5 Feet but spoon was very wet. Tried to resample but couldn't get spoon in the interval. Will set screen over interval (13.0-18.0 Ft) to catch possible water interval.

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Fernald RIFS
PROJECT NO. 602 3.7.1
BORING NO. 1299
PIEZOMETER NO. 1299

FIELD ENG./GEO. L. Adams DATE 7/16/89
CHECKED BY WAHeckel DATE ~~7/16/89~~ 7/20/89
DATE OF INSTALLATION 7/16/89

BOREHOLE DRILLING

DRILLING METHOD Auger (Rotary)	TYPE OF BIT Rotary
DRILLING FLUID (S) USED: None	CASING SIZE (S) USED: None
FLUID — FROM — TO —	SIZE — FROM — TO —
FLUID — FROM — TO —	SIZE — FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Well	RISER PIPE MATERIAL 2" PVC
DIAMETER OF PERFORATED SECTION 2.0 I.D.	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. ~~2"~~ 2 5/16" I.D. 2"
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 10'
AVERAGE SIZE OF PERFORATIONS 0.02	JOINING METHOD Flush Joint threaded
TOTAL PERFORATED AREA 5.0 ft.	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 Ft.	OTHER PROTECTION Locking Cap.
PROTECTIVE PIPE O.D. 4.5 in.	w/padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.2			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS: Cement	top surface	bottom 10 ft.		
GROUT/SLURRY	TOP none	BOTTOM none	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 11.6	TOP	BOTTOM
SAND	TOP 11.6	BOTTOM 18.0	TOP	BOTTOM
GRAVEL	TOP none	BOTTOM none	TOP	BOTTOM
PERFORATED SECTION	TOP ~~13.0~~ 12.8	BOTTOM 17.8	TOP	BOTTOM
PIEZOMETER TIP	18.0			
BOTTOM OF BOREHOLE	18.0			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Water zone 15.0 - 16.5 ft.

ACG-11-86

5549

18.0
- .4
17.6
- 4.8
12.8
18.0
2.2

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

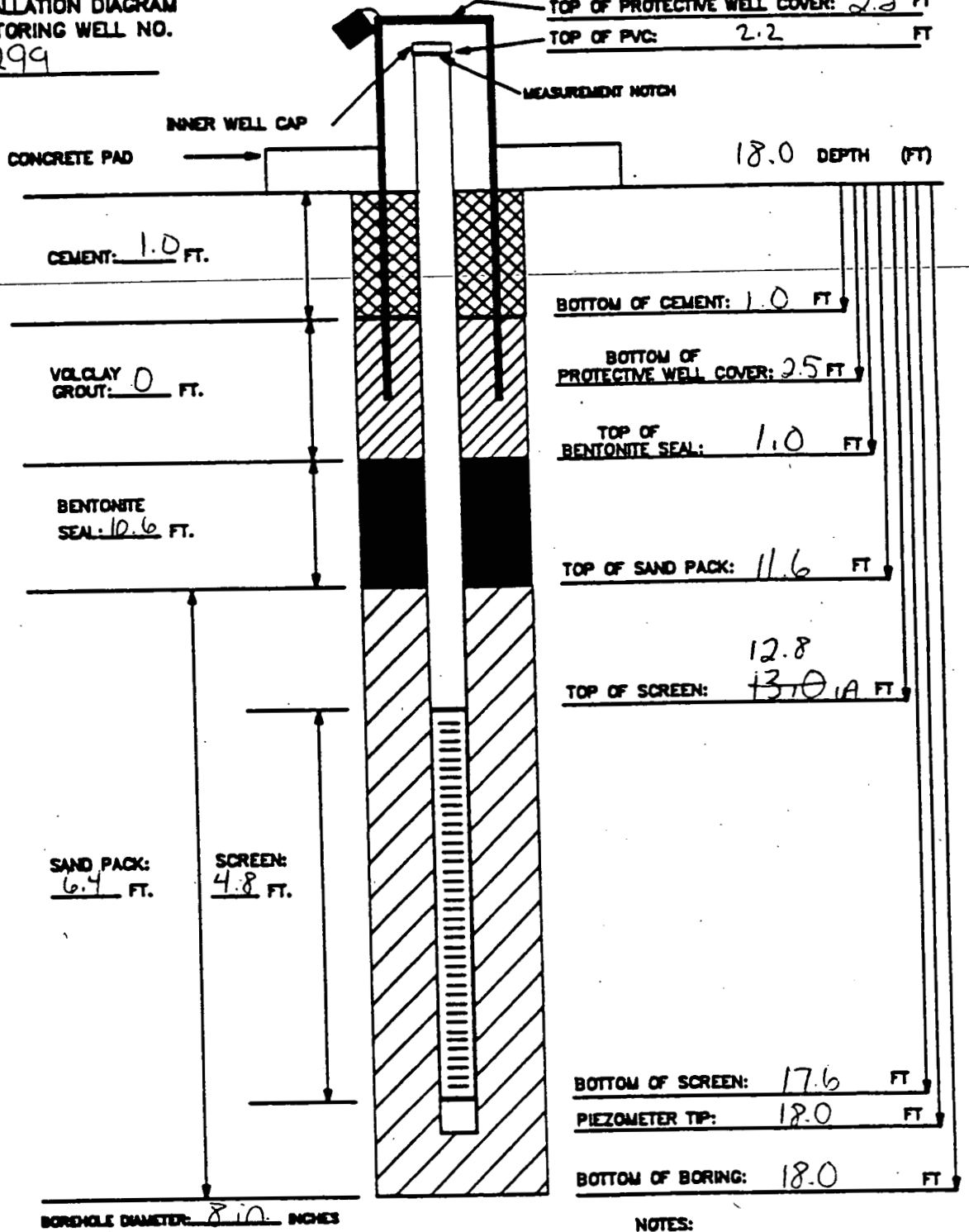
NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

INSTALLATION DATE: 1/16/89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1299



BOREHOLE DIAMETER: 8 in. INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 3 bags
BENTONITE PELLETS (5-GALLON BUCKETS): 6
BAGS OF VOLCLAY GROUT: none
AMOUNT OF CEMENT:
AMOUNT OF WATER USED:
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: L. Adams

QA/QC 7-20-89 by WAHertel

FERNALD RI/FS

5549

	Date	7.16.89			
	Initial	[illegible]			
		Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS Facilities Testing		
BORING NUMBER: 1300	COORDINATES:	DATE: 7/14/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89	
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: ~~7/14/89~~ WAF 7/18	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 25	

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19169 1330 7-14	8	6	Very stiff, gray (10yr 5/1) to yellowish brown (10yr 5/6) silty clay. Some surface gravel at top of sample. Trace sand. Low plasticity, slightly damp.	CL	2.25	HNU = Bkg
	19170 1330 7-14	7	6			3.25	α =
1	19171 1330 7-14	7	0	no recovery	N/A		BG = ↓
	19172 1333 7-14	4	6	Very stiff, gray (10yr 5/1) to yellowish brown (10yr 5/4) silty clay. Some sand, very top of sample. Low to med. plasticity, damp.		3.0	HNU = Bkg
2	19173 1330 7-14	6	3	Stiff, *SAA	CL	1.75	α =
	19174 1330 7-14	9	0	no recovery.	N/A		BG = ↓
3	19175 1334 7-14	13	5	Med. stiff, Dark brown (10yr 4/3) silty clay. Damp. (1st 3 in.)	CL	.75	HNU = Bkg
	19176 1334 7-14	13	0	Very stiff, brown (10yr 5/3) silty clay. Dk. brown spotty stains. Some gravel, some surface gravel. Damp. (last 2 in.)		4.0	α =
4	19177 1334 7-14	13	0	no recovery.	N/A		BG = ↓
	19178 1335 7-14	10	6	Very stiff to hard, yellowish brown (10yr 5/4) silty clay. Slightly damp.		3.25	HNU = Bkg
5	19179 1335 7-14	12	6		CL	4.5+	α =
6	19180 1335 7-14	14	6			4.5+	BG = ↓
	19181 1425 7-14	7	6	Very stiff, brown to yellowish brown (10yr 5/3 to 5/6) silty clay. Dark brown spotty stains. Some gravel, trace sand. Slightly damp.		3.25	HNU = Bkg
7	19182 1425 7-14	11	6		CL	3.5	α =
	19183 1425 7-14	14	6			4.5+	BG = ↓

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile B-53 ATV
DRILLER: J. Saccani
ASSISTANT: K. Felty
αβ Detector: ASI # 2
d Detector: ASI # 1
HNU: 00199 Intrinsically Safe

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 ppm
α = ~~80~~ 0 CPM
βγ = 800 CPM
LELO2: → LEL = 0 %
→ O2 = 20.6%

000202

* SAA - Same as above.

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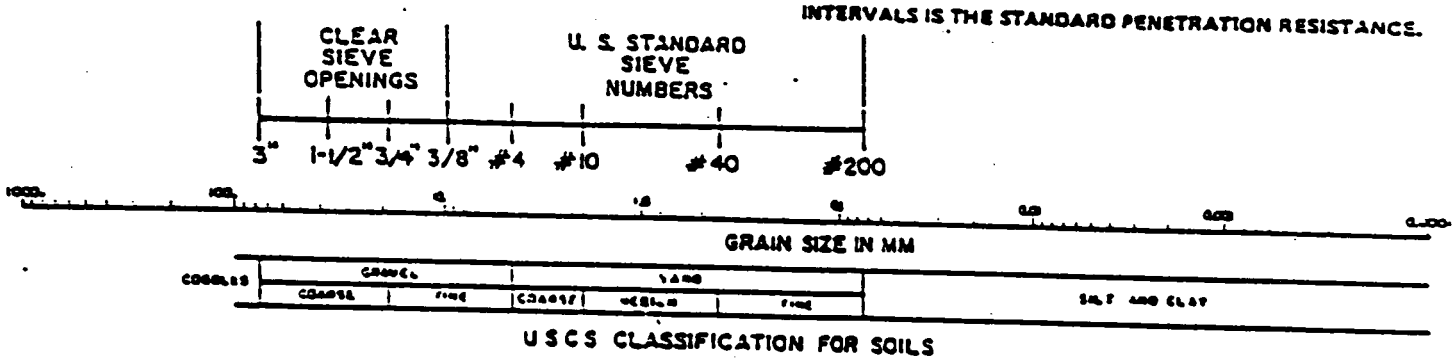
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTT

FERNALD RI/FS

5549

	Initial	Date
1st Key In		
2nd Key In		
Hard Copy Verification		

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1300	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/15/89 WAH
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5 BIA

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19184 1426 7-14	14	6	Hard, to very stiff, brown to gray (10yr 5/3 to 10yr 5/1) sandy, silty, clay. Some gravel. Slightly damp.	CL	4.5+	HNU = Bkg α = Bδ = ↓
	19185 1426 7-14	15	6			3.75	
	19186 1426 7-14	18	6	SAA, with some dark yellowish brown (10yr 4/6) coloring also		3.75	
9	19187 1427 7-14	13	6	Very stiff, gray (10yr 5/1) sandy, silty, gravelly clay. Slightly damp.		3.0	HNU = Bkg α = Bδ = ↓
	19188 1427 7-14	14	6			3.75	
10	19189 1427 7-14	14	6			4.0	
11	19190 1436 7-14	3	6	Very stiff, brown to gray (10yr 5/3 to 5/1) silty, gravelly clay.		4.0	HNU = Bkg α = Bδ = ↓
	53695 1436 7-14	5	6			3.0	
	53696 1436 7-14	8	6			2.7	
12	53697 1512 7-14	6	6	Very stiff, gray (10yr 5/1) silty clay. Trace gravel and sand, becoming sandier toward bottom of sample. Damp.		2.5	HNU = Bkg α = Bδ = ↓
	53698 1512 7-14	10	6			3.0	
13	53699 1512 7-14	10	6			4.0	
14	53700 1534 7-14	3	6	Stiff to very stiff, gray (10yr 5/1) sandy silty clay. Trace gravel. Damp.		1.5	HNU = Bkg α = Bδ = ↓
	53701 1534 7-14	7	6			3.5	
	53702 1534 7-14	10	4			2.75	

NOTES:

SAA - Same as above.

000204

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1300	COORDINATES:	DATE: 7/14/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89	
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED: 7/15/89 WAM	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 3	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53703 1539 7-14	3	6	SAA, medium plasticity		2.0	HNU = Bkg α = BS = ↓
	53704 1539 7-14	6	6		CL	1.5	
16	53705 1539 7-14	9	1			2.5	
	53706 1545 7-14	3	6	Stiff, gray to brown (10yr 5/1 to 5/3) sandy silty clay. Trace gravel. Med. plasticity, damp.		1.5	HNU = Bkg α = BS = ↓
17	53707 1545 7-14	5	6		CL	1.75	
18	53707 1545 7-14	6	6			1.25	
	53709 1548 7-14	4	6	SAA with increasing sand content		1.25	HNU = Bkg α = BS = ↓
19	53710 1548 7-14	5	6		CL	1.5	
	53711 1548 7-14	7	6			1.25	
20	53712 1548 7-14	12	6	SAA	CL	1.25	HNU = Bkg α = BS = ↓
				Bottom of Borehole 20.0ft			

NOTES: SAA - Same as above.

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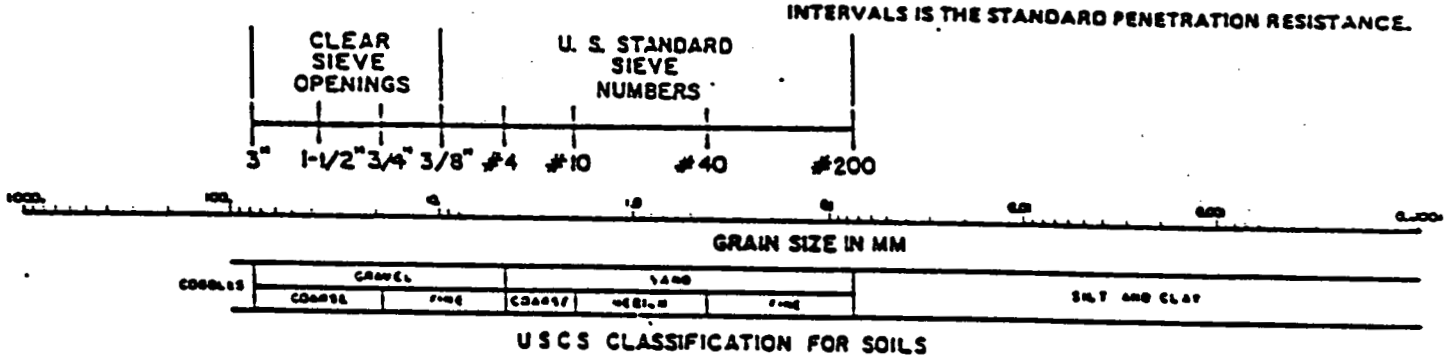
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

554 Pg 34 of 5

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
PROJECT NO. 602 3.7.1
BORING NO. 1300
PIEZOMETER NO. N/A

FIELD ENG./GEO. ~~L. Sinfield~~ L. Adams DATE 7/14/89
CHECKED BY W.A. Hertel DATE 7/16/89
DATE OF INSTALLATION (Grouting): ~~7/15/89~~ 7/18/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED: N/A	CASING SIZE (S) USED: N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE N/A	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS: N/A
PERFORATION TYPE: N/A	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION Cement Plug 1.0–0.0 ft
PROTECTIVE PIPE O.D. N/A	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	N/A		N/A	
GROUND SURFACE	0.0 ft		ft	
BOTTOM OF PROTECTIVE PIPE	N/A		N/A	
BOREHOLE FILL MATERIALS:	Cement: 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 20.0 ft	TOP	BOTTOM
BENTONITE	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
SAND	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
GRAVEL	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PIEZOMETER TIP	N/A		N/A	
BOTTOM OF BOREHOLE	20.0 ft		ft	
GWL AFTER INSTALLATION	Dry - No Ground Water Encountered		N/A	

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐ N/A
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐ N/A

REMARKS Borehole grouted from 20.0 ft to 1.0 ft depth.
Cement plug installed from 1.0 ft to 0.0 ft depth
Borehole was plugged and Abandoned

000207

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

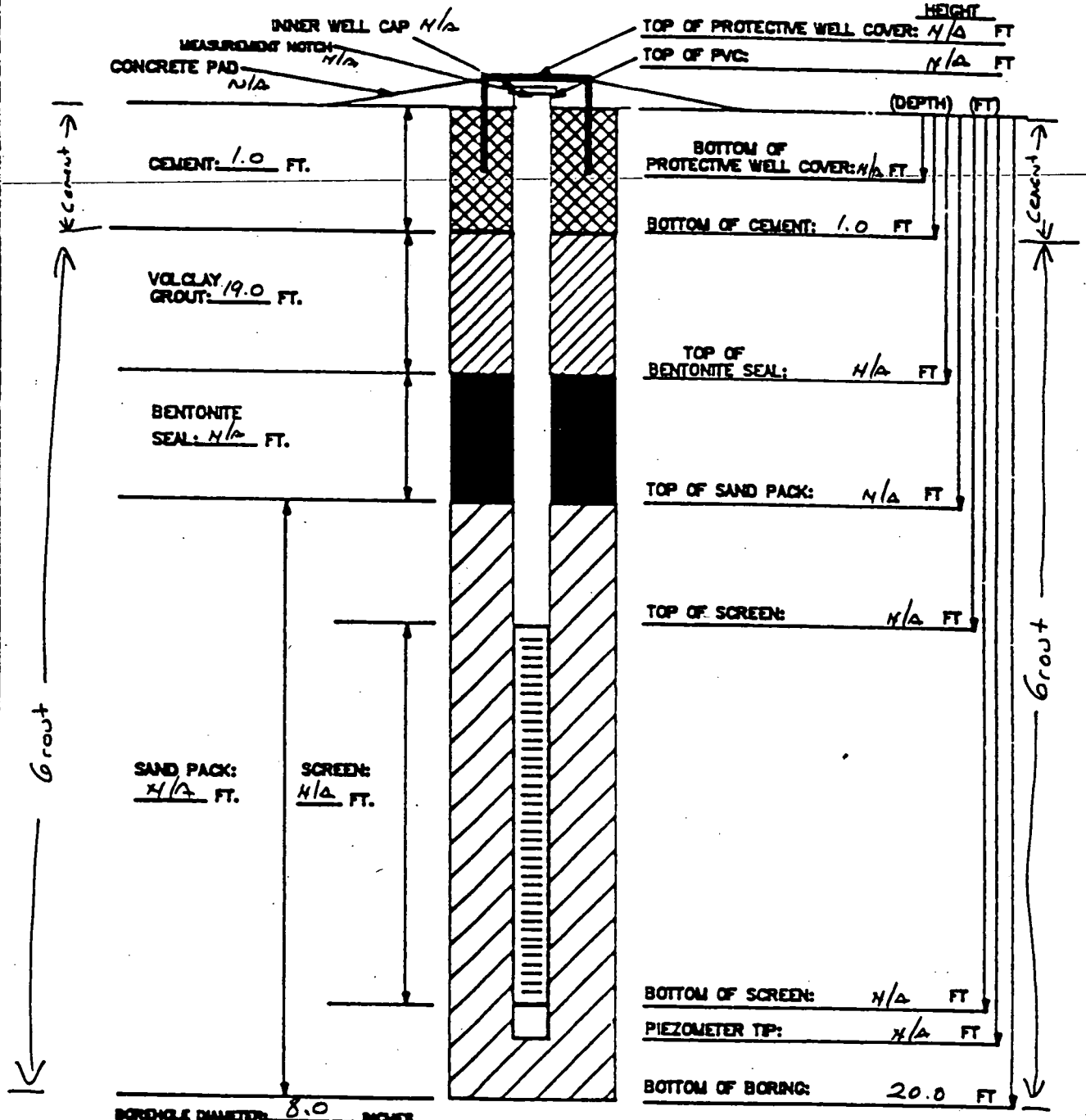
NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1300

INSTALLATION DATE: ~~7/16/89~~ 7/18/89 LA



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: N/A
BENTONITE PELLETS (5-GALLON BUCKETS): N/A
BAGS OF VOLCLAY GROUT: 2 bags
AMOUNT OF CEMENT: 1/3 sac
AMOUNT OF WATER USED: ~~22~~ 46 gal LA
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESES INDICATE DEPTH BELOW GROUND LEVEL.

000209

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: ~~L. Smithfield~~ L. Adams

FERNALD RI/FS

5549 Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1300	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19169 1330 7-14	8	6	Very stiff, gray (10yr 5/1) to yellowish brown (10yr 5/6) silty clay. Trace sand. Low plast. Slightly damp. Some surface gravel at top.		2.25	Hnu = Bkg
	1330 19180 7-14	7	6			3.25	α = ↓ Bγ =
1	19171 1330 7-14			SAA			
		7	0	No recovery			
	19172 1333 7-14	4	6	SAA Some sand in very top of sample. low to med. plast. damp		3.0	Hnu = Bkg
2	19173 1333 7-14	6	3			1.75	α = ↓ Bγ =
	19174 1333 7-14	9	0				
3	19175 1334 7-14	13	5	Med. stiff, dark brown (10yr 4/3) silty clay. Damp. (1st 3 in.)		.75	Hnu = Bkg
	19176 1334 7-14	13	0	(last 2 in) Very stiff (Hard) brown (10yr 5/3) silty clay with dk. brown spotty stains. Some gravel slightly damp some surface gravel.		4.0	α = ↓ Bγ =
4	19177 1334 7-14	13	0				
	19178 1335 7-14	10	6	Very stiff yellowish brown (10yr 5/4) silty clay, slightly damp		3.25	Hnu = Bkg
5	19179 1335 7-14	12	6			4.5+	α = ↓ Bγ =
	19180 1335 7-14	14	6			4.5+	
6	19181 1425 7-14	7	6	Very stiff brown to yellowish brown silty clay (10yr 5/3 to 5/6) Some gravel Some dk. brown spotty stains Trace sand. Slightly damp		3.25	Hnu = Bkg
	19182 1425 7-14	11	6			3.5	α = ↓ Bγ =
7	19183 1425 7-14	14	6			4.5+	

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile
DRILLER: J. Saccani
ASSISTANT: K. Felty

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: Hnu = 0ppm PPM
α = 0cpm CPM
Bγ = 800 CPM
LEL = 0%
O_2 = 20.6 %

LELO$_2$:

Bγ = 2
α = 1

Hnu =

000210

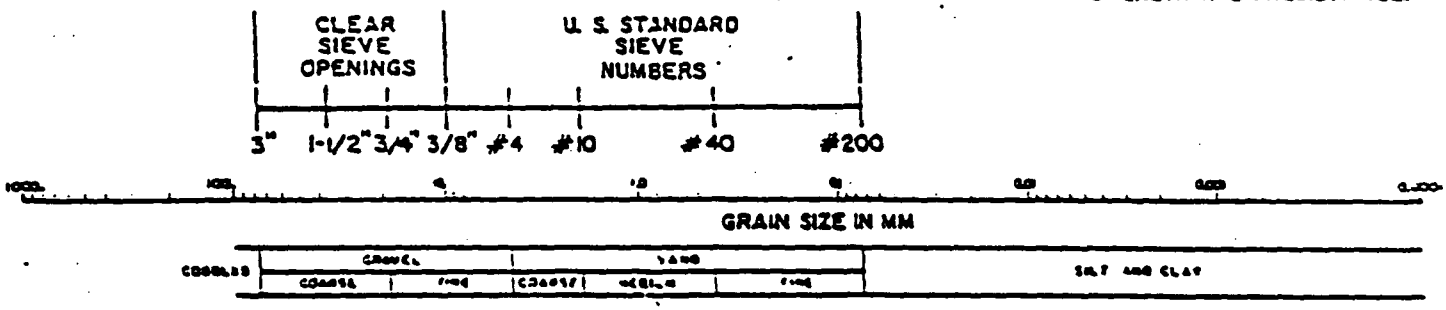
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTY

FERNALD RI/FS

Field Copy 5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1300	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19184 1426 7-14	14	6	Hard brown (10yr 5/3) silty clay. Slightly damp. Some sand, to gray (10yr 5/1)		4.5+	HNU = Bkg α = ↓ Bδ =
	19185 1426 7-14	15	6	SAA, sandy clay some gravel		3.75	
9	19186 1426 7-14	18	6	SAA, to (10yr 4/6)		3.75	
10	19187 1427 7-14	13	6	Gray, stiff (10yr 5/1) sandy gravelly clay. Slightly damp		3.0	HNU = Bkg α = ↓ Bδ =
	19188 1427 7-14	14	6	SAA		3.75	
	19189 1427 7-14	14	6	SAA		4.0	
11	19190 1436 7-14	3	6	Very stiff brown to gray (10yr 5/3 to 5/1) silty gravelly clay.		4.0	HNU = Bkg α = ↓ Bδ =
	53695 1436 7-14	5	6			3.0	
12	53696 1436 7-14	8	6			2.7	
13	53697 1512 7-14	6	6	Very stiff, gray (10yr 5/1) silty clay. Trace gravel + sand. Damp. Becomes sandy toward bottom.		2.5 3.0	HNU = Bkg α = ↓ Bδ =
	53698 1512 7-14	10	6			4.0	
	53699 1512 7-14	10	6				
14	53700 1534 7-14	3	6	SAA		1.5	HNU = Bkg α = ↓ Bδ =
	53701 1534 7-14	7	6			3.5	
	53702 1534 7-14	10	4			2.75	

NOTES:

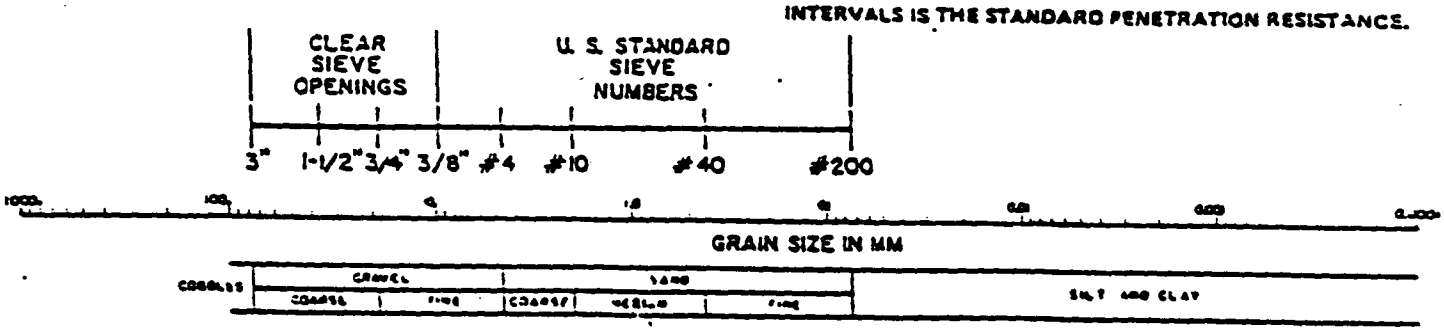
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

Field Copy 5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1300	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
16	53703 1539 7-14	3	6	SAA mod. plast.		2.0	HNU = Bkg α = BS = ↓
	53704 1539 7-14	6	6			1.5	
	53705 1539 7-14	9	1			2.5	
17	53706 1545 7-14	3	6	SAA except some brown (10yr 5/3) coloring. mod. plast.		1.5	HNU = Bkg α = BS = ↓
	53707 1545 7-14	5	6			1.75	
18	53708 1545 7-14	6	6			1.25	
	53709 1548 7-14	4	6	SAA more sand.		1.25	HNU = Bkg α = BS = ↓
19	53710 1548 7-14	5	6			1.5	
	53711 1548 7-14	7	6			1.25	
20	53712 1548 7-14	12	6			1.25	HNU = α = BS =

NOTES:

000214

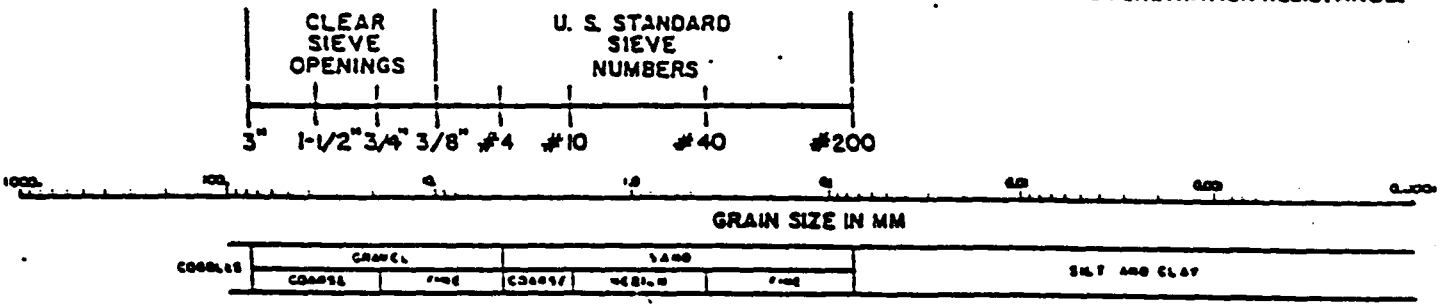
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
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	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
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	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT.

FERNALD RI/FS

5549

Date	7-16-89			
Initial	HB			
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1302	COORDINATES:	DATE: 7/12/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/12/89	
ENGINEER/GEOLOGIST: L. Adams	Depth Date/Time	DATE COMPLETED: 7/12/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5	

	DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6")	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
UA	19213	~~19123~~ 1512 7-12	8	4	Yellowish brown (10yr 5/8) silty clay. Some roots + grass. Dry (Topsoil)		N/A	HNU: 0 ppm α: 0 cpm Bγ: 240-260
UA	19214	~~19124~~ 1512 7-12	8	0				
UA	19215	~~19125~~ 1512 7-12	8	0				
UA	19216	~~19126~~ 1514 7-12	8	6	Very stiff, brown to yellowish brown (10yr 5/3 to 10yr 5/6) silty clay. Some very dark brown spotty staining. Some sand. Slightly damp		3.25	HNU: 0 ppm α: 0 cpm Bγ: 300 cpm
UA	19217	~~19127~~ 1514 7-12	10	6			3.0	
UA	19218	~~19128~~ 1514 7-12	13	0				
UA	19219	~~19129~~ 1526 7-12	20	6	Stiff dark yellowish brown (10yr 4/3) clay. Damp Med. Plasticity Trace Sand.		1.25	HNU: Bkg α: Bγ: ↓
	19220 1526 7-12	41	6	Very stiff, light olive brown (2.5y 5/4 to 5/6) sandy clay. Some very light gray (10yr 8/1) very fine sand. Some gravel. Damp.		3.5		
4	19221 1526 7-12	26	0					
	19222 1541 7-12	14	6	Hard, yellowish brown (10yr 5/4) clay Some very dark brown spotty staining Same sand as above present on outer and 10" of core, slightly damp med. plas. Some gravel		4.5	HNU: Bkg α: Bγ: ↓	
5	19223 1541 7-12	14	6			3.0		
	19224 1541 7-12	14	2	SAA except no sand, less gravel. SAA slightly damp.		3.5		
6	19225 1616 7-12	5	6	Stiff, yellowish brown (10yr 5/3) clay. Med. plast. Some dk. brown stains. damp SAA Trace gravel.		3.75	HNU: Bkg α: Bγ: ↓	
	19226 1616 7-12	6	6			4.5		
7	19227 1616 7-12	9	6	SAA		3.0		

NOTES: CONTRACTOR: PENN DRILL
RIG: Mobile B-53
DRILLER: J. Sawan
ASSISTANT: W Felty
HNU - Hazco HH 18
α - #4
B - #2

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bγ : 400-480 CPM
LEL/O2: → LEL: 0 ~~PPM~~ % UA
→ O2: 20.7%

000216

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1302	COORDINATES:	DATE: 7/12/89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/12/89 WAH	
ENGINEER/GEOLOGIST: L. ADAMS	Depth Date/Time	DATE COMPLETED: ~~7/12/89~~ 7/13	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 35 IA	

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	537745 1720 7-12	4	6	Stiff, ~~gray~~ Yellowish brown (10yr 5/4) to gray (10yr 5/1) Clay. Some fine gravel. Low to med. plasticity damp.		2.25	HNU = BKG α = BG = ↓
	537744 1720 7-12	7	6			2.0	
16	537745 1720 7-12	9	6			3.0	
	537746 1725 7-12	4	6	Stiff, gray (10yr 5/1) clay. Some sand and gravel. Med. to high plasticity. Moist.		1.25	HNU = BKG α = BG = ↓
17	537747 1725 7-12	6	6			1.25	
	537748 1725 7-12	8	6			1.25	
18	537749 1735 7-12	6	6	SAA		2.5	HNU = BKG α = BG = ↓
	537750 1735 7-12	9	6			2.5	
19	537751 1735 7-12	11	6			1	
	537752 1735 7-12	18	6	SAA		1	HNU = BKG α = BG = ↓
20				Total depth of borehole. 20.0 ft.			

NOTES:

SAA = SAME AS ABOVE

000217

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
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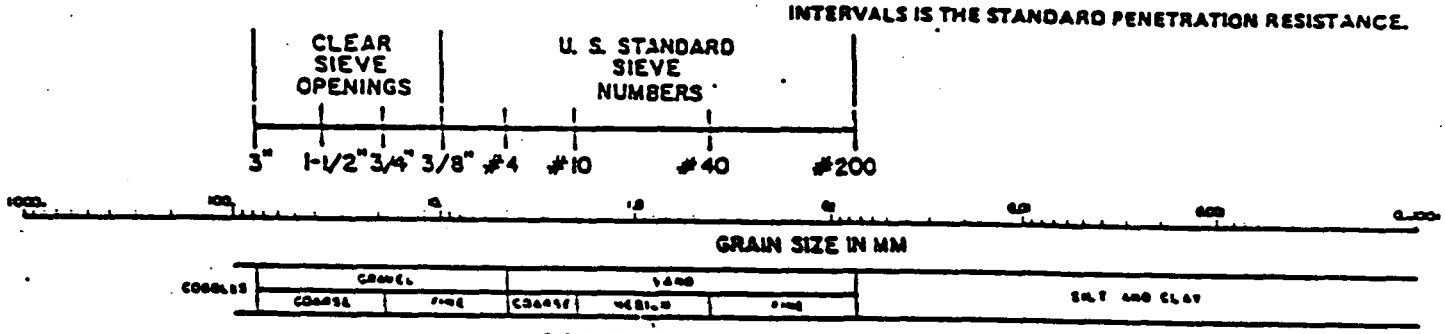

USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

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	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. ~~L. Sinfield~~ L. Adams
DATE 7/14/89
PROJECT NO. 602 3.7.1
CHECKED BY WA Hertel
DATE 7/16/89
BORING NO.
PIEZOMETER NO. N/A
DATE OF INSTALLATION (Grouting):

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE N/A
DIAMETER OF PERFORATED SECTION N/A
PERFORATION TYPE: N/A
SLOTS ☐ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS N/A
TOTAL PERFORATED AREA N/A

RISER PIPE MATERIAL N/A
RISER PIPE DIAMETERS: N/A
O.D. N/A I.D. N/A
LENGTH OF PIPE SECTIONS N/A
JOINING METHOD N/A

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A
PROTECTIVE PIPE O.D. N/A

OTHER PROTECTION Cement Plug 1.0-0.0 ft

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	N/A		N/A	
GROUND SURFACE	0.0 ft		ft	
BOTTOM OF PROTECTIVE PIPE	N/A		N/A	
BOREHOLE FILL MATERIALS:	Cement: 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 20.0 ft	TOP	BOTTOM
BENTONITE	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
SAND	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
GRAVEL	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PIEZOMETER TIP	N/A		N/A	
BOTTOM OF BOREHOLE	20.0 ft		ft	
GWL AFTER INSTALLATION	Dry - No Ground Water Encountered		N/A	

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐ N/A
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐ N/A

REMARKS Borehole grouted from 20.0 ft to 1.0 ft depth.
Cement plug installed from 1.0 ft to 0.0 ft depth
Borehole was plugged and Abandoned

000219

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

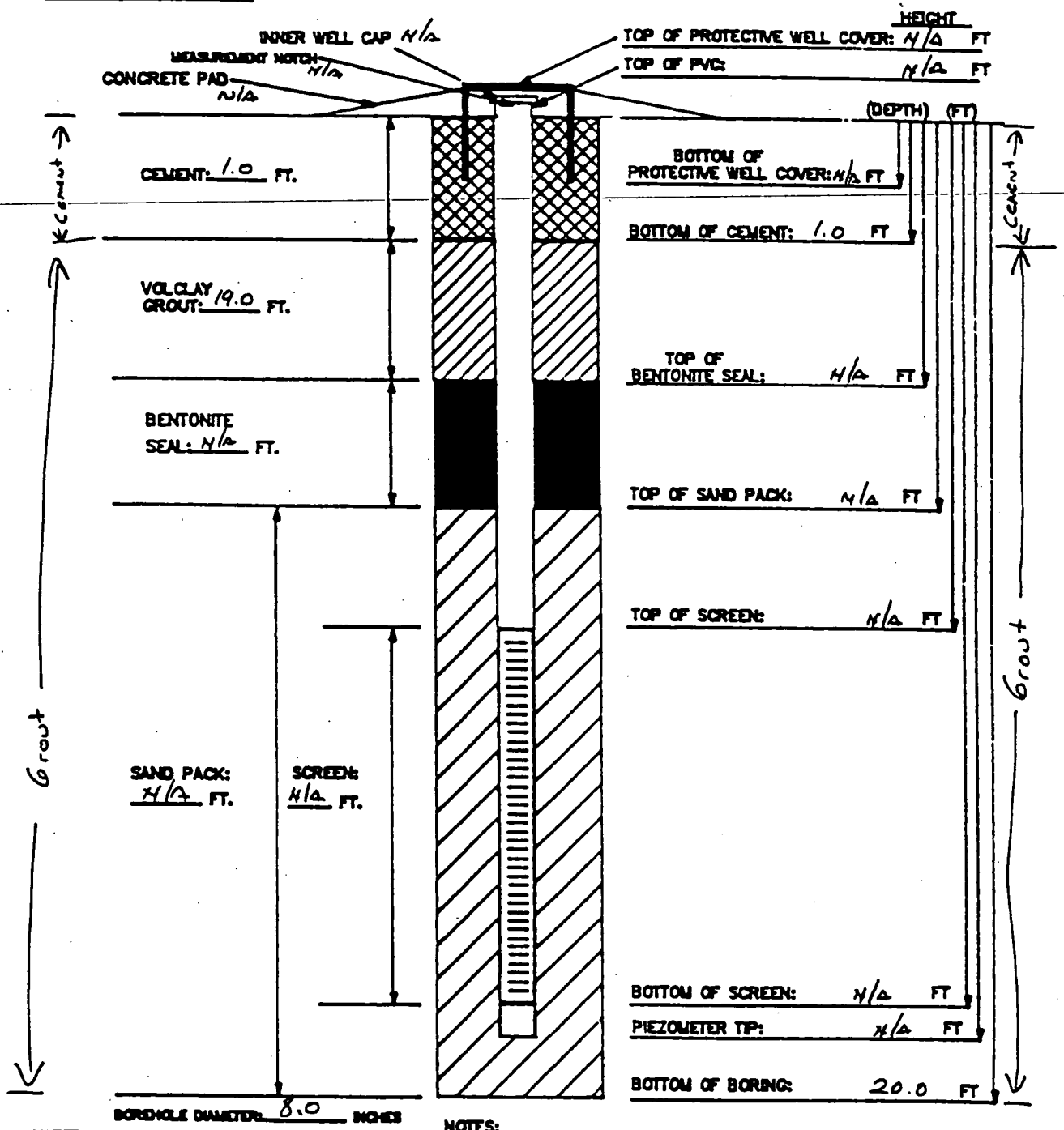
NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1302

INSTALLATION DATE: 7/14/89



MATERIALS USED:
SAND TYPE AND QUANTITY: N/A
BENTONITE PELLETS (5-GALLON BUCKETS): N/A
BAGS OF VOLCLAY GROUT: 1
AMOUNT OF CEMENT: 1/2 bag.
AMOUNT OF WATER USED: 22 gal.
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESES INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: ~~L. Smfield~~

WAH QA/QC 7-16-89

L. Adams

Field Copy 554

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1302	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1720	4	6	SAA Except top 4" is yellowish brown (10 yr 5/4).		2.25	HNU = Bkg α = BG = ↓
16	1720	7	6		CL	2.0	
	1720	9	6			3.0	
17	1725	4	6	SAA except moist. med-high plast. ~~So Trace~~ some gravel, sand.		1.25	HNU = Bkg α = BG = ↓
		6	6		CL	1.25	
18		8	6			1.25	
	1735	6	6	SAA		2.5	HNU = Bkg α = BG = ↓
	1735	9	6		CL	2.5	
19	1735	11	6			1	
20	1735	18	6		CL	1	HNU = Bkg α = BG = ↓
				Total depth of borehole 20.0 Ft.			

NOTES:

SAA = Same as above.

000222

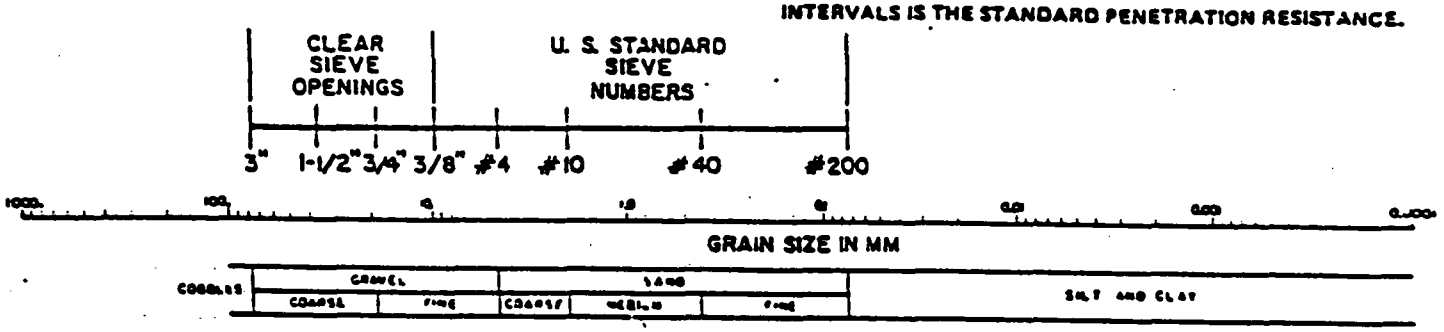
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

5549

Date	7-20-89	7-21-89		
Initial	[illegible]	[illegible]		
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1307	COORDINATES:	DATE: 7/18/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/18/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/19/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	19325 7-18 1040	4	6	Very Stiff (10yr 3/3) dark brown sandy clay, some silt, low plasticity slightly moist, roots	CL	2.75	HNU: 3-4 ppm α: 0 cpm Bγ: 240-260 cpm
1	19326 7-18 1040	7	6	HARD (10yr 5/4) yellowish brown silty clay, trace sand & fine to med gravel, low plasticity, moist ...	CL	4.5	
	19327 7-18 1040	8	3	Stiff SAA	CL	1.75	
2	19328 1045 7-18	12	6	Very Stiff (10yr 5/4) yellowish brown silty clay, some sand, low plasticity, moist	CL	3.5	HNU: 80-100 ppm α: 0 cpm Bγ: 100-110 ppm
	19329 1045 7-18	14	6	Stiff SAA + fine gravel	CL	1.25	
3	19330 1045 7-18	13	6	HARD SAA + (5y 4/1) dark gray mottled.	CL	4.25	
	19331 1047 7-18	11	6	Stiff (5y 4/1) dark gray, silty clay, trace of sand and fine to medium gravel, low plasticity, moist	CL	2.0	HNU: 10-30 ppm α: 0 cpm Bγ: 90-100 cpm
4	19332 1047 7-18	13	6	SAA	CL	1.75	
	19333 1047 7-18	16	5	Very Stiff SAA	CL	2.25	
5	19334		X	Bottom of sampling at 4.5 FT Bottom of boring at 2.0 FT			HNU: α: Bγ:
	19335						
	19336						
6	19337						HNU: α: Bγ:
	19338						
7	19339						

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 45-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
GEO ASSISTANT: Cindy Melroy

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0-1.5 PPM
α = 0 CPM
Bγ = 90-100 CPM

SAA = Same As Above
NR = No Recovery

LEL/O_2: LEL = 0% ~~PPM~~ @ 7/18/89
O_2 = 20.6%

HNU # 905513 29

5549

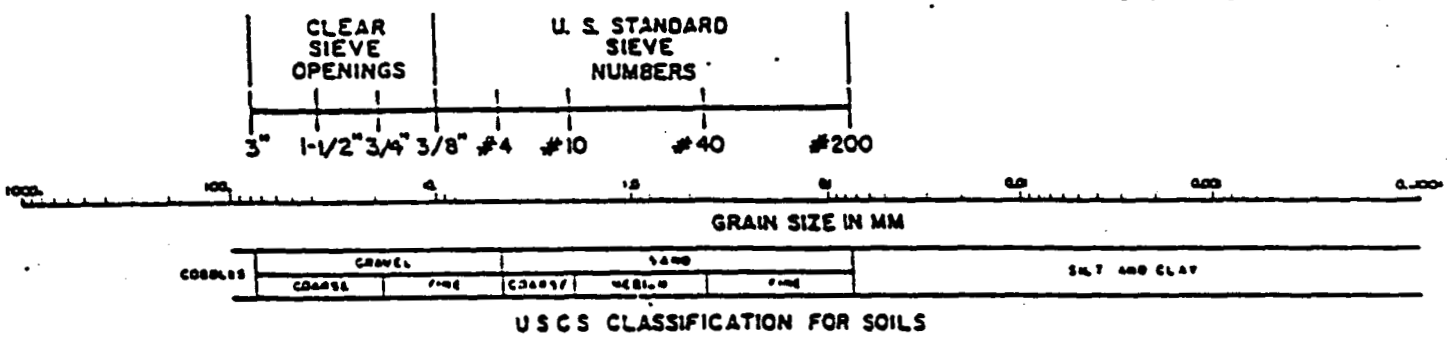
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

5549

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 7/19/89
PROJECT NO. 602 3.7.1 CHECKED BY WA Hartel DATE 7/20/89
BORING NO. 1307
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger	TYPE OF BIT 8.0 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY/cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 2.0	TOP	BOTTOM
SAND	TOP NA —	BOTTOM NA	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	2.0			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Well was sampled to 4.5 FT - No water encountered however, high HNU meter readings about 100 ppm were picked up in bore hole. — Augered was stopped at 2.0 FT — Boring was plugged with bentonite and cement. May be redrilled after Analysis is complete on soil samples

000226

409-11-86

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE :

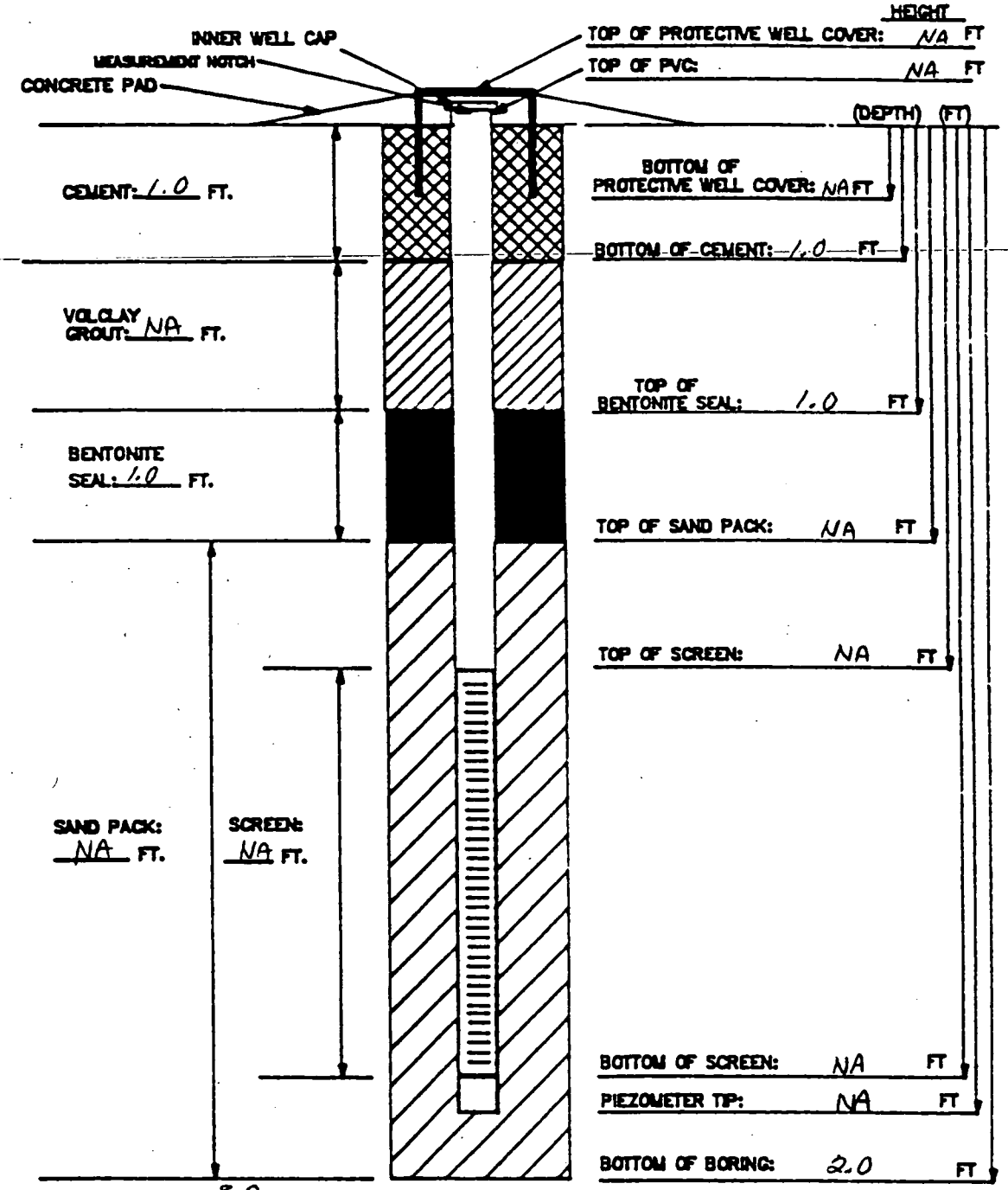
THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

5549

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1307

INSTALLATION DATE: 7/19/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): 1/2 bucket
BAGS OF VOLCLAY GROUT: NA
AMOUNT OF CEMENT: 1/2 (94#) sack
AMOUNT OF WATER USED: 10 gal
OTHER: NA

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESES INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

5549

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1313	COORDINATES:	DATE: 7/26/97	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 7/26/89	
ENGINEER/GEOLOGIST: C. Lube	Depth / Date/Time	DATE COMPLETED: 7/27/89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN.	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1145	–	UA	CEMENT	NA	NA	HNU = 0 ppm
	1145	–	UA	CEMENT	NA	NA	α = 0 cpm
1	19457 1400	10	6	STIFF (2.5Y 4/2) Dark grayish brown silty clay, low plasticity, trace sand, moist	CL	1.25	Bγ = 200-220 cpm
2	19458 1400	9	6	STIFF (10YR 5/4) yellowish brown, silty clay, trace sub angular gravel, med plasticity, moist	CL	1.25	HNU = 0 ppm
	19459 1400	11	3	SAA	CL	1.25	α = 0 cpm
	19460 1400	6	0	NR	NA	NA	Bγ = 200-210 cpm
3	19461 1410	6	6	STIFF (2.5Y 5/4) light olive brown silty clay, some sand, trace fine gravel, med plasticity, moist	CL	1.0	HNU = 0 ppm
	19462 1410	10	6	very stiff SAA	CL	2.5	α = 0 cpm
4	19463 1410	14	3	STIFF SAA	CL	1.5	Bγ = 200-210 cpm
	19464 1450	10	6	VERY STIFF (10YR 5/4) yellowish brown silty clay, trace sand, fine to med gravel, low plasticity, moist	CL	2.75	HNU = 1.5 ppm
5	19465 1450	12	6	HARD SAA	CL	4.5	α = 0 cpm
	19466 1450	16	4	VERY STIFF SAA	CL	3.0	Bγ = 240-250 cpm
6	19467 1500	15	6	HARD (2.5Y 4/4) olive brown, silty clay trace sand, fine to med gravel low plasticity, moist	CL	4.25	HNU 0.5 ppm
	19468 1500	22	6	HARD SAA / HARD (5Y 4/1) Dark gray, silty clay, trace sand & gravel, low plasticity, moist	CL	>4.5	α = 0 cpm
7	19469 1500	22	5	VERY STIFF SAA	CL	3.75	Bγ = 140-160 cpm

NOTES: CONTRACTOR: PENNDRILL
RIG: model 45-C
DRILLER: Hedd Andrews
ASSISTANT: Charlie Elkowitz
GEO ASSISTANT: Chris Nagro
SAA = Same as Above
NR = No Recovery

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 150-200 CPM
LEL = 0% ppm
O_2 = 20.6%

FAX # 6022

LEL O_2:

000229

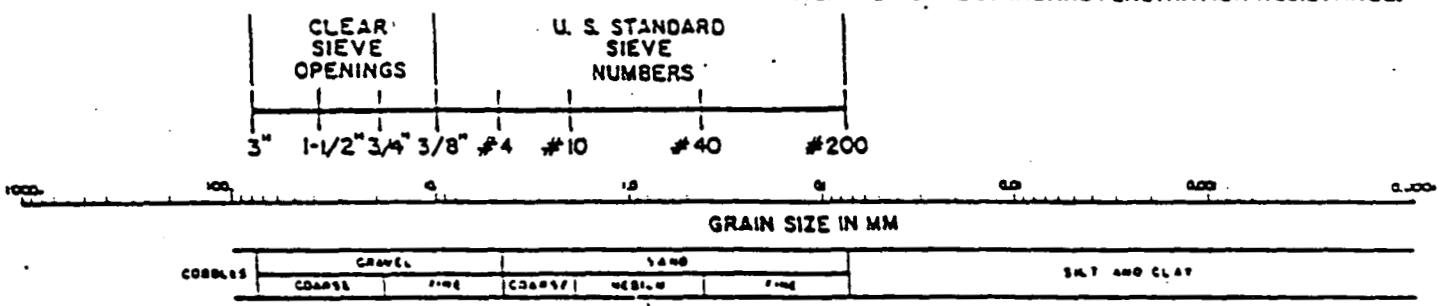
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1313	COORDINATES:		DATE: 7/26/89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 7/26/89
ENGINEER/GEOLOGIST: C. Grube	Depth	Date/Time	DATE COMPLETED: 7/27/89
DRILLING METHODS: AUGER (HOLLOW STEM)			PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	19470 1525 7-26	24	6	HARD (5y 4/1) Dark gray silty clay, trace sand and fine to med gravel, low plasticity, moist	CL	4.25	HNU = 0 ppm α = 0 ppm Bδ = 190-200 ppm
	19471 1525 7-26	27	3	SAA	CL	4.25	
9	19472 1525 7-26	31	0	NR	NA	NA	7-27-89
	19473 0915 7-27	24	0	NR	NA	NA	HNU = α = Bδ = NA
10	19474 0915 7-27	20	0	NR	NA	NA	SAMPLE FROM AUGER PLUG INVALID
	19475 0915 7-27	17	0	NR	NA	NA	
11	19476 7-27 0940	13	6	STIFF (5y 4/1) Dark gray silty clay trace sand & fine to med gravel low plasticity, moist	CL	1.75	HNU = 0 ppm α = 0 ppm Bδ = 190-200 ppm
	53955 7-27 0940	16	6	STIFF SAA + WOOD CHUNKS	CL	1.5	
12	53956 0940 7-27	19	0	NR	NA	NA	
13	53957 0953 7-27 0940	17	6	Very stiff (5y 4/1) Dark gray, silty clay, trace of sand and fine to med gravel, low plasticity, moist	CL	2.5	HNU = 0 ppm α = 0 ppm Bδ = 240-250 ppm
	53958 7-27 0953 0940	18	6	Very stiff SAA	CL	3.25	
	53959 0953 7-27 0940	24	6	STIFF SAA	CL	1.5	
14	53960 7-27 1410	0	0	HARD (5y 4/1) Dark gray silty clay, trace sand and fine to med gravel low plasticity, moist	CL	4.5	HNU = 0 ppm α = 0 ppm Bδ = 220-240 ppm
	53961 7-27 1410	0	0	NR	NA	NA	
	53962 7-27 1410	11	0	NR	NA	NA	

NOTES:

SAA = Same As Above
NR = No Recovery

5549

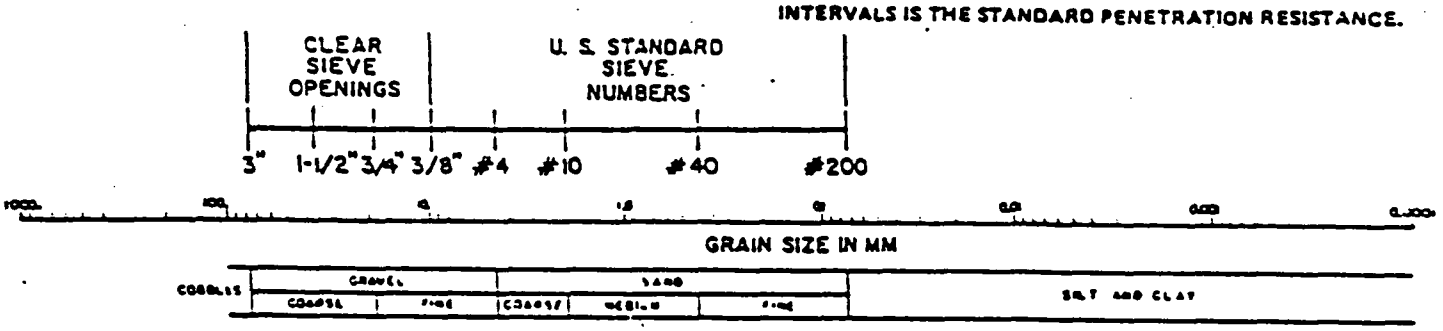
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 13B	COORDINATES:	DATE: 7-27-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7-26-89
ENGINEER/GEOLOGIST: [illegible]	Depth Date/Time	DATE COMPLETED: 7-27-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	~~53963~~ 53963 7-27 1430	7 25 21 11	6	Med. Stiff (5y 4/1) Dk Gray silty clay trace sand & fine to med gravel moist	CL	.75	HNU = 0 ppm α = 0 BG = 230-210 cpm
16	53964 7-27 1430	13	6	Med Stiff SAA	CL	.75	
	53965 7-27 1430	19	6	STIFF SAA	CL	1.5	
17	53966 7-27 1410	30		Medium Stiff (5y 4/1) Dk Gray silty clay, trace sand & fine to med gravel low plasticity moist	CL	.5	HNU = 0 ppm α = 0 cpm BG = 190-200 cpm
	53967 7-27 1410	22	6	SAA	CL	.75	
18	53968 7-27 1410	27	6	SAA	CL	.75	
	53969 7-27 1500	19	6	STIFF SAA	CL	1.25	HNU = 0 ppm α = 0 cpm BG = 200-220 cpm
19	53970 7-27 1500	16	6	STIFF SAA	CL	1.5	
	53971 7-27 1500	17	6	SOFT SAA	CL	.25	
20	53972 7-27 1500	19	6	Med Stiff SAA	CL	.75	HNU = 0 ppm α = 0 cpm BG = 200-220 cpm
				Bottom of Boring & sampling at 20.0 ft			

NOTES:

SAA = Same As Above

NR = No Recovery

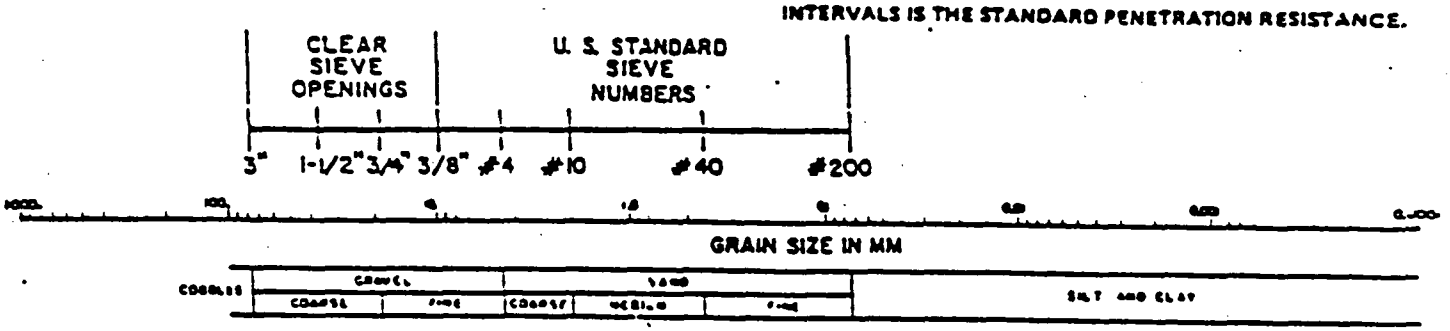
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 7-27-89
PROJECT NO. 602 3.7 CHECKED BY _____ DATE _____
BORING NO. 1313
PIEZOMETER NO. NA DATE OF INSTALLATION NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger	TYPE OF BIT 8.0 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE NA	RISER PIPE MATERIAL NA
DIAMETER OF PERFORATED SECTION NA	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. NA I.D. NA
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS NA	JOINING METHOD NA
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH NA	OTHER PROTECTION NA
PROTECTIVE PIPE O.D. NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS: Volclay GROUT / ~~SLURRY~~ cement	Top 0.0 TOP 1.0	BOTTOM 1.0 BOTTOM 20.0	TOP	BOTTOM
BENTONITE	TOP NA	BOTTOM NA	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL	TOP NA	BOTTOM NA	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION	NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS No water zone encountered - well was plugged with volclay grout and capped with cement

000235

409-11-86

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

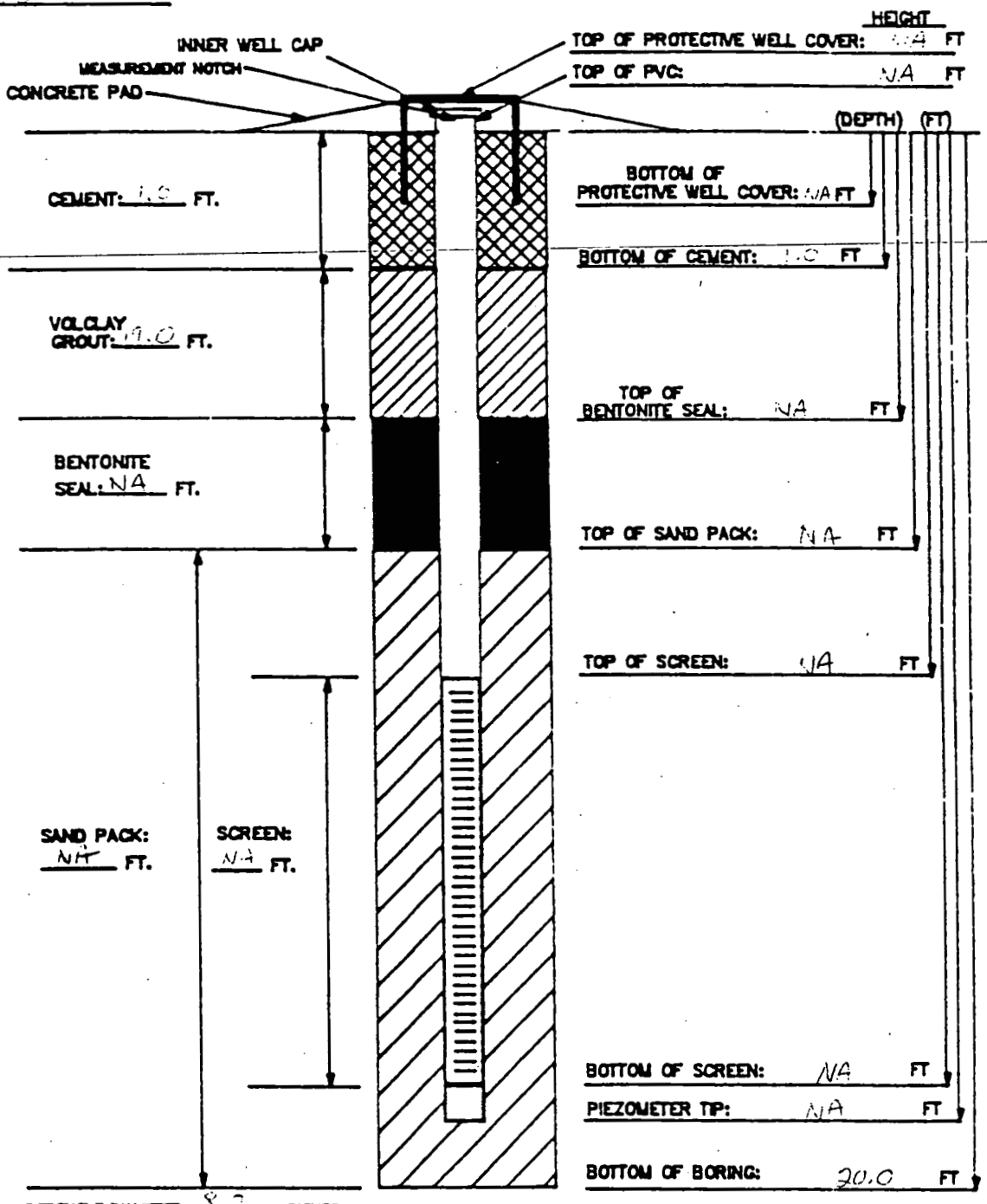
NOTE:

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1313

INSTALLATION DATE: 7-27-87



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANTITY: NA
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 2 bags (50#) + 1 initiator
AMOUNT OF CEMENT: ½ (94#) sack
AMOUNT OF WATER USED: 50 gal.
OTHER: NA

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESIS INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 602 3.7 GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

5549

	Date	Initial	Field Check	1st Key In	2nd Key In	Hard Copy Verification
	7-12-89					

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1314	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/16/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				CORED THRU ≈ 7" CONCRETE on 7-1-89			
	19477 1003 7-14-89	5	6	MEDIUM DENSE, (10YR 5/3) BROWN, CLAYEY, GRAVEL SOME SAND, WET DUE TO SURFACE WATER	GC	NA	HNU = 5 PPM. α = 0 CPM Bγ = 190 CPM
1	19478 1003 7-14-89	5	6	VERY STIFF (10YR 5/3) BROWN, SILTY CLAY SOME SAND, TRACE OF FINE GRAVEL, MEDIUM PLASTICITY, VERY MOIST,	CL	2.75	
	19479 1003 7-14-89	13	5	STIFF, SAA	CL	1.5	
2	19480 1006 7-14-89	9	6	MEDIUM DENSE, (10YR 5/3) BROWN, CLAYEY GRAVEL SOME SAND, WET,	GC	NA	HNU = 4 PPM α = 0 CPM Bγ = 160-170 CPM
	19481 1006 7-14-89	11	6	VERY STIFF (10YR 5/4) YELLOWISH BROWN SILTY CLAY SOME SAND, TRACE OF FINE TO MED. GRAVEL, LOW PLASTICITY, MOIST	CL	3.0	
3	19482 1006 7-14-89	13	6	HARD, SAA	CL	4.5	
	19483 1027 7-14-89	5	6	DENSE, (10YR 5/3) BROWN, CLAYEY GRAVEL, SOME SAND. WET DUE TO SURFACE WATER.	GC	NA	HNU = 6 PPM α = 0 CPM Bγ = 150-160 cpm
4	19484 1027 7-14-89	18	6	VERY STIFF (10YR 5/4) YELLOWISH BROWN, SILTY CLAY SOME SAND TRACE OF FINE TO MED. GRAVEL, LOW PLASTICITY, MOIST,	CL	2.5	
	19485 1027 07-14-89	21	6	VERY STIFF, SAA	CL	2.25	
5	19486 1105 07-14-89	12	5	MEDIUM STIFF (10YR 5/4) YELLOWISH BROWN SILTY CLAY, SOME SAND AND GRAVEL, MEDIUM PLASTICITY, VERY MOIST.	CL	1.0	HNU = 6.5 PPM α = 0 CPM Bγ = 140-150 cpm
	19487 1105 07-14-89	15	0	NR	NA	NA	
6	19488 1105	20	0	NR	NA	NA	
	19489 1108 7-14-89	10	3	MEDIUM STIFF, (2.5Y 4/4) OLIVE BROWN, SILTY CLAY, SOME SAND AND GRAVEL, MEDIUM PLASTICITY MOIST.	CL	.75	HNU = 7 PPM α = 0 CPM Bγ = 160-170 cpm
7	19490 1108 11-14-89	12	0	NR	NA	NA	
	19491 1108 11-14-89	12	0	NR	NA	NA	

NOTES:
CONTRACTOR: PENN DRILL
RIG: ~~Acker Soil Century~~ 45-C
DRILLER: Craig Coulter
ASSISTANT: Bill Anderson
Geo Assistant: ~~Cindy McLeod~~ Wendy Budach
HNU # ~~60511~~ 90551329

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bγ : 180-240 CPM
SAA = Same As Above
NR = No Recovery
LEL/O_2: LEL: 0% ~~PPM~~ 7/17/89
O_2: 20.6 %

000238

UXB 07/14/89

5549

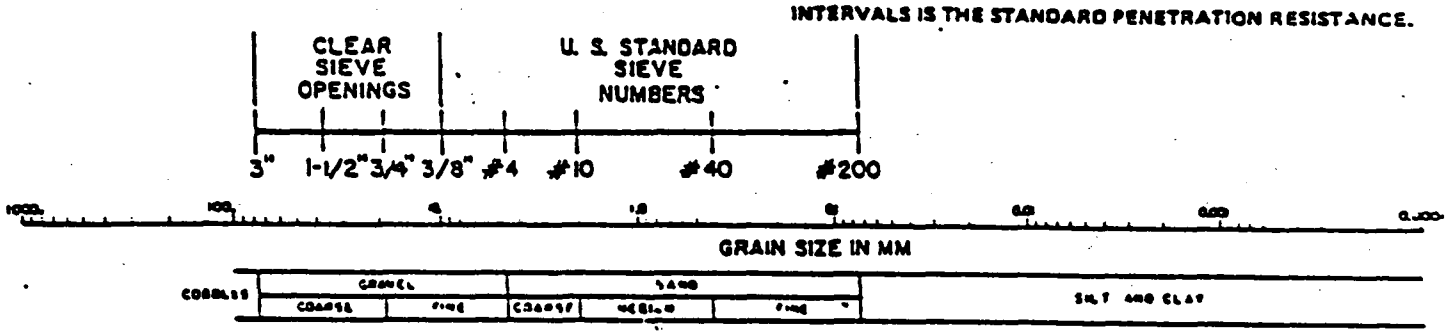
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOIL

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

5549

	Initial	Date
1st Key In	JAH	8/2/89
2nd Key In		
Hard Copy Verification		

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1314	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/14/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN.	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
11/14/89 8	19472 11-12	9	6	MED STIFF, (5Y 4/1) DRK. GREY, SILTY CLAY, SOME SAND, TRACE OF FINE TO MEDIUM GRAVEL, LOW PLASTICITY, MOIST.	CL	.5	HNU = 3.5 PPM α = 0 CPM Bγ = 140-150 CPM
	19473 1112 11-14-89	18	2	MED. STIFF SAA NR WJB 7/14/89	CL	.75	
9	19474 1112 7-14-89	20	0	NR CB 7/14/89	NA	NA	
10	19475 1338 07-14-89	4	0	NR	NA	NA	HNU = NA α = NA Bγ = NA (WITH SCREEN)
	19476 1338 07-14-89	8	0	NR	NA	NA	
	19497 1338 07-14-89	10	0	NR	NA	NA	
11	19498 1340 07-14-89	9	6	SOFT (5Y 4/1) DK. GREY, SILTY CLAY. TRACE OF SAND AND FINE GRAVEL, MED PLASTICITY, MOIST,	CL	.25	HNU = 4.5 PPM α = 0 CPM Bγ = 160-170 CPM
	53977 1340 07-14-89	10	5	VERY SOFT, (5Y 4/1) DK. GREY TO (10YR ~~5/4) YELLOWISH BROWN, SILTY CLAY~~ TRACE OF SAND + FINE GRAVEL MED PLASTICITY MOIST	CL	<.25	
12	53978 1340 07-14-89	12	0	NR	NA	NA	
	53979 1346 7-14-89	10	6	SOFT, (5Y 4/1) DK. GREY, SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, MED. PLASTICITY, MOIST	CL	.25	HNU = 1 PPM α = 0 CPM Bγ = 130-140 CPM
13	53980 1346 7-14-89	12	6	SOFT, SAA	CL	.25	
	53981 1346 7-14-89	15	6	SOFT, SAA	CL	.25	
14	53982 1355 7-14-89	8	6	SOFT, SAA	CL	.50	HNU = 0 PPM α = 0 CPM Bγ = 170-180 CPM
	53983 1355 7-14-89	9	6	SOFT. SAA	CL	.50	
	53984 1355 7-14-89	10	6	VERY SOFT, SAA	CL	.25	

NOTES:

SAA = Same As Above
NR = No Recovery

000240

5549

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

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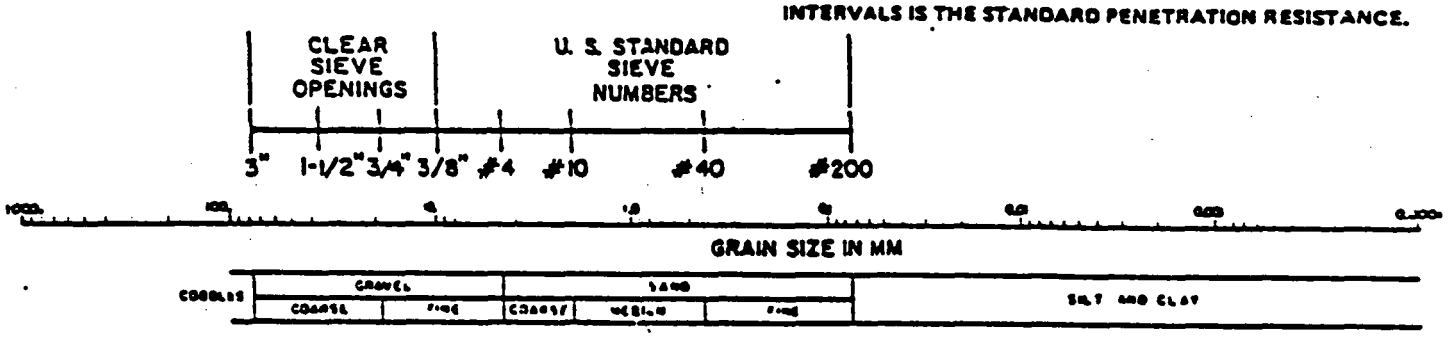

USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

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	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

000241

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1314	COORDINATES:	DATE: 7/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 7/14/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 7/14/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	53985 1521 7-14-89	2	0	NR	NA	NA	HNU: ~~0 PPM~~ α: ~~0 CPM~~ BG: ~~140-150 CPM~~ NA 07-14-89 WB
16	53986 1521 7-14-89	5	0	NR	NA	NA	
	53987 1521 7-14-89	7	0	NR	NA	NA	
3	53988 1525 7-14-89	4	6	VERY SOFT, (54 4/1) DARK GREY, SILTY CLAY TRACE OF SAND AND FINE GRAVEL MEDIUM PLASTICITY MOIST	CL	<.25	HNU: 0 PPM α: 0 CPM BG: 140-150 CPM
+7	53989 1525 7-14-89	5	6	VERY SOFT SAA	CL	<.25	
18	53990 1525 7-14-89	5	6	VERY SOFT SAA	CL	<.25	
	53991 1530 7-14-89	7	6	SAA	CL	<.25	HNU: 0 PPM α: 0 CPM BG: 180-190 CPM
19	53992 1530 7-14-89	12	6	SAA	CL	.5	
	53993 1530 7-14-89	12	6	SAA	CL	<.25	
20	53994 1530 7-14-89	13	6	SAA	CL	<.25	HNU: 0 PPM α: 0 CPM BG: 180-190 CPM
			*	Bottom of Boring & sampling at 20.0 FT			

NOTES:

SAA = Same As Above

NR = No Recovery

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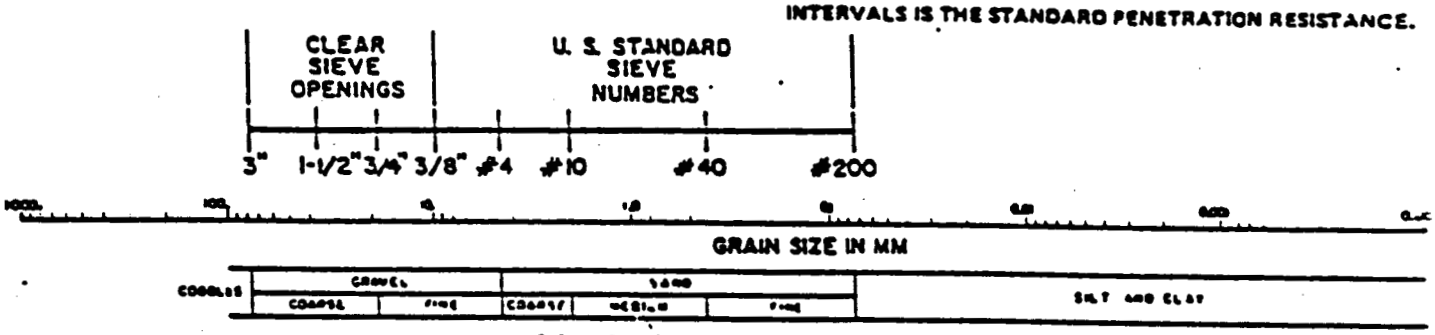
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 7/16/89
PROJECT NO. 6023.7 CHECKED BY W.A. Hertel DATE 7/16/89
BORING NO. 1314
PIEZOMETER NO. NA DATE OF INSTALLATION ~~7/ /89~~ 7/14/89 NA

BOREHOLE DRILLING

DRILLING METHOD 8.0 in Hollow Stem Auger	TYPE OF BIT 8.0 Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID NA FROM — TO —	SIZE NA FROM — TO —
FLUID NA FROM — TO —	SIZE NA FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer – NA	RISER PIPE MATERIAL Schedule 40 PVC – NA
DIAMETER OF PERFORATED SECTION 2.0 in. ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 FT
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS NA
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Screw type – flush joint threaded
TOTAL PERFORATED AREA NA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT – NA	OTHER PROTECTION Hinged protective cover with installed padlock – NA
PROTECTIVE PIPE O.D. 4 3/8 in – NA	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	NA			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	NA			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~/cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
~~BENTONITE~~ Volclay grout	TOP 1.0	BOTTOM 20.0	TOP	BOTTOM
SAND	TOP NA	BOTTOM NA	TOP	BOTTOM
GRAVEL N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP NA	BOTTOM NA	TOP	BOTTOM
PIEZOMETER TIP	NA			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION	~~To be taken at a later date~~ 7/14/89 NA			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at — NA
Bottom of water bearing zone at — NA
No water zone encountered — well plugged 7-16-89 with volclay grout from 20.0 FT to 1.0 then topped with cement plug

000244

409-11-86

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE :

THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.