Lakes
Mich. File
Cont. Sites

February 6, 1984

Michigan Department of Natural Resources
ATTN: Mr. Donald Schultz
Project Engineer
State Office Building
411 J - East Genesee
Saginaw, MI 40687

Gentlemen:

This refers to our telephone conversation of January 31, 1984, concerning the SCA site near Kawkawlin, Michigan. Enclosed is a copy of the NRC criteria for onsite disposal of thorium or uranium waste. These criteria were developed for use by NRC licensees and therefore do not exactly apply to this situation since a licensee does not possess the property. However, these criteria are a rational basis to judge the acceptability of the disposal method.

From our telephone conversation it would appear that your method of closing the SCA site with respect to the chemical waste may meet option 4 in the NRC criteria.

If you need additional information, please do not hesitate to call.

Sincerely,

C. J. Paperiello, Chief
Emergency Preparedness and
Radiological Safety Branch

Enclosure: As stated

A/14

RIII/DRMSP RIII
Paperiello/mf
2/6/84 2/6/84

The Assistant Secretary finds that good cause exists for not publishing the supplement to the Puerto Rico State Plan as a proposed change and making the Regional Administrator's approval effective upon publication for the following reasons:

1. The standards are identical to the Federal standards which were promulgated in accordance with Federal law meeting requirements for public participation.

2. The standards were adopted in accordance with the procedural requirement of State Law and further participation would be unnecessary.

The decision is effective October 23, 1981.

(Sec. 18 Pub. L. 91-596, 84 Stat. 1608 (29 U.S.C. 667))

Signed at New York City, New York, this 15th day of June 1981.

Roger A. Clark,

Regional Administrator.

[FR Doc. 81-30743 Filed 10-22-81; 8:45 am]

BILLING CODE 4510-26-M

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards, Subcommittee on Callaway Plant; Location Change

The ACRS Subcommittee on Callaway Plant will hold a meeting on November 4 and 5, 1981, at the HOLIDAY INN-WEST, 1900 I-70 Drive Southwest, Columbia, MO instead of the Hilton Inn.

Notice of this meeting was published in the Federal Register on October 19, 1981 (46 FR 51329), and all other items remain the same except for the location change as indicated above.

Dated: October 19, 1981.

John C. Hoyle,

Advisory Committee Management Officer.

[FR Doc. 81-30733 Filed 10-22-81; 8:45 am]

BILLING CODE 7590-01-M

Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations

AGENCY: Nuclear Regulatory Commission (NRC).

ACTION: Discussion of options for NRC approval of applications for disposal or onsite storage of thorium or uranium wastes; interim use and public comment.

SUMMARY: This notice discusses five options for NRC approval of disposal or onsite storage of thorium or uranium wastes from past nuclear operations. The options are contained in a Branch Technical Position for administration by the Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

DATES: Comments on the options for disposal or onsite storage of thorium or uranium are encouraged. Such comments will be considered in any subsequent revision of the Branch Technical Position. Comments are due December 22, 1981.

Note.—Comments received after the expiration date will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments filed on or before that date.

FOR FURTHER INFORMATION CONTACT: Ralph G. Page, Chief, Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, Washington, D.C. 20555, telephone 301-427-4309.

SUPPLEMENTARY INFORMATION:

I. Introduction

Some of the sites formerly used for processing thorium and uranium are known today to be contaminated with residual radioactive materials. Some are currently covered by NRC licenses. Others were once licensed, but the licenses to possess and use material have expired. In many cases, the total amount of contaminated soil is large, but the activity concentrations of radioactive materials are believed sufficiently low to justify their disposal on privately owned lands or storage onsite rather than their transport to a licensed radioactive materials disposal (commercial) site. In many instances packaging and transporting these wastes to a licensed disposal site would be too costly and not justified from the standpoints of risk to the public health or cost-benefit. Furthermore, because of the total volume of these wastes, limited commercial waste disposal capacity, and restrictions placed on receipt of long-lived wastes at commercial sites, it is not presently feasible to dispose of these wastes at commercial low-level waste disposal sites.

Effective January 28, 1981, NRC regulations in 10 CFR 20, "Standards for Protection Against Radiation", were amended (45 FR 71761-71762) to delete § 20.304 which provided general authority for disposal of radioactive materials by burial in soil. Under the amended regulations, licensees must apply for and obtain specific NRC approval to dispose of radioactive materials in this manner under the provisions of 10 CFR 20.302. A case-by-case review was believed needed to assure that burial of radioactive wastes would not present an unreasonable health hazard at some future date.

The deleted provisions of § 20.304 previously permitted burial of up to 100 millicuries of thorium or natural uranium at any one time, with a yearly limitation of 12 burials for each type of material at each site. The only disposal standards specified were (1) burial at a minimum depth of four feet, and (2) successive burials separated by at least six feet. Thus a total of 1.2 curies of these materials were permitted to be disposed of each year by burial in a 12 foot by 18 foot or larger plot of ground.

Under the amended regulations, it is incumbent on an applicant who wants to bury radioactive wastes to demonstrate that local land burial is preferable to other disposal alternatives. The evaluation of the application takes into account the following information:

Types and quantities of material to be buried
Packaging of waste
Burial location
Characteristics of burial site
Depth of burial
Access restrictions to disposal site
Radiation safety procedures during disposal operations
Recordkeeping
Local burial restrictions, if any

For applications involving disposal of soils contaminated with low level concentrations of thorium and uranium (other than concentrations not exceeding EPA cleanup standards), the matters of principal importance are:

Concentrations of thorium and uranium (either in secular equilibrium with their daughters or without daughters present)
Volume of contaminated soil
Costs for offsite and onsite disposal
Availability of offsite burial space
Disposal site characteristics
Depth of burial and accessibility of buried wastes
State and local government views

II. Branch Technical Position

There are five acceptable options for disposal or onsite storage of thorium and uranium contaminated wastes. Applications for disposal or storage will be approved if the guidelines discussed under any option are met. Applications for other methods of disposal may be submitted and these will be evaluated on their own merits.

1. Disposal of acceptably low concentrations (which meet EPA cleanup standards) of natural thorium with daughters in secular equilibrium, depleted or enriched uranium, and

uranium ores with daughters in secular equilibrium with no restriction on burial method.

Under this option, the concentrations of natural thorium and depleted or enriched uranium wastes are set sufficiently low that no member of the public is expected to receive a radiation dose commitment from the disposed materials in excess of 1 millirad per year to the lung or 3 millirads per year to the bone from inhalation and ingestion, under any foreseeable use of the material or property. These radiation dose guidelines were recommened by the Environmental Protection Agency (EPA) for protection against transuranium elements present in the environment as a result of unplanned contamination (42 FR 60956–60959). In addition, the concentrations are sufficiently low so that no individual may receive an external dose in excess of 10 microroentgens per hour above background. This is compatible with guidelines EPA proposed as cleanup standards for inactive uranium processing sites (46 FR 2556–2563).

For natural uranium ores having daughters in equilibrium, the concentration limit is equal to that set by the EPA (46 FR 2556–2563) for radium-226 (i.e., 5 pCi/gm, including background) and its decay products.

The concentrations specified below are believed appropriate to apply. It is expected, however, that currently licensed operations will be conducted in such a manner as to minimize the possibility of soil contamination and when such occurs the contamination will be reduced to levels as low as reasonably achievable.

Kind of material	Concentration (pCi/gm)
Natural thorium (Th-232 plus Th-228) if all daughters are present and in equilibrium	10
Depleted Uranium	35
Enriched Uranium	30
Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium	10

The analysis upon which the Branch Technical Position is based is available for inspection at the Commission's Public Document Room at 1717 H St., N.W., Washington, D.C.

The concentrations specified under this option may be compared with naturally occurring thorium and uranium ore concentrations of 1.3 pCi/gm in igneous rock and uranium concentrations of 120 pCi/gm in Florida phosphate rock and 50–80 pCi/gm in Tennessee bituminous shale. Concentration limits for natural thorium and natural uranium ore wastes containing daughters not at secular equilibrium can be calculated on a case-by-case basis using the applicable isotopic activities data.

2. Disposal of certain low concentrations of natural thorium with daughters in secular equilibrium and depleted or enriched uranium with no daughters present when buried under prescribed conditions with no subsequent land use restrictions and no continuing NRC licensing of the material.

Under this option the concentrations of natural thorium and uranium are set sufficiently low so that no member of the public will receive a radiation dose exceeding those discussed under option 1 when the wastes are buried in an approved manner absent intrusion into the burial grounds. This option will require establishing prescribed conditions for disposal in the license, such as depth and distribution of material, to minimize the likelihood of intrusion. Burial will be permitted only if it can be demonstrated that the buried materials will be stabilized in place and not be transported away from the site.

Acceptability of the site for disposal will depend on topographical, geological, hydrological and meteorological characteristics of the site. At a minimum, burial depth will be at least four feet below the surface. In the event that there is an intrusion into the burial ground, no member of the public will likely receive a dose in excess fo 170 millirems to a critical organ. An average dose not exceeding 170 millirems to the whole body for all members of a general population is recommended by international and national radiation expert bodies to limit population doses. With respect to limiting doses to individual body organs, the concentrations are sufficiently low that no individual will receive a dose in excess of 170 millirems to any organ from exposure to natural thorium, depleted uranium or enriched uranium.

The average activity concentration of radioactive material that may be buried under this option in the case of natural thorium (Th-232 plus Th-228) is 50 pCi/gm, if all daughters are present and in equilibrium; for enriched uranium it is 100 pCi/gm if the uranium is soluble and 250 pCi/gm if insoluble; for depleted uranium it is 100 pCi/gm if the uranium is soluble and 300 pCi/gm if insoluble. Natural uranium ores containing radium 226 and its daughters are not included under this option, because of possible radon 222 emanations and resultant higher than acceptable exposure of individuals in private residences if houses were built over buried materials.

3. Disposal of low concentrations of natural uranium ores, with all daughters in equilibrium, when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the specified land contains buried radioactive materials and are conditioned in a manner acceptable under state law to impose a covenant running with the land that the specified land may not be used for residential building. (There is no continuing NRC licensing of the material.)

Disposal will be approved if the burial criteria outlined in option 2 (including burial at a minimum of 4 feet) are met. Depending upon local soil characteristics, burials at depths greater than 4 feet may be required. In order to assure protection against radon 222 releases (daughter in decay chain of uranium 238 and uranium 234), it is necessary that the recorded title documents be amended to state in the permanent land records that no residential building should be permitted over specified areas of land where natural uranium ore residues (U-238 plus U-234) in concentrations exceeding 10 pCi/gm has been buried. Industrial building is acceptable so long as the concentration of buried material does not exceed 40 pCi/gm of uranium (i.e., Ra-226 shall not exceed 20 pCi/gm).

4. Disposal of land-use-limited concentrations of natural thorium or natural uranium with daughters in secular equilibrium and depleted or enriched uranium without daughters present when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the land contains buried radioactive material and are conditioned in a manner acceptable under state law to impose a covenant running with land that the land (1) may not be excavated below stated depths in specified areas of land unless cleared by appropriate health authorities, (2) may not be used for residential or industrial structures over specified areas where radioactive materials in concentrations higher than specified in options 2 and 3 are buried, and (3) may not be used for agricultural purposes in the specified areas. (There is no continuing NRC licensing of the disposal site.)

Under this option, conditions of burial will be such that no member of the public will receive radiation doses in excess of those discussed under option 1 absent intrusion into the burial ground. Criteria for disposal under these conditions is predicated upon the assumption that intentional intrusion is less likely to occur if a warning is given

in land documents of record not to excavate below burial depths in specified areas of land without clearance by health authorities; not to construct residential or industrial building on the site; and not to use specified areas of land for agricultural purposes. Because of this, we believe it appropriate to apply a maximum critical organ exposure limit of 500 millirems per year to thorium and uranium buried under this restriction instead of 170 millirems as used in options 2 and 3. In addition, any exposure to such materials is likely to be more transient than assumed (essentially continual exposure) under those options. These two factors combine to increase the activity concentration limits calculated under option 2 by about 10. Thus, the average concentration that may be buried under this option for thorium (Th-232 plus Th-228) is 500 pCi/gm if all daughters are present and in equilibrium; for enriched uranium it is 1000 pCi/gm if the uranium is soluble and 2500 pCi/gm if insoluble; and for depleted uranium it is 1000 pCi/gm if the uranium is soluble and 3000 pCi/gm if insoluble.

With respect to natural uranium with daughters present and in equilibrium, the concentration that may be buried under this option is 200 pCi/gm of U-238 plus U-234, i.e., 100 pCi/gm Ra-226. This concentration is based on a limited exposure of 2.4 hours per day to limit the radon dose to less than 0.5 working level month (WLM) which is equivalent to continuous exposure to 0.02 working level (WL). Depending upon local soil characteristics, burials at depths greater than 4 feet may be required.

SUMMARY OF MAXIMUM CONCENTRATIONS PERMITTED UNDER DISPOSAL OPTIONS

Kind of Material	Disposal Options			
	1 [1]	2 [2]	3 [3]	4 [4]
Natural Thorium (Th-232 + Th-228) with daughters present and in equilibrium	10	50	.....	500
Natural Uranium (U-238 + U-234) with daughters present and in equilibrium	10	.....	40	200
Depleted Uranium:				
*Soluble	35	100	.....	1,000
*Insoluble	35	300	.....	3,000
Enriched Uranium:				
*Soluble	30	100	.....	1,000
*Insoluble	30	250	.....	2,500

[1] Based on EPA cleanup standards.
[2] Concentrations based on limiting individual doses to 170 mrem/yr.
[3] Concentration based on limiting equivalent exposure to 0.02 working level or less.
[4] Concentrations based on limiting individual doses to 500 mrem/yr and, in case of natural uranium, limiting exposure to 0.02 working level or less.

5. Storage of licensed concentrations of thorium and uranium onsite pending the availability of an appropriate disposal site.

When concentrations exceed those specified in option 4, long term disposal other than at a licensed disposal site will not normally be a viable option under the provisions of 10 CFR 20.302. In such cases, the thorium and uranium may be permitted to be stored onsite under an NRC license until a suitable method of disposal is found. License conditions will require that radiation doses not exceed those specified in 10 CFR Part 20 and be maintained as low as reasonably achievable.

Before approving an application to dispose of thorium or uranium under options 2, 3, or 4, NRC will solicit the view of appropriate State health officials within the State in which the disposal would be made.

Dated at Silver Spring, Maryland this 19th day of October, 1981.

Richard E. Cunningham,

Director, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

[FR Doc. 81-30858 Filed 10-22-81; 8:45 am]

BILLING CODE 7590-01-M

OFFICE OF PERSONNEL MANAGEMENT

Postponement of Application Deadline for Fund-Raising Privileges Among Federal Employees by Private Voluntary Organizations

Section 5.43 of the "Manual on Fund-Raising Within the Federal Service for Voluntary Health and Welfare Agencies" sets December 1 of each year as the deadline by which national voluntary agencies must submit applications for participation in the Combined Federal Campaign (CFC) to be conducted in the fall of the following year. This year's deadline is being postponed from December 1, 1981, to February 1, 1982. In June 1981, the U.S. Office of Personnel Management (OPM) announced that the eligibility criteria for participation in the 1982–83 CFC are being reviewed. The deadline date is being postponed to avoid national voluntary agencies having to revise their applications to meet eligibility criteria which may be changed.

Donald J. Devine,

Director.

[FR Doc. 81-30730 Filed 10-22-81; 8:45 am]

BILLING CODE 6325-01-M

OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE

Resolution of Complaint of Price-Undercutting of Subsidized Cheese Imports

On October 1, 1981, the United States Trade Representative received a letter from the Secretary of Agriculture informing him of the Secretary's finding that imported Grade A Swiss type cheese produced in Finland has been offered for sale in the United States at duty-paid wholesale prices which are five cents per pound less than the domestic wholesale market price of similar cheese produced in the United States.

In accordance with Section 702(c)(2) of the Trade Agreements Act of 1979 (the Act) (19 U.S.C. 1202 note), the Office of the United States Trade Representative notified Finland of the price undercutting determination made by the Secretary of Agriculture, requested that corrective action be taken, and asked for appropriate assurances concerning the commitments made in the Arrangement Between the United States and Finland Concerning Cheese.

On October 14, 1981, Finland notified the United States Trade Representative that measures have been taken to ensure that the duty-paid wholesale price of imported Grade A Swiss type cheese produced in Finland will not be less than the domestic wholesale market price of similar cheese produced in the United States. In addition, Finland gave assurance that it will respect the price commitments in the Arrangement. Since the above notification by Finland has occurred within the 15-day period provided in Section 702(c)(3) of the Act, the United States Trade Representative has notified the Secretary of Agriculture of his belief that no further action is required.

William E. Brock,

United States Trade Representative.

[FR Doc. 81-30684 Filed 10-22-81; 8:45 am]

BILLING CODE 3190-01-M

SECURITIES AND EXCHANGE COMMISSION

[Release No. 22236; 70-6650]

Arkansas Power & Light Co.; Proposed Issuance and Sale of First Mortgage Bonds

October 19, 1981.

Arkansas Power & Light Company

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF
5AR

RECEIVED
APR 19 1984
[redacted] DIVISION
Ground Water

APR 17 1984

Mr. Don Shultz
State Office Building
411-J East Genesee
Saginaw, Michigan 48607

Dear Mr. Shultz:

Pursuant to your telephone request and our conversation recently, I have obtained complete results of 3 water samples (No activity identified) taken at Tobico Marsh and analyzed for radioactivity at EPA's Eastern Environmental Radiation Facility. These are enclosed. If you have questions on the results, and/or their interpretation, please feel free to call me at (312) 886-6175, or Pete Tedeschi at (312) 353-2654.

Sincerely yours,

Larry Jensen

Larry Jensen,
Radiation Specialist

Enclosure:

Thus Show normal bkd. unremarkable.

A/16

MAY 11 1984

32380

AMPLE ID RSIM32016
AMPLE TYPE WATER
OLLECTION DATE, TIME 5/ 3/83 0: 0
ECEIPT DATE 5/ 6/83
PLETION DATE 6/23/83
G DATE 7/ 6/83
OCATION MI:KAWKAWLIN
THER ID'S HARTLEY & HARTLEY
OMMENTS EAST SIDE,STATE'S PENINSULA,TOBICO MARSH
EPORT TO CHICK PHILLIPS

YPE OF ANALYSIS ********** GAMMA **********
VERIFIED BY MS (5/20/83) AND CP (5/20/83)
DATE, TIME COUNTED 5/16/83 13:56
LENGTH OF COUNT 50 MIN
PREPARER
COUNTING SYSTEM NAI1
SAMPLE SIZE 3.500 L
COMMENTS

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
CE-144	-2.5540E+01	237.60 %	PCI/L	5/16/83
I-131	-8.9422E+00	154.93 %	PCI/L	5/16/83
RU-106	-2.3851E+01	167.48 %	PCI/L	5/16/83
CS-137	-1.0663E+00	762.97 %	PCI/L	5/16/83
ZR-NB	7.5405E-01	935.22 %	PCI/L	5/16/83
TH-232	3.2470E+00	473.08 %	PCI/L	5/16/83
ZN-65	-6.2393E+00	228.23 %	PCI/L	5/16/83
CO-60	-6.5437E+00	133.96 %	PCI/L	5/16/83
K-40	-5.8038E+01	133.01 %	PCI/L	5/16/83
BA-140	2.4215E+00	337.67 %	PCI/L	5/16/83
BI-214	2.5008E+01	149.11 %	PCI/L	5/16/83

TYPE OF ANALYSIS ********** ALPHA **********
VERIFIED BY GL (5/18/83) AND MM (5/18/83)
DATE, TIME COUNTED 5/16/83 12:35
LENGTH OF COUNT 100 MIN
PREPARER ZS
COUNTING SYSTEM 2
SAMPLE SIZE 0.050000 L
COMMENTS ***** MG/L WT= 54.40 GCPM= 0.19 BCPM=0.07 ABS FACT= 0.456

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
ALPHA	5.8110E+00	84.98 %	PCI/L	5/16/83

TYPE OF ANALYSIS ********** BETA **********
VERIFIED BY GL (5/18/83) AND MM (5/18/83)
DATE, TIME COUNTED 5/16/83 14:25
LENGTH OF COUNT 50 MIN
PREPARER ZS
COUNTING SYSTEM 1R
SAMPLE SIZE 0.050000 L
COMMENTS ***** MG/L WT= 54.40 GCPM= 2.72 BCPM=1.17 ABS FACT= 0.969

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
BETA	3.1110E+01	35.97 %	PCI/L	5/16/83 EFF= 0.440RAW ACT= 32.

76

E OF ANALYSIS ********** TH **********
VERIFIED BY GL (6/ 1/83) AND MM (6/ 1/83)
DATE, TIME COUNTED 5/26/83 15:45
LENGTH OF COUNT 1000 MIN
PREPARER AS
COUNTING SYSTEM AS 1
SAMPLE SIZE 1.000 L
COMMENTS PREP 5/25/83

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
TH-227	1.0230E-02	149.07 %	PCI/L	5/26/83
TH-228	7.5280E-02	35.43 %	PCI/L	5/26/83
TH-230	1.0150E-01	26.72 %	PCI/L	5/26/83
TH-232	3.6000E-02	42.72 %	PCI/L	5/26/83
YIELD	1.0710E+02	1.81 %	PER CENT	5/26/83

[illegible]: [illegible]
SAMPLE TYPE: WATER
COLLECTION DATE, TIME: 5/ 3/83 0: 0
RECEIVED: 5/11/83
COMPLETION DATE: 6/23/83
REPORT DATE: 7/11/83
LOCATION: MICHAWKAWLIN
TASK ID'S: HARTLEY & HARTLEY
COMMENTS: EAST SIDE,STATE'S PENINSULA,TOBICO MARSH
REPORT TO: CHICK PHILLIPS

TYPE OF ANALYSIS: ********** GAMMA **********
VERIFIED BY: MS (5/20/83) AND CP (5/20/83)
DATE, TIME COUNTED: 5/16/83 14:48
LENGTH OF COUNT: 50 MIN
PREPARER:
COUNTING SYSTEM: NAI1
SAMPLE SIZE: 3.500 L
COMMENTS:

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
CE-144	4.9032E+00	1228.16 %	PCI/L	5/16/83
I-131	4.2433E+00	314.50 %	PCI/L	5/16/83
RU-106	-3.1205E+01	126.47 %	PCI/L	5/16/83
CS-137	-4.3845E+00	183.62 %	PCI/L	5/16/83
ZR-NB	-3.0605E-01	1720.33 %	PCI/L	5/16/83
TE-132	-5.6290E+00	274.16 %	PCI/L	5/16/83
ZN-65	-2.2218E+00	648.30 %	PCI/L	5/16/83
CO-60	6.2855E+00	140.35 %	PCI/L	5/16/83
K-40	2.0189E+01	386.87 %	PCI/L	5/16/83
BA-140	1.3181E+00	605.74 %	PCI/L	5/16/83
RI-214	-9.2708E+01	181.73 %	PCI/L	5/16/83

TYPE OF ANALYSIS: ********** ALPHA **********
VERIFIED BY: GL (5/18/83) AND MM (5/18/83)
DATE, TIME COUNTED: 5/14/83 12:35
LENGTH OF COUNT: 100 MIN
PREPARER: ZS
COUNTING SYSTEM: 3
SAMPLE SIZE: 0.050000 L
COMMENTS: 282.0 MG/L WT= 14.10 GCPM= 0.16 BCPM=0.14 ABS FACT= 0.857

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
ALPHA	5.1910E-01	547.68 %	PCI/L	5/16/83

TYPE OF ANALYSIS: ********** BETA **********
VERIFIED BY: GL (5/18/83) AND MM (5/18/83)
DATE, TIME COUNTED: 5/16/83 14:25
LENGTH OF COUNT: 50 MIN
PREPARER: ZS
COUNTING SYSTEM: 1D
SAMPLE SIZE: 0.050000 L
COMMENTS: 282.0 MG/L WT= 14.10 GCPM= 0.96 BCPM=0.74 ABS FACT= 1.000

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
BETA	4.1440E+00	167.59 %	PCI/L	5/16/83 EFF= 0.450 W ACT= 4.

10

TYPE OF ANALYSIS: ********** TH **********
VERIFIED BY: GL (6/ 1/83) AND MM (6/ 1/83)
DATE, TIME COUNTED: 5/26/83 15:45
LENGTH OF COUNT: 1000 MIN
PREPARER: AS
COUNTING SYSTEM: AS 2
SAMPLE SIZE: 1.000 L
COMMENTS: PREP 5/25/83

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
TH-227	8.1150E-03	141.47 %	PCI/L	5/26/83
TH-228	7.7910E-02	31.74 %	PCI/L	5/26/83
TH-230	5.8430E-02	36.61 %	PCI/L	5/26/83
TH-232	2.9210E-02	51.73 %	PCI/L	5/26/83
YIELD	8.4290E+01	1.82 %	PER CENT	5/26/83

SAMPLE ID KSIM32518
SAMPLE TYPE WATER
COLLECTION DATE, TIME 5/ 3/83 01 0
SHIPT DATE 5/ 6/83
COMPLETION DATE 6/23/83
LAB DATE 7/ 6/83
LOCATION MIKAWKAWLIN
OTHER IDS HARTLEY & HARTLEY
COMMENTS WEST SIDE,STATE'S PENINSULA,TOBICO MARSH
REPORT TO CHICK PHILLIPS

TYPE OF ANALYSIS ********** GAMMA **********
VERIFIED BY MS (5/20/83) AND CF (5/20/83)
DATE, TIME COUNTED 5/16/83 15:43
LENGTH OF COUNT 50 MIN
PREPARER
COUNTING SYSTEM NAI1
SAMPLE SIZE 3.500 L
COMMENTS

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
CE-144	1.0550E+01	570.56 %	PCI/L	5/16/83
I-131	-2.4527E+00	547.89 %	PCI/L	5/16/83
RU-106	-7.9912E+00	504.20 %	PCI/L	5/16/83
CS-137	2.7889E+00	291.24 %	PCI/L	5/16/83
ZR-NB	1.7374E+00	405.67 %	PCI/L	5/16/83
TH-232	-4.3472E+00	240.83 %	PCI/L	5/16/83
ZN-65	3.1666E+00	459.86 %	PCI/L	5/16/83
CO-60	4.4182E+00	200.79 %	PCI/L	5/16/83
K-40	6.1922E+01	128.39 %	PCI/L	5/16/83
BA-140	6.6677E+00	122.47 %	PCI/L	5/16/83
BI-214	-1.0393E+01	401.39 %	PCI/L	5/16/83

TYPE OF ANALYSIS ********** ALPHA **********
VERIFIED BY GL (5/18/83) AND MM (5/18/83)
DATE, TIME COUNTED 5/16/83 12:35
LENGTH OF COUNT 100 MIN
PREPARER ZS
COUNTING SYSTEM 4
SAMPLE SIZE 0.050000 L
COMMENTS 490.0 MG/L WT= 24.50 GCPM= 0.12 BCPM=0.08 ABS FACT= 0.745

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
ALPHA	1.1860E+00	223.82 %	PCI/L	5/16/83

TYPE OF ANALYSIS ********** BETA **********
VERIFIED BY GL (5/18/83) AND MM (5/18/83)
DATE, TIME COUNTED 5/16/83 15:15
LENGTH OF COUNT 50 MIN
PREPARER ZS
COUNTING SYSTEM 1D
SAMPLE SIZE 0.050000 L
COMMENTS 490.0 MG/L WT= 24.50 GCPM= 1.80 BCPM=0.74 ABS FACT= 1.000

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
BETA	9.0700E+01	42.51 %	PCI/L	5/16/83 EFF= 0.450RAW ACT= 21.

TYPE OF ANALYSIS ********** TH **********
VERIFIED BY GL (6/ 1/83) AND MM (6/ 1/83)
DATE, TIME COUNTED 5/26/83 15:45
LENGTH OF COUNT 1000 MIN
PREPARER AS
COUNTING SYSTEM AS 3
SAMPLE SIZE 1.000 L
COMMENTS PREP 5/25/83

NUCLIDE	ACTIVITY	2 SIG ERROR	UNITS	DATE
TH-227	0.0000E-01	0.00 %	PCI/L	5/26/83
TH-228	3.0570E-02	63.98 %	PCI/L	5/26/83
TH-230	2.6490E-02	73.84 %	PCI/L	5/26/83
TH-232	2.6490E-02	55.53 %	PCI/L	5/26/83
YIELD	1.6140E+02	1.79 %	PER CENT	5/26/83

SCA SERVICES, INC.
[illegible] Avenue
Somerville, Massachusetts 02145
(617) 387-8200 Telex 94-0473

SCA SERVICES

RECEIVED
APR 27 1984
EPB-FIELD STAFF

Dan Shultz
Michigan DNR
Resource Recovery Division
General Office Building
Secondary Complex
Dimondale, MI 48821

April 19,1984

Dear Dan,

Enclosed please find a copy of the final design plans and specifications for the slurry wall to be installed at our Hartley & Hartley site in Michigan. This package is presently out to bid with an award scheduled for early May. Construction will begin by the end of May.

With respect to the inclusion of the state property into the containment plan, I offer the following: Based upon the initial DNR comments of October 24, 1983, my comments of February 2, 1984 and follow-up comments by the DNR of April 11,1984, SCA is willing to include the State's property (an area of approximately 450' x 450' in the northwest corner of our site) in the slurry wall containment plan in exchange for the following:

1. Elimination of the requirement for a treatment system of any type on site. We believe that containment and effective monitoring will adequately contain the buried materials.

2. Elimination of the requirement for TSP & VOC air monitoring during construction which we believe is totally unjustified for a project of this type.

3. Elimination of the request that a gas vent system be required in the cap of the encapsulated area.

If the above proposal is acceptable to the DNR, I will immediately commence the additional engineering required to include State lands in the program. Construction on the State's parcel would proceed after the receipt of supplemental bids and the signing of an appropriate legal agreement between SCA and DNR.

IA/17

I believe that our proposal represents the best overall solution to the problems at this site. In order to effectively include the State lands in the program I must have a reply to this proposal no later than Ma[illegible]8, 1984. I would appreciate your discussing this offer with the appr[illegible]iate parties at DNR, or,

if you like, I will talk to them directly.

As always, if you have any questions, please do not hesitate to call.

Sincerely,

John J. DiNapoli
Manager,
Special Sites Program

cc: R. Covel
T. Bogan
J. Bayer
R. Petersen

JJD:mah

Duplicate
Pad 2

CONSTRUCTION SPECIFICATIONS

HARTLEY & HARTLEY LANDFILL

KAWKAWLIN, MICHIGAN

CONSTRUCTION SPECIFICATIONS

SLURRY WALL, CAP AND MONITORING SYSTEM

HARTLEY & HARTLEY LANDFILL

KAWKAWLIN, MICHIGAN

OWNER:

SCA CHEMICAL SERVICES, INC.

5 MIDDLESEX AVENUE

SOMERVILLE, MASSCHUSETTS

ENGINEER:

GROUND/WATER TECHNOLOGY, INC.

100 FORD ROAD

DENVILLE, NEW JERSEY

JEFFREY L. DUNCAN

N.J.P.E. #GE28969

MARCH 30, 1984

Jeffrey L Duncan

11/83

INSTRUCTIONS TO BIDDERS

TABLE OF ARTICLES

Approx 60 pages of bidding detail apt
out of transmittal to WMSS.

SPECIAL PROVISIONS

SECTION I

SOIL AND WATER CONDITIONS

This section includes a summary of available information pertaining to soil and water conditions in and near the area included in this project as indicated in Figure 1. The conditions presented have been obtained over the course of six years and represent water level and subsurface contours at the time and location indicated only. Subsurface conditions between these locations have been estimated. Indication of site conditions in this package is not warranted (see Paragraph 2.03, General Conditions, Instructions to Bidders). The Contractor is responsible for field determination of all surface and subsurface elevations and conditions deemed necessary to complete this project to the satisfaction of the Engineer and Owner. It should be noted: a six (6) inch oil transmission line is located in the vicinity of the slurry wall construction. The approximate location is shown in Figure 2.

The Contractor is solely responsible for the health and safety of its employees and subcontractors. The Contractor shall be responsible, at no extra cost to the Owner, for all tests and other evaluations of surface and subsurface conditions to protect all personnel, onsite and offsite, to ensure a safe, finished product. The Contractor should be aware of the possibility of encountering buried organic wastes of unknown concentration, especially during excavation of the slurry wall. See the attached Water Quality Summary Sheet, Table I. The Contractor is referred to Section 7.20 of General Conditions, "Responsibility for Damage Claims."

Summaries of anticipated groundwater and soil conditions in the vicinity of the work area in this project are presented in the following twenty-nine (29) pages. Groundwater elevations have been presented from the most recent monitoring program (January, 1984). Elevations are given in feet above MSL (mean sea level).

The general soil conditions of the area consist of a zone approximately 40 feet thick of stable, glacial till of low permeability overlain by an unstable, highly permeable sand the thickness varying from zero to approximately ten (10) feet. The site is located less than one mile from the west shore of Lake Huron. Metallic objects are believed to have been placed in the landfill during the course of its operation, as indicated by the magnetometer survey, Figure 3. These areas may provide additional void space adjacent to the slurry wall excavation.

TABLE I

GROUND/WATER ANALYTICAL RESULTS

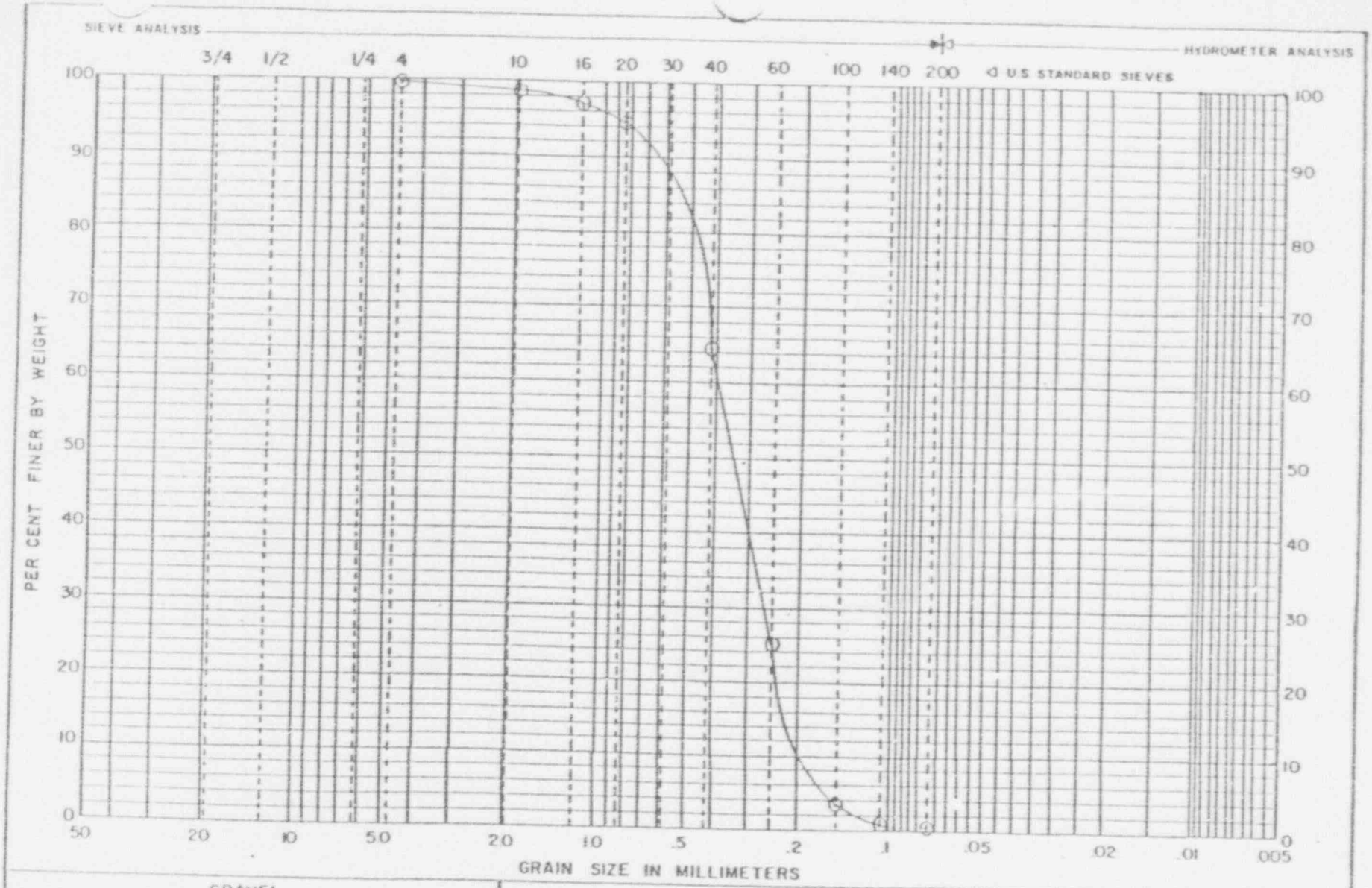
MONITORING WELLS IN AND AROUND AFFECTED AREA(1)

Chemical Oxygen Demand, mg/L	64-3200
Total Organic Carbon	7-500
Phenol	N.D-2.33
pH (No Units)	6.33-7.46
Chloride, mg/L	140-2200
Sulphate	<1-260
Alkalinity	110-1080
Conductivity, µmhos/cm	1600-6800
Benzene, µg/l	2900-10,000
Chloroethane	180(2)
Chloroform	9000
1,1 Dichloroethane	40-170,000
1,2 Dichloroethane	200-650
1,1 Dichloroethylene	29-100
1,2 Dichloropropane	200
Ethyl Benzene	1400-2400
Methylene Chloride	14-21
Tetrachloroethylene	600-2000
Toluene	13-28000
trans 1,2 Dichloroethylene	36-70-760
1,1,1 Trichloroethane	15-350
1,1,2 Trichloroethane	13,000
Trichloroethylene	46->100,000

Trichloro fluoromethane µg/L	11-16
Vinyl Chloride	14-7910
2 Chlorophenol	10
Pentachlorophenol	26
Acenaphthene	28-12,000
Anthracene	16000
Benzo(a)Anthracene	1900
Benzo(a)Pyrene	1500
Benzo(k)Fluoranthene	1200
Chrysene	2400
Fluoranthene	1800
Fluorene	13000
Naphthalene	7.4-260,000
Pyrene	3900

(1) Includes Monitoring Wells 12,15, 16, 18, 43, 45 (Figure 2)

(2) Compounds With Only One Analytical Result Given Were Detected in Only One Sample



GRAVEL			SAND			SILT OR CLAY	M.I.T. SOIL CLASSIFICATION
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

Sieve	% Finer
4	99.8
10	98.97
16	97.05
20	94.41
40	84.62
60	65.19
100	38.52
140	25.59
200	19.72

$D_{60} = .40$ $D_{50} = .35$

$D_{10} = .2$

$K \approx 350$ m/s

$U = \frac{D_{60}}{D_{10}} = 2.0$ (745 GPD/ft²)

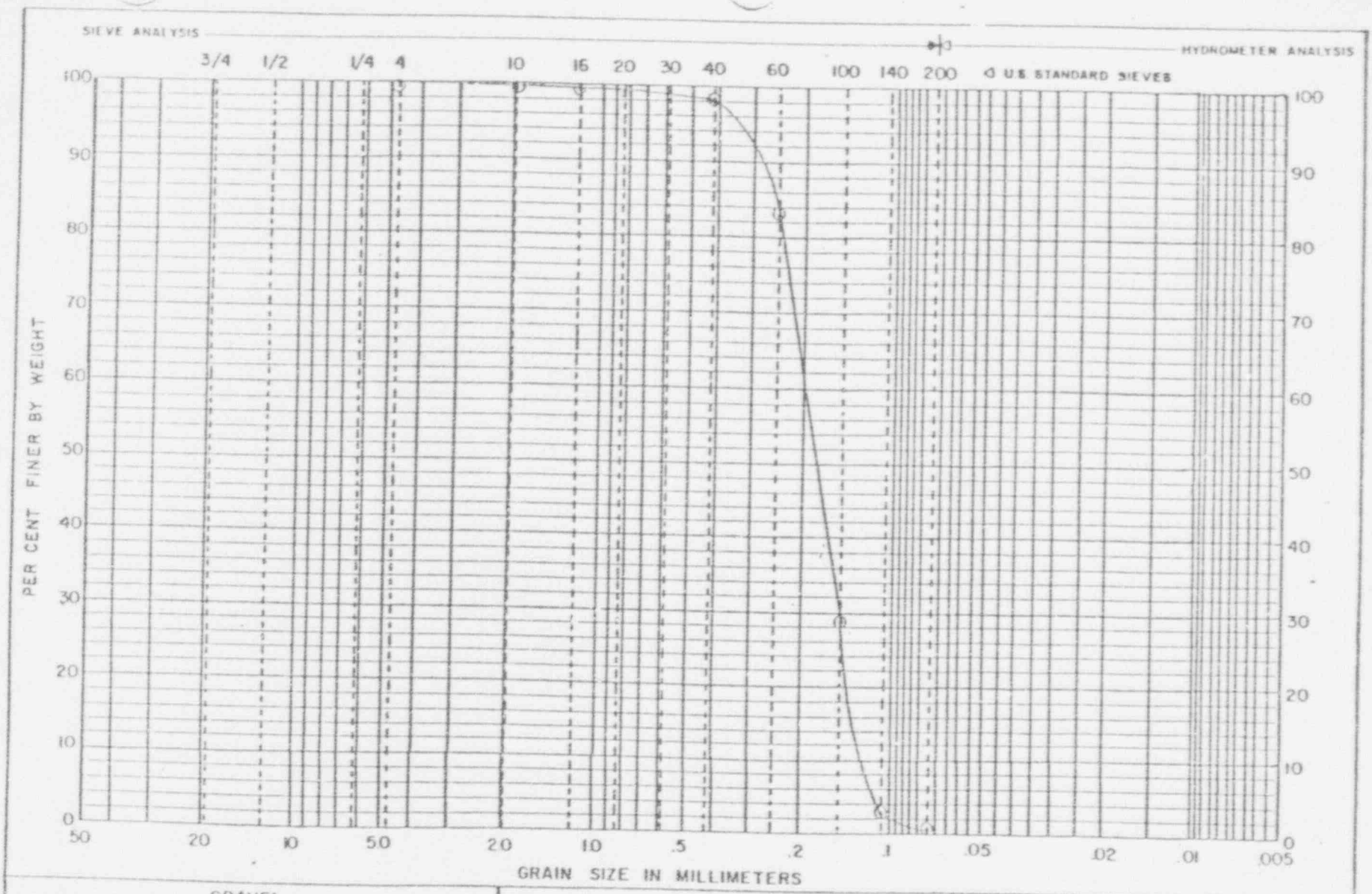
CLIENT: SCA - Kalkaska Mich.

LOCATION: H-1

FILE NO.:

DATE: 2-8-84 BY: SS

GROUNDWATER TECHNOLOGY, INC.



GRAVEL			SAND			SILT OR CLAY
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	M.I.T. SOIL CLASSIFICATION

Sieve	% Finer
4	99.82
10	99.79
16	99.56
20	99.44
40	99.05
60	82.9
100	20.51
140	2.78
200	.45

$D_{60} = .2$ $D_{50} = .18$

$D_{10} = .13$ $K = 225$ m/s

$\eta = \frac{D_{60}}{D_{10}} = 1.53$ (479 GPD/ft²)

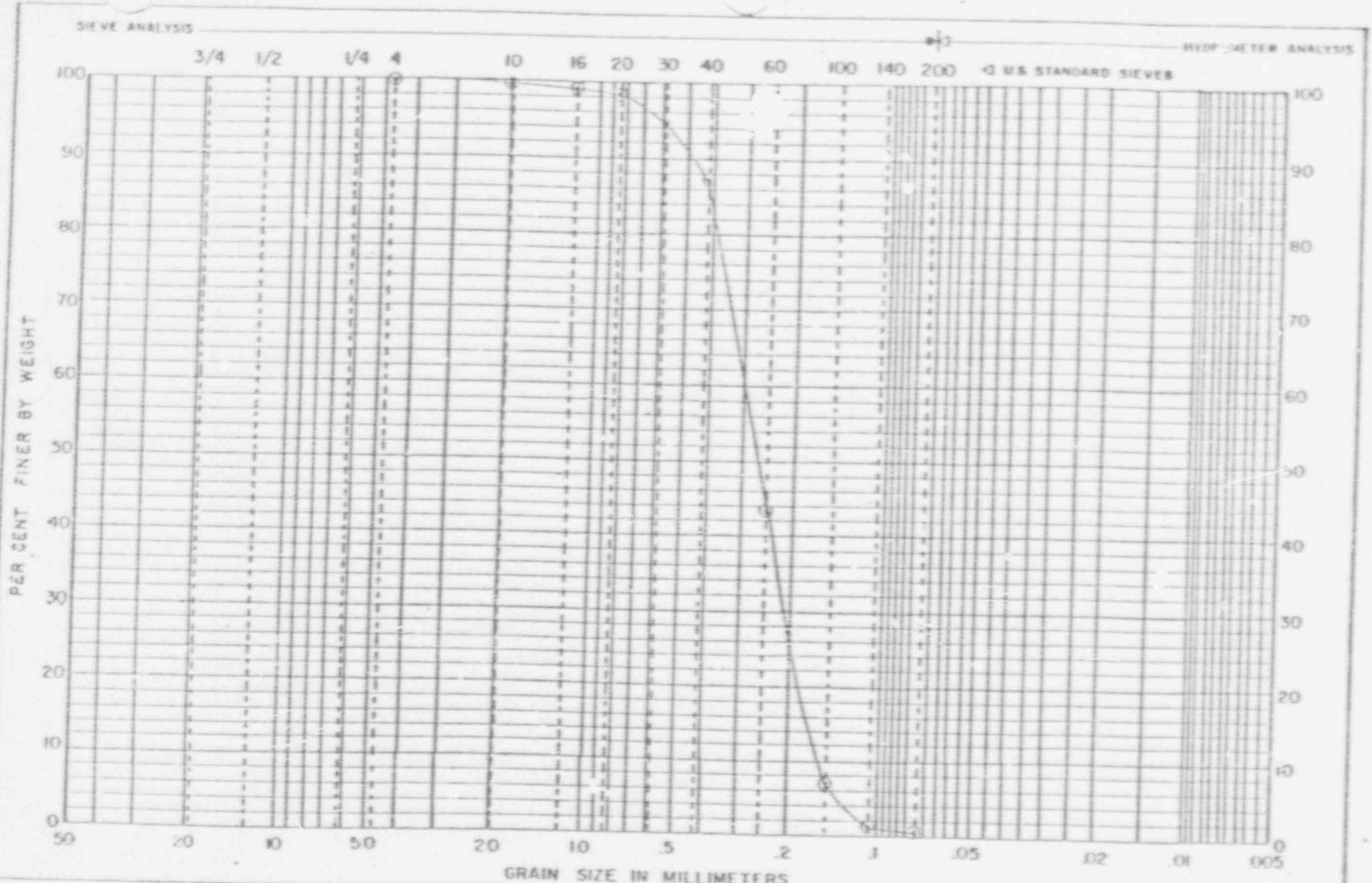
CLIENT: SCA Kruetzelin Mich

LOCATION: H-2

FILE NO.:

DATE: 2-8-84 BY: SS

GROUNDWATER TECHNOLOGY INC



GRAVEL			SAND			SILT OR CLAY	M.I.T. SOIL CLASSIFICATION
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

Sieve	% Finer
4	99.39
10	99.16
16	99.07
20	94.52
40	57.62
60	42.62
100	7.32
140	4.6
200	.19

$D_{60} = .30$ $D_{50} = .27$

$D_{10} = .16$

$K = 325$ m/s

$C_u = \frac{D_{60}}{D_{10}} = 1.875$

(691 GPD/ft²)

SOIL P.D

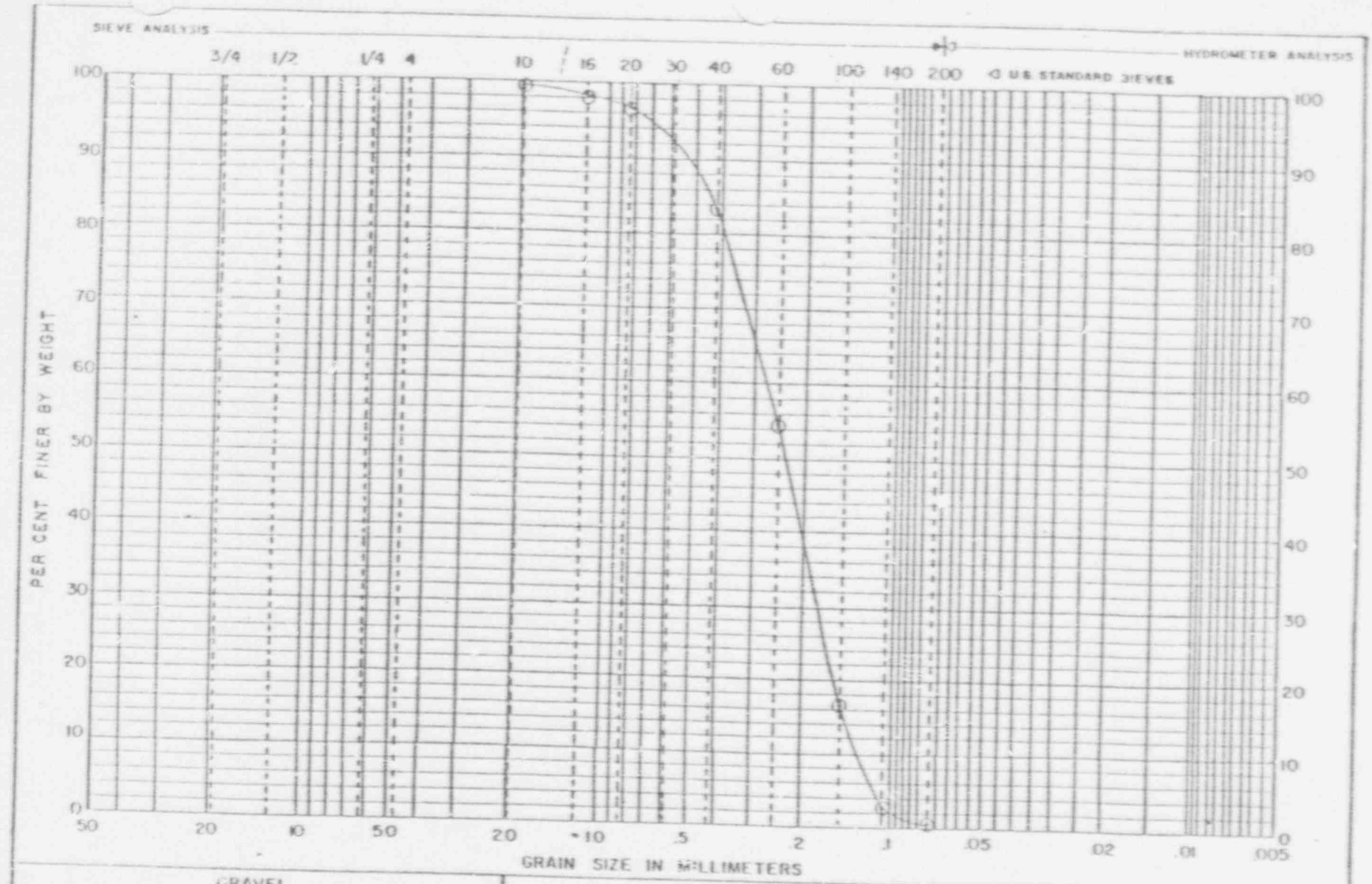
CLIENT: SCA - Kawkawlin Mich

LOCATION: H-3

FILE NO.:

DATE: 2-8-84 BY: SS

GROUNDWATER TECHNOLOGY, INC.



GRAVEL			SAND			
COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT OR CLAY

M.I.T. SOIL CLASSIFICATION

Sieve	% Finer
10	99.62
16	98.39
20	96.99
40	83.51
60	54.68
100	16.66
140	2.68
200	.38

$D_{60} = .275$ $D_{50} = .24$

$D_{10} = .135$

$U = \frac{D_{60}}{D_{10}} = 2.03$

$K = 270$ m/s

(574 GPD/ft²)

KD 30%

CLIENT: SCA - Kawkawlin Mich.

LOCATION: # 4

FILE NO.:

DATE: 2-8-84 BY: S.S.

GROUNDWATER TECHNOLOGY, INC.

KEY TO VISUAL SOILS IDENTIFICATION

A. Granular Soils - Particle Size Classification

Material		Symbol	Fractions	Sieve Limit	
				Upper	Lowe
BOULDERS	Material retained on the 9 in. sieve	Bldr			9 in.
COBBLES	Material passing the 9 in. sieve and retained on the 3 in. sieve	Cbl		9 in.	3 in.
GRAVEL	Material passing the 3 in. sieve and retained on the No. 10 sieve	G	coarse (c) medium (m) fine (f)	3 in. 1 in. 3/8 in.	1 in. 3/8 i No. 1
SAND	Material passing the No. 10 sieve and retained on the No. 200 sieve	S	coarse (c) medium (m) fine (f)	No. 10 No. 30 No. 60	No. 3 No. 6 No. 2
SILT	Material passing the No. 200 sieve that is non-plastic in character and exhibits little or no strength when air-dried	$		No. 200	

B. Clay Soils - Plasticity Classification

Material*	Symbol	Degree of Overall Plasticity	Overall Plasticity Index Sand - Silt Clay Components
Clayey SILT	Cy Si	Slight	1 to 5
SILT & CLAY	Si & C	Low	5 to 10
CLAY & SILT	C & Si	Medium	10 to 20
Silty CLAY	Si Cy C	High	20 to 40
CLAY	C	Very high	40 and greater

*Soils passing the No. 200 sieve which can be made to exhibit plasticity and clay qualities within a certain range of moisture content, and which exhibits considerable strength when air-dried.

C. Terms Identifying Gradation of Sand & Gravel Soils

Written	Symbol	Defining Proportions by Weight
No modifier		Approximately equal amounts of coarse medium, and fine components
medium to fine	mf	Somewhat more medium than fine, less than 10 percent coarse
fine to medium	fm	Somewhat more fine than medium, less than 10 percent coarse
coarse to medium	cm	Somewhat more coarse than medium, less than 10 percent fine
medium to coarse	mc	Somewhat more medium than coarse, less than 10 percent fine
fine	f	Predominantly fine, less than 10 percent medium and coarse
medium	m	Predominantly medium, less than 10 per cent fine and coarse
coarse	c	Predominantly coarse, less than 10 per cent fine and medium

D. Terms Identifying Composition of Soil

Written*	Symbol	Defining Range of Percentage by Weig
and	a	35 to 50
some	s	20 to 35
little	l	10 to 20
trace	t	0 to 10

*Plus (+) or minus (-) sign used after identifying term denotes extremes of range; e.g., "some (-) Gravel" indicates 20 to 24 percent Gravel; "some (+) Gravel" indicates 31 to 35 percent Gravel.

E. Miscellaneous Descriptive Terms

Color	Soil Deposition	Size	Miscellaneous
rd - red	vvd - varved	lge - large	veg - vegetation
br - brown	ptg - parting	sm - small	Ss - sandstone
bk - black	pkt - pocket	thk - thick	Sh - shale
gy - gray	lyr - layer	thn - thin	fr - fragment
or - orange	lns - lens		jnk - junk
tn - tan	mtld- mottled		F - fill
yl - yellow			org - organic
dk - dark			Ts - topsoil
lt - light			occ - occasional
			desic-desiccated

NOTE: In writing soil description, the primary soil component is placed first and is capitalized; lesser components have first letter only capitalized; e.g., "rd br fm S, l S, t G, occ Bldr" indicates red-brown fine to medium SAND, little Silt, trace Gravel, occasional Boulder.

WEHRAN ENGINEERING

TEST BORING LO

Project No. C-77170 Client SCA Services, Inc. Boring No. Well A

Project Hartley & Hartley, Inc. Date Start 6/14/77

Location Kawkawlin, Michigan Date Finish 6/15/7

Type of Rig CME Auger Driller Mich. Test'g. Eng'rs Inspector WDM

Depth	Elevation	Casing Blows/ft	Sample No.	Sample Type	Spoon blows 6" Penetr.		Average Blows/ft	Log	Classification "0" Elev. = 586.2	Remarks
									Dk. brown Sand; Topsoil 0-3'	
									White medium SAND	
									Very clean, massive, moist to saturated 4'-0"	
5			1	SS	7	5			Alternating sequence of varying beds of:	
					18"	Rec.			(+) Grey mf SAND, some Clayey Silt	Transition Zone
10			2	SS	11	23			(-) White medium SAND 6'-0"	Saturated Dense
					24	30				
					6"	Rec.			Grey mf SAND, and (+) Clay & Silt, trace fm Gravel, trace vegetation	V. dense, massive
15			3	SS	11	15				
					24	30				
					No	Rec.			Grading @ 10' to:	
			4	SS	14	18			Grey-brn SILT & CLAY, and mf Sand, trace Gravel	Hard, massive
20					24	26				
			5	SS	10	17				
					22	30				
					24"	Rec.			Grading @ 25' to:	
25			6	SS	9	14			Grey CLAY & SILT, and mf Sand, trace Gravel	Hard, massive
					19	23				
					24"	Rec.				
30			7	SS	8	14			ditto	
					17	21				
					16"	Rec.				
35			8	SS	7	11			ditto	
					17	24				

2" STEEL CASING

SAND PACK

2"x3' JOHNSON FLANGED SCREEN WELL POINT

WEHRAN ENGINEERING

TEST BORING L

Project No. C-7717Q Client SCA Services, Inc. Boring No. Well

Project Hartley & Hartley, Inc. Date Start 6/14/

Location Kawkawlin, Michigan Date Finish 6/15/

Type of Rig CME Auger Driller Mich. Test'g. Eng'rs Inspector RWM

Depth	Elevation	Casing Blows/ft	Sample No.	Sample Type	Spoon blows 6" Penetr.		Average Blows/ft	Log	Classification "0" Elev. = 586.2	Remarks
			9	SS	6	10				
					14	18				
45			10	SS	5	6			Becoming @ 45': Grey, indistinctly laminated, CLAY, little ± Sand, trace Gravel	
					7	9				
50			11	SS	3	5			Firm, rotted sand & gravel, laminations (vanes?) less distinct w/ depth	
					5	7				
55			12	SS	4	5				Silt
					7	8			Grading @ 60' to: Grey CLAY & SILT, and ± Sand, trace Gravel	
60			13	SS	12	19				Hard
					28	38			62'0"	
65										
0										
5										

WEHRAN ENGINEERING

TEST BORING LOG

Project No. C-77170 Client SCA Services, Inc. Boring No. Well #3

Project Hartley & Hartley, Inc. Date Start 6/15/77

Location Kawkawlin, Michigan Date Finish 6/15/77

Type of Rig CME Auger Driller Mich. Test'g. Enz'r Inspector RDH

Depth	Elevation	Casing Blows/ft	Sample No.	Sample Type	Sample Spoon blows 6" Penetr.	Average Blows/ft	Log	Classification "0" Elev. = 588.0	Remarks
								Fill: Brown medium SAND, with entrained "blocks" of Grey CLAY & SILT, and mf Sand 3'-6"	Loose
5			1	SS	4 6 / 4 5			Black highly organic Topsoil overlying Red-brown Peat 4'-0"	Soft, wet
10			2	SS	7 10 / 14 18			Brown medium SAND med-dense, v. clean, massive, saturated 7'-0"	GWT @ 4'-7" (6/17/77)
15			3	SS	17 23 / 30 34			Very thin bed (4") of mf SAND, little Silt @ 9'-0" Transition zone - 7'-0" to 9'-0"	Stiff
20			4	SS	14 20 / 28 32			Grey CLAY & SILT, and mf Sand, trace fm Gravel	
25			5	SS	16 24 / 32 40				Hard
30			6	SS	15 24 / 26 34			30'-0"	
35									

SAND PACK

2"x8' Johnson Stainless Steel Well Point

2" dia. Cas.

Screen

WEHRAN ENGINEERING

TEST BORING LC

Project No. C-77170 Client SCA Services, Inc. Boring No. Well #
Project Hartley & Hartley, Inc. Date Start 6/16/7
Location Kawkawlin, Michigan Date Finish 6/16/7
Type of Rig CME Auger Driller Mich. Test'g. Eng'rs Inspector RDM

Depth	Elevation	Casing Blows/ft	Sample No.	Sample Type	Sample Spoon blows 6" Penetr.		Average Blows/ft	Log	Classification "0" Elev. = 587.3	Remarks
									Dark brown Sandy Topsoil 0'-2"	
5			1	SS	5 6	5 7			Grey medium SAND Very clean, massive, wet-saturated, med-dense	GWT @ 4'-0" (6/17/77)
									7'-0"	
0			2	SS	7 18	13 22			Brn. medium SAND, some Silt & Clay, little fm Gravel Med-dense	Transition Zone
									Grading @ 10' to:	
5			3	SS	14 25	17 33				
									Grey CLAY & SILT, and(-) mf Sand, little fm Gravel Stiff, massive.	
0			4	SS	12 18	14 25				
5			5	SS	13 21	17 28				
0			6	L	13 22	18 25			30'-0"	
									Well constructed in an adjacent boring.	
5										

2" x 3' Johnson Screen, 10 slot

WEHRAN ENGINEERING — TEST PIT LOG

Project No. C-77170 Client SCA Services, Inc. Test Pit No. 4

Project Hartley & Hartley, Inc.

Location Kawkawlin, Michigan Date 6/15/77

Contractor Hartley & Hartley, Inc. Equipment Rubber-tired BH Inspector PDM

Location of Pit See Plan

Ground Elev. 584.4 Ground Water Depth 1'-8" Elev. 582.7

Remarks —

ELEVATION	DEPTH (Feet)	LOG	SAMP NO	DESCRIPTION
	1			Black highly organic Topsoil — 1'-3"
	2–3			Brown-white medium SAND
	4			Very clean, massive, saturated, unstable, water infiltrating @ 2'-0" — 3'-0"
	5–6			Grey mf SAND, some Silt & Clay, trace Gravel } 1' Transition Zone
	7			Grey CLAY & SILT, and mf Sand, trace Gravel — V. stiff, stable, massive, occ. cobble — 7'-0"
	8–17			1½" Piezometer set @ 4'-6" w/ 2'-0" S.S.

KEY TO VISUAL DESCRIPTIONS

trace = 0–10%, little = 10–20%, some = 20–35%, and = 35–50%, (+) or (–) after denotes extremes of range ie. 19% is written as little (+)

WEHRAN ENGINEERING — TEST PIT LOG

Project No. C-77170 Client SCA Services, Inc. Test Pit No. 5

Project Hartley & Hartley, Inc.

Location Kawkawlin, Michigan Date 6/16/77

Contractor Hartley & Hartley, Inc. Equipment Rubber-tired BH Inspector RDM

Location of Pit See Plan

Ground Elev. 583.7 Ground Water Depth 1'-0" Elev. 582.7

Remarks

ELEVATION	DEPTH (Feet)	LOG	SAMP NO	DESCRIPTION
	1			Black organic Topsoil 0'-6"
	2			Grey medium SAND
	3			Very clean, unstable, massive, odorous
	4			Grey mf SAND, little f Gravel @ base 6'-0"
	5			
	6			Grey mf SAND, and Clay & Silt, trace Gravel
	7			Dense, massive, occ cobble, stable
	8			6'-0"
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			

KEY TO VISUAL DESCRIPTIONS

trace = 0–10%, little = 10–20%, some = 20–35%, and = 35–50%, (+) or (–) after denotes extremes of range ie. 19% is written as little (+)

WEHRAN ENGINEERING — TEST PIT LOG

Project No. C-7717Q Client SCA Services, Inc. Test Pit No. 6

Project Hartley & Hartley, Inc.

Location Kawkawlin, Michigan Date 6/15/77

Contractor Hartley & Hartley, Inc. Equipment Rubber-tired BH Inspector PDM

Location of Pit See Plan

Ground Elev. 586.6 Ground Water Depth 3'-1.5" Elev. 583.5

Remarks

ELEVATION	DEPTH (Feet)	LOG	SAMP NO	DESCRIPTION
	1–17			Black Sandy Topsoil 0'-3"
				White medium SAND Very clean, massive, unstable, sloughing in 1' slabs, odorous @ zone of saturation - of petroleum, stained green-brown 6'-0"
				Grey mf SAND, and Clay & Silt, trace fn Gravel Very dense, massive, stable 8'-0"

KEY TO VISUAL DESCRIPTIONS

trace = 0–10%, little = 10–20%, some = 20–35%, and = 35–50%, (+) or (–) after denotes extremes of range ie. 19% is written as little (+)

CLOW

HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation

408 Auburn Avenue
Pontiac, MI 48058

313 334 1630
313 334 4747

TO:

Date:

SCA Chemical Services, Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

January 9, 1984

Samples taken 12-5/12-6-83 Hartley & Hartley Landfill, Kawkawlin, MI.

Hydro number:	72598	72599	72600	72601	72602
Client identification:	#16S ✓	#17S	#19S	#23S	#25S
Chemical Oxygen Demand, mg/l	130	190	120	110	110
Iron, Fe, dissolved mg/l	0.12	0.28	0.05	<0.02	<0.02
Chloride, Cl, mg/l	1160	370	880	420	420
Specific Conductivity, umhos/cm	4100	1900	2900	1800	1750
Total Organic Carbon, mg/l	43	49	22	32	20
Sulfate, SO_4, mg/l	31	66	6	31	67
pH	6.93	7.70	7.67	8.10	7.90
Calcium, Ca, dissolved, mg/l	270	82	190	43	75
Sodium, Na, dissolved, mg/l	360	210	170	330	180
Magnesium, Mg, dissolved, mg/l	120	52	90	29	38
Total Alkalinity, mg/l	200	340	100	290	480
Nitrogen Nitrate, N, mg/l	0.02	0.02	0.03	0.02	0.54
Nitrogen Ammonia, N, mg/l	1.8	2.2	0.56	0.81	1.1
Lead, Pb, dissolved, mg/l	0.11	<0.05	0.10	<0.05	<0.05
Total Chromium, TCr, mg/l	<0.02	<0.02	<0.02	<0.02	<0.02
Phenol, mg/l	0.005	0.007	0.019	0.013	<0.004

CLOW

HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation

408 Auburn Avenue
Pontiac, MI 48058

313 334-1630
313 334-4747

TO:

Date:

SCA Chemical Services, Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Na Poli

January 9, 1984

Samples taken 12-5-83/12-6-83.Hartley & Hartley Landfill, Kawkawlin, MI.

Hydro number:	72608	72609	72610	72611	72612
Client identification:	#50-S	#12-W	#15-W	#16-W	#18-W
Chemical Oxygen Demand, mg/l	120	130	110	1260	110
Iron, Fe, dissolved, mg/l	0.09	7.5	0.38	28	0.27
Chloride, Cl, mg/l	2110	1320	1190	140	810
Specific Conductivity, umhos/cm	5800	4200	3900	1600	1700
Total Organic Carbon, TOC, mg/l	14	34	27	470	21
Sulfate, SO_4, mg/l	38	5	21	34	2
pH	7.38	6.50	7.01	6.49	6.81
Calcium, Ca, dissolved, mg/l	570	340	260	60	180
Sodium, Na, mg/l, dissolved	120	200	200	170	160
Magnesium, Mg, dissolved mg/l	220	140	130	47	82
Total Alkalinity, mg/l	110	240	200	530	110
Nitrogen Nitrate, N, mg/l	0.09	0.04	<0.02	0.03	<0.02
Nitrogen Ammonia, N, mg/l	1.3	2.1	0.82	16	0.72
Pb, dissolved, mg/l	0.20	0.16	0.11	<0.05	0.10
Total Chromium, TCr, mg/l	<0.02	<0.02	<0.02	0.10	<0.02
Phenol, mg/l	0.003	<0.002	<0.002	1.47	0.002

CLOW

HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation

408 Auburn Avenue
Pontiac, MI 48058

313 334 1630
313 334 4747

TO:

Date:

SCA Chemical Services, Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

January 9, 1984

Samples taken 12-5/12-6-83. Hartley & Hartley Landill, Kawkawlin, MI

Hydro Number:	72613	72614	72615	72616	72617
Client identification:	#39-W	#40-W	#43-W	#45-W	#47-W
Chemical Oxygen Demand, mg/l	190	220	150	3200	1040
Iron, Fe, dissolved, mg/l	3.1	33	0.27	0.26	0.43
Chloride, Cl, mg/l	77	3360	1860	1040	3110
Specific Conductivity, umhos/cm	325	9400	6250	4650	11,200
Total Organic Carbon, mg/l	23	92	25	290	180
Sulfate, SO_4, mg/l	18	<1	180	26	4
pH	4.99	6.01	6.75	6.33	7.31
Calcium, Ca, dissolved, mg/l	20	970	480	88	160
Sodium, Na, dissolved, mg/l	28	340	580	860	1400
Magnesium, Mg, dissolved, mg/l	4.6	280	160	97	260
Total Alkalinity, mg/l	14	410	400	1010	2160
Nitrogen Nitrate,N, mg/l	<0.02	0.07	<0.02	0.05	<0.02
Nitrogen Ammonia, N, mg/l	0.41	27	1.1	35	190
Pb, dissolved, mg/l	<0.05	0.33	0.16	0.08	0.17
Total Chromium, TCr, mg/l	<0.02	<0.02	<0.02	0.06	<0.02
Phenol, mg/l	<0.002	<0.002	0.003	1.5	0.14

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

SCA Chemical Services Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

1-10-84

PRIORITY POLLUTANT ANALYSIS

Client I.D.:	#16 S	Concentration, ug/l #17S	#19S
Hydro Number:	72598	72599	72600
Volatile Organic Compounds			
Acrolein	<100	<100	<100
Acrylonitrille	<100	<100	<100
Benzene	1300	<10	<10
Bis(Chloromethyl)ether	<10	<10	<10
Bromoform	<10	<10	<10
Carbon Tetrachloride	<10	<10	<10
Chlorobenzene	<10	<10	<10
Chlorodibromomethane	<10	<10	<10
Chloroethane	<10	<10	<10
2-Chloroethylvinyl ether	<10	<10	<10
Chloroform	2500	<10	<10
Dichlorobromomethane	<10	<10	<10
Dichlorodifluoromethane	<10	<10	<10
1,1-Dichloroethane	21	<10	<10
1,2-Dichloroethane	9000	230	<10
1,1-Dichloroethylene	77	<10	<10
1,2-Dichloropropane	10	<10	<10
1,3-Dichloropropene	<10	<10	<10
Ethylbenzene	26	<10	<10
Methyl Bromide	<10	<10	<10
Methyl Chloride	260	<10	<10
Methylene Chloride	<10	<10	<10
1,1,2,2-Tetrachloroethane	<10	<10	<10
Tetrachloroethylene	<10	<10	<10
Toluene	1900	<10	<10

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

1-10-84

PRIORITY POLLUTANT ANALYSIS	Concentration, ug/l		
Client I.D.:	#16 S	#17S	#19S
Hydro Number:	72598	72599	72600
Volatile Organic Compounds			
trans-1,2-dichloroethylene	18	76	<10
1,1,1-Trichloroethane	10	<10	<10
1,1,2-Trichloroethane	3000	24	<10
Trichloroethylene	<10	<10	<10
Trichlorofluoromethane	<10	<10	<10
Vinyl Chloride	17	<10	<10

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

SCA Chemical Services Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

1-10-84

PRIORITY POLLUTANT ANALYSIS

Client I.D.:	#15 W	Concentration, ug/l #16 W	#18 W
Hydro Number:	72610	72611	72612
Volatile Organic Compounds			
Acrolein	<100	<500	<100
Acrylonitrille	<100	<500	<100
Benzene	<10	2900	<10
Bis(Chloromethyl)ether	<10	<50	<10
Bromoform	<10	<50	<10
Carbon Tetrachloride	<10	<50	<10
Chlorobenzene	<10	<50	<10
Chlorodibromomethane	<10	<50	<10
Chloroethane	<10	<50	<10
2-Chloroethylvinyl ether	<10	<50	<10
Chloroform	<10	9000	<10
Dichlorobromomethane	<10	<50	<10
Dichlorodifluoromethane	<10	<50	<10
1,1-Dichloroethane	<10	170,000	<10
1,2-Dichloroethane	<10	650	<10
1,1-Dichloroethylene	<10	100	<10
1,2-Dichloropropane	<10	<50	<10
1,3-Dichloropropene	<10	<50	<10
Ethylbenzene	<10	2400	<10
Methyl Bromide	<10	<50	<10
Methyl Chloride	<10	<50	<10
Methylene Chloride	<10	<50	<10
1,1,2,2-Tetrachloroethane	<10	<50	<10
Tetrachloroethylene	<10	600	<10
Toluene	<10	28,000	<10

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

1-10-84

PRIORITY POLLUTANT ANALYSIS — Concentration, ug/l

Client I.D.:	#15 W	#16 W	#18 W
Hydro Number:	72610	72611	72612
Volatile Organic Compounds			
trans-1,2-dichloroethylene	<10	400	<10
1,1,1-Trichloroethane	<10	350	<10
1,1,2-Trichloroethane	<10	13,000	<10
Trichloroethylene	<10	800	<10
Trichlorofluoromethane	<10	<50	<10
Vinyl Chloride	<10	200	<10

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

SCA Chemical Services Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

1-10-84

PRIORITY POLLUTANT ANALYSIS

Client I.D.:	#39 W	#40 W	#43 W
		Concentration, ug/l	
Hydro Number:	72613	72614	72615
Volatile Organic Compounds			
Acrolein	<100	<100	<100
Acrylonitrille	<100	<100	<100
Benzene	<10	<10	<10
Bis(Chloromethyl)ether	<10	<10	<10
Bromoform	<10	<10	<10
Carbon Tetrachloride	<10	<10	<10
Chlorobenzene	<10	<10	<10
Chlorodibromomethane	<10	<10	<10
Chloroethane	<10	<10	<10
2-Chloroethylvinyl ether	<10	<10	<10
Chloroform	<10	<10	<10
Dichlorobromomethane	<10	<10	<10
Dichlorodifluoromethane	<10	<10	<10
1,1-Dichloroethane	<10	<10	45
1,2-Dichloroethane	<10	<10	<10
1,1-Dichloroethylene	<10	<10	91
1,2-Dichloropropane	<10	<10	<10
1,3-Dichloropropene	<10	<10	<10
Ethylbenzene	<10	<10	<10
Methyl Bromide	<10	<10	<10
Methyl Chloride	<10	<10	<10
Methylene Chloride	<10	<10	<10
1,1,2,2-Tetrachloroethane	<10	<10	<10
Tetrachloroethylene	<10	<10	<10
Toluene	<10	<10	20

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

1-10-84

PRIORITY POLLUTANT ANALYSIS — Concentration, ug/l

Client I.D.:	#39 W	#40 W	#43 W
Hydro Number:	72613	72614	72615
Volatile Organic Compounds			
trans-1,2-dichloroethylene	<10	<10	6800
1,1,1-Trichloroethane	<10	<10	<10
1,1,2-Trichloroethane	<10	<10	<10
Trichloroethylene	<10	<10	5200
Trichlorofluoromethane	<10	<10	<10
Vinyl Chloride	<10	<10	220

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

SCA Chemical Services Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

1-10-84

PRIORITY POLLUTANT ANALYSIS

	Concentration, ug/l	
Client I.D.:	#45 W	#47 W
Hydro Number:	72616	72617
Volatile Organic Compounds		
Acrolein	<500	<100
Acrylonitrille	<500	<100
Benzene	10,000	1200
Bis(Chloromethyl)ether	<50	<10
Bromoform	<50	<10
Carbon Tetrachloride	<50	<10
Chlorobenzene	<50	<10
Chlorodibromomethane	<50	<10
Chloroethane	<50	<10
2-Chloroethylvinyl ether	<50	<10
Chloroform	<50	<10
Dichlorobromomethane	<50	<10
Dichlorodifluoromethane	<50	<10
1,1-Dichloroethane	400	29
1,2-Dichloroethane	200	<10
1,1-Dichloroethylene	50	100
1,2-Dichloropropane	200	<10
1,3-Dichloropropene	<50	<10
Ethylbenzene	1400	1900
Methyl Bromide	<50	<10
Methyl Chloride	<50	<10
Methylene Chloride	<50	<10
1,1,2,2-Tetrachloroethane	<50	<10
Tetrachloroethylene	2000	290
Toluene	15,000	3700

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

1-10-84

PRIORITY POLLUTANT ANALYSIS	Concentration, ug/l	
Client I.D.:	#45 W	#47 W
Hydro Number:	72616	72617
Volatile Organic Compounds		
trans-1,2-dichloroethylene	>60,000	30
1,1,1-Trichloroethane	<50	3400
1,1,2-Trichloroethane	<50	<10
Trichloroethylene	>100,000	4600
Trichlorofluoromethane	<50	700
Vinyl Chloride	1,000	<10

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
312/334-4747

SCA Chemical Services Inc.
5 Middlesex Avenue
Somerville, Mass 02145
Attn: Mr. John Di Napoli

1-10-84

PRIORITY POLLUTANT ANALYSIS

		Concentration, ug/l
Client I.D.:	#45 W	
Hydro Number:	72616	

Base Neutral Compounds

Acenapthene	12,000
Acenaphthylene	<1000
Anthracene	16,000
Benzidine	<1000
Benzo(a)anthracene	1900
Benzo(a)pyrene	1500
3,4-Benzofluoranthene	<1000
Benzo(ghi)perylene	<2500
Benzo(k)fluoranthene	1200
Bis(2-chloroethoxy)methane	<1000
Bis(2-chloroethyl)ether	<1000
Bis(2-ethylhexyl)phthalate	<1000
4-Bromophenyl phenyl ether	<1000
Butyl Benzyl phthalate	<1000
2-Chloronaphthalene	<1000
4-Chlorophenyl phenyl ether	<1000
Chrysene	2400
Dibenzo(a,h)anthracene	<2500
1,2-Dichlorobenzene	<1000
1,3-Dichlorobenzene	<1000
1,4-Dichlorobenzene	<1000
3,3'-Dichlorobenzidine	<1000
Diethyl phthalate	<1000
Dimethyl phthalate	<1000
Di-n-butyl phthalate	<1000

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

1-10-84

PRIORITY POLLUTANT ANALYSIS — Concentration, ug/l

Client I.D.: #45 W

Hydro Number: 72616

Base Neutral Compounds

2,4-Dinitrotroluene	<1000
2,6-Dinitrotoluene	<1000
Di-n-octyl phthalate	<1000
1,2-Diphenylhydrazine	<1000
Fluoranthene	1800
Fluorene	13,000
Hexachlorobenzene	<1000
Hexachlorobutadiene	<1000
Hexachlorocylopentadiene	<1000
Hexachloroethane	<1000
Indeno(1,2,3-cd)pyrene	<2500
Isophorone	<1000
Napthalene	260,000
Nitrobenzene	<1000
N-Nitrosodimethylamine	<10,000
N-Nitroso-di-n-propylamine	<1000
N-Nitrosodiphenylamine	<1000
Phenanthrene	<1000
Pyrene	3900
1,2,4-Trichlorobenzene	<1000

Acid Compounds

2-Chlorophenol	<200
2,4-Dichlorophenol	<200
2,4-Dimethylpherol	<200
4,6-Dinitro-o-cresol	<1000
2,4-Dinitrophenol	<1000
2-Nitrophenol	<200

CLOW
HYDRO RESEARCH SERVICES
Water Management Division
Clow Corporation
313/334-4747

1-10-84

PRIORITY POLLUTANT ANALYSIS		Concentration, ug/l
Client I.D.:	#45 W	
Hydro Number:	72616	
Acid Compounds		
4-Nitrophenol	<200	
p-Chloro-m-cresol	<200	
Pentachlorophenol	<200	
Phenol	<200	
2,4,6-Trichlorphenol	<200	

SPECIAL PROVISIONS

SECTION II

EXISTING FACILITIES

This section discusses exisiting facilities and the Contractors responsibilities with respect to them. Figure 2 indicates locations of test pits, monitoring wells, an oil transmission line and surface vessels.

The Contractor shall remove the vessels from the affected area. They shall be placed on the Owner's property at the direction of the Owner. For bidding purposes, the Contractor shall assume relocation to the southeast site entrance as shown in Figure 1.

Three monitoring wells inside and four monitoring wells outside the slurry wall enclosed area are required as part of this project. The approximate locations are indicated in Figure 3. If an existing monitoring well or piezometer is acceptable to the Engineer, the Contractor may do what is required to upgrade such existing well to meet or exceed the requirements of a new well. All existing monitoring wells or piezometers to be surrounded by the slurry wall will not be upgraded and will be abandoned as per the State of Michigan DNR regulations before being covered by fill and/or a clay cap. See "Specifications - Ground/Water Monitoring System" for the monitoring well installation requirements.

SPECIAL PROVISIONS

SECTION III

SOIL EROSION AND SEDIMENT CONTROL

The Contractor is reponsible for constructing, implementing and maintaining all soil erosion and sediment control measures that are deemed necessary to minimize ecological damage to the surface waters of the State of Michigan. Damage will be minimized by stabilizing disturbed areas and by removing sediment from construction site discharges. Construction activities will be planned and executed to minimize the area and duration of site disruption. The soil erosion and sediment control plan, as presented below, represents the minimum control to be included by the Contractor during the term of the contract. Further measures as required by additional federal, state and local authorities will apply.

The Contractor shall adhere to the following soil erosion and sediment control measures as a minimum:

1. All soil erosion and sediment control measures are to be installed prior to any major soil disturbance, or in their proper sequence, and maintained until permanent protection is established.

2. Any disturbed areas that will be left exposed for more than thirty (30) days, and not subject to construction traffic, will immediately receive a temporary seeding. If the season prevents the establishment of a temporary cover, the disturbed areas will be mulched with straw or equivalent material at a rate of two (2) tons per acre.

3. Permanent vegetation to be seeded or sodded on all exposed areas within ten (10) days after final grading. Mulch to be used as necessary for protection until seeding is established.

4. Immediately following initial disturbance or rough grading, all critical areas subject to erosion (i.e. steep slopes and roadway embankments) will receive a temporary seeding in combination with straw mulch or a suitable equivalent at a rate of 1.5 tons per acre.

5. The local soil conservation district office shall be notified 72 hours in advance of any construction activity that disturbs the land surface.

In the event that construction is halted for periods greater than thirty (30) days, areas disturbed by construction will be stabilized by seeding. Temporary vegetative stabilization may be performed by conventional seeding methods such as by hand, cyclone seeder, drill, cultipacker type seeder or equivalent. The hydroseeding method may also be used.

1. Seedbed Preparation: All stones two (2) inches or larger in any dimension, and all other debris such as tree roots, logs, pieces of concrete, etc., will be removed. Fertilizer (12:12:12) will be applied at a rate of 500 lb. per acre. Also pulvarized dolomitic limestone will be applied at a rate of 2 tons per acre. Fertilizer and limestone will be worked into the soil as nearly as practical to a depth of four inches with a disc, springtooth harrow, or other suitable equipment. The final harrowing or discing operation should be performed on the general contour until a reasonable uniform seedbed is prepared. If traffic has compacted the soil, the area will be retilled and firmed. If the hydroseeding method is used, fertilizer and limestone may be included in the seeding slurry mixture.

2. Seeding: The seed mixture for temporary vegetative cover will consist of 50 lb. annual ryegrass and 50 lb. perennial ryegrass, per acre. In the event seeding cannot occur as determined by the Engineer, disturbed areas will be temporarily stabilized with anchored mulch. Seed applied by conventional methods will be applied to a depth of 1/4 to 1/2 inch. Hydroseedings may be left on the soil surface.

3. Mulching: Mulch will be placed immediately after seeding. Mulch will consist of either unrotted hay or small grain straw spread uniformly by hand or mechanically at a rate of 1.5 tons per acre and anchored immediately after placement. Mulch anchoring will consist of liquid mulch binder or netting tiedown. Liquid mulch binders, when used, will consist of one of the following:

- Synthetic or organic binders such as Curasol, Terra-Tack 1, or equivalent at rates recommended by the manufacturer.

- Combined wood cellulose fiber mulch/tack products such as Conweed Hydro Mulch or equivalent at a rate of 400 lb. per acre. Mulch nettings may be used in place of liquid mulch binders. Mulch nettings will consist of either jute, paper, excelsior, cotton, or plastic, and will be anchored on three foot centers by firmly stapling the netting into the soil over the straw or hay mulch. Regardless of the anchoring method employed, mulch anchoring will be performed immediately after placement of hay or straw mulch.

Permanent Vegetative Stabilization - Stabilization with vegetative cover will be performed. In the event that seeding cannot occur as determined by the Engineer, disturbed areas will be temporarily stabilized with anchored mulch.

Permanent vegetation will be applied as discussed in Paragraph 2.4.5 of "Specifications: Cover Design."

Hay Bale Berms

Stockpile Protection: - The Contractor will construct hay bale berms around all stockpiles of fill, topsoils, and excavated

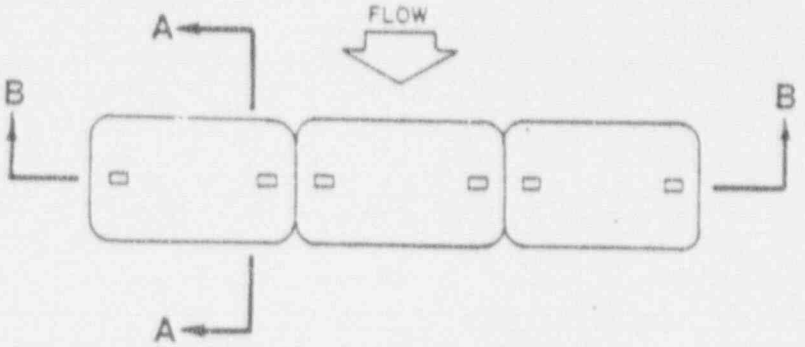
overburden that are to remain exposed for periods greater than one week and when runoff from these stockpiles may enter state waters. Hay bale berms will be anchored and constructed as specified in the attached Figure 4, and will be maintained in good operating condition by the Contractor until they are removed and the stockpiling areas are brought to final grade and stabilized with permanent vegetative cover. Where stockpiles lie on paved surfaces, the Contractor will remove residual stockpiled materials to the maximum extent practicable before removing the hay bale berms. It will be the responsibility of the Contractor to remove all hay bale berms from the construction site after the stockpiles are depleted. Where applicable, stockpiling areas will be stabilized by permanent vegetative measures.

Maintenance of Control Measures

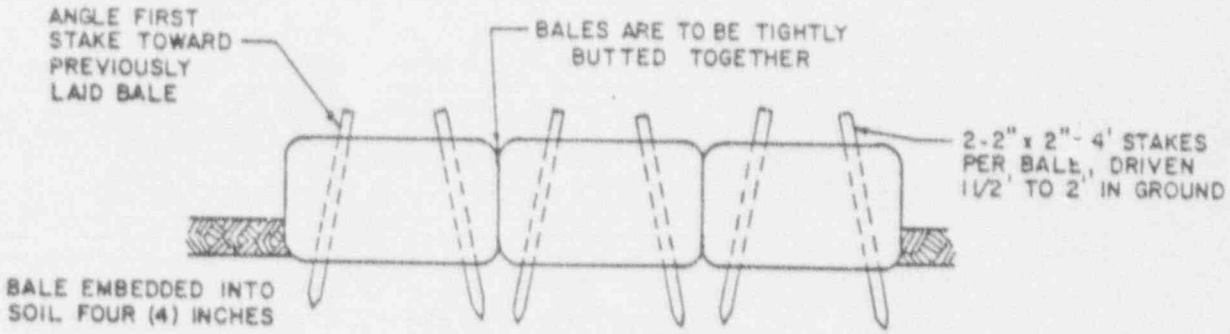
Maintenance of all soil erosion and sediment control measures will be the responsibility of the Contractor during construction. The Contractor will maintain structural and non-structural measures such that soil erosion is minimized throughout the construction period. When complete site stabilization is achieved, the Contractor will be responsible for removal of remaining control structures and return of disturbed areas to pre-construction grade. These areas will then be permanently vegetated as specified in the plan.

Following the completion of construction activities onsite and the restoration of construction areas as discussed in Section 2 by the Contractor, the Owner or their representative will be responsible for maintenance of all permanent soil erosion and sediment control measures.

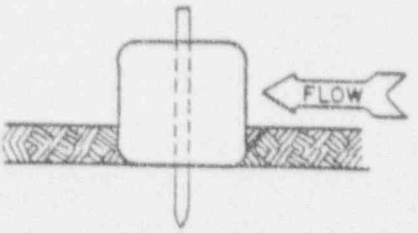
HAY BALE BERM



PLAN
NO SCALE



SECTION B-B
NO SCALE



SECTION A-A
NO SCALE

FIGURE NO. 4

SPECIAL PROVISIONS

SECTION IV

MISCELLANEOUS REQUIREMENTS

ON ROAD VEHICLES:

The Contractor shall be responsible for removing all soils from all vehicles to the satisfaction of the Engineer which leave the construction site prior to traveling on local, state or federal roads. The site for cleaning shall be designated by the Owner. Cleaning of all vehicles shall be accomplished by scraping all soil from tires and other accessible areas. If additional cleaning is required, the Owner shall provide the necessary equipment to accomplish it. The Contractor is responsible for all labor and waste disposal costs related to vehicle cleaning. Cleaning is required to minimize tracking of dirt onto local roadways.

WASTEWATER:

The Contractor shall collect all water generated from, but not be limited to, the following operations: (1) vehicle cleaning, (2) monitoring well installation, and (3) monitoring well development. The collected water shall be hauled to a State approved wastewater treatment facility for disposal. The Contractor shall submit a letter of intent to accept the water from one or more possible facilities with their bid. For bidding purposes, the Contractor shall estimate a total of one thousand (1000) gallons of water shall be collected. Under no circumstances shall this water be allowed to enter onsite or neighboring soils or water bodies.

PERMITS:

The Contractor shall be responsible for obtaining all necessary local, state and federal permits required to complete the work in a lawful manner.

SPECIAL PROVISIONS

SECTION IV

MISCELLANEOUS REQUIREMENTS

ON ROAD VEHICLES:

The Contractor shall be responsible for removing all soils from all vehicles to the satisfaction of the Engineer which leave the construction site prior to traveling on local, state or federal roads. The site for cleaning shall be designated by the Owner. Cleaning of all vehicles shall be accomplished by scraping all soil from tires and other accessible areas. If additional cleaning is required, the Owner shall provide the necessary equipment to accomplish it. The Contractor is responsible for all labor and waste disposal costs related to vehicle cleaning. Cleaning is required to minimize tracking of dirt onto local roadways.

WASTEWATER:

The Contractor shall collect all water generated from, but not be limited to, the following operations: (1) vehicle cleaning, (2) monitoring well installation, and (3) monitoring well development. The collected water shall be hauled to a State approved wastewater treatment facility for disposal. The Contractor shall submit a letter of intent to accept the water from one or more possible facilities with their bid. For bidding purposes, the Contractor shall estimate a total of one thousand (1000) gallons of water shall be collected. Under no circumstances shall this water be allowed to enter onsite or neighboring soils or water bodies.

PERMITS:

The Contractor shall be responsible for obtaining all necessary local, state and federal permits required to complete the work in a lawful manner.

SECTION 1

SPECIFICATIONS

SOIL/BENTONITE SLURRY WALL

1.1 SCOPE

This section of the Specifications defines the minimum requirements to furnish and install a soil/bentonite slurry wall, a minimum of thirty-six (36) inches wide, around a waste disposal area at the location indicated in Figure 3. The Contractor is responsible to take all steps to install a slurry wall with a permeability of less than or equal to 1×10^{-7} cm/sec whether such steps are indicated herein or not.

The slurry wall shall extend from a preconstructed working platform across the site to a minimum of two (2) feet below the top of the glacial till. Total depth of the wall is estimated to vary from seven (7) feet to fifteen (15) feet. The approximate length is three thousand (3000) feet. The wall shall be installed using the slurry trench method of excavation. Only imported material is to be used for construction of the slurry wall.

1.2 CONTRACTOR QUALIFICATIONS

The Contractor shall submit evidence of experience in slurry wall construction of similar magnitude to this project. The Contractor shall also provide resumes of competent, affiliated personnel experienced in this type of construction and able to satisfactorily carry out the operations specified herein. One person, designated "Slurry Wall Specialist," shall be s designated and must be employed by the Contractor. This person shall be assigned full-time to this project for its duration. This person shall be responsible for all aspects of the slurry wall installation including, but not limited to: composition, mixing, placing, cleaning and maintaining the slurry and backfill to produce a slurry wall with an in-place permeability of 1×10^{-7} cm/sec or less.

1.3 SUBMITTALS

Submittals during construction shall be made as required by these specifications. In addition, the following information shall be submitted by the Contractor prior to the start-up of any onsite construction:

A. Contractors proposed schedule and operations sequence

B. Source of all imported materials and report of analysis or certificate as follows:

1) Bentonite and UltraSeal N, or Equivalent: Certificate of Compliance

2) Soil: Report showing gradation, Atterberg Limits and moisture content

C. Soil/Bentonite mix design and trial mix analytical reports including slump, Atterberg limits, moisture content, density, gradation, permeability and total bentonite content on at least four (4) samples of the Contractor's design mix showing conformance with the specifications.

D. A sample of approximately fifty (50) pounds of each imported material including backfill, unaltered bentonite and UltraSeal N, or equivalent

1.4 SITE PREPARATION

1.4.1 Road Access

Road access to the site already exists; therefore, road construction is not necessary. However, it is the Contractor's responsibility to determine if the road capacity is sufficient for the vehicles planned for the implementation of this contract and to upgrade the road as necessary. The Contractor is also responsible for restoring the access roads used during this project to their pre-project condition unless otherwise directed by the Owner or Engineer.

1.4.2 Clearing

The affected area shall be cleared of all trees, brush and other debris by the Contractor. Stumps shall be removed. All vegetative debris may be disposed of onsite in the low lying area to the north of the affected area as directed by the Engineer. All non-vegetative debris, such as tankage, must be removed from the affected area and relocated by the Contractor. For bidding purposes include relocation of three (3) tanks to the Owner's property accessway to the southeast as shown in Figure 1. Transport beyond this area shall be reimbursed as described in Paragraph 9.03 of "General Conditions."

1.4.3 Initial Filling

The Contractor shall provide and place sufficient fill, as described in Paragraph 2.4 of "Specifications: Cover Design," to provide adequate structural support for the wall and produce a flat site over the affected area at Elevation 587, except as noted below. As some areas, particularly the southwest corner, are above Elevation 587, they are to be excavated to their proper subgrade contour, see Figure 5. These areas should not be excavated beyond their subgrade contour to minimize the potential of uncovering buried wastes.

The Contractor is responsible for all surveying required to accomplish the filling and excavation to complete the work as shown in the drawings, or as approved by the Engineer. Benchmarks located onsite shall be used as horizontal and vertical reference points.

1.4.4 Upper Key Construction

After the initial fill has been placed and properly compacted, and high spots excavated to final fill contours, as shown in Figure 5, a compacted clay key must be installed prior to placement of the slurry wall. The key must be a minimum of ten (10) feet wide by one (1) foot deep, as shown in Figure 6. It shall be positioned with its center line matching the slurry wall center line. It shall be installed as per "Specifications: Cover Design," Paragraph 2.4.2.

1.4.5 Temporary Earthwork

The Contractor may make temporary modifications to the grading plan as presented above to accomodate slurry wall excavation and placement. The area inside the to-be-placed slurry wall primarily shall be used for this purpose when possible. The use of the surface outside of the wall shall be avoided, if possible, to minimize soil erosion and addition of sediments to nearby waters.

1.5 SLURRY WALL CONSTRUCTION

A continuous slurry wall shall be constructed with its centerline alignment indicated in Figure 3. The excavation shall not deviate by more than two (2) feet from the centerline unless approved by the Owner or their representative.

The wall shall be vertical, within limitations of subsurface conditions and shall be continuous. The excavation shall be a minimum of three (3) feet wide and shall extend through fill, existing native soils and a minimum of two (2) feet into the underlying glacial till, see Figures 6 and 7.

The native soils through which the wall will be constructed have been previously described in Section I, Special Provisions, "Soil and Water Conditions." These descriptions are provided as estimates for bidding purposes only. The Contractor is responsible to determine soil characteristics and "top of till" in the field along the alignment of the slurry wall. The Contractor shall perform borings along the wall center line at a maximum spacing of one (1) every one hundred (100) feet. Borings shall be completed, at a minimum, four hundred (400) feet in front of the wall excavation at all times. If the top elevation of the glacial till in successive borings differs by more than two (2) feet, additonal borings may be required between them. Additional borings requested by the Engineer shall be paid as per line item 1.04 of Exhibit C, Bid Form Paragraph 9.03, "Payment for Extra

Work" of "General Conditions."

A log of all borings including plan location, top of boring, water elevation and top of glacial till shall be kept by the Contractor. All boring material shall be disposed of in the center of the affected area after logging by the Contractor and approval by the Engineer.

1.5.1 Materials

A. Water:

City water is available to the Contractor at the southeast entrance to the Owner's property for the purpose of slurry generation. It is the Contractor's responsibility to bring the water to the slurry mixing site by an acceptable means such as temporary pipe, truck or other methods approved by the Engineer and to verify that water quality is suitable for the purpose of these specifications. If the Contractor can show to the Engineer that local surface waters are acceptable for formation of slurry, local surface water may be substituted for city water. Water used must be clean, free of floating hydrocarbons, hazardous contaminants, acid, alkali, soluble salts or other deleterious contaminants.

The tests required, at the Contractor's expense, are analysis for chloride, total dissolved solids, hardness, total organic carbon, oil and grease, and pH. The Contractor shall also show the slurry produced using surface waters in all ways meets or exceeds the standards established in this specification. Under no circumstances shall subsurface waters be used for producing slurry.

Water used shall have a quality equal to or exceeding the following as determined by duplicate analyses unless otherwise approved by the Engineer:

Total Hardness	50 mg/L	pH	7 +/- 1
Total Dissolved Solids	500 mg/L	Chlorides	500 mg/L
Total Organic Carbon	50mg/L	Oil and Grease	50 mg/L

The test procedures required to establish water quality are as follows:

Chloride	Method 325.1, 325.2 or 325.3**
Total Organic Carbon	Method 415.1
Oil and Grease	Method 413.2
pH	Method 150.1
Hardness	Method 130.1
Total Dissolved Solids	Method 160.2

** Methods for Chemical Analysis of Water & Wastes, 1979; Environmental Monitoring & Support Laboratory, Office of Research and Development, U.S. EPA, Cinncinnati, Ohio 45268; EPA-600-4-79-020

The Contractor is responsible for the cost of and shall supply and operate a means of monitoring the amount of water used.

B. Bentonite

Two grades of bentonite are required during the construction of the slurry wall. The first grade is required during excavation of the trench and for sluicing the backfill. During this phase, the bentonite required shall be pulverized, unaltered sodium-montmorillonite (bentonite). The bentonite shall meet or exceed the requirements of the API (American Petroleum Institute) "Specifications for Oil Well Drilling Materials, API Standard 13A." The freshly mixed bentonite water slurry shall meet or exceed the following standards as determined by "API Standard 13B, Standard Procedure for Testing Drilling Fluids:"

1) A miminum of twenty (20) pounds of bentonite per barrel (42) gallons of bentonite-water slurry. Additional bentonite may be required depending on subsurface water conditions. Other materials added to the bentonite-water mixture shall be made only upon approval by the Engineer.

2) The bentonite-water slurry shall have an apparent viscosity greater than 15 centipoise at 20 degrees C. as measured by direct-indicating viscometer or not less than 40 seconds reading through a Marsh Funnel (1500 ml of slurry in and 1000 ml out).

3) The pH of slurry shall not be less than 8.

4) The water-bentonite slurry unit weight shall not be less than 1.04 g/cc.

The second phase of slurry wall construction is installation of a soil-bentonite mixture. The bentonite material used for this phase shall be UltraSeal N, physically altered, sodium montmorillinite as manufactured by Federal Bentonite (see attached) or an equivalent approved by the Engineer. Sufficient dry UltraSeal N shall be mixed with backfill material, described below, to produce a 1×10^{-7} cm/sec or less in place permeability as determined by a modified ASTM D2435, see description of test in Paragraph 1.9.4 of this Section. A minimum amount of dry bentonite (UltraSeal N) equal to 2% by weight of the dry soil before mixture is required. Permeability will be determined using the soil-UltraSeal N-bentonite/water slurry mixture as placed in the excavation as described in 1.5.1 C of this Section.

C. Backfill

The material for backfilling the excavation shall be composed of slurry, soil and UltraSeal N. The soil shall be friable and free from roots, organic matter or other deleterious materials. The

mixture shall be thoroughly mixed. Under no circumstances shall the amount of UltraSeal N fall below the 2% by weight of the dry soil minimum.

Because of the possibility of organic materials being present in the material removed from the excavation, these soils are not to be considered for trench backfill material. These materials shall be mixed with imported fill to give a stable mixture in the center of the slurry wall enclosed area such that final covering of this material is maximized as directed by the Engineer.

Imported fill material meeting or exceeding the physical specifications stipulated below shall be used. Material not meeting the specifications may be treated by screening or addition of materials to upgrade it to meet or exceed the specifications. The minimum specifications for soils used during excavation backfilling are as follows:

1) Free from roots, organic matter, rocks larger than three (3) inches or other deleterious materials.

2) Friable.

3) Have an uniformity coefficient greater than 4.

4) Between twenty (20) and sixty (60) percent by weight (dry) passing No. 200 sieve as determined by ASTM D422.

Bentonite-water slurry from the trench or from the mixing plant meeting or exceeding the specifications for in place slurry shall be used to prepare the backfill. The slurry used to prepare the backfill mix shall meet or exceed the following specifications as determined by test procedures in API Standard 13B unless otherwise aproved by the Engineer:

1) The unit weight shall not exceed 1.40 g/cc.

2) The maximum filtrate loss shall not exceed 30 mL in thirty (30) minutes at 100 psig air pressure as determined with a filter press.

Sufficient slurry shall be added to the soil-UltraSeal N mixture to obtain the following specifications for the backfill:

1) Homogeneous, free from lumps greater than 6 inches, pockets of fines, sand or gravel.

2) A slump of three (3) to six (6) inches as measured in accordance with ASTM C143.

3) A density equal to or greater than 15 pounds/ft^3 greater than that of the in-excavation bentonite/water slurry as determined by ASTM D854.

4) A permeability less than or equal to 1×10^{-7} cm/sec as measured in accordance with ASTM D2435 as modified in Paragraph 1.9.4 of this Section.

If all four quality criteria cannot be met using the above described backfill mix, the Engineer shall recommend an alternative back fill mix or approve a Contractor recommended backfill mix before backfilling of the excavation shall begin. Satisfactory compliance with these specifications must be demonstrated by the Contractor at their expense prior to commencement of backfilling, as per 1.3C of this Section and periodically during backfilling as prescribed in 1.9.3 of this Section.

If additional UltraSeal N is required above the specified 2%, the material cost shall be reimbursed as priced in line item 1.03 of Exhibit C as specified in Section 9.03 of "General Conditions."

1.5.2 Equipment

A. Trench Excavation

The Contractor is required to perform all excavation, regardless of subsurface conditions, as specified, shown or otherwise required by this project. Excavation shall be accomplished using a backhoe and/or clamshell or any other suitable piece of earth moving equipment so that the required width (minimum of three (3) feet) can be obtained in a single pass to the final depth of the excavation (minimum of two (2) feet into the glacial till) continuously along the slurry wall centerline as shown in Figure 3. The depth of excavation shall be determined using borings along the slurry wall centerline as previously described, Paragraph 1.5 of this Section.

An airlift pump, or other suitable equipment, shall be used to clean the bottom of the excavation and/or slurry as described below in Paragraph 1.6.4.

B. Slurry Mixing

The Contractor shall mix the slurry in a unit which achieves complete dispersion of the bentonite in water. Pumps, valves, hoses and all other equipment required to supply a continuous flow of slurry to the excavation shall be provided and operated by the Contractor. Storage of the slurry in shallow lagoons is allowed within the slurry wall centerline enclosed area. After the bentonite has been mixed with water, the mixture shall be continuously circulated until its introduction to the excavation. Storage of slurry shall be provided to provide an emergency supply in the event of unexpected loss to subsurface voids or pervious zones.

C. Backfill Mixing

Equipment necessary to prepare and mix the soil, UltraSeal N and bentonite/water slurry as required by these specifications shall be provided and operated by the Contractor. Equipment shall consist of suitable types of earthmoving or grading equipment. Mixing may be accomplished by windrowing, disc harrowing, bulldozing, blading or other Engineer approved methods.

D. Backfill Placement

The Contractor shall provide and operate all necessary equipment to place the backfill material.

1.6 EXECUTION OF WORK

1.6.1 Initial Fill

The Contractor shall place sufficient imported fill material meeting the specifications set in "Specifications: Cover Design," Paragraph 2.3 to raise the affected area to a final elevation of 587 feet, except as noted in Paragraph 1.4.3. The Contractor shall also provide sufficient clean fill to establish a stable slope on the outside perimeter of the fill. The terrain and material which the perimeter contacts varies. The material includes bodies of water with undefined bottom conditions, marshland and stable soils. Refer to Figure 5 for location of fill perimeter and material of contact.

The fill shall be placed in eighteen (18) inch lifts (maximum) after compaction to raise the affected area to a 587 contour. Each lift shall be compacted to 90 percent of maximum density at optimum water content as determined by ASTM D698. The upper six (6) inches shall be compacted to at least 95 percent maximum dry density as determined by ASTM D698.

1.6.2 Slurry Wall Upper Key

The Contractor shall excavate sufficient material along the slurry wall centerline to place a compacted clay key along the top of the to be installed slurry wall. The upper key shall be a minimum of ten (10) feet wide (five (5) feet each side of wall centerline) and a minimum of one (1) foot deep as shown in Figure 6 for the entire length of the slurry wall. The clay used shall meet the specifications established for the clay layer on the cover as set in "Specifications: Cover Design," Paragraph 2.3. The clay shall be placed in two (2), six (6) inch lifts after compaction. The moisture content of the clay shall be maintained at its optimum plus or minus two (2) percentage points. The clay shall be compacted to at least 95 percent of its maximum dry density as determined by ASTM D698.

1.6.3 Slurry Wall Excavation

The excavation shall proceed continuously and without undue interruption from the starting point along the centerline and end at the starting point. To ensure continuity at the end point, the Contractor shall re-excavate the first ten (10) feet of the slurry wall for the entire depth of the excavation.

The excavation shall be developed to a minimum of two (2) feet below the top of the glacial till as determined by the soil borings along the entire length. The final depth of the excavation shall be measured by the Contractor and approved by the Engineer immediately following excavation and before placement of backfill. If adjacent borings indicate greater than two (2) feet difference in glacial till elevation, one or more intermediate boring(s) shall be taken to determine the till contour. Extra borings as requested by the Engineer shall be reimbursed as per line item 1.04, Exhibit C, Bid Form as specified in Paragraph 9.03 of "General Conditions."

The slurry wall shall be installed as a continuous segment. The point of excavation shall not be greater than one hundred (100) feet nor less than twenty (20) feet from the toe of the backfill.

Bentonite/water slurry shall be introduced to the excavation at the beginning of work and shall be maintained until the excavation is backfilled. The Contractor shall maintain the excavation's wall stability at all times for its full depth. The level of the slurry in the open excavation shall be maintained at no more than one foot below the working surface at all times. The Contractor shall have personnel, equipment and materials ready to raise the level at any time. This includes designating personnel familiar with the equipment to be on call during off hours, holidays and weekends.

If for any reason, it is necessary for the slurry wall to be constructed in more than one continuous segment, re-excavation of a section of the wall is necessary. Ten (10) feet of backfill, from the point the backfill rises above the slurry and for the entire depth of excavation, shall be re-excavated. Except for causes which the Owner or their representative are responsible, or are considered an Act-of-God, the Contractor is responsible for all costs of the re-excavation. For those exceptions listed above, the Contractor shall be reimbursed as per Section 9.03 of "General Conditions."

1.6.4 Excavation Bottom Cleaning

Upon completion of excavation and prior to placement of backfill, any loose material, cuttings, or settled sand or sediment shall be removed from the bottom of the cut with the excavation equipment or other suitable means such as air lift pumps.

If the unit weight of the in-place slurry fails to meet contract limits, or becomes unworkable, the slurry shall be removed from

the excavation by means acceptable to the Engineer. Excess solids shall be removed from the slurry by screening, centrifugal type desander or other means acceptable to the Engineer before the slurry may be reused.

1.6.5 Backfill

After the bottom of the excavation has been cleaned as discussed above and the bottom has been sampled, as per Paragraph 1.9.2 of this Section backfill shall be mixed and placed in the excavation.

A. Mixing

The Contractor shall prepare and mix the soil, UltraSeal N and bentonite/water slurry as specified in Paragraphs 1.5.1 and 1.5.2 of this Section. Sluicing with slurry shall be used during blending. Under no circumstances will sluicing with water be allowed.

B. Placement

The Contractor shall place the backfill continuously from the beginning of the excavation in the direction of the digging, to the end of the excavation. Backfill placement shall proceed so the surface of the backfill below the surface of the slurry shall follow a reasonable smooth grade and shall not have hollows which may trap pockets of slurry during subsequent backfilling.

The backfill shall not be dropped or deposited in any manner which will cause particle segregation. Free-dropping of backfill through the slurry will not be permitted. The Contractor shall rod the surface of the backfill as necessary to maintain slope and avoid pockets.

Initial backfill shall be placed by lowering it to the bottom of the excavation with a clamshell bucket or backhoe or other means approved by the Engineer until the surface of the backfill rises above the surface of the slurry at the beginning of the excavation. Additional backfill may then be placed in such a manner that the subsequent backfill enters the excavation by sliding down the forward face of the previously placed backfill. A bulldozer, or other acceptable piece of equipment, may be used to pile sufficient amount of backfill on the edge of the in-place backfill to cause a slump and sliding action on the face of the previously placed fill.

If placement of the backfill is stopped for any reason for a time exceeding seventy-two (72) hours, backfilling shall be considered non-continuous. A portion of the backfill must be re-excavated as per Paragraph 1.6.3 of this Section unless otherwise approved by the Engineer.

1.7 TREATMENT FOR TOP OF SLURRY WALL

Upon completion of backfill placement to the satisfaction of the Engineer and before significant drying of the backfill can occur, the Contractor shall cap the slurry wall with the first six inch lift of clay as per "Specifications: Cover Design," Paragraph 2.4 to a minimum of five (5) feet of each side of the centerline.

1.8 CLEANUP

After the Contractor has completed backfilling and installing the first six (6) inch lift over the slurry wall, all remaining, excavated material and slurry shall be removed from the working surfaces. The slurry shall be disposed of by spreading in thin layers within the slurry wall enclosed area. These layers shall be mixed with the surface soils to provide stability. Slurry shall not be left in ponds. All slurry storage ponds shall be pumped dry and backfilled. All excavated materials not previously removed from the work area shall be mixed with imported fill to give a stable mixture in the center of the slurry wall enclosed area as directed by the Engineer.

1.9 QUALITY CONTROL

The Contractor is reponsible for maintaining quality control for the slurry wall construction. A licensed Professional Engineer in the State of Michigan shall be responsible for directing the quality control program. A licensed Land Surveyor in the State of Michigan shall be responsible for all surveying requirements. All test work required by these specifications may be conducted onsite by qualified Contractor personnel, as indicated by their resume(s), or by a subcontracted laboratory except for tests required by Paragraph 1.9.5 of this Section which must be conducted by a non-affiliated, State of Michigan recognized laboratory. If the Contractor uses an onsite laboratory facility, those facilities shall be made availabe to the Engineer.

1.9.1 Trench Continuity

The Contractor shall be responsible for demonstrating to the satisfaction of the Engineer that the excavation is continuous. Continuity shall be assured by the movement of the excavation equipment. Digging tools must be able to pass vertically from top to bottom of the excavation as well as move horizontally along the center line of the excavation at any elevation from top to bottom without encountering any unexcavated material.

1.9.2 Excavation Depth

The Contractor shall be responsible for demonstrating to the satisfaction ofthe Engineer that the excavation is a minimum of two (2) feet below the top of the subsurface glacial till.

Penetration by the bottom of the excavation of the glacial till shall be demonstrated by the following procedures:

1) Borings along the slurry wall centerline (100 feet on center) shall be taken ahead of the excavation to determine the till top elevation. If adjacent borings indicate greater than two (2) feet difference, the distance shall be halved and another boring taken until the difference is less than two (2) feet.

2) Observation of the material removed from the excavation shall be made by the Contractor and Engineer to determine continuous penetration along the entire length of the construction.

3) After the excavation bottom has been cleaned, the Contractor shall measure the actual excavated depth and take at least one sample of the native soil at the bottom every thirty (30) feet along the entire excavation. The sample may be obtained by split-spoon, by use of the excavation equipment or other means approved by the Engineer. A minimum of three (3) inches of samples is required.

If this procedure indicates insufficient excavation, the Contractor is responsible, at no additional cost to the Owner, for further excavation and rechecking to ensure the specified depth has been obtained or exceeded.

1.9.3 Slurry and Backfill

Testing requirements for slurry and backfill are as follows:

A. Slurry

1) Materials

- Bentonite: Certificate of compliance with the specification shall be obtained from the material manufacturer.

- Water: The Contractor must submit an analytical report from a state recognized laboratory, independent of the Contractor, Owner and Engineer certifying the water meets the water quality criteria set forth in Paragraph 1.5.1 of this Section.

If onsite surface water or water other than city water supplied to the site is to be used, the Contractor shall submit a sample of the alternative water supply and the city water to the bentonite manufacturer for testing with the bentonite to be used. A test report from the manufacturer with their recommendations shall be submitted to the Engineer for evaluation.

2) As Introduced to the Excavation

A complete series of tests shall be conducted by the Contractor on slurry ready for introduction to the excavation at least once per shift or each time a mix is prepared, whichever is most frequent. The series includes pH, unit weight and viscosity.

3) In the Excavation

Slurry in the excavation shall be tested by the Contractor at least once per shift to determine unit weight and filtrate loss. The sample shall be obtained from near the bottom of the excavation near the active excavating site.

B. Backfill

1) Materials

- o UltraSeal N or equivalent as approved by the Engineer: Certificate of compliance with the specifications shall be obtained from the material manufacturer.

- o Bentonite/water slurry: Testing of material removed from the excavation and/or the slurry mixing system must indicate the slurry meets or exceeds the quality specified herein for slurry in the excavation.

- o Soil: The Contractor shall test all soils prior to mixing with other components for gradation.

Testing frequency will be as directed by the Engineer with a minimum of one series of tests per two hundred (200) cubic yards of soil or every two hundred (200) feet of excavation backfilled whichever is less. One series of tests shall be conducted prior to any excavation. If significant variations in results occur, more frequent testing will be required.

- o Backfill Mix: The Contractor shall test the backfill prior to placement in the excavation for slump, permeability and unit weight. The testing frequency shall be the same as that established for the soil.

Testing of samples shall commence within one hour of sampling unless otherwise approved by the Engineer. All test results shall be documented and submitted to the Engineer as soon as they are available. Permeability results shall be submitted within twenty-four (24) hours of sampling.

If test results do not meet the requirements of this specification, all material placement will cease. All placed material since the previous acceptable test results will be re-excavated at no cost to the Owner unless the Engineer may be shown with documented evidence that the deviation from specification occurred elsewhere. This proof is the responsibility of the Contractor. If satisfactory evidence is provided, re-excavation of only the material failing to meet the 1×10^{-7} cm/sec permeability specification plus ten (10) feet on each side must be undertaken.

1.9.4 Permeability Testing

Permeability tests shall be made by the Contractor on backfill samples prior to and during construction of the slurry wall.

Test methods and apparatus shall be a modification of the standard one-dimensional consolidation test (ASTM D2435) using a fixed ring consolidometer. The minimum sample diameter shall be 100 millimeters to minimize boundary effects. The sample height shall be between 30 and 50 millimeters. The porous stones on each face of the sample shall be replaced with a disposable filter medium consisting of fine sand (ASTM D1556, Paragraph 2.2) and filter cloth. The filter cloth shall be a woven geotextile and have an effective opening size (E.O.S) equivalent to the 70 to 100 sieves. The consolidomoter shall be calibrated at the beginning of the work to determine flow rate of the apparatus without the specimen and shall be recalibrated during construction as deemed appropriate by the Engineer.

The backfill sample to be tested shall be poured into the consolidometer ring and lightly tamped, rodded and/or vibrated to work voids out of the specimen. Determine the thickness of the test specimen to within one millimeter. Inundate the sample and filter media and keep saturated throughout the test. Apply a seating pressure of 100 grams per square centimeter (g/cm^2) to seat the extensometer, then apply a test pressure of 1,000 (g/cm^2) and maintain constant throughout the test. The test pressure shall be applied at a lighter load if the sample seems to shear during testing. Record the change in thickness of the sample at 0.10, 0.25, 0.50, 1.0, 4, 8, 15 minutes, etc. as specified in ASTM D2435. Plot the change in thickness readings versus the square root of time in minutes and determine 90 percent primary consolidation time and the coefficient of consolidation (cv) in accordance with the procedures described in ASTM D2435.

Calculate the permeability of the test sample by the following equation:

$$k = (dh/h)\ (w/dp)\ (cv)$$

where:
- k = coefficient of permeability (cm/sec)
- dh = change in thickness of sample (cm)
- h = thickness of sample (cm)
- w = unit weight of water (g/cm^3)

dp = change in pressure (g/cm^3)
cv = coefficient of consolidation (cm^2)

1.9.5 Final Testing

After construction of the slurry wall is complete, including the placement of the first clay lift, the Contractor is responsible to demonstrate to the Engineer and Owner the satisfactory placement of the slurry wall. Demonstration of satisfactory placement is to be done by analysis of three samples from the wall. The samples shall be obtained at mid-depth, on center at the three interior quarter points of the wall length. Samples shall be collected by Shelby tube or other device yielding an undisturbed sample approved by the Engineer. Samples shall be analyzed for grain size distribution and permeability. Procedures for these tests are as described in these specifications. Samples shall be analyzed by a State of Michigan recognized soils laboratory independent of the Contractor, Owner and Engineer. An original, certified, analytical report from the laboratory must be provided to the Engineer.

If the results of these tests indicate the permeability is in excess of 1×10^{-7} cm/sec, the Contractor is responsible for all appropriate remedial action as defined by the Engineer at no additicnal cost to the Owner.

1.10 DOCUMENTATION

Results of all tests performed in accordance with these specifications will be recorded by the Contractor on forms acceptable to the Engineer and signed by the Contractor's project Engineer and the Engineer's onsite representative. Results will be submitted daily to the Engineer. All submittals may be photocopies bearing an original signature except for the permeability test report obtained on the in place slurry wall which must be an original.

All results must be available to the Engineer for inspection at any time including holidays, weekends and after hours if Contractor personnel are onsite.

A report signed by the onsite Slurry Wall Specialist, a Michigan registered Professional Engineer and a Michigan registered Land Surveyor documenting the installation of the slurry wall shall be submitted to the Engineer upon completion of the slurry installation. This report shall include material quantities, equipment used, labor and dates of installation. A description of the installed slurry wall shall also be part of the report and shall include copies of all test results, boring and quality control results obtained during slurry wall installation.

1.11 METHOD OF PAYMENT

Payment shall be made to the Contractor based on a square foot of installed slurry wall as specified herein. The square footage of

the slurry wall shall be the sum of the areas of the vertical plane sections between consecutive borings. The section areas shall be determined as follows:

(The horizontal length of the wall between consecutive borings as determined by survey) times (the vertical depth along the slurry wall centerline)

The vertical depth between the borings shall be the average depth of the two borings; the depth determined as follows:

(Working platform elevation minus top of till elevation as determined by borings) plus two (2) feet.

The square foot cost shall be as per line item 1.02 of Exhibit C. Additional UltraSeal N or equivalent, (greater than specified 2% by weight of dry soil) shall be paid as per line pay 1.03 of Exhibit C. Borings requested by the Engineer shall be paid as per line item 1.04 of Exhibit C. Exhibit C is the Bid Form. The initial fill prior to installation of the slurry wall shall be paid as a lump sum under line item 1.05 of Exhibit C, Bid Form.

SECTION 2

SPECIFICATIONS:

COVER DESIGN

2.1 SCOPE

This section of the Specifications defines the minimum requirements to furnish and install a multi-media cover over the slurry wall enclosed portion of a waste disposal area at the location indicated in Figure 3. The requirements include providing all equipment, materials and labor, and performing all necessary tasks to construct a multi-media cover to the specifications established herein.

The cover shall consist of three distinct layers rising from the slurry wall work platform elevation (587 feet MSL) to a maximum of 597.5 MSL. The cover will be made of imported fill to create the foundation for a clay cap which in turn is covered with vegetated topsoil.

2.2 SUBMITTALS

Submittals during construction shall be made as required by these specifications. In addition, the following information shall be submitted by the Contractor prior to the start of any onsite construction:

A. Contractors proposed schedule and operations sequence

B. Source of all imported materials and report of analyis or certificate showing the materials meet or exceed the quality specified herein

1) Fill: Gradation, Compaction Density

2) Clay: Gradation, Atterberg Limits, Unified Soil Classification, Moisture Content, Compaction Density

3) Topsoil: Gradation, Compaction Density, Chemical Analysis for Lime and Fertilizer Requirements

4) Seed Mix: Certificate Guaranteeing Composition and Germination Rate

2.3 MULTI-MEDIA CAP CONSTRUCTION

A cap covering the slurry wall enclosed portion of the waste disposal area, the slurry wall and approximately twenty (20) feet beyond (outside) the slurry wall centerline shall be constructed as shown in Figures 5, 8 and 9.

The foundation fill shall be placed and compacted as described herein. Approximately 80,000 cubic yards of fill material is required. The amount of material required shall be determined by the Contractor.

A minimum of two (2) feet of compacted clay shall be placed over the foundation fill material following the same shapes and slopes established by the foundation material. Approximately 45,000 cubic yards of clay shall be required. The Contractor shall be responsible for determining the volume of clay required.

Atop the clay layer, a six (6) inch layer of topsoil shall be placed following the same shapes and slopes as established by the previous layers. Approximately 11,250 cubic yards of topsoil shall be required. The Contractor shall be responsible for determining the volume of topsoil required.

Fill, clay and topsoil are not available at the site. The Contractor is responsible for providing all soils meeting or exceeding the specifications established herein. The one exception, however, is: all material excavated during construction of the slurry wall shall be mixed with imported fill to give a stable mixture at the location of the maximum, finished grade elevation as directed by the Engineer prior to cap installation.

2.3.1 Materials

A. Foundation Fill

The Contractor shall supply granular material as fill which meets or exceeds the requirements established below:

1) Free from roots, organic material, rocks larger than three (3) inches or other deleterious materials

2) At least 20% by weight (dry) smaller than No. 200 sieve as determined by ASTM D422

3) Friable

4) Uniformity coefficient greater than four (4)

B. Clay

The Contractor shall supply natural clay that shall meet or exceed the following requirements:

1) Free from roots, organic material, stones larger than one (1) inch, debris and other deleterious material

2) Less than 15% of this material shall be coarser than No. 200 sieve as determined by ASTM D422

3) Liquid limit between 40 and 90 inclusive (ASTM D423)

4) Plasticity index greater than 15 (ASTM D424)

5) Classified CH or CL in accordance with the Unified Soil Classification System (ASTM D2487)

6) Moist and pliable

The Contractor shall protect stockpiled clay from drying and cracking by sprinkling, covering or other acceptable means. Clay material which becomes hard, brittle, fissured or cracked shall not be used unless it is thoroughly wetted and reworked to the satisfaction of the Engineer.

C. Topsoil

The Contractor is responsible to provide topsoil representative of productive soils of the area free from roots, sticks, hard clay and stones which will not pass through a one (1) inch sieve. The soil shall also meet or exceed the following specifications:

- Free from contaminants and other deleterious materials harmful to plant growth
- Friable
- Free from subsoil(s)
- Maximum of 65% sand
- Minimum of 10% organic matter

D. Vegetation

The topsoil shall be treated, as required based on analysis, with nutrients and seeded to provide a vegetative cover over all disturbed areas. The Contractor shall supply all nutrients, seed, equipment and labor to meet or exceed the specifications herein.

The seed mix shall be approximately the following:

20 lbs/acre Creeping Red Fescue
20 lbs/acre Tall Fescue
5 lbs/acre Kentucky Bluegrass
2 lbs/acre Timothy
1 lb/acre Redtop
10 lbs/acre Birdsfoot Trefort*

* Innoculate all legumes with correct innoculant

The seed shall be certified by the supplier as: clean,95% pure with an analysis of the contents and a minimum germination rate of 85% within one (1) year.

E. Water

The water shall be as supplied by the City to the site.

2.3.2 Equipment

The Contractor is responsible to provide and operate all equipment necessary to excavate, fill, compact, grade and vegetate the cover as set forth in these specifications. The equipment includes trucks, bulldozers, front end loaders, graders and/or other equipment acceptable to the Engineer.

A vibratory roller is also required to compact the different soils. Sheepfoot rollers or other compaction devices which potentially may disturb subsurface conditions shall not be used to compact the topsoil.

Topsoil shall be placed using a rubber tired tractor with grader blade or equivalent not weighing more than 3-1/2 tons. A rototiller, toothed ripping machine or other means acceptable to the Engineer shall be used for mixing fertilizers, lime and seed with the soil.

The entire area shall be raked to a uniform grade in compliance with the final contours as shown in Figure 9.

2.4 EXECUTION OF WORK

As noted in "Specifications: Slurry Wall," Section 1.6.1, a portion of the fill shall be placed prior to installation of the slurry wall.

2.4.1 Foundation Fill

After the slurry wall has been completed and approved by the Engineer and prior to placement of the compacted clay cover, the remaining foundation fill must be placed and compacted. The fill shall be placed so the contours conform to those shown in Figure 5 unless directed otherwise in writing by the Engineer.

The Contractor shall place the fill in maximum of 18 inch lifts after compaction. Each lift shall be compacted to 90% of maximum density at optimum water content as determined by ASTM D698. Compaction shall be achieved using an approved vibratory roller.

After rough grading is complete on the final lift, the upper six (6) inches shall be compacted to at least 95% maximum dry density as determined by ASTM D698.

The surface of the foundation fill shall be uniform in appearance, free from roots, mounds, lumps, loose stones or other surface irregularities. Any coarse stones, debris, wood chips or other material that projects above the compacted surface shall be removed.

2.4.2 Clay Cap

After compaction of the foundation fill is complete, the Contractor shall install a compacted clay layer conforming to the contours of Figure 8 or as approved by the Engineer. The clay shall be excavated at its source in a manner which avoids sand or silt and prevents the contamination of the clay with unacceptable matter. Shipping, handling, storing and/or placing of the clay shall proceed so as to avoid admixing sand, silt, debris or subsoils. The in-place clay quality shall conform to the requirements specified in 2.3.1B of this Section. The moisture content shall be maintained within plus or minus two (2) percentage points of optimum.

The clay shall be placed in lifts of six (6) inches, after compaction, to a total of two (2) feet. The surface of each lift shall be scarified to provide a continuous, uniform layer free from seams, joints, inclusions or areas of non-homogeneity. Each lift shall be compacted to at least 95% of its maximum dry density as determined by ASTM D698. The Contractor is responsible to provide documentation indicating the clay's quality before compacting.

The Contractor shall protect the surface of each lift from unnecessary traffic, precipitation or other disturbances and repair at no additional cost to the Owner any section of the clay lift that becomes damaged (i.e. does not conform with the specifications as defined herein).

2.4.3 Topsoil

Following acceptance of the final clay lift by the Engineer, the Contractor shall place the topsoil as soon as practicable conforming with the contours shown in Figure 9 or as approved by the Engineer. The maximum area of unprotected clay shall be limited to no more than four (4) acres at any given time. The maximum time that any portion of the clay is left unprotected shall be limited to no more than fifteen (15) days.

The Contractor shall submit at least ten (10) samples, as directed by the Engineer, of the topsoil to the County or State soil testing service for chemical analysis. These samples shall be taken after the topsoil is shown to conform or exceed the quality specifications established in 2.3.1C of this Section and before placement begins. These samples shall be analyzed to determine lime and fertilizer requirements. Liming is required to obtain a soil pH of 6.5 to 7.0.

For estimating purposes, assume 500 lbs/acre of 12:12:12 fertilizer and 2200 lbs/acre of ground dolomitic limestone.

The Contractor shall spread the topsoil over the entire affected area to a minimum depth of six (6) inches. Shape, trim and finish slopes, adding additional soil if required, to conform with the contours and cross-sections shown in Figures 6, 9, 10 or

as approved by the Engineer. Round off tops of banks and mounds to circular curves, in general, not less than six (6) foot radii. Over-excavation and backfilling shall not be acceptable. All surfaces shall be free from all exposed roots and stones. Finished grading and surface conditions shall be approved by the Engineer.

2.4.4 Groundwater Monitoring System

See "Specifications: Groundwater Monitoring System," Section 3.

See "Special Provisions: Existing Facilities" for procedures applicable to existing monitoring wells and their possible upgrading to meet the specifications established herein.

2.4.5 Vegetation

After the topsoil has been placed and contoured, the Contractor shall amend the soil as indicated by chemical analysis. A mechanical spreader shall be used to apply lime and fertilizer. The application shall be uniform as determined by analysis.

The Contractor shall thoroughly mix the amendments with the in place topsoil to a minimum depth of five (5) inches. Do not exceed six (6) inches. Mixing shall be done with a rototiller by running over the area in two directions at right angles or as approved by the Engineer. Rake the surface to a uniform grade and remove all trash and stones exceeding two (2) inches in diameter.

Seed shall be applied to the entire surface after it has been prepared. The seed mix specified in 2.3.1D shall be applied with a mechanical spreader or by hydroseeding. Seed shall be applied at the rate specififed in 2.3.1D. If a mechanical spreader is used, a cultipacker shall be used to cover the seed and an application of water shall be made by the Contractor. If hydroseeding is used, premoisten the soil and do not apply seed if there is standing water.

After application of seed, the area shall be mulched to minimize evaporation, wind loss and erosion. Mulching shall be accomplished by uniformly spreading 1.5 tons straw/acre not later than two (2) days after seeding. The mulch shall be anchored by lightly discing the straw into the top inch of the soil or other approved method as presented in "Special Provisions: Soil Erosion and Sediment Control."

2.4.6 Maintenance

The Contractor shall immediately begin maintenance after each portion of grass is planted and continue for eight (8) weeks after all grass planting is completed. Maintenance shall consist of watering all grassed areas to keep surface soil moist, repairing washed out areas by filling with topsoil, reseeding and mulching, replacing mulch on banks when washed or blown away,

mowing to two (2) inches after grass reaches three (3) inches in height and frequently enough to keep grass from exceeding 3-1/2 inches, and weeding by local spot application of selective herbicides as recommended by the county or state soil testing service only after grass is established.

If, at the end of the eight (8) week grass maintenance period, a satisfactory stand of grass has not been produced, the Contractor shall renovate and reseed the area or unsatisfactory portions thereof immediately or, if after October 1, the Contractor shall seed all areas with dormant seeding and mulch all areas with straw of equivalent material at a rate of two (2) tons per acre. If a satisfactory stand of grass develops by July 1 of the following year, it will be accepted. If it is not accepted, a complete replanting will be required during the planting season meeting all of the requirements specified under Paragraph 2.4.5. A satisfactory stand is defined as a section of grass of 10,000 square feet that has no bare spots larger than three (3) square feet, not more than 10 percent of total area with bare spots larger than one (1) square foot, and not more than 15 percent of total area with bare spots larger than six (6) inches square.

Eight (8) weeks after the start of maintenance on the last section of completed grass and on written notice from the Contractor, the Owner or their representative will, within (fifteen) 15 days of such written notice, make an inspection to determine if a satisfactory stand has been produced. If a satisfactory stand has not been established, the Contractor shall replant as specified and another inspection shall be made following the next maintenance period at no additional cost to the Owner.

2.5 QUALITY CONTROL

The Contractor shall maintain quality control for the multi-media cap as detined in these specifications. A licensed Professional Engineer in the State of Michigan shall be responsible for directing the Quality Control program. A licensed Land Surveyor in the State of Michigan shall be responsible for all surveying requirements.

2.5.1 Materials

The Contractor shall demonstrate to the Engineer prior to delivery to the site, by way of certificate, that all materials meet or exceed the requirements established in Paragraph 2.3.1.

The Contractor shall obtain and analyze samples for testing during construction from each 1500 tons of imported material. If significant variation in results indicate variable quality of material, the Engineer may direct the Contractor to increase the frequency of sampling and analyzing. Additonal samples requested by the Engineer will be paid for under Section 9.03 of "General Conditions." The sample of fill material shall be analyzed for

gradation (ASTM D422) and compaction density (ASTM D698). The samples of clay shall be analyzed for gradation (ASTM D422), Liquid Limit (ASTM D423), Plastic Limit (ASTM D424), Moisture Content (ASTM D2216), and Compaction Density (ASTM D698). The samples of topsoil shall be analyzed for gradation (ASTM D422), Compaction Density (ASTM D698) and chemical analysis (by local state soil testing service).

If tests conducted by the Contractor indicate the material does not conform with the specifications established herein, material placement will be halted until corrective measures may be taken and recently placed material will be analyzed by the Contractor as directed by the Engineer at no cost to the Owner. If in place material is found not to conform with specifications, it shall be removed and replaced at the Contractor's expense.

2.5.2 Placement

The Contractor shall document the results of all surveying done on the job to show placement of the different media conforms with the specifications established herein.

Four randomly positioned (to be determined by the Engineer) samples of each in place material per acre-lift shall be required of the Contractor and analyzed for compaction density (ASTM D698). The sample shall be taken by Shelby tube or other means of non-disruptive sampling. The hole created by the sampler shall be filled with fresh material of the same type and meeting the same specifications as the material removed. If these samples indicated the in-place material does not conform with the specifications herein, the Contractor shall be instructed to remedy the problem at no extra cost to the Owner. Remeding the problem shall consist of additional in place material sampling to determine the areal extent of the situation and recompacting that area until samples indicate compliance to the satisfaction of the Engineer.

2.6 DOCUMENTATION

Results of all tests performed in accordance with these specifications will be recorded on forms acceptable to the Engineer and signed by the Contractor's Project Engineer and the Engineer's onsite representative. Results will be submitted to the Engineer within one (1) working day of receipt by the Contractor. The Contractor shall be responsible for obtaining all results within twenty-four (24) hours of sampling unless otherwise approved by the Engineer.

All submittals may be photocopies of analytical results or certificates of compliance. All photocopies must bear an original signature. All results must be available to the Engineer for inspection at any time including holidays, weekends and after hours if Contractor's personnel are onsite.

2.7 METHOD OF PAYMENT

The Contractor shall be reimbursed for all work under this Section in one lump sum as indicated in line item 1.05 of Exhibit C, the Bid Form.

SECTION 3

SPECIFICATIONS:

GROUNDWATER MONITORING SYSTEM

3.1 SCOPE

This section of the Specifications defines the minimum requirements to furnish and install a groundwater monitoring system to provide groundwater elevations within and outside the slurry wall enclosed area of a waste disposal area at the location indicated in Figure 3. The system shall be used to monitor the integrity of the slurry wall. The requirements include providing all equipment, materials, labor and performing all necessary tasks, as described herein, to install a groundwater monitoring system.

The system shall include one (1) well to the south, two (2) wells to the north, one well to the west and three (3) wells inside of the enclosed area. The system will be used to monitor variations, if any, in groundwater elevation over time by the Owner. The system shall be installed in and used to monitor only the aquifer above the glacial till into which the slurry wall was keyed.

3.2 SUBMITTALS

Submittals during construction shall be made as required by these specifications. In addition, the following information shall be submitted by the Contractor prior to the start of any construction:

A. Contractor's proposed schedule and operations sequence

B. Source of all materials and the following information:

   1) Slot size for wellscreens

   2) Length of wellscreen for each well

   3) Material for well filter including gradation

3.3 CONTRACTOR QUALIFICATIONS

The Contractor shall submit evidence of experience in installation of monitoring wells in accordance with Michigan Department of Natural Resources, Groundwater Quality Division's specifications as documented in the DNR Hydrogeologic Study Handbook and summarized herein. One (1) person shall be designated by the Contractor as responsible for installation of the monitoring wells. This person shall be assigned full time to

the project during well installation. The resume of the designated person shall be provided. The person shall be employed by the Contractor and shall be responsible for all aspects of the monitoring well installation including, but not limited to, quality of materials, logging of borings, installation of filter screen(s), construction of well, sealing of the surface and development of the wells according to these specifications or as agreed upon by the Engineer.

3.4 INSTALLATION

The Contractor shall install a groundwater monitoring system as specified herein and depicted in Figures 3, 10 and 11 or as approved by the Engineer. Three (3), two (2) inch, stainless steel monitoring wells shall be installed inside the slurry wall enclosed area. One (1) PVC monitoring well shall be installed south of the enclosed area, two (2) PVC monitoring wells shall be installed north of the enclosed area, and one (1) PVC monitoring well shall be installed west of the enclosed area.

Estimated soil profiles for the well locations are provided in Figure 10. Information obtained during installation of the slurry wall should also be used. The Contractor shall be responsible for providing complete boring logs for each well installed. Any abnormalities in soil qualities should be noted in the logs.

The three wells installed inside the slurry wall enclosed area shall be installed after completion of a multi-media cap over the area and before vegetation, as defined in "Specifications: Cover Design." See "Special Provisions: Existing Facilities" for procedures applicable to existing monitoring wells and their possible upgrading to meet the specifications established herein. Installation of all wells which penetrate the multi-media cap should proceed with caution to avoid damage to the impermeable clay layer and to avoid contact between personnel and fluids contained within.

As noted in "Special Provisions: Soil and Water Conditions," areas enclosed by the slurry wall may contain a high concentration of metallic objects. The site has been used as a landfill; therefore, the Contractor should make all necessary provisions to drill to the required depth through obstacles or relocate the drilling location to a site approved by the Engineer at no additional cost to the Owner.

3.4.1 Materials

A. Wellscreen

The wellscreen for wells inside the slurry wall enclosed area shall consist of two (2) inch inside diameter, schedule 40, stainless steel, wire wound wellscreen. The slot size is to be field determined, but shall not exceed number 10 slot. The

estimated screen length shall be defined by the following:

length = estimated groundwater elevation - estimated glacial till elevation

The wellscreens for wells outside of the slurry wall shall consist of two (2) inch inside diameter, schedule 80, slotted PVC. The slot size is to be field determined, but shall not exceed number 10 slot. The screen length shall be determined as above. All screens shall be capped at the bottom.

B. Well Casing

The well casing for wells inside the slurry wall enclosed area shall consist of two (2) inch, inside diameter, schedule 40, stainless steel. The well casing for all wells outside the slurry wall shall consist of two (2) inch, inside diameter, schedule 80 PVC.

The well casing shall extend from the top of the wellscreen section to a minimum of two (2) feet above finish grade. Refer to Section 3.6 for discussion of finish grade. The casing shall consist of threaded, flush jointed, stainless steel or PVC as applicable. All other means of attaching sections is not allowed. The casing shall have a threaded cap at the top and shall have a 1/4 inch air vent approximately six (6) inches below the cap.

C. Protective Casing

A length of carbon steel, schedule 40, six (6) inch diameter pipe shall be placed over the well head to provide a protective casing and placed in concrete. The casing length shall be sufficient to extend six (6) inches below grade and six (6) inches above the top of the well casing. A hinged plate shall be affixed to the carbon steel casing with fixtures on both to allow a secure sealing of the well with a padlock. A drain hole (1/4" in diameter) shall be drilled in the casing approximately 1" above finished grade to allow drainage.

D. Concrete

Proportioned and mixed to provide a compressive strength not less than 2000 psi at 28 days.

E. Sand/Gravel Pack

All wells must be packed with clean sand and/or gravel appropriately sized for the wellscreen. The pack material shall be recommended by the Contractor and approved by the Engineer prior to placement.

F. Casing Seal

A bentonite/cement slurry shall be tremie grouted into the

annulus around the well casing to provide a seal located between the pack material and the concrete collar. Measures will be taken by the Contractor to ensure the slurry does not enter the filter pack. The bentonite shall be the same as that used in the excavation of the slurry wall. Five (5) percent by weight bentonite to water and twenty (20) percent by weight cement to water mix shall be used.

3.4.2 Equipment

The Contractor is required to perform all drilling and well material installation as required by this specification. All efforts shall be made to minimize the disturbance of the soil forming the site cap. The Contractor shall be responsible for returning the site to the condition prior to well drillng if any disturbance is made. These conditions include, but are not limited to, compactness and contour of the topsoil cover as established in "Specifications: Cover Design."

3.5 EXECUTION OF WORK

3.5.1

Upon completion of placement of the final cap media (topsoil) and prior to vegetation the Contractor shall install the groundwater monitoring system as specified herein.

The Contractor shall drill a borehole with a diameter equal to or greater than six (6) inches for each well required. The hole shall be drilled six (6) inches into the top of the glacial till as determined by the boring log. Approximate depths of the wells range from ten (10) to twenty (20) feet. The soil conditions expected (1) have generally been described in "Special Provisions: Soil and Water Conditions" and (2) have been supplemented by the materials placed in the cover construction. The Contractor is responsible for logging all borings conducted for monitoring well installation. A minimum of one (1) split spoon sample every five (5) feet or at any change in lithology shall be required to generate a boring log.

The wells shall be installed at the locations indicated in Figure 3. These locations are approximate and shall be verified in the field by the Contractor and approved by the Engineer. The Contractor is responsible for providing a report to the Engineer showing surveyed, actual location of all wells shown in Figure 3.

Seven wells shall be installed or upgraded, if possible, as part of this specification. Three (3) wells inside the slurry wall enclosed area, one (1) well to the south of the area, two (2) to the north of the area and one (1) to the west of the area.

The following design summary is presented for the seven (7) wells as a guideline only. If borings for the wells indicate to the Contractor the design presented herein may not be suitable for

the material encountered, the Contractor is reponsible for notifying the Engineer in writing and making recommendations for revision to the original design. The Contractor is responsible for providing a well which passes the tests specified in Paragraph 3.5.2 of this Section.

Well ID	Total Depth Feet	Screen Interval	Pack Interval
INS-1	14.5	584.5 - 578.5	589 - 584.5
INS-2	17.5	584.5 - 575	588 - 584.5
INS-3	13	584.5 - 579	588 - 584.5
UP-1	6.5	583.5 - 578.5	585.5 - 584
DWN-1	7	584.5 - 579.5	586 - 584
DWN-2	8.5	584 - 578.5	586 - 584
DWN-3	7	584.5 - 578.5	586 - 584.5

The Contractor shall submit, in writing, a proposed procedure for installation of the wells and this procedure must be approved by the Engineer prior to commencing work. Approval does not release the Contractor from the requirement of providing a functioning monitoring well as defined herein.

The following procedure is supplied as a minimum requirement, see Figure 11:

- All equipment shall be washed prior to drilling and installation of each hole. Wash water shall be collected and disposed of offsite by the Contractor at an acceptable disposal site.

- The southernmost outside well shall be installed first. The northeastern well shall be installed next followed by the north central well. The western well shall be the last outside well installed. The inner wells shall be installed last in an order chosen by the Contractor.

- Boreholes and split spoon samples as per ASTM 1586-67 shall be drilled and logged in the sequence specified. The drill hole must be cased through its entire depth prior to well installation. Hollow stem augers are acceptable. The minimum hole size is six (6) inch nominal diameter. Air rotary shall not be allowed to minimize air emissions of volatile organic compounds.

- Drilling fluids other than potable water are not allowed during drilling. All efforts shall be made to minimize the use of water during drilling.

- Install the screen and casing.

- Backfill the hole with filter sand resulting in an as-built height of two (2) feet (minimum) above the top of the screen.

- Bentonite/cement slurry shall be tremie grouted to fill the annulus from the top of the filter sand to within three feet of ground surface.

- The outer protective casing shall be placed over the well casing. The protective casing shall extend six inches above the well casing when it has been inserted six (6) inches into the bentonite slurry layer.

- The remainder of the hole inside and outside of the protective casing shall be filled with concrete to grade after the bentonite/cement slurry has achieved its initial set.

- After the concrete has set remove approximately two (2) feet radius of topsoil (upper six (6) inches), spread approximately two (2) pounds of dry bentonite powder over this area, and place and compact clay as per "Specifications: Cover Design" atop the exposed clay. The clay shall be six (6) inches at the well's protective casing and taper off to zero inches at the outside of the cleared area. The removed topsoil shall be replaced as per "Specifications: Cover Design" to create the finished grade.

- Variations to this procedure as dictated by specific field conditons shall be proposed by the Contractor prior to well installation in those borings. Engineer approval of written procedures is required.

3.5.2 Testing Wells for Acceptance

All wells are to be pumped by the Contractor until they yield clear, sand free water. Air lifting is not allowed. All water generated by well develcpment shall be collected by the Contractor and disposed of offsite at an acceptable location. Payment shall not be made for wells which do not meet these criteria. The Contractor may continue to pump to determine if a successful well has been installed or install a new well at a location approved by the Engineer. All wells not accepted by the Engineer shall be abandoned as per the State of Michigan DNR regulations. These corrective measures are to be taken at no additional costs to the Owner.

3.6 CLEANUP

3.6.1 Spoils

The Contractor is reponsible for removal and transportation of all spoil material associated with the work specified herein to a location onsite designated by the Engineer. Spoil material shall not be used in any circumstance for backfilling the well holes.

3.7 DOCUMENTATION

The Contractor is responsible for providing a written report documenting the location of each monitoring well as the result of a survey. Each well shall be surveyed for elevation of the top of the well casing, the top of the protective casing with the hinged top open, the plan location and static water level twenty-four (24) and fourty-eight (48) hours after development.

The survey shall be recorded to a + or - 0.01 foot using reference points determined by the Engineer. All surveying shall be conducted by a Licensed Surveyor in the State of Michigan. The Contractor shall also submit a boring log for each hole drilled. This includes all wells installed and any wells which failed the Acceptance Test described herein.

A written description of each installed well is also required. The description shall include length of well and protective casing and screen; depth of filter sand, bentonite/cement slurry and concrete, and static water levels determined at twenty-four (24) and forty-eight (48) hours after the well has been successfully developed. Gradation analysis of the filter sand, mixing ratios for the concrete and the bentonite/cement slurry, and test data and observations pertinent to acceptance shall also be included. Drawings of each installed well shall be provided. The report provided shall be signed by a Licensed Surveyor and Professional Engineer in the State of Michigan.

3.8 METHOD OF PAYMENT

The Contractor shall be reimbursed for all work under this Section in one lump sum as indicated in line item 1.06 of Exhibit C, Bid Form.

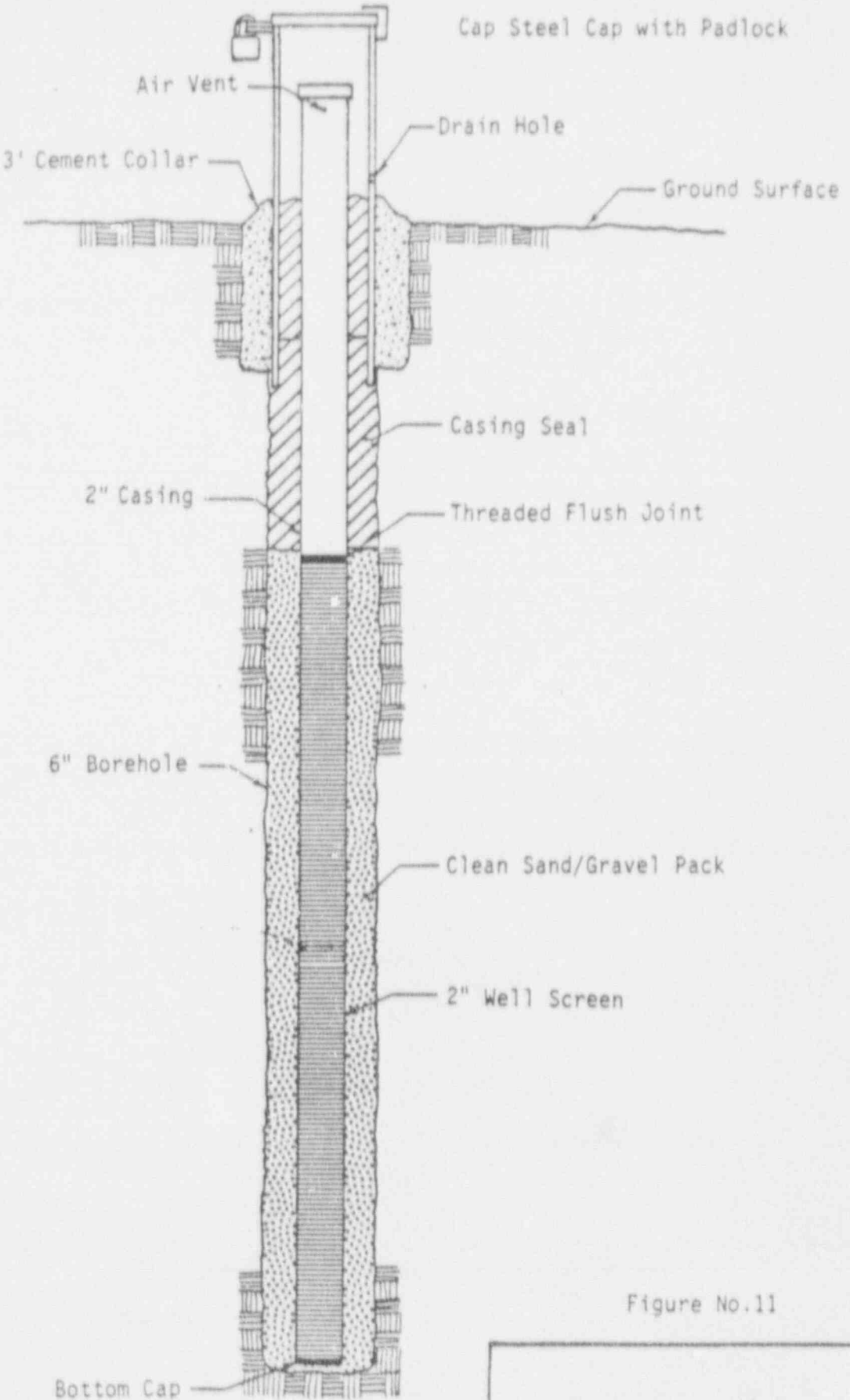
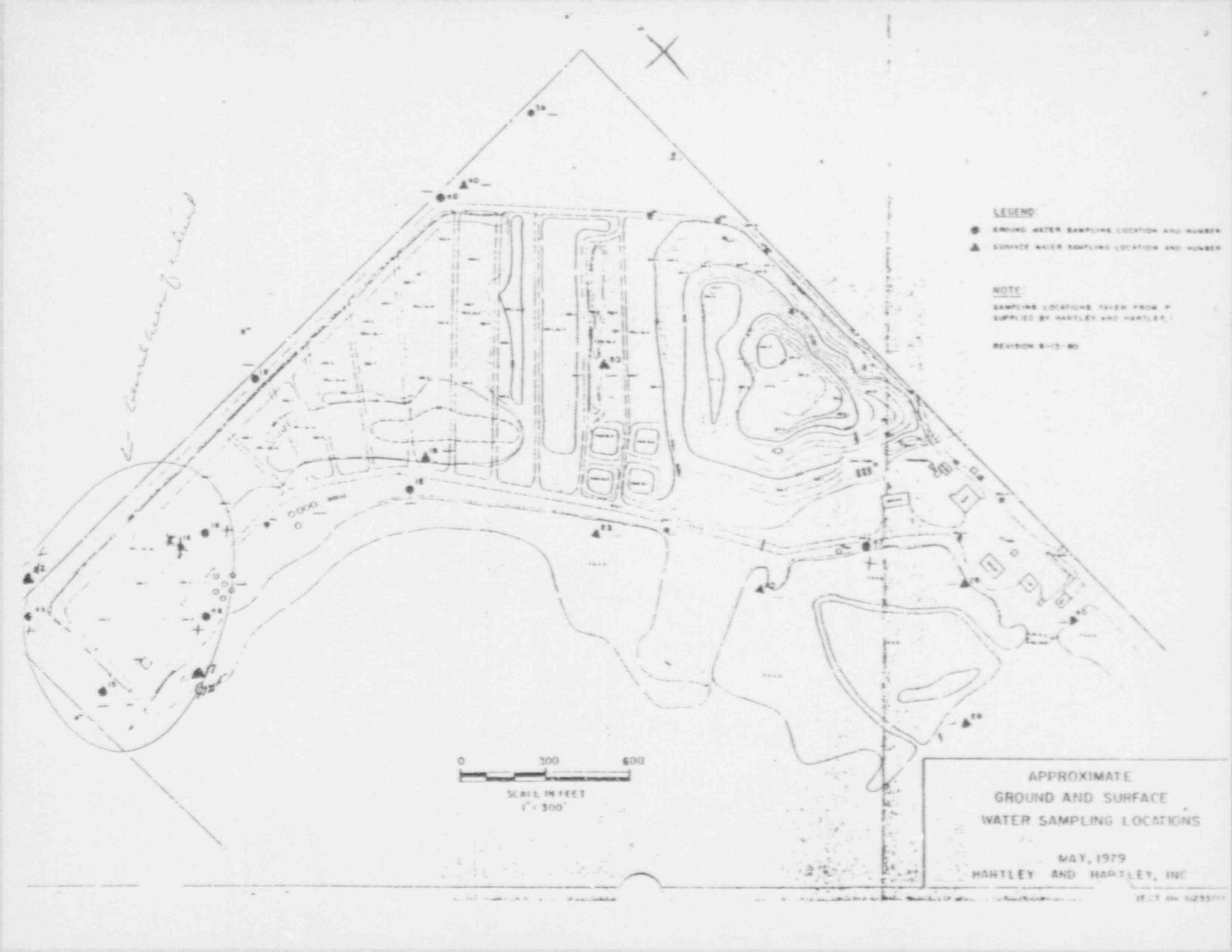
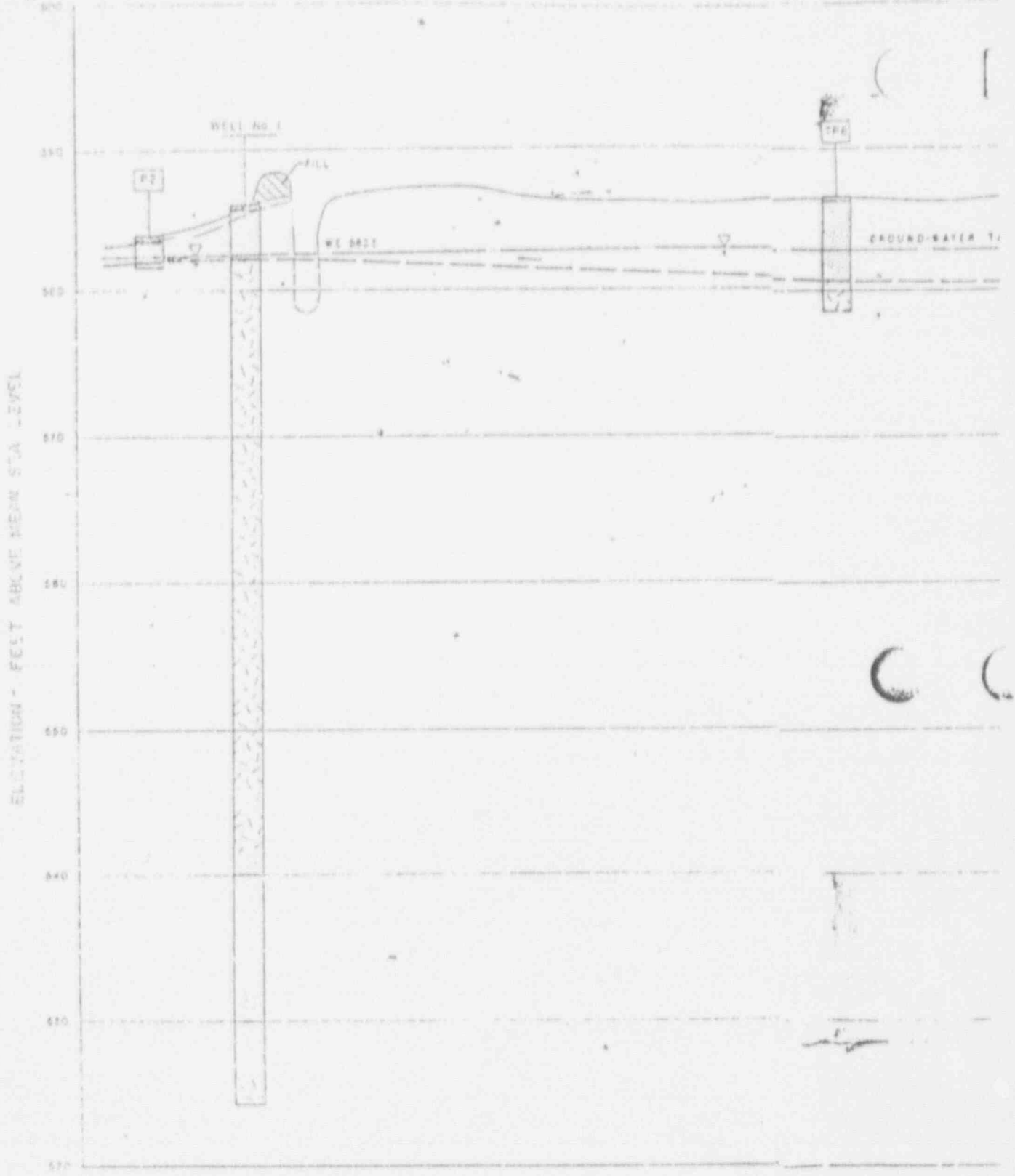


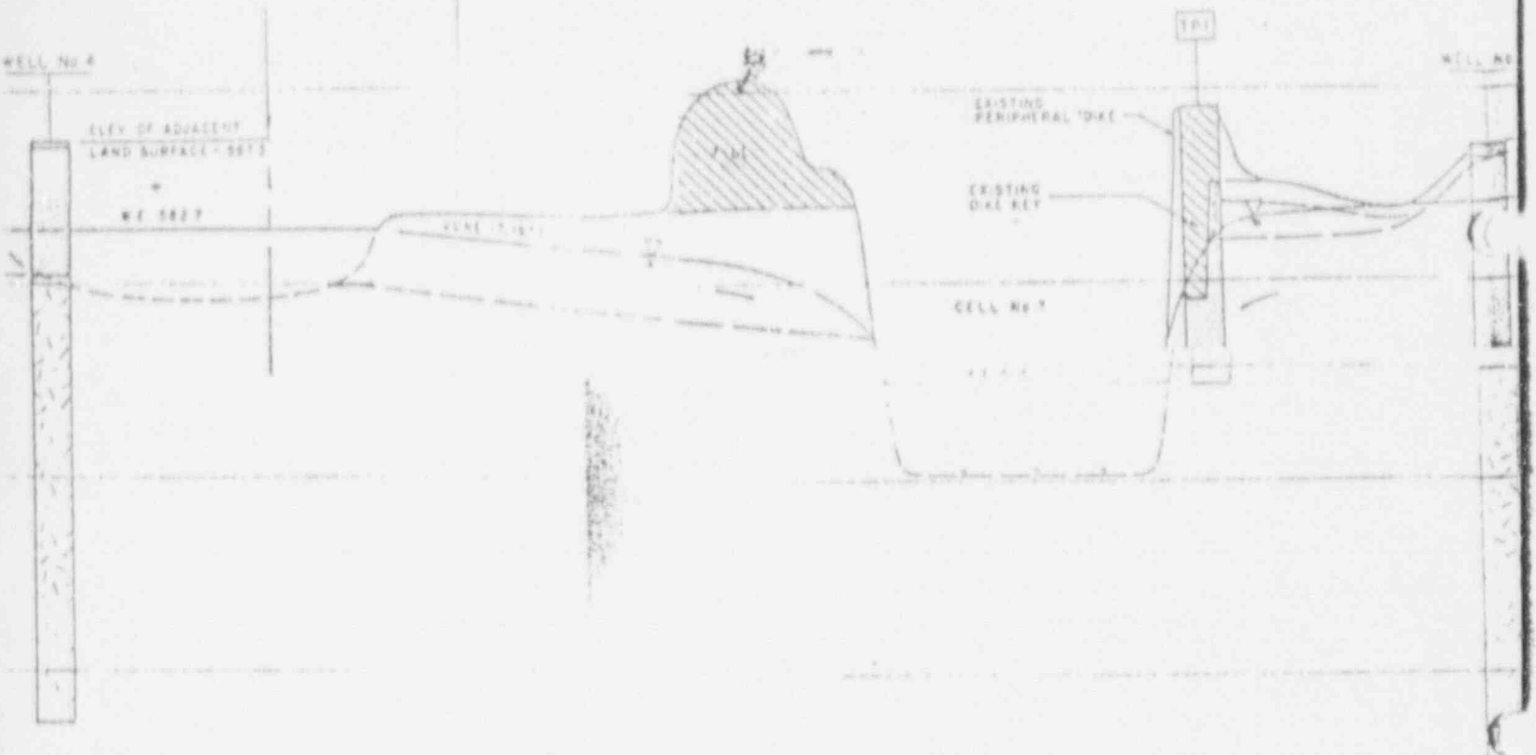
Figure No.11

Monitoring Well Detail

GROUNDWATER TECHNOLOGY, INC.


LEGEND
GROUND WATER SAMPLING LOCATION AND NUMBER
SURFACE WATER SAMPLING LOCATION AND NUMBER
NOTE:
SAMPLING LOCATIONS TAKEN FROM P
SUPPLIED BY HARTLEY AND HARTLEY, I
REVISION 8-13-80
0
300
600
SCALE IN FEET
1" = 300'
APPROXIMATE
GROUND AND SURFACE
WATER SAMPLING LOCATIONS
MAY, 1979
HARTLEY AND HARTLEY, INC


WELL NO. 1
TP6
P2
FILL
WE DRIFT
GROUND-WATER T
ELEVATION - FEET ABOVE MEAN SEA LEVEL
560
550
540
530



RTICAL EXAGGERATION

100 0

HORIZONTAL SCALE

F25f

600

590

580

570

560

550

540

530

520

LEGEND

WELL LOCATION AND NUMBER

TEST PIT (TP) OR PIEZOMETER (P) LOCATION AND NUMBER

BORING LOCATION AND NUMBER
ELEVATION AT GROUND SURFACE
CONTACT
SOIL DESIGNATION

EXISTING GROUND SURFACE

CONTACT

GROUNDWATER TABLE

GROUNDWATER FLOW DIRECTION

KEY TO SUBSURFACE SOILS

FILL — PREDOMINATELY STOCKPILED SOIL OF DIKES

TOPSOIL — DARK BROWN TO BLACK TOPSOIL; BLACK AND HIGHLY ORGANIC IN LOW LYING AREAS; DARK BROWN AND SANDY ELSEWHERE.

PEAT — RED-BROWN TO BROWN PEAT, SOFT, SATURATED, OCCASIONAL DECOMPOSED TREE TRUNKS AND LIMBS, GENERALLY STABLE IN CUT, PERMEABLE

SAND — WHITE, TAN OR GREY MEDIUM COARSE SAND; VERY CLEAN, MASSIVE, UNSTABLE IN CUT, PARTICULARLY BELOW WATER-TABLE, HIGHLY PERMEABLE

GLACIAL TILL — GREY CLAY & SILT, AND TO SOME mf SAND, TRACE GRAVEL, VERY STIFF TO HARD, MASSIVE, VERY STABLE IN CUT, HIGHLY IMPERMEABLE

GLACIAL LAKE DEPOSITS — GREY LAMINATED CLAY AND SILT, LITTLE SAND, TRACE GRAVEL, STIFF, STRATIFIED, HIGHLY IMPERMEABLE

DUPLICATE

FIGURE 4
GEOLOGIC SECTION A-A