Town of Hempstead

Office of the Town Attorney

HEMPSTEAD TOWN HALL, TOWN HALL PLAZA
MAIN STREET, HEMPSTEAD, N. Y. 11550
(516) 489-5000

December 11, 1987

Mr. Russ Keller, P.E.
Senior Sanitary Engineer
New York State Department
of Environmental Conservation
Building 40
Stony Brook, New York 11794

Town of Hempstead
File - Superfund
Merrick Landfill
1-30-022

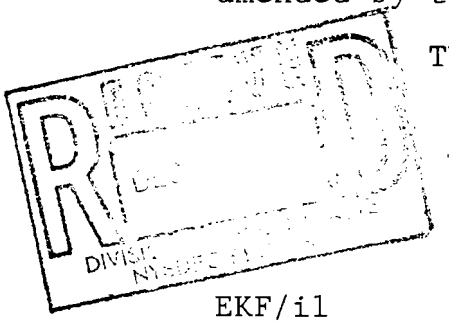
Re: Merrick Landfill
TA# Sanitation

Dear Mr. Keller:

I am transmitting herewith a copy of the Order on Consent which the Town and Special District have executed with your department (White Plains Office) for the investigation of the Merrick Landfill for inactive hazardous waste.

I believe that your office has on file prior Order(s) which effect in the same document both the Oceanside and Merrick landfills. I respectfully request that any prior documentation which addresses or includes the Merrick site be deemed superseded and automatically amended by the enclosed.

Thank you.



Very truly yours,

W. KENNETH CHAVE, JR.
Town Attorney

By Eugene K. Ferencik
Eugene K. Ferencik
Deputy Town Attorney

EKF/il
Enclosure

cc: Joan F. Scherb, Esq., Regional Attorney (without enclosure)
Robert Williams, Esq., Special Counsel (without enclosure)
James H. Heil, Commissioner, Department of Sanitation (w/o enc.)

Stony Brook

New York State Department of Environmental Conservation

Division of Environmental Conservation
202 Mamaroneck Avenue Room 304
White Plains, N.Y. 10601-5381

Thomas C. Jorling
Commissioner

November 25, 1987

Eugene K. Ferencik, Esq.
Deputy Town Attorney
Office of the Town Attorney
Hempstead Town Hall
Town Hall Plaza
Main Street
Hempstead, New York 11550

Re: MERRICK LANDFILL
ORDER ON CONSENT

Dear Gene:

Please find enclosed a fully executed copy of the Order on Consent signed by Commissioner Jorling on November 19, 1987.

Thank you for your courtesy and cooperation.

Sincerely,

Robert J. Owens /jg/
Robert J. Owens
Senior Attorney

RO/jg

STATE OF NEW YORK: DEPARTMENT OF ENVIRONMENTAL CONSERVATION

X----------X

In the Matter of a Field Investigation to Identify Any Threat to the Environment Caused by the Disposal of Industrial and Hazardous Wastes by

ORDER ON CONSENT

INDEX # W1-0931-85-12

TOWN OF HEMPSTEAD AND TOWN OF HEMPSTEAD REFUSE DISPOSAL DISTRICT (MERRICK LANDFILL)

Respondents

X----------X

WHEREAS,

1. The New York State Department of Environmental Conservation (the "Department") is responsible for the enforcement of Article 27, Title 13, of the Environmental Conservation Law of the State of New York (the "ECL"), entitled "Inactive Hazardous Waste Disposal Sites".

2. The Town of Hempstead (the "Respondent"), is a municipal corporation organized and existing under the laws of the State of New York, and is doing business in the State of New York in that Respondent owns real estate within the State of New York.

3. Respondent owns the landfill located at 1600 Merrick Road Town of Merrick, County of Nassau, State of New York (the "Site"). The landfill is maintained and operated by the Town of Hempstead Refuse Disposal District, a special district (the "Respondent"). A map of the Site is attached hereto and is hereby incorporated into this Order as Appendix "A".

4. The Site is a municipal landfill covering 42 acres on an 82 acre site located in Merrick, Nassau County, New York. The landfill has been operated by the Town of Hempstead, Department of Sanitation since 1950. Prior to 1950, the Site was reportedly used by local residents as an open dump. The landfill was closed in 1984 when it reached its capacity. Site facilities included an inactive incinerator and settling lagoons.

5. The Site is an inactive hazardous waste disposal site, as that term is defined in ECL Section 27-1301(2).

6. Pursuant to ECL Section 27-1313(3)(a), whenever the Commissioner of Environmental Conservation (the "Commissioner") "finds that hazardous wastes at an inactive hazardous waste disposal site constitute a significant threat to the environment, he may order the owner of such site and/or any person responsible for the disposal of hazardous wastes at such site (i) to develop an inactive hazardous waste disposal site remedial program, subject to the approval of the department, at such site, and (ii) to implement such program within reasonable time limits specified in the order."

7. The Department and Respondents acknowledge that the goals of this Order shall be that Respondents shall develop and implement a field investigation program to:

(1) determine the nature of the wastes and the areal extent and vertical distribution of the wastes disposed of at the Site;

(ii) identify any past, current and/or potential future releases or migration of hazardous waste, as that term is defined in ECL Section 27-1301(1), and/or industrial waste, from the site to other on-Site and off-Site areas; and

(iii) evaluate the on-Site and off-Site impacts of such migration upon the environment.

8. Respondents, having waived their right to a hearing herein as provided by law, and having consented to the issuance and entry of this Order, agree to be bound by provisions, terms and conditions hereof. Respondents reserve their rights to a hearing as provided by E.C.L. Section 27-1313(4) prior to the issuance of any Order concerning a remedial plan.

NOW, having considered this matter and being duly advised, **IT IS ORDERED THAT:**

I. All investigations, proposals, reports, plans, remedial programs, and supplements and revisions thereto required by this Order shall address both on-Site and off-Site contamination caused by the disposal of hazardous and industrial wastes at the Site, and shall be prepared, designed and executed in accordance with Requisite Technology. As used in this Order, Requisite Technology means engineering, scientific and construction principles and practices subject to the Department's approval, which (a) are technologically feasible, and (b) will most effectively identify,

mitigate and eliminate any present or potential future threat to the environment posed by the disposal of hazardous and industrial wastes at [redacted] the Site.

The failure of Respondents to submit or undertake a proposal, report, field investigation, construction program plan or any supplement or revision thereof, which is in accordance with Requisite Technology shall constitute a violation of this Order.

II. As used herein, "hazardous wastes" shall be those hazardous wastes defined by 6 NYCRR 371 and any constituents or degradation products thereof.

III. Respondents shall undertake a field investigation of the Site and of areas off-Site affected by the disposal of hazardous and industrial wastes (the "Field Investigation") at the Site.

IV. Within thirty (30) days after the effective date of this Order, Respondents shall submit to the Department a proposed written scope of work (the "Proposal") outlining the nature and extent of the work to be undertaken in conducting the Field Investigation. At a minimum, the Proposal shall meet the requirements of the following:

A. Generic Workplan (Appendix "B")

B. Oversight Checklist (Appendix "C")

C. Guidelines for Exploratory Boring (Appendix "D")

D. DOT Soil Description Procedure (Appendix "E")

V. Within 30 days after receipt of the Proposal, the Department shall provide written notification to Respondents of their approval or disapproval of the Proposal. If the Department approves the Proposal, Respondents shall perform the Field Investigation in accordance with the Proposal. If the Department disapproves the Proposal, then within 15 days after receipt of the Department's objections to the Proposal, Respondents shall revise the Proposal in accordance with the terms, provisions and conditions of this Order and shall submit to the Department a Proposal which has been revised in accordance with the Department's objections (the "Revised Proposal"). Within fifteen (15) days after receipt of the Revised Proposal, the Department shall provide written notification to Respondent of its approval or disapproval of the Revised Proposal. If the Department approves the Revised Proposal, Respondents shall perform the Field Investigation in accordance with the Revised Proposal. If the Department disapproves the Revised Proposal, the Respondents shall be in violation of this Order, not having submitted an approvable Proposal in accordance with the terms, provisions and conditions of this Order. The approved Proposal or the approved Revised Proposal shall be attached hereto and shall be incorporated into this Order as Appendix "F". Such Proposal shall hereafter be referred to as the "Approved Proposal".

VI. Within sixty (60) days after approval of the proposal, Respondents shall submit to the Department a Field

Investigation Report (the "Report"), founded upon its performance of the Field Investigation in accordance with the Approved Proposal. The Report shall include all data generated, and all other information obtained, during the Field Investigation and completed site Hazard Ranking Score ("HRS") sheets and draft HRS score, as contained in the generic workplan [Appendix "B"]. The Report shall identify, and provide the rationale for, all deviations from the Approved Proposal.

VII. Within sixty (60) days after its receipt of the Report, the Department shall determine if the Field Investigation was conducted, and the Report prepared in accordance with the terms, provisions and conditions of this Order, and shall provide written notification to Respondents of its approval or disapproval of the Report. If the Department disapproves the Report, the Department shall notify Respondents in writing of the Department's objections. Within thirty (30) days after its receipt of notice of disapproval, Respondents shall revise the Report and/or reperform or supplement the Field Investigation in accordance with the terms, provisions and conditions of this Order and shall submit to the Department a Report which has been revised in accordance with the Department's objections (the "Revised Report"). Within fifteen (15) days after its receipt of the Revised Report, the Department shall determine if the Revised Report is in accordance with the terms, provisions and conditions of this Order and shall provide written notification to Respondents of its approval or

disapproval of the Revised Report. If the Department disapproves the Revised Report, the Respondents shall be in violation of this Order, not having submitted an approvable report and/or conducted a Field Investigation in accordance with the terms, provisions and conditions of this Order. The approved Report or the approved Revised Report shall be attached hereto and shall be incorporated into this Order as Appendix "G". Such Report shall hereafter be referred to as the "Approved Report."

VIII. The Department reserves the right to require a modification and/or an amplification and expansion of the Field Investigation and Report by Respondents to address specific off-Site areas if the Department determines that further off-Site investigation is necessary, as a result of reviewing data generated by the Field Investigation or as a result of reviewing other data or facts. Such an expanded investigation into additional off-Site areas is based upon the belief that such contamination came from the Site.

IX. The Department shall review the Report and shall use the Report as the basis for the review and, if necessary, revision of the draft Site Hazard Ranking Score ("HRS") prepared by Respondents (See Appendix "B"). The HRS is assigned to the Site for State Superfund Site ranking purposes.

X. The Department shall have the right to obtain "split samples" or "duplicate samples", at the Department's option, of

all substances and materials sampled by Respondents pursuant to this Order. As used herein: "split samples" shall mean whole samples divided into aliquots; "duplicate samples" shall mean multiple samples, collected at the same time from exactly the same location, using the same sampling apparatus, collected into identical containers prepared identically, filled to the same volume, and thereafter identically handled and preserved.

XI. Respondents shall provide notice to the Department of any field work, including, but not limited to, excavating, drilling or sampling to be conducted pursuant to the terms of this Order at least five (5) working days in advance of such activities.

XII. Respondents shall permit any duly designated officer, employee, consultant, contractor or agent of the Department to enter upon the Site or areas in the vicinity of the Site which may be under the control of Respondents, and any areas necessary to gain access thereto, for inspection purposes and for the purpose of making or causing to be made such sampling and tests as the Department deems necessary, and for ascertaining Respondents' compliance with the provisions of this Order.

XIII. Respondents shall obtain whatever permits, easements, rights-of-way, rights-of-entry, approvals or authorizations which are necessary in order to perform the Field Investigation and all of Respondents' other obligations pursuant to this Order.

XIV. Respondents shall retain a third-party professional consultant, contractor and/or laboratory to perform the technical, engineering, and analytical obligations required by this Order. Said consultant, contractor and/or laboratory shall have demonstrable experience and qualifications in the type of work which they will be performing.

XV. Respondents shall not suffer any penalty under any of the provisions, terms and conditions hereof, or be subject to any proceedings or actions for any remedy or relief, if it cannot comply with any requirements of the provisions hereof because of an act of God, war, riot, or other condition as to which negligence or willful misconduct on the part of Respondents was not a proximate cause, provided, however, that Respondents shall immediately notify the Department in writing when they obtain knowledge of any such condition and request an appropriate extension or modification of the provisions hereof.

XVI. The Department reserves any rights it may have to seek reimbursement from Respondents for expenses including, but not limited to, direct labor, overhead, analytical costs, and contractor costs incurred heretofore by the Department in investigating the conditions at the Site,preparing this Order,for oversight of the Field Investigation and review of the Field Investigation Report. Such payment shall be to the Hazardous Waste Remedial Fund.

XVII. The failure of Respondents to comply with any provision of this Order shall constitute a default and a failure to perform an obligation under this Order and under the ECL.

XVIII. Nothing contained in this Order shall be construed as barring, diminishing, adjudicating or in any way affecting (1) any legal or equitable rights or claims, actions, suits, causes of action or demands whatsoever that the Department may have against anyone other than Respondents, their directors, officers, employees, servants, agents, successors and assigns; (2) the Department's right to enforce, at law or in equity, the terms and conditions of this Order against Respondent, their directors, officers, employees, servants, agents, successors and assigns in the event that Respondents shall fail to fulfill any of the provisions hereof; and (3) the Department's right to bring any action, at law or in equity against Respondents, their directors, officers, employees, servants, agents, successors and assigns with respect to areas or resources that may have been affected or contaminated as a result of the release or migration of hazardous or industrial wastes from the Site. Nothing herein shall be construed as affecting the Department's right to commence any action or proceeding to which it may be entitled in connection with, relating to, or arising out of Respondents' disposal of hazardous or industrial wastes at the Site.

XIX. The terms of this Order shall not be construed to prohibit the Commissioner or his duly authorized representative

from exercising any summary abatement powers, either at common law or as granted pursuant to statute or regulation.

XX. Respondents shall indemnify and hold the Department, the State of New York, and their representatives and employees harmless for all claims, suits, actions, damages and costs of every name and description arising out of or resulting from the negligence or willful misconduct and the fulfillment or attempted fulfillment of the provisions hereof by Respondents, their directors, officers, employees, servants, agents, successors or assigns. If the State makes a payment for which it will look to Respondents for reimbursement, then any settlement or litigation directing such payment shall be on notice to Respondents.

XXI. The effective date of this Order shall be the date this Order is signed by the Commissioner or his designee.

XXII. If, for any reason, Respondents desire that any provision of this Order be changed, Respondents shall make timely written application therefor to the Commissioner, setting forth reasonable grounds for the relief sought.

XXIII. In the event that Respondents propose to convey the whole or any part of its ownership interest in the Site, Respondents shall, not less than 30 days prior to the consummation of such proposed conveyance, notify the Department in writing of the identity of the transferee and of the nature and date of the proposed conveyance. In advance of such proposed conveyance,

Respondents shall notify the transferee in writing, with a copy to the Department, of the applicability of this Order.

XXIV. A. All communication required hereby to be made between the Department and Respondents shall be made in writing and transmitted by United States Postal Service - Return Receipt Requested or hand delivered to the addresses in Paragraph B hereinunder.

B. Communication to be made from Respondents to the Department shall be made as follows:

1. Two copies to: The Division of Solid and Hazardous Waste
50 Wolf Road - Room 209
Albany, New York 12233-2500

2. Two copies to: The Division of Environmental Enforcement
White Plains Field Unit
202 Mamaroneck Avenue - Room 304
White Plains, N.Y. 10601-5381

3. Two copies to: The Regional Director, Region I
Dept. of Environmental Conservation
Bldg. # 40 SUNY
Stony Brook, New York 11794

4. Two copies to: Ron Tramontano of the New York State
Department of Health
Empire State Plaza
Albany, New York 12237

C. Communication to be made from the Department to Respondents shall be made as follows:

1. One copy to: Town of Hempstead
Dept. of Sanitation
James H. Heil, P.E., Commissioner
1600 Merrick Road
Merrick, New York 11566

2. One copy to: Eugene K. Ferencik
Deputy Town Attorney
Office of the Town Attorney
Town Hall Plaza
Main Street
Hempstead, New York 11550

D. The Department and Respondents respectively reserve the right to designate other or different addresses on notice to the other.

XXV. The provisions of this Order shall be deemed to bind the Department and the Respondents, their officers, directors, agents, servants, employees, successors and assigns.

XXVI. Nothing herein shall be construed to bind any entity not specifically bound by the terms of this Order.

XXVII. The provisions hereof shall constitute the complete and entire Order between Respondents and the Department concerning the Site. No terms, conditions, understandings or agreements purporting to modify or vary the terms hereof shall be binding unless made in writing and subscribed by the party to be bound. No informal advice, guidance, suggestions or comments by the Department regarding reports, proposals, plans, specifications, schedules or any other writing submitted by Respondents shall be construed as relieving Respondents of their obligations to obtain

such formal approvals as may be required by this Order.

DATED: Albany, New York
Nov. 19, , 1987

THOMAS C. JORLING
Commissioner
New York State Department of
Environmental Conservation

TO: Town of Hempstead
Department of Sanitation
1600 Merrick Road
Merrick, New York 11566
Attn: Mr. James Heil, Commissioner

CONSENT BY RESPONDENTS

TOWN OF HEMPSTEAD AND TOWN OF HEMPSTEAD REFUSE DISPOSAL DISTRICT

Respondents hereby consent to the issuing and entering of this Order, waive their right to a hearing herein as provided by law, and agree to be bound by the provisions, terms and conditions contained in this Order.

By: Joseph N. Mondello
Joseph N. MONDELLO

Title: PRESIDING SUPERVISOR TOWN OF HEMPSTEAD.

Date: ______________

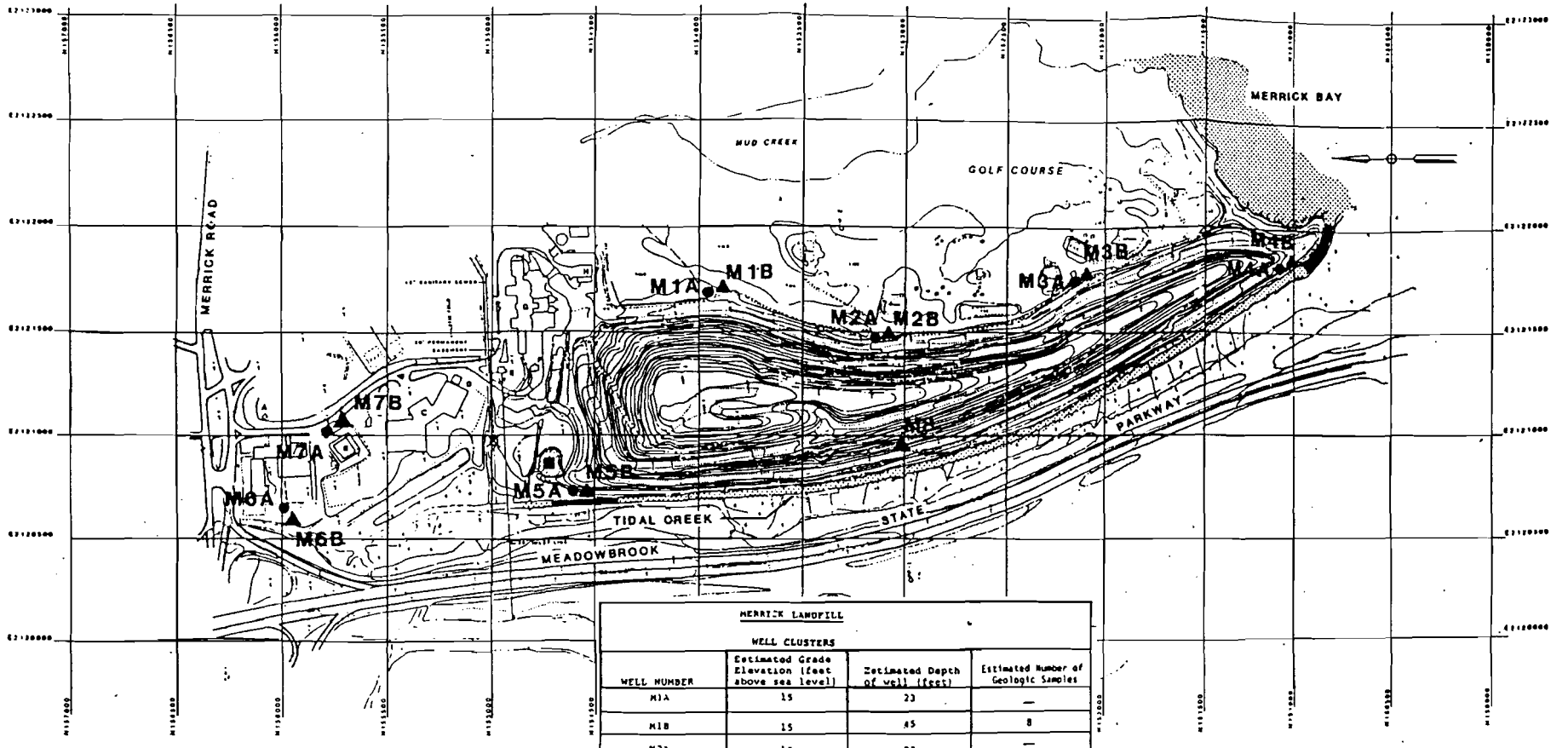
STATE OF NEW YORK)
) s.s.:
COUNTY OF NASSAU)

On this 30TH day of September, 1987, before me personally came JOSEPH N. MONDELLO, to me known, who being duly sworn, did depose and say that he/[redacted] resides in LEVITTOWN, N.Y.; that he/[redacted] is the PRESIDING SUPVI of THE TOWN OF HEMPSTEAD, the respondents described in the foregoing instrument, and that he/[redacted] signed his/[redacted] name as duly authorized.

D. A. Levy
Notary Public

DAVID A. LEVY
NOTARY PUBLIC, State of New York
No. 30-4729519
Qualified in Nassau County
Commission Expires March 30, 1988

Approved as to form
E. K. Fenerick
Dep Town Attorney
Dated 9-26 1987



MERRICK LANDFILL

WELL CLUSTERS

WELL NUMBER	Estimated Grade Elevation (feet above sea level)	Estimated Depth of well (feet)	Estimated Number of Geologic Samples
M1A	15	23	—
M1B	15	45	8
M2A	15	23	—
M2B	15	45	8
M4A	15	23	—
M4B	15	45	8
M5A	15	23	—
M5B	15	45	8
M7A	7	15	—
M7B	7	37	7
M3A	15	23	—
M3B	15	45	8
M6A	7	15	—
M6B	7	37	7

PROPOSED SAMPLING SITES

LEGEND

- PROPOSED WELL
- PROPOSED WELL WITH GEOLOGIC SAMPLING
- PROPOSED EXPLORATORY BORING
- PROPOSED AREA OF CREEK SEDIMENT SAMPLING

PROPOSED SAMPLING SITES

MERRICK LANDFILL

FIGURE 3-1

Velzy ASSOCIATES

Revised: 7/85

EXHIBIT 1

Generic Work Plan

STATE SUPERFUND PROGRAM

Phase II Investigations

The Division of Solid and Hazardous Waste, requires that certain aspects be addressed in any investigative work (Phase II) undertaken to determine the hazardous nature of a site. This document describes generally the minimum amount of work and reporting that must be accomplished by the consultant in performing a Phase II investigation; the requirements by the Division of the consultant in performing a satisfactory Phase II investigation is not limited to the items described herewith, but may include other needs to satisfy unanswered questions on a site-specific basis.

This generic work plan will be divided into five main areas:

1. Geophysical Survey
2. Well Drilling/Development
3. Recommended Well Sampling and Analyses
4. QA/QC Protocols
5. Phase II Report Format

1. Geophysical Survey

The broad considerations are:

a. Location of buried materials

b. Determination of the presence of contaminated plumes

c. Characterization of subsurface conditions

Because of complexities involved in detecting hazardous waste at a given site, with added complications of geologic anomalities, the Department requires that specific geophysical studies be conducted during each investigation. Generally, the goals of a geophysical survey are.

- to minimize the number of drilling sites
- to locate drilling and monitoring wells at representative sites

Appendix B

- to reduce risks associated with drilling into unknown terrain and waste

- to reduce overall project time and costs

- to provide improved accuracy and confidence levels to the project

Some of the specifics that are required to be determined by the geophysical survey are:

- layer thickness and depth of soil and rock formations

- mapping lateral anomaly locations

- determining vertical anomaly depths

- depth to water table

- existence of contamination and/or buried wastes

- mapping contamination and buried waste boundaries and contaminated plumes

- determining vertical extent of buried wastes and contamination

- quantify magnitude of buried wastes or contamination

- determine direction of groundwater flow

- detection of organics floating on the water table

- detection and mapping of contamination or wastes within the unsaturated zone

Table 1 specifies techniques, which have been proven at hazardous waste sites, and their application for various categories of a Phase II investigation. The preferred method must be employed to characterize to the maximum extent possible the subsurface stratigraphy of an inactive hazardous waste site.

The findings of the geophysical survey must be used to enhance the location of wells for obtaining samples, from leachate plumes or affected groundwater regimes. This means that geophysical data must be reduced and the findings used to determine the best locations for wells.

2. Well Drilling

These shall include, but are not limited to:

a. number of wells (nested or single) and located on a map of the site.

b. estimated depth of wells to the nearest foot based on available data.

c. materials needed to properly construct wells, seal annular space and secure wells with a steel protective casing and padlock.

d. split spoon sampling from grade elevation must be done at every 5 feet. A grain size analysis or Atterberg limits for non-cohesive materials or cohesive materials respectively must be done at every change in subsurface lithology, as well as one such analysis in the screened interval. If conditions are such that a mixture of cohesive and non-cohesive materials are encountered, perform only grain size analysis. Hydrometer analysis must also be done if 20 percent of the sample is less than a No. 200 sieve size.

e. Permeability testing of each well. Evacuation of the well for this determination will be accepted.

f. groundwater elevation readings in each well before and after development. These readings must be accomplished for normally recovering wells before the drill rig leaves the site, since if data is unable to show direction of groundwater flow, additional wells should be placed.

If low yielding wells, requiring greater than 8 hours for recovery, are encountered, then the consultant and sub-contractor must depart the site, after the last well development and return at a later date for its groundwater elevation measurement. It is required that a well must be developed as soon as its recovery is completed and as soon as practically possible before or during the drilling operations of the next well. This process of staggered well development will result in only the last well remaining underdeveloped at the end of the drilling operations. The consultant at this stage will have gathered enough information to aid in determining the next course of action.

g. development of each well.

h. classification of the split spoon samples by a geologist in the field using the N.Y.S.D.O.T. Soil Description Procedure. See Attachment 1.

i. shallow soil samples, if required, may be obtained with a hand auger.

j. The standard operating procedures anticipated to be used in drilling and installation of borings and wells.

It must be noted that in moving from one well to another on-site location for constructing a new well, all drilling equipment must be cleaned of all foreign matter, washed with a detergent, rinsed properly with water, given an acetone wash, then followed with a final hexane wash, in that order, or cleaned of foreign matter and sanitized with a steam cleaner. Any alteration to the method of cleaning is to be determined for each site by New York State Department of Environmental Conservation. Similarly, in conducting split spoon sampling, the split spoon must be cleaned as above after each sample and before introduction in a new bore hole.

It is also required that a HNu detector or OVA analyzer be used to monitor the gases emitted from each split spoon sample as soon as the sampler is opened.

When an OVA analyzer is used, special precautions must be taken in using a [illegible] by which methane concentrations are recorded. Both filtered and unfiltered samples must be taken to show the difference for methane.

Prior to leaving a site, all equipment that was used in constructing the well, i.e., augers, split spoons, tools, accessories and other items such as vehicles and drill rigs must be cleaned as described above.

3. Recommended Well Sampling and Analyses

The Division expects that a minimum of 1 groundwater sample will be taken from each well. The consultant is therefore required to note in the work plan:

a. number of groundwater samples recommended.

b. recommended analysis for each sample, keeping in mind that:

i. if a determination on the type(s) of chemical(s) can be made from a foregoing Phase I study or other sources, then analysis shall be concentrated on those items.

ii. if there is a suspected multiplicity of chemicals, but no determination on their classification can be made, serious consideration will be given in analysing for:

A) total metals

B) identification and quantitation of compounds should be done in accordance with New York State Department of Environmental Conservation's Analytical, Quality Control and Reporting Requirements as adopted from the USEPA Caucus Protocol for the Contract Laboratory Program, with the requirement that all GC/MS peaks greater than 10 percent of the nearest calibrating standard be included in the identification and quantitation.

An analysis for total halogenated compounds (TOX) must also be performed. This is to ensure that no highly soluble halogenated compound was undetected by the GC/MS analysis. The results of the TOX analysis must be quantitively compared to the halide content (mg/l as chlorine) of individual chemicals identified by the comprehensive analysis. If less than 95 percent of the TOX is accounted for, consideration must be given for the presence of highly soluble halogenated chemicals.

In developing and extracting samples from wells, the Division will require that dedicated tubes, hoses, (rubber or tygon unacceptable), bailers including line and other sampling equipment must be provided for each well. Groundwater elevation equipment may be used between wells, provided that after use in each well, the detector is cleaned with a detergent wash, water rinse, acetone rinse and hexane rinse in that order.

4. Quality Assurance/Quality Control

QA/QC protocols for sample integrity from the field to the laboratory, as well as those employed in the laboratory must be submitted by the consultant. Generally, the sampling QA/QC protocols should describe sampling techniques and methods used in ensuring sample integrity, as cleaning of equipment, dedicated samplers, chain-of-custody procedures, sample preservation, experience and capabilities of personnel and other factors associated with obtaining and delivering hazardous waste samples to the laboratory.

A quality assurance document providing for the committment to the implementation of quality assurance and quality control practices applicable to field and laboratory activities of the hazardous waste program must be provided. This document must be in accordance with the NYSDEC, Division of Solid and Hazardous Waste Quality Assurance Program Plan which contain "Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Water Monitoring (OWRS QA-1), U.S. EPA, Washington, D.C., May 1983.

5. Phase II Report Format

Cover:

The report cover shall be in accordance with the sample attached hereto as Attachment 3 and shall be printed on 65lb. Atlantic Pastel uncoated cover, Misty Blue color. The back cover shall be of the same material as that of the front cover.

Title Page:

Indicate: name of project (i.e., "Engineering Investigations at Inactive Hazardous Waste Sites in the State of New York, Phase II Investigations"); the site name, location (i.e., municipality and county) and NYSDEC site number; prepared for (i.e. Division of Solid and Hazardous Waste, New York State Department of Environmental Conservation, 50 Wolf Road, Albany, New York, 12233-0001); prepared by (i.e., contractor's name and address); and date submitted.

Table of Contents:

List all sections and subsections of the Phase II Report.

Section I:

Executive Summary -

Briefly describe the site, Phase II effort, site assessment and HRS score. (Include a portion of the USGS 7.5 minute Quadrangle Sheet 8 1/2" x 11") with site located, name of the quadrangle and the coordinates of the site, identified on it, as well as a sketch map of the site).

Section II:

Purpose -

Describe the goal of the Phase II effort at the specific site.

Section III:

Scope of Work -

Describe the scope of the Phase II effort including, but not necessarily limited to: geophysical studies, boring and monitoring well placement and installation, sampling and sampling station selection (soil, surface water, groundwater and air samples.)

Give reasons for the locations chosen for monitoring wells and sampling stations. Also include details of monitoring well installation and environmental sampling techniques used.

Section IV:

Site History-

A description of waste disposal, operation of the site, change in ownership and significant events such as, boil water notices issued by a health agency, reports of leachate outbreak, fish kills and remedial actions taken should be included.

Section V:

Site Assessment -

i) Description of site topography indicating such items as general slope of the site and proximity to surface waters, private and public wells, commercial buildings, dwellings and sensitive environments.

ii) Description of hydrology of the site, include data from geophysical studies (plots), boring logs, monitoring well data and soil test data. (Depth to groundwater, aquifers of concern, depth of bedrock, soil and bedrock permeabilities, and any unique geological characteristics such as, but not limited to, multiple aquifer systems and karst topography should be noted.)

iii) Describe the observations of the site inspection, e.g., was leachate flow noted, were drums observed and were they full or empty. Assess site contamination. Summarize the results of both past and Phase II sampling programs. Indicate the waste types and quantities on site if known, and the extent of contamination of soil, surface water, groundwater and air. Note when samples were taken and the location of samples on a map or sketch of the site. Include a description of how the QA/QC plan was applied to the site.

Section VI:

Final Application of the Hazard Ranking System - The final application of the HRS must incorporate all information collected in the Phase I and Phase II investigations of the site. This section of the report is to include:

i) Narrative Summary - Limit each narrative summary to one page (DOUBLE SPACED). Use active voice as much as possible and identify actors--that is, say "EPA erected a fence." not "a fence was erected," or "the State filed suit," not "a suit was filed." Be sure to tie the information to the response category/status codes you are assigning the site.

a. Site name (including origin of name).

b. Site location - city, county, and state

c. Size

d. Nature of operations (landfill, recycling, manufacturing, etc.)

e. History of ownership/operations - private, public, bankrupt, permitted (by whom? to do what?) currently operating (how long), closed (how long).

f. Wastes present (types, amounts, in what form, buried, on surface, etc.)

g. Media affected and with what (including source of analytical data)

h. Important demographic information.

i. Important geographic information (nearby surface water, aquifers, wetlands, etc.)

k. Enforcement actions

A typical summary is outlined below. While no single example can cover the variety of conditions at hazardous waste sites, this one illustrates the types of information and form we want.

Name
Location

The ABC/DEF (name) site covers (size) acres in (location, including county). ABC (describe operations) on the site (date), when it purchased the property from DEF (relationship of DEF to the site operation), until (date), when it (describe operations/ownership history).

The companies disposed of about (quantities of waste) of (types of waste) on the site by (describe disposal methods). According to tests conducted by (source of data), (media) are contaminated with (chemicals). The site is (important geographic information). About (population affected) are (affected how).

In (date), (who) filed (describe any legal action). In (date), (who) (describe any cleanup actions).

ii) Portion of USGS quadrangle with site located on it and the name of quadrangle identified as also required in Section I.

iii) Updated HRS Worksheets

All applicable data collected in the Phase I and Phase II investigations will be used to complete these worksheets.

iv) Updated HRS Documentation Records

All applicable data collected in the Phase I and Phase II investigations will be used to complete the HRS Documentation Records. All sources of information supplied in the documentation records must be clearly referenced on the same page where this information is presented. In addition, copies of all documents indicated as a source of information must be supplied. This includes correspondence, sampling and analytical data (even if previously presented in the Phase I report), professional papers and reports. Information based on conversations with knowledgeable individuals must be confirmed in a memorandum or a letter, and a copy included with the HRS Documentation Records. Also, a copy of the site sketch or map indicating the location of samples (as required in Section IV) must also be included in this section.

Updated EPA Form 2070-13 "Potential Hazardous Waste Site, Site Inspection Form," or any revision of such forms shall be used.

NOTE: Information presented on the HRS Documentation Records is to be typed and not handwritten or printed.

Appendix:

All raw data (i.e. geophysical, analytical, etc.) shall be presented in the appendix. This shall be in addition to any reduction of data presented elsewhere in the report.

6. Special Conditions

The consultant is required to observe certain conditions during the conduct of a Phase II investigation. These are:

a. Site visit must be made prior to completion of the work plan for reconnaisance and especially for determining access problems. Those of concern should include: is physical acccess possible, is auxiliary equipment required, can wells be located on or off the site, is off-site access permitted, are easements necessary, etc.

[redacted]

b. Name and address of all sub-contractor must be submitted with an itemized list of jobs and charges.

c. The following requirements deal with the construction of overburden and rockwells. These are entitled:

   i. Guidelines for Exploratory Boring, Monitor Well Installation and Documentation of these activities.

   ii. Guidelines for rockwells

d. The attached Oversight Checklist (DSHW personnel) are items that DEC staff ensure will be met during their oversight of the Phase II investigation. The checklist is made a part hereof, and the consultant must at a minimum meet these requirements during his Phase II investigation field activities.

Reference

Geophysical Techniques for Sensing; Bureau of Wastes and Waste Migration; U.S. Environmental Protection Agency, Las Vegas, Nevada. 236pp.

TABLE 1. APPLICATION OF GEOPHYSICAL METHODS TO HAZARDOUS WASTE SITES

Application	Radar	Electromagnetics	Resistivity	Seismic	Metal Detector	Magetometer
Mapping of Geohydrologic Features	1	1	1	1	-	-
Mapping of Conductive Leachates and Contaminant Plumes (ex. Landfills, Acids, Bases)	2	1	-	-	-	-
Location and Boundary Definition and Buried Trenches with Metal	1	1	2	2	2	2
Location and Boundary Definition of Buried Trenches without Metal	1	1	2	2	-	-
Location and Definition (ex. Drums, Ordinance)	2	2	-	-	1	1

1. Primary Method - Indicates the most effective method
2. Secondary Method - Indicates and alternative approach

Revised:
MAC:sb;sjc

EXHIBIT 2

New York State Department of Environmental Conservation
Division of Solid and Hazardous Waste
Bureau of Hazardous Site Control
State Superfund Program (Phase II Investigations)

Oversight Checklist (BHSC Personnel)

1. Are the consultant's personnel actually on site? (Hydrogeologist/ Geologist?) Do not let work begin until he or she is there. Advise Central Office if possible.

2. Are the drillers being supervised by the consultant's representative as the contract dictates?

3. Is the reduced geophysical data available on site? Is this data being used to locate the wells? If not, why?

4. Are the number of wells being installed, the ones proposed in the scope of work? If not, why?

5. Is drilling fluid being used in the ongoing procedure? What kind? Only clean potable water may be introduced into the well. A sample of the water must be obtained and returned to the NYSDEC mobile laboratory for analysis.

6. Is an up-to-date work plan on site? Is it similar to your copy?

7. Make notes of types of equipment and procedures being used.

8. If the wells cannot be completed in a single day, are the proper precautions being taken to protect the integrity of the well? i.e., Are steel plates being used to cover the wells? Are locks being installed on the wells before the contractor leaves the site?

9. If the safety equipment contracted for being used?

   - Level A, B, C, D?
   - HNu, OVA, Explosimeters? Daily Calibration at the beginning of each workday prior to use is required. Determine if the consultant has done this?
   - It is not sufficient for the consultant to merely show you that protective equipment is in the back of his vehicle. Advise him that they must be worn by all personnel at all times for him to receive payment.

10. Sampling During Well Drilling

    a) Did the consultant perform an upwind and downwind air sample of the site with and HNu or OVA? Ask to see record of this event if you

were not there. If OVA, were multiple readings taken with and without a filter for methane? Request records by which the last calibration of the HNu or OVA may be determined. A period of one (1) day between calibration and use is not acceptable.

b) Is the sampling equipment being properly cleaned and/or dedicated? Is all drilling and sampling equipment (augers, drills, spoons, bailers, etc.) being steam cleaned or washed with a detergent, rinsed properly with clean potable water, given an acetone wash, then followed with a final hexane wash and air dried. All equipment must be steam cleaned or chemically washed prior to drilling a new well, i.e., before the first well on a site is commenced and thereafter between each well on the same site.

c) When taking split samples, the sample must be placed in the sample container as soon as possible! Are these samples being checked for volatiles right away? Have they been left sitting for any length of time over 1 minute? If so, this is unacceptable.

d) Personnel taking samples should be noted along with types of sample being taken (air grab samples, rock cuttings).

11. During drilling operations, look for signs of waste (garbage, refuse,etc.) coming out of the hole. If waste is encountered, DEC personel must halt the operation. The consultant must be notified as well as Central Office IMMEDIATELY!

12. If at any time DEC personnel feel in personal danger as a result of the ongoing operation, they should leave the site and inform the consultant and Central Office immediately!

13. Entries in the field book provided should be made in indelible ink. Please remember to enter the:

Site Name
Date and Time
Name(s) consultant's representative(s)
Signature
Comments. You should take as many notes as possible.

This book will be returned to the Central Office at the end of the second round of Phase II investigations.

14.a) The consultant is required to place all down-hole equipment, instruments and tools in a specially-designated staging area. This staging area should be made of saw horses with a plywood platform. The purpose is to ensure that all items to be used in the hole are kept off the ground and out of mud and any other material that may potentially contaminate the well.

Use of ground sheets, tarpaulins, or any woven fibrous organic or inorganic mats laid on the ground around the work area is unacceptable. Plastic sheets may be used only if the thickness is great enough to withstand heavy duty work, i.e., the sheet must not be cut through at anytime during its use.

b) There are times when drilling equipment has to be withdrawn from the hole for various reasons, then re-inserted in the hole. In such instances, the equipment (e.g., drill or pipe), if required, may be lowered end first only onto clean plywood or some other item specifically intended for keeping the equipment off the ground and out of mud. If the equipment is to be broken into sections then reassembled and used in the hole, each section must be stored in the specially-designated staging area.

15. During drilling operations and especially well construction, no foreign matter should be introduced into the hole. For example, a tape may be used in measuring the depth of the hole, or length of PVC well casing. Usually, this is left laying in the mud around the well then used without cleaning. It must be demanded of the consultant's representative that the tape be rolled up or placed in a bucket or clean water after each use to ensure that it is not left laying on the ground after each use. The argument that the mud is the orginal cuttings from the hole is not acceptable. The tape must be washed between holes.

16. In constructing the wells, at least a 1" layer of medium grade sand must be placed at the bottom of the hole, then followed by the well screen and casing. Medium grade sand must be placed around the casing up to a 2 ft. level above the casing with the use of a TREMIE. Following this, a bentonite seal 2 ft. in depth must be placed on top of the sand by means of a TREMIE. There may be resistance from the driller/consultant to introducing the bentonite pellets with a tremie, but this must be demanded, since there is no guarantee that bridging will not occur if done by hand. A seal of a cement-bentonite mixture should then be introduced from the top of the bentonite seal up to grade. This must also be placed with a TREMIE.

    The volume of sand pack from the bottom of the hole to the desired 2 ft. above the well screen should be calculated; likewise, the volume of cement/bentonite mix required should be calculated. These will give a reasonable approximation that bridging has not occured.

17. Only threaded flush-end, NSF-approved PVC pipes are to be used as well screens and casings. NO PVC glue is to used!

18. Be sure that the depth of well coincides with the requirement of the work plans. For example, if the work plan calls for a 50 foot well, require that the consultant measure the final depth in your presence. If less than 50 ft. or depth required, make a note in your field book.

19. Well Development

    During the drilling of the well, the sides of the hole can become smeared with clays and other fine soils. This can effectively plug the wall of the hole, reduce permeability and retard the movement of water into the well screen. If these fines are not removed, then it becomes difficult and time consuming to remove sufficient water from the well before obtaining a fresh groundwater sample because water cannot flow easily into the well.

Well development is the process of cleaning the face of the borehole and the formation around the outside of the well screen to permit water to flow easily into the monitoring well. Development is required for the following purposes:

a. To restore the natural permeability of the formation adjacent to the borehole to permit water to flow into the screen easily.

b. To remove clay, silt and other fines from the formation so that during sampling, water will not be turbid or contain suspended materials which can interfere with chemical analysis.

The development process is best accomplished for monitoring wells by causing the natural formation water inside the well screen to move vigorously in and out through the screen in order to agitate the clay and silt, and move these fines into the screen.

Methods suitable for the development of monitoring wells are as follows:

a. Surge block:

A surge block is a round plunger with pliable edges such as belting that will not catch on the well screen. Moving the surge block forcefully up and down inside the well screen causes the water to surge in and out through the screen accomplishing the desired cleaning action.

Surge blocks are commonly used with cable-tool drilling rigs, but are not easily used by other types of drilling rigs.

b. Air lift:

Compressed air pumped down a pipe inside the well casing can be used to blow water out of the monitoring well. If air is applied to the well intermittently and for short periods then the water is only raised inside the casing rather than blown out and will fall back down the casing causing the desired back washing action. Finally, blowing the water out will remove the fines brought into the screen by the agitating action.

Considerable care must be exercised to avoid injecting air in the formation outside the well screen and alter subsequent chemical analyses of water samples. For this reason, the bottom of the air pipe should never be placed down inside the screen.

Another restriction on the use of air is the submergence factor. Submergence is the feet of water above the bottom of the air pipe while pumping (blowing water out) divided by the total length of the air pipe. Submergence should be on the order of at least 20 percent, which may be difficult to achieve with many shallow monitoring wells.

c. Bailer:

A bailer sufficiently heavy that it will sink rapidly through the water can be raised and lowered through the well screen. The resulting agitating action of the water is similar to that caused by a surge block. The bailer, however, has the added advantage of removing the fines each time it is brought to the surface and dumped. Separate bailers and lines must be dedicated to each well.

d. Surging by pumping:

Starting and stopping a pump so that the water is alternately pulled into the well through the screen and backflushed through the screen is an effective development method. Periodically pumping to waste will remove the fines from the well and permit checking the progress to assure that development is complete.

EXHIBIT 3

Guidelines for Exploratory Boring, Monitoring Wells Installation, and Documentation of These Activities

PREFACE

This Document is intended to provide guidance and references for use by NYSDEC Division of Solid and Hazardous Waste staff. It is intended for use as a standard to be utilized when discussing or negotiating the scope of field work, when evaluating proposals submitted to DEC for approval, when designing a DEC-sponsored project and for DEC oversight, supervision and documentation of exploratory boring and monitoring well installation activities.

I. INTRODUCTION

The guidelines presented herein describe procedures, equipment and materials which represent a minimum level of performance to be followed by the Department's consultants or to be acceptable to DEC staff when discussing, negotiating, reviewing, designing, overseeing, supervising, and documenting the performance of the subject activities at inactive hazardous waste disposal sites.

II. IMPLEMENTATION

A. PURPOSE

1. Exploratory Boring

Exploratory boring is performed to obtain samples of subsurface materials which can be visually examined and identified, to conduct downhole geophysical logging, to obtain samples of subsurface materials for physical and/or chemical analysis and to determine approximate groundwater elevations.

2. Monitoring Well Installation

Monitoring well installation is performed to obtain accurate piezometric measurements, to obtain samples of groundwater for physical and/or chemical analysis, and to obtain information on aquifer characteristics.

3. Documentation

Documentation of exploratory boring and monitoring well installation activities is performed for the purpose of establishing and maintaining a permanent, accurate, factual record of site conditions and work performed on a project. The record will be utilized to evaluate the results obtained, to determine site conditions, to ensure that the data obtained for Phase II investigations is accurate, and for establishing justification for approval of the work or authorization of payment for the work performed.

B. SCOPE

1. Exploratory Boring

Exploratory boring consists of all machinery, equipment, materials and procedures utilized to advance a borehole into and below the ground surface. Machinery and equipment include drill rigs, rods, bits, augers, casing, wash tubs and tools. Materials include drilling water and muds (bentonite). Procedures include driving, jetting, washing, augering, and drilling. Exploratory boring also includes the following related activities: consultant's procurement of required permits, and any prior approvals required from DEC or other federal, State or local agencies, and surveying to determine the precise location and ground elevation of each exploratory boring. The Universal Trans - Mercator System and the 1929 U.S. -odetic Survey. See Section II C for details of such activities.

2. Monitoring Well Installation

Monitoring well installation consists of all machinery, equipment, materials and procedures utilized to advance a boring into the ground and to place a monitoring well in the borehole. Machinery and equipment are similar to that utilized in exploratory boring. Materials include drilling fluids and the items utilized in a monitoring well assembly including well screen, casing, sand pack, bentonite pellets and grout, cement and/or concrete and protective casing. Procedures are similar to those utilized in exploratory borings but also include placing the well screen, sand packing, sealing, grouting and protecting the monitoring well assembly. Monitor well installation also includes the following related activities: consultant's procurement of required permits, and any prior approvals

Throughout the period during which the work is progressing, the consultant is responsible for providing reasonable access to the work site for the personnel and equipment performing the work, supervising agency personnel and for any other personnel authorized to be on the site.

C.1.3 Work Area, Utilities and Obstructions

Prior to moving equipment on to the site, the consultant is responsible for establishing locations of any necessary office area, equipment and material storage area, maintenance area, drilling locations and roadways to and from such areas. The consultant is responsible for maintaining such buildings and areas in a condition which are both accessible and usable and for leaving such areas in a satisfactory condition upon completion of the work.

The consultant is responsible for determining the presence and location of any subsurface utilities or obstructions prior to the commencement of work, and for avoiding such features during the performance of the work. The consultant is responsible for repairing, replacing or paying the cost of any such work on any utility or object which is damaged during the performance of the work.

C.1.4 Performance

C.1.4.a General

The consultant is responsible for thorough familiarity with and knowledge of plans, specifications, and work schedule and must be thoroughly prepared to perform the required work in accordance with such plans, specifications and schedule.

The consultant is responsible for performing all work in a professional manner, utilizing experienced and qualified personnel (no substitution without DEC approval), machinery and equipment in good working order, quality materials, procedures and codes in accordance with accepted industry standards and applicable safety codes and requirements.

required from DEC or other federal, State or local agencies and surveying to determine the precise location and ground elevation at each monitor well location, and to establish a fixed measuring point for each monitor well. See Section II C for details of such activities.

3. Documentation

Documentation consists of creating and maintaining a permanent written (narrative and graphic) daily record of weather conditions, site conditions and developments, of all work performed on a project including all personnel, machinery, equipment, materials and procedures utilized on the project. Documentation also includes the compilation of a complete written record which summarizes all pertinent observations, details, problems encountered and how they were dealt with, personnel present on the site, and specific details relative to the installation of each exploratory boring or monitor well.

C. SPECIFICS

C.1 Consultant's Responsibility

C.1.1 Permits

Prior to commencing work, the consultant is responsible for obtaining all permits, licenses, approvals, etc., required by any and all agencies with jurisdiction over the work to be performed. The consultant must comply with all terms, conditions, provisions, etc., of such approvals and with all directives, both written and verbal, issued by such agencies.

C.1.2 Access to Site

The consultant is responsible for confirming that all necessary rights-of-access, easements, rights-of-way, etc. have been obtained prior to commencing any activity at a site.

C.1.4.b Adherence to Plans, Specifications and Schedule

The consultant is responsible for performing all work in accordance with the plans and specifications and the work schedule agreed upon prior to commencement of the project. If the consultant wishes to deviate from the plans and specifications or work schedule, verbal agreement must be reached with DEC staff, and such agreement must be confirmed in writing by the DEC staff no later than five working days after the date of such verbal agreement. Appropriate notes of such verbal agreements must be maintained by both DEC and the consultant. Throughout the progress of all work, the consultant must coordinate his efforts with other contractors or workers on the site to ensure that satisfactory progress on the project is maintained.

DEC will provide its staff with equipm materials and supplies for these aspects of the investigation, which comes under its responsib

C.1.4.c Equipment and Materials

The consultant is responsible for providing all appropriate equipment and materials in accordance with the plans and specifications; for assuring that such items are functional and of required capacity, dimensions and quality; for maintaining the equipment and materials in a condition suitable for use; and for utilizing such equipment and materials in a professional and safe manner.

C.1.4.d Restoration of Disturbed Areas

The consultant is responsible for restoring the project area and all other areas disturbed during the performance of the work to a condition at least equal to that which existed at the time of the commencement of such work (under certain conditions arrangements made prior to ordering performance of the work may dictate that a person other than the consultant is responsible for restoration). Such restoration should, at a minimum, preclude adverse impacts on or danger to the health of persons who may be allowed to have access to the site, impacts to the environment such as erosion, contamination, ponding, etc.

C.1.4.e Record Keeping

The consultant is responsible for maintaining a complete set of records documenting work performed on the site. Such records include the driller's daily log, a driller's well log, records of materials and quantities used.

C.2. Exploratory Boring

C.2.1 General Intent and Design

The location and design of exploratory borings are to be based on a number of factors. Such factors include: the intent of the investigation, the specific purpose of the borings, the amount and type of information which is to be generated from the data to be obtained from the borings, an estimate of existing subsurface conditions, the type of drilling equipment available to perform the work, the accessibility of the drilling locations and the nature of the actual samples to be obtained from the borings.

It is imperative that the consultant comply with the applicable plans and specifications and procedures and protocols where provided to ensure that the equipment, materials and procedures utilized do not jeopardize the quantity or quality of the information and samples obtained and the success of the boring program and the overall investigation.

C.2.2 Equipment

Exploratory boring equipment consists of a drilling rig and appurtenant items such as drilling casing, rods, bits, wash tubs, pumps, hoses, etc. Drilling rigs commonly used for exploratory boring are augers (solid or hollow stem), rotary (air or water) and cable tool rigs.

C.2.3 Methods

Exploratory boring may be accomplished by various drilling methods such as augering, drilling, washing, percussion or cable tool drilling. Since

representative samples of the material encountered at discrete depth intervals will generally be required, the use of solid stem augers, jet or wash borings and percussion drilling methods are not acceptable methods for performing exploratory boring.

C.2.4 Additives

Every precaution is to be taken to minimize or avoid the introduction of extraneous material into a borehole. Extraneous material can be introduced into a borehole intentionally or by accident. The intentional introduction of such materials will usually be in the form of additives such as drilling water, drilling muds and shock treatments to accelerate the breakdown of such muds.

The intentional introduction of any additives into the borehole will not be acceptable without the prior knowledge and approval of the DEC personnel.

When the use of additives has been approved, they are to be stored in packages, containers or tanks which preclude the addition of extraneous materials and the deterioration, decomposition, etc., of the additive. Any additive which is contaminated or has deteriorated in any way is not to be utilized. In an exploratory boring or monitor well installation, mud tubs or other positive containers are to be utilized for the storing, mixing, introduction or collection of drill additives or return fluids (water, additives and cuttings). Pits excavated in the ground will not be acceptable for the storage, mixing, introduction or collection of such additives or return fluids.

The use of additives is to be in accordance with the approvals given by DEC personnel and with any instructions provided by a manufacturer, where applicable.

C.2.5 Air Systems

The use of air systems in the drilling process requires the use of adequate filtration (e.g., an air line oil filter) to preclude the accidental

introduction of extraneous materials, such as lubricating oils, into the borehole.

C.3 Samples for Visual Examination, Identification and Analysis

C.3.1 Sample Collection Methods and Frequency

Samples of subsurface materials are to be collected in a manner which is consistent with the purpose of the project and the nature of the material being sampled. A description of sampling methods will be provided by DEC in a separate document at a later date. Refer also to ASTM designation D1586-67, D1587-74, D2113-70 and ASTM publication STP 479 for a description of sampling techniques.

If it is determined that continuous sampling is not necessary, split-spoon samples of subsurface materials (soil, rock, waste, etc.), for visual examination and identification, are to be obtained at a minimum five foot intervals with a grain size analysis for non-cohesive materials or Atterberg limits for cohesive materials at every change in sub-surface lithology, as well as one such analysis in the screened interval. Most changes in material will be initially evident to the well driller on the basis of the behavior of the drilling equipment and by observation of cuttings returned to the ground surface. Such indications should be noted, heeded, and the sampling schecule and/or process adjusted to address such changes.

C.3.2 Use of Cuttings and Wash Samples

Cuttings and wash samples will generally not be acceptable for physical or chemical analysis but may be utilized to monitor subsurface conditions between sampling intervals. A simple kitchen strainer can be utilized to collect and observe samples from bail cuttings or drill return water.

C.3.3 Inadequate Sample

The consultant must redouble his efforts at obtaining an adequate sample if the amounts from his prior attempts were insufficient. He must utilize all appropriate precautions as conditions permit. If conditions do not permit, if the attempt fails or if the sample is so disturbed as to be unsatisfactory, then the borehole should be cleaned out and an acceptable sample obtained from the interval immediately succeeding the location (depth) of the previous attempt.

C.3.4 Initial Examination

When possible, samples are to be examined initially in the sampling device or on a surface which allows adequate visual and HNu examination of the material. Such examination should include observation of both internal and external features and characteristics of the sample, including color, texture, moisture content, gradation and grain size.

If a sample is to be obtained for physical or chemical analysis, the initial examination process is to be modified in accordance with a document to be supplied by DEC at a later date, which deals specifically with the subject of soil/waste sampling for physical and chemical analysis.

C.3.5 Sample Handling

Care is to be exercised in the handling of all samples commensurate with information already available about the site and the material(s), which may be present at the site and the purpose for which the samples are to be utilized. Prudent judgement is to be employed by all personnel involved in the project, and adjustments made in the field as dictated by visual and HNu examination of samples, by the use of field monitoring techniques and other factors which might become evident as the work progresses.

C.3.6 Sample Storage

Representative portions of all samples are to be retained in appropriate storage containers by the consultant. Such samples are to be stored at the work site or at a location which is convenient for observation of the samples by appropriate personnel.

Split spoon samples are to be placed in one pint (minimum) capacity glass jars with screw-on caps, labeled as to project, boring number, date, and sample interval, and stored in a manner which protects the sample from damage and/or the elements.

Rock core samples are to be retained in standard covered wood core boxes of a size suitable to store alternate side-by-side rows of core of the appropriate core diameter, i.e., EX, AX, BX, or NX. Each core box is to be labeled as to project, boring number, run number, sampling interval and date. Zones of loose or fragmented materials such as rock chips, mud seams, washed-in sand and gravel, etc., interspersed with the rock cores are to be placed in plastic bags and inserted in the core row at the proper location and noted on the boring log. Intervals of missing core are to be identified when possible and a wood spacing block or other marker inserted at the appropriate location in the core row and such occurrence noted on the boring log with possible reasons for the loss of core, if known or suspected. Wood spacing blocks are to be inserted between cores representing the beginning and end of each drill "run," marked to identify run number, run length, recovery and top and bottom of run.

C.4 Monitoring Well Installation

C.4.1 General Intent and Design

The location and design of monitoring wells and procedures for their installation are to be based upon a number of factors. Such factors include:

the intent of the investigation, the specific purpose of the wells, the amount and type of information which is to be generated from data to be obtained from the monitor wells; and estimate of existing subsurface conditions; the type of drilling equipment and procedures applicable to such an investigation, the type of materials and procedures available with which to construct monitoring wells, the nature of samples expected to be obtained from such wells and the physical and chemical analyses to be performed on such samples.

To ensure that the equipment, materials and procedures utilized do not jeopardize the quality of the information obtained and the success of the investigation, it is imperative that the consultant comply with the applicable plans and specifications, and procedures and protocols as provided. If such documents are not provided, the consultant is to submit such details, in the form of work plans to the DEC personnel for approval prior to initiation of the work.

C.4.2 Monitoring Well Borehole Details

C.4.2.a - The construction of a borehole for the installation of a monitoring well is to be performed in accordance with the procedures for exploratory boring as described in Section C.2 of this document.

C.4.2.b - The diameter of a borehole or the inside diameter of the drive casing or the auger flights is to be a minimum of one and one-half inches larger than the outside diameter of the monitor well assembly (it is required that flush joint casing always be used). Such annular space is needed to convey a sand pack freely to the bottom of the boring to fill the area around the well screen, to allow accurate measurements of the top of the pack as it is being placed, to allow the placement of a bentonite pellets seal on top of the pack and to allow the use of a tremie pipe to convey the sand, bentonite pellets and cement/bentonite grout backfill above the seal.

into zones where none existed previously. Consequently, origin of materials used must be carefully documented.

C.4.3 Monitoring Well Installation Materials and Procedures

C.4.3.a Casing

Monitoring well casings are to consist of NSF-approved, threaded, flush-joint, PVC pipe. If other materials as stainless or galvanized steel, iron or Teflon pipes are to be used, the consultant must receive prior approval from DEC staff.

Joints, caps and end plugs are to be secured by welds, threads with teflon tape or force fittings as appropriate to the material being utilized. Glues or other adhesives are not acceptable.

Monitoring well caps are to be vented to allow for proper pressure equilibration.

The diameter of each monitoring well is to be of a size (internal diameter) sufficient to allow adequate development, accurate water level measurements, proper evacuation and procurement of acceptable samples. These have typically, for a Phase II investigation, been 2 inches.

C.4.3.b Screen

PVC well screens are to be used in Phase II investigations, unless conditions dictate that some other material should be used. In such a case, the consultant must receive DEC's prior approval for a change from PVC.

The length of the screen(s) and the depth of installation are to be determined on the basis of the intent of the investigation, the characteristics of subsurface conditions known prior to or encountered during drilling, and maximum expected seasonal changes in groundwater levels relative to the levels encountered at the time of installation.

Conditions such as elevation of water table, multiple aquifers, thickness of aquifer(s), and the behavior of contaminants in the water column, are to be considered in determining the screen length and location. Typically, ten-foot well screens have been used for Phase II investigations.

The slot size of the screen is to be determined on the basis of the grain size characteristics of the water producing zone. If characteristics of the formation are not known and if the screens are to be ordered prior to drilling, it is usually acceptable to order number 10 to 20 slot screens and compatible packing material.

C.4.3.c Pack

The pack is to consist of a clean, inert, siliceous material of a size compatible with both the natural formation material and the slot size of the screen. The source and size of the packing material are to be identified prior to commencement of the project and compared to formation material (if known) and proposed screen slot size. A gradation analysis will not be required if the packing material is familiar to and acceptable to the supervising agency personnel.

A sample of the pack material is to be retained with the soil samples for further reference and/or analysis.

A sand or gravel pack is to be placed in the annular space surrounding that portion of the well occupied by the well screen and for a minimum distance of two feet above the top of the screen.

The annular space between the outside diameter of the monitoring well casing and the inside diameter of the auger flights, drill casing or borehole wall should be of a size sufficient to allow free passage of the packing material to the screened depth. A minimum of one and one-half inch is recommended.

The packing material is to be placed slowly with a tremie pipe to allow the material to settle and to avoid bridging. Frequent checks of the level of the pack within the annular space are to be performed as the pack is being placed.

Sections of the auger flights or drill casing are to be removed periodically to avoid binding of the casing in the borehole. Frequent and careful measurements are to be taken to assure that some portion of the pack is retained within the auger flights or drill casing at all times as they are removed. Measurements are also to be taken to ensure that the monitoring well assembly is not being pulled out of the ground as the augers and/or casing is being removed.

C.4.3.d Seal

A bentonite seal is to be placed on top of the sand pack to isolate the water bearing zone to be monitored from the remaining portion of the borehole. The bentonite seal may consist of pellets, granules or powder depending on specific conditions such as water in the annular space, monitoring well couplings, site of annular space, etc. Gelatin-coated bentonite pellets are generally preferable. They are available in various diameters and shapes to suit specific needs. The seal is to be placed by a tremie pipe into the annular

portion of

the borehole to achieve a minimum two-foot seal between the pack and the grout which is to be placed in the upper portion of the borehole. If bentonite pellets are used, a minimum of 60 minutes must be waited to allow for proper swelling of the pellets, before placement of the grout. If the pellets are placed in a dry zone, a continuous stream of water must be introduced into the hole until a reservoir of water can be detected above the pellets. It can now be concluded that the pellets are swalloen, but the 60 minutes waiting period must be observed; periodic testing every 10 minutes must be made to ensure that the reservior of water remains, and if this is not detected, then more water must be introduced into the hole until a satisfactory seal is obtained.

The size (diameter) and shape (sphericity) of the bentonite seal particles (pellets, granules, powder) must be selected so as to assure free travel from the surface to the top of the pack and to assure a complete pack around the screen at the proper vertical interval within the borehole.

C.4.3.e Grout

A grout mix consisting of cement/bentonite is to be placed in that portion of the annular space between the auger flight, drill casing or borehole wall and the monitoring well assembly, extending from the top of the pack to the surface seal.

The cement/bentonite ratio and the viscosity of the grout mix is to be determined in the field by the consistency of the grout as it is being mixed. The mix is to be dense enough to set up without being diluted by formation water, and to displace water from within the annular space such that undiluted grout will flow out of the auger flight, drill casing or borehole at the ground surface. The proportions of cement/bentonite/water in the grout mix shall be 94

5 lbs/6.5 gallons. A ten percent (10%) by volume hydrated lime (CaO) dded to facilitate pumping.

The grout mix is to be tremied, either by gravity or pumped to the f the annular space to be filled by means of a continuous pipe or hose.

Auger flights or drill casing remaining in the borehole are to be as the annular space is being filled with the grout mix. Upon removal tems, additional grout mix is to be added to the borehole to fill the a point no less than two feet below the ground surface.

C.4.3.f Protective Casing and Surface Well Seal

A protective steel casing, a minimum of two inches in diameter greater monitoring well casing, is to be placed over the monitoring well casing ed in a surface well seal in the upper portion of the borehole. The e casing is to project a minimum of 3½ feet below the ground surface enough above the surface to ensure adequate protection of the well ess otherwise dictated by field conditions. A locking cap is to be the protective casing, and secured with a padlock, with duplicate keys to the DEC personnel in the central office.

During installation of the protective casing, a surface well seal is structed utilizing the cement/bentonite grout mixture or by mounding around the casing to secure the casing in the ground and to provide drainage of surface water away from the monitor well assembly. The of this well seal must be a minimum of 2 feet.

Partially completed wells must be secured at the end of a day's work. acceptable to DEC in the use of hollow-stem augers is to leave the lace in the hole, but attached to the driveblock assembly. The instance provided by hydraulic system will ensure that the flights removed from the hole without large, heavy duty equipment. If this

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method cannot be used, then other systems as steel plates must be used to cover the hole. In any case, if the well site is in a depression, well cuttings may be used as a mound to ensure that run off does not enter the hole.

Upon completion of monitoring well installation, each well is to be developed to produce an amount of sediment-free water sufficient to obtain a sample for physical and chemical analysis.

Development is to be accomplished by such methods as surging, bailing, pumping or by means of compressed air. The method selected and the equipment utilized are to be compatible with the amount of water yielded by the well, such that maximum practicable advantage is taken of the flushing action produced by the natural and induced inflow of formation water.

Intermittent flow (a gentle surging action) is recommended during the early stages of development to obtain maximum flushing action. This is to be followed by a period of continuous flow at a rate which produces a stabilization of the natural formation and the pack, such that sediment-free water is obtained from the well.

During development, efforts are to be made to circulate water and develop the well throughout the entire vertical screened interval.

Water from outside sources is not to be utilized to develop a low yield well without prior approval.

Well development is to be completed immediately after drilling.

If air is to be utilized for the development of monitoring wells, the air discharge is to be checked for the presence of oil prior to attachment of the air line and periodically thereafter as each well is being developed. An air line oil filter is to be installed and maintained to provide a clean flow of air to the well.

If there is a question as to the introduction of oil to the well from the development process, a sample of the oil may be obtained by either holding a sample bottle over the end of the discharge line or by bubbling the air through a sample of deionized water.

If contaminated water is withdrawn during monitor well development, it must be collected, packaged, stored, protected and disposed of in a manner which is acceptable to the DEC. Methods of handling, storage, protection and disposal should be decided upon prior to the work being commenced.

C.6 Cluster Wells and Well Clusters (Nested Wells)

Cluster wells refer to the placement of multiple casings in one borehole, each casing being screened over a different interval in the vertical column. In such wells, the sand or gravel pack is to occupy the annular space between each screen and the borehole wall, extending one foot below and above each screened interval. The annular space for a minimum of two feet above and below each sand or gravel pack is to be filled with bentonite, creating a seal around each screened interval is to be backfilled with grout.

Well clusters (nested wells) refer to the placement of multiple monitor wells in separate boreholes at a single location. Each monitoring well is a separate installation isolated from other wells at the same location. Such installations are usually screened over distinct intervals to obtain information on variations in piezometric heads and water quality.

C.7 Contaminated Materials

Methods of handling, storage, protection, and disposal of contaminated materials encountered during exploratory boring and monitoring well installation are to be developed and approved prior to work being commenced and are to be clearly outlined in plans, specifications, or procedures and protocols for the project.

Contaminated soil, waste or water generated during the project, is to be collected, packaged, stored, protected, and disposed of, in a manner which is consistent with the plans and specifications and procedures and protocols and acceptable to the supervising agency personnel. As a general policy, cuttings and drilling fluids from any upgradient borings or wells (if known ahead of time) may be disposed of on site. Materials removed from downgradient borings or wells are to be placed in containers and further treated as a hazardous waste or stored until the results of chemical analysis of samples from the borings or wells are available. The results of such analysis will dictate the appropriate proper method of disposal.

C.8 Sealing and Abandonment

All abandoned exploratory borings and monitor well boreholes are to be sealed in a manner which precludes cross contamination of soils and/or groundwater within the borehole, and the introduction of contaminants from the surface. Such efforts will generally require the use of impermeable materials such as clay, bentonite, cement grout, etc., throughout all or some portion of the borehole, depending upon subsurface conditions encountered at each boring location. Abandonment will also require restoration of the work area in accordance with applicable plans and specifications.

C.9 Documentation

C.9.1 Supervision and Record Keeping

C.9.1.1 Qualified Person-in-Charge

Each drill rig and crew is to have a qualified experienced engineer or geologist assigned by the consultant to oversee the drilling operation and to be responsible for conformance with all applicable plans, specifications or other requirements.

The consultant must document and ensure that each boring is progressed at a rate commensurate with the capability of the drill rig, the resistance of the material being penetrated and with the ability of the drilling crew to perform their assigned tasks in a professional manner.

Close communication is to be maintained between the consultant and DEC personnel to identify and document any significant change(s) noted during progression of the boring. Such change(s) should be noted and related to sample conditions and characteristics where possible.

C.9.1.2 Daily Log

A thorough and accurate daily record of all boring/sampling/well installation activities is to be entered in a field notebook maintained by the consultant.

Information in the log is to provide a complete daily documentation of all work performed on a task-by-task basis, including observations during drilling, samples taken, as well as sampling intervals, sample description, continuous substrata description, blow counts, numbers assigned in the field, a boring log (subsurface materials descriptions), progress in well installation, weather conditions, visitors to the site, problems encountered, solutions to the problems, modifications implemented, and any other pertinent information.

C.9.1.3 Boring Log

A separate boring log is to be prepared, maintained by the consultant. The log is to provide a clear, continuous documentation of all subsurface conditions encountered during progression of each exploratory and monitoring well boring. The information for the boring log is to be compiled and recorded continuously, and immediately, to avoid the loss of important information (observations, measurements, etc.). Information required for compiling a boring

log is to be incorporated into each party's daily log (or kept separately as a boring log). It is to include a continuous lithologic log (description of subsurface materials), blow accounts for advancing casing and/or sampling device, water levels in the hole (measured as appropriate, i.e., early a.m. before resuming work), accurate measurements of depths to sampled intervals, and detailed descriptions of all samples collected.

C.9.1.4 Boring/Sampling/Completion Record

A boring/sampling/completion record is to be prepared and provided by the consultant for each exploratory boring or monitor well. These records are formal, clear, concise, and permanent documentation of all information pertaining to a particular boring or well. They are generally presented in reports prepared based upon a field investigation program. They should include at a minimum:

Heading

Include site name and DEC ID number

(i) Name of drilling contractor;

(ii) Name of project;

(iii) Borehole identification number;

(iv) Borehole location (approximate when possible);

(v) Ground surface elevation;

(vi) Type and size (diameter) of drilling equipment (rig, casing, augers, bit, rods, etc.);

(vii) Sampling method (split spoon, Shelby tube, bailer, etc.);

(viii) Details of hammer weight and drop distance for split spoon samples (when applicable);

(ix) Date of start and completion of boring/well installation; and

(x) Elevation of top of monitor well casing, ground surface and any other pertinent benchmarks.

Body

(i) Record of depths penetrated in feet and tenths of feet;

(ii) Sampling intervals/depths;

(iii) Number of blows on sampler for each six inches penetrated;

(iv) Recovery of samples in feet and tenths of feet.

(v) Identification and description of materials by driller and/or geologist/soil scientist in accordance with a recognized classification system that is to be identified;

(vi) Depth to water table during drilling;

(vii) Depth to significant changes in material, geologic strata and rock;

(viii) Pertinent comments by driller relative to significant differences in drilling progress, fluid gain or loss, unusual occurrences, etc.;

(ix) Pertinent comments by drilling/geologist/soil scientist relative to significant or unusual sample conditions such as appearance, color, odor, behavior, loss of material, etc.;

(x) Use of drill water or additives and sources of such items; and

(xi) Final depth of hole, method of sealing or backfilling, or other completion, i.e., monitoring well installed, hole abandoned, etc. If a monitoring well is installed, "as-built" sketch including depths of screen(s), seal(s), pack(s), etc., are to be submitted.

(xii) Amounts/volumes of sand, bentonite and gallons of grout used.

Closing

(i) Name of driller and helper(s);

(ii) Name of geologist/soil scientist; and

(iii) Legend (such as for soil classification system).

C.10 Surveying

A map is to be prepared showing the location and appropriate elevations (ground surface, top of monitor well casing) for each exploratory boring and monitor well.

A licensed land surveyor is to establish the locations and elevations of each exploratory boring and monitor well, as follows:

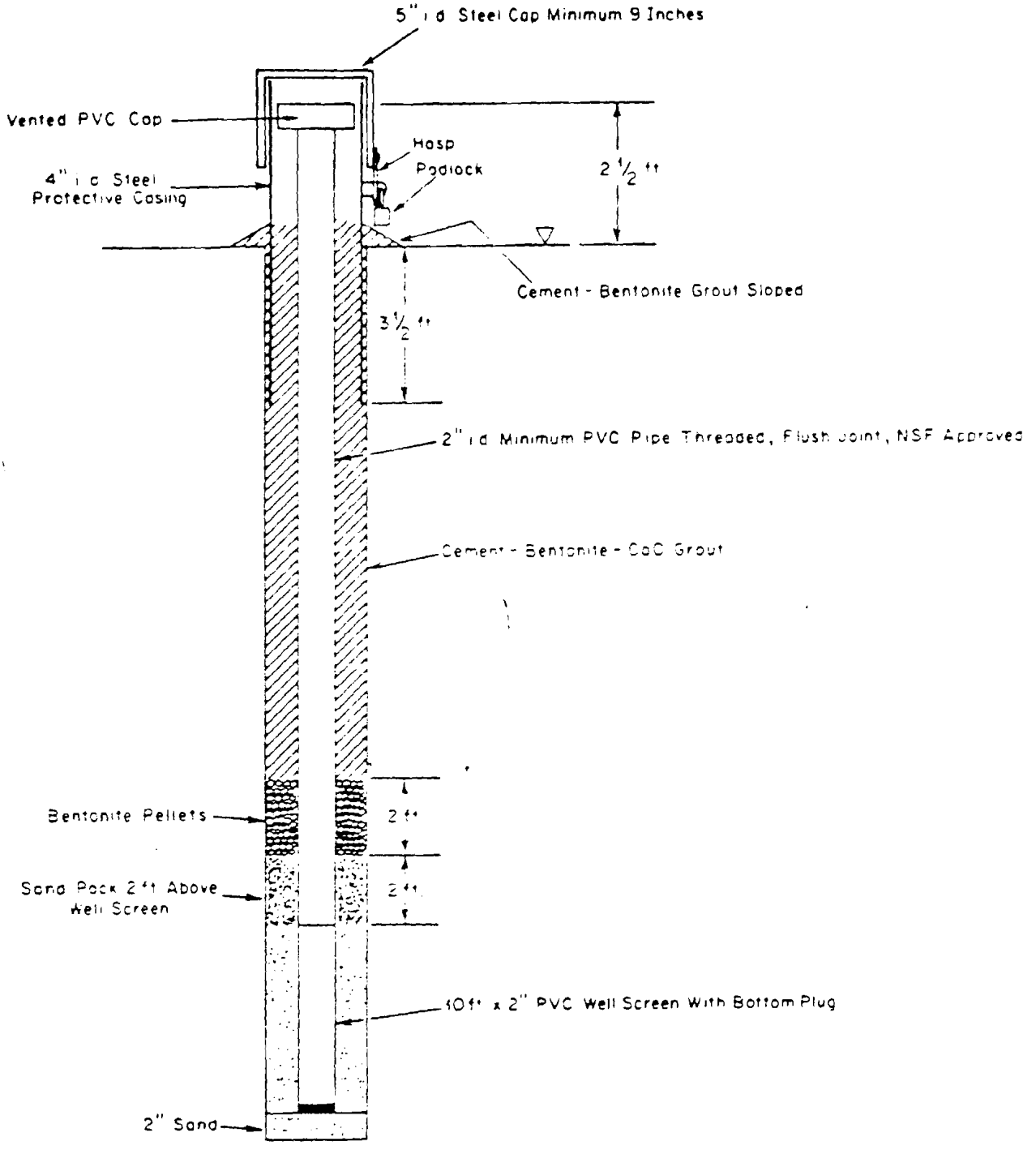
Vertical Control - Elevations (0.01') are to be established for the ground surface at the well, the top of monitor well casing (T.C.), and at least one other permanent object in the vicinity of the boring and well. Elevations are to be relative to a regional, local or project specific datum. Use USGS bench marks whenever available.

Horizontal Control - Exploratory borings and monitor wells are to be located by ties (location and distance) to at least two nearby permanent objects. Use USGS bench marks whenever available.

Standby Time

It may be necessary to interrupt the work for short periods of time to allow the DEC staff to make measurements, to collect data or readings, to collect samples, or for other reasons determined necessary to the purpose of the work. In such cases, the Contractor shall be paid for the time employees and equipment are not being utilized. Standby time will be compensated for only when ordered by the DEC staff. Standby time will not be compensated when delays

are incurred due to the contractor's employees, equipment failure, material problems, delivery problems, inability to perform for reasons attributable to the Contractor, or by inclement weather, strike or other circumstances beyond the control of DEC, unless it can be demonstrated that a "force majuere" was involved.



OVERBURDEN WELL

Figure 1

GUIDELINES FOR ROCK WELLS

I. Division 1 - General Conditions

A. Summary of Work

This project includes furnishing all labor, equipment, materials and tools necessary to drill, construct, develop and test, 2-inch diameter wells to be installed at assigned Phase II sites.

Prior to commencing work on the project, the Contractor will be responsible for obtaining all permits, approvals, licenses, etc., required by any and all agencies with jurisdiction over the work to be performed.

The Contractor will be responsible for completing all work on the project in a professional manner and in accordance with all requirements of the contract documents.

B. Existing On-Site Subsurface Conditions

The Contractor will be responsible for determining the presence and location of any subsurface utilities or obstructions prior to the commencement of the work, and for avoiding any such features during the performance of the work. The Contractor will be responsible for repairing or replacing any feature damaged during the performance of the work. Any delay or expense caused by such repair or replacement will be the responsibility of the Contractor.

II. Division 2 - Specific Items

The Contractor shall furnish, transport to the project area and remove from the project area following termination of work, all equipment, pumps, generators, tools, testing and sampling devices, and any other equipment

necessary to properly install and develop the wells and removal of all trash generated through this process.

A. Setting Up and Dismantling Drilling Equipment

The Contractor shall set up and dismantle at each test well site all drilling, construction and testing equipment necessary to properly execute the work.

B. Drilling

General

The Contractor shall progress a borehole through the overburden and at each well site as identified on the project location plans, or as directed by the DEC staff to allow for the unobstructed installation of a 2-inch well casing. The drilling method selected shall be compatible with the description of the various items of work and details thereof as provided in this contract. Details of the proposed drilling method shall be submitted to the Department to allow an evaluation and approval of the method.

All work executed by the Contractor under the provisions of this contract shall be performed by and/or under the supervision of personnel experienced in the drilling and installation of monitor wells.

Each boring is to be drilled straight and plumb and shall be tested for alignment and plumbline in accordance with the procedures described in Section 02034.

Driller's Log and Reports

During the drilling of each borehole, the Contractor shall prepare and keep an accurate log setting forth the following:

1. The reference point for all depth measurements.

2. The depth at which each change of formation occurs.

3. The depth at which the first water was encountered.

4. The depth at which each stratum was encountered.

5. The thickness of each stratum.

6. The description of the material of which each stratum is composed including:

   a. grain size

   b. color

   c. degree of compaction or cementation

   d. other physical characteristics (i.e., moisture content)

7. The depth interval from which each water and formation samples was taken.

8. The depth at which hole diameters (bit sizes) change.

9. The depth to the static water level (SWL) and changes in SWL with well depth.

10. Total depth of completed well.

11. The depth and description of the well casing.

12. The sealing off of water-bearing strata, if any, and the exact location thereof.

13. Depth or location of any lost drilling materials or tools.

14. The depth of the surface seal, if applicable.

15. The nominal hole diameter of the well bore above and below the casing seal.

16. The amount of cement (number of bags) installed for the seal, if applicable.

The log shall be kept in a neat and organized manner and be made available for inspection by DEC staff at all times. In addition, the Contractor

shall furnish DEC with a copy of the above log following completion or abandonment of each well site. Receipt of this log by DEC is a prerequisite to final payment.

The Contractor shall also prepare and make available to DEC a Daily Driller's Report. The report shall give a complete description of all formations encountered, number of feet drilled, number of hours on the job, shutdown due to breakdown, the water level in the well at the beginning and end of each shift, water level at each change of formation if readily measurable with the drilling method used, feet of casing set, and such other pertinent data as is required for payment under the provisions of the contract or as may be requested by the DEC staff.

C. Formation Sampling

a. Overburden

The Contractor shall collect, icentify, log and store representative samples of the overburden at all changes in materials. The method of sampling shall be in accordance with ASTM method D1586.

Immediately after retrieval and examination, formation samples shall be placed in approved plastic or glass containers, securely closed to avoid spillage and contamination, and clearly labeled with the following information:

1. Project
2. Name or number of the well
3. Depth interval represented by the sample
4. Blow counts
5. Date taken

b. Bedrock

Continuous NX-size core samples shall be taken from the top 15 feet of bedrock. Core runs shall not exceed five feet in length. Core samples shall

be examined and logged immediately upon retrieval and stored in standard wooden core boxes. Each core box shall be labeled with the project, boring/well identification number, depth of interval sampled, run number, the top and bottom of the run and the date. The core boxes shall be fitted with fasteners and shall be kept securely closed when stored.

The Contractor shall be responsible for security of the samples at the well site. The Contractor shall store the samples in a secure area in the project area, available for inspection by the DEC staff at all times. See the foregoing section C.3.6 Sample Storage.

D. Plumbline and Alignment

Each borehole shall be sufficiently plumb and straight to accomodate installation of temporary and permanent well casing. All permanent casing shall be installed round, plumb and true so that there will be no interference with construction and operation of the well. The Contractor shall furnish all labor, materials and equipment necessary to test for plumbline and alignment. Such tests shall be made both during and following construction of the well and before test pump equipment is installed.

E. Equipment Cleaning

The drill rig shall be dry-brushed and steam-cleaned before being transported to the project area to remove any extraneous material, grease and oil that might be a source of contamination. The drill rig shall be cleaned in the same manner between borings, and before leaving the site. The entire vehicle must be cleaned before leaving the site.

All drill tools, augers, bits, casing, rods, etc., shall be cleaned in the same manner as the drill rig.

F. Payment

Payment for any borehole abandoned for reasons other than faulty construction or negligence by the Contractor shall be paid per linear foot. No payment will be made for any borehole abandoned or rejected by the DEC staff due to faulty construction or negligence by the Contractor.

G. Well Casing (Rock Well)

Temporary

Under this item, the Contractor shall install temporary well casing and shall be advanced through the overburden to the top of bedrock. Such casing will be left in place during rock coring, drilling the rock socket, installing the permanent casing and grouting the permanent casing in place. All temporary casing removed from a borehole shall remain the property of the Contractor.

Permanent

2-inch casing will be installed inside the temporary casing. The 2-inch casing will be installed with a stick-up of two and one-half feet from grade to a point five feet into bedrock. The permanent casing will be cemented into bedrock.

The permanent 2-inch PVC casing will be installed with a removable vented cap acceptable to DEC.

Cleaning

All casing to be installed in the borehole will be cleaned in accordance with Section E prior to installation.

After cleaning, the casing should be protected from contact with possible contaminants. Wrapping the casing with plastic sheeting or storage on clean pallets is suggested.

Well Installation

Installation of well casing shall be the Contractor's responsibility and he shall utilize equipment he deems suitable to insure a satisfactory well which will maintain alignment, plumbline and roundness during installation.

H. Rock Coring

General

Rock coring will be required at each drilling location once bedrock is reached. It is the intention of this item to obtain fifteen feet of rock core to confirm the top of rock, to determine the extent of weathering and fracturing of rock throughout the core length, to identify the rock type and formation and to evaluate the amount of water in the upper zones of the bedrock formation.

Method

Rock core of NX diameter shall be obtained by rotary drilling methods. Three five-foot core runs are to be drilled successively at each well location unless otherwise ordered by DEC. The methods used shall be adaptable to progressing shorter runs should the condition of the rock, as ascertained by drilling behavior and the results of the first core run at each location, so dictate. The success of the recovered core to accomplish the stated goals shall determine if shorter runs will be required.

I. Drilling Rock Sockets

General

A socket shall be drilled into the top of rock at each well location to allow permanent 2-inch casing to be grouted securely in place prior to completion of the well. It is the intention of this item to provide a seal at

the overburden/bedrock interface and into the upper fractured bedrock surface (if one exists), to prevent the entrance of overburden water into the bedrock well annulus.

Method

A 2-inch or sufficiently greater diameter boring shall be progressed into the bedrock to allow the placement of permanent 2-inch diameter well casing into the bedrock surface. The method selected may be percussion or rotary drilling equipment at the option of the Contractor. The method and equipment selected must be capable of penetrating the bedrock at each well location to a depth required by the workplan on the basis of results of the rock coring performed under Item H.

J. Well Grouting (for Rock Wells)

General

A bentonite seal and cement grout shall be placed in the annulus between the 2-inch casing and oversized holes or other casing where used. The depths and locations of the grout seal shall be as required in the workplan and in no case shall be less than that necessary to prevent the entrance of surface or subsurface water into the well.

Prior to any sealing or grouting, the annular space between permanent casing and oversized hole shall be cleaned.

Sealing and grouting shall be continuous from the bottom of the permanent casing to the land surface. If a section of larger pipe is temporarily installed to keep the space open in caving materials, the pipe must be removed while the grout is still fluid. The temporary pipe shall remain the property of the Contractor.

Methods of Installation

A detailed description of the desired grout placement procedure shall be submitted by the Contractor to the DEC staff for review and approval prior to any placement or grout.

Grout shall be placed in one continuous operation prior to initial set.

If bentonite pellets are used, a minimum of 30 minutes must be waited to allow for proper swelling of the pellets, before placement of the grout. The size and shape of the bentonite seal must be selected to assure free travel from the surface to top of rock to assure a complete pack around the casing. Bentonite and grout shall be introduced at the bottom of the space to be grouted by a tremie or grout pipe and continued upward in all cases where the interval to be grouted is not clearly visible from the surface.

Grout may be uniformly poured into the annular space without the aid of a tremie or grout pipe where the interval to be grouted is clearly visible from the surface and is dry.

No work will be permitted on the well for a period of 48 hours after placement of grout. If high early strength cement (Type 3) is used, the waiting period may be reduced to 24 hours upon approval of the DEC staff.

Materials

The materials required to grout a well shall consist of Portland cement (ASTM C150) and water. Hydrated lime may be added to facilitate pumping of the grout mixture. Bentonite must be added to reduce shrinkage in amounts from 3 to 5 pounds per bag (94 lbs.) of cement, in which case about 6.5 gallons of water per bag may be used.

Cement grout placed to seal the annular space of the permanent 2-inch well casing shall be mixed in the proportion of not less than five nor more than

six gallons of water to one bag of cement. Hydrated lime (10% by volume) maybe and bentonite (3% by volume) must be added to facilitate pumping and reduce shrinkage respectively.

K. Well Development

General

The Contractor shall develop each well by such methods approved by the DEC staff that will effectively remove from the water-bearing formation the maximum practical quantity of sediment and other fine materials in order to produce a satisfactory amount of sediment-free water. The work shall be done in a manner that does not cause undue settlement and disturbance of the strata above the water-bearing formation nor disturb the seal established around the well casing and thereby reduce the protection otherwise afforded by such seal.

Methods

Development may be accomplished by pumping, bailing, surging, or by compressed air. Development work shall start slowly with rates gradually increasing as development progresses. Development of each well shall be continued until water pumped from the well at a satisfactory test pumping rate is clear and free of sediment.

L. Sealing an Abandoned Well

General

A well that is to be abandoned may, depending upon local conditions, require placement of a concrete seal to prevent contamination of the groundwater. Concrete may be necessary to seal off part of or the entire length of the abandoned well as ordered by the DEC staff. Wells which have penetrated a

confining layer may require placement of the concrete seal only where the confining layer has been breached to insure the quality of the groundwater in the confined aquifer. If practical, all casing or other lining shall be removed from the well as part of the sealing operation. Casing which cannot be removed from the well may require perforation in order to assure placement of an effective seal. All materials salvaged in the performance of this work shall remain or become the property of the Contractor.

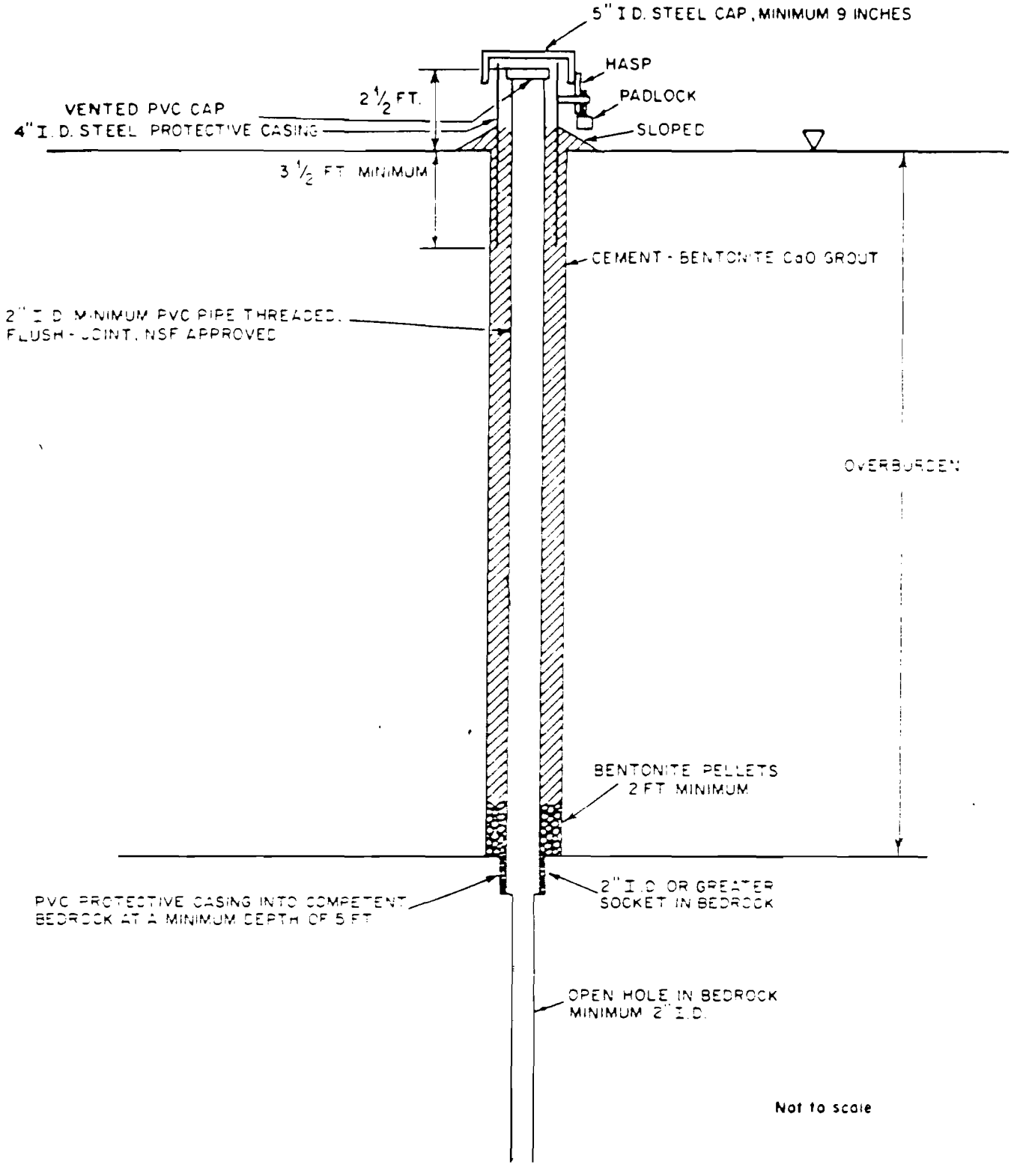
Placement of Concrete Seal

The concrete seal may be introduced from the top of the well. Flowing wells may be sealed by extending the confining walls of the well prior to placing the concrete or by other means approved by the DEC representative. Positive means of venting air shall be provided during placement of this concrete.

The top of the concrete seal shall terminate five feet below the ground surface or as directed by the DEC staff. The remaining portion of the well shall be filled with native material., When the casing or other lining is left in place, the well shall be sealed as above with the casing or lining removed to a point five feet below the ground surface. The remaining portion of the well shall be filled with native material.

Materials

The sealing material shall be Portland Cement concrete consisting of a mixture of two and one-half (2½) bags of Portland Cement per cubic yard, with fine and coarse aggregate in equal proportions by volume. Water shall be added in the amount required to obtain a slump of seven to nine inches. The fine aggregate shall consist of sand. The coarse aggregate to be placed in a well less than twelve inches in diameter shall have a maximum size of one inch. All materials used in the concrete shall be approved by the DEC staff.



BEDROCK WELL

FIGURE 2

ATTACHMENT I

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
RAYMOND T. SCHULER COMMISSIONER

SOIL DESCRIPTION PROCEDURE

OFFICIAL ISSUANCE NO. 7.41-5STP 2/75

SOIL MECHANICS BUREAU
SOIL TEST PROCEDURE STP-2

INTRODUCTION

This manual presents a procedure for describing soil samples obtained for earth and foundation engineering purposes by the New York State Department of Transportation. The procedure involves visually and manually examining soil samples with respect to texture, plasticity and color. A method is presented for preparing a "word picture" of a sample for entering on a subsurface exploration log or other appropriate data sheet. The procedure applies to soil descriptions made in the field or laboratory.

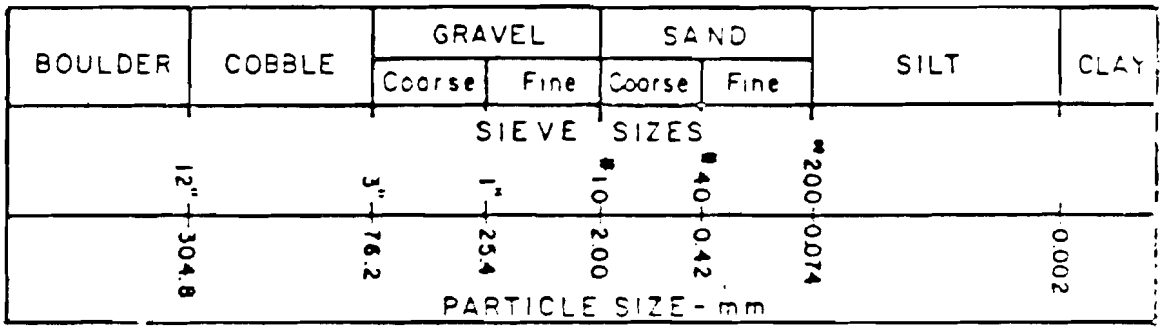
It should be understood that the soil descriptions are based upon the judgment of the individual making the description. Classification tests are not intended to be used to verify the description, but to provide further information for analysis of soil design problems or for possible use of the soil as a construction material.

It is the intent of this system to describe only the constituent soil sizes that have a significant influence on the visual appearance and behavior of the soil. This description system is intended to provide the best word description of the sample to those involved in the planning, design, construction, and maintenance processes.

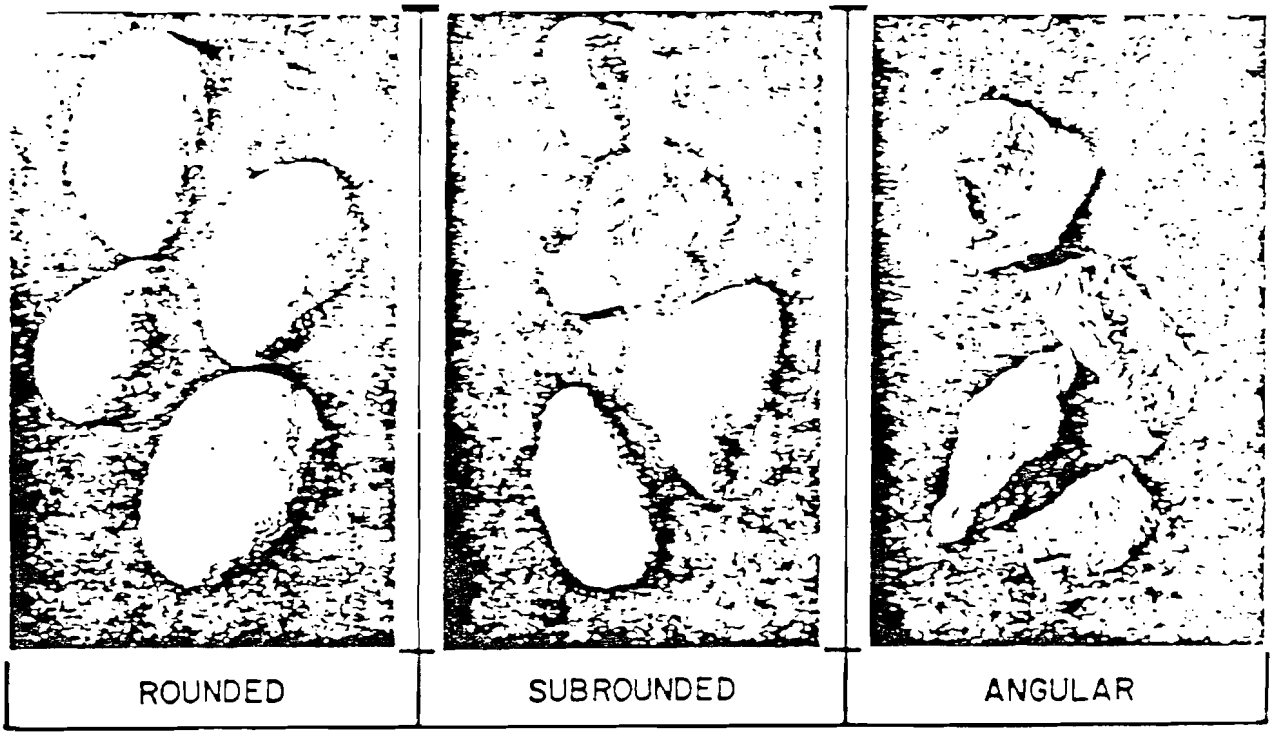
Coarse-Grained Soil - Soil having a predominance of gravel and/or sand.

Fine-Grained Soil - Soil having a predominance of silt and/or clay.

Mixed-Grained Soil - Soil having significant proportions of both fine-grained and coarse-grained sizes.



PARTICLE SIZE LIMITS



EXAMPLES OF PARTICLE SHAPES

SOIL SAMPLE IDENTIFICATION PROCEDURE

1st Decision -

Is sample coarse-grained, fine-grained, mixed-grained or organic?

If mixed-grained, decide whether coarse-grained or fine-grained predominates.

2nd Decision -

What is principal component?

Use as noun in soil description.
Example: Sand

3rd Decision -

What is secondary component?

Use as adjective in soil description.
Example: Silty Sand

4th Decision -

Are there additional components?

Use as additional adjective.
Example: Silty Sand, Gravelly

OTHER INFORMATION FOR DESCRIBING SOILS

1. COLOR OF THE SAMPLE - Brown, Gray, Red, Black, etc.

2. MOISTURE CONDITION - Dry, Moist, Wet.
   Judge by appearance of sample before manipulating.

3. PLASTICITY - Plastic, Low Plastic, Nonplastic.
   Note: Sample must be in moist or wet condition for plasticity determination. For dry samples requiring wetting make note in description. Example - "plastic (low or nonplastic) when wet."

   Plasticity not required for marl, muck and peat.

4. STRUCTURE - Fissured, Blocky, Varved, Layered.
   (Indicate approximate thickness of layers)
   The description of layering for coarse-grained soils must be made from field observations before sample is removed from sampler.

5. PARTICLE SHAPE - Angular, Rounded, Subrounded

6. Other words, phrases, notes or remarks that will add to the meaningfulness of the complete soil description.

Light Brown Sand, wet, nonplastic

Gray Clayey Sand with angular Gravel, moist, low plastic

Black Sandy Muck, wet

Dark brown fibrous Peat, wet

Dark brown Peat, wet