ALTERNATIVE GROUND WATER SAMPLING TECHNIQUES GUIDE

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
SITE REMEDIATION PROGRAM
HAZARDOUS SITE SCIENCE ELEMENT
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INTRODUCTION

The New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program is committed to streamlining and expediting the investigation and remediation of contaminated sites. To achieve this goal, the Alternative Ground Water Sampling Techniques Guide has been developed to assist investigators in evaluating ground water during a site investigation and reduce the time and money spent on the installation of monitor wells. The use of the alternative methods described in this guide will allow for a greater number of ground water samples to be collected at a reduced cost per sample. A larger data base will in turn guide the investigation and provide a greater understanding of the distribution of ground water contamination, leading to more effective placement of monitor wells and subsequent remedial decisions.

The guide provides a compilation of six (6) alternative methods for the acquisition of ground water samples in lieu of monitor well installation. These methods are presented in standard format and include detailed procedures for equipment installation, sampling, QA/QC, and a description of their advantages and limitations. Based upon site specific objectives and targeted levels of data quality, data obtained with these methods may be used as a screening tool to reduce the number and optimize the placement of monitor wells and may also be accepted on a case by case basis as stand alone data points of ground water evaluation. The actual representativeness and subsequent acceptability of the associated data is dependent upon site conditions, application of the sampling method, experience of the sampling team and the remedial decision to be made.

The guide is intended for use by the regulated community and consultants to implement rapid and technically sound site investigations. Users of the Alternative Ground Water Sampling Techniques Guide will be most successful when used in conjunction with the NJDEPE Field Sampling Procedures Manual and the Site Remediation Program Field Analysis Manual.

Procedures for the use of alternative sampling methods are requirements referenced in Sections 1.6(c) and (d) in the current Technical Requirements for Site Remediation (N.J.A.C. 7:26E). Section 1.6(c) designates criteria which the alternative ground water sampling method must satisfy when used without NJDEP approval as allowed by N.J.A.C. 7:26E. To use the alternative methods with NJDEP approval, a NJDEP variance must be obtained. The procedures for obtaining a variance and the criteria which must be met are described in section 1.6(d). The reader is cautioned that site-specific conditions must be evaluated on a case by case basis to determine applicability of a particular method. It is also strongly suggested that a consultation occur with the NJDEP Case Manager to discuss the intended use of a particular method prior to implementation.

Prior drafts of this document have been previously distributed for review and comment within the NJDEP and the regulated community. The Alternative Ground Water Sample Techniques Guide will be updated regularly to reflect changes in the rapidly growing area of environmental monitoring and measurement technology.

The Alternative Ground Water Sampling Techniques Guide may be reproduced without NJDEP authorization. Comments on the document are encouraged and may be addressed to:

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Title: Ground Water Sampling with the use of a Screened Auger Tool (SAT) (3/94)

Method Number: AGWST 1.00

Summary:

The Screened Auger Tool (SAT) is a five foot length of laser-slotted hollow stem auger, available in 2¬ to 12« inch ID, constructed of carbon steel through which samples of ground water may be obtained.

I PURPOSE AND SCOPE

This document summarizes the minimum requirements for the use of the Screened Auger Tool for the collection of ground water screening data for site investigations.

II METHOD OVERVIEW

A. Tool Description

1. The SAT is a length of laser slotted hollow stem auger which will allow the passing of groundwater into the auger for sampling (Figure I).

2. The slots are bevel cut to a slot size of 0.007 inches which allows for quick cleaning and helps eliminate the passage of fine soil particles.

3. The SAT must be equipped with a knock out plug at the cutting head to prevent the entrance of soil and eliminates the need for a center bit and rod while advancing. The knock out plug will not affect hole advancement and can be dislodged by a split spoon or well casing.

B. Applications

1. Field screening tool for the collection of ground water samples to aid in the placement of monitor wells.

2. Use of the SAT can provide a quick assessment of ground water conditions at a potentially contaminated site during auger advancement.

C. Capabilities

1. Obtain samples from unconfined aquifers.

2. Sampling from confined aquifers provided the upper aquifer is cased off and the casing is driven a minimum of two feet into the confining layer.

3. Obtain samples across the water table to determine the presence of floating product.

4. Capable of obtaining ground water samples and allows for continued auger advancement immediately after collection.

5. Capable of collecting samples for obtaining a vertical profile of contamination in an aquifer.

6. A comparison of the advantages and limitations of the SAT are listed in Table I.

III *SAMPLING METHOD REQUIREMENTS*

A. Installation

1. The SAT is used in the same manner as conventional auger drilling techniques. It is designed to be used in well sorted, unconsolidated, fine to coarse sands.

2. Augers, used in conjunction with the SAT, must be constructed in a manner which provides a water tight seal at the auger connection. This will prevent cross-contamination by water seepage at the joints from different depth intervals below the water table.

3. Since a center bit and drill rod are not used with the SAT, a plug constructed of TeflonR or polypropylene must be used in the bottom of the screened auger section when drilling. This plug prevents soils from entering the auger during drilling, development and sampling. When at the final target depth, the plug is knocked out and left in the ground for split spoon sampling or well installation.

4. Always accurately measure the depth of the SAT and auger stick-up to determine depth of sample zone.

5. Installation of the tool is required to comply with all permit, license, sealing and grouting requirements as per Appendices I and II. Any tool left in the ground longer than 48 hours is considered a monitor well and therefore must comply with the permit installation and license requirements for monitor wells.

B. Sampling Procedures

1. Development

The SAT must be developed by one of the standard methods used for well development prior to sampling. If an air lift development technique is used, the air outlet must be at a minimum of two feet above the screened auger. Operations must be continuous and not pulsed. The air lift pipe shall not be placed within the screened auger and only the double pipe method shall be used. Therefore this development technique cannot be used for sampling at water table locations.

The well should be developed until the ground water is clear and sediment free. This clears the screen and removes all sediment in the auger.

2. Purging

After development, three to five volumes of the standing water must be purged from the SAT utilizing a submersible or centrifugal pump. This removes water agitated in the formation by the development process. Caution should be used during purging to avoid pumping to dryness. The NJDEPE Field Screening Procedures Manual can be used as a reference for the selection of appropriate purging equipment, construction and decontamination procedures.

3. Sampling

Groundwater samples are collected through the center of the auger. The acquisition of samples can be performed by one of several recommended ground water sampling methodologies described in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual.

C. Quality Assurance/Quality Control

1. Decontamination

The SAT, associated augers and equipment used for development must be decontaminated between borings using the following procedure:

1. Remove all adherent soil material with stiff bristle brush.

2. Wash with a laboratory grade glassware detergent.

3. Steam clean interior and exterior of the SAT and all associated augers.

NOTE: For proper decontamination, stronger cleaning agents are recommended when the tool is exposed to heavy contamination. This can be performed prior to step 2.

2. Field Blanks

Field blanks must be obtained in the same manner as the sample. The blank water must pass through all the sampling equipment then into the sample container.

The parameters and frequency for field blanks are designated in the May, 1992 edition of the NJDEPE Field Sampling Procedures Manual.

3. Sample Equipment

A variety of equipment may be used to obtain samples from the SAT. The NJDEPE Field Sampling Procedures Manual can be used as a reference for the selection of the appropriate sampling equipment.

All sampling equipment must be decontaminated in accordance with the NJDEPE Field Sampling Procedures Manual and dedicated to each sample point.

4. Auger Seals

If drilling and sampling with the SAT below the water table, the augers used with the SAT MUST provide a water tight seal at the connection. This will prevent cross contamination of samples from formation water leaking through the auger connection and into the augers from different depths.

The type of augers used should be equipped with an o-ring or other device which will ensure a water tight seal.

5. Formation Type

The design of the SAT gears itself towards use in highly permeable unconsolidated formations. If the formation contains silts and clays the formation will yield slow recharge rates and highly turbid samples.

IV REFERENCES

1. Taylor, T.W.; Serafini, M.S.; Screened Auger Sampling: The Technique and Two Case Studies. Ground Water Monitor Review, v.10 No.4 pp145-152, Summer 1988

TABLE I

ADVANTAGES AND LIMITATIONS OF THE SCREENED AUGER TOOL

ADVANTAGES	LIMITATIONS
1. Provides for quick and cost effective collection of ground water samples across a geologic water-bearing unit during auger advancement.	1. Obtaining piezometeric data may be difficult due to "equilibration" time in some geologic conditions.
2. Does not require the installation and removal of well casing or well point.	2. Requires the development and purging of water from the SAT which may cause a problem with containerizing and disposal of the purge water and increase sample time.
3. Upon completion of the boring a well screen can be placed at the desired interval based on analytical field screening or laboratory results.	3. Unable to obtain split spoon samples until the maximum target depth of the boring is reached due to knock out plug. Soil can be evaluated as it comes up the auger flights to the surface.
4. Can provide general hydraulic conductivity data based on purge water rates.	4. Screened intakes are exposed as hole is advanced possibly carrying down contaminants to the sample zone therefore requiring large quantities of development water to be purged.
5. Provides a water sample with less turbidity than other screening methods (hydropunch, well points, narrow diameter wells).	5. When used in formations with silt and clays, the hole will not collapse around the augers thereby possibly permitting contamination from other areas entering the targeted sample zone via the annulus between the borehole and auger.
	6. Can drag contamination deeper into aquifer or create a temporary conduit for contamination migration.
	7. Formations with 20-30% silts and clays may not yield sufficient water for sampling and limit use of the tool.
	8. Potential for cross contamination when surficial zones are highly contaminated.
	9. Requires a drill rig for use.

Title: Ground Water Sampling with the use of A Miniature Drive Point (MDP) (3/94)

Method Number: AGWST 2.00

Summary:

A miniature Drive Point (MDP) is a retractable screened probe (3/4-« inch OD) connected to small diameter (1/8-« inch OD) flexible tubing. The tip and tubing are driven into place with a temporary outer casing. It is used for the collection of ground water samples. The probe is constructed of stainless steel with the tubing constructed of PTFE (polytetraflouroethylene e.g. TeflonR) or drinking water grade polyethylene. No filter or gravel pack is used in the installation.

I PURPOSE AND SCOPE

This document summarizes the minimum requirements for the use of a MDP for the collection of ground water screening data for site investigations. Installation is for temporary use (less than 48 hours).

II METHOD OVERVIEW

A. Tools

A variety of tools are commercially available with various designs. Most are designed for the collection of soil gas samples as well as ground water samples (Figure I).

The screened probe is constructed of stainless steel. Its design allows for the screen to remain inside the probe until at the target depth at which time the drive casing is pulled back and the screen is exposed. Tubing is connected to the top of the probe and extends to the surface inside the drive casing.

B. Applications

Field screening tool for the collection of ground water samples to aid in the placement of monitor wells.

C. Capabilities

1. Obtain ground water samples from unconfined aquifers.

2. Obtain samples at depths less than 40 feet.

3. A comparison of the advantages and limitations for MDPs are listed in Table I.

III SAMPLING METHOD REQUIREMENTS

A. Installation

1. A MDP is emplaced by connecting a screened probe and tubing and inserting into an outer drive casing. Since the probe

inlets and tubing are inside the drive casing there are no problems with cross contamination by driving through contaminated soils or probe clogging with silts and clays. The unit is driven to the desired depth with a slide hammer or rotary hammer. Once at the targeted depth, the drive casing is pulled back, exposing the telescoping screened probe inlets to the ground water.

CAUTION must be used when employing a hammering device since this may cause the rod connectors to loosen, causing cross-threading, and damaging the rod.

2. Prior to installation of any MDP, previous knowledge of the depth to water must be known for proper depth setting. Initial probes should be set at a maximum depth of three feet below the water table. This will ensure the detection of Light Non-Aqueous Phase Liquids.

3. Installation of the tool is required to comply with all permit, license, sealing and grouting requirements as per Appendices I and II. Any tool left in the ground longer than 48 hours is considered a monitor well and therefore must comply with the permit installation and license requirements for monitor wells.

B. Sampling Procedures

1. Purging

Purging or development is not required for the MDP prior to sample acquisition.

2. Sampling

Sample acquisition from a MDP is limited to the use of an evacuation chamber or peristaltic pump due to the narrow diameter of the tool. Tubing used in the MDP and sampling device must be dedicated to each point. These sampling methods will bias samples for volatile and semi-volatile analysis low due to the vacuum created by the device.

C. Quality Assurance/Quality Control

1. Decontamination

The MDP and associated equipment (drive casing, probe, etc.) must be decontaminated prior to initial use and between borings using the following procedure:

1. Remove all adherent soil material with a stiff wire brush.

2. Wash with a laboratory grade glassware detergent.

3. Rinse with potable water and/or steam clean.

4. Rinse with distilled and deionized ASTM type II water.

NOTE: For proper decontamination stronger cleaning agents are recommended when tool has been exposed to heavy contamination. This can be performed prior to step 2.

2. Field Blanks

Field blanks must be obtained in the same manner as the sample. The blank water must pass through the probe and tubing prior to installation and evacuation device and into the sample container. The parameters and frequency for field blanks are designated in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual.

3. Sampling Equipment

Due to the small diameter of the wells, the available sampling equipment may be limited to evacuation chambers and peristaltic pumps.

All sample tubing should be dedicated to each sample point.

4. Formation Types

MDPs can be installed in unconsolidated materials which are free of pebbles, cobbles and boulders. The presence of these materials may inhibit the penetration depth of the probe.

The soil texture will dictate the recharge rates of the MDP.

IV REFERENCES

1. Barker, J.F.; Patrick, GC; Lemon, L; Travis G.M.; Some Biases in Sampling Multilevel Piezometers for Volatile Organics, Ground Water Monitoring Review, Spring 1987, p48-54

2. Kerfot, William B; A Portable Well Point Sampler for Plume Tracking. Ground Water Monitoring Review, Fall 1984, p38-41

3. Robbins, G.A.; Hayden J.M.; Bristol, R.D.; Vertical Dispersion of Ground Water Contaminants in the Near-Field of Leaking Underground Gasoline Storage Tanks. In Procedures of the Natural Water Well Association Petroleum Hydrocarbons Conference, November 15-17, 1989, Houston, TX

4. Stites, Will; Chambers, Lucy W; A Method for Installing Miniature Multilevel Sampling Wells Ground Water Vol. 29, November 3, 1991. p430-432.

5. Reynolds, Glenn W. and Robert W. Gillham. 1985. Absorption of Halogenated Organic Compounds by Polymer Materials Commonly Used in Ground Water Monitors.
In: Hitchon, Brian and Mark Trudell, Hazardous Wastes in Ground Water: A Soluble Dilemma. Proc. Second Canadian/American Conference on Hydrogeology, Banff, Alberta, June 25-29, 1985. pp125-132

TABLE I

ADVANTAGES AND LIMITATIONS OF MINIATURE DRIVE POINTS

ADVANTAGES	LIMITATIONS
1. Minimal cost of probes and tubing allows for temporary installation (less than 48 hours) of multiple points.	1. Depth limits are up to 30 feet.
2. Equipment required to install MDP is portable which enables their placement in remote and hard to access areas.	2. Cannot sample across the water table due to the sample acquisition technique (suction) which requires the probe to be submerged.
3. Many MDPs (15-20) can be installed in a single day.	3. Cannot sample confined aquifers due to problems with properly sealing the hole.
	4. Can be used only in unconsolidated formations without pebbles, cobbles, and boulders.
	5. Excessive solids or tight formation will cause probe to be inoperable.
	6. Due to the narrow diameter tubing, there is a high ratio of ground water to tubing surface area contact which may cause increased adsorption of volatiles. This will result in sample results biased low.
	7. Yields a highly turbid sample therefore samples for various analytes may be biased high.
	8. Many types of equipment are not capable of sampling a MDP due to the use of narrow diameter flexible tubing.
	9. MDPs cannot be used for piezometeric data gathering due to the flexible tubing which will vary the depth to water measurements.
	10. Unable to obtain representative vertical profile samples. Retractable probes do not have a seal which will allow leakage of formation water into probe while driving.
	11. Formations with 20-30% silts and clays may not yield sufficient water for sampling and limit use of the tool.

Title: Ground Water Sampling with the use of a Well Point (3/94)

Method Number: AGWST 3.00

Summary:

A well point is a small diameter (1-2 inch) probe constructed of continuously wrapped stainless steel or wrapped stainless steel gauze screen over perforated carbon steel pipe. They may be used as a screening tool to collect ground water samples and piezometeric data to aid in the optimal placement of monitor wells. No filter or gravel pack is used in the installation.

I PURPOSE AND SCOPE

This document summarizes the minimum requirements for the temporary installation of well points and for the collection of ground water screening data for site investigations. Installation is for temporary use (less than 48 hours).

II METHOD OVERVIEW

A. Tool

The well point may be constructed in a variety of configurations with similar materials. They may be constructed of continuously wrapped stainless steel or wrapped stainless steel gauze screen over perforated carbon steel pipe. Slot size should be 0.010 inches or 60 mesh to reduce fines in sample water (Figure I).

Most units have a cast iron drive point for ruggedness which may be hexagonal in shape to prevent turning as extension pipe is added. The end will have a threaded coupling or open thread pipe for the connection of riser pipe. Their construction allows sample collection across the water table. The material of construction must meet the intended use of the data.

B. Applications

1. Field screening tool to collect ground water samples and to estimate ground water flow directions to aid in the placement of monitor wells in unconfined aquifers (less than 48 hour placement).

2. Installation can be temporary (less than 48 hrs.) or permanent use. If placed longer than 48 hours a well permit must be secured and placement must be in accordance with the subsurface and percolating waters act N.J.S.A. 58:4A et seq and performed by a New Jersey licensed well driller.

C. Capabilities

1. Obtain samples from unconfined aquifers.

2. Obtain samples across the water table to determine the presence of floating product.

3. Small screen lengths can be used to sample specific intervals in the saturated zone.

4. Capable of collecting samples to determine the vertical profile of contaminants in an aquifer.

5. Sampling from confined aquifers provided; the upper aquifer is cased off and the casing is driven a minimum of two (2) feet into the confining layer.

6. Can be used to estimate groundwater flow directions. Must remain in place for 24-36 hours for stabilization prior to measurement.

7. A comparison of the advantages and limitations for the use of well points are listed in Table I.

III SAMPLING METHOD REQUIREMENTS

A. Installation

1. The well point can be placed with the use of a conventional hollow stem auger rig, slide hammer, jack hammer, rotary hammer or by hand; JETTING OF THE POINTS INTO PLACE IS NOT A NJDEP APPROVED PROCEDURE.

2. The well point may be driven through the unsaturated zone only in known "clean" soils. Driving the well point through contaminated soil may carry some contamination with the point resulting in analytical sample results which are biased high. In contaminated unsaturated zones the well points must be placed with the aid of a hollow stem auger.

3. If the well point is to be installed in an oversized (20% larger than the well point) pre-drilled hole, the hollow stem augers or bull drive point must be advanced to a point which is just above the targeted sample zone. The well point is then placed in the hole and advanced beyond the bottom of the hole by hammering or pushing into place. The use of pre-drilled holes will reduce clogging of well point screens when driving.

4. After sample collection, the well point is removed by back hammering or pulling the tool out with the rig hydraulics.

5. If the well point is to be left as a permanent installation, it must be constructed and permitted as per NJDEP monitor well requirements.

6. If the well point is used for piezometeric data a survey mark must be made on top of the casing as a reference point for water level measurements.

7. Caution must be used when using well points in areas of contaminated soil. Possible cross contamination may be introduced to the screen as it passes through the zone of contamination.

8. Installation of the tool is required to comply with all permit, license, sealing and grouting requirements as per Appendices I and II. Any tool left in the ground longer than 48 hours is considered a monitor well and therefore must comply with the permit, installation and license requirements for monitor wells.

B. Sampling Procedures

1. Development

Development of a well point is not required except when performing vertical profile sampling. The well point must be developed by one of the standard methods used for well development prior to sampling. If an air lift development technique is used, the air outlet must be at a minimum of two feet above the screen. Operations must be continuous and not pulsed. The air lift pipe shall not be placed within the screen and only the double pipe method shall be used.

2. Purging

Purging of the well point is required. The procedure should follow the methodologies found in the May 1992 NJDEPE Field Sampling Procedures Manual for monitor well purging.

3. Sampling

The acquisition of ground water samples and piezometeric data must be performed by one of several recommended methods described in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual.

C. Quality Assurance/Quality Control

1. Decontamination

The well points and associated riser pipe must be decontaminated prior to installation using the following procedure:

1. Remove all adherent soil material with a stiff wire brush.

2. Wash well point and associated riser pipe and couplings with a laboratory glassware detergent.

3. Rinse with potable water and/or steam clean.

4. Rinse interior of well point and riser pipe with distilled and deionized ASTM Type II water.

NOTE: For proper decontamination stronger cleaning agents are recommended when the tool has been exposed to heavy contamination. This can be performed prior to step 2.

2. Field Blanks

Field blanks must be obtained in the same manner as the sample. The blank water must pass through all the sampling equipment then into the sample container.

The parameters and frequency for field blanks are designated in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual.

3. Sampling Equipment

A variety of equipment may be used to obtain samples from the well point. The NJDEPE Field Sampling Procedures Manual can be used as a reference for the selection of the appropriate sampling equipment and decontamination procedures.

All sampling equipment must be decontaminated and dedicated to each sample point.

4. Formation Types

Well points can be installed in unconsolidated materials which are free of pebbles, cobbles and boulders. The presence of this material may damage the screen material or the well point.

The soil texture and sorting will dictate the recharge rates of the well points. If the well point is driven through formations with high percentages of clay, clogging of the screens may occur, impeding the entry of formation water into the well point.

IV REFERENCES

1. Ground Water and Wells. Johnson Division, UOP Inc.; St. Paul, Minn. 1982. p277-294

2. Ground Water Manual - A Water Resources Technical Publication; U.S. Dept. of Interior, Bureau of Reclamation. Government Printing Office,Washington DC 1977

Table I

ADVANTAGES AND LIMITATIONS OF WELL POINTS

ADVANTAGES	LIMITATIONS
1. Capable of collecting ground water samples and piezometeric data.	1. If driven to the desired zone through contaminated soil, well points may carry down contaminants.
2. Minimal cost of well points and riser pipe. Temporary installation (less than 48 hours) of multiple points.	2. If driven in clay soils, slots may clog.
3. Materials are readily available so damaged components may be replaced at a reduced cost.	3. In contaminated soils, soil plug at end of auger may contaminate well point as it is driven past the end of the auger.
4. Can be set in a gravel pack for permanent installation.	4. Cannot be used in soil with cobbles or boulders due to potential damage to point.
5. Various lengths available (18-60 inches) for monitoring specific zones of interest.	5. Temporary installations yield a highly turbid sample, therefore samples for various analytes may be biased high.
6. Able to collect split spoon samples during auger advancement prior to well point placement.	6. Cannot perform vertical profiles of aquifers.
7. Capable of collecting samples to determine vertical profile of contaminants in an aquifer.	7. May require use of drill rig for installation.
	8. Formations with 20-30% silts and clay may not yield sufficient water for sampling and limit use of tool.

Title: Ground Water Sampling with the use of a Passively Placed Narrow Diameter Point (PPNDP) (3/94)

Method Number: AGWST 4.00

Summary:

A narrow diameter point (PPNDP) is a small diameter («-1 inch OD) screened casing passively placed in a borehole. It isused for the collection of a ground water sample or piezometeric data. The casing can be constructed of stainless steel, carbon steel or PVC. No filter or gravel pack is used in the installation.

I PURPOSE AND SCOPE

This document summarizes the minimum requirements for the use of passively placed PPNDPs for the collection of ground water screening data for site investigations. Installation is for temporary use (less than 48 hours).

II METHOD OVERVIEW

A. Tools

A solid push rod (bull point) is used to create a narrow diameter hole to a depth below the water table. This can be performed by hand or with a rotary hammer.

A piece of schedule 40 PVC screen with 0.010 inch slots and an end cap is placed to the bottom of the hole.

Glues or adhesives cannot be used for joining the casing. Threaded PVC casing must be used.

B. Applications

1. Field screening tool for the collection of ground water samples for site investigations to evaluate the presence/absence and extent of ground water contamination and to estimate groundwater flow directions (less than 48 hour placement).

2. Field screening tool to aid in the placement of monitor wells.

3. A comparison of the advantages and limitations for NDPs are listed in Table I.

C. Capabilities

1. Obtain samples from unconfined aquifers only.

2. Obtain samples across the water table to determine the presence of floating product.

III SAMPLING METHOD REQUIREMENTS

A. Installation

1. Pre-drill a borehole with a diameter slightly larger than the casing using a bull point drive rod. The hole should be made to a depth of 1-3 feet below the water table. Rotary hammer bits or augers (hand and power) cannot be used. The rotary action results in an area of disturbance which alters ground water quality. Since development of NDPs is difficult, this area of impacted ground water cannot be effectively removed.

2. The screened section of PVC is placed into the borehole so the screened section is across the ground water table.

3. Prior to installation of any PPNDP, knowledge of the depth to water should be known by previous site data for proper placement of the probe. If no groundwater data is available, then depth to water can be determined with a NDP. If NDPs are employed for the acquisition of piezometeric data, the point cannot remain in the ground longer than 48 hours from installation.

4. A survey mark must be made on the casing as a reference if a NDP is to be surveyed for the purpose of obtaining water level data.

5. Caution should be used when using passively placed slotted PVC casing in areas of contaminated soil. Possible cross contamination may be introduced to the casing as it passes through the zone of contamination.

6. Installation of the tool is required to comply with all permit, license, sealing and grouting requirements as per Appendices I and II. Any tool left in the ground longer than 48 hours is considered a monitor well and therefore must comply with the permit, installation and license requirements for monitor wells.

B. Sampling Procedures

1. Purging

   For passively placed NDPs, three to five volumes of the standing water in the NDP must be purged. This is due to the potential for cross contamination of the screen from upper soil horizons. This can be accomplished utilizing a peristaltic pump, inertial pump or a small centrifugal pump.

2. Sampling

   The acquisition of samples and water level measurements must be performed by one of several recommended methodologies described in the May 1992 edition of NJDEPE Field Sampling Procedures Manual.

C. Quality Assurance/Quality Control

1. Decontamination

The PPNDP and associated equipment (bull point, riser pipe, etc.) must be decontaminated between borings using the following procedure:

1. Remove all adherent soil material.

2. Wash with a laboratory grade glassware detergent.

3. Rinse with potable water and/or steam clean.

4. Rinse with distilled and deionized ASTM Type II water.

NOTE: For proper decontamination, stronger cleaning agents are recommended when tool has been exposed to heavy contamination. This can be performed prior to step 2.

2. Field Blanks

Field blanks must be obtained in the same manner as the sample. The blank water must pass through the sample device and PPNDP, prior to installation then into the sample container.

The parameters and frequency for field blanks are designated in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual.

3. Sampling Equipment

Due to the small diameter of the points, the available sampling equipment may be limited. The NJDEPE Field Sampling Procedures Manual can be used as a reference for the selection of sampling equipment.

All sampling equipment must be decontaminated in accordance with the NJDEPE Field Sampling Procedures Manual and dedicated to each sample point.

4. Formation Types

PPNDPs can be installed in unconsolidated materials with limited amounts of pebbles, cobbles and boulders. The presence of these materials in large quantities may inhibit the penetration depth of the PPNDP. The soil texture will dictate the recharge rates of ground water to the well.

IV REFERENCES

1. Barker, J.F.; Patrick, GC; Lemon, L; Travis G.M.; Some Biases in Sampling Multilevel Piezometers for Volatile Organics. Ground Water Monitoring Review, Spring 1987, p48-54

2. Kerfort, William B; A Portable Well Point Sampler for Plume Tracking. Ground Water Monitoring Review, Fall 1984, p38-41

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TABLE I

ADVANTAGES AND LIMITATIONS OF
PASSIVELY PLACED NARROW DIAMETER POINTS (PPNDP)

ADVANTAGES	LIMITATIONS
1. Capable of collecting ground water samples and piezometeric data.	1. Installation of screen zone through contaminated soil may lead to "carry down" of contaminants and possibly bias samples high.
2. Minimal cost of screen material and riser pipe allows for temporary installation (less than 48 hrs.) of multiple points	2. Placement through high clay content soils may clog slots or screen of probe.
3. Equipment required to install NDPs is small and portable which enables their placement in remote and hard to access areas.	3. Yields a highly turbid sample, therefore samples for various analytes may be biased high.
4. No gravel pack is required.	4. Cannot perform vertical contaminant profile sampling (cross section) of an aquifer due to constant exposure of screen to contaminants.
	5. Cannot sample confined aquifers.
	6. In sand aquifers, hole below ground water table will collapse thus making it difficult to penetrate into the water table.
	7. Points are low yielding.
	8. Sampling methods may be limited due to small casing diameter.
	9. Operational depth limitations of approximately 10 feet.
	10. Formations with 20-30% silts and clays may not yield sufficient water for sampling and limit use of the tool.

Title: Ground Water Sampling with the use of a Small Diameter Direct Push Point (SDDPP) (3/94)

Method Number: AGWST 5.00

Summary:

A small diameter direct push point (SDDPP) is a «-1 inch OD casing (slotted or blank) which can be driven or pushed through the soil into the ground water (Tracer Research, GeoprobeR). It is used for the collection of a ground water sample or estimating piezometeric data. The casing can be constructed of stainless steel or carbon steel. No filter or gravel pack is used in the installation.

I PURPOSE AND SCOPE

This document summarizes the minimum requirements for the use of a SDDPP for the collection of ground water screening data for site investigations. Installation is for temporary use (less than 48 hours).

II METHOD OVERVIEW

A. Tools

Several types of tools are available as SDDPPs; blank stainless steel with a sacrificial tip, mill slotted casing and a telescoping screened point (Figure I, II and III).

B. Applications

1. Field screening tool for the collection of ground water samples for site investigations to evaluate the presence/absence and extent of ground water contamination.

2. Field screening tool to aid in the placement of monitor wells.

3. Temporary placement for the collection of ground water samples and estimating ground water flow direction (less than 48 hours).

C. Capabilities

1. Obtain ground water samples from unconfined aquifers.

2. Obtain samples across the water table to determine the presence of floating product (slotted casing).

3. Capable of collecting samples to determine the vertical profile of contaminants in an aquifer (only tools with an O-ring seal-blank casing with a sacrificial tip and telescoping screen with sacrificial tip).

4. Can be used to estimate ground water flow directions. Must remain in place for 24-36 hours to allow for stabilization prior to measurements.

5. A comparison of the advantages and limitations for SDDPPs are listed in Table I.

III SAMPLING METHOD REQUIREMENTS

A. Installation of Blank Casing SDDPP

1. SDDPPs constructed of blank stainless steel or carbon steel casing with a sacrificial tip or telescoping screen with a sacrificial tip are emplaced by driving the point to the desired depth with hydraulics or a rotary hammer. Caution must be used in using a hammering device since this may cause the rod threads to loosen and cross, damaging the rod.

2. The probe should be placed a minimum of 2 feet below the water table. Once at depth, the casing is pulled back leaving the point in place and exposing the opening of the casing or the telescoping screen. Ground water fills the casing through the bottom of the blank casing or screen for sample acquisition. These tools are not capable of obtaining a sample across the water table.

3. If blank casing SDDPPs are used to perform vertical profiling of an unconfined aquifer, the sacrificial tip must provide a water-tight seal with the casing. This will prevent cross contamination of the casing from water outside the targeted sample zone. Also the practice of acquiring samples from different intervals as the casing is pulled to the surface must not be performed. This practice yields a sample of unknown quality and location.

4. Prior to installation of any SDDPP, previous knowledge of the depth to water should be known by previous site data or from soil samples for proper placement of the probe. If no ground water data is available, then depth to water can be estimated with the SDDPP. If SDDPPs are employed for estimating piezometeric data, the point cannot remain in the ground longer than 48 hours from installation.

5. Installation of the tool is required to comply with all permit, license, sealing and grouting requirements as per Appendices I and II. Any tool left in the ground longer than 48 hours is considered a monitor well and therefore must comply with the permit, installation and license requirements for monitor wells.

B. Installation of Slotted Casing SDDPP

1. SDDPPs constructed of a slotted section of stainless steel or carbon steel can be emplaced by driving the screened section of casing to the desired depth with hydraulics or a rotary hammer.

2. Slotted SDDPPs can be placed across the unconfined water table to determine the presence of floating product. They are not recommended for vertical profiling of unconfined aquifers due

to the potential cross contamination of the point, as it passes contaminated zones of an aquifer.

3. Prior to installation of any SDDPP, previous knowledge of the depth to water should be known by previous site data or from soil samples for proper placement of the probe. If no ground water data is available, then depth to water can be estimated with the slotted SDDPP. If SDDPPs are employed for estimating piezometeric data, the point cannot remain in the ground longer than 48 hours from installation.

4. Caution should be used when using slotted probes which are exposed to areas of contaminated soil. Possible cross contamination to the casing may be introduced as it passes through the zone of contamination.

C. Sampling Procedures

1. Purging

For slotted SDDPPs, three to five volumes of the standing water must be purged. This can be accomplished utilizing a peristaltic pump, inertial pump or a small centrifugal pump.

Purging is not required for SDDPPs which are sealed until opened at the target depth for sample acquisition.

2. Sampling

Due to the small diameter of a SDDPP, the sampling tools are limited. The acquisition of samples and water level measurements must be performed by one of several recommended ground water sampling methodologies described in the May 1992 edition of NJDEPE Field Sampling Procedures Manual.

D. Quality Assurance/Quality Control

1. Decontamination

The SDDPP and associated equipment (points, casing, etc.) must be decontaminated between borings using the following procedure:

1. Remove all adherent soil material.

2. Wash with a laboratory grade detergent.

3. Rinse with potable water and/or steam clean.

4. Rinse with distilled and deionized ASTM Type II water.

NOTE: For proper decontamination, stronger cleaning agents are recommended when tool has been exposed to heavy contamination. This should be performed prior to step 2.

2. Field Blanks

Field blanks must be obtained in the same manner as the sample. The blank water must pass through the sample device and NDDPP prior to installation then into the sample container.

The parameters and frequency for field blanks are designated in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual.

3. Sampling Equipment

Due to the small diameter of the points, the available sampling equipment may be limited. The NJDEPE Field Sampling Procedures Manual can be used as a reference for the selection of sampling equipment.

All sampling equipment must be laboratory decontaminated in accordance with the NJDEPE Field Sampling Procedures Manual and dedicated to each sample point.

4. Rod Sealing

When using the SDDPP below the water table the drive rod/casing joints must be sealed. This will prevent fluid from entering the rods and potentially contaminating the sample. The rods should be sealed with TeflonR tape on the threads. Once put together the joints must be sealed with gas pipe tape. Another option is the use of drive rod with O-Rings at the threads for sealing.

4. Formation Types

SDDPPs can be installed in unconsolidated materials with limited amounts of pebbles, cobbles and boulders. The presence of these materials in large quantities may inhibit the penetration depth of the SDDPP. The soil texture will dictate the recharge rates of ground water to the well.

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TABLE I

ADVANTAGES AND LIMITATIONS OF A
SMALL DIAMETER DIRECT PUSH POINT (NDDPP)

ADVANTAGES	LIMITATIONS
1. Capable of collecting ground water samples and piezometeric data.	1. Slotted points placed to sampling zone through contaminated soil may lead to "carry down" of contaminants and possibly bias samples high.
2. Minimal cost of screen material and riser pipe allows for temporary installation (less than 48 hrs.) of multiple points.	2. If placed through soils with high clay content may clog slots or screen of probe.
3. Equipment required to install SDDPPs is small and portable which enables their placement in remote and hard to access areas.	3. Yields a highly turbid sample, therefore samples for various analytes may be biased high.
4. No gravel pack is required.	4. Cannot perform vertical contaminant profile sampling of an aquifer with a slotted probe due to potential exposure of screen to contaminants.
5. Capable of performing vertical profile sampling of an aquifer (Blank casing with sealing sacrificial point and sealing telescoping screen only).	5. Cannot sample confined aquifers.
	6. Points yield low volume of ground water for sample collection.
	7. Construction of the telescoping screened point does not allow for sampling across the water table.
	8. Formations with 20-30% silts and clay may not yield sufficient water for sampling and limit use of the tool.

Title: Ground Water Sampling with the use of a HydroPunchR Direct Push Sampler (3/94)

Method Number: AGWST 6.00

Summary:

The HydroPunchR is a sampling tool constructed of stainless steel and teflon used for collecting ground water samples. This document provides guidance for the use of this tool in ground water investigations.

I PURPOSE AND SCOPE

This document summarizes the minimum requirements for the use of the HydroPunchR (HP-I and HP-II) for the collection of ground water data for site investigations.

II METHOD OVERVIEW

A. Tool

1. The HydroPunchR I (HP-I) sampling tool collects the sample in only one mode, within the sample chamber (Figure I). This tool collects ground water through the effect of in-situ hydrostatic head, therefore, the top of the sample chamber must be below the ground water table for sample acquisition. A sample cannot be collected across the ground water table with the HP-I. The HP-I is designed to be used by cone penetrometer or drill rig.

2. The HydroPunchR II (HP-II) sampling tool can be operated in two modes, hydrocarbon and water sampling (Figure II). The water sampling mode is similar in operation to the HP-I. In the hydrocarbon mode a PVC screen is exposed so samples can be collected across the ground water table of an unconfined aquifer to determine the presence of floating product. The HP-II was specifically designed to be used by drilling contractors. Its larger diameter limits the effective depth when pushed from the surface with cone penetrometer rigs.

B. Applications

1. Collection of ground water samples for the determination of the presence/absence and extent of ground water contamination.

2. Field screening tool to aid in the placement of monitor wells.

3. Temporary placement for the collection of ground water samples and estimating ground water flow directions (less than 48 hours).

C. Capabilities

1. Obtain ground water samples from unconfined aquifers.

2. Obtain ground water samples from confined aquifers provided the upper aquifer is cased off and the casing is driven a minimum of two feet into the confining layer.

3. Obtain samples across the water table to determine the presence of floating product (HP-II).

4. Capable of collecting samples to determine the vertical profiling of contaminants in an aquifer.

5. Ability to collect ground water samples from small discrete water bearing zones. (HP-I & HP-II)

6. Capable of being used with a cone penetrometer rig or a conventional drill rig.

7. A comparison of the advantages and limitations for both the HP-1 and HP-II are listed in Table I.

III SAMPLING METHOD REQUIREMENTS

A. Installation

1. The HydroPunchR is capable of use in unconsolidated formations only. When being installed, the drilling must stop above the target sample depth thereby not disturbing the zone to be sampled. It is therefore imperative to have some idea of the depth at which the sample will be collected. If little is known of the site geology, then an initial boring should be made to determine 1) depth of water bearing zones 2) permeability of sample zone 3) density of soil 4) identify the subsurface stratigraphy 5) other pertinent data for the investigation.

2. When used with a conventional drill rig the hole must be advanced (with hollow stem augers, mud rotary etc.) to the depth which is above the zone of interest, eliminating any interference from the drilling. The HydroPunchR may then be driven to the desired sampling interval for sample collection.

3. DO NOT set the HydroPunchR down on the bottom of the borehole and pick it up. This will open the tool and compromise the sample integrity. Damage to the tool may be incurred if it is driven after being opened. Also, caution must be taken not to back hammer when driving the HydroPunchR for the above stated reason.

4. Always accurately measure the distance the tool is pushed or driven and the distance pulled back.

5. Never pull the HydroPunchR back farther than it is pushed or driven into the undisturbed soil. This may result in cross contamination of the sample from other zones in the borehole, or loss of the casing (in the hydrocarbon mode) resulting in the inability for sample collection.

6. Installation of the tool is required to comply with all permit, license, sealing and grouting requirements as per Appendices I and II. Any tool left in the ground longer than 48 hours is considered a monitor well and therefore must comply the permit, installation and license requirements for monitor wells.

B. Sampling Procedures

1. Hydrocarbon Mode (HP-II)

a. The hydrocarbon mode is used to collect ground water samples when:

- o A sample must be obtained from the water table interface of an unconfined aquifer.
- o A large volume of sample is required.
- o The presence of floating product is suspected.

b. A sacrificial 0.010-inch PVC screen (approx. 5') is attached to a disposable drive cone. The screen and drive cone are then inserted into the body of the HP-II until the O-Ring on the cone is sealed in drive shoe. Place the sleeve over the juncture of the drive cone and body of the unit.

c. Once driven to the desired depth, the body of the unit is pulled back exposing the screen. Friction with the seal will hold the cone in position while the screen is exposed. Do not pull back a distance greater than the length of the screen.

d. The EW, BW, or NW casing used to drive the tool allows for the placement of a small diameter bailer (3/4" or 1") to be lowered down through the casing and body of the HP-II and into the screen for sample collection.

e. The Hydropunch does not have to be purged or developed prior to sampling.

2. Water Sampling Mode (HP-1 and HP-II)

a. The HP-II in the ground water sampling mode or HP-I can be used when samples are required at a minimum of five (5) feet below the top of the water table and when a small sample volume (500 ml-1,200 ml dependent upon tool) is adequate.

b. Place the lower check valve with attached

filter screen into the bottom of the tool body and place the upper check valve in the top of the tool. Insert the disposable drive cone into the drive shoe ensuring a seal is made by the O-Ring. Place sleeve over the juncture of the drive cone and drive shoe.

c. Push or drive (with 140 lb hammer, 30 inch travel) the unit to the desired depth and pull back approximately two (2) feet. Soil friction will hold the drive cone in place.

d. Ground water flows into the intake screen past the lower check valve, into the sample chamber and finally out the top check valve.

e. When full the tool is pulled to the surface, increasing the hydrostatic head within the tool closing the two check valves.

f. At the surface the HP-II is inverted and the sample is decanted through a discharge valve and tubing into the sample containers.

C. Quality Assurance/Quality Control

1. Decontamination

The HydroPunchR, drill rods and drive casing must be decontaminated between samples using the following procedure:

a) Disassemble the HydroPunchR unit and remove O-Rings. The PVC screen is disposable and must be discarded.

b) Scrub with a laboratory grade glassware detergent.

c) Rinse with potable water and/or steam clean.

d) Rinse entire unit with distilled and deionized ASTM Type II water.

e) Replace O-Rings.

f) Reassemble unit.

g) The PVC screen is supplied by the manufacturer already cleaned. If the packaging is compromised then it should be cleaned in the same manner as the HydroPunch and casing.

2. Field Blanks

Field blanks must be obtained in the same manner as samples (i.e., if hydrocarbon mode is used blank water must pass through bailer, screen and HydroPunchR body).

Parameters and frequency for field blanks are designated in the May 1992 edition of the NJDEPE Field Sampling Procedures Manual (FSPM).

3. Sample Equipment

The NJDEPE Field Sampling Procedures Manual can be used as a reference for the selection of sampling equipment and procedures for use with the HP-II in the hydrocarbon mode. The HydroPunchR in the water sampling mode is in itself a sampler.

All sampling equipment must be decontaminated in accordance with the NJDEPE Field Sampling Procedures Manual and dedicated to each sample point.

4. Rod Sealing

When using the HydroPunchR in the hydrocarbon or ground water mode for obtaining samples deep in the unconfined aquifer or in a confined aquifer, or using the unit with hollow stem augers on mud rotary drilling, the drill rod/casing joints must be sealed. This will prevent fluid from entering the rods and potentially contaminating the sample. The rods should be sealed with TeflonR tape on the threads. Once put together the joints must be sealed with gas pipe tape. Another option is the use of drill rod with O-Rings at the threads for sealing.

5. Formation Types

The HydroPunchR can be installed in unconsolidated materials. Varying amounts of pebbles, cobbles and boulders may impede advancement or damage the tool.

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TABLE I

ADVANTAGES AND LIMITATIONS
COMPARISON OF HP-I AND HP-II

	HP-I	HP-II
ADVANTAGES	1. Small diameter - can be used with cone penetrometer rig. 2. Reusable cone. 3. Vertical profiling from a single borehole without concern about drilling through disposable cones and screens.	General: 1. Simpler design and fewer parts for fast decontamination. 2. No moving parts are attached permanently to the tool making it more durable and reliable. 3. Removable check valves providing 2 sample modes which increases flexibility. Hydrocarbon Mode: 1. Can collect sample at top of aquifer, including product. 2. Can collect an unlimited volume of sample. 3. Can collect sample from thin aquifer. 4. Can directly measure fill rate. Ground Water Mode: 1. Tool does not have to be driven on special casing. 2. Only tool needs to be decontaminated. 3. Tool can be driven using downhole wireline hammers.

Table I contd.

	HP-I	HP-II
LIMITATIONS	1. Thin diameter and sliding parts with close tolerances make tool susceptible to damage when driven by drilling rig. 2. Short intake interval (11-inch) makes sampling from thin water bearing zones difficult. 3. The intake screen must be at least 5 feet below the top of the aquifer to collect a complete sample. 4. Sample volume is limited to approximately 500 ml. 5. Yields a turbid sample. 6. Sample time intervals in low aquifers may cause degeneration of sample integrity. 7. Requires drill rig for installation.	Hydrocarbon Mode: 1. Hollow drive pipe must extend to surface. 2. Drive pipe must be decontaminated. 3. A cone and screen is lost each time the tool is used. 4. The rate and amount of sample obtained is dependent upon the permeability of the formation. 5. Yields a turbid sample therefore samples for various analytes may be biased high. 6. Long sample acquisition times in low yielding aquifers may cause degenera-tion of sample integrity. 7. Requires drill rig for installation. Ground Water Mode: 1. The intake must be at least 5 feet below the top of the aquifer to obtain a full sample. 2. Direct monitoring of the tool fill rate is difficult. 3. Sample volume is limited to 1.2 liters. 4. Yields a turbid sample therefore samples for various analytes may be biased high. 5. Long sample acquisition times in low yielding aquifers may cause degeneration of sample integrity. 6. Requires drill rig for installation. 7. Formations with 20-30% silts and clays may not yield sufficient water for sampling and limit use of the tool

APPENDIX I

PERMIT REQUIREMENTS

A. Definition

The temporary (less than 48 hour placement) uncased hole created by these alternative ground water sampling methods is considered to be a "boring" which is a specific type of well defined by The Subsurface and Percolating Waters Act N.J.S.A. 58:4a-1 et seq. If the temporary casing is left in the ground longer than 48 hours a well permit is required.

B. Permit Requirements

Borings/probe holes have well permitting requirements based on the total depth of the hole. If the total depth of the installation is less than twenty-five (25) feet, no permit is required for installation.

If the total depth of the boring is equal to or greater than twenty-five (25) feet, a well permit is required from the Bureau of Water Allocation prior to installation. The "type of well" applied for would be a "boring".

C. License

Regardless of the depth, all borings must be installed and sealed by a New Jersey certified Borer or New Jersey Licensed Well Driller.

D. Sealing

In addition, as per the above referenced procedures, all borings must be sealed upon completion of sampling. Borings less than 25 feet may be backfilled and tamped. Borings deeper than 25 feet must be grouted under pres- sure using a tremie pipe. Any boring which is permitted also requires the completion of a "Well Abandonment Form" (DWR-020) once it has been sealed. A list of approved sealing materials is included in Appendix II.

APPENDIX II

a. The following materials shall be acceptable for the grouting of boreholes.

i. Portland Neat Cement - In accordance with Table 1

ii. Portland Cement/High Grade Bentonite - In accordance with Table 2

iii. High Grade Bentonite - In accordance with Table 3

PROCEDURES FOR SEALING BORINGS/PROBE HOLES

Table 1

Portland Cement

Type of Cement	Pounds of Cement	Gallons of Water	Target Density lbs/gal	Acceptable Density Range lbs/gal	Water to Cement Ratio
I & III	94	5.2	15.6	15.0-16.3	0.46
III	94	6.3	14.8	14.2-15.5	0.56

Table 2

Portland Cement/High Grade Bentonite
Only Portland Cement Types I or II

Pounds of Bentonite	Pounds of Cement	Gallons of Water	Target Density lbs/gal	Acceptable Density Range lbs/gal	Water to Cement Ratio
5.0	94	8.3	13.9	13.4-14.5	0.74

Table 3

High Grade Bentonite
Numbers Based on 15 to 30% Solids by Weight

Pounds of Bentonite	Target Gallons of Water*	Acceptable Range of Water (gallons)*	Target Density lbs/gal**	Acceptable Density Range lbs/gal**
5.0	18	14-34	9.8	9.2-10.5

* Accurate Measurement of materials prior to mixing is imperative as air entrainment during the physical mixing of the slurry tends to decrease the density of the mixture.

** Bentonite Products and additives should be mixed in accordance with manufacturers specifications.

b. When using straight bentonite - Bentonite shall not be used for grouting in those instances where it will come in contact with ground water having a pH less than 5.0 and/or a Total Dissolved Solids content in excess of 1,000 ppm.

c. Where the grouting material extends through zones of salt water, a salt/water resistant grout material shall be used.

Grout Placement

a. Pressure Grouting - The grout shall be pumped, through a tremie pipe, in one continuous operation, from the bottom to the top of the borehole. The tremie/grout pipe may be slowly raised as the grout is being placed but the discharge end of the pipe shall remain submerged in the grout at all times until grouting is complete.

b. When grouting a borehole, the grout must extend up to the ground surface.

Potable water must be used for mixing grouting materials and drilling fluids.

The driller must maintain an accurate written log of all materials encountered, record details for each boring, and record the depth of each water bearing zone. This information must be submitted to the Bureau of Water Allocation as required N.J.S.A. 58:4A-14.

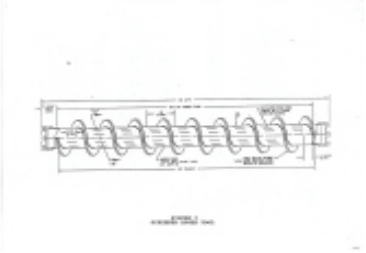
APPENDIX III

ALTERNATIVE GROUND WATER SAMPLING TECHNIQUES MATRIX SUMMARY

Tool	Construction	Floating Product Thickness Detection	Groundwater Flow Determination	Depth Limits	Sample Confined Aquifer	Vertical Profiling	Installation Dutration	Placement Method	Purge Required	Sampling Method
Screened Auger	CS	Yes	Estimate	150'	Yes (a)	Yes	less than 48 hrs	DR	Yes	B,I,P,E
Miniature Drive Point	SS, PTFE	No	No	40'	No	No	less than 48 hrs	E/Hy, H	No	P,E
Well Point	SS, CS	Yes	Yes(b)	150'	Yes (a)	Yes	less than 48 hrs(c)	DR, E/HY, H	Yes	B,I,P,E
Passively Placed Narrow Diameter Points	SS, PVC	Yes	Estimate	10'	No	No	less than 48 hrs	E/HY, H	Yes	B,I,P,E
Small Diameter Direct Push Points	SS, PVC	Yes (Slotted point only)	Estimate	80'	No	Yes(d)	less than 48 hrs	E/HY	Yes (Slotted point only)	B,I,P,E
Hydropunch Direct Push Sampler	SS, PVC	Yes (HP-II only)	Estimate	250'	Yes(a)	Yes	less than 48 hrs	DR	No	B,I,P,E

(a) Provided intermediate casing is used to isolate unconfined aquifer.
(b) If permanent installation. If not, then only an estimate.
(c) Longer installations are permitted however, installation must follow monitor well installation specifications and permit requirements.
(d) Only using blank casing with sealed point.

CS - Carbon Stee
SS - Stainless Steel
DR - Drill Rig
E/HY - Electric or Hydraulic
H - Hand
B - Bailer
I - Inertial Pump
P - Peristaltic Pump
E - Evacuation Chamber



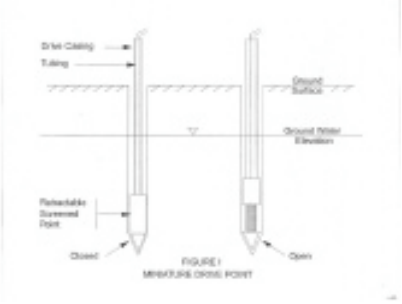


FIGURE I
MINIATURE DRIVE POINT

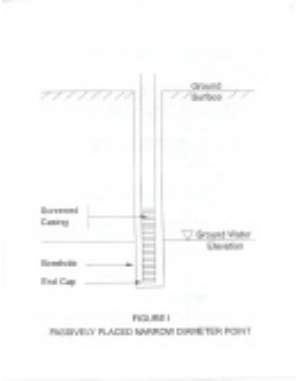


FIGURE I
PASSIVELY PLACED NARROW DIAMETER POINT

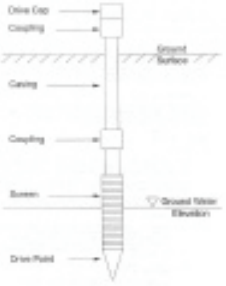


FIGURE I
WELLPOINT

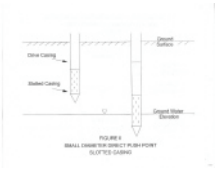


FIGURE II
SMALL DIAMETER DIRECT PUSH POINT
SLOTTED CASING

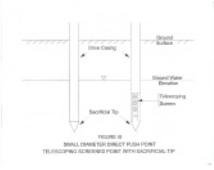
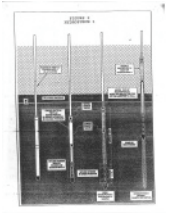
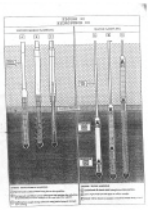


FIGURE III
SMALL DIAMETER DIRECT PUSH POINT
TELESCOPING SCREENED POINT WITH SACRIFICIAL TIP





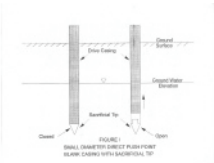


FIGURE I
SMALL DIAMETER DIRECT PUSH POINT
BLANK CASING WITH SACRIFICIAL TIP