Work Plan
for
Monitoring Well Installation

Naval Weapons
Industrial Reserve Plant
Bethpage, New York

Northern Division
Naval Facilities Engineering Command
Contract Number N62472-90-D-1298
Delivery Order 004

May 2000

TETRA TECH NUS, INC.

Work Plan Addendum for Vertical Profile Borings adjacent to the Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, New York

This document is intended to serve as an addendum to the "Hydraulic and Groundwater Quality Monitoring Plan, Northrop Grumman Corporation, Bethpage, New York", dated July 21, 1999 and prepared by ARCADIS Geraghty and Miller, Inc. (Monitoring Plan). This addendum addresses the installation of 3 Vertical Profile Borings (VPB's) that were not originally included in the Monitoring Plan.

Tetra Tech NUS, Inc. (TTNUS) is preparing this addendum under contract with the United States Navy, Northern Division. TTNUS will be performing drilling operations and monitoring well installations that are detailed in the Monitoring Plan and this addendum. This addendum will provide the necessary detail regarding the methodology for installation of the VPBs and will reference drawings in the Monitoring Plan for the VPB locations.

The purpose of the VPBs will be to collect depth specific groundwater samples from borings to establish a vertical profile of groundwater contamination at a particular location. The groundwater samples will be collected and submitted to a local laboratory for expedited analyses. The results of the laboratory analyses will be subsequently reviewed to determine the optimum depth interval for placement of proposed permanent monitoring wells. Plans for the permanent monitoring wells have already been submitted with the Monitoring Plan.

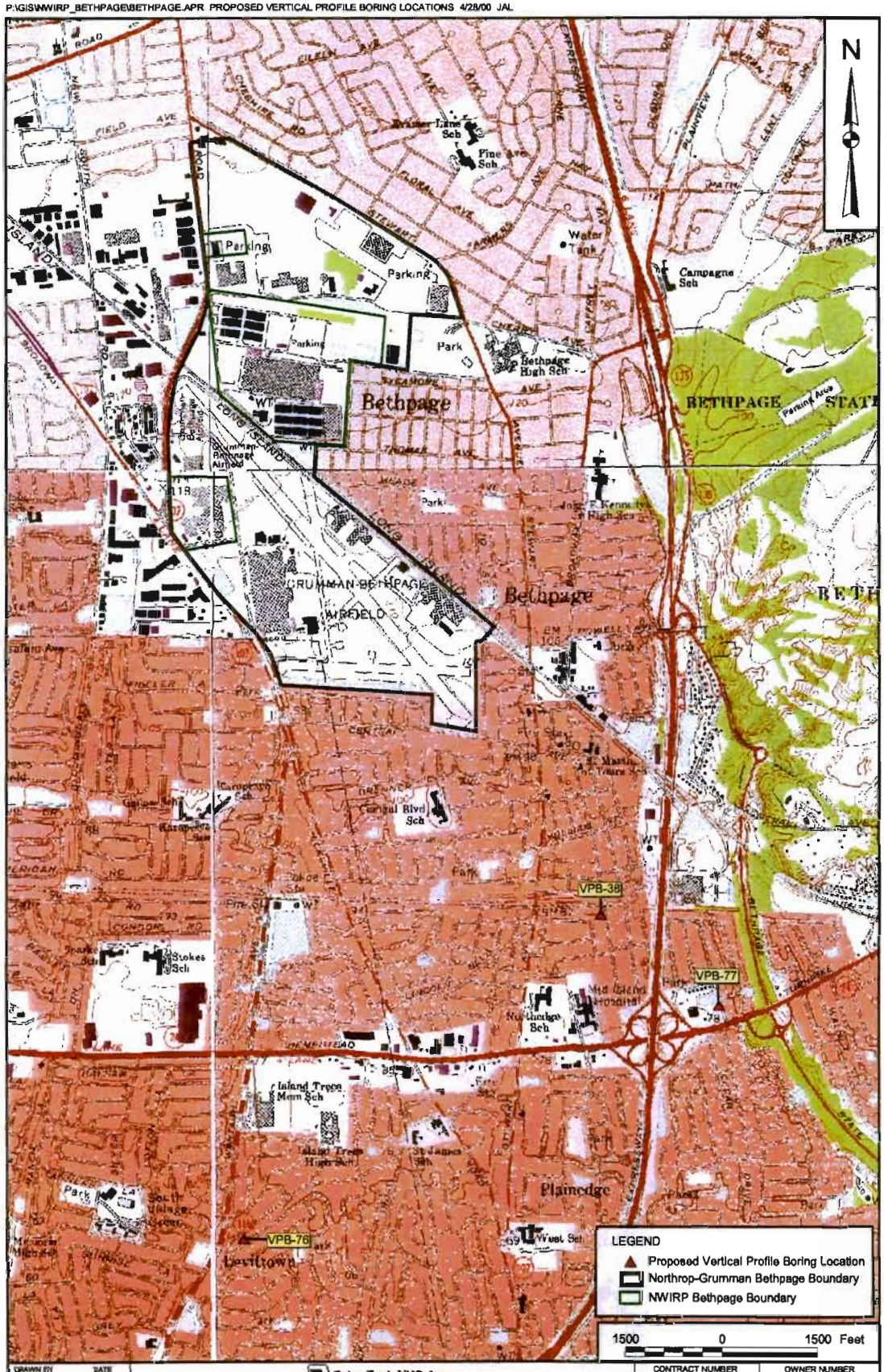
VPB's (VPB-76 and VPB-77) will be installed at two proposed well locations labeled GM-76D2/D3, and GM-77D/D2/D3; respectively. Based on the remedy selected in the off site groundwater ROD, a vertical profile boring (VPB-38) may be installed at well location GM-38D/D2. The proposed well locations are shown on Figure 1.

The VBPs will be drilled using truck mounted mud rotary drilling techniques. The injection of water and drilling mud will be performed during the drilling activity. The VPB diameters will be at least 4 inches to accommodate direct push technology (DPT) groundwater samplers. A multi baffle chamber, high capacity mud pan or dug mud pit will be used to hold muds during the drilling activity.

The groundwater samples will be collected at 10 foot intervals starting at approximately 200 to 300 feet below the ground surface and will continue until the total depth of each boring is reached. When the desired sample depth is reached in a boring, a hollow DPT sampling point that is capable of water sample collection will be advanced a distance of approximately 5 feet below the boring bottom to ensure representative groundwater samples. The DPT sampling point will be opened until filled with groundwater, closed, and then raised to the ground surface. Once reaching the ground surface, the DPT sampler will be opened and the sample vials will be filled with groundwater. Drilling and sampling will continue to the next depth interval until the total depth of each boring is reached. The estimated depth of VPB-38 is 500 feet and the estimated depth of VPB-76 and 77 are 680 feet beneath the ground surface. All groundwater samples will be submitted to the laboratory for analyses of volatile organic compounds for the analytes listed in, and accordance with, GC method SW846 8260B or equivalent New York State method. A typical VPB diagram is included in Figure 1.

QA/QC samples will be limited to trip blanks collected on a daily basis and duplicates collected at a rate of 1 in 10. Samples will be analyzed within 48 hours of sample pickup.

P:\GIS\NWIRP_BETHPAGE\BETHPAGE.APR PROPOSED VERTICAL PROFILE BORING LOCATIONS 4/28/00 JAL



DRAWN BY: J. LAMEY	DATE: 4/28/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER: N0565 / OWNER NUMBER: —
CHECKED BY: —	DATE: —	PROPOSED VERTICAL PROFILE BORINGS NWIRP BETHPAGE, NEW YORK	APPROVED BY: — / DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — / DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 1 / REV: 0

WORK PLAN FOR

MONITORING WELL INSTALLATION PROGRAM,

NWIRP BETHPAGE, NEW YORK

1.0 INTRODUCTION AND OVERVIEW

Tetra Tech NUS, Inc. (TtNUS) has been contracted to perform a subsurface investigation for the Department of Navy, Northern Division at and near the Naval Weapons Industrial Reserve Plant (NWIRP) in Bethpage, New York (hereinafter referred to as the site). Since 1994, Northrop Grumman, the U.S. Navy, and the New York State Department of Environmental Conservation (NYSDEC) have been working together to address the regional groundwater contamination issues associated with historic NWIRP Bethpage and Northrop Grumman Corporation operations. This current program is being conducted on a voluntary basis in support of a planned Operable Unit No. 2 groundwater record of decision (ROD) for the NWIRP Bethpage (Navy) and Northrop Grumman Corporation sites. Historic activities conducted in conjunction with this project include the following.

- The installation of onsite and offsite groundwater monitoring wells by Northrop Grumman and the Navy.
- The installation of well head treatment units on Bethpage Water District Wells by Northrop Grumman and the Navy as Interim Remedial Measures.
- Installation of an onsite groundwater containment and treatment system by Northrop Grumman.

These activities in combination with the installation of approximately 26 new groundwater monitoring wells and long term groundwater monitoring are expected to complete most, if not all, of the anticipated requirements of the Operable Unit No. 2 Groundwater ROD.

This work plan was developed based on the Northrop Grumman's Draft Hydraulic and Groundwater Quality Monitoring Plan (prepared by Arcadis Geraghty & Miller) dated July 21, 1999 that addressed long term groundwater monitoring in the area. The Northrop Grumman's work plan identified the need for 20 additional monitoring wells. An evaluation of the existing monitoring wells found that six of the historic wells were damaged, were lost, or went dry. As a result, six wells will be replaced as part of this field effort. After these wells and borings are installed, the Navy anticipates that Northrop Grumman will conduct the long term groundwater monitoring.

In addition to the permanent monitoring wells, vertical profile borings (VPBs) will be installed. Two VPBs will be installed to evaluate lithologic characteristics and groundwater quality conditions south (VPB-76) and southeast (VPB-77) of the sites in areas estimated to be at or beyond the leading edge of the off-site solvent plume attributable to Northrop Grumman and NWIRP. If based on the groundwater data, it is determined that solvents have not impacted groundwater in these areas, then permanent outpost monitoring well triplets would be installed in these areas as specified in the Monitoring Plan. If elevated concentrations of solvents (i.e., above the New York State Ambient Water Quality Standards) are detected in these areas, then the permanent wells would not be installed at these locations. Rather, a second location (further downgradient) would be identified and a VPB would be performed at the second location to assess whether permanent outpost wells should be installed at that location.

The third VPB, VPB-38, is a component of a contingency plan that is appended to the groundwater Feasibility Study (FS) for the Northrop Grumman/NWIRP sites. VPB-38 would be performed only if the contingency plan is selected in the Record of Decision for the site.

This document is the work plan for the subsurface investigation, which will include the drilling and installation of approximately 26 monitoring wells and 3 vertical profile borings (VPB's). The site location is shown on Figure 1. A summary of the drilling program is included in Table 1. For purposes of discussion in this work plan, the monitoring wells have been grouped in categories, consisting of wells located on property owned by Northrop Grumman, wells located off the Northrop Grumman property, and replacement wells.

The monitoring wells will be installed to different depths, which are generally classified as shallow, intermediate, deep, D2, and D3, as defined below.

- the shallow zone (+50 to +40 feet relative to mean sea level [ft msl]),
- intermediate zone (+40 to -50 ft msl),
- deep zone (-50 to -365 ft msl),
- deep2 (D2) zone (-365 to -530 ft msl), and
- deep3 (D3) zone (-530 to –600 ft msl)

The wells will be installed in clusters or adjacent to existing wells. Monitoring well clusters will be drilled, installed, and developed in the following general order, however, site-specific conditions may cause the sequence to be modified:

1. Drilling the deepest boring and collecting split-spoon samples.
2. Conducting geophysical logging (by TtNUS) of the deepest boring.
3. Constructing well (includes setting the screen and installing the backfill materials, seals, and locking protective casing), as specified below.
4. Drilling and installing the remaining shallow wells in the cluster.
5. Well developing, as specified below.

The VPB's will be drilled to depths ranging from 500 to 680 feet beneath the ground surface, depending on location. The VPB's will be drilled at locations that are adjacent to existing monitoring wells, or will be installed at locations to determine whether the areas are suitable for outpost wells. In all cases, the VPBs will be the first boring drilled at each cluster location, followed by the deepest to the shallowest monitoring well boring(s).

This section provides an introduction and overview of the program. Section 2 describes the necessary tasks to complete the fieldwork activities.

2.0 FIELD INVESTIGATION TASKS

The tasks that are necessary to complete the field activities are described in this section.

2.1 Mobilization / Demobilization

The subsurface investigation will be performed by TtNUS, with support from subcontractors for drilling, investigation derived waste (IDW) disposal, and surveying activities. The supervisor of the team will consist of a TtNUS representative, who will be identified as the Field Operations Leader (FOL). Additional TtNUS staff will be on-site as needed, and the subcontractor staff will vary from one individual for IDW activities upwards to several people for drilling activities.

It should be noted that portions of the site are high security areas. All onsite personnel must be United States citizens, and proof of citizenship will be required prior to site entry. All personnel will be required to get access to the site through TtNUS. Access will include a check in and out each day with site security, and all personnel will be required to wear a badge at all times while on site.

The TtNUS Field Operations Leader (FOL) will obtain the necessary equipment for completion of the fieldwork, including setting up the command post. Health and Safety training will be conducted for all site personnel, including maintaining all necessary documentation and ensuring compliance in accordance with the Health and Safety Plan and the subcontract documents. Locations will be cleared of utilities prior drilling.

2.2 Drilling Activities

Drilling activities will be performed by using mud rotary or hollow stem auger drilling techniques. Borings that are less than 150 feet in depth will be drilled using hollow stem auger drilling techniques, whereas borings greater than 150 feet in depth will be drilled using mud rotary drilling techniques, as described below. A boring log will be maintained for each boring drilled.

2.2.1 Hollow Stem Auger Drilling

Those borings that are less than 150 feet in depth (9 total) will be drilled using hollow stem auger drilling techniques. The inside diameter of the augers will be greater than 6 inches (outside diameter of 8 inches), to accommodate split-spoon sampling and the installation of 4-inch diameter wells.

2.2.2 Mud Rotary Drilling

Those borings that are more than 150 feet in depth (17 total and the 3 VPB's) will be drilled using mud rotary drilling techniques. The well boring diameters will be at least 8 inches to provide sufficient annular space for split –spoon sampling and the installation of 4 inch-diameter wells. A smaller diameter pilot hole can be drilled during soil sampling, however, the boring must be reamed with a larger drill bit prior to well installation. The VPB boring diameters will be at least 4 inches to accommodate direct push and split-spoon samplers. A multi-baffle chamber, high capacity mud pan or dug mud pit will be used to hold muds during the drilling activity. The injection of water and polymer free bentonite drilling mud is allowed. All lubricants that will potentially come in contact with the drilling mud will be of food grade quality. The use of any other types of additives is prohibited without prior approval with the TtNUS Project Manager.

2.3 Soil Sampling

Soil samples will be collected from selected borings for lithologic descriptive purposes. The soil samples will be collected using split spoon samplers according to ASTM D-1586 methods, at 5 or 10 foot intervals at the depths specified in Table 1, or as directed by the field geologist. In general, split spoon samples from the well borings will be collected as follows:

- If the new well to be drilled at an existing cluster will be screened deeper than the existing well(s), split spoon samples will be collected at 10-foot intervals from the total depth of the next shallowest existing well to 10 feet above the screen interval of the new well. Split spoon sampling will then proceed at 5-foot intervals to the total depth of the boring. A borehole geophysical log (natural gamma) will be performed in the deepest boring.

- If the new well to be drilled at an existing cluster will be screened shallower than the existing well(s), split spoon samples will be collected at 5-foot intervals from 10 feet above the top of the screen zone to the total depth of the boring.
- If a new cluster of wells is to be installed, the deepest well will be drilled first. Split spoon samples will be collected from the deepest well boring at 10-foot intervals from the land surface to 10 feet above the top of the proposed screen zone. Sampling will then proceed at 5-foot intervals to the total depth of the boring. Split spoon samples from shallower wells will be collected at 5-foot intervals starting at 10 feet above the top of the proposed screen zone to the total depth of the boring. A borehole geophysical log (natural gamma) will be performed in the deepest boring.

Split spoon samples in the VPB's will be collected at 10-foot intervals starting at depths of approximately 200 feet beneath the ground surface, and continuing to the total depth of each boring. Groundwater sampling will also be required in the VPB's at 10-foot intervals (as described in the Section 2.4), and will be conducted prior to collection of the soil sample at each interval, to minimize groundwater sample disturbance.

2.4 Groundwater sampling using Direct Push Technology (DPT)

Groundwater samples will be collected from the 3 VPB's using DPT. Once the desired sample depth is reached by mud rotary drilling, a DPT sampling point that is capable of water sample collection will be advanced a distance of 5 feet below the boring bottom, or as directed by the field geologist to ensure representative groundwater samples. Samples will be collected at 10-foot intervals as defined in Table 1, starting once the water table is reached, and will continue to the total depth of the boring.

Once the DPT sampler is advanced to the desired sample depth, the retractable tip will be opened, thus allowing water to fill the sampler. The filled sampler will be raised to the ground surface and the sample will be directly transferred to the sample containers for laboratory analyses. Measurements of pH, specific conductivity, and temperature will be taken from the remaining sample volume using a water quality meter. Drilling and sampling will continue to the

next depth interval until the total depth of each boring is reached. All groundwater samples will be submitted to the laboratory for analyses of volatile organic compounds for the analytes listed in, and accordance with, GC method SW846 8260B or equivalent New York State method.

Additional detail on the vertical profile boring is provided in the attached Work Plan Addendum for Vertical Profile Borings, dated May 15, 2000.

2.5 Natural Gamma Logging

Downhole Natural Gamma logging will be performed by the drilling subcontractor in selected well borings and VPBs as shown on Table 1. Upon reaching the final depth of each boring, the downhole drilling equipment will be removed, and the gamma log will be recorded from the land surface to the total depth of the boring. The results of the logging will be evaluated by TtNUS and Arcadis Geraghty and Miller (Northrop Grumman) and will be used in combination with split spoon sample observations to determine exact well screen placement within a zone.

2.6 Monitoring Well Installation

Monitoring wells will be installed in both hollow stem auger borings and in the mud rotary borings at the depth intervals shown on Table 1. A typical well construction detail is provided in Attachment 1. The well screen and riser pipe will be lowered through the center of the augers in hollow stem auger borings, and the augers will be withdrawn slowly from the boring as backfill materials are placed. Backfill materials will be kept inside the augers at all times to ensure adequate annular construction and to minimize caving. It may be necessary to remove drill cuttings from the center of the augers prior to starting well construction. The well screen and riser pipe will be lowered into the open hole of mud rotary borings, after the mud is thinned to the fullest extent possible without resulting in excessive caving. The mud rotary borings will also be reamed along the screened interval, prior to well installation to remove as much drilling mud as possible.

The depths of all backfilled materials will be constantly monitored during the well installation process by means of a wire-line measuring device. Those monitoring wells that are deeper

than 200 feet below ground surface will be fitted with centralizers at a frequency of one per 40 linear feet.

Wells shallower than 150 feet will be constructed of 4-inch inside diameter, schedule 40, NSF-grade polyvinyl chloride (PVC) well casing and screen. Wells deeper than 150 feet will be constructed of 4-inch inside diameter, schedule 80, NSF-grade PVC well casing and screen. Only materials meeting API and ASTM water well standards will be used. All well screens (slotted construction) will be 10 slot (0.010 inches). A vented PVC well cap and threaded PVC bottom cap will be installed on each well. The well riser will be completed approximately 1 foot below grade to permit installation of dedicated pumps.

All riser and screen sections will be flush-joint, internally-threaded. Joints will be made up so that when tight, all threads are buried within the riser walls. No coupling, solvents, glues, or chemical cleaners will be used in well construction.

After setting the well screen and casing, the appropriately sized gravel pack will be placed within the boring annulus, to a depth as identified in Table 1. In general, well gravel will be placed as follows:

- Shallow Wells: to a minimum of 5 feet above the top of the screen.
- Intermediate Wells: to a minimum of 5 feet above the top of the screen.
- Deep Wells: to a minimum of 10 feet above the top of the screen.
- D2 Wells: to a minimum of 20 feet above the top of the screen.
- D3 Wells: to a minimum of 40 feet above the top of the screen.

The gravel pack will be carefully poured down the annulus with a tremie pipe and its depth will be carefully checked during placement to be sure that it has not bridged. A fine sand layer (finer than gravel pack) will be placed in the annulus on top of the gravel pack in the same manner as the gravel pack, as follows:

- Shallow Wells: 1 foot thick above the top of the gravel pack.

- Intermediate Wells: 1 foot thick above the top of the gravel pack.
- Deep Wells: 5 feet thick above the top of the gravel pack.
- D2 Wells: 10 feet thick above the top of the gravel pack.
- D3 Wells: 15 feet thick above the top of the gravel pack.

A 2- to 8-foot thick bentonite seal will be installed above the fine sand layer using a tremie pipe. The seal will consist of approximately 1.25 pounds of pure bentonite per gallon of water. A Volclay® bentonite slurry will be installed within the annular space above the bentonite seal using a tremie pipe. In all wells, the slurry will be installed to approximately 3 feet below land surface in one continuous operation. The tremie pipe will be gradually removed from the annular space as the slurry is added from the bottom up. Manufacturer's specifications for all bentonite products must be submitted and approved by TtNUS prior to use.

Wells will be completed at grade by cementing a 6-inch diameter, locking curb box in place over the wells. A 0.5 foot thick concrete apron measuring 2 feet by 2 feet square will be placed around each well. Keyed alike well locks will also be required. A fine sand will be installed above the top of the bentonite slurry and inside the curb box to permit any water which may accumulate inside the curb box to drain. A typical well detail is provided as Attachment 1.

2.7 Monitoring Well Development

The monitoring wells will be developed no sooner than 24 hours after installation to remove fine materials and sediments from the area around the well screens, and to remove drill cuttings and residual fluids from the area around the monitored interval of the boring.

Monitoring wells will be developed using a combination of air lift and mechanical surging. A threaded, 2-inch diameter steel eductor pipe with a dual surge block assembly (i.e., two rubber swabs set three feet apart along a length of perforated steel pipe) will be installed in the well with the surge block set at the base of the well screen. A 3/4-inch diameter polyethylene airline will then be inserted in the eductor pipe to a depth above the top of the well screen. The well will be developed using the combination of air lift pumping and surging (vertical movement of the

surge block in the screen zone) at two-foot discrete intervals upwards along the entire length of the well screen. Field parameters, including pH (standard units), specific conductance (mS/cm), temperature (oC), and turbidity (NTU) will be monitored and recorded periodically throughout well development.

Well development will also include purging stagnant water from the well and rinsing the interior well casing above the water table by using only water from that well. The well will be covered with a clean well cap, which will be rinsed with distilled water prior to installation. The result of this operation will be a well casing free of extraneous materials (grout, bentonite, sand, etc.).

Development will continue until the well responds to water-level changes in the formation, all traces of drilling mud are removed (if the mud rotary method is used), and the well produces clear, sediment-free water, to the extent practical. In compliance with NYSDEC policy, every effort will be made to develop wells until turbidity (as measured in the field) is less than 50 nephelometric turbidity units (NTUs). However, in some instances, the 50 NTU standard may not be attainable, and the observed turbidity may be the result of the formation screened, and not inefficiencies in well design, installation, or development. Therefore, if after a "best well development effort," the 50 NTU standard cannot be attained and turbidity stabilizes (above the 50 NTU standard), the well will be acceptable, provided the integrity of the well is satisfactorily proven.

The development fluid will be containerized and transported to the decontamination area where it will be stored in a tank.

2.8 Investigative Derived Waste Handling

All Investigative Derived Waste (IDW) accumulated during the drilling activity will be collected, accumulated at the NWIRP Bethpage, and eventually disposed off site. These materials include soil cuttings, drilling mud, discharge water, and decontamination water. The soil cuttings and drilling mud will be collected in 55 gallon drums by the drilling subcontractor and will be transferred to a rolloff container that is capable of separating liquids from solid materials. The separated liquids will be pumped from the rolloff container to a holding tank. The discharge waters and decontamination waters will be collected by the drilling contractor and will be transferred to the

holding tank. All wastes will be staged for future characterization and disposal.

2.9 Decontamination

A centrally located decontamination pad will be constructed on the NWIRP Bethpage to allow for the collection of all decontamination-generated fluids. The decontamination pad would consist of a plastic liner that drains to a sump with a pump, and a plywood protective cover. All decontamination fluids will be collected and staged for characterization and subsequent disposal.

The decontamination operations will consist of washing drilling equipment using a high-pressure potable steam wash. The split spoons and the downhole groundwater sampling equipment will be decontaminated with a detergent wash a potable water rinse, and a deionized water rinse.

2.10 Surveying

All newly installed monitoring wells and the VPB's will be surveyed for both horizontal and vertical control. A total of 3 reference points will be surveyed for vertical control in the monitoring wells, including the top of the protective casing, the top of the riser pipe, and the ground surface. The center of the well cap will be surveyed for horizontal control. The VPB's will be surveyed for vertical control at the ground surface adjacent to the boring location, and for horizontal control in the center of the boring.

2.11 Documentation

Documentation required to support this project will consist of the following items:

- Field Notebook
- Boring log for each boring
- Well completion form for each well
- Sample logsheet for each sample collected for laboratory analyses

- Chain of custody form for each laboratory shipment

2.12 Spill Control Measures

Spills will be controlled using those measures that are defined in the Health and Safety Plan. The general process will include immediate response to contain the spill and subsequent cleanup measures to prevent any further impact to the environment.

Table 1
Monitoring Well Drilling and Sampling Specifications
NWIRP Bethpage, New York.

Well Designation	Drilling Method	Land Surface Elevation (ft msl)	Screened Interval (ft bls)	Total Well Depth (ft bls)	Nominal Borehole/Well Diameter and Casing Specifications (inches)	Height Gravel Pack (ft bls)	Height Fine Sand (ft bls)	Number of Split Spoons	Split Spoon or Groundwater sample Interval @ Frequency (ft)	Gamma Log	Previously Drilled Wells in cluster and Comments
NORTHROP GRUMMAN ON-SITE MONITORING WELLS (10 WELLS)											
GM-15S	HSA	110.11	60 - 70	70	8/4 Sch. 40 PVC	55	54	4	50-70@5	N	GM-15I
GM-15D	MR	110.11	300 - 320	320	8/4 Sch. 80 PVC	290	285	6	290-320@5	N	
GM-15D2	MR	110.11	540 - 560	560	8/4 Sch. 80 PVC	520	510	48	115-530@10, 530-560@5	Y	
GM-17I	HSA	116.44	100 - 120	120	8/4 Sch. 40 PVC	95	94	6	90-120@5	N	GM-17S
GM-17D	MR	116.44	305 - 325	325	8/4 Sch. 80 PVC	295	290	31	48-295@10, 295-325@5	Y	
GM-18D	MR	109.74	300 - 320	320	8/4 Sch. 80 PVC	290	285	25	105-290@10, 290-320@5	Y	GM-18S GM-18I
GM-73D2	MR	110	540 - 560	560	8/4 Sch. 80 PVC	520	510	59	0-530@10, 530-560@5	Y	
GM-74I	HSA	110	95 - 115	115	8/4 Sch. 40 PVC	90	89	6	85-115@5	N	
GM-74D	MR	110	300 - 320	320	8/4 Sch. 80 PVC	290	285	6	290-320@5	N	
GM-74D2	MR	110	540 - 560	560	8/4 Sch. 80 PVC	520	510	59	0-530@10, 530-560@5	Y	
NORTHROP GRUMMAN OFF-SITE MONITORING WELLS (13 WELLS)											
GM-21D[1]	MR	106	210 - 230	230	8/4 Sch. 80 PVC	200	195	12	140-200@10, 200-230@5	Y	GS-21S/I, N6635 replacement
GM-71S	HSA	95	50 - 60	60	8/4 Sch. 40 PVC	45	44	4	40-60@5	N	GM-71D2
GM-75D2	MR	95	525 - 545	545	8/4 Sch. 80 PVC	505	495	28	295-515@10, 515-545@5	Y	10624 10627
GM-76D[1]	MR	85	320 - 340	340	8/4 Sch. 80 PVC	310	305	6	310-340@5	N	N10999 replacement
GM-76D2	MR	85	510 - 530	530	8/4 Sch. 80 PVC	490	480	6	500-530@5	N	
GM-76D3	MR	85	660 - 680	680	8/4 Sch. 80 PVC	620	605	6	650-680@5	N	
GM-77D	MR	80	280 - 300	300	8/4 Sch. 80 PVC	270	265	6	270-300@5	N	
GM-77D2	MR	80	515 - 535	535	8/4 Sch. 80 PVC	495	485	6	505-535@5	N	
GM-77D3	MR	80	665 - 685	685	8/4 Sch. 80 PVC	625	610	6	655-685@5	N	
GM-78S	HSA	95	60 - 70	70	8/4 Sch. 40 PVC	55	54	4	50-70@5	N	
GM-78I	HSA	95	90 - 110	110	8/4 Sch. 40 PVC	85	84	14	0-80@10, 80-110@5	Y	
GM-79I	MR	95	175 - 195	195	8/4 Sch. 80 PVC	175	174	16	165-195@5	N	10628
GM-79D[1]	MR	95	300 - 320	320	8/4 Sch. 80 PVC	290	285	28	67-290@10, 290-320@5	Y	N6634 replacement

Table 1 (Continued)
Monitoring Well Drilling and Sampling Specifications
NWIRP Bethpage, New York.

Well Designation	Drilling Method	Land Surface Elevation (ft msl)	Screened Interval (ft bls)	Total Well Depth (ft bls)	Nominal Borehole/Well Diameter and Casing Specifications (inches)	Height Gravel Pack (ft bls)	Height Fine Sand (ft bls)	Number of Split Spoons	Split Spoon or Groundwater sample Interval @ Frequency (ft)	Gamma Log	Previously Drilled Wells in cluster and Comments
REPLACEMENT MONITORING WELLS (3 WELLS)											
GM-17SR[2]	HSA	116	60-70	70	8/4 Sch. 40 PVC	55	54	3	60-70@5	N	GM-17S replacement
TtNUSMW-29IR[3]	HSA	116	120-130	130	8/4 Sch. 40 PVC	120	119	4	60-110@10, 110-130@5	N	HN-29S/I, HN-29I replocement
GM-16SR[2]	HSA	116	43-53	53	8/4 Sch. 40 PVC	65	64	3	60-70@5	N	GM-16S replacement
VERTICAL PROFILE BORINGS (3 BORINGS)											
VPB-38[4]	MR	NA	NA	500	NA	NA	NA	30	50 (water table) - 500@10;	Y	GM-38D
VPB-76[5]	MR	NA	NA	680	NA	NA	NA	48	50 (water table) - 680@10;	Y	
VPB-77[5]	MR	NA	NA	680	NA	NA	NA	48	50 (water table) - 680@10;	Y	

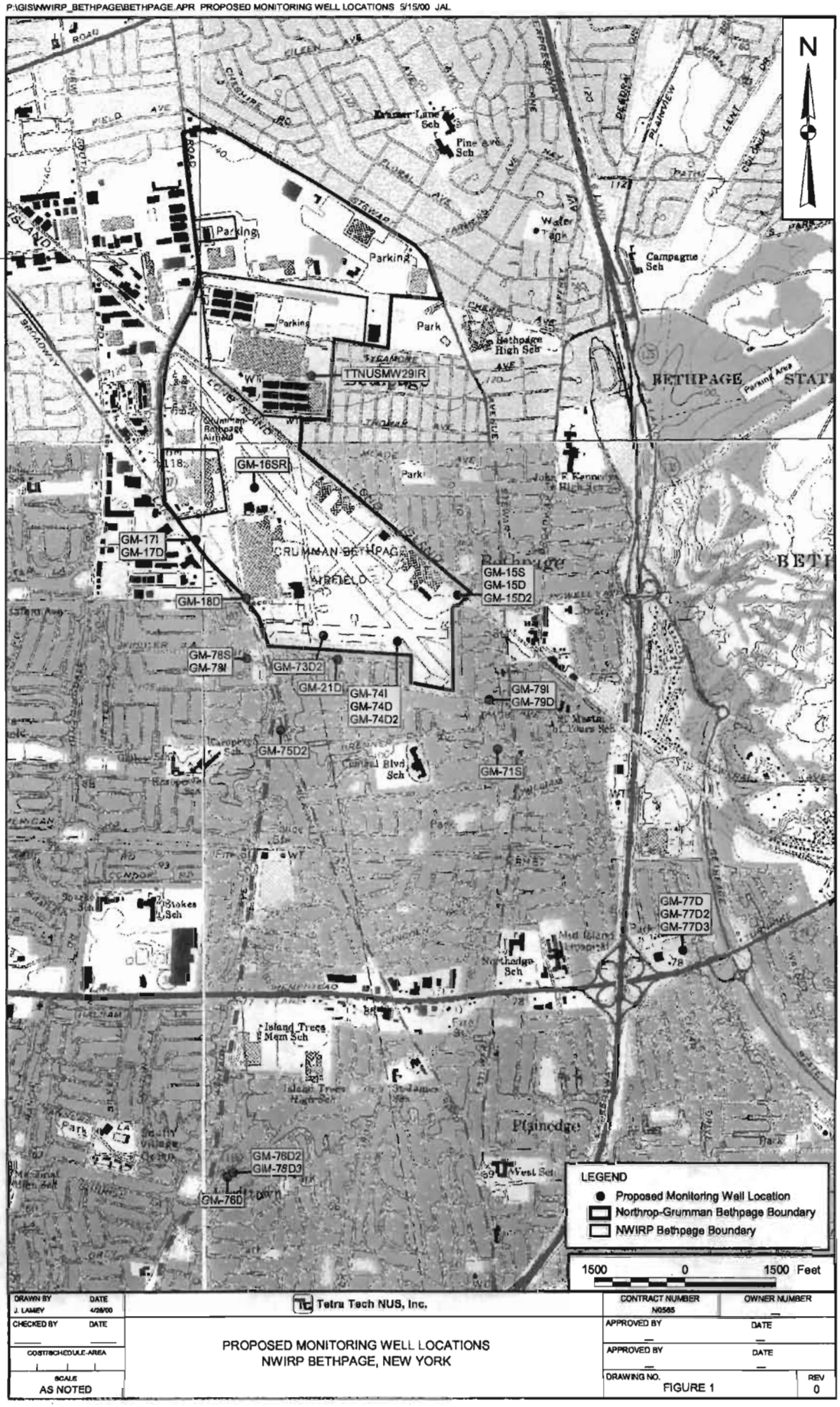
Total auger footage and Schedule 40 wells:	798	Totol Split Spoons:	528
Total MR footage and Schedule 80 wells:	7,325	Total VPB GW Samples:	171
VPB Footage	1,860		
Total	9,983	Total Footage Gamma Logs:	5,390

Note:

HSA	Hollow Stem Auger
MR	Mud Rotary
ft bls	feet below surface
ft msl	feet above mean sea level
NA	Not applicable

1 Original well could not be located. This well will be used instead of a previously proposed well.
2 The water table wells originally installed at this location went dry. This well will replace the previous water table well.
3 TtNUS is attempting to recover this monitoring well. If the well is recovered, then HN-29IR will not be installed.
4 VPB-38 will be installed only if a contingency plan for this area is included in the ROD.
5 This vertical profile boring is being installed to determine if contamination has reached this area. In the event contamination is discovered in this well, then the planned sentry wells (D, D2, and/or D3) for this area may be located further downgradient rather than at this location.

P:\GIS\NWIRP_BETHPAGE\BETHPAGE.APR PROPOSED MONITORING WELL LOCATIONS 5/15/00 JAL



DRAWN BY: J. LAMEY	DATE: 4/28/00	Tetra Tech NUS, Inc.	CONTRACT NUMBER: N0585 / OWNER NUMBER: —
CHECKED BY: —	DATE: —		APPROVED BY: — / DATE: —
COST/SCHEDULE-AREA: —		PROPOSED MONITORING WELL LOCATIONS NWIRP BETHPAGE, NEW YORK	APPROVED BY: — / DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 1 / REV: 0

ATTACHMENT 1

TYPICAL WELL DETAIL

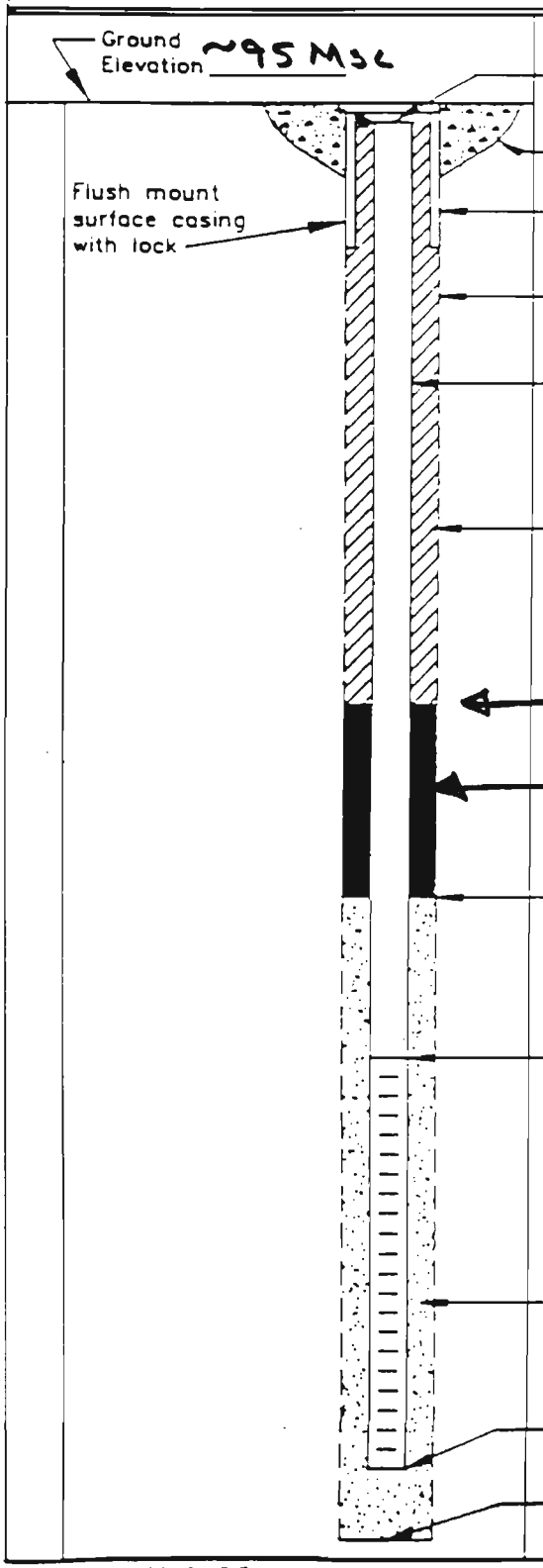
BORING NO.: 75-D2

Tetra Tech NUS, Inc.

PROPOSED MONITORING WELL SHEET 75-D2

NWIRP

PROJECT: BETHPAGE	LOCATION: BETHPAGE	DRILLER: NA-TBD	
PROJECT NO.: 5174	BORING: 75-D2	DRILLING METHOD: MUD ROTARY	
ELEVATION: ~95 MSL	DATE: 1-11-00	DEVELOPMENT METHOD: TBD	
FIELD GEOLOGIST: NA-TBD			



ELEVATION TOP OF RISER: ~ 95' MSL

TYPE OF SURFACE SEAL: CONCRETE

TYPE OF PROTECTIVE CASING: FLUSH MOUNT COVER

I.D. OF PROTECTIVE CASING: 8"

DIAMETER OF HOLE: 8"

TYPE OF RISER PIPE: PVC SCH. 80 4" DIAMETER

RISER PIPE I.D.: 3 7/8"

TYPE OF BACKFILL/SEAL: VOLCLAY BENTONITE SLURRY

DEPTH/ELEVATION OF BENTONITE SEAL: 490'/-395'

POLYMER FREE BENTONITE SEAL

DEPTH/ELEVATION TOP OF SAND: 505'/-405'

FINE SAND TO 495'

DEPTH/ELEVATION TOP OF SCREEN: 525'/-425'

TYPE OF SCREEN: PVC SCH 80 4" DIAMETER

SLOT SIZE x LENGTH: .010" X 20'

TYPE OF SAND PACK: COARSE SAND

DIAMETER OF HOLE [redacted]: ~8"

DEPTH/ELEVATION BOTTOM OF SCREEN: 545'/-450'

DEPTH/ELEVATION BOTTOM OF SAND: 545'/-450'

DEPTH/ELEVATION BOTTOM OF HOLE: 545'/[redacted]-450'

BACKFILL MATERIAL BELOW SAND: