Letter Work Plan

for

Site 6A – Fuel Calibration Area and the Southern Area

Naval Weapons Industrial Reserve Plant

Calverton, New York

Northern Division
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298

Delivery Order 033

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TETRA TECH NUS, INC.

1.0 INTRODUCTION

This Letter Work Plan for the Supplemental Sampling at Site 6A (Fuel Calibration Area) and the Southern Area at Naval Weapons Industrial Reserve Plant (NWIRP) in Calverton, New York, has been prepared under Contract Task Order (CTO) 270 by TetraTech NUS, Inc., (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298. The purpose of this Letter Work Plan is to describe the field sampling and analysis activities for additional sampling activities at Site 6A and the Southern Area, the field activities for a groundwater flow study, and natural attenuation evaluation of groundwater for the Southern Area.

1.1 OBJECTIVE AND SCOPE

The objectives of this investigation are to further characterize the southern extent of the solvent-type contamination plume from NWIRP Calverton in the Southern Area; determine if the plume is discharging to the Peconic River; and determine if biological degradation of contaminants is occurring and the rate of biodegradation and other attenuation factors relative to groundwater flow.

The field activities will be conducted in two steps. The scope of Step 1 includes installing temporary monitoring wells and piezometers, sampling and analyzing groundwater from the temporary wells, and measuring water levels in the piezometers and the Peconic River to determine hydraulic gradients in the Southern Area. Step 2 will include sampling of four existing wells or piezometers for natural attenuation evaluation and abandonment of the piezometers.

1.2 PLAN FORMAT

Section 1.0 of this plan presents this brief introduction. Section 2.0 describes the field tasks and methodologies in detail. Table 2-1 provides a summary of the field tasks with rationale. Table 2-2 summarizes the sampling program and identifies sampling locations and sample identification numbers. Table 2-3 provides a summary of temporary well and piezometers depths and split-spoon and groundwater sample depths and frequencies. Table 2-4 summarizes analytical methods; bottleware, preservation requirements, and, holding times; and, the number of environmental sample and quality assurance (QA) and quality control (QC) samples. Figure 2-1 illustrates the site plan and proposed monitoring well locations.

1.3 SCHEDULE

Step 1 field activities will begin in April 2000, concurrently with Step 2 of the Site 7 Natural Attenuation Evaluation (CTO 189) field activities. Step 2 for this investigation will begin following evaluation of the Step 1 analytical results. The proposed start date for implementation of this workplan for the Southern Area sampling will be directly related to the time that it takes to obtain the proper site access agreements from landowners in order to enter their property for the purpose of the conducting the investigation described in this workplan

2.0 FIELD TASKS

2.1 STEP 1 TASKS

2.1.1 Temporary Well Installation and Groundwater Profile Sampling

Eight temporary wells (4 at Site 6A, 1 south of Site 10B, and 3 in the Southern Area) will be installed and sampled at depth for profiling of groundwater contamination. Temporary well locations are illustrated on Figure 2-1. Sample numbers, depths, analyses and rationale are provided in Table 2-1 and 2-2. Table 2-3 provides a summary of temporary well depths and split-spoon and groundwater sampling intervals and depths. All groundwater samples from the temporary wells will be analyzed for VOCs by GC with quick-turnaround times at a local, contract laboratory.

The temporary well borings will be advanced using hollow stem auger (HSA) drilling techniques. Groundwater samples will be collected from the temporary well borings at multiple depths to provide a vertical profile of groundwater contamination. Several methods may be used for collection of representative groundwater samples of the formation at depth. Several methodologies used in past investigations include the following:

1) A Direct Push Technology (DPT) sampling point capable of water sample collection will be lowered through the center of the augers and advanced a distance of approximately 5 feet below the bottom of the lead auger. The sample point will have a retractable opening that fills with water once the sample depth is reached and closes during recovery until being raised to the ground surface. Drilling will then continue until the next sampling interval is reached.

2) A slotted lead HSA will be advanced to the desired sampling depth. Once the depth is reached, a submersible pump will be lowered through the center of the augers to the slotted section of the hollow stem auger. A sufficient volume of groundwater will be evacuated (minimum 3 volumes of boring interval), and the sample will be collected directly from the pump outlet. The pump will be removed and decontaminated, and the boring will be advanced to the next sample depth.

3) An HSA with a removable center plug will be advanced to the desired sample depth. Once the sample depth is reached, the plug will be removed, and a 2-inch diameter, PVC well screen and riser pipe will be lowered through the center of the augers to the bottom of the boring. The auger will be retracted until the well screen is exposed to the surrounding formation. A submersible pump will be lowered into the well, and a sufficient volume of groundwater will be evacuated (minimum 3 volumes of boring interval). The sample will be

collected directly from the pump outlet. The pump and screen will be removed and decontaminated, and the boring will be advanced to the next sample depth.

The water level in the well and water quality parameters of the purge water will be measured at an interval of 5 to 10 minutes during purging. Water quality parameters of pH, specific conductivity, temperature, dissolved oxygen, turbidity, salinity, and Eh/ORP will be measured during purging. Water quality parameters will be measured using a water quality meter with a flow-through or slow-over cell. A minimum of three well casing volumes will be removed prior to sampling. Following purging, groundwater samples will be collected from the wells. Sample containers for VOCs will be filled directly from the pump discharge of the submersible pump (in contrast to being collected using the "soda straw" method for a peristaltic pump, as described in Section 2.1.2). The groundwater samples will be analyzed for VOCs by GC with quick-turnaround times at a local, contract laboratory.

Additionally, groundwater from existing wells FC-MW02S and FC-MW02I will be sampled for VOCs by GC with quick turnaround times at a local, contract laboratory. Purging and sampling will be the same procedure as stated above.

All purge and sampling information will be recorded on purge data sheets and groundwater sample logsheets, respectively.

All purge water will be containerized, transported and temporarily stored in the existing polytank at NWIRP Calverton, as per Section 2.5.

Upon temporary well completion, all temporary well borings will be grouted with a bentonite / cement slurry using a tremie pipe from the bottom of the boring to the ground surface.

2.1.2 Piezometer Installation and Groundwater Sampling

Twelve temporary piezometers will be installed to collect groundwater head data to determine groundwater flow gradients in the Southern Area and to collect groundwater samples for quick-turnaround VOC analyses to profile ground contamination at depth. The piezometers will be grouped in four clusters of three piezometers, installed at shallow, intermediate, and deep depths. Piezometer locations are illustrated on Figure 2-1. If a low-permeability unit (i.e., clay layer) is encountered at depth (approximately 60 feet) at a piezometer cluster, The intermediate piezometer will be installed above the unit, and the deep piezometer will be installed below it and sealed from the aquifer above by cement/bentonite grout seal .

The piezometer borings will be advanced using HSA drilling techniques. The HSA will have an inside diameter (I.D.) of at least 3-1/4 inches to accommodate split-spoon sampling for lithology classification during advancement. Two-inch diameter split-spoon samples will be collected at the depths and frequencies summarized in Table 2-3. The deep piezometer for each cluster will be logged using a geophysical probe (i.e., natural gamma ray probe) to identify any clay layer below the depth of the intermediate piezometer. The geophysical logs will be correlated to the intermediate piezometer soil logs to confirm interpretation.

All drilling cuttings from the piezometers will be spread out at the associated piezometer locations.

After advancement to the target depth, the piezometer screen and riser pipe will be installed through the center of the drilling tools. The HSA will be retracted from the boring to a depth of 10 feet above the piezometer screen, and the boring formation will be allowed to collapse around the piezometer screen. The remainder of the boring annulus will be backfilled with a bentonite grout using a tremie pipe. The depths of all backfilled materials will be constantly monitored during the piezometer installation process by means of a weighted tape measure.

All piezometers will be constructed of 1-inch I.D., Schedule 40 PVC, flush-joint, flush-threaded riser pipe and factory-slotted well screen. All well construction materials shall be National Sanitation Foundation-approved and provided in certified clean packaging. Piezometer screens will be 5 feet in length and have slot sizes of 0.02 inches. A lockable, expandable J-plug type cap will be placed over each riser pipe.

Groundwater from the twelve piezometers will be sampled during Step 1 for quick-turnaround VOCs analyses by GC at a local, contract laboratory. The wells will be purged prior to sampling using a peristaltic pump. The tubing will be disposable high disposable polyethylene (HDPE), and the tubing intake will be placed at approximately the middle of the saturated screen. The flow rate will be approximately 0.5 to 1.5 gallons per minute (gpm). The water level in the well and water quality parameters of the purge water will be measured at an interval of 5 to 10 minutes during purging. The water quality parameters will consist of pH, specific conductivity, temperature, dissolved oxygen, turbidity, salinity, and Eh/ORP. Water quality parameters will be measured using a water quality meter with a flow-through or slow-over cell. A minimum of three well casing volumes will be removed prior to sampling. All purge water will be containerized, transported and temporarily stored in the existing polytank at NWIRP Calverton, as per Section 2.5.

Following purging, groundwater samples will be collected from the wells. Sample containers for VOCs will be filled using the "soda straw" method: the pump will be shutoff, the tubing discharge crimped, the tubing withdrawn from the well, and the sample containers filled from the intake end of the tubing while the other end is uncrimped. The process may be repeated to acquire sufficient volume to fill the sample containers. The groundwater samples will be analyzed for VOCs by GC with quick-turnaround times at a local, contract laboratory.

All purge and sampling information will be recorded on purge data sheets and groundwater sample logsheets, respectively.

A reference notch at the top of piezometer will be surveyed for horizontal location and elevation.

The piezometers will abandoned as described in Section 2.2.2.

2.1.3 River Gauge Installation

Two river gauges (RG-1 and RG-2) will be installed downstream (east) of Connecticut Avenue to measure the surface water elevation of the Peconic River to aid in determination of hydraulic gradients between the groundwater and the river. Locations for the gauges are illustrated in Figure 2-1. River gauge RG-1 will be installed in the river near piezometer cluster SA-PZ102S,I,D, and river gauge RG-2 will be installed in the river near piezometer cluster SA-PZ104S,I,D.

The gauges may be constructed of a heavy gauge, ¾- to 1-inch pipe (PVC or steel) or 2-inch slotted PVC screen (i.e., a stilling water), driven sufficiently into the river bottom as not to shift during its operational use. A surveyed, reference mark at the top of the pipe will be the measuring point for water level measurements. For the narrow, non-slotted pipe measurements will be taken from the outside of the pipe, whereas the slotted pipe may have water level measurements taken from the inside or outside.

2.1.4 Water Level Measurements

Two to three rounds of water level will be measured in the twelve piezometers and the two river gauges in the Southern Area (Figure 2-1). The number of rounds will be dependent on whether the initial water level measurement round provides sufficient hydraulic head data to accurately determine vertical hydraulic gradients in the Southern Area.

Water levels will be measured using an electronic water level/free product indicator to 0.01 feet. The measurements will be taken within an 8-hour period, no sooner than 1 week after installation the piezometer clusters, and no sooner than 48 hours after a significant rainfall event (1.0 inches). Measurements will be recorded on a water level measurement logsheet.

2.2 STEP 2 TASKS

2.2.1 Groundwater Sampling for Natural Attenuation Evaluation

Groundwater at three existing wells (FC-MW01S, FC-MW02S and FC-MW03S) and two temporary wells or piezometers (to be determined) will be sampled for natural attenuation parameters and VOCs. The sample locations for the temporary wells or piezometers will be determined based on the results of the Step 1 analytical results. The sample analyses and rationale for the five sample locations are summarized in Table 2-2.

[Note: As noted in the guidance *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents In Ground Water* (USEPA, September 1998), hydrogen is an "optional specialized analysis". The analysis of hydrogen for evaluation of natural attenuation processes involves a complex field extraction using a glass, bubble-strip sampler. In order to perform the field extraction, the method requires approximately 30 additional minutes of groundwater purging at a flow rate of 300 ml/minute. In addition, a very limited number of analytical laboratories are capable of performing the innovative analysis, and the current level of quality assurance using the method is very low.

In the majority of aquifer systems, an evaluation of available electron donors and acceptors is sufficient to determine the terminal electron acceptor process (TEAP) that is responsible for the site-specific biodegradation processes. There are some site where the relationship is not straightforward and the collection of hydrogen may be warranted. However, based on the current cost and low quality assurance of the current methodology, it is recommended that hydrogen not be collected unless otherwise required based on site-specific conditions.]

The wells will be purged prior to sampling using a peristaltic pump. The tubing will be disposable high disposable polyethylene (HDPE), and the tubing intake will be placed at approximately the middle of the saturated screen. Care will be taken during tubing installation as to minimize disturbance to the water for accurate measurement of parameters and minimize suspension of any fine particles in the well, which would influence turbidity. The flow rate will be approximately 0.5 to 1.5 gallons per minute (gpm). The water level in the well and water quality parameters of the purge water will be measured at an interval of 5 to 10 minutes during purging. The water

quality parameters will consist of pH, specific conductivity, temperature, dissolved oxygen, turbidity, salinity, and Eh/ORP. Water quality parameters will be measured using a water quality meter with a flow-through or slow-over cell. A minimum of three well casing volumes will be removed prior to sampling. Turbidity readings of less than 1 NTU, or stabilization (±10%) of consecutive readings for turbidity values greater than 1 NTU, should also be achieved prior to sampling. All purge water will be containerized, transported and temporarily stored in the existing polytank at NWIRP Calverton, as per Section 2.5.

Following purging, groundwater samples for VOCs analyses by GC/MS will be collected from the wells. Sample containers for VOCs will be filled using the "soda straw" method: the pump will be shutoff, the tubing discharge crimped, the tubing withdrawn from the well, and the sample containers filled from the intake end of the tubing while the other end is uncrimped. The process may be repeated to acquire sufficient volume to fill the sample containers.

All purge and sampling information will be recorded on purge data sheets and groundwater sample logsheets, respectively.

If it is determined additional temporary wells are required to satisfy the rationale in Table 2-2, these new temporary well will be installed with PVC riser and screen, as described Section 2.1.1.

All purge water will be handled as described in Section 2.5.

2.2.2 Piezometer Abandonment

All piezometers will be abandoned after the completion of the water level measurement round and the groundwater sampling for natural attenuation parameters. The shallow and intermediate depth piezometers will be abandoned by removal of the well casing and screen from the borings and the remaining annulus backfilled with a cement/bentonite grout. The piezometers will be filled with a thin grout slurry prior to removal of the well pipe in the event that it breaks off during removal. The deep depth piezometers will be grouted in place without removal of the well pipe. The casing for the deep depth piezometers will be cutoff approximately 1 to 2 feet below grade, and the surface restored to surrounding conditions (i.e., grass or asphalt). Grout will be backfilled using a tremie pipe.

2.3 SAMPLE DESIGNATION, HANDLING, AND ANALYSIS

All samples will be identified with a unique sample number. The sample number will consist of up to five parts, including the site identifier, media type, well number, sample depth, and year. An example sample number is provided below with explanation.

e.g., FC-GW04-160-00

where, FC = site identifier (Fuel Calibration Area)
GW = media type (groundwater)
04 = temporary well FC-TW04
160 = 160 feet below grade
00 = Year 2000.

QA samples (trip blanks and field duplicates) will be designated by media type and QA type with the date collected

e.g., GWFD-041500 would be the groundwater field duplicate collected on April 15, 2000

GWTB-041500 would the trip blank collected on the same day.

Sample analyses, bottleware, preservation, and holding times are provided in Table 2-4.

2.5 INVESTIGATION-DERIVED WASTE HANDLING

Several types of investigation-derived waste (IDW) are anticipated to be generated during this fieldwork. They include soil cuttings, well development water, purge water, decontamination water, and used personal protective equipment (PPE). Soil cuttings from temporary well and piezometer installation will be spread in the area immediately surrounding the associated source boring, unless elevated PID readings or visual observations indicate contamination. In such a case, contaminated soil cuttings will be containerized and temporarily stored on-site for disposal off-site.

All development water, purge water, and decontamination water in be collected and transported to the existing on-site holding tank. One sample will be collected from the holding tank for off-site disposal characterization.

Used PPE (gloves, Tyvek coveralls, etc.) will rinsed and then double-bagged and disposed in NWIRP trash receptacles.

2.6 DECONTAMINATION

All drilling equipment (i.e., split spoon samplers and augers) along with any part of the drilling rig which comes in contact with the site soil will be decontaminated using a high-pressure steam wash prior to commencing drilling, between locations, and prior to leaving the site. Split-spoon samplers and pumps will also be decontaminated between samples using Alconox/Liquinox® detergent wash and analyte-free water rinse. All decontamination fluids will be collected and stored in the existing holding tank.

Water quality meters and water level/free product indicators will be rinsed with deionized water between measurements in wells.

2.7 QUALITY ASSURANCE (QA) /QUALITY CONTROL (QC)

2.7.1 Equipment Calibration

Field instruments (water quality meters and PIDs) will be calibrated according to manufacturer's recommendations and at a frequency recommended by the manufacturer.

2.7.2 QA/QC Samples

The frequency and type of QA/QC samples is summarized in Table 2-4.

TABLE 2-1

FIELD TASKS SUMMARY
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK
PAGE 1 of 2

STEP	ACTIVITY	SAMPLE ANALYSES	RATIONALE
1	**Site 6A** **Temporary Well Installation and Groundwater Profile Sampling** • 5 temporary wells – 18 groundwater samples (3 samples from 4 wells and 6 samples from 1 well)	• VOCs • Lithology	Collect additional data to characterize VOC contaminant plume vertically around Sites 6A and 10B.
	Southern Area **Temporary Well Installation and Groundwater Profile Sampling** • 3 temporary wells – 15 groundwater samples (5 samples per well)	• VOCs • Lithology	Collect additional data to characterize VOC contaminant plume laterally and vertically in Southern Area and determine hydraulic relationship of Peconic River and groundwater.
	Piezometer Installation • 12 piezometers [4 clusters of 3 piezometers (shallow, intermediate, and deep depths)]	• VOCs • Lithology	
	Additional Step 1 Activities: **River Gauge Installation** • 2 River Gauges along Peconic River		
	Water Level Measurement		

TABLE 2-1 (Continued)
FIELD TASKS SUMMARY
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK
PAGE 2 of 2

STEP	ACTIVITY	SAMPLE ANALYSES	RATIONALE
2	**Site 6A/Southern Area** **Groundwater Sampling** • 5 existing or temporary wells or piezometers – 5 groundwater samples (1 sample from each well) **Temporary well and piezometer abandonment**	• VOCs, Natural Attenuation Parameters	Collect chemical and geochemical data for natural attenuation evaluation of plume.

Notes:

VOCs = volatile organic compounds.

TABLE 2-2

SUMMARY OF SAMPLE PROGRAM
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK

STEP	WELL NUMBER	SAMPLE IDENTIFICATION[1]	SAMPLE DEPTH (feet bgs)	SAMPLE ANALYSES	RATIONALE
1	FC-TW-04	FC-GW04-160-00 FC-GW04-180-00 FC-GW04-200-00	160 180 200	VOCs (quick-turn)	Characterize plume at depth in source area; at existing location FC-TW02/MW02
	FC-TW-09	FC-GW09-160-00 FC-GW09-180-00 FC-GW09-200-00	160 180 200	VOCs (quick-turn)	Characterize plume at depth downgradient along centerline
	FC-TW-20	FC-GW20-100-00 FC-GW20-120-00 FC-GW20-140-00 FC-GW20-160-00 FC-GW20-180-00 FC-GW20-200-00	100 120 140 160 180 200	VOCs (quick-turn)	Provide groundwater quality data at depth upgradient of Site 6A and along western property line
	FC-TW-21	FC-GW21-60-00 FC-GW21-80-00 FC-GW21-100-00	60 80 100	VOCs (quick-turn)	Characterize plume at depth downgradient along centerline; at existing location FC-MW05S/I
	ET-TW-04[2]	FC-GW09-60-00 FC-GW09-80-00 FC-GW09-100-00	60 80 100	VOCs (quick-turn)	Characterize plume at depth downgradient along centerline, near southern property line
	FC-MW02S	FC-GW02S-00	Water table	VOCs (quick-turn)	Characterize plume in source area
	FC-MW03S	FC-GW03S-00	Water table	VOCs (quick-turn)	Characterize plume in source area
	SA-TW-11G	SA-GW113-05-00 SA-GW113-20-00 SA-GW113-40-00 SA-GW113-60-00 SA-GW111-80-00	5 or water table 20 40 60 80	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-101S	SA-PZ101S-05-00	5-10	VOCs (quick-turn)	Characterize plume in Southern area, downgradient terminus of plume
	SA-PZ-101I	SA-PZ101I-50-00	50-55	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume

TABLE 2-2 (Continued)
SUMMARY OF SAMPLING PROGRAM
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK
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STEP	WELL NUMBER	SAMPLE IDENTIFICATION[1]	SAMPLE DEPTH (feet bgs)	SAMPLE ANALYSES	RATIONALE
1 (Cont.)	SA-PZ-101D	SA-PZ101D-70-00	75-80	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-102S	SA-PZ102S-05-00	5-10	VOCs (quick-turn)	Characterize plume in Southern area, downgradient terminus of plume
	SA-PZ-102I	SA-PZ102I-50-00	50-55	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-102D	SA-PZ102D-70-00	75-80	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-103S	SA-PZ103S-05-00	5-10	VOCs (quick-turn)	Characterize plume in Southern area, downgradient terminus of plume
	SA-PZ-103I	SA-PZ103IS-50-00	50-55	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-103D	SA-PZ103D-70-00	75-80	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-104S	SA-PZ104S-05-00	5-10	VOCs (quick-turn)	Characterize plume in Southern area, downgradient terminus of plume
	SA-PZ-104I	SA-PZ104I-50-00	50-55	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
	SA-PZ-104D	SA-PZ104D-70-00	75-80	VOCs (quick-turn)	Characterize plume at depth in Southern area, downgradient terminus of plume
2	FC-MW01S	FC-GW01S-15-00	Water table	VOCs, Natural Attenuation Parameters[3]	Upgradient of plume (reference location)
	FC-MW02S	FC-GW02S-15-00	Water table	VOCs, Natural Attenuation Parameters[3]	Center of plume
	FC-MW03S	FC-GW03S-15-00	Water table	VOCs, Natural Attenuation Parameters[3]	Downgradient, center of plume
	TBD	XX-GWXX-XX-00	TBD	VOCs, Natural Attenuation Parameters[3]	Downgradient, center of plume, near Peconic River with VOCs detected during Step 1
	TBD	XX-GWXX-XX-00	TBD	VOCs, Natural Attenuation Parameters[3]	Downgradient, center of plume, near Peconic River with VOCs nondetected during Step 1

VOCs = volatile organic compounds.
TBD = to be determined.

[1] Sample identification includes four section: AA- = site name [Fuel Calibration (FC), Engine Test House (ET), or Southern Area (SA)]
GWNN = media type (groundwater) and alphanumeric temporary well number
-NN = sample profile depth

TABLE 2-2 (Continued)
SUMMARY OF SAMPLING PROGRAM
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK
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-NN = year
(XX = TBD)

[2] Location downgradient of Site 10B-Engine Test House.

[3] Natural attenuation parameters include ethene, ethane, methane, dissolved iron and manganese, alkalinity, BOD, COD, TOC, chloride, nitrate, nitrite, orthophosphate, sulfate, sulfide and field-measured parameters of carbon dioxide, dissolved oxygen, dissolved ferrous iron, hydrogen sulfide, pH, temperature, specific conductivity, and Eh.

TABLE 2-3

WELL/PIEZOMETER INSTALLATION SUMMARY
SUPPLEMENTAL SAMPLING
SITE 6A-FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK

Temporary Well/ Piezometer Number	Total Depth (feet bls)	Screen Interval (feet bls)	Split Spoon Samples		Groundwater sample	
			Total Number	Interval (feet bls) @ Frequency (feet)	Total Number	Interval (feet bls) @ Frequency (feet)
SITE 6A						
FC-TW04	200	NA	9	160-200 @ 5	3	160-200 @ 20
FC-TW09	200	NA	9	160-200 @ 5	3	160-200 @ 20
FC-TW20	200	NA	21	100-200 @ 5	6	100-200 @ 20
FC-TW21	100	NA	9	60-100 @ 5	3	60-100 @ 20
ET-TW06	100	NA	9	60-100 @ 5	3	60-100 @ 20
SOUTHERN AREA						
SA-TW111	80	NA	17	0-80 @ 5	5	5-80 @ 20
SA-TW112	80	NA	17	0-80 @ 5	5	5-80 @ 20
SA-TW113	80	NA	17	0-80 @ 5	5	5-80 @ 20
SA-PZ101S	10	5-10	0	0	1[3]	5-10
SA-PZ101I	60	50-55[1]	9	0-40 @ 5	1[3]	50-60
SA-PZ101D	80	75-80[1]	0	GR[2] @ 0-80	1[3]	70-80
SA-PZ102S	10	5-10	0	0	1[3]	5-10
SA-PZ102I	60	50-55[1]	9	0-40 @ 5	1[3]	50-60
SA-PZ102D	80	75-80[1]	0	GR[2] @ 0-80	1[3]	70-80
SA-PZ103S	10	5-10	0	0	1[3]	5-10
SA-PZ103I	60	50-55[1]	9	0-40 @ 5	1[3]	50-60
SA-PZ103D	80	75-80[1]	0	GR[2] @ 0-80	1[3]	70-80
SA-PZ104S	10	5-10	0	0	1[3]	5-10
SA-PZ104I	60	50-55[1]	9	0-40 @ 5	1[3]	50-60
SA-PZ104D	80	75-80[1]	0	GR[2] @ 0-80	1[3]	70-80

TW = temporary well
PZ = piezometer
bls = below land surface

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[1] Actual depths of screen intervals for intermediate and deep piezometers dependent upon depth of clay layer (if encountered).
[2] GR = natural gamma ray log only; no split-spoon samples
[3] Collected during Step 2

TABLE 2-4

SUMMARY OF GROUNDWATER ANALYTICAL PROGRAM
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK
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ANALYSIS	METHOD	BOTTLEWARE[1]	PRESERVATION	HOLDING TIME	NUMBER OF SAMPLES	TRIP BLANK[2]	DUPLICATE[3]	MS/MSD[4]	TOTAL NUMBER OF SAMPLES[5]
FIXED-BASE LABORATORY ANALYSES									
Volatile Organic Compounds (VOCs)	CLP OLM03.2	3 x 40 mL glass vial	HCl, pH<2, 4ºC	14 days	5	2	1	1	8
VOCs (GC)	SW-846 8021B	3 x 40 mL glass vial	HCl, pH<2, 4ºC	14 days	47	10	5	3	62
Ethene, Ethane, Methane	RSK SOP 147, 175	1 x 40 mL glass vial	HCl, pH<2, 4ºC	14 days	5	--	1	--	6
Iron, Manganese (Dissolved)	SW-846 6010B	1 x 1L HDPE	HNO_3, pH<2, 4ºC	6 months	5	--	1	--	6
Alkalinity	EPA 310.1 (Manual Titrimetric)	100-250 mL in glass or HDPE	4ºC	14 days	5	--	1	--	6
Biological Oxygen Demand (BOD) (5-day)	EPA 405.1	1 x 2L HDPE	4ºC	48 hours	5	--	--	--	6
Chemical Oxygen Demand (COD)	EPA 410.1	1 x 125 mL HDPE	H_2SO_4, pH<2, 4ºC	28 days	5	--	--	--	6
Total Organic Carbon (TOC)	EPA 415.1	1 x 125 mL amber glass	H_2SO_4, pH<2, 4ºC	28 days	5	--	--	--	6
Chloride (Cl^-)[6]	EPA 300	250 mL in HDPE	4ºC	48 hours	5	--	1	--	6
Nitrate (NO_3^-)[6]	EPA 300	250 mL in HDPE	4ºC	48 hours	5	--	1	--	6
Nitrite (NO_2^-)[6]	EPA 300	250 mL in HDPE	4ºC	48 hours	5	--	1	--	6
Orthophosphate (PO_4)[6]	EPA 300	250 mL in HDPE	4ºC	48 hours	5	--	1	--	6
Sulfate (SO_4^{-2})[6]	EPA 300	250 mL in HDPE	4ºC	28 days	5	--	1	--	6
Sulfide (S^{-2})	EPA 376.1	1L HDPE	NaOH to pH>12	7 days	5	--	1	--	6

TABLE 2-4 (Continued)
SUMMARY OF GROUNDWATER ANALYTICAL PROGRAM
SUPPLEMENTAL SAMPLING
SITE 6A – FUEL CALIBRATION AREA AND SOUTHERN AREA
NWIRP CALVERTON, CALVERTON, NEW YORK
PAGE 2 of 2

ANALYSIS	METHOD	BOTTLEWARE[1]	PRESERVATION	HOLDING TIME	NUMBER OF SAMPLES	TRIP BLANK[1]	DUPLICATE[2]	MS/MSD[3]	TOTAL NUMBER OF SAMPLES[4]
FIELD LABORATORY ANALYSES									
Carbon Dioxide (CO_2)	Hach Test Kit No. CA-DT or CHEMetrics Test Kit No. K-1910, K-1920, K-1925	As per test kit instructions	As per test kit instructions	Analyze Immediatley	5	--	5	--	10
Dissolved Oxygen	Hach Test Kit No. OX-DT or CHEMetrics Test Kit No. K-7501, K-7512	As per test kit instructions	As per test kit instructions	Analyze Immediatley	5	--	5	--	10
Ferrous Iron (Fe^{+2})	Hach Test Kit No. IR-18C	As per test kit instructions	As per test kit instructions	Analyze Immediatley	5	--	5	--	10
Hydrogen Sulfide (H_2S)	Hach Test Kit No. HS-C	As per test kit instructions	As per test kit instructions	Analyze Immediatley	5	--	5	--	10

1 Bottleware requirements may differ in number depending on the requirements of the contracted laboratory.
2 Trip Blank – Quality assurance (QA) sample of analyte-free water originating from the laboratory, taken to the site, and returned with the VOC samples. Collected at a frequency of one trip blank per cooler containing VOC samples per day.
3 Duplicate – A single sample split into equal portions during a single act of sampling. Will be collected at a frequency of 1 duplicate sample for fixed-based laboratory analyses during Step I and II, and all field analyses will be duplicated during Step II.
4 MS/MSD – Matrix Spike/Matrix Spike Duplicate. Additional sample volume supplied to fixed-base laboratory for internal QA/Qulaity Control (QC) checks. Will be collected at a frequency of 20% of samples for VOCs only.
5 Excludes MS/MSD samples.
6 May be collected in 1 x 1L HDPE bottle with other water chemistry parameters..

HCl = hydrochloric acid.
HNO_3 = nitric acid.
NaOH = sodium hydroxide.
HDPE = high-density polyethylene plastic.

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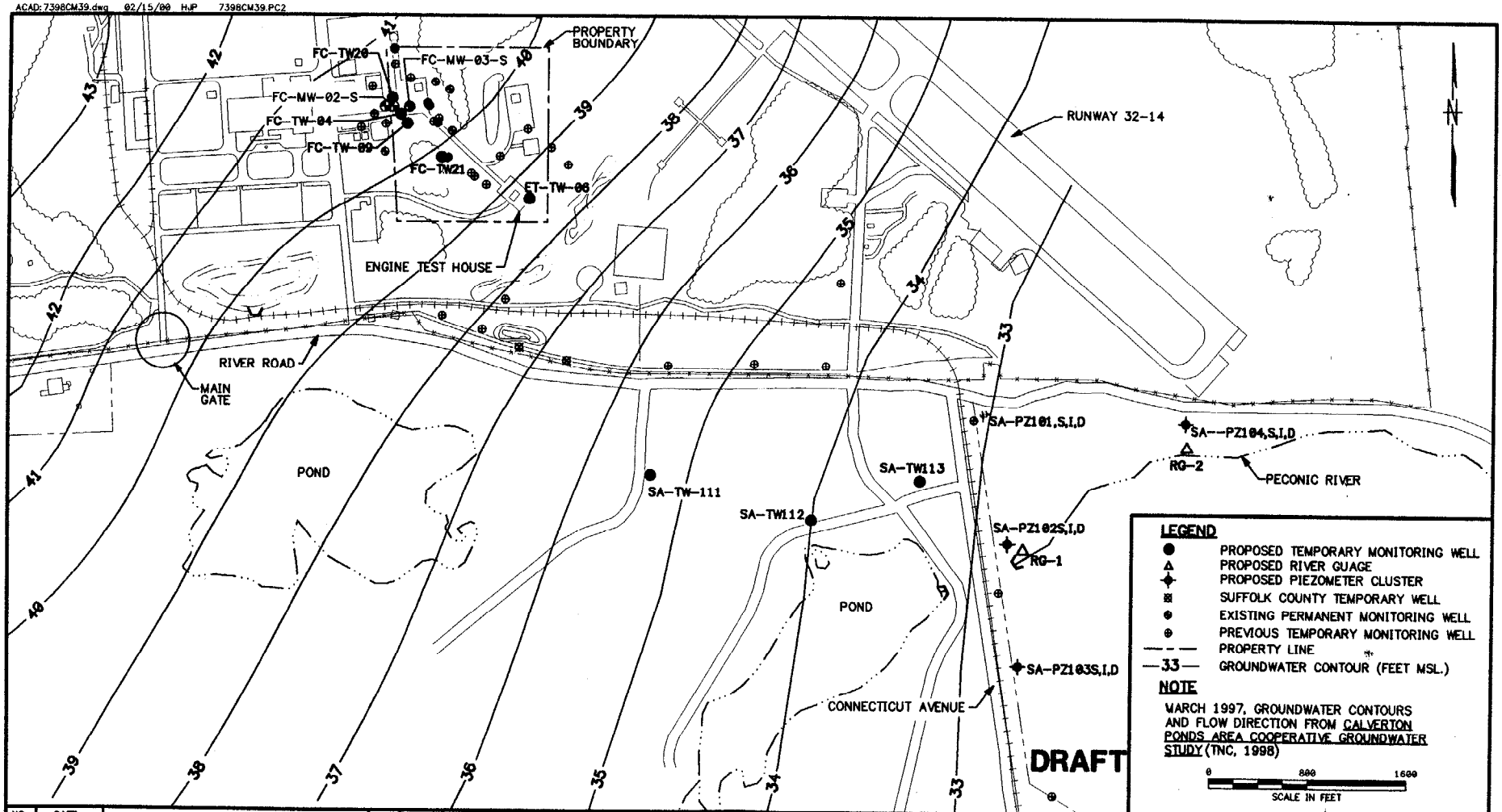

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 1/26/00
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

EXISTING AND PROPOSED WELL LOCATIONS
SITE 6A AND SOUTHERN AREA
NWIRP, CALVERTON, NY

CONTRACT NO. 7398
OWNER NO. 0270
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2-1
REV. 0

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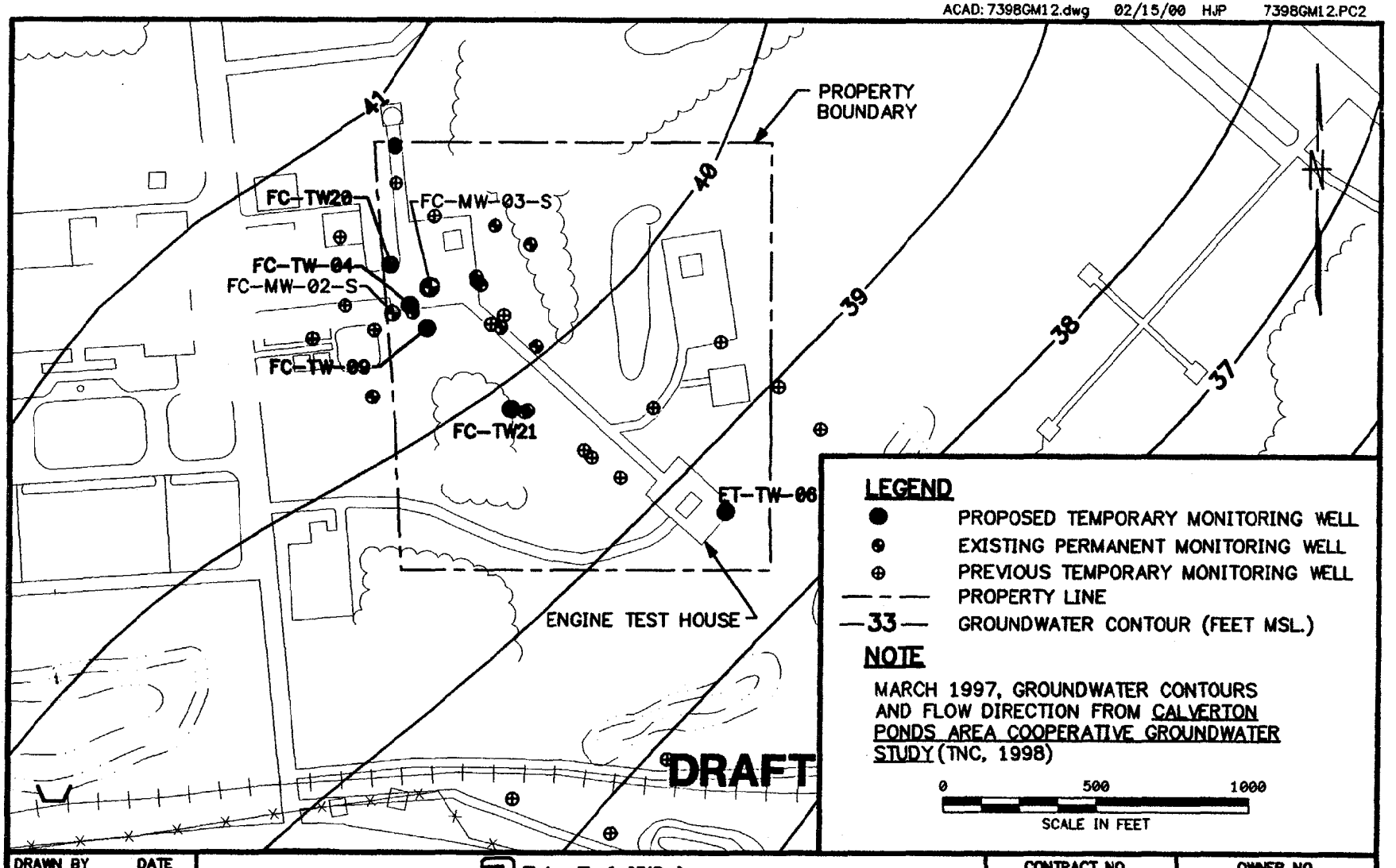

DRAWN BY HJP DATE 2/15/00	Tetra Tech NUS, Inc.	CONTRACT NO. 7398	OWNER NO. 0270
CHECKED BY DATE	EXISTING AND PROPOSED MONITORING WELL LOCATIONS SITE 6A NWIRP, CAVERTON, NY	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 2-2	REV. 0

FORM CADD NO. T+NUS_AH.DWG - REV 0 - 1/22/98