LETTER WORK PLAN
SOUTHERN AREA – BIODEGRADATION STUDY
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK

1.0 INTRODUCTION

This Work Plan has been prepared for the Mid-Atlantic Division of the Naval Facilities Engineering Command (NAVFAC) under Contract Task Order (CTO) 160 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) contract number N62472-03-D-0057. This Work Plan outlines activities to be performed to evaluate biological activity in groundwater at the Southern Area, NWIRP Calverton, Calverton, New York (Figures 1-1 and 1-2). This Work Plan provides supplemental guidance to the Work Plan for Groundwater Investigation and Groundwater Monitoring (2009 and 2010) at Site 2/Site 6A/Site 10B and Southern Area (Master Work Plan) (Tetra Tech, 2008a). This project is being conducted in accordance with the Navy Environmental Restoration (ER) Program and New York State Department of Environmental Conservation (NYSDEC) Resource Conservation and Recovery Act (RCRA) permit number 1-4730-00013/00001-0.

1.1 SCOPE AND OBJECTIVE

The Southern Area has been identified as having been impacted by historic releases of volatile organic chemicals (VOCs). A non-continuous VOC plume has been identified emanating from Site 6A, and traveling to the southeast into the Southern Area. Groundwater samples collected in Southern Area wells have reported detections of chlorinated VOCs including 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), and chloroethane (CA).

The objective of this testing is to investigate specified subsurface conditions and gauge its favorability for biodegradation of site-related chlorinated VOCs. The chlorinated VOCs at the site may be addressed by biodegradation, either unaided (natural) or assisted (enhanced) by means of augmentation injections. In order for biodegradation to be a viable option, certain physical and chemical conditions need to exist in the groundwater. Optimal conditions for biodegradation of chlorinated VOCs include an anaerobic environment (oxygen deficient), a chemically reducing environment (negative oxygen-reduction potential), and the presence of soluble biodegradable organics that allow bacterial growth. In addition, the detection of certain bacteria that have a demonstrated ability to degrade chlorinated VOCs, (i.e., *Dehalobacteri* (DHB) and *Dehalococcoides* (DHC), provide additional evidence of biodegradation. Some of the chlorinated VOCs (1,1-DCA, 1,1-DCE, and CA) can also biodegrade under aerobic conditions. The Study activities include the sampling of six groundwater wells for geochemical parameters, VOCs, and bacterial species.

2.0 SITE BACKGROUND

2.1 SITE HISTORY

The Southern Area is located southeast of Site 10B and extends to the south and southeast. This area was originally investigated because chlorinated VOCs were detected in a Suffolk County monitoring well down gradient of the facility in the 1980s and 1990s. There are no known or suspected contaminant sources within this area. However, the area is hydraulically down gradient of Site 6A, Site 10B, and the NWIRP general industrial complex. Site 6A is a documented source of chlorinated VOCs in groundwater. The groundwater flow direction through this area is southeast toward the Peconic River and the River is the likely end point for groundwater flow from this area.

The Southern Area is mostly wooded and includes two shallow ponds and drainage swales. The ponds also receive runoff through a drainage swale and culvert directly from Site 6A. From the late 1980s to the early 1990s, chlorinated VOC-contaminated groundwater from Site 6A was discharged into this drainage swale and culvert and into one of the shallow ponds. As a result, the presence of chlorinated VOCs in groundwater at the Southern Area may be attributable to Site 6A (TtNUS, 2007).

The Peconic River Sportsman's Club (PRSC) is located in the Off-site Southern Area. Water supply wells on the PRSC are classified as a Non-Community Public Water Supply under Part 5 Sub Part 5-1 of the New York State Sanitary Code. Two of the wells have been impacted by chlorinated VOCs.

2.2 BACKGROUND

Southern Area - On-Site

The On-Site Southern Area extends south and east from Sites 6A and 10B to the Navy property line along River Road (see Figure 1-2). Groundwater in the On-Site Southern Area was studied during several investigations conducted between 1997 and 2008. During these investigations, groundwater samples were collected from temporary well points at several depths and permanent groundwater monitoring wells. Chlorinated VOCs consisting of a chlorinated solvent (1,1,1-TCA) and associated degradation products (1,1-DCA, 1,1-DCE, and CA) were detected in groundwater at Site 6A and in wells approximately 3,000 feet down gradient of Site 6A. The highest concentrations of chlorinated VOCs were detected just north of River Road (Navy property line). Groundwater between Site 6A and an area approximately 500 feet north of River Road was relatively free of VOCs. Only sporadic and relatively low concentrations of chlorinated VOCs were detected and there was no apparent pattern to the detections. The finding of discontinuous contamination from the original source area (Site 6A) to the contamination found along River Road indicates that an ongoing release from Site 6A is not occurring. Also, the On-Site

Southern Area groundwater contamination is likely to have resulted from either historic intermittent releases at Site 6A and groundwater migration, or from potential overland migration through a series of ditches and ponds in the area and then infiltration.

The area of the on-site plume is approximately 34 acres (1,500,000 square feet). The chlorinated VOC contamination was generally detected in a 10-foot thick interval, located approximately 40 to 50 feet below ground surface (bgs). Soils from the ground surface to approximately 40 or 50 feet bgs are generally a fine grained sand. At 50 feet bgs, there is a silty clay aquitard that would prevent deeper migration of contamination. Some fuel-related compounds were also detected in the On-Site Southern Area Plume, but these detections were generally very low.

The quantity of chlorinated and non-chlorinated VOC contamination in the On-Site Southern Area Plume is estimated to be 40 pounds and 0.7 pounds, respectively. The volume of contaminated groundwater is estimated to be 42,000,000 gallons. The highest concentrations of chlorinated VOCs detected in more than one Southern Area groundwater monitoring well was 1,1,1-TCA at 94 µg/L, 1,1-DCA at 470 µg/L, and 1-1-DCE at 27 µg/L (SA-MW27I). Other chlorinated VOCs such as chlorobenzene, chloroform, methylene chloride, and vinyl chloride (VC) were detected infrequently in groundwater samples at concentrations greater than NYSDOH MCLs.

Southern Area - Off-Site

The Off-Site Southern Area is a continuation of the On-Site Southern Area Plume and consists of the area south of River Road to the Peconic River (Figure 1-2). Groundwater in the Off-Site Southern Area was studied during several investigations conducted between 1997 and 2008. During these investigations groundwater samples were collected from temporary well points, piezometers, and permanent monitoring wells. In addition, surface water and sediment samples were collected from the Peconic River.

The groundwater contaminants in the Off-Site Southern Area Plume include chlorinated VOCs (1,1,1-TCA, 1,1-DCA, 1,1-DCE, and CA) and non-chlorinated VOCs (e.g., benzene, toluene, ethyl benzene, xylene), and several VOCs suspected to be artifacts during sample analysis (e.g., acetone, 2-butanone, etc.). Similar contaminants, but with greater concentrations were detected in groundwater at Site 6A (historically) and the On-Site Southern Area Plume.

1,1-DCA was the dominant VOC present in the Off-site Southern Area groundwater, at a maximum concentration of 125 µg/L in a permanent monitoring well. Higher concentrations of 1,1-DCA were

detected in several temporary well points near monitoring well SA-MW127I. Maximum concentrations of other contaminants were one to two orders-of-magnitude less than 1,1-DCA concentrations.

The off-site portion of the Southern Area plume is approximately 100 acres (4,400,000 square feet). VOC contamination was generally detected at depths of 60 feet to 90 feet bgs. Between River Road and the Peconic River, the aquitard at a depth of approximately 50 feet bgs ends. At 130 feet bgs, there is another silty clay unit that would prevent deeper migration of contamination. Near the Peconic River, the chlorinated VOC contamination is near the top of the water table as the groundwater flow at the River is upward. The volume of contaminated groundwater is estimated to be 210,000,000 gallons. The total masses of chlorinated VOC and other VOC contamination in the Off-Site Southern Area Plume were estimated to be 300 pounds and 6 pounds, respectively.

In groundwater monitoring wells near the Peconic River, 1,1-DCA and 1,1-DCE were detected in groundwater samples from shallow monitoring wells. 1,1 DCA (38 µg/L) and 1,1-DCE (15 µg/L) were detected at concentrations greater than NYSDOH MCLs (5 µg/L) wells. These groundwater detections are less than NYSDEC Surface Water Quality Standards of 3,000 µg/L for 1,1-DCA and 210 µg/L for 1,1-DCE. Alternative minimum surface water quality standards from Oakridge National Laboratories based on potential impact to ecological receptors are 47 µg/L for 1,1-DCA and 25 µg/L for 1,1-DCE (TtNUS, 2007).

3.0 FIELD INVESTIGATION

3.1 GROUNDWATER SAMPLING

The area being investigated for this Survey is located to the southeast of Site 6A, extending through the Peconic River Sportsman Club (PRSC), across Connecticut Avenue and south to the Peconic River. Existing monitoring wells will be used for the collection of field geochemical parameters and groundwater samples that will be collected for laboratory analysis. Six groundwater monitoring wells (monitoring wells FC-MW-07S, SA-MW-127I, SA-MW-128D, SA-MW-131D, SA-PZ-123I, and SA-PZ-118S) will be sampled for geochemical parameters, chemical constituents, and bacterial species during this investigation. Table 3-1 provides a list of the monitoring wells to be sampled and the sampling rational for each well. Figure 3-1 presents the location of the monitoring wells to be sampled. Groundwater sampling will be conducted in accordance with TtNUS SOP SA-1-1.

Groundwater level measurements will be obtained prior to monitoring well sampling. Measurements will be taken with an electronic water level indicator using the marked location on the top of the well casing as the reference point. Groundwater level measurements will be recorded to the nearest 0.01-ft on the appropriate field log. This information will be used to confirm groundwater flow direction.

The wells will be purged with a peristaltic pump using low flow quiescent purging techniques per TtNUS SOP SA-1-1. The field data will be recorded on the data collection sheets. Sampling may be conducted once a minimum of one well screen volume is purged and once three consecutive readings, taken at 5 to 10 minute intervals, are within the following limits:

- pH ±0.2 standard units
- Specific conductance ±10%
- Temperature ±10%
- Turbidity less than 10 NTUs
- Dissolved oxygen ±10%

If the above conditions have still not been met after the well has been purged for one hour, purging will be considered complete and sampling can begin. Low-flow purge and final well stabilization parameters will be recorded on the Data Collection and Log Forms.

Groundwater samples will be collected according to the methods outlined in TtNUS SOP SA-1-1. Samples requiring preservation will be collected in pre-preserved bottles provided by the laboratory.

Pertinent sampling data will be recorded using the appropriate sample log sheet and field logbook.

3.2 SAMPLE ANALYSIS SUMMARY

Both field and laboratory analytical data will be collected to evaluate the specified subsurface conditions, and gauge their favorability to biodegradation of chlorinated VOCs. Sections 3.2.1 and 3.2.2 provide details regarding the laboratory and field analytical programs, respectively.

3.2.1 LABORATORY SAMPLE ANALYSIS SUMMARY

A Navy and National Environmental Laboratory Accreditation Program (NELAP) certified laboratory will be subcontracted by TtNUS to perform the chemical analyses for the environmental samples collected during this investigation. Parameters, analytical methods, anticipated containers, preservation, and holding times are presented in Table 3-2. All samples submitted will be reported on 14 day turn-around time basis.

3.2.2 FIELD ANALYSIS SUMMARY

Field geochemical parameters will be collected from each well during this investigation. The field parameters, analytical methods and holding times are presented in Table 3-3. Results from the field geochemical analysis will be recorded on field analytical log sheets. Procedures for field sample analysis are outlined in TtNUS SOP SA-1.6.

3.2.3 SAMPLE IDENTIFICATION

Each sample collected will be assigned a unique sample tracking number. The sample tracking number will consist of a four-segment, alphanumeric code that identifies the site, sample location, and sample round. Pertinent information regarding sample identification will be recorded in the field logbooks.

The appropriate alphanumeric sample identification code is explained as follows:

(Site Location) - (Site) - (Sample Number) – (Sample round)

Site Location: SA (Southern Area)
Sample Number: Groundwater sample = well identifier.
Sample Round: Date by year, followed by month, then date (e.g. 20091102 for November 2nd 2009)

For example, a groundwater sample collected from monitoring well MW-127I from the Southern Area on November 2nd, 2009 will be designated as SA-MW127I-20091102.

3.2.4 SAMPLE PACKAGING AND SHIPPING

The FOL will be responsible for completion of the following forms:

- Sample labels
- Chain-of-custody forms
- Appropriate labels applied to shipping coolers
- Chain-of-custody seals
- Federal Express air bills

All samples will be packaged and shipped in accordance with TtNUS SOPs.

3.2.5 SAMPLE CUSTODY

Custody of samples must be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. TtNUS SOP SA-6.3 provides a description of the chain-of-custody procedures to be followed.

3.2.6 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC samples to be collected include matrix spike/matrix spike duplicates (MS/MSD), field duplicates, and trip blanks. MS/MSD samples will be collected at a rate of one sample per 20 environmental samples. Field duplicate samples will collected at a rate of one sample per 10 environmental samples. Field duplicate samples will be blind numbered. Trip blanks will be included in each sample cooler containing VOC samples.

3.3 GENERAL FIELD OPERATIONS

Procedures for the following topics; Site Management and Field Team Responsibilities, Mobilization/Demobilization, Decontamination, Field Changes and Corrective Action, and Investigation-Derived Waste Management are outlined in Section 3.2 of the Work Plan. All analytical results from this investigation will be validated.

REFERENCES

Tetra Tech NUS, Inc. (TtNUS), 2007. Letter Report Results of October 2006 Groundwater, Surface Water, and Sediment testing Southern Area, Naval Weapons Industrial Reserve Plant (NWIRP) Calverton, New York. January.

Tetra Tech NUS, Inc. (TtNUS), 2008a. Work Plan for Groundwater Investigation and Groundwater Monitoring (2009 and 2010) At Site 2 – Fire Training Area, Site 6A – Fuel Calibration Area, Site 10B – Engine Test House, and Southern Area Naval Weapons Industrial Reserve Plant (NWIRP), Calverton, New York. December.

Tetra Tech NUS, Inc. (TtNUS), 2008b. Data Summary Report for Site 6A – Fuel Calibration Area, Site 10B – Engine Test House, and Southern Area Naval Weapons Industrial Reserve Plant (NWIRP), Calverton, New York. October.

TABLES

TABLE 3-1
MONITORING WELL CONSTRUCTION DETAILS
AND SAMPLING RATIONALE
SOUTHERN AREA AND FUEL CALIBRATION AREA
NWIRP CALVERTON, NEW YORK

Monitoring Well ID	Installation Date	Total Depth (feet)	Screened Interval Depth (feet)	Reference Elevation TOC (PVC) (feet)	Ground Surface Elevation (feet)	Rationale for Sampling	Chlorinated VOCs
FC-MW07S	NA	15	5 - 15	48.38	46.38*	Upgradient of current plume. Historic contamination no longer present.	None present
SA-PZ-118S	5/3/2007	60	50 - 60	31.67	29.67*	Downgradient edge of plume.	1,1-DCA, 1,1-DCE
SA-PZ-123I	1/2/2008	42	32 - 42	37.58	35.26	Located in path of plume. Negative ORP, low DO.	1,1-DCA, 1,1-DCE
SA-MW-127I	12/11/2007	46	36 - 46	40.84	38.51	Located near the center of the current plume. Geochemical parameters not conducive to bioremediation	1,1,1-TCA, 1,1-DCA, 1,1-DCE, CA
SA-MW-128D	12/12/2007	68	58 -68	41.00	38.59	Located along plume. Geochemical parameters conducive to bioremediation, no COCs present.	1,1-DCA
SA-MW-131D	NA	80	70 - 80	NA	NA	Located in path of plume. Low COC concentrations. Negative ORP, and low DO.	1,1-DCA

FC: Fuel Calibration Area
SA: Southern Area
MW: Monitoring Well
NA: Not Available
1,1-DCA - 1,1-dichloroethane
1,1,1-TCA - 1,1,1-trichloroethane
1,1-DCE - 1,1-dichloroethene
CA - chloroethane
* Estimated

TABLE 3-2
LABORATORY GROUNDWATER ANALYSIS

Parameter	Number of Samples[1]	Preparation/ Analytical Method	Bottle Requirements	Holding Time
Volatile Organic Compounds	9	SW-846 5030B/8260B	3 - 40ml vials; hydrochloric acid (HCl) pH< 2; cool to 4°C	14 days
Nitrate/Nitrite/Sulfate	7	EPA 300	500 ml HDPE; cool to 4°C	48 hours-Nitrate/Nitrite 28 days-Sulfate
Ammonia	7	EPA 350.1	500 ml HDPE; H_2SO_4 to pH<2	14 days
Sulfide	7	EPA 376.1	500 ml HDPE; NaOH to pH>9	7 days
Methane, Ethane, Ethene	7	RSK SOP 147, 175	3 - 40ml vials; hydrochloric acid (HCl) pH< 2; cool to 4°C	14 days
Total Organic Carbon	7	EPA 415.1	4°C, H_2SO_4 to pH<2	28 days
Manganese (total) Iron (total)	7	SW-846/6010B or C or 6020	500 ml HDPE bottle; HNO_3 to pH<2	6 months
Chloride	7	EPA 300	200 ml HDPE	28 days
Dehalobacteri (DHB) Dehalococcoides (DHC)	6	Bio-Dechlor Census Technology	Filter	not applicable

1. Number of samples consists of six samples from wells, one duplicate, and two trip blanks for volatile organic compounds. Field blank and rinsate blank samples are not required.

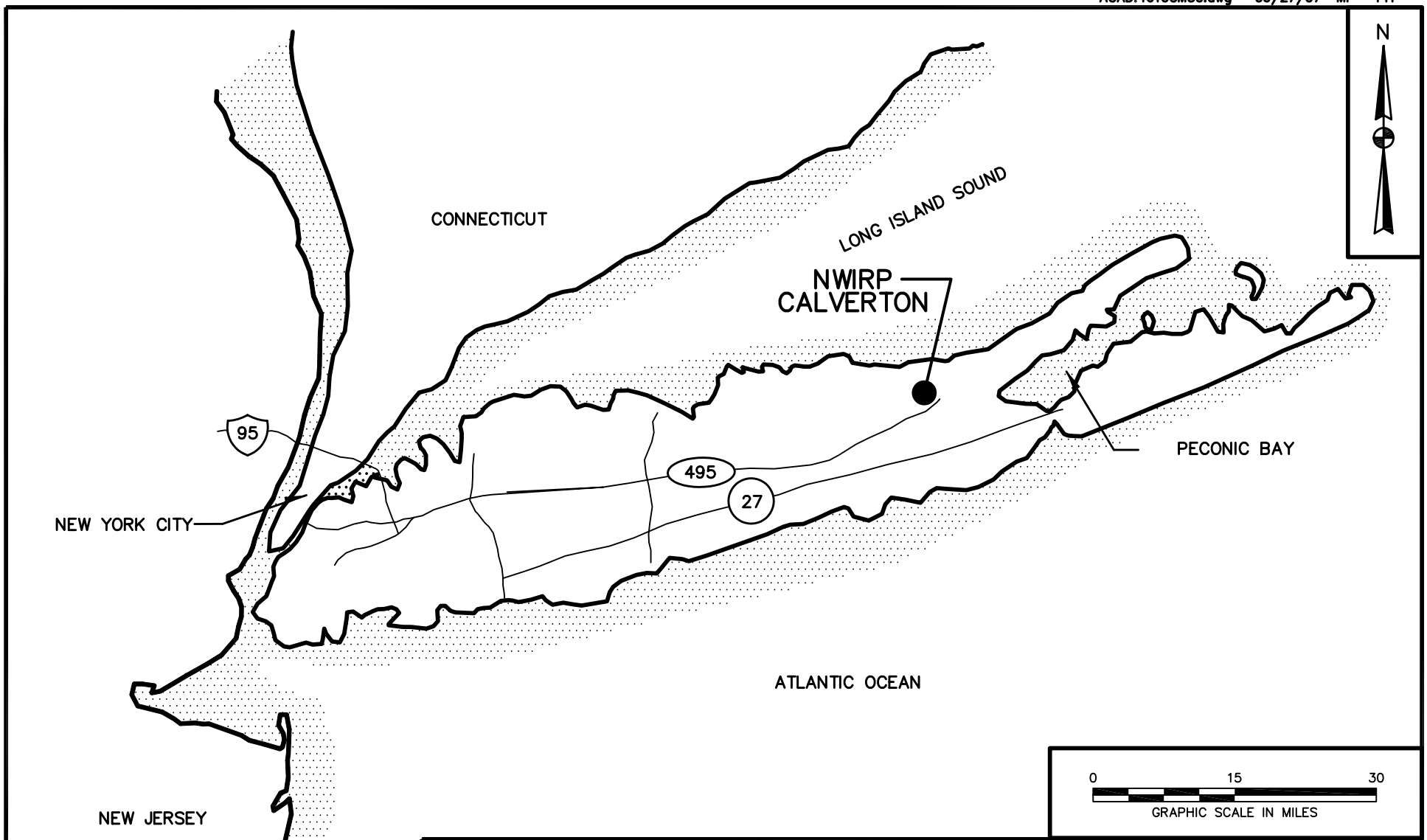
ml - milliliter
HDPE - High density polyethylene
SW - Solid Waste
H_2SO_4- Sulfuric acid
HNO_3 - Nitric acid
HCl - Hydrochloric acid
°C - degrees Celsius
NaOH - Sodium hydroxide
EPA - Environmental Protection Agency

TABLE 3-3
FIELD ANALYSIS REQUIREMENTS

Parameter	Analytical Method	Holding Time
Dissolved oxygen	CHEMetrics K-7501/7512 and Horiba U-22	Analyze immediately
Carbon dioxide	CHEMetrics K-1910/1920/1925	Analyze immediately
Alkalinity	CHEMetrics K-9810/9815/9820	Analyze immediately
Ferrous iron	HACH IR-18C	Analyze immediately
Hydrogen sulfide	HACH HS-C	Analyze immediately
Temperature	Horiba U-22	Analyze immediately
pH	Horiba U-22	Analyze immediately
Conductivity	Horiba U-22	Analyze immediately
Turbidity	LaMotte Turbidity Meter	Analyze immediately
Oxidation Reduction Potential (ORP)	Horiba U-22	Analyze immediately

FIGURES

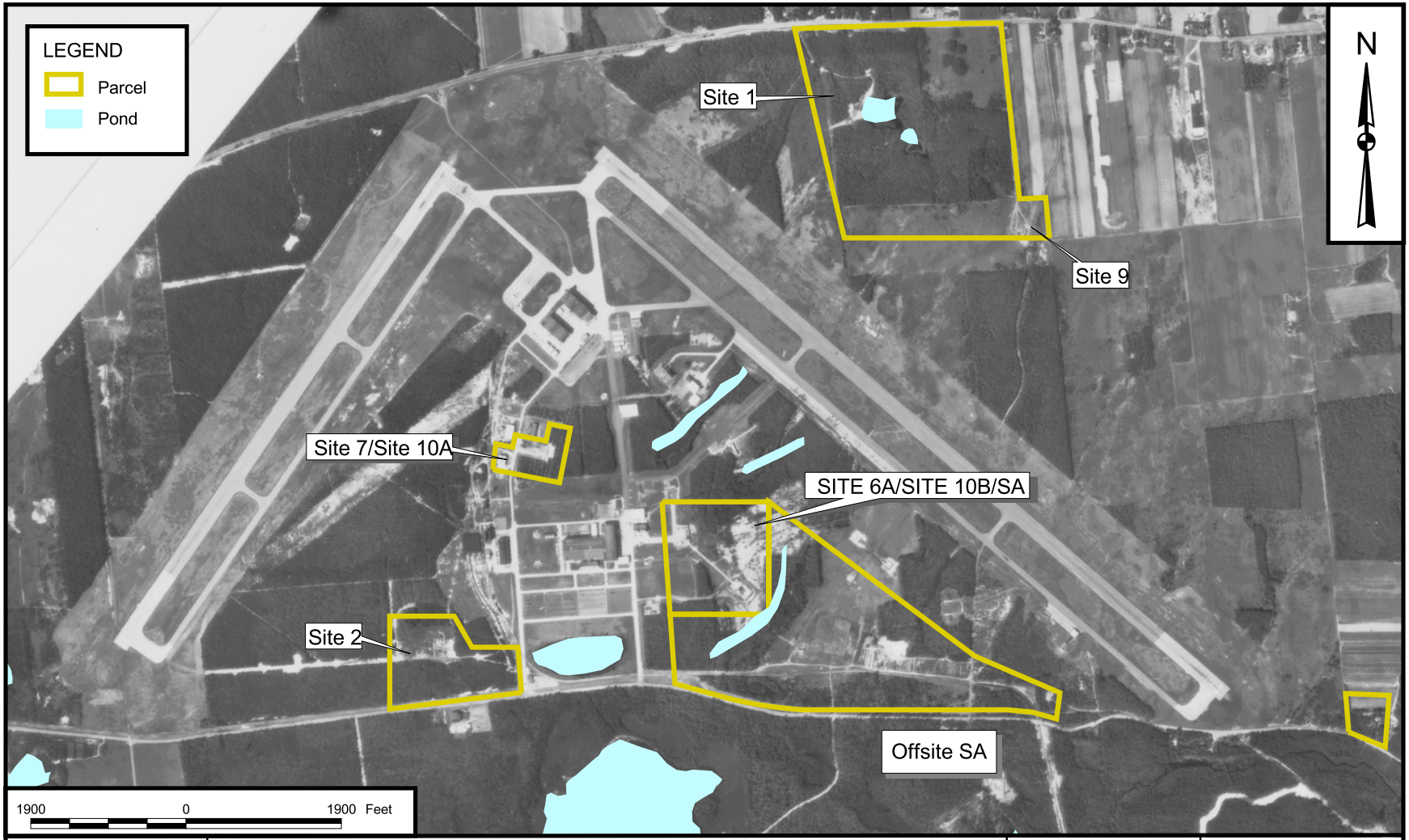
ACAD:1610CM30.dwg 06/27/07 MF PIT



DRAWN BY MF	DATE 6/27/07	Tetra Tech NUS, Inc.	GENERAL LOCATION MAP NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 0804	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 1-1	REV. 0

FORM CADD NO. TTNUS-AH.DWG - REV 1 -9/10/98



DRAWN BY J. LAMEY	DATE 11/22/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7398 / OWNER NUMBER 0270
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COST/SCHEDULE-AREA			APPROVED BY ___ / DATE ___
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 / REV 0

P:\GIS\NWIRP_CALVERTON\SURFACE_WATER_HYDROLOGY.APR SITE LOCATION MAP 06/28/07 SS

P:GIS Files/Calverton/6A_11122009.mxd map created 11122009

Aerial photographs provided by the NYS GIS Clearinghouse, March -May 2007.

DRAWN BY MMC	DATE 11/12/09	MONITORING WELL & PIEZOMETER LOCATIONS SOUTHERN AREA NWIRP CALVERTON NEW YORK	CONTRACT NUMBER
CHECKED BY ___	DATE ___		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. 3-1 REV 0