Dump Road Source Areas Soil and Groundwater Characterization Work Plan Martin State Airport 701 Wilson Point Road Middle River, Maryland

Prepared for:

Lockheed Martin Corporation

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June 2013, Revision 1

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ACRONYMS

ASTM	ASTM International
Bgs	below ground surface
BOD	biological oxygen demand
BTEX	benzene, toluene, ethylbenzene, and xylenes
BWI	Baltimore/Washington International
$Ci_{(1\%)}$	effective solubility of 1%
C^T	partitioning threshold concentration
CEC	cation-exchange capacity
cis-1,2-DCE	*cis*-1,2-dichloroethene
COPC	chemicals of potential concern
COD	chemical oxygen demand
CPT	cone penetrometer
CRA	Compass Rose Area
cVOC	chlorinated volatile organic compounds
DA	Drum Area
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DOC	dissolved oxygen carbon
DPT	direct push technology
DRA	Dump Road Area
DR	Dump Road
DRO	diesel range organics
DT	dual-tube
ECD	electron capture detector
EESH	energy, environment, safety, and health
EGIS	environmental geographic information system
EM	electromagnetic
EO	Enterprise Operations
FAA	Federal Aviation Administration
FID	flame-ionization detector
feet per day	ft/day
FOC	fraction organic carbon

Fs	sleeve friction
GC	gas chromatography
GIS	geographic information system
GPR	ground penetrating radar
GPS	global positioning system
GRO	gasoline range organics
GSP	Greater Strawberry Point
HASP	health and safety plan
IDW	investigation derived waste
ISCO	*in–situ* chemical oxidation
LM	limited magnetometry
LNAPL	light non-aqueous phase liquid
Lockheed Martin	Lockheed Martin Corporation
MAA	Maryland Aviation Administration
MCL	maximum contaminant level
MDANG	Maryland Air National Guard
MDE	Maryland Department of the Environment
µg/L	microgram(s) per liter (i.e., parts per billion)
mg/kg	milligram(s) per kilogram (i.e., parts per million)
MIP	membrane interface probe
MRC	Middle River Complex
MSA	Martin State Airport
msl	mean sea level
MW	monitoring well
NAVD 1988	North American Vertical Datum of 1988
NO	natural oxidant demand
OB	open burning
ORP	oxidation reduction potential
ORNL	Oak Ridge National Laboratory
PA	preliminary assessment
PAH	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PDF	portable document format
PHA	Petroleum Hydrocarbon Area
PID	photoionization detector
PM	project manager

PPE	personal protective equipment
ppmv	part(s) per million per volume
PVC	polyvinyl chloride
pVOC	petroleum volatile organic compound
QA/QC	quality assurance/quality control
Qc	cone bearing/tip pressure
Rf	friction ratio
RI	remedial investigation
RSL	regional screening levels
SB	soil boring
SBT	soil behavior type
SOD	soil oxidant demand
SP	Strawberry Point
SS	surface soil
SVOC	semi-volatile organic compound
TB	trip blank
TCE	trichloroethene
TCE_{EQ}	trichloroethene equivalent
TCLP	toxicity characteristics leaching procedure
Tetra Tech	Tetra Tech, Inc.
TINC	total inorganic carbon
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TT Median Area	Taxiway Tango Median Anomaly Area
U	pore water pressure
µg/kg	microgram per kilogram
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VAS	vertical aquifer sampling
VC	vinyl chloride
VFA	volatile fatty acids
VOC	volatile organic compound
ZVI	zero valent iron

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Section 1
Introduction

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech, Inc. (Tetra Tech) has prepared the following work plan to perform a soil, groundwater, surface water, and sediment investigation at the Dump Road Area (DRA) at Martin State Airport (MSA) in Middle River, Maryland. The site referred to as the Dump Road Area is along the northeast side of the runway at Martin State Airport. A portion of the area extends across Taxiway Tango into the median between the taxiway and airport runway. The primary objective of this investigation is to perform additional characterization of the 0.7 acre wetland area east of Ponds 1 and 2 and immediately west of Frog Mortar Creek including installation of additional monitoring well clusters adjacent to Frog Mortar Creek along the limits of buried waste, additional soil and groundwater sampling, and additional sediment and surface water sampling in the wetland near the Frog Mortar Creek shoreline. Additional characterization will include direct push groundwater profiling, soil borings, sediment and surface water sampling, test pit excavations, and installation and monitoring of multi-level monitoring wells in the DRA. The investigations and testing will further evaluate the extent of hazardous materials that were placed or spilled in the area of Martin State Airport. The depth and volume of the source areas will be further defined to help select and design remedial options. The locations of Martin State Airport and the Dump Road Area are shown on Figure 1-1. This investigation also incorporates additional scope to address comments from the Maryland Department of the Environment (MDE) on Tetra Tech's *Dump Road Source Areas Investigation Work Plan* (Tetra Tech, 2012a) and *Technical Memorandum for the Dump Road Area, Source Area Delineation* (Tetra Tech, 2012b).

This investigation will support the following:

- Characterizing soil, surface water, sediment, groundwater, and waste conditions in the 0.7–acre wetland area west of Frog Mortar Creek and downgradient of Ponds 1 and 2, as well as along the creek shoreline downgradient of the landfilled waste material
- Further characterizing the chemical characteristics of surface water and sediment in Ponds 1 and 2

- Characterizing additional areas in the Dump Road Area, based on Maryland Department of the Environment comments on Tetra Tech's *Dump Road Source Areas Investigation Work Plan* (Tetra Tech, 2012a) and *Technical Memorandum for the Dump Road Area, Source Area Delineation* (Tetra Tech, 2012b)

- Assessing groundwater flow direction and groundwater gradient

- Determining aquifer parameters

- Assessing contaminant concentrations (horizontally and vertically) in support of updating (if necessary) the conceptual model of the site

- Determining the source and extent of chemicals of potential concern (COPC) detected in soil and groundwater during the direct-push technology (DPT) investigations, as appropriate.

In 2012, Tetra Tech compiled available existing data regarding possible source areas in the Dump Road Area into a technical memorandum (Tetra Tech, 2012b). Tetra Tech evaluated historical soil and groundwater data from borings, monitoring wells, membrane-interface probes (MIPs), and temporary monitoring wells (e.g., the PA–series from the Petroleum Area and the DA–series from the Drum Area) to prepare the memorandum. The memorandum provided a summary of the evaluated data and identified possible source areas. The known or suspected horizontal and vertical extent of contamination was detailed using cross–sections of the identified source areas. The memorandum also identified existing data gaps and provided recommendations for additional characterization. The recommendation from this memorandum and the data obtained during the 2012 Dump Road Area source areas investigation were the basis for the technical approach included in this work plan.

Field activities are expected to proceed in the following sequence:

- clear utilities

- excavate test pit(s) to further investigate the Dump Road Area, including areas east of Ponds 1 and 2

- investigate soil using direct push technology to characterize site lithology soil and waste conditions in the 0.7-acre wetland east of Ponds 1 and 2, and in the DRA between the waste limits and Frog Mortar Creek, the Drum Area, and Taxiway Tango Area-North

- conduct vertical profiling for groundwater using a direct-push technology drill rig to further investigate aquifer conditions and collect discrete groundwater samples to depths of up to 60 feet below ground surface (bgs)

- install groundwater monitoring wells and collect associated soil samples to characterize soil and groundwater conditions near the shoreline of Frog Mortar Creek, with final locations based on the results of the direct-push technology groundwater investigation

- collect groundwater samples from the eighteen newly installed wells, and surface water and sediment samples from the 0.7 acre wetland area and in Ponds 1 and 2

- survey locations of the eighteen newly installed wells

This work plan is organized as follows:

Section 2—Site Background: Briefly describes the site history, subsurface conditions, areas of concern and the historical source areas characterization.

Section 3—Investigation Program and Methodology: Presents the technical approach for the field investigation program and data evaluation.

Section 4—Project Deliverables: Describes the report that will summarize the investigation program and data evaluation.

Section 5—References: Cites references used to compile this work plan.

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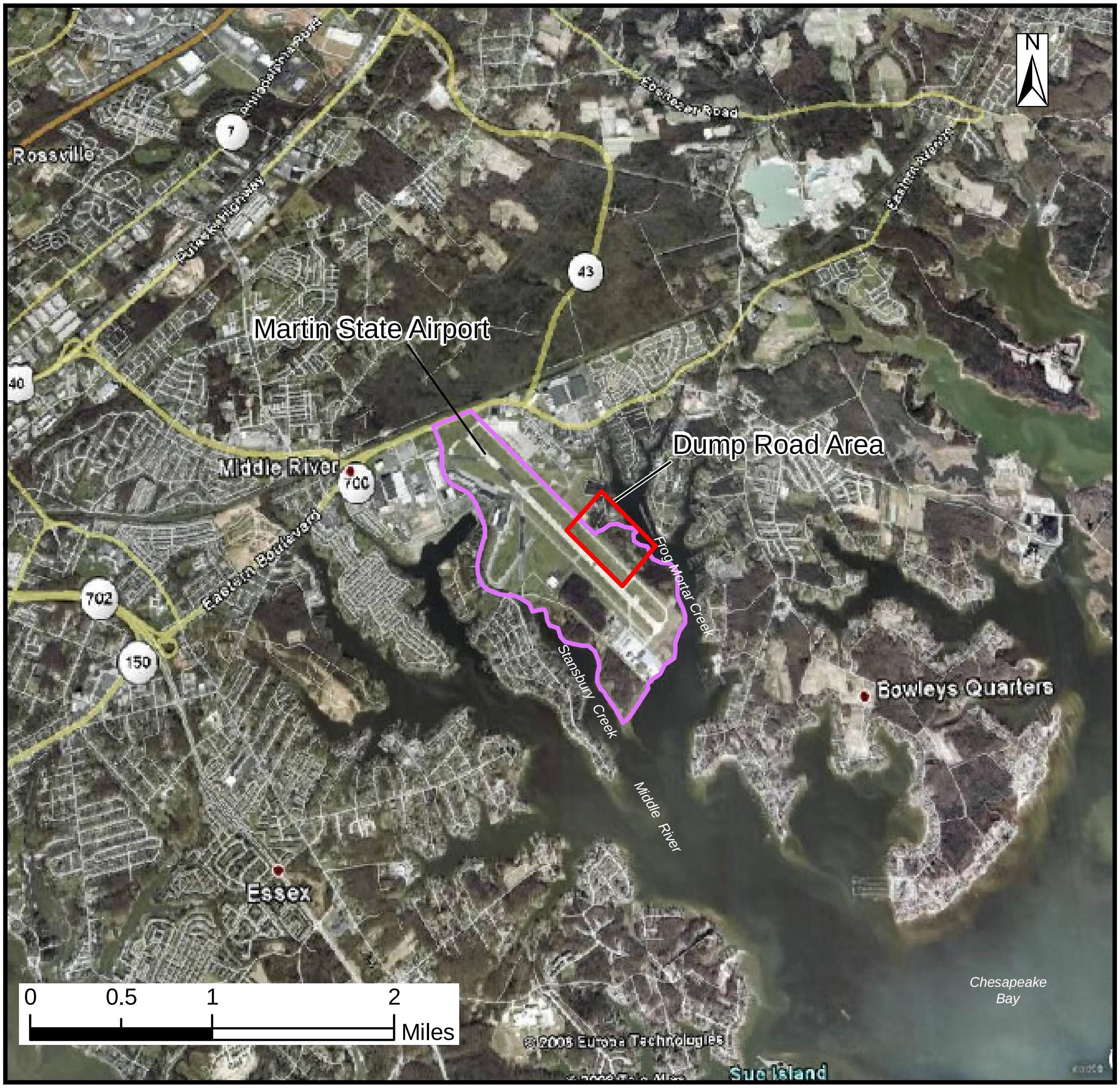

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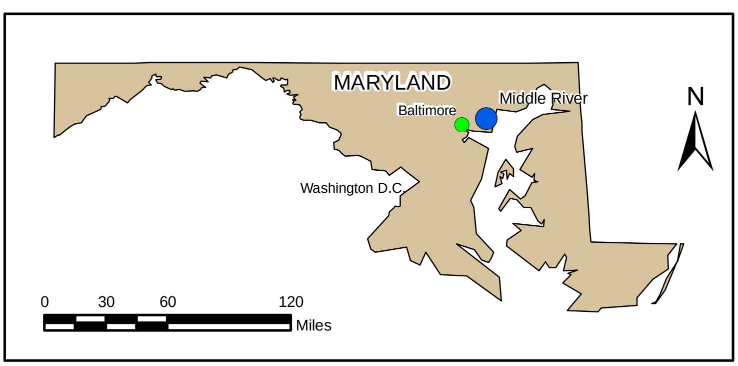

FIGURE 1-1

MARTIN STATE AIRPORT AND DUMP ROAD AREA LOCATION MAP

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED: 10/05/11	CREATED BY: MP

TETRA TECH

Section 2
Site Background

2.1 SITE DESCRIPTION

2.1.1 Location

Martin State Airport (MSA) is at 701 Wilson Point Road in Middle River, Maryland, and is bounded by Frog Mortar Creek to the east and Stansbury Creek to the west (Figure 2-1). Both creeks are tidal tributaries of the Chesapeake Bay and join the bay at the south side of the airport. The Dump Road Area (DRA) is in the southeastern portion of MSA and is bounded by Frog Mortar Creek to the east and the airport runway to the west. Although the area has been investigated since the 1990s, Lockheed Martin Corporation (Lockheed Martin) designated the site as the DRA to distinguish it from other MSA areas under investigation (e.g., Frog Mortar Creek, Strawberry Point [SP], Greater Strawberry Point [GSP], and the Main Terminal area).

2.1.2 History

The current MSA property was part of the Glenn L. Martin Company's original 1,260-acre property, which previously included both the MSA and the manufacturing portion of the original facility now known as Lockheed Martin's Middle River Complex (MRC) (see Figure 2-1). In the spring and summer of 1929, the Glenn L. Martin Company purchased six parcels of land from private landowners. During the 1940s and 1950s, nine additional parcels were acquired from private landowners; together these parcels comprise the current areas of MSA and the MRC.

In 1932, the B-10 bomber was one of the first aircraft produced at the Glenn L. Martin Company Baltimore facility. Three runways, Hangars 1–3, and the airport administration building were built at the MSA in 1939 and 1940. Hangars 4–6 and the SP Hangar were completed in 1940 and 1941. After World War II, commercial transports and jet aircraft were produced at the manufacturing portion of the facility. In July 1955, the Maryland Air National Guard (MDANG) 104th Tactical Fighter Group began leasing property from the Glenn L. Martin Company. On April 1, 1960, the 135th Tactical Airlift, previously based in Baltimore, was transferred to MSA, and by October 1962, the 104th Tactical Fighter Group had been reorganized and designated the 175th Tactical Fighter Group.

The Glenn L. Martin Company consolidated with American Marietta Corporation in September 1961 to form Martin Marietta Corporation. On September 20, 1975, the Maryland Aviation Administration (MAA) purchased 747 acres that are now used as the airfield, of which 175 acres in the northeastern portion are now leased to MDANG. In 1995, Lockheed Corporation and Martin Marietta merged to form Lockheed Martin Corporation. Lockheed Martin, northwest of the airport, occupies 338 acres of the original 1,260 acres at the MRC, and is currently conducting environmental investigations and remediation at MSA and the MRC.

2.1.3 Current Conditions

MAA currently operates MSA on behalf of the Maryland Department of Transportation. MSA has an administration building (Main Terminal building), aircraft hangars, a 7,000-foot long runway, several taxiways, and the SP Hangar. MAA manages more than 130,000 square feet of heated hangar space and 190 smaller aircraft T-hangars. The southwestern portion of MSA contains numerous aboveground fuel storage tanks for Jet A and Avgas 100LL fuels. MSA is also home to more than 20 commercial tenants providing fuels and lubricants, helicopter avionics repair, and flight instruction, in addition to hosting Baltimore County Police aviation and marine units and the Glenn L. Martin Museum (MAA, 2012).

The DRA consists mostly of mowed grass surrounding Taxiway Tango and the runway, heavily wooded areas in the northern, eastern, and southeastern portions of the site, and open meadows in the east–central and southeastern portions of the site. The DRA also includes portions of Taxiway Tango and the airport runway and two small ponds (Ponds 1 and 2). Site topography is generally flat and slopes gently to the northeast toward Frog Mortar Creek. Along the Frog Mortar Creek shoreline lies a steeply sloped embankment comprised of fill placed there as part of airport construction.

2.1.4 Land Use

MSA is generally characterized as a moderately developed tract in a largely suburbanized, moderate density, populated setting. Land use surrounding MSA is, to a significant degree, a combination of mixed suburban, industrial, commercial, lightly- to moderately-developed tracts, and woodland tracts. The northern boundary of MSA is bordered by Eastern Boulevard (Maryland Route 150) and Amtrak railroad lines.

Undeveloped woodland tracts and low-density residential properties are north of MSA and the Amtrak line. The MSA's eastern, southern, and western boundaries are bordered by Frog Mortar Creek and Stansbury Creek, which are wide, brackish, tidal tributaries of the middle Chesapeake Bay. The MRC lies along MSA's northwestern boundary. The Old Navy Depot–Bengies (Plant 2) is across from the MSA on Eastern Avenue. Low- to medium-density residential and light commercial land uses (e.g., shopping centers, convenience stores, restaurants, etc.) are beyond the creeks east, south, and west of MSA. Farther east and west of MSA are the high-density residential communities of Bengies Corner and Hawthorne Park. The town of Middle River is approximately 1.5 miles northwest of MSA.

2.1.5 Climate

The MSA has a humid, temperate climate, with hot humid summers and relatively mild winters. The Middle River, Maryland area receives an average of 42 inches of precipitation annually, distributed evenly throughout the year. Rainfall normally occurs in the summer as showers and thunderstorms. In winter, precipitation is typically light to heavy rainfall or snow. Tropical storms in late summer and fall, and occluded, meso-scale frontal systems (i.e., coastal low pressure systems) in winter and spring occasionally provide short-term above average precipitation.

2.1.6 Physiography

MSA is in the western shore of the Coastal Plain physiographic province. The Coastal Plain consists of sediments composed of alluvium from the Pleistocene Epoch and the Potomac Group from the Cretaceous Period. Coastal Plain sediments begin at the Fall Line and follow a regional dip to the southeast at approximately 110 feet per mile (Hansen and Edwards, 1986). The Fall Line is the division between the Piedmont and Atlantic Coastal physiographic provinces. Its name refers to an imaginary line connecting changes in stream flow characteristics between the hard-rock upland areas of the Piedmont and the soft-sediment lowland areas of the Coastal Plain. The Coastal Plain is generally characterized by low topographic relief. However, steep embankments and hills are found along stream channels, rivers, and Chesapeake Bay.

2.1.7 Topography

Most of MSA's land surface is generally flat to gently sloping in the areas of the runway, taxiways, and surrounding support operations. The MSA runway forms a trending topographic ridge, or drainage divide, that slopes gently from the northwest end to the southeast end. Runway elevations range from slightly more than 20 feet above the North American Vertical Datum of 1988 (NAVD 1988) at the northern end to slightly more than 10 feet above NAVD 1988 at the southern end. The land slopes away from the runway toward Frog Mortar Creek to the northeast, and Stansbury Creek to the southwest.

In the northern portion of the DRA, land elevations range from approximately 11 feet above NAVD 1988 near the runway to approximately seven feet above NAVD 1988 at Pond 2. In the southeastern portion of the site near Frog Mortar Creek, land elevations are approximately 20 feet above NAVD 1988 at a mounded area near the creek embankment. The elevation at the top of the creek embankment ranges from approximately 10 feet above NAVD 1988 at the northern portion of the DRA to approximately 20 feet above NAVD 1988 in the southern portion. Land surface elevation at the Frog Mortar Creek shoreline is near zero feet, relative to NAVD 1988.

2.1.8 Surface Water Hydrology

The eastern, southern, and western boundaries of MSA are bordered by Frog Mortar Creek and Stansbury Creek, which are wide, brackish, tidal tributaries of the middle Chesapeake Bay. Surface water runoff from MSA enters these creeks via localized gullies in the eastern and western undeveloped portions of the site, or via storm sewers that drain the airport runway, taxiways, and developed portions of the facility. MSA encompasses 47 drainage areas in three watersheds, forming a total drainage area of 700 acres (MAA, 2008). The airport drainage areas range from seven to more than 170 acres.

In the DRA, six drainage areas drain the runway, taxiways, and wooded areas, discharging to Frog Mortar Creek on the east side of MSA. The DRA has two small ponds, wetlands, and a storm water management pond near the fire pump house in the western portion of MSA. One of the small ponds (Pond 1) and the wetland in the DRA are contained within each drainage area and do not discharge to Frog Mortar Creek. The storm water pond near the fire pump house discharges to the upper reaches of the Stansbury Creek tidal area.

All storm water runoff originating from MSA discharges to outfall areas that are monitored monthly to ensure that no oily discharges to surface water occur. Secondary containment drains are also routinely inspected and emptied of storm water. The facility maintains a General National Pollutant Discharge Elimination System Permit (No. MDR 05501, General Discharge Permit No. 05-SF-5501), with an effective date of November 12, 2004 and an expiration date of November 12, 2009. However, the current permit remains in effect because the Maryland Department of the Environment (MDE) has administratively extended it until they issue a new general permit.

The site general industrial permit has no monitoring requirements. However, limited monitoring is performed as part of the separate municipal storm-sewer system permit required for the federal Illicit Discharge Detection and Elimination program. This limited monitoring includes laboratory analysis for ammonia, dissolved oxygen, surfactants, fecal coliform, potassium, water temperature, conductivity, pH, and fluoride concentrations in monitored outfalls during annual inspections. Visual inspections are routinely performed and annual reports are submitted to MDE.

2.1.9 Geology and Hydrogeology

MSA is in the western shore of the Coastal Plain physiographic province. Regional and local studies (Vroblesky and Fleck, 1991; Chapelle, 1985) indicate that MSA lies on the Patapsco Formation. This formation consists of complex and interbedded mixtures of gray, brown, and red sands, silts, and clays originating from sediment deposition in a low coastal plain traversed by low-gradient meandering streams. Below the Patapsco Formation lies a regionally extensive thick-clay confining-unit known as the Arundel Formation. It is a massive and probably impermeable unit underlying the site and surrounding area.

The Arundel Formation outcrops northwest of the site and dips and thickens to the southeast. The Arundel Formation extends as far east as Cambridge, Maryland, where it is more than 600 feet thick. Regional lithologic information indicates that the Arundel Formation may be up to 150 feet thick at MSA (Vroblesky and Fleck, 1991; Chapelle, 1985). The formation probably acts as an impermeable barrier to the downward movement of any constituents found in the surficial aquifer. The base of the Arundel Formation (i.e., the top surface of the deeper Patuxent Formation) is approximately 225 feet below NAVD 1988 near MSA (Vroblesky and Fleck, 1991;

Chapelle, 1985). The depth to the base of the Arundel Formation may therefore range from 235-255 feet below grade at MSA.

Below the Arundel Formation is the Patuxent Formation. The Patuxent Formation is a multi-aquifer unit comprised of various interbedded sand and silt/clay layers and rapid changes of deposited material types over short distances. Permeable sand-rich units range from bounded sand sheets to isolated sand bodies (Glaser, 1969). In the MSA area, potentiometric maps of the Patuxent Formation indicate groundwater flows to the south and southwest, in response to industrial wells withdrawing water southwest and west of the site (Chapelle, 1985 and Curtin, 2006).

2.1.10 Vicinity Subsurface Conditions

An extensive and ongoing subsurface investigation continues at the DRA. Less extensive environmental investigations have been conducted at SP and GSP, which are south and southwest of the DRA. As part of the DRA investigation, numerous shallow and deep soil borings have been advanced to collect soil samples for subsurface lithologic information. Synoptic water level measurements, single-well permeability tests, and pumping tests have been conducted to characterize subsurface hydraulic conditions at the DRA. Figure 2-2 is a fence diagram of the generalized geology at the DRA, based on the lithology encountered in the course of subsurface investigations.

Early studies at the DRA indicated that the subsurface hydrogeology is comprised of a surficial aquifer (i.e., the Patapsco Formation) containing highly heterogeneous mixtures of unconsolidated sand, silt, gravel/sand mixtures, and clay. A layer of fill, consisting of heterogeneous sand, silt, clay, and localized industrial debris and wastes overlies these native sediments. In the northern portion of the DRA and south of the current MDANG munitions storage area, a former tidal cove (identified as Limehouse Cove on a 1951 United States Geological Survey [USGS] topographic map) was filled in with hydraulically-placed fill beginning sometime between 1938 and 1945, with the majority of the filling work completed by 1960 (Tetra Tech, 2013a). Based on current topography, 10 or more feet of fill is likely present in portions of the former cove. For data evaluation and correlation, the surficial aquifer is divided into upper, intermediate, and lower surficial aquifer zones. The lower surficial aquifer zone is encountered up to approximately 45–73 feet below NAVD 1988, and overlies at least several feet of stiff, dense clay.

A deep groundwater study investigated the lithology beneath the lower surficial aquifer in the DRA of MSA (Tetra Tech, Inc. [Tetra Tech], 2009a). Lithologic data from four deep wells indicate six to 40 feet of clay beneath the lower surficial aquifer. Deep well logs also indicate alternating sand and silt aquifers and clay aquitards beneath the lower surficial aquifer. These sandy units are referred to as the deep confined aquifer zones.

2.2 AREAS OF CONCERN

During the 1930s through the 1960s, three pits are reported to have been used to dump spent battery acid, acid-type strippers, and other acidic solutions. Dredge spoils and construction debris associated with industrial operations were also reported to have been placed in the pits. MDE found only two of the three pits during site visits made as part of a 1989 preliminary assessment (PA). MDE referred to the two pits as ponds in the PA; these pits were later named Acid Pit #1 (Pond 1) and Acid Pit #2 (Pond 2) in subsequent studies. Pond 1 and Pond 2 are shown in Figure 2-3. Additionally, aerial photographs from 1952 and 1957 reviewed during a 1996 DRA investigation (i.e., the July 1996 expanded investigation) show an open “burial area” or “dump” adjacent to what is now Taxiway Tango.

In July 1991, four drums containing dried zinc-chromate paint were uncovered during installation of underground electric cables adjacent to Taxiway Tango (Figure 2-3). This discovery prompted MDE to order MAA to conduct additional studies of the Taxiway Tango area. Early investigations from 1991–1996 identified four areas of concern known as the Taxiway Tango Median Anomaly Area (TT Median Area), the Drum Area (DA), two ponds (Pond 1 and Pond 2), and the Petroleum Hydrocarbon Area (PHA). These four areas are shown in Figure 2-3. Brief descriptions of these four areas follow:

- *Taxiway Tango Median Anomaly Area*—Located between Taxiway Tango and the airport runway, northwest of Taxiway D, four buried drums containing dried zinc-chromate paint were unearthed and removed from this area in 1991. A construction drawing indicates fill and trash, and an initial geophysical survey indicates several electromagnetic (EM) anomalies, suggesting buried metal.

- *Drum Area*—In the forested area near wells MW-2 and MW-5, northeast of Taxiway Tango, several drums were uncovered when surface vegetation was cleared during a 1996 site investigation.

- *Two ponds*—Historical records indicate that acids may have been discharged at the present location of these ponds (approximately 450 feet and 600 feet northeast of Taxiway Tango, respectively) sometime during the 1930s through the 1960s. A third pond is shown in the area on a USGS topographic map (photo-revised in 1985) in the PA, but MDE could not locate a third pond during the 1989 site visits.

- *Petroleum Hydrocarbon Area*—The PHA is approximately 200 feet west of the ponds. Petroleum hydrocarbons were encountered while drilling a soil boring in this area during the 1996 site investigation.

These four areas became the focus of subsequent studies when chemical constituent impacts to soil, pond sediment, and groundwater became apparent. MAA first investigated Frog Mortar Creek in 1998.

From 1999–2010, Lockheed Martin conducted a remedial investigation (RI) (Tetra Tech, 2012c) and a supplemental RI (Tetra Tech, 2013c) to further delineate the extent of soil, groundwater, and pond sediment chemical contamination indicated by earlier studies at MSA. Through geophysical surveys, membrane interface probes (MIPs), test pits, soil borings, and chemical analyses of soil and pond sediment samples the RI identified large areas of buried fill and debris, and surface and subsurface soil contamination in and around the buried fill material and in pond sediment. Buried fill and debris were estimated present over approximately 25 acres of the DRA.

The fill material consists of soil, stained soil, and debris, the latter of which is comprised of concrete rubble and disposed industrial items (e.g., batteries, deteriorated drums, tires, paint cans, burned items, sludge, buckets, glass, wood, etc.). Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and several metals were detected in soil at concentrations exceeding human health risk screening levels. Chlorinated VOCs (cVOCs) (trichloroethene [TCE] and its degradation products), petroleum VOCs (pVOCs) (e.g., benzene, toluene, etc.), and metals were also detected in surficial aquifer groundwater at concentrations exceeding Maryland groundwater and drinking water standards.

2.3 SOURCE AREAS CHARACTERIZATION

The DRA investigation area was initially identified in the 1989 PA as possible acid pits and was investigated in 1991 after the MAA encountered four drums adjacent to Taxiway Tango during trenching to install an electrical cable. Preliminary investigations from 1992–1996 and follow-on work to date have identified soil and groundwater contaminant source areas through geophysical surveys, soil-gas surveys, trenches, test pits, MIP screening, soil borings, soil sample analyses, and groundwater sampling and analyses. These investigations identified a large area of soil fill and buried debris east of Taxiway Tango, extending to the base of the embankment at Frog Mortar Creek. Investigation of this fill area identified geophysical EM anomalies and areas containing buried debris, soil containing VOCs, and soil containing other soil contaminants such as polycyclic aromatic hydrocarbons (PAHs) and metals from past dumping and backfilling. Past dumping and backfilling have led to VOCs remaining in soil and pond sediment at the DRA, and to the development of large contaminant plumes of VOCs in groundwater in the upper, intermediate, and deep portions of the surficial aquifer east of Taxiway Tango and extending to Frog Mortar Creek.

2.3.1 Dump Road Fill Characteristics

Several events indicate that fill, debris, and wastes were placed in the area of the DRA. During the 1989 PA of the airport, the MSA facility manager stated that former aircraft facility employees had told him that spent battery acid, acid-type strippers, and other acidic solutions were routinely dumped into three ponds or “acid pits” east of Taxiway Tango. The former aircraft facility employees also told the MSA facility manager that dredge spoils and construction debris had been disposed of in these ponds. The PA investigation did not include follow-up work at the acid pits.

A recent study of historical drawings and aerial photographs identified the locations of several disposal pits and open burning areas that were present in the 1950s (Tetra Tech, 2013a). One as-built engineering drawing identified what is now Pond 1 as a designed “acid and oil disposal” pit (see feature #1 on Figure 2-4). Aerial photographs showed a second, slightly smaller pit southeast of and adjacent to Pond 1 (feature #2 on Figure 2-4) and a small linear pond (feature #24 on Figure 2-4) that was located along the eastern end of feature #2 in 1955 prior to the feature #2, which was first observed in a 1959 photograph. Aerial photographs showed both pits with dark soil staining on the sides, presumably from chemical and/or fuel dumping. One photograph shows what appeared to be dark product floating on the water surface of the smaller pit located adjacent to Pond 1. A pit and an open burning area (features #44 and #15 on

Figure 2-4) were shown near DRA wells MW-45S and DMW-1A. Other pits were identified beneath Taxiway Tango approximately 600 feet northwest of Taxiway Delta between wells MW-24S and MW-2 (feature #43 on Figure 2-4), northwest of the PHA (features #46 and #47 on Figure 2-4), and east of wells MW-18S/I/D (feature #42 on Figure 2-4). Another open burning area and more debris piles were identified west-southwest of the DA (see features #45 and #51 in Figure 2-4).

The aerial photograph study also showed that a cove of Frog Mortar Creek existed in the northern portion of the DRA before filling activities conducted in the 1950 (see blue dashed outline of Limehouse Cove in Figure 2-4). Photographs show that the upper reach of Limehouse Cove is in the area of present-day Taxiway Tango; the upper portion was filled in between 1938 and 1945. Filling of Limehouse Cove continued into the 1950s, with much of the filling taking place during the mid-1950s. In a 1959 photograph, the cove appears completely filled in. Based on present day topography, more than 10 feet of fill was placed in certain portions of the former cove area. The results of the aerial photograph study also showed grading and filling of areas south of the cove and in the Compass Rose Area (CRA).

In July 1991, four drums were uncovered during installation of underground electric cables immediately west of Taxiway Tango. A subsequent file review in 1991 produced a 1956 United States Army Corps of Engineers map and soil profiles that indicated an area of fill and trash west of the ponds, approximately 900 feet long and five feet deep, underlying Taxiway Tango. This discovery prompted MAA to conduct a geophysical survey of a 200- by 1,600-foot area adjacent to Taxiway Tango between the taxiway and the runway.

Numerous geophysical anomalies were detected indicating possible buried metal within the survey area. This area became known as the TT Median Area because of these anomalies. The top surfaces of the metal were estimated to be at shallow depths of 2–3 feet below grade. During a 1996 environmental investigation of the DRA, several drums were uncovered in the forested area near wells MW-2 and MW-5 northeast of Taxiway Tango. These events indicated that industrial debris and wastes were possibly in the subsurface at the DRA.

In 2000, trenches and two test pits were excavated in the TT Median Area and DA of the DRA (Tetra Tech, Inc. [Tetra Tech], 2000). Debris types were noted in the field and fill depths and anomalous areas were investigated via test pits A1 through A44 in 2008–2009 to confirm the geophysical investigation findings, to evaluate fill depth, and assess any buried materials.

The 2007 geophysical survey and follow-on test-pit investigation (Tetra Tech, 2012c) delineated several geophysical anomaly areas at the DRA. The EM anomaly areas range in size from 0.18 acres for Area 3 to 5.10 acres for Area 2. The site also has non-anomalous EM areas where the geophysical survey results do not indicate buried metal or debris. The geophysical survey results indicated areas of fill and buried debris suspected of containing waste. These were designated Areas 1–10, which are shown in Figures 6-1 and 6-2 located in Appendix A. The fill/debris thicknesses and fill/debris maximum depths of the test pits and trenches were also plotted and contoured in these figures.

Detailed descriptions of the ten areas and test pit results are provide in the *Dump Road Area Characterization of Possible Source Areas Report* (Tetra Tech, 2013b) and are, therefore, not repeated herein. However, the findings of this investigation (Tetra Tech, 2013b) are described below for the areas related to the current work plan scope of work.

Area 2, in the northern portion of the site, includes Pond 2 to the east and extends past Taxiway Tango to the west. This area includes test-pit excavations TT-EX-1, A1, A2, A14, A15, A24, A25, A34, and A36. Test pits A26, A35, and A42 are immediately south, north, and east, respectively, of the Area 2 boundaries. Elevated field measurements of VOCs in soil (jar head-space analysis) range from 1.2 parts per million per volume (ppmv) at A26 to greater than 2,000 ppmv at excavation TT-EX1.

Area 9 is a 2.07-acre area in the northeastern portion of the site. It is a densely vegetated area outside the MSA security fence bordering Frog Mortar Creek where geophysical surveying could not be conducted due to steep terrain and dense vegetation. Three test pits (A16, A17, and A44) were excavated in this area to determine the presence, thickness, and depth of possible fill and buried debris. Fill was not encountered at A16, although a black sludge-like soil and a strong odor of what was described as paint thinner was found at eight to 10 feet below grade.

Non-Anomalous Areas - Test pits N2, N3, N4, N6, N7, and N8 were excavated in non-anomalous areas outside of Areas 1 through 10. The fill material at test pit N4 (north of

Pond 1) is three feet thick and contained a greenish-black liquid and an odor that provided a field reading of 700 ppmv for VOC. Debris encountered in this pit includes glass and wood.

2.3.2 Soil Borings B-8 and B-15

In 1996, MAA expanded its investigation of soil and groundwater quality to include the fill area between Taxiway Tango and Frog Mortar Creek (Maryland Environmental Service, 1996). This investigation involved the area east of Taxiway Tango, including the two former acid pits (i.e., ponds) that had been identified in the 1989 PA. During the expanded investigation, three groundwater monitoring wells (MW-4, MW-5, and MW-6) were installed. In addition, 25 DPT soil borings and five manual soil-probe borings were advanced in this area to depths ranging from six to 22 feet below grade. Boring B-8 was advanced in the DA southwest of current well MW-5, and soil boring B-15 was advanced near the unpaved road in the PHA, adjacent to current well cluster DMW-9S/I/D.

A void was encountered while advancing soil boring B-8. Neither the boring log nor the report includes clear details regarding this void; however, the boring log does indicate that the void may be from a buried tank or container at depths of eight to 13 feet. No lithology is listed from two to eight feet in the soil lithology column of the boring log of B-8, but soil samples from five and 10 feet are described, and continuous lithology is shown in the log from eight to 14 feet (the bottom depth of the soil boring). The report indicated that the void is 11 feet long.

Soil at the 12 to 14 feet depth interval in boring B-8 was reported as having a strong odor, and had a high field reading (greater than 2,500 ppmv for total VOCs using a portable photoionization detector [PID]). The boring log also indicates that pure product was observed at this depth. Soil samples from the 12 to14 foot depth interval (as noted in the soil boring log) were submitted to both the field laboratory and to an off-site analytical laboratory for chemical analyses (note, however, that Table 1 in the 1996 expanded investigation report lists the sampling depth as 10 to 14 feet). The field laboratory analyses of soil from boring B-8 found high concentrations of TCE (6.2 milligrams per kilogram [mg/kg]) and total petroleum hydrocarbons (TPH)-diesel-range organics (DRO) (19,000 mg/kg). However, the off-site laboratory analyses reported a much lower TCE concentration (130 micrograms per kilogram [µg/kg]), which is equivalent to 0.130 mg/kg.

Monitoring well MW-5 was installed in January 1996 directly downgradient and 12 feet east of boring B-8; this well is screened from 19 to 39 feet below grade. In January 1996, TCE, *cis*-1,2-dichloroethene (*cis*-1,2-DCE), and toluene were detected in groundwater samples collected from MW-5 at concentrations of 63,000, 38,000, and 6,900 micrograms per liter (µg/L), respectively. The January 1996 TCE concentration (63,000 µg/L) indicated the likely presence of TCE dense non-aqueous phase liquid (DNAPL) at or near well MW-5.

During the same investigation, free product was also observed at depths of four to seven feet in boring B-15, located in the dirt access road near the PHA. A soil VOC reading of 9,300 ppmv was recorded at the groundwater table six feet below grade. This was presumably petroleum-related product (light non-aqueous phase liquid). A sample from four to seven feet in depth (as indicated on the log, but listed in Table 1 of the 1996 report as seven to 10 feet) was collected for chemical analyses. Laboratory results reported TCE in boring B-15 soil at 140 µg/kg and xylenes at 13,000 µg/kg (13 mg/kg).

Well MW-4 was installed in January 1996 near borings B-1 and B-15 to assess the strong petroleum odor observed at B-1. In January 1996, TCE was not detected, and only low concentrations of other VOCs were detected at MW-4. MW-4 is screened from 4-30 feet below grade.

From March to May 2000, the source identification and assessment program (Tetra Tech, 2000) further investigated areas previously identified as possible chemical-release areas. Each possible chemical source area was investigated through a combination of excavations, localized trenching, drilling of soil borings, and sampling and laboratory chemical analyses of soil, sediment, and groundwater samples. Shallow soil from Pond 1, Pond 2, and the PHA was investigated by collecting 15 soil samples at depths of 11 feet or less (typically four to five feet deep) from drilled soil borings. The PHA soil borings were located near soil boring B-15 (advanced during the 1996 confirmation investigation), which contained petroleum hydrocarbons.

The highest reported concentration of the petroleum-related compounds of benzene, toluene, ethylbenzene, and xylenes (BTEX) at the PHA was 2,138,900 µg/kg, detected in a sample collected from test pit DR-A33 (six-feet deep). Soil boring PHA-SB-1 (Figure 6-14 in Appendix A), advanced adjacent to soil boring B-15 (where free product had been observed at 4-7 feet), had a field VOC reading of 9,300 ppmv for soil at six feet below grade. BTEX were detected at 1,470 µg/kg adjacent to boring B-15 in sample PHA-SB-1-4 (Figure 6-14 in Appendix A) collected at a depth of four feet. Many elevated BTEX concentrations, including the concentration detected at DR-A33, were detected at depths near the water table. As shown in Figure 6-14 (Appendix A), BTEX were detected at low concentrations ranging from 2.97 to 20.47 µg/kg in deep subsurface soil samples at borings DR-SB-7(16 and 20 feet), DR-SB-17 (19 feet), DR-SB-10 (24 feet), and MIP-25 (40 feet).

In general, however, current TCE concentrations from wells DMW-7S (4,700 µg/L), MW-5 (not detected), MW-40S/I (3,900 and 6,800 µg/L, respectively) and probe groundwater samples CPT-11 through CPT-15 (10-9600 µg/L) do not indicate the presence of DNAPL. However, TCE concentrations of 9,600 µg/L at CPT-13 (40 feet deep), 8,000 µg/L at CPT-12 (30 feet deep), and 7,200 µg/L at CPT-11 (35 feet deep) suggest that additional probe groundwater sampling may be required to further assess the possible presence of DNAPL in these areas. High concentrations of cis-1,2-DCE and vinyl chloride at many DA probe groundwater sample locations, particularly those downgradient of DMW-7, indicate that degradation of TCE is occurring at the DA. This higher level of degradation is likely in response to past injections of substrate during a pilot scale test in 2007.

2.3.3 Soil and Groundwater Contaminant Sources

As discussed in Section 2.2, previous investigations have identified four primary contaminant source areas for TCE (and other associated cVOCs), and for BTEX:

- TT Median Area
- Ponds 1 and 2
- DA
- PHA

- PHA

The present review of existing data confirms all but Pond 2 as primary source areas for DRA soil, pond sediment, and groundwater contamination. Results of shallow sediment samples from Pond 2 do not indicate that Pond 2 is a VOC source at the DRA. These four possible source areas have been the focus of the initial investigations conducted in the 1990s and the follow-on work conducted to date. However, the *Dump Road Source Areas Investigation Work Plan* (Tetra Tech, 2012a) and *Technical Memorandum for the Dump Road Area, Source Area Delineation* (Tetra Tech, 2012b) identified three additional areas of elevated VOCs in soil and groundwater that required further investigation. These areas were identified as:

- Taxiway Tango Area – East (TT East)
- Taxiway Tango Area – North (TT North)
- area east of Pond 1

The 2012 source area investigation was designed to gather additional environmental data at all seven identified areas.

The 2012 historical aerial photograph and document review (Tetra Tech, 2013a) confirmed the location and use of Pond 1 as an acid and oil pit, and identified other operational features such as debris piles at the DA (feature #51 on Figure 2-4) and an open burning area and open pit at TT East (features #44 and #15 on Figure 2-4). Based on the review of aerial photographs, historical documents, and previous chemical data, the *Dump Road Area Characterization of Possible Source Areas Report* (Tetra Tech, 2013b) also identified other features that are considered to be possible chemical source areas. For the current study, possible source areas are identified as:

- former Pond 3 and linear pond — ponds located south of Pond 1 - features #2 and #24 in Figure 2-4

- former open burning area and pit— features #15 and #44 in Figure 2-4

- former Ponds 5 and 6 — features #46 and #47 in Figure 2-4

- DMW-4 former debris pile area — feature #51 in Figure 2-4

- Taxiway Tango South - former disturbed area — feature #53 in Figure 2-4

- former Pond 7 — feature #42 in Figure 2-4 and currently a wetland

- former ammo or fuel bunkers — features #20 and #26 in Figure 2-4 (same area as TT North)

The former ammo or fuel bunkers (features #20 and #26) are located in TT North; feature #51 (former debris piles) is in the DA; and the former open burning area and pit (features #15 and #44) are located in TT East. Therefore, these features are combined with the previously identified TT North, DA, and TT East source areas.

From Tetra Tech (2013b) and combining previous sites and historical (former) features, the following areas and media are possible TCE source areas (see Figures 6-3 through 6-12 in Appendix A):

- PHA, Pond 1 – surface sediment/subsurface soil, groundwater
- TT Median Area – subsurface soil, groundwater
- TT East, former open burning area and pit (features #44 and #15) –subsurface soil, groundwater
- DA, former debris piles (feature #51) – surface and subsurface soil, groundwater
- TT North, former ammo or fuel bunkers (features #20 and #26) – subsurface soil, groundwater
- area east of Pond 1 – subsurface soil, groundwater
- former Pond 3 and former linear pond (features #2 and #24) – groundwater, soil is unknown
- DMW-4 former debris pile area (feature #50) – soil, groundwater

The affected media are unknown for the following possible source areas:

- former Pond 4/open burning (OB) area (features #43 and #45) – surrounding samples indicate trace to low concentrations of TCE in soil and groundwater
- former Ponds 5 and 6 (features #46 and #47)
- former Pond 7 (feature #42)
- Taxiway Tango South - former disturbed area (feature #53)

The following areas and media are considered possible BTEX sources, as identified through previous investigations (Tetra Tech, 2012b) and combining sites with historical (former) features (see Figures 6-13 through 6-21 in Appendix A):

- PHA, Pond 1 — surface sediment/subsurface soil, groundwater
- TT Median Area — subsurface soil, groundwater
- TT East-former open burning area and pit (features #44 and #15) — subsurface soil, groundwater
- DA, former debris pile (feature #51) — groundwater
- DMW-4 former debris pile area (feature #50) — soil (groundwater is unknown)

The affected media are unknown for the following possible BTEX source areas:

- former Pond 3 and linear pond (features #2 and #24) — soil is unknown
- former Pond 4/open burning (OB) area (features #43 and #45) — nearby samples indicate trace to low concentrations in soil and groundwater
- former Ponds 5 and 6 (features #46 and #47)
- former Pond 7 (feature #42)
- Taxiway Tango South - former disturbed area (feature #53)

Detailed discussions of these known and possible VOC source areas, along with the chemical results of historical and 2012 sampling, are provided in the DRA source characterization study (Tetra Tech, 2013b) and are not repeated herein. The known and possible VOC source areas listed above are shown in Appendix A (Figures 7-1 and 7-2) of this work plan. VOC source areas and possible VOC source areas in these two figures are indicated by text boxes, shadings highlighting soil and groundwater VOC source areas, and shadings of former DRA features.

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA Main Terminal and Surrounding Features_revised 1 13 12.mxd)
1/13/2012 -- 1:01:35 PM

Source: Google Earth Pro, 2010

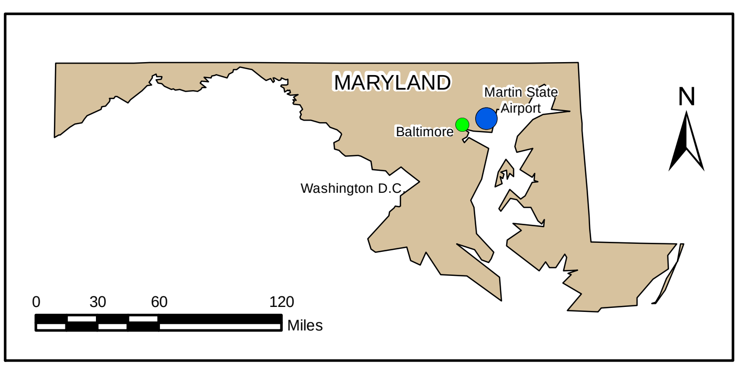

FIGURE 2-1

MARTIN STATE AIRPORT AND SURROUNDING FEATURES

Frog Mortar Creek
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED:	CREATED BY:
1/13/12	MP

TETRA TECH

P:\GIS\LOCKHEED_MSA\MAPDOCS\MXD\FENCE_SEP2009_G.MXD 10/06/11 JEE

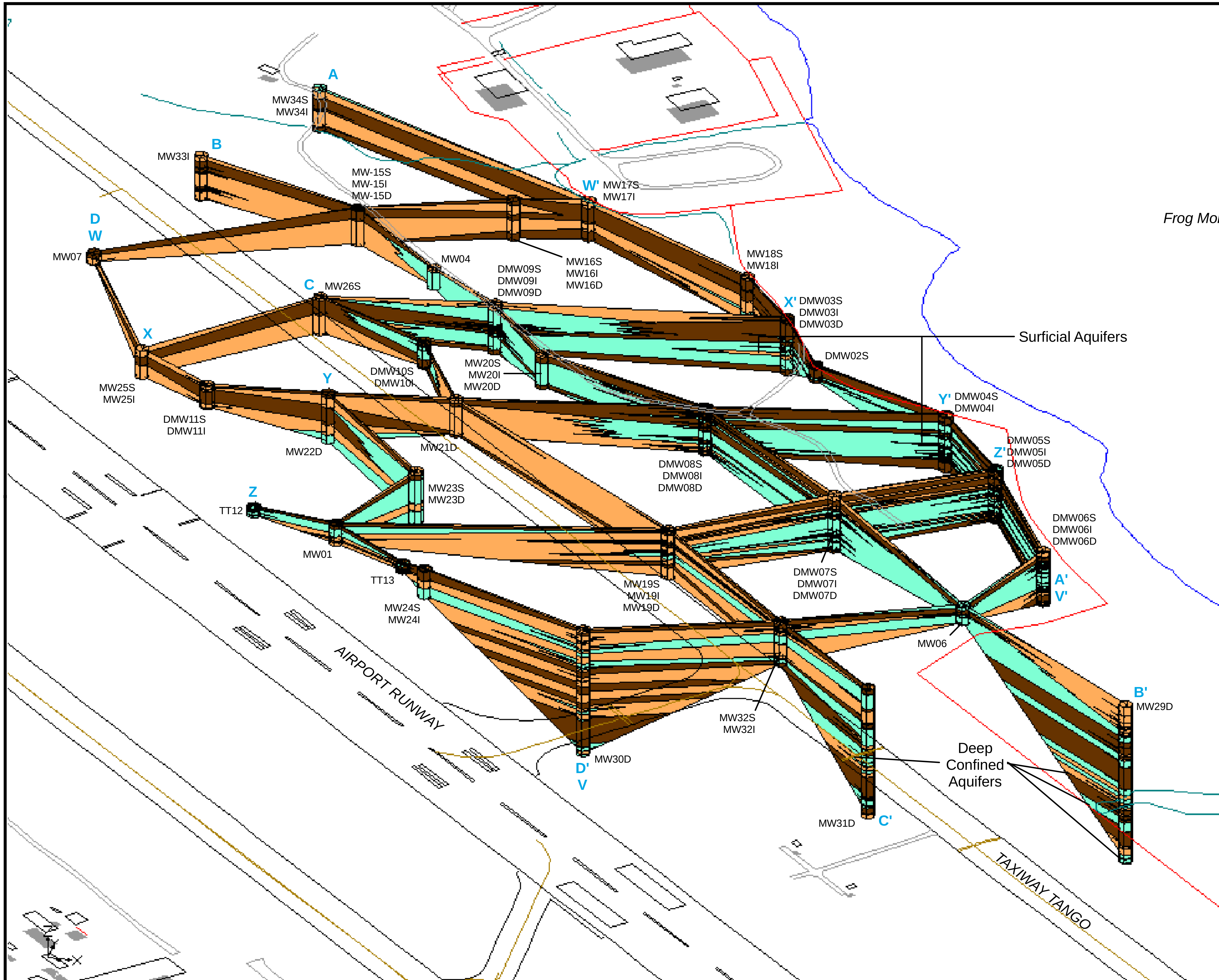

FIGURE 2-2

GEOLOGIC FENCE DIAGRAM OF THE DUMP ROAD AREA

LEGEND

MATERIALS

HIGHER PERMEABILITY (TYPICALLY >10 FT/DAY): SAND AND SAND & GRAVEL

MEDIUM PERMEABILITY (TYPICALLY 1-10 FT/DAY): MIXTURE OF SAND, SILT, AND/OR SOME CLAY

LOWER PERMEABILITY (TYPICALLY <1 FT/DAY): CLAY AND SILT & CLAY

Hydrostratigraphic units were interpreted from lithology information of boring logs and slug test results.

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED:	10/06/11	CREATED BY:	JEE

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA Dump Road Features Fig 2-1_revised 1 13 12.mxd)
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FIGURE 2-3

AREAS OF CONCERN
DUMP ROAD AND RUNWAY AREA

LEGEND

POND

MARYLAND AIR NATIONAL GUARD BOUNDARY

Frog Mortar Creek
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 60 120 240 Feet

N

DATE MODIFIED: 1/13/12

CREATED BY: MP

TETRA TECH

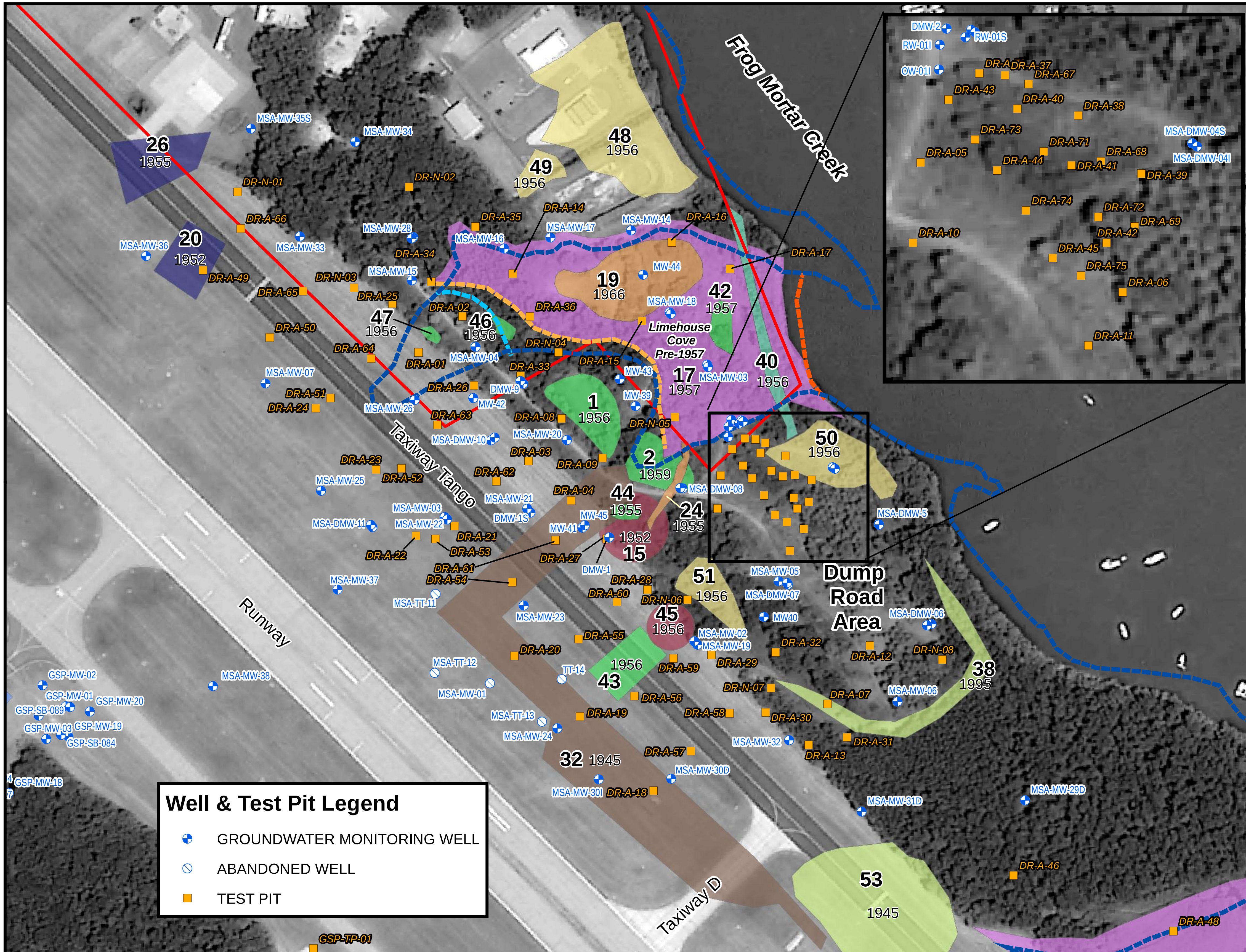

FIGURE 2-4

DUMP ROAD AREA
HISTORICAL FEATURES
MARTIN STATE AIRPORT

Legend

Historical Features

- Bermed Structure
- Bunker Ammo or Fuel
- Debris Piles
- Dike/Berm
- Dike/Berm Terraced
- Disturbed Earth
- Earthen Mound
- Fill
- Fuel Truck Bunker
- Open Burning
- Pond
- Pond/Pit

Site Area Boundary

- Maryland Air National Guard

Shorelines from Aerials

- 1959
- 1952
- 1945
- 1941
- 1938

NOTE: Locations of features 43 and 45 were taken from oblique aerials and are approximate in size and location.

Background Photo Source: USDA - July 27, 2011

Lockheed Martin, Martin State Airport
Middle River, Maryland

0 75 150 300 Feet

N

DATE MODIFIED: 1/17/13

CREATED BY: LR

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\historic Aerials\Historical Features DRA_wells.mxd)

Section 3
Investigation Program and Methodology

The 2013 Dump Road source area soil and groundwater characterization will investigate the 0.7 acre wetland area east of Ponds 1 and 2 and immediately west of Frog Mortar Creek, along with additional possible source areas (see Figure 2-4) in the Dump Road Area (DRA), as identified in the *Dump Road Area Characterization of Possible Source Areas Report* (Tetra Tech, 2013b). Additional sample locations are based on comments from the Maryland Department of the Environment (MDE) on Tetra Tech's *Dump Road Source Areas Investigation Work Plan* (Tetra Tech, 2012a) and *Technical Memorandum for the Dump Road Area, Source Area Delineation* (Tetra Tech, 2012b). The MDE comments and Tetra Tech's responses are in Appendix B.

Elevated trichloroethene (TCE) concentrations have been detected historically in intermediate-zone monitoring wells MW18I, DMW3I, and DMW2, located in the eastern portion of the DRA. This investigation will assess the subsurface conditions east of these monitoring wells approaching Frog Mortar Creek, and will help determine potential contaminant pathways and concentrations toward the creek. Additional samples will be collected to further delineate the known source areas in the DRA, and to help define the possible source areas identified in the DRA source area characterization report (Tetra Tech, 2013b). Chemicals of potential concern (COPC) detected in soil and groundwater will be compared to cleanup goals developed by the state of Maryland described in the Dump Road remedial investigation report (Tetra Tech, 2012c). COPC concentrations also will be compared to concentrations detected in soil and groundwater elsewhere at the DRA. Data also will be used to update the site conceptual model, and will help to provide conclusions and recommendations regarding the nature and extent of possible groundwater source areas in environmental media (groundwater, sediment, surface water, and soils) at the site.

The objectives of this investigation are presented in Section 1. The activities proposed for this investigation are as follows:

- obtain utility clearances and an access agreement and associated permits for intrusive investigations from Lockheed Martin Corporation (Lockheed Martin), Martin State Airport (MSA), the Maryland Aviation Administration (MAA), and the Federal Aviation Administration (FAA), as required

- advance 10 soil borings for lithological characterization using a direct push technology (DPT) drill rig and collect discreet soil samples to a depth of approximately 30 feet below ground surface (bgs)

- collect lithology data at 21 locations using a DPT drill rig, and collect up to 231 discrete groundwater samples (11 per location), at a minimum of 5-foot intervals, to depths of up to 60 feet below grade

- install six monitoring well clusters (each consisting of three two–inch diameter groundwater monitoring wells, including a shallow, intermediate, and deep well set at approximately 20, 40 and 60 feet bgs, respectively), to characterize groundwater conditions in the wetlands west of Frog Mortar Creek and downgradient of Ponds 1 and 2, as well as along the Frog Mortar Creek shoreline downgradient of the landfilled waste material

- collect water level data from each of the 18 newly installed groundwater monitoring wells and from 35 nearby existing wells

- collect groundwater samples from the 18 new monitoring wells

- collect surface water samples from three sediment sampling locations in the 0.7 acre wetland located near the Frog Mortar Creek shoreline (before collecting sediment samples), from two additional sampling points in Pond 1, and from the two existing stilling wells (MW-43S and MW-44S) installed in Ponds 1 and 2 in 2012

- survey the eighteen newly installed groundwater monitoring wells (i.e., six well couplets) using a Maryland-licensed surveyor

- collect sediment cores using a Shelby Tube, piston tube, or comparable sediment sampling device from three locations within the 0.7- acre wetland near the Frog Mortar Creek shoreline (two samples per core, for a total of six samples) and from four locations in Pond 1, to a depth of 2-feet below the sediment surface. Two sediment samples will be taken from each of three sediment cores between 0-1 foot and 1-2 foot depths. These sediment samples will be collected to assess sediment contaminant concentrations (both horizontally and vertically), and will be used to update the conceptual site model, determine the source, extent, and trends of COPCs detected in the 0.7-acre wetland sediment, and provide for a more complete characterization of Pond 1 sediment. Sediment samples from the three areas of the wetland will be analyzed for grain size distribution (ASTM International [ASTM] Method D422) and soil permeability (ASTM Method D2434).

- excavate a total of seven test pits at three locations based on comments from MDE regarding the DRA source area characterization report (Tetra Tech, 2012a):
    - o area east of Ponds 1 and 2 and along Frog Mortar Creek, and in the area near four test pits (at soil boring locations B8 and B15, advanced in 1996), to further assess free product and/or subsurface anomalies described on the boring and test pit logs
    - o test pit location N4, to further evaluate the black/green liquid described on the N4 test pit log
    - o test pit location A16 in DRA9 where a black sludge-like soil and a strong solvent odor was previously encountered
- collect, store, and characterize investigation derived waste (IDW), and dispose of the waste at an off-site Lockheed Martin-approved treatment or disposal facility
- perform laboratory chemical analyses and chemical data validation on soil, groundwater, surface water, and sediment samples
- evaluate environmental sampling data
- report results

DRA areas proposed for this work include areas with difficult access, thick vegetation, security issues (Maryland Air National Guard fence line) and rough terrain. Substantial site access activities such as brush clearing and tree removal will be required to gain access to the proposed sample locations. Significant surface disturbance (i.e., creating new roads, cutting into the sloped surface, etc.) or engineering controls (i.e., silt fence) are not expected to be necessary. Positioning of the proposed sample locations will be contingent upon MAA approval, as select sample locations may be located in established wetland areas. No significant repair or site restoration is expected to be required following the project (i.e., sodding, replanting of trees, restoring any site access road to its original condition).

3.1 MOBILIZATION/DEMOBILIZATION

Following approval of this work plan, the Tetra Tech, Inc. (Tetra Tech) field operations leader will coordinate mobilization and demobilization, procuring the required subcontractors and mobilizing personnel and materials to the field. This will include locating the appropriate equipment required for all field tasks, purchasing and leasing necessary equipment as required, and staging equipment for efficient loading and transportation to the site. Mobilization will likely begin in the spring of 2013 and include the following:

- coordinate with Lockheed Martin, MSA, MAA and Maryland Air National Guard (MDANG) facilities
- obtain utility clearance for the proposed DPT, monitoring well, and test pit locations using both Miss Utility and a private firm, as described in Section 3.2
- mobilize subcontractors, equipment, and materials to the site
- implement the following:
  - site-specific health and safety plan (HASP)
  - emergency response plan
  - sampling and analysis plan
  - waste management plan conforming to Lockheed Martin's *Energy, Environment, Safety, and Health (EESH) Remediation Waste Management Procedure No: EROP-03, Revision 4* (effective April 17, 2009)
  - quality assurance/quality control (QA/QC) plan
  - data management plan
- arrange a decontamination area

Demobilization activities will include the following:

- demobilize equipment and materials from the site (at work completion)
- perform general site cleanup and removing trash (at work completion)
- perform surface restoration/landscaping repair as necessary (at work completion)
- manage IDW (as described in Section 3.3.12)

Before beginning field operations, appropriate Tetra Tech personnel will review the site–specific HASP and the respective Safe Work permits included therein. Tetra Tech will conduct a daily mandatory health and safety tailgate meeting before all fieldwork. All Tetra Tech and subcontractor personnel will sign work permits as specified in the HASP. Subcontractors present for the day's field activities will be included in these meetings. The Tetra Tech field operations leader will document the topics covered, personnel in attendance, and conduct the safety audit, in accordance with the Lockheed Martin *Contractor Handbook*. Safety requirements are addressed in detail in the site-specific Tetra Tech HASP included as Appendix C.

3.2 SITE ACCESS, PERMITS, AND UTILITY CLEARANCE

Tetra Tech will establish, maintain, and mobilize to support the field investigation activities including providing clearance for subsurface investigations and obtaining required permits to conduct the investigation. Before starting intrusive work Tetra Tech will obtain all of the required access agreements and permits to conduct the subsurface investigations including drilling permits, excavation permits from MSA, MAA digging and zoning permits, MDE wetland permits (if necessary), and FAA or state permits, if any are required.

Tetra Tech will schedule a meeting with MAA to discuss the proposed field activities. A permit will be required before starting any investigation field activities. Depending on the location of the proposed DPT, monitoring well, and test pit sample locations, and their proximity to any critical airport operations areas (e.g., taxiway and runway), MAA will make a decision whether an MAA permit is adequate to perform the work, or whether an FAA permit would be required. Issuance of the MAA permit may include additional conditions such as requiring work near the runway to occur during the night time hours only to minimize risk and air traffic disruptions, thus maintaining safe airport operations. Based on Tetra Tech's previous experience, it will take approximately four weeks to acquire the MAA permit. If, however, an FAA form 7460-1 (Notice of Proposed Construction or Alteration) is required, it may take up to four months to get approval and obtain the permit. The FAA permit is also likely to include a condition requiring work only during night time hours for drilling near the runway (e.g., DPT-38). The FAA review might also include the review of the work plan and multiple site visits to confirm the proposed locations.

Based on historical work conducted at the site and the location of the proposed sample locations in this work plan, Tetra Tech assumes that only an MAA permit will be required, and that no significant work restrictions will be mandated. Most sample locations included in this work plan are located behind the fence line in the wooded portion of the DRA, away from the active airport taxiways and runway. Some additional samples are located adjacent to Taxiway Tango in the midfield area between Taxiway Tango and the active runway. Similar to previous investigations, these locations are expected to be sampled during localized taxiway shutdowns coordinated through MAA and MDANG. Assuming these conditions, an FAA permit should not be required.

Sampling the proposed locations in the 0.7-acre wetland east of Ponds 1 and 2 may require a Joint Federal/State Non-Tidal Wetlands Permit, obtained through the MDE. However, based on historical work at the DRA site, using smaller drill rigs may not cause surface disruption, thus eliminating the need for the MDE wetlands permit. Upon marking the final sample locations in the field, Tetra Tech will consult with MAA and MDE to determine if the wetland permit is required.

Tetra Tech will secure the proper permits (airport zoning permit, building permit, and digging authorization) through the MAA. Final permit approvals and work restrictions will be finalized upon meeting with MAA. Tetra Tech will obtain all required clearances and permits before beginning any intrusive field activities related to this investigation, including:

- notifying the underground-utility location center Miss Utility (1-800-257-7777; www.missutility.net)
- reviewing facility and site utility maps
- following Enterprise Operations (EO)-28 and Lockheed Martin *Minimum Requirements for Intrusive Fieldwork Work Plans*, completing the digging authorization form, and obtaining the required signatures. Activities described in this work plan will not occur on Lockheed Martin owned or operated property; therefore, signatures of Lockheed Martin representatives will be obtained at the discretion of the approving personnel
- obtaining FAA approval (as required)
- completing the airport zoning permit, the building inspection permit, and the digging authorization through MAA
- obtaining monitoring well permits
- using a private utility-locating firm (Enviroscan, Inc.) to identify subsurface utilities/anomalies. (As part of the subcontract, Enviroscan will provide a full report of the utility clearance.)

Previous correspondence with Baltimore Washington International Airport (BWI)/MAA personnel indicates that the time required to obtain a permit is largely based on the meeting schedule and current workload of the BWI/MAA permit committee, which ultimately processes and approves each permit application. Tetra Tech assumes that the proposed work will not be affected by any MSA or MDANG restrictions, and that no significant work restrictions will be imposed due to airport operations that could interfere with the proposed tasks. Following the same procedures as for all MSA projects to date, Tetra Tech will work closely with MSA, MDANG, MAA, and their tenants to keep all parties apprised of the field schedule.

Access to the area for the site walk will be arranged through MSA and MAA at Lockheed Martin's direction. Tetra Tech may also schedule select subcontractors to attend the site walk so they can view site conditions before mobilizing for the proposed work.

Based on a site walk conducted in January 2013, it is recommended that an additional gate be installed along the DRA fence line running parallel to Frog Mortar Creek. This additional gate will provide a better route for the drill rigs, excavator, and support vehicles to access the sample locations in the central portion of the DRA, and will reduce the amount of necessary brush and small tree clearing. Tetra Tech will consult with both MAA and MDANG to determine the logistics of installing the additional gate. Based on initial discussions with both MAA and MDANG, a security escort may be provided by MDANG while conducting work in this area. An MAA-provided lock placed on the new gate will be controlled by MAA and MDANG, similar to the other gates in the DRA.

Before any intrusive field activities, each proposed DPT, monitoring well, and test pit location will be cleared for subsurface utilities. In addition to calling in a Miss Utility ticket, a private utility locating service will be used to mark any underground utilities and anomalies. Tetra Tech will also verify that the necessary drilling permits that are required by the state of Maryland for the work contained in this proposal are obtained by the selected drilling subcontractor(s) before starting any drilling activities. Utility clearance work and documentation will conform to the provisions of the Lockheed Martin *Remediation Contractor's ESH Handbook, Revision 1*, June 10, 2009 (included in Appendix C–HASP) or latest update. Copies of permits, Miss Utility tickets and the report prepared by the utility locating company will be submitted as part of the final project report.

Tetra Tech will also follow the procedures outlined in the Lockheed-Martin Corporate Staff Procedure *EO-28 Digging Projects*. As directed in EO-28, the utility and underground structure location survey will include the appropriate equipment necessary to detect buried foundations and slabs, piping, direct–bury cables, and other buried conduits and structures, using the technologies appropriate to the anticipated utilities such as an electromagnetic detector; ground penetrating radar; acoustic plastic pipe locators; probes, beacons, or trace wire; or cesium magnetometer. Examples of commonly used equipment include a Fisher TW-6 electromagnetic (EM) pipe and cable locator/tracer; a Radiodetection cable-avoidance tool and Genny pipe and cable locator/tracer, a Radiodetection RD4000 Multifrequency pipe and cable tracer, and a Geophysical Survey Systems Inc. Subsurface Interface Radar System (GSSI SIR-2000) ground-penetrating radar (GPR) system. All utilities within a 30-foot radius of each designated drilling or excavating location will be located using the appropriate technology, and marked on the ground surface with paint of the appropriate colors.

The proposed area of the investigation is bounded by extensive tree cover and vegetation. Before utility clearance and intrusive subsurface field activities, the area covered by vegetation and trees will require brush and small tree clearing. Tetra Tech will obtain the necessary permits for these activities. All cleared brush will be chipped and spread on-site and handled in accordance with applicable rules, regulations, and permits.

DPT borings, monitoring well, and test pit locations may be offset in the field based on the subsurface utility mark–out. Minimum distances for borings from underground utilities are provided in the HASP. Miss Utility will be requested to clear and locate utilities in the investigation area in and around the DRA shown in the figures herein. Borings relocated out of these areas will require a new Miss Utility ticket as well as MSA operational approval, and possibly an MAA permit. Miss Utility tickets must be renewed every 12 days. Before beginning work, access arrangements will be coordinated through MSA operations to gain access to the DRA. Tetra Tech will maintain radio communication with the MSA air traffic control tower regarding the daily field schedule during field activities.

3.3 FIELD METHODOLOGY

3.3.1 Test Pit Investigation

An estimated seven test pits (TP-A76 through TP-A82) will be excavated at locations selected in response to comments MDE had for the *Dump Road Source Areas Investigation Work Plan* (Tetra Tech, 2012a). Data from these test pits will be used to further investigate the DRA east of Ponds 1 and 2, and areas of elevated historical elevated concentrations of COPC. Test pits will be excavated in the following areas (Figure 3-1):

1) **Test pit location A16 in Area 9 (TP-A76) –** to investigate the black sludge-like soil and a strong solvent odor previously encountered

2) **Test pit location N4 (TP-A77) –** to further evaluate the black/green liquid described on the N4 test pit log

3) **Near 1996 soil borings B-8 (TP-A79) and B15 (TP-A78) –** to evaluate the presence of strong odors and product (likely petroleum product) in soil in areas with elevated VOC levels (near previous soil borings B-8 and B-15, advanced in 1996)

Three additional test pits (TP-A80 through TP-A82) will be excavated in areas of concern indicated by historical observations and detections. Any test pit excavations located in critical areas near Taxiway Tango will be scheduled with MAA and MDANG to occur on days and at times when Taxiway Tango is not in use, or during a localized taxiway shutdown. Based on the location of the proposed test pits and the distance from Taxiway Tango, this is not expected to be a concern. Figure 3-1 is a map detailing the proposed test pit locations and the summary and rationale for the test pit locations are shown on Table 3-1.

Test pits will be excavated using an excavator (rubber-tired backhoe or similar equipment) to a depth that extends through the waste material to natural subsurface soils, if possible (i.e., the anticipated maximum depth of 15 feet bgs) and until groundwater is reached precluding further excavation. At each test pit excavation, soils will be described and logged by a qualified geologist and screened for the presence of volatile organic compounds (VOCs) with a photoionization detector (PID) using a consistent headspace screening methodology (e.g., foil sealed jar or zip-top bag technique). Waste materials, soil type, and anthropogenic material encountered in the test pits will be described, photographed, and a test pit log will be completed. A global positioning system (GPS) unit capable of sub-meter accuracy will be used to establish the coordinates of each end of each test pit excavation and will be noted on the test pit log.

One composite soil sample from each of the four test pits will be collected, as requested by MDE, and submitted for laboratory analysis. The composite samples requested by MDE will consist of a minimum of five grab samples from the excavated soil and waste pile, focusing on material exhibiting clear evidence of contamination (i.e., odor, PID readings, appearance, etc.). Two grab soil samples will also be collected from the three remaining test pits using the same criteria and methodology. In the absence of identifiable impacts, grab samples will be collected from the upper three feet of the test pit and from the interval directly above the water table. Large debris such as pieces of glass, metal, fabric, or masonry will not be included with the samples. The presence of such debris and the grab-sample location(s) will be recorded on the test pit log. Approximate percentages of debris types based on volume (e.g., 50% concrete, 10% plastic, etc.) will be estimated for each test pit and recorded on the test pit log sheet. Soil samples will be analyzed for VOCs; semi-volatile organic compounds (SVOC) including 1,4-dioxane; polychlorinated biphenyls (PCB); total petroleum hydrocarbons (TPH)-diesel range organics (DRO)/gasoline range organics (GRO); and priority pollutant metals.

Test pits will be backfilled after environmental characterization activities are completed. Excavated material will be used as backfill; any large debris will be placed in the bottom of the excavation. The backfill material will be compacted in lifts using the excavator bucket to prevent subsidence and the ground surface will be restored to its original grade. Surface soil and grass turf that was set aside during test-pit excavation will be restored at the surface to complete the site restoration. No personnel will be allowed to enter the pits, and test pits will not remain open overnight. No debris or excess soil will be left in the vicinity of the test pit.

In 1999, test pit excavations uncovered several inactive (i.e., dummy) bombs, therefore Tetra Tech will provide visual monitoring for unexploded ordnance (UXO) during test pit excavations. Should UXO be discovered, field work will be terminated, and the area will be marked and secured. MAA will be notified immediately. No further work will be performed in the UXO location(s) until they have been cleared.

3.3.2 DPT Soil Investigation

Ten soil borings (SB-187 through SB-196) will be advanced to depths of approximately 30 feet bgs using a mobile all-terrain vehicle track-mounted DPT drill rig. These borings specifically target three areas of the DRA:

- boring SB-187 – in TT North where elevated levels of TCE were detected in soil at SB-31;
- borings SB-188 through SB-192 – in the eastern portion of the DRA near Frog Mortar Creek and down gradient of monitoring wells MW-18S/I/D, DMW-3S/I/D, and DMW5S/I/D, wells that have exhibited elevated VOC concentrations;
- borings SB-193 through SB-196 – in the Drum Area (DA) where elevated concentrations of TCE were detected in shallow soil but where no deep soil samples have been collected.

The soil boring locations are based on comments from MDE on the DRA source areas work plan (Tetra Tech, June 2012a), historical observations and detections, and the results of the test pit investigation discussed in the previous section. Figure 3-2 shows the proposed locations of the DPT soil borings; Table 3-2 provides a summary and the rationale for the boring locations.

Continuous soil samples (DPT macrocores) will be collected for lithologic description and field screening. Soil borings will be advanced by a Maryland-licensed driller. Soil borings will be continuously logged and screened in the field for VOCs. All soil samples will be screened with a PID using a consistent headspace screening methodology (e.g., foil sealed jar or zip-top bag technique). Two soil samples from each boring will be collected for laboratory analysis based on the water table depth, DPT/vertical aquifer sampling (VAS) groundwater data field screening results, and visual evidence of possible contamination such as staining, discolorations, and odors. If no contamination is evident and no preferential migration or preclusion layers are identified, the first and last sample from the borehole will be submitted for laboratory analysis. Soils will be described on a lithologic log prepared by a qualified geologist. All bore holes will be pressure grouted from the bottom of the borehole to ground surface using a tremie pipe. Boring locations will be located using a GPS. Soil samples will be analyzed for VOCs, SVOCs including 1,4-dioxane, PCBs, TPH-GRO and –DRO, and priority pollutant metals. A subset of these soil samples will be analyzed for total organic carbon (TOC), total inorganic carbon (TINC), cation-exchange capacity (CEC), nitrates, phosphates, total Kjeldahl nitrogen (TKN), and pH. These parameters will be used to assess soil reactivity and buffering of metals, nutrient availability, and buffering capacity for possible *in situ* remediation technologies.

Brush and small tree clearing will be required to gain access to the DPT soil boring locations. Leveling of the rough terrain or establishing new access roads is not expected to be required. These site clearing and access activities will be subject to approval by the MAA.

3.3.3 DPT Groundwater Investigation

Vertical aquifer sampling (VAS) will be conducted at approximately twenty-one borings (DPT-23 through DPT-43) using a DPT drill rig. This technique will be used to collect discrete groundwater samples to a depth of up to 60 feet bgs to further investigate aquifer conditions. Groundwater samples will be collected at MDE-recommended locations, in areas identified as possible source areas, and in areas of known contamination. Each boring will be drilled to a terminal depth of approximately 60 feet bgs unless refusal is encountered. Seven locations (DPT-23 through DPT-29) will be advanced near Frog Mortar Creek, at locations suited for installation of monitoring well clusters. The results of the VAS will be used to target the screen interval depths. The remaining thirteen DPT groundwater locations will further delineate groundwater conditions in areas of known contamination (including the Drum Area (DA), Taxiway Tango Median Area and Taxiway Tango North), and will also investigate possible source areas including former Pond 4/open burning area and former Pond 3 and the former linear pond. A proposed DPT location map for groundwater samples is presented as Figure 3-3; the location summary and rationale for this sampling protocol is presented as Table 3-3.

All VAS borings will be advanced using the dual-tube (DT) sampling system. The DT technology uses 2.25 or 3.25 inch outer-diameter probe rods as an outer casing and 1.0 or 1.25 inch outer-diameter rods for the inner rod string. The outer rods are equipped with a cutting shoe threaded into the lead rod. When driven into the subsurface, the cutting shoe cuts a soil core, which is collected inside of the outer casing sliding, into the acetate liner held in place by the inside rod string. Upon reaching the desired depth, the inside rod string with the soils retained in the acetate liner are removed from inside of the outer rod. The outer rod remains in the ground thereby providing a cased hole to prevent any cross contamination. A clean liner is then attached to the inner rod, which is sent back downhole in the outer rod, and another outer rod is added to the drill string. This tooling is then further advanced into the subsurface 5 feet, and the sequence is repeated as described above.

A reusable, 3-foot long, stainless steel groundwater sampler fitted with a one-foot screen will be used to collect the groundwater samples. The push rods and stainless steel samplers/screens will be decontaminated between sample collections. After completion of each exploration, boreholes will be pressure grouted from the bottom of the borehole to ground surface using a tremie pipe. DPT groundwater investigation locations will be located using a GPS.

Groundwater samples will be collected from each of the 21 DPT locations at five foot intervals, starting at approximately 10 feet bgs (at the estimated groundwater table) to a depth of 60 feet bgs. The DPT rig will be used to collect 231 groundwater samples (plus 24 duplicate samples for a total of 255 samples) for off-site laboratory analysis for VOCs under a standard turnaround time.

3.3.4 Monitoring Well Installation

Tetra Tech will arrange for and monitor the installation of six monitoring well clusters (MW-46S/I/D, through MW-51S/I/D) which will be used to characterize groundwater conditions in the wetlands west of Frog Mortar Creek and downgradient of Ponds 1 and 2. These wells will also provide information about groundwater along the Frog Mortar Creek shoreline downgradient of the landfilled waste material to assess the direction of groundwater flow and the groundwater gradient; to determine aquifer parameters; to assess contaminant concentrations (horizontally and vertically) in support of updating (if necessary) the conceptual site model; and to determine the source and extent of COPC detected in groundwater, as appropriate. Soil samples will be collected during drilling activities. The well drilling and well installation will be conducted by a Maryland-licensed driller. A Proposed Monitoring Well Location Map is presented as Figure 3-4; the rationale for sampling and a sample summary are in Table 3-4.

Six 2-inch diameter groundwater monitoring well clusters will be installed at approved locations based on the results of the DPT groundwater investigation. Each well cluster will consist of a shallow, intermediate, and deep overburden monitoring well (i.e., 18 monitoring wells) with the midpoint of the well screens set at approximately 20 feet bgs, 40 feet bgs, and 60 feet bgs, respectively. The proposed location of the wells is on high ground (not along the immediate shoreline of Frog Mortar Creek); thus, the total depths of each well may increase and will be dependent upon the current water table conditions. Each well cluster will consist of a shallow overburden monitoring well ("S-interval" well) installed within a single well borehole along with the intermediate overburden monitoring well ("I-interval" well), with the deeper overburden monitoring well ("D-interval" well) installed in a separate borehole. The 18 wells will be installed by advancing a test boring with Rotosonic drilling methods in accordance with the approved work plan. This type of monitoring well will be consistent with other monitoring wells in the MSA network. The costing at each well cluster location is based on the configuration previously described (the shallow and intermediate wells nested in one boring, with the deeper well installed in a separate offset boring).

Drilling and Sampling: Well boreholes will be advanced using a low-profile, mini-sonic drilling rig (i.e., rotosonic method) operated by a Maryland-licensed well driller to characterize groundwater conditions in the study areas. The rotosonic method involves using a four-inch by six-inch drill rod/override-casing configuration (with temporary casing) to install the well to the target depth. Soil will be continuously sampled during drilling using a 10-foot core-barrel. Tetra Tech field personnel will monitor test boring and monitoring well installation activities, collect and screen soil samples for VOCs with a portable photoionization detector (PID) and a consistent-headspace screening methodology (e.g., glass-jar headspace technique), and maintain a field log of encountered materials of the formation. A qualified Tetra Tech field geologist will perform lithologic logging. All pertinent information, including boring location, soil/lithology descriptions, and PID readings, will be recorded on a soil boring log-form.

Up to six soil samples will be collected from each test boring for laboratory analysis during the installation of the groundwater monitoring wells. Sample collection will be based on the water table depth, corresponding DPT groundwater data field screening results, and visual evidence of possible contamination such as staining, discolorations, and odors. If no contamination is evident, the first sample from the borehole and the sample at the groundwater table will be submitted for laboratory analysis. Each soil sample will be analyzed for VOCs, SVOCs, PCBs, TPH-GRO and –DRO, and priority pollutant metals. A subset of representative soil samples will be analyzed for TOC, TINC, CEC, nitrates, phosphates, TKN, and pH. These parameters will be used to assess soil reactivity and buffering of metals, nutrient availability, and buffering capacity for possible *in situ* remediation technologies.

Trip blanks will be provided by the laboratory. One trip blank will be analyzed daily per cooler of VOC samples collected; no other QA/QC samples will be collected. Duplicate samples for matrix spike purposes will be collected and analyzed on a 1:20 basis. All samples will be analyzed on a standard 21–day turnaround time.

Monitoring Well Construction: Monitoring wells will be installed to a maximum depth of 60 feet bgs by a Maryland-licensed driller. Monitoring wells will be constructed using 10-slot Schedule 40 polyvinyl chloride (PVC) well screen, based on the fine grain size typically encountered in the surrounding formation. Monitoring well total depth and screen location will be determined based on an evaluation of previous soil and groundwater investigations, soil boring field screening results and the VAS sampling conducted as part of this investigation. The screen length may be adjusted in the field to address the depth to groundwater and installation of a surface seal. At a minimum, a 5-foot section of well screen in the shallow overburden wells will be installed beneath the water table.

In all wells, a sand pack around the well screen will extend a minimum of two feet above the top of the well screen and a minimum of one foot below the bottom of the well screen. Following placement of the sand pack, the well will be pre-developed by surging to settle the sand pack around the screen. The depth to sand will be measured using a weighted tape or known length of tremie pipe. If settlement of the sand pack is noticed, additional sand will be used to bring the sand pack back up to the desired depth. A bentonite seal will be installed above the sand pack and allowed to hydrate during installation. A second sand pack will be installed above the bentonite and then a cement/bentonite grout will completely fill the remaining annular space up to the ground surface. The relative thickness of the bentonite seal, upper sand pack, and surface seal may be adjusted to accommodate the shallow depth to groundwater. Using concrete, a protective steel stick-up casing or flush–mounted manhole will be secured around the well casing to protect the well. Well locations in the wooded area will be completed using a locking, stick–up casing while wells in the open grass areas will be completed using a flush-mounted cover to allow for grass mowing. Steel protective covers for stick-up constructed wells or expandable sanitary seals for flush-mount wells will be locked using currently available MSA well locks (keyed-alike American Lock™ Series 1105).

The highest point on the top of the PVC well casing will be marked using a file (i.e., filing a small groove in the casing) or an indelible marker. The marked location of each well will be surveyed by the land surveyor and will be used to measure the depth to groundwater at the well. Well construction details will be recorded in the field logbook and on a well construction form.

Mobilization and set-up will take longer at the airport due to security and site access. The six groundwater monitoring locations will be located in the area between Frog Mortar Creek and the MAA security fence line; this includes both rough terrain and a heavily wooded area. Site clearing tasks such as brush and tree clearing will likely be required for drill rig and vehicle access, and will increase the time to access the sample location. Final drilling locations and field constraints will be determined upon consultation with the MAA.

Following well installation, the 18 new monitoring wells will be developed before sampling. Well development will be scheduled as soon as possible following installation, but not before a minimum of 24-hours have elapsed to allow the grout to set-up following well construction. The wells will be developed by bailing to remove heavy sediments, then by gentle surging and purging with a centrifugal pump, submersible pump, or equivalent to remove fines and sediment from the sand pack and well screen. If the well is not cleared, air lift mechanisms will be implemented to clear the well from sediments. The development process will begin at the bottom of the well, working up to the top of the screened interval, and then back down to the bottom of the well incrementally.

Development will continue until the water is clear and free of suspended solids, when field parameters such as pH, conductivity, temperature, and turbidity have stabilized, when the well is purged dry and the groundwater level does not return to 80 percent of the static level within 24 hours or a maximum of two hours, whichever occurs first. Stabilization will be considered achieved when three consecutive readings, taken at five-minute intervals, are within ±0.1 standard units for pH, ±3% for specific conductance and temperature, and less than 50 nephalometric turbidity units for turbidity. Field parameters will be recorded using a water quality meter and turbidity readings will be collected using a separate turbidity meter. Field parameters will be collected every three to five minutes until pumping is complete and recorded in the appropriate site-specific logbook and on a well development record. If the development water is very turbid, physical parameters will not be collected to prevent damage to the water quality meter. If a well is purged dry, the water level will be allowed to recover a minimum of 80 percent of its initial static water level before resuming development. Additional well development will not be conducted if the well is pumped dry and the groundwater level does not return to 80 percent of the static level within 24 hours. All development water will be collected in United States Department of Transportation (USDOT)-approved, 55-gallon steel drums, properly labeled, and stored at a facility–approved location.

3.3.5 Water Level Measurements

Water level data will be collected from the six new well clusters prior to any groundwater sampling activities. Arrangements will be made with MAA and MDANG to access the monitoring wells. Water levels in every well will be measured using a water level meter or an interface probe and the information will be recorded on field data sheets. The water-level data will provide information on groundwater flow characteristics and will be used to create a groundwater contour map for the upper, intermediate, and deeper surficial aquifer zones. The static water level will be determined by lowering the meter's probe into the well until the liquid level indicator emits an audible tone, indicating the air/water interface. Water levels will be measured with an electronic water level meter to 0.01 foot accuracy. Water level measurements will be taken at the eighteen newly installed groundwater monitoring wells and also from 35 nearby existing wells in the DRA. Water level measurements will be recorded in the appropriate site-specific field logbook and on a groundwater level measurement field form. The depth of each well will also be recorded when synoptic water level measurements are collected.

3.3.6 Groundwater Sampling

Groundwater samples will be collected from each of the new 18 monitoring wells after the wells have been allowed to equilibrate with the aquifer for a minimum of one week (i.e., 7 days) following well development activities. Per MDE request, groundwater samples will also be collected from existing wells MW-43S and MW-44S.

Sampling will be performed for all wells using low-flow methods whereby water quality parameters (pH, temperature, conductivity, oxygen-reduction potential [ORP], dissolved oxygen [DO], and turbidity) will be monitored and recorded every 5 minutes or each purge volume, whichever is quicker. Purging will continue until parameters have stabilized, which will be considered achieved when three consecutive readings are within ±0.1 pH, ±3% for conductivity, ±10 mV of ORP, and ±10% for turbidity, or a maximum of two hours, whichever occurs first. Ferrous iron will be measured in the field using HACH field test kits.

One sample will be collected from each of the newly installed wells and existing wells MW-43S and MW-44S during the groundwater investigation and will be submitted for laboratory analysis. Groundwater samples from all sampled wells will be analyzed for the following parameters:

- VOCs by SW846 Method 8260B
- SVOCs and 1,4-dioxane by SW846 Method 8270D
- TPH-GRO and TPH-DRO by SW846 Method 8015D
- total and dissolved priority pollutant metals by SW846 Method 6010C/7470A

- hexavalent chromium by SW846 Method 7199

Three groundwater samples (from one well cluster), will be analyzed for natural attenuation parameters including the following: nitrate, nitrite, ammonia nitrogen, phosphate, sulfate, total alkalinity, dissolved organic carbon, total iron, total manganese, total potassium, total calcium, total magnesium, total chloride, total sodium, total silica, total dissolved solids, and methane, ethene and ethane (Microseeps® AM 20GAX protocols). The laboratory analytical method for methane, ethane and ethane will be capable of achieving the following detection limits: 0.10 micrograms per liter (µg/L), 0.025 µg/L, and 0.025 µg/L, respectively.

Groundwater samples for VOCs and TPH-GRO will be collected first, followed by samples to be analyzed for SVOCs/1,4-dioxane, TPH–DRO, metals and hexavalent chromium. Each groundwater sample to be analyzed for dissolved metals will be filtered in the field before sample preservation using a dedicated, disposable, 0.45-micron filter and a peristaltic pump. Groundwater samples collected for hexavalent chromium will not be field filtered.

Trip blanks will be provided by the laboratory. One trip blank will be analyzed daily per cooler of VOC samples collected; no other QA/QC samples will be collected. Duplicate samples for matrix spike purposes will be collected and analyzed on a 1:20 basis. All samples will be analyzed on a standard 21–day turnaround time.

3.3.7 Pond Surface Water Sampling

Tetra Tech will collect surface water samples from the three sediment sampling locations (EWT-SW1 through EWT-SW3) in the 0.7 acre wetland located near the Frog Mortar Creek shoreline; two additional surface water samples (EP1-SW15 and EP1-SW16) will be collected from Pond 1. Surface water samples will be collected before sediment samples are collected. Figure 3-5 shows the proposed surface water sampling locations; Table 3-5 includes a summary and the rationale for sample location. Figure 3-5 also shows the locations of the previous surface water samples collected in Pond 1 and Pond 2.

All samples will be collected with the use of waders or from a small watercraft (rowboat or similar), using manual methods. Surface water samples will be collected as grab samples using direct filling sampling techniques at a depth of approximately one-foot below the water surface, taking care not to disturb the bottom sediment in the near-shore sample location. Alternately, samples may be collected using a peristaltic pump, Teflon tubing, and a stainless-steel tubing weight in accordance with USEPA guidance (USEPA, 2007). Sampling using a peristaltic pump will provide a method consistent with surface water samples collected from Frog Mortar Creek in 2007 and 2008. At the time of sample collection, the locations will be surveyed using a hand-held GPS and surveyed in the Maryland State Plane North American Datum (NAD) 1983 (feet). Water quality parameters, including temperature, pH, specific conductance, salinity, turbidity, DO, and oxidation-reduction potential will be measured at all surface water sample locations on both sides of the creek at the time of sampling. Surface water quality parameters will be monitored using a Horiba U-52 Water Quality Meter in the site-specific logbook and appropriate field forms. Ferrous iron will be measured in the field using a HACH field test kit.

The five surface water samples will be analyzed for the following parameters:

- VOCs by SW846 Method 8260B
- 1,4-dioxane by SW846 Method 8270D
- TPH-GRO and TPH-DRO by SW846 Method 8015D
- total and dissolved priority pollutant metals by SW846 Method 6010C/7470A
- hexavalent chromium by SW846 Method 7199
- perchlorate by USEPA Method 314
- hardness by USEPA SW846 protocol

The sample analyses will provide chemical data to assess contaminant concentrations potentially dissolving/migrating into the pond water column, and will provide data to evaluate potential risks to human health and ecological receptors. Trip blanks will be provided by the laboratory. One trip blank will be analyzed daily per cooler of VOC samples collected; no other QA/QC samples will be collected. Duplicate samples for matrix spike purposes will be collected and analyzed on a 1:20 basis. All samples will be analyzed on a standard 21-day turnaround time.

3.3.8 Pond Sediment Sampling

Sediment samples will be collected to assess sediment contaminant concentrations (both horizontally and vertically) in support of updating the conceptual site model, to evaluate COPC trends, for use in determining the source and extent of COPCs detected in the sediment within the 0.7 acre wetland near the Frog Mortar Creek shoreline, and to provide a more complete characterization of Pond 1 sediment.

Tetra Tech will use a Shelby Tube, piston tube, or comparable sediment sampling device to collect samples from each of three locations (EWT-SD1 through EWT-SD3) within the 0.7 acre wetland near the Frog Mortar Creek shoreline, to a depth of two feet below the sediment surface. Sediment samples will be collected at two intervals: at 0-1 foot and 1-2 feet below the sediment surface. The sediment samples will be transferred directly from the sampling device into the appropriate glassware for submittal for chemical laboratory analysis, grain size analysis, and permeability testing. Undisturbed samples collected using a Shelby Tube are required for the permeability tests. Surface water will be decanted from the sample container prior to sealing and care will be taken to retain the fine sediment fraction during this procedure.

In addition, eight sediment samples will be collected from four sample locations (EP1-SD15 through EP1-SD18) in Pond 1. Tetra Tech will collect all sediment samples manually using waders or from a flat-bottom boat. Figure 3-5 shows the proposed sample locations and Table 3-5 provides a summary and the rationale for the selected locations. Figure 3-5 also shows the locations of the previous sediment samples collected in Pond 1 and Pond 2 during the 2012 investigation. Two sediment samples will be collected from each location using the sampling technique described above.

Sediment samples will be analyzed for the following:

- VOCs by SW846 Method 8260B
- SVOCs including 1,4-dioxane by SW846 Method 8270D
- PCBs by SW846 Method 8082
- TPH including GRO and DRO by SW846 Method 8015B
- priority pollutant metals by SW846 Method 6010

Trip blanks will be provided by the laboratory. One trip blank will be analyzed daily per cooler of VOC samples collected; no other QA/QC samples will be collected. Duplicate samples for matrix spike purposes will be collected and analyzed on a 1:20 basis. All samples will be analyzed on a standard 21-day turnaround time.

3.3.9 Surveying

A qualified, Maryland–licensed, land surveyor will provide horizontal and vertical coordinates for each of the eighteen new groundwater monitoring wells. Wells will be surveyed at the top of the well casing, and surveyed locations will be accurate to the nearest 0.01 foot for vertical elevations in the North American Vertical Datum 1988 and to the nearest 0.1 foot for horizontal coordinates in the North American Datum 1983. Ground elevations at the wells will be surveyed with a vertical accuracy of 0.1 foot. Horizontal coordinates for the monitoring wells will be determined using GPS. This information will also be used to update the MSA environmental geographic information system (EGIS).

3.3.10 General Sampling Procedures, Nomenclature, and Handling

A master site-logbook will be maintained at the site as an overall record of field activities. Each sample will receive a unique sample-identification consisting of the following: site location; the test pit, DPT soil boring, DPT water, surface water, sediment sample or well number; a sample depth for soil or DPT water samples, and a six-digit sampling date for groundwater samples as follows:

- Soil samples collected from test pits will carry the designation DR-TP (for Dump Road–Test Pit), followed by the unique identifier "A," and then the test pit number). The sample identification ends in a two-digit label indicating the depth of the soil sample. For example, "DR-TP-A67-08" would designate that the sample was collected from the DRA at test pit location A67 at eight feet below grade.

- Soil samples collected from the soil borings, the sample identification tag will carry the designation DR-SB (for Dump Road–Soil Boring), followed by the boring number, followed by the depth range of the soil sample. For example, DR-SB-190-10-12 designates that the soil sample was collected from the DRA at soil boring 190 from 10 to 12 feet below grade.

- DPT water samples will carry the designation DR-DPT (for Dump Road–direct push technology), followed by the boring number, followed by the depth of the water sample. For example, DR-DPT-23-20 designates that the DPT water sample was collected from the DRA at DPT location 23, from a depth of 20 feet below grade.

- Soil samples collected from the monitoring well borings will carry the designation DR-SB (for Dump Road–soil boring), followed by the boring number, followed by the depth range of the soil sample. For example, DR-SB-46S-10-12 designates that the soil sample was collected from the DRA at boring/well location 46S from 10 to 12 feet below grade.

- Surface water samples collected from Pond 1 and the wetland area will carry the designation EP1-SW (for existing Pond 1–surface water) and EWT-SW (for existing wetland–surface Water), followed by the sample number, followed by the depth of the sample below the water surface. For example, EP1-SW-15-1 designates that the surface water sample was collected from Pond 1, at location 15, and at a depth of 1 foot below the water surface.

- Sediment samples collected from Pond 1 and the wetland area will carry the designation EP1-SD (for existing Pond 1–sediment) and EWT-SD (for existing wetland–sediment), followed by the sample number, followed by the depth of the sample below the sediment surface. For example, EWT-SD-15-0-1 designates that the sample was collected from the wetland area, at location 15, from the top of the sediment surface to a depth of one foot below the sediment surface.

- Groundwater monitoring well samples will be designated by MSA-MW followed by the well location number and a six-digit number indicating the date of sample collection. For example, a groundwater sample collected on July 24, 2013 from the DRA monitoring well MSA-MW-46S would be labeled MSA-MW46S-072413.

- Trip blanks (TB) will be labeled with a TB prefix followed by a six-digit submittal date (e.g., TB-072413).

Sample handling includes the field-related considerations concerning the selection of sample containers, preservatives, allowable holding times, and analyses requested. Proper custody procedures will be followed throughout all phases of sample collection and handling. Chain of custody protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate (or detect) possible tampering.

Due to the short holding time for hexavalent chromium water sample analyses (analysis must occur within 24 hours of collection), these samples must be expedited to the laboratory in order for them to be analyzed within the 24-hour holding period. If the laboratory is local, the samples will be delivered to the laboratory the same day as the samples are collected, or when the laboratory opens the next morning. If the laboratory is not local, the samples will be collected later in the day (i.e., afternoon); this allows sufficient time for analyses after the samples are received by the laboratory the next morning via the overnight shipping company. The laboratory will be notified of delivery each day hexavalent chromium samples are collected. Samples collected for hexavalent chromium analysis will not be collected on Fridays or holidays to minimize the sample hold time before analysis.

Sample containers will be released under signature from the laboratory and will be accepted under signature by the samplers or individual responsible for maintaining custody, until the sample containers are transferred to the sampling team. Each sample container will be placed in a cooler with ice immediately after each sample container is filled in the field. Trip blanks will be placed in the coolers with the ice at the beginning of each day, and will remain in the cooler along with the VOC samples at all times. Coolers returning to the laboratory will be sealed with strapping tape and a tamper-proof custody seal. The custody seal contains the signature of the individual releasing the transport container, along with the date and time.

3.3.11 Equipment Decontamination

Decontamination of field equipment will be completed at a designated decontamination area established at the perimeter of the restricted work zone or will be conducted at each individual drilling location depending upon site logistics. All decontamination fluids will be containerized for subsequent disposal. Dedicated and/or disposable equipment will be used whenever possible. Reusable equipment (i.e., samplers, DPT drill rods, water level meters) will be decontaminated before and after each use. Decontamination of reusable small equipment will consist of the following steps:

- laboratory grade, phosphate free, ionic-anionic surfactant (Alconox®, Liquinox®, or equivalent) and potable water wash
- potable water rinse
- air drying
- collection of decontamination solutions for disposal.

All downhole drilling equipment, including the rear of the DPT rig, Roto–Sonic drill rig, and other equipment, will be cleaned before arriving on-site using heated, high-pressure water. The equipment will be cleaned in the same way before beginning work; between drilling locations; any time the rig leaves and returns to a hole before completing a boring; any time the drill rig leaves the site; and at the conclusion of the drilling program. All decontamination activities will be done at each individual drill location. Decontamination rinsate will be collected in USDOT-approved 55-gallon drums, labeled properly, for waste characterization and disposal.

3.3.12 Waste Management

A waste management plan conforming to Lockheed Martin *EESH Remediation Waste Management Procedure No. EROP-03, Revision 4* (effective April 17, 2009) is included as Appendix D. This plan will be followed during this investigation to store, manage, test and dispose of project IDW. IDW for this project will consist of soil cuttings from drilling, decontamination rinsate water, well–development water, groundwater sampling purge water, and used personal protective equipment (PPE). PPE IDW will be brushed off, placed in trash bags, and disposed of in an MSA facility trash receptacle designated by facility personnel. Soil cuttings from drilling, decontamination fluids, well–development water, and groundwater sampling purge water will be stored in USDOT-approved, 55-gallon steel drums. All drums will be properly labeled and logged on a drum inventory form in accordance with Appendix D. Drums will be moved to a staging area identified by facility personnel after completion of a task generating IDW.

After the field investigation, samples of the soil and water IDW will be collected and submitted for waste profiling. Upon receipt of the IDW analytical data, the generated IDW will be removed from the facility by a Lockheed Martin-approved waste contractor and properly disposed of in accordance with federal, state, and local regulations.

3.3.13 Site Restoration

The site will be restored to match original site conditions as necessary and as required by MSA operations or MAA following the field investigation described herein. Site restoration may be needed in the disturbed areas to match the areas' original conditions and can include filling truck ruts, resurfacing test pit locations or other surface disturbances to grade with soil and placing seed, seed tack, or sod.

3.4 DATA MANAGEMENT

Data handling procedures to be followed by the laboratory will meet the requirements in the laboratory subcontract. All analytical and field data will be maintained in the Tetra Tech project files. The project files will contain copies of the chain of custody forms, sampling log forms, sampling location maps, and documentation of QA/QC.

3.4.1 Data Tracking and Control

A cradle to grave sample tracking system will be used from throughout each sampling event. Before field mobilization, the field operations leader will coordinate and initiate sample tracking. Sample labels will be handwritten in the field or preprinted before entering the field. Labels will be reviewed for adherence to work plan requirements and for accuracy. The project manager (PM) will coordinate with the analytical laboratory to ensure that they are aware of the number and type of samples and analyses they will receive. When field sampling is underway, the field operations leader forwards the chain of custody forms to the PM/designee and the laboratory for each day of sampling. The PM/designee will confirm that the chain of custody forms provide the information required by the work plan.

This data management system will ensure early detection of errors made in the field so adjustments can be made while the field team is mobilized. After successful completion of all requested analyses, the laboratory will submit an electronic deliverable for every sample delivery group. When all electronic deliverables have been received from the laboratory, the PM/designee will ensure that the laboratory has performed all requested analyses. Ideally, discrepancies can be noted early enough so that all samples can be analyzed within the prescribed holding times.

3.4.2 Sample Information

Data from field measurements will be recorded using the appropriate log sheets. Reduction of field data entails summarizing and presenting these data in tabular form. Reducing laboratory data entails manipulating raw data instrument output into reportable results. Field data (e.g., temperature readings) will be verified daily by the field operations leader. Laboratory data will be verified by the group supervisor and then by the laboratory's quality control (QC)/documentation department.

3.4.3 Project Data Compilation

The analytical laboratory will generate an Adobe *Acrobat*® portable document format (PDF) file of the analytical data packages, as well as electronic database deliverables. The electronic database will be checked against the PDF file provided by the laboratory and updated as required, based on data-qualifier flags applied during data validation. Soil, sediment, surface water, and groundwater data, including DPT groundwater sample data and well sample data, will be incorporated into the EGIS database. All data, such as units of measure and chemical nomenclature, will be reviewed and corrected, if necessary, to maintain consistency with the project database.

3.4.4 Geographical Information System

Data management systems now in use consist of a relational database and geographic information system (GIS) used to manage environmental information pertaining to MSA. The relational database stores chemical, geological, hydrogeologic, and other environmental data collected during environmental investigations. The GIS is built from the relational database and contains subsets of the larger data pool. Using the GIS, environmental data can be posted on base mapping to provide a graphical representation of the information. Upon compilation of sample, chemical, and positional data, these data will be compiled and incorporated into the MSA EGIS. The EGIS system can generate various maps from the MSA data, including site and sampling location maps and contaminant tag maps, as needed.

3.4.5 Data Review

Definitive data from this investigation will consist of chemical data for soil and groundwater samples. These data will further delineate the nature and extent of soil and groundwater contamination, and will be used to evaluate the boundaries of contaminant groundwater plumes. These data will also be used in human health screening. Upon receipt of chemical data from the laboratory, it will be entered into a sample database and evaluated against risk-based criteria or standards. Data validation consisting of data completeness, holding time, calibrations, laboratory and field blank contamination, field duplicate precision, and detection limits will be completed concurrent with the data evaluation. This review will be based on the USEPA Region 3 *Modifications to the National Functional Guidelines for Data Review* (USEPA, 1993 and 1994), and the specifics of the analytical method used.

The samples for this project will be analyzed by a state-accredited laboratory for the compounds prescribed in this work plan, using the methodologies prescribed in the sampling and analysis plan and the QA plan. All analytical results will be thoroughly checked for quality and usability by qualified chemists. Results of data usability reviews (data validation) will be transmitted to the project personnel as they are received. All data provided by the laboratory will be validated for all QA/QC parameters including accuracy, precision, completeness, and comparability in accordance with USEPA Region 3 Level M2 protocols. In addition, oversight of the laboratory QA/QC will be as proactive as possible to ensure valid data are produced during the sampling event. Therefore, an evaluation of the methodology, method compliance, and any corrective actions will also be performed. Results of data usability reviews will be provided to Lockheed Martin and the managing contractor as they are received.

Table 3-1

Test Pit Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
Page 1 of 3

Test pit number	Test pit location	Approximate dimensions	No. of samples	Analysis (method)	Rationale/purpose[1]
A76	Dump Road Area 9 east of Pond #2	Length—10 feet Width—2 feet Depth—15 feet maximum	Two grab samples focusing on areas of suspected contamination	volatile organic compounds [VOCs] (8260B); semi-volatile organic compounds [SVOCs] including 1,4-dioxane (8270D); polychlorinated biphenyls [PCBs] (8082A); total petroleum hydrocarbons (TPH)-gasoline–range organics (GRO) and diesel–range organics (DRO) by (8015D); priority pollutant metals (6010C, 7471A)	Further investigate the area of historical test pit A16 in Dump Road Area 9 where black sludge-like soil with a strong solvent odor was previously encountered.
A77	Dump Road Area 2 north of Pond #1	Length—10 feet Width—2 feet Depth—15 feet maximum	One VOC grab sample; One composite sample for non-VOC analytes consisting of a minimum of five grab samples from the test pit	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH-GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	Further investigate area of 2008 test pit N4 where a green-black liquid with a very strong solvent odor was encountered.

Table 3-1

Test Pit Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
Page 2 of 3

Test pit number	Test pit location	Approximate dimensions	No. of samples	Analysis (method)	Rationale/purpose[1]
A78	West of monitoring well cluster DMW-9S/I/D in the Petroleum Hydrocarbon Area	Length—10 feet Width—2 feet Depth—15 feet maximum	One VOC grab sample; One composite sample for non-VOC analytes consisting of a minimum of five grab samples from the test pit	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH-GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	Further investigate 1996 soil boring B-15 where free product was identified.
A79	Northeast of the Drum Area and southwest of monitoring well MW-5	Length—10 feet Width—2 feet Depth—15 feet maximum	One VOC grab sample; One composite sample for non-VOC analytes consisting of a minimum of five grab samples from the test pit	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH-GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	Further investigate 1996 soil boring B-8 where a suspected buried tank/container and pure product were identified
A80	West of the 0.7 acre wetland area located west of Frog Mortar Creek and east of well cluster DMW-3S/I/D	Length—10 feet Width—2 feet Depth—15 feet maximum	Two grab samples focusing on areas of suspected contamination	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH-GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	Further investigate the area downgradient (east) of well cluster DMW-3S/I/D where elevated VOC concentrations have been detected.

Table 3-1

Test Pit Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland

Test pit number	Test pit location	Approximate dimensions	No. of samples	Analysis (method)	Rationale/purpose[1]
A81	Dump Road Area 2 west of Pond #2 and north of Pond #1 between the location of historical test pits A2 and A14	Length—10 feet Width—2 feet Depth—15 feet maximum	One VOC grab sample; One composite sample for non-VOC analytes consisting of a minimum of five grab samples from the test pit	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH-GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	To investigate Dump Road Area 2 where field measurements of VOCs, ranging from 1.2 to 2,000 parts per million (ppm) per volume were detected in soil in the location of a possible source area (former pit/pond; feature #46 in Figure 2-4) located in the 1956 aerial photo survey.
A82	Dump Road Area 9 east/southeast of Pond #2	Length—10 feet Width—2 feet Depth—15 feet maximum	Two grab samples focusing on areas of suspected contamination	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH-GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	Further investigate the area down gradient (east) of well cluster DMW-18S/I/D where elevated VOC concentrations have been detected.

[1] Rationale and purpose partially based on MDE comments (Appendix B) on *Dump Road Source Areas Investigation Work Plan* (Tetra Tech, *2012a)* and *Technical Memorandum for the Dump Road Area, Source Area Delineation* (Tetra Tech, 2012b).

DRO = diesel-range organics
GRO = gasoline-range organics
MDE = Maryland Department of the Environment
PCBs = polychlorinated biphenyls
SVOCs = semi-volatile organic compounds
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds

Table 3-2

DPT Soil Boring Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
Page 1 of 2

Direct-Push Technology (DPT) Soil Boring number	Location	Number of Direct-Push Technology (DPT) soil samples/depth (feet)	Analysis (method)	Rationale/purpose[1]
SB-187	Taxiway Tango Area-North	Two soil samples based on the water table depth and visual evidence of possible contamination such as staining, discolorations, and odors.	Volatile organic compounds [VOCs] (8260B); semi-volatile organic compounds [SVOCs] including 1,4-dioxane (8270D); polychlorinated biphenyls [PCBs] (8082A); total petroleum hydrocarbons (TPH)-gasoline–range organics (GRO) and diesel–range organics (DRO) by (8015D); priority pollutant metals (6010C, 7471A) one representative soil sample will also be analyzed for total organic carbon/total inorganic carbon (TOC/TINC; SW-848 9060), cation-exchange capacity (CEC; SW-846 9081), nitrates/phosphates (SW-846 9056), total Kjeldahl nitrogen (TKN; USEPA 351.3), and pH (SW-846 9045C)	To further investigate the soil conditions in the southern end of the VOC source area (Taxiway Tango Area-North) based on elevated TCE (11,000 µg/kg in boring SB-27 and 1,100 µg/kg in boring SB-31), vinyl chloride (580 µg/kg in boring SB-31) and cis-1,2-DCE (4,400 µg/kg in boring SB-31) concentrations detected in 2011.
SB-188 through SB-191	East of Pond #2 and west of Frog Mortar Creek	Two soil samples based on the water table depth and visual evidence of possible contamination such as staining, discolorations, and odors.	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH GRO/DRO (8015D); priority pollutant metals (6010C, 7471A) representative soil samples will also be analyzed for TOC/TINC (SW-848 9060), CEC (SW-846 9081), nitrates/phosphates (SW-846 9056), TKN (USEPA 351.3), and pH (SW-846 9045C)	To further investigate soil and waste conditions in the area east of Pond #2 and west of Frog Mortar Creek (former Pond 7-feature #42) along with the areas downgradient of monitoring well clusters MW-18S/I, DMW-3S/I, and DMW-2A/B which have exhibited elevated VOC concentrations.

Table 3-2

DPT Soil Boring Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
Page 2 of 2

Direct-Push Technology (DPT) Soil Boring number	Location	Number of Direct-Push Technology (DPT) soil samples/depth (feet)	Analysis (method)	Rationale/purpose[1]
SB-192	East of wells DMW-5S/I/D and west of Frog Mortar Creek	Two soil samples based on the water table depth and visual evidence of possible contamination such as staining, discolorations, and odors.	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH GRO/DRO (8015D); priority pollutant metals (6010C, 7471A); one representative soil sample will also be analyzed for TOC/TINC (SW-848 9060), CEC (SW-846 9081), nitrates/phosphates (SW-846 9056), TKN (USEPA 351.3), and pH (SW-846 9045C)	To further investigate soil and waste conditions in the area west of Frog Mortar Creek and east and hydraulically downgradient of well DMW-5S, which has exhibited elevated VOC concentrations in upper surficial aquifer groundwater.
SB-193 through SB-196	Drum Area	Two soil samples based on the water table depth and visual evidence of possible contamination such as staining, discolorations, and odors.	VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH GRO/DRO (8015D); priority pollutant metals (6010C, 7471A) representative soil samples will also be analyzed for TOC/TINC (SW-848 9060), CEC (SW-846 9081), nitrates/phosphates (SW-846 9056), TKN (USEPA 351.3), and pH (SW-846 9045C)	Further investigate the Drum Area based on elevated TCE concentrations detected in soil and groundwater in 2000 and 2002. Elevated TCE concentrations include; former DA Trench 2 (highest surface soil TCE concentration detected in the DRA site); groundwater from boring DA-7 collected from 26 feet below grade east of the DA trenches and excavation (191,384 µg/L); and the indication of DNAPL extending from the DA Trench area west of sampling location DA-1 to several hundred feet northeast between DA-6 and DA-9.

[1] Rationale and purpose partially based on MDE Comments (Appendix B) on Tetra Tech's June *2012 Dump Road Source Areas Investigation Work Plan and Technical Memorandum for the Dump Road Area, Source Area Delineation.*

CEC=	cation-exchange capacity
COPC=	chemicals of potential concern
DA =	Drum Area
1,2-DCE =	1,2-dichloroethene
DNAPL =	dense non-aqueous phase liquid
DRO=	diesel-range organics
GRO=	gasoline-range organics
PCBs=	polychlorinated biphenyls
SVOCs=	semi-volatile organic compounds
TCE =	trichloroethene
TINC=	total inorganic carbon
TKN=	total Kjeldhar nitrogen
TOC=	total organic carbon
TPH=	total petroleum hydrocarbons
USEPA=	United States Environmental Protection Agency
VOCs =	volatile organic compounds

Table 3-3

DPT Groundwater Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
Page 1 of 5

Direct-Push Technology (DPT) Groundwater Boring number	Location	Number of Direct-Push Technology (DPT) water samples/depth (feet)[1]	Analysis (method)	Rationale/purpose[2]
DPT-23 through DPT-29	East of Ponds 1 and 2 and immediately west of Frog Mortar Creek along the limits of buried waste	11/60[(1)]	Volatile organic compounds (VOCs) by SW846 Method 8260B	To provide vertical aquifer sampling to assess the shallow subsurface groundwater conditions immediately west of Frog Mortar Creek. The boring locations are strategically placed to coincide with the proposed groundwater monitoring well locations which will provide groundwater data to aid in determining the position of the well screens.
DPT 30 and DPT-31	Taxiway Tango Area-North	11/60[(1)]	VOCs by SW846 Method 8260B	Characterize groundwater conditions in the southern end of the possible VOC source area (Taxiway Tango Area-North) based on elevated TCE (11,000 µg/kg in boring SB-27 and 1,100 µg/kg in boring SB-31), vinyl chloride (580 µg/kg in boring SB-31) and cis-1,2-DCE (4,400 µg/kg in boring SB-31) concentrations detected in 2011.TCE has been detected in groundwater at wells MW-33S (TCE at 1,500 µg/L in 2009 and 690 µg/L in 2010), MW-15S/I (TCE at 63 and 1,500 µg/L for MW-15S and MW-15I in 2011) and MW-28I (TCE at 1,000 µg/L in 2011), which are hydraulically downgradient of the Taxiway Tango Area-North possible VOC source area. These groundwater TCE concentrations exceed the Maryland groundwater standard of 5 µg/L.
DPT-32	Taxiway Tango Median Area	11/60[(1)]	VOCs by SW846 Method 8260B	Characterize groundwater south/southeast of well DMW-11S to delineate VOCs in the area of the highest chlorinated VOC (cVOC) concentrations in monitoring well groundwater samples in the Dump Road Area.

Table 3-3

DPT Groundwater Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland

Direct-Push Technology (DPT) Groundwater Boring number	Location	Number of Direct-Push Technology (DPT) water samples/depth (feet)[1]	Analysis (method)	Rationale/purpose[2]
DPT-33	Eastern/southeastern portion of Taxiway Tango North Area	11/60[(1)]	VOCs by SW846 Method 8260B	Characterize groundwater quality hydraulically downgradient toward the southeastern/eastern portion of the Taxiway Tango North Area possible VOC source area in Dump Road Area 1 where TCE has been detected in groundwater at wells MW-33S (TCE at 1,500 µg/L in 2009 and 690 µg/L in 2010), MW-15S/I (TCE at 63 and 1,500 µg/L for MW-15S and MW-15I in 2011) and MW-28I (TCE at 1,000 µg/L in 2011). These groundwater TCE concentrations exceed the Maryland groundwater standard of 5 µg/L.
DPT-34	South of the Petroleum Hydrocarbon Area (PHA)	11/60[(1)]	VOCs by SW846 Method 8260B	Further characterize the groundwater quality upgradient of the Petroleum Hydrocarbon Area where elevated VOCs have been detected at CPT-16, MW-42S/I and DMW-9S/I/D. DPT-34 is located upgradient of CPT-16 and MW-42S/I/D (elevated VOC concentrations) and will aid in determining whether contamination present in the Taxiway Tango Median Area (DMW-11S/I and CPT-03 which exhibited the highest TCE and second highest BTEX groundwater concentration at the site) extends under Taxiway Tango toward the Petroleum Hydrocarbon Area.
DPT-35	Between the Drum Area (DA)and the Petroleum Hydrocarbon Area (PHA)	11/60[(1)]	VOCs by SW846 Method 8260B	Upgradient of monitoring well MW-45S and CPT-08 where elevated concentrations of VOCs were detected in 2012.

Table 3-3

DPT Groundwater Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
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Direct-Push Technology (DPT) Groundwater Boring number	Location	Number of Direct-Push Technology (DPT) water samples/depth (feet)[1]	Analysis (method)	Rationale/purpose[2]
DPT-36 and DPT-37	West/upgradient of the Drum Area (DA)	11/60[(1)]	VOCs by SW846 Method 8260B	Further characterize the groundwater conditions near former Pond 4/open burning area– features #43 and #45
DPT-38 and DPT-39	Area of Former Pond #3 and a former linear pond	11/60[(1)]	VOCs by SW846 Method 8260B	Further characterize the groundwater conditions in former Pond 3-feature #2 and a former linear pond-feature #24 south and southeast of previous sample location CPT-22. CPT-22 is located in an area southeast of Pond 1 which is indicated to be a third pit or pond on historical aerial photographs and a historical U.S.Geological Survey topographic map. Interviews conducted as part of the 1989 preliminary assessment indicated that a third pit was used to dump wastes; however, the third pit was not found during the preliminary assessment site visits. The third pit as well as an earlier linear pond or pit were identified on historical aerial photographs of the site. TCE in groundwater at well DMW-2A (13,000 µg/L), which is hydraulically downgradient of the former third pond and linear pond area, indicates possible TCE DNAPL in this area. Additionally, a groundwater sample collected near the third pond area (MIP-26 with a TCE groundwater concentration of 8,000 µg/L and $TCE_{(EQ)}$ of 58,006 µg/L in the intermediate surficial aquifer) also indicates the potential presence of TCE DNAPL in this area.

Table 3-3

DPT Groundwater Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland

Direct-Push Technology (DPT) Groundwater Boring number	Location	Number of Direct-Push Technology (DPT) water samples/depth (feet)[1]	Analysis (method)	Rationale/purpose[2]
DPT-40	Taxiway Tango Median Area	11/60[(1)]	VOCs by SW846 Method 8260B	Further investigate elevated TCE concentrations in CPT-01 down to 55 feet bgs (highest concentration of 630 µg/L at 23-25 feet). Boring will be located adjacent to the runway to investigate the source area contributing to the elevated concentrations detected in DMW-11S/I and whether the source is located west/southwest of CPT-01 or possibly on the western side of the runway.
DPT-41 through DPT-43	Downgradient of the Drum Area	11/60[(1)]	VOCs by SW846 Method 8260B	High cVOC concentrations are present in the upper surficial aquifer, and TCE concentrations detected in the wells and temporary wells in this area suggest the presence of DNAPL. VOCs have not been sufficiently delineated to the north, east, south, and west in this area. Therefore, three locations are distributed around the Drum Area and wells DMW-7S and MW-5S. These sample locations will provide additional characterization of the upgradient side of the Drum Area and areas north and east (down gradient) of wells DMW-7S and MW-5S along with delineating the extent of the VOCs in the upper surficial aquifer and confirm lower concentrations in the intermediate surficial aquifer.

[1] Two hundred thirty one groundwater samples (plus 24 duplicates for a total of 255 samples) will be collected from the 21 DPT groundwater boring locations. The actual number of samples depends upon the depth to groundwater at each location; therefore, the number of samples collected per boring will vary. Assuming the water table is at 10 feet on average, and groundwater is collected every five feet from 10 to 60 feet in each boring, an estimated 11 samples will be collected per boring. The total number of samples/borings may be adjusted in the field based on site conditions.

[2] Rationale and purpose partially based on MDE Comments (Appendix B) on Tetra Tech's June *2012 Dump Road Source Areas Investigation Work Plan and Technical Memorandum for the Dump Road Area, Source Area Delineation.*

Table 3-3

DPT Groundwater Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland
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bgs=	below ground surface
BTEX =	benzene, toluene, ethylbenzene, xylenes
COPC =	chemicals of potential concern
cVOCs =	chlorinated volatile organic compounds
DCE=	dichloroethene
DNAPL =	dense non-aqueous phase liquids
DPT =	direct-push technology
DRO =	diesel-range organics
GRO =	gasoline-range organics
MDE =	Maryland Department of the Environment
MIP=	membrane-interface probe
µg/kg	micrograms per kilogram
µg/L=	micrograms per liter
PCBs =	polychlorinated biphenyls
SVOCs =	semi-volatile organic compounds
TCE =	trichloroethene
TCE (EQ)	trichloroethene equivalents
TPH =	total petroleum hydrocarbons
USEPA =	United States Environmental Protection Agency
VOCs =	volatile organic compounds

Table 3-4

Groundwater Monitoring Well Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland

Well number	Location	Well bottom depth[1]	Soil sample analysis (method)	Groundwater sample analysis (method)	Rationale/purpose
MW-46S/I/D through MW-51S/I/D	East of Ponds 1 and 2 and immediately west of Frog Mortar Creek along the limits of buried waste	"S" shallow wells to an approximate depth of 20 feet below grade "I" intermediate wells to an approximate depth of 40 feet below grade "D" deep wells to an approximate depth of 60 feet below grade Final well depths will be based on the current water table conditions and may increase due to the proposed locations on the higher ground as opposed to down along the immediate Frog Mortar Creek shoreline.	Up to two soil samples will be collected from each monitoring well boring for VOCs (8260B); SVOCs including 1,4-dioxane (8270D); PCBs (8082A); TPH GRO/DRO (8015D); priority pollutant metals (6010C, 7471A)	Volatile organic compounds [VOCs] (8260B); semi-volatile organic compounds [SVOCs] including 1,4-dioxane (8270D); total petroleum hydrocarbons (TPH)-gasoline–range organics (GRO) and diesel–range organics (DRO) by (8015D); priority pollutant metals –total and dissolved (6010C, 7471A); hexavalent chromium (7199) Ferrous iron (Hach test kit or equivalent) Three groundwater samples, from one well cluster, will be analyzed for the following natural attenuation parameters: nitrate, nitrite, ammonia nitrogen, phosphate, sulfate, total alkalinity, dissolved organic carbon, total iron, total manganese, total potassium, total calcium, total magnesium, total chloride, total sodium, total silica, total dissolved solids and methane and ethane using Microseeps® AM 20GAX protocols.	To provide soil and groundwater chemical-monitoring data and to provide shallow, intermediate and deep monitoring points to assess the shallow subsurface groundwater conditions immediately west of Frog Mortar Creek.

DRO = diesel-range organics
GRO = gasoline-range organics
PCBs = polychlorinated biphenyls
SVOCs = semi-volatile organic compounds
TPH = total petroleum hydrocarbons
USEPA = United States Environmental Protection Agency
VOCs = volatile organic compounds

Table 3-5

Sediment Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland

Sediment sample number	Location	Sample depth	Sample analysis and method	Rationale/purpose
EP1-SD15 EP1-SD16 EP1-SD17 EP1-SD18	Pond 1	Two samples at each location from 0-1 feet and 1-2 feet	Volatile organic compounds (VOCs) by USEPA SW846 Method 8260B; total petroleum hydrocarbons (TPH)-gasoline–range organics (GRO) and diesel–range organics (DRO) by 8015D; polychlorinated biphenyls (PCBs) by USEPA SW846 Method 8082 A; total priority pollutant metals by USEPA SW846 Method 6010C	Sediment samples will be collected to assess sediment contaminant concentrations (both horizontally and vertically) in support of updating the conceptual site model; provide for a more complete characterization of Pond 1 sediment; and evaluate trends of COPC.
EWT-SD1 EWT-SD2 EWT-SD3	0.7 acre wetland area east of Ponds 1 and 2 and immediately west of Frog Mortar Creek	Two samples at each location from 0-1 feet and 1-2 feet	VOCs by USEPA SW846 Method 8260B TPH-GRO and DRO by USEPA SW846 Method 8015D PCBs by USEPA SW846 Method 8082A total priority pollutant metals by USEPA SW846 Method 6010C Geotechnical analyses: soil grain size analyses (ASTM Method D422 with hydrometer; requires one quart of soil) and soil permeability testing (ASTM Method D5084; requires undisturbed samples)	Sediment samples will be collected to assess sediment contaminant concentrations (both horizontally and vertically), grain size, and vertical permeability in support of updating the conceptual site model; determine the source and extent of COPC detected in the sediment in the 0.7 acre wetland near the Frog Mortar Creek shoreline; and evaluate trends of COPC.

ASTM ASTM International, Inc.
COPC = chemicals of potential concern
DRO = diesel-range organics
GRO = gasoline-range organics
PCBs = polychlorinated biphenyls
SVOCs = semi-volatile organic compounds
TPH = total petroleum hydrocarbons
USEPA = United States Environmental Protection Agency
VOCs = volatile organic compounds

Table 3-6

Surface Water Sample Summary and Rationale
Dump Road Source Area Soil and Groundwater Characterization, Martin State Airport, Middle River, Maryland

Sample number	Location	Sample depth	Sample analysis and method	Rationale/purpose
EP1-SW15 EP1-SW16	Pond 1	One sample at each location from one foot below the water surface	Volatile organic compounds (VOCs) by SW846 Method 8260; 1,4-dioxane by SW826 Method 8270D; Total petroleum hydrocarbons (TPH)-gasoline–range organics (GRO) and diesel–range organics (DRO) by 8015D; Total and dissolved priority pollutant metals including hexavalent chromium by SW846 Method 6010; Perchlorate by USEPA Method 314; Hardness by USEPA SW846 protocol **Field Measurements**: temperature, pH, specific conductance, hardness, salinity, turbidity, dissolved oxygen (DO), oxidation-reduction potential (ORP)	Surface water samples will be collected to update and characterize pond water contaminant concentrations. Surface water from Pond 1 was previously sampled in 2004 and 2012. The sample analyses will provide updated and additional chemical data to assess contaminant concentrations potentially dissolving/migrating into the pond water column from highly contaminated sediments, and data to evaluate potential risks to human health and ecological receptors.
EWT-SW1 EWT-SW2 EWT-SW3	0.7 acre wetland area east of Ponds 1 and 2 and immediately west of Frog Mortar Creek	One sample at each location from one foot below the water surface	VOCs by SW846 Method 8260; 1,4-dioxane by SW826 Method 8270D; TPH including GRO and DRO by Method 8015D; Total and dissolved priority pollutant metals including hexavalent chromium by SW846 Method 6010; Perchlorate by USEPA Method 314; Hardness by USEPA SW846 protocol **Field Measurements**: temperature, pH, specific conductance, hardness, salinity, turbidity, dissolved oxygen (DO), oxidation-reduction potential (ORP)	Surface water samples will be collected to characterize wetland water quality. To date, surface water from the wetland area has not been sampled. The sample analyses will provide chemical data to assess possible dissolved contaminant concentrations that could migrate from the water column to groundwater, and data to evaluate potential risks to human health and ecological receptors.

VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds; PCBs = polychlorinated biphenyls; TPH = total petroleum hydrocarbons; GRO = gasoline-range organics; DRO = diesel-range organics.

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA Proposed Test Pit 2013_revised 060513.mxd)
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FIGURE 3-1

PROPOSED TEST PIT LOCATION MAP - 2013
DUMP ROAD AREA

LEGEND

Location

- GROUNDWATER MONITORING WELL - OCTOBER 2012
- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- SOIL BORING SAMPLE LOCATION (1996)
- PROPOSED TEST PIT
- TEST PIT (A18-A44) (AUG 2009)
- A2 TEST PIT (JAN-FEB 2008)
- FORMER POND
- FORMER POND/PIT

TEST PIT

- A Anomalous
- N Non-Anomalous
- SOIL OR SEDIMENT BTEX SOURCE (from Tetra Tech, 2013a)
- GROUNDWATER BTEX SOURCE (from Tetra Tech, 2013a)
- SOIL OR SEDIMENT TCE SOURCE (from Tetra Tech, 2013a)
- GROUNDWATER TCE SOURCE (from Tetra Tech, 2013a)
- SUSPECTED LANDFILL AREA
- POND

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 6/5/13

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Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA Proposed DPT Soil Map 2013.mxd)

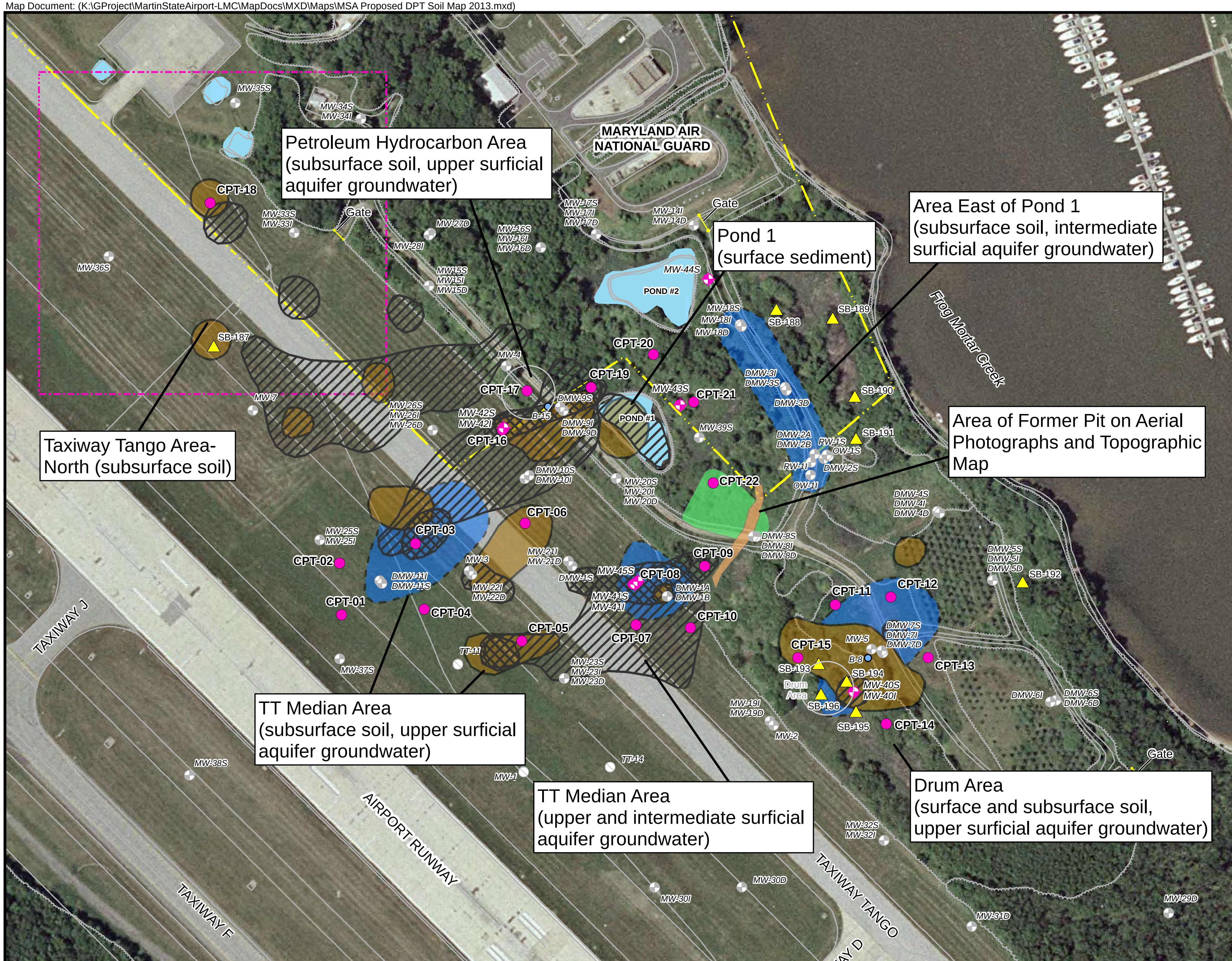

FIGURE 3-2

PROPOSED DPT SOIL LOCATION MAP - 2013
DUMP ROAD AREA

LEGEND

- PROPOSED DPT SOIL BORING - 2013
- GROUNDWATER MONITORING WELL - OCTOBER 2012
- CPT LOCATION: AUG-SEPT 2012
- SOIL BORING SAMPLE LOCATION (1996)
- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- FORMER POND
- FORMER POND/PIT
- SOIL OR SEDIMENT BTEX SOURCE (from Tetra Tech, 2013a)
- GROUNDWATER BTEX SOURCE (from Tetra Tech, 2013a)
- SOIL OR SEDIMENT TCE SOURCE (from Tetra Tech, 2013a)
- GROUNDWATER TCE SOURCE (from Tetra Tech, 2013a)
- TAXIWAY TANGO AREA- NORTH
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- POND

CPT= cone penetration test
TCE(EQ)= trichloroethene equivalent
TT= Taxiway Tango
VOC= volatile organic compound

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 6/5/13

CREATED BY: MP

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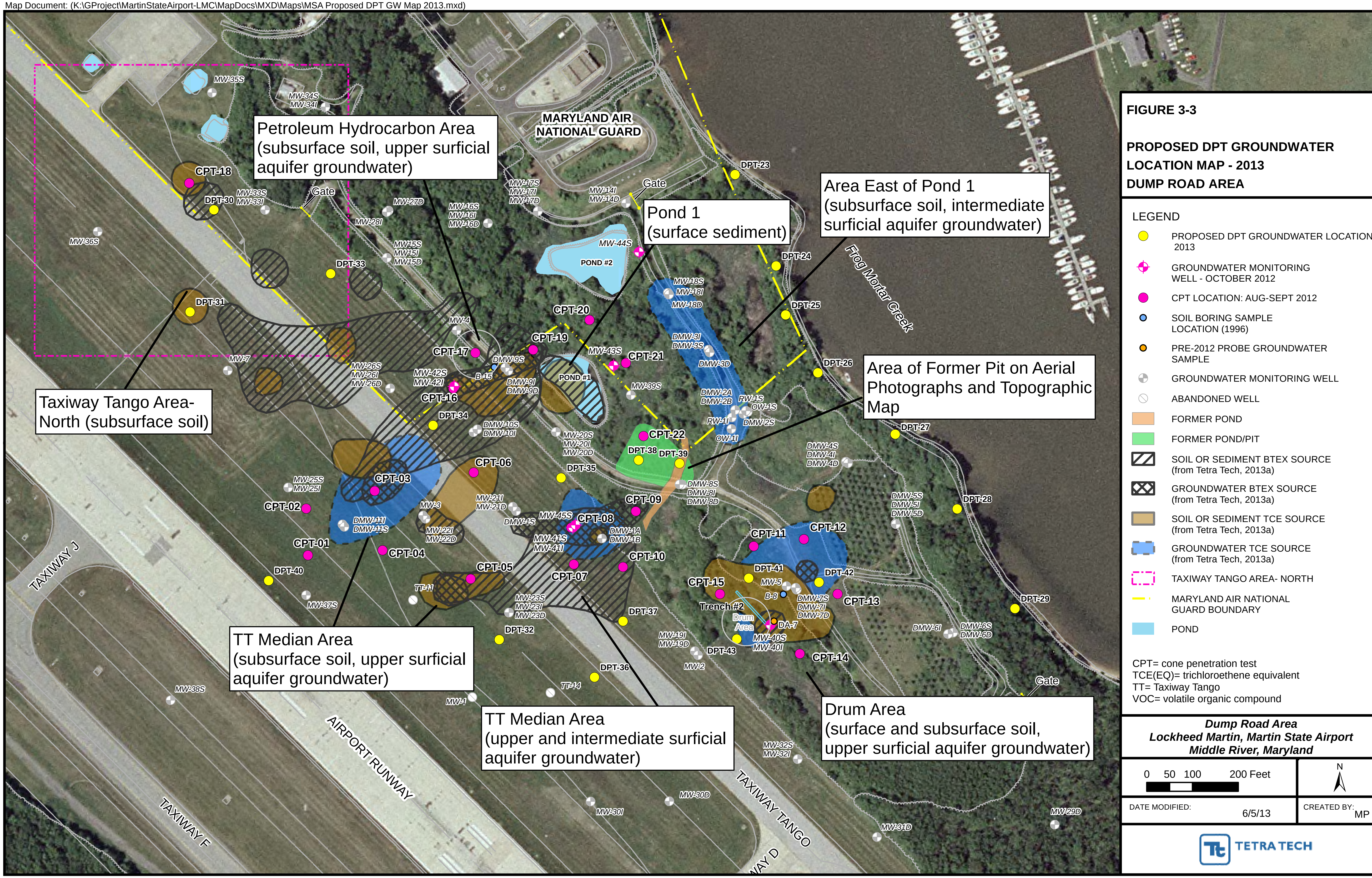
Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA Proposed DPT GW Map 2013.mxd)



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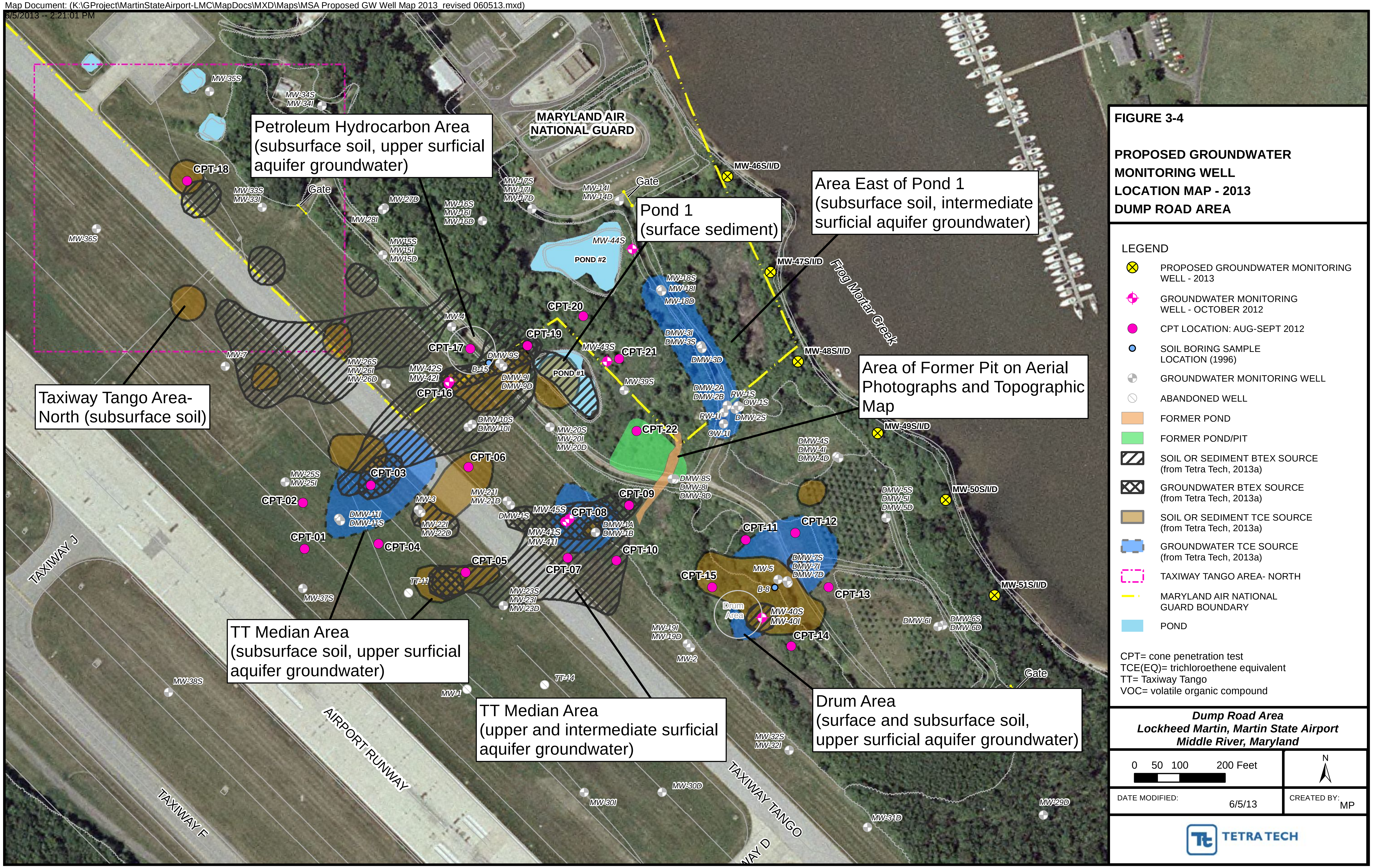

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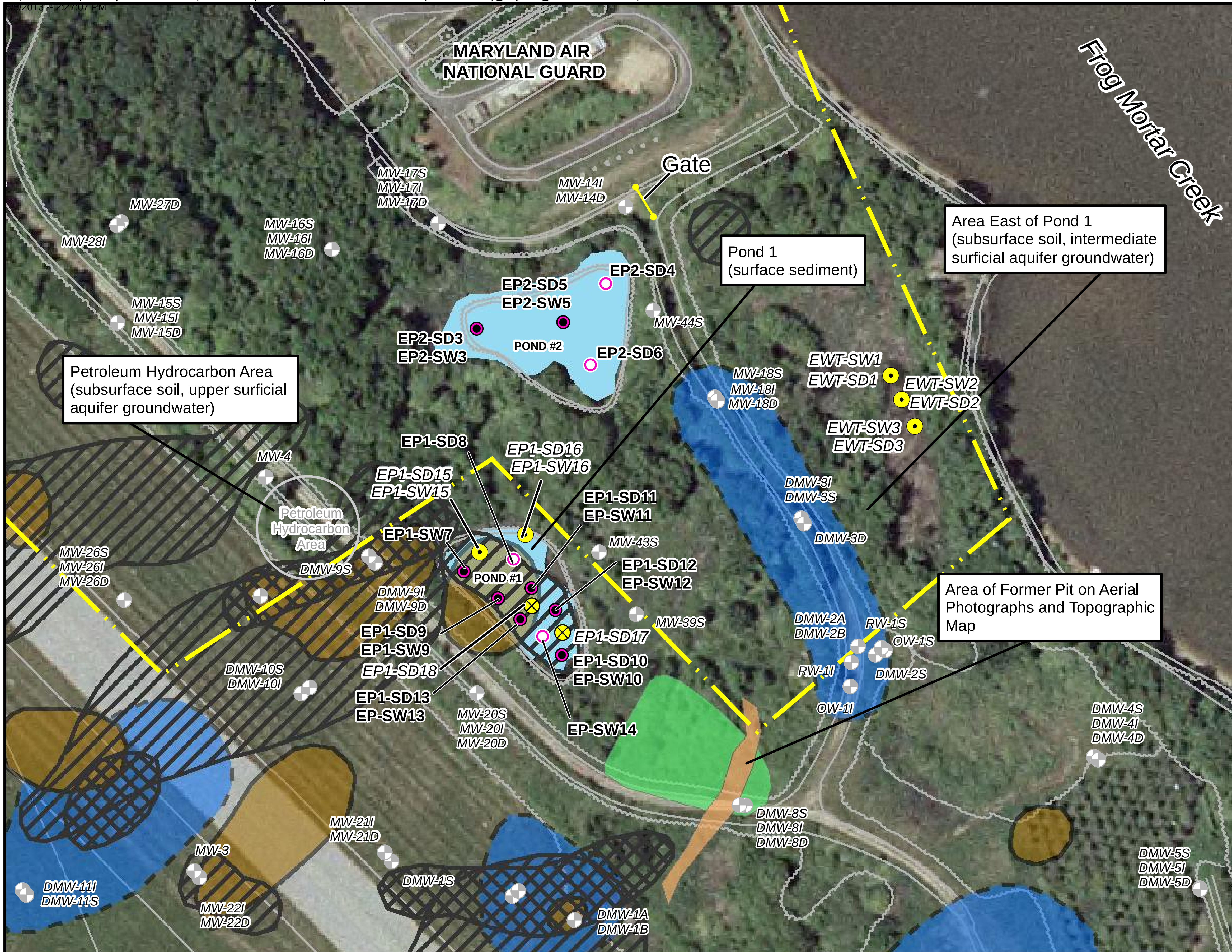

FIGURE 3-5

PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATION MAP - 2013
DUMP ROAD AREA

LEGEND

- PROPOSED SEDIMENT SAMPLE LOCATION - 2013
- PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATION - 2013
- POND SEDIMENT SAMPLE LOCATION- NOVEMBER 2012
- POND SURFACE WATER AND SEDIMENT SAMPLE LOCATION - NOVEMBER 2012
- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- FORMER POND
- FORMER POND/PIT
- SOIL OR SEDIMENT BTEX SOURCE (from Tetra Tech, 2013a)
- GROUNDWATER BTEX SOURCE (from Tetra Tech, 2013a)
- SOIL OR SEDIMENT TCE SOURCE (from Tetra Tech, 2013a)
- GROUNDWATER TCE SOURCE (from Tetra Tech, 2013a)
- POND

TCE(EQ)= trichloroethene equivalent
TT= Taxiway Tango
VOC= volatile organic compound

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 25 50 100 Feet

N

DATE MODIFIED: 6/5/13

CREATED BY: MP

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Section 4
Project Deliverables

Tetra Tech Inc. (Tetra Tech) will prepare a Dump Road Area (DRA) source area soil and groundwater characterization report summarizing the results of the field investigation. Data obtained during the field program will be evaluated and presented to obtain an understanding of both the water quality and the hydrogeologic conditions of the aquifer beneath the site. The report will include a location map, potentiometric surface map, boring logs, cross sections, isoconcentration maps, a summary of field activities, summary tables of sample results, and findings and conclusions. The report will provide data to augment data evaluated in the *Technical Memorandum for Dump Road Area Source Area Delineation* (Tetra Tech, 2012b) and in the 2012 *(Draft) Dump Road Area Characterization of Possible Source Areas Investigation Report* (Tetra Tech, 2013b). The data obtained from this investigation will be used to update the conceptual site model; compare concentrations of contaminants detected in soil and groundwater to concentrations detected elsewhere at DRA; compare concentrations to the cleanup goals developed by the State of Maryland and in the Dump Road remedial investigation report (Tetra Tech, 2012c); and to present conclusions and recommendations on the nature and extent of possible groundwater source areas in groundwater, sediment, surface water, and soils of the DRA. Data will be entered and maintained in the Martin State Airport (MSA) environmental geographic information system (EGIS).

Soil, groundwater, surface water, and sediment analytical data collected during this investigation will be validated in accordance with United States Environmental Protection Agency (USEPA) Region 3 Level M2 protocols. Analytical results will be provided in summary tables with detectable concentrations and detection limits presented. Screening and regulatory criteria will be noted in the tables, and results will be compared to these in the text of the report. Management of the data in the Martin State Airport environmental geographic information system (EGIS) will be completed with updates made to the data tables for sampling and inclusion of this information in the report.

Soil, groundwater, surface water, and sediment analytical data will be compared to cleanup goals established by the state of Maryland and USEPA Region 3 Oak Ridge National Laboratories (ORNL) regional screening levels (RSLs). The chemical data will also be compared and discussed in relationship to concentrations detected elsewhere in the Dump Road Area. Analytical results will be provided in summary tables, with detectable concentrations and detection limits presented. Screening and regulatory criteria will be noted in the tables and results will be compared to those in the text of the report. The data will be used to update the delineation of wastes in the DRA feasibility study and for evaluations of data gaps and recommended future site characterizations.

Section 5
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APPENDIX A—HISTORICAL FIGURES

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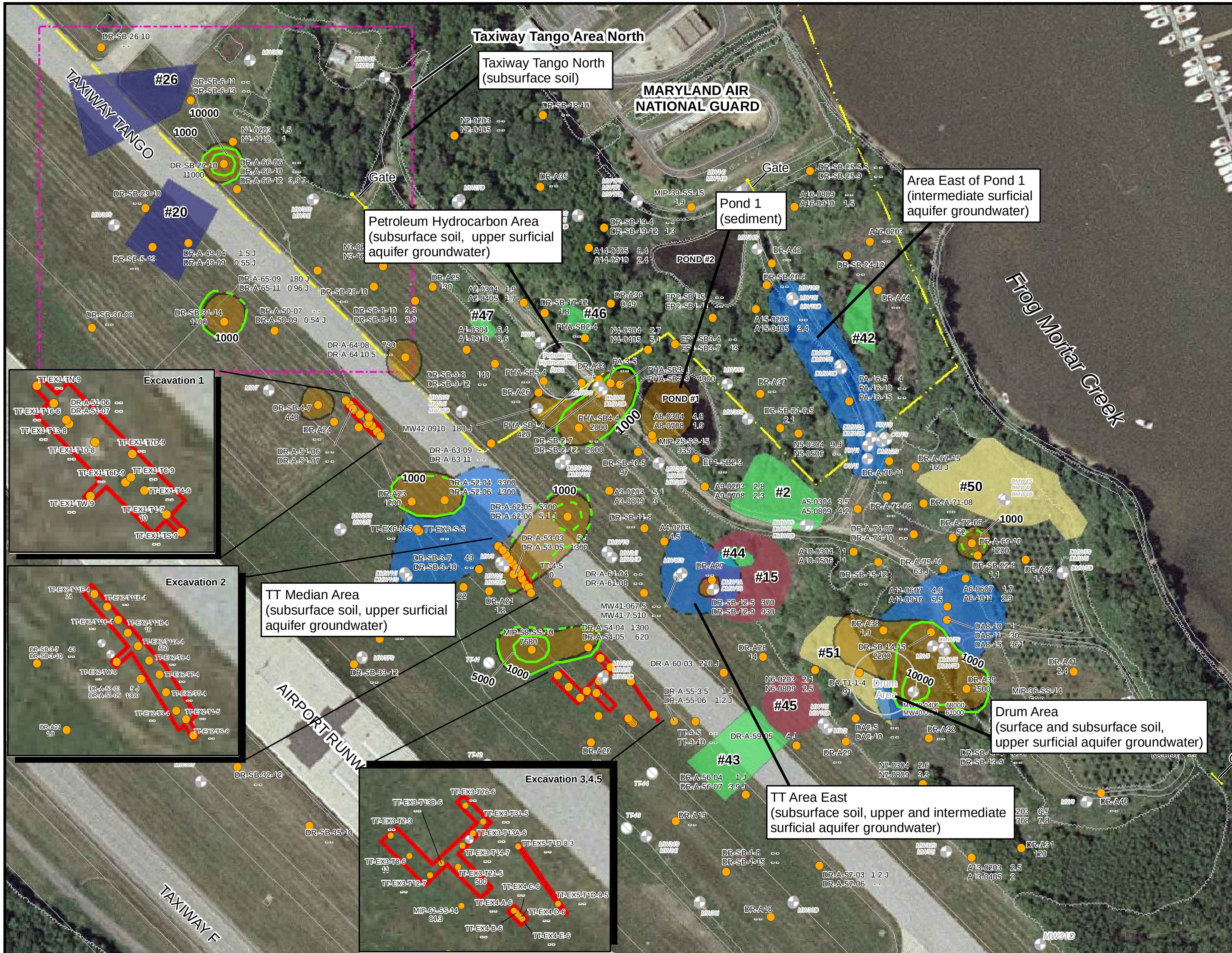

FIGURE 7-1

TRICHLOROETHENE SOURCE AREAS
DUMP ROAD AREA

LEGEND

- SOIL SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN UG/KG
- INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/KG)
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- EXCAVATION LOCATION- YEAR 2000
- SOIL OR SEDIMENT TCE SOURCE
- GROUNDWATER TCE SOURCE
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram
TCE= trichloroethene
TT= Taxiway Tango
TP= test pit
SB= subsufrace soil
SS= soil sample
DR= Dump Road

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 1/29/13

CREATED BY: MP

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Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA BTEX Source Areas 021513.mxd)
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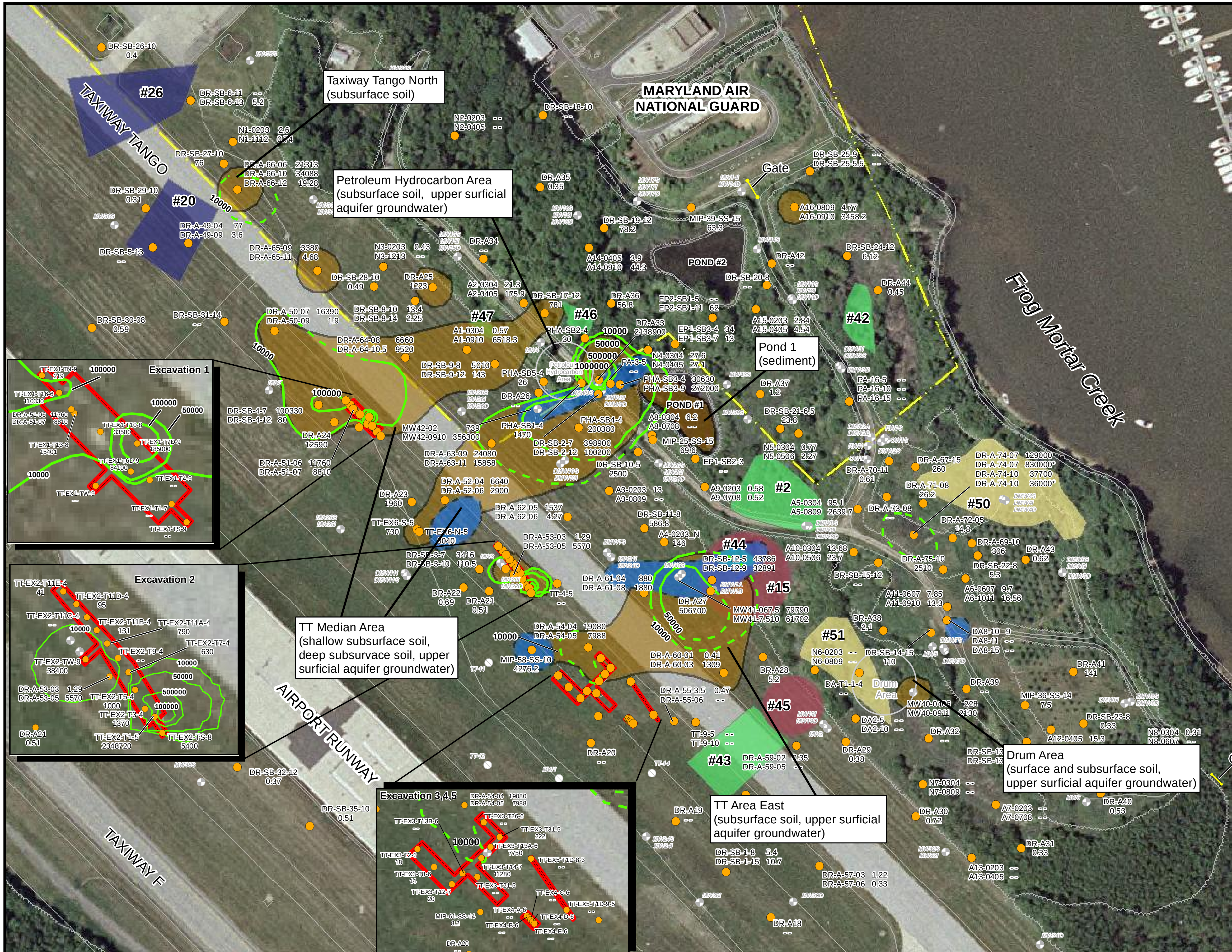

FIGURE 7-2

BTEX SOURCE AREAS
DUMP ROAD AREA

LEGEND

- SOIL SAMPLE
- BTEX ISOCONCENTRATION CONTOUR IN UG/KG
- INFERRED
- 11 BTEX CONCENTRATION (UG/KG)
- EXCAVATION LOCATION - YEAR 2000
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- SOIL OR SEDIMENT BTEX SOURCE
- GROUNDWATER BTEX SOURCE

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

* = Chlorobenzene concentration
-- = Not Detected
UG/KG = micrograms per kilogram

BTEX = benzene, toluene, ethylbenzene and xylenes

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 2/15/13

CREATED BY: MP

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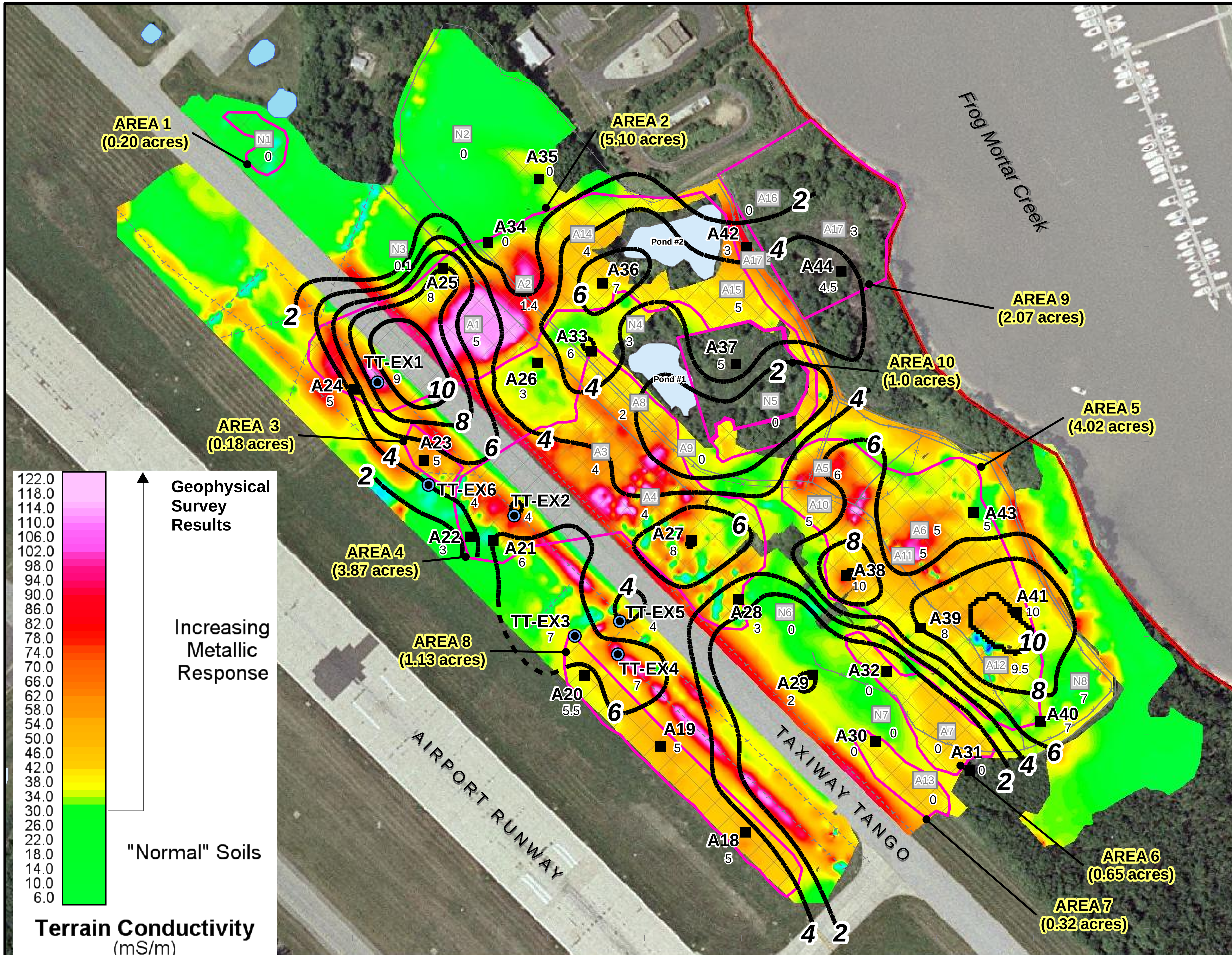

FIGURE 6-1

GEOPHYSICAL SURVEY RESULTS AND DEBRIS THICKNESS

LEGEND

- TRENCHES (TT-EX1 to TT-EX6, 2000)
- TEST PIT (A1 to A17; Jan-Feb 2008)
- TEST PIT (A18 to A44; Aug 2009)
- 10 DEBRIS MAXIMUM THICKNESS ISOCONTOUR LINE (FEET)
- 6.5 DEBRIS MAXIMUM THICKNESS (FEET)
- APPROXIMATE FENCELINE
- SUSPECTED UTILITY
- PONDS
- SUSPECTED LANDFILL AREA
- FACILITY BOUNDARY
- A ANOMALOUS AREA TEST PIT
- N NON-ANOMALOUS AREA TEST PIT

mS/m= milliSiemens per meter

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 2/5/13

CREATED BY: MP

TETRA TECH

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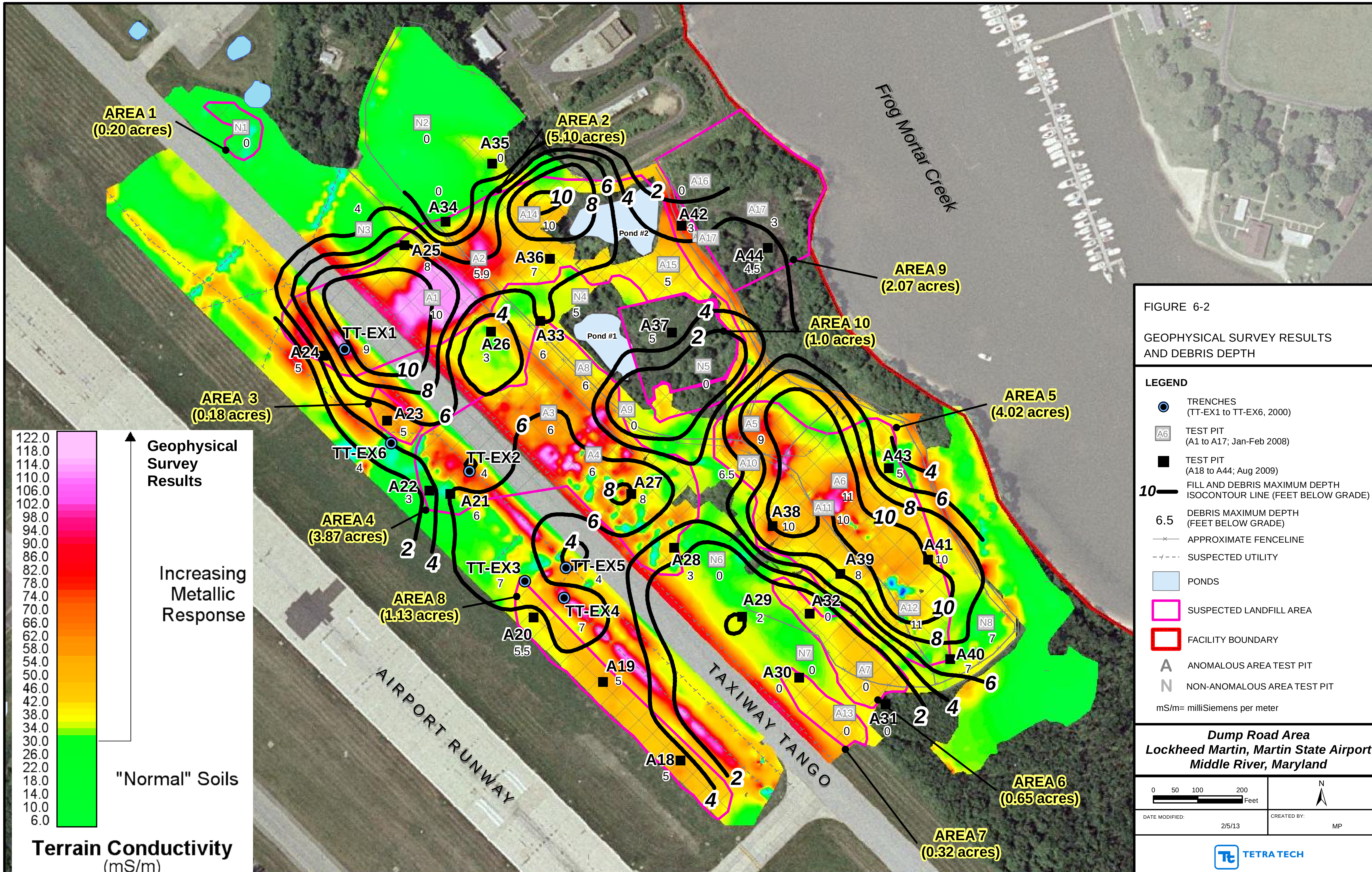

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FIGURE 6-3

TRICHLOROETHENE IN SOIL AND POND SEDIMENT - 0 to 2 FEET

DUMP ROAD AREA

LEGEND

- SOIL OR POND SEDIMENT SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN UG/KG
- INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/KG)
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- EXCAVATION LOCATION- YEAR 2000
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram
TT= Taxiway Tango
TP= test pit
SB= subsufrace soil
SS= soil sample
DR= Dump Road

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 1/29/13

CREATED BY: MP

TETRA TECH

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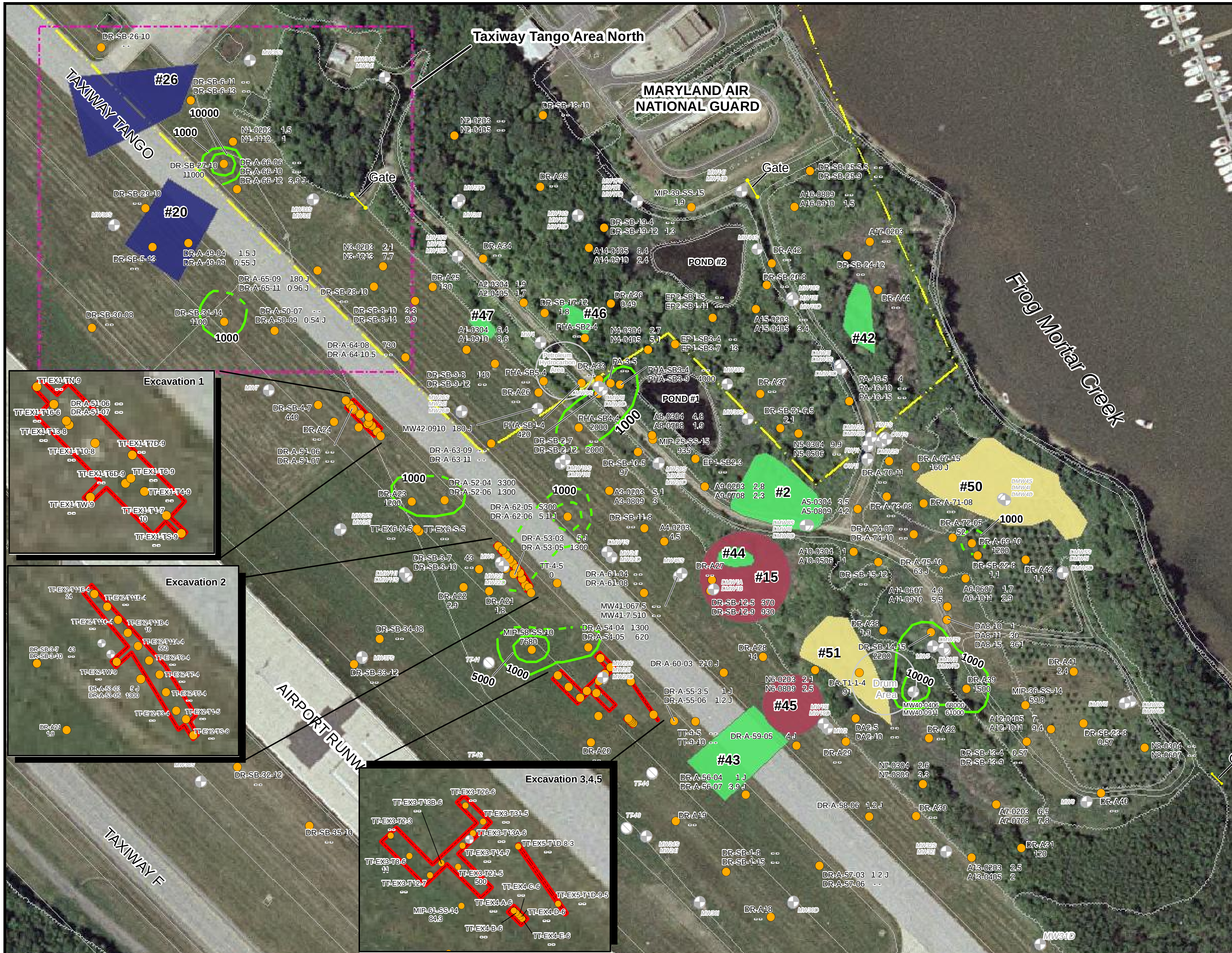

FIGURE 6-4

TRICHLOROETHENE IN SOIL
>2 TO 15 FEET
DUMP ROAD AREA

LEGEND

- SOIL SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN UG/KG
- INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/KG)
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- EXCAVATION LOCATION- YEAR 2000
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram
TT= Taxiway Tango
TP= test pit
SB= subsufrace soil
SS= soil sample
DR= Dump Road

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 1/29/13

CREATED BY: MP

TETRA TECH

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FIGURE 6-5

TRICHLOROETHENE IN SOIL
>15 FEET
DUMP ROAD AREA

LEGEND

- SOIL SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN UG/KG
- INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/KG)
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- EXCAVATION LOCATION- YEAR 2000
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram
TT= Taxiway Tango
TP= test pit
SB= subsufrace soil
SS= soil sample
DR= Dump Road

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 1/30/13

CREATED BY: MP

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA TCE GW S_wells 2012.mxd)
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FIGURE 6-6

TRICHLOROETHENE IN GROUNDWATER - UPPER SURFICIAL AQUIFER
DUMP ROAD AREA

LEGEND

- PROBE GROUNDWATER SAMPLE LOCATION: AUG-SEPT 2012 MAXIMUM TCE OF SAMPLES IN THIS AQUIFER ZONE
- PRE-2012 TEMPORARY WELL/PROBE GROUNDWATER SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN UG/L- DASHED WHERE INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/L)
- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- EXCAVATION LOCATION- YEAR 2000
- GROUNDWATER ELEVATION CONTOUR CONTOUR INTERVAL = 1 FOOT (DASHED WHERE INFERRED)
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/L = micrograms per liter

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 1/25/13

CREATED BY: MP

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA TCE GW I_wells 2012.mxd)
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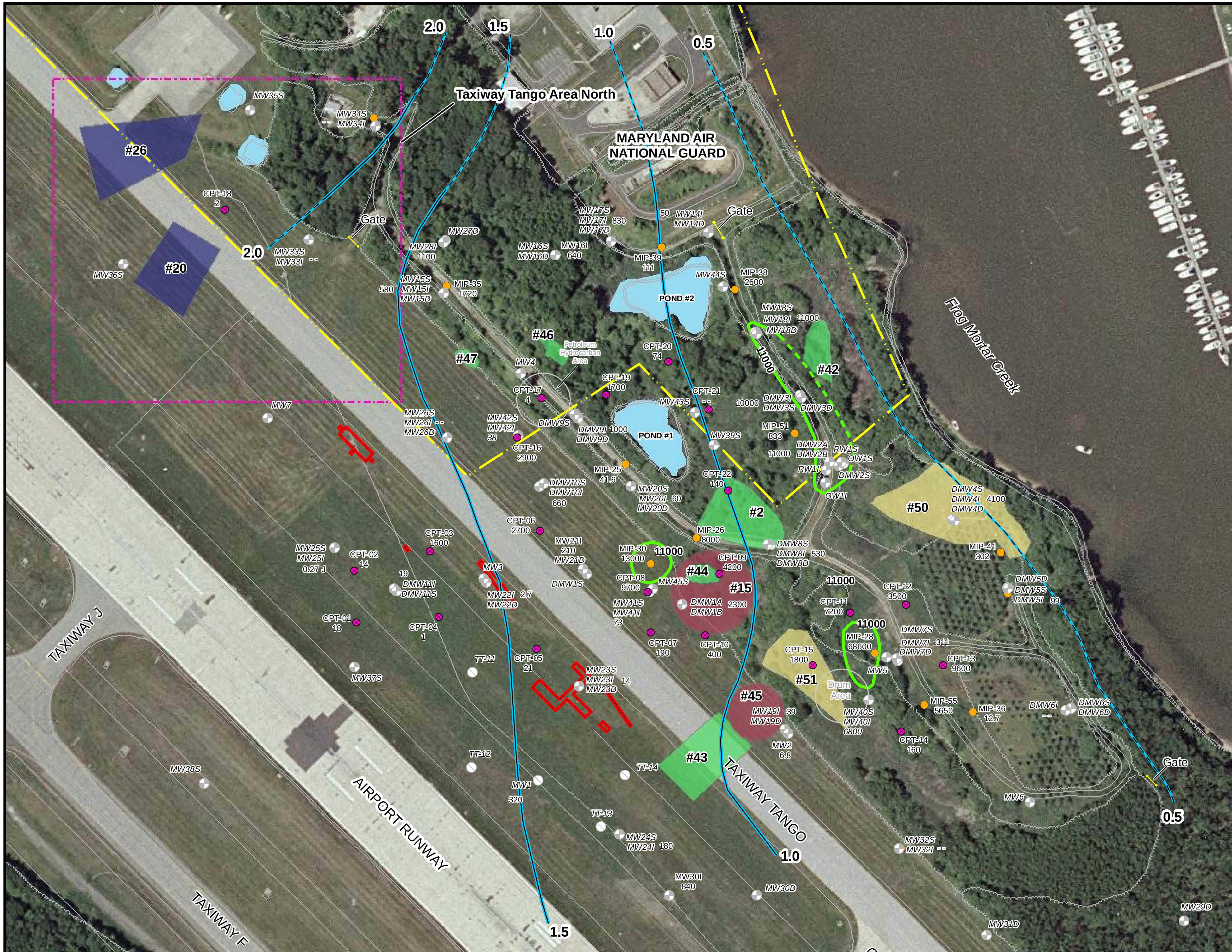

FIGURE 6-7

TRICHLOROETHENE IN GROUNDWATER - INTERMEDIATE SURFICIAL AQUIFER DUMP ROAD AREA

LEGEND

- PROBE GROUNDWATER SAMPLE LOCATION: AUG-SEPT 2012 MAXIMUM TCE OF SAMPLES IN THIS AQUIFER ZONE
- PRE-2012 TEMPORARY WELL/PROBE GROUNDWATER SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOUR IN UG/L - DASHED WHERE INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/L)
- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- EXCAVATION LOCATION- YEAR 2000
- GROUNDWATER ELEVATION CONTOUR CONTOUR INTERVAL = 0.5 FOOT (DASHED WHERE INFERRED)
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/L = micrograms per liter

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 1/28/12

CREATED BY: MP

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA TCE GW D_wells 052212.mxd)
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FIGURE 6-8

TRICHLOROETHENE IN GROUNDWATER - LOWER SURFICIAL AQUIFER
DUMP ROAD AREA

LEGEND

- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- 11 TRICHLOROETHENE CONCENTRATION (UG/L)
- EXCAVATION LOCATION- YEAR 2000
- GROUNDWATER ELEVATION CONTOUR CONTOUR INTERVAL = 0.5 FOOT (DASHED WHERE INFERRED)
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

-- = Not Detected
UG/L = micrograms per liter

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 5/22/12

CREATED BY: MP

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA Cross Section Locations_020713.mxd)
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FIGURE 6-9

CROSS - SECTION LOCATIONS
DUMP ROAD AREA

LEGEND

- PROBE GROUNDWATER SAMPLE LOCATION: AUG-SEPT 2012 MAXIMUM TCE OF SAMPLES IN THIS AQUIFER ZONE
- SOIL OR POND SEDIMENT SAMPLE
- TRICHLOROETHENE ISOCONCENTRATION CONTOURS IN UG/KG
- INFERRED
- 11 TRICHLOROETHENE CONCENTRATION (UG/KG)
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- A A' CROSS SECTION TRANSECT
- EXCAVATION LOCATION- YEAR 2000
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- TAXIWAY TANGO AREA NORTH
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram
TT= Taxiway Tango
TP= test pit
SB= subsufrace soil
SS= soil sample
DR= Dump Road

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 2/7/13

CREATED BY: MP

TETRA TECH

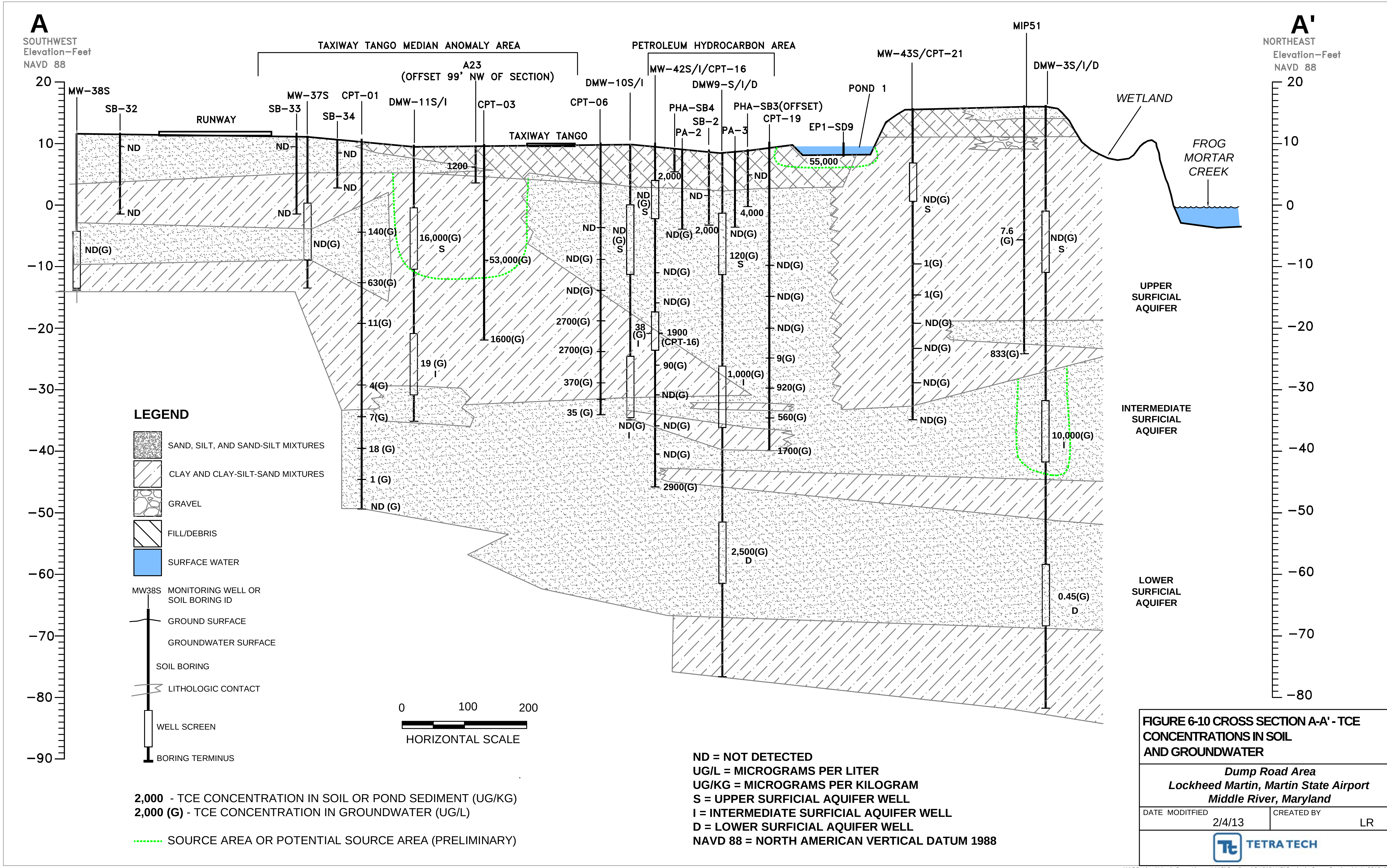

FIGURE 6-10 CROSS SECTION A-A' - TCE CONCENTRATIONS IN SOIL AND GROUNDWATER

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED	CREATED BY
2/4/13	LR

TETRA TECH

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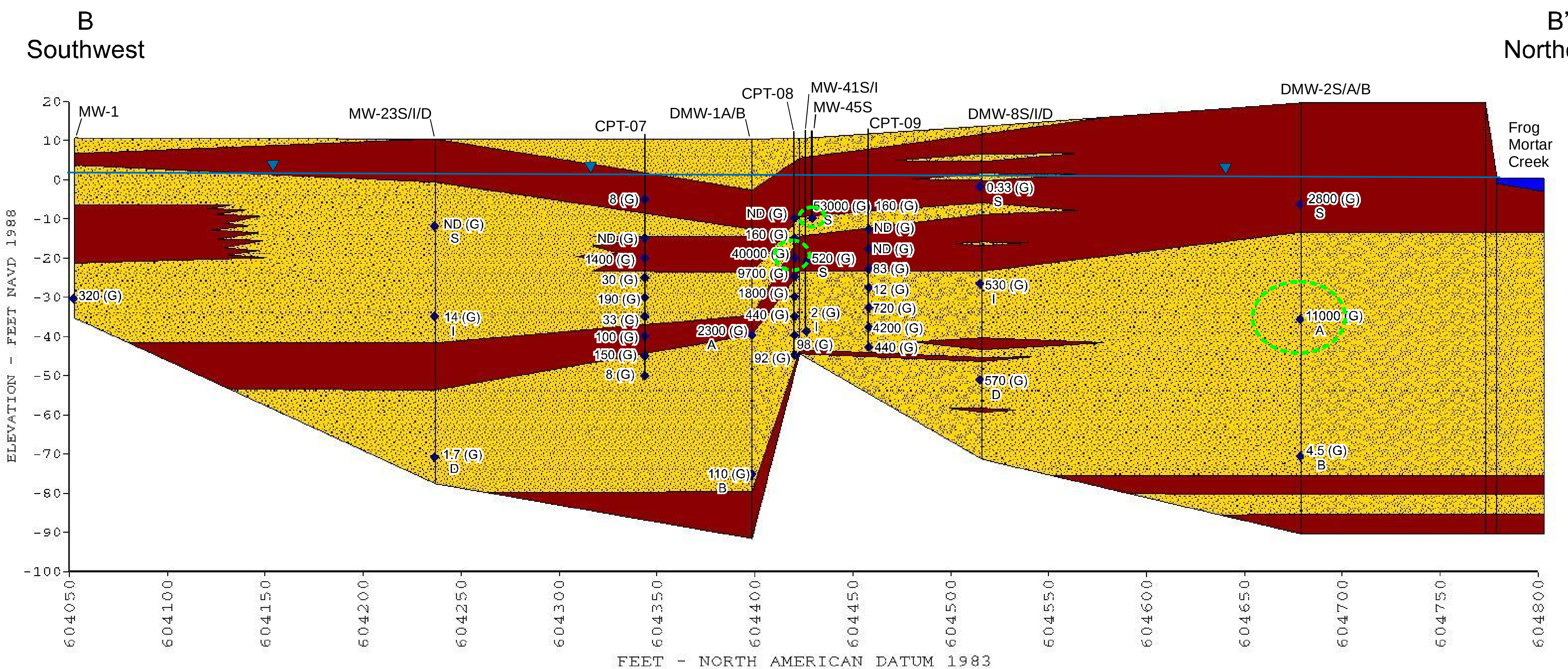

FIGURE 6-11

CROSS SECTION B-B'
TCE CONCENTRATIONS IN SOIL AND GROUNDWATER

LEGEND

- GROUNDWATER SAMPLE
- 720 (G) TCE CONCENTRATION IN GROUNDWATER (UG/L)
- 60 TCE CONCENTRATION IN SOIL (UG/KG)
- SAND, SILT, AND SAND-SILT MIXTURES
- CLAY AND CLAY-SILT-SAND MIXTURES
- WATER
- GROUNDWATER SURFACE
- TCE SOURCE AREA OR POTENTIAL SOURCE AREA
- G = GROUNDWATER SAMPLE
- S = UPPER SURFICIAL AQUIFER WELL
- A or I = INTERMEDIATE SURFICIAL AQUIFER WELL
- B or D = LOWER SURFICIAL AQUIFER WELL
- MW OR DMW = MONITORING WELL
- NAVD = NORTH AMERICAN VERTICAL DATUM
- CPT = CONE PENETRATION TEST
- TCE = TRICHLOROETHENE
- ND = NOT DETECTED
- UG/L = MICROGRAMS PER LITER
- UG/KG = MICROGRAMS PER KILOGRAM

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED:	CREATED BY:
2/08/13	MP

TETRA TECH

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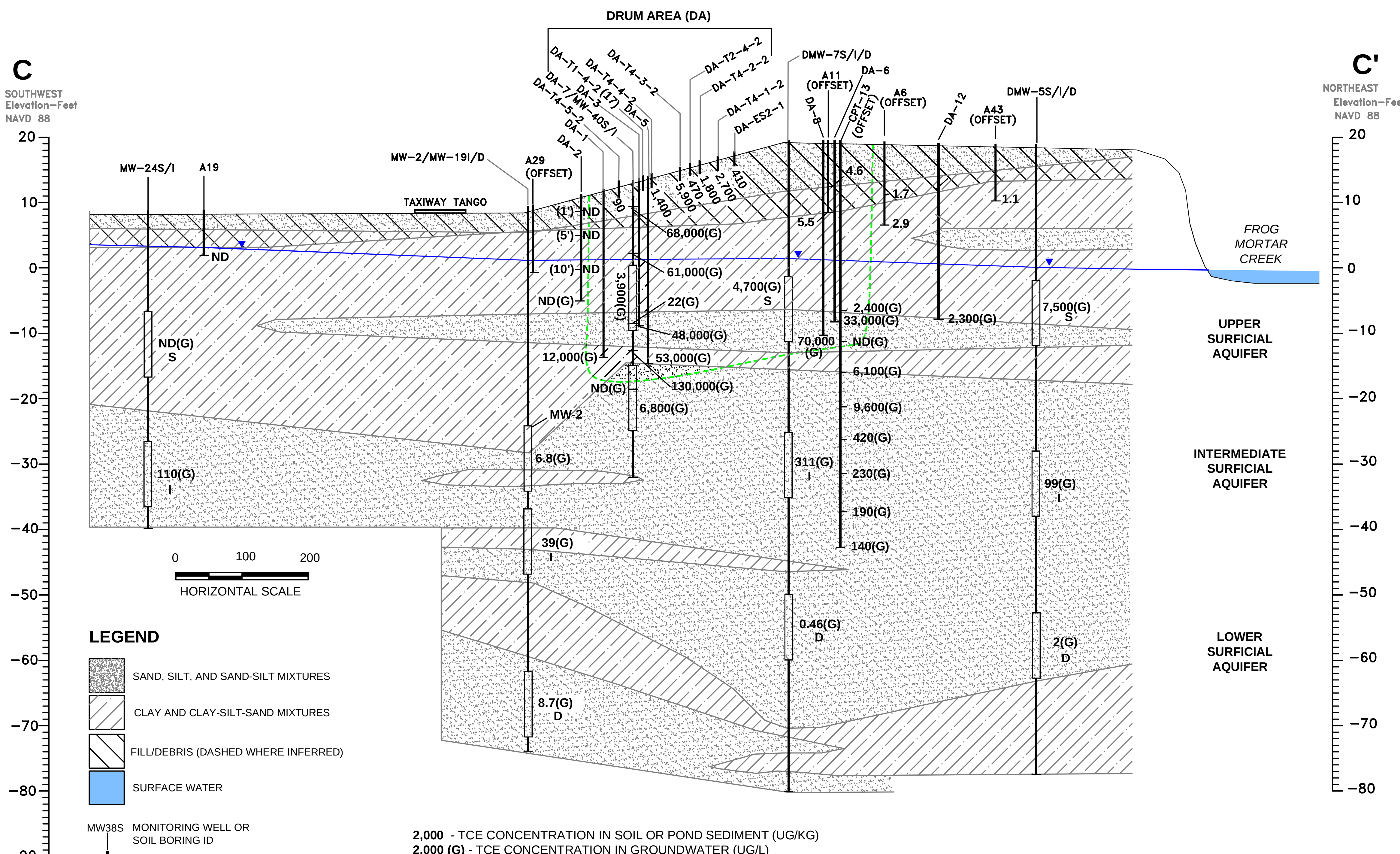

LEGEND

SAND, SILT, AND SAND-SILT MIXTURES

CLAY AND CLAY-SILT-SAND MIXTURES

FILL/DEBRIS (DASHED WHERE INFERRED)

SURFACE WATER

MW38S MONITORING WELL OR SOIL BORING ID

GROUND SURFACE

GROUNDWATER SURFACE

SOIL BORING

LITHOLOGIC CONTACT (DASHED WHERE INFERRED)

WELL SCREEN

BORING TERMINUS

2,000 - TCE CONCENTRATION IN SOIL OR POND SEDIMENT (UG/KG)
2,000 (G) - TCE CONCENTRATION IN GROUNDWATER (UG/L)

SOURCE AREA OR POTENTIAL SOURCE AREA (PRELIMINARY)

ND = NOT DETECTED
UG/L = MICROGRAMS PER LITER
UG/KG = MICROGRAMS PER KILOGRAM
A11 = TEST PIT
DA-2 = SOIL BORING
S = UPPER SURFICIAL AQUIFER WELL
I = INTERMEDIATE SURFICIAL AQUIFER WELL
D = LOWER SURFICIAL AQUIFER WELL
NAVD 88 = NORTH AMERICAN VERTICAL DATUM 1988

FIGURE 6-12 CROSS SECTION C-C' - TCE CONCENTRATIONS IN SOIL AND GROUNDWATER

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODITFIED	CREATED BY
2/5/13	LR

TETRA TECH

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Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA BTEX in Soils_0 TO 2 FT_032712_revised012913.mxd)
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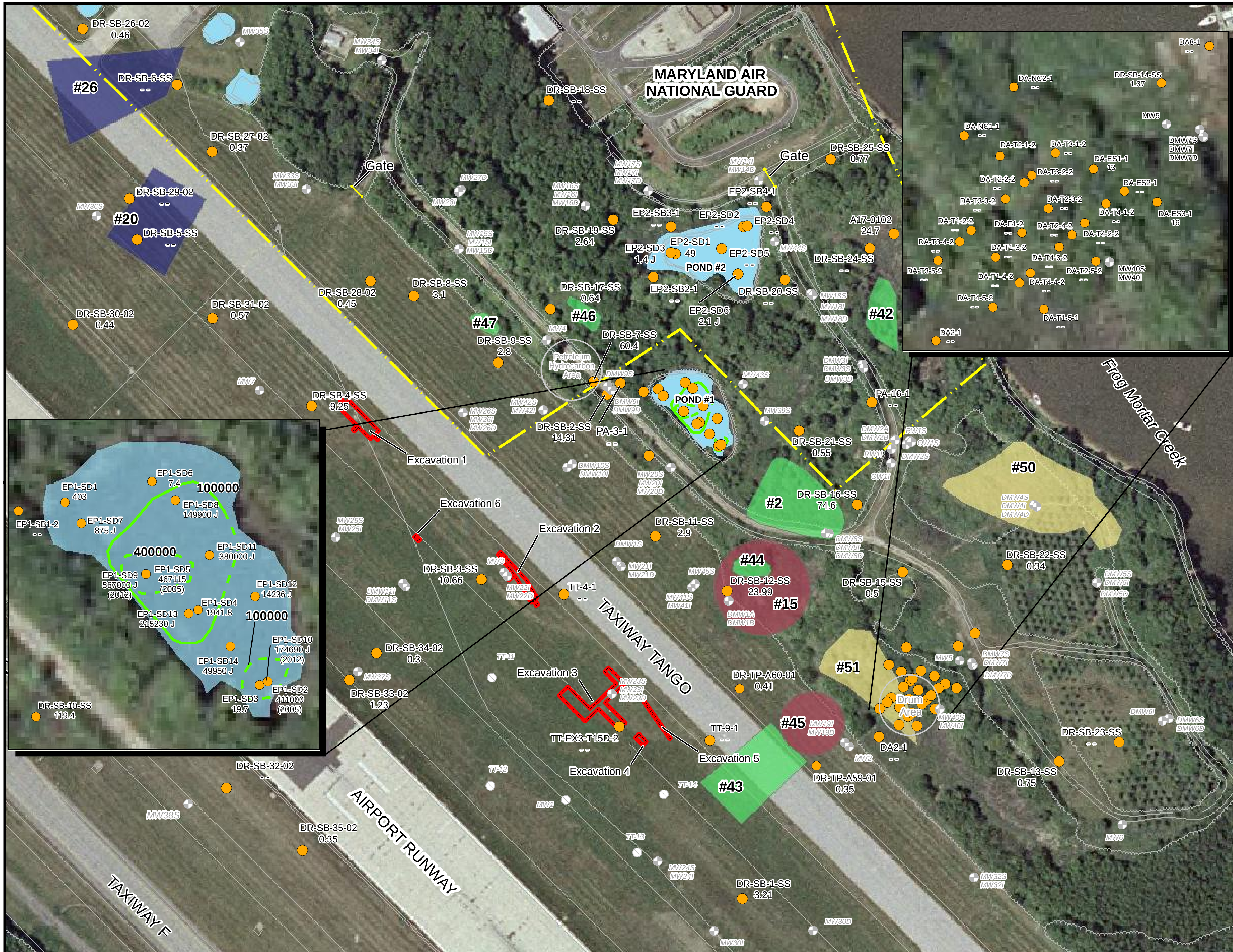

FIGURE 6-13

BTEX IN SOIL AND POND SEDIMENT
0 to 2 FEET
DUMP ROAD AREA

LEGEND

- SOIL OR POND SEDIMENT SAMPLE
- BTEX ISOCONCENTRATION CONTOURS IN UG/KG
- INFERRED
- 11 BTEX CONCENTRATION (UG/KG)
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- EXCAVATION LOCATION - YEAR 2000
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram
BTEX = benzene, toluene, ethylbenzene and xylenes
TT= Taxiway Tango
TP= test pit
SB= subsufrace soil
SS= surface soil
DR= Dump Road

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 1/29/13

CREATED BY: MP

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA BTEX in Soils_GT2 TO 15 FT_032712_revised013013.mxd)
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FIGURE 6-15

BTEX IN SOIL
>15 FEET
DUMP ROAD AREA

LEGEND

- SOIL SAMPLE
- BTEX ISOCONCENTRATION CONTOUR IN UG/KG - DASHED WHERE INFERRED
- 11 BTEX CONCENTRATION (UG/KG)
- EXCAVATION LOCATION - YEAR 2000
- ABANDONED WELL
- GROUNDWATER MONITORING WELL
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/KG = micrograms per kilogram

BTEX = benzene, toluene, ethylbenzene and xylenes

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 45 90 180 Feet

N

DATE MODIFIED: 1/31/13

CREATED BY: MP

TETRA TECH

Map Document: (K:\GProject\MartinStateAirport-LMC\MapDocs\MXD\Maps\MSA BTEX in GW S_wells 2012.mxd)
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FIGURE 6-16

BTEX IN GROUNDWATER -
UPPER SURFICIAL AQUIFER
DUMP ROAD AREA

LEGEND

- PROBE GROUNDWATER SAMPLE LOCATION: AUG-SEPT 2012 MAXIMUM BTEX OF SAMPLES IN THIS AQUIFER ZONE
- PRE- 2012 TEMPORARY WELL/PROBE GROUNDWATER SAMPLE
- BTEX ISOCONCENTRATION CONTOUR IN UG/L
- 11 BTEX CONCENTRATION (UG/L)
- GROUNDWATER MONITORING WELL
- ABANDONED WELL
- EXCAVATION LOCATION - YEAR 2000
- GROUNDWATER ELEVATION CONTOUR CONTOUR INTERVAL = 1 FOOT (DASHED WHERE INFERRED)
- MARYLAND AIR NATIONAL GUARD BOUNDARY
- POND

Historical Features

- FORMER ORDNANCE OR FUEL BUNKER
- FORMER DEBRIS PILES
- FORMER OPEN BURNING AREA
- FORMER PIT OR POND
- #20 FORMER FEATURE NUMBER (FROM 2012 AERIAL PHOTOGRAPHY STUDY)

* = Chlorobenzene concentration
\- - = Not Detected
UG/L = micrograms per liter
BTEX = benzene, toluene, ethylbenzene and xylenes

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

0 50 100 200 Feet

N

DATE MODIFIED: 5/21/12

CREATED BY: MP

TETRA TECH

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FIGURE 6-18

BTEX IN GROUNDWATER -
LOWER SURFICIAL AQUIFER
DUMP ROAD AREA

LEGEND

11 BTEX CONCENTRATION (UG/L)

GROUNDWATER MONITORING WELL

ABANDONED WELL

EXCAVATION LOCATION - YEAR 2000

GROUNDWATER ELEVATION CONTOUR
CONTOUR INTERVAL = 0.5 FOOT
(DASHED WHERE INFERRED)

MARYLAND AIR NATIONAL
GUARD BOUNDARY

POND

Historical Features

entity_id

FORMER ORDNANCE OR FUEL BUNKER

FORMER DEBRIS PILES

FORMER OPEN BURNING AREA

FORMER PIT OR POND

#20 FORMER FEATURE NUMBER
(FROM 2012 AERIAL PHOTOGRAPHY STUDY)

- - = Not Detected
UG/L = micrograms per liter
BTEX = benzene, toluene, ethylbenzene
and xylenes

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

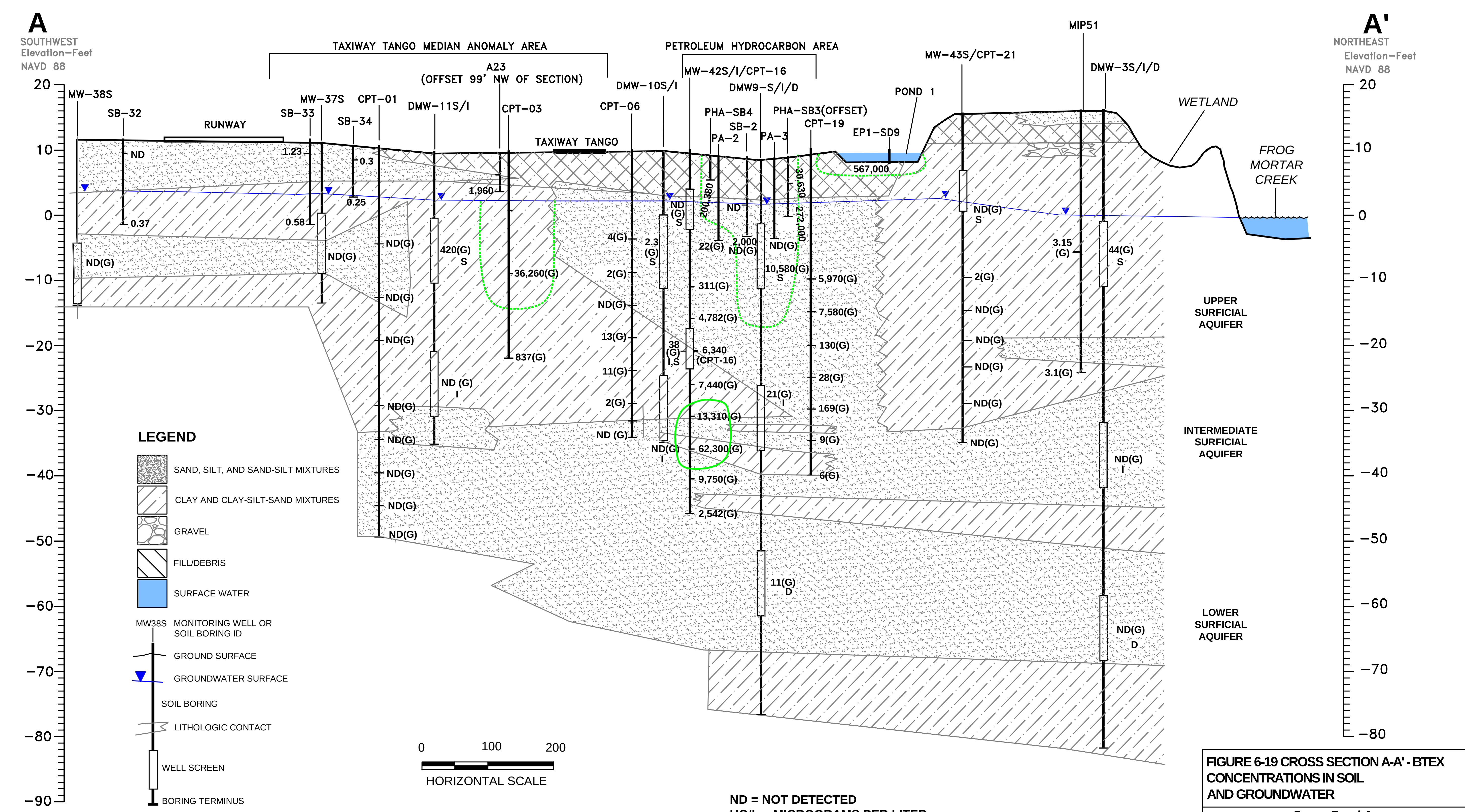
0 50 100 200 Feet

N

DATE MODIFIED: 2/8/13

CREATED BY: MP

TETRA TECH



2,000 - BTEX CONCENTRATION IN SOIL OR POND SEDIMENT (UG/KG)

2,000 (G) - BTEX CONCENTRATION IN GROUNDWATER (UG/L)

SOURCE AREA OR POTENTIAL SOURCE AREA (PRELIMINARY)

ND = NOT DETECTED
UG/L = MICROGRAMS PER LITER
UG/KG = MICROGRAMS PER KILOGRAM
S = UPPER SURFICIAL AQUIFER WELL
I = INTERMEDIATE SURFICIAL AQUIFER WELL
D = LOWER SURFICIAL AQUIFER WELL
NAVD 88 = NORTH AMERICAN VERTICAL DATUM 1988

FIGURE 6-19 CROSS SECTION A-A' - BTEX CONCENTRATIONS IN SOIL AND GROUNDWATER

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODITFIED	CREATED BY
2/7/13	LR

TETRA TECH

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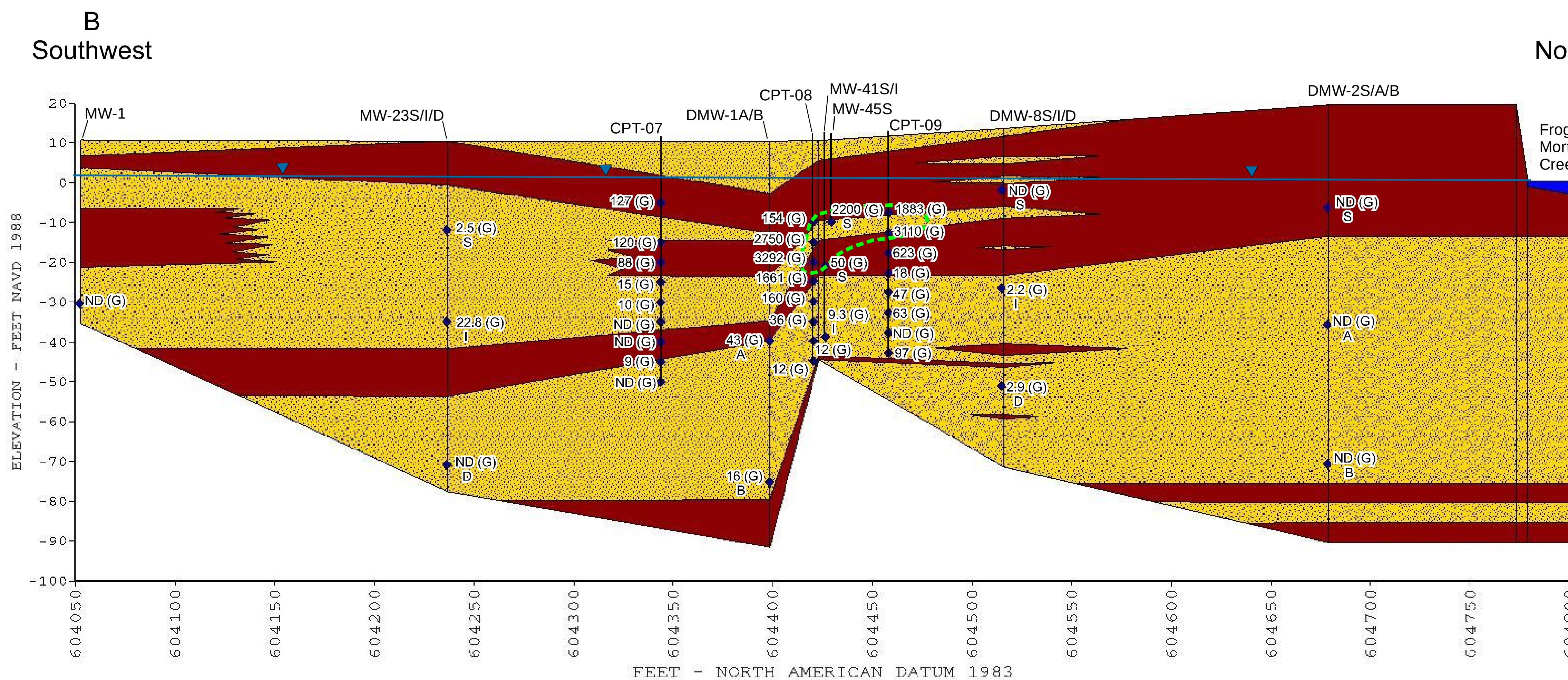

FIGURE 6-20

CROSS SECTION B-B'
BTEX CONCENTRATIONS IN SOIL AND GROUNDWATER

LEGEND

◆	GROUNDWATER SAMPLE
720 (G)	BTEX CONCENTRATION IN GROUNDWATER (UG/L)
60	BTEX CONCENTRATION IN SOIL (UG/KG)
	SAND, SILT, AND SAND-SILT MIXTURES
	CLAY AND CLAY-SILT-SAND MIXTURES
	WATER
▽	GROUNDWATER SURFACE
	BTEX SOURCE AREA OR POTENTIAL SOURCE AREA
G =	GROUNDWATER SAMPLE
S =	UPPER SURFICIAL AQUIFER WELL
A or I =	INTERMEDIATE SURFICIAL AQUIFER WELL
B or D =	LOWER SURFICIAL AQUIFER WELL
MW OR DMW =	MONITORING WELL
NAVD =	NORTH AMERICAN VERTICAL DATUM
CPT =	CONE PENETRATION TEST
TCE =	TRICHLOROETHENE
ND =	NOT DETECTED
UG/L =	MICROGRAMS PER LITER
UG/KG =	MICROGRAMS PER KILOGRAM

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED: 2/08/13 | CREATED BY: MP

TETRA TECH

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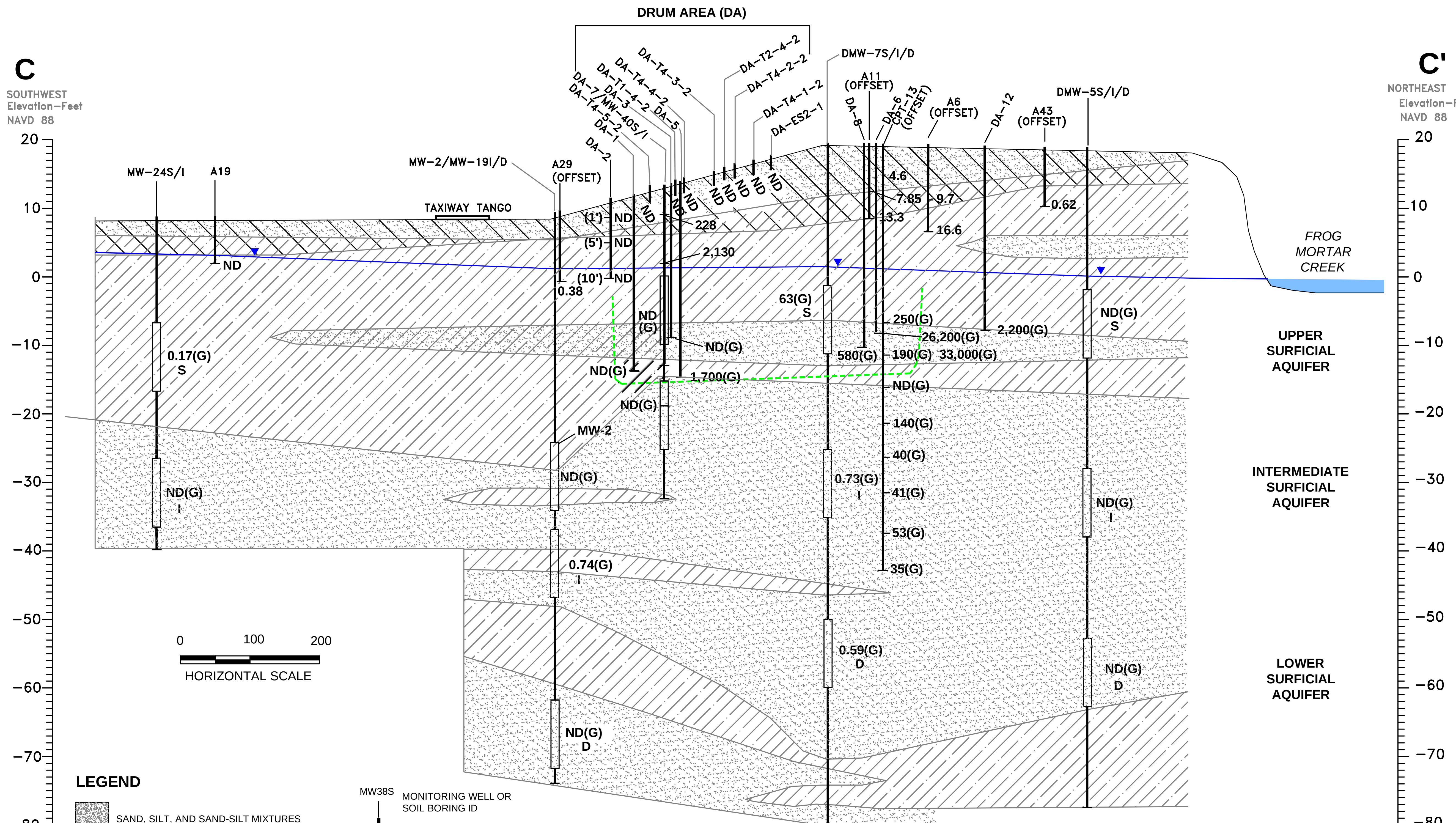

LEGEND

- SAND, SILT, AND SAND-SILT MIXTURES
- CLAY AND CLAY-SILT-SAND MIXTURES
- FILL/DEBRIS
- SURFACE WATER
- MW38S MONITORING WELL OR SOIL BORING ID
- GROUND SURFACE
- GROUNDWATER SURFACE
- SOIL BORING
- LITHOLOGIC CONTACT
- WELL SCREEN
- BORING TERMINUS

2,000 - BTEX CONCENTRATION IN SOIL OR POND SEDIMENT (UG/KG)
2,000 (G) - BTEX CONCENTRATION IN GROUNDWATER (UG/L)
SOURCE AREA OR POTENTIAL SOURCE AREA (PRELIMINARY)

ND = NOT DETECTED
UG/L = MICROGRAMS PER LITER
UG/KG = MICROGRAMS PER KILOGRAMS
BTEX - BENZENE, TOLUENE, ETHYLBENZENE AND XYLENES
S = UPPER SURFICIAL AQUIFER WELL
I = INTERMEDIATE SURFICIAL AQUIFER WELL
D = LOWER SURFICIAL AQUIFER WELL
NAVD 88 = NORTH AMERICAN VERTICAL DATUM 1988

FIGURE 6-21 CROSS SECTION C-C' - BTEX CONCENTRATIONS IN SOIL AND GROUNDWATER

Dump Road Area
Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED	CREATED BY
2/7/13	LR

TETRA TECH

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APPENDIX B—MDE COMMENTS

MARTIN STATE AIRPORT (MD-304)
Dump Road Area (DRA)
701 Wilson Point Road, Middle River, Maryland

MDE Comments on Tetra Tech's June 2012
Dump Road Source Areas Investigation Work Plan and
Technical Memorandum for the Dump Road Area Source Area Delineation
(Finalized 08/09/12)

1. Provide MDE with a hard-copy (complete with full-size figures) of the work plan (WP)'s Appendix A document, *June 2012 Technical Memorandum for the Dump Road Area Source Area Delineation* (TM); hard copies of Appendices B and C are not necessary.

2. The depth of the WP's proposed cone penetrometer (CPT) borings should be increased from 40 feet to 60 feet to better understand the interaction of the DRA's shallow and intermediate groundwater flow zones and the effect it has on contaminant migration. Use of a 40-foot depth will miss much of the DRA's intermediate flow zone and might; therefore, provide a distorted view of the existing contaminant migration patterns.

3. Explain the purpose of the "second sand pack" that is called for in the WP's monitoring well (page 3-10) and piezometer (page 3-13) design specifications.

4. Resolve the apparent discrepancy caused by the following statements found on page 3-12 of the WP's **Monitoring Well Development** section: (a) *"Development will be considered complete when the ...or when the well is purged dry."* and (b) *"If a well is purged dry, the water level will be allowed to recover a minimum of 80 percent of its initial static water level before resuming development."*

5. The WP should specify the collection and analysis of water samples from the piezometers MW-43 and -44 and the bottom of stilling wells STW-1 and STW-2 to help evaluate the hydraulic connectivity, or lack thereof, between Ponds 1 and 2 and the shallow groundwater zone. The samples should be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), 1, 4-dioxane, dissolved priority pollutant metals, and standard water quality parameters.

6. Add two CPT borings (not including CPT-22) to the WP's proposed characterization of the "Area of Former Pit" shown on WP Figure 3-1. The additional borings will help evaluate this largely un-studied, but important, area of the DRA.

7. Add two or more CPT borings (not including CPT-18) to the WP's proposed characterization of the VOC source identified in the "Taxiway Tango Area-North" on WP Figure 3-1. Install one of the borings toward the southern end of the VOC source area, some distance away from the proposed CPT-18 boring location.

8. Use the word "pond" instead of "creek" in the 1st sentence of the 4th paragraph on WP page 3-17.

9. Explain why the WP does not propose any test pits (TP)s and/or CPT borings in the following areas spotlighted in the Technical Memorandum (TM):
   - 1996 soil boring B-8 (TM pages 2-13 and 2-14), where a suspected buried tank/container and "**pure product**" were identified;
   - 1996 soil boring B-15 (TM page 2-14), where "**free product**" was identified;
   - 2011 soil borings DRSB-31 and -32, where elevated concentrations of VOCs and SVOCs were found, respectively (TM page 2-44 and Figure 2-30). TM page 4-15 went on to say that additional soil and groundwater samples are needed at depth near DRSB-31 to further delineate an area of elevated TCE concentrations in soil;
   - 2011 MIP borings MIP-84, -85, -86A/B, where highly-elevated concentrations of chlorinated VOCs were found (TM Figure 2-29);
   - 2008 test pit N4, where a **green-black liquid** with a very strong solvent odor was encountered (TM page 3-6);
   - Dump Road Area 2, where field measurements of VOCs, ranging from 1.2 to 2,000 parts per million per volume, were detected in soil (TM page 4-3);
   - Dump Road Area 9, where a **black sludge-like soil** with a strong solvent odor was encountered immediately upgradient of Frog Mortar Creek (TM page 4-5).

   At the very least, MDE believes that the WP should require the sampling and laboratory analysis of the **bolded** materials above to determine their physical and chemical properties.

10. Given that a dense non-aqueous phase liquid (DNAPL) source area might extend from monitoring well DMW-11S through borings MIP-58 and MIP-61 (TM page 4-10), the WP should specify the installation of an additional CPT boring immediately upgradient of boring MIP-61.

11. The following statements found on TM pages 4-13 and 4-14 argue for the installation of additional CPT borings (described below) in the Drum Area (DA):

    a. *"Deep subsurface soil samples with depths greater than 15 feet have not been collected below the DA trench samples."*

The WP should specify the installation of at least one additional CPT boring in the approximate footprint of former DA Trench 2. This trench had the highest surface soil trichloroethene (TCE) concentrations measured in the DA to date.

b. *"The maximum TCE_{EQ} concentration for these samples in groundwater at the DA was detected in DA-7 (191,384 µg/L), a groundwater sample collected from 26 feet below grade east of the DA trenches and excavation."*

   The WP should specify the installation of an additional CPT boring at the approximate location of the former DA-7 boring.

c. *"DA sampling results indicate that DNAPL in the upper surficial aquifer groundwater likely extends from the DA trench area west of sampling location DA-1 to several hundred feet northeast between DA-6 and DA-9"* AND "...at well DMW-5S, a *TCE_{EQ} concentration of 11,336 µg/L also indicates the possible presence of DNAPLs. Groundwater sampling results indicate that DNAPLs may be extensive in the upper surficial aquifer..."*

   The WP should specify the installation of two additional CPT borings installed downgradient of the already-proposed borings, CPT-12 and -13.

d. *"Concentrations of TCE slightly less than the 11,000 µg/L threshold at MIP-41 (24-26 feet) and DMW-5S suggest additional sampling is required in these areas to further assess the presence of DNAPL."*

   The WP should specify the installation of at least one additional CPT boring in the vicinity of monitoring well DMW-5S and former boring MIP-41 "to further assess the presence of DNAPL".

12. The WP should specify the installation of additional CPT borings in the vicinity of monitoring wells MW-18I, DMW-3I, and DMW-2A and previous borings PA-12 and -13 because, as was stated on TM pages 4-15 and 4-16, the TCE concentrations measured in these wells in 2011 indicated *"the possible presence of DNAPL"* and *"groundwater samples have not been collected in the intermediate and lower surficial aquifer zones directly east of Pond 1, where DNAPL or higher concentrations of VOCs in groundwater in this area would be expected."*

MDE Comments on Tetra Tech's June 2012
Dump Road Source Areas Investigation Work Plan and
Technical Memorandum for the Dump Road Area Source Area Delineation
(Finalized 08/09/12)

13. The WP should specify the installation of a shallow-zone, plume-delineation monitoring well between DMW-5S and Frog Mortar Creek based on the elevated TCE_{EQ} groundwater concentrations, shown on TM Figure 4-14, for borings and/or monitoring wells DMW-7S, DA-8, DA-6, DA-12, and DMW-5S.

14. Referring to the TCE_{EQ} calculations used in the TM to assist with delineating possible DNAPL source zones, explain the steps that were taken to account for the presence of DNAPL compounds other TCE and its daughter products.

15. Provide the basis for the TM's assertion (in Section 5) that DNAPL has never been directly identified in any soil or groundwater sample collected at the DRA, given the fact that little to no oil-water interface probe or bailer testing has been performed.

16. Provide MDE's CHS Enforcement Division with a hard-copy of the 2012 *Dump Road and Runway Area Soil and Groundwater Investigation* report referenced in TM Section 2.3.25.

17. The WP should specify further investigation activities in the vicinity of the 2011 MIP boring MIP-85. The investigation activities should be designed to, among other things, determine if the MIP-85 contamination is in any way linked to the former Storage Yard located near the maintenance building shown on TM Figure 2-4. TM Section 2 indicated that a high VOC concentration was detected at MIP-85 during the *Dump Road and Runway Area Soil and Groundwater Investigation*; however, no further soil or groundwater investigation was conducted in and around this possible area of concern (PAOC) to delineate its nature and extent.

18. Explain how the boundaries of the various VOC source zones, shown on WP Figures 3-1 through 3-4, were drawn; especially the boundaries drawn in areas lacking hard data (e.g., the boundaries between the Drum and TT Median areas AND TT Median and Petroleum Hydrocarbon areas.

Attachment A

RESPONSES TO THE MARYLAND DEPARTMENT OF THE ENVIRONMENT'S COMMENTS ON THE DUMP ROAD AREA SOURCE AREAS INVESTIGATION WORK PLAN, JUNE 2012 MARTIN STATE AIRPORT, MIDDLE RIVER, MARYLAND

The following are Lockheed Martin's responses to the August 9, 2012 comments received from the Maryland Department of the Environment (MDE) for the June 2012 Dump Road Area (DRA) Source Areas Investigation Work Plan, Martin State Airport (MSA), Middle River, Maryland. MDE's comments are highlighted in bold and are followed by Lockheed Martin's responses. The updated pages based on the comment responses are included in Attachment B.

1. **Provide MDE with a hard-copy (complete with full-size figures) of the work plan (WP)'s Appendix A document, *June 2012 Technical Memorandum for the Dump Road Area Source Area Delineation* (TM); hard copies of Appendices B and C are not necessary.**

   Lockheed Martin will provide a hard copy of the requested document, including full-size color figures.

2. **The depth of the WP's proposed cone penetrometer (CPT) borings should be increased from 40 feet to 60 feet to better understand the interaction of the DRA's shallow and intermediate groundwater flow zones and the effect it has on contaminant migration. Use of a 40-foot depth will miss much of the DRA's intermediate flow zone and might; therefore, provide a distorted view of the existing contaminant migration patterns.**

   As requested, Lockheed Martin will increase the CPT and DPT boring depths to 60 feet. Please note that CPT/DPT penetration may not achieve 60 feet due to potential lithologic characteristics such as dense gravels/sands and ironstone that have been encountered at the site. The additional penetration depth will add an expected four groundwater samples per boring location.

3. **Explain the purpose of the "second sand pack" that is called for in the WP's monitoring well (page 3-10) and piezometer (page 3-13) design specifications.**

   For the proposed well couplets, two wells and well screens are being installed within a single borehole. The second sand pack refers to the sand pack that will be installed around the second well screen for the shallow or "S" well screen to be installed above the grout seal above the deeper "I" interval sand pack. This section will be revised to clarify the purpose of the second sand pack. For the piezometers on page 3-13, only a single well will be installed into the borehole. Therefore, the sentence discussing the second sand pack will be removed from this paragraph.

4. **Resolve the apparent discrepancy caused by the following statements found on page 3-12 of the WP's Monitoring Well Development section: (a) *"Development will be considered complete when the ...or when the well is purged dry."* and (b) *"If a well is purged dry, the***

water level will be allowed to recover a minimum of 80 percent of its initial static water level before resuming development."

This section will be revised to indicate that well development will be considered complete if the well is purged dry and does not recover to 80 percent of the initial static level within 24 hours of the well having been purged dry.

5. **The WP should specify the collection and analysis of water samples from the piezometers MW-43 and -44 and the bottom of stilling wells STW-1 and STW-2 to help evaluate the hydraulic connectivity, or lack thereof, between Ponds 1 and 2 and the shallow groundwater zone. The samples should be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), 1, 4-dioxane, dissolved priority pollutant metals, and standard water quality parameters.**

   The work plan will be revised to specify the collection and chemical analyses of surface water samples from the bottom of the stilling wells, and groundwater samples from MW-43 and MW-44. The samples will be analyzed for VOCs, SVOCs, 1,4-dioxane, dissolved priority pollutant metals, and standard water quality parameters, the latter of which will be collected using a portable water quality meter.

6. **Add two CPT borings (not including CPT-22) to the WP's proposed characterization of the "Area of Former Pit" shown on WP Figure 3-1. The additional borings will help evaluate this largely un-studied, but important, area of the DRA.**

   Per the agreement between Lockheed Martin and MDE, this additional work will be considered as part of tasks to be completed at MSA in 2013.

7. **Add two or more CPT borings (not including CPT-18) to the WP's proposed characterization of the VOC source identified in the "Taxiway Tango Area-North" on WP Figure 3-1. Install one of the borings toward the southern end of the VOC source area, some distance away from the proposed CPT-18 boring location.**

   Per the agreement between Lockheed Martin and MDE, this additional work will be considered as part of tasks to be completed at MSA in 2013.

8. **Use the word "pond" instead of "creek" in the 1st sentence of the 4th paragraph on WP page 3-17.**

   This section will be revised as suggested.

9. **Explain why the WP does not propose any test pits (TP)s and/or CPT borings in the following areas spotlighted in the Technical Memorandum (TM):** *(For clarity, the font size was increased for the text highlighted in bold in the original MDE comment)*

   - **<u>1996 soil boring B-8</u> (TM pages 2-13 and 2-14), where a suspected buried tank/container and "pure product" were identified;**

   - **<u>1996 soil boring B-15</u> (TM page 2-14), where "free product" was identified;**

- **2011 soil borings DRSB-31 and -32, where elevated concentrations of VOCs and SVOCs were found, respectively (TM page 2-44 and Figure 2-30). TM page 4-15 went on to say that additional soil and groundwater samples are needed at depth near DRSB-31 to further delineate an area of elevated TCE concentrations in soil;**

- **2011 MIP borings MIP-84, -85, -86A/B, where highly-elevated concentrations of chlorinated VOCs were found (TM Figure 2-29);**

- **2008 test pit N4, where a green-black liquid with a very strong solvent odor was encountered (TM page 3-6);**

- **Dump Road Area 2, where field measurements of VOCs, ranging from 1.2 to 2,000 parts per million per volume, were detected in soil (TM page 4-3);**

- **Dump Road Area 9, where a black sludge-like soil with a strong solvent odor was encountered immediately upgradient of Frog Mortar Creek (TM page 4-5).**

At the very least, MDE believes that the WP should require the sampling and laboratory analysis of the bolded materials above to determine their physical and chemical properties.

Per the agreement between Lockheed Martin and MDE, this additional work will be considered as part of tasks to be completed at MSA in 2013.

10. **Given that a dense non-aqueous phase liquid (DNAPL) source area might extend from monitoring well DMW-11S through borings MIP-58 and MIP-61 (TM page 4-10), the WP should specify the installation of an additional CPT boring immediately upgradient of boring MIP-61.**

    Per the agreement between Lockheed Martin and MDE, this additional work will be considered as part of tasks to be completed at MSA in 2013.

11. **The following statements found on TM pages 4-13 and 4-14 argue for the installation of additional CPT borings (described below) in the Drum Area (DA):**

    a. ***"Deep subsurface soil samples with depths greater than 15 feet have not been collected below the DA trench samples."***

       The WP should specify the installation of at least one additional CPT boring in the approximate footprint of former DA Trench 2. This trench had the highest surface soil trichloroethene (TCE) concentrations measured in the DA to date.

    b. ***"The maximum TCE_{EQ} concentration for these samples in groundwater at the DA was detected in DA-7 (191,384 µg/L), a groundwater sample collected from 26 feet below grade east of the DA trenches and excavation."***

The WP should specify the installation of an additional CPT boring at the approximate location of the former DA-7 boring.

c. ***"DA sampling results indicate that DNAPL in the upper surficial aquifer groundwater likely extends from the DA trench area west of sampling location DA-1 to several hundred feet northeast between DA-6 and DA-9"* <u>AND</u> "...at well DMW-5S, a *TCE_{EQ} concentration of 11,336 µg/L also indicates the possible presence of DNAPLs. Groundwater sampling results indicate that DNAPLs may be extensive in the upper surficial aquifer..."***

The WP should specify the installation of two additional CPT borings installed downgradient of the already-proposed borings, CPT-12 and -13.

d. ***"Concentrations of TCE slightly less than the 11,000 µg/L threshold at MIP-41 (24-26 feet) and DMW-5S suggest additional sampling is required in these areas to further assess the presence of DNAPL."***

The WP should specify the installation of at least one additional CPT boring in the vicinity of monitoring well DMW-5S and former boring MIP-41 "to further assess the presence of DNAPL".

Per the agreement between Lockheed Martin and MDE, this additional work will be considered as part of tasks to be completed at MSA in 2013.

12. **The WP should specify the installation of additional CPT borings in the vicinity of monitoring wells MW-18I, DMW-3I, and DMW-2A and previous borings PA-12 and -13 because, as was stated on TM pages 4-15 and 4-16, the TCE concentrations measured in these wells in 2011 indicated *"the possible presence of DNAPL"* and *"groundwater samples have not been collected in the intermediate and lower surficial aquifer zones directly east of Pond 1, where DNAPL or higher concentrations of VOCs in groundwater in this area would be expected."***

Per the agreement between Lockheed Martin and MDE, this additional work will be considered as part of tasks to be completed at MSA in 2013.

13. **The WP should specify the installation of a shallow-zone, plume-delineation monitoring well between DMW-5S and Frog Mortar Creek based on the elevated TCE_{EQ} groundwater concentrations, shown on TM Figure 4-14, for borings and/or monitoring wells DMW-7S, DA-8, DA-6, DA-12, and DMW-5S.**

14. **Referring to the TCE_{EQ} calculations used in the TM to assist with delineating possible DNAPL source zones, explain the steps that were taken to account for the presence of DNAPL compounds other TCE and its daughter products.**

15. Provide the basis for the TM's assertion (in Section 5) that DNAPL has never been directly identified in any soil or groundwater sample collected at the DRA, given the fact that little to no oil-water interface probe or bailer testing has been performed.

16. Provide MDE's CHS Enforcement Division with a hard-copy of the 2012 *Dump Road and Runway Area Soil and Groundwater Investigation* report referenced in TM Section 2.3.25.

    Lockheed Martin will provide a hard copy of the requested document, including full-size color figures.

17. The WP should specify further investigation activities in the vicinity of the 2011 MIP boring MIP-85. The investigation activities should be designed to, among other things, determine if the MIP-85 contamination is in any way linked to the former Storage Yard located near the maintenance building shown on TM Figure 2-4. TM Section 2 indicated that a high VOC concentration was detected at MIP-85 during the *Dump Road and Runway Area Soil and Groundwater Investigation*; however, no further soil or groundwater investigation was conducted in and around this possible area of concern (PAOC) to delineate its nature and extent.

18. **Explain how the boundaries of the various VOC source zones, shown on WP Figures 3-1 through 3-4, were drawn; especially the boundaries drawn in areas lacking hard data (e.g., the boundaries between the Drum and TT Median areas AND TT Median and Petroleum Hydrocarbon areas.**

    The source zones shown in Figure 3-1 are preliminary, generalized potential source areas based primarily on the evaluation of chlorinated VOC chemical data presented in Appendix A of the Work Plan (Technical Memorandum [TM] for Dump Road Area Source Area Investigation). Section 3 of the TM describes the methods used to evaluate the presence of DNAPL and potential source areas. The source areas were based primarily on the chlorinated VOC chemical data for soil and groundwater because other evidence such as history and visual observations do not provide details on specific source locations. The soil and groundwater VOC data were contoured using the inverse-distance weighted (IDW) algorithm included in the Department of Defense Groundwater Modeling System (GMS) software Version 6.5. These source areas are considered to be preliminary and are based on currently available chemical data. The TM acknowledges the presence of data gaps for both soil and groundwater, and the preliminary source areas in the figure are expected to be updated based on the 2012 Source Areas field program and other future studies based on the 2012 study results.

    For soil, TCE concentrations from numerous soil samples were evaluated at three depth intervals (i.e., surface soil, shallow subsurface soil, and deep subsurface soil) across the site (see TM Figures 4-3 through 4-5)., Using dashed contour lines, these figures indicate where data are not available and where the endpoints of TCE concentrations contours are not certain. The IDW contouring method interpolates beyond data points by weighting the nearby data and giving lower weighting to points further away. Therefore, the brown shading in the figures shows there areas where elevated concentrations of TCE (generally 1,000 µg/kg and above) were contoured in any of the three soil depths intervals. The brown shading does not represent exact boundaries and is not intended to indicate areas where data do not exist, but shows where known elevated concentrations have been reported in soil samples and conservatively extrapolates beyond those points.

    The TCE source areas in groundwater are based primarily on the TCE DNAPL saturation threshold concentration of 11,000 micrograms per liter (µg/L) which is recommended by USEPA and is generally accepted in the scientific literature for initial evaluations of most groundwater conditions. The blue groundwater source areas in Figure 3-1 are based on areas within TCE groundwater contours of 11,000 µg/L for both the upper surficial aquifer zone and intermediate surficial aquifer zone (see TM Figures 4-7 and 4-9). TCE concentrations are less than this threshold in the lower surficial aquifer. Because groundwater data are not available east of wells MW-18S/I, DMW-3S/I, and DMW-2A/B, the groundwater source area was extended beyond the contours to indicate a potentially larger source zone (for investigating) than indicated by the TCE figures. For potential source areas based on TCE_{EQ} (green shaded areas), the 11,000 µg/L TCE_{EQ} contour was used for areas that do not overlap the TCE contours results, and typically indicate larger source areas (e.g., green shading around wells DMW-11S/I and west of wells DMW-9S/I). Green shading was also used where TCE_{EQ} exceeds 11,000 µg/L and TCE was the primary component near the concentration threshold of 11,000 µg/L (e.g., at DMW-5S/I and MIP-41 were TCE is 9,300 and 8,780 µg/L, but not further east at DA-12 and DA-13 where TCE_{EQ} exceeds 11,000 µg/L but the TCE contribution is only 2,300 and 1,900 µg/L.

APPENDIX C— HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
FOR
LOCKHEED MARTIN CORPORATION

SOIL AND GROUNDWATER CHARACTERIZATION

MARTIN STATE AIRPORT

MIDDLE RIVER, MARYLAND

TETRA TECH, INC.
20251 Century Boulevard Suite 200
Germantown, Maryland 20874-7114

JANUARY 2013

HEALTH AND SAFETY PLAN
FOR
LOCKHEED MARTIN CORPORATION

SOIL AND GROUNDWATER CHARACTERIZATION
MARTIN STATE AIRPORT

701 WILSON POINT ROAD
MIDDLE RIVER, MARYLAND

Submitted by:
Tetra Tech, Inc.
20251 Century Boulevard, Suite 200
Germantown, MD 20874

JANUARY 2013

PREPARED UNDER THE SUPERVISION OF:	PREPARED AND APPROVED BY:
______________________________	Matthew M. Soltis
MICHAEL MARTIN, P.G.	MATTHEW M. SOLTIS, CIH, CSP
REGIONAL MANAGER	CORPORATE HEALTH AND SAFETY MANAGER
GERMANTOWN, MARYLAND	PITTSBURGH, PENNSYLVANIA

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed to provide the minimum practices and procedures for Tetra Tech, Inc. (Tetra Tech) and subcontractor personnel engaged in the Martin State Airport at the Lockheed Martin Corporation (LMC), in Middle River, Maryland.

This HASP must be used in conjunction with the Tetra Tech Health and Safety Guidance Manual (HSGM). The HSGM contains Tetra Tech Health and Safety Standard Operating Procedures (SOPs), as well as detailed reference information on a variety of topics referenced in this HASP. This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 CFR 1910.120 (OSHA's Hazardous Waste Operations and Emergency Response Standard) and applicable sections of 29 CFR 1926 (Safety and Health Regulations for Construction).

All contractor responsibilities stipulated in Section 1 of the Lockheed Martin Remediation Contractor's ESH Handbook (LM Handbook) will be adhered to. The LM Handbook can be found in Attachment I of this HASP.

Copies of all pertinent environmental, safety and health (ESH) records must be maintained <u>at the job site.</u> This includes, but is not limited to, this site-specific HASP, the Tetra Tech Health and Safety Guidance Manual, personnel training documentation, evidence of enrollment in a medical surveillance program, accident/injury reporting, work area inspections, periodic safety meetings, MSDS's, air monitoring data, waste container inspections, etc. These records must also be provided electronically to the Lockheed Martin Project Lead.

This HASP has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work and site. The HASP will be modified if the scope of work changes or if new information regarding site conditions, hazards, or contaminants of concern becomes available. If deviations are encountered from the field work plan, the contractor shall A) notify to the Lockheed Martin Project Lead and B) suspend work to assess changes to the work plan(s) and the HASP. Changes to the work plan(s) and the HASP shall be reviewed by the Project Lead. Procedures addressing changes to this HASP as described in Section 6 of the LM Handbook (Attachment I) will be followed.

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibilities for site safety and health for Tetra Tech employees conducting field activities under this field effort. All personnel assigned to participate in the field work have the primary responsibility for performing all of their work tasks in a manner that is consistent with the Tetra Tech Health and Safety Policy, the health and safety training that they have received, the contents of this HASP, and in an overall manner that protects their personal safety and health and that of their co-workers. The following persons are the primary point of contact and have the primary responsibility for observing and implementing this HASP and for overall on-site health and safety.

- The Tetra Tech Project Manager (PM) is responsible for the overall direction and implementation of this HASP.

- The Field Operations Manager (FOL) manages field activities, executes the work plan, and enforces safety procedures as applicable to the work plan.

- The Project Health and Safety Officer (PHSO) is responsible for developing this HASP in accordance with applicable OSHA regulations. Specific responsibilities include:
  - Providing information regarding site contaminants and physical hazards.
  - Establishing air monitoring and decontamination procedures.
  - Assigning personal protective equipment based on task and potential hazards.
  - Determining emergency action procedures.
  - Identifying appropriate emergency contacts.
  - Stipulating training and medical surveillance requirements.
  - Providing standard work practices to minimize potential injuries and exposures associated with hazardous waste site work.
  - Modify this HASP, where and when necessary.

- The Site Safety Officer (SSO) supports site activities by advising the PM on the aspects of health and safety on site. These duties may include the following:
  - Coordinate health and safety activities with the FOL.
  - Select, inspect, implement, and maintain personal protective equipment.
  - Establish work zones and control points.
  - Implements air-monitoring program for onsite activities.
  - Verify training and medical status of onsite personnel status in relation to site activities.
  - Implements hazard communication, respiratory protection, and other associated safety and health programs as necessary.
  - Coordinates emergency services.
  - Provides site specific training for onsite personnel.
  - Investigates accidents and injuries (see Attachment II Incident Report Form)

- Provides input to the PHSO regarding the need to modify, this HASP, or other applicable health and safety associated documents as per site-specific requirements.

- Compliance with the requirements of this HASP are monitored by the SSO and coordinated through the Tetra Tech Health and Safety Manager (HSM).

Note: In some cases one person may be designated responsibilities for more than one position. For example, the FOL may also be responsible for the SSO duties. This action will be performed only as credentials, experience, and availability permits.

1.2 STOP WORK

ALL employees are empowered, authorized, and responsible to STOP WORK at any time when an imminent and uncontrolled safety or health hazard is perceived. In a Stop Work event (immediately after the involved task has been shut down and the work area has been secured in a safe manner) the employee shall contact the Project Manager and the Corporate Health and Safety Manager. Through observations and communication, all parties involved shall then develop, communicate, and implement corrective actions necessary and appropriate to modify the task and to resume work.

1.3 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: Martin State Airport Lockheed Martin

Address: Middle River, Maryland

LMC Contact: Paul Calligan **Phone Number:** (240) 676-5392

Proposed Dates of Work: January 2013 until completion

Project Team:

Tetra Tech Management Personnel:	Discipline/Tasks Assigned:	Telephone
Michael Martin, P.G.	Regional Manager	(301) 528-3022 (410) 707-5259
Tony Apanavage	Project Manager (PM)	(301)-528-3021 (301)-233-8230
TBD	Site Safety Officer (SSO)	
Matthew M. Soltis, CIH, CSP	Health and Safety Manager	(412) 921-8912
Clyde J. Snyder	Project Health and Safety Officer (PHSO)	(412) 921-8904
TBD	***Excavation Competent Person**	**TBD**

*** MUST BE FILLED OUT PRIOR TO BEGINNING WORK**

Non-Tetra Tech Personnel	Affiliation/Discipline/Tasks Assigned	Telephone

Hazard Assessment (for purposes of 29 CFR 1910.132) for HASP preparation has been conducted by:

Prepared by: Clyde J. Snyder and Jennifer Carothers, PhD

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a planning effort to direct and guide field personnel in the event of an emergency. In the event of an emergency, the field team will primarily evacuate and assemble to an area unaffected by the emergency and notify the appropriate local emergency response personnel/agencies. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured/ill person. The emergency response agencies listed in this plan are capable of providing the most effective response, and as such, will be designated as the primary responders. These agencies are located within a reasonable distance from the area of site operations, which ensures adequate emergency response time.

Tetra Tech personnel may participate in minor event response and emergency prevention activities such as:

- Initial fire-fighting support and prevention
- Initial spill control and containment measures and prevention
- Removal of personnel from emergency situations
- Provision of initial medical support for injury/illness requiring only first-aid level support
- Provision of site control and security measures as necessary

2.2 EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, emergencies resulting from chemical, physical, or fire hazards are the types of emergencies which could be encountered during site activities. To minimize or eliminate the potential for these emergency situations, pre-emergency planning activities will include the following (which are the responsibility of the SSO and/or the FOL):

- Coordinating with Lockheed Martin Middle River and/or local emergency response personnel to ensure that Tetra Tech emergency action activities are compatible with existing emergency response procedures.

- Establishing and maintaining information at the project staging area (support zone) for easy access in the event of an emergency. This information will include the following:

  - Chemical Inventory (of chemicals used onsite), with Material Safety Data Sheets.

- Onsite personnel medical records (Medical Data Sheets).
- A log book identifying personnel onsite each day.
- Hospital route maps with directions (these should also be placed in each site vehicle).
- Emergency Notification - phone numbers.

The Tetra Tech FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action.
- Educating site workers to the hazards and control measures associated with planned activities at the site, and providing early recognition and prevention, where possible.
- Periodically performing practice drills to ensure site workers are familiar with incidental response measures.
- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Through the hazard assessment, it has been determined that the following potential hazards that could be encountered:

Physical Injury resulting from:

Struck By: High-pressure lines could become disconnected and whip resulting in possible injury. Prevention methods include having locking/ or pinned hose connections and whip checks to prevent disconnection.

Entanglement: Entanglement hazards exist with the conveyor auger and rotating pump components. To minimize these hazards equipment will be inspected to ensure guarding is in place. If the auger conveyor is not equipped with a safety interlock on the lid to the auger, then administration controls will be put in place to control persons accessing an unguarded rotating auger. See Section of the HSGM for additional direction.

Chemical Exposure: The scope of this work involves possible exposure to chemical contaminants site personnel will:

- Reviewed the MSDSs (Attachment II) and will have ready any emergency response measures necessary for response. This includes an eyewash station and safety shower or drench hose if required.

- Locate a hospital that has decontamination capabilities and can provide care to chemical exposed personnel.

Foreseeable emergency situations that may be encountered during site activities will generally be recognizable by visual observation. A clear knowledge of the signs and symptoms of overexposure to contaminants of concern may alert personnel of the potential hazards concerning themselves or their fellow workers.

Tetra Tech will minimize or eliminate exposure to recognized hazardous substances covered by OSHA. OSHA requires that exposure to hazardous materials that are not directly covered be monitored and maintained below the limits set forth by the American Conference of Governmental Industrial Hygiene (ACGIH), National Institute for Occupational Safety and Health (NIOSH), and manufacturers' recommended limits. OSHA and the ACGIH have established required or suggested exposure limits for various chemicals in use today. For materials that have more than one established exposure limit, the most stringent exposure limit will apply when determining exposure limits, monitoring requirements, effective control technologies, employee training, and reporting.

In determining the substances that are in use and the areas of exposure, the SSO will develop a program to monitor the operation. The PHSO will determine the potential for exposure and will monitor appropriately for the determination of hazard levels. In addition, the SSO will make any recommendations deemed necessary for the protection of worker health and safety. When hazards are identified, they will be addressed in accordance with the following prevention measures to eliminate the workplace hazards:

- Whenever possible, engineering controls will be implemented to eliminate or control hazards,
- Followed by administrative controls
- As a last resort, the use of personal protective equipment.

These potential hazards, are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition will be supported by periodic site surveys to eliminate any conditions that may predispose site personnel or properties to an emergency. These surveys will consist of ensuring:

- Approach paths to monitoring wells are maintained (cleared, mowed, etc.)
- Monitoring well protective casings are cleared of spider and insect nests.
- All equipment is inspected and ready for use looking for items such as guards, connections are pinned or whip checked control potential flailing in the event the connect disconnects.
- Ensure emergency equipment is staged, inspected, and is ready for immediate response.
- Ensure personnel are employing protective equipment as described in this HASP.

The FOL and the SSO will constitute the site evaluation committee responsible for these periodic surveys. Site surveys will be conducted at least once a week during the initiation of this effort. These surveys will be documented in the Project Logbook.

2.3.2 Prevention

Tetra Tech and subcontractor personnel will minimize the potential for emergencies by following the Health and Safety Guidance Manual and ensuring compliance with the HASP and applicable OSHA regulations. Daily site surveys of work areas, prior to the commencement of that day's activities, by the FOL and/or the SSO will also assist in prevention of illness/injuries when hazards are recognized early and control measures initiated.

2.3.3 Fire Prevention / Flammable Liquids

Tetra Tech and subcontractor personnel are responsible for fire prevention and protection in all of their work areas at all times during the duration of this field effort (24 hours per day/seven days per week). Since fuels will be maintained on site approved ABC fire-fighting extinguishers must be provided. Tt personnel and subcontractor personnel will only fight fires in the incipent stage (small fires) when there is no danger of injury to personnel. Fire beyond the incipant stage requires immediate site evacuation and notification of the Fire Department.

The Lockheed Martin Project Lead will be notified as soon as possible of any fire, if Tetra Tech or subcontractor personnel use a Lockheed Martin fire extinguisher, and of any and all fires that are extinguished. In case of fire, Tetra Tech and subcontractor personnel will call 9-1-1.

All flammable and combustible liquids must be stored, dispensed and used in accordance with OSHA regulations and the Uniform Fire Code. Bonding and grounding of containers containing flammable liquids will be required.

All fire prevention/flammable liquids safety procedures and requirements stipulated in Section 3.15 of the LM Handbook (Attachment I) will also be adhered to.

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

An evacuation will be initiated whenever recommended hazard controls are insufficient to protect the health, safety or welfare of site workers. Specific examples of conditions that may initiate an evacuation include, but are not limited to the following: severe weather conditions; fire or explosion; monitoring instrumentation readings which indicate levels of contamination are greater than instituted action levels; and evidence of personnel overexposure to potential site contaminants.

In the event of an emergency requiring evacuation, personnel will immediately stop activities and report to the designated safe place of refuge unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain until further notification from the Tetra Tech FOL. Safe places of refuge will be identified prior to the commencement of site activities by the SSO and will be conveyed to personnel as part of the pre-activities training session. This information will be reiterated during daily safety meetings. Whenever possible, the safe place of refuge will also serve as the telephone communications point for that area. During an evacuation, personnel will remain at the refuge location until directed otherwise by the Tetra Tech FOL or the on-site Incident Commander of the Emergency Response Team. The FOL or the SSO will perform a head count at this location to account for and to confirm the location of site personnel. Emergency response personnel will be immediately notified of any unaccounted personnel. The SSO will document the names of personnel onsite (on a daily basis) in the site Health and Safety Logbook. This information will be utilized to perform the head count in the event of an emergency.

Evacuation procedures will be discussed during the pre-activities training session, prior to the initiation of project tasks. Evacuation routes from the site and safe places of refuge are dependent upon the location at which work is being performed and the circumstances under which an evacuation is required. Additionally, site location and meteorological conditions (i.e., wind speed and direction) may dictate evacuation routes. As a result, assembly points will be selected and communicated to the workers relative to the site location where work is being performed. Evacuation should always take place in an upwind direction from the site.

2.5 EMERGENCY CONTACTS

Prior to initiating field activities, personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an accident. Table 2-1 provides a list of emergency contacts and their associated telephone numbers. This table must be posted where it is readily available to site personnel. Facility maps should also be posted showing potential evacuation routes and designated meeting areas.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite (see Attachment III). If an exposure to hazardous materials has occurred, provide hazard information from Medical Data Sheet to medical service personnel.

The Lockheed Martin Project Lead shall be contacted immediately in the event of a fatal or serious injury, and unpermitted environmental release, or any ESH incident that is likely to generate significant publicity or an adverse situation for Lockheed Martin. Detailed requirements are describe in Section 1.15 of the LM Handbook (Attachment I).

In the event of an emergency not requiring 9-1-1, LMC facility personnel should be contacted in the order presented on Table 2-1.

TABLE 2-1

EMERGENCY CONTACTS
LMC MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND

AGENCY	TELEPHONE
EMERGENCY (Police, Fire, and Ambulance)	**911**
LMC Project Lead, Paul Calligan	(240) 676-5392
Airport Operations Manager Charles M. Baublitz	(410) 682-8831
Director Al Pollard, A.A.E	(410) 682-8800
Mike Musheno	(410) 682-1315 (Office) (610) 656-4012 (Cell)
Lt Col Peter Loebach (Maryland Air National Guard)	(410) 918-6486
Franklin Square Hospital	(443) 777-7000
Chemtrec	(800) 424-9300
National Response Center	(800) 424-8802
Poison Control Center	(800) 222-1222
WorkCare	(800) 229-3674
Regional Manager, Michael Martin	(301) 528-3022
HSM, Matthew M. Soltis, CIH, CSP	(412) 921-8912
PHSO, Clyde Snyder	(412) 921-8904
Miss Utility Maryland/DC	1-800-257-7777

2.6 EMERGENCY ROUTE TO HOSPITAL

Franklin Square Hospital
9000 Franklin Square Drive
Baltimore, Maryland 21237
(410) 682-7000

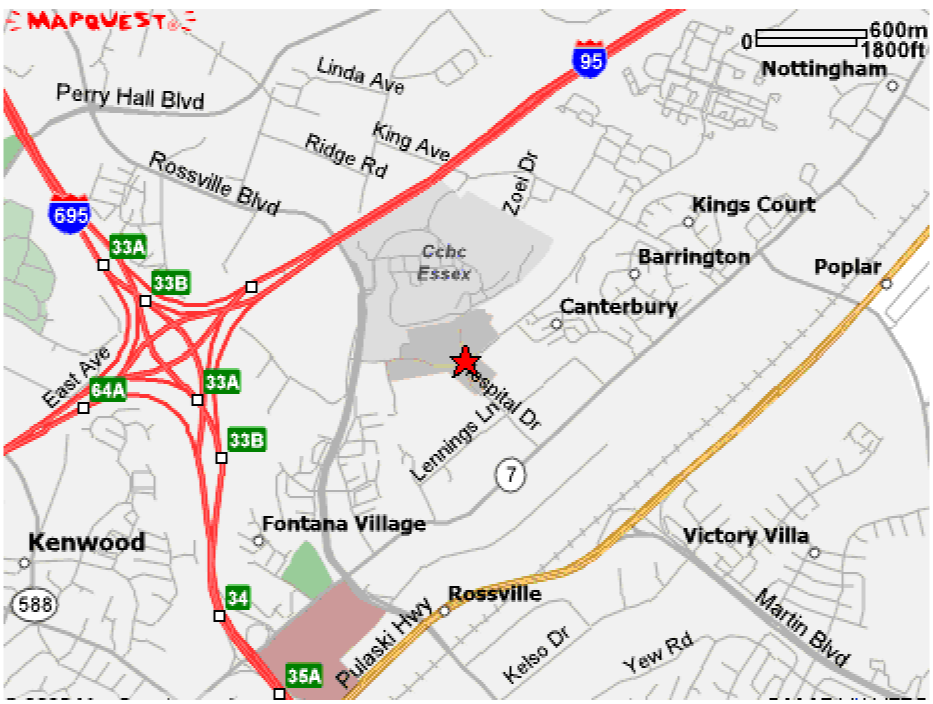
Driving Directions:

1) From Eastern Boulevard, take the Interstate 695.
2) Exit at exit number 34 (Philadelphia Road) and turn right.
3) Proceed on Philadelphia Road and turn left on Rossville Boulevard.
4) Proceed on Rossville Boulevard and take a right on Franklin Square Drive.
5) Proceed on Franklin Square Boulevard to 9000 and the hospital will be on the left hand side.

Routes and directions to the hospital are provided in Figure 2-1.

FIGURE 2-1

ROUTE TO HOSPITAL



2.7 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

Tetra Tech personnel will be working in close proximity to each other at Lockheed Martin MSA. As a result, hand signals, voice commands, and line of site communication will be sufficient to alert site personnel of an emergency.

If an emergency warranting evacuation occurs, the following procedures are to be initiated:

- Initiate the evacuation via hand signals, voice commands, or line of site communication
- Report to the designated refuge point where the FOL will account for all personnel
- Once non-essential personnel are evacuated, appropriate response procedures will be enacted to control the situation.
- Describe to the FOL (FOL will serve as the Incident Coordinator) pertinent incident details.

In the event that site personnel cannot mitigate the hazardous situation, the FOL and SSO will enact emergency notification procedures to secure additional assistance in the following manner:

Dial 911 and call other pertinent emergency contacts listed in Table 2-1 and report the incident. Give the emergency operator the location of the emergency, the type of emergency, the number of injured, and a brief description of the incident. Stay on the phone and follow the instructions given by the operator. The operator will then notify and dispatch the proper emergency response agencies.

2.8 PPE AND EMERGENCY EQUIPMENT

A first-aid kit, eye wash units (or bottles of disposable eyewash solution) and fire extinguishers (strategically placed) will be maintained onsite and shall be immediately available for use in the event of an emergency. This equipment will be located in the field office as well as in each site vehicle. At least one first aid kit supplied with equipment to protect against bloodborne pathogens will also be available on site. Personnel identified within the field crew with bloodborne pathogen and first-aid training will be the only personnel permitted to offer first-aid assistance.

Safety eyewear meeting ANSI Z87.1 is required in areas designated as “Eye Projection Required” and is also required on all jobs where a potential injury to the eye is possible whether or not the area is posted.

Safety shoes and boots which meet the ANSI Z41 Standard shall be provided when impact and/or compression hazards exist.

Appropriate NIOSH-approved respiratory protective devices must be worn when applicable state and/or federal action levels or OSHA permissible exposure levels are exceeded. Appropriate air monitoring and respiratory protection equipment will be supplied and maintained if inhalation hazards are anticipated and a respiratory protection adhering to all state and federal regulations implemented.

Hearing protection must be worn in all areas posted to indicate high noise level or where employees are exposed to noise levels in excess of the OSHA action level (85 dBA over an 8-hour time-weighted average or a dose of fifty percent).

Protective clothing such as suits, aprons, boots or gloves shall be worn where there is a hazard to the body through dermal contact with chemicals, dusts, heat or other harmful agents or conditions.

Hard hats meeting the ANSI Z89.1 Standard will be worn in all areas where there is danger of impact to the head or hazard from falling or moving objects.

All personal protective clothing and equipment will be used and approved as detailed in Section 3.1 of the LM Handbook (Attachment I).

2.9 HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

Tetra Tech and subcontractor personnel conducting work at Lockheed Martin will adhere to Title 29, Code of Federal Regulations, Section 1910.120 – Hazardous Waste Operations and Emergency Response or the applicable state OSHA standards.

Tetra Tech and/or subcontractor personnel will to perform periodic work area inspections to determine the effectiveness of the site safety and health plan and to identify and correct unsafe conditions in the work area. These inspections shall be documented and available to Lockheed Martin upon request for review.

The requirements and regulations described in Section 3.20 of the LM Handbook (Attachment I) will be adhered to.

2.10 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will be postponed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur which would require workers to evacuate the site without first performing the necessary decontamination procedures.

Tetra Tech personnel will perform rescue operations from emergency situations and may provide initial medical support for injury/illnesses requiring only "Basic First-Aid" level support, and only within the limits of training obtained by site personnel. Basic First-Aid is considered treatment that can be rendered by a trained first aid provider at the injury location and not requiring follow-up treatment or examination by a physician (for example; minor cuts, bruises, stings, scrapes, and burns). Personnel providing medical assistance are required to be trained in First-Aid and in the requirements of OSHA's Bloodborne Pathogen Standard (29 CFR 1910.1030). Medical attention above First-Aid level support will require assistance from the designated emergency response agencies. Attachment II provides the procedure to follow when reporting an injury/illness, and the form to be used for this purpose.

2.11 INJURY/ILLNESS REPORTING

If any Tetra Tech personnel are injured or develop an illness as a result of working on site, the Tetra Tech "Incident Report Procedure" (Attachment II) must be followed. Following this procedure is necessary for documenting of the information obtained at the time of the incident.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide information on the chemical, physical, and toxicological properties of the subject chemical(s) to medical service personnel**.**

Tetra Tech personnel will contact the LMC personnel in the order presented in Table 2-1 in the event of a fatality injury, environmental release (spill), near-miss incident, or an ESH incident that is likely to generate significant publicity. A written report of the incident/injury/spill and corrective action(s) must be submitted to LMC personnel within one (1) day of the incident.

Section 8.1 of the LM Handbook (Attachment I) describing the requirements of accident, injury, illness and incident reporting will be addressed.

2.11.1 TOTAL Incident Reporting System

TOTAL is Tetra Tech's new online incident reporting system. Use TOTAL to directly report health and safety incidents, notify key personnel, and initiate the process for properly investigating and addressing the causes of incidents, including near-miss events. An incident is considered any unplanned event. It may include several types of near misses, events where no loss was incurred, or incidents that resulted in injuries or illness, property or equipment damage, chemical spills, fires, or damage to motor vehicles.

TOTAL looks like the incident reporting form in Attachment II. TOTAL is an intuitive system that will guide you through the necessary steps to report an incident within 24 hours of its occurrence. Behind the scenes, TOTAL is a powerful tool for H&S professionals, and will help Tetra Tech to better track incidents, analyze root causes, implement corrective action plans, and share lessons learned. The ultimate result is a more safe and healthy working environment.

TOTAL is maintained on the Tetra Tech Intranet site at https://my.tetratech.com/

Once on the "My Tetratech" site, TOTAL can be found under the Health and Safety tab, Incident Reporting section, select "Report an Incident (TOTAL)". This will connect you directly to TOTAL. TOTAL can also be accessed directly from the internet using the following web address: http://totalhs.tetratech.com/

Note: When using the system outside the Tetra Tech intranet system or when operating in a wireless mode, a VPN connection will be required. The speed of the application may be affected dependent upon outside factors such as connection, signal strength, etc. Enter the system using your network user name and password. The user name should be in the following format - TT\nickname.lastname.

2.12 DRILL/INCIDENT AFTER ACTION CRITIQUE

The FOL will conduct a drill or exercise to test the Emergency Action Plan. A critique with the site personnel after each drill or incident will be conducted. This critique provides a mechanism to review the incidents and exercises or drills to determine where improvements can be made. For incidents recorded in TOTAL, the FOL will utilize the Lessons Learned component for the critique.

3.0 SITE BACKGROUND

3.1 SITE HISTORY

The LMC MRC is located at 2323 Eastern Boulevard in Middle River, Maryland. The site consists of approximately 180 acres of land and twelve main buildings. The subject property also includes perimeter parking lots, an athletic field, Lot D (presently a vacant lot with a concrete foundation for former Building D), a trailer and parts storage lot, and a vacant waterfront lot. The site is bounded by Eastern Boulevard (Route 150) to the north, Dark Head Creek to the south, Cow Pen Creek to the west, and Martin State Airport to the east.

The Martin State Airport (MSA) is located at 701 Wilson Point Road in Middle River, Maryland, and is bounded by Frog Mortar Creek to the east and Stansbury Creek to the west. Both creeks join into Chesapeake Bay to the south of the airport. With surface water bodies surrounding most of MSA, the site can be considered a small peninsula.

Historically, MSA was owned and operated by the Glenn L. Martin Company from approximately 1929 to 1975. Glenn L. Martin Company is the predecessor to Martin Marietta; Lockheed and Martin Marietta merged in 1996 to form Lockheed Martin Corporation. Since the 1950's the Maryland Air National Guard has leased land at the northeastern portion of the airport just north of the MSA site being investigated by LMC. In 1975, the airport was sold to the Maryland Aviation Administration (MAA), an agency within the Maryland Department of Transportation.

Currently, LMC is completing voluntary investigations conducted under the Maryland Department of the Environment (MDE) Environmental Restoration and Redevelopment program on a 50 acre portion of the MSA. This study is in support of the characterization of the 50 acre area.

Martin State Airport is an active airport, operated by the Maryland Aviation Administration. It is comprised of 747 acres, and is described by the MAA as a General Aviation Reliever Airport.

3.2 STRAWBERRY POINT AND GREATER STRAWBERRY POINT FACILITY

Strawberry Point (SP) is located within the confines of the MSA at the southern tip of the peninsula between the confluence of Stansbury Creek and Frog Mortar Creek. SP can be accessed from Eastern Avenue by traveling on Wilson Point Road and entering through a secured unmanned gate. The previously investigated, SP wooded area is located at the southwest termi of the peninsula and covers approximately 25 acres. The wooded area is bounded by earthen berms near the water line with thick brush and trees covering the entire area. Much of the SP wooded area was filled during the 1940's reportedly from deposition of dredge spoils from Stansbury Creek and Frog Mortar Creek. A locked gate controls the entrance to the wooded area. The remainder of the area is currently being investigated, referred to as GSP, is a cleared and partially developed 75-acre area that houses a seaplane ramp, hangar, tank farm, police building and other maintenance buildings extending from the southern end of peninsula to the northern end bordering Taxiway J and eastward from Stansbury Creek to the Taxiway F. The airport runway is located northeast of the GSP.

Greater Strawberry Point was leased from the Glenn L. Martin Company by the Department of Navy on December 23, 1943. At that time, the Navy used the facility and the supporting structures, including a large hangar, for seaplane maintenance, launching, and recovery operations. During Navy occupancy, the former hangar and surrounding GSP area was known as the Naval Weapons Industrial Reserve Plant No. 148. Beginning on December 16, 1963, the Air Force occupied the facility (Permit No.1-N-MD-714) for a brief period. During the Department of Defense (DOD) usage (Navy and Air Force operations), the southern portion of the GSP near the wooded portion of the site contained more than 10 buildings. These included the Beach House (Building No. 3), the Pumping Station (Building No. 4), the Chlorination Station (Building No. 5), two Power Fence Service Houses (Building No. 6 and No. 9), Solvent Storage (Building No. 7), Equipment Storage Building (Building No. 8), Power Fence Switch House (Building No. 10), Delivery Hangar (Building ND/No. 11), and a general Storage Building (Building No. 12). A tank farm containing aboveground storage tanks (ASTs), used for the storage of aircraft fuels, was located adjacent to the wooded area near the southernmost tip of the developed area.

During the same time period (1940s to 1960s), the northern portion of greater GSP was developed with several improvements related to the Naval weapons research. These structures included the Induction Test Building (Building No. 13), Control House (Building No. 14), Noise Suppression Building (Building No. 15), Jet Test Shed (Building No. 16), Storage Building (Building No. 17), Propulsion Test Building (Building No. 22), Compressor Shed (Building No. 23), Engine Test Building (Building No. 24), and Vibration Slosh Test Building (near location of current ground surface mounding). A missile testing area was located along a straight road northwest of the Propulsion Test Building that included the Hyper-therm Test Facility (Building No. 25), Propellant Storage Shed (Building No. 18), Furnace Building (Building No. 19), Acetylene Storage Shed (Building No. 20), Vanguard Tower (Building No. 21), Block House (Building No. 26), and three Coupon Test Sheds (Building No. 27, No. 28, and No. 29).

Further to the northwest, along a former dirt road connecting Strawberry Point Road to the historic airfield maintenance storage building (Building No. 37), several buildings dedicated to nuclear research and testing were constructed. Two main research buildings were designated as the Critical Test Building (Building No. 36/Building. KC) and the Radioisotope Lab (Building No. 35/Building KJ). These research labs operated under Nuclear Regulatory Commission (NRC) permits. These buildings were decontaminated in the late 1980s and NRC terminated the licenses in 1995. A third building was located just south of the labs and was known as the Liquid Metal Test Facility (Building No. 34). Additional buildings near the nuclear labs included several sheds that were removed by Martin-Marietta Corporation to construct Taxiway J, including an organic material storage shed.

Available records indicate that two underground storage tanks (USTs) were installed during DOD's usage of the southern GSP facilities. A 10,000-gallon, heating oil UST was located adjacent to the hangar (Building ND) to provide fuel to the hangar's heating system. This UST was closed-in-place in 1987 (post-DOD period) as the hangar's heating system was converted from fuel oil to natural gas. Both the lease and permit expired on November 30, 1967.

Just prior to that date, the Glenn L. Martin Company merged with Marietta Corporation to form Martin-Marietta Corporation. On June 30, 1975, MSA was conveyed to the MDOT. The State of Maryland currently uses MSA to house and maintain Medivac Units and Helicopters. The southern portion of GSP is occupied by the Baltimore County Marine Police. Eleven USTs have been removed from MSA since 1983 and no evidence of leakage was reported. The large hangar (designated as Building ND) was demolished in 1989, and another hangar that currently houses the Maryland State Police was constructed in 1989 and 1990. GSP currently contains a tank farm consisting of 12 ASTs containing jet fuel, fuel oil, and gasoline along with a pump house and other ancillary buildings currently used by the airport. In addition, as many as six ASTs present at the tank farm are in use by other tenants. An oil spill was reported during the construction of the new hangar in 1989 and 1990, when a fuel oil return and receiving line to two 12,000-gallon ASTs located in the tank farm was severed.

4.0 SCOPE OF WORK

This section summarizes the specific tasks that are to be conducted as part of this scope of work and covered by this HASP. Any modifications (additions, or substantive changes) to these specified tasks will be a change in scope, which will require a review and appropriate modification of this HASP. In such an event, the PM is responsible for communicating the nature of the change to the HSM prior to the initiation of any onsite activity associated with the scope of work change. The HSM is then responsible for assuring that appropriate changes to this HASP are made.

The planned tasks covered by this HASP include the following:

- Mobilization/demobilization activities
- Soil lithology and groundwater assessment using Cone Penetrometer Testing (CPT) equipped with a Membrane Interface Probe (MIP)
- Confirmatory Direct Push Technology (DPT) soil and groundwater assessment
- Installation and development of groundwater monitoring wells and well points via Direct Push Technology
- Surveying new monitoring wells
- Multi-media Sampling
  - Groundwater Samples
  - Soil Samples
  - Sediment Samples
  - Storm Water Samples
  - Surface Water Samples
- Wetland Survey
- Concrete Coring
- Passive Soil Gas survey
- Aquifer pump testing
- Geophysical Surveying
- Test pit excavation and soil sampling
- Decontamination of heavy equipment and sampling equipment
- IDW Management

For more detailed description of the planned tasks associated with LMC MSA, refer to the Work Plan (WP). Any tasks to be conducted outside of the elements listed here will be considered a change in scope requiring modification of this document. All requested modifications to this document will be submitted to the HSM by the PM or a designated representative.

No other activities are anticipated to be necessary. If it becomes apparent that additional or modified tasks must be performed beyond those listed above, the work is not to proceed until the FOL or SSO notifies the Project Manager and the HSM, so that any appropriate modifications to this HASP can first be developed and communicated to the intended task participants.

5.0 IDENTIFYING AND COMMUNICATING TASK-SPECIFIC HAZARDS AND SAFE WORK PRACTICES

The purpose of this section is to identify the anticipated hazards and appropriate hazard prevention/hazard control measures that are to be observed for each planned task or operation. These topics have been summarized for each planned task through the use of task-specific Safe Work Permits (SWPs), which are to be reviewed in the field by the SSO with all task participants prior to initiating any task. Additionally, potential hazard and hazard control matters that are relevant but are not necessarily task-specific are addressed it the following portions of this section.

Section 6.0 presents additional information on hazard anticipation, recognition, and control relevant to the planned field activities.

In the event of an emergency, not requiring 911, LMC facility personnel should be contacted in the order presented on Table 2-1.

5.1 GENERAL SAFE WORK PRACTICES

In addition to the task-specific work practices and restrictions identified in the SWPs (Attachment IV) the following general safe work practices are to be followed when conducting work on-site.

- Eating, drinking, chewing gum or tobacco, taking medication, or smoking in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists is prohibited.

- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. If a source of potable water is not available at the work site that can be used for hands-washing, the use of waterless hands cleaning products will be used, followed by actual hands-washing as soon as practicable upon exiting the site.

- Avoid contact with potentially contaminated substances including puddles, pools, mud, or other such areas. Avoid, kneeling on the ground or leaning or sitting on equipment. Keep monitoring equipment away from potentially contaminated surfaces.

- Plan and mark entrance, exit, and emergency evacuation routes.

- Rehearse unfamiliar operations prior to implementation.

- Buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity to assist each other in case of emergency.

- Establish appropriate safety zones including support, contamination reduction, and exclusion zones.

- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Non-essential vehicles and equipment should remain within the support zone.

- Establish appropriate decontamination procedures for leaving the site.

- Immediately report all injuries, illnesses, and unsafe conditions, practices, and equipment to the SSO.

- Observe co-workers for signs of toxic exposure and heat or cold stress.

- Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.

5.2 DRILLING (HSA/DPT/LITTLE BADGER UNIT/ROTOSONIC) SAFE WORK PRACTICES

The following Safe Work Practices are to be followed when working near operating drilling equipment.

5.2.1 Before Drilling

- Identify underground utilities, buried structures, and aboveground utility lines before drilling. Tetra Tech , Inc. personnel will use the Utility Locating and Excavation Clearance Standard Operating Procedure provided in the Tetra Tech Health and Safety Guidance Manual.

- Drill rigs will be inspected by the SSO or designee, prior to the acceptance of the equipment at the site and prior to the use of the equipment. Needed repairs or identified deficiencies will be corrected prior to use. The inspection will be accomplished using the Equipment Inspection Checklist provided in Attachment V. Additional inspections will be performed at least once every 10-day shift or following repairs.

- Check operation of the Emergency Stop/Kill Switch and/or the "Dead Man's" operational controls. These operational checks are required initially as part of the equipment pre-use inspection, and then periodically thereafter. Periodic checks are required at least weekly, or more frequently if recommended by the rig manufacturer.

- Ensure that machine guarding is in place and properly adjusted.

- Block drill rig and use out riggers/levelers to prevent movement of the rig during operations.

- The work area around the point of operation will be graded to the extent possible to remove any trip hazards near or surrounding operating equipment.

- The driller's helper will establish an equipment staging and lay down plan. The purpose of this is to keep the work area clear of clutter and slips, trips, and fall hazards. Mechanisms to secure heavy objects such as drill flights will be provided to avoid the collapse of stacked equipment.

- Potentially contaminated tooling will be wrapped in polyethylene sheeting for storage and transport to the centrally located equipment decontamination unit.

- Prior to each instance of engaging the HSA drill rig, the Driller will look to ensure that the drilling area is clear of personnel and obstructions, and verbally alert everyone in the area that the rig is about to be engaged.

- Prior to the start of boring operations, one individual will be designated at the person responsible for immediate activation of the emergency stop device (if applicable) in the event of an emergency. This individual will be made known to the field crew and will be responsible for visually checking the work area and verbally alerting everyone of boring operations prior to engaging the equipment.

5.2.2 During Drilling

- The Driller will ensure that an individual is constantly stationed at a location were the drill rig emergency stop switch can be immediately engaged.

- Minimize contact to the extent possible with contaminated tooling and environmental media.

- Support functions (sampling and screening stations) will be maintained a minimum distance from the drill rig of the height of the mast plus five feet or 35-feet for Rotosonic/HSA, 25-feet for DPT operations whichever is greater to remove these activities from within physical hazard boundaries.

- Only qualified operators and knowledgeable ground crew personnel will participate in the operation of the drill rig.

- During maintenance, use only manufacturer provided/approved equipment (i.e. auger flight connectors, etc.)

- In order to minimize contact with potentially contaminated tooling and media and to minimize lifting hazards, multiple personnel should move auger flights and other heavy tooling.

- Only personnel absolutely essential to the work activity will be allowed in the exclusion zone.

5.2.3 After Drilling

- Equipment used within the exclusion zone will undergo a complete decontamination and evaluation by the SSO to determine cleanliness prior to moving to the next location, exiting the site, or prior to down time for maintenance.

- Motorized equipment will be fueled prior to the commencement of the day's activities. During fueling operations equipment will be shutdown and bonded to the fuel source.

- When not in use drill rigs will be shutdown, and emergency brakes set and wheels will be chocked to prevent movement.

- The mast will be completely lowered and outrigger completely retracted during movement to decontamination or the next location.

- Areas subjected to subsurface investigative methods will be restored to equal or better than original condition. Any contamination that was brought to the surface by drilling or DPT operations will be removed and containerized. Physical hazards (debris, uneven surfaces, ruts, etc.) will be removed, repaired or otherwise corrected. In situations where these hazards cannot be removed these areas will be barricaded to minimize the impact on field crews working in the area.

5.2.4 Concrete Coring Operations

The following safe work practices will be employed during concrete coring operations:

- The coring machine will be inspected to insure housings; plugs; guards are intact, and the coring machine is in good operating order.

- If the power source to be employed is not through a Ground Fault Circuit Interrupter (GFCI) then a temporary GFCI plug extension shall be put in place.

- A shop vac or similar device also connected to the GFCI will be used to collect the water employed during the coring process. All water in the coring area will be cleaned to reduce the potential for slip, trip and falls. Place floor wet signs as necessary from all approach venues.

- The preferred method is to bolt the coring machine to the floor during coring operations. It is however acceptable to utilize sand bags or similar weighted devices to control movement during this activity.

- No open core holes will be permitted after the termination of the shift. All cores will be placed back in the holes or the holes will be fitted for their permanent casings for the sub-slab soil gas vapor monitoring points.

- All core holes finished with protective casings or finished using concrete will be finished to grade again to prevent slip, trips, and/or falls.

5.3 EXCAVATION –SAFE WORK PRACTICES

See Section 16.0 of this HASP.

5.4 PERMANENT SOIL GAS VAPOR MONITORING POINTS WITHIN BUILDINGS

If installation of permanent soil gas vapor monitoring points is conducted within buildings on site, soil gas monitoring points may need to be installed at various locations using a diesel powered DPT rig. If necessary, a gasoline or electric powered concrete coring machine may used if the DPT rig cannot push through the concrete floor.

Operation of diesel/gasoline powered equipment within enclosed areas such as buildings presents unique hazards particularly the inhalation of exhaust gasses, fumes, and dusts generated during concrete coring or soil boring. Additional hazards that may be present during these operations include, increased noise levels, contact with utilities, electrocution hazards (particularly if water is present), and the movement of heavy equipment.

The major gaseous products of both diesel and gasoline fueled engines are carbon monoxide and water, but lower percentages of carbon monoxide, sulfur dioxide, and nitrogen dioxides as well as low molecular weight hydrocarbons and their derivatives are also formed. Submicron-size particles are present in the exhaust emissions of internal combustion engines. The particles present in diesel engine exhaust are composed mainly of elemental carbon, absorbed organic material, and traces of metallic compounds. The particles emitted from gasoline engines are composed primarily of metallic compounds, elemental carbon and adsorbed organic material. However, the composition and quantity of the emissions from an engine depend mainly on the type and condition of the engine, fuel composition and additives, operating conditions, and emission control devices.

Short-term (acute) effects of workers exposed to high concentrations of exhaust gasses/fumes may include irritation of the eyes, nose, and throat; lightheadedness; heartburn; headache; weakness, numbness and tingling in the extremities; chest tightness; wheezing; and vomiting. Although there have been relatively few studies on the long-term health effects of exhaust gasses/fumes, the available studies indicate that they can be harmful to your health. According to the National Institute for Occupational Safety and Health (NIOSH), human and animal studies show that diesel/gasoline exhaust should be treated as a human carcinogen. Exposure to diesel/gasoline exhaust in combination with other cancer causing substances may increase your risk of developing lung or other forms of cancer. Some studies have suggested that workers exposed to diesel/gasoline exhaust are more likely to have chronic respiratory symptoms such as persistent cough and mucous, bronchitis, and reduced lung capacity than unexposed workers.

The follow controls may be used to minimize potential exposures to exhaust gases/fumes:

- Use flexible tailpipe or stack exhaust hoses to vent equipment exhaust gases/fumes to the outside.

- Use of general ventilation (roof vents, open doors and windows, roof fans, rollup doors, floor fans, etc.) to move air through the work area to facilitate dilution of airborne exhaust gases/fumes. If exhaust gas/fume concentrations cannot be diluted with existing general ventilation methods, use local exhaust ventilation devices (portable axial blowers, coppus blowers) to vent exhaust gases/fumes to the outside.

- If feasible, use grade 1K diesel fuels which burns more clearly than Diesel 1 fuels.

- All equipment must have regular maintenance and frequent tune ups including checks of the exhaust system to determine if leaks exist. All equipment will be inspected using the Equipment Inspection Checklist provided in Attachment V.

- Prolonged idling of machinery should be avoided.

- Minimize the number of personnel in the area where internal combustion engines are operating. Observe workers for signs and symptoms of exposure.

- Monitor the work area for airborne concentrations of carbon monoxide which will be used to control exposures to carbon monoxide and other exhaust gases – follow established action levels.

- Use wetting methods to suppress airborne dusts generated during concrete coring or soil boring within the building.

5.5 HAND AND POWER TOOL SAFE WORK PRACTICES

The following safe work practices will be employed during hand and power tool usage:

- All hand and power tools will be maintained in a safe condition.

- Electrical power tools shall be grounded or double insulated with proper assured equipment grounding inspections or Ground Fault Interrupter (GFI) circuit protection provided.

- Pneumatic power tools shall be secured to the hose or whip by some positive means.

- Only properly trained Contractor employees shall operate power-actuated tools.

- All grinding machines shall conform to OSHA and ANSI requirements.

Hand and power tool use procedures are detailed in Section 3.16 of the LM handbook and will be followed.

5.6 HOUSEKEEPING / CLEANUP

Housekeeping procedures described in Section 5 of the LM Handbook (Attachment I) will be addressed and the following housekeeping practices will be employed during this field effort:

- Ensure discharge permits and/or Stormwater Pollution Prevention Plans (if applicable) are available at the project job site.

- Tetra Tech and/or subcontractor personnel will clean up its respective work area(s) and maintain work areas free from all slip, trip, and fall hazards at all times.

- Debris shall be kept cleared from work areas, passageways, stairs, and in and around buildings or other structures. The work area must be left free from accumulation of waste and rubbish at the end of each work shift.

- Combustible scrap and debris shall be removed at regular intervals during the course of work. Safe means shall be provided to facilitate such removal.

- At the end of each working day and/or the conclusion of work being performed, the work area will be restored to the same degree of neatness as when work commenced.

- Tetra Tech and/or subcontractor will furnish necessary equipment and/or receptacles to remove waste and rubbish from the job site unless otherwise specified by Lockheed Martin.

5.7 WATER HAZARDS

- Planned activities involve locations that are near bodies or on bodies of water. Sampling activities will be conducted from a flat bottom motor boat. Other tasks, such as depth measurement, will be conducted from a canoe. To avoid potential hazards associated with working near water (drowning), the field team shall employ lifelines (tie-off procedure), safety harnesses, when within 4 feet of the water's edge. When working out of a canoe or other boat, U.S. Coast Guard (USCG) approved personal flotation devices (PFD) will be used. Due to the obvious hazards associated with working on or near water's edge during inclement weather, all field activities may be temporarily suspended or terminated at the discretion and direction of the FOL or SSO.

5.7.1 <u>U.S.C.G. Flotation Device Types</u>

- Use the following information to determine the proper type of U.S.C.G. PFD.

- Off Shore Life Jacket (type I, 22lbs buoyancy)

- Type I life jacket is the best choice for rough or open waters. This type will float you the best and is favorable if rescue may be long in coming. This type will turn an unconscious person upright in the water. Though is bulky it does have a highly visible color for easier detection.

- Near Shore Buoyant Vest (Type II, 15.5lbs buoyancy)

- Type II is a good choice for calmer waters. It will turn most unconscious persons face-up in the water. Though it is less bulky than Type I, it is not intended for long hours in calm or rough water.

- Flotation Aid (Type III, 15.5lbs buoyancy)

- Type III is probably the most comfortable device offering more freedom of movement, such as water skiing or fishing, but is not intended for rough water. Also, an unconscious person may end up face-down in the water.

- Throwable Devices (Type IV)

- Throwable devices are intended for calm waters with heavy boat traffic where help is always close. It is not intended for unconscious persons or non-swimmers or long hours in the water. They are good backups for the other devices.

5.7.2 U.S.C.G Boat Regulations

- A flat bottom (Jon) boat can be used to collect the surface and sediment samples. These boats generally have a shallow draft and can get up on plane easily but unless the water surface is perfectly calm they tend to give a rough ride because of the flat bottom pounding on each wave. They also tend to be less stable and require careful balancing of cargo and crew. The U.S.C.G. requires these types of boats to have the following equipment on board:
  - One personal flotation device per person

- A sound producing device such as an air horn or whistle which can be heard one half mile.

5.7.3 Strain/Muscle Pulls from Heavy Lifting

- During execution of planned activities there is some potential for strains, sprains, and/or muscle pulls due to the physical demands and nature of this site work. To avoid injury during lifting tasks personnel are to lift with the force of the load carried by their legs and not their backs. When lifting or handling heavy material or equipment use an appropriate number of personnel. Keep the work area (e.g., inside of boat) free from clutter to avoid unnecessary twisting or sudden movements while handling loads.

5.7.4 Proper Canoe Lifting and Carrying Techniques

- Some tasks such as depth level determination may be taken from a canoe. Therefore, it is important to know how to transport a canoe to and from the water. This includes carrying the canoe by hand and transporting it on your vehicle.

  - Lift the canoe with another person (or persons) whenever possible. Canoes are often carried by single individuals, but lifting is almost always easier with more than one person. Empty the canoe of all water and equipment before you lift it. Extra weight is harder to lift and it can damage the hull. Lift using the muscles in your legs as much as possible, keeping your back straight and your knees bent. Lifting and carrying techniques designed for two or more people require communication and coordination.

  - Two-person lifts and carries are commonly used to carry boats short distances or to lift them up onto roof-top car racks.

- The Underhand Lift And Carry

  - To carry the canoe a short distance, use a basic underhand lift. Stand on the opposite side and opposite end of the canoe from your partner. Grab the closest carrying handle or gunwale edge with your boat-side hand (while your partner does the same) and lift straight upwards. Don't use your boat's deck plates for lifting unless they have a built-in carrying handle.

  - Face in the direction of travel so you can see where you're going and avoid obstacles in your path. Communicate with your partner, so they know if you need to stop and set the canoe down. The person in front should act as the eyes for the rear person, warning them of any obstacles in the path.

- The Overhead Lift And Carry

  - When transporting the canoe over longer distances, you can reduce arm and shoulder strain by carrying the boat overhead on your shoulders. The following lift procedure can also be used when lifting a canoe to place it on a roof-top car rack:

  - Begin by standing at the opposite end (but the same side) of the canoe as your partner, both of you facing the boat.

- Grab both gunwales (one in each hand) just in front of the seat closest to you. Have your partner do the same. Make sure your hand closest to the bow is on the far gunwale, while your hand closest to the stern is on the near gunwale.

- Working in conjunction with your partner, lift upwards simultaneously (being careful to lift with your legs and keep your backs as straight as possible) until the boat is resting right-side-up against your thighs.

- Pause briefly to make sure your partner is ready to proceed, then lift and roll the canoe up over your heads in a single, smooth motion, using one thigh to thrust the canoe hull upwards if necessary. NOTE: You may find that cupping the hull of the canoe with your stern-side arm as you rotate it helps you control the boat.

- Once the canoe is directly overhead, carefully lower the boat until the gunwales are resting comfortably on your (and your partner's) shoulders.

- The two-person overhead carry is most effective when the ground is relatively flat and the distance to be covered is not too long. On rough terrain and long trails, it can be somewhat difficult to stay coordinated.

- The two-person overhead technique can also make seeing the trail ahead somewhat difficult, especially if the person in front is the same size or shorter than the rear person. If this is the case, the front person may wish to scoot forward until they can rest the deck of the canoe on one shoulder or the other, so that their head is not under the hull.

5.8 WETLAND SAFE WORK PROCEDURES

This investigation entails a wetland survey to conduct work safely field crews will know the wetland where the survey is being conducted:

- Depth of water in area where survey is being conducted

- Species (both plant and animal) that could be encountered relevant to the body of water where the survey is being conducted.

- Protective equipment required for a survey including:
  - Ranging pole to check water depths and bottom surface configuration in murky waters
  - Life jacket as specified in Section 5.7

- Chest waders
- Binoculars
- Workers will work in groups of no less than two people for safety
- Notify the guard station or site contact when working in or near water. In the event of an emergency site personnel are required to have a contact and or control point.

This wetland survey may possibly be performed from a water craft. In order to avoid potential hazards associated with working on water (drowning), the field team will follow the safety procedures outlined in Section 5.7 of this HASP

6.0 HAZARD ASSESSMENT AND CONTROLS

This section provides information regarding the chemical, physical, and natural hazards associated with the sites to be investigated and the activities that are to be conducted as part of the scope of work. Section 6 provides information on potential chemical contaminants, symptoms of exposure, physical properties, and air monitoring and sampling data.

6.1 CHEMICAL HAZARDS

Previous investigations indicate that the contaminants of concern are Volatile Organic Compunds (VOCs), Semi Volatile Organic Compounds (SVOCs) and Metals but are present in relatively low concentrations. Exposure to site personnel via inhalation is considered low.

6.1.1 Volatile Organic Compounds (VOCs)

The majority of VOCs are often related to chlorinated solvents and associated degradation products, paint thinners, dry cleaning solvents, constituents of petroleum fuels (e.g. gasoline and natural gas), and crude oil tanking. Symptoms of exposure to VOCs can include abdominal pain, irritation of the skin, eyes, nose, and throat, dizziness, tremors, vomiting, GI bleeding, enlarged liver, pallor of the extremities, and frostbite like-symptoms.

Short-term exposure to VOCs, such as TCE and VC, can cause irritation of the nose and throat and central nervous system (CNS) depression, with symptoms such as drowsiness, dizziness, giddiness, headache, loss of coordination. High concentrations have caused numbness and facial pain, reduced eyesight, unconsciousness, irregular heartbeat and death. Very high concentrations have produced death due to CNS effects, and, in rare cases, irregular heart beat. Permanent nervous system damage and/or liver injury have resulted from severe overexposure.

6.1.2 Semi-Volatile Organic Compounds (SVOCs)

SVOCs are substances composed primarily of carbon and hydrogen atoms that have boiling points greater than 200 degrees C. Sites where halogenated SVOCs may be found include burn pits, chemical manufacturing plants and disposal areas, contaminated marine sediments, disposal wells and leach fields, electroplating/metal finishing shops, firefighting training areas, hangars/aircraft maintenance areas, landfills and burial pits, leaking collection and system sanitary lines, leaking storage tanks, radiologic/mixed waste disposal areas, oxidation ponds/lagoons, pesticide/herbicide mixing areas, solvent degreasing areas, surface impoundments, and vehicle maintenance areas and wood preserving sites.

Potential health effects related to SVOC expose include organ system toxicity (non-reproductive), cancer, birth or developmental effects, brain and nervous system damage, and reproduction and fertility damage.

6.1.3 Metals

Specific toxicities and symptoms from metals vary between individual metal compounds and associated isomers. However, general toxicities exist that can be applied to the general category of metals. For example metals are considered kidney toxins. Other generalized effects have demonstrated impacts on the peripheral and central nervous systems, blood forming mechanisms, gastrointestinal disturbances, cardio and vascular toxicities and some are cancer causing agents. In a particulate form, metals will cause respiratory, dermal, and eye irritation. Acute symptoms associated with ingestion include stomach pain, cramps, headaches, possibly diarrhea and vomiting. These conditions are typically symptomatic of chronic exposure or acute exposure to high concentrations which are not anticipated at this site.

Overexposure to these substances as indicated above typically occurs through ingestion or inhalation of particulates and/or fumes found within some industrial settings. The majority of the available toxicological information has been derived from such settings. In this investigation, potential exposure to these compounds are greatly reduced if not eliminated based on the media in which the contaminants exist. The mobility of these substances are greatly reduced as they are commingled and bound with soil particulates, sediments, as well as underwater. This aspect greatly reduces the mobility of the metals and thereby has a direct impact on the exposure through inhalation. Ingestion possibilities still exist. Exposure via this route is generally facilitated through contaminated hand or glove to mouth contact or to some media which eventually contacts the mouth. This exposure route can also be controlled and thereby minimize exposure potential. Actions include the use of gloves, good work hygiene practices, and through the employment of a suitable decontamination procedure.

These compounds will not have a distinct look, odor, or other physical characteristic.

6.1.4 Inhalation

From a worst-case scenario, COC concentrations immediately above a captured air phase above contaminated groundwater (such as in the head space of a monitoring well) would be of greatest concern. However, in regarding the results of this data evaluation, it is important to recognize the following:

- the planned work area is outdoors, with ample natural ventilation that will reduce any airborne COCs through dilution and dispersion,

- the groundwater value used in this evaluation was the ***highest*** concentration detected during the most recent groundwater monitoring event,

As a result of these factors, it is very unlikely that workers participating in this activity will encounter any airborne concentrations of COCs that would represent an occupational exposure concern. To monitor this route, real-time direct reading monitoring instruments will be used (as described in Section 7.0). This will be performed during intrusive tasks, as these tasks are the most likely to involve encountering/releasing any COCs into the air phase.

In addition, workers will monitor for visible dust, and in the event that visible dust is seen, area wetting techniques will be employed for dust suppression during active/intrusive activities.

6.1.5 Ingestion and Skin Contact

Potential exposure concerns to the COCs may also occur through ingestion, or coming into direct skin contact with contaminated groundwater. The likelihood of worker exposure concerns through these two routes are also considered very unlikely, provided that workers follow good personal hygiene and standard good sample collection/sample handling practices, and wear appropriate PPE as specified in this HASP. Examples onsite practices that are to be observed that will protect workers from exposure via ingestion or skin contact include the following:

- No hand-to-mouth activities on site (eating, drinking, smoking, etc.)

- Washing hands upon leaving the work area and prior to performing any hand to mouth activities

- Wearing surgeon's-style gloves whenever handling potentially-contaminated media, including groundwater and any potential free product, sampling equipment, and sample containers.

6.2 PHYSICAL HAZARDS

The following is a list of physical hazards that may be encountered at the site or may be present during the performance of site activities.

- Slips, trips, and falls
- Cuts (or other injuries associated with hand tool use)
- Lifting (strain/muscle pulls)
- Ambient temperature extremes (heat stress)
- Pinches and compressions

- Vehicular and foot traffic
- Noise in excess of 85 dBA
- Flying projectiles
- Contact with underground or overhead utilities/electrical safety
- Heavy equipment hazards (rotating equipment, hydraulic lines, etc.)
- Compressed gas cylinders

Specific hazards are discussed further below, and are presented relative to each task in the task-specific Safe Work Permits.

6.2.1 Slips, Trips, and Falls

During various site activities there is a potential for slip, trip, and fall hazards associated with wet, steep, or unstable work surfaces. To minimize hazards of this nature, personnel required to work in and along areas prone to these types of hazards will be required to exercise caution, and use appropriate precautions (restrict access, guardrails, life lines and/or safety harnesses) and other means suitable for the task at hand. Site activities will be performed using the buddy system.

6.2.2 Strain/Muscle Pulls from Heavy Lifting

During execution of planned activities there is some potential for strains, sprains, and/or muscle pulls due to the physical demands and nature of this site work. To avoid injury during lifting tasks personnel are to lift with the force of the load carried by their legs and not their backs. When lifting or handling heavy material or equipment use an appropriate number of personnel. Keep the work area free from ground clutter to avoid unnecessary twisting or sudden movements while handling loads.

6.2.3 Heat/Cold Stress

Because of the length of planned project activities, the likely seasonal weather conditions that will exist during the planned schedule, and the physical exertion that can be anticipated with some of the planned tasks, it will be necessary for the field team to be aware of the signs and symptoms and the measures appropriate to prevent cold stress. This is addressed in detail in Section 4.0 of the Tetra Tech Health and Safety Guidance Manual, which the SSO is responsible for reviewing and implementing as appropriate on this project.

6.2.4 Pinch/Compression Points

Handling of tools, machinery, and other equipment on site may expose personnel to pinch/compression point hazards during normal work activities. Where applicable, equipment will have intact and functional guarding to prevent personnel contact with hazards. Personnel will exercise caution when working around pinch/compression points, using additional tools or devices (e.g., pinch bars) to assist in completing activities.

6.2.5 Natural Hazards

Natural hazards such as poisonous plants, bites from poisonous or disease carrying animals or insects (e.g., snakes, ticks, mosquitoes) are often prevalent at sites that are being investigated as part of hazardous waste site operations. To minimize the potential for site personnel to encounter these hazards, nesting areas in and about work areas will be avoided to the greatest extent possible. Work areas will be inspected to look for any evidence that dangerous animals may be present. Based on the planned location for the work covered by this HASP, encountering wild animals is not a likely probability.

During warm months (spring through early fall), tick-borne Lyme Disease may pose a potential health hazard. The longer a disease carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long sleeved shirts and long pants (tucked into boots and taped) will prevent initial tick attachment, while performing frequent body checks will help prevent long term attachment. Site first aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. For information regarding tick removal procedures and symptoms of exposure, consult Section 4.0 of the Health and Safety Guidance Manual.

Contact with poisonous plants and bites or stings from poisonous insects are other potential natural hazards. Long sleeved shirts and long pants (tucked into boots), and avoiding potential nesting areas, will minimize the potential for exposure. Additionally, insect repellents may be used by site personnel. Personnel who are allergic to stinging insects (such as bees, wasps and hornets) must be particularly careful since severe illness and death may result from allergic reactions. As with any medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet (see Attachment III of this HASP), and the FOL or SSO notified.

6.2.6 Vehicular and Equipment Traffic

If working in or near streets or roadways, hazards associated with vehicular and equipment traffic are likely to exist during various site activities and whenever site personnel performed work on or near roadways. Site personnel will be instructed to maintain awareness of traffic and moving equipment when performing site activities. When working near roadways, site personnel will wear high visibility vests.

6.2.7 Inclement Weather

Project tasks under this Scope of Work will be performed outdoors. As a result, inclement weather may be encountered. In the event that adverse weather (electrical storms, tornadoes, etc.) conditions arise, the FOL and/or the SSO will be responsible for temporarily suspending or terminating activities until hazardous conditions no longer exist.

6.2.8 Contact with Underground or Overhead Utilities/Electrical Safety

Contact with energized sources can result in severe injury and even death. There are two areas of concern with this potential hazard: contact with energized processing equipment and contact with energized utilities including underground utilities (i.e., electrical transmission lines, gas lines, water lines, etc.) and overhead utilities (i.e., power lines, etc.).

- Use and application of the Tetra Tech Standard Operating Procedure (SOP) for Utility Locating and Excavation Clearance found in the Tetra Tech Health and Safety Guidance Manual will be employed. This procedure provides step-by-step instructions for clearance of underground utilities, as well as avoidance techniques, and required documentation.

- Establishment of a suitable clearance distance (20-feet) from overhead utilities will be the primary method to control hazards conveyed through contact with these power sources.

- Identify underground utilities and buried structures before commencing any DPT operations. Follow the Tetra Tech Utility Locating and Excavation Clearance Standard Operating Procedure.

In addition, the electrical safety procedures stipulated in Section 3.9 of the LM Handbook and the overhead power line safety procedures in Section 3.14 of the LM Handbook will also be followed.

No hazardous energy work is being conducted as part of this field effort. However, should activities associated with lockout/tagout be required, the requirements stipulated in Section 3.5 of the LM Handbook (Attachment I) will also be adhered to.

6.2.9 Heavy Equipment/Excavation Hazards

Ensure that workers are thoroughly trained and competent to perform their assigned task with the equipment used in investigation. Ensure that back-up alarms are functional on equipment. Heavy equipment will be subjected to an equipment inspection, upon arrival on-site and prior to leaving. This inspection will be recorded on the Equipment Inspection Checklist provided in Attachment V of this HASP. The equipment operators and on-site Supervisors responsible for the equipment are to ensure that the

Equipment Inspection Checklist has been reviewed and completed, and that all moving parts are guarded if such parts are exposed. Check/test all emergency stop controls. Use escort vehicles with flashing lights to ward and control local traffic when moving large equipment to support area. Only trained and authorized workers may operate heavy equipment, industrial vehicles and/or cranes. All manufacturer's specifications and limitations will be adhered to. Utility clearances should be in place prior to the beginning of excavation (in accordance with the Tetra Tech Utility Locating SOP in the Health and Safety Guidance Manual Section 7.0).

An Excavation Competent Person must be specifically identified to handle this responsibility prior to work beginning in the specified space provided (Section 1.3) in this HASP. Detailed Tetra Tech Excavation Safety Procedures, the Excavation Competent Person Checklist, the Tetra Tech Confined Space Entry Program and Procedures, and the Heavy Equipment Inspection Checklist are included in Attachments VI, VII, VIII, and IX, and must be completed prior to beginning work. The OSHA Health and Safety Construction-Related regulations P-650 to 699 – Subpart P – Excavations are included in Attachment X and must be followed during all excavation work.

In addition, the heavy equipment, industrial vehicle, and crane operation safety procedures and excavation procedures stipulated in Section 3.13 and 3.8 of the LM Handbook and will be followed.

6.2.10 Compressed Gas Cylinders

Work utilizing compressed gas cylinders is not anticipated as part of this field effort. However, if work utilizing compressed gas cylinders is required, this HASP will be updated/amended as necessary and the procedures in Section 3.17 of the LM Handbook (Attachment I) will be followed.

6.2.11 Noise

Hearing protection must be worn in all areas posted to indicate high noise level or where employees are exposed to noise levels in excess of the OSHA action level (85 dBA over an 8-hour time-weighted average or a dose of fifty percent).

7.0 AIR MONITORING

As a precaution direct reading instrument will be used for onsite activities to screen source areas (i.e., monitoring wells) and worker breathing zones for the presence of volatile site contaminants. At least twice each day (e.g., at the beginning and end of each work day), the SSO will establish background levels by operating the instrument at locations that are at the perimeter of the site property, and that are upwind of planned or ongoing site activities, unlikely to be affected by any intrusive site activities performed as part of this investigation. These daily-established background levels will be the baseline for comparing all other direct reading instrument readings noted during the performance of intrusive activities. Any readings noted above 10 PPM for five minutes four times a day will be regarded as "elevated" and interpreted as possible indications of airborne releases from site activities, warranting specific action specified in this section.

If instrument readings indicate airborne levels (lasting five minutes or longer) in BZ areas that are higher than the daily established background levels, this will require site activities to be suspended and workers to retreat upwind to the pre-determined emergency congregation point. Work may not resume until and unless readings return to background levels. The use of personal protective equipment and the observance of the other control requirements presented in this HASP have been selected to minimize potential for personnel exposures to hazardous concentrations of the site contaminants of concern presented in Section 6.0.

7.1 INSTRUMENTS AND USE

Instruments will be used primarily as described above to monitor source points and worker breathing zone areas, observing instrument action levels. Action levels are discussed in Section 7.1.1 as they may apply to a specific task or location.

7.1.1 Photoionization Detector

Based on the properties of the identified contaminants of concern, a Photoionization Detector (PID) equipped with a lamp strength of at least 10.6 eV lamp will be appropriate to screen source areas (sampling locations, monitoring wells, bore holes, etc.) during intrusive site activities at the two planned site work areas. This instrument will also be used to periodically (e.g., at least 3-4 times each day) to monitor the breathing zones of employees during site activities for elevated readings above the daily-established background level. The PID suitably equipped with the appropriate lamp strength has been selected because it is capable of detecting all of the identified contaminants of concern at the site.

As previously mentioned, daily background level readings will be taken away from any areas of potential contamination. These readings must be documented in the field operations logbook or other site documentation (e.g., sample log sheet).

Instrument Action Levels: The use of a PID will be acceptable, provided that the following action levels are observed:

- PID Action Level: any reading >10 ppm for more than 5 minutes above background in the breathing zone for 4 exposures of 5 minutes in one workday.
- Generation of dusts should be minimized. If airborne dusts are observed, area wetting methods will be used. If area wetting methods are not feasible, termination of activities may be used to minimize exposure to observed airborne dusts.

7.1.2 Hazard Monitoring Frequency

The frequency that hazard monitoring will be performed as well as the action levels will be determined by the PHSO who will also initiate the use of elevated levels of protection. The SSO may decide to increases these frequencies based on instrument responses and site observations. The frequency at which monitoring is performed will not be reduced without the prior consent of the PHSO or HSM.

7.2 INSTRUMENT MAINTENANCE AND CALIBRATION

Hazard monitoring instruments will be maintained and pre-field calibrated by the equipment provider (i.e., rental agency used). Operational checks and field calibration will be performed on site instruments each day prior to their use. Field calibration will be performed on instruments according to manufacturer’s recommendations. These operational checks and calibration efforts will be performed in a manner that complies with the employees health and safety training, the manufacturer's recommendations, and with the applicable manufacturer standard operating procedure (which the SSO must assure are included with the instrument upon its receipt onsite). Field calibration efforts must be documented. Figure 7-1 is provided for documenting these calibration efforts. This information may instead be recorded in a field operations logbook, provided that the information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Individual calibrating the instrument
- Instrument name, model, and serial number
- Any relevant instrument settings and resultant readings (before and after) calibration

- Identification of the calibration standard (lot no., source concentration, supplier)
- Any relevant comments or remarks

7.3 DOCUMENTING INSTRUMENT READINGS

The SHSO is responsible for ensuring that air monitoring instruments are used in accordance with the specifications of this HASP and with manufacturer's specifications/recommendations. In addition, the SHSO is also responsible for ensuring that all instrument use is documented. This requirement can be satisfied either by recording instrument readings on pre-printed sampling log sheets or in a field log book. **This includes the requirement for documenting instrument readings that indicate no elevated readings above noted daily background levels (i.e., no-exposure readings)**. At a minimum, the SHSO must document the following information for each use of an air monitoring device:

- Date, time, and duration of the reading
- Site location where the reading was obtained
- Instrument used (e.g., PID, etc.)
- Personnel present at the area where the reading was noted
- Other conditions that are considered relevant to the SHSO (such as weather conditions, possible instrument interferences, etc.)

FIGURE 7-1

DOCUMENTATION OF FIELD CALIBRATION

SITE NAME: ____ PROJECT NO.:______________

Date of Calibration	Instrument Name and Model	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot Number)	Remarks/ Comments
				Pre-Calibration	Post-Calibration	Pre-Calibration	Post-Calibration		

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

This section is included to specify health and safety training and medical surveillance requirements for Tetra Tech personnel participating in on site activities. Tetra Tech personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at the LMC MRC. Tetra Tech personnel who have had introductory training more than 12 months prior to site work must have completed 8 hours of refresher training within the past 12 months before being cleared for site work. In addition, 8-hour supervisory training in accordance with 29 CFR 1910.120(e)(4) will be required for site supervisory personnel. Tetra Tech and subcontractor personnel working on site who are potentially exposed to hazardous substances shall receive initial and annual refresher training in accordance with *29 CFR 1910.120(e) – Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard. Lockheed Martin shall be provided with electronic copies of the training certificates.

Documentation of Tetra Tech introductory, supervisory, and refresher training as well as site-specific training will be maintained at the site. Copies of certificates or other official documentation will be used to fulfill this requirement.

The requirements described in Section 3.20.3 of the LM Handbook (Attachment I) addressing training will be followed.

8.2 SITE-SPECIFIC TRAINING

Tetra Tech SSO will provide site-specific training to Tetra Tech employees who will perform work on this project. Figure 8-1 will be used to document the provision and content of the project-specific and associated training. Site personnel will be required to sign this form prior to commencement of site activities. This training documentation will be employed to identify personnel who through record review and attendance of the site-specific training are cleared for participation in site activities. This document shall be maintained at the site to identify and maintain an active list of trained and cleared site personnel.

The Tetra Tech SSO will also conduct a pre-activities training session prior to initiating site work. This will consist of a brief meeting at the beginning of each day to discuss operations planned for that day, and a review of the appropriate Safe Work Permits with the planned task participants. A short meeting may also be held at the end of the day to discuss the operations completed and any problems encountered.

8.3 MEDICAL SURVEILLANCE

Tetra Tech personnel participating in project field activities will have had a physical examination meeting the requirements of Tetra Tech's medical surveillance program. Documentation for medical clearances will be maintained in the Tetra Tech Pittsburgh office and made available, as necessary, and will be documented using Figure 8-1 for every employee participating in onsite work activities at this site. Tetra Tech shall provide evidence of employee enrollment in a medical surveillance program. Lockheed Martin does not provide medical surveillance examinations to contractor employees.

The medical surveillance requirements described in Section 3.20.4 of the LM Handbook (Attachment I) will be followed.

Each field team member, including visitors, entering the exclusion zone(s) shall be required to complete and submit a copy of the Medical Data Sheet (see Attachment III of this HASP). This shall be provided to the SSO, prior to participating in site activities. The purpose of this document is to provide site personnel and emergency responders with additional information that may be necessary in order to administer medical attention.

FIGURE 8-1

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing field activities at LCM MSA and that I have received site-specific training which included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on site
- Use of personal protective equipment
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Emergency response procedures (evacuation and assembly points)
- Incipient response procedures
- Review of the contents of relevant Material Safety Data Sheets
- Review of the use of Safe Work Permits
- Stop Work Procedures

I have been given the opportunity to ask questions and all of my questions have been answered to my satisfaction. The dates of my training and medical surveillance requirements indicated below are accurate.

Name (Printed and Signature)	Site-Specific Training Date	40-Hour Training (Date)	8-Hour Refresher Training (Date)	8-Hour Supervisory Training (Date)	Medical Exam

9.0 SITE CONTROL

This section outlines the means by which Tetra Tech will delineate work zones and use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas of the site. It is anticipated that a three-zone approach will be used during work at this site. This approach will be comprised of an exclusion zone, a contamination reduction zone, and a support zone. It is also anticipated that this approach will control access to site work areas, restricting access by the general public, minimizing the potential for the spread of contaminants, and protecting individuals who are not cleared to enter work areas.

9.1 EXCLUSION ZONE

The exclusion zone will be considered the areas of the site of known or suspected contamination. It is anticipated that the areas around active/intrusive activates will have the potential for contaminants brought to the surface. These areas will be marked and personnel will maintain safe distances. Once active/intrusive activities have been completed and any surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. The exclusion zones for this project are those areas of the site where active work (DPT work areas, drilling, installation, and sample collection, etc.) is being performed plus a designated area of at least 25 feet surrounding the work area. Exclusion zones will be delineated as deemed appropriate by the FOL, through means such as erecting visibility fencing, barrier tape, cones, and/or postings to inform and direct personnel.

9.1.1 Exclusion Zone Clearance

An Exclusion Zone (EZ) will be established at each well installation/sampling location. The purpose of establishing and maintaining these localized exclusion zones is to define areas where more rigorous safety and health protection measures will be required and to designate areas restricted to non-essential and unauthorized personnel. The size and dimensions of these EZs will vary based on the nature of the planned activities, and may be subject to change at the SSO's discretion based on factors such as visual observations, nearby concurrent operations, and other factors. However, the following dimensions represent basic considerations for establishing EZs:

- DPT and associated concurrent sampling activities. The EZ for this activity will be set at the height of the mast, plus five feet surrounding the point of operation, with a minimum of 25-feet. This distance will also apply when surface and subsurface soil sampling from behind these type rigs.

- Monitoring well development, purging, piezometer construction and use, and collecting groundwater samples and water level readings. The EZ for these activities will be set to encompass an area of at least 10-feet surrounding the well head.

- Decontamination operations. The EZ for this activity will be set at 25 feet surrounding the gross contamination wash and rinse as well as 25-feet surrounding the heavy equipment decontamination area. Sample equipment decontamination boundaries will be set at 10-feet surrounding hand wash and rinse areas.

- Investigative Derived Waste (IDW) area will be constructed and barricaded. Only authorized personnel will be allowed access.

EZs will be marked using barrier tape, traffic cones and/or drive pole, or other readily-visible devices. Signs may also be posted at the SSO's discretion to inform and direct site personnel and site visitors. EZs shall remain marked until the SSO has evaluated the restoration effort and has authorized changing the zone status.

9.2 CONTAMINATION REDUCTION ZONE

Contamination Reduction Zones (CRZs) will be established to minimize the potential for the spread of contaminated media from being spread into previously-unaffected areas. The primary function of a CRZ is to provide an adequate area for decontamination activities. For personal and small item (e.g., sampling equipment) decontamination activities, a CRZ will be established at the perimeter of each EZ. For decontamination activities that will require specialized equipment, larger areas, and more significant containment, a heavy equipment decontamination pad CRZ will be established in one or more areas to support the two work areas...

In order to move from on EZ to another, the following activities will be performed in the localized CRZs:

- As samplers move from location to location, dedicated sampling devices and PPE will be washed to remove visible gross contamination, and then these items will be bagged and removed. Personnel will use hygienic wipes (such as "baby wipes") as necessary for interim personnel decontamination until they can access a facility equipped with hands washing and rinsing capabilities. At the first available opportunity personnel will wash their face and hands. This is critical prior to breaks and lunch when contamination may be transferred to the mouth through hand to mouth contact.

- Disposable PPE, sampling equipment, and other items are to be sequentially removed/deposited and double-bagged. Such waste is to be disposed of in accordance with the direction of the client.

Reusable items that are grossly contaminated (such as muddy over-boots, hardhats, etc.) will be required to be removed, bagged, and taken to the established decontamination pad for washing and rinsing prior to being used at another EZ. .

- Potentially contaminated tooling will be wrapped, as necessary, for transport to the decontamination area for cleaning.

9.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and where food and drink containers will be maintained. The support zones will be established at areas of the site where away from potential exposure to site contaminants during normal working conditions or foreseeable emergencies.

9.4 SAFE WORK PERMITS

Exclusion Zone work conducted in support of this project will be performed using Safe Work Permits (SWPs) to guide and direct field crews on a task by task basis. An example of the SWP to be used is provided in Figure 9-1. Partially completed SWPs for the work to be performed are attached (Attachment IV) to this HASP. These permits were completed to the extent possible as part of the development of this HASP. It is the SSO's responsibility to finalize and complete all blank portions of the SWPs based on current, existing conditions the day the task is to be performed, and then review that completed permit with all task participants as part of a pre-task tail gate briefing session. This will ensure that site-specific considerations and changing conditions are appropriately incorporated into the SWP, provide the SSO with a structured format for conducting the tail gate sessions, as well will also give personnel an opportunity to ask questions and make suggestions. All SWPs require the signature of the FOL or SSO.

9.5 SITE SECURITY

As this activity will take place at an active facility, the first line of security will be provided by the facility entrance/gate restricting the general public. The second line of security will take place at the work site referring interested parties to the FOL and LMC Contact.

Security at the work areas will be accomplished using field personnel. This is a multiple person operation, involving multiple operational zones. Tetra Tech personnel will retain complete control over active operational zones.

The site contact will serve as the focal point for facility personnel and interested parties and will serve as the primary enforcement contact.

9.6 SITE VISITORS

Site visitors for the purpose of this document are identified as representing the following groups of individuals:

- Personnel invited to observe or participate in operations by Tetra Tech
- Regulatory personnel (i.e. EPA, MDEP, OSHA)
- Property Owners
- Authorized Personnel
- Other authorized visitors

Non Tetra Tech personnel working on this project are required to gain initial access to the facility by coordinating with the Tetra Tech FOL or designee and following established facility access procedures.

Once access to the base is obtained, personnel who require site access into areas of ongoing operations will be required to obtain permission from the PM. In addition, site visitors wishing to observe operations in progress will be escorted by a Tetra Tech representative and shall be required to meet the minimum requirements discussed below:

- Site visitors will be directed to the FOL/SSO, who will sign them into the field logbook. Information to be recorded in the logbook will include the individual's name (proper identification required), the entity which they represent, and the purpose of the visit.

- Site visitors must be escorted and restricted from approaching any work areas where they could be exposed to hazards from Tetra Tech operations. If a visitor has authorization from the client and from the Tetra Tech Project Manager to approach our work areas, the FOL must assure that the visitor first provides documentation indicating that he/she/they have successfully completed the necessary OSHA introductory training, receive site-specific training from the SSO, and that they have been physically cleared to work on hazardous waste sites. Site visitors wishing to enter the exclusion zone will be required to produce the necessary information supporting clearance to the site. This shall include information attesting to applicable training and medical surveillance as stipulated in Section 8.0 of this document. In addition, to enter the site operational zones during planned activities, visitors will be required to first go through site-specific training covering the topics stipulated in Section 8.2 of this HASP. All jobsite visitors must have a safety orientation prior to commencing work or touring the site. A visitor log will be kept to document the orientation.

- Once the site visitors have completed the above items, they will be permitted to enter the operational zone. Visitors are required to observe the protective equipment and site restrictions in effect at the site at the time of their visit. Visitors entering the exclusion zones during ongoing operations will be accompanied by a Tetra Tech representative. Visitors not meeting the requirements, as stipulated in this plan, for site clearance will not be permitted to enter the site operational zones during planned activities. Any incidence of unauthorized site visitation will cause the termination of on site activities until the unauthorized visitor is removed from the premises. Removal of unauthorized visitors will be accomplished with support from local law enforcement personnel.

9.7 SITE MAP

Once the areas of contamination, access routes, topography, and dispersion routes are determined, a site map will be generated and adjusted as site conditions change. These maps will be posted to illustrate up-to-date collection of contaminants and adjustment of zones and access points.

9.8 BUDDY SYSTEM

Personnel engaged in on site activities will practice the "buddy system" to ensure the safety of personnel involved in this operation.

9.9 COMMUNICATION

As personnel will be working in proximity to one another during field activities, a supported means of communication between field crew members will not be necessary.

External communication will be accomplished by using the cell phones/telephones at predetermined and approved locations. External communication will primarily be used for the purpose of resource and emergency resource communications. Prior to the commencement of activities at the LCM MRC, the FOL will determine and arrange for telephone communications.

9.10 SELF-AUDITS

The procedures outlined in Section 7 of the LM Handbook (Attachment I) addressing self-audits will be adhered to.

Tetra Tech and/or subcontractor personnel will perform periodic work area/project field inspections to monitor compliance with project environmental, safety and health requirements. The name of Tetra Tech’s jobsite health and safety (H&S) representative will be provided to Lockheed Martin prior to starting work at the jobsite.

For jobs that are ongoing, an annual H&S audit shall be conducted and for jobs with a duration of less than one year at least one audit shall occur. A competent H&S representative designated by the Tetra Tech shall perform the audit. Unsafe acts and/or non-compliance conditions noted during inspections shall be corrected immediately.

The documentation related to the audits and inspections shall be submitted electronically to the Lockheed Martin Project Lead.

FIGURE 9-1
EXAMPLE SAFE WORK PERMIT

Permit No. ______________ Date: __________________ Time: From ____________ to _____________

I. Work limited to the following (description, area, equipment used): ______________________

II. Primary Hazards: Potential hazards associated with this task: ______________________

III. Field Crew: ______________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector __________Tetra Tech

Equipment Inspection required ☐ Yes ☐ No Initials of Inspector __________Tetra Tech

V. Protective equipment required

Level D ☐ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required

Yes ☐ Specify on the reverse
No ☐

Modifications/Exceptions: ______________________

VI.

Chemicals of Concern	**Hazard Monitoring**	**Action Level(s)**	**Response Measures**

Primary Route(s) of Exposure/Hazard: ______________________

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No	Safety belt/harness	☐ Yes	☐ No
Chemical/splash goggles	☐ Yes	☐ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash Shield	☐ Yes	☐ No	Barricades	☐ Yes	☐ No
Splash suits/coveralls	☐ Yes	☐ No	Gloves (Type –)	☐ Yes	☐ No
Impermeable apron	☐ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No
Steel toe Work shoes or boots	☐ Yes	☐ No	Chemical Resistant Boot Covers	☐ Yes	☐ No
High Visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire Extinguisher	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☐ No	Other	☐ Yes	☐ No

Modifications/Exceptions: ______________________

VIII. Site Preparation	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☐ No

If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: ______________________

Permit Issued by: ______________________ Permit Accepted by: ______________________

10.0 SPILL CONTAINMENT PROGRAM AND WASTE MANAGEMENT PLAN

10.1 SCOPE AND APPLICATION

It is not anticipated that bulk hazardous materials (over 55-gallons) will be generated or handled at any given time as part of this scope of work. It is also not anticipated that such spillage would constitute a danger to human health or the environment.

This Spill Prevention and Containment Program applies to the potential release from one or more containers on the work site involving a single or aggregate accumulation of bulk storage materials (over 55-gallons). As the classification of certain materials such as IDW is unknown, these materials will be treated as hazardous, pending laboratory certification to the contrary.

However, as the job progresses, some potential may exist for accumulating Investigative Derived Wastes (IDW) such as decontamination fluids, soil cuttings, disposable sampling equipment and PPE.

The spill containment and control will be engaged any time there is a release of the above-identified materials from a containment system or vessel. This spill containment program will be engaged in order to minimize associated hazards.

10.2 POTENTIAL SPILL AREAS

Potential spill areas will be periodically monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Currently, limited areas are vulnerable to this hazard including:

- Resource deployment
- Waste transfer
- Central staging

It is anticipated that the IDW generated as a result of this scope of work will be containerized, labeled, and staged to await further analyses. The results of these analyses will determine the method of disposal.

10.3 LEAK AND SPILL DETECTION

To establish an early detection of potential spills or leaks, a periodic walk-around by the personnel staging or disposing of drums area will be conducted during working hours to visually determine that storage vessels are not leaking. If a leak is detected, the contents will be transferred, using a hand pump, into a new vessel. The leak will be collected and contained using absorbents such as Oil-Dry, vermiculite, or sand, which are stored at the vulnerable areas in a conspicuously marked drum. This used material, too, will be containerized for disposal pending analysis. Inspections will be documented in the project logbook.

In case of a spill or release of hazardous chemicals, Tetra Tech shall immediately notify the Lockheed Martin Project Lead, and/or if the severity of the spill warrants, the local fire department by calling 9-1-1. Tetra Tech shall take all necessary steps to control the spread of the release and to provide site control to prevent unauthorized personnel from entering the affected area.

Section 8.2 of the LM Handbook (Attachment I) pertaining to spill reporting will be addresses.

10.4 PERSONNEL TRAINING AND SPILL PREVENTION

Personnel will be instructed in the procedures for incipient spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and the SSO will serve as the Spill Response Coordinators for this operation, should the need arise.

10.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the types of equipment that should be maintained at the staging areas for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, vermiculite, or other non combustible absorbent (Oil-dry)
- Drums (55-gallon U.S. DOT 1A1 or 1A2)
- Shovels, rakes, and brooms
- Container labels

Hazardous materials shall be stored in designated areas and all containers effectively closed. Spill equipment/supplied shall be readily available to contain and/or mitigate accidental spills of hazardous materials.

10.6 SPILL CONTROL PLAN

This section describes the procedures the Tetra Tech field crew members will employ upon the detection of a spill or leak.

- Notify the SSO or FOL immediately upon detection of a leak or spill. Activate emergency alerting procedures for that area to remove non-essential personnel.

- Employ the personal protective equipment stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the container or raising the leak to the highest point in the vessel. Spread the absorbent material in the area of the spill, covering it completely.

- Transfer the material to a new vessel; collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment and disposal options.

- Re-containerize spills, including 2-inch of top cover impacted by the spill. Await test results for treatment or disposal options.

It is not anticipated that a spill will occur that the field crew cannot handle. Should this occur, notification of the appropriate Emergency Response agencies will be carried out by the FOL or SSO in accordance with the procedures discussed in Section 2.0 of this HASP.

As mentioned above, in the event of a spill or release of hazardous chemicals, Tetra Tech will immediately notify the LMC personnel in the order presented in Table 2-1, and/or if the severity of the spill warrants, the local fire department by calling 9-1-1.

10.7 WASTE MANAGEMENT PLAN

Tetra Tech personnel will adhere to the decontamination and waste management procedures laid out the Tetra Tech HSGM and the Tetra Tech Decontamination of Field Equipment and Waste Handling Standard Operating Procedure (Attachment XI).

In addition, all requirements described in Sections 4.1 and 4.2 of the LM Handbook (Attachment I) will be addressed.

11.0 CONFINED-SPACE ENTRY

It is not anticipated, under the proposed scope of work, that confined space and permit-required confined space activities will be conducted. **Therefore, personnel under the provisions of this HASP are not allowed, under any circumstances, to enter confined spaces**. A confined space is defined as an area which has one or more of the following characteristics:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit (for example, tanks, manholes, sewers, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- Is not designed for continuous employee occupancy.

Additionally, a Permit-Required Confined Space must also have one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly caving walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized, serious, safety or health hazard.

For further information on confined space, consult the Health and Safety Guidance Manual or call the PHSO. If confined space operations are to be performed as part of the scope of work, detailed procedures and training requirements will have to be addressed and this HASP will be updated/amended as necessary to address the confined space entry requirements detailed in Section 3.3 of the LM Handbook (Attachment I).

12.0 HOT WORK

No hot work activities are being conducted as part of this field effort. Should hot work be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 3.4 of the LM Handbook (Attachment I).

13.0 USE OF LOCKHEED MARTIN MATERIALS AND EQUIPMENT

No Lockheed Martin materials, tools, equipment, PPE shall be used until authorized by Lockheed Martin.

No Tetra Tech personnel will start, stop, relocate, or adjust any Lockheed Martin process or production equipment without approval of the Lockheed Martin Project Lead. Details of these requirements are described in Section 3.6 of the LM Handbook.

14.0 ELEVATED LOCATIONS / LADDERS / SCAFFOLDS

No elevated location work, ladder work, or scaffolding activities are being conducted as part of this field effort. Should any of these activities be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Sections 3.10, 3.11, and 3.12 of the LM Handbook (Attachment I).

15.0 DANGEROUS OPERATIONS

Tetra Tech and subcontractor personnel will isolate their work areas from Lockheed Martin operations, employees, and the public. Barricades, signs, and signals will be employed as necessary and will be visible at all times where hazards exist.

Tetra Tech and subcontractors will effectively barricade excavations, floor openings, etc. as required by OSHA regulations.

Prior to beginning work, Tetra Tech and subcontractors must inform the Lockheed Martin Project Lead of any potentially dangerous operations.

All requirements addressing dangerous operations are detailed in Section 3.7 of the LM Handbook and will be adhered to.

16.0 EXCAVATIONS, TRENCHES, AND EARTHWORK

This field effort includes the excavation of test pits, therefore the following excavation procedures will apply to the excavation work.

16.1 EXCAVATION SAFE WORK PRACTICES

- Utility clearances should be in place prior to the beginning of excavation (in accordance with the Tetra Tech Utility Locating SOP in the Health and Safety Guidance Manual Section 7.0).

- Excavation boundaries should be demarcated with appropriate warning signs (e.g., construction activities in progress).

- Traffic patterns for equipment and the loading of trucks should be established. This pattern should form a loop to minimize backing, an activity which causes many accidents.

- Traffic patterns for foot and small vehicular traffic should keep workers away from heavy equipment.

- Traffic patterns for heavy equipment should be constructed to maintain traffic flow a minimum of 10 feet from unsupported walls or excavation boundaries.

- Excavation along thoroughfares will require the use of warning signs, barricades and flag-persons for alteration of traffic patterns, as necessary.

- Ground personnel should be provided with reflective vests to increase visibility and air horns to signal loud trucks and heavy equipment.

- Ground activities with heavy equipment should be supported with a ground spotter. The operators should be instructed that they are to follow the instructions provided by the ground spotter unless another party is otherwise authorized.

- Surface encumbrances within the intended work area of the excavation will be removed or supported, as necessary, in accordance with OSHA 1926.651(a).

- Prior to being put into service at the site, the excavator will be inspected by the SSO, and this inspection will be documented using the applicable forms in Attachment V.

- Heavy equipment will be positioned and operated so that it never approaches closer than 4 feet from the edge of an open excavation (other than the boom and bucket portion of the excavator).

- A decontamination station should be established at the loading and off-loading areas to flush mud and dirt from the wheels and tires as well as any areas of the vehicle impacted during the loading operation.

16.2 EMPLOYER DESIGNATED "COMPETENT PERSON"

The Employer Designated "Competent Person" is responsible for all aspects of excavation safety. This includes:

16.2.1 Pre-Excavation Activities

- Utility Clearance identification and marking
- Establishment of site control measures (temporary utilities, temporary traffic patterns, barricades, signs, etc.)
- Removal and/or control of Surface and Subsurface Encumbrances
- Traffic (Foot/Vehicular) Impact and routing
- Surface drainage patterns and impact

16.2.2 During Excavation Activities

- Utility sweeps
- Review and evaluation of entry/egress systems
- Installing support systems for surface and subsurface encumbrances as necessary (i.e. supporting building foundations, sidewalks, utility runs, etc.)
- Soil classification – Visual and Manual Analysis
- Hazardous atmosphere evaluation (initial and periodic monitoring)
- Recommendation/Installation/Evaluation of protective system (in and out of the excavation)

16.2.3 Post Excavation Activities

- Evaluation of the protective systems installed (sloping, benching, shielding, etc.)
- Soil conditions (Moisture content, fissures developing, horizontal cracks, etc.)
- Loading the excavation walls (Spoils piles, resource/fill materials stock piling, traffic, etc.)
- Atmospheric monitoring
- Backfill

16.2.4 Competent Persons Qualifications

- The employer designates Competent Person(s) based on knowledge and training.
- Capable of identifying existing or predictable hazards associated with excavated cuts or cavities in the earth.
- Has the authority to take prompt action to abate these hazards.
- Working knowledge of Soil Analysis/Soil Classification.
- Knowledgeable in the area of Protective Systems.
- Working knowledge of the requirements of 29 CFR 1926 Subpart P.

This position will typically be filled by Site Safety Officer (SSO), Field Operations Leader (FOL), or a Registered Professional Engineer (PE). The Excavation Competent Person must be specifically identified to handle this responsibility prior to work beginning in the specified space provided (Section 1.3) in this HASP.

Detailed Tetra Tech Excavation Safety Procedures, the Excavation Competent Person Checklist, the Tetra Tech Confined Space Entry Program and Procedures, and the Heavy Equipment Inspection Checklist are included in Attachments VI, VII, VIII and IX, and must be completed prior to beginning work. The OSHA Health and Safety Construction-Related regulations P-650 to 699 – Subpart P – Excavations are included in Attachment X and must be followed during all excavation work.

16.3 LM EXCAVATION REQUIREMENTS

In addition, the requirements stipulated in Section 3.8 of the LM Handbook (Attachment I) will be reviewed and adhered to during the excavation work and a trained, competent person will be designated to oversee the activities. These requirements include:

- Review the Lockheed Martin intrusive fieldwork requirements in Appendix A of the LM Handbook.

- If workers are to enter excavations, a competent person must be designated and trained in soil classification and the recognition of trenching and excavation hazards.

- Excavations and trenches shall be inspected by a competent person daily and after every rainstorm, earthquake, or other hazard-increasing occurrence.

- Inspect the face, banks, and top daily when workers are exposed to falling or rolling materials.

- Shore, bench, slope, or use equivalent methods to protect workers in excavations four feet deep or more.
- Locate soil at least two feet from the edge of the excavation, or one foot from the edge when the excavation is less than five feet deep.
- Ladders or steps shall be provided and secured in all trenches four feet or more in depth. Ladders shall be located to require no more than twenty-five feet of lateral travel before having access or egress and shall extend three feet above the top of the trench bank.
- Install crossings with standard guardrails and toeboards when the excavation is more than 7½ feet deep.
- All open trenches and other excavations shall be provided with suitable barriers, signs, and lights to the extent that adequate protection is provided to the public.
- Do not excavate beneath the level of adjacent foundations, retaining walls, or other structures until a qualified person has determined that the work will not be hazardous. Support undermined sidewalks.

17.0 ASBESTOS

No asbestos abatement work is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 3.19 of the LM Handbook (Attachment I).

It is not anticipated during this field effort, but should asbestos containing material (ACM) or presumed asbestos containing material (PACM) be disrupted, Tetra Tech and/or subcontractor personnel shall <u>immediately</u> report to the Lockheed Martin Project Lead and to other employers of employees working at the job site any discovery, disturbance, and/or spill of ACM and/or PACM. All operations will cease in the immediate area of the suspect ACM and/or PACM and demarcate the area. The approval of the Lockheed Martin Project Lead is required before resuming operations.

Tetra Tech and/or subcontractor personnel shall not disturb any pipe insulation, boiler insulation, or any other material reasonably suspected of containing asbestos until the Lockheed Martin is notified and approval is obtained.

Abatement of asbestos can be performed only by persons properly trained and licensed to perform such activities.

All requirements addressed in Section 3.18 of the LM Handbook pertaining to incidental asbestos exposure will be followed.

18.0 NANOTECHNOLOGY

No nanotechnology work is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 3.21 of the LM Handbook (Attachment I).

19.0 WORK INVOLVING AIR EMISSIONS

No work involving air emissions is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 4.3 of the LM Handbook (Attachment I).

20.0 WORK INVOLVING WATER DISCHARGES

No work involving water discharges is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 4.4 of the LM Handbook (Attachment I).

21.0 MATERIALS AND DOCUMENTATION

The Tetra Tech Field Operations Leader (FOL) shall ensure the following materials/documents are taken to the project site and used when required.

- A complete copy of this HASP
- Health and Safety Guidance Manual
- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for chemicals brought on site, including decontamination solutions, fuels, sample preservatives, calibration gases, etc.
- A full-size OSHA Job Safety and Health Poster (posted in the site trailer)
- Training/Medical Surveillance Documentation Form (Blank)
- First-Aid Supply Usage Form
- Emergency Reference Form (Section 2.0, extra copy for posting)
- Directions to the Hospital

21.1 MATERIALS TO BE POSTED AT THE SITE

The following documentation is to be posted or maintained at the site for quick reference purposes. In situations where posting these documents is not feasible (such as no office trailer), these documents should be separated and immediately accessible.

- **Chemical Inventory Listing (posted)** - This list represents all chemicals brought on-site, including decontamination solutions, sample preservations, fuel, etc. This list should be posted in a central area.

- **MSDSs (maintained)** - The MSDSs should also be in a central area accessible to all site personnel. These documents should match all the listings on the chemical inventory list for all substances employed on-site. It is acceptable to have these documents within a central folder and the chemical inventory as the table of contents.

- **The OSHA Job Safety & Health Protection Poster (posted – Attachment XII)** - This poster should be conspicuously posted in places where notices to employees are normally posted, as directed by 29 CFR 1903.2 (a)(1). Each FOL shall ensure that this poster is not defaced, altered, or covered by other material. The law also states that reproductions or facsimiles of the poster shall be at least 8 1/2 by 14 inches with 10 point type.

- **Site Clearance (maintained)** - This list is found within the training section of the HASP (Figure 8-1). This list identifies all site personnel, dates of training (including site-specific training), and medical surveillance. The list indicates not only clearance, but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.

- **Emergency Phone Numbers and Directions to the Hospital(s) (posted)** - This list of numbers and directions will be maintained at all phone communications points and in each site vehicle.

- **Medical Data Sheets/Cards (maintained)** - Medical Data Sheets will be filled out by on-site personnel and filed in a central location. The Medical Data Sheet will accompany any injury or illness requiring medical attention to the medical facility. A copy of this sheet or a wallet card will be given to all personnel to be carried on their person.

- **Personnel Monitoring (maintained)** - All results generated through personnel sampling (levels of airborne toxins, noise levels, etc.) will be posted to inform individuals of the results of that effort.

- **Placards and Labels (maintained)** - Where chemical inventories have been separated because of quantities and incompatibilities, these areas will be conspicuously marked using DOT placards and acceptable [Hazard Communication 29 CFR 1910.1200(f)] labels.

The purpose of maintaining or posting this information, as stated above, is to allow site personnel quick access. Variations concerning location and methods of presentation are acceptable providing the objective is accomplished.

21.2 HAZARD COMMUNICATION – USE OF HAZARDOUS MATERIALS

- All hazardous substance (as defined by OSHA) brought onto Lockheed Martin remediation sites must be accompanied by a MSDS and the containers labeled in accordance with the Red OSHA Hazard Communication Standard, 29 CFR 1910.1200 or applicable state OSHA standard. Tetra Tech and subcontractor personnel will provide MSDSs for chemicals brought on site. The contents of these documents will be reviewed by the SSO with the user(s) of the chemical substances prior to any actual use or application of the substances on site. A chemical inventory of the chemicals used on site will be developed using the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request.

The Lockheed Martin Project Lead shall be notified prior to bringing ay quantity of hazardous materials onto Lockheed Martin remediation sites. Hazardous materials shall be stored in designated areas and all containers effectively closed. Spill equipment/supplied shall be readily available to contain and/or mitigate accidental spills of hazardous materials.

All other hazard communication requirements are detailed in Section 3.2 and Section 4.1 of the LM Handbook (Attachment I) and will be adhered to.

22.0 ACRONYMS / ABBREVIATIONS

CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPT	Cone Penetrometer
CSP	Certified Safety Professional
DPT	Direct Push Technology
DRI	Direct Reading Instrument
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
IDW	Investigation Derived Waste
MDEP	Maryland Department of Environmental Protection
MIP	Membrane Interface Probe
N/A	Not Available
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PHSO	Project Health and Safety Officer
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
SSO	Site Safety Officer
TBD	To be determined
TCE	Trichloroethene
Tetra Tech	Tetra Tech, Inc.
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds

ATTACHMENT I

LOCKHEED MARTIN'S

REMEDIATION CONTRACTOR'S ESH

HANDBOOK

LOCKHEED MARTIN

REMEDIATION CONTRACTOR'S ESH HANDBOOK

June 10, 2009

Revision 1

Lockheed Martin Corporation
Energy, Environment, Safety & Health

A COPY OF THE JOB SPECIFIC HASP SHALL BE AVAILABE AT THE JOB SITE FOR THE DURATION OF THE PROJECT

REVISION STATUS

REVISION	DATE	COMMENTS
1	06/10/2009	

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CONTRACTOR’S ESH HANDBOOK

GENERAL

Lockheed Martin Corporation management at all levels is committed to conducting operations and activities in a manner that provides and maintains safe and healthful working conditions, protects the environment, and conserves natural resources.

This *Contractor’s ESH Handbook* has been prepared to assist each project jobsite employer/contractor in satisfying its’ contractual and legal accident prevention responsibilities, in such a manner that a safe, efficient operation is assured. All applicable requirements outlined in this handbook shall be incorporated into the contractor’s site specific Safety and Health Plan The site specific Safety and Health plan shall be submitted to the Lockheed Martin Project Lead at least two weeks prior to starting work on any Lockheed Martin remediation projects.

This material must not be considered to be all inclusive as to the hazards that might be encountered, safe practices that should be performed, or safe conditions that should be maintained during the course of any project. Moreover, this handbook does not replace the contractor’s legal obligation to its employees under all relevant environmental, safety and health requirements and laws. All legal standards not specifically referenced in this handbook shall apply when applicable.

1 <u>CONTRACT RESPONSIBILITIES</u>

The Contractor agrees to comply with all rules and procedures contained in this document, known as the *Remediation Contractor’s ESH Handbook*, unless Lockheed Martin specifically agrees, in writing, to a modification or exemption. In addition, the Contractor and subcontractors, at any tier, shall:

1.1 Lockheed Martin is a drug free-work workplace. This requirement extends to contractors working on Lockheed Martin remediation projects. Additionally, the use of tobacco is not permitted on Lockheed Martin owned property.

1.2 Take all prudent and proper environmental, safety and health (ESH) precautions to protect Lockheed Martin employees, all other workers, and the public from ESH hazards associated with contractor activities.

1.3 Comply with all applicable Federal, State, municipal, local, and any other applicable occupational safety and health statutes, rules, ordinances, regulations, and requirements issued or imposed by any governmental authority (including, but not limited to *Title 29, Code of Federal Regulations Parts 1903, 1904, 1910* and *1926*).

1.4 Comply with all applicable Federal, State, municipal, local, and any other applicable air pollution statutes, rules, ordinances, regulations, and requirements issued or imposed by any governmental authority.

1.5 Comply with all Federal, State, municipal, local and Lockheed Martin hazardous materials, hazardous waste, and non-hazardous waste statutes, rules, ordinances, regulations, and requirements (including, but not limited to *Title 40, Code of Federal Regulations*).

1.6 Obtain the applicable ESH permits to conduct the work in compliance with local, state, federal ESH regulations and site requirements (including, but not limiting to *Title 29, Code of Federal Regulations, 1910 and 1926*).

1.7 Ensure that all employees and subcontractors have received the appropriate level of ESH training in accordance with applicable ESH regulations necessary for the performance of the work requested by Lockheed Martin.

1.8 To instruct, prior to commencement of operations, all employees on the jobsite about relevant governmental laws and regulations, specific hazards expected to be encountered and proper safety precautions to be observed. In addition, jobsite employees shall read and certify that they have read and understand the job specific health and safety plan (HASP). The certification forms provided by the contractor within the HASP shall be electronically sent to the Lockheed Martin Project Lead.

1.9 Provide all jobsite visitors with a safety orientation prior to commencing work or touring the site. A visitor log shall be kept to document the orientation.

1.10 To ensure Contractor's job specific health and safety plan (HASP) encompasses Federal, State, municipal, local and the Lockheed Martin requirements found within this document the HASP should contain a section on crisis management / emergency response. A copy of the job specific HASP shall be maintained at the job site where jobsite employees have access to a copy. All Contractor Project Managers shall be provided a copy of the *Contractor's ESH Handbook* found within the Lockheed Martin Request for Proposal or as an appendix of the Key National Contractor Agreement. Contractors shall flow these requirements down to their subcontractors.

1.11 Contractor understands that Lockheed Martin may immediately stop Contractor's work if Contractor violates any applicable Federal, State, municipal, local, or any other rules, regulations, and requirements, *Remediation Contractor’s ESH Handbook* provisions, or other contract terms and conditions regarding environmental, safety and health compliance. Lockheed Martin shall not incur work stoppage charges unless the contractor demonstrates that the work stoppage was unwarranted for any of the reasons stated above. Any dispute regarding work stoppage charges must be resolved through binding arbitration.

1.12 Contractor is advised that the Project may be inspected from time to time by Lockheed Martin or a representative of Lockheed Martin. Periodic Lockheed Martin inspections in no way relieve the Contractor of their obligation to maintain its own inspection program to identify unsafe conditions or acts. ESH violations will be considered in evaluation of Contractor’s performance.

1.13 Lockheed Martin is not responsible for training or supervising Contractor employees or abating workplace hazards created by the Contractor or to which the Contractor's employees are exposed.

1.14 Contractor agrees to maintain copies of all pertinent ESH records at the job site. Pertinent records include, but is not limited to, personnel training documentation, evidence of enrollment in a medical surveillance program, accident/injury reporting, work area inspections, periodic safety meetings, MSDS's, air monitoring data, waste container inspections, etc. These records shall also be provided electronically to the Lockheed Martin Project Lead.

1.15 Contractor shall contact the Lockheed Martin Project Lead immediately in the event of a fatal or serious injury, an unpermitted environmental release, or any ESH incident that is likely to generate significant publicity or an adverse situation for Lockheed Martin (e.g., alleged releases of contaminants beyond property boundaries, purported fish or wildlife impacts, allegations of adverse community health or property impacts, etc.)

2 DEFINITION

2.1 Contractor: any agent/agency engaged by Lockheed Martin through written contract (or other written agreement) to perform work on Lockheed Martin Remediation Sites. For the purposes of this *Remediation Contractor's ESH Handbook*, "Contractor" shall also include Contractor's subcontractors at any tier.

2.2 EPA: the Environmental Protection Agency.

2.3 Fed/OSHA: the Federal Occupational Safety and Health Administration

2.4 Hazard Communication Program: a written program meeting the requirements of Title 29, Code of Federal Regulations, Section 1910.1200 - Hazard Communication.

2.5 Lockheed Martin: Lockheed Martin Corporation, Corporate Energy, Environment, Safety & Health

2.6 Lockheed Martin Project Lead: the Lockheed Martin Corporate Environment, Safety & Health individual that has been designated to manage a specific project.

2.7 Lockheed Martin Contract Representative: the Lockheed Martin Corporate Environment, Safety & Health contract representative (Contract Administrator/Buyer) for the project.

2.8 RCRA: the Federal Resource Conservation and Recovery Act and all amendments or revisions.

3 SAFETY & HEALTH

Contractor shall comply with applicable provisions of Federal, State, municipal, local, and any other applicable occupational safety and health statutes, rules, ordinances, regulations and requirements. Contractor shall take all precautions for the protection of the safety and health of Contractor employees, subcontractor employees, and Lockheed Martin employees to prevent accidents or injury to them or to other persons on, about, or adjacent to site of work performance. Notwithstanding this handbook, Contractor will hold harmless Lockheed Martin for any incident, violation, regulatory agency inspection resulting in a finding, or any other ESH issue that occurs to a Contractor employee.

Within Section 3.0, Lockheed Martin is identifying specific requirements within the Federal regulations that need extra attention. These are not all encompassing and adherence to the all rules and regulations must be followed.

3.1 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

1926 Subpart E or 1910 Subpart I
1910.139 / 1926.103
ANSI Z87.1
ANSI Z41 Standard
ANSI Z89.1 Standard

3.1.1 Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

- <u>Eye Protection</u>. Safety eyewear meeting ANSI Z87.1 shall be worn in areas designated as "Eye Protection Required" and on all jobs where a potential injury to the eyes is possible whether or not the area is posted.
- <u>Foot Protection</u>. Affected employee(s) shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. Safety shoes and boots which meet the ANSI Z41 Standard shall be provided when impact and/or compression hazards exist. Soft-shoes, including but not limited to, tennis shoes, athletic shoes, moccasins, sandals, and open-toed or open-heeled shoes shall not be worn.
- <u>Respiratory Protection Devices</u>. Appropriate, MSHA/NIOSH-approved respiratory protective devices must be worn when applicable state and/or federal action levels or OSHA permissible exposure levels (PELs) are exceeded. Contractor must have fully implemented a respiratory protection program meeting the requirements of *Title 29, Code of Federal Regulations, Section 1910.139 / 1926.103* or applicable state OSHA regulations prior to issuing and using respiratory equipment. Contractor shall supply and maintain

appropriate air monitoring and respiratory protection equipment if inhalation hazards are anticipated.

- Protective Clothing such as suits, aprons, boots, or gloves shall be worn where there is a hazard to the body through dermal contact with chemicals, dusts, heat or other harmful agents or conditions.
- Hearing Protection (muffs and/or plugs) must be worn in all areas posted to indicate high noise level or where Contractor employees are exposed to noise levels in excess of the OSHA action level (85 dBA over a 8-hour time-weighted average or a dose of fifty percent).
- Hard Hats will be worn in all areas where there is a danger of impact to the head or hazard from falling or moving objects. Hard hats must meet the ANSI Z89.1 Standard.

3.1.2 Contractor will issue or cause to be issued prior to commencing the job all necessary personal protective equipment and air monitoring equipment to all its agents and employees, together with full instructions and training on the use of said equipment.

3.1.3 Contractor will meet all applicable Federal, Sate, municipal, local, and Lockheed Martin requirements for protective clothing and equipment. Contractor will properly supervise all its agents and employees to ensure protective clothing and equipment are used in conformance with applicable rules and regulations.

3.2 HAZARD COMMUNICATION - USE OF HAZARDOUS MATERIALS

Title 29, Code of Federal Regulations, Section 1926.59 Hazard Communication
Title 29, Code of Federal Regulations, Section 1910.1200 Hazard Communication

3.2.1 Contractor personnel shall not bring any hazardous substances (as defined by OSHA) onto Lockheed Martin remediation sites unless accompanied by a Material Safety Data Sheet (MSDS) and the containers are appropriately labeled. MSDS's must be maintained at the job site.

3.2.2 Contractor shall notify the Lockheed Martin Project Lead prior to bringing onto Lockheed Martin remediation sites any quantity of hazardous materials.

3.2.3 Contractor shall ensure all containers of hazardous materials are labeled in accordance with the Fed OSHA Hazard Communication Standard, 29 CFR 1910.1200 or applicable state OSHA standard.

3.2.4 Do not handle or use any hazardous material that does not have adequate safety warning labels.

3.2.5 Do not dump, drain or discharge any hazardous materials or wastes into any sink, drain or sewer.

3.2.6 The Lockheed Martin Project Lead shall inform the Contractor(s) of the identity of hazardous chemicals to which Contractor's employees may be exposed from

Lockheed Martin operations, if applicable. The Lockheed Martin Project Lead shall provide the following information:

- Where to obtain information concerning any hazardous substances used in Lockheed Martin operations that the Contractor's employees may come in contact with while performing their work;
- If Lockheed Martin owns or uses chemicals on a remediation site for any process where contractors could be exposed, Lockheed Martin shall make available to the Contractor Material Safety Data Sheets (MSDS) and sufficient information to permit the Contractor to train its employees on the hazards of the chemical Appropriate protective measure Contractor employees may take to protect themselves from exposure to known hazards from Lockheed Martin operations; and
- Appropriate work practice procedures (safety rules) for the location where work is to be performed.

3.2.7 Contractor shall ensure its employees are trained in the safe handling and use of hazardous materials in accordance with *29 CFR 1910.1200 - Hazard Communication* or the applicable state-OSHA hazard communication standard.

3.2.8 Contractor shall ensure that all applicable employees are medically qualified (as defined by OSHA) to perform the work assigned.

3.2.9 Hazardous materials shall be stored in designated areas and all containers effectively closed. Spill equipment/supplies shall be readily available to contain and/or mitigate accidental spills of hazardous materials.

3.3 <u>CONFINED SPACE ENTRY</u>

Title 29, Code of Federal Regulations, Section 1910.146 Permit-Required Confined Spaces

3.3.1 If Contractor or any other employee must enter a confined space (tank, vat, pit, sewer, etc.), the entry must be performed in accordance with the applicable state OSHA or federal OSHA regulations.

3.3.2 Before Contractor's employees are permitted entry into any confined space, the internal atmosphere shall be tested with a calibrated direct-reading instrument for the following conditions in the order given: 1) Oxygen content, 2) Flammable gases & vapors, and 3) Potential toxic air contaminants. Contractor shall furnish the air testing equipment and a person competent in the use of the testing equipment.

3.3.3 When possible, the Contractor shall notify the Lockheed Martin Project Lead prior to entering a permit required confined space. A permit shall be issued by the contractor prior to entry and electronically submit a copy to the Lockheed Martin Project Lead.

3.3.4 To ensure the safety of Contractor personnel during entry into confined spaces, the Contractor shall have a written confined space entry program.

3.4 HOT WORK REQUIREMENTS (i.e., welding, torch cutting, brazing, etc.)

Title 29, Code of Federal Regulations, Section 1910 Subpart Q
Title 29, Code of Federal Regulations, Section 1926 Subpart J

3.4.1 All hot work activities shall be conducted in accordance with the hot work permit requirements outlined in the site specific HASP (i.e., fire suppression equipment availability, removal of combustibles, fire watch, etc.).

3.4.2 Contractor personnel must secure all oxygen and acetylene cylinders in a manner that will prevent them from falling or tipping over. Oxygen and acetylene cylinders must be stored separately. Oxygen cylinders in storage must be separated from fuel gas cylinders a distance of 20 feet or by a noncombustible barrier 5 feet high. Acetylene cylinders shall not be stored horizontally, lying on their side.

3.4.3 When welding, Contractor personnel shall use welding curtains and/or suitable protective devices to protect persons from indirect exposure to welding flashes.

3.5 LOCKOUT / TAGOUT - Control of Hazardous Energy

Title 29, Code of Federal Regulations, Section 1910.147

3.5.1 Contractors are required to establish a written program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employee.

3.5.2 Contractor shall not service and/or maintain machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. Servicing and/or maintaining such equipment shall not be conducted until appropriate energy control methods have been initiated.

The Contractor shall provide training to ensure that the purpose and function of the energy control program are understood by their employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by the employees.

3.5.3 If Contractor needs to service or maintain Lockheed Martin equipment, Contractor(s) shall notify the Lockheed Martin Project Lead and/or on-site facility operator (if applicable) of the intended equipment service for any unscheduled maintenance.

3.5.4 Upon completion of the job, Contractor is to notify the Lockheed Martin Project

Lead and/or on-site facility operator (if applicable) so power can be resumed to the equipment after the lock-outs and tags have been removed.

3.6 USE OF LOCKHEED MARTIN MATERIALS AND EQUIPMENT

3.6.1 Contractor's employees shall not use Lockheed Martin tools, equipment, materials, or personal protective equipment unless otherwise authorized by Lockheed Martin.

3.6.2 Contractor shall not start or stop any production equipment without the approval of the Lockheed Martin Project Lead.

3.6.3 Contractor shall not adjust or relocate any Lockheed Martin process equipment without the approval of the Lockheed Martin Project Lead.

3.7 DANGEROUS OPERATIONS - WARNINGS AND BARRICADES

Title 29, Code of Federal Regulations, Section 1926, Subpart G-Signs, signals and barricades

3.7.1 Contractor shall isolate their work areas from Lockheed Martin operations, employees, and the public by using barricades or other effective means of isolation. Signs, signals and barricades shall be visible at all times where a hazard exists.

3.7.2 Contractor personnel shall erect and properly maintain, at all times, all necessary safeguards for the protection of Contractor personnel, Lockheed Martin employees and the public. This includes:

- If doing any overhead work, Contractor must utilize warning signs and barricades, or station someone on the ground to prevent passers-by from entering the area below the overhead work;
- Contractor must effectively barricade excavations, floor openings, etc., as required by OSHA regulations;
- Contractor must construct and maintain all scaffolds and working platforms in accordance with OSHA regulations; and
- If Contractor's equipment, barricades or other safeguards restrict fire lanes or fire equipment access, the Contractor shall notify the Lockheed Martin Project Lead about its notification to the local fire department.

3.7.3 Prior to commencing work, Contractor must inform Lockheed Martin Project Lead of any work posing a potential danger to personnel.

3.8 EXCAVATIONS, TRENCHES, EARTHWORK

Title 29, Code of Federal Regulations, Section 1926 Subpart P

3.8.1 Review the Lockheed Martin intrusive fieldwork requirements in Appendix A.

3.8.2 If workers are to enter excavations, a competent person must be designated and trained in soil classification and the recognition of trenching and excavation hazards.

3.8.3 Excavations and trenches shall be inspected by a competent person daily and after every rainstorm, earthquake, or other hazard-increasing occurrence.

3.8.4 Inspect the face, banks, and top daily when workers are exposed to falling or rolling materials.

3.8.5 Shore, bench, slope, or use equivalent methods to protect workers in excavations four feet deep or more.

3.8.6 Locate soil at least two feet from the edge of the excavation, or one foot from the edge when the excavation is less than five feet deep.

3.8.7 Ladders or steps shall be provided and secured in all trenches four feet or more in depth. Ladders shall be located to require no more than twenty-five feet of lateral travel before having access or egress and shall extend three feet above the top of the trench bank.

3.8.8 Install crossings with standard guardrails and toeboards when the excavation is more than 7½ feet deep.

3.8.9 All open trenches and other excavations shall be provided with suitable barriers, signs, and lights to the extent that adequate protection is provided to the public.

3.8.10 Do not excavate beneath the level of adjacent foundations, retaining walls, or other structures until a qualified person has determined that the work will not be hazardous. Support undermined sidewalks.

3.9 ELECTRICAL SAFETY

Title 29, Code of Federal Regulations, Section 1926 Subpart K-Electrical
Title 29, Code of Federal Regulations, Section 1910.269 Electrical Power Generation, Transmission and Distribution

3.9.1 Only qualified persons are permitted to work on electrical systems, as defined by *Title 29, Code of Federal Regulations Section 1910.269(a)(2).* Qualified persons shall be trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment;
- The skills and techniques necessary to determine the nominal voltage of exposed live parts;
- The minimum approach distances specified by OSHA corresponding to the voltages to which the qualified employee will be exposed; and

- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment.

3.9.2 Contractor personnel shall properly ground all electrical tools, mechanical digging or concrete breaking equipment and all other electrical equipment while in use.

3.9.3 All electrical work, installation and wire capacities shall be in accordance with the pertinent provisions of the National Electrical Code, ANSI and OSHA.

3.9.4 Covers or barriers must be installed on boxes, fittings, and enclosures to prevent accidental contact with live parts.

3.9.5 Temporary wiring installations must be grounded.

3.9.6 Electrical systems shall be de-energized utilizing appropriate lockout/tagout procedures prior to conducting work.

3.10 ELEVATED LOCATIONS / FALL PROTECT

Cal/OSHA General Industry Safety Orders, 8 CCR 3210
Title 29, Code of Federal Regulations, Section 1926 Subpart M – Fall Protection

3.10.1 California employers: Guardrails shall be provided on all open sides of unenclosed room openings, open and glazed sides of landings, balconies or porches, platforms, runways, ramps, or working levels more than 30 inches above the floor, ground, or other working areas. The railing must be provided with a toeboard where the platform, runway, or ramp is 6 feet or more above places where employees normally work or pass and the lack of a toeboard could create a hazard from falling tools, material, or equipment.

3.10.2 Contractor must provide fall protection systems whenever a worker is exposed to a fall of four feet or more (in construction the threshold is six feet). Guardrails are the most common forms of fall protection systems. If guardrail systems are not feasible, safety nets, personal fall arrest systems, positioning device systems, warning line systems, or some other demonstrated, effective means of fall protection shall be used. Fall protection systems and devices shall be inspected prior to each use Title 29, Code of Federal Regulations, Section 1926 Subpart M.

3.11 LADDERS

Title 29, Code of Federal Regulations, Section 1910 Subpart D – Walking and Working Surfaces
Title 29, Code of Federal Regulations, Section 1926 Subpart X - Ladders

3.11.1 The use of ladders with broken or missing rungs or steps, broken or split rails or other defective construction is prohibited.

3.11.2 Ladders shall extend no less than 36 inches above landing and be secured to prevent displacement.

3.11.3 Portable ladders must be equipped with safety shoes.

3.11.4 Wooden ladders shall not be painted.

3.11.5 Do not use metal ladders for electrical work or near live electrical parts.

3.12 SCAFFOLDS

Title 29, Code of Federal Regulations, Section 1910.28 – Safety Requirements for Scaffolding
Title 29, Code of Federal Regulations, Section 1926 Subpart L - Scaffolds

3.12.1 Scaffolds must be provided for all work that cannot be done safely by employees standing on solid construction at least 20 inches wide, except where such work can be safely done from ladders.

3.12.2 Erection and dismantling of scaffolds shall be performed in accordance with good engineering practice.

3.12.3 Footings or anchorage for any scaffold shall be sound, rigid and capable of carrying the maximum intended load without settling or displacement.

3.12.4 No unstable objects such as concrete blocks shall be used to support scaffolds or planks.

3.12.5 Any part of a scaffold weakened or damaged shall be repaired or replaced immediately.

3.12.6 All scaffold planking shall be free of knots and cracks (Class A number) and shall completely cover the work platform.

3.12.7 Scaffold planks shall be laid tight, cleated at both ends or overlapped a minimum of 12 inches and nailed or bolted to prevent movement. Overlaps to occur directly above scaffold supports.

3.12.8 A safe and unobstructed means of access, such as a walkway, stair, or ladder shall be provided to all scaffold platforms.

3.13 HEAVY EQUIPMENT, INDUSTRIAL VEHICLES, AND CRANES

Title 29, Code of Federal Regulations, Section 1926 Subparts N, O and W

3.13.1 Only trained and authorized workers may operate heavy equipment, industrial vehicles, and/or cranes.

3.13.2 The Contractor shall designate a competent person who shall inspect all machinery and equipment prior to each use to make sure it is in safe operating condition.

3.13.3 The Contractor shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all heavy equipment, industrial vehicles, and cranes.

3.13.4 Seatbelts are required to be worn if the vehicle has Roll-Over Protection Structures (ROPS).

3.13.5 The swing radius of cranes shall be barricaded.

3.13.6 Equipment shall not be lubricated while in use.

3.13.7 Rated load capabilities, recommended operating speeds, special hazard warning, specific hand signal diagrams and special instructions shall be visible to the operator while he is at the control station.

3.13.8 Contractor's employees shall not be allowed to work under the load of cranes. Tag lines shall be used on all loads.

3.14 OVERHEAD POWER LINES

Title 29, Code of Federal Regulations, Section 1926.550 (a) (15)

3.14.1 If work is to be performed near overhead power lines, the lines must be de-energized and grounded by the owner or operator of the lines, or other protective measures must be provided before work is started. Protective measures (such as guarding or insulating the lines) must be designed to prevent employees from contacting the lines.

3.14.2 Unqualified employees and mechanical equipment must stay at least 10 feet away from overhead power lines. If the voltage is over 50,000 volts, the clearance should be increased by four inches for each additional 10,000 volts.

3.14.3 When mechanical equipment is being operated near overhead lines, employees standing on the ground may not contact the equipment unless it is located so that the required clearance cannot be violated even at the maximum reach of the equipment.

3.14.4 A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.

3.14.5 Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicates that it is not energized.

3.15 FIRE PREVENTION / FLAMMABLE LIQUIDS

Title 29, Code of Federal Regulations, Section 1926 Subpart F or 1910 Subpart E

3.15.1 Contractor shall be responsible for fire protection in its work and operational areas, including offices, tool rooms, and storage areas 24 hours per day, seven days per week through the duration of this Contract. Approved fire-fighting equipment, in adequate quantities, must be provided.

3.15.2 Contractor shall familiarize Contractor's employees with the locations of fire extinguishers in their respective work areas and ensure they are prepared to use them safely if necessary. In certain remote field locations or within abandoned (discontinued) facilities where fire extinguishers may not exist in the immediate work area, contractor shall provide and locate fire extinguisher(s) in close proximity to the active work area(s).

3.15.3 In case of fire, Contractor shall call 9-1-1. Contractor shall also inform all Contractor and Lockheed Martin employees in the area to evacuate to a safe place and direct arriving fire response personnel to the fire. Notify the Lockheed Martin Project Lead as soon as reasonably possible.

3.15.4 Contractor employees shall only attempt to put out a fire when such action can be performed safely.

3.15.5 If a Contractor employee uses a Lockheed Martin fire extinguisher, Contractor shall report its use to the Lockheed Martin Project Lead.

3.15.6 Contractor shall report all fires extinguished by the Contractor to the Lockheed Martin Project Lead.

3.15.7 Contractors are to store, dispense, and use flammable and combustible liquids in accordance with OSHA regulations and the Uniform Fire Code. Bonding and grounding of containers containing flammable liquids will be required.

3.15.8 Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas.

3.15.9 Contractor shall provide sufficient fire extinguishers necessary for their work activities.

3.16 <u>HAND AND POWER TOOLS</u>

Title 29, Code of Federal Regulations, Section 1910 Subpart P – Hand and Portable Powered Tools and Other Hand-Held Equipment
Title 29, Code of Federal Regulations, section 1926 Subpart I – Tools Hand and Power

3.16.1 All hand and power tools, whether furnished by Contractor, or by Contractor’s employee, shall be maintained in a safe condition.

3.16.2 Electrical power tools shall be grounded or double insulated with proper assured equipment grounding inspections or Ground Fault Interrupter (GFI) circuit protection provided.

3.16.3 Pneumatic power tools shall be secured to the hose or whip by some positive means.

3.16.4 Only properly trained Contractor employees shall operate power-actuated tools.

3.16.5 All grinding machines shall conform to OSHA and ANSI requirements.

3.17 COMPRESSED GAS CYLINDERS

Title 29, Code of Federal Regulations, Section 1910.101 – Compressed Gases
Title 29, Code of Federal Regulations, Section 1926.350 – Gas Welding and Cutting

3.17.1 Compressed gas cylinders shall be secured in an upright position at all times.

3.17.2 When transporting, moving and storing cylinders, valve protection caps shall be in place and secured.

3.17.3 Compressed gas cylinders shall be kept away from excessive heat, shall not be stored where they might be damaged or knocked over by passing or falling objects, and shall be stored at least 20 feet away from highly combustible materials.

3.17.4 Cylinders shall be labeled as to the nature of their contents.

3.17.5 Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials a minimum of 20 feet or by a noncombustible barrier at least five feet high having a fire-resistant rating of at least one-half hour.

3.17.6 Acetylene cylinders shall be stored and used in a vertical, valve-end-up position only.

3.17.7 Anti-flashback arrestors shall be installed on all oxygen and acetylene cylinders.

3.18 INCIDENTAL CONTACT WITH ASBESTOS

3.18.1 This section applies to all contractors who incidentally disrupt the matrix of asbestos containing material (ACM) or presumed asbestos containing material (PACM); i.e., contractors who have not been specifically hired to perform ACM abatement.

3.18.2 Contractor shall immediately report to the Lockheed Martin Project Lead and to other employers of employees working at the job site any discovery, disturbance, and/or spill of ACM and/or PACM. Contractor(s) is to cease all operations in the immediate area of the suspect ACM and/or PACM and demarcate the area. The approval of the Lockheed Martin Project Lead is required before resuming operations.

3.18.3 Contractor shall not disturb any pipe insulation, boiler insulation, or any other material reasonably suspected of containing asbestos until the Contractor notifies the Lockheed Martin Project Lead. Lockheed Martin approval is required before operations may commence.

3.18.4 Abatement of asbestos can be performed only by persons properly trained and licensed to perform such activities

3.19 <u>ASBESTOS ABATEMENT CONTRACTORS</u>

3.19.1 This section applies to Contractors performing maintenance, construction, repair, renovation, demolition, salvage, or any other operation in which any material containing more than 1% asbestos is sanded, abrasive blasted, sawed, shoveled, removed, or otherwise handled in a manner that would generate airborne asbestos fibers. These requirements are in addition to any requirements contained in Contractor's scope of work.

3.19.2 All Contractors working with asbestos shall comply with applicable federal and state OSHA, EPA, local air district, and other applicable Federal, State, municipal, and local statutes, regulations, rules, and ordinances; and specific contract terms and conditions regarding the handling of, use of, and work involving asbestos.

3.19.3 The contractor shall ensure that a competent person, as defined by OSHA supervises all asbestos work performed within regulated areas.

3.19.4 Before commencing work, all asbestos abatement contractors shall supply to Lockheed Martin proof of:

- Asbestos abatement contractor certification by the state Contractor's License Board
- Liability insurance for Contractor employees engaged in asbestos work operations
- Copies of asbestos work notification letters to state OSHA
- Local air district Asbestos Demolition/Renovation Notification

3.19.5 Contractors shall minimize the creation and spread of airborne asbestos fibers by using appropriate work practices, engineering controls, and established procedures (i.e., wet methods, HEPA filter vacuums, negative pressure enclosure, local exhaust ventilation equipped with HEPA filter dust collection system, etc.).

3.19.6 All Class I, II and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they may demarcate the regulated area. Signs shall be provided and displayed at each location where a regulated area is required to be established. Signs shall be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Warning signs shall bear the following information:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

3.19.7 On multiple employer worksites requiring the establishment of a regulated area, the asbestos Contractor shall inform other employers on the site of the nature of the work with asbestos and/or PACM, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.

3.19.8 Contractors shall package and label asbestos waste in accordance with federal and or applicable state OSHA requirements and federal or applicable state hazardous waste regulations. Labels shall be affixed to all products containing asbestos and to all containers containing such products, including waste containers. Labels shall be printed in large, bold letters on a contrasting background and shall contain the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

3.19.9 Contractors shall properly dispose of all asbestos waste. Proper disposal includes the use of hazardous waste manifests and Lockheed Martin approved and licensed waste haulers, and disposal facilities according to federal RCRA law and applicable state hazardous waste regulations. Contractor shall contact the Lockheed Martin Project Lead before transporting or disposing of any hazardous waste. Lockheed Martin must review all hazardous waste manifests prior to shipment.

3.19.10 Contractors shall ensure that employee exposure air monitoring is conducted as required by federal or applicable state OSHA regulations. All other air monitoring (i.e. clearance sampling) shall be conducted by a third-party contracted air monitoring firm not affiliated with the Contractor.

3.19.11 Contractor shall, at no cost to the employee, institute a training program for and ensure the participation of all employees engaged in asbestos-related work who may reasonably be expected to be exposed to asbestos fibers from asbestos containing construction materials.

3.19.12 Contractor shall institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of fibers of asbestos at or above the TWA and/or excursion limit.

3.20 <u>HAZARDOUS WASTE OPERATIONS and EMERGENCY RESPONSE</u> (HAZWOPER)

Title 29, Code of Federal Regulations, Section 1910.120 - Hazardous Waste Operations and Emergency Response

Title 29, Code of Federal Regulations, Section 1926.65 – Hazardous Waste Operations and Emergency Response

This section applies to Contractors performing hazardous waste-type activities. This includes operations that pose a potential or reasonable possibility for employee exposure to hazardous waste/chemical contaminants during site investigations, clean-up operations, abatement, or hazardous substance removal work (remedial actions). These requirements are in addition to any requirements contained in Contractor's scope of work.

3.20.1 Contractor shall provide a **site-specific safety and health plan** at least two (2) weeks prior to field mobilization to the Lockheed Martin Project Lead (global statement – move to the beginning).

Contractor shall provide a **safety and health plan** in accordance with *Title 29, Code of Federal Regulations, Section 1910.120 - Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard and, at a minimum, shall contain the following elements:

- Safety and health risk or hazard analysis for each anticipated site task
- Employee training requirements
- Personal protective equipment to be used by employees for each of the site tasks and operations
- Medical surveillance requirements
- Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used
- Site control measures
- Decontamination requirements and procedures
- Emergency response plan
- Confined space procedures (if applicable)
- Emergency response plan
- Confined space procedures (if applicable)
- Spill containment program
- Periodic documented safety meetings
- Periodic documented work area safety inspections and corrective actions

3.20.2 Contractors performing hazardous waste-type operations shall adhere to the requirements specified in *29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard.

3.20.3 <u>Training</u>: All Contractor and subcontractor employees working on site who are potentially exposed to hazardous substances shall receive initial and annual refresher training in accordance with *29 CFR 1910.120(e) – Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard. Lockheed Martin shall be provided with electronic copies of the training certificates.

3.20.4 Medical Surveillance: Contractor employees must be enrolled in a medical surveillance program prior to performing hazardous waste operations. Upon Lockheed Martin request, Contractor shall provide evidence of employee enrollment in a medical surveillance program. Lockheed Martin does not provide medical surveillance examinations to Contractor employees.

3.20.5 Periodic work area inspections: Contractor agrees to perform periodic work area inspections to determine the effectiveness of the site safety and health plan and to identify and correct unsafe conditions in contractor's responsible work area. These inspections shall be documented and available to Lockheed Martin upon request for review.

3.21 MANAGEMENT OF NANOTECHNOLOGY

3.21.1 The Lockheed Martin Project Lead shall work with the designated contractor responsible for nanotechnology to implement this procedure and ensure areas where nanomaterials (materials incorporating engineered nanoparticles or nanoscale features that exhibit unique physical and chemical properties as a result of the nanoparticles or nanoscale features) will be used meet engineering control requirements of this procedure.

3.21.2 The contractor shall ensure that the safety and environmental hazards of nanomaterials are managed as described in the requirements of this section.

3.21.3 A plan must be developed and executed that addresses the following requirements:

3.21.3.1 **Hazard Analysis:** Identify potential adverse health effects and environmental impacts that could result from the chemical and physical properties exhibited by the nanomaterials and/or nanoparticles in use, to be used, under development, or to be developed at the site.

3.21.3.2 **Exposure Assessment**: Evaluate all tasks involving nanomaterials and identify where exposures could occur. The evaluation must include at a minimum, an evaluation of materials; chemical intermediates; by-products; end-products; waste products; processes; process equipment; the amount of material used; material form; degree of containment; duration of use; and work space including laboratory and manufacturing space.

3.21.3.3 **Exposure Control**

- Implement appropriate controls to mitigate worker exposure and environmental emissions identified in sections 3.21.2.1 and 3.21.2.2 of this procedure.

- Implement Control Bands as indicated on the Control Band Matrix below.

Exposure Duration	Bound Materials	Potential Release	Free / Unbound
Hazard Group A (Known to be inert)			
Short	1	1	2
Medium	1	1	2
Long	1	2	2
Hazard Group B (Understand reactivity/function)			
Short	1	2	2
Medium	1	2	3
Long	1	3	3
Hazard Group C (Unknown Properties)			
Short	2	2	3
Medium	2	3	4
Long	2	4	4

Duration Key:
Short - Less than 4 hrs/day; 2 days/week
Medium - Between 4 to 6 hrs/day; 3 to 5 days/week
Long - 6 to > 8 hrs/day; 3 to 5 days/week

Release Key:
Bound Materials: Nanoparticles in a solid matix e.g. polycarbonate
Potential Release: Nanoparticles in friable or solgel matrix
Free / Unbound: Nanoparticles unbound, not aggregated

Control Band:
1. General Ventilation and PPE
2. Engineering Controls and/or Respirators and additional PPE
3. Containment e.g. glove box
4. Specialist Advise

- Establish designated areas for Control Banding. The designated area shall, at a minimum, include warning signs informing employees that they are entering a nanomaterial work area as well as signs specifying administrative controls and personal protective equipment (PPE) required for entry.
- Identify appropriate administrative controls (e.g. good housekeeping methods, HEPA vacuums, wet wipe methods, employee training, safe work practices), engineering controls (e.g. containment, exhaust ventilation) and Personal Protective Equipment (e.g. respiratory protection, protective coveralls, gloves, goggles) based on Control Band and best industry practices.
- Develop and execute procedures for housekeeping, including clean-as-you-go practices that do not re-suspend particles.
- Develop and execute procedures for management of nanomaterial-associated waste.

4 ENVIRONMENTAL

Contractors shall comply with all applicable provisions of Federal, State, municipal, local, and other environmental statutes, rules, and regulations. Contractor shall take all necessary precautions to protect the environment. Contractor shall also store, transport, dispose, or otherwise handle hazardous wastes and non-hazardous wastes to prevent discharges of materials into the environment except in accordance with applicable governmental regulations.

4.1 HAZARD COMMUNICATION - USE OF HAZARDOUS MATERIALS

4.1.1 Contractor shall develop a Waste Management Plan in accordance with the requirements outlined in the LMC Remediation Waste Management Procedure in

Appendix B. Lockheed Martin shall approve the Waste Management Plan prior to work commencement.

4.1.2 Contractor must segregate hazardous from non-hazardous waste; all hazardous waste generated by its operations must be labeled in accordance with all governmental regulations.

4.1.3 Contractor shall dispose of all hazardous waste within the time frame stipulated by local, state, or federal regulations. Contractor shall not leave behind on Lockheed Martin remediation sites any containers of hazardous materials or waste (including drums, roll-offs, maintenance chemicals, etc.), empty or not, after the termination of operations.

4.1.4 In case of a spill or release of hazardous materials or waste, Contractor shall immediately notify the Lockheed Martin Project Lead and if the severity of the spill warrants, notify the local fire department (Call 9-1-1). The Contractor shall be liable for the costs of any spill resulting from Contractor's actions, including, but not limited to, costs of containment, cleanup, and disposal.

4.2 NON-HAZARDOUS WASTE DISPOSAL

4.2.1 Contractor shall develop a Waste Management Plan in accordance with the requirements outlined in the LMC Remediation Waste Management Procedure in Appendix B. This plan must be approved by the Lockheed Martin Project Lead.

4.3 WORK INVOLVING AIR EMISSIONS

4.3.1 Contractor shall work with the Lockheed Martin Project Lead to identify applicable Federal, state, and/or local permit application requirements for air emission sources (i.e., stationary point source, fugitive emissions, etc.) associated with the anticipated project.

4.3.2 Contractor shall submit permit applications and/or notifications to the Lockheed Martin Project Lead for review prior to submittal to the applicable regulatory agency.

4.3.3 Contractor shall abide by the requirements of the permit(s) and gather emissions data (as applicable) to document compliance. This data shall be electronically submitted to the Lockheed Martin Project Lead.

4.3.4 Contractor shall immediately contact the Lockheed Martin Project Lead in the event permit conditions are not met.

4.3.5 Ensure permits are posted on permitted equipment (or in close proximity) as required by the respective permit.

4.4 WORK INVOLVING WATER DISCHARGES

4.4.1 At no time is an unauthorized, unpermitted release allowed. Contractor shall notify the Lockheed Martin Project Lead in the event of a release and obtain the approval of Lockheed Martin before discharging any material into storm drains or sewers.

4.4.2 Contractor shall work with the Lockheed Martin Project Lead to identify applicable National Pollutant Discharge Elimination System (NPDES), Stormwater Pollution Prevention Plans (SWPPP), and POTW requirements associated with the anticipated project.

4.4.3 Contractor shall submit permit applications and/or Notice of Intent forms to the Lockheed Martin Project Lead for review prior to submittal to the applicable regulatory agency.

4.4.4 Contractor shall abide by the requirements of the discharge permit(s) and maintain discharge monitoring information and inspection data to document compliance. This documentation shall be electronically provided to the Lockheed Martin Project Lead.

4.4.5 Contractor shall immediately contact the Lockheed Martin Project Lead in the event permit conditions are not met.

5 HOUSEKEEPING / CLEANUP

5.1 Ensure discharge permits and/or SWPPP plans (as applicable) are available at the project job site.

5.2 Contractor shall continuously clean up its respective work area(s). Contractor shall maintain its work areas free from all slip, trip, and fall hazards at all times.

5.3 Debris shall be kept cleared from work areas, passageways, stairs, and in and around buildings or other structures. The work area must be left free from accumulation of waste and rubbish at the end of each work shift.

5.4 Combustible scrap and debris shall be removed at regular intervals during the course of work performed by Contractor. Safe means shall be provided to facilitate such removal.

5.5 At the end of each working day and/or the conclusion of work being performed, Contractor shall restore the work area to the same degree of neatness as when work commenced.

5.6 Contractor shall furnish necessary equipment and/or receptacles to remove waste and rubbish from the job site unless otherwise specified by the Lockheed Martin.

6 CHANGE MANAGEMENT

If deviations are encountered from the field work plan, the contractor shall A) notify to the Lockheed Martin Project Lead and B) suspend work to assess changes to the work plan(s) and the HASP. Changes to the work plan(s) and the HASP shall be reviewed by the PL.

7 REQUIREMENT TO PERFORM & DOCUMENT SELF-AUDITS

7.1 Contractor agrees to perform periodic work area/project field inspections to monitor compliance with project environmental, safety and health (ESH) requirements. The name of Contractor’s jobsite ESH representative will be provided to Lockheed Martin prior to the Contractor starting work at the jobsite.

7.2 For jobs that are ongoing, an annual ESH audit shall be conducted and for jobs with a duration of less than one year at least one audit shall occur. A competent ESH representative designated by the Contractor shall perform the audit. Unsafe acts and/or non-compliance conditions noted during inspections shall be corrected immediately.

7.3 The documentation related to the audits and inspections shall be submitted electronically to the Lockheed Martin Project Lead.

8 ACCIDENT, INJURY, ILLNESS, INCIDENT and SPILL REPORTING

8.1 Contractor shall immediately contact the Lockheed Martin Project Lead and/or Lockheed Martin Safety & Health Manager in the event of a fatality, injury, environmental release (spill), near-miss incident, or any ESH incident that is likely to generate significant publicity. <u>A written report of the incident/injury/spill and corrective action(s) taken shall be submitted to the Lockheed Martin Project Lead within one (1) day of the incident</u>. Representatives from Lockheed Martin may conduct joint investigations with the contractor if deemed necessary.

8.2 In case of a spill or release of hazardous chemicals, Contractor shall immediately notify the Lockheed Martin Project Lead, and/or if the severity of the spill warrants, the local fire department by calling 9-1-1. Contractor shall take all necessary steps to control the spread of the release and to provide site control to prevent unauthorized personnel from entering the affected area. The Contractor shall be liable for the costs of any spill resulting from Contractor's actions, including, but not limited to, costs of containment, cleanup, and disposal.

9 FINES, PENALTIES AND COSTS

9.1 Contractor shall indemnify and hold Lockheed Martin harmless from any and all liability (including but not limited to fines and penalties), loss, cost, damage, or expense (including attorney's fees) suffered or incurred by Lockheed Martin by reason of Contractor's failure to comply with Federal, State, municipal, local or other laws, rules, regulations, ordinances and requirements, or failure to comply with generally accepted environmental safety and health practices.

10 LOCKHEED MARTIN ESH MANAGER

10.1 The Lockheed Martin ESH Manager is Jimmy Yeager. Contact Jimmy regarding any questions or concerns at (301) 873-1444 or via email at james.l.yeager@lmco.com.

Appendix A – LMC Requirements for Invasive Fieldwork

LMC Minimum
Requirements for Inv

Appendix B – LMC Waste Management Procedure

LMC Waste Mgmt
Procedure Rev 4

LOCKHEED MARTIN

CONTRACTOR'S ESH HANDBOOK

COMPLIANCE AGREEMENT

The Key National Contractor Program Manager has read and understands the contents of the *Contractor's ESH Handbook*. Contractor agrees while performing work on Lockheed Martin-owned or Lockheed Martin-controlled premises, that the Contractor shall require its employees and subcontractors at any tier to comply with the contents of this *Contractor's ESH Handbook* and the job specific HASP. A copy of the HASP shall be maintained at the job site and made readily available to contractor and subcontractor employees for their information. All contractor employees and subcontractors shall read and certify that they have read and understand the job specific health and safety plan (HASP). The certification forms shall be electronically sent to the Lockheed Martin Project Lead.

I further understand that this handbook and the rules and regulations it contains do not in any way relieve the Contractor (employer) of its responsibility to comply with the applicable environmental safety and health (ESH) regulations and its obligation to implement and enforce its own written ESH programs while working on this project.

Company: ____

Name: ____

Signature: ____

Title: ____

Date: ____

COMPLETE, SIGN AND RETURN THIS CERTIFICATE TO THE LOCKHEED MARTIN ESH MANAGER.

ATTACHMENT II

INCIDENT REPORT FORM

Tetra Tech.
Incident Report

Report Date	Report Prepared By	Incident Report Number

INSTRUCTIONS:

All incidents (including those involving subcontractors under direct supervision of Tetra Tech personnel) must be documented on the IR Form.

Complete any additional parts to this form as indicated below for the type of incident selected.

TYPE OF INCIDENT (Check all that apply)		Additional Form(s) Required for this type of incident
Near Miss (No losses, but could have resulted in injury, illness, or damage)	☐	Complete IR Form Only
Injury or Illness	☐	Complete Form IR-A; Injury or Illness
Property or Equipment Damage, Fire, Spill or Release	☐	Complete Form IR-B; Damage, Fire, Spill or Release
Motor Vehicle	☐	Complete Form IR-C; Motor Vehicle

INFORMATION ABOUT THE INCIDENT

Description of Incident

____

____

____

Date of Incident	Time of Incident
	____________ AM ☐ PM ☐ *OR* Cannot be determined ☐
Weather conditions at the time of the incident	**Was there adequate lighting?**
	____________ Yes ☐ No ☐

Location of Incident

____________________ Was location of incident within the employer's work environment? Yes ☐ No ☐

Street Address	City, State, Zip Code and Country
Project Name / Project #	**Client:**
Tt Supervisor or Project Manager	**Was supervisor on the scene?**
	Yes ☐ No ☐

WITNESS INFORMATION (attach additional sheets if necessary)

Name	Company
Street Address	**City, State and Zip Code**
Telephone Number(s)	

CORRECTIVE ACTIONS

Corrective action(s) immediately taken by unit reporting the incident:

____

____

____

Corrective action(s) still to be taken (by whom and when):

____

____

____

ROOT CAUSE ANALYSIS LEVEL REQUIRED

Root Cause Analysis Level Required: Level - 1 ☐ Level - 2 ☐ None ☐

Root Cause Analysis Level Definitions

Level - 1	**Definition:** A Level 1 RCA is conducted by an individual(s) with experience or training in root cause analysis techniques and will conduct or direct documentation reviews, site investigation, witness and affected employee interviews, and identify corrective actions. Activating a Level 1 RCA and identifying RCA team members will be at the discretion of the Corporate Administration office. The following events may trigger a Level 1 RCA: ▪ Work related fatality ▪ Hospitalization of one or more employee where injuries result in total or partial permanent disability ▪ Property damage in excess of $75,000 ▪ When requested by senior management
Level - 2	**Definition:** A Level 2 RCA is self performed within the operating unit by supervisory personnel with assistance of the operating unit HSR. Level 2 RCA will utilize the 5 Why RCA methodology and document the findings on the tools provided. The following events will require a Level 2 RCA: ▪ OSHA recordable lost time incident ▪ Near miss incident that could have triggered a Level 1 RCA ▪ When requested by senior management

Complete the Root Cause Analysis Worksheet and Corrective Action form. Identify a corrective action(s) for each root cause identified within each area of inquiry.

NOTIFICATIONS

Title	Printed Name	Signature	Telephone Number	Date
Project Manager or Supervisor				
Site Safety Coordinator or Office H&S Representative				
Operating Unit H&S Representative				
Other: ____________________				

The signatures provided above indicate that appropriate personnel have been notified of the incident.

TETRA TECH, INC.
Safety Excellence

TETRA TECH, INC.
INCIDENT FORM IR-A

INSTRUCTIONS:

Complete all sections below for incidents involving injury or illness.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)

EMPLOYEE INFORMATION

Company Affiliation

Tetra Tech Employee? ☐ TetraTech subcontractor employee (directly supervised by Tt personnel)? ☐

Full Name	**Company (if not Tt employee)**

Street Address, City, State and Zip Code

____

____

Address Type

Home address (for Tt employees) ☐

Business address (for subcontractors) ☐

Telephone Numbers

Work: ________	Home: ________	Cell: ________

Occupation (regular job title)	**Department**

Was the individual performing regular job duties?

Yes ☐ No ☐

Time individual began work

________ AM ☐ PM ☐ *OR* Cannot be determined ☐

Safety equipment

Provided? Yes ☐ No ☐

Used? Yes ☐ No ☐ If no, explain why

____

____

____

Type(s) provided:

☐ Hard hat ☐ Protective clothing
☐ Gloves ☐ High visibility vest
☐ Eye protection ☐ Fall protection
☐ Safety shoes ☐ Machine guarding
☐ Respirator ☐ Other (list)

____

NOTIFICATIONS

Name of Tt employee to whom the injury or illness was first reported	**Was H&S notified within one hour of injury or illness?**
	Yes ☐ No ☐
Date of report	**H&S Personnel Notified**
Time of report	**Time of Report**

If subcontractor injury, did subcontractor's firm perform their own incident investigation?

Yes ☐ No ☐ If yes, request a copy of their completed investigation form/report and attach it to this report.

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INCIDENT FORM IR-A

INJURY / ILLNESS DETAILS

What was the individual doing just before the incident occurred? Describe the activity as well as the tools, equipment, or material the individual was using. Be specific. Examples: "Climbing a ladder while carrying roofing materials"; "Spraying chlorine from a hand sprayer"; "Daily computer key-entry"

____

____

____

What Happened? Describe how the injury occurred. Examples: "When ladder slipped on wet floor and worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; Worker developed soreness in wrist over time"

____

____

____

____

Describe the object or substance that directly harmed the individual: Examples: "Concrete floor"; "Chlorine"; "Radial Arm Saw". If this question does not apply to the incident, write "Not Applicable".

____

____

MEDICAL CARE PROVIDED

Was first aid provided at the site: Yes ☐ No ☐ If yes, describe the type of first aid administered and by whom?

____

Was treatment provided away from the site: Yes ☐ No ☐ If yes, provide the information below.

Name of physician or health care professional	**Facility Name**
Street Address, City State and Zip Code	**Type of Care?**
______________________ ______________________	Was individual treated in emergency room? Yes ☐ No ☐ Was individual hospitalized overnight as an in-patient? Yes ☐ No ☐
Telephone Number	Did the individual die? Yes ☐ No ☐ If yes, date: ________
	Will a worker's compensation claim be filed? Yes ☐ No ☐

NOTE: Attach any police reports or related diagrams to this report.

SIGNATURES

I have reviewed this report and agree that all the supplied information is accurate

Affected individual (print)	**Affected individual (signature)**	**Telephone Number**	**Date**

This form contains information relating to employee health and must be used in a manner that protects the confidentiality of the employee to the extent possible while the information is being used for occupational safety and health purposes.

TETRA TECH, INC.
Safety Excellence

TETRA TECH, INC.
INCIDENT FORM IR-B

INSTRUCTIONS:

Complete all sections below for incidents involving property/equipment damage, fire, spill or release.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

TYPE OF INCIDENT (Check all that apply)

Property Damage ☐ Equipment Damage ☐ Fire or Explosion ☐ Spill or Release ☐

INCIDENT DETAILS

Results of Incident: Fully describe damages, losses, etc.

____
____
____

Response Actions Taken:

____
____
____

Responding Agency(s) (i.e. police, fire department, etc.)	**Agency(s) Contact Name(s)**

DAMAGED ITEMS (List all damaged items, extent of damage and estimated repair cost)

Item:	**Extent of damage:**	**Estimated repair cost**

SPILLS / RELEASES (Provide information for spilled/released materials)

Substance	**Estimated quantity and duration**	**Specify Reportable Quantity (RQ)**
		________ Exceeded? Yes ☐ No ☐ NA ☐

FIRES / EXPLOSIONS (Provide information related to fires/explosions)

Fire fighting equipment used? Yes ☐ No ☐ If yes, type of equipment: ______________________________

NOTIFICATIONS

Required notifications	**Name of person notified**	**By whom**	**Date / Time**
Client: ______________ Yes ☐ No ☐			
Agency: ______________ Yes ☐ No ☐			
Other: ______________ Yes ☐ No ☐			

Who is responsible for reporting incident to outside agency(s)? Tt ☐ Client ☐ Other ☐ Name: ______________

Was an additional written report on this incident generated? Yes ☐ No ☐ If yes, place in project file.

TETRA TECH, INC.
Safety Excellence

TETRA TECH, INC.
INCIDENT FORM IR-C

INSTRUCTIONS:

Complete all sections below for incidents involving motor vehicle accidents. Do NOT leave any blanks. Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)	

INCIDENT DETAILS

Name of road, street, highway or location where accident occurred	**Name of intersecting road, street or highway if applicable**	
County	**City**	**State**

Did police respond to the accident?	**Did ambulance respond to the accident?**
Yes ☐ No ☐	Yes ☐ No ☐
Name and location of responding police department	**Ambulance company name and location**
Officer's name/badge #	

Did police complete an incident report? Yes ☐ No ☐ If yes, police report number: ______________________
Request a copy of completed investigation report and attach to this form.

VEHICLE INFORMATION

How many vehicles were involved in the accident? _______________ (Attach additional sheets as applicable for accidents involving more than 2 vehicles.)

Vehicle Number 1 – Tetra Tech Vehicle		**Vehicle Number 2 – Other Vehicle**	
Vehicle Owner / Contact Information		**Vehicle Owner / Contact Information**	
Color		**Color**	
Make		**Make**	
Model		**Model**	
Year		**Year**	
License Plate #		**License Plate #**	
Identification #		**Identification #**	
Describe damage to vehicle number 1		**Describe damage to vehicle number 2**	
Insurance Company Name and Address		**Insurance Company Name and Address**	
Agent Name **Agent Phone No.**		**Agent Name** **Agent Phone No.**	
Policy Number		**Policy Number**	

TETRA TECH, INC. Safety Excellence

TETRA TECH, INC.
INCIDENT FORM IR-C

DRIVER INFORMATION

Vehicle Number 1 – Tetra Tech Vehicle		Vehicle Number 2 – Other Vehicle	
Driver's Name		Driver's Name	
Driver's Address		Driver's Address	
Phone Number		Phone Number	
Date of Birth		Date of Birth	
Driver's License #		Driver's License #	
Licensing State		Licensing State	
Gender	Male ☐ Female ☐	Gender	Male ☐ Female ☐
Was traffic citation issued to Tetra Tech driver? Yes ☐ No ☐		Was traffic citation issued to driver of other vehicle? Yes ☐ No ☐	
Citation #		Citation #	
Citation Description		Citation Description	

PASSENGERS IN VEHICLES (NON-INJURED)

List all non-injured passengers (excluding driver) in each vehicle.
Driver information is captured in the preceding section.
Information related to persons injured in the accident (non-Tt employees) is captured in the section below on this form.
Injured Tt employee information is captured on FORM IR-A

Vehicle Number 1 – Tetra Tech Vehicle		Vehicle Number 2 – Other Vehicle	
How many passengers (excluding driver) in the vehicle? ___		How many passengers (excluding driver) in the vehicle? ___	
Non-Injured Passenger Name and Address		Non-Injured Passenger Name and Address	
Non-Injured Passenger Name and Address		Non-Injured Passenger Name and Address	
Non-Injured Passenger Name and Address		Non-Injured Passenger Name and Address	

INJURIES TO NON-TETRATECH EMPLOYEES

Name of injured person 1				Address of injured person 1		
Age	Gender	Car No.	Location in Car	Seat Belt Used?	Ejected from car?	Injury or Fatality?
	Male ☐ Female ☐			Yes ☐ No ☐	Yes ☐ No ☐	Injured ☐ Died ☐
Name of injured person 2				Address of injured person 2		
Age	Gender	Car No.	Location in Car	Seat Belt Used?	Ejected from car?	Injury or Fatality?
	Male ☐ Female ☐			Yes ☐ No ☐	Yes ☐ No ☐	Injured ☐ Died ☐

OTHER PROPERTY DAMAGE

Describe damage to property other than motor vehicles	
Property Owner's Name	Property Owner's Address

COMPLETE AND SUBMIT DIAGRAM DEPICTING WHAT HAPPENED

ATTACHMENT III

MEDICAL DATA SHEET

MEDICAL DATA SHEET

This Medical Data Sheet must be completed by on-site personnel and kept in the command post during the conduct of site operations. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

Project ______________________________

Name ______________________ Home Telephone __________

Address ______________________________

Age __________ Height ______________ Weight ____________

Person to notify in the event of an emergency: Name: ______________________

Phone: ________________

Drug or other Allergies: ______________________________

Particular Sensitivities : ______________________________

Do You Wear Contacts?______________________________

What medications are you presently using? ______________________________

____

Name, Address, and Phone Number of personal physician: ________________

____

____

Note: Health Insurance Portability and Accountability Act (HIPAA) Requirements

HIPAA took effect April 14, 2003. Loosely interpreted, HIPAA regulates the disclosure of Protected Health Information (PHI) by the entity collecting that information. PHI is any information about health status (such as that you may report on this Medical Data Sheet), provision of health care, or other information. HIPAA also requires Tetra Tech to ensure the confidentiality of PHI. This Act can affect the ability of the Medical Data Sheet to contain and convey information you would want a Doctor to know if you were incapacitated. So before you complete the Medical Data Sheet understand that this form will not be maintained in a secure location. It will be maintained in a file box or binder accessible to other members of the field crew so that they can accompany an injured party to the hospital.

DO NOT include information that you do not wish others to know, only information that may be pertinent in an emergency situation or treatment.

________________ ________________ __________

Name (Print clearly) Signature Date

ATTACHMENT IV

SAFE WORK PERMITS

SAFE WORK PERMIT
MOBILIZATION AND DEMOBILIZATION ACTIVITIES
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND

Permit No. _______________ Date: ___________________ Time: From _____________ to _____________

I. Work limited to the following (description, area, equipment used): Mobilization and demobilization activities

II. Primary Hazards: Lifting; slips, trips and falls; vehicular and foot traffic; insect/animal bites and stings; poisonous plants; inclement weather.

III. Field Crew: ______________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector ____________Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector ____________Tetra Tech

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, or coveralls, safety, glasses and safety footwear. Hard hats and hearing protection will be worn when working near operating equipment.

VI.

Chemicals of Concern	**Hazard Monitoring / Action Level(s)**	**Response Measures**
None anticipated	None	None

Primary Route(s) of Exposure/Hazard: NA

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio/Cellular Phone	☐ Yes	☒ No
Splash Shield	☐ Yes	☒ No	Barricades	☐ Yes	☒ No
Splash suits/coveralls	☐ Yes	☒ No	Gloves (Type – Work)	☒ Yes	☐ No
Impermeable apron	☐ Yes	☒ No	Work/rest regimen	☐ Yes	☒ No
Steel toe work shoes/boots	☒ Yes	☐ No	Chemical Resistant Boot Covers	☐ Yes	☐ No
High visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire Extinguisher	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☐ No	Other	☐ Yes	☐ No

Modifications/Exceptions: Tyvek coverall to protect against natural hazards (e.g., ticks) if working/walking through areas of high grass. Use insect repellants containing at least 10% DEET and tape up in such areas. Follow manufacturer's recommendations for proper application and reapplication. Hard hat when overhead hazards exist. Safety glasses when near eye hazards. Hearing protection when in high noise areas.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc)	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Review PPE needs based on activities being performed and the associated hazards. Use safe lifting procedures and obtain assistance when handling heavy or awkward objects. Suspend site activities in the event of inclement weather. Observe site workers for signs and symptoms of heat/cold stress. Use sun block (SPF > 15) to prevent sunburn if necessary.

Permit Issued by:______________________ Permit Accepted by:______________________

SAFE WORK PERMIT
TEST PIT EXCAVATION AND SAMPLING ACTIVITIES
LOCKHEED MARTIN MSA

Permit No. ________________ Date: ____________________ Time: From _____________ to _____________

I. **Work limited to the following (description, area, equipment used):** Test pit excavation and sampling activities – may include confined space entry and step trenching (if necessary)

II. **Primary Hazards:** Contact with site contaminants; transfer of contamination; heavy lifting; slip, trip and fall; cuts and lacerations; vehicular and foot traffic; ambient temperature extremes; insect/animal bites and stings, poisonous plants, inclement weather, heavy equipment and excavation hazards, possible confined space entry

III. **Field Crew:** ______________________________

IV. **On-site Inspection conducted** ☐ Yes ☐ No Initials of Inspector ____________ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector ____________ Tetra Tech

V. **Protective equipment required**
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, or coveralls, safety, glasses and safety footwear. Hard hats and hearing protection will be worn when working near operating equipment.

VI.

Chemicals of Concern	Hazard Monitoring /Action Level(s)		Response Measures
VOC's, SVOC's	PID with 10.6 eV (or greater) probe	>10 ppm above BGL in BZ no more than 4 exposures of 5 minutes a day	Monitor Breathing zone (BZ) areas Retreat upwind to unaffected area
Metals	Visual Observation	Visible dust	Employ area wetting methods to suppress dust generation

Primary Route(s) of Exposure/Hazard: inhalation, dermal, ingestion

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. **Additional Safety Equipment/Procedures**

	Yes	No		Yes	No
Hard-hat	☒	☐	Hearing Protection (Plugs/Muffs)	☒	☐
Safety Glasses	☒	☐	Safety belt/harness/lifeline	☒	☒
Chemical/splash goggles	☐	☒	Radio/Cellular Phone	☐	☒
Splash Shield	☐	☐	Barricades	☐	☒
Splash suits/coveralls	☐	☐	Gloves (Type – Work)	☒	☐
Impermeable apron	☐	☒	Work/rest regimen	☐	☒
Steel toe work shoes/boots	☒	☐	Chemical Resistant Boot Covers	☐	☐
High visibility vest	☐	☐	Tape up/use insect repellent	☐	☐
First Aid Kit	☐	☐	Fire Extinguisher	☐	☐
Safety Shower/Eyewash	☐	☐	Other	☐	☐

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety footwear, and nitrile gloves Tyvek coverall to protect against natural hazards (e.g., ticks) if working/walking through areas of high grass. Use insect repellants containing at least 10% DEET and tape up in such areas. Follow manufacturer's recommendations for proper application and reapplication. Complete Heavy Equipment Inspection Checklist must be completed prior to work beginning. An Excavation Competent Person must be specifically identified to handle this responsibility prior to work beginning in the specified space provided (Section 1.3) in this HASP. Detailed Excavation Safety Procedures and the Excavation Competent Person Checklist and Heavy Equipment Inspection Checklist are included in Attachments IV, V, and VI and must be completed prior to beginning work. The OSHA Health and Safety Construction-Related regulations P-650 to 699 – Subpart P – Excavations are included in Attachment VII and must be followed during all excavation work. See Section 5 of the HASP for further details. If confined space entry is necessary, review the Tetra Tech Confined Space Entry Program and Procedures in Attachment VIII and complete the Confined Space Checklist in Attachment VIII prior to beginning work.

VIII. **Site Preparation**

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. **Additional Permits required** (Hot work, confined space entry, excavation etc.)........ ☐ Yes ☒ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. **Special instructions, precautions:** Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Review PPE needs based on activities being performed and the associated hazards. Use safe lifting procedures and obtain assistance when handling heavy or awkward objects. Suspend site activities in the event of inclement weather. Observe site workers for signs and symptoms of heat/cold stress. Use sun block (SPF > 15) to prevent sunburn if necessary.

Permit Issued by: ______________________________ Permit Accepted by: ______________________________

SAFE WORK PERMIT
SOIL BORING MONITORING WELL INSTALLATION
CPT/MP INVESTIGATION
LOCKHEED MARTIN AT MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND

Permit No. _______________ Date: ___________________ Time: From _____________ to _________

I. Work limited to the following (description, area, equipment used): Soil Boring and Monitoring well installation via DPT Drill Rigs. This task includes MIP/CPT Investigation and sampling soil sampling will occur concurrently with these operations. Also includes concrete coring.

II. Primary Hazards: Contact with contaminated soil or groundwater; transfer of contamination; heavy equipment hazards; noise exposures; contact with energized systems/utilities; heavy lifting; slip, trip and fall; cuts and lacerations; vehicular and foot traffic; insect/animal bites and stings, , inclement weather

III. Field Crew: ____________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____Tetra Tech

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐
Modifications/Exceptions: ____________________

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

VI.

Chemicals of Concern	**Hazard Monitoring**	**/Action Level(s)**	**Response Measures**
VOC's, SVOC's	PID with 10.6 eV (or greater) probe	>10 ppm above BGL in BZ no more than 4 exposures of 5 minutes a day	Monitor Breathing zone (BZ) areas Retreat upwind to unaffected area
Metals	Visual Observation	Visible dust	Employ area wetting methods to suppress dust generation

Primary Route(s) of Exposure/Hazard: Airborne concentrations of VOCs will be monitored through the use of the PID to prevent exposures via inhalation. Incidental ingestion and contact with contaminants will be prevented through the use of PPE and safe work practices. Exposure symptoms can include irritation of eyes, skin, mucous membranes, dizziness, nausea, blurred vision, or narcotic effects,

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☒ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☒ Yes	☐ No
Safety Glasses	☒ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio/Cellular Phone	☐ Yes	☐ No
Splash shield	☐ Yes	☒ No	Barricades	☐ Yes	☐ No
Splash suits/coveralls	☐ Yes	☐ No	Gloves (Type – nitrile/work)	☒ Yes	☐ No
Impermeable apron	☐ Yes	☒ No	Work/rest regimen	☐ Yes	☐ No
Steel toe work shoes/boots	☒ Yes	☐ No	Chemical resistant boot covers	☐ Yes	☐ No
High visibility vest	☐ Yes	☐ No	Tape up/use insect repellent	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No	Fire extinguisher	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☒ No	Other	☐ Yes	☐ No

Modifications/Exceptions: Coveralls if the potential for soiling work clothing exists. Other PPE may be specified by the SSO based on conditions (rain gear, rubber boots, etc.), cut resistant gloves during soil sampling, reflective vests in thigh traffic areas.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc.)	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090 (Excavation Permit is Required)

X. Special instructions, precautions: Use safe lifting/carrying techniques. Inspect equipment prior to use. Ensure emergency stop devices are functional and initially and then at least weekly thereafter. Minimize contact with potentially contaminated media. Tape up and use insect repellants in high grass or brush areas.

Permit Issued by:______________________ Permit Accepted by:______________________

SAFE WORK PERMIT
MONITORING WELL DEVELOPMENT AND MULTIMEDIA SAMPLING
LOCKHEED MARTIN AT MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND

Permit No. _______________ Date: ____________________ Time: From ______________ to __________

I. Work limited to the following (description, area, equipment used): Monitoring well development, surface, sediment,surface and groundwater sampling, synoptic water levels and aquifer pump testing are part of this task.

II. Primary Hazards: Contact with site contaminants; transfer of contamination; heavy lifting; slip, trip and fall; ambient temperature extremes; insect/animal bites and stings, inclement weather.

III. Field Crew: ____________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector ____________ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector ____________ Tetra Tech

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: ____________________

VI.

Chemicals of Concern	**Hazard Monitoring /Action Level(s)**		**Response Measures**
VOC's, SVOC's	PID with 10.6 eV (or greater) probe	>10 ppm above BGL in BZ no more than 4 exposures of 5 minutes a day	Monitor Breathing zone (BZ) areas Retreat upwind to unaffected area
Metals	Visual Observation	Visible dust	Employ area wetting methods to suppress dust generation

Primary Route(s) of Exposure/Hazard: Airborne concentrations of VOCs will be monitored through the use of the PID to prevent exposures via inhalation. Incidental ingestion and contact with contaminants will be prevented through the use of PPE and safe work practices. Exposure symptoms can include irritation of eyes, skin, mucous membranes, dizziness, nausea, blurred vision, or narcotic effects

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☒ No
Safety Glasses	☒ Yes	☐ No
Chemical/Splash Goggles	☐ Yes	☒ No
Splash Shield	☐ Yes	☒ No
Splash Suits/Coveralls	☐ Yes	☒ No
Impermeable Apron	☐ Yes	☒ No
Steel Toe Work Shoes or Boots	☒ Yes	☐ No
High Visibility Vest	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☐ No
Hearing Protection (Plugs/Muffs)	☐ Yes	☒ No
Safety Belt/Harness	☐ Yes	☒ No
Radio/Cellular Phone	☐ Yes	☐ No
Barricades	☐ Yes	☐ No
Gloves (Type – Nitrile)	☒ Yes	☐ No
Work/rest regimen	☐ Yes	☒ No
Chemical Resistant Boot Covers	☐ Yes	☐ No
Tape/Insect Repellent	☐ Yes	☐ No
Fire Extinguisher	☐ Yes	☐ No
Other	☐ Yes	☐ No

Modifications/Exceptions: Boot covers may be specified if work area is muddy. Reflective vests may be required if working near or high traffic areas.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Use safe lifting/carrying techniques. Inspect equipment prior to use. Minimize contact with potentially contaminated media. Tape up and use insect repellants in high grass or brush areas.

Permit Issued by: ______________________ Permit Accepted by: ______________________

SAFE WORK PERMIT
LAND, EM GEOPHYSICAL WETLAND SURVEYING
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND

Permit No. _______________ Date: ___________________ Time: From _____________ to _________

I. Work limited to the following (description, area, equipment used): Surveying activities both geophysical, geographical and wetland.

II. Primary Hazards: Potential hazards associated with this task: slip, trip and fall; vehicular and foot traffic; temperature extremes; inclement weather; insect /animal bites or stings, poisonous plants, etc.

III. Field Crew: ____________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____Tetra Tech

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: ____________________

VI.

Chemicals of Concern	**Hazard Monitoring**	**Action Level(s)**	**Response Measures**
None expected during this task	NA	NA	NA

Primary Route(s) of Exposure/Hazard: ____________________

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☒ No
Safety Glasses	☐ Yes	☐ No
Chemical/splash goggles	☐ Yes	☒ No
Splash Shield	☐ Yes	☒ No
Splash suits/coveralls	☐ Yes	☐ No
Impermeable apron	☐ Yes	☒ No
Steel toe work shoes or boots	☒ Yes	☐ No
High Visibility vest	☐ Yes	☐ No
First Aid Kit	☐ Yes	☐ No
Safety Shower/Eyewash	☐ Yes	☒ No
Hearing Protection (Plugs/Muffs)	☐ Yes	☒ No
Safety belt/harness	☐ Yes	☒ No
Radio/Cellular Phone	☐ Yes	☐ No
Barricades	☐ Yes	☒ No
Gloves (Type – Work)	☐ Yes	☐ No
Work/rest regimen	☐ Yes	☐ No
Chemical Resistant Boot Covers	☐ Yes	☒ No
Tape up/use insect repellent	☐ Yes	☐ No
Fire Extinguisher	☐ Yes	☒ No
Other	☐ Yes	☐ No

Modifications/Exceptions: Tape up, use insect repellents. Follow manufacturer's label directions for application and re-application of these products. Wear snake chaps in any high grass or brush areas. Wetland Servey use hip waders and a ranging pole.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Suspend activities in the event of inclement weather. For wetland surveys conducted in water follow the procedures outlined in Section 5.8 . For the wetland survey follow the procedure outlined in Section 5.4 of this HASP for safe work procedures.

Permit Issued by: ____________________ Permit Accepted by: ____________________

SAFE WORK PERMIT
SOIL BORING AND MONITORING/DEEP WELL INSTALLATION
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND

Permit No. ________ Date: ________ Time: From ________ to ________

I. Work limited to the following (description, area, equipment used): Soil boring and monitoring well installation. Soil boring will generally be performed using DPT and HSA Rigs, while the monitoring wells will be installed via HSA. This task includes well development and the installation of vapor monitoring points and installation of membrane interface probes. Deep well installation via Rotosonic drill rig from a barge will be part of this activity.

II. Primary Hazards: Contact and transfer of site contaminants; heavy equipment hazards; elevated noise; energized systems/utilities; heavy lifting; slip, trip and fall; cuts and lacerations; vehicular and foot traffic; ambient temperature extremes; flying projectiles; insect/animal bites and stings, poisonous plants, inclement weather, drowning.

III. Field Crew: ________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector ______Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector ______Tetra Tech

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: ________

VI. Chemicals of Concern

Chemicals of Concern	Hazard Monitoring	/Action Level(s)	Response Measures
VOC's, SVOC's	PID with 10.6 eV (or greater) probe	>10 ppm above BGL in BZ no more than 4 exposures of 5 minutes a day	Monitor Breathing zone (BZ) areas Retreat upwind to unaffected area
Metals	Visual Observation	Visible dust	Employ area wetting methods to suppress dust generation

Dust components may include metals, sand, grout. Encountering airborne concentrations above background levels in the breathing zone (BZ) during this activity is not anticipated based on historical source concentrations. SSO to take and record background levels at least daily.

Primary Route(s) of Exposure/Hazard: Inhalation, ingestion and skin contact. Controls include monitoring instrument use, dust control, use of PPE, and following safe work practices. VOCs – irritating at all points of contact; CNS effects (blurred vision, narcotic effects, dizziness); Extremely high concentrations may result in Irregular heartbeats, possible cardiac arrest. Sand, bentonite, grout may cause mechanical irritation (eyes) as well as potential alkali burns; respiratory, eye, and mucous membrane irritation.

Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

	Yes	No		Yes	No
Hard-hat	☒	☐	Hearing Protection (Plugs/Muffs)	☒	☐
Safety Glasses	☒	☐	Safety belt/harness	☐	☒
Chemical/splash goggles	☐	☒	Radio/Cellular Phone	☐	☐
Splash shield	☐	☒	Barricades	☐	☐
Splash suits/coveralls	☐	☐	Gloves (Type – nitrile/work)	☒	☐
Impermeable apron	☐	☒	Work/rest regimen	☐	☐
Steel toe work shoes or boots	☒	☐	Chemical resistant boot covers	☐	☐
High visibility vest	☐	☐	Tape up/use insect repellent	☐	☐
First Aid Kit	☐	☐	Fire extinguisher	☐	☐
Safety Shower/Eyewash	☐	☒	Other	☐	☐

Modifications/Exceptions: Coveralls if the potential for soiling work clothing exists. Other PPE is possible based on conditions (rain gear, rubber boots, etc.)

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☒ Yes ☐ No

If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090 (Excavation Permit is Required)

X. Special instructions, precautions: Use safe lifting/carrying techniques. Inspect equipment prior to use. Ensure emergency stop devices are functional and test daily. Minimize contact with potentially contaminated media and assume soils/groundwater are contaminated. Use waterless hand cleaner products or disinfecting wipes on boat after sampling until access to proper hands washing facilities on shore can be reached. Heavy Equipment Inspection Checklist must be completed prior to beginning work.

Permit Issued by: ________ Permit Accepted by: ________

SAFE WORK PERMIT
IDW MANAGEMENT
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND

Permit No. ________________________ Date: ______ Time: From _______ to _______

SECTION I: General Job Scope

I. **Work limited to the following (description, area, equipment used):** IDW management activities includes containerization, staging, monitoring for leaks of IDW accumulated wastes. Wastes types include soil cutting, purge and decontamination wash waters.

II. **Primary Hazards:** Lifting, pinches and compressions; flying projectiles; slips, trips, and falls and chemical contamination.

III. **Field Crew:** ____________________

IV. **On-site Inspection conducted** ☐ Yes ☐ No Initials of Inspector __________ Tetra Tech
Equipment Inspection required ☐ Yes ☒ No Initials of Inspector __________ Tetra Tech

SECTION II: General Safety Requirements (To be filled in by permit issuer)

V. **Protective equipment required**
Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required
Yes ☐ See Reverse
No ☒

Modifications/Exceptions: None anticipated

VI. Chemicals of Concern	**Hazard Monitoring /Action Level(s)**	**Response Measures**
None anticipated	N/A	N/A

Primary Route of Exposure/Hazard: inhalation, dermal, ingestion

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes or No)

VII. **Additional Safety Equipment/Procedures**

	Yes	No		Yes	No
Hard-hat	☐	☐	Hearing Protection (Plugs/Muffs)	☐	☒
Safety Glasses	☐	☐	Safety belt/harness	☐	☒
Chemical/splash goggles	☐	☒	Radio/Cellular Phone	☐	☐
Splash Shield	☐	☒	Barricades	☐	☐
Splash suits/coveralls	☐	☒	Gloves (Type – Leather/Cotton)	☒	☐
Impermeable apron	☐	☒	Work/rest regimen	☐	☒
Steel toe work shoes/boots	☒	☐	Chemical Resistant Boot Covers	☐	☒
High visibility vest	☐	☐	Tape up/use insect repellent	☐	☐
First Aid Kit	☒	☐	Fire Extinguisher	☐	☐
Safety Shower/Eyewash	☐	☒	Other	☐	☐

Modifications/Exceptions: If using pneumatic/electric power to open drums – Safety glasses are required. If power equipment is used to move drums or you are working near operating equipment hard hats will be worn. Tyvek coverall to protect against natural hazards (e.g., ticks) if working/walking through areas of high grass. Use insect repellants containing at least 10% DEET if necessary. Follow manufacturer's recommendations for proper application and reapplication. If working in areas where snakes are a threat, wear snake chaps to protect against bites. High visibility vest if near active traffic areas.

VIII. **Site Preparation**

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☒
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. **Additional Permits required** (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. **Special instructions, precautions:** Suspend site activities in the event of inclement weather. Employ proper lifting techniques. When/where possible use heavy equipment to move and place containers. When placing drums – Place the label and retention ring nut on the outside where it is readily visible. Place 4-drums to a pallet. Maintain a minimum distance of 4-feet between pallet rows. An IDW inventory shall be generated to provide the number of drums, contents, and volumes. This inventory should be provided to the facility contact. Inspect equipment prior to use.

Permit Issued by: ____________________ Permit Accepted by: ____________________

SAFE WORK PERMIT
DECONTAMINATION ACTIVITIES
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND

Permit No. ________________ Date: ____________________ Time: From ______________ to __________

I. Work limited to the following (description, area, equipment used): Decontamination of Split Spoons, MacroCore Samplers (or similar equipment) DPT drive rods, associated heavy equipment and CPT/MIB Probes and equipment. Personal decon activities. Decontamination of heavy equipment and machinery with pressure washers and/or steam cleaning units. This will be accomplished at a constructed temporary decontamination pad at the work site.

II. Primary Hazards: Contact with site contaminants; decon fluids; elevated noise; heavy lifting; slip, trip and fall; cuts; flying projectiles; inclement weather

III. Field Crew: ____________________

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____Tetra Tech

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐
Modifications/Exceptions: ____________________

Respiratory equipment required
Yes ☐ Specify on the reverse
No ☒

VI.

Chemicals of Concern	Hazard Monitoring	Action Level(s)	Response Measures
Volatile Organics Compounds (VOCs)	PID	Any detection above bkgd	Repeat decontamination procedure
Liquinox (soap)	None Required	None	Eye irritant/flush with clean water

Primary Route(s) of Exposure/Hazard: During this activity the primary concern is contact and potential absorption. Soap – Contact - eye/skin/mucous membrane irritation upon direct contact...

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

	Yes	No		Yes	No
Hard-Hat	☒	☐	Hearing Protection (Plugs/Muffs)	☒	☐
Safety Glasses	☒	☐	Safety Belt/Harness	☐	☒
Chemical/Splash Goggles	☐	☐	Radio/Cellular Phone	☐	☐
Splash Shield	☒	☐	Barricades	☐	☒
Splash Suits/Coveralls	☐	☐	Gloves (Type – Nitrile)	☒	☐
Impermeable apron	☐	☐	Work/rest Regimen	☐	☐
Steel Toe Work Shoes or Boots	☒	☐	Chemical Resistant Boot Covers	☒	☐
High Visibility Vest	☐	☒	Tape/Insect Repellent	☐	☐
First Aid Kit	☐	☐	Fire Extinguisher	☐	☐
Safety Shower/Eyewash	☐	☐	Other	☐	☐

Modifications/Exceptions: Impermeable aprons may be used to control splashing/overspray. If this is inadequate replace with rainsuit or PE coated Tyvek. Hard hat, splash shield, and hearing protection will be worn when working near operating equipment or during pressure washer/steam cleaner operation. Gloves – Nitrile (surgeons style) or nitrile type outer gloves for deconning associated sampling equipment. Overboots will be used when working in the temporary decontamination pad.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☒
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	☐	☐	☐
Physical Hazards Identified and Isolated (Splash and containment barriers)	☐	☐	☐
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Suspend site activities in the event of inclement weather (storms, high winds, etc.). In addition, do NOT point the Pressure washer wand at other people or place it against any part of your body. Accidental compression of the trigger can cause serious lacerations or burns. All hoses and fittings will be inspected to ensure structural integrity prior to use. For pressure washers or steam cleaners in excess of 3,000 psi, a fan tip of 25° or greater will be used to control potential for water cuts or lacerations. A light coating of sand should be applied to the plastic liner should the surface becomes too slippery to prevent slips. Keep hoses gathered to prevent trips and falls. A site control boundary for this activity is 25-feet surrounding the point of operation. Follow directions provided in the MSDSs for any decontamination solvents/solutions used in the decontamination procedure.

Permit Issued by:______________________________ Permit Accepted by:______________________________

ATTACHMENT V

EQUIPMENT INSPECTION CHECKLIST

FOR DRILL/DPT RIGS

Equipment Inspection Checklist for Drill/DPT Rigs

Company:______________________ **Unit/Serial No#:**______________________

Inspection Date: ____/____/____ **Time:**____:____ **Equipment Type:**______________________
(e.g., Drill Rigs Hollow Stem, Mud Rotary, Direct Push, HDD)

Project Name:______________________ **Project No#:**______________________

Yes	No	NA	Requirement	Comments
			Emergency Stop Devices	
☐	☐	☐	• Emergency Stop Devices (At points of operation)	
☐	☐	☐	• Have all emergency shut offs identified been communicated to the field crew?	
☐	☐	☐	• Has a person been designated as the Emergency Stop Device Operator?	
			Highway Use	
☐	☐	☐	• Cab, mirrors, safety glass?	
☐	☐	☐	• Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	
☐	☐	☐	• Seat Belts?	
☐	☐	☐	• Is the equipment equipped with audible back-up alarms and back-up lights?	
☐	☐	☐	• Horn and gauges	
☐	☐	☐	• Brake condition (dynamic, park, etc.)	
☐	☐	☐	• Tires (Tread) or tracks	
☐	☐	☐	• Windshield wipers	
☐	☐	☐	• Exhaust system	
☐	☐	☐	• Steering (standard and emergency)	
☐	☐	☐	• Wheel Chocks?	
☐	☐	☐	• Are tools and material secured to prevent movement during transport? Especially those within the cab?	
☐	☐	☐	• Are there flammables or solvents or other prohibited substances stored within the cab?	
☐	☐	☐	• Are tools or debris in the cab that may adversely influence operation of the vehicle (in and around brakes, clutch, gas pedals)	

Unit/Serial No#:____________________________________ **Inspection Date: _____/_____/_____**

Yes	No	NA	Requirement	Comments
☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	Fluid Levels: • Engine oil • Transmission fluid • Brake fluid • Cooling system fluid • Hoses and belts • Hydraulic oil	
☐ ☐ ☐	☐ ☐ ☐	☐ ☐ ☐	High Pressure Hydraulic Lines • Obvious damage • Operator protected from accidental release • Coupling devices, connectors, retention cables/pins are in good condition and in place	
☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	Mast Condition • Structural components/tubing • Connection points • Pins • Welds • Outriggers • Operational • Plumb (when raised)	
☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐ ☐	Hooks • Are the hooks equipped with Safety Latches? • Does it appear that the hook is showing signs of wear in excess of 10% original dimension? • Is there a bend or twist exceeding 10% from the plane of an unbent hook? • Increase in throat opening exceeding 15% from new condition • Excessive nicks and/or gouges • Clips • Number of U-Type (Crosby) Clips (cable size 5/16 – 5/8 = 3 clips minimum) (cable size 3/4 – 1 inch = 4 clips minimum) (cable size 1 1/8 – 1 3/8 inch = 5 clips minimum)	

Unit/Serial No#:____________________________________ **Inspection Date:** _____/_____/_____

Yes	No	NA	Requirement	Comments
 ☐ ☐ ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐ ☐ ☐	Power cable and/or hoist cable • Reduction in Rope diameter π (5/16 wire rope>1/64 reduction nominal size -replace) (3/8 to 1/2 wire rope>1/32 reduction nominal size-replace) (9/16 to 3/4 wire rope>3/64 reduction nominal size-replace) • Number of broken wires (6 randomly broken wires in one rope lay) (3 broken wires in one strand) • Number of wire rope wraps left on the Running Drum at nominal use ($\geq$3 required) - Lead (primary) sheave is centered on the running drum • Lubrication of wire rope (adequate?) • Kinks, bends – Flattened to > 50% diameter	
 ☐ ☐	 ☐ ☐	 ☐ ☐	Hemp/Fiber rope (Cathead/Split Spoon Hammer) • Minimum ¾; maximum 1 inch rope diameter (Inspect for physical damage) • Rope to hammer is securely fastened	
 ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐	Safety Guards – • Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact? • Hot pipes and surfaces exposed to accidental contact? • High pressure lines • Nip/pinch points	
 ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐	 ☐ ☐ ☐ ☐	Operator Qualifications • Does the operator have proper licensing where applicable, (e.g., CDL)? • Does the operator, understand the equipment's operating instructions? • Is the operator experienced with this equipment? • Is the operator 21 years of age or more?	

Unit/Serial No#:______________________________________ **Inspection Date: ______/_____/_____**

Yes	No	NA	Requirement	Comments
			PPE Required for Drill Rig Exclusion Zone	
☐	☐	☐	• Hardhat	
☐	☐	☐	• Safety glasses	
☐	☐	☐	• Work gloves	
☐	☐	☐	• Chemical resistant gloves_______________________________	
☐	☐	☐	• Steel toed Work Boots	
☐	☐	☐	• Chemical resistant Boot Covers	
☐	☐	☐	• Apron	
☐	☐	☐	• Coveralls Tyvek, Saranex, cotton)____________________________	
			Other Hazards	
☐	☐	☐	• Excessive Noise Levels? ___________dBA	
☐	☐	☐	• Chemical hazards (Drilling supplies - Sand, bentonite, grout, fuel, etc.)	
☐	☐	☐	- MSDSs available?	
☐	☐	☐	• Will On-site fueling occur	
☐	☐	☐	- Safety cans available?	
☐	☐	☐	- Fire extinguisher (Type/Rating -__________ _)	

Approved for Use ☐ Yes ☐ No ☐ See Comments

____ ____
Site Health and Safety Officer Operator

ATTACHMENT VI

EXCAVATION SAFETY PROCEDURES

This program outlines minimum requirements to protect employees who may be exposed to hazards during trenching and excavation activities and to provide general guidance for compliance with Title 29 of the *Code of Federal Regulations* (CFR), Part 1926, Subpart P, "Excavations."

1.0 SCOPE

This program and procedures applies to all sites and activities involving excavation or trenching as defined in 29 CFR 1926 Subpart P.

2.0 RESPONSIBILITIES

Project managers (PMs) shall ensure that all excavation, shoring, and trenching activities are conducted in accordance with the requirements outlined in this document and Subpart P of 29 CFR 1926. Project managers must also ensure that projects involving trenching and excavation are staffed by an individual trained and qualified to perform "competent person" duties as described in this procedure. Operating unit health and safety managers (HSMs) will provide assistance to PMs in implementing this SWP.

The site safety coordinator (SSC) is responsible for on-site enforcement of this SWP.

3.0 DEFINITIONS

The following definitions apply to this SWP:

Benching: Forming one or a series of horizontal levels or steps in the sides of an excavation to protect employees from cave-ins.

Competent Person: One capable of identifying existing or predictable hazards in the work environment that are unsanitary or dangerous to employees and who has authorization to take prompt corrective measures to eliminate the hazards.

Excavation: Any manmade cut, cavity, trench, or depression in an earth surface formed by earth removal.

Shoring: Metal, hydraulic, mechanical, or timber system that supports the sides of an excavation and that is designed to prevent cave-ins.

Sloping: Sloping the sides of an excavation at an incline away from the excavation to protect employees from cave-ins.

Trench: A narrow excavation (in relation to its length) that is usually deeper than it is wide but less than 15 feet wide.

4.0 PROCEDURES

Described below are the general safety requirements and protective system requirements for trenching and excavation activities.

4.1 General Safety Requirements

General safety requirements that must be in place before work begins are as follows:

- Utility companies or a utilities locating service in the area must be notified **before excavation or trenching activities begin** to arrange for locating and protecting underground utilities.
- Access to trenching areas must be controlled and limited to authorized personnel. Prior to entering a trench or excavation, workers must notify the project manager, SSC, and nearby equipment operators whose activities could affect the trench or excavation.
- No person may enter a trench or work at the foot of the face of an excavation until a qualified, competent person has inspected the excavation and determined whether sloping or shoring is required to protect against cave-in or subsidence and the appropriate protection has subsequently been installed.
- Trenches and excavations must be assessed by a qualified, competent person, even in the absence of working personnel, whenever heavy equipment will be operating nearby in order to ensure that the trench or excavation will support the weight of the equipment without subsistence or causing the accidental overturning of machinery.

- Trenches and excavations must be inspected regularly (daily at a minimum) to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibration, or nearby equipment operation have not caused weakening of the sides, faces, and floors and to ensure that personnel protection is being maintained. Form TEC – Trenching and Excavation Checklist or its equivalent is to be used to document inspections.

- When subsidence or tension cracks are apparent anywhere in an excavation, all work should be stopped until the problem is corrected.

- The competent person must inspect trenches or excavations after any precipitation event to ensure integrity has been maintained.

- Sufficient ramps or ladders must be provided in excavations 4 or more feet deep to allow quick egress. Ramps or ladders may be placed no more than 25 feet apart, must be secured from shifting, and must extend at least 3 feet above the top of the trench or excavation. Structural ramps must be designed by a competent person.

- Material removed from an excavation or trench must be placed far enough from the edge (at least 2 feet) to prevent it from sliding into the excavation or trench or from stressing the trench or excavation walls. Worker protection must also be provided from loose rock or soil on the excavation faces.

- If trenches or excavations are near walkways or roadways, guards or warning barriers must be placed to alert pedestrians and drivers of the presence of the trench or excavation.

- If possible, trenches or excavations should be covered or filled in when unattended. Otherwise, strong barriers must be placed around the trench or excavation and lighting must be provided at night if the trench or excavation is near a walkway or roadway.

- When a hazardous atmosphere could exist, the excavation must be tested for appropriate hazardous substances and oxygen level before personnel entry. Excavation where hazardous atmospheres exist must be treated as a confined space. Entry must follow procedures outlined in "Confined Spaced Entry Program," Document Control No. 2-5.

- Entry is not allowed into excavations where water has accumulated.

4.2 Protective System Requirements

Protective systems protect employees from cave-ins, material that could fall in or roll off the face of the excavation, and collapse of adjacent structures. Protective systems include shoring, shielding, sloping and benching, and other systems. Sloping and benching and shoring system requirements are described below.

4.2.1 Sloping and Benching Requirements

Sloping and benching system construction must follow the guidelines established in Appendix B to Subpart P of 29 CFR 1926. Maximum allowable slopes for excavations are summarized below. All slopes indicated are expressed as the ratio of horizontal distance (H) to vertical rise (V).

Soil or Rock Type	Maximum Allowable Slope (H:V) for Excavations Less than 20 Feet Deep
Stable Rock	Vertical (90°)
Type A	0.75:1 (53°)
Type B	1:1 (45°)
Type C	1.5:1 (34°)

Soil types are defined in Appendix A to Subpart P of 29 CFR 1926 and are summarized below.

Type A: Cohesive soils with an unconfined compression strength of 1.5 tons per square foot (ton/ft^2) or greater (such as clay, silty clay, sandy clay, or clay loam)

Type B: Cohesive soils with unconfined compression strength of greater than 0.5 but less than 1.5 ton/ft^2 (such as angular gravel, silt, silt loam, or sandy loam)

Type C: Cohesive soils with an unconfined compression strength of less than 0.5 ton/ft^2 (such as gravel, sand, loamy sand, submerged soil, or unstable submerged rock)

Sloping and benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.

Soil types must be determined by the competent person using at least one visual and one manual test. Manual tests include plasticity, dry strength, thumb penetration, and drying tests.

4.2.2 Shoring System Requirements

Appendixes C, D, and E to Subpart P of 29 CFR 1926 outline requirements for timber shoring for trenches, aluminum hydraulic shoring for trenches, and alternatives to timber shoring, respectively. Guidelines for shoring systems are listed below.

- If it is not economically feasible or there are space restrictions to prevent cutting the trench or excavation walls back to a safe angle of repose, all trenches or excavations 5 feet deep or more must be shored.
- Shoring should be erected as trenching or excavation progresses and as closely as possible to the excavation floor.
- Shoring timber dimensions must meet the minimum timber requirements specified in Tables C1.1 through C1.3 of Appendix C to Subpart P 29 CFR 1926. Aluminum hydraulic shoring must be constructed using the guidelines and dimension requirements specified in Appendix D of the same standard.
- Trench shields may be used instead of shoring or bracing. Shields must be constructed of steel flat sides welded to a heavy framework of structural pipe. Shields should be moved along by the excavator as trenching or excavation proceeds.

Revision Date	Document Authorizer	Revision Details
10/1/2008	Chris McClain	Update from 1998 format

ATTACHMENT VII

TRENCHING AND EXCAVATION
COMPETENT PERSON CHECKLIST

TRENCHING AND EXCAVATION COMPETENT PERSON CHECKLIST				
Contract Name and Number:	Contractor/Subcontractor:			
Government Inspector:	Location:			
Contractor Inspector:	Date:			
Weather (circle one) Dry Raining Previous Rain Freezing				

COMPETENT PERSON INFORMATION	Yes	No	N/A
Competent Persons Name: ____ Length of experience in this occupation: _________________ Length of experience with this employer: ________________			
Does the designated individual have training in:			
Soil Analysis?			
Use of protective Systems?			
Requirements of 29 CFR 1926.650-652?			
List Training Experience:			
Does the designated individual have knowledge about:			
Soil Analysis? *(Describe types of soils and properties)*			
Use of protective systems? *(What method is being used and how was it determined)*			
Requirements of 29 CFR 1926.650-652?			
Does the designated individual have authority to:			
Take prompt corrective action to eliminate existing and predictable hazards?			
Stop work?			
GENERAL			
When was the last inspection of the excavation conducted?			
Was an inspection done and documented prior to the start of work?			
Were inspections done and documented as needed throughout the work shift?			

This checklist is based on OSHA requirements. Use of this checklist is optional.

TRENCHING AND EXCAVATION COMPETENT PERSON CHECKLIST (con.)			
GENERAL (con.)	**Yes**	**No**	**N/A**
Were inspections done and documented after rainstorms or other hazard-increasing occurrence?			
Is the excavation deeper than 4 feet?			
WATER CONDITIONS			
Is dewatering equipment being used on the site?			
If yes is the competent person monitoring the equipment and it's proper operation?			
Has the excavation been subject to water accumulation?			
Has the soil in the trench been adversely affected?			
If yes has the competent person inspected the excavation and taken action?			
EGRESS			
Is a means of egress provided every 25 feet?			
Is a ramp used for access or egress to the excavation? (if no skip to the next section.			
Is the ramp used solely for employee access?			
If yes was it designed by competent person for safe access and egress?			
If yes, is the competent person who designed the ramp qualified?			
Does the ramp meet specifications?			
CONFINED SPACES			
Is there a potential for a hazardous atmosphere in the trench? If not, why?			
Is air monitoring equipment on site?			
Has a qualified person been assigned to assess the hazards of confined space? *(OSHA Definition: A Qualified Person is designed by the employer in writing, as capable (by education and/or specialized training) of anticipating, recognizing and evaluating employee exposure to hazardous substances or other unsafe conditions in a confined space. This person shall be capable of specifying necessary control and/or protective section to ensure safety.)*			
Is emergency rescue equipment as outlined in 29 CFR 1926.651(g)(2)(I) readily accessible to employees?			

______________________________ ______________

Government Inspector Date

______________________________ ______________

Signature of Competent person (contractor Date

____

Printed Name of Competent person

This checklist is based on OSHA requirements. Use of this checklist is optional.

ATTACHMENT VIII

TETRA TECH, INC.

CONFINED SPACE ENTRY PROGRAM

TABLE OF CONTENTS

TETRA TECH

CONFINED SPACE ENTRY PROGRAM

1.0 PURPOSE

To establish a uniform procedure specifying the minimum requirements for confined space entry operations performed by (or managed by) Tetra Tech , Inc.

2.0 SCOPE

For the purpose of clarification, this program applies to confined space operations which falls within the definitions provided below for confined spaces and permit required confined spaces.

2.1 **Confined space** A confined space means a space that:

- Is large enough and so configured to permit an employee to enter and perform work; and,
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, pits, etc.); and,
- Is not designed for continuous employee occupancy.

2.2 **Permit required confined space (PRCS).** A confined space having one or more of the following characteristics:

- Contains a hazardous atmosphere, or possesses the potential to contain a hazardous atmosphere.
- Contains a material which has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant entering the PRCS could become entrapped or asphyxiated by inwardly converging walls or a floor which slopes downward, tapering to a smaller cross-section.

- Contains any other recognized serious safety or health hazard, or by virtue of the task to be undertaken, may generate unsafe conditions.

This procedure applies to projects with a scope of work that includes the performance of confined space entry operations by Tetra Tech or subcontracted personnel. This program has been developed on the basis of two principle requirements. These are as follows:

- That this program will be implemented on a **SITE SPECIFIC** basis, establishing flexibility to provide for the protection of the health and safety of Tetra Tech and subcontractor personnel, as well as for internal and regulatory compliance. This concept recognizes that Tetra Tech personnel work on many different sites, often with only brief field operations tasks, as opposed to longer term project sites. Therefore, this performance-based program has been developed to establish the minimum requirements for confined space entry operations at any individual Tetra Tech office location or project site.

- That confined space entry operations will be performed using a **PERMIT-REQUIRED** system, with the requirements of this procedure followed as minimum requirements. Recognizing the Federal OSHA regulatory delineation between a Non-permit Confined Space and a Permit-Required Confined Space[1], and also recognizing that OSHA standards are minimum requirements. It is Tetra Tech policy that confined space entry operations will be performed in accordance with the written permit system specified in this procedure.

3.0 RESPONSIBILITIES

Project Manager (PM)/Task Order Manager (TOM) **-** The PM/TOM is also ultimately responsible for the effective compliance with these requirements. The PM/TOM will ensure that sufficient information has been provided to the PHSO to develop a site-specific Confined Space Entry Program appropriate for the nature of the planned activities. This is to be accomplished in conjunction with the preparation of the site-specific Health and Safety Plan (HASP). In addition, the PM/TOM will ensure that confined space entry is only considered as a last resort.

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[1] Occupational Safety and Health Administration Title 29 CFR 1910.146, Permit-Required Confined Spaces, paragraph (b) “Definitions”.

Tetra Tech Health and Safety Manager (HSM): Provide technical management and oversight of this program, and to aid Tetra Tech employees in effectively implementing these requirements. The Tetra Tech HSM will also be responsible for monitoring the overall effectiveness of this program. This will be accomplished by:

- Reviewing completed permits on an annual basis.
- Performing field audits of select project sites where confined space entry operations are performed.
- Maintaining proficiency in regulatory requirements on confined space entry matters.
- Modifying elements of this program, when or as appropriate.
- Establishing minimum components of confined space entry training course material, both for in-house and subcontractor-provided training courses
- Maintaining appropriate record-keeping for this program.

Project Health and Safety Officer (PHSO) - The PHSO shall ensure that confined space activities are adequately addressed in the Site Specific Health and Safety Plan for assigned projects. In addition, it is the PHSO responsibility to provide technical assistance to the SSO and/or the Field Operations Leader. The PHSO must also ensure that the requirements of this program are satisfied for confined space entry operations performed or managed at their location, whether by Tetra Tech personnel or by subcontractors. Other responsibilities include ensuring that:

- If training is provided by subcontractors, that an appropriate organization is selected, and that the training course material satisfies the Tetra Tech requirements.
- No individual participates in any confined space entry operations unless they are fully compliant with program requirements.
- The HSM is alerted when activities at a project site will involve confined space entry operations.
- A properly completed written program is present at every site where confined spaces exist.
- Appropriate documentation is maintained for that office, and that written permits are submitted to the HSM at the conclusion of project activities to facilitate the annual permit review requirement.

Site Safety Officers (SSO): Ensure that the requirements of this program are satisfied for confined space entry operations performed or managed at their site location, whether by Tetra Tech personnel or by subcontractors. Other responsibilities include ensuring that:

- Confined spaces are identified and labeled as such.

- Personnel to participate in confined space are trained to the appropriate level for the tasks to be performed and documentation certifying this training is obtained and maintained on site. In addition, ensure drilling/practice requirements to establish proficiency are up to date.

- Personnel meet the necessary medical qualifications for this type of activity.

- Rescue services are established and confirmed on the dates the confined space operations will be conducted.

- Provide the intended rescue services, the necessary information concerning the hazards associated with the confined space operations. This includes Material Safety Data Sheets, where available, information concerning hazard atmospheres and any associated physical hazards.

- The duties of the Entry Supervisor is completed in their entirety. In many cases the SSO will serve as the Entry Supervisor.

- The site-specific program for confined space operations is completed at each site, where applicable.

<u>Field Operations Leader (FOL)</u> – The FOL may share responsibility with the SSO or in the absence of an SSO ensure the implementation of this program for operations conducted under their direction. Substitution for the SSO will depend on the nature of the confined space operations and the anticipated severity of the hazards conveyed in the confined space. Substitution shall proceed based on the PHSO recommendation.

<u>Tetra Tech Employees -</u> The employees are responsible for following the tenets of this Confined Space Entry Program and/or conditions or modifications of this program, that may be site-specific in nature. In addition the employees are responsible for reporting any deficiencies or inadequacies of these program or site-specific elements to the SSO and/or the FOL.

4.0 PROCEDURES

4.1 Introduction

Tetra Tech recognizes that the participation of Tetra Tech personnel in confined space entry operations can be one of the most potentially dangerous types of field activities that they may encounter in their work. The risks associated with this type of work are most remarkable because they can be immediate and severe. It is for this reason that the requirements of this program will be strictly enforced at Tetra Tech locations.

There are two commonly encountered situations in which Tetra Tech field personal operate. These include project sites where we are the contractor performing work at a client location, and project sites where we are the prime contractor, and we have a subcontractor working under our direction. Also, specific to addressing confined space concerns, we need to address sites where confined spaces exist but our work scope will not involve entry versus sites where actual entry is necessary. As the regulatory requirements for each of these scenarios vary, separate procedures are established in the following sections of this overall program. These procedures involve the use of a simple, fill-in-the-blank written program that is to be completed

4.2 General Requirements

The following are General Requirements for each Tetra Tech Confined Space Entry policy and program.

Confined space entry operations on any Tetra Tech project site will be performed only a last resort. Available alternative means to accomplish the task objectives must be exhausted before commencing any confined space entry activities.

The following represents scenarios where Tetra Tech , Inc. personnel and/or subcontractor personnel working under the direction of Tetra Tech , Inc. would require the use of this program.

- Tetra Tech , Inc. personnel will enter a confined space.

- There are confined spaces in the area of operation under the guidance/control of Tetra Tech , Inc.

- Subcontractor personnel will enter a confined space under the guidance and/or direction of Tetra Tech , Inc.

Therefore, any project site where planned activities may involve work in or near a confined space must have a written Confined Space Entry Program completed on site and available prior to the commencement of site activities. The program must be attached to the Health and Safety Plan prepared for that project. The written program shall be completed by the assigned SSO, and will be kept current and available for review by the Tetra Tech HSM.

Work involving entry into a confined space will be performed by written permit only. There will be no exceptions to this requirement without the express, written consent of the Tetra Tech HSM.

4.2.1 Role and Responsibility of the Site Safety Officer

For applicable projects, the assigned SSO must be thoroughly familiar with this procedure and with the OSHA regulation on Permit-Required Confined Spaces, and will be responsible for completing the on-site elements of this program. The SSO will also be responsible for implementing the specific requirements of the program on his/her site, including ensuring that:

- Confined spaces at the site are properly identified, labeled, and inventoried. Signs should be appropriate size (12x18 minimum or greater) and color designation

- Site personnel are made aware of these spaces, and that unauthorized entry is prohibited. This is to be covered as part of the site-specific health and safety training.

- Entries are performed using the written permit system specified in the site written program.

- Necessary training requirements are satisfied, and that appropriate training documents are collected and maintained.

- Personnel participating in the confined space operation are medically (physically and psychologically) qualified to do so. Documentation to be provided are the medical surveillance clearance and the ability to wear respiratory protection.

- Necessary entry equipment is on hand, and maintained in proper working order. Equipment will be inspected by the SSO to ensure operation status.

- Permits are completed specifying a duration only long enough to perform the job.

- A trained and equipped rescue team is on standby prior to the beginning of the confined space activity. It will be the SSO responsibility to ensure the rescue teams capabilities and equipment resources to support the planned operation.

- The rescue team is fully aware of the potential hazards which may be encountered and pertinent information has been provided by the SSO.

The SSO will, in the majority of cases, serve as the Entry Supervisor. This means that he/she is responsible for determining that acceptable entry conditions are present before and during entry, for authorizing (by completing and signing the written permits) and overseeing entries, and for terminating entries and canceling permits.

4.2.2 Testing and Monitoring of Confined Spaces

Air monitoring in the confined space must be performed before and periodically during entry operations. The frequency, types, and sequence of air monitoring are clearly specified in the site specific program included as Attachment I. While that program specifies that periodic air monitoring during an entry may be acceptable for an isolated space, it is recommended that continuous monitoring always be performed, even for a completely isolated space. Acceptable entry conditions are as specified in Table 1, below.

Table 1

Acceptable Entry Conditions

Testing Sequence	Atmospheric Parameter	Acceptable Entry Condition
1st	Oxygen content in air	≥ 19.5% and ≤ 23.5%
2nd	Flammable or explosive conditions	≤ 10% of an LEL* for gases, vapors or mists ≤ LEL for airborne combustible dusts
3rd	Toxic concentrations of chemical hazards	Any exposure reaching a substances published Action Level, Permissible Exposure Limit, Threshold Limit Value, or Recommended Exposure Limit. These will be specified in the site Health and Safety Plan
4th	Any other atmospheric condition that is Immediately Dangerous to Life or Health	Varies by specific parameter

*LEL = Lower Explosive Limit, sometimes also referred to as LFL for Lower Flammability Limit. For dusts, this may be approximated as a visual condition where the dust obscures vision at a distance of 5 feet or less.

If the acceptable entry conditions do not exist, or appear that they may not be constant throughout the entry, the SSO can use the following approach:

- Ensure that the space is properly isolated (block and bleed lines, use Lockout/Tagout procedures, etc.
- Purge, inert, flush, or ventilate the space to control or eliminate the hazard.

If acceptable entry conditions still do not exist due to flammability or explosive concerns, the entry must not be authorized. If the limiting factor is toxic airborne concerns, appropriate PPE may be used to allow the entry (Note: PPE is chosen as a control option always only as a last resort. Efforts should be made to control hazards through engineering controls).

4.2.3 Rescue

When confined space entry operations are performed, personnel and equipment must be adequate and available to effect non-entry rescue operations in the event of an emergency. This shall include items such as body harnesses (or wristlets, as a second choice), tie-offs, mechanical retrieval apparatus, etc. This equipment must be available and in use during entry operations. This will enable the Attendant and other authorized personnel to perform an emergency rescue and extract an injured person from outside of the space. Rescue procedures requiring other personnel to enter a space to assist or evacuate an injured or incapacitated entrant are expressly prohibited. Also, unauthorized personnel must be prohibited from participating in emergency rescue operations.

It is anticipated that in most instances, we will be prepared to provide non-entry emergency rescue services ourselves, at least to the point of removing an injured person and stabilizing them until professional emergency services can be summoned. The identity of the specific emergency response service and the method for contacting them will be clearly identified on the permit completed by the SSO. At least one member of the team serving in the role of Attendant or Rescue member (a non-entrant) must have current certification in First Aid and CPR. (Note: The person of choice must ensure that Bloodborne Pathogen Program requirements are satisfied whenever First Aid or CPR practice is authorized.)

4.3 Employee Training

Personnel must be adequately trained in order to be authorized to participate in confined space operations. Training must be performance-based so that participants can successfully demonstrate proficiency in performing their assigned duties. Training shall take place before an individuals first assignment, when their assigned duties change, or when changes occur in the site's written program. Also, if a new hazard is suspected that was not addressed in the employee's training, supplemental training will be required. Retraining may also be conducted when through periodic inspections or reviews identify deficiencies in confined space operations.

Whether training is provided in-house or by a training contractor, the contents of the training must satisfy the requirements of this program, and will be held to the criteria published by the Hazardous Waste Action Coalition Risk Management Committee, Health and Safety Subcommittee (entitled "Confined Space Entry Training Courses", published in 1996). A copy of these criteria are available from the Tetra Tech HSM. These criteria are directly applicable as they have been specifically developed by health and safety representatives of firms from within our industry (hazardous waste/environmental consulting).

The SSO will ensure that appropriate training has taken place for authorized individuals, and will have on-hand at the site documentation for each involved employee attesting to:

- Employee name
- Signature or initials of the instructor
- Dates of training

Site-specific training for authorized individuals will cover the duties of the entrants and attendants. This will address the aspects for each of these positions as presented below.

4.3.1 Authorized Entrants Training

- Hazards that may be encountered in the space
- How to properly use the necessary equipment
- Communication methods with the Attendant
- Recognizing when emergency exit of the space is necessary

4.3.2 Attendant Training

- Hazards that may be encountered in the space
- Behavioral effects of hazard exposure
- To continuously maintain an accurate count of entrants and know their identity
- To never leave the space unless relieved by another attendant
- Communication methods and aspects with Entrants
- Monitoring of the space
- How and when to summon emergency services
- Control unauthorized personnel issues
- Performance of non-entry rescues

4.3.3 Entry Supervisor Training

- Hazards that may be encountered in the space
- Verifies that tests have been conducted (by checking permit entries)
- Verifies that procedures and equipment specified in the permit are in place before signing it and putting it into effect
- When and how to terminate the entry and cancel the permit

- Verify that rescue services are available at the time of the entry and that the means for summoning them are operable
- Removes or prevents unauthorized personnel from entering the space

4.4 Coordination with Clients

Tetra Tech operations will involve arrangements where we are serving as a contractor to a client facility. That is, we will not be addressing entering spaces that we own or control. Therefore, appropriate coordination with the client representative will be essential to properly understand the nature of any confined spaces and to successfully perform the work. When the scope of work entails (or may entail) working in or near confined spaces, the PM/TOM must gather the following information as part of the initial data gathering process:

- Obtain any available information regarding confined spaces, including descriptions, potential or known hazards, and the client's confined space entry program information.
- Determine, if the client has located and designated confined spaces in the work area.
- Establish how the client desires to coordinate our work with their operations, relative to the confined spaces.
- If the scope of work will involve actual entry by Tetra Tech personnel, inform the client of our program.

Gathered information is to be provided to the PHSO responsible for preparing the site-specific Health and Safety Plan.

At the conclusion of any confined space entry work done at a client location, the PM/TOM is to request a debriefing meeting, so that a representative from the project team can communicate hazards that were encountered in the work.

4.5 Project Sites Involving Confined Spaces Where Entries Will Not Be Performed

In many instances, we may be performing work at sites where confined spaces exist and our scope of work does not involve any entry into those spaces. In this application, the SSO has only to ensure that spaces in our work area are adequately identified and posted, and complete the one-page written program in Attachment II and post it on site in the work area.

4.6 Confined Space Entry Operations Involving Subcontractors

For some projects, the scope of work may require a specialized of a subcontractor. When the work involves requiring a subcontractor to perform a confined space entry, the SSO must complete and utilize the written program included as Attachment III. We must provide our subcontractor with the following information:

- Information regarding the confined space(s), including descriptions, potential or known hazards, and the details of our confined space entry program.
- Information on the location and designations (postings) of the confined spaces in the work area.
- Establish how we desire to coordinate our work with their operations, relative to the confined spaces.
- If the scope of work will involve actual entry by subcontractor personnel, inquire if they have their own Permit-Required Confined Space Program and obtain it for our review.
- If the nature of the work is such that Tetra Tech and subcontractor personnel will have to perform concurrent operations in or near a confined space, very close coordination will be necessary and the Tetra Tech HSM must be contacted for guidance.

At the conclusion of any confined space entry work done by a subcontractor, a debriefing meeting will be held by the SSO to learn of any hazards that were encountered in the work.

4.7 Program Evaluations and Availability

The Tetra Tech HSM is responsible for performing evaluations of this overall Program to ensure its continued effectiveness. These reviews will be properly documented, and will occur as follows:

- Annually, at the end of each calendar year.
- At any time when an indication is discovered that a component of the program is not effective.
- In the event of any modifications in the regulatory requirements for confined space operations.
- If the event of changes or mandates from Tetra Tech, Inc. Corporate Health and Safety.

Annual Program evaluations will entail a review of canceled written permits prepared and used during the course of that year by Tetra Tech locations. The various site-specific written programs that these permits were prepared under are also subject to review. Canceled permits will be retained by the Tetra Tech HSM for no less than one calendar year.

Field audits of project work sites where confined space operations are conducted will also be performed. These will be coordinated through the Tetra Tech HSM , and will do on an unannounced, random basis.

Information gathered and program modifications that become necessary will be communicated to Tetra Tech personnel by the Tetra Tech HSM.

4.7.1 Equipment and Evaluation of Confined Spaces

Spaces must be properly evaluated before and during entry operations. Figure 2 specifies the criteria for equipment inspections that will be maintained on this site to evaluate and support Confined Space Entry operations.

4.7.2 Confined Spaced Signage

Each of these spaces have been (or will be, upon creation) clearly posted with signs stating "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER" or "DANGER - CONFINED SPACE - DO NOT ENTER" as applicable.. Unauthorized entry into any of these spaces is strictly prohibited.

The remaining text represents the site-specific portion of this program and the activities to be conducted when involved in one or more of the scenarios defined above.

5.0 DEFINITIONS

Acceptable entry conditions - The conditions that must exist and be maintained in a confined space in order to allow entry and work activities to be performed by personnel. For purposes of this program, this definition will also reflect those conditions which must be maintained and must not be compromised. Therefore, acceptable entry conditions are defined as, but not limited to, the following:

- A "hazardous atmosphere" either does not exist, or it can be adequately controlled to allow entry. Examples of control measures may include ventilating, purging, or inerting the PRCS, or a combination of these measures. Additionally, the use of appropriate personal protective equipment may be considered a control measure when other engineering and administrative controls are not feasible or are unable to be adequately controlled.

- The space to be entered has been properly isolated. This involves ensuring that energy sources have been identified and secured in a zero energy state to the greatest possible extent. This is accomplished through the use of energy control measures such as lockout procedures, blanking or blinding techniques, double block and bleed procedures, or other appropriate energy control methods. This effort must be documented, and members associated with the entry must concur that control sources have been identified, tested, and are disabled.

- The space to be entered does not contain a material that could engulf an entrant. If such a material is involved, adequate control methods such as shoring or sloping of the material must be adequately implemented prior to initiation of the entry.

- The space to be entered does not contain any other serious hazard potential(s) which cannot be contained or controlled to the satisfaction of the entry supervisor.

Attendant - An individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs attendant's duties assigned by this Confined Space Entry Program.

Authorized entrant - An employee who is authorized by Tetra Tech to enter a confined space or a permit required confined space.

Blanking or blinding - The absolute closure of a pipe, line, or duct by the fastening of a solid plate that completely covers the bore, which ensures no leakage occurs beyond the plate.

Confined space. A confined space means a space that:

- Is large enough and so configured to permit an employee to enter and perform work; and,
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, pits, etc.); and,
- Is not designed for continuous employee occupancy.

Double block and bleed - The closure of a line, duct, or pipe by closing and locking two in line valves and by opening and locking a drain or vent valve in the line between the two closed valves.

Emergency - Any occurrence (including any failure of hazard control or monitoring equipment) or event internal and/or external of the confined space and/or permit-required confined space, that could endanger entrants.

Entry - The action by which a person passes through an opening into a confined space. Entry includes ensuing work activities that are performed in the confined space. Entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the confined space.

Entry permit - The written or printed document which is provided by the employer to allow and control entry into a confined space and/or a permit required confined space. The permit contains pertinent information regarding the space to be entered.

Entry supervisor - The person responsible for determining if acceptable entry conditions are present the confined space and/or the permit required confined space where entry is planned. The Entry supervisor is also responsible for authorizing entry, overseeing entry operations, and for terminating the entry as conditions dictate.

Hazardous atmosphere - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self rescue, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit -LEL (sometimes referred to as the lower flammable limit - LFL).

- Airborne combustible dust at a concentration that meets or exceeds 10 percent of its LEL/LFL.

- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.

- Atmospheric concentration of any substance for which a dose or a permissible exposure limit is established. Also an atmospheric concentration which could impede the entrant's ability to self rescue resulting in employee exposure and adverse health effects associated with that exposure.

- Any other atmospheric condition that is immediately dangerous to life or health.

Hot Work Permit - The employer's written authorization to perform operations (e.g., welding, cutting, burning, heating, etc.) capable of providing a source of ignition.

Immediately Dangerous to Life or Health (IDLH) - Any condition which poses an immediate or delayed threat to life, or a condition that would cause irreversible adverse health effects. In addition, an IDLH condition includes any condition which would interfere or impede an individual's ability to escape unaided from a confined space and/or a permit-required confined space.

Inerting - The displacement of the hazardous atmosphere in a permit-required confined space by introducing a non-reactive gas (such as nitrogen) to such an extent that the resulting hazardous atmosphere would be pushed from the permit-required confined space rendering that permit-required confined space non-reactive. Inert spaces are still considered hazardous due to the displacement of oxygen.

Isolation - The process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as:

- blanking or binding;
- misaligning or removing sections of lines, pipes, or ducts;
- a double block and bleed system;
- lockout of energy sources, and the reduction of potential energy sources to their zero mechanical state;

- blocking or disconnecting mechanical linkages.

Line breaking - The intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or by the SSO.

Lockout - [As defined by OSHA 29 CFR 1910.147 (b)] The placement of a lockout device on an energy isolating device, in accordance with an established procedure, which ensures that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Permit required confined space (PRCS). A confined space having one or more of the following characteristics:

- Contains a hazardous atmosphere, or possesses the potential to contain a hazardous atmosphere.
- Contains a material which has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant entering the PRCS could become entrapped or asphyxiated by inwardly converging walls or a floor which slopes downward, tapering to a smaller cross-section.
- Contains any other recognized serious safety or health hazard, or by virtue of the task to be undertaken, may generate unsafe conditions.

Permit system - The employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition - Any condition in a confined space and/or a permit-required confined space that is not allowed by the permit during the period when entry is authorized.

Tagout - [As defined by OSHA 29 CFR 1910.147 (b)] The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed. It should be emphasized that any time tagout is employed as an energy control measure, it must offer the same level of protection as its energy control measure counterpart lockout.

Testing - The process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space. Details pertaining to testing methods and procedures are discussed in Section 4.4 of this program.

ATTACHMENT I

TETRA TECH , INC.
CONFINED SPACE
ENTRY OPERATIONS

PROJECTS SITES INVOLVING CONFINED SPACE ENTRY OPERATIONS

The written program presented will be used at Tetra Tech project sites where confined space entry operations are planned. That program has been developed to provide the SSO with a standardized tool to serve two purposes:

- To protect the health and safety of Tetra Tech and subcontractor personnel working in or near confined spaces.
- To comply with Federal regulatory requirements.

PERSONNEL RESPONSIBLE FOR PROGRAM COMPLETION

The following persons are available to provide assistance in elements of this program including question/conflict resolution and modification variances. These persons exercise the primary responsibility for the implementation of this site-specific program.

Site Safety Officer:____________________________________**Phone #:**____________
Field Operations Leader: __________________________**Phone #:**____________
Project Health and Safety Officer:_______________________**Phone #:**____________
Health and Safety Manager: __________________________**Phone #:**____________

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PERSONNEL WHO WILL PARTICIPATE IN CONFINED SPACE OPERATIONS

The following list of personnel, represent personnel or subcontractor personnel working under the provision of this confined space entry program. The persons listed below represent only those who will actively engage in confined space operations by way of assignment.

Personnel Name and Signature	**Role in the Confined Space Entry Program**	**Confined Space Training (Dates)**		**Medical Clearance (Date)**	**Comments** *i.e., most recent drill (vertical/horizontal); First-Aid Training*
		Initial	**Refresher**		

<u>RESCUE SERVICES</u>

The ____________________ Rescue Department will serve as the identified rescue service. The rescue service can be obtained at (___) ___-____. The entry operation will be coordinated through the rescue service. Pertinent information will be provided prior to entry. Notification shall take place prior to, and after entry operations cease.

CONFINED SPACE INVENTORY/STATUS

The following inventory represents the confined spaces at this project site. These spaces are listed by way of planned entry or proximity. This list will be updated by the SSO and/or the FOL as necessary.

CONFINED SPACE INVENTORY/STATUS

Confined Space/Permit-Required Confined Space Identified	**Location/ Tasks To Be Conducted**	**Type of Entry**	Hazards Identified	*1.1.1.1.1.1.1.1 Control Measures*

<u>CONFINED SPACE ENTRY PERMIT</u>

Entries into Identified Confined Spaces Will Be By Written Permit Only.

The Confined Space Entry Permit will guide and direct field personnel regarding aspects of the entry by using the permit as a checklist. It is based on this application that no spaces on the permit be left unchecked.

The assigned authorized entrant(s) and attendant(s) will complete the Confined Space Entry Permit. However, entry is not permitted until the Entry Supervisor reviews the permit and signs off.

Figure 1 will be used as the written permit on this site. Permits will be reviewed, issued, and canceled by the SSO, who will also serve in the role of Entry Supervisor. Permits must be completed before any entry operations begin. Completed permits will be reviewed with involved personnel as part of their task-specific training, and then posted at or near the entrance to the space.

<u>HAZARD MONITORING</u>

Spaces will be initially evaluated by the Authorized Entrant and Attendant as follows:

- Pre-entry, to determine that satisfactory entry conditions exist
- Continuously, if the space cannot be isolated – For activities at _____
- Periodically, if the space can be isolated (at least once every __ minutes)

The sequence for conducting these evaluations will be (from first to last):

1. Oxygen level
2. Lower Explosive Level (for gases, vapors, mists, or particulates)
3. Toxic gases or vapors

Specific equipment and instrument action levels are specified on the permit.

Information derived from the monitoring activity will be recorded on the Entry Permit. This information will be used to determine if acceptable entry conditions exist and whether entry is permitted. The SSO will review the information collected and authorize entry, if conditions are determine to be acceptable.

Figure 1

CONFINED SPACE ENTRY PERMIT

CONFINED SPACE ENTRY PERMIT ________________________________ **No:** ____

INITIAL ATMOSPHERIC TESTS PERFORMED

CAUTION: Toxic or flammable gasses or vapors may _________ in the confined space. Be sure to vent at various intervals and locations within the confined space. Always check the oxygen content first.

INITIAL TESTING						
HAZARD TESTED	**ACCEPTABLE RANGE**	**READING**	**DATE AND TIME**	**TESTER INITIALS**	**ACCEPTABLE**	
					YES	**NO**
%Oxygen	19.5-23.5%	%				
%LEL	10% or less	%				
	PEL=	PPM=				
	PEL=	PPM=				
	PEL=	PPM=				

EVACUATION PROCEDURE

Route:____

Assembly Points:____

RESCUE PROCEDURE – Initiate self rescue, if incapacitated; initiate external extraction; If unable to facilitate external extraction; notify the Fire Dept. for entry and removal

PLAN DESCRIPTION

ON-SITE RESCUE CONTACTS			
PHONE NUMBER	RADIO NUMBER	PAGER NUMBER	OUTSIDE SOURCES AND PHONE
(252) 335-6222			FIRE DEPARTMENT
			AMBULANCE
			HOSPITAL
			OTHER

SPECIAL EQUIPMENT NEEDED

- ☐ RESPIRATORS (Type): ______________________________
- ☐ SAFETY HARNESSES/WRISTLETS
- ☐ LIFELINES
- ☐ HOISTING APPARATUS
- ☐ VENTILATION EQUIPMENT:______________________________
- ☐ TEMPORARY LIGHTING (Type/voltage):______________________________
- ☐ NON-SPARKING TOOLS
- ☐ PROTECTIVE CLOTHING:______________________________
- ☐ OTHER:

ENTRY SUPERVISOR'S SIGNATURE	DATE	PERMIT RECEIVER SIGNATURE	DATE

CONFINED SPACE ENTRY PERMIT

No: ___

GENERAL INFORMATION:

DESCRIPTION OF THE CONFINED SPACE:

DATE ISSUED	TIME ISSUED	DATE EXPIRES	TIME EXPIRES
	:		:

ENTRY SUPERVISOR

ATTENDANT(S)

COMMUNICATION BETWEEN ATTENDANT(S) – ENTRANTS

‘ VOICE ‘ LIGHT ‘ RADIO ‘ OTHER

DESCRIPTION OF WORK:

CHECKLIST FOR ISOLATION AND UNAUTHORIZED ACCESS PREVENTION

	Yes	NO	NA	INITIAL
External Battery(ies) in Place	☐	☐	☐	______
Mechanical Lockout/Tagout	☐	☐	☐	______
Lines/Pipes Disconnected	☐	☐	☐	______
Lines/Pipes Blocked	☐	☐	☐	______
Lines/Pipes Capped	☐	☐	☐	______
Lines/Pipes Blinded	☐	☐	☐	______
Warning Signs	☐	☐	☐	______
Other:______________________	☐	☐	☐	______

REPORT ANY UNAUTHORIZED ENTRY TO: **Health Sciences Department and Project Management**	PHONE NO.	RADIO NO.	PAGER NO.

PRE-ENTRY CHECKLIST

PURGING, INERTING, OR FLUSHING

PERFORMED ☐ YES ☐ NO ☐ NA

METHOD USED ☐ Nitrogen ☐ steam ☐ Water ☐ Other (specify)

____

____

MECHANICAL VENTILATION

Estimated Confined Space Volume:______________

Air Exchange Rate Required: ______________

	Initial	Continuous	Partial	Description
Fresh Air Injection	☐ ____hrs.	☐	☐	______
General	☐ ____hrs.	☐	☐	______
Local Exhaust	☐ ____hrs.	☐	☐	______

SPECIFIC HAZARDOUS TASKS

Certain tasks performed in confined spaces greatly increase the risks to entrants. Check tasks to be performed.

- ☐ WELDING/GRINDING
- ☐ THERMAL CUTTING
- ☐ SOLDERING/BRAZING
- ☐ ELECTRICAL
- ☐ OTHER, EXPLAIN: ______________________
- ☐ PAINTING OR CLEANING WITH SOLVENTS
- ☐ CLEANING/SWEEPING/VACUUMING
- ☐ SCRAPING/REMOVING RESIDUE
- ☐ CHEMICAL USE

____

Additional Permits Required ☐ Hot Work Permit ☐ Utility Locating/Excavation Clearance

ENTRY SUPERVISOR'S SIGNATURE	DATE	PERMIT RECEIVER SIGNATURE	DATE

CONFINED SPACE ENTRY PERMIT **No:** ____

PERIODIC ATMOSPHERIC TEST RESULTS

TESTER INFORMATION	ATMOSPHERIC HAZARD TESTED	ACCEPTABLE RANGE OF HAZARD	HAZARD MONITORING RESULTS	ACCEPTABLE	
				YES	NO
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%0_2)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		

CONFINED SPACE ENTRY PERMIT No:

PERSONNEL ENTRY LOG

DESCRIPTIONOF CONFINED SPACE

ENTRY SUPERVISOR	DATE

ATTENDANT(S)

AUTHORIZED ENTRANT'S NAME	TIMES IN AND OUT							
	IN	OUT	IN	OUT	IN	OUT	IN	OUT

EQUIPMENT INSPECTION

Equipment to be used in support of the confined space operation(s) will be inspected by the SSO or duly appointed representative, prior to initial use. Inspections will entail a physical examination and an operational check. The Confined Space Equipment Inspection Record will be used to document these inspections. Where appropriate existing inspection records for instance Respiratory Equipment Checklist will be used in place of the Confined Space Equipment Inspection Record.

PERMIT TERMINATION

A confined space entry permit can be terminated for a number of reasons. These include, but not limited to, the following:

- Scope of work change
- Acceptable conditions within the space change
- Time limit expires
- Planned activities are completed

Upon termination of an active permit the following steps will take place.

- The Confined Space Permit and any other associated permit (Safe Work Permit, Hot Work Permit, etc.) or hazard monitoring results will be copied. The copies will be forwarded to the PHSO for evaluation.
- Upon evaluation the PHSO will forward the copied permits to the HSM for record-keeping and review. The PHSO will include any relevant comments for the HSM to be considered during his/her review.
- The HSM will maintain the completed permits and associated materials for a period of one year from the date of issue.

TYPE OF EQUIPMENT	Visual Condition	Operational Status	
Testing and Monitoring Serial # ____________ ____ ____________ ____ ____________ ____ ____________ ____ ____________ ____	Acceptable ☐ ☐ ☐ ☐ ☐ Needs repaired ☐ ☐ ☐ ☐ ☐ Comments:____________	Functional Yes ☐ ☐ ☐ ☐ ☐ No ☐ ☐ ☐ ☐ ☐ Comments:____________	Calibrates Yes ☐ ☐ ☐ ☐ ☐ No ☐ ☐ ☐ ☐ ☐ Span Concentration ____ ____ ____ ____ ____ Comments:____________
Ventilation Equipment Fans/blowers (Flow rate/per unit ________) Compressor unit (as applicable) Hoses/Connections (as applicable) Power Cords/Connections (as applicable) Back-up Energy Source	Acceptable ☐ ☐ ☐ ☐ Needs repaired ☐ ☐ ☐ ☐ Comments:____________	Functional Yes ☐ ☐ ☐ ☐ No ☐ ☐ ☐ ☐ Comments:____________	Confined Space Estimated Volume:____________ Ventilation Unit Flow Rate Input:________Exhaust:________ Estimated Changes/Hour:________
Lighting Equipment (Intrinsically Safe) Power Cords Connections and Plugs Protective Cages Ground Fault Interrupter Back-up Energy Source	Acceptable ☐ ☐ ☐ ☐ ☐ Needs repaired ☐ ☐ ☐ ☐ ☐	Functional Yes ☐ ☐ ☐ ☐ ☐ No ☐ ☐ ☐ ☐ ☐	Adequate lighting for safe operations? Yes ☐ No ☐ Comments:____________
Site Preparation Warning/Hazard Signs (Size, Legible, Correct Color Designation) Barrier Systems (Tape, fencing, etc.) Traffic Control Provisions (Foot & Vehicular) Energy Control Provisions Additional Permits Required (Hot, Excavation, Energy Control, etc.) Permits Posted	Acceptable ☐ ☐ ☐ Unacceptable ☐ ☐ ☐ ☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A ☐ Yes ☐ No ☐ N/A	Functional Yes ☐ ☐ ☐ ☐ No ☐ ☐ ☐ ☐ Comments:____________	

TYPE OF EQUIPMENT	Visual Condition	Operational Status	
Communications Equipment Type__________________________ Intrinsically Safe? Back-up Communication method? _ Will line of sight be maintained during the entry operations? Will relay points be established to support radio communications?	Acceptable ☐ ☐ / Unacceptable ☐ ☐ ☐ Yes ☐ No ☐ Yes ☐ No ☐ N/A	Functional Yes ☐ ☐ ☐ ☐ / No ☐ ☐ ☐ ☐	Comments:_____________________________ ____________________________________
Rescue/Emergency Equipment Retrieval/Fall Arresting Systems [Tripods, Hoist(extraction cables, connections), lifeline, harnesses] Stretcher Fire Extinguishment -Type_Rating__ First-Aid Equipment/Supplies	Acceptable ☐ ☐ ☐ ☐ / Needs repaired ☐ ☐ ☐ ☐	Functional Yes ☐ ☐ ☐ ☐ / No ☐ ☐ ☐ ☐	Method/Means to summon Rescue Team provided? ☐ Yes ☐ No Hazard Information regarding The space to be entered been Provided to the Rescue Team? ☐ Yes ☐‘ No Procedures for Self or Non-Entry rescue been Accomplished? ☐ Yes ☐ No If no why not?_________________________ ____________________________________ Comments:_____________________________ ____________________________________
Personal Protective Equipment Hard Hat Safety Glasses Splash Shield Splash Suits Type______________________ Steel Toe Work Boots Chemically Resistant Overboots Hearing Protection Gloves – Type_________________________ Heat Shielding	Acceptable ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ / Unacceptable ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ / N/A ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Comments:____ ____ Respiratory Protection: Attach Respiratory Protection Checklist.	

RECORD KEEPING

The following represent records to be maintained on-site supporting confined space entry operations. As stated in the administrative guidelines, these records will be copied upon completion and submitted to the PHSO and/or the HSM for review and evaluation. Records to be maintained are as follows:

Completed Elements of this Program

- Completed Confined Space Entry Permits
- Associated Safe Work Permits, Hot Work Permits, Excavation Permits, as applicable.
- Training Records
  - Confined Space Training Records (To define level of training – Entry Supervisor, Authorized Entrant, Attendant, Rescue). These records should identify initial and refresher dates and be accompanied by official Certificates of Training.
  - Site Specific Training Documentation of this completed Program.
- Medical Surveillance Evaluations

GENERAL REQUIREMENTS AND RESPONSIBILITIES

Only properly authorized and trained personnel will be permitted to participate in entry operations. The Entry Supervisor (the site Health and Safety Officer) will be responsible for conducting these authorizations and for ensuring that training requirements are satisfied. Persons involved with entry operations will be properly designated on the Permit. At least one Entry Attendant will be stationed outside of the space at all times during any confined space entry operation. The identity of the Attendant(s) will be clearly indicated on the entry permit. Attendants will not be assigned any additional duties that could interfere with fulfilling their responsibilities as space Attendants. **Multiple spaces will not be monitored by a single attendant**. This type of approach is strictly prohibited.

Emergency rescue operations will be non-entry means only. Emergency procedures will be specified on the entry permit.

If entry operations will involve the use of contractor personnel, the Subcontractor Permit Required Confined Space Program (See Attachment III of the Tetra Tech Confined Space Entry Operations Program) must be completed by the site Health and Safety Officer and maintained onsite.

At the conclusion of entry operations, the SSO will ensure that personnel and equipment have been removed from the space, that a final space evaluation is performed, and the permit will be canceled and filed. A copy of the canceled permit must be sent to the Tetra Tech Health and Safety Manager at the conclusion of the project, and not later than by November 30 for projects where work continues toward the end of a calendar year in order to facilitate the annual program evaluation process.

ATTACHMENT II

CONFINED SPACE ENTRY PROGRAM

For

Project Sites Involving Confined Spaces

Where Entries Will Not be Performed

CONFINED SPACE ENTRY PROGRAM
For
Project Sites Involving Confined Spaces
Where Entries Will Not be Performed

Site Name and Address: ____________________________ Project No.___________

____

Project Manager/Task Order Manager: ___________________________________

Site Manager: ___________________________________

Site Safety Officer: ___________________________________

Confined spaces that exist (or that may be created by project activities) at this site include the following: ____

____

____

____

____

____

____

Each of these spaces have been (or will be, upon creation) clearly posted with signs stating "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER".

Entry into any of these spaces is NOT permitted by site personnel is for any reason.

Site Manager: ___________________________________ Date / /

Site Safety Officer:_________________________________ Date / /

POST THIS ON SITE

ATTACHMENT III

SUBCONTRACTOR PERMIT-REQUIRED CONFINED SPACE ENTRY OPERATIONS

SUBCONTRACTOR PERMIT-REQUIRED CONFINED SPACE ENTRY OPERATIONS

Site Name and Address:_________________________________ Project No.___________

____

Project Manager/Task Order Manager: ____

Telephone Number: (___) ___-____

Site Manager: ____

Site Safety Officer:____

Subcontractor Performing Confined Space Entry Operations:______________________________

1.0 General

This project site contains the confined spaces specified in Table 1. Entry into any of these spaces will be written permit only, and in compliance with the requirements of OSHA 29 CFR 1910.146. Permits will be coordinated with and submitted to the site Health and Safety Officer.

Table 1
Confined Spaces
at the
__________________________ Site

Space	Reason For Entry	Associated Hazards

2.0 Space Description and History (Note to SSO: this section must be filled out for EACH space to be entered by the subcontractor personnel. Attach additional pages to this program as appropriate.)

The nature of the work to be performed by ____

(name of subcontractor)

is ____

____

____

This will involve/require entry into ____

(description of space)

The hazards recognized or anticipated with this space include or may include (check and describe at apply):

_______a hazardous atmosphere involving ____

_______Material that could engulf an entrant, specifically_________________________

_______An internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section _______ ____

_______Other serious safety or health hazards__________________________________

____

____

Tetra Tech has implemented the following precautions/procedures for the protection of our employees in or near this space:

- Education and training on confined space recognition
- Posting with "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER" or "DANGER - CONFINED SPACE - DO NOT ENTER" signs
- Other means as follows:____
  ____

If Tetra Tech and ________________________________ will need to perform concurrent operations in or near the space, activities will be conducted in accordance with the following coordinated system:________

____

____

____

____

____

3.0 Subcontractor Debrief

Work was concluded on _______/___/___. The following confined space hazards were confronted or created during entry operations.

____
____
____
____
____
____
____
____

Problems encountered in administering or complying with the site Confined Space Entry Program were as follows:____
____
____

Suggestions for improvements of this program discussed during the debrief included

____
____
____

______________________________	______________________________
Signature of Subcontractor Agent	SSO Signature

ATTACHMENT IX

HEAVY EQUIPMENT INSPECTION CHECKLIST

Heavy Equipment Inspection Checklist

Company:______________________________ **Unit/Serial No#:**____________________

Inspection Date: ____/____/____ **Time:**______:_____ **Equipment Type:**______________________________
(e.g., earthmoving equipment - tractors backhoes, bulldozers, etc.)

Project Name:______________________________ **Project No#:**______________________________

Yes	No	NA	Requirements	Comments
			Seat Belts	
☐	☐	☐	• Are available for intended operator and passengers (where applicable)	
☐	☐	☐	• Seat Belts are operational?	
			Roll-Over Protection (ROPS)	
☐	☐	☐	• Roll-over protection structures (ROPS) are provided on vehicles and heavy equipment (including scrapers, tractors, loaders, bulldozers, carryalls, etc.)	
			Brakes	
☐	☐	☐	• Brake systems capable of stopping and holding fully loaded equipment	
☐	☐	☐	• Parking Brake functions properly	
☐	☐	☐	• Wheel Chocks available (where and as applicable)	
			Access	
☐	☐	☐	• Non-slip steps	
☐	☐	☐	• Grab Handles (3-Point Grab/Step Mounting Points)	

Yes	No	NA	Requirements	Comments
			Audible Alarms	
☐	☐	☐	• Audible alarms – All bidirectional machines, such as rollers, compacters, front-end loaders, bulldozers, and similar equipment, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction.	
☐	☐	☐	- Back up Alarms – All self propelled equipment with an obstructed view to the rear will be equipped with a reverse gear signal alarm distinguishable from the surrounding noise level.	
☐	☐	☐	• Horn functioning properly	

Yes	No	NA	Requirements	Comments
			Highway Use	
☐	☐	☐	• Fenders for equipment that can exceed 15mph	
☐	☐	☐	• Fire Extinguisher	
☐	☐	☐	• Are exhaust emissions directed away from the Operator?	
☐	☐	☐	• Cab	
☐	☐	☐	- Clean, free from debris, tools or equipment that can interfere with foot Control.	
☐	☐	☐	- Free from storage of flammable material/solvents	
☐	☐	☐	• Mirrors,	
☐	☐	☐	• Safety glass	
☐	☐	☐	- Equipped with defrosters	
☐	☐	☐	- Windshield wipers	
☐	☐	☐	• Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	
☐	☐	☐	• Gauges functioning properly	
☐	☐	☐	• Tires (Tread) or tracks	
☐	☐	☐	• Steering (standard and emergency)	
☐	☐	☐	• Are tools and material secured to prevent movement during transport?	
			Fluid Levels:	
☐	☐	☐	• Engine oil	
☐	☐	☐	• Transmission fluid	
☐	☐	☐	• Brake fluid	
☐	☐	☐	• Cooling system fluid	
☐	☐	☐	• Hoses and belts	
☐	☐	☐	• Hydraulic oil	

Yes	No	NA	Requirements	Comments
			Fueling	
☐	☐	☐	• Fueling of vehicles and heavy equipment is done with the engine off.	
☐	☐	☐	• No smoking is permitted at or near the fuel storage or refueling area. A sign is posted stating: NO SMOKING WITHIN 50 FEET.	
☐	☐	☐	• No sources of ignition are present near the fuel storage or refueling area.	
☐	☐	☐	• A dry chemical or carbon dioxide fire extinguisher (rated 6:BC or larger) is in a location accessible to the fueling area, no closer than 50-feet.	
☐	☐	☐	• Safety cans available?	
			Safety Guards –	
☐	☐	☐	• Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact?	
☐	☐	☐	• Hot pipes and surfaces are protected from accidental contact?	
☐	☐	☐	• High pressure pneumatic lines have safety cable to prevent thrashing should it become disconnected?	
			Attachments	
☐	☐	☐	• Have the attachments designed for use (as per manufacturer’s recommendation) with this equipment been inspected and are considered suitable for use?	

Yes	No	NA	Requirements	Comments
			Operator Qualifications	
☐	☐	☐	• Does the operator have proper licensing where applicable, (e.g., CDL)?	
☐	☐	☐	• Does the operator, understand the equipment's operating instructions?	
☐	☐	☐	• Is the operator experienced with this equipment?	
☐	☐	☐	• Is the operator 21 years of age or more?	
			PPE Required	
☐	☐	☐	• Hardhat	
☐	☐	☐	• Safety glasses	
☐	☐	☐	• Work gloves	
☐	☐	☐	• Chemical resistant gloves__________________________	
☐	☐	☐	• Steel toed Work Boots	
☐	☐	☐	• Chemical resistant Boot Covers	
☐	☐	☐	• Apron	
☐	☐	☐	• Coveralls Tyvek, Saranex, cotton)___________________	
☐	☐	☐	Key(s)?	
☐	☐	☐	Operating Manual?	
			Other Hazards	
☐	☐	☐	• Excessive Noise Levels _______________________dBA	
☐	☐	☐	• Chemical hazards (Drilling supplies - Sand, bentonite, grout, fuel, etc.)	
☐	☐	☐	- MSDSs available?	

Approved for Use ☐ Yes ☐ No ☐ See Comments

______________________________________ Site Health and Safety Officer

______________________________________ Operator

ATTACHMENT X

OSHA HEALTH & SAFETY
CONSTRUCTION-RELATED
REGULATIONS - P - 650 TO 699
SUBPART P - EXCAVATIONS

OSHA Health & Safety Construction-related Regulations - P - 650 to 699

Subpart P - Excavations

§ 1926.650 - Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or other wise injure and immobilize a person.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or *sides* means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 - Specific excavation requirements.

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.*

(b)(1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(b)(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations,the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(b)(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(b)(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c)(2) *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) *Exposure to vehicular traffic.* Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) *Exposure to falling loads.* No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) *Warning system for mobile equipment.* When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(h) *Protection from hazards associated with water accumulation.*

(h)(1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(h)(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(h)(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) *Stability of adjacent structures.*

(i)(1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(i)(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(i)(2)(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(i)(2)(ii) The excavation is in stable rock; or

(i)(2)(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(i)(2)(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(i)(3) Sidewalks, pavements and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.*

(j)(1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(j)(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.*

(k)(1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(k)(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Gurardrails which comply with 1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

§ 1926.652 - Requirements for protective systems.

(a) *Protection of employees in excavations.*

(a)(1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(a)(1)(i) Excavations are made entirely in stable rock; or

(a)(1)(ii) Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(a)(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3); or, in the alternative, paragraph (b)(4), as follows:

(b)(1) Option (1) - Allowable configurations and slopes.

(b)(1)(i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(b)(1)(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(b)(2) Option (2) - Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(b)(4) Option (4) - Design by a registered professional engineer.

(b)(4)(i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(b)(4)(ii) Designs shall be in written form and shall include at least the following:

(b)(4)(ii)(A) The magnitude of the slopes that were determined to be safe for the particular project;

(b)(4)(ii)(B) The configurations that were determined to be safe for the particular project;

(b)(4)(ii)(C) The identity of the registered professional engineer approving the design.

(b)(4)(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(2) as follows:

(c)(2) Option (2) - Designs Using Manufacturer's Tabulated Data.

(c)(2)(i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(c)(2)(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(c)(2)(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(e) *Installation and removal of support-*

(e)(1) *General.*

(e)(1)(i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(e)(1)(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(e)(1)(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(e)(1)(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(e)(1)(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(e)(1)(vi) Backfilling shall progress together with the removal of support systems from excavations.

(e)(2) *Additional requirements for support systems for trench excavations.*

(e)(2)(i) Excavation of material to a level no greater than 2 feed (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(e)(2)(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems.*

(g)(1) *General.*

(g)(1)(i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(g)(1)(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(g)(1)(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(g)(1)(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(g)(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Subpart P Appendix A - Soil Classification

(a) *Scope and application.*

(a)(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(a)(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following; American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System; The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if: (i) The soil is fissured; or (ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or (iii) The soil has been previously disturbed; or (iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or (v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means: (i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or (ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam. (iii) Previously disturbed soils except those which would otherwise be classed as Type C soil. (iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or (v) Dry rock that is not stable; or (vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means: (i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48kPa) or less; or (ii) Granular soils including gravel, sand, and loamy sand; or (iii) Submerged soil or soil from which water is freely seeping; or (iv) Submerged rock that is not stable, or (v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*

(c)(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(c)(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(c)(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(c)(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(c)(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests.-*

(d)(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(d)(1)(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(d)(1)(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(d)(1)(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(d)(1)(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(d)(1)(v) Observed the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(d)(1)(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(d)(1)(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(d)(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(d)(2)(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(d)(2)(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(d)(2)(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488 - "Standard Recommended Practice for Description of Soils (Visual - Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(d)(2)(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(d)(2)(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(d)(2)(v)(A) If the sample develops cracks as it dries, significant fissures are indicated.

(d)(2)(v)(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined.

(d)(2)(v)(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Subpart P Appendix B - Sloping and Benching

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements -*

(c)(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(c)(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(c)(3) *Actual slope.*

(c)(3)(i) The actual slope shall not be steeper than the maximum allowable slope.

(c)(3)(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

(c)(3)(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with 1926.651(i).

(c)(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1.
Maximum Allowable Slopes

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A [2]	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

[1] Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

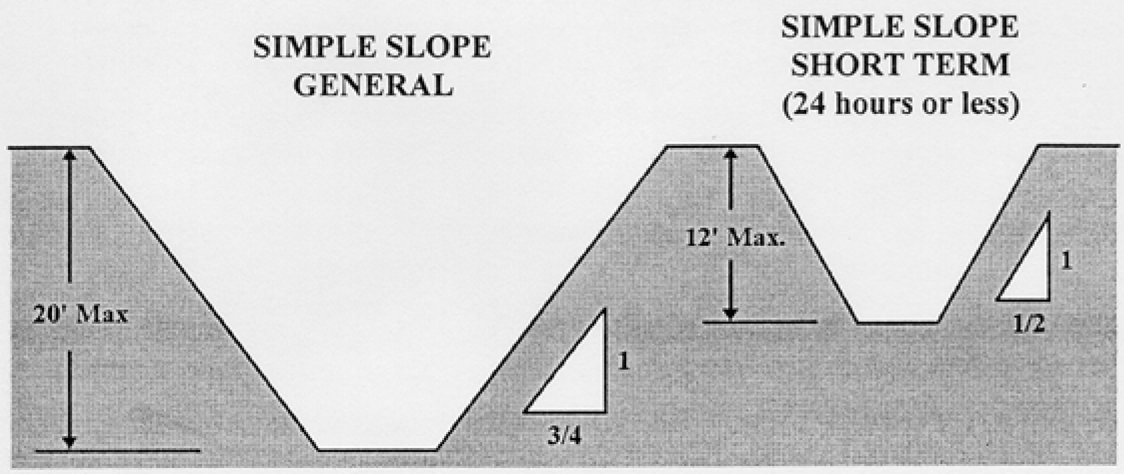
[2] A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feed (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).

[3] Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

Figure B-1 - Slope Configurations
(All slopes stated below are in the horizontal to vertical ratio)

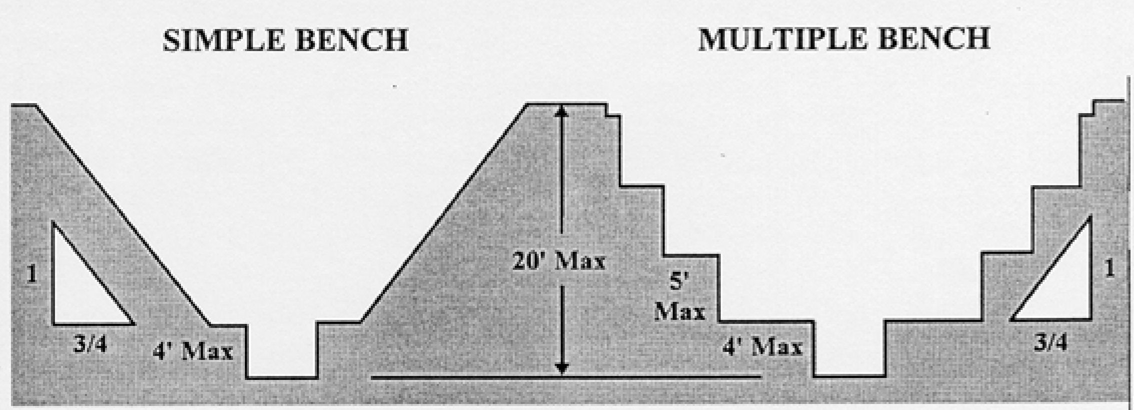
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.

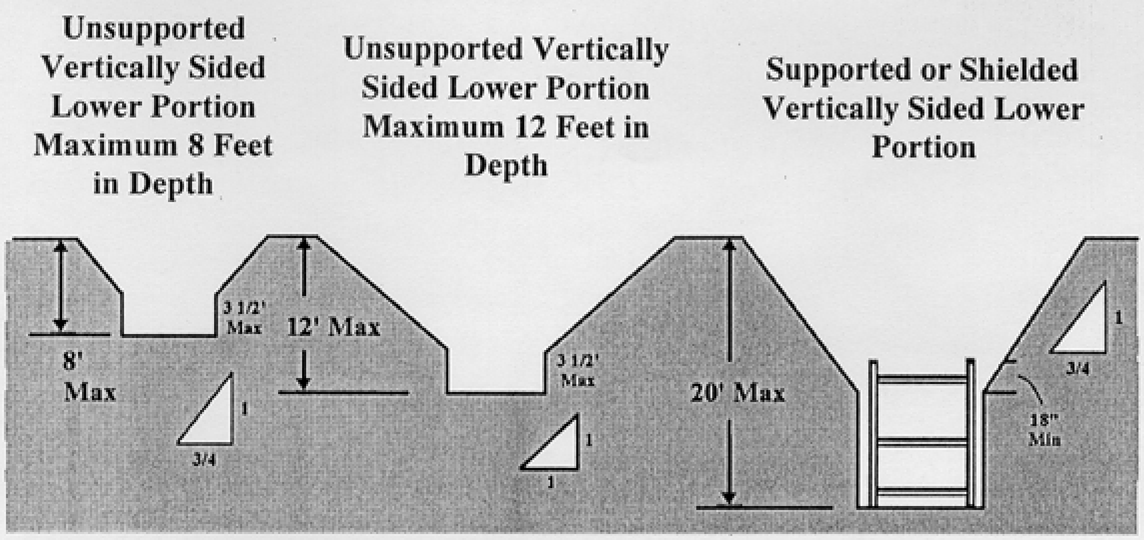


Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:



3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.



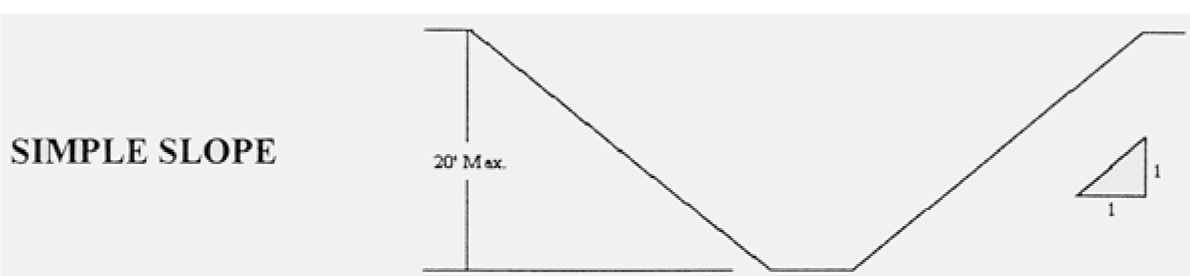
All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3 1/2 feet.

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

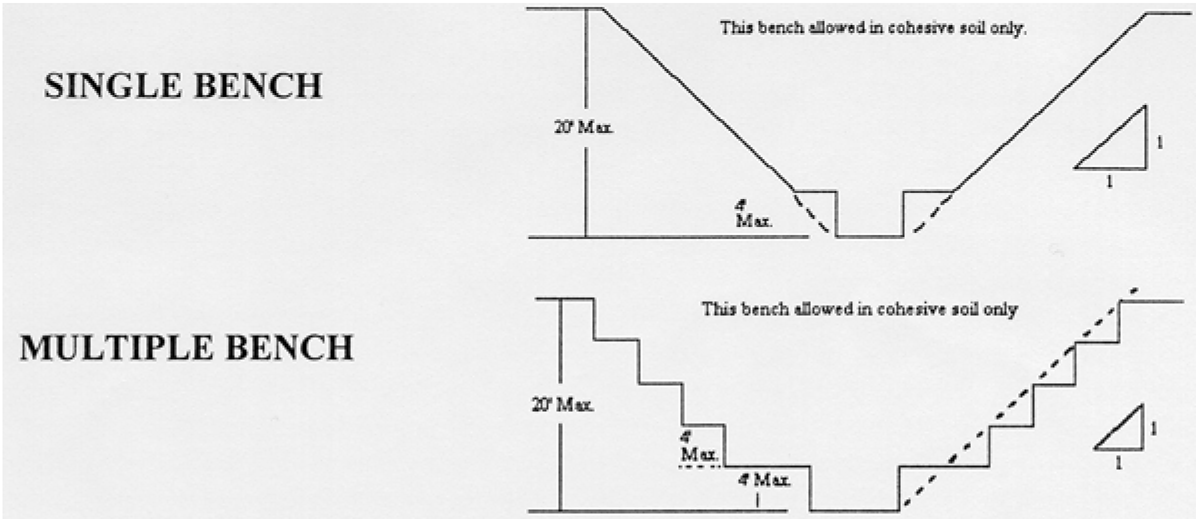
4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1926.652(b).

B-1.2 Excavations made in Type B soil.

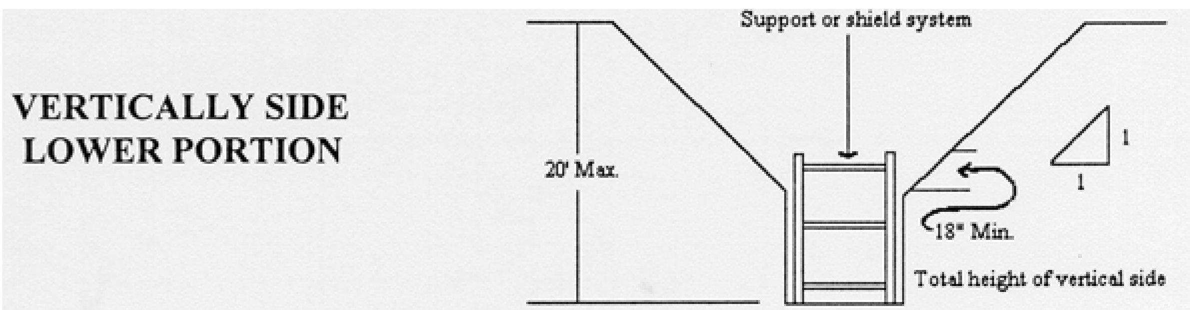
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



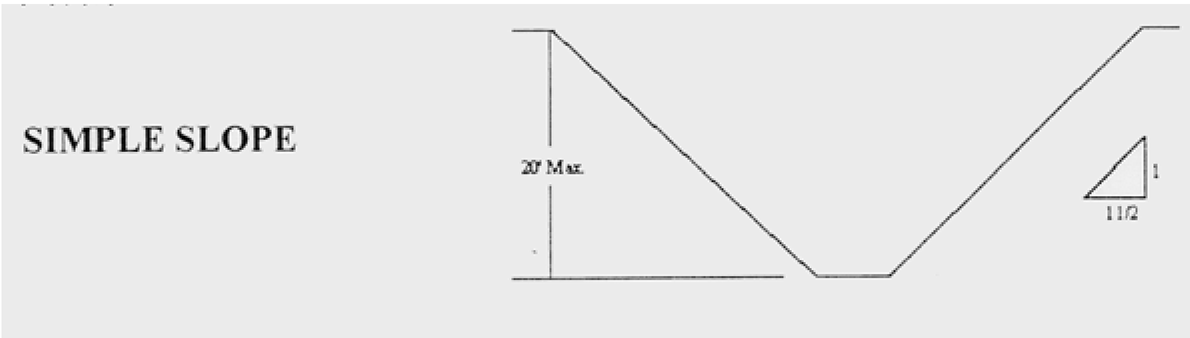
3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.



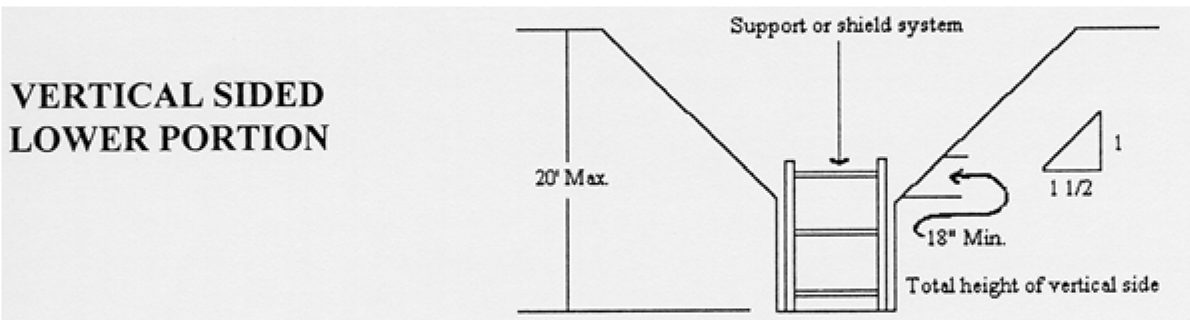
4. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

B-1.3 Excavations made in Type C soil.

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.



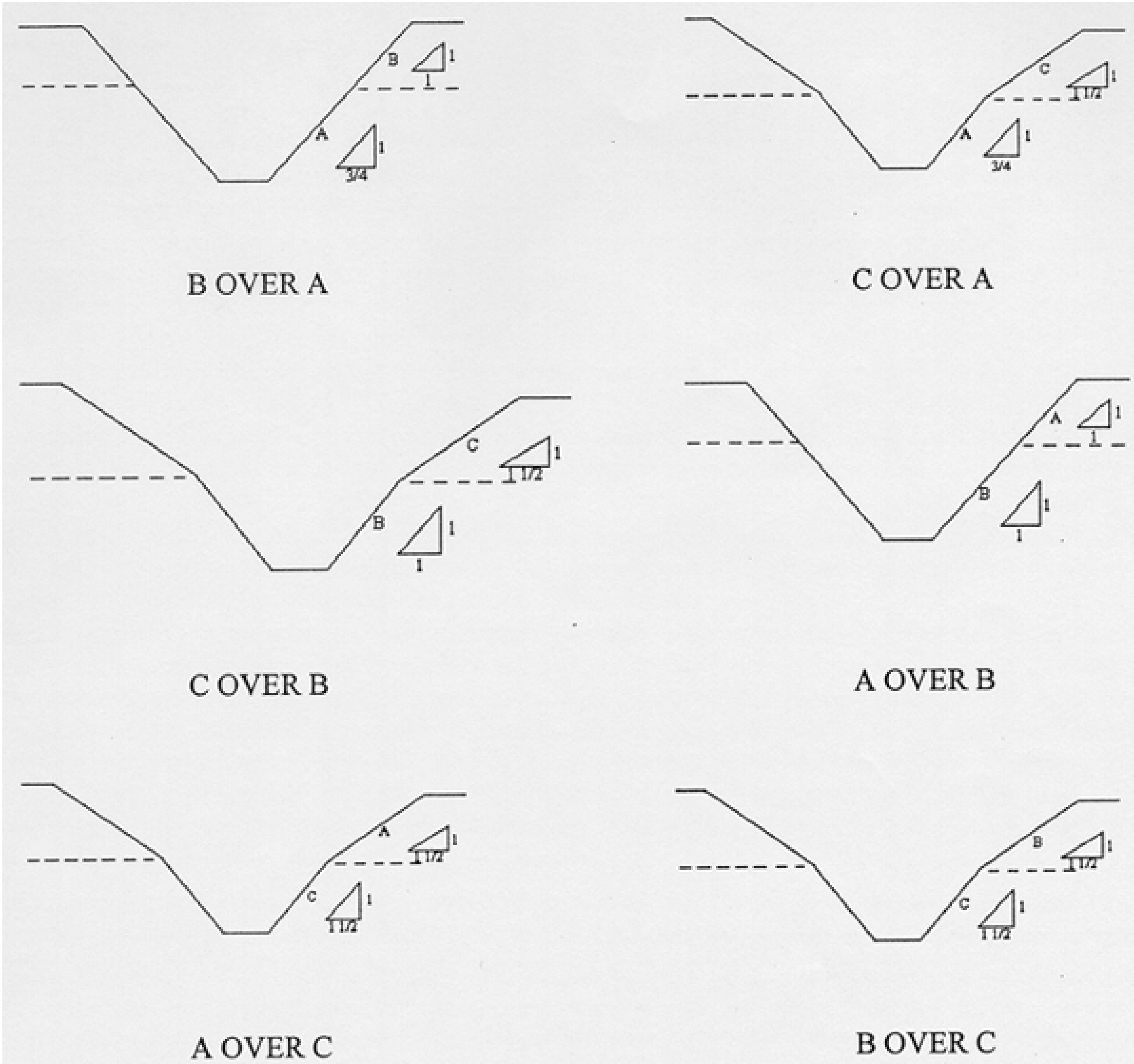
2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1.



3. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

B-1.4 Excavations made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



2. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

ATTACHMENT XI

TETRA TECH DECONTAMINATION OF FIELD EQUIPMENT AND WASTE HANDLING STANDARD OPERATING PROCEDURE

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number SA-7.1	Page 1 of 8
		Effective Date 09/03	Revision 3
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject DECONTAMINATION OF FIELD EQUIPMENT		Approved D. Senovich	

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SECTION **PAGE**

1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The objective/purpose of this SOP is intended to protect site personnel, general public, and the sample integrity through the prevention of cross contamination onto unaffected persons or areas. It is further intended through this procedure to provide guidelines regarding the appropriate procedures to be followed when decontaminating drilling equipment, monitoring well materials, chemical sampling equipment and field analytical equipment.

2.0 SCOPE

This procedure applies to all equipment including drilling equipment, heavy equipment, monitoring well materials, as well as chemical sampling and field analytical equipment decontamination that may be used to provide access/acquire environmental samples. Where technologically and economically feasible, single use sealed disposable equipment will be employed to minimize the potential for cross contamination. This procedure also provides general reference information on the control of contaminated materials.

3.0 GLOSSARY

Acid - For decontamination of equipment when sampling for trace levels of inorganics, a 10% solution of nitric acid in deionized water should be used. Due to the leaching ability of nitric acid, it should not be used on stainless steel.

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - Is a solution selected/identified within the Health and Safety Plan or Project-Specific Quality Assurance Plan. The solution is selected and employed as directed by the project chemist/health and safety professional.

Deionized Water (DI) - Deionized water is tap water that has been treated by passing through a standard deionizing resin column. This water may also pass through additional filtering media to attain various levels of analyte-free status. The DI water should meet CAP and NCCLS specifications for reagent grade, Type I water.

Potable Water - Tap water used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Employs high pressure pumps and nozzle configuration to create a high pressure spray of potable water. High pressure spray is employed to remove solids.

Solvent - The solvent of choice is pesticide-grade Isopropanol. Use of other solvents (methanol, acetone, pesticide-grade hexane, or petroleum ether) may be required for particular projects or for a particular purpose (e.g. for the removal of concentrated waste) and must be justified in the project planning documents. As an example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

Steam Pressure Washing - This method employs a high pressure spray of heated potable water. This method through the application of heat provides for the removal of various organic/inorganic compounds.

4.0 RESPONSIBILITIES

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved Standards Operating Procedures or as otherwise dictated by the approved project plan(s).

Site Health and Safety Officer (SHSO) - The SHSO exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on-site (as part of the equipment inspection), leaving the site, moving between locations are required to go through a decontamination evaluation. This is accomplished through visual examination and/or instrument screening to determine the effectiveness of the decontamination process. Failure to meet these objectives are sufficient to restrict equipment from entering the site/exiting the site/ or moving to a new location on the site until the objectives are successfully completed.

5.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or the isolation of contaminants. In order to accomplish this activity a level of preparation is required. This includes site preparation, equipment selection, and evaluation of the process. Site contaminant types, concentrations, media types, are primary drivers in the selection of the types of decontamination as well as where it will be conducted. For purposes of this SOP discussion will be provided concerning general environmental investigation procedures.

The decontamination processes are typically employed at:

- Temporary Decontamination Pads/Facilities
- Sample Locations
- Centralized Decontamination Pad/Facilities
- Combination of some or all of the above

The following discussion represents recommended site preparation in support of the decontamination process.

5.1 Decontamination Design/Constructions Considerations

5.1.1 Temporary Decontamination Pads

Temporary decontamination pads are constructed at satellite locations in support of temporary work sites. These structures are generally constructed to support the decontamination of heavy equipment such as drill rigs and earth moving equipment but can be employed for smaller articles.

The purpose of the decontamination pad is to contain wash waters and potentially contaminated soils generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations

- Site Location – The site selected should be within a reasonable distance from the work site but should avoid:

  - Pedestrian/Vehicle thoroughfares
  - Areas where control/custody cannot be maintained
  - Areas where a potential releases may be compounded through access to storm water transport systems, streams or other potentially sensitive areas.
  - Areas potentially contaminated.

- Pad – The pad should be constructed to provide the following characteristics

  - Size – The size of the pad should be sufficient to accept the equipment to be decontaminated as well as permitting free movement around the equipment by the personnel conducting the decontamination.

  - Slope – An adequate slope will be constructed to permit the collection of the water and potentially contaminated soils within a trough or sump constructed at one end. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks.

  - Sidewalls – The sidewalls should be a minimum of 6-inches in height to provide adequate containment for wash waters and soils. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls maybe constructed of wood, inflatables, sand bags, etc. to permit containment.

  - Liner – Depending on the types of equipment and the decontamination method the liner should be of sufficient thickness to provide a puncture resistant barrier between the decontamination operation and the unprotected environment. Care should be taken to examine the surface area prior to placing the liner to remove sharp articles (sticks, stones, debris) that could puncture the liner. Liners are intended to form an impermeable barrier. The thickness may vary from a minimum recommended thickness of 10 mil to 30 mil. Achieving the desired thickness maybe achieved through layering lighter constructed materials. It should be noted that various materials (rubber, polyethylene sheeting) become slippery when wet. To minimize this potential hazard associated with a sloped liner a light coating of sand maybe applied to provide traction as necessary.

  - Wash/drying Racks – Auger flights, drill/drive rods require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process. A minimum ground clearance of 2-feet is recommended.

  - Maintenance – The work area should be periodically cleared of standing water, soils, and debris. This action will aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross contamination. Hoses should be gathered when not in use to eliminate potential tripping hazards.

5.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including drilling and direct push activities decontamination of drive rods, Macro Core Samplers, split spoons, etc. are typically conducted at an area adjacent to the operation. Decontamination is generally accomplished using a soap/water wash and rinse utilizing buckets and brushes. This area requires sufficient preparation to accomplish the decontamination objectives.

Buckets shall be placed within mortar tubs or similar secondary containment tubs to prevent splash and spills from reaching unprotected media. Drying racks will be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/re-use.

5.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations sampling devices such as trowels, pumps/tubing should be evacuated of potentially contaminated media to the extent possible. This equipment should be wrapped in plastic for transport to the temporary/centralized decontamination location for final cleaning and disposition.

5.2 Equipment Decontamination Procedures

The following represents procedures to be employed for the decontamination of equipment that may have contacted and/or accumulated contamination through site investigation activities.

5.2.1 Monitoring Well Sampling Equipment

5.2.1.1 Groundwater sampling pumps – This includes pumps inserted into the monitoring well such as Bladder pumps, Whale pumps, Redi-Flo, reusable bailers, etc.

1) Evacuate to the extent possible, any purge water within the pump.

2) Scrub using soap and water and/or steam clean the outside of the pump and tubing, where applicable.

3) Insert the pump and tubing into a clean container of soapy water. Pump a sufficient amount of soapy water through the pump to flush any residual purge water. Once flushed, circulate soapy water through the pump to ensure the internal components are thoroughly flushed.

4) Remove the pump and tubing from the container, rinse external components using tap water. Insert the pump and tubing into a clean container of tap water. Pump a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).

5) Rinse equipment with pesticide grade isopropanol

6) Repeat item #4 using deionized water through the hose to flush out the tap water and solvent residue as applicable*.

7) Drain residual deionized water to the extent possible, allow components to air dry.

8) Wrap pump in aluminum foil or a clear clean plastic bag for storage.

5.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

During water level measurements, rinsing with the extracted tape and probe with deionized water and wiping the surface of the extracted tape is acceptable. However, periodic full decontamination should be conducted as indicated below.

---

* - The solvent should be employed when samples contain oil, grease, PAHs, PCBs, and other hard to remove materials. If these are not of primary concern, the solvent step may be omitted. In addition, do not rinse PE, PVC, and associated tubing with solvents.

1) Wash with soap and water
2) Rinse with tap water
3) Rinse with deionized water

Note: In situations where oil, grease, free product, other hard to remove materials are encountered probes and exposed tapes should be washed in hot soapy water.

5.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) should be cleaned per manufacturer's instructions. This generally includes wiping down the sensor housing and rinsing with tap and deionized water.

Coolers/Shipping Containers employed to ship samples are received from the lab in a variety of conditions from marginal to extremely poor. Coolers should be evaluated prior to use for

- Structural integrity – Coolers missing handles or having breaks within the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples will not be attempted and request a replacement unit.

- Cleanliness – As per protocol only volatile organic samples are accompanied by a trip blank. If a cooler's cleanliness is in question (visibly dirty/stained) or associated with noticeable odors it should be decontaminated prior to use.

  1) Wash with soap and water
  2) Rinse with tap water
  3) Dry

If these measures fail to clean the cooler to an acceptable level, remove the unit from use as a shipping container and notify the laboratory to provide a replacement unit.

5.2.2 Down-Hole Drilling Equipment

This includes any portion of the drill rig that is over the borehole including auger flights, drill stems, rods, and associated tooling that would extend over the borehole. This procedure is to be employed prior to initiating the drilling/sampling activity, then between locations.

1) Remove all soils to the extent possible using shovels, scrapers, etc. to remove loose soils.
2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.
3) Rinse with tap water.
4) Rinse equipment with pesticide grade isopropanol
5) To the extent possible allow components to air dry.
6) Wrap or cover equipment in clear plastic until it is time to be used.

5.2.3 Soil/Sediment Sampling Equipment

This consists of soil sampling equipment including but not limited to hand augers, stainless steel trowels/spoons, bowls, dredges, scoops, split spoons, Macro Core samplers, etc.

1) Remove all soils to the extent possible.

2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.

3) Rinse with tap water.

4) Rinse equipment with pesticide grade isopropanol

5) Rinse with deionized water

6) To the extent possible allow components to air dry.

7) If the device is to be used immediately, screen with a PID/FID to insure all solvents (if they were used) and trace contaminants have been adequately removed.

8) Once these devices have been dried wrap in aluminum foil for storage until it is time to be used.

5.3 Contact Waste/Materials

During the course of field investigations disposable/single use equipment becomes contaminated. These items include tubing, trowels, PPE (gloves, overboots, splash suits, etc.) broken sample containers.

With the exception of the broken glass, single use articles should be cleaned (washed and rinsed) of visible materials and disposed of as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned should be containerized for disposal in accordance with applicable federal state and local regulations.

5.3.1 Decontamination Solutions

All waste decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility. These containers must be appropriately labeled.

5.4 Decontamination Evaluation

Determining the effectiveness of the decontamination process will be accomplished in the following manner

- Visual Evaluation – A visual evaluation will be conducted to insure the removal of particulate matter. This will be done to insure that the washing/rinsing process is working as intended.

- Instrument Screening – A PID and/or an FID should be used to evaluate the presence of the contaminants or solvents used in the cleaning process. The air intake of the instrument should be passed over the article to be evaluated. A positive detection requires a repeat the decontamination process. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instruments capabilities.

- Rinsate Blanks – It is recommended that Rinsate samples be collected to

  - Evaluate the decontamination procedure representing different equipment applications (pumps versus drilling equipment) and different decontamination applications.

  - Single use disposable equipment – The number of samples should represent different types of equipment as well as different Lot Numbers of single use articles.

The collection and the frequency of collection of rinsate samples are as follows:

- Per decontamination method
- Per disposable article/Batch number of disposable articles

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and in an effort to avoid using a contaminated batch of single use articles. It is recommended that a follow up sample be collected during the execution of the project to insure those conditions do not change. Lastly, rinsate samples collection may be driven by types of and/or contaminant levels. Hard to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.

ATTACHMENT XII

OSHA POSTER

Job Safety and Health

It's the law!

OSHA

Occupational Safety
and Health Administration
U.S. Department of Labor

EMPLOYEES:

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in that inspection.
- You can file a complaint with OSHA within 30 days of retaliation or discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have the right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violations.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records and records of your exposures to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.
- You must comply with all occupational safety and health standards issued under the *OSH Act* that apply to your own actions and conduct on the job.

EMPLOYERS:

- You must furnish your employees a place of employment free from recognized hazards.
- You must comply with the occupational safety and health standards issued under the *OSH Act*.

This free poster available from OSHA –
The Best Resource for Safety and Health

Free assistance in identifying and correcting hazards or complying with standards is available to employers, without citation or penalty, through OSHA-supported consultation programs in each state.

1-800-321-OSHA

www.osha.gov

OSHA 3165-12-06R

APPENDIX D—WASTE MANAGEMENT PLAN

Waste Management Plan
Martin State Airport and Satellite Sites
701 Wilson Point Road
Middle River, Maryland

Prepared for:

Lockheed Martin Corporation

Prepared by:

Tetra Tech, Inc.

January 2013

Michael Martin, P.G.
Regional Manager

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Appendix B— Hazardous Waste Manifest Signature-Authorization Form

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Appendix F— EESH Remediation Operating Procedure No: EROP-03, "EESH Remediation Waste Management"

ACRONYMS

CFR	*Code of Federal Regulations*
HAZWOPER	hazardous waste operations
IDW	investigation-derived waste
LMCPI	LMC Properties, Inc.
Lockheed Martin	Lockheed Martin Corporation
MAA	Maryland Aviation Administration
MDANG	Maryland Air National Guard
MDOT	Maryland Department of Transportation
MSA	Martin State Airport
OSHA	(federal) Occupational Safety and Health Administration
PPE	personal protective equipment
Tetra Tech	Tetra Tech, Inc.
TSD	treatment, storage, and disposal
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency

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Section1
Purpose

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech, Inc. (Tetra Tech) has prepared this *Waste Management Plan* due to the potentially contaminated nature of the waste that will be generated as part of the field investigations conducted at the Martin State Airport (MSA) Dump Road, Main Terminal, and Strawberry Point locations and adjacent creeks (Figure 1-1). Waste materials that will be generated will be both solid and liquid and will be handled as investigation derived waste (IDW). Following proper IDW procedures, the IDW generated will be collected in U.S. Department of Transportation approved steel drums, stored at a facility designated location (considered a temporary, satellite accumulation area), sampled for waste profiling and characterization and, once characterized, disposed of off-site at a Lockheed Martin approved facility. IDW generated during MSA field investigations will include, but is not limited to, soil, sediment, and water (surface, groundwater, purge and/or decontamination water).

A Tetra Tech geologist will be on-site for all field activities performed by Lockheed Martin at MSA. All work conducted by a subcontractor will be performed under the direction of the Tetra Tech geologist and in full compliance with the Maryland Department of Transportation (DOT), and other local, state, and federal regulations, including the federal Resource Conservation and Recovery Act, Toxic Substances Control Act, Occupational Safety and Health Administration (OSHA) 1910.120, and Lockheed Martin's EROP-03. IDW will be handled in accordance with the U.S. Environmental Protection Agency (USEPA) guidance *Management of Investigation Derived Wastes During Site Inspections*, OERR Directive 9345.3-02, May 1991. This plan is organized as follows:

<u>Section 2—Responsibilities and Training Requirements</u>: Presents the requirements and responsibilities of Tetra Tech and the appointed subcontractor

<u>Section 3—Hazardous Waste Determinations</u>: Briefly describes how the determination of waste characterization is completed

<u>Section 4—Shipping Requirements</u>: Pre-shipment, shipping, and post-shipping requirements

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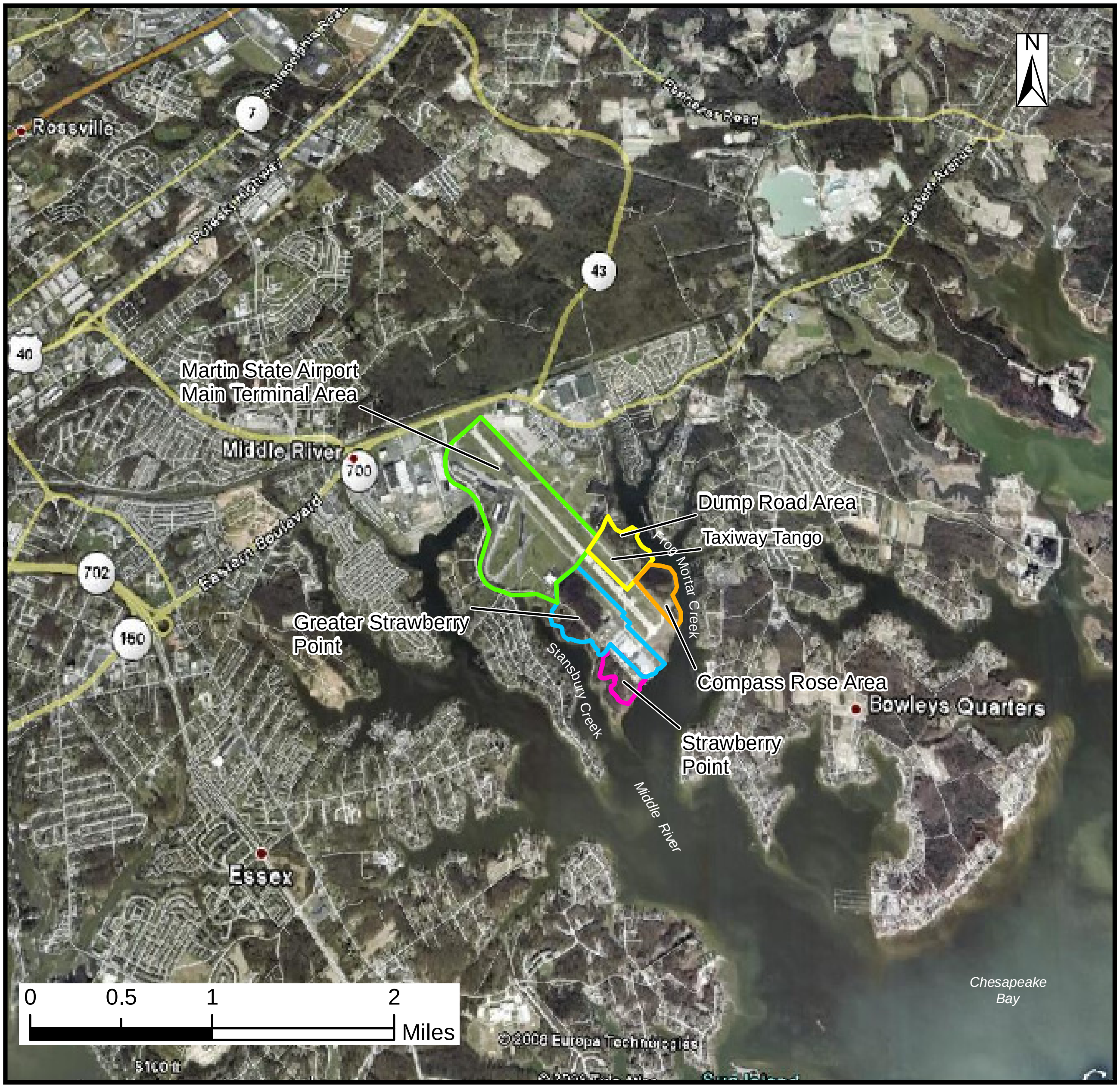

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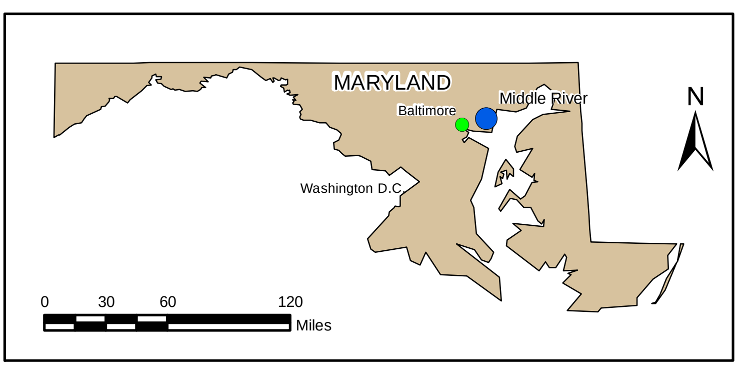

FIGURE 1-1

MARTIN STATE AIRPORT AND DUMP ROAD AREA INCLUDING COMPASS ROSE SITE LOCATION MAP

Lockheed Martin, Martin State Airport
Middle River, Maryland

DATE MODIFIED: 3/19/12	CREATED BY: MP

TETRA TECH

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Section 2
Responsibilities and Training Requirements

Training complying with all state and federal protocols is required for all Tetra Tech personnel and subcontractors. All personnel will complete appropriate federal Occupational Safety and Health Administration (OSHA) hazardous waste operations (HAZWOPER) training and annual refresher training as specified in 29 *Code of Federal Regulations (CFR)* §1910.120. All subcontractor-training certifications shall be provided electronically to the Lockheed Martin project lead. Tetra Tech personnel certificates are maintained internally and can be provided to Lockheed Martin upon request.

U.S. Department of Transportation (USDOT) HAZMAT employee training is required for anyone involved in preparing hazardous waste for shipment and offering hazardous waste for transport and transportation, including signing of hazardous waste manifests (see 49 CFR 172, Subpart H). The waste management subcontractor will have completed HAZMAT employee training and will renew the training as necessary to meet USDOT requirements for hazardous waste transportation. Martin State Airport (MSA) is listed as a U.S. Environmental Protection Agency (USEPA) “large quantity generator” (MDR000518760). Facilities that generate more than 1,000 kilograms per month of hazardous waste must comply with the emergency preparedness and personnel training requirements outlined in 40 CFR §265.16 (see 40 CFR §262.34[a][4]). This training is intended for the generator’s contactors (Tetra Tech) and includes training by a person qualified in hazardous waste management and emergency response procedures.

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Section 3
Hazardous Waste Determination and Process

Hazardous waste determinations shall be made in accordance with 40 *Code of Federal Regulations* (CFR) 262.11, using a combination of process knowledge and analytical evaluation of waste sampling. Hazardous waste determinations shall be reevaluated whenever any of the following occurs:

- a change in the process that produces the waste (e.g. a new chemical constituent is discovered, the treatment process changes, etc.)
- a change in the treatment media (e.g. new media vendor or media type)
- a waste is tainted by inadvertent mixing with another waste
- a change occurs to the hazardous waste regulations governing that waste

Waste generated during field investigations will include (but is not limited to) soil, sediment, water (surface, groundwater, purge, and/or decontamination water), and disposable personal protective equipment (PPE). PPE investigation derived waste (IDW) will be brushed off, placed in trash bags, and disposed of in a facility trash receptacle designated by Martin State Airport (MSA) personnel. IDW generated during field activities will be segregated into drums based upon historical data, when applicable, labeled to indicate the wells and locations from which the waste was generated, and the generation date. IDW generated during this activity will be further characterized and disposed of in accordance with state regulations unless state requirements are less stringent than federal requirements, in which case federal requirements shall apply.

When received from the analytical laboratory for the field investigations, the analytical data will be provided to the subcontractor to facilitate IDW classification, i.e., non-hazardous versus hazardous. IDW generated during previous sampling events were classified predominantly as non-hazardous; however, since then, in some cases IDW has been classified as hazardous.

Therefore, IDW materials may be characterized as hazardous during future sampling events conducted at MSA.

All analytical data shall be presented to the IDW subcontractor for classification of IDW generated from the field project. The IDW subcontractor will determine whether additional IDW sampling is required to complete the profiles based on the analytical data. If additional sampling is required to satisfy waste characterization parameters, Tetra Tech will schedule a site visit and oversee the sampling conducted by the IDW subcontractor.

Following receipt of the approved analytical data, the IDW subcontractor shall develop a profile for the waste. In some cases, if the IDW is classified under a waste stream that has already been profiled within the past year, a new profile will not be required and the IDW will be handled under the existing profile. In this case, an "Annual Generator Waste Recertification" form will be issued by the IDW subcontractor, which shall be signed and approved by Mike Musheno of LMC Properties, Inc. (LMCPI). If no existing profile applies, the new profile shall be sent to the Tetra Tech project manager for initial review. The Tetra Tech project manager will review and forward the waste profile forms to the appropriate site contact. All forms related to IDW from Martin State Airport will be signed and approved by Mike Musheno of LMCPI.

The "Waste Listing Assessment Form" is in Appendix A. This form will be completed by the Tetra Tech project manager as the first step in the IDW classification/removal process. It serves as first notification and is presented to the managing contractor for review. The form presents pertinent information such as the project name, description of the waste, date generated, type and classification of waste.

Lockheed Martin may choose to issue a Lockheed Martin "Hazardous-Waste-Manifest Signatory Authorization Form," presented in Appendix B. This form authorizes a Lockheed Martin subcontractor to sign for the IDW and certifies that the representative has taken the USDOT training delineated in 49 CFR Part 172 *et seq.* and is in compliance with all state and federal requirements for hazardous waste manifesting. Lockheed Martin remains responsible and liable for the hazardous waste being disposed regardless of the signatory authorization provided on the form.

Following signature of the waste profile forms by Lockheed Martin or an authorized representative, the IDW will be scheduled for removal from the site. The Tetra Tech project manager will coordinate the IDW removal with the appropriate Lockheed Martin site contact. The Lockheed Martin site contact or authorized representative shall be on-site to sign the bills of lading for nonhazardous IDW or the waste manifests for hazardous IDW. Signed copies of the returned bills of lading and waste manifests will be kept on file for at least three years and be available for review if requested.

Before IDW leaves the site, the Lockheed Martin site contact or authorized representative will complete a waste shipment checklist. (The “Hazardous Material/Waste Shipment Checklist” is presented in Appendix C for reference.) Completion of this checklist ensures that all protocols, standards and requirements have been adhered to and that the waste can be removed from the site. The checklist includes such line-item prompts as ensuring that the truck is fitted with proper waste placards, that the truck’s hazardous waste containers are double walled, and that waste manifests and bills of lading have been properly completed. Once the IDW is removed from the site, the Lockheed Martin representative and the Tetra Tech geologist will each be provided a copy of the associated paperwork. Tetra Tech will record the drums on a master “Drum Inventory Form” for each site. (A “Drum Inventory Form” is in Appendix D.)

A site contact list (Appendix E) will be maintained listing who shall be contacted in case of an emergency at the site or if questions arise about IDW disposal. An emergency contingency plan will be incorporated into the on-site health and safety plan and it will comply with all current and applicable regulations and requirements including, but not limited to OSHA 29 CFR 1903, 1904, 1910, and 1926. Lockheed Martin Corporation will be listed as the waste generator on all paperwork, including those waste profile sheets on which the generator was initially listed as Glenn L. Martin State Airport. The areas of Lockheed Martin investigations at MSA, including the Dump Road, Main Terminal, and Strawberry Point sites, and Frog Mortar and Stansbury Creeks, are identified by USEPA ID number MDR000518760 for hazardous waste disposal.

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Section 4
Shipping Requirements

4.1 PRE-SHIPMENT REQUIREMENTS

Waste generated during sampling will include but is not limited to drill cuttings from monitoring well installation, decontamination water, purge water from monitoring wells, and sediment and surface water from offshore sampling activities. Investigation derived waste (IDW) generated during previous investigations has been characterized as both non-hazardous and hazardous waste. Pre-shipping requirements have been discussed in detail in section 3.0.

4.1.1 Packing

All waste materials will be collected in new or reconditioned United States Department of Transportation (USDOT)-approved 55-gallon drums that will be sealed at the end of daily sampling. Special consideration will be made to manage certain wastes (such as bentonite grout) separately from other IDW so as not to increase the volume of material that may be classified as hazardous due to elevated pH.

4.1.2 Labeling

Drums will be marked with appropriate “Hazardous” or “Non-Hazardous” labels that include the following information:

- **site** name where waste was generated (e.g. Martin State Airport)
- **location** where the waste was generated (i.e., well identification, soil boring, test pit, sediment and surface water location number)
- **date** when waste materials accumulation began
- **drum number** in the series of drums from this sampling event
- **contents**, i.e., sediment, soil cuttings, groundwater and surface water
- **volume** should be estimated and must not exceed three quarters of drum capacity

- **site contact and emergency contact information** for the designated authorized Lockheed Martin representative for the site and the telephone number of the local fire department.

4.1.3 Storing

IDW storage areas will meet the following specifications to permit access to the drums and to conduct spill/leak monitoring, sampling, and extraction once the disposal route is determined:

- A temporary spill containment system, made of polyethylene sheeting and 2-inch by 6-inch wooden boards creating a bermed edge, will be placed under the container to contain any spills or leaks. The dimensions of the temporary spill-containment area will depend on the number of 55-gallon drums at the site. For most jobs, the spill containment area will likely be 10-feet by 20-feet. The integrity of the containment system will be monitored periodically.

- Fifty-five-gallon drums will be stored on wooden pallets, with four or fewer drums per pallet. The wooden pallets will be stored on a hard, flat surface inside the spill containment system and will be covered with polyethylene sheeting.

- The drum-retaining bolt and label will be readily visible.

- Approximately four feet of space will be left between each row of pallets/drums to allow access for sampling, drum removal, and spill response.

- Caution tape or temporary fencing will be placed around the drums to help identify and secure the area.

- Signs will be posted in front of the IDW storage area identifying the site, location, date of collection, number of drums, drum contents, volume of contents, site and emergency contact information, and the location of spill control materials for the wastes.

- Appropriate authorities will be informed that hazardous waste materials are on-site and of emergency response procedures. The emergency coordinator will be identified and emergency planning documented.

- A copy of work plans, waste disposal forms, and the IDW inventory list will be maintained on-site and provided to the project manager at the end of each shift.

- Spill response equipment will be readily available.

- Appropriate equipment will be used to move containers whenever possible, to avoid injury. When not possible, personnel will obtain help to manipulate containers.

- All storage containers will be monitored weekly to ensure that they remain in original condition and to ensure that no leaks or spills have occurred. Weekly inspections will be documented in a field notebook dedicated to the site and will include photographs.

Two IDW drum storage areas at MSA have been designated and approved by the Maryland Aviation Administration (MAA) and the Maryland Air National Guard (MDANG): a flat concrete pad area inside Gate 12, and a small, abandoned, concrete-block building located in the Strawberry Point portion of the site. An alternative area may be used to minimize drum transportation. Airport personnel will confirm IDW storage areas at Dump Road and Strawberry Point at the start of field activities. Single drums will be temporarily staged on wooden pallets on a hard, flat surface overlain by a temporary, secondary spill-containment system made of polyethylene sheeting and wooden boards with sufficient capacity to contain the contents of one 55-gallon drum. All IDW drums will be stored within the secondary containment until they can be removed from the site. Lockheed Martin has 90 days to remove non-hazardous- and hazardous-waste drums from the facility. Access for the subcontractor's representative and IDW transport carrier will be coordinated by Tetra Tech.

4.1.4 Material Identification and Classification

All waste materials shall be identified and classified per USDOT requirements.

4.1.5 Waste Shipment

Tetra Tech will subcontract all IDW removal. Tetra Tech will ensure the use of Lockheed Martin purchasing agreements and associated Lockheed Martin-approved waste-management vendors and will ensure that hazardous waste is transported by an approved vendor to a treatment, storage, and disposal (TSD) facility on the Lockheed Martin "Corporate Hazardous Waste Approved Vendors "list. Non-hazardous waste is not required to be managed by Lockheed Martin approved waste management vendors but shall be transported to an approved industrial waste disposal facility. The Lockheed Martin "Hazardous Waste Manifest Signatory Authorization" (Attachment D) must be filled out by the Lockheed Martin project lead in coordination with the Tetra Tech project manager if the IDW is hazardous.

4.1.6 Hazardous Waste Generator Identification Number

The Lockheed Martin USEPA identification number for hazardous waste generation at MSA is MDR000518760. All IDW will be removed from the site by a subcontractor adhering to the shipping requirements in Section 4.2.

4.2 SHIPPING REQUIREMENTS

USDOT HAZMAT employee training is required for anyone involved in shipment preparation, offering for transport and transportation of hazardous waste, including signing hazardous waste manifests (see 49 CFR 172, Subpart H). The manifest for the waste to be shipped must be certified as accurate. Non-hazardous materials do not require the signature of a USDOT HAZMAT-trained individual. Waste manifests will be signed for all hazardous wastes, and bills of lading will be signed for all non-hazardous wastes, by Mr. Mike Musheno (LMCPI). Preparation and pre-transport review of non-hazardous waste shipments will be documented using the Lockheed Martin “Hazardous Material/Waste Shipment Checklist” (Attachment B). A completed electronic copy will be provided to Tetra Tech and to the Lockheed Martin project lead. along with the shipping documentation.

Detailed records of authorized work will be maintained by the subcontractor, and will include the following:

- all manifests of waste transported to the approved off-site disposal facility
- receipt of waste acceptance by the approved treatment/disposal facility
- certification that the waste has been disposed of at the approved facility
- receipt of acceptance of waste containers by the approved disposal facility
- certification of disposal of waste containers by the approved disposal facility, weighing slips
- any other documentation required by local, state, or federal requirements

4.3 POST-SHIPMENT REQUIREMENTS

Waste characterization, chain of custody, transportation, and destruction records will be scanned and submitted electronically to the Lockheed Martin project lead for records retention. This will include profile sheets, the “Hazardous Material/Waste Checklist,” the generator copy of the waste manifest, a copy of the treatment, storage, and disposal (TSD)- signed manifest, “Land Disposal Restriction” forms, and certificates of waste destruction, when applicable. All monitoring records will be submitted for each year’s waste generation activities in the first quarter of the following year or per the project lead’s direction. The documentation noted above must be kept for at least three years. All documents must be available for review if requested.

Section 5
Reporting Requirements

5.1 BIENNIAL REPORTING REQUIREMENTS

The Code of Maryland Regulations (COMAR) 26.13.03.06B requires facilities that manage hazardous waste to file a Biennial Hazardous Waste Report once every two years which includes hazardous waste activity for the preceding calendar year. Facilities are required to submit the report for a given site if:

1. The facility either
   a. generates hazardous waste and ships it off-site to a facility in the United States; or
   b. treats, stores, or disposes of hazardous waste on-site
2. The facility is regulated under Maryland's hazardous waste regulations by:
   a. generating 220 pounds or more of hazardous waste, or more than 2.2 pounds of acute hazardous waste, in a calendar month; or
   b. accumulating, at any time, more than 220 pounds of hazardous waste, or more than 2.2 pounds of acute hazardous waste.

Guidance for completing the biennial report form is available at the Maryland Department of the Environment's (MDE) biennial report web page, which is available at

http://www.mde.state.md.us/programs/Land/HazardousWaste/BiennialHazardousWasteReport/Pages/Programs/LandPrograms/Hazardous_Waste/2001_biennialreport/index.aspx.

The report must be completed, typically by March 1 of even numbered years (e.g. 2010, 2012), and filed with:

Maryland Department of the Environment
Technical Services and Operations Program
1800 Washington Boulevard, Suite 610
Baltimore, Maryland 21230-1719

Before each report is filed, the Maryland hazardous waste regulations must be consulted to confirm or update regulatory thresholds.

5.2 WASTE MINIMIZATION

Hazardous waste generators, when preparing a manifest, are required to certify they have taken steps to minimize the volume and toxicity of hazardous waste generated. Waste minimization efforts are required under COMAR 26.13.03.06B(1)(d)(vi) to be reported on the biennial report submittal.

Efforts should be taken, to the degree economically practicable, to reduce the volume and toxicity of hazardous waste generated and a reasonable method of treatment, storage, or disposal should be selected which will minimize the present and future threat to human health and the environment.

APPENDIX A—WASTE IDENTIFICATION AND CLASSIFICATION FORM

Waste Identification and Classification Form

LMC Remediation Project		State Generated	
Description of Waste			
Generic Name		Solid, Liquid, Gas	
		Additional Info.	
Date of Waste Generation		Ongoing (Y/N)?	

Description of Process Generating Waste

Listed Waste ? (Y/N)		F,K, P or U Codes, if applicable	

Justification for Waste Classification (attach support documentation)

Completed by	
Company	
Date	

APPENDIX B—HAZARDOUS WASTE MANIFEST SIGNATURE AUTHORIZATION FORM

Lockheed Martin Hazardous Waste Manifest Signatory Authorization

This Authorization Agreement, effective for the remediation site and period of performance written below, is entered into by and between:

LOCKHEED MARTIN CORPORATION (hereinafter "Lockheed Martin"), having a business office at 6801 Rockledge Drive, Bethesda, Maryland 20817 USA, and incorporated in the State of Maryland, and

____

(hereinafter "_____________________________")

having a business office at____

____.

WHEREAS, _____________________________ (company representative) of __________ (company) will sign Hazardous Waste Manifests on behalf of Lockheed Martin for the project and hazardous waste, as defined at 40 CFR Pt. 261 *et seq.* indicated below.

Remediation Site: ____________________________________
Site Address: ____
Period of Performance: ____________________________________
Hazardous Waste Description:
____
____
Hazardous Waste Disposal Facility and Location: ___________________________
____
____

This Authorization Agreement certifies that the representative signing on behalf of Lockheed Martin has taken the appropriate Department of Transportation training, as delineated at 49 CFR Part 172 *t seq.* to sign Hazardous Waste Manifests and is in compliance with all state and federal requirements for hazardous waste manifesting.

Lockheed Martin shall remain responsible and liable for the hazardous waste being disposed regardless of the Signatory Authorization provided herein.

LOCKHEED MARTIN CORPORATION	______________________________
By:______________________________	By:__________________________
Name:___________________________	Name:_______________________
Title:_____________________________	Title:_________________________
Date:____________________________	Date:________________________

APPENDIX C—HAZARDOUS MATERIAL/WASTE SHIPMENT CHECKLIST

Lockheed Martin Hazardous Material/Waste Shipment Checklist

Date:
Project Site Name:
Shipping Document No.:

A. DESCRIPTION

A1.______ UN/NA Identification Number, Proper Shipping Name, Hazard Class/Division Number, Packing Group
A2.______ Subsidiary hazard class(es) or division number(s), if any, in parenthesis
A3.______ Total Quantity of Material
A4.______ 24-Hour Emergency Phone Number and Response Information ERG No.: ______________________
A5.______ Page of Pages, *for multiple shipping papers/EPA Manifest/Air Decs.*
A6.______ Shipper's Certification, *as applicable*
A7.______ Small Quantity Exception/Dangerous Goods In Excepted Quantities/Diagnostic Specimen/Sample

B. ADDITIONAL DESCRIPTIONS - GENERAL

B1.______ Exemptions "DOT-E-*ex.#*"
B2.______ "Limited Quantity" (*not to exceed 66 lb gross weight*)
B3.______ "X" or "RQ" (if RQ, Hazardous Substance Contact @ 1-800-424-8802)
B4.______ "Waste" for RCRA regulated material
B5.______ "Mixture" or "Solution" - as appropriate.
B6.______ *(technical names), for poisons/mixtures/n.o.s./generic proper shipping names*
B7.______ "Marine Pollutant" and constituent in ( ), *for bulk shipments only*
B8.______ *(hazardous substance names) per 172.101 appendix if not contained in proper shipping name*
B9.______ *(EPA waste identification numbers)- used to identify the hazardous substance*
B10._____ "Poison" - *if not identified in proper shipping name or hazard class*
B11._____ "Poison-Inhalation Hazard" & Zone A, Zone B, Zone C, or Zone D, as appropriate*
(**Note Special Provisions 1-6 and 13 in Column 7 of 172.101)*

C. MARKING FOR NON-BULK PACKAGINGS

C1.______ Proper Shipping Name, UN/NA Identification Number
C2.______ (*technical name)*
C3.______ (*EPA waste identification number)*
C4.______ "RQ"
C5.______ Exemption Packagings "DOT-E-*ex.#*"
C6.______ Consignee's Name & Address
C7.______ Net or Gross quantity for non-rad Dangerous Goods (adjacent to PSN & UN#)
C8.______ Ltd. Qty - PSN only *per 172.301(a)(1) or* UN ID# placed in square-on-point border *per 172.315*
C9.______ Package Orientation Arrows, *for liquids in inner packagings*
C10._____ "Inhalation Hazard", unless these words appear on the label prescribed in *172.416* or *172.429*
C11._____ "Overpack" adjacent to proper shipping name marking [*see 173.25(a)(4)*]
C12._____ TSCA PCB Marking (*for actual or source concentration greater than or equal to 50 ppm **)
(* Note Potential Vehicle Marking Requirements in *40 CFR 761.40*)

D. MARKING FOR BULK PACKAGINGS (DUMP TRUCKS OR ROLL-OFFS)

D1.______ UN/NA Identification Number on orange panel or placard or white square-on-point display configuration as prescribed by 172.302 and 172.332

E. LABELING

E1.______ Primary Hazard Label(s): ______________________________
E2.______ Subsidiary Hazard Label(s) with class/division: ______________________________
E3.______ Hazardous Wastes Label(s)

F. PLACARDING

F1. 172.504 Table 1 Materials - Any Amount
F1.1.______ Dangerous When Wet (4.3)
F1.2.______ Poison (6.1, Inhalation Hazard, Zone A or B)* (Primary or Subsidiary ____________
*(*Materials subject to the "Poison-Inhalation Hazard" notation must be placarded with a POISON INHALATION HAZARD or POISON GAS placard , as appropriate, and also placarded for any other hazard class required for that material in 172.504)*
F1.3.______ Radioactive (7, LSA/SCO Exclusive Use Shipments)

F2. 172.504 Table 2 Materials - 1,001 lb:

G. PACKAGING

G1.______ Container Type: (Inner Pkg)______
G2.______ Container Type: (Outer Pkg)______
G3.______ Container Type: (Bulk Pkg)______
G4.______ Loaded and Closed As Required______

H. PAPERWORK AND MISCELLANEOUS ITEMS

H1.______ Shipping Paper/Hazardous Waste Manifest/Bill of Lading/Airway Bill/Shipper's Declaration
H2.______ Instructions for Maintenance of Exclusive Use Shipments
H3.______ Small Quantity/Excepted Quantity Statement on Package, *for 173.4 shipments* / **DGEQ** statement per *2.7.7.2* noted on Airway Bill
H4.______ Photograph, *if applicable*
H5.______ Vehicle Inspection
H6.______ Check Driver's Qualifications
H7.______ Emergency Telephone Number Notification, if required, see 172.604(b)
H8.______ LMC Notification Instructions

I. ADDITIONAL REQUREMENTS FOR RADIOACTIVE MATERIAL SHIPMENTS

I1. SHIPPING PAPER DESCRIPTIONS
I1.1.____ Radionuclide Symbol(s), *per 173.435*
I1.2.____ Physical & Chemical Form, *if not special form*
I1.3.____ Activity per Package
I1.4 ____ Radioactive Labels
I1.5.____ Fissile Excepted, *if applicable*
I1.6.____ "Exclusive Use Shipment"

I2. MARKING FOR NON-BULK PACKAGINGS
I2.1.____Gross Weight, *for radioactive material packages in excess of 110 lb*
I2.2.____ "Radioactive"; "Radioactive – LSA" ; "Radioactive – SCO"
I2.3.____ Package Certification Number, *for radioactive material packages, as appropriate*
I2.4.____ IP-1, IP-2, IP-3 markings
I2.5.____ "USA" on all IP and Type A packagings
I2.6.____ Packaging manufacturer marking on Type A

I3. LABELING
I3.1.____ Radioactive Labels
I3.2.____ "EMPTY" Label
I3.3.____ "Radioactive Material, Excepted Package" handling label

I4. PLACARDING (172.504 TABLE 1 MATERIALS - ANY AMOUNT)
I4.1.____ Radioactive (7, LSA/SCO Exclusive Use Shipments)

I5. PAPERWORK AND MISCELLANEOUS ITEMS
H1.____ Instructions for Maintenance of Exclusive Use Shipments
H2.____ Radioactive Excepted Package statement per *10.8.8.3.3* on Airway Bill
H3.____Limited Quantity Radioactive Material *for multiple hazard limited quantity Class 7.*
H4.____Health Physics Information
H5.____NRC Manifest #540 for radioactive waste shipment for land disposal.

Completed By: **Company:** **Date:**

APPENDIX D—DRUM INVENTORY FORM

Tetra Tech NUS, Inc.

DRUM INVENTORY

PROJECT NAME: **PROJECT NUMBER:**

CLIENT: **LOCATION:**

Tt NUS PERSONNEL: **DATE (START):**

IDW CONTRACTOR: **DATE (END):**

DRUM ID	GENERATION LOCATION	DATE GENERATED	AMOUNT (gal.)	STORAGE LOCATION	COMMENTS

APPENDIX E—SITE CONTACT SHEET

Site Contact List

1)	Charlie Baublitz: Airport Operations Manager:	Office: 410-682-8831
2)	Al Pollard: Director:	Office: 410-682-8800
3)	Thomas Thompson: Airport Operations Engineer:	Office: 410-682-8856
4)	Mike Musheno: ESH / Projects:	Office: 410-682-1315 Cell: 610-656-4012
5)	Lt Col Peter Loebach: MDANG:	Office: 410-918-6486
6)	A&A Environmental / Spill Response:	1-800-404-8037
7)	Paul Calligan: Project Lead:	Cell: 240-676-5392
8)	Tony Apanavage: Project Manager:	Office: 1-301-528-3021 Cell: 1-301-233-8230
9)	Michael Martin: Program Manager:	Office: 1-301-528-3022 Cell: 1-410-707-5259
10)	Baltimore County Police & Fire Department:	911
11)	State of Maryland Emergency Response Center:	410-974-3551

APPENDIX F—“EESH REMEDIATION OPERATING PROCEDURE NO: EROP-03, “EESH REMEDIATION WASTE MANAGEMENT

Subject: EESH Remediation Waste Management

Ref: 1. Code of Federal Regulations, Title 40, Parts 260, 261, 262, 264, 265, 268, 761, and 763
2. Code Federal Regulations, Title 49, Parts 100 through 180
3. Corporate Functional Procedure No: ESH-06
4. Corporate Functional Procedure No: ESH-08
4. Corporate Policy Statement 527

1.0 Purpose

This procedure establishes practices for management and transportation of solid and hazardous waste (waste in this context also refers to DOT hazardous materials) generated at remediation project sites in a manner that complies with Subtitle C of the. Resource Conservation and Recovery Act (RCRA), Department of Transportation (DOT) regulations, and similar state and/or host country waste regulations. Additionally, this procedure ensures waste disposal is managed in accordance with Corporate Functional Procedure ESH-06 and ESH-08, and records retained in accordance with Corporate Policy Statement 527.

2.0 Applicability

This procedure applies to the Energy, Environment, Safety and Health (EESH) Remediation Organization (the Organization) and to the remediation projects for which the Organization has waste management responsibility. Each member of the Organization, including IWTA, contractor staff and, where applicable, support organizations (e.g. Global Supply Chain Management), is responsible for execution of this procedure.

The materials to which this practice applies are solid wastes generated as a result of remediation project activities, including such things as investigation derived waste, environmental sampling, treatment of contaminated media, and routine operations and maintenance, unless such solid waste is exempt under applicable regulations.

3.0 Key National Agreement

Waste management requirements shall be included within the EESH Key National Agreements (KNA). The KNA establishes the requirements under which Remediation Contractors perform work for Lockheed Martin.

The KNA will stipulate that the Remediation Contractor shall comply with Lockheed Martin waste management, transportation, and disposal requirements and all applicable state, federal, and/or host country laws and regulations.

4.0 Statement of Work Requirements

4.1 Waste Management Plan

All remediation project statements of work that include the generation of solid waste, excluding office trash (e.g. food wastes, consumer packaging) that may be disposed of at a municipal solid waste facility, shall include a requirement for the waste management contractors (i.e. Remediation Contractors and/or Corporate Approved Waste Management Vendors) to submit a waste management plan to Lockheed Martin. A site specific waste management plan shall be prepared that identifies all potential solid waste streams that may reasonably be expected to be generated or discovered during project activities. The plan will address the required elements listed below; however, if the waste is determined to be non-hazardous following completion of Element A, then only the additions of Elements D and E are required.

Element A) Hazardous Waste Determination

i) Listing assessment (See Attachment #1 – Waste Listing Assessment Form)
ii) Characteristic determination

Hazardous waste determinations shall be made in accordance with 40 CFR 262.11 using a combination of process knowledge and/or analytical evaluation of waste sampling. Hazardous waste determinations shall be reevaluated whenever any of the following circumstances occur:

- A change in the process that produces the waste (e.g. a new chemical constituent is discovered, the treatment process changes);
- A change in the treatment media is made (e.g. new media vendor or media type);
- A waste was tainted by inadvertent mixing with another waste; or
- A change occurred to the hazardous waste regulations that apply to that waste.

Characteristic waste determinations based on analytical sampling shall be reevaluated at some reasonable frequency to verify the accuracy of the initial waste determination. <u>The waste determination reevaluation frequency for ongoing remediation or treatment operations should be specified in the waste management plan and be profiled at least once a year.</u>

Element B) Responsibilities and Training Requirements

i) Contractor staff responsibilities with regard to waste management and training requirements necessary to comply with Section 6.0 and all state, federal, and/or host country laws and regulations. Contractor training certifications shall be provided electronically to the Lockheed Martin Project Lead.

Element C) Pre-Shipment Requirements

i) Material identification and classification per DOT requirements
ii) Packaging, storage, segregation, marking, labeling, and accumulation of waste
iii) Waste shipment documentation
    (1) Hazardous Waste Generator Identification Number

iv) Hazardous Material Transportation Plan
   (1) Hazardous material transportation risk identification, prioritization, and mitigation plan
   (2) Emergency Response (material information to be provided with shipments, actions to be taken in the event of an incident, staffing the emergency response phone number)
   (3) Hazmat Security Plan (as required based on thresholds outlined in 49 CFR §172.800)
   (4) Transportation and disposal logistics

Lockheed Martin Project Leads shall ensure the use of the Lockheed Martin Corporate Purchasing Agreements and the associated Corporate Approved Waste Management Vendors (WMV) for hazardous waste management and ensure that waste is transported to a treatment, storage, and disposal (TSD) facility on the Lockheed Martin Corporate Hazardous Waste Approved Vendors List as outlined in the ESH-06. Remediation contractors can contract directly with the WMV.

Additionally, hazardous waste manifests shall be signed only by a DOT trained and qualified Lockheed Martin employee or authorized designee (See Attachment #2 – Hazardous Waste Manifest Authorization Form). In addition to completing the Authorization Form, Project Leads shall verify that the designee is DOT trained and qualified to sign manifests and has adequate DOT experience. It is preferable to have contractors designated to sign that are involved in the waste characterization and oversight. For contractor personnel handling hazardous waste, appropriate hazardous waste handling training shall be provided by the contractor as outlined in Section 6.0 and complying with all state, federal, and/or host country laws and regulations.

Non-hazardous waste is not required to be managed by Corporate Approved Waste Management Vendors but shall be transported to an approved industrial waste disposal facility as outlined in ESH-06.

Within the United States, waste shall be characterized and disposed in accordance with the state regulations where it was generated unless the state requirements are less stringent than the federal requirements. For instance, California non-RCRA hazardous waste cannot be disposed of in a non-hazardous waste facility. Within a host country, waste shall be managed in accordance with the host country regulations; however, if the host country standards are less stringent than those of the US Environmental Protection Agency (EPA), than the EPA standards shall apply.

Element D) Shipping Requirements

i) Manifest certification and accuracy verification of physical waste shipment against manifested waste shipment (for non-hazardous waste this may not be applicable)
   (1) For hazardous waste, the contractor responsible for waste shipment shall utilize the Lockheed Martin Hazardous Material/Waste Shipment Checklist (see Attachment #3) during the preparation and pre-transport review of waste shipments and submit a completed electronic copy to the Lockheed Martin Project Lead with the shipping documentation.

ii) For non-specification bulk containers (e.g. dump trucks and roll-offs), the contractor responsible for waste shipment shall adhere to the Lockheed Martin requirements for packing and closing (see Attachment #4). These requirements are meant to supplement the applicable regulations.

Element E) Post Shipment Requirements - Records

i) Waste characterization, chain of custody, transportation, and destruction records shall be scanned and electronically submitted to the Lockheed Martin Project Lead for records retention. This shall include profile sheets, the Hazardous Material/Waste Checklist, the generator copy of the waste manifest, a copy of the TSD signed waste manifest, Land Disposal Restriction forms, and certificates of waste destruction where applicable. For finite-duration remediation projects, waste transportation and disposal records shall be submitted to the project lead at the completion of the project unless submittals are required by regulatory agencies on a more frequent basis. For recurring remediation project activities such as annual groundwater monitoring or groundwater treatment, these records shall be submitted for each year's waste generation activities in the first quarter of the following year or per the Project Lead's direction.

The waste management plan shall be submitted in a phased approach. The first section of the waste management plan will provide the hazardous listing assessment and the characteristic determination methodology (addressing Element A). This section of the plan shall be submitted in a timeframe that allows for Lockheed Martin's review prior to waste generation. Upon approval to proceed, the second section will document the waste profiling results and must be signed off on by a Lockheed Martin Project Lead. Additionally, it shall outline the logistics for waste handling, transportation and disposal (addressing Elements B through E). This section of the plan shall specify a reevaluation frequency for waste generated as a result of ongoing remediation or treatment operations.

Following the approval of the second section by the Lockheed Martin Project Lead, the waste management contractor shall implement the waste management plan. This plan shall be updated when the remedial treatment system process, waste stream, media, or regulations change.

4.2 Health and Safety Plan

For remediation sites managing waste, a section shall be included in the site Safety and Health Plan to address the safety and health requirements for managing the site specific waste.

4.3 Electronics and Scrap Metal Recycling

Where applicable and feasible, electronics and scrap metals shall be recycled or refurbished to the extent possible in accordance with ESH-06.

5.0 Responsibilities

5.1 Project Lead

The Project Lead shall:

- Ensure that all remediation projects for which they have responsibility have a waste management plan as outlined in Section 4.0. Review and ensure updates are completed as necessary. Plans must also be submitted to the Records Manager for upload to the Document Management System (DMS).
- Consult with Corporate EESH Legal as needed to verify the listing determination.
- Ensure that the Contractor has outlined the applicable training requirements and provided a training plan or statement of completion within the waste management plan.
- Verify that the site has a Hazardous Waste Generator Identification Number prior to hazardous waste shipments, where applicable.
- Ensure that all hazardous waste manifests are signed and certified by a Lockheed Martin employee or authorized designee. For non-hazardous waste, there are no signatory requirements for waste manifests.
- Ensure that non-hazardous or hazardous waste is shipped to an approved facility per ESH-06 and that the Corporate Approved Waste Management Vendors are being used for hazardous waste transportation, storage, and/or disposal services.
- Ensure receipt of the waste characterization, chain of custody, transportation, and destruction records, where applicable, and submit them to the Records Manager for upload to the DMS.
- Ensure that the required regulatory and state hazardous waste reports are submitted (e.g. biennial waste reports).

5.2 Remediation Global Supply Chain Management Representative

The Global Supply Chain Representative shall:

- Ensure that the KNA includes the requirements defined in Section 3.0.
- Send the Remediation Contractors an updated version of the approved non-hazardous facility list quarterly.
- Send the Corporate Approved Waste Management Vendors an updated version of the Lockheed Martin Corporate Hazardous Waste Approved Vendors List quarterly.

5.3 Corporate EESH Legal

The Corporate EESH Legal Counsel shall:

- Provide the Project Lead with support when making listed waste determinations.
- Notify the Project Leads of regulation changes that would affect prior listing determinations.

6.0 Training Requirements

The EESH remediation staff training requirements are summarized in Table 1.

6.1 RCRA Hazardous Waste Handling and Emergency Procedures

RCRA Generator Status Facilities
Generators who generate more than 1,000 kg/month of hazardous waste (or more than 1 kg/month of acutely hazardous waste) must comply with the emergency preparedness and personnel training requirements outlined in 40 CFR §265.16 (see 40 CFR §262.34(a)(4)). This training is intended for all facility personnel including the generator's contractors and includes training by a qualified person on hazardous waste management and emergency response procedures. Personnel shall receive an annual refresher. Project Leads are responsible for ensuring this training is provided to contractor staff on remediation projects that meet this generator criterion. Contractor personnel training records must also be maintained by the Project Lead.

"Small quantity generators" who generate greater than 100 kg but less than 1000 kg/month of hazardous waste, must comply with the emergency preparedness and personnel training requirements at 40 CFR §262.34(d)(5). These generators "must ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities during normal facility operations and emergencies" (40 CFR §262.34 (d)(5)(iii)). Project Leads shall ensure that all contractor staff has had the appropriate hazardous waste handling and emergency procedure training on remediation projects that meet this generator criterion.

Federal training requirements do not apply to remediation projects that generate less than 100 kg/month of hazardous waste. However, Project Leads shall ensure that the contractor staff is familiar with hazardous waste handling and emergency procedure training appropriate for waste management.

RCRA Permitted or Interim Status Facilities
Permitted or interim status facilities must follow training requirements in accordance with 40 CFR §264.16 and 40 CFR §265.16, respectively (the same requirements apply as outlined in the first paragraph under Section 6.1).

Additional training may be required by state and/or host country hazardous waste regulations. Any such additional training shall be verified and implemented by the Project Lead.

6.2 Department of Transportation Training

Department of Transportation (DOT) Hazmat Employee training is required for a person involved in shipment preparation, offering for transport and transportation of hazardous waste, including signing of hazardous waste manifests (see 49 CFR 172, Subpart H). All Lockheed Martin Remediation representatives, designees, and/or waste management contractors shall complete the hazmat employee training and renew the training as necessary to meet DOT requirements for hazardous waste transportation.

6.3 OSHA HAZWOPER Training

All contractors working on Lockheed Martin remediation sites shall complete the appropriate OSHA hazardous waste operations (HAZWOPER) training and annual refresher training specified in 29 CFR §1910.120. Lockheed Martin employees managing projects where hazardous waste is generated shall complete the 24 hour OSHA HAZWOPER training and annual refresher training.

7.0 Deviations

All deviations from this procedure must have prior approval by the Director of Environmental Remediation. The approval shall be documented and uploaded to the DMS.

Table 1

EESH Remediation Staff Waste Management Training Matrix			
Function	Task	Training Required	Requirements
EESH Remediation Employees (including IWTA and managing contractor staff (where the task description matches responsibilities))	Completing / Approving Waste Determinations	RCRA Generator Training	Refresher every 5 years
	Managing Remediation Sites where Hazardous Waste is Generated	OSHA HAZWOPER 24 HR	8 hr refresher annually
	Managing Hazardous Waste Shipments	DOT HazMat Certification (see Table 2)	Refresher every 3 years

The Lockheed Martin Project Lead shall update the Remediation Waste Management Training Matrix located on the Remediation Process Asset Library once training has occurred. All training and certification documentation will reside on the Remediation DMS under Training Records.

Table 2

EESH Remediation Staff DOT Requirements for Hazmat Employees	
Requirement	**Completion Method**
General Awareness [49 CFR 172.704(a)(1)]	• Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME)
Function-Specific [49 CFR 172.704(a)(2)]	• Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME)
Safety [49 CFR 172.704(a)(3)]	• Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME) • Hazwoper 24 Hour Training • Site specific safety training [NOTE: This element of safety training may be fulfilled through completing any one (1) of the following three (3) options which provides the required site specific safety information: 1) Site Safety Plan Review, 2) Site HazCom/ General Employee Training or 3) Site Visitor Safety Briefing/Training. The source of the training must be entered as part of the information on the test which is administered for site specific safety training.]
Security Awareness [49 CFR 172.704(a)(4)]	• Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME) • Site specific security awareness training [NOTE: This element of security awareness training may be fulfilled through completing any one (1) of the following three (3) options which provides the required site specific security information: 1) Site Security Plan Review, 2) Site HazCom/General Employee Training or 3) Site Visitor Security Briefing/Training. The source of the training must be entered as part of the information on the test which is administered for site specific security training.]
In-Depth Security (Hazmat Security Plan) Only applicable when haz material/waste meets certain class and volume thresholds (reference Section 4.1, Element C, iv, 4) [49 CFR 172.704(a)(5)]	• Site Hazmat Transportation Security Plan Training

The EESH DOT SME will certify EESH Remediation staff members as DOT Hazmat Employees on behalf of Lockheed Martin once training and safety and security tests have been completed.

Attachment #1

Waste Listing Assessment Form

Waste Listing
Assessment Form

Attachment #2

Hazardous Waste Manifest Signature Authorization Form

Designee
Authorization Form

Attachment #3

Hazardous Material/Waste Shipment Checklist

Hazardous Material/
Waste Shipment Che(

Attachment #4

Non-Specification Bulk Container Packing and Closing Instructions

Non-Specification
Bulk Container Packin

Waste Listing Assessmet Form

LMC Remediation Project		State Generated	
Description of Waste			
Generic Name		Solid, Liquid, Gas	
		Additional Info.	
Date of Waste Generation		Ongoing (Y/N)?	

Description of Process Generating Waste

Listed Waste ? (Y/N)		F,K, P or U Codes, if applicable	

Justification for Waste Classification (attach support documentation)

Completed by	
Company	
Date	

Lockheed Martin Hazardous Waste Manifest Signatory Authorization

This Authorization Agreement, effective for the remediation site and period of performance written below, is entered into by and between:

LOCKHEED MARTIN CORPORATION (hereinafter "Lockheed Martin"), having a business office at 6801 Rockledge Drive, Bethesda, Maryland 20817 USA, and incorporated in the State of Maryland, and

____

(hereinafter "______________________________")

having a business office at____

____.

WHEREAS, ______________________________ (company representative) of __________ (company) will sign Hazardous Waste Manifests on behalf of Lockheed Martin for the project and hazardous waste, as defined at 40 CFR Pt. 261 *et seq.* indicated below.

Remediation Site: _____________________________________

Site Address: ____

Period of Performance: _____________________________________

Hazardous Waste Description:

____

____

Hazardous Waste Disposal Facility and Location: ____________________________

____

____

This Authorization Agreement certifies that the representative signing on behalf of Lockheed Martin has taken the appropriate Department of Transportation training, as delineated at 49 CFR Part 172 *t seq.* to sign Hazardous Waste Manifests and is in compliance with all state and federal requirements for hazardous waste manifesting.

Lockheed Martin shall remain responsible and liable for the hazardous waste being disposed regardless of the Signatory Authorization provided herein.

LOCKHEED MARTIN CORPORATION	______________________________
By:______________________________	By:__________________________
Name:___________________________	Name:_______________________
Title:_____________________________	Title:_________________________
Date:____________________________	Date:________________________

Lockheed Martin Hazardous Material/Waste Shipment Checklist

Date:
Project Site Name:
Shipping Document No.:

A. DESCRIPTION

A1.______ UN/NA Identification Number, Proper Shipping Name, Hazard Class/Division Number, Packing Group
A2.______ Subsidiary hazard class(es) or division number(s), if any, in parenthesis
A3.______ Total Quantity of Material
A4.______ 24-Hour Emergency Phone Number and Response Information ERG No.: ________________________
A5.______ Page of Pages, *for multiple shipping papers/EPA Manifest/Air Decs.*
A6.______ Shipper's Certification, *as applicable*
A7.______ Small Quantity Exception/Dangerous Goods In Excepted Quantities/Diagnostic Specimen/Sample

B. ADDITIONAL DESCRIPTIONS - GENERAL

B1.______ Exemptions "DOT-E-*ex.#*"
B2.______ "Limited Quantity" (*not to exceed 66 lb gross weight*)
B3.______ "X" or "RQ" (if RQ, Hazardous Substance Contact @ 1-800-424-8802)
B4.______ "Waste" for RCRA regulated material
B5.______"Mixture" or "Solution" - as appropriate.
B6.______ *(technical names), for poisons/mixtures/n.o.s./generic proper shipping names*
B7.______ "Marine Pollutant" and constituent in ( ), *for bulk shipments only*
B8.______ *(hazardous substance names) per 172.101 appendix if not contained in proper shipping name*
B9.______ *(EPA waste identification numbers)- used to identify the hazardous substance*
B10._____ "Poison" - *if not identified in proper shipping name or hazard class*
B11._____ "Poison-Inhalation Hazard" & Zone A, Zone B, Zone C, or Zone D, as appropriate*
(**Note Special Provisions 1-6 and 13 in Column 7 of 172.101)*

C. MARKING FOR NON-BULK PACKAGINGS

C1.______ Proper Shipping Name, UN/NA Identification Number
C2.______ (*technical name)*
C3.______ (*EPA waste identification number)*
C4.______ "RQ"
C5.______ Exemption Packagings "DOT-E-*ex.#*"
C6.______ Consignee's Name & Address
C7.______ Net or Gross quantity for non-rad Dangerous Goods (adjacent to PSN & UN#)
C8.______ Ltd. Qty - PSN only *per 172.301(a)(1) or* UN ID# placed in square-on-point border *per 172.315*
C9.______ Package Orientation Arrows, *for liquids in inner packagings*
C10._____ "Inhalation Hazard", unless these words appear on the label prescribed in *172.416* or *172.429*
C11._____ "Overpack" adjacent to proper shipping name marking [*see 173.25(a)(4)*]
C12._____ TSCA PCB Marking (*for actual or source concentration greater than or equal to 50 ppm **)
(* Note Potential Vehicle Marking Requirements in *40 CFR 761.40*)

D. MARKING FOR BULK PACKAGINGS (DUMP TRUCKS OR ROLL-OFFS)

D1.______ UN/NA Identification Number on orange panel or placard or white square-on-point display configuration as prescribed by 172.302 and 172.332

E. LABELING

E1.______ Primary Hazard Label(s): ____
E2.______ Subsidiary Hazard Label(s) with class/division: ____________________________
E3.______ Hazardous Wastes Label(s)

F. PLACARDING

F1. 172.504 Table 1 Materials - Any Amount
F1.1._______ Dangerous When Wet (4.3)
F1.2._______ Poison (6.1, Inhalation Hazard, Zone A or B)* (Primary or Subsidiary _______________
*(*Materials subject to the "Poison-Inhalation Hazard" notation must be placarded with a POISON INHALATION HAZARD or POISON GAS placard , as appropriate, and also placarded for any other hazard class required for that material in 172.504)*
F1.3._______ Radioactive (7, LSA/SCO Exclusive Use Shipments)

F2. 172.504 Table 2 Materials - 1,001 lb:

G. PACKAGING

G1.______ Container Type: (Inner Pkg)____
G2.______ Container Type: (Outer Pkg)____
G3.______ Container Type: (Bulk Pkg)____
G4.______ Loaded and Closed As Required____

H. PAPERWORK AND MISCELLANEOUS ITEMS

H1.______ Shipping Paper/Hazardous Waste Manifest/Bill of Lading/Airway Bill/Shipper's Declaration
H2.______ Instructions for Maintenance of Exclusive Use Shipments
H3.______ Small Quantity/Excepted Quantity Statement on Package, *for 173.4 shipments /* **DGEQ** statement per *2.7.7.2* noted on Airway Bill
H4.______ Photograph, *if applicable*
H5.______ Vehicle Inspection
H6.______ Check Driver's Qualifications
H7.______ Emergency Telephone Number Notification, if required, see 172.604(b)
H8.______ LMC Notification Instructions

I. ADDITIONAL REQUREMENTS FOR RADIOACTIVE MATERIAL SHIPMENTS

I1. SHIPPING PAPER DESCRIPTIONS
I1.1.____ Radionuclide Symbol(s), *per 173.435*
I1.2.____ Physical & Chemical Form, *if not special form*
I1.3.____ Activity per Package
I1.4 ____ Radioactive Labels
I1.5.____ Fissile Excepted, *if applicable*
I1.6.____ "Exclusive Use Shipment"

I2. MARKING FOR NON-BULK PACKAGINGS
I2.1.____Gross Weight, *for radioactive material packages in excess of 110 lb*
I2.2.____ "Radioactive"; "Radioactive – LSA" ; "Radioactive – SCO"
I2.3.____ Package Certification Number, *for radioactive material packages, as appropriate*
I2.4.____ IP-1, IP-2, IP-3 markings
I2.5.____ "USA" on all IP and Type A packagings
I2.6.____ Packaging manufacturer marking on Type A

I3. LABELING
I3.1.____ Radioactive Labels
I3.2.____ "EMPTY" Label
I3.3.____ "Radioactive Material, Excepted Package" handling label

I4. PLACARDING (172.504 TABLE 1 MATERIALS - ANY AMOUNT)
I4.1.____ Radioactive (7, LSA/SCO Exclusive Use Shipments)

I5. PAPERWORK AND MISCELLANEOUS ITEMS
H1._____ Instructions for Maintenance of Exclusive Use Shipments
H2._____ Radioactive Excepted Package statement per *10.8.8.3.3* on Airway Bill
H3.______Limited Quantity Radioactive Material *for multiple hazard limited quantity Class 7.*
H4._____Health Physics Information
H5._____NRC Manifest #540 for radioactive waste shipment for land disposal.

Completed By: **Company:** **Date:**

PACKING AND CLOSING INSTRUCTIONS FOR NON-SPECIFICATION BULK CONTAINERS (DUMP TRUCKS AND ROLL-OFFS) 04/10/2009

PRELIMINARY TASKS

- Select the transport container based on the Department of Transportation hazard classification and the packaging requirements specified in the Hazardous Materials Table.
- Perform moisture evaluation of waste material to be loaded into transport containers to determine the potential for releasing liquid.

PREPARATION OF BULK CONTAINERS FOR LOADING

- Transport containers must be inspected for any condition that may affect their safety or performance prior to each use.
- Dump trucks and roll-offs with doors must have gaskets installed at the tailgate or doors that when the tailgate or doors are closed the gasket is compressed sealing the tailgate or doors to assure package integrity and containment of materials. The gasket must be inspected prior to each use for overall integrity including positioning, damage such as holes or tears or debris which could prevent tight closure. Any deficiencies shall require replacement prior to use.
- An absorption pad shall be placed in the truck or roll-off bed. The pad specification shall be determined utilizing the data determined in the waste material moisture evaluation and must be capable of absorbing the liquid which could be released.
- An absorption log at the rear of the transport container along the bottom of the tailgate or rear doors.
- A minimum 6 mil poly liner shall be placed over the absorption pad and absorption log prior to loading.
- Determine the amount of waste that can be loaded into the transport container. (Subtract the unladen weight of the transport vehicle from the maximum licensed weight of the transport vehicle. NOTE: Do not load the maximum permissible load determined in the mathematical calculation to allow for variance in scales that may be utilized to weigh the loaded vehicle.)

LOADING AND CLOSING BULK CONTAINERS

- Waste material shall be loaded into the transport container in such a manner that does not compromise either the liner or container integrity.
- Do not load material above the height of the sides of the transport container.
- Close the poly liner over of the waste material prior to tarping the load.
- Close the transport container by putting a heavy roll tarp over the top of the transport container and secure the tarp by utilizing tie downs on all four sides.