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ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

SITE 1 REMOVAL ACTION
FORMER NAVAL AIR WARFARE CENTER TRENTON
EWING TOWNSHIP, NEW JERSEY

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ACRONYMS AND ABBREVIATIONS

1,2-DCE	1,2-Dichloroethene
AC	Alternating Current
ARARs	Applicable or Relevant and Appropriate Requirement
BRAC	Base Realignment and Closure
CMP	Corrugated Metal Pipe
CTO	Contract Task Order
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CMP	Corrugated Metal Pipe
EE/CA	Engineering Estimate/Cost Analysis
ERH	Electrical Resistance Heating
GMC	General Motors Corporation
GWTP	Ground Water Treatment Plant
NAVFAC	Naval Facilities Engineering Command
NAWC	Naval Air Warfare Center
NCP	National Oil and Hazardous Substances Contingency Plan
N.J.A.C	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
RAC	Remedial Action Contract
RGH	Rogers, Golden, and Halpern
RI	Remedial Investigation
SI	Site Investigation
SOW	Scope of Work
SRS	Soil Remediation Standards
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
SWQS	Surface Water Quality Standards
TBCs	To Be Considereds
TCE	Trichloroethene
TtEC	Tetra Tech EC, Inc.
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds

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1.0 INTRODUCTION

Tetra Tech EC, Inc. (TtEC) has prepared this Engineering Evaluation/Cost Analysis (EE/CA) for the United States Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic under a Removal Action Contract (RAC), N62470-13-D-8007, Contract Task Order (CTO) WE11. This EE/CA is developed to evaluate and recommend a non-time critical removal action to address a source of contamination within Site 1 at former Naval Air Warfare Center (NAWC) Trenton, located in Ewing Township, New Jersey (the Site). A Site Location Map is included as Figure 1. The EE/CA has been prepared based on the Statement of Work (SOW) prepared by the Navy dated June 5, 2013.

1.1 Facility Location and Layout

The former NAWC facility is located 5 miles northwest of Trenton, New Jersey in Ewing Township, Mercer County (Figure 1). The facility, when owned and operated by the Navy, consisted of approximately 67 acres. NAWC Trenton can be found on the United States Geological Survey (USGS) Pennington and Trenton West 7.5-minute topographic maps. As shown on Figure 1, the Mercer County Airport borders most of the northern and western portions of the former NAWC Trenton property. An active rail line owned by CSX Transportation, Inc. divides the former facility and separates Parcel C to the east (former Buildings 1 and 2) from Parcels A, B and D, on the west side of the facility. Site 1 is located within Parcel B. Parkway Avenue abuts the southern boundary of the NAWC Trenton property. Across Parkway Avenue and east of the railroad is a parcel where General Motors Corporation (GMC)-Delphi Interior formerly operated a manufacturing facility. East of the former GMC site is Gold Run stream and two ponds which drain southwesterly to the Delaware River. South of Parkway Avenue and west of the railroad tracks are several small commercial facilities. Residential and light-industrial areas are located further south and southwest of the NAWC Trenton facility.

1.2 Facility History

NAWC Trenton was commissioned in 1951 as the Naval Air Turbine Test Station. NAWC Trenton was primarily used as a testing facility for military aircraft engine performance under simulated high and low altitude conditions. Three large buildings (see Figure 2) formerly comprised the experimental engine laboratory: the Blower Wing (Building 40), the Test Wing (Building 41), and the Exhauster Wing (Building 42). By the mid-1980s, construction of cruise missile-related engine test equipment became a priority at the site. An on-site industrial wastewater treatment plant, an automotive workshop, a machine shop, a woodworking shop, fuel and lubrication laboratories, a general chemistry laboratory, and various engineering and administrative offices were also located at the facility. Industrial wastewaters from former site operations were diverted through a central piping system to a 52- feet deep gravity sump, located between Buildings 41 and 42, known as the Barometric Well (Figure 2). The Navy decommissioned the Barometric Well in May 1998, at which time the concrete well vault was filled with gravel and capped with concrete, and the related piping was cut and sealed. Operational closure of NAWC Trenton occurred on December 15, 1998 under the Base Realignment and Closure (BRAC) Act of 1993. Several large buildings currently remain in place; however, they were decommissioned and cleaned as necessary by the Navy as

part of the 1998 closure activities and there are no active utility hookups, except for those for the pump and treat system, between the various buildings that remain at the site. Former macadam paved areas and driveways remain. Overgrown bushes and grasses are present in those areas that were formerly grass-covered. The building housing the groundwater treatment plant (GWTP) equipment was added in 1995.

Environmental investigations have been conducted by the Navy at NAWC Trenton since the mid-1980s. In 1986, Rogers, Golden, and Halpern (RGH) completed a preliminary investigation that identified seven areas (Sites 1 through 7) of potential concern and recommended further investigation (RGH, 1986). Site 1, which is the focus this EE/CA, is located in the southwest corner of the NAWC Trenton facility between Buildings 40 and 41 (the Blower Wing and Test Wing, respectively) and the West-end Drainage Ditch, hereafter also referred to as the West Ditch or West Ditch Area (Figure 2). From 1951 to 1957, liquid solvents and heat exchange fluids were used for various operations conducted in a rectangular-shaped area between Buildings 40 and 41, known as the Brine Handling Area and subsequently, drained into the West-end Drainage Ditch. The Brine Handling Area measures approximately 150 feet by 300 feet and is a flat, vegetated covered area. The West Ditch was a rectangular open swale approximately 25 feet wide and 400 feet long that collects surface water runoff from various portions of the facility including the Brine Handling Area. In 1970, the Navy installed a corrugated metal storm sewer pipe and overlying backfill within a major portion of the open swale. Groundwater and soil sampling was conducted at nine sites during the initial site inspection (SI) and the remedial investigation (RI) of Site 1 (IT Corporation, 1994). The SI added two sites (barometric well and sludge drying beds) to raise the total number of Sites to nine.

Based on the RI, it was determined that soil located within Site 1 exceeded New Jersey Department of Environmental Protection (NJDEP) soil cleanup criteria for select volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and inorganic compounds. Sampling results also indicated that groundwater beneath the site was contaminated from the various soil contaminants. In 1998, the Navy elected to excavate the most contaminated soil for Site 1, specifically between Buildings 40 and 41, and towards Building 48 and the nearby Barometric well, Site 8, from the existing ground surface to the top of bedrock or groundwater (approximately 6 to 8 feet below grade). Following backfilling and grading the area was seeded.

A Reuse Plan for NAWC Trenton was approved on July 15, 1996 and property ownership was transferred by parcel between 1997 and 2001. The Navy has easements in place with each of the deeds to allow for access to the site, including a number of capped impacted soil areas, groundwater monitoring and extraction wells, outfalls, associated piping, and the on-site GWTP building. A chain-link fence borders the site on most sides; however, a portion of Parcel A is owned and contained within the active Trenton-Mercer Airport and the fence was removed there and replaced with a new fence along the new southern boundary of the Parcel A. The fence along the south and east side of the East campus (Parcel C) has been removed. Future land use at the site consists of light industrial or commercial activities of Parcels A, B, and D; and mixed commercial/residential use of Parcel C. As of 2014, no active development activities are occurring on Parcels A, B or D. As construction occurs, the parcel owners will abide by existing easements or negotiate changes with the Navy if any changes to the location of monitoring wells, extraction

wells or treatment system can be made while maintaining the effectiveness of the groundwater extraction and treatment system.

1.3 Description of Site

The west end drainage ditch is an area that was contaminated by trichloroethylene (TCE) releases to the land surface and transported via the storm sewer system (of storm sewer pipes and open ditches). TCE was used as a heat exchange fluid in air cooling systems at NAWC Trenton. The Navy has conducted numerous repairs and replacement of storm sewer pipe to mitigate infiltration of contaminated groundwater and transport off-site (Tetra Tech, 2011). A volume of approximately 15,500 cubic yards of soil was excavated (to bedrock-approximately 8 to 12 feet below land surface) in 1998 (Foster Wheeler, 2001).

In 2012, a deteriorated section of pipe 130 feet long ending at manhole #140 was identified as failed. The failed pipe is a subset of a 300 foot section of pipe that drains north to south. The deteriorated pipe was confirmed by video inspection in 2012. TCE was detected in soil around and beneath the pipe at up to 10 mg/Kg in 2012 (Tetra Tech, 2013). The soil and the failed corrugated metal pipe (CMP) are immediately west of the area excavated by Foster Wheeler in 1998. The most contaminated soil was identified immediately above bedrock at a depth of 9 to 10 feet (Tetra Tech 2013).

1.4 Report Organization

A brief introduction and a discussion of general facility/site characteristics are presented in Section 1.0. Section 2.0 of this report provides summaries of previous site investigation results and risk evaluations. Section 3.0 presents the identification of removal action objectives, applicable or relevant and appropriate requirements (ARARs), and technology screening. Removal action alternatives are identified and analyzed in Section 4.0, and a comparative analysis of these alternatives is presented in Section 5.0.

2.0 SITE INVESTIGATION RESULTS AND EVALUATIONS

Elevated VOC concentrations in the NAWC storm sewer system were first identified by the Navy during an RI conducted in the early 1990s (IT Corporation, 1994). That RI and subsequent investigations led to the discovery and delineation of a groundwater plume originating at NAWC Trenton that contained elevated concentrations of VOCs. The Navy is actively remediating this groundwater plume through the use of 12 extraction wells and a pump and treat groundwater remediation system. The effectiveness of the remediation is monitored and evaluated through the quarterly sampling and reporting of contaminant concentrations in active extraction wells and 8 surface water locations, including Gold Run and the 4 storm sewer outfalls. Annual sampling and reporting of contaminant concentrations in monitoring wells is conducted in accordance with the approved Sampling and Analysis plan for Long Term Monitoring (Watermark, 2011).

The NJDEP, in its review of the Summary Report for the Winter (February) 2010 Quarterly Sampling Event (NJDEP, May 24, 2010) recognized that the Navy has taken various actions to

stop the continued discharge of contaminated groundwater to the storm sewers and to Gold Run, but commented that by allowing continued discharge, the Navy had failed to meet the applicable standards as required by New Jersey Administrative Code (N.J.A.C.) 7:26E-1.3(c), specifically, the Minimum Surface Water Remediation Standards identified in N.J.A.C. 7:26D-3. It was also in this letter (see Section 4.1) that the NJDEP required that subsequent to the submittal of an Remedial Action Report (RAR), the Navy must submit either a Remedial Action Selection Report (RASR) to identify the technology that would be used to remediate the infiltration problem, or a Remedial Action Work Plan for additional site investigation that would be used to acquire any additional data that would be needed to evaluate and select the best available technology. This EE/CA is the functional equivalent of, and is being submitted to fulfil the requirements of, a RASR.

The storm water infiltration issue and discharge to Gold Run is discussed in detail in the Remedial Action Report – Evaluation of Groundwater Infiltration to Gold Run Creek (Tetra Tech, 2010). The RAR report thoroughly summarized and evaluated the effectiveness of the Navy's multiple efforts to date to identify, isolate, and eliminate the discharge of contaminated groundwater to the storm sewers and to Gold Run, most notably by replacing an approximately 160-foot long section of deteriorated CMP within the Outfall 1 storm sewer (also known as the West Ditch) between Manhole 140 and the former oil-water separator. The RAR also noted, however, that (as concluded by the NJDEP) none of the completed actions had sufficiently mitigated the infiltration problem.

The RAR concluded that multiple lines of converging evidence indicated that by far, the bulk of the VOCs detected in the Navy drain line beneath Parkway Avenue were entering the storm water system through the infiltration of contaminated groundwater into the upper (northern) segment of the West Ditch CMP that had not been replaced, between Manhole 140 and the headwall of the storm sewer line. Although the available data are limited, the preliminary results from the current USGS investigation indicate that up to 1,200 micrograms per liter (µg/L) of VOCs (trichloroethene [TCE], cis-1,2-dichloroethene [1,2-DCE], and vinyl chloride [VC]) enters the CMP with the infiltrating groundwater through this upper stretch, although total concentrations of about 200 µg/L appear to be more typical. The invert elevation of the CMP along this stretch is not known, but the monitoring of MW-1S by the USGS (Section 4.2.1) indicates that the groundwater elevation within the overburden along this stretch may always be above the invert elevation, and is certainly above the invert elevation after periods of significant precipitation. In summary, the failed section of CMP is often below the water table.

Since the submittal of the RAR, additional quarterly monitoring data recently collected by the Navy in March 2011 (see Appendix A) has indicated that additional VOCs may also be infiltrating the West Ditch (Outfall 1) sewer system in the approximately 30-foot long stretch of original pipe between the on-base former oil-water separator and the connection of the Outfall 1 sewer to the Navy drain line beneath Parkway Avenue. This was confirmed by video inspection of the 30 foot section of pipe in 2011. The absolute and relative changes in the site's primary TCE, cis-1,2-DCE, and VC concentrations indicate that the water discharging from the former separator is chemically dissimilar to the water discharging into the Navy line.

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES AND TECHNOLOGY SCREENING

This section provides an evaluation of ARARs, Removal Action Objectives, statutory limits, and discussions of applicable technologies for remediation of contaminated soil at the Site.

3.1 Compliance with Applicable or Relevant and Appropriate Requirements

ARARs are used to develop cleanup criteria for the Removal Action Objectives and to identify removal technologies. The term ARAR is defined in the National Oil and Hazardous Substances Contingency Plan (NCP) as follows:

- Applicable requirements are generally defined as cleanup standards, standards of control, or other substantive environmental protection requirements promulgated under Federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, removal action, or location. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be considered as applicable requirements.
- Relevant and appropriate requirements are defined as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state environmental or facility siting laws that are not directly "applicable" to a hazardous substance, pollutant, contaminant, removal action, or location, but address situations sufficiently relevant to those encountered at the site that their use is appropriate. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be considered as relevant and appropriate requirements.
- Any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated Federal standard, requirement, criterion, or limitation.

Based on the manner in which they are applied during a removal action, ARARs are classified into three categories.

- Chemical-specific ARARs are developed to provide health or risk-based concentration limits. These limits are specific for an individual chemical or group of chemicals. Often, these ARARs are used to determine the extent of site remediation. Chemical-specific ARARs may be concentration-based cleanup goals or may provide the basis for calculating such levels. In cases where no chemical-specific ARAR exists, chemical advisories may be used to develop Removal Action Objectives.
- Location-specific ARARs are considered in view of natural or man-made site features. These ARARs are intended to limit activities within designated areas.
- Action-specific ARARs pertain to the implementation of a given remedy. These ARARs control or restrict hazardous substance- or pollutant-related activities. These controls are considered when specific removal activities are planned for a site.

In addition to ARARs, other regulations and guidance may be classified as guidance "To Be Considered" (TBC). TBCs are non-promulgated, non-enforceable guidelines or criteria that may be useful for developing removal actions or for determining what is protective of human health and/or the environment. TBCs are also identified in this section to aid in the evaluation of the removal action alternatives.

Section 121(d)(4) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) identifies circumstances under which ARARs may be waived in the context of a CERCLA remedial action, including the instance where the selected remedial action is an interim remedy and the final remedial action will attain the ARAR upon its completion. In addition, whereas compliance with ARARs is required unless waived when conducting a remedial action, for removal actions attainment of ARARs is only required "to the extent practicable considering the exigencies of the situation" (NCP Section 300.415[j]). Because this is a removal action and not a final remedial action, the selected removal action for the site being addressed under this EE/CA will not necessarily comply with all identified ARARs, but rather will contribute to attainment of ARARs as part of the broader remedial action strategy for the Site. The overarching remedial action objectives for the site are identified in Decision Document for Ground Water at the Naval Air Warfare Center, Aircraft Division, Trenton, New Jersey (US Navy, 2000).

3.2 Removal Action Objectives

It has been determined that impacted groundwater is currently entering into surface water bodies at the Site at levels exceeding the NJDEP surface water quality standards (SWQS). It has also been determined that the groundwater is being impacted by soil with high levels of TCE. The removal action is proposed in order to reduce the mass of contaminants that are present in the subsurface. The Removal Action Objectives presented in this EE/CA are to address soils only. The continued operation and monitoring of the pump and treat system remains a component of the final remedy.

The specific Removal Action Objectives for this EE/CA are as follows.

- Reduce the amount of VOC-impacted soil that remains in the subsurface in order to prevent the discharge of groundwater with concentrations of VOCs above the SWQS to Parkway Avenue storm sewers and ultimately to Gold Run.

As the removal action is being performed to provide contaminant mass removal only, it is not expected that NJDEP Soil Remediation Standards (SRS) will be met for the surrounding soils.

3.3 Removal Action Schedule

Field activities are tentatively scheduled to start in the summer of 2014 and are anticipated to be completed in 2 to 3 months.

3.4 Statutory Limits

The NCP Code of Federal Regulations (CFR) Part 300.415 dictates statutory limits of $2 million and 6 months of CERCLA fund-financed removal actions, with statutory exemptions for emergencies and actions consistent with the removal action to be taken. This removal action will not be CERCLA fund-financed; the Department of Defense will finance it. As such, these limits do not apply to this action. However, cost-effectiveness is a recommended criterion for the evaluation of removal action alternatives.

3.5 Technology Screening

This section presents identification, screening, and evaluation of the potential technologies and process options that may be applicable to assemble remedial alternatives for the Site. Screening evaluations at this stage generally focus on effectiveness and implementability, with less emphasis on cost. Criteria for each element are presented below.

Effectiveness: Effectiveness is evaluated based on the following criteria:

- Ability of the technology to address the estimated areas or volumes of contaminated medium.
- Ability of the technology to meet the goals identified in the Removal Action Objectives.
- Technical reliability (innovative versus well proven) with respect to contaminants and site conditions.
- Potential impacts to human health and the environment during implementation.

Implementability: Implementability is evaluated based on the following criteria:

- Overall technical feasibility at the site.
- Availability of vendors, mobile units, storage, disposal services, etc.
- Administrative feasibility.

Cost: Cost is evaluated based on the following criteria:

- Capital costs.
- Operation and maintenance (O&M) costs.

The technology evaluation will address the relevant elements of each criteria.

3.5.1 No Action

Under a No Action alternative, no additional removal/remedial action, maintenance, or institutional controls are to be performed at the site. There would be no additional restrictions placed on site use. This is a walk-away alternative to provide baseline comparison with other alternatives. Under this No Action alternative, the existing pump and treat system would remain in operation with no additional cost implications.

Effectiveness: Under current conditions, access to the site is limited and most of the contamination is located in subsurface soils. Under current unrestricted access conditions, potential risks to trespassers may result from contact with contaminated surface soils. For unrestricted access, potential risks could occur. As it has been determined that the Site is currently causing an exceedance of NJDEP Surface Water Criteria, no action would not be protective of receptors.

No Action may not be protective of human health in the long term. In the event the soils are removed and used elsewhere, there is a potential for unrestricted access to contaminated soils that could adversely affect human health. In addition, No Action would allow the continued presence of a potential source for the discharge of contamination to the surface water.

Implementability: No Action is technically and administratively feasible at the site.

Cost: There are no additional costs for this technology.

Conclusion: No Action is implementable and costs are minimal, but would not be effective. The No Action technology will be retained as a baseline for comparison to other alternatives, as required by CERCLA.

3.5.2 Soil Heating

Electrical Resistance Heating (ERH) is an intensive in situ method that uses the flow of alternating current (AC) electricity to heat soil and groundwater and evaporate contaminants. Electric current is passed through a targeted soil volume between subsurface electrode elements. The resistance to electrical flow that exists in the soil causes the formation of heat; resulting in an increase in temperature until the boiling point of water at depth is reached. After reaching this temperature, further energy input causes a phase change, forming steam and removing volatile contaminants.

ERH consists of constructing electrodes in the ground, applying (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface along with recovered air and steam. Similar to soil vapor extraction (SVE), the air, steam and volatilized contaminants are then treated at the surface to separate water, air and the contaminants. Treatment of the various streams depends on local regulations and the amount of contaminant.

Effectiveness: ERH is typically most effective on VOCs. The chlorinated compounds trichloroethylene, and cis- or trans- 1,2-dichloroethylene are contaminants that are easily remediated with ERH. ERH is adaptable to all soil types and sedimentary bedrock. ERH is also effective in both the vadose and saturated zones. Certain lithologies can limit traditional methods of remediation by preventing a reliable removal/destruction pathway for the contamination of concern. Because electricity can and does travel through any lithology that contains some water, ERH can be effective in any soil type. By forming buoyant steam bubbles during the heating process, ERH creates a carrier gas that transports the contamination of concern up and out of any

soil type. ERH is not capable of desiccating the subsurface. In order for the subsurface to conduct electricity, there must be water present in the subsurface. Conductivity will cease before the subsurface is desiccated. Weaknesses of ERH include heat losses on small sites. Treatment volumes that have a large surface area but are thin with respect to depth will have significant heat losses which makes ERH less efficient. In addition, underground utilities that are present would be affected by the heat present in the ground and this heat may cause failures in certain pipes.

A TCH pilot test was done in close proximity to the area of this removal action. One lesson learned was that the effectiveness TCH was hindered in an area of active groundwater extraction. The continuous flow of groundwater through the heating zone slowed the heating process. It is expected that a similar effect would be experienced with ERH.

Implementability: Installing and maintaining an ERH system would be implementable, but not without concerns. Specifically, the underground piping for the groundwater treatment system may be affected by the high heat that this method produces. This method would also require the installation of an SVE system and the required maintenance. This treatment would not repair or remove the CMP and could accelerate its failure.

Cost: The cost of ERH at the Site would be high.

Conclusion: ERH is retained for the development of removal action alternatives. It permanently removes the contamination from the site.

3.5.3 Soil Excavation

Excavation can be performed by various types of equipment such as front-end loaders, backhoes, etc. The type of equipment selected must take into consideration several factors such as the type of material to be removed, the load-bearing capacity of the ground surrounding the removal area, the depth and aerial extent of removal, the required rate of removal, the presence of any subsurface infrastructure, and the elevation of the groundwater table. Excavation is the technology of choice for the removal of well-consolidated material such as unsaturated soil to a depth of up to 30 feet. The logistics of excavation must take into account the available space for operating the equipment, loading and unloading of the excavated material, location of the site, etc. After excavation is completed, the location is filled and graded with clean fill material or treated soils, that meet the specification for clean fill.

Effectiveness: Excavation is a well-proven and effective method of removing contaminated material from a site. Monitoring is typically required to verify the effectiveness of the removal action. Excavation would not be expected to have significant short-term impacts on the community or environment. An increase in traffic volume and noise associated with dump trucks traveling facility roads and roads between the Site and the off Site treatment and/or disposal facility will be associated with excavation activities. Any dust that would be generated could be adequately controlled. Erosion and sedimentation controls would be required to control off-site migration of soil contaminants. Excavation would expose workers to contaminants during the implementation phase, although exposure would be minimized through the use of proper health and safety

procedures. Excavation would provide protection of human health and the environment at the site for the long term because contaminated material would be removed from the site. The excavated material would require further treatment and/or disposal.

Implementability: Excavation of contaminated soil at the Site would be implementable. Due to the shallow bedrock at the Site, it is possible to excavate soil down to the bedrock surface. Excavation equipment is readily available from multiple vendors. This technology is well proven and established in the construction and remediation industry. During excavation, site-specific health and safety procedures and Occupational Safety and Health Administration (OSHA) regulations would have to be complied with to ensure that the exposure of workers to contaminants is minimized.

The groundwater pump and treat should continue to operate during excavation to maximize the depth of the unsaturated zone. Additionally, it is likely that the clean backfill would come into contact with contaminated groundwater and become contaminated due to equilibrium partitioning.

Cost: The cost of excavation at the Site would be low to moderate.

Conclusion: Excavation is retained in combination with other process options for the development of removal action alternatives. It permanently removes the contamination from the site.

3.5.4 Off-Site Disposal

Off-site disposal in a landfill consists of placing the contaminated soils in a managed facility that accepts wastes. These landfills are required to be lined, and include leachate collection and treatment facilities. The waste is buried and ultimately covered with a low-permeable cover system to prevent infiltration and contaminant migration. Landfills are regulated through state or federal permitting mechanisms that identify the type of wastes that can be accepted. Wastes that are classified as hazardous or contain free liquids must generally be treated prior to placement in the landfill. Many industrial waste-type landfills have limited treatment facilities on site for adding cement and/or lime to address concerns of leachable contents.

Effectiveness: Off-site disposal is a very effective long-term disposal action for contaminated soil and other material, and would provide long-term protection of human health and the environment. After the contamination is removed, there would be no residual risks at the site. Off-site transport of contaminated material would have a limited impact on the community (e.g., increased traffic, potential for spills). Off-site disposal is a very reliable process option.

Implementability: Off-site disposal is very implementable because facilities with adequate capacity are available. Transportation and permit will be required, but are readily available.

Cost: The capital cost associated with off-site disposal is low to moderate, depending on the waste classification. There are no O&M costs associated with this process option.

Conclusion: Off-site disposal is readily implementable and requires no post-remedial monitoring or maintenance. For small volumes of soil, off-site disposal is easy to manage and cost effective. It is retained in combination with other process options for the development of removal action alternatives.

3.6 Summary of Applicable Technologies

TABLE 1
SUMMARY OF APPLICABLE TECHNOLOGIES

Remedial Technologies	Retained for Consideration	Comments
No Action	Yes	Not effective, retained as a baseline for comparison.
Electrical Resistance Heating	Yes	Retained for the development of removal alternatives.
Soil Excavation	Yes	Retained for the development of removal alternatives.
Off-Site Disposal	Yes	Retained for the development of removal alternatives.

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

In this section, each removal alternative is described and analyzed in detail in accordance with Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA (USEPA, 1993a). The detailed analysis of removal alternatives provides information needed for the comparison of alternatives, as well as for the final selection of an alternative(s).

4.1 National Oil and Hazardous Substance Pollution Contingency Plan (NCP)

The purpose of the EE/CA and the overall remedy selection process is to identify removal actions that eliminate, reduce, or control risks to human health and the environment (40 CFR 300). The national program goal for the EE/CA process, as defined in the NCP, is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste. Criteria for identifying and evaluating potentially applicable technologies to achieve these goals are provided in United States Environmental Protection Agency (USEPA) guidance (USEPA, 1993) and in the NCP.

In addition, the NCP directs that removal actions shall, to the extent practicable, contribute to the efficient performance of any anticipated permanent or long-term remedies, and that there be an orderly transition from the removal action to the remedial action process. In the present case, this EE/CA evaluates removal action alternatives that would be consistent with, and are expected to contribute to, the long-term remedial action strategy for the Site as identified in [Cite to Decision Doc or ROD]

4.2 Development of Removal Action Alternatives

The purpose of the EE/CA is to evaluate the information provided in the previous site investigations, which assess site conditions, and develop an appropriate range of alternatives that allow selection of a removal action alternative. This EE/CA specifically addresses chlorinated solvent contaminants in soil. The development of alternatives should reflect the scope and complexity of the site problems that are being addressed. The number and types of alternatives should also be based on the site characteristics and complexity of the site concerns. The technologies and process options that are retained from the screening evaluation in Section 3.6 will be combined as appropriate to develop alternatives which are protective of human health and the environment.

These process options will be used individually or combined with each other, as appropriate, to form removal alternatives based on land use and exposure scenarios. Additionally, process options which, by themselves, do not address Removal Goals (e.g., monitoring) will be combined with the primary process options to achieve Removal Action Objectives for each alternative.

4.2.1 Land Use Scenarios

The potential exposure of humans to environmental media was evaluated in the context of two land use scenarios: (1) industrial land use and (2) nearby residential land use. It is anticipated that the Site will remain an industrial or commercial area in the future, but that the areas surrounding the Site will continue to be used for residential and commercial purposes. As such, alternatives for Site remediation were developed for the industrial land use scenario only. In conjunction with institutional controls and monitoring, these alternatives meet Removal Action Objectives and are protective of human health and the environment.

4.2.2 Exposure Scenarios

Assumptions for the land use scenarios and receptors used for alternative development are consistent with the risk assessment and allow quantification of risk for contaminants at the site. Exposure to site contamination will be controlled by removing a large mass of contaminated soil from the Site. Contamination in the Site will be reduced by removing the suspected sources of contamination and allowing the existing groundwater treatment system to remove additional contaminants.

The excavation is expected to result in a reduction in mass flux of contaminants into the storm sewer system and subsequently to Gold Run.

4.2.3 Accommodation of Removal Goals and ARARs

The alternatives presented in the following sections take into consideration the Removal Goals and ARARs presented in Section 3.0. Removal alternatives will address the industrial land use scenario for human exposure and reduction or elimination of VOCs that can continue to impact groundwater over an extended period. Removal alternatives will contribute to the achievement of groundwater

remedial action objectives that have previously been established and which are being addressed under the existing decision document.

4.3 Description and Analysis of Alternatives

Three alternatives, including the No Action alternative, were developed to address the contaminated soil present at the Site. Alternative 1 is the No Action alternative and provides a baseline analysis. Alternative 2 was developed to heat the soil and groundwater causing the VOCs in the subsurface soil to evaporate. The vapor would then be recovered by an SVE system.

Alternative 2 involves the heating and extraction of the VOCs that are present in the Site soils via ERH and SVE. Alternative 2 includes the following components:

- Installation of electrodes into the subsurface into the area of soil impact to be treated
- Installation of soil vapor extraction wells to recover the evaporating VOCs
- Operations and maintenance of the ERH system for a time period sufficient to allow for the removal of the contamination

Alternative 3 was developed to remove and dispose of contaminated soil to reduce the volume of TCE in the subsurface as shown on Figure 3. Alternative 3 includes the following components:

- Removal and off-site disposal of approximately 660 tons of impacted soil
- Removal and disposal of failed drainage pipe
- Replacement of the removed drainage pipe with an open drainage ditch and construction of headwalls to tie into the existing storm drainage system.

4.3.1 Alternative 1 - No Action

The No Action alternative is evaluated to provide a comparative baseline against which other alternatives can be evaluated. Under this alternative, no removal action will be taken and the site is left “as is,” without the implementation of any remedial, treatment, or other mitigating actions. Results from previous site investigations indicated that contaminants exist in subsurface soil, are dissolving in the groundwater, and migrating to surface water.

Effectiveness: The No Action alternative would not be effective and would not achieve the Removal Action Objectives. Under existing site conditions, the contaminated soil is buried, and there is no significant exposure. However without controls, there remains unacceptable risk to surface water.

Implementability: Under the No Action alternative, no removal action would be taken; therefore, there would not be difficulties or uncertainties associated with implementation.

Cost: There would be no capital or O&M costs associated with this alternative.

4.3.2 Alternative 2 – Soil Heating

Effectiveness: The Soil Heating alternative may be effective and achieve the Removal Action Objectives in a limited area. Under existing site conditions, there remains a source of VOC contaminated soil that continues to dissolve into the groundwater beneath the Site. The field study that was performed previously at the Site indicated that the heating of the subsurface within the capture zone of the pump and treat caused a large quantity of contaminated groundwater to move through the treatment area. Soil Heating will volatilize the VOCs and the SVE system would be able to recover them for above ground treatment.

Implementability: The equipment and services needed for soil heating are available although this method requires additional testing and longer lead times for equipment and materials. This would also require construction of a SVE system and would require O&M of both the heating system and SVE system.

Cost: The estimated capital cost for soil heating would be approximately $1,000,000. The annual O&M costs of the SVE are assumed to be performed concurrently with the O&M of the groundwater treatment system and would add approximately $380,000 per year to that cost for a period of approximately one year.

4.3.3 Alternative 3 – Soil Excavation and Off-Site Disposal

Effectiveness: Excavation and off-site disposal of soil would eliminate potential risk to human health and the environment associated with these materials. Excavation and off-site disposal is commonly used at sites to remove contaminated soil and wastes. Hauling the material off site and providing cover would have a short-term impact on the community by generating additional traffic (30 trucks) with an additional 30 trucks hauling clean fill to the site. Although there would be a potential for spills of contaminated soil and waste during transport, all materials would be solids that could easily be re-deposited into the transport container. Any dust that would be generated could be adequately controlled. Exposure of workers during remediation would be minimized through use of proper personal protective equipment and health and safety standards. Erosion and sediment controls would be needed to control off-site migration of soil contaminants during removal activities.

Implementability: The equipment and services needed for excavation, transportation, and off-site disposal are readily available. Upon approval of construction plans, construction could begin within approximately one month and be completed within 6 months. Also, post-construction documents could be completed within three months.

Cost: The estimated capital cost for excavation and off-disposal would be approximately $900,000. As this is not a stand-alone remedial option, there are no O&M costs associated with this option.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparative analysis of the alternatives relative to specific evaluation criteria. Under EPA removal action guidance, removal action alternatives are to be evaluated under three broad criteria (i.e., effectiveness, implementability, and cost). Although not specifically required by the NCP for removal actions, nine specific factors from the NCP's remedial action framework were used to assess the short-term and long-term aspects of each removal action alternative. Under removal action guidance, these factors are among the subfactors that can be considered when assessing Effectiveness, Implementability, and Cost). The nine factors included:

1. Overall Protection of Human Health and the Environment
2. Compliance With ARARs and TBCs
3. Long-term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility, and Volume through Treatment
5. Short-term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance

The first seven factors are specifically addressed in this EE/CA. State acceptance will be evaluated after NJDEP has reviewed and commented on this EE/CA report. Community acceptance will be addressed in an Action Memorandum that will be finalized after the public comment period for the EE/CA. For the purposes of this EE/CA, these factors are also evaluated in the context of the removal action alternative's contribution to the overall remedial action objectives for the Site, as established in the existing decision document. A summary of the factors are included in the table at the end of this section. The following contains a description of each of the specific factors.

1. Overall Protection of Human Health and the Environment. The primary requirement for CERCLA removal actions is that they are protective of human health and the environment. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential health risks. All pathways of exposure must be considered when evaluating the removal alternative. After the remedy is implemented, if hazardous substances remain without engineering or institutional controls, the evaluation must consider unrestricted use and unlimited exposure for human and environmental receptors. For those sites where hazardous substances remain and unrestricted use and unlimited exposure are not allowable, engineering controls, institutional controls, or some combination of the two must be implemented to control exposure and, thereby, ensure reliable protection over time. In addition, implementation of a remedy cannot result in unacceptable short-term risks or cross-media impacts with regard to human health and the environment.

2. Compliance with ARARs and TBCs. Compliance with ARARs and TBCs is one of the statutory requirements for remedy selection, and is to be attained to the extent practicable under a removal action scenario. Alternatives are developed and refined throughout the EE/CA process to ensure that they will meet their respective ARARs to the extent

practicable. During the detailed analysis, information on Federal and state action-specific ARARs will be assembled along with previously identified chemical-specific and location-specific ARARs. Alternatives will be refined to ensure compliance with these requirements.

3. Long-Term Effectiveness and Permanence. This criterion reflects CERCLA's emphasis on implementing remedies that will ensure protection of human health and the environment in the future, as well as in the near term. In evaluating removal alternatives for their long-term effectiveness and the degree of permanence they afford, the analysis should focus on the residual risks that will remain at the site after the completion of the removal action, and the contribution of the removal action to the overall remedial strategy for the site. This analysis should include consideration of the following:

   - Degree of threat posed by the hazardous substances remaining at the site.
   - Adequacy of any controls (e.g., engineering and institutional controls) used to manage the hazardous substances remaining at the site.
   - Reliability of those controls.
   - Potential impacts on human health and the environment, should the remedy fail, based on assumptions included in the reasonable maximum exposure scenario.

4. Reduction of Toxicity, Mobility, and Volume through Treatment. This criterion addresses the statutory preference for remedies that employ treatment as a principal element by ensuring that the relative performance of the various treatment alternatives in reducing toxicity, mobility, or volume will be assessed. Specifically, the analysis should examine the magnitude, significance, and irreversibility of reductions.

5. Short-Term Effectiveness. This criterion examines the short-term impacts of the alternatives (i.e., impacts of the implementation) on the neighboring community, the workers, or the surrounding environment, including the potential threat to human health and the environment associated with excavation, treatment, and transportation of hazardous substances. The potential cross-media impacts of the remedy and the time to achieve protection of human health and the environment are also evaluated.

6. Implementability. Implementability considerations include the technical and administrative feasibility of the alternatives, as well as the availability of the goods and services (e.g., treatment, storage, or disposal capacity) on which the viability of the alternative depends. Implementability considerations often affect the timing of various removal alternatives (e.g., limitations on the season in which the remedy can be implemented), the number and complexity of materials-handling steps that must be followed, the need to obtain permits for off-site activities, and the need to secure technical services (such as well drilling and excavation).

7. Cost. Cost encompasses all capital costs and O&M costs incurred over the life of the project. The focus during the detailed analysis is on the net present value of these costs. Costs were used to select the least expensive (or most cost-effective) alternative that will

achieve the Removal Action Objectives. For purposes of calculating the present worth for the annual O&M costs, a 7 percent annual discount factor is used.

8. State Acceptance. This criterion, which is an ongoing concern throughout the response action process, reflects the statutory requirement to provide for substantial and meaningful state involvement.

9. Community Acceptance. This criterion refers to the community's comments on the removal alternatives under consideration, where "community" is broadly defined to include all interested parties. These comments are taken into account throughout the EE/CA and Action Memorandum process.

5.1 Effectiveness

The No Action alternative would not be effective because contaminated soil would remain on site and would continue to cause exceedances of SWQS. The contaminated soil would continue to cause the surface water VOC concentrations to be above SWQS. Alternatives 2 and 3 would be effective because the VOC impacted soil would either be removed from the Site or be treated to lower levels.

Alternatives 2 and 3 are technically reliable with respect to contaminants and site conditions. Soil heating and excavation and off-site disposal are well proven methods to address contamination. There are no short-term impacts to site workers under Alternative 1. For Alternatives 2 and 3 exposure of workers during remediation would be minimized through the use of proper protective equipment and health and safety standards. Alternative 3 would have a slightly higher risk of exposure to workers, but standard industry practices would be sufficient to limit exposure.

There are no short-term impacts to the environment under Alternative 1. Activities proposed under Alternatives 2 and 3 would have minor effects on the surrounding environment. In particular, existing site vegetation would be removed. Under Alternative 2, a small amount of vegetation would be affected by the installation activities and also to house the SVE building. Under Alternative 3 approximately one acre would be affected. Erosion and sediment controls would be needed for Alternative 3 to control off-site migration of soil contaminants during removal of contaminated soil. For Alternative 3 hauling material off site and bringing cover soil onsite would have a short-term impact on the community by generating additional traffic. Alternatives 2 and 3 are expected to provide long-term effectiveness and permanence by removing contaminant mass from the Site.

In summary, Alternative 1, No Action, would not be effective, Alternatives 2 and 3 would be effective.

5.2 Implementability

The No Action alternative would be easiest to implement of the alternatives because no additional action would be taken, and therefore, there would not be difficulties or uncertainties associated

with implementation. The technologies to be utilized for the action-oriented alternatives are well proven.

Alternatives 2 and 3 would use locally available materials, including soil. Equipment required to implement both Alternatives 2 and 3 are readily available. Disposal capacity for the volume of soil under Alternative 3 is available. Alternatives 2 and 3 would not require operational considerations, easements or right-of-ways, and would not impact adjoining properties. Alternatives 2 and 3 can be implemented within approximately the next year.

5.3 Cost

Alternative 1 would have no additional cost as it involves no additional action. Alternative 2 would have significant startup costs including installing the heating elements as well as the SVE system. In addition, utility costs for Alternative 2 would be significant. Alternative 3 would involve moderate costs to complete, but there would be no O&M costs associated with this method.

6.0 PUBLIC PARTICIPATION

This EE/CA is being made available for public review and comment. A notice of availability has been placed in the December 4th through 6th, 2014 Trenton Times advising the public of the availability of this EE/CA and providing opportunity for thirty days (from December 4, 2014 through January 3, 2015) of public review and comment. This EE/CA will be available at the Ewing Branch of the Mercer County Library and online at:

http://www.bracpmo.navy.mil/brac_bases/northeast/former_warfare_center_trenton.html

The Navy favors Alternative 3, Excavation and Off-Site Disposal, but would like the public's opinion. Once public comments are received and considered, the Navy will select and implement an alternative, or a modified alternative, and publish the decision in an Action Memorandum that will also be made available to the public.

Comments can be sent to:
Willington Lin, BRAC Environmental Coordinator
4911 South Broad Street
Philadelphia, PA 19112
Willie.lin@navy.mil

TABLE 2 EVALUATION OF SOIL ALTERNATIVES			
EVALUATION CRITERIA	Alt. 1 No Action	Alt. 2 Soil Heating	Alt. 3 Soil Excavation and Disposal
Threshold Criteria – Selected Alternatives must meet these criteria			
1. Protects Human Health and the Environment – *Will it protect people and animal life near the site? Is protection permanent?*	Ø	●	●
2. Meets Federal and State Standards – *Does alternative comply with federal and state environmental laws, regulations, and requirements?*	Ø	●	●
Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria			
3. Provides Long-Term Effectiveness and Permanence – *Do risks remain on site? If so, are the controls adequate and reliable?*	Ø	●	●
4. Reduces Mobility, Toxicity and Volume Through Treatment – *Is treatment used to reduce contaminant threats?*	Ø	●	●
5. Provides Short-Term Protection – *How soon will risks be reduced? Will implementing the action cause impacts to people or the environment? If so, are the impacts controllable and acceptable?*	Ø	○	●
6. Implementability – *Can it be implemented? Is the alternative technical feasible? Are necessary goods and services available?*	●	○	●
7. Costs			
Capital Costs (up-front costs to design and construct)	$10,000	$1,000,000	$900,000
Operation and Maintenance Costs (annual costs)	$0	$380,000	$0
Assumed Duration of Alternative (years)	30	1	1
Time for construction (months)	NA	8	2
Notes: ● Meets or Exceeds Criterion o Partially or Potentially Meets Criterion (some uncertainty) ∅ Does NOT Meet Criterion			

7.0 REFERENCES

Foster Wheeler Environmental Corporation, 1999. *Remedial Action Report Former NAWC Trenton, Trenton, New Jersey.*

IT Corporation, 1990. Site Inspection Report.

IT Corporation, 1994. Remedial Investigation Report.

RGH, (Rogers, Golden, and Halpern), 1986. *Initial Assessment Study: Naval Air Propulsion Center, Trenton, New Jersey*. RGH, Philadelphia, and BCM Eastern, Inc. Plymouth Meeting, Pennsylvania. Environmental Restoration Department, Naval Energy and Environmental Support Activity, Port Hueneme, California.

Tetra Tech (Tetra Tech, Inc.), 2010. *Remedial Action Report – Evaluation of Groundwater Infiltration to Gold Run Creek, Former NAWC Trenton, Trenton, New Jersey*. September.

Tetra Tech (Tetra Tech, Inc.), 2013. *Technical Memorandum Report of Results for the West Ditch Groundwater Infiltration Investigation Former NAWC Trenton, Trenton, New Jersey*. May.

U.S. Department of Defense Strategic Environmental Research and Development Program (SERDP), 2012. *Dense Non Aqueous Phase Liquid (DNAPL) Removal from Fractured Rock Using Thermal Conductive Heating (TCH).* August. *http://www.serdp.org/content/download/18746/206355/file/ER-200715-FR.pdf*

U.S. Environmental Protection Agency, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final.* Office of Solid Waste and Emergency Response, Directive 9355.3-01. EPA 540-G-89-004.

U.S. Environmental Protection Agency, 1993. *Guidance on Conducting Non-Time Critical Removal Actions under CERCLA*, Office of Solid Waste and Emergency Response, Directive 9360.0-32. EPA 540-F-94-009.

US Navy, 2000. Decision Document for Groundwater at the Naval Air Warfare Center, Aircraft Division, Trenton, New Jersey. February

Watermark, 2011 *Sampling and Analysis Plan, Trenton Treatment Plant, Trenton, New Jersey.*

FIGURES

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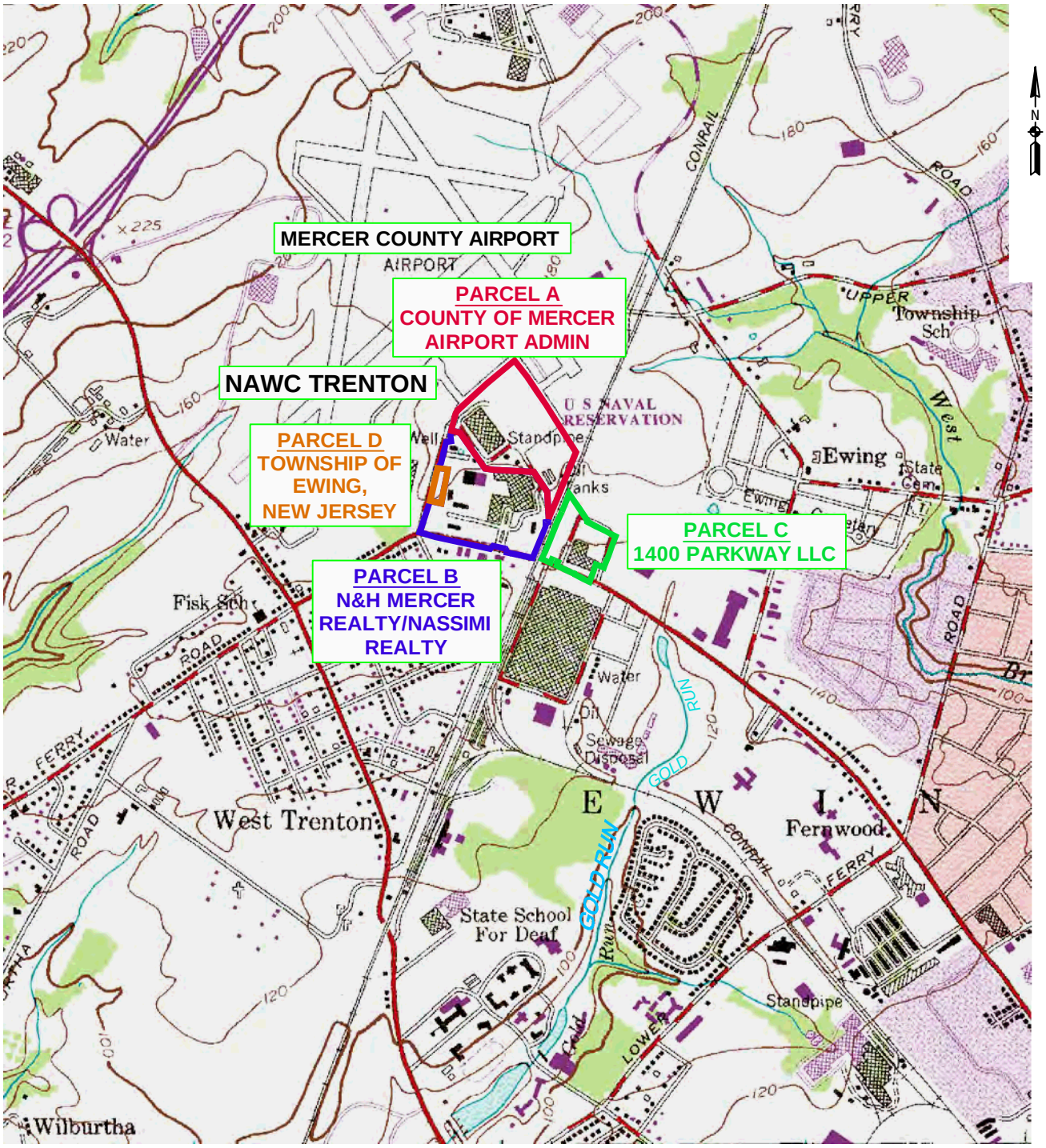

QUADRANGLE LOCATION

SOURCE:
BASE MAP IS A PORTION OF THE PENNINGTON, NJ U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 19543, PHOTOREVISED IN 1981.

0 1,600 3,200

SCALE IN FEET

FIGURE 1

FACILITY LOCATION MAP

NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

REVISION:
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

P:\CAD Project Files\Trenton CAD Files\DWG Files\FIGURE 1 SAP.DWG 10/4/13

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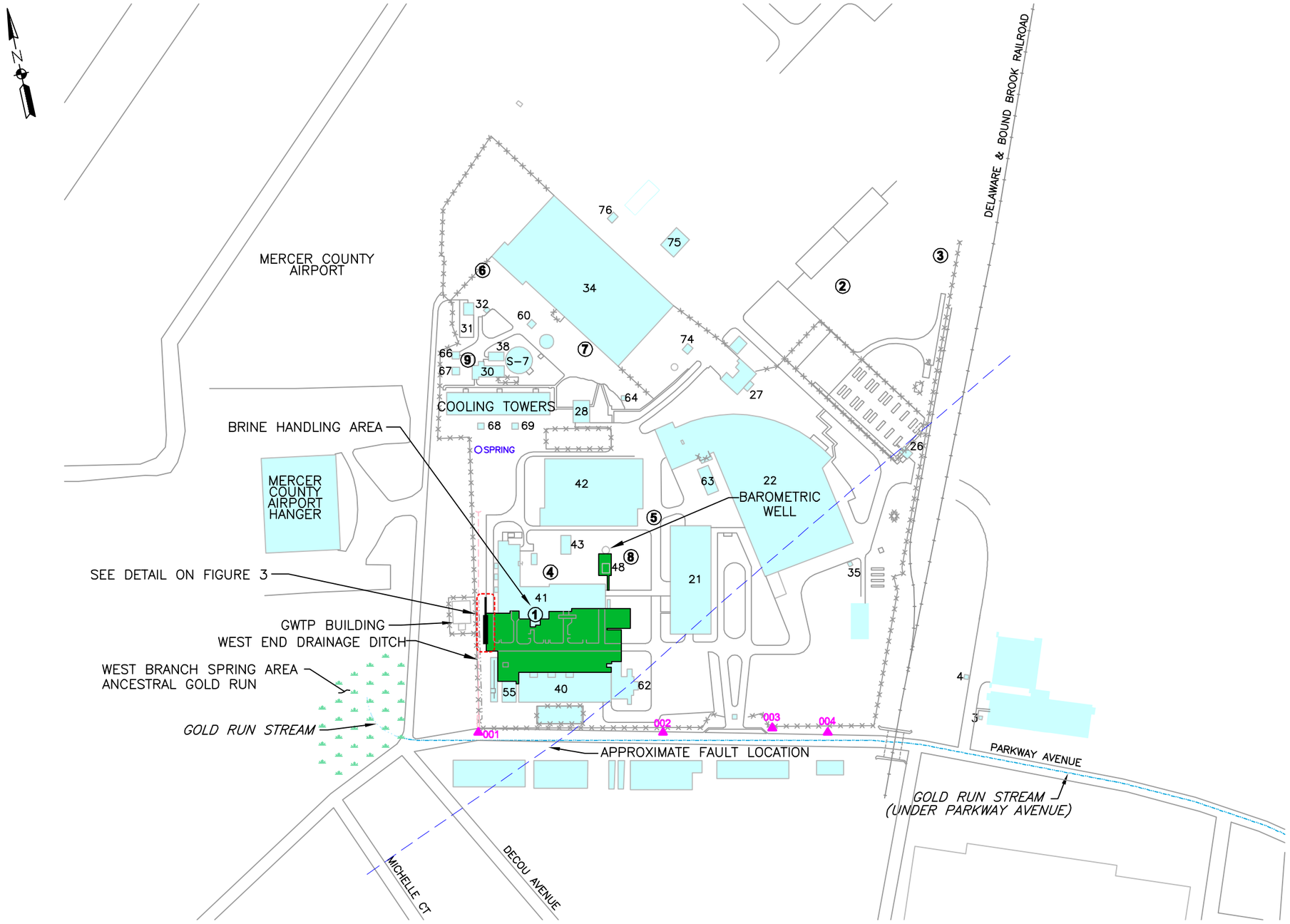

LEGEND

- ④ IR PROGRAM SITE NUMBER
- 26 BUILDING NUMBER
- ▲ OUTFALL
- APPROXIMATE FENCE LOCATION
- WETLANDS
- APPROXIMATE AREA OF SOIL REMOVAL PERFORMED IN 1998

FIGURE 2

SITE MAP

NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

REVISION: –
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

P:\CAD Project Files\Trenton CAD Files\DWG Files\FIGURE 2.DWG

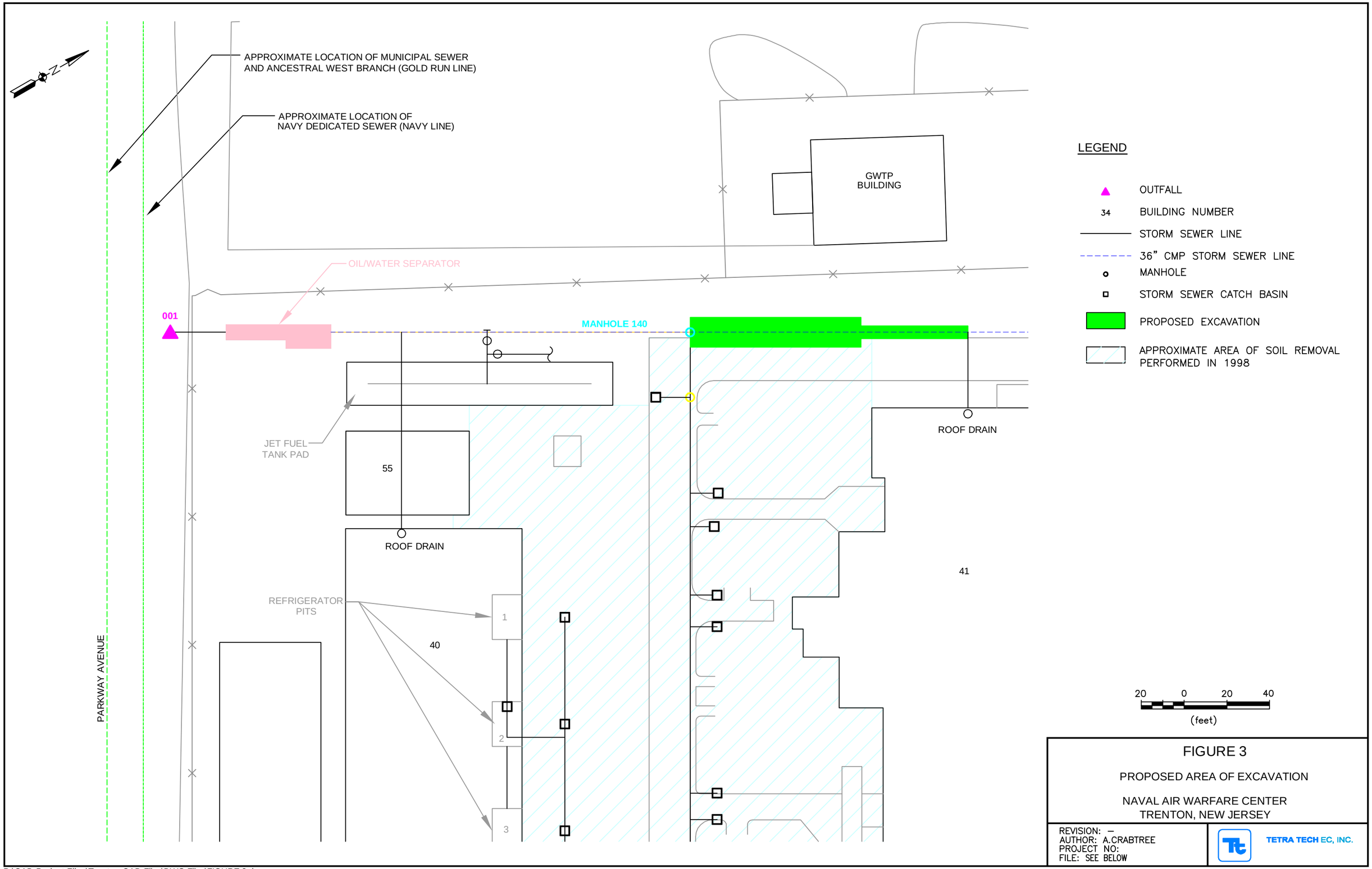

FIGURE 3

PROPOSED AREA OF EXCAVATION

NAVAL AIR WARFARE CENTER
TRENTON, NEW JERSEY

REVISION: –
AUTHOR: A.CRABTREE
PROJECT NO:
FILE: SEE BELOW

TETRA TECH EC, INC.

P:\CAD Project Files\Trenton CAD Files\DWG Files\FIGURE 3.dwg

APPENDIX A

COST ESTIMATES

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Alternative #2 – Soil Heating

Objective: Calculate the costs for the major components of Alternative #2 – Soil Heating. Present all assumptions used in the calculations.

Description of Alternative #2:

Alternative 2 involves the heating and extraction of the VOCs that are present in the Site soils via ERH and SVE. Alternative 2 includes the following components:

- Installation of electrodes into the subsurface into the area of soil impact to be treated
- Installation of soil vapor extraction wells to recover the evaporating VOCs
- Operations and maintenance of the ERH system for a time period sufficient to allow for the removal of the contamination

Prior to any installation activities, a design would need to be performed in order to evaluate site data and determine the best method for soil heating. Permits would be needed to allow for the installation of the wells that would be needed as well as the discharge for the SVE system. Once the system was designed and approved, the heating electrodes and SVE wells would be installed. It is assumed that a portable SVE would be procured for this work and that existing utilities would be used to provide power. Once the system has been installed, it is expected that it would run for approximately six months. After the active period of performance, monitoring would be performed in order to determine if the system would be restarted to treat additional soil.

Assumptions:

- There are two areas of treatment, one is 80'x14' and one is 50'x6'.
- Volume to be treated = 550 cubic yards.
- A total of 35 wells will be installed for heating, SVE, steam injection, multi-phase extraction, temperature monitoring and pressure monitoring purposes.
- It is assumed the system will run for six months.
- Permitting/planning has been estimated to take eight months.
- Construction has been estimated to take two months.
- Post remedial monitoring will be performed for two quarters after system shut down.
- No additional institutional controls will be needed for this option.

BASE - SCOPE of WORK	Quantity	Unit	Unit Price	Extended Cost Excld Fee & PMO
WE 01 PERMITTING/PLANNING	1	LS	$ 207,297.00	$ 207,297
WE 02 MOBILIZATION AND SITE PREPARATION	1	LS	$ 214,824.00	$ 214,824
WE 03 CONSTRUCTION	1	LS	$ 158,667.00	$ 158,667
WE 04 O&M/MONITORING	1	LS	$ 275,912.00	$ 275,912
			Total Cost	$ 856,700
			Total Base Fee	$ 52,066
			Total Price	**$ 908,766**

PERMITTING/PLANNING
WE 01

SCOPE

BASIS OF ESTIMATE
16 months for Permitting

PROFESSIONAL LABOR			TOTAL HRS	Basis of Estimate	Backup
Program Manager			128.0	hours/mon	8.00
Total Program Manager			**128.0**		
Senior Project Engineer/Manager *			200.0	Design/Permitting - LS	200.00
Total Senior Project Engineer/Manager *			**200.0**		
Quality Control (QC) Manager			128.0	hours/mon	8.00
Total Quality Control (QC) Manager			**128.0**		
Certified Industrial Hygienist (CIH)			128.0	hours/mon	8.00
Total Certified Industrial Hygienist (CIH)			**128.0**		
Contract Administration Manager			128.0	hours/mon	8.00
Total Contract Administration Manager			**128.0**		
Project Task Order Manager			640.0	hours/mon	40.00
Total Project Task Order Manager			**640.0**		
Senior Secretary / Clerk			60.0	Tech Editing/Production	
Total Senior Secretary / Clerk			**60.0**		
Supervising Designer			60.0	CAD - LS	
Total Supervising Designer			**60.0**		
Engineer/Scientist/Technical Specialist			200.0	Design/Permitting - LS	
Total Engineer/Scientist/Technical Specialist			**200.0**		
Subtotal Professional Labor Hours			**1,672.0**		
Total Direct Hire Classifications			**0.0**		
Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**

SCOPE

BASIS OF ESTIMATE

Drilling Mobilization has been included in this task.

A total of 35 wells will be installed for heating, SVE, steam injection, multi-phase extraction, temperature monitoring and pressure monitoring purposes.

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Senior Engineer/Scientist/Technical Specialist				50.0	mob	
Total Senior Engineer/Scientist/Technical Specialist				**50.0**		
Engineer/Scientist/Technical Specialist				350.0	10 hrs/day	
Total Engineer/Scientist/Technical Specialist				**350.0**		
Supervising Construction Staff				50.0		
Total Supervising Construction Staff				**50.0**		
Subtotal Professional Labor Hours				**450.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Driller	$120,000.00	LS	1	$120,000.00		
T&D of Non-Haz cutting	$250.00	drum	140	$35,000.00		
				$0.00		
Total Subcontracts				**$155,000.00**		
Materials						
Misc. Supplies	$10,000.00	ls	1.00	$10,000.00		
Total Materials				**$10,000.00**		
Total EC - SUBS & ODC				**$165,000.00**		

SCOPE

BASIS OF ESTIMATE

2 months of construction

Purchase and installation of piping, controls, SVE system and heating system

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Senior Engineer/Scientist/Technical Specialist				200.0		
Total Senior Engineer/Scientist/Technical Specialist				**200.0**		
Supervising Construction Staff				200.0		
Total Supervising Construction Staff				**200.0**		
Subtotal Professional Labor Hours				**400.0**		
CRAFT LABOR					**Basis of Estimate**	**Backup**
Foreman				160.0		
Operator				160.0		
Laborer				480.0		
Total Craft Labor Hours			-	**800.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Materials						
System Components	$50,000.00	LS	1.00	$50,000.00		
Total Materials				**$50,000.00**		
Total EC - SUBS & ODC				**$50,000.00**		

SCOPE

BASIS OF ESTIMATE

6 months of O&M
6 months post remedial monitoring
Includes Well Abandonment

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Supervising Engineer/Scientist/Technical Specialist				120.0	System Evaluation	
Total Supervising Engineer/Scientist/Technical Specialist				**120.0**		
Senior Engineer/Scientist/Technical Specialist				400.0	Reporting	
Total Senior Engineer/Scientist/Technical Specialist				**400.0**		
Senior Engineering Technician				960.0	O&M	
Total Senior Engineering Technician				**960.0**		
Subtotal Professional Labor Hours				**1,480.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Lab Analytical	$50,000.00	LS	1	$50,000.00		
Driller	$40,000.00	LS	1	$40,000.00		
				$0.00		
Total Subcontracts				**$90,000.00**		
Equipment						
Sampling Equipment	$10,000.00	LS	1	$10,000.00		
Total Equipment				**$10,000.00**		
ODC						
Electric Usage	40000	ls	1	$40,000.00		
Total ODC				**$40,000.00**		
Materials						
Misc. Supplies	$25,000.00	LS	1.00	$25,000.00		
Total Materials				**$25,000.00**		
Total EC - SUBS & ODC				**$165,000.00**		

Alternative #3 – Soil Excavation and Off-Site Disposal

Objective: Calculate the costs for the major components of Alternative #3 – Soil Excavation and Off-Site Disposal. Present all assumptions used in the calculations.

Alternative 3 was developed to remove and dispose of contaminated soil to reduce the volume of TCE in the subsurface. Alternative 3 includes the following components:

- Removal and off-site disposal of approximately 660 tons of impacted soil
- Removal and disposal of failed drainage pipe
- Replace the removed drainage pipe with an open drainage ditch and construct headwalls to tie into the existing storm drainage system.

Prior to beginning the excavation activities, soil sampling would be performed in order to characterize the soil so that stockpiling would not be necessary. It is assumed that this could be performed using a direct-push rig and standard analytical parameters.

The initial phase of the removal action would be the implementation of erosion and sedimentation controls to reduce the potential migration of soil contaminants to downgradient areas or surface water bodies. A staging area would be constructed for temporary handling of contaminated soil before off-site transport (if necessary). A temporary decontamination pad would also be constructed. Equipment and vehicles used during site preparation, excavation and soil handling would be cleaned and decontaminated at this point. The actual size, design and location of the staging area and decontamination area would be determined in the planning stages. Contaminated soil would be excavated using common excavation equipment. Confirmatory sampling would be used to evaluate conditions after excavation has been performed.

Temporary sheet piling would also be placed along one edge of the excavation in order to prevent soil from falling into the excavation and to allow for the creation of the open drainage ditch. After the impacted soil has been removed, the excavated areas would be regraded with imported clean backfill and vegetated. The staging area and the decontamination pad would be removed.

Assumptions:

- There are two areas of excavation, one is 80'x14' and one is 50'x6'.
- Volume to be excavated = 550 cubic yards (including sloping).
- The excavated soil can be disposed of as non-hazardous waste.
- After the soil has been removed, the area will be backfilled with imported fill and graded to allow for the installation of an open drainage ditch in the northeastern portion of the excavation.
- Field work can be completed in approximately one month.
- No additional institutional controls will be needed for this option.

Client: NAVFAC Mid-Atlantic
Contract #: N62470-13-D-8007
Project: XE12 - Removal Action at Site 1 at the former Naval Air Warfare Center (NAWC) Trenton, NJ

BASE - SCOPE of WORK			Quantity	Unit	Unit Cost	Extended Cost Excld Fee & PMO
WORK ELEMENT 1	PROJECT MANAGEMENT, ADMINISTRATIVE SUPPORT AND MEETINGS					
	WE01	Project Management, Administrative Support, and Meetings	1	LS	$ 288,340	$ 288,340
WORK ELEMENT 2	PRECONSTRUCTION ACTIVITIES					
	WE02a	Work Plan Development	1	LS	$ 67,501	$ 67,501
WORK ELEMENT 3	MOBILIZATION ACTIVITIES					
	WE03a	Pre-Characterization of Soil	1	LS	$ 11,058	$ 11,058
	WE03b	Mobilization	1	LS	$ 7,331	$ 7,331
	WE03c	Site Preparation	1	LS	$ 55,022	$ 55,022
WORK ELEMENT 4	FIELD ACTIVITIES					
	WE04a	Construction Management (Labor and ODCs)	1	LS	$ 112,175	$ 112,175
	WE04b	Install Sheet Piling	1	LS	$ 67,587	$ 67,587
	WE04c	Excavation	1	LS	$ 79,319	$ 79,319
	WE04d	Post-Excavation Grading	1	LS	$ 57,567	$ 57,567
WORK ELEMENT 5	TRANSPORTATION AND DISPOSAL OF SOIL/DEBRIS					
	WE05	Transportation and Disposal of Soil	1	LS	$ 40,239	$ 40,239
WORK ELEMENT 6	SITE RESTORATION AND DEMOBILIZATION					
	WE06b	Site Restoration	1	LS	$ 28,508	$ 28,508
	WE06c	Demobilization	1	LS	$ 5,926	$ 5,926
WORK ELEMENT 7	POST CONSTRUCTION DELIVERABLES					
	WE07a	Remedial Action Completion Report	1	LS	$ 20,863	$ 20,863
					Subtotal Total Cost	**$ 841,436**
					Subtotal Total Fee	**$ 52,555**
					Subtotal Total Price	**$ 893,991**
					PMO Incld Fee	**$ 20,257**
					Total Price w/ PMO	**$ 914,248**

SCOPE

* Project management includes personnel and resources for the management and control of project activities, including planning, tracking, analyzing, coordinating and closure of the project.

BASIS OF ESTIMATE

8 Months for approved submittals
1.4 Months of field work
8 Months for finalizing deliverables and CTO closeout
17.4 Total Months of Project Management and Project Support Included

MEETINGS
3 Technical / Project Meetings included here
> Attendees will be Project Manager and Site Superintendent

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Program Manager				69.6	Hrs per Mon	4.00
Total Program Manager				**69.6**		
Quality Control (QC) Manager				104.4	Hrs per Mon	6.00
Total Quality Control (QC) Manager				**104.4**		
Certified Industrial Hygienist (CIH)				104.4	Hrs per Mon	6.00
Total Certified Industrial Hygienist (CIH)				**104.4**		
Contract Administration Manager				208.8	Hrs per Mon	12.00
Total Contract Administration Manager				**208.8**		
Project Task Order Manager				556.8	Project Mgt - Hrs per Mon	32.00
Project Task Order Manager				24.0	Technical / Project Meetings - Hrs per Trip	8.00
Total Project Task Order Manager				**580.8**		
Senior Secretary				139.2	Hrs per Mon	8.00
Total Senior Secretary				**139.2**		
Senior Procurement Specialist				192.0	Initial - Upfront Procurements / SOW - LS	192.00
Senior Procurement Specialist				104.4	Ongoing Mgt Procurements - Hrs Per Mon	6.00
Total Senior Procurement Specialist				**296.4**		
Senior Consulting Engineer/Scientist/Technical Specialist				16.0	Regulatory Compliance - LS	16.00
Total Senior Consulting Engineer/Scientist/Technical Specialist				**16.0**		
Supervising Engineer/Scientist/Technical Specialist				556.8	Project Controls - Hrs per Mon	32.00
Total Supervising Engineer/Scientist/Technical Specialist				**556.8**		
Principal Engineer/Scientist/Technical Specialist				8.0	Estimating Turnover - Internal Kickoff	8.00
Total Principal Engineer/Scientist/Technical Specialist				**8.0**		
Senior Engineer/Scientist/Technical Specialist				104.4	Financial Analysts hrs per Mon	6.00
Senior Engineer/Scientist/Technical Specialist				40.0	Assist in SOW for Procurement - LS	40.00
Total Senior Engineer/Scientist/Technical Specialist				**144.4**		
Manager Construction / Field Operations				72.0	Technical / Project Meetings - Hrs per Trip	24.00
Total Manager Construction/Field Operations				**72.0**		
Subtotal Professional Labor Hours				**2,300.8**		
ODC						
Black & White Copies	$0.08	ea	5,220	$417.60	Copies per Month	300
Color Copies	$0.42	ea	522	$219.24	10% of B&W	
E / D Size Drawings	$7.00	ea	52	$364.00	10% of Color	
				$0.00		
Total ODC				**$1,000.84**		
Travel						
Mileage (Site Superintendent)	$0.55	mile	1,800	$990.00	Boston to Ewing Twp.-RT Miles / Trip	600
Travel Cost / Tolls (Site Superintendent)	$25.00	ls	3	$75.00	allowance	1
Per Diem (Site Superintendent)	$180.00	day	6	$1,080.00	Days per Trip	2
Mileage (Project Manager)	$0.55	mile	90	$49.50	Langhorne to Ewing Twp.-RT Miles / Trip	30
Travel Cost / Tolls (Project Manager)	$10.00	ls	3	$30.00	allowance	1
				$0.00		
Total Travel				**$2,224.50**		
Total EC - SUBS & ODC				**$3,225.34**		

SCOPE

* Preparation of base wide Work Plan to complete project
* Preparation of a Public Notice

BASIS OF ESTIMATE

* Internal Draft, Draft, and Final versions of Pre-Construction Deliverables to include:
  > Work Plan
  > UFP - QAPP
  > AHA as part of the Work Plan
  > APP as part of the Work Plan
  > Construction Quality Control Plan as part of the Work Plan
  > Waste Management Plan as part of the Work Plan
  > Environmental Protection Plan as part of the Work Plan
  > Excavation Plan as part of the Work Plan
  > Traffic Plan as part of the Work Plan
  > Storm Water Pollution Prevention Plan as part of the Work Plan
  > Public Notice
  >Engineering Evaluation / Cost Analysis
* Two versions of a Public Notice will be developed; Internal Draft and Final

PROFESSIONAL LABOR			TOTAL HRS	Basis of Estimate	Backup
Quality Control (QC) Manager			4.0	Review of WP	
Quality Control (QC) Manager			2.0	Review of HSP	
Quality Control (QC) Manager			4.0	Review of EE/CA	
Total Quality Control (QC) Manager			**10.0**		
Certified Industrial Hygienist (CIH)			4.0	Review APP	
Total Certified Industrial Hygienist (CIH)			**4.0**		
Project Task Order Manager			16.0	WP-Review	
Project Task Order Manager			2.0	H&S Review	
Project Task Order Manager			8.0	Site Meeting	
Project Task Order Manager			40.0	EE/CA Prep and Review	
Total Project Task Order Manager			**66.0**		
Senior Secretary / Clerk			16.0	Word Processing for WP	
Senior Secretary / Clerk			6.0	Word Processing for APP	
Senior Secretary / Clerk			24.0	Word Processing for EE/CA	
Total Senior Secretary / Clerk			**46.0**		
Supervising Designer			8.0	CAD/Drawing for WP	
Supervising Designer			6.0	CAD/Drawing for APP	
Supervising Designer			6.0	CAD/Drawing for SWPPP	
Supervising Designer			16.0	CAD/Drawing for EE/CA	
Total Supervising Designer			**36.0**		
Senior Consulting Engineer/Scientist/Technical Specialist			4.0	WP-Regulatory Review	
Senior Consulting Engineer/Scientist/Technical Specialist			4.0	H&S Reg/Peer Review	
Senior Consulting Engineer/Scientist/Technical Specialist			4.0	WMP Peer Review	
Senior Consulting Engineer/Scientist/Technical Specialist			4.0	SWPPP - Reg. Review	
Senior Consulting Engineer/Scientist/Technical Specialist			4.0	EE/CA Review	
Total Senior Consulting Engineer/Scientist/Technical Specialist			**20.0**		
Consulting Engineer/Scientist/Technical Specialist			2.0	WP-Technical Review	
Consulting Engineer/Scientist/Technical Specialist			4.0	SWPPP - Engineer Review	
Consulting Engineer/Scientist/Technical Specialist			40.0	EE/CA Evaluation	
Total Consulting Engineer/Scientist/Technical Specialist			**46.0**		
Supervising Engineer/Scientist/Technical Specialist			4.0	SAP/QAPP Peer Review	
Supervising Engineer/Scientist/Technical Specialist			4.0	QACP - Peer Review	
Supervising Engineer/Scientist/Technical Specialist			40.0	UFP-SAPP Prep	
Total Supervising Engineer/Scientist/Technical Specialist			**48.0**		
Senior Engineer/Scientist/Technical Specialist			60.0	WP - Doer/Task Manager	
Senior Engineer/Scientist/Technical Specialist			40.0	H&S Doer	
Senior Engineer/Scientist/Technical Specialist			100.0	EE/CA Doer	
Senior Engineer/Scientist/Technical Specialist			16.0	WMP Doer	
Senior Engineer/Scientist/Technical Specialist			32.0	QACP - Doer	
Total Senior Engineer/Scientist/Technical Specialist			**248.0**		

Engineer/Scientist/Technical Specialist				4.0	WP-Checker/Editor	
Engineer/Scientist/Technical Specialist				2.0	SWPPP - Checker	
Engineer/Scientist/Technical Specialist				4.0	QACP-Checker	
Engineer/Scientist/Technical Specialist				16.0	EE/CA Prep and Checker	
Total Engineer/Scientist/Technical Specialist				**26.0**		
Associate Engineer/Scientist/Technical Specialist				12.0	SWPPP - Prepare E&S Plan	
Total Associate Engineer/Scientist/Technical Specialist				**12.0**		
Assistant Engineer/Scientist/Technical Specialist				24.0	SWPPP - Review Requirements and Prepare	
Total Assistant Engineer/Scientist/Technical Specialist				**24.0**		
Manager Construction / Field Operations				12.0	Schedule/Const. Review	
Manager Construction / Field Operations				0.0		
Total Manager Construction/Field Operations				**12.0**		
Subtotal Professional Labor Hours				**598.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Newspaper notification	$250.00	ls	1	$250.00		
				$0.00		
Total Subcontracts				**$250.00**		
ODC						
Black & White Copies	$0.08	ea	5,000	$400.00		
Color Copies	$0.42	ea	500	$210.00	10% of B&W	
E / D Size Drawings	$7.00	ea	50	$350.00	10% of Color	
FEDEX shipping	$25.00	shipment	6	$150.00		
Office - binders, CD	$100.00	deliverable	3	$300.00		
				$0.00		
Total ODC				**$1,410.00**		
Total EC - SUBS & ODC				**$1,660.00**		

SCOPE

* Soil will be characterized for waste disposal in advance of excavation by collecting and analyzing soil samples from the planned excavation area.

BASIS OF ESTIMATE

10 soil borings will be advanced using Geoprobe Direct Push Technology (DPT) and macro core sampling to determine the waste characteristics of the soil

2 Days of field work to obtain soil samples for pre-classification purposes.

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Supervising Designer				4.0	Prepare location maps/ID points	
Total Supervising Designer				**4.0**		
Senior Engineer/Scientist/Technical Specialist				20.0	Field Work	
Total Senior Engineer/Scientist/Technical Specialist				**20.0**		
Subtotal Professional Labor Hours				**24.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Driller	$3,190.00	ls	1	$3,190.00		
Lab Analytical - TPH 8015	$120.00	ea	8	$960.00		
Lab Analytical - TOX 9023	$150.00	ea	8	$1,200.00		
Lab Analytical - Total Metals 6000/7000	$50.00	ea	2	$100.00		
Lab Analytical - TCLP Metals 1311/6010	$130.00	ea	2	$260.00		
Lab Analytical - Ignitability 1030	$100.00	ea	2	$200.00		
Lab Analytical - Corrosively 9045D	$35.00	ea	2	$70.00		
Lab Analytical - Reactivity SW846	$100.00	ea	2	$200.00		
Lab Analytical - PCBs 8082A	$110.00	ea	2	$220.00		
Lab Analytical - TCLP VOCs 1311/8260B	$180.00	ea	2	$360.00		
Lab Analytical - TCLP SVOCs 1311/8270D	$220.00	ea	2	$440.00		
				$0.00		
Total Subcontracts				**$7,200.00**		
Equipment						
Misc Sampling Equipment/Supplies/PPE	$200.00	ls	1.0	$200.00		
				$0.00		
Total Equipment				**$200.00**		
Travel						
Mileage	$0.55	mile	300	$165.00	Langhorne to Ewing Twp.-RT Miles / Trip	30
Travel Cost / Tolls	$10.00	ls	10	$100.00	allowance	1
Per Diem (Meals)	$56.00	day	10	$560.00		
				$0.00		
Total Travel				**$825.00**		
Total EC - SUBS & ODC				**$8,225.00**		

SCOPE

* Mobilization of field personnel and all heavy equipment and temporary facilities required.

BASIS OF ESTIMATE

FIELD MANAGEMENT

1 Project Site Superintendent
1 Field Engineer / Health & Safety Officer

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Senior Engineer/Scientist/Technical Specialist				8.0	Field Engineer / Safety Officer	8.00
Total Senior Engineer/Scientist/Technical Specialist				**8.0**		
Manager Construction / Field Operations				8.0	Site Superintendent	8.00
Total Manager Construction/Field Operations				**8.0**		
Subtotal Professional Labor Hours				**16.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Equipment						
Equipment Rental (Transportation Charges)	$1,500.00	ls	1	$1,500.00		
8' x 20' Steel Trench Box (Transportation Charges)	$125.00	ea	1	$125.00		
Sales Tax	$1,625.00	percent	7%	$113.75		
Total Equipment				**$1,738.75**		
ODC						
Office Trailer Delivery and Set-Up	$1,974.40	ea	1	$1,974.40		
Conex Delivery	$260.16	ea	1	$260.16		
21,000 Gallon Temporary Storage Tank (Delivery)	$353.40	ea	1	$353.40		
Trash Dumpster	$50.00	ea	1	$50.00		
				$0.00		
Total ODC				**$2,637.96**		
Travel						
Mileage (Site Super)	$0.55	mile	300	$165.00	Boston to Trenton-Miles / Trip	300
Travel Cost / Tolls (Site Super)	$25.00	ls	1	$25.00	allowance	1
Mileage (Field Engineer / HSO)	$0.55	mile	300	$165.00	Boston to Trenton-Miles / Trip	300
Travel Cost / Tolls (Field Engineer / HSO)	$25.00	ls	1	$25.00	allowance	1
				$0.00		
Total Travel				**$380.00**		
Total EC - SUBS & ODC				**$4,756.71**		

SCOPE

* Preparatory construction activities to include the following:
  > Staging Area Setup
  > Establish Site Controls (erosion & work zones)
  > Underground Utility Clearance will be conducted
  > Site survey will be performed

BASIS OF ESTIMATE

1,000 LF of temporary chain-link fence has been included to secure the site support and lay-down area(s) throughout the field duration

* An electrical subcontractor is included to do the following:
  > Connect power from the generator to the site trailer
  > Set up temporary service at the natural spring location for the pump around pumps. Service to come from the Pump and Treat Building.
* Utility locating services are included to locate and mark-out sub-surface utilities
  > The Navy will locate and mark the pump and treat utilities
* An initial survey is included to record existing conditions at Site 1 and to identify the areas of excavation

5 Field Days (1 week) are estimated for Site Preparation and Site Set-Up

* Craft labor works Monday thru Friday for 10-hr days resulting in a 50 hour work week.

CRAFT REQUIREMENTS

2 Operators
4 Laborers

CRAFT LABOR					Basis of Estimate	Backup
Operator				80.0	8 hrs per Day x Total Craft	2.00
Operator OT				20.0	2 hrs per Day x Total Craft	2.00
Laborer				160.0	8 hrs per Day x Total Craft	4.00
Laborer OT				40.0	2 hrs per Day x Total Craft	4.00
Total Craft Labor Hours			-	**300.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Electrical / Utility Connections	$7,500.00	ls	1	$7,500.00	allowance	
Utility Clearance	$7,500.00	ls	1	$7,500.00		
Surveyor	$1,425.00	day	3	$4,275.00		R.S. Means Costworks 2013
				$0.00		
Total Subcontracts				**$19,275.00**		
Equipment						
JD270 Excavator (65,000 lbs.)	$8,500.00	mon	0.25	$2,125.00		1
JD544 Wheel Loader (28,000 lbs.)	$4,500.00	mon	0.25	$1,125.00		1
Ride-on Sweeper	$2,100.00	mon	0.25	$525.00		1
Forks for Wheel Loader	$800.00	mon	0.25	$200.00		1
20KW Generator	$1,500.00	mon	0.25	$375.00		1
2" Submersible Pump w/ 300' of hose	$550.00	mon	0.50	$275.00		2
3" Electric Pump	$600.00	mon	0.25	$150.00		1
8' x 20' Steel Trench Box	$412.00	week	1	$412.00		1
Fuel / FOG	$5,187.00	percent	25%	$1,296.75		
Sales Tax	$6,483.75	percent	7%	$453.86		
Total Equipment				**$6,937.61**		
Government Property						
				$0.00		
Total Government Property				**$0.00**		
ODC						
Temporary Fence	$4,226.50	ls	1	$4,226.50	1000 lf of 8' x 10' Chain Link Surface Fence	
Sand Bags	$8.56	ea	101	$864.56	for Chain Link Surface Fence	
21,000 Gallon Temporary Storage Tank	$868.00	mon	0.25	$217.00		
Bag Filter Housing	$900.00	mon	0.25	$225.00		
				$0.00		
Total ODC				**$5,533.06**		
Total EC - SUBS & ODC				**$31,745.67**		

SCOPE

* Field Oversight (Labor and Expenses)

BASIS OF ESTIMATE

Field Personnel located On-Site and Other Direct Costs (ODC's) are included here.

28 days to complete the field work

FIELD MANAGEMENT

1 Project Site Superintendent will be on-site throughout the field effort
1 Field Engineer / Health & Safety Officer will be on-site throughout the field effort

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Senior Engineer/Scientist/Technical Specialist				280.0	Field Engineer / Safety Officer - Hrs per day	10.00
Total Senior Engineer/Scientist/Technical Specialist				**280.0**		
Manager Construction / Field Operations				280.0	Site Superintendent - Hrs per day	10.00
Total Manager Construction/Field Operations				**280.0**		
Subtotal Professional Labor Hours				**560.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Equipment						
F150 Pick-up Truck	$1,200.00	mon	4.0	$4,800.00		2
Air Monitoring Equipment	$1,000.00	mon	2.0	$2,000.00	PID and Drager Sampling Pump and Detector Tubes	
Fuel / FOG	$6,800.00	percent	25%	$1,700.00		
Sales Tax	$8,500.00	percent	7%	$595.00		
Total Equipment				**$9,095.00**		
ODC						
Office Trailer Rental	$625.92	mon	2.0	$1,251.84		
Conex Rental	$147.50	mon	2.0	$295.00		
Portable Toilet	$81.20	mon	2.0	$162.40		1
Trash Dumpster	$200.00	mon	2.0	$400.00		
Temporary Fence	$374.50	mon	2.0	$749.00	1000 lf of 8' x 10' Chain Link Surface Fence	
Office Supplies	$55.00	mon	2.0	$110.00		2
Cell Phone	$100.00	mon	2.0	$200.00		2
Small Tools / Consumable	$500.00	mon	2.0	$1,000.00		
Safety Supplies	$100.00	mon	2.0	$200.00		
				$0.00		
Total ODC				**$4,368.24**		
Travel						
Per Diem (Site Superintendent)	$180.00	day	39.2	$7,056.00	Total Wks x 6 days avg x # of People >	1
Per Diem (Field Engineer / HSO)	$180.00	day	39.2	$7,056.00	Total Wks x 6 days avg x # of People >	1
				$0.00		
Total Travel				**$14,112.00**		
Total EC - SUBS & ODC				**$27,575.24**		

Install Sheet Piling
WE04b

SCOPE

* Sheet piling will be used along the western perimeter of the excavation area to stabilize the area between the water treatment building and the excavation

BASIS OF ESTIMATE

100 LF of sheet pile will be installed

3 Days duration to complete this activity

	Unit Cost	Units	Qty	Cost	Basis of Estimate	Backup
Subcontractors						
Sheet Pile	$65,000.00	ls	1	$65,000.00		
				$0.00		
Total Subcontracts				**$65,000.00**		
Total EC - SUBS & ODC				**$65,000.00**		

SCOPE

* Excavation of soil along the upper segment of the West Ditch

BASIS OF ESTIMATE

660 CY of non-hazardous contaminated soil to be excavated. A 20% contingency for additional excavation has been included.

* Excavation Area #1
  > 80' L x 14' W x 10' D
  > 450 in-place CY with sloping
* Excavation Area #2
  > 50' L x 6' W x 6' D
  > 100 in-place CY with sloping

40 Post-excavation samples will be collected and analyzed for:
  > volatile organic compounds (VOCs)
  > target analyte list (TAL) metals

* All soil sample locations will be surveyed by a licensed surveyor and the information loaded into NIRIS
* Soil Sampling Lead will be on-site during this activity

10 Days for the total duration of this activity

* Craft labor works Monday thru Friday for 10-hr days resulting in a 50 hour work week.

CRAFT REQUIREMENTS

2 Operators
4 Laborers

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Senior Engineer/Scientist/Technical Specialist				100.0	Soil Sampling Lead - Hrs / day	10.00
Total Senior Engineer/Scientist/Technical Specialist				**100.0**		
Subtotal Professional Labor Hours				**100.0**		
CRAFT LABOR					**Basis of Estimate**	**Backup**
Operator				160.0	8 hrs per Day x Total Craft	2.00
Operator OT				40.0	2 hrs per Day x Total Craft	2.00
Laborer				320.0	8 hrs per Day x Total Craft	4.00
Laborer OT				80.0	2 hrs per Day x Total Craft	4.00
Total Craft Labor Hours			-	**600.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Lab Analytical - TCL VOC	$100.00	ea	40	$4,000.00		
Lab Analytical - TAL Metals	$50.00	ea	40	$2,000.00		
Surveyor	$1,425.00	day	2	$2,850.00		R.S. Means Costworks 2013
				$0.00		
Total Subcontracts				**$8,850.00**		
Equipment						
JD270 Excavator (65,000 lbs.)	$8,500.00	mon	0.5	$4,250.00		1
JD544 Wheel Loader (28,000 lbs.)	$4,500.00	mon	0.5	$2,250.00		1
Ride-on Sweeper	$2,100.00	mon	0.5	$1,050.00		1
Forks for Wheel Loader	$800.00	mon	0.5	$400.00		1
20KW Generator	$1,500.00	mon	0.5	$750.00		1
2" Submersible Pump w/ 300' of hose	$550.00	mon	1.0	$550.00		2
3" Electric Pump	$600.00	mon	0.5	$300.00		1
8' x 20' Steel Trench Box	$412.00	week	2	$824.00		1
Fuel / FOG	$10,374.00	percent	25%	$2,593.50		
Sales Tax	$12,967.50	percent	7%	$907.73		
Total Equipment				**$13,875.23**		
ODC						
21,000 Gallon Temporary Storage Tank	$868.00	mon	0.50	$434.00		
Bag Filter Housing	$900.00	mon	0.50	$450.00		
Misc Supplies/PPE	$200.00	ls	1.0	$200.00		
				$0.00		
Total ODC				**$1,084.00**		
Materials						
5 micron polyester bags	$5.25	ea	25.00	$131.25		
Sales Tax	$131.25	percent	7%	$9.19		
Total Materials				**$140.44**		
Total EC - SUBS & ODC				**$23,949.67**		

SCOPE

* The area of excavation shall be restored to an open drainage ditch with a pervious paver durable interlocking paving system at the bottom elevation at the invert elevation of the existing CMP. The restored open ditch shall be sloped at the north end where the CMP will not be excavated. At the south end, the open ditch shall be routed into Manhole #140 with a constructed headwall or sloped to the constructed ditch. One roof drain that is connected to the CMP will be redirected into concrete gutter in the restored ditch.

BASIS OF ESTIMATE

625 tons of sub-base gravel fill layer will be imported and placed
2,880 so of True Grid grid paving system at the bottom and sides of the open ditch which will provide a safeguard against erosion control
100 ton of #57 stone will be imported and placed to fill the cells of the grid system
25 tons of 4-6" rip-rap will be imported and placed at the North end of the drainage ditch
5 **Days included to construct geosynthetic component**

* Craft labor works Monday thru Friday for 10-hr days resulting in a 50 hour work week.

CRAFT REQUIREMENTS

2 Operators
4 Laborers

CRAFT LABOR					Basis of Estimate	Backup
Operator				80.0	8 hrs per Day x Total Craft	2.00
Operator OT				20.0	2 hrs per Day x Total Craft	2.00
Laborer				160.0	8 hrs per Day x Total Craft	4.00
Laborer OT				40.0	2 hrs per Day x Total Craft	4.00
Total Craft Labor Hours			-	**300.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Equipment						
JD270 Excavator (65,000 lbs.)	$8,500.00	mon	0.25	$2,125.00		1
JD544 Wheel Loader (28,000 lbs.)	$4,500.00	mon	0.25	$1,125.00		1
Ride-on Sweeper	$2,100.00	mon	0.25	$525.00		1
Forks for Wheel Loader	$800.00	mon	0.25	$200.00		1
20KW Generator	$1,500.00	mon	0.25	$375.00		1
2" Submersible Pump w/ 300' of hose	$550.00	mon	0.50	$275.00		2
3" Electric Pump	$600.00	mon	0.25	$150.00		1
8' x 20' Steel Trench Box	$412.00	week	1	$412.00		1
Fuel / FOG	$5,187.00	percent	25%	$1,296.75		
Sales Tax	$6,483.75	percent	7%	$453.86		
Total Equipment				**$6,937.61**		
ODC						
21,000 Gallon Temporary Storage Tank	$868.00	mon	0.25	$217.00		
Bag Filter Housing	$900.00	mon	0.25	$225.00		
				$0.00		
Total ODC				**$442.00**		
Materials						
Non-Woven Geotextile 8 oz. / sy	$415.00	roll	1.00	$415.00		
TrueGrid Permeable Paver	$2.09	sf	2,880.00	$6,019.20		
1" Gravel	$25.00	ton	625.00	$15,625.00		
#57 Stone	$20.00	ton	100.00	$2,000.00		
4" - 6" rip-rap	$40.00	ton	25.00	$1,000.00		
Sales Tax	$25,059.20	percent	7%	$1,754.14		
Total Materials				**$26,813.34**		
Total EC - SUBS & ODC				**$34,192.95**		

Transportation and Disposal of Soil
WE05

SCOPE

* Transport and Disposal - Pricing & Logistics

BASIS OF ESTIMATE

660 Total CY of Non-Hazardous soil x 1.5

> The material will not be classified as an "F-Listed" waste

Craft / Equipment / Productions

* Craft and Equipment hours are included within the Field Work WBS
* Load out will be concurrent with our ongoing field operations

	Unit Cost	Units	Qty	Cost	Basis of Estimate	Backup
Subcontractors						
T&D of Non-Hazardous Soil	$39.09	ton	990	$38,699.10		
				$0.00		
Total Subcontracts				**$38,699.10**		
Total EC - SUBS & ODC				**$38,699.10**		

SCOPE

* Site Restorations

BASIS OF ESTIMATE

* Any areas impacted by construction activities such as the lay down area, equipment storage, decontamination areas, etc. will be restored to their original condition. The Contractor shall spread and dress the topsoil to finished grade leaving no irregularities or depressions and promote positive drainage.
* Existing asphalt surfaces in the area of excavation will not be restored to original condition
* An electrical subcontractor is included to make the necessary power disconnections

1 Acre of impacted areas will be re-seeded and hayed to prevent erosion control

* The following waste streams will be removed from the site:

18 Drums containing soil cuttings
6 Drums containing well development water

5 Days duration to complete this activity

* Craft labor works Monday thru Friday for 10-hr days resulting in a 50 hour work week.

CRAFT REQUIREMENTS

2 Operators
4 Laborers

CRAFT LABOR					Basis of Estimate	Backup
Operator				40.0	8 hrs per Day x Total Craft	2.00
Operator OT				10.0	2 hrs per Day x Total Craft	2.00
Laborer				80.0	8 hrs per Day x Total Craft	4.00
Laborer OT				20.0	2 hrs per Day x Total Craft	4.00
Total Craft Labor Hours			-	**150.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Subcontractors						
Electrical / Utility Disconnects	$5,000.00	ls	1	$5,000.00	allowance	
Disposal - Soil Cuttings	$94.21	drum	18	$1,695.78		
Disposal - Well Development Water	$88.59	drum	6	$531.54		
Transportation - Load	$1,200.00	ls	1	$1,200.00		
Landscape - Seed & Straw (Hand)	$1,950.00	acre	1	$1,950.00		
				$0.00		
Total Subcontracts				**$10,377.32**		
Equipment						
JD270 Excavator (65,000 lbs.)	$8,500.00	mon	0.25	$2,125.00		1
JD544 Wheel Loader (28,000 lbs.)	$4,500.00	mon	0.25	$1,125.00		1
Ride-on Sweeper	$2,100.00	mon	0.25	$525.00		1
Forks for Wheel Loader	$800.00	mon	0.25	$200.00		1
20KW Generator	$1,500.00	mon	0.25	$375.00		1
2" Submersible Pump w/ 300' of hose	$550.00	mon	0.50	$275.00		2
3" Electric Pump	$600.00	mon	0.25	$150.00		1
8' x 20' Steel Trench Box	$412.00	week	0.125	$51.50		1
Fuel / FOG	$4,826.50	percent	25%	$1,206.63		
Sales Tax	$6,033.13	percent	7%	$422.32		
Total Equipment				**$6,455.45**		
Total EC - SUBS & ODC				**$16,832.77**		

SCOPE

* Demobilization of field personnel and all heavy equipment and temporary facilities required.

BASIS OF ESTIMATE

FIELD MANAGEMENT

1 Project Site Superintendent
1 Field Engineer / Health & Safety Officer

PROFESSIONAL LABOR				TOTAL HRS	Basis of Estimate	Backup
Senior Engineer/Scientist/Technical Specialist				8.0	Field Engineer / Safety Officer	8.00
Total Senior Engineer/Scientist/Technical Specialist				**8.0**		
Manager Construction / Field Operations				8.0	Site Superintendent	8.00
Total Manager Construction/Field Operations				**8.0**		
Subtotal Professional Labor Hours				**16.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
Equipment						
Equipment Rental (Transportation Charges)	$1,500.00	ls	1	$1,500.00		
8' x 20' Steel Trench Box (Transportation Charges)	$125.00	ea	1	$125.00		
Sales Tax	$1,625.00	percent	7%	$113.75		
Total Equipment				**$1,738.75**		
ODC						
Office Trailer Tear-down and Return	$623.02	ea	1	$623.02		
Conex Return	$260.16	ea	1	$260.16		
Trash Dumpster	$50.00	ea	1	$50.00		
21,000 Gallon Temporary Storage Tank Pick-up	$353.40	ea	1	$353.40		
				$0.00		
Total ODC				**$1,286.58**		
Travel						
Mileage (Site Super)	$0.55	mile	300	$165.00	Trenton to Boston-Miles / Trip	300
Travel Cost / Tolls (Site Super)	$25.00	ls	1	$25.00	allowance	1
Mileage (Field Engineer / HSO)	$0.55	mile	300	$165.00	Trenton to Boston-Miles / Trip	300
Travel Cost / Tolls (Field Engineer / HSO)	$25.00	ls	1	$25.00	allowance	1
				$0.00		
Total Travel				**$380.00**		
Total EC - SUBS & ODC				**$3,405.33**		

SCOPE

* Post Construction Deliverable, Remedial Action Completion Report (RACR)

BASIS OF ESTIMATE

* Three versions of the RACR will be developed; Internal Draft, Draft and Final
* One round of compiled Navy/Regulator comments

PROFESSIONAL LABOR			TOTAL HRS	Basis of Estimate	Backup
Quality Control (QC) Manager			4.0	Review of RACR	
Total Quality Control (QC) Manager			**4.0**		
Project Task Order Manager			4.0	Review of RACR	
Total Project Task Order Manager			**4.0**		
Senior Secretary / Clerk			24.0	Word Process/Scan	
Total Senior Secretary / Clerk			**24.0**		
Supervising Designer			24.0	CAD/Drawings	
Total Supervising Designer			**24.0**		
Senior Consulting Engineer/Scientist/Technical Specialist			2.0	RACR Reg. Review	
Total Senior Consulting Engineer/Scientist/Technical Specialist			**2.0**		
Consulting Engineer/Scientist/Technical Specialist			2.0	RACR Technical Review	
Total Consulting Engineer/Scientist/Technical Specialist			**2.0**		
Senior Engineer/Scientist/Technical Specialist			40.0	RACR Prep and Review	
Total Senior Engineer/Scientist/Technical Specialist			**40.0**		
Engineer/Scientist/Technical Specialist			32.0	RACR Prep and Review	
Total Engineer/Scientist/Technical Specialist			**32.0**		
Associate Engineer/Scientist/Technical Specialist			16.0	Field Engineer RACR Prep	
Total Associate Engineer/Scientist/Technical Specialist			**16.0**		
Manager Construction / Field Operations			32.0	RACR Prep and Review	
Total Manager Construction/Field Operations			**32.0**		
Subtotal Professional Labor Hours			**180.0**		
	Unit Cost	**Units**	**Qty**	**Cost**	**Basis of Estimate**	**Backup**
ODC						
Black & White Copies	$0.08	ea	2,000	$160.00		
Color Copies	$0.42	ea	200	$84.00	10% of B&W	
E / D Size Drawings	$7.00	ea	20	$140.00	10% of Color	
FEDEX shipping	$25.00	shipment	6	$150.00		
Office - binders, CD	$75.00	deliverable	6.00	$450.00		
				$0.00		
Total ODC				**$984.00**		
Total EC - SUBS & ODC				**$984.00**		

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE

Media	Requirement	Status	Synopsis	Evaluation / Action to be Taken
Groundwater (Federal)	Safe Drinking Water Act 40 CFR part 141	Relevant and Appropriate	MCLs are standards for public drinking water systems. MCLs can be used as cleanup standards for aquifers that are potentially drinking water supplies. Establishes non-enforceable MCLGs for public drinking water systems.	MCLs and SMCLs may be used for the development of PRGs in the absence of applicable state criteria.
	Clean Water Act (33 USC 1251-1376); Federal Ambient Water Quality Criteria	To Be Considered	Non-enforceable standards established for the protection of human health and/or aquatic organisms.	Ambient Water Quality Criteria, with modification, may be considered for the development of PRGs for groundwater based on the potential for discharge to surface water which may be used for fishing and wildlife habitat.
Groundwater (State)	New Jersey Water Pollution Control Act, Groundwater Quality Standards (NJAC 7:9-6)	Applicable	Identifies benefical uses of waters of the state. Sets criteria to protect those uses and defines anti-degradation policy.	Groundwater Quality Standards and Practical Quantitation Levels are applicable to the development of PRG for groundwater.
	NJAC 7:10-16.7 Safe Drinking MCLs for Hazardous Contaminants, NJAC 7:10-7.2 Secondary Drinking Water Regulations	Relevant and Appropriate	New Jersey Department of Environmental Protection's enforcement of the Safe Drinking Water Act. Requires purveyors to monitor drinking water contaminants at varying intervals and to comply with established MCLs.	As for Safe Drinking Water Act MCLs and MCLGs, may be used for the development of PRGs in the absence of applicable Groundwater Quality Standards.
	New Jersey Surface Water Quality Standards (NJAC 7:9B-1 et seq.)	Relevant and Appropriate	Standards established for the protection of human health and/or aquatic organisms.	These standards, with modification, may be considered for the development of PRGs for groundwater based on the potential for groundwater to discharge to surface water.

SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE

Media	Requirement	Status	Synopsis	Evaluation / Action to be Taken
Monitoring (Federal)	Resource Conservation and Recovery Act (RCRA) 40 CFR 264.94 through 264.101 (Subpart F)	Relevant and Appropriate	General requirements for monitoring of corrective action programs if required at regulated facilities.	Surface water monitoring will be conducted in accordance with these requirements.
Discharge (Federal)	Clean Water Act (40 DFR 122-125); National Pollutant Discharge Elimination System (NPDES) Permit Requirements	To Be Considered	Permits contain applicable effluent standards (i.e. technology-based and/or water quality based), monitoring requirements, and standards and special conditions for discharge.	The Navy is exempt from the requirement to obtain permits under CERCLA Section 121(e). However, discharges of treated groundwater to surface waters will meet the substantive requirements of these standards. The federal NPDES program will be administered by the New Jersey Pollutant Discharge Elimination System (NJPDES) program.
	Federal Clean Water Act (33USC 1251-1376); Water Quality Criteria, Section 404 (40 CFR 230), Section 311 (40 CFR Section 112, 116, and 117)	To Be Considered	Non-enforceable standards established for the protection of human health and/or aquatic organisms.	May be used for the development of discharge limits under a NJPDES permit.
Discharge (State)	New Jersey Pollutant Discharge Elimination System (NJAC 7:14A-2.5[a]12.ii)	To Be Considered	Permits contain applicable effluent standards (i.e. technology-based and/or water quality based), monitoring requirements, and standards and special conditions for discharge.	A NJPDES permit would not be obtained for discharges of treated groundwater to the surface water. However, if they occur, discharges of treated water to surface water will meet the substantive requirements of these standards.
	New Jersey Pollution Control Act (NJSA 58:10A et seq.) (NJAC 7:14A-1.1, 7:9-4.1, 7.9-5.1, 7.9-6.1)	To Be Considered	Requires a permit for discharges into groundwater and surface water of the state.	Remedial actions which include discharge of treated groundwater to surface water will meet the substantive requirements of a discharge permit.

SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE

Media	Requirement	Status	Synopsis	Evaluation / Action to be Taken
	New Jersey Surface Water Quality Standards (NJAC 7:9B-1 et seq.)	Applicable	Standards established for the protection of human health and/or aquatic organisms.	These criteria would be used by the NJDEP for the development of discharge limitations. These Standards are also driving this remedial action. Soil removal is being performed to prevent the discharge of water that does not meet these Standards. Although the removal action itself may not achieve this standard, the removal action will contribute to the overall site remedial strategy to achieve the standards.
Onsite Treatment (Federal)	RCRA (40 CFR 262) Generator Requirements for Manifesting Waste for Offsite Disposal	Applicable	Standards for manifesting, marking and recording hazardous waste shipments for offsite treatment and disposal	Generator requirements will be followed as waste will be generated for off-site disposal.
	RCRA (40 CFR 264) Subpart I - Use and Management of Containers	Applicable	Outlines use and management standards applicable to owners and operators of all hazardous waste facilities that store containers of hazardous waste.	If the waste generated is determined to be hazardous, then management procedures will comply with these requirements.
Onsite Treatment (State)	Solid Waste Management Act (NJSA 13.1E et seq.) (NJAC 7:26-7, 7:26-8, 7:26-9, 7:26-12)	Applicable	Regulates generation, transportation and treatment, storage, and disposal of hazardous waste.	If the waste generated is determined to be hazardous, then management procedures will comply with these requirements.
	Technical Requirements for Site Remediation (7:26 E et seq.)	Applicable	Establishes NJDEP's minimum technical requirements for remediation of contaminated sites.	The remedial actions being performed at the Site will meet these requirements.
Off-Site Disposal (Federal)	RCRA Transporter Requirements for Offsite Disposal (40 CFR 263)	Applicable	Regulates the transportation of hazardous wastes generated during remedial action.	If the waste generated is determined to be hazardous, then management procedures will comply with these requirements.
	RCRA Land Disposal Restrictions (40 CFR 268)	Applicable	Regulates the implementation of disposal actions for hazardous waste.	If the waste generated is determined to be hazardous, then management procedures will comply with these requirements.

SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO BE CONSIDERED GUIDANCE

Media	Requirement	Status	Synopsis	Evaluation / Action to be Taken
Venting / Discharges to Air (Federal)	Clean Air Act (40 CFR 61) National Emissions Standards for Hazardous Pollutants	To Be Considered	Establishes emissions limitations for hazardous air pollutants and sets forth regulated sources of those pollutants.	Any air emissions generated during the performance of the work will be treated to meet these regulations.
	RCRA 40 CFR 264.1030-264.1036 Subpart AA - Air Emissions Standards for Process Vents	To Be Considered	Establishes standards for air emissions from process vents associated with distillation, fractionation, thin film evaporation, column extraction, or air stream stripping operations that treat RCRA substances and have a total organic concentration of 10 ppm or greater.	Any air emissions generated during the performance of the work will be treated to meet these regulations.
	EPA Technical Guidance Document: Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites (OSWER Directive 9355.0.28)	Not Applicable	Guidance regarding the control of air emissions from air strippers used at Superfund sites for groundwater treatment. Distinguishes between attainment and non-attainment areas for ozone.	Not Applicable
Venting / Discharges to Air (State)	Air Pollution Control Act (NJSA 26:2C et seq.)	To Be Considered	Air emissions sampling and reporting. Control of Toxic Substances discharges.	Any air emissions generated during the performance of the work will be treated to meet these regulations.