US Army Corps
of Engineers®

# FINAL

# LONG TERM MONITORING PLAN
# FORMER BUCKS HARBOR AIR FORCE RADAR TRACKING STATION (AFRTS) AND GROUND-TO-AIR TRANSMITTER AND RECEIVER (GATR) SITE,
# MACHIASPORT, MAINE

## FUDS PROPERTY NUMBERS:
## AFRTS: D01ME0486 PROJECT NUMBER 02
## AND
## GATR: D01ME0486 PROJECT NUMBER 03

**Prepared by:**

**US Army Corps of Engineers, New England District**
**696 Virginia Road**
**Concord, MA**

**October 2019**

## TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

## LIST OF ACRONYMS

| | |
|---|---|
| ARAR | Applicable or Relevant and Appropriate Requirements |
| AFRTS | Air Force Radar Tracking Station |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| cis-1,2-DCE | cis-1,2-Dichloroethene |
| COC | Contaminant of Concern |
| CSM | Conceptual Site Model |
| DCE | Dichloroethene |
| DCF | Downeast Correctional Facility |
| DD | Decision Document |
| DO | dissolved oxygen |
| DoD | Department of Defense |
| DOI | Department of Interior |
| DW | Domestic Well |
| FAA | Federal Aviation Administration |
| FLUTe™ | Flexible Liner Underground Technologies, Ltd. |
| ft | feet |
| FS | Feasibility Study |
| FUDS | Formerly Used Defense Site |
| GAC | Granulated Activated Charcoal |
| GATR | Ground to Air Transmitter and Receiver |
| GWM | Groundwater Monitoring |
| HCl | Hydrochloric Acid |
| ICZ | Institutional Control Zone |
| JCO | The Johnson Company |
| LTMP | Long Term Monitoring Plan |
| MCL | Maximum Contaminant Level |
| MEDEP | Maine Department of Environmental Protection |
| MEG | Maximum Exposure Guidelines |
| mg/L | milligrams per liter |
| mL | milliliter |
| MNA | Monitored Natural Attenuation |
| MW | Monitor Well |
| NAE | New England District |
| NavFac | Naval Facilities Engineering Command |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPS | National Park Service |
| OB | Overburden |
| ORP | Oxidation-reduction potential |
| POET | Point-of-Entry Treatment |
| PRG | Preliminary Remediation Goals |
| RAGs | Remedial Action Guidelines [MEDEP] |
| RAO | Remedial Action Objectives |
| RI | Remedial Investigation |
| SAP | Sampling and Analysis Plan |
| TCE | Trichloroethylene (also known as Trichloroethene) |

| | |
|---|---|
| TOC | Total Organic Carbon |
| USACE | United States Army Corps of Engineers |
| USAF | United States Air Force |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| UU/UE | Unlimited Use/Unrestricted Exposure |
| VIP | Vapor Intrusion Pathway |
| VISL | Vapor Intrusion Screening Level |
| VOA | Volatile Organic Analysis |
| VOC | Volatile Organic Compound |
| WWTP | Wastewater Treatment Plant |

## 1.0 INTRODUCTION

This report presents the Long Term Monitoring Plan (LTMP) for two Formerly Used Defense Sites (FUDS) including the Bucks Harbor Air Force Radar Tracking Station (AFRTS) and the Ground-to-Air Transmitter and Receiver (GATR) Site in Machiasport, Maine; FUDS Property Numbers D01ME0486 Project Number 02 and D01ME0509 Project Number 03, respectively. These two FUDS have been handled together under the Defense Environmental Restoration Program (DERP) because of their close proximity and relation to each other (the GATR Site was used as an antennae field in conjunction with the AFRTS located 1.7 miles away). In addition, the remedy for both these FUDS is formalized in one Decision Document (USACE, 2017).This Introduction section includes a history of the Site (Section 1.1), a description of the regulatory framework guiding the monitoring program for the Site (Section 1.2), a discussion of the relevant contaminants at the site (Section 1.3) and a presentation of the Conceptual Site Model (CSM) for the Site (Section 1.4).

The objective of this LTMP is to define the specific locations and analytes for the long term monitoring, based on the criteria detailed in the Decision Document (USACE, 2017). Using the current (2017) monitoring program as a basis the LTMP, described herein, this document also provides recommendations for optimization of the monitoring program.

### 1.1 Location and Site History

The Bucks Harbor AFRTS on Howard Mountain (including the Transmitter Site) was acquired by the US Government between 1955 and 1963. The site consisted of 3.11 acres lease, 43.2 acres fee and 6.49 acres easement. Approximately 25 acres fee were obtained by condemnation, the rest were obtained by purchase (USACE, 2009).

The Bucks Harbor facility on Howard Mountain was used by the United States Air Force (USAF) as a radar tracking station until 1984 and had three major functional areas: Radar Operations, the Cantonment Area, and the Housing Area (Figure 1). Other site features include a sanitary sewer filter bed and a sanitary wastewater treatment plant (WWTP), located east of Base Road. The outpost facilities were associated with the former AFRTS include: the Transmitter Site, which is located on a spur ridge at Howard Mountain and the GATR site at Miller Mountain (see below). See operational areas and features for the AFRTS, Transmitter Site, and GATR Site, shown on Figures 2, 3, and 4, respectively.

The radar operations facility, located near the Howard Mountain summit, was transferred to the Federal Aviation Administration (FAA) for use in tracking commercial air traffic, and the Cantonment Area was transferred to the State of Maine Department of Corrections for use as a minimum-security prison. The former Housing Area and the Transmitter Site were also transferred to the State of Maine and are used by the Downeast Correctional Facility (DCF). The former DCF Housing Area consisted of 27 housing units, which historically were used as rental units and/or for storage by the DCF and its employees. The units are currently unoccupied, and seven of the housing units were demolished in 2016. Inmates and DCF employees use the Transmitter Site Building 300 as a carpentry shop. The DCF was unexpectedly closed in February 2018, and was subsequently re-opened with minimal inmate occupation and staffing in March 2018, but is currently completely closed and unoccupied.

The GATR property (5.55 acres fee and 33.51 acres easement) was acquired by the US Government via purchase between 1962 and 1963 (USACE, 1995). The USAF used the GATR site on Miller Mountain as an antennae field in conjunction with the AFRTS a few miles away. The USAF maintained ownership of the GATR site, before transferring the property to the FAA sometime around 1984. The language of this transfer document is not available. The property was identified as surplus government property in 1990. In 1992, The US Department of the Interior (DOI), National Park Service (NPS) transferred the property, on behalf of FAA, to its current owner, the Town of Machiasport for recreational use. Due to environmental condition of the site, the property has not been used for recreational use since its transfer to the Town of Machiasport.

### 1.2 Regulatory Framework

The Department of Defense (DoD) is responsible for reducing risk to human health and the environment through implementation of effective, legally compliant, and cost-effective response actions at former DoD facilities under the FUDS program. The United States Army Corps of Engineers (USACE) is the lead agency responsible for the remediation of any residual contamination as a result of historical DoD practices at the former AFRTS, Transmitter Site, and GATR facility. The ultimate goal of the USACE New England District (USACE-NAE) is to bring the Sites to closure. All site investigation and remediation activities must meet federal and State Applicable and Relevant or Appropriate Requirements (ARARs).

Actions at this site, including the monitoring program, presented herein, are conducted in compliance with federal laws and regulations including the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the USACE Engineer Regulation ER 200-3-1 (USACE, 2004b), and the DoD Environmental Field Sampling Handbook (DoD EDQW, 2013). CERCLA and the NCP require that remedial actions comply with State ARARs that are more stringent than Federal ARARs, if they are legally enforceable (promulgated), generally applicable, and consistently enforced Statewide. No State ARARs were identified for this remedy in the Decision Document but new ARARs may be identified at five year reviews.

The USACE has completed a Remedial Investigation (RI) (Weston, 2005), Feasibility Study (FS) (ENSR, 2007), Feasibility Study Addendum (Watermark, 2011) and a Proposed Plan (USACE, 2016). The remedy details are formalized in the Decision Document (USACE, 2017). The monitoring outlined in this LTMP document describes the long term monitoring and assessment of monitored natural attenuation in groundwater throughout the AFRTS and GATR sites.

Remedial investigations and monitoring have determined that trichloroethylene (TCE) (also known as trichloroethene) is present in bedrock groundwater, with onsite bedrock groundwater concentrations exceeding the US Environmental Protection Agency (USEPA) Maximum Contaminant Level (MCL) and State of Maine Remedial Action Guidelines (RAGs) (MEDEP, 2018). In accordance with CERCLA guidance, the lowest of the available promulgated values are used in developing Remedial Action Objectives (RAOs) and Preliminary Remediation Goals (PRGs). The USEPA TCE MCL of 5 µg/L is the actionable Applicable or Relevant and Appropriate Requirement (ARAR) for the Site groundwater (USACE, 2017) and the MCL is considered the Action Level for TCE (and any potential TCE degradation by-products (e.g., cis-1,2-Dichloroethene (cis-1,2-DCE) and Vinyl Chloride). No adverse health effects from DoD-related contaminants are present for other media at the Site (air, soil, surface water, and sediment).

The Selected Remedy identified in the project Decision Document (USACE, 2017) includes the following components:

- Monitored Natural Attenuation;
- Long term monitoring of groundwater;
- Alternate water supply or Point of Entry Treatment (POET) system for impacted Residents;
- Monitoring of indoor air; and
- Land Use Controls.

## 1.3 Site Contaminants

USACE first investigated environmental conditions at the Site in 1991. Since then, USACE has completed multiple phases of investigation, including a Site Assessment Report, Hydrogeological Investigation, Engineering Evaluation of Contamination, and numerous specialized geophysical studies, reports, and publications. In addition to USACE investigations, the FAA has conducted its own investigations and remedial actions including removal of remaining tanks, contaminated soil, and several of the historical structures. CENAE and FAA have actively shared information throughout these programs to support and expedite the groundwater remediation.

These investigations culminated in the production of a Remedial Investigation (RI) Report, which was finalized in 2005 (Weston, 2005). The RI identified the primary contaminant of concern (COC) as trichloroethene (TCE) in groundwater. The FS Report (ENSR, 2007) included evaluation of monitored natural attenuation (MNA) parameters to address groundwater contamination at the Site.

## 1.4 Conceptual Site Model

The Bucks Harbor study areas were grouped into three separate sites based on their locations, individual geologic and hydrogeologic characteristics, and the distribution of groundwater impacts. These areas are Howard Mountain, Miller Mountain, and the Transmitter Site, as shown in Figure 1. The Regional Hydrogeological Setting is summarized in Section 1.4.1. The study areas are located on mountains overlooking Machias Bay are separately discussed in Section 1.4.2 (Howard Mountain), 14.3 (Transmitter Site), and 1.4.4 (Miller Mountain).

The Maine DEP began sampling groundwater from a limited number of residential wells along Machias Road in May 1995 (Weston, 2005) following the discovery of petroleum contaminated soil during the removal of USTs from the DCF Housing Area. USACE subsequently began a quarterly domestic well Groundwater Monitoring (GWM) program for impacted and potentially-impacted residential water supply wells. The GWM program that began in May 1995 has continued (at least annually) with specific wells added or deleted as data and supporting information become available. The program samples a variety of residential/domestic wells (DW), public water supply wells (WY), selected test wells (TW) and environmental groundwater monitoring wells (MW) and focuses primarily on analysis of TCE. The GWM program has typically included 13 monitoring wells, one seep, 32 residential wells, and one public water supply well. A summary of the recent sampling locations, frequency (annual to triannual), and resultant maximum TCE concentrations (non-detect to 3,300 µg/L) since 2006 is presented in Tables 2 and 3.

### 1.4.1 Regional Hydrogeologic Setting

There have been a significant number of geophysical investigations at the Bucks Harbor sites that are documented in the RI (Weston, 2005) and the Feasibility Study (FS) (ENSR, 2007) and in several other investigation reports (ANL, 2005; USGS, 2009; USGS, 2005 and USGS, 2004). Generally there is little unconsolidated overburden (OB) in the Bucks Harbor study areas. Bedrock is exposed in many locations and has low primary porosity and hydraulic conductivity. Bedrock fractures, measured at outcrops in the study areas and interpreted from boreholes, are oriented in a variety of directions, with some of the major fractures reflecting the regional geologic patterns, with generally NNW-SSE trending features. However, an adequate characterization of the moderately-sized and smaller-scale fractures that control the fate and transport of contaminants within the aquifer has not been fully achieved to the point where the migration of contaminant can be understood to the extent needed to implement the successful application of an in-situ remediation technique.

Throughout the sites, the concentration of TCE in groundwater ranges from below the MCL (5 µg/L) to levels in the vicinity of 2,000 to 3,000 µg/L adjacent to former operational areas. With few exceptions, the concentrations have been relatively constant during the GWM program. A summary of the maximum groundwater TCE concentrations follows (see also Figures 5 and 6):

### 1.4.2 Conceptual Site Model - Howard Mountain

The highest concentrations of TCE at the Bucks Harbor facility have been detected in the vicinity of Howard Mountain. The most likely primary source of TCE at Howard Mountain is Building 114 (Figure 2). The building has been removed, but the foundation remains. Based on the historical and investigatory information compiled for the study area, it is likely that TCE from Building 114 migrated through the subsurface into soil, shallow bedrock, deep bedrock, and/or the nearby gravel pit. The following is the CSM for Howard Mountain and describes the geology, bedrock structure, hydrogeology, contaminant distribution and geochemistry. For a more detailed overview, see the Bucks Harbor FS (ENSR, 2007).

<u>*Howard Mountain Geology*</u>: The most prominent topographic features of Howard Mountain are the cliffs and steep slopes on its eastern and northeastern flanks. Smaller cliffs are also present on the northern and northwestern slopes. The southern slopes of Howard Mountain are characterized by gentler slopes and fewer outcrops. Topography in the gravel pit and DCF Housing Area east of Howard Mountain has been altered by excavation and filling, with a significant portion of the glaciofluvial sand and gravel that was originally present removed by excavation. Also, topography near the summit of Howard Mountain may have been altered (i.e. filled) during construction and subsequent demolition of former onsite Buildings.

<u>*Howard Mountain Bedrock Structure and Fracture Network*</u>: The most prominent geologic structure in the area is the Howard Mountain Fault, which occurs along the eastern edge of Howard Mountain and trends NNW/SSE. The down-thrown side of the fault is to the east and the fault is likely steeply-dipping. The fault is high-angle, but could be either normal or reverse (high-

angle thrust), depending on its dip. Photo-lineaments and topography suggest that a fault zone associated with the Howard Mountain Fault may extend from the cliffs on Howard Mountain, eastward through the DCF Housing Area. West of the fault zone, many different fracture strikes are present. In the vicinity of former Buildings 114 and 501, located near the Howard Mountain summit, NNW-striking fractures with steep dips are common. Transmissive fractures occur near former Building 114 that generally trend northeast and dip southeast/northwest.

*Howard Mountain Hydrogeology and Interconnectivity*: The higher portions of Howard Mountain, where fractured rock outcrops and unsaturated soils are present, are generally groundwater recharge areas, while springs on the flanks of Howard Mountain, pumping wells, and Howard Cove are groundwater discharge areas and potential contaminant receptors. Groundwater flows through permeable overburden and open fractures from areas of higher head to areas of lower head. However, flow will not occur in bedrock fractures unless they are connected to permeable overburden, the earth's surface or another transmissive water-bearing feature.

In the summit area, the water levels in well MW-10 and MW-16 are approximately 120 feet below the ground, and many unsaturated rock fractures are inferred to be present above that depth. However, water-bearing fractures have been encountered at shallower depths than the water level observed in wells MW-10 and MW-16. For example, the water level is less than 20 feet below ground in shallow bedrock monitoring well MW-15, which is located approximately 32 feet from MW-10.

*Howard Mountain Contaminant Distribution*: The distribution of TCE contamination at the site is indicative of residual TCE in poorly connected or small aperture-width bedrock fractures, likely in the fully saturated portion of the bedrock aquifer, based on the higher concentrations detected in deep wells than shallow wells at Howard Mountain. While no discrete source of TCE has been located in the area of Howard Mountain, elevated TCE concentrations are indicative of residual source material in or upgradient of the area and TCE concentrations in Howard Mountain wells vary with both location and depth. The extent of this area has not been delineated to the northwest or southeast, although it is apparent that the highest concentrations do not extend to the Building 501 area. The distribution of TCE believed to be associated with this source area, extends east, south and southeast from Howard Mountain toward Howard Cove. Off-site concentrations are greatest immediately south of Howard Mountain. The Howard Mountain Fault may dilute impacted groundwater, may direct contaminant migration toward Howard Cove along the fault, or may pose a barrier to contaminant migration toward the southeast. The detection of only trace concentrations of TCE southeast of the fault suggests that the influence of the fault in this regard may be sufficient to prevent significant migration of the TCE further to the southeast, despite the operation of water supply well WY-03.

Some shallow water-bearing bedrock fractures are not connected to nearby deeper bedrock fractures. An example of this is given by the measured water levels at MW-15, which is a shallow bedrock well and MW-10, which is a deep bedrock well; both located within 32 feet of each other at the radar site. At MW-15 concentrations of TCE ranging from approximately 2.5 to 46 μg/L have been detected, while at well MW-10, only 32 feet away, TCE has been measured at levels ranging from approximately 570 to 3,630 μg /L.

Domestic wells south, southeast, and east of the Howard Mountain summit are the primary potential receptors in the Howard Mountain area.

*Howard Mountain Geochemistry*: The aquifer in the vicinity of Howard Mountain is generally well oxygenated with a low potential for anaerobic degradation of TCE.

### 1.4.3 Conceptual Site Model - Transmitter Site

The primary source of TCE at the Transmitter Site appears to be Building 300, historic operational areas, and the septic tank (cesspool) area (Figure 3). The building and septic tank are still intact and operational. The building was used as the carpentry workshop by the DCF employees and inmates when the DCF was open. It is likely that TCE from these areas migrated through the subsurface into soil, shallow bedrock, and deep bedrock. These three areas are considered to be the most likely secondary sources of TCE, which may continue to impact groundwater. Only the on-site groundwater monitoring well network exists for site characterization.

*Transmitter Site Geology*: Overburden deposits are generally thicker (2 to 12 feet at well sites and thicker at the small gravel pit) at the Transmitter Site than they are on the higher portions of Howard Mountain, although outcrops are present in some locations in the Transmitter Site area. Topography generally slopes downward in all directions from the fenced area of the Transmitter Site. Slopes are gentle compared to the rest of Howard Mountain and to Miller Mountain. Most of the area outside the fence is wooded.

*Transmitter Site Bedrock Structure and Fracture Network*: A compilation of bedrock fracture measurements from outcrops indicate that west of the Howard Mountain Fault Zone, many different fracture strikes are present. NNW-striking fractures are present, but not predominant, as is the case closer to the fault zone. Most fractures observed are steeply-dipping.

*Transmitter Site Hydrogeology and Interconnectivity*: The higher portions of Howard Mountain, where fractured rock outcrops and unsaturated soils are present, are generally groundwater recharge areas, while springs on the flanks of Howard Mountain, pumping wells, and Howard Cove are groundwater discharge areas and potential contaminant receptors. The same may be true, but to a lesser extent at the Transmitter Site, which is a broad shoulder of Howard Mountain.

*Transmitter Site Contaminant Distribution*: The limited data available suggests that TCE concentrations are highest to the south and southwest of Building 300. The lower concentrations are inside the perimeter fence, which theoretically would be closer to the historic source areas from site operations. While this may be merely the result of greater interconnection between fractures impacted by secondary source material and the more distant wells than the nearby wells, or it may be indicative of a source outside of the perimeter fence.

*Transmitter Site Geochemistry*: The aquifer in the vicinity of the Transmitter Site is generally well oxygenated with a low potential for anaerobic degradation of TCE. The lack of microbial degradation at the Transmitter Site could be primarily attributed to the lack of sufficient organic material.

### 1.4.4 Conceptual Site Model - Miller Mountain

The likely primary source of TCE at Miller Mountain is the leach field and building area on the mountain summit (Figure 4). Both the building and leach field are still intact, but no longer operational. Based on available information, it is likely that TCE from these areas migrated through the subsurface into soil, shallow bedrock, and deep bedrock. These three areas are considered to be the most likely secondary sources of TCE, which may continue to impact groundwater.

*Miller Mountain Geology*: The topography of Miller Mountain is generally broad and moderate on the southern and western slopes and in the summit area; however, the summit (GATR) area features are glacially enhanced bedrock coarse-grained greenish gabbro troughs and ridges that trend NW/SE with a relief of 4 to 15 feet. The trough and the outcrops extend for several hundred feet and contain several small seeps and seasonal springs. Where present on Miller Mountain, overburden generally consists of glacial till and artificial fill and is mostly unsaturated or only seasonally saturated.

*Miller Mountain Bedrock Structure and Fracture Network*: No significant geologic structures have been mapped or observed in the Miller Mountain area and the transmissive fractures strike northwest and southeast, and dip moderately-steeply towards the northeast and southwest, respectively. Fractures measured at Miller Mountain outcrops show a range of strikes, with north-northwest/south-southeast striking fractures common at almost all outcrops and the dominant fracture strike at a majority of outcrops. Considerable local variability is present within Miller Mountain, and east/west, north/south, and NE/SW-striking fractures are also common. In general, both average fracture length and average fracture spacing are greater than at Howard Mountain.

*Miller Mountain Hydrogeology and Interconnectivity*: The higher portions of Miller Mountain, where fractured rock outcrops and unsaturated soils are present, are generally groundwater recharge areas, while springs on the flanks of Miller Mountain, pumping wells and Bucks Harbor are groundwater discharge areas and potential contaminant receptors.

A shallow, water-bearing fracture that does not connect with other, deeper fractures may exist at Miller Mountain at a depth considerably shallower than the depth to water in a well such as WY-GATR. The observed discrepancy in water levels suggests that an observed deep water level, such as 140 feet below ground in WY-GATR, does not necessarily indicate that the rock mass and fractures above the observed water level are dry. Disparities in water levels exist in adjacent wells and indicate that the wells are not hydraulically connected. The disparity in water levels between the shallow and deep zones in WY-GATR illustrates the varying hydraulic conditions and hydraulic isolation that can exist between fracture zones at different depths in the same location.

*Miller Mountain Contaminant Distribution*: TCE has been detected above MCLs at both onsite wells with TCE typically detected at WY-GATR at concentrations of approximately 2,000 to 3,000 µg/L, and ranging from non-detect to approximately 6.5 µg/L at MW-13. The WY-GATR well is 416 feet deep. Straddle (dual) packer sampling indicates that TCE concentrations are generally higher at depths of less than 200 feet than near the bottom of the WY-GATR well.

Similar to the Howard Mountain CSM, data collected for the Miller Mountain area indicate that the TCE in groundwater is most likely attributable to TCE remaining in poorly connected fractures, which could provide a persistent source of TCE in the aquifer underlying the WY-GATR area.

Four residential wells, which are located south-southeast of Miller Mountain, are the only residential wells impacted with TCE. However, detections have been intermittent, and TCE concentrations are below MCLs with the notable exception of DW-31 where TCE was measured in excess of the MCL in 2018, which may have been the result of blasting associated with the installation of a cellular tower at the top of Miller Mountain. TCE has not been delineated to the northwest and west of well WY-GATR; however as described in the FS (ENSR, 2007), given the dominant north-northwest/south-southeast fracture orientation at Miller Mountain and a south-southwesterly regional hydraulic gradient (i.e., towards Bucks Harbor), TCE migration would not be expected to be significant in any of those directions (ENSR, 2007). However, the source is on the top of Miller Mountain, so it is possible that groundwater flow could be radial.

*Miller Mountain Geochemistry*: The aquifer in the vicinity of Miller Mountain is less oxygenated than Howard Mountain and thus, has a slightly higher potential for anaerobic degradation of TCE. These findings are consistent with a prior monitored natural attenuation (MNA) analysis conducted for WY-GATR at Miller Mountain. A review of the operational history of the Miller Mountain area suggests that a source of organic carbon (such as the wastewater leach field at the mountain summit) may have been sufficient to stimulate anaerobic metabolism and reductive dechlorination of TCE historically. However, there is insufficient information to conclude that reductive dechlorination at Miller Mountain would be a primary factor in natural attenuation processes over time.

## 2.0 LONG-TERM MONITORING OBJECTIVES AND APPROACH

The Decision Document (DD) (USACE, 2017) sets forth the LTMP and Enhanced Site Controls remedy (Alternative 2) and Connection to Existing Downeast Correctional Facility Water Supply and Pretreatment (Addendum Alternative 2A) or point of entry well head treatment for Bucks Harbor. It is noted that the DCF was unexpectedly closed in February 2018, so connection to the DCF public water supply is currently on hold.

The optimized monitoring program addresses TCE in groundwater and its discharge points (water supply wells, monitoring wells, and springs) and sub-slab soil vapor and indoor air at the AFRTS, Transmitter Site, and residential locations. The LTMP's purpose is to 1) verify that the selected remedy remains protective of human health and the environment by evaluating changes in contaminant distribution and impacts to public and domestic water supply wells and indoor air, 2) to support the five-year review evaluations, 3) to prevent ingestion of drinking water that contains VOCs greater than their MCLs, 4) to evaluate the restoration of the groundwater within the Site to MCLs, and 5) to prevent inhalation of vapors from TCE that could pose potential risks in excess of EPA recommended thresholds. In addition to these objectives the LTMP will be used to continually re-evaluate and update the Conceptual Site Model, to determine if any changes to the Institutional Controls Zones are necessary and to determine if any new drinking water wells have been installed in the area (and if so, they should be sampled).

This section describes the objectives of the monitoring program (Section 2.1) and the general approach used to develop the LTMP (Section 2.2). The following subsections describe the key components of this alternative, as presented in the FS (ENSR, 2007) and FS Addendum (Watermark, 2011). The selected remedy identified in the Decision Document (USACE, 2017) includes the following components:

- Monitored natural attenuation (MNA);
- Long-term monitoring (LTM) of groundwater;
- Alternate water supply or point of entry well head treatment for impacted water supply wells;
- Monitoring of indoor air; and
- Land Use Controls.

This remedy was selected because it achieves the RAOs (including 1) prevent ingestion of drinking water that contains chlorinated VOCs greater than the MCL, 2) restore the groundwater within the Site to MCLs and 3) if present, prevent inhalation of vapors from TCE in groundwater that could pose potential risks in excess of EPA recommended thresholds (EPA, 2015; MEDEP 2016) for the site in a cost-effective manner. It will continue to protect current residents from exposure to TCE in groundwater above the MCL by providing an alternate water supply (Watermark, 2011) or well head treatment to affected residents. This remedy will also protect residents from potential indoor air exposure to TCE or other VOCs. The possibility of exposure through soil vapor intrusion is present when volatile chemicals exist in the shallow subsurface. If vapor intrusion impacts above risk-based thresholds are present, the potential exposure will be remedied by first identifying areas with subsurface VOCs, then identifying residences with unacceptable levels of VOCs, and following up with appropriate mitigation actions, such as the installation and operation of Sub-Slab Depressurization (SSD) Systems to the extent warranted for those residences. The selected remedy will also maintain awareness of current and future residents by providing annual notifications to properties within the Institutional Control Zones (ICZs), currently shown on Figures 5 and 6 (to be updated, if necessary, in concert with the Town and MEDEP). These notifications will inform residents regarding potential exposure to TCE through drinking water and/or vapor intrusion within the defined ICZs.

## 2.1 Monitoring Program and Data Objectives

To ensure the protection of human health, USACE will continue to conduct a groundwater well monitoring program. The program is primarily designed to evaluate the concentration of TCE in those wells that have Granulated Activated Carbon (GAC) systems in place, as well as to collect data from other domestic and monitoring wells near TCE-impacted areas. While the ultimate goal at the site is to replace the GAC systems with a permanent water supply, as long as GAC systems are in place a primary goal of the LTMP is to ensure they are working properly and providing the residents with clean water. Currently, both domestic wells (including wells with GAC systems and a public water supply well) and monitoring well screens are included in the monitoring program.

Multiple samples are collected from domestic wells on properties that have GAC filtration systems, to assess the continued performance of the treatment system during each event. Parameters currently analyzed as part of the LTMP include VOCs (including TCE) and MNA parameters including dissolved and total metals (including iron, arsenic, and manganese), ferrous iron, anions (nitrate, sulfate, chloride) and gasses (methane, ethane, and ethene), and total organic carbon. A full list of analytical parameters is shown in Table 4A (for VOC analysis) and Table 4B (for MNA parameters). These tables list the current analytical methods, analyte list, sensitivity, and quality control acceptance limits.

A Sampling and Analysis Plan (SAP) or SAP addendum will be completed prior to each groundwater sampling event. The SAP will include details specific to the sampling event, including: data quality objectives, field and laboratory standard operating procedures, laboratory methods references and reporting limits, quality control sample information, laboratory control limits, data validation protocol, laboratory certification, electronic data deliverable specifications, and schedule for sampling and reporting.

This groundwater monitoring component of the selected remedy consists of converting the current “GWM” program into a long term monitoring “LTM” program. The difference is essentially in nomenclature only. The precise LTM network, sampling frequency and other details will initially be similar to the current GWM but will be continually optimized, at a minimum to coincide with required five year reviews. The data from the LTM will be used to evaluate the ongoing MNA processes at the site.

The concentration of TCE in groundwater should naturally attenuate over time, albeit very slowly. Currently, there is little evidence of microbial degradation of TCE in the Howard Mountain and Transmitter site areas, and the minor degree of attenuation observed may be predominantly the result of natural abiotic (i.e., non-microbial) attenuation. Although information from the Miller Mountain Site is limited, there is evidence that some microbial transformation may have occurred based on the presence of DCE and other less-chlorinated compounds. The sampling program currently includes an annual assessment of data and trend analysis to evaluate how effective natural processes (whether abiotic or microbial) is in the attenuation of TCE concentrations. This selected remedy will continue with this assessment. The specific wells, sampling frequencies, and analytical parameters to support an MNA evaluation will be assessed on an annual basis.

The data collected from the LTMP will be reported to stakeholders (USACE, MEDEP, and Town of Machiasport) in an annual groundwater sampling report, which includes all data collected during the year, and an assessment of MNA and TCE trends. Results from residential and public water supply wells will be reported by letter to the property owners, with an explanation of the results.

Over time, as the TCE distribution and concentrations dissipate (as expected based on the evaluation presented in the FS), the network of monitoring points should continue to be reduced. For planning purposes, the LTM program is anticipated to include 11 monitoring wells with 24 discrete sampling intervals, one seep, and 36 domestic wells/screens to be sampled annually over a 30-year period, which is the EPA-required default duration in an FS.

### 2.2 Approach

This LTMP was developed by reviewing the CSM and the historical groundwater VOC data. The temporal distribution of data was previously evaluated to determine the “worst-case” time of year for sampling (USACE, 2012) and the spatial distribution was evaluated to determine the most suitable locations for sampling.

The following elements were considered during the Bucks Harbor sampling program evaluation (2012) and during the development of the LTMP:

- Qualitative Evaluation: Use the structural geologic trends, transmissive fracture statistics, field water quality, and hydraulics to identify wells for retention or removal from the program.
- Frequency Analysis: Determine detection frequency and detection trend. Use local and regional water level data, and hydraulic test results, to identify hydraulic controls on TCE data trends and to determine the optimal sampling frequency and timing.
- Spatial Evaluation: In conjunction with the Qualitative Evaluation and the TCE monitoring objectives, identify data gaps or redundant sampling points relative to overburden and bedrock wells.
- Defining rationale for adding and removing wells from monitoring network.
- Defining rationale for adding or removing POET systems to/from domestic drinking water wells.
- Indoor air quality testing (also known as Vapor Intrusion testing) has been performed at the most likely impacted residential and commercial properties in the Howard Mountain and Miller Mountain areas (WHG, 2013). The most recent investigation was performed in 2012 (see Section 3.2.4). Risk assessment calculations show the cancer

and non-cancer hazards associated with contaminants which have a complete VI pathway from the groundwater to indoor air do not pose an unacceptable risk due to DoD contamination. However, site characteristics (e.g., increasing groundwater contaminant concentrations) which may lead to vapor intrusion will continue to be evaluated to determine if further investigation and/or mitigation of vapors in indoor air is necessary. The VI pathway will continue to be evaluated and assessed (see Section 3.2.4).

## 3.0 LONG TERM GROUNDWATER MONITORING PROGRAM

The Former AFRTS and GATR Facility groundwater monitoring program has been in existence for several years with a general objective of collecting enough data to gain an understanding of the temporal and spatial variability of contamination at the site and to guide the development of the LTMP presented in this document. The chemical analyses and wells selected for sampling have been based on the potential for groundwater contamination using the CSM as a guide. Over the period of sampling, these data have provided valuable information regarding the spatial and temporal distribution of contamination in the aquifer system. Samples have been collected at 1) domestic wells, 2) a public water supply well, 3) springs and seeps, 4) overburden monitoring wells and 5) bedrock monitoring wells. This section describes the current analytical requirements (Section 3.1) and sampling locations and frequency (Section 3.2).

### 3.1 Analytical Requirements for Groundwater and Seep/Spring Samples

Since 1995, groundwater and seep/spring samples at the Former AFRTS and GATR Facility Site have been analyzed for Volatile Organic Compounds (VOCs) by approved USEPA methods (method 524.2) to assess the extent of TCE contamination (and related degradation by-products). Since 2014, MNA parameters have been sampled to assess the type and degree of natural attenuation caused by biodegradation occurring at the Site.

### 3.2 Sampling Locations and Frequency

The current VOC groundwater and seep/spring water monitoring program at the Site is focused on baseline and detection monitoring, summarized in Table 1. Unlike most programs, the offsite contaminant is monitored using domestic water supply wells. Program optimization occurred several times since the 1990s, reflecting improved site knowledge, domestic well access, new construction, and changes in contaminant concentrations over time. The 2017 monitoring program includes a fall sampling round of groundwater monitoring wells, domestic drinking water wells, and a public water supply well (WY-03 at the DCF) and a spring/seep location. All current sampling locations are summarized in Tables 2 and 3, and are illustrated on Figures 5 and 6.

#### 3.2.1 Bedrock Monitoring Wells

As part of the LTMP, groundwater samples will be collected from 13 groundwater monitoring wells including: MW-03, MW-07, and TSMW-002, at the Transmitter Site; MW-09, MW-12, MW-15, MW-16, MW-17, MW-501, STMW-001, and WY-15, at Howard Mountain; and MW-13 and WY-GATR, at the GATR Site. Monitoring wells will be sampled in accordance with the SAP (ARA, 2017a), the EPA Region 1 guidance document, Low Stress (low flow) Purging and Sampling Procedures for the Collection of Ground Water Samples from Monitoring Wells (USEPA, 2010), or the FLUTe™ sampling procedure, unless otherwise noted in this section. These sampling locations are indicated in Table 2 and Figure 5.

Groundwater monitoring wells that have a depth to groundwater of less than 25 feet below the ground surface (bgs) will be sampled using a peristaltic pump; otherwise, a submersible bladder pump will be used for groundwater depths greater than 25 feet bgs. Groundwater monitoring wells with the FLUTe™ liners will be purged and sampled using compressed nitrogen through a regulator at pressures specified by the manufacturer. New or dedicated Teflon™ lined polyethylene tubing will be used at groundwater monitoring wells sampled using a bladder pump.

Each of the WY-GATR well water bearing sample intervals (187 and 414 feet below the top of steel casing), which are divided by a Portland cement plug, have new dedicated bladder pumps installed and Teflon-lined tubing, which were replaced as new during the October 2016 event due to poor performance of the previous dedicated equipment.

The FLUTe™ systems installed (in April 2013) in monitoring wells MW-07, MW-12, MW-16, and MW-17 use a nitrogen gas groundwater purge system and are not designed for low flow sampling. The FLUTe™ liner system is installed such that specific fracture zones are captured in individual FLUTe™ system monitoring ports. The ports will be sampled with nitrogen gas and a three-way valve to purge the system. The gas line is pressurized with inert nitrogen gas to the recommended purge pressure to force water in the pump tube and the sample tube to the surface. The purging is complete when inert nitrogen gas is expelled from the sample tube following the water flow. Each monitoring port will be purged at least four times prior to sampling.

Groundwater monitoring wells and ports will be purged through a multi-meter with a flow-through cell to continuously monitor temperature, specific conductance, dissolved oxygen (DO), pH, and oxidation-reduction potential (ORP). In addition, a turbidity meter will be used to monitor turbidity of the purge water during sample purging. Turbidity samples will be collected via a T-valve assembly prior to the purge water entering the flow-thru cell. Groundwater levels will be recorded in each monitoring well location prior to sample purging and then continuously monitored during purging and sample collection. Purge water monitoring data will be recorded on the field logs. Groundwater monitoring wells will be purged until they achieved the following stability criteria (USEPA, 2010) below:

- pH: ±0.1 standard unit
- Temperature: ± 3%
- ORP: ±10 mV
- DO: ±0.5 milligrams per liter (mg/L) for values less than 2 mg/L or ±10% for values greater than 2 mg/L
- Specific conductivity: ± 3%
- Turbidity: ±10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized
- Drawdown: no more than 0.3 feet

After groundwater stabilization is achieved, groundwater samples will be collected into two (2) hydrochloric acid (HCl) preserved 40-milliliter (mL) glass volatile organic analysis (VOA) vials. Sample containers will be filled until a convex meniscus formed, and will be inverted to ensure VOC samples have been collected with no headspace (i.e., bubbles) in the VOA vial. A subset of wells will also be sampled for analysis of MNA parameters including anions (nitrate, sulfate, and chloride), total organic carbon (TOC), methane, ethane, ethene, alkalinity, total and dissolved iron, arsenic, manganese and ferrous iron. Dissolved metals samples will be filtered in the field using a disposable 0.45-micron in-line filter. A summary of groundwater samples that will be collected from groundwater monitoring wells at the Site is provided in Table 2.

Samples are stored in a cooler with ice and will be received by the laboratory at an acceptable temperature, greater than freezing and up to 6°C. Samples are analyzed for VOCs by USEPA Method 524.2; and MNA parameters, including methane, ethane, and ethene by EPA method 8015B; total organic carbon (TOC) by USEPA Standard Methods 5310C; alkalinity by USEPA Standard Methods 2320B; anions nitrate, sulfate and chloride by USEPA Method 300A; total and dissolved iron, arsenic, and manganese by USEPA Method 6020A, and ferrous iron by Standard Method 3500 Fe-B.

The purged groundwater from each monitoring well containing elevated concentrations of VOCs based on historical data will be containerized in 5-gallon buckets, transported to the former radar base housing garage, and filtered through a GAC drum prior to being discharged to the ground surface.

### 3.2.2 Domestic Drinking and Water Supply Wells

As part of the LTMP, drinking water samples will be collected from 36 residential drinking water wells and public water supply wells (DW-01, DW-02, DW-03, DW-04, DW-05, DW-06, DW-08, DW-09, DW-10, DW-11, DW-12, DW-13, DW-44, DW-45, DW-46, DW-47, DW-48, DW-49, DW-50, DW-52, DW-53, and public water supply well WY-03 at Howard Mountain and DW-22, DW-23, DW-24, DW-28, DW-29, DW-30, DW-31, DW-32, DW-34, DW-39, DW-40, DW-43, DW-54, and DW-55 at Miller Mountain) in accordance with the 2017 SAP (ARA, 2017a). These sampling locations are indicated in Table 3 and Figures 5 and 6. Of note is that DW-51 is not included in the LTMP since it is far removed from Howard Mountain and TCE has been sampled for but not been detected. Also of note is that DW-52, DW-53, DW-54, and DW-55 are included in the LTMP, none of which have been sampled previously, but will be sampled to ascertain the presence of contamination at these locations.

Sample collection and analysis methods are detailed in the SAP relevant to the annual sampling. The sample collection procedure includes removing aerators and other appurtenances prior to sampling the residential well. Purging the well to remove stagnant water from the well and piping. The well may be purged directly to the outside from a spigot or garden hose, or into a sink inside the home. The sampling point shall be before any treatment system. The ideal time required to purge a well depends on the well, piping, and aquifer characteristics. For locations which have POET systems in place a sample will be collected before GAC treatment, between GAC filters, and at the effluent point.

Ideally up to three well volumes should be purged prior to sampling (USGS, various dates); however, this volume of water can be significant and historically homeowners at the Site have not wanted their well pump running for the amount of time needed to purge this volume of water. Therefore, a qualitative assessment of the amount of water used by the residence that day will be conducted and taken into consideration when determining the actual volume of water to be purged. Purging the well until the pump kicks on may be considered in the field. The estimated volume of water purged will be recorded, as well as the basis of the volume of water to be purged. Holding tank volume shall be considered if sampling at the tap.

Purging will continue until stabilization of the field parameters has been reached or after a maximum of one well volume of water has been removed. Stabilization is defined by three consecutive readings within the following limits:

- pH: ±0.1 standard unit
- Temperature: ± 3%
- ORP: ±10 mV
- DO: three consecutive readings within the limits of 10% for values greater than 0.5 mg/L or three DO values less than 0.5 mg/L

- Specific conductance: ± 3%
- Turbidity: three consecutive readings within the limits, 10% for values greater than 5 NTU or three values less than 5 NTU

Currently samples will be analyzed for VOCs at all wells shown in Table 3 by USEPA Method 524.2 and MNA parameters at wells with the highest concentration of VOCs (currently this included DW-02, DW-03, DW-04, DW-12, DW-23, DW-31, and WY-03). MNA parameters include: methane, ethane, and ethene by EPA method 8015B modified; TOC by USEPA Standard Methods 5310C; alkalinity by Standard Methods 2320B; anions nitrate sulfate, and chloride by USEPA Method 300; total and dissolved iron, manganese, and arsenic by USEPA Method 6020A, and ferrous iron by Standard Methods 3500 Fe-B.

### 3.2.3 Seep

One water sample will be collected from a shallow groundwater seep (Seep No. 20) located down slope from former Building 501 near the top of Howard Mountain in accordance with the SAP (ARA, 2017a) and EPA guidance document Pore Water Sampling (USEPA, 2007) (Figure 5). The sample will be collected using a pore-water sampler inserted into the ground at the seep location connected to a peristaltic pump. If the volumetric flow rate withdrawn permits, water should be run through a flow-through cell to monitor field parameters; however, if this is not possible measurement of field parameters from a collected sample will be adequate and duly noted. Samples will be analyzed for VOCs by USEPA Method 524.2; in accordance with the relevant SAP.

### 3.2.4 Indoor Air Vapor Monitoring

Indoor air quality testing (also known as Vapor Intrusion testing) has been performed at the most likely impacted residential and commercial properties in the Howard Mountain and Miller Mountain areas. Risk assessment calculations using these data show the cancer and non-cancer hazards associated with contaminants which have a complete VI pathway from the groundwater to indoor air do not pose an unacceptable risk (Woods Hole Group, 2013). However, site characteristics (e.g., increasing groundwater contaminant concentrations) which may lead to vapor intrusion will continue to be evaluated to determine if further investigation and/or mitigation of vapors in indoor air is necessary. Therefore, continued VI sampling may be necessary to insure that risks from VI remain at acceptable levels. Sampling and Quality Assurance Project Plans will be developed for future VI testing at the site, as needed. The next VI investigation will occur before the first Five Year Review (2022) for the project. An evaluation of the properties recommended for sampling will be made during the scoping phase for the VI investigation project. It is assumed that seven residential properties with the highest TCE concentrations in groundwater (DW-01, DW-02, DW-03, DW-04, DW-12, DW-23, and DW-31) and two commercial buildings (FAA Building and Transmitter Site Building 300) will be sampled. Sub-slab vapor samples, indoor air samples and ambient air samples will be collected to evaluate the vapor intrusion pathway and indoor air concentrations of contaminants.

Since VOCs will remain in groundwater, USACE plans to monitor VI regularly (every five years) and/or if changes in site conditions dictate (e.g., increase in groundwater concentrations, changes in building conditions) that the sampling frequency should be re-evaluated. Locations with occupied structures in the vicinity of groundwater containing concentrations of VOCs above the MCL will be included in the VI sampling program.

The most recent VI investigation was completed in two sampling events April 2012 (Phase I) and August/September 2012 (Phase II) (WHG, 2013). Four residences (DW-01, DW-02, DW-12, and DW-23) with the detections of TCE in drinking water in the Howard Mountain and Miller Mountain areas; and two commercial buildings (FAA Building and Transmitter Site Building 300) were evaluated. Based on the 2012 Phase I and Phase II vapor intrusion sampling results, a complete exposure pathway in which contaminants detected in the indoor air exceed the lowest applicable screening criteria was interpreted to exist in commercial structure Building 300 (TCE and chloroform) and residential structure DW-01 (chloroform).

As described in the Vapor Intrusion Monitoring Report (WHG, 2013), the total noncancer hazards (HI=13) at the Building 300 workshop exceed the upper limit prescribed by the National Contingency Plan (the HI>1). However, the primary reason for the exceedance is due to the use of solvents within the workshop. Four of the detected chemicals are associated with hazard quotients exceeding the limit of one, representing eighty-nine percent of the total hazard index. Three of those four chemical vapors are associated with petroleum fuel products that are not associated with vapor intrusion (1,2,4-trimethybenzene HQ=6, 1,3,5 trimethylbenzene HQ=2, and naphthalene HQ=2). The hazard quotient for xylenes, which is associated with petroleum fuel products, approaches but does not exceed the limit (HQ=0.9). The fourth chemical with an excessive hazard quotient is methylene chloride (HQ=3), which is associated with paints and varnishes. Cancer risk estimates for occupants at Building 300 (at 3×10-5) do not reach a level of concern (>1x10-4) that indicates a need for a response action to mitigate cancer risks, as prescribed by the National Contingency Plan.

As stated in the Recommendations section of the Vapor Intrusion Monitoring Report (WHG, 2013): Because the conceptual model indicates a VI source from the underlying groundwater, continued monitoring of the groundwater should consider variations in concentration that may have a bearing on VI at Building 300. Increasing trends in the concentration of volatile constituents in the underlying groundwater will indicate if and when further VI monitoring of Building 300 is warranted. The property owner was advised of the risks associated with the chemicals used within the building, so that they may consider appropriate measures to manage the risk, and to confirm whether solvents containing TCE are used during operations at Building 300.

For the DW-01 residence, the calculated noncancer hazards and the cancer risk estimate for residents at this residence does not reach a level of concern that indicates a need for a response action to mitigate cancer risks, as prescribed by the National Contingency Plan (WHG, 2013).

### 3.3 Land Use Controls

The USACE will provide annual notification letters to the property owners within the institutional control zones (ICZ) (Figures 5 and Figure 6) to ensure that they are aware of the potential contaminated groundwater under their property; and to indicate that USACE will test any new drinking water well for VOCs, and connect to an alternate water supply (DCF water supply) or install and maintain a POET system, if MCLs are exceeded (due to DOD contamination) or if concentrations are trending toward an MCL exceedance. Additionally, site characteristics (e.g., increasing groundwater contaminant concentrations) which may lead to vapor intrusion will continue to be evaluated to determine if investigation and/or mitigation of vapors in indoor air is necessary. These annual notification letters will be sent by USACE and will be based on Town tax records to ensure that current owners of the property are notified.

The properties designated in the ICZ are those which have historically had detections of TCE or those that may become impacted due to their proximity to impacted properties. Annual notification letters will also be sent to property owners within the ICZ even if there is no well currently on their property. Figures 5 and 6 show the ICZ area for the Howard Mountain and Miller Mountain areas, respectively. Note that the ICZ may change as the TCE impacted groundwater areas change over time. Also, the potential for groundwater usage within and immediately outside of the ICZ will be re-evaluated each year to identify any changes.

In addition to annual notifications to property owners, USACE is working with the Town of Machiasport to develop notices that will be provided with each building permit issued by the town. The notice will provide information on the areas which contain groundwater contamination and advise the public of the potential need for water treatment. It is noted that the Town does not have a well installation permit process in place, so that is not a viable notification vehicle. If the Town does not agree to providing notices with the building permits, USACE will contact the Code Enforcement Officer (or local town official) on a semi-annual basis to determine if any new homes are planned to be constructed in the ICZ. If so, a notification (as described above) will be provided to the building permit applicant.

### 3.4 Five-year Reviews

Because contamination will remain in the groundwater at concentrations which do not allow unlimited use and unrestricted exposure (UU/UE), CERCLA five-year reviews will be performed at this site until the site's contamination falls below levels safe for UU/UE.
CERCLA §121(c) states the following:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with the section [104] or [106], the President shall take or require such action.*

The start of remedial action at this site began with the first groundwater sampling event following finalization of the Decision Document. This sampling event was conducted in October 2017. Therefore, the first Five Year Review is due (should be finalized) by October 2022.

## 4.0 REQUIREMENTS FOR REVISING THE LTMP

Groundwater conditions at the Site have been relatively consistent for much of the monitoring period; however, a necessary part of the LTMP is the ability of the plan to be adaptable. For example, additional domestic wells may be brought into the program if upgradient and previously un-contaminated wells begin to show increasing concentrations. This would require that downgradient wells be added to the program to act as new boundary wells for that portion of the Site. Conversely, as contamination declines to less than the MCL for an extended period of time, domestic wells may be considered for removal from the program. Finally, domestic wells that show an increase in TCE concentrations at a rate that will approach the MCL prior to the next scheduled sampling will require a POET system to maintain homeowner protectiveness. Each water quality data collection report will include a section that evaluates the results on a well by well basis, in accordance with the following protocol and will include recommendations to make any necessary changes to the program. The following sections outline the specific requirements for making changes to the LTMP.

### 4.1 Adding Domestic Wells to LTMP

The addition of downgradient domestic wells in response to increasing upgradient concentrations is a necessary component of the LTMP to ensure protection from contaminant migration. Domestic wells south, southeast, and east of the Howard Mountain summit are the primary potential receptors in the Howard Mountain area. TCE is absent or occurs only in low concentrations in available wells located in other directions from the source area. Because the TCE in groundwater is not uniformly distributed, TCE migration in other directions is possible, as hydraulic gradients at Howard Mountain have been demonstrated to be widely varied. The variable distribution of TCE in three dimensions at Howard Mountain suggests that discrete fracture pathways (as opposed to an effective porous medium) are responsible for the flow of either contaminated or uncontaminated groundwater at the scale of investigation. The extent of groundwater contamination has not been fully delineated to the south and southwest of the Transmitter Site. However, sampling results from the closest downgradient receptors (Starboard Cove) indicated that there are no site-related contaminants in the groundwater in that vicinity, therefore there is no complete exposure pathway. TCE has not been delineated to the northwest and west of well WY-GATR; however as described in the FS, given the dominant NNW-SSE fracture orientation at Miller Mountain and a south-southwesterly regional hydraulic gradient (i.e., towards Bucks Harbor), TCE migration would not be expected to be significant in any of those directions (ENSR, 2007). However, the source is on the top of Miller Mountain, so it is possible that groundwater flow could be radial. The area to the north and northwest of well WY-GATR is undeveloped. Therefore, there are no receptors in that direction, and no complete exposure pathway.

Downgradient domestic wells will be added to the LTMP in response to increasing upgradient concentrations. If any monitoring wells or domestic wells have TCE concentrations equal to or greater than the MCL (or are increasing at a rate such that they are projected to exceed the MCL by the next sampling event), a downgradient boundary of domestic wells will be included in the LTMP. The boundary wells will have no detectable TCE or concentrations lower than the reporting limit (currently 0.5 ug/L). This will be used as a general guideline for determining if a domestic well should be considered for addition to the LTMP to extend the network of boundary wells due to upgradient detections. Other factors such as past TCE concentrations, TCE concentration trends, and proximity of the well to other TCE containing wells will also be considered in making a final determination to add a well to the LTMP.

Newly drilled domestic wells within Zone 1, 2, or 3 will be tested (and treated (if necessary)); where Zone 1 is within the FUDS property boundary, Zone 2 is within the MCL concentration boundary, and Zone 3 is within the buffer of the Zone 2 MCL concentration boundary (Figures 5 and 6). New wells (within Zone 1, 2, or 3) will be sampled over the course of a minimum one-year period at a quarterly frequency for the first year of testing. Continued sampling will be dependent on the quarterly sampling results and on the location of the new well (see paragraphs above).

Newly drilled domestic wells within Zone 1, 2, or 3 will be tested (and treated (if necessary)). New wells (within Zone 1, 2, or 3) will be sampled quarterly for two years. If TCE is detected above the MCL at any time during the two year period, a point of entry treatment system will be installed. At the end of the two year sampling program (eight sampling events) the USACE will calculate the 95% upper confidence limit (UCL) of the mean for all eight events. If the 95% UCL of the mean is above the MCL, a point of entry treatment system will be installed. If the 95% UCL of the mean is below MCL the well will be added to the long term sampling program. If after eight rounds of samples, TCE was not detected above the reporting limit, sampling at the location may be discontinued, or it may be retained in the sampling plan to serve as a boundary location or to fulfill some other data need. Other factors such as past TCE concentrations, TCE concentration trends, and proximity of the well to other TCE containing wells will also be considered in making a final determination to add a well to the LTMP.

### 4.2 Removing Domestic Wells from LTMP

If upgradient monitoring or domestic well concentrations decrease, this may result in the recommendation for removal of a domestic well from the LTMP. The removal of monitoring wells from the LTMP will largely be dictated by not just the concentration in the well but the concentrations in upgradient wells.

Domestic wells will be removed from the LTMP in response to decreasing upgradient concentrations. If any monitoring or domestic wells have TCE concentrations equal to or greater than the MCL then a further downgradient well will be added to the LTMP and used as a boundary well, as stated above. Conversely, if the extent of contamination decreases, such that an upgradient location can serve to delineate the extent of TCE contamination, this will be used as a general guideline for determining if a downgradient domestic well should be considered for removal from the LTMP. Specifically, if a domestic well has detectable concentrations of TCE it will remain in the LTMP, regardless of upgradient concentrations. Domestic wells will only be removed after at least four rounds of non-detect concentrations. Even then, if a well has previously had detections it will be evaluated at five year reviews to ensure it remains at non-detect levels. Other factors such as past TCE concentrations, TCE concentration trends, and proximity of the well to other TCE containing wells will also be considered in making a final determination to remove a well from the LTMP.

### 4.3 Removing Monitoring Wells from the LTMP

Monitoring wells will be removed from the LTMP if the well is deemed to serve no further purpose with respect to determining the extent of contamination or contaminant migration pathway. It is noted that monitoring wells are present on the Former Bucks Harbor Air Force Radar Tracking Station (AFRTS), Transmitter, and Ground-to-Air Transmitter and Receiver (GATR) Sites only, and domestic wells are used to assess the extent of Off-site contamination.

Most likely a bedrock monitoring well will only be recommended for removal from the LTMP if it consistently attains a condition of having no measurable TCE, and significant reductions in concentration of TCE in the aquifer occurs. Even in this condition, it is likely to be beneficially retained as a sentinel well.

### 4.4 Providing Point of Entry Treatment (POET) Systems to Domestic Wells

Treatment systems may be required on domestic wells that have TCE concentrations that are either above the MCL or are projected to be above the MCL based on historical data. Currently, there are five domestic wells with POET systems installed include; DW-02, DW-03, DW-04, DW-12, and DW-23; additionally, DW-31 has POET system installed (June 2018) due to recent (2017) elevated TCE detections. There are several other domestic wells that have historically been included in the monitoring program and that are included in the LTMP to ensure protectiveness of domestic drinking water. To maintain protectiveness during the long term monitoring program, TCE concentrations at domestic water supply wells will be evaluated using recent and historical data. If TCE concentrations either reach the MCL or increase at a rate such that they are projected to exceed the MCL by the next annual sampling event, then a POET system will be installed as soon as is reasonably possible following the most recent data collection. Each monitoring report will include an evaluation of historic domestic well TCE concentration data to determine if there is a significant positive trend and a recommendation will be made to add POET systems, if this is the case. If the concentration exceeds the MCL, temporary measures (e.g., commercially available water treatment products) will be supplied to the homeowner until the POET system installation can be scheduled.

Other factors such as past TCE concentrations, TCE concentration trends, and proximity of the well to other TCE containing wells will also be considered in making a final determination to add a POET system. If there is not enough data for a trend determination, the other factors (e.g., past TCE concentrations, proximity of the well to other TCE containing wells) will be used to determine whether to add a POET system. Treatment system performance monitoring will then be implemented (influent and treated water sampling) on the new treatment system.

### 4.5 Discontinuance of Domestic Well POET Systems

The monitoring of groundwater contaminant concentrations in drinking water supply wells is a primary consideration for the LTMP. Currently, there are five domestic wells with POET systems installed: DW-02, DW-03, DW-04, DW-12, and DW-23; additionally, DW-31 will have a POET system installed (in 2018) due to recent elevated TCE detections.

If the TCE concentration is less than the MCL and shows a decreasing trend, the POET system will be removed from the domestic well. Each monitoring report will include an evaluation of historic domestic well TCE concentration data to determine if there is a significant decreasing trend. A recommendation will be made to discontinue POET systems, if this is the case.

When at least 8 measurements of TCE concentrations in a domestic water supply well demonstrate a downward trend (e.g. Mann-Kendall statistical method) of the 95% upper confidence limit of the mean that is less than the TCE MCL for at least 3 years (beginning at the date of the signed Decision Document for currently existing POET systems (i.e., DW-02)), then the POET system will be recommended for removal at the earliest convenience. Other factors such as past TCE concentrations, TCE concentration trends, and proximity of the well to other TCE containing wells will also be considered in making a final determination to discontinue point of entry treatment.

The data will be assessed to determine if a parametric or nonparametric method is appropriate, then compatible trend and UCL methods will be chosen and used to evaluate if a downward trend is demonstrated.

### 4.6 Addition of a structure for Vapor Intrusion Pathway Evaluation

USEPA OSWER Technical Guidance for Assessing and Mitigating the Vapor Intrusion from Subsurface Vapor Sources to Indoor Air (USEPA, 2015) will continue to be utilized to determine if the Vapor Intrusion Pathway (VIP) needs to be further investigated at any structure impacted by TCE in groundwater. Other available sound scientific information can be used to assess vapor intrusion at the Site such as the USEPA Vapor Intrusion Screening Level (VISL) Calculator (USEPA, 2017).

## 5.0 CONCLUSIONS

The long term monitoring of groundwater, is summarized in Tables 1-3. The following bullets summarize the LTMP:

- Bedrock Monitoring Wells: The locations shown in Table 2 will be sampled annually.
- Residential Domestic and a Public Water Supply Wells: The locations shown in Table 3 will be sampled on an annual basis.
- Seep: The location shown in Table 2 will be sampled annually.

Additionally, on-going and future actions at the site include:

- Continue to monitor, maintain and evaluate multiport bedrock monitor wells with historic TCE detections.
- Redevelop existing bedrock monitoring wells as needed to acquire reliable data.
- Collect water level measurements as part of each sampling round
- A Sampling and Analysis Plan (SAP) or SAP addendum will be completed prior to each groundwater sampling event. The SAP will include details specific to the sampling event, including: data quality objectives, field and laboratory standard operating procedures, laboratory methods references and reporting limits, quality control sample information, laboratory control limits, data validation protocol, laboratory certification, electronic data deliverable specifications, and schedule for sampling and reporting.
- Groundwater sampling reports will be prepared after each groundwater sampling event and will include: a summary of the field activities and laboratory results (with comparison to MCL), evaluation of contaminant trends and assessment of natural attenuation. The sampling reports shall also include complete laboratory reports. Electronic data deliverables (EDD) with validated results will be submitted to USACE (using FUDSChem) and MEDEP (Environmental and Groundwater Analysis Database (EGAD)) before reports are submitted for review. The report will also include a discussion of any changes to the Institutional Control Zone.
- Evaluate the need for Vapor Intrusion Investigations on an annual basis based on groundwater monitoring results. Conduct VI sampling and evaluation at a minimum in advance of the first Five-Year Review.

## 6.0 REFERENCES


ARA, 2017a. Final Sampling and Analysis Plan – 2017, Bucks Harbor Former Air Force Radar Tracking Station and Former Ground/Air Transmitter/Receiver Site Machiasport, Maine. November 2017.

ARA, 2017b. Draft October 2016 Residential and Monitoring Well Sampling Event Report, Bucks Harbor Former Air Force Tracking Station and Ground/Air Transmitter/Receiver Site, November 2017.

Argonne National Laboratory (ANL), 2005. Geophysical Investigation of the Formerly Used Defense Site, Machiasport, Maine.

DoD Environmental Data Quality Workshop. 2013. Department of Defense Quality Systems Manual for Environmental Laboratories, (DoD QSM) Version 5.0, July 2013.

ENSR, 2007. Feasibility Study. Former Bucks Harbor Air Force Radar Tracking Station Machiasport, Maine. December 2007. Prepared by: ENSR Corporation Delivery Order 0010 2 Technology Park Drive Contract DACW33-00-D-0003 Westford, MA Document: 09000-347-615.

MEDEP, 2018. Maine Department of Environmental Protection, Maine Remedial Action Guidelines (RAGs) for Site Contaminated with Hazardous Substances, effective October 19, 2018.

USACE, 1995. Memorandum-DERP-FUDS Inventory Project Report (INPR) for Site No. DO1ME0509, Property of the Town of Machiasport, (Former Air Force GATR Site), Machiasport, Maine.

USACE, 2004a. Lineation Analysis of the Bucks Harbor Area, Maine, report by Judy Ehlen and Robert L. Fischer, USACE Topographic Engineering Center.

USACE, 2004b. Department of the Army, Corps of Engineers, Environmental Quality, Formerly Used Defense Sites (FUDS) Program Policy, ER 200-3-1, May 10, 2004.

USACE, Department of the Army, 2009. DERP-FUDS Amended Findings of Facts for FAA Station and Downeast Correctional Facility (Bucks Harbor Air Force Radar Tracking Station), Site No. D01ME0486, Machiasport, Maine, 30 October 2009.

USACE. 2012. FINAL Groundwater Sampling Plan Optimization for the Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) and Ground/Air/Transmitter/Receiver (GATR) Site, Bucks Harbor, Maine. April 2012.

USACE, 2016. US Army Corps of Engineers Bucks Harbor Proposed Plan. April 13, 2016.

USACE, 2017. Decision Document. Final Decision Document Former Bucks Harbor Air Force Radar Tracking Station (AFRTS) [D01ME0486 02] and Ground-to-Air Transmitter and Receiver (GATR) Site [D01ME0509 03], Machiasport, Maine, May 2017.

USEPA. 2007. Pore Water Sampling. Region 4, Science and Ecosystem Support Division, Athens, Georgia. February 5.

USEPA. 2010. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Jan. 19, 2010.

USEPA, 2015. OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OWER Publication 9200.2-154, June 2015.

USEPA, 2017. OSWER Vapor Intrusion Assessment, Vapor Intrusion Screening Level (VISL) Calculator. https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator

USGS, 2004. Johnson, C.D., Joesten, P.K., Analysis of Borehole Radar-Reflection Data from Machiasport, Maine, December 2003.

USGS, 2005. Surface- and Borehole-Geophysical Investigation of a Formerly Used Defense Site, Machiasport, Maine, February 2003. Scientific Investigations Report 2004-5099.

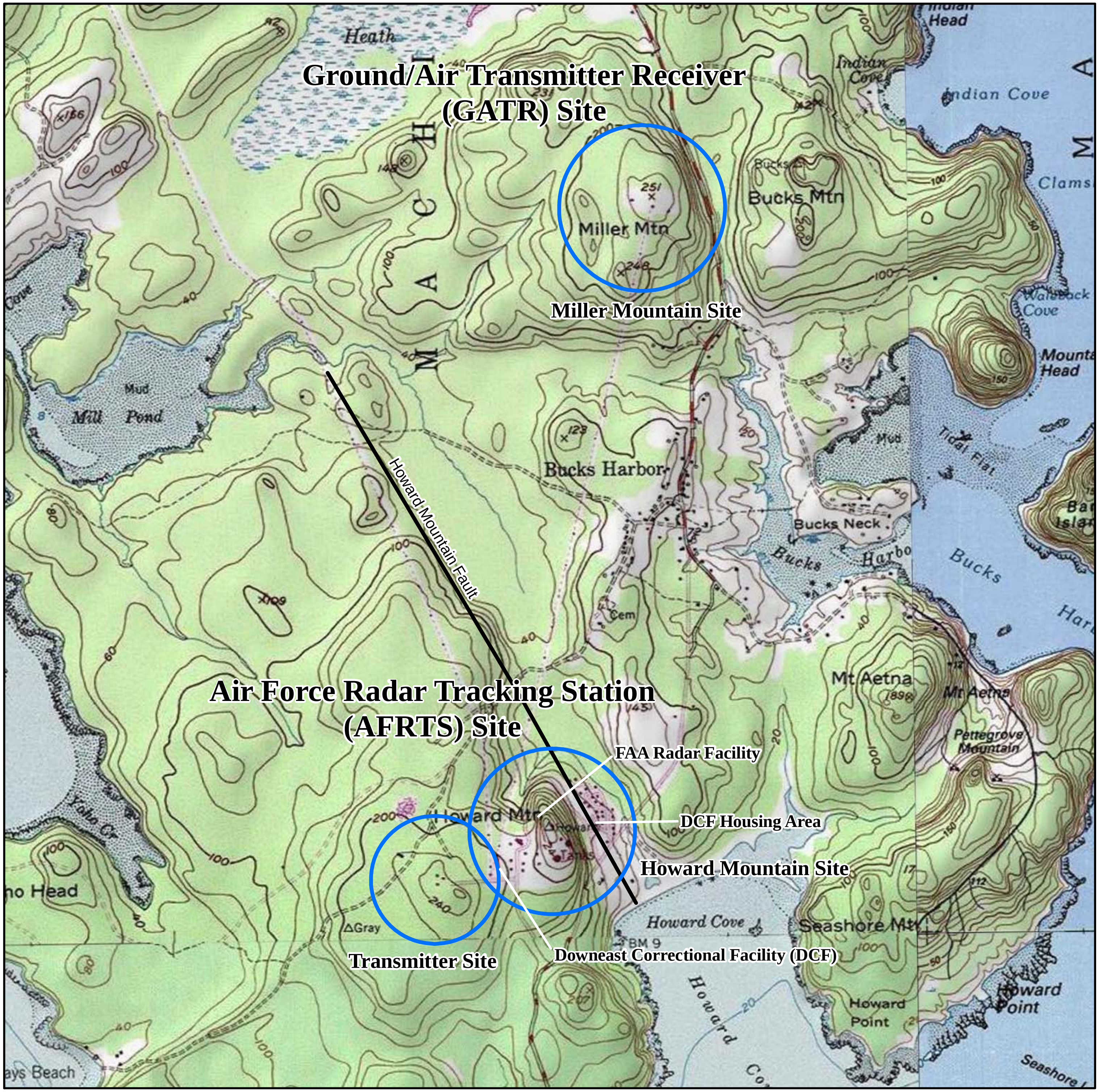
USGS, 2009. Borehole Geophysical Investigation of a Formerly Used Defense Site, Machiasport, Maine, 2003–2006. Scientific Investigations Report 2009–5120.

Watermark, 2011. Final Feasibility Study Addendum, Alternate Water Supply Evaluation, Bucks Harbor Former Air Force Radar Tracking Station, Machiasport, Maine, August 2011.

Weston, 2005. Remedial Investigation, Former Bucks Harbor Air Force Radar Tracking Station, Machiasport, Maine, Final Remedial Investigations Report, Contract No. DACA31-96-D-0006, Task Order No. 17, DCN: BUCKS2-041205-AAJJG.

Woods Hole Group (WHG), 2013. Sub-slab Vapor and Indoor Air Vapor Intrusion Sampling Report, Former Bucks Harbor Air Force Radar Tracking Station Site, Machiasport, Maine, December 2013.

## Figures




LEGEND

Approximate site locations

HowardMountainFault

LOCATION MAP


NOTES & SOURCES

Map Coordinate System:
Maine Stateplane East NAD83 Feet

TITLE

Location Map Showing
Bucks Harbor Sites

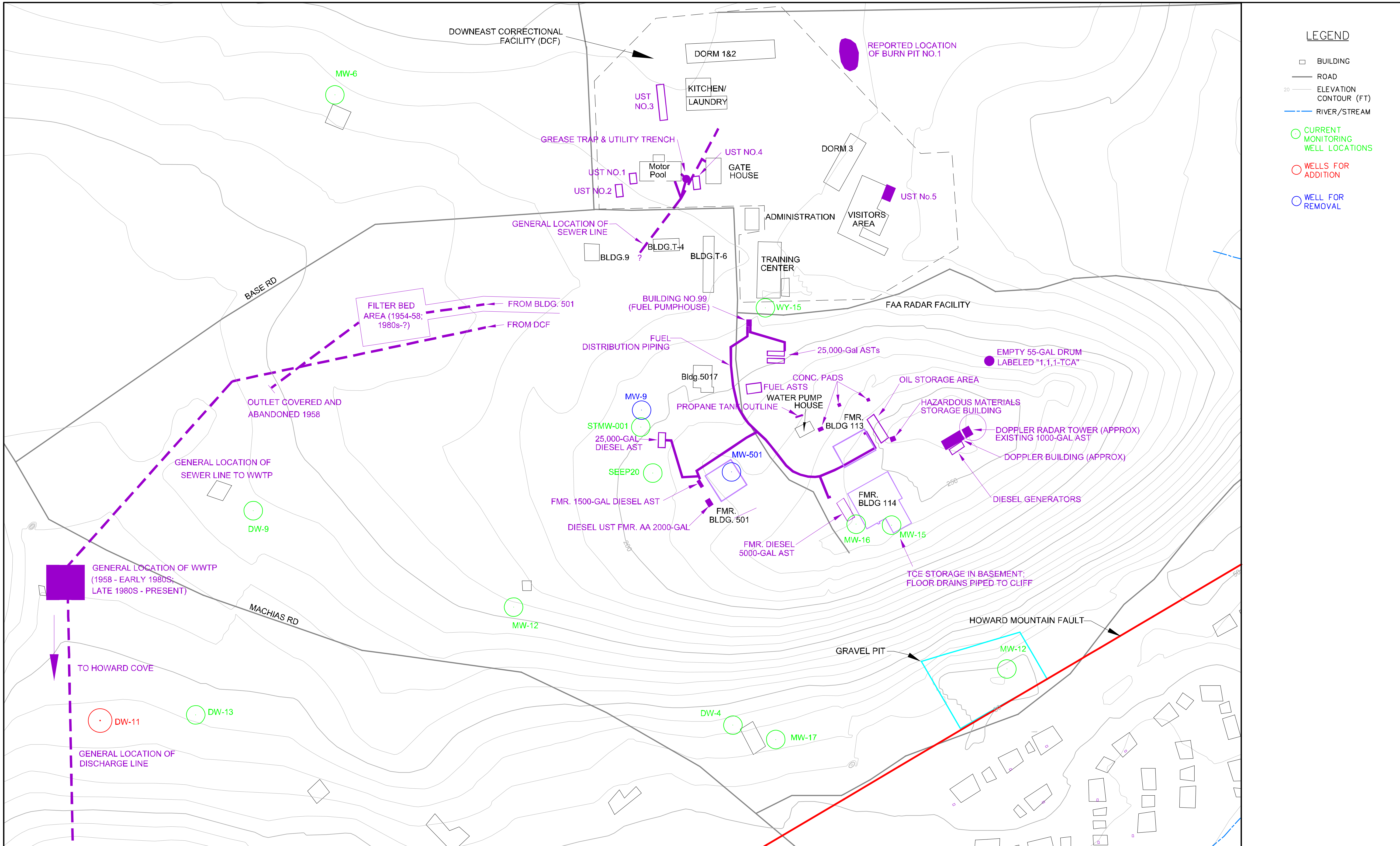
0 2,000 Feet

N

US Army Corps of Engineers
New England District

FIGURE
1

M:\Projects\FUDS\BucksHarbor\2016\Figures\Fig1_021716.pdf
M:\Projects\FUDS\BucksHarbor\2016\MXDs\Fig1_021716.pdf
February 17, 2016 DWN: MTW CHKD: MAW




NOTES:

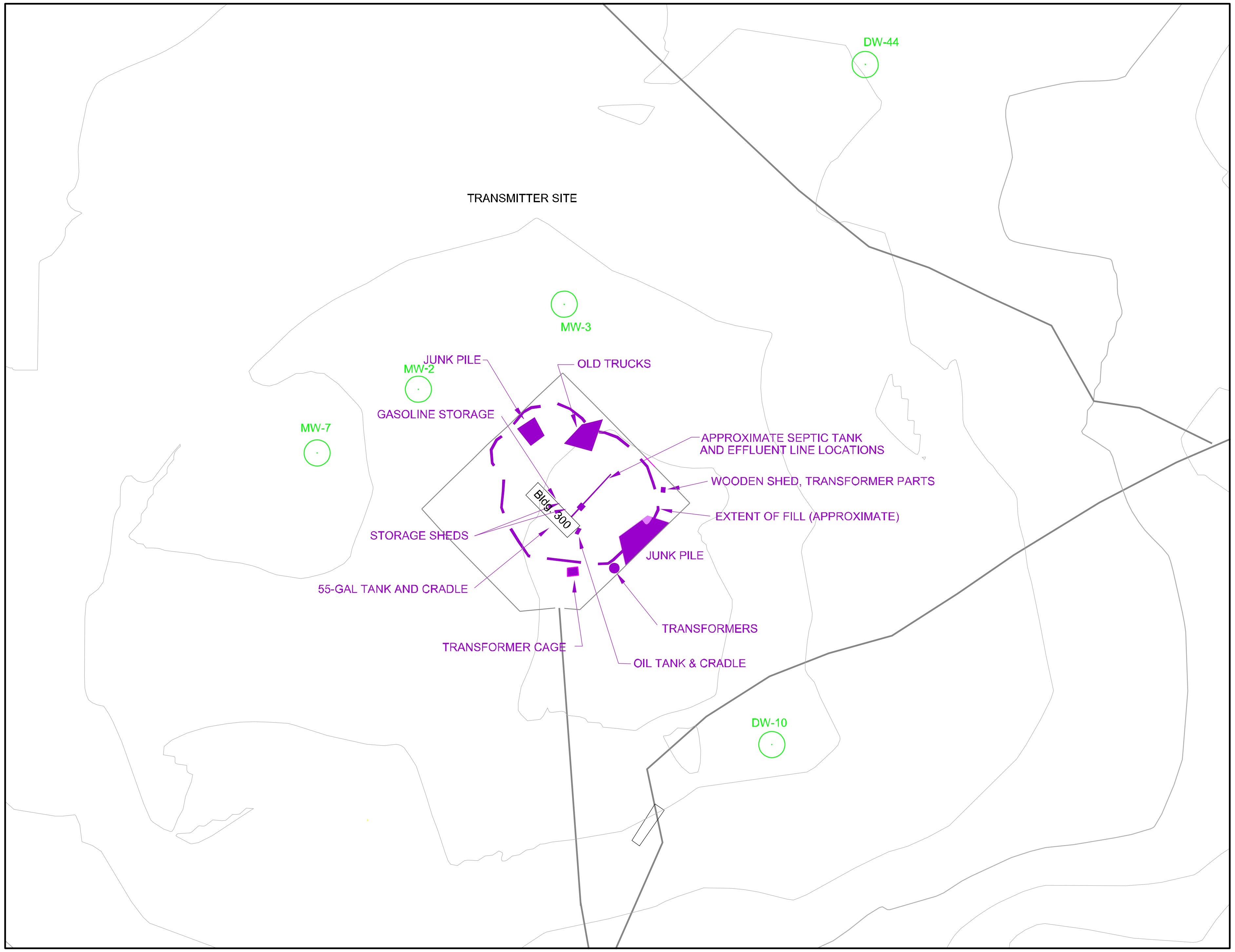
1. BASE MAP ADAPTED FROM USACE, 2003. PHOTOGRAMMETRIC MAP AND ORTHOPHOTO, BUCKS HARBOR, MAINE. PRODUCED FOR USACE NEW ENGLAND DISTRICT BY USACE TOPOGRAPHIC ENGINEERING CENTER.
2. COORDINATE SYSTEM MAINE STATE PLANE, NAD 83, US FEET.
3. ALL WELLS FROM USACE SURVEY MAP (JULY 2004) EXCEPT DW-5 THROUGH DW-40 FROM USACE 2003 REFERENCED IN NOTE 1 ABOVE.
4. SOURCE OF THE FEATURES SHOWN IN PURPLE "AECOM, 2007. FEASIBILITY STUDY FORMER BUCKS HARBOR AIR FORCE RADAR TRACKING STATION. MACHIASPORT, MAINE. DECEMBER 2007."
5. POTENTIAL CONTAMINATION SOURCES FROM USACE 2003 (NOTE 1 ABOVE), ABB INC. REPORT ENTITLED "ENGINEERING EVALUATION OF CONTAMINATION REPORT, BUCKS HARBOR, FORMER AIR FORCE RADAR TRACKING STATION" (JULY 1997), AND ENSR FIELD OBSERVATIONS.
6. LOCATION OF POTENTIAL CONTAMINATION SOURCES FROM THE ABB REPORT AND ENSR OBSERVATIONS ARE APPROXIMATE AND NOT THE RESULT OF A SURVEY.

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

HOWARD MOUNTAIN OPERATIONAL AREAS

FILE: BH1_C-101_5-14-2018.DWG
DATE: 18 MAY 2018

FIG 2




LEGEND

- BUILDING
- ROAD
- ELEVATION CONTOUR (FT)
- CURRENT MONITORING WELL LOCATIONS
- WELLS FOR ADDITION
- WELL FOR REMOVAL

NOTES:

1. BASE MAP ADAPTED FROM USACE, 2003. PHOTOGRAMMETRIC MAP AND ORTHOPHOTO, BUCKS HARBOR, MAINE. PRODUCED FOR USACE NEW ENGLAND DISTRICT BY USACE TOPOGRAPHIC ENGINEERING CENTER.
2. COORDINATE SYSTEM MAINE STATE PLANE, NAD 83, US FEET.
3. ALL WELLS FROM USACE SURVEY MAP (JULY 2004) EXCEPT DW-5 THROUGH DW-40 FROM USACE 2003 REFERENCED IN NOTE 1 ABOVE.
4. SOURCE OF THE FEATURES SHOWN IN PURPLE "AECOM, 2007. FEASIBILITY STUDY FORMER BUCKS HARBOR AIR FORCE RADAR TRACKING STATION. MACHIASPORT, MAINE. DECEMBER 2007."
5. POTENTIAL CONTAMINATION SOURCES FROM USACE 2003 (NOTE 1 ABOVE), ABB INC. REPORT ENTITLED "ENGINEERING EVALUATION OF CONTAMINATION REPORT, BUCKS HARBOR, FORMER AIR FORCE RADAR TRACKING STATION" (JULY 1997), AND ENSR FIELD OBSERVATIONS.
6. LOCATION OF POTENTIAL CONTAMINATION SOURCES FROM THE ABB REPORT AND ENSR OBSERVATIONS ARE APPROXIMATE AND NOT THE RESULT OF A SURVEY.

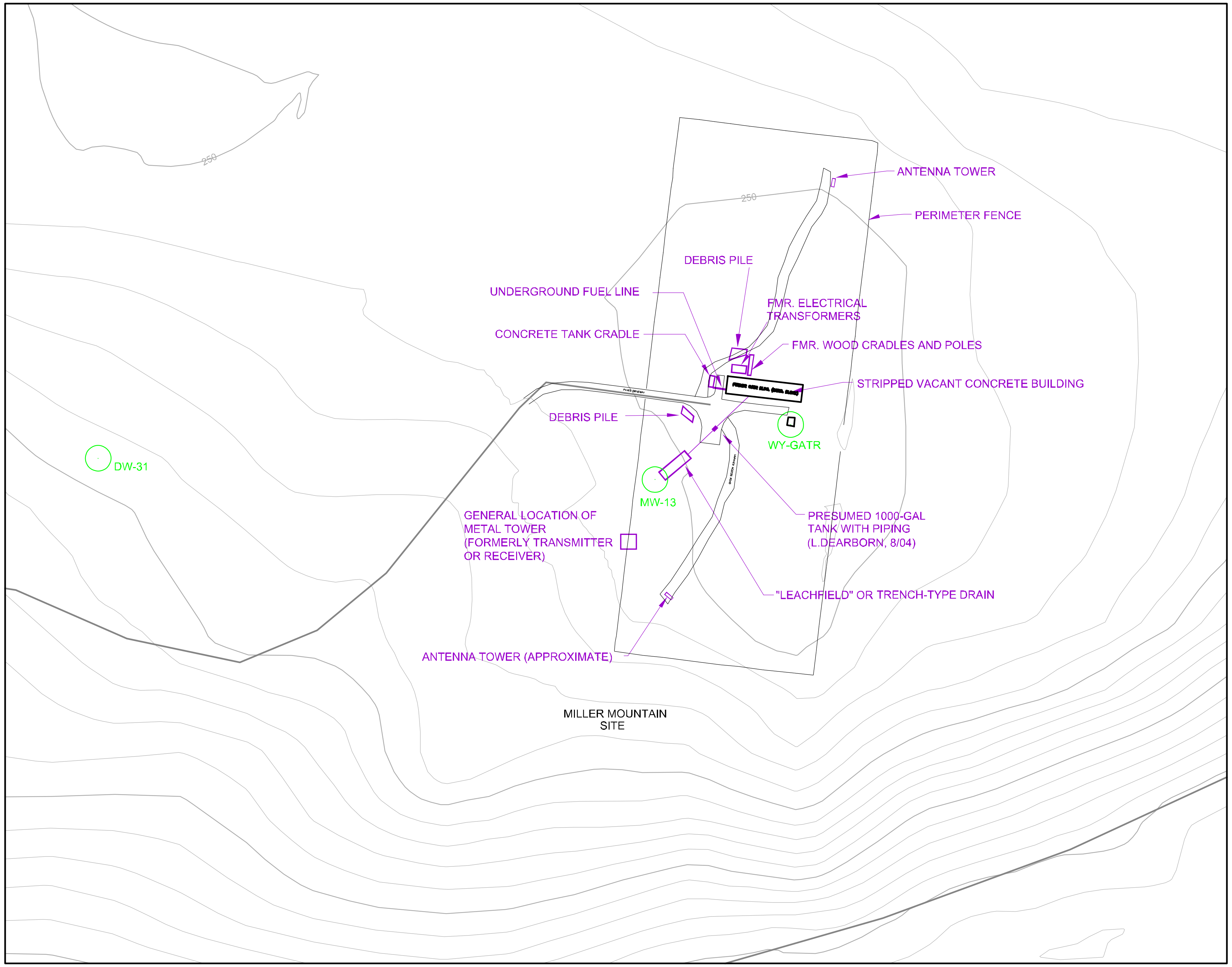
GRAPHIC SCALE
0 50' 100' 150' 200' 250'
APPROXIMATE SCALE IN FEET
1/100

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

# TRANSMITTER SITE OPERATIONAL AREAS

FILE: BH1_C-101_5-14-2018.DWG
DATE: 17 MAY 2018

FIG 3




## LEGEND

- BUILDING
- ROAD
- ELEVATION CONTOUR (FT)
- CURRENT MONITORING WELL LOCATIONS
- WELLS FOR ADDITION
- WELL FOR REMOVAL

NOTES:

1. BASE MAP ADAPTED FROM USACE, 2003. PHOTOGRAMMETRIC MAP AND ORTHOPHOTO, BUCKS HARBOR, MAINE. PRODUCED FOR USACE NEW ENGLAND DISTRICT BY USACE TOPOGRAPHIC ENGINEERING CENTER.
2. COORDINATE SYSTEM MAINE STATE PLANE, NAD 83, US FEET.
3. ALL WELLS FROM USACE SURVEY MAP (JULY 2004) EXCEPT DW-5 THROUGH DW-40 FROM USACE 2003 REFERENCED IN NOTE 1 ABOVE.
4. SOURCE OF THE FEATURES SHOWN IN PURPLE "AECOM, 2007. FEASIBILITY STUDY FORMER BUCKS HARBOR AIR FORCE RADAR TRACKING STATION. MACHIASPORT, MAINE. DECEMBER 2007."
5. POTENTIAL CONTAMINATION SOURCES FROM USACE 2003 (NOTE 1 ABOVE), ABB INC. REPORT ENTITLED "ENGINEERING EVALUATION OF CONTAMINATION REPORT, BUCKS HARBOR, FORMER AIR FORCE RADAR TRACKING STATION" (JULY 1997), AND ENSR FIELD OBSERVATIONS.
6. LOCATION OF POTENTIAL CONTAMINATION SOURCES FROM THE ABB REPORT AND ENSR OBSERVATIONS ARE APPROXIMATE AND NOT THE RESULT OF A SURVEY.

GRAPHIC SCALE

0 50' 100' 150' 200' 250'

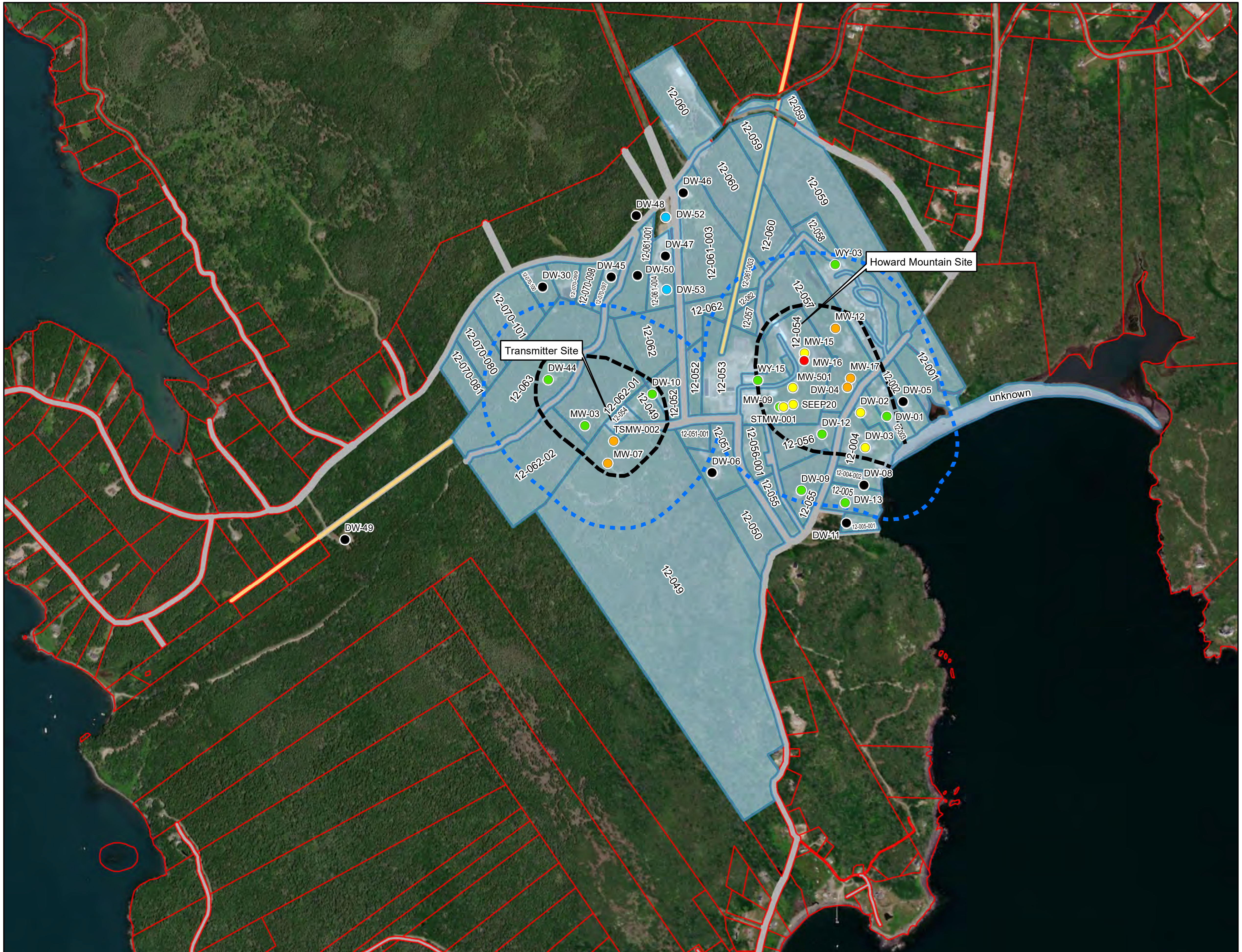
APPROXIMATE SCALE IN FEET 1/100

DEPARTMENT OF THE ARMY
NEW ENGLAND DISTRICT, CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

# MILLER MOUNTAIN OPERATIONAL AREAS

FILE: BH1_C-101_5-17-2018.DWG
DATE: 17 MAY 2018

FIG 4



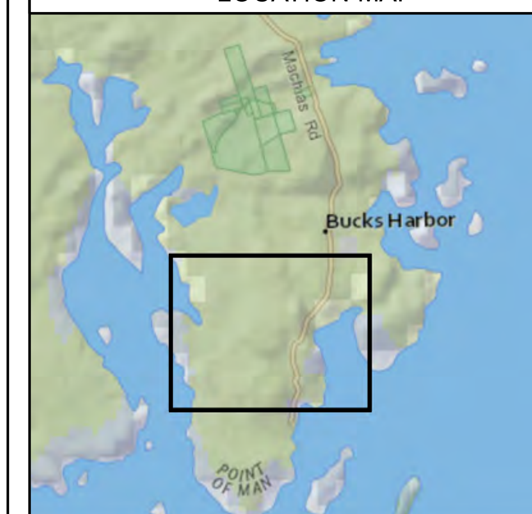

## LEGEND

Maximum TCE Concentrations (µg/L)
Domestic Wells in Long Term
Groundwater Monitoring Program
Data from 2006 to 2017

- Not Yet Sampled
- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

- Approximate extent of TCE impacted groundwater
- 500 foot buffer zone surrounding extent of TCE impacted groundwater
- Machiasport Parcels
- Institutional Control Zone
- Easements
- Roads

## LOCATION MAP




## NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

## TITLE

Wells for Long Term Monitoring at Howard Mountain and Transmitter Sites Bucks Harbor

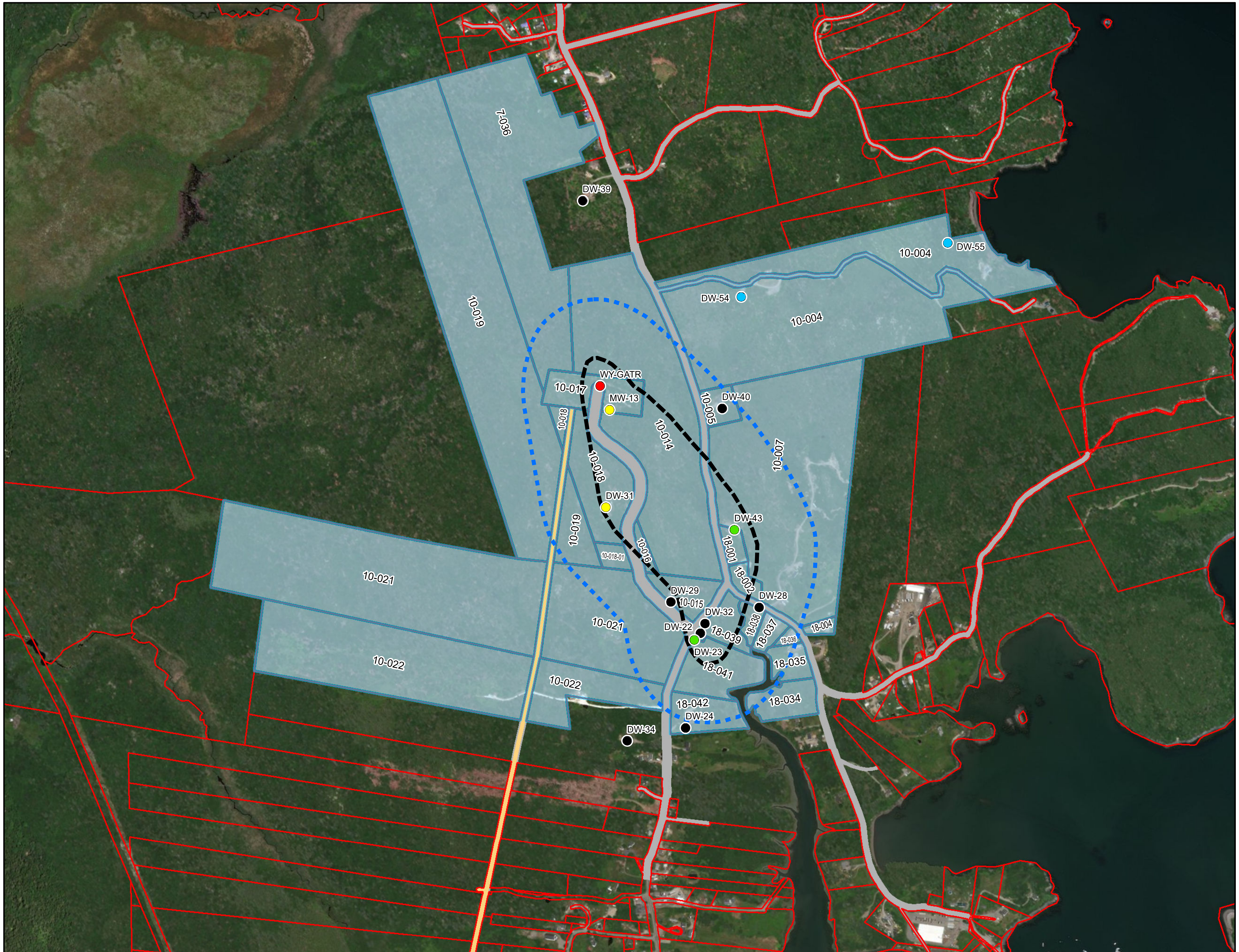
0 900 Feet

N

US Army Corps of Engineers
New England District

M:\Projects\FUDS\BucksHarbor\2018\Figures\Fig5_101518.pdf
M:\Projects\FUDS\BucksHarbor\2018\MXDs\Fig5_101518.mxd
Oct 15, 2018 DWN: PDM CHKD: KJH MAW

FIGURE 5



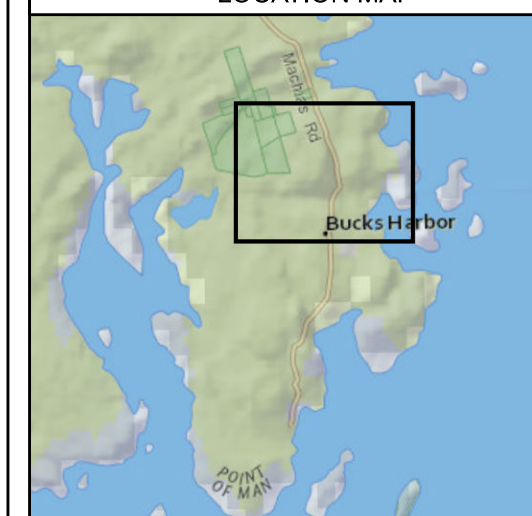

## LEGEND

Maximum TCE Concentrations (µg/L)
Domestic Wells in Long Term
Groundwater Monitoring Program
Data from 2006 to 2017

- Not Yet Sampled
- Non Detect or < 0.5
- 0.5 - < 5.0
- 5.1 - 50
- 51 - 500
- > 500

- Approximate extent of TCE impacted groundwater
- 500 foot buffer zone surrounding extent of TCE impacted groundwater
- Machiasport Parcels
- Institutional Control Zone
- Easements
- Roads

## LOCATION MAP




## NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

## TITLE

Wells for Long Term Monitoring at
Miller Mountain Site
Bucks Harbor

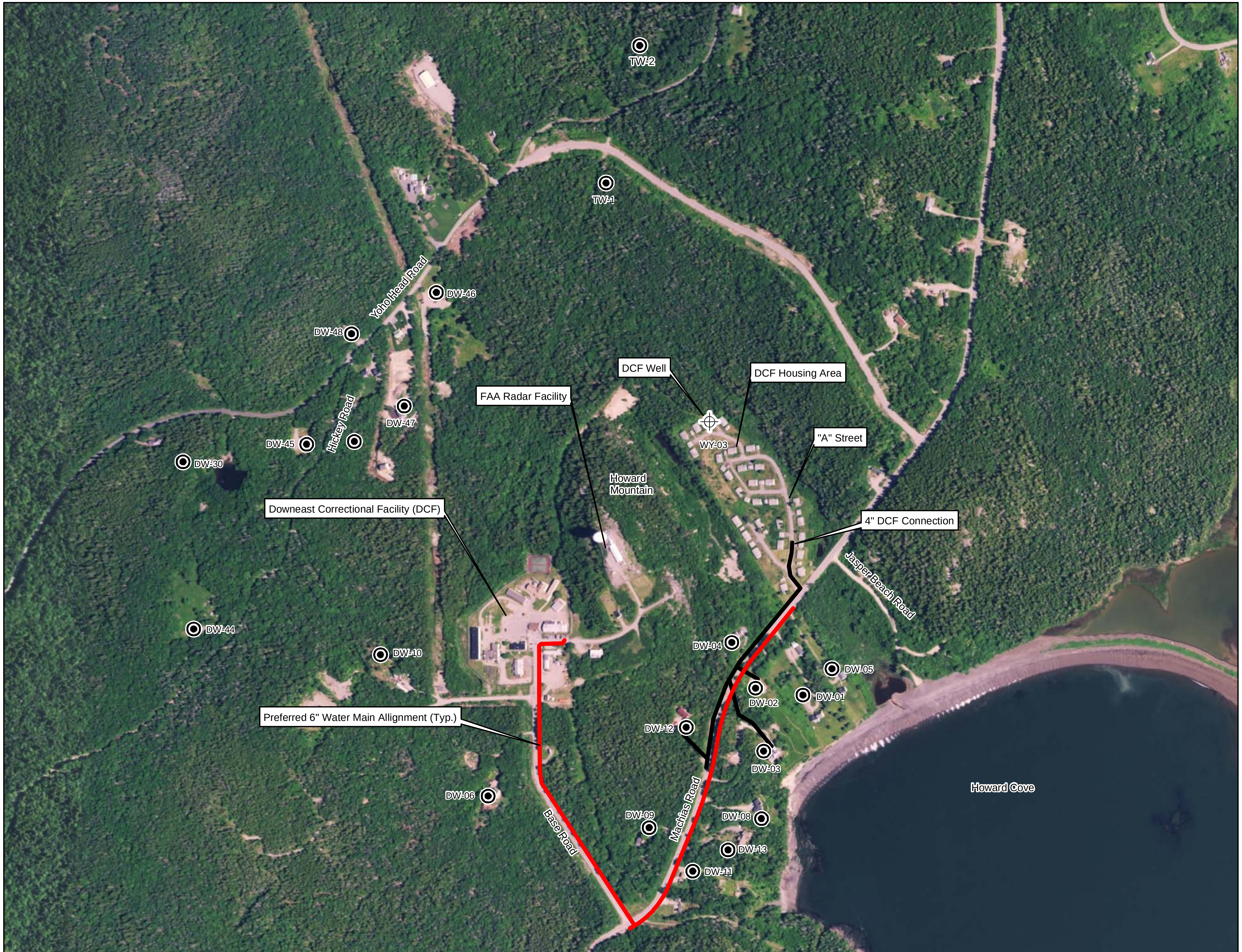
0 800
Feet

N

US Army Corps
of Engineers®
New England District

M:\Projects\FUDS\BucksHarbor\2018\Figures\Fig6_032618.pdf
M:\Projects\FUDS\BucksHarbor\2018\MXDs\Fig6_030518.pdf
March 26, 2018 DWN: MTW CHKD: KJH MAW

FIGURE
6

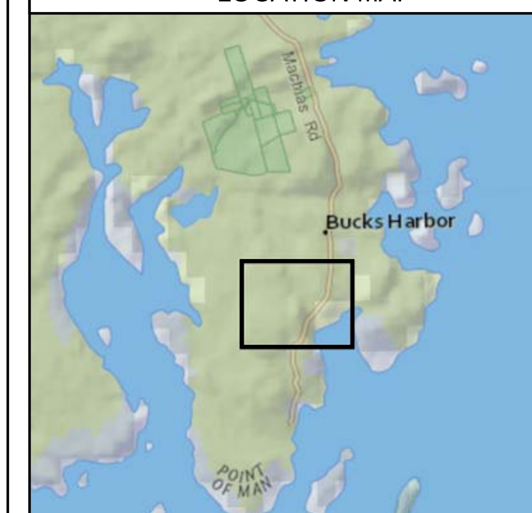



## LEGEND

Piping Network

- Feasibility Study Addendum, 2011
- Design Build RFP, 2017
- DW-01 Domestic Well
- WY-3 Production Well
- TW-1 Test Well

## LOCATION MAP




## NOTES & SOURCES

Machisaport Parcels data from Maine Office of GIS
Map Coordinate System: Maine Stateplane East NAD83 Feet

## TITLE

Connection to Existing DCF Water Supply
Howard Mountain and Transmitter Sites
Bucks Harbor

0 500 Feet

N

US Army Corps of Engineers
New England District

M:\Projects\FUDS\BucksHarbor\2016\Figures\Fig7_050217.pdf
M:\Projects\FUDS\BucksHarbor\2016\MXDs\Fig7_041017.pdf
May 2, 2017 DWN: MTW CHKD: KJH MAW

FIGURE 7

Tables

Table 1
Summary of Long Term Monitoring Plan

| Sample Type | Matrix | Current Groundwater Monitoring Prgram | Long Term Monitioring Plam | Number of Samples per Sample Location | Analyses | Objectives |
|---|---|---|---|---|---|---|
| Monitoring Wells | Aqueous | 13 locations (26 well screens) | 11 locations (24 well screens) | Varies for each monitoring well (see Table 2) | VOCs and MNA parameters | To continue monitoring the nature and extent of groundwater contamination. |
| Seep | Aqueous | 1 location | 1 location | One sample | VOCs | To monitor seep water quality and evaluate the potential for discharging contaminated water to the ground surface. |
| Residential Wells | Aqueous | 32 locations | 35 locations | Varies for each residential well (see Table 3) | VOCs (MNA parameters at some locations) | To continue monitoring affected and potentially impacted residential wells. |
| Public Water Supply Well | Aqueous | 1 location | 1 location | Two samples (before and after treatment) | VOCs | To continue monitoring public water supply system. |

Table 2
Monitoring Well and Seep
Long Term Monitoring Plan

| Location Monitored | Monitoring Well Location ID | Northing SPME East (feet) | Easting SPME East (feet) | Well Depth (ft bgs) | Well Type | Pump Intake Depth(s) (ft bgs) | Pump Type | Dedicated Tubing or Pump | Screen Interval (ft bgs) | Analyses | Maximum Concentration | | | | | Period of Results Summarized | Frequency | LUC Zone | Status in LTMP | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | > MCL | < MCL and > $^1/_2$ MCL | < $^1/_2$ MCL and > ND | Non-Detect | Max Conc (µg/L) | | | | | |
| Transmitter Site | MW-03 | 1,269,918 | 352,033 | 15 | Hybrid | 12 | Peristaltic | Dedicated Tubing | Open Borehole | VOCs and MNA Parameters | | | X | | 1.4 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 2 | Retain | Monitoring well located in the immediate vicinity and west of the Transmitter Site intended to monitor shallow groundwater VOCs in overburden and bedrock. |
| | MW-07 | 1,270,135 | 351,671 | 130 | Bedrock | 7-17; 43.5-53.5; 81-91; 114.5-124.5 (FLUTe lined) | FLUTe-Nitrogen | FLUTe Liner | 7-17<br>43.5-53.5<br>81-91<br>114.5-124.5 | VOCs and MNA Parameters | X | | | | P1 (7'-17'): 320<br>P2 (43.5'-53.5'): 350<br>P3 (81'-91'): 290<br>P4 (114.5'-124.5'): 300 | Sep-13 to Oct-17 | A: 2013-16 | 2 | Retain | Monitoring well located in the immediate vicinity and south of the Transmitter Site intended to monitor groundwater VOCs at multiple elevations in bedrock. |
| | TSMW-002 | 1,270,193 | 351,884 | 13 | Hybrid | 8 | Peristaltic | Dedicated Tubing | Open Borehole | VOCs and MNA Parameters | X | | | | 150 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 2 | Retain | Monitoring well located in the immediate vicinity and south of the Transmitter Site intended to monitor shallow groundwater VOCs in overburden and bedrock. |
| Howard Mountain | MW-09 | 1,271,783 | 352,213 | 120 | Bedrock | 80 | Peristaltic | Dedicated Tubing | Open Borehole | VOCs and MNA Parameters | | X | | | 3.8 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | TCE concentrations consistently below MCL and generally decreasing since 2013. |
| | MW-12 | 1,272,316 | 352,965 | 243 | Bedrock | 44.5-49.5; 91.5-101.5; 161-176; 211.5-221.5 (FLUTe lined) | FLUTe-Nitrogen | FLUTe Liner | 44.5-49.5<br>91.5-101.5<br>161-176<br>211.5-221.5 | VOCs and MNA Parameters | X | | | | P1 (44.5'-49.5'): 150<br>P2 (91.5'-101.5'): 140<br>P3 (161'-176'): 16<br>P4 (211.5'-221.5'): 4.5 | Sep-13 to Oct-17 | A: 2013-16 | 2 | Retain | Monitoring well located in the immediate vicinity and east of the Howard Mountain Site intended to monitor groundwater VOCs at multiple elevations in bedrock. |
| | MW-15 | 1,272,020 | 352,728 | 50 | Bedrock | 22.5 | Peristaltic | Dedicated Tubing | Open Borehole | VOCs and MNA Parameters | X | | | | 45.3 | Jul-06 to Oct-17 | S: 2006<br>T: 2007-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | Monitoring well located in the immediate vicinity and southeast of the Howard Mountain Site intended to monitor groundwater VOCs in shallow bedrock. |
| | MW-16 | 1,272,018 | 352,655 | 170 | Bedrock | 144-149; 159-164 (FLUTe lined) | FLUTe-Nitrogen | FLUTe Liner | 144-149<br>159-164 | VOCs and MNA Parameters | X | | | | P1 (144'-149'): 663<br>P2 (159'-164'): 330 | Sep-13 to Oct-17 | A: 2013-16 | 1 | Retain | Monitoring well located in the immediate vicinity and southeast of the Howard Mountain Site intended to monitor VOCs at multiple elevations in bedrock. |
| | MW-17 | 1,272,461 | 352,489 | 250 | Bedrock | 69-74; 107-117; 155-170; 176-183; 219-224 (FLUTe-lined) | FLUTe-Nitrogen | FLUTe Liner | 69-74<br>107-117<br>155-170<br>176-183<br>219-224 | VOCs and MNA Parameters | X | | | | P1 (69'-74'): 16<br>P2 (107'-117'): 100<br>P3 (155'-170'): 120<br>P4 (176'-183'): 120<br>P5 (219'-224'): 100 | Sep-13 to Oct-17 | A: 2013-16 | 1 | Retain | Monitoring well located in the immediate vicinity and southeast of the Howard Mountain Site intended to monitor VOCs at multiple elevations in bedrock. |
| | MW-501 | 1,271,911 | 352,398 | 50 | Angled Bedrock | 27 | Peristaltic | Dedicated Tubing | Open Borehole | VOCs and MNA Parameters | X | | | | 8.9 | Jul-06 to Oct-17 | S: 2006<br>T: 2007-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | With the exception of 8.9 ug/L in 2013, TCE concentrations have consistently been below the MCL and generally decreasing. |
| Howard Mountain | STMW-001 | 1,271,818 | 352,212 | 45 | Bedrock | 40 | Bladder | Dedicated Pump | Open Borehole | VOCs and MNA Parameters | X | | | | 21 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | Monitoring well located in the immediate vicinity and south of the Howard Mountain Site intended to monitor groundwater VOCs in shallow to intermediate bedrock. |
| | WY-15 | 1,271,573 | 352,468 | 320 | Bedrock | 73 | Bladder | Dedicated Pump | Open Borehole | VOCs and MNA Parameters | | X | | | 4.1 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | Monitoring well located in the immediate vicinity and southwest of the Howard Mountain Site intended to monitor groundwater VOCs in shallow to intermediate bedrock. |
| Howard Mountain | Seep No. 20 | 1,271,913 | 352,236 | Ground Water | Pore water sampler | Below surface | Peristaltic | Dedicated Tubing | Surface Seepage | VOCs | X | | | | 10.6 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | Surface discharge of groundwater in the immediate vicinity of Howard Mountain intended to monitor groundwater VOCs in shallow bedrock |
| GATR | MW-13 | 1,273,380 | 361,759 | 219 | Bedrock | 35, 150 | Peristaltic | Dedicated Tubing | Open Borehole | VOCs and MNA Parameters | X | | | | MW-13-35': 6.5<br>MW-13-150': 6 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | Monitoring well located in the immediate vicinity and southeast of the Miller Mountain Site intended to monitor groundwater VOCs in both shallow and deep bedrock. |
| | WY-GATR | 1,273,298 | 361,962 | 416 | Bedrock | Preset at 187 and 414 ft with two dedicated sampling pumps | Dedicated Bladder | Dedicated Pump | Open Borehole | VOCs and MNA Parameters | X | | | | WY-GATR-185': 3300<br>WY-GATR-414': 2640 | Jul-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-16 | 1 | Retain | Monitoring well located in the immediate vicinity of the Miller Mountain Site intended to monitor groundwater VOCs in both intermediate and deep bedrock. |

Notes:
1) MW indicates monitoring well.
2) Sampling frequency (A) annual, (S) semi-annual, and (T) triannual.

Table 3
Domestic Well and Supply Well
Long Term Monitoring Plan

| Location | Residential (DW) or Public Supply (PW) Well Location ID | POET Attached | Street Address | Map-Book-Lot | Monitoring Source or Boundary Well | Number of Sampling Points (see notes) | Analyses | Maximum Concentration | | | | | Period of Results Summarized | Frequency | LUC Zone | Status in LTMP | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | > MCL | < MCL and >1/2 MCL | <1/2 MCL and > ND | Non-Detect | Max Conc (µg/L) | | | | | |
| Howard Mountain | DW-01 | Yes | 1490 Port Road | 012-003-000 | Source | 1 | VOCs | | | X | | 1.7 | Apr-06 to Oct-16 | T: 2006<br>S: 2007<br>A: 2008-16 | 2 | Retain | Domestic well located southeast of Howard Mountain near Jasper Beach. |
| | DW-02 | Yes | 1508 Port Road | 012-004-001 | Source | 2 | VOCs and MNA Parameters | X | | | | 26 | Jul-06 to Oct-17 | S: 2006-07<br>T: 2008-09<br>S: 2010-11<br>A: 2012-17 | 2 | Retain | Domestic well located southeast of Howard Mountain near Jasper Beach. |
| | DW-03 | Yes | 1532 Port Road | 012-004-000 | Source | 3 | VOCs and MNA Parameters | X | | | | 7.3 | Apr-06 to Oct-17 | T: 2006-09<br>A: 2012-17 | 2 | Retain | Domestic well located southeast of Howard Mountain near Jasper Beach. |
| | DW-04 | Yes | 1503 Port Road | 012-057-000 | Source | 2 | VOCs and MNA Parameters | X | | | | 83.8 | Apr-06 to Oct-17 | T: 2006-09<br>A: 2012-17 | 2 | Retain | Domestic well located southeast of Howard Mountain approximately halfway between Howard Mountain and Jasper Beach. |
| | DW-05 | No | 1482 Port Road | 012-002-000 | Boundary | 1 | VOCs | | | X | | 0.16 J | Jul-06 to Oct-17 | A: 2006-09<br>A: 2011-14, 16-17 | 3 | Retain | Domestic well located southeast of Howard Mountain near Jasper Beach. |
| | DW-06 | No | 46 Base Road | 012-051-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011, 2016,2017 | 3 | Retain | Domestic well located southwest of the Howard Mountain Site. |
| | DW-08 | No | 1536 Port Road | 012-004-002 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Jun-09 | A: 2006-09 | 3 | Retain | Domestic well located south-southwest of the Howard Mountain Site. |
| | DW-09 | No | 1543 Port Road | 012-055-000 | Boundary | 1 | VOCs | | | X | | 0.7 | Jul-06 to Oct-17 | A: 2006-11<br>A: 2014-17 | 3 | Retain | Domestic well located southeast of Howard Mountain located approximately halfway between Howard Mountain and Jasper Beach. |
| | DW-10 | No | 27 Utility Road | 012-052-000 | Boundary | 1 | VOCs | | | X | | 1.0 | Apr-06 to Oct-16 | T: 2006-08<br>S: 2009<br>T: 2010<br>S: 2011<br>A: 2016 | 2 | Retain | Domestic well located southeast of the Howard Mountain Site. |
| | DW-11 | No | 1552 Port Road | 012-005-001 | Boundary | 1 | VOCs | | | | X | 0.05 U | 16-Oct | A: 2016 | 3 | Retain | Domestic well located south-southeast of the Howard Mountain Site near Jasper Beach. |
| | DW-12 | Yes | 1527 Port Road | 012-056-000 | Boundary | 2 | VOCs and MNA Parameters | | X | | | 4.4 | Apr-06 to Oct-17 | T: 2006-10<br>S: 2011<br>A: 2012-17 | 2 | Retain | Domestic well located south-southeast of Howard Mountain. |
| | DW-13 | No | 1544 Port Road | 012-005-000 | Source | 1 | VOCs | | X | | | 3.6 | Sep-12 to Oct-16 | A: 2012-16 | 3 | Retain | Domestic well located south-southeast of the Howard Mountain Site near Jasper Beach. |
| | DW-30 | No | 248 Yoho Head Road | 012-070-100 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | A: 2006-11<br>A: 2016-17 | 3 | Retain | Domestic well located north of the Transmitter Site. |
| | DW-44 | No | 29 Grays Beach Road | 012-063-000 | Source | 1 | VOCs | | | X | | 1.4 | Sep-13 to Sep-13 | 2013 | 2 | Retain | Domestic well located northwest of the Transmitter Site. |

Table 3
Domestic Well and Supply Well
Long Term Monitoring Plan

| Location | Residential (DW) or Public Supply (PW) Well Location ID | POET Attached | Street Address | Map-Book-Lot | Monitoring Source or Boundary Well | Number of Sampling Points (see notes) | Analyses | Maximum Concentration | | | | | Period of Results Summarized | Frequency | LUC Zone | Status in LTMP | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | > MCL | < MCL and >$^1/_2$ MCL | <$^1/_2$ MCL and > ND | Non-Detect | Max Conc (µg/L) | | | | | |
| Howard Mountain | DW-45 | No | 204 Yoho Head Road | 012-070-097 | Boundary | 1 | VOCs | | | X | | 0.47 J | Sep-12 to Oct-17 | A: 2012-17 | 3 | Retain | Domestic well located north of the Transmitter Site. |
| | DW-46 | No | 22 Splinter Lane | 012-061-004 | Boundary | 1 | VOCs | | | X | | 0.31 J | Sep-13 to Oct-17 | A: 2013-17 | 3 | Retain | Domestic well located north-northeast of the Transmitter Site. |
| | DW-47 | No | 124 New Hickey Road | 012-061-003 | Boundary | 1 | VOCs | | | | X | 0.50 U | Sep-13 to Oct-16 | A: 2013-16 | 3 | Retain | Domestic well located north-northeast of the Transmitter Site. |
| | DW-48 | No | 199 Yoho Head Road | 012-070-095 | Boundary | 1 | VOCs | | | | X | 0.50 U | Sep-13 to Oct-16 | A: 2013-16 | >3 | Retain | Domestic well located north-northeast of the Transmitter Site. |
| | DW-49 | No | 364 Yoho Head Road | 012-070-088 | Boundary | 1 | VOCs | | | | X | 0.50 U | Sep-13 to Oct-16 | A: 2013-16 | >3 | Retain | Domestic well located west-southwest of the Transmitter Site. |
| | DW-50 | No | 144 New Hickey Road | 012-061-001 | Boundary | 1 | VOCs | | | | X | 0.50 U | Oct-16 to Oct-17 | A: 2016-17 | 3 | Retain | Domestic well located northwest of the Howard Mountain Site. |
| | DW-51 | No | 1697 Port Road | 012-043-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Oct-16 to Oct-17 | A: 2016-17 | >3 | Remove | Domestic well located far south of the Howard Mountain Site and has not indicated contamination in recent measurements. |
| | DW-52 | No | 132 New Hickey Road | 012-061-002 | Boundary | 1 | VOCs | | | | | TBD | Not yet sampled | Proposed annual | >3 | Add | Domestic well located north-northeast of the Transmitter Site. Slightly outside of ICZ, but will be sampled to confirm no TCE impact. |
| | DW-53 | No | 34 Splinter Lane | 012-061-005 | Boundary | 1 | VOCs | | | | | TBD | Not yet sampled | Proposed annual | >3 | Add | Domestic well located north-northeast of the Transmitter Site. Has not been previously sampled. Within an area of non-detect water supply wells. |
| | Public Water Supply Well WY-03 | No | 64 Base Road Downeast Correctional Facility | 012-053 | Source | 2 | VOCs and MNA Parameters | | | X | | 0.68 | Apr-06 to Oct-17 | T: 2006-09<br>A: 2011-17 | 3 | Retain | Production well located east of the Howard Mountain Site, water supply to the Downeast Correctional Facility and alternate water supply identified in the Bucks Harbor Decision Document |
| Miller Mountain | DW-22 | No | 1202 Port Road | 018-040-000 | Boundary | 1 | VOCs | | | X | | 0.10 J | Jul-06 to Oct-15 | A: 2006-09<br>A: 2015 | 2 | Retain | Domestic well located south-southwest of the Miller Mountain Site. |
| | DW-23 | Yes | 1208 Port Road | 018-041-000 | Source | 2 | VOCs and MNA Parameters | | | X | | 1.8 | Apr-06 to Oct-17 | T: 2006-08<br>S: 2009<br>T: 2010<br>A: 2016-17 | 2 | Retain | Domestic well located south-southwest of the Miller Mountain Site. |
| | DW-24 | No | 1234 Port Road | 018-042-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | A: 2006-11<br>A: 2016-17 | 3 | Retain | Domestic well located south-southwest of the Miller Mountain Site. |
| | DW-28 | No | 11 Smalls Point Road | 018-038-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | A: 2006-11<br>A: 2016-17 | 3 | Retain | Domestic well located south-southwest of the Miller Mountain Site. |
| | DW-29 | No | 1 Gator Road | 010-015-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | 2006<br>A: 2008-11<br>A: 2016-17 | 3 | Retain | Domestic well located south-southwest of the Miller Mountain Site. |
| | DW-31 | No | 48 Gator Road | 010-018-000 | Source | 1 | VOCs | | | X | | 6.00 | Apr-06 to Oct-17 | B: 2006-08<br>A: 2009-12<br>A:2016-17 | 2 (formerly 3) | Retain | Domestic well located south of the Miller Mountain Site which had recent (2017) increase in TCE concentration (from approximately 0.8 to 6 ppb). |
| | DW-32 | No | 1196 Port Road | 018-039-001 | Boundary | 1 | VOCs | | | X | | 0.18 J | Jul-06 to Oct-17 | A: 2006-11<br>A: 2016-17 | 2 | Retain | Domestic well located south-southwest of the Miller Mountain Site. |

Table 3
Domestic Well and Supply Well
Long Term Monitoring Plan

| Location | Residential (DW) or Public Supply (PW) Well Location ID | POET Attached | Street Address | Map-Book-Lot | Monitoring Source or Boundary Well | Number of Sampling Points (see notes) | Analyses | Maximum Concentration | | | | | Period of Results Summarized | Frequency | LUC Zone | Status in LTMP | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | > MCL | < MCL and >$^1/_2$ MCL | <$^1/_2$ MCL and > ND | Non-Detect | Max Conc (µg/L) | | | | | |
| Miller Mountain | DW-34 | No | 1237 Port Road | 010-022-001 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | A: 2006-11<br>A: 2016-17 | > 3 | Retain | Domestic well located south of the Miller Mountain Site. |
| | DW-39 | No | 1047 Port Road | 007-035-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | A: 2006-11<br>A: 2016-17 | > 3 | Retain | Domestic well located north of the Miller Mountain Site. |
| | DW-40 | No | 1124 Port Road | 010-005-000 | Boundary | 1 | VOCs | | | | X | 0.50 U | Jul-06 to Oct-17 | A: 2006-17 | 3 | Retain | Domestic well located east-southeast of the Miller Mountain Site. |
| | DW-43 | No | 1170 Port Road | 018-001-000 | Source | 1 | VOCs | | | X | | 2.1 | Jul-10 to Oct-17 | A: 2010-17 | 2 | Retain | Domestic well located southeast of the Miller Mountain Site. |
| | DW-54 | No | 120 Indian Cove Road | 010-004-001 | TBD | 1 | VOCs | | | | | TBD | Not yet sampled | Proposed annual | 3 | Add | Domestic well located east of the Miller Mountain Site. Recommend adding this location as this is a sub-parcel within lot 010-004-000 (within the ICZ) which has not been |
| | DW-55 | No | Indian Cove Road | 010-004-003 | TBD | 1 | VOCs | | | | | TBD | Not yet sampled | Proposed annual | 3 | Add | Domestic well located east of the Miller Mountain Site. Recommend adding location as this is a sub-parcel within lot 010-004-000 (within the ICZ) which has not been previously sampled. This is new construction; building |

Notes:
1) DW indicates domestic well.
2) Locations with POETs were sampled at multiple locations including (inlet → mid-point) for single cartridge systems and (inlet → mid-point → 2nd mid-point) for two cartridge systems.
3) Sampling frequency (A) annual, (S) semi-annual, and (T) triannual.

**Table 4A**
**Analysis Method and Project Data Quality Objectives for VOC Analysis**
**Bucks Harbor Former Air Force Radar Tracking Station and Ground/Air Transmitter/Receiver Site**
**Machiasport, Maine**

| VOCs | CAS No. | MCL | RAGs[1] | Sensitivity | | | Accuracy | Precision | Field Duplicate RPD | Project Completeness[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Methods: EPA 5030B (preservation) & 524.2 | | Regulatory Criteria | Guidance Criteria | Lab LOQ[3] | Lab LOD | Lab MDL | LCS /MS / MSD | LCS / LCSD MS/ MSD/DUP | FD | |
| | | µg/L | µg/L | µg/L | µg/L | µg/L | (%R) | (%RPD) | (%RPD) | % |
| **Volatile Organic Compounds - Project-Specific List** | | | | | | | | | | |
| Benzene | 71-43-2 | 5 | 4.6 | 0.5 | 0.2 | 0.08 | 70 - 130 | 20 | 30 | 95% |
| Bromobenzene | 108-86-1 | NA[4] | 62 | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| Bromochloromethane | 74-97-5 | NA | 83 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| Bromodichloromethane | 75-27-4 | 80 | 1.3 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| Bromoform | 75-25-2 | 80 | 33 | 0.5 | 0.3 | 0.3 | 70 - 130 | 20 | 30 | 95% |
| Bromomethane | 74-83-9 | NA | 7.6 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| n-Butylbenzene | 104-51-8 | NA | 1,000 | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| sec-Butylbenzene | 135-98-8 | NA | 2,000 | 0.5 | 0.2 | 0.08 | 70 - 130 | 20 | 30 | 95% |
| tert-Butylbenzene | 98-06-6 | NA | NA | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| Carbon Tetrachloride | 56-23-5 | 5 | 4.6 | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| Chlorobenzene | 108-90-7 | 100 | 78 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| Chloroethane | 75-00-3 | NA | 21,000 | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| Chloroform | 67-66-3 | NA | 2.2 | 0.5 | 0.2 | 0.09 | 70 - 130 | 20 | 30 | 95% |
| Chloromethane | 74-87-3 | NA | 190 | 1 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| 2-Chlorotoluene | 95-49-8 | NA | 240 | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| 4-Chlorotoluene | 106-43-4 | NA | 250 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| Dibromochloromethane | 124-48-1 | NA | 8.7 | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| 1,2-Dibromo-3-chloropropane | 96-12-8 | 0.2 | 0.0033 | 0.2 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| 1,2-Dibromoethane (EDB) | 106-93-4 | NA | 0.075 | 0.5 | 0.2 | 0.09 | 70 - 130 | 20 | 30 | 95% |
| Dibromomethane | 74-95-3 | NA | 8.3 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| 1,2-Dichlorobenzene | 95-50-1 | 600 | 300 | 0.5 | 0.2 | 0.05 | 70 - 130 | 20 | 30 | 95% |
| 1,3-Dichlorobenzene | 541-73-1 | NA | 300 | 0.5 | 0.2 | 0.04 | 70 - 130 | 20 | 30 | 95% |
| 1,4-Dichlorobenzene | 106-46-7 | 75 | 4.8 | 0.5 | 0.2 | 0.04 | 70 - 130 | 20 | 30 | 95% |
| Dichlorodifluoromethane | 75-71-8 | NA | 200 | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| 1,1-Dichloroethane | 75-34-3 | NA | 28 | 0.5 | 0.2 | 0.08 | 70 - 130 | 20 | 30 | 95% |
| 1,2-Dichloroethane | 107-06-2 | 5 | 1.7 | 0.5 | 0.2 | 0.09 | 70 - 130 | 20 | 30 | 95% |
| 1,1-Dichloroethene | 75-35-4 | 7 | 290 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| cis-1,2-Dichloroethene | 156-59-2 | 70 | 35 | 0.5 | 0.2 | 0.09 | 70 - 130 | 20 | 30 | 95% |
| trans-1,2-Dichloroethene | 156-60-5 | 100 | 300 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| 1,2-Dichloropropane | 78-87-5 | 5 | 8.3 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| 1,3-Dichloropropane | 142-28-9 | NA | 370 | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| 2,2-Dichloropropane | 594-20-7 | NA | NA | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| 1,1-Dichloropropene | 563-58-6 | NA | NA | 0.5 | 0.2 | 0.08 | 70 - 130 | 20 | 30 | 95% |
| cis-1,3-Dichloropropene | 10061-01-5 | NA | 4.7 | 0.4 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| trans-1,3-Dichloropropene | 10061-02-6 | NA | 4.7 | 0.4 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| Ethylbenzene | 100-41-4 | 700 | 15 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| Hexachlorobutadiene | 87-68-3 | NA | 1.4 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| Isopropylbenzene | 98-82-8 | NA | NA | 0.5 | 0.2 | 0.05 | 70 - 130 | 20 | 30 | 95% |
| 4-Isopropyltoluene | 99-87-6 | NA | NA | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| Methylene Chloride | 75-09-2 | NA | 110 | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| Methyl-tert-butyl ether | 1634-04-4 | 35 | 140 | 0.5 | 0.2 | 0.07 | 70 - 130 | 20 | 30 | 95% |
| Naphthalene | 91-20-3 | NA | 1.7 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| n-Propylbenzene | 103-65-1 | NA | 660 | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |

**Table 4A**
**Analysis Method and Data Quality Objectives**
**Bucks Harbor Former Air Force Radar Tracking Station and Ground/Air Transmitter/Receiver Site**
**Machiasport, Maine**

| VOCs | CAS No. | MCL | RAGs[1] | Sensitivity | | | Accuracy | Precision | Field Duplicate RPD | Project Completeness[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| Methods: EPA 5030B (preservation) & 524.2 | | Regulatory Criteria | Guidance Criteria | Lab LOQ[3] | Lab LOD | Lab MDL | LCS /MS / MSD | LCS / LCSD MS/ MSD/DUP | FD | |
| | | µg/L | µg/L | µg/L | µg/L | µg/L | (%R) | (%RPD) | (%RPD) | % |
| Styrene | 100-42-5 | 100 | 1,200 | 0.5 | 0.2 | 0.05 | 70 - 130 | 20 | 30 | 95% |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | NA | 5.7 | 0.5 | 0.2 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | NA | 0.76 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| Tetrachloroethene | 127-18-4 | 5 | 41 | 0.5 | 0.2 | 0.08 | 70 - 130 | 20 | 30 | 95% |
| Toluene | 108-88-3 | 1000 | 1,100 | 0.5 | 0.2 | 0.04 | 70 - 130 | 20 | 30 | 95% |
| 1,2,3-Trichlorobenzene | 87-61-6 | NA | 7.0 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| 1,2,4-Trichlorobenzene | 120-82-1 | NA | 4.0 | 0.5 | 0.2 | 0.09 | 70 - 130 | 20 | 30 | 95% |
| 1,1,1-Trichloroethane | 71-55-6 | 200 | 8,000 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| 1,1,2-Trichloroethane | 79-00-5 | 5 | 0.42 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| Trichloroethene | 79-01-6 | 5 | 2.8 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| Trichlorofluoromethane | 75-69-4 | NA | 5,200 | 0.5 | 0.2 | 0.08 | 70 - 130 | 20 | 30 | 95% |
| 1,2,3-Trichloropropane | 96-18-4 | NA | 0.0075 | 0.5 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| 1,2,4-Trimethylbenzene | 95-63-6 | NA | 56 | 0.5 | 0.2 | 0.05 | 70 - 130 | 20 | 30 | 95% |
| 1,3,5-Trimethylbenzene | 108-67-8 | NA | 60 | 0.5 | 0.2 | 0.06 | 70 - 130 | 20 | 30 | 95% |
| Vinyl chloride | 75-01-4 | 2 | 0.19 | 0.2 | 0.2 | 0.1 | 70 - 130 | 20 | 30 | 95% |
| o-Xylene | 95-47-6 | 10000 | 190 | 0.5 | 0.2 | 0.05 | 70 - 130 | 20 | 30 | 95% |
| m,p-Xylene | 108-38-3/106-42-3 | 10000 | 190 | 0.5 | 0.04 | 0.2 | 70 - 130 | 20 | 30 | 95% |
| **Volatile Organic Compound 524.2 Surrogates** | | | | | | | | | | |
| 4-Bromofluorobenzene | 460-00-4 | | %R 70 – 130% | | | | | | | |
| 1,2-Dichlorobenzene-d4 | 2199-69-1 | | %R 70 – 130% | | | | | | | |

LOQ = Limit of Quantitation
LOD = Limit of Detection
MDL = Minimum Detection Limit

MCL = Maximum Contaminant Level
MEG = Maximum Exposure Guideline (Maine)

LCS = Laboratory Control Sample
MS = Matrix Spike
MSD = Matrix Spike Duplicate

%R = percent Recovery
RPD = relative percent difference

Notes:
[1] Maine Remedial Action Guidelines (RAGs), effective October 19, 2018.
[2] Project completeness is < 100% due to potential field sampling issues and human error in field and/or lab. Completeness will be calculated by ARA to assess data gaps, as necessary.
[3]LOQs are current as of September 2017 for current project laboratory. Values below the LOQ will reported as estimated (J). Lab MDLs may vary during the course of the monitoring project as they are periodically updated by the laboratory. Limit of Detections (LODs) are verified quarterly. The current 524.2 LODs are based on the lowest point in the calibration curve. The information provided in this table is subject to change at any time as it is laboratory dependent.
[4]NA indicates there is no MEG and/or MCL for that compound.
[5] Standard for Total Xylene (o- and m,p-)

**Table 4b**
**Analysis Method and Data Quality Objectives**
**Bucks Harbor Former Air Force Radar Tracking Station and Ground/Air Transmitter/Receiver Site**
**Machiasport, Maine**

| MNA Parameters | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MNA Parameters** | **CAS No.** | **Lab LOQ [3]** | **Lab MDL** | **LCS/MS/MSD Accuracy** | **LCS/MS/MSD/DUP Precision** MS/MSD | **Duplicate Precision** FD | **Project Completeness[2]** |
| | | | | **(%R)** | **(%RPD)** | **(%RPD)** | **%** |
| Nitrate by 300.0 | 14797-55-8 | 0.1 mg/L | 0.011 mg/L | 90-110 | 10 | 30 | 95% |
| Sulfate by 300.0 | 18785-72-3 | 0.5 mg/L | 0.146 mg/L | 90-110 | 10 | 30 | 95% |
| Chloride by 300.0 | 16887-00-6 | 0.5 mg/L | 0.020 mg/L | 90-110 | 10 | 30 | 95% |
| TOC by SM5310C | 7440-44-0 | 1.0 mg/L | 0.300 mg/L | 85-115/75-125 | 20 | 30 | 95% |
| Methane by 8015Modified | 74-82-8 | 10 µ/L | 1.1 µg/L | 75-125 | 20 | 30 | 95% |
| Ethane by 8015Modified | 74-84-0 | 20 µ/L | 1.2 µg/L | 75-125 | 20 | 30 | 95% |
| Ethene by 8015Modified | 74-85-1 | 20 µ/L | 1.1 µg/L | 75-125 | 20 | 30 | 95% |
| Alkalinity by SM2320B | 471-34-1 | 5 mg/L | 0.47 mg/L | 90-110 (for LCS) | 10 | 30 | 95% |
| Arsenic by SW3005A6020A | 7440-38-2 | 0.005 mg/L | 0.00035 mg/L | 80-120/75-125 | 20 | 30 | 95% |
| Iron by SW3005A6020A | 7439-89-6 | 0.05mg/L | 0.00323 mg/L | 80-120/75-125 | 20 | 30 | 95% |
| Manganese by SW3005A6020A | 7439-96-5 | 0.01mg/L | 0.005 mg/L | 80-120/75-125 | 20 | 30 | 95% |
| Ferrous Iron by SM3500 Fe B | 15438-31-0 | 0.1 mg/L | 0.03 mg/L | 90-110 LCS MS/MSD | 10 | 30 | 95% |

LOQ = Limit of Quantitation
LOD = Limit of Detection
MDL = Minimum Detection Limit

LCS = Laboratory Control Sample
MS = Matrix Spike
MSD = Matrix Spike Duplicate

%R = percnet Recovery
RPD = relative percent difference

Notes:
[1] Maine Maximum Exposure Guideline (MEG), revised December 31, 2016.
[2] Project completeness is < 100% due to potential field sampling issues and human error in field and/or lab. Completeness will be calculated by ARA to assess data gaps, as necessary.
[3]LOQs are current as of September 2017 for current project laboratory. Values below the LOQ will reported as estimated (J). Lab MDLs may vary during the course of the monitoring project as they are periodically updated by the laboratory. Limit of Detections (LODs) are verified quarterly. The information provided in this table is subject to change at any time as it is laboratory