

DRAFT Pre-Design  
Investigation Work Plan  
Former Aerovox Facility  
New Bedford, Massachusetts

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Prepared for  
AVX Corporation  
Fountain Inn, South Carolina  
August 10, 2018  
Revised April xx, 2019

DRAFT Pre-Design Investigation Work Plan  
Former Aerovox Facility MCP/21E Site  
New Bedford, Massachusetts

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Prepared for  
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April xx, 2019

Project Number: 152448

DRAFT



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# Table of Contents

List of Figures .....	iii
List of Tables .....	iii
List of Abbreviations .....	i
1. Introduction.....	1-1
1.1 Site Description .....	1-1
1.1.1 Site History .....	1-2
1.2 Site Hydrogeology.....	1-3
1.3 Purpose and Objectives .....	1-4
2. Scope of Work.....	2-1
2.1 Access.....	2-1
2.2 Underground Utilities .....	2-1
2.2.1 Utility Company Mark-outs.....	2-1
2.2.2 Field Mark-out by Surveyor of Known Utility Locations and Mean High Water .....	2-1
2.3 Operable Unit 1 – Titleist Area Assessment.....	2-2
2.4 Operable Unit 2 – Precix Area Assessment.....	2-2
2.5 Operable Unit 3/4 – Aerovox Assessment .....	2-2
2.5.1 Geotechnical Evaluation.....	2-3
2.5.2 Hydraulic Barrier Evaluation.....	2-3
2.5.2.1 Bench-Scale Testing .....	2-3
2.5.2.2 Corrosivity Testing.....	2-4
2.5.2.3 Test Pits .....	2-4
2.5.3 Waste Characterization .....	2-4
2.5.4 Bedrock Characterization .....	2-4
3. Methods and Procedures.....	3-1
3.1 Health and Safety Plan .....	3-1
3.2 Construction Mobilization and Site Preparation .....	3-1
3.2.1 Site Operations Management .....	3-1
3.2.2 Utility Mark Out.....	3-2
3.2.3 Potable Water Access .....	3-2
3.3 Surveying.....	3-2
3.4 Identification of Boring Locations .....	3-2
3.5 Time Series Groundwater Sampling at MW-34B .....	3-2
3.6 Drilling and Soil Sampling Methods.....	3-3
3.6.1 Geotechnical Investigation .....	3-3
3.6.1.1 Geotechnical Samples.....	3-3
3.6.1.2 Hydraulic Conductivity Sample Collection .....	3-4
3.6.2 Overburden Drilling.....	3-4

3.6.3	Bedrock Characterization Drilling .....	3-5
3.6.4	Decontamination.....	3-6
3.7	Waste Management.....	3-7
3.7.1	General Investigation Derived Waste .....	3-7
3.7.1.1	Waste Characterization Sample Collection .....	3-7
3.7.2	Groundwater and Construction Wastewater .....	3-8
3.8	Well Profiling Methods .....	3-8
3.8.1	Vertical Bedrock Contaminant Profiling.....	3-8
3.8.2	Transmissivity and Hydraulic Head Profiling .....	3-9
3.8.3	Geophysical Borehole Logging .....	3-9
3.8.4	Water Level Monitoring.....	3-9
3.9	Additional Studies .....	3-9
3.9.1	Test Pitting.....	3-9
3.9.2	Corrosion Study.....	3-10
3.9.3	Treatment of Excavation Dewatering Fluids.....	3-10
3.10	Sampling and Analysis QA/QC .....	3-10
4.	Schedule .....	4-1
	Appendix A: PDI Implementation Schedule .....	A-1



## List of Figures

---

Figure 1 – Site Location Plan

Figure 2 – Site Plan Showing Pilot Study Locations

Figure 3 – Proposed PRB Pilot Test Layout

Figure 4 – Overburden ISCO Pilot Test Layout

Figure 5 – Bedrock ISCO Pilot Test Layout

Figure 6 – Proposed Geotechnical Boring Locations: Titleist Property

Figure 7 – Proposed Geotechnical Boring Locations: PRB Alignment

Figure 8 – Proposed Geotechnical Boring Locations: Hydraulic Barrier

Figure 9 – Proposed Bedrock Characterization Well Locations

## List of Tables

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Table 1 – Summary of Geotechnical, Waste Characterization and Chemical Characterization Data Collection

Table 2 – Hydraulic Barrier Bench Scale Composition Matrix

Table 3 – Proposed Well Construction Details

## List of Abbreviations

ASTs	Aboveground Storage Tanks	MHW	Mean High Water
AVX	AVX Corporation	MFR	Modified Fenton's Reaction
BC	Brown and Caldwell	mg/kg	milligram per kilogram
bgs	Below Ground Surface	NOD	Natural Oxidant Demand
CFR	Code of Federal Regulations	NPDES	National Pollutant Discharge Elimination System
COCs	Compounds of Concern	NTCRA	Non-Time-Critical Removal Action
CNB	City of New Bedford	ORP	Oxidation Reduction Potential
CSA	Comprehensive Site Assessment	OSHA	Occupational Safety and Health Administration
CVOCs	Chlorinated Volatile Organic Compounds	PCE	Tetrachloroethene
cy	cubic yards	PDI	Pre-Design Investigation
DOIE	Department of Infrastructure Engineering	PID	Photoionization Detector
DNAPL	Dense Non-Aqueous Phase Liquid	PPE	Personal Protective Equipment
eV	Electro Voltage	POTW	Publicly Owned Treatment Works
FACT	FLUTe™ Activated Carbon Technique	PRB	Permeable Reactive Barrier
FLUTe™	Flexible Liner Underground Technology	RAP	Remedial Action Plan
ft.	Feet	RGP	Remediation General Permit
GAC	Granular Activated Carbon	ROW	Right of Way
gpd	gallons per day	SPT	Standard Penetration Test
HASP	Health and Safety Plan	SVOCs	Semi-Volatile Organic Compounds
HSA	Hollow Stem Auger	TCE	Trichloroethene
ID	Inner Diameter	TCLP	Toxicity Characteristic Leaching Procedure
IDW	Investigation Derived Waste	USEPA	United States Environmental Protection Agency
IRA	Immediate Response Action	USCS	Unified Soil Classification System
ISCO	In Situ Chemical Oxidation	USGS	United States Geologic Survey
LCS	Lab Control Sample	VOCs	Volatile Organic Compounds
MassDEP	Massachusetts Department of Environmental Protection	ZVI	Zero Valent Iron
MDL	Method Detection Limit		
MCP	Massachusetts Contingency Plan		

## Section 1

# Introduction

This Work Plan has been prepared by Brown and Caldwell (BC) on behalf of AVX Corporation (AVX) for the former Aerovox Facility MCP/21E site. The former Aerovox Facility (the Property) is located at 740 Belleville Avenue, Bristol County, New Bedford, Massachusetts, where site assessment and remediation is being conducted under Massachusetts General Law Chapter 21E and the Massachusetts Contingency Plan (MCP). The Property is owned by the City of New Bedford. The former Aerovox Facility MCP Site (Aerovox Site, Site or Disposal Site) encompasses the Property and portions of adjacent properties and is assigned Release Tracking Number (RTN) 4-601.

Assessment and remediation of the Site is also subject to the June 3, 2010 Administrative Consent Order and Notice of Responsibility (identified as ACO-SE-09-3P-016 and referred to herein as the ACO) and associated modifications, between AVX and the Massachusetts Department of Environmental Protection (MassDEP) and Massachusetts Office of the Attorney General. In addition to the ACO, work at the Site is subject to the Administrative Order on Consent (AOC) between the United States Environmental Protection Agency (USEPA) and AVX, and the Cooperation and Settlement Agreement between the City of New Bedford and AVX. The effective date of these documents is also June 3, 2010.

## 1.1 Site Description

The Property is located at 740 Belleville Avenue, Bristol County, New Bedford, Massachusetts (the Property). Figure 1 provides the location of the Site on the United States Geological Survey (USGS) topographic map for New Bedford, Massachusetts. The coordinates of the Site (referenced to the corner of Belleville Avenue and Hadley Street) are latitude 41° 40' 25.12" N and longitude 70° 55' 13.84" W (UTM coordinates 340135.53m E and 4615326.34m N).

The Property was formerly occupied by a 2- to 3-story, 450,000-square foot brick and wood manufacturing building, associated ancillary buildings, asphalt paved parking lot and several small landscaped areas. Ancillary structures included a brick boiler house that was attached to the south side of the main building; a brick sewer pump station located south of the main building; a pump station located along the Acushnet River (the river) shoreline; and, a brick electrical switching equipment building located near the southwest corner of the main building along Hadley Street. All facility infrastructures on the Property were demolished and removed in 2011 as part of a Non-Time-Critical Removal Action (NTCRA) and pursuant to the USEPA AOC. After demolition of the buildings, an asphalt cap was integrated with the existing hydraulic asphalt concrete (HAC) cap and installed across the Property, except for the northwest corner. This area was not impacted and left as a green space for public use.

Industrial properties are present to the south and north of the Property, and residences are located to the west, across Belleville Avenue. The river borders the eastern end of the Property. The Acushnet River and the area below Mean High Water (MHW) east of the Site is part of the New Bedford Harbor Superfund Site.

The MCP defines the Disposal Site as "...any structure, well, pit, pond, lagoon, impoundment, ditch, landfill or other place or area, excluding ambient air or surface water, where uncontrolled oil and/or hazardous material have come to be located as a result of any spilling, leaking, pouring, abandoning, emitting, emptying, discharging, injecting, escaping, leaching, dumping, discarding or otherwise

disposing of such oil and/or hazardous material.” The current Disposal Site boundaries, as defined by the MCP are identified as follows:

- The eastern Disposal Site boundary remains unchanged from the ACO definition and is the existing sheet pile wall (inclusive of the wall itself) running generally in a north-south orientation along the river, and the line formed by the elevation of MHW where the sheet pile wall is not present.
- The western Disposal Site boundary is approximately 115 feet east of and parallel to the western property line along Belleville Avenue.
- The northern Disposal Site boundary extends northeast from the western Disposal Site boundary across the northern abutting property occupied by Precix, Inc. (744 Belleville Avenue) and onto the former Coyne Industrial Laundry property (20 Howard Avenue). Approximately 125 feet north of the Precix Property line, the Disposal Site Boundary turns east, extending to the river. The northern extent of the Site boundary is based solely on the limits of groundwater impacts.
- The southern Disposal Site boundary extends southeast from the western Disposal Site boundary, across the Titleist property (700 Belleville Avenue) to a point approximately 265 feet south of the southern Aerovox property boundary, then turns northeast paralleling the shoreline until it intersects with the eastern property line. The southern extent of the Site boundary is based solely on the limits of groundwater impacts.

### 1.1.1 Site History

Electrical component manufacturing began at the Facility in approximately 1938. Use of PCB containing dielectric fluid in capacitor manufacturing started in the 1940s and was terminated in 1978. Dielectric fluids were stored in above ground storage tanks (ASTs) throughout the building, but mainly in the first floor of the two-story section of the main building. Delivery of PCB stock for use in manufacturing occurred primarily through fill pipes along the north wall of the former building.

Aerovox also used solvents in the manufacturing process, including trichloroethene (TCE). The TCE was used in a capacitor degreasing operation and was stored in an AST located in the second floor of the two-story building, just outside of the Impregnation Room. The TCE solvent recovery system ASTs were located in the first floor of the three-story building, and degreasing residues were stored in 55-gallon drums on a concrete floor. Delivery of chlorinated solvent stock for use in the manufacturing process occurred primarily through fill pipes along the north wall of the former building. Note that the Precix facility on the northern abutting property also historically used TCE for manufacturing operations. The TCE used by Precix was stored in an outdoor AST located directly north of the location of the former Aerovox ASTs.

The use of PCBs in the manufacturing process ceased around October 1978; however, the use of solvents is thought to have continued through the end of manufacturing operations at the facility which closed in 2001. Operations and disposal practices involving the use of PCBs and solvents reportedly resulted in the release of hazardous materials. Records indicate that EPA observed “oil impregnated soil...in the culverts leading to and at both outfalls” during a 1981 compliance inspection of the facility. Culvert, as used here by EPA is believed to refer to the open drainage trenches that were adjacent to and ran parallel to the north and south sides of the three-story section of the building. In addition to the oily soils observed in the drainage trenches, EPA observed oily soils in the “backyard power substation” located between the former Aerovox building and the river.

Subsequent facility inspections, assessments and sampling programs were undertaken by the former owner and operator, Aerovox, Inc., as well as by EPA from the 1980s through 2010. These investigations confirmed the presence of PCBs in building materials, soils under the concrete foundation and outside the building, in the asphalt used to pave the parking lot, in groundwater, and in sediments within the

adjacent Acushnet River (i.e., the New Bedford Harbor Superfund site). These investigations also confirmed the presence of chlorinated solvents in soil and groundwater. All facility infrastructures on the Property were demolished and removed in 2011 as part of a NTCRA and pursuant to the EPA AOC.

After completion of the NTCRA and receipt of EPA's approval of the NTCRA Final Report, the MCP/21E process was initiated under the MCP with completion and submittal of a Phase I Initial Site Investigation (Phase I ISI), Tier Classification, and Phase II Scope of Work in August 2013. Phase II Investigations were completed between October 2013 and August 2015, to evaluate subsurface geological and hydrogeological conditions and define the nature and extent of contamination at the Site. The Phase II Comprehensive Site Assessment (CSA) confirmed soil and groundwater contaminants of concern (COCs) at the Disposal Site to be PCBs and chlorinated volatile organic compounds (CVOCs), including chlorinated benzenes and chlorinated ethenes. Both the PCBs and chlorinated benzenes were components of the dielectric fluid used in capacitor manufacturing, and the chlorinated ethenes are due to the use of TCE (and to a lesser extent tetrachloroethene (PCE)) as a solvent, and the reductive dichlorination breakdown (daughter) products of PCE and TCE. Dense Non-aqueous Phase Liquid (DNAPL) was identified in two monitoring wells (MW-15B/MW-15D) in the northeast corner of the Property. The presence of DNAPL constitutes an Immediate Response Action (IRA) MCP reporting condition, and DNAPL recovery activities are ongoing as part of the IRA.

A Remedial Action Plan (RAP), revised RAP, and RAP Addendum were submitted to MassDEP in 2016, 2017 and 2019, respectively. The Revised RAP identified four Operable Units (OUs) on the site, include the east end of the Titleist property (OU1), the Precix property (OU2), and the Aerovox Property Overburden soil and groundwater (OU3) and Bedrock groundwater (OU4). The Phase III RAP concluded with the selection of the following comprehensive remedial action:

OU	Property	Description	Selected Remedy
1	Titleist	Impacted shallow uncapped soils	Soil excavation and consolidation
2	Precix	Vapor intrusion mitigation	Monitoring and natural attenuation
3	Aerovox	Source area	Soil excavation and consolidation, asphalt cap, engineered barrier, vertical barrier, in situ hot spot treatment, and permeable reactive barrier (PRB)
4	Aerovox	Bedrock groundwater	In situ hot spot treatment and natural attenuation

The 2019 RAP Addendum updated the volume of soils to be excavated and consolidated, and provided for off-site disposal of Highly Impacted Soil (as defined in the Addendum); revised the configuration of the consolidation cell to minimize changes to existing site grades; confirmed the media to be used in the PRB; and included provisions for an adaptive site management program to assess and address remedial alternative performance failures, if they were to occur.

## 1.2 Site Hydrogeology

Overburden material on the site consists of two to 10 feet of fill overlying peat, peaty clay, and fine silt in the central to eastern portion of the property at depths of between two to 11 feet below ground surface (bgs) overlying stratified sand and gravel. Till has been identified in several borings between the glacial outwash deposits and the bedrock surface, including MW-20B on the western side of the site, and MW-103D, MW-24B, MW-102D, MW-103, MIP-23, MIP-43, MIP-49, MIP-50E, MIP-53, MIP-54 and MIP-55S. The bedrock has been identified as granitic gneiss and has been observed at depths from four feet bgs in the western part of the Site (SB-2), two to six feet bgs in the center of the Property (SB-1 and SB-12), 45 feet along the northern Property boundary (MW-6B), and 29 feet (MW-103B) to 35 feet bgs (MW-23B) feet along the river.

There are three (3) identified water bearing zones at the Site: shallow overburden, deep overburden, and bedrock. Hydrogeologic conditions of the three zones were evaluated during the drilling and installation of the overburden and bedrock monitoring wells, several rounds of synoptic water level measurements, and a week-long tidal study. Generally, the net flow for all three aquifers is from west to east and towards the Acushnet River. However, the water levels, and thus groundwater flow in all zones are affected by the tidally influenced river level causing flow direction reversals during incoming (high) tide in the three zones. Groundwater flow velocity in the three water bearing zones are estimated to be 100 ft/year, 290 ft/year, and 252 ft/year, respectively.

### 1.3 Purpose and Objectives

The purpose of this PDI is to inform the design of the comprehensive remedial actions for the Site as selected in the Phase III RAP and as modified by the Phase III Addendum. The specific objectives for the work are the following:

- **Titleist Property**
  - Obtain geotechnical data, including standard penetration tests, soil classification, and laboratory analyses for grain size and compaction tests
  - Collect soil samples from the saturated zone for bench scale stabilization testing to meet targeted moisture content requirements for placement within the consolidation cell
  - Collect sufficient, representative data to prepare preliminary design drawings and outline suggested performance-based specifications for the selected remedial action
- **Precix Property**
  - Evaluate the condition and viability of existing soil vapor point locations
  - Evaluate and identify proposed locations for additional soil vapor point locations
  - Evaluate utility and other penetrations, foundation cracks, or other potential locations that may require sealing to protect Precix workers from potential vapor intrusion
  - Utilize the collected data to evaluate the most appropriate and optimal soil vapor point installation methodologies for the remedial action
- **Aerovox Property**
  - Obtain updated survey coordinates and verify existing conditions for the site base plan
  - Obtain geotechnical data, including standard penetration tests, soil classification, and laboratory analyses for grain size and compaction tests
  - Collect soil samples for baseline concentration and waste characterization analyses
  - Collect samples from the saturated zone for bench scale stabilization and soil treatment testing to meet moisture content requirements for placement within the consolidation cell and evaluate transportation and disposal procedures for soils to be shipped off site
  - Obtain soil samples for use in bench scale testing for the evaluation of hydraulic barrier construction materials
  - Identify and evaluate potential obstructions to the proposed PRB and hydraulic barrier alignments
  - Create a more refined bedrock topographic profile along the proposed hydraulic barrier and PRB alignments

- Evaluate water treatment processes using existing site groundwater data to meet National Pollution Discharge Elimination System (NPDES) or Publicly Operated Treatment Works (POTW) permit requirements
- Complete additional bedrock characterization to assist with design of pilot study and full scale In-Situ Chemical Oxidation (ISCO)
- Collect sufficient, representative data to enable preparation of preliminary design drawings and outline suggested performance-based specifications for the selected remedial action

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## Section 2

# Scope of Work

The field investigation program will be performed in a series of mobilizations, as described in the following sections. Refer to Figure 2 for a depiction of the areas of investigation to be included in the PDI.

### 2.1 Access

Access agreements with the property owner (City of New Bedford) and the owners of the north abutting Precix property, and south abutting Acushnet (Titleist) property currently exist. Prior to mobilization, representatives for the three property owners will be contacted to communicate the general schedule and scope of ongoing work.

### 2.2 Underground Utilities

#### 2.2.1 Utility Company Mark-outs

Prior to mobilization to the Site, BC will contact Dig Safe® and the City of New Bedford Department of Public Infrastructure to mark out utilities at the site and surrounding roadways. A separate Dig Safe® Ticket ID is required for each of the properties on which intrusive activities will occur (Aerovox and Titleist). The Dig Safe® service informs the applicable utility companies who then mark their respective utility lines. However, the City of New Bedford does not participate in the Dig Safe system, and a separate call must be made to the City of New Bedford Department of Infrastructure Engineering (DOIE).

Prior to calling Dig Safe® or the City of New Bedford DOIE, the subsurface investigation locations will be marked by BC with white spray paint and/or stakes (tip painted white) as required by law.

#### 2.2.2 Field Mark-out by Surveyor of Known Utility Locations and Mean High Water

A licensed Massachusetts surveying company will field mark the location of known utilities based on the plans entitled *As Built Subsurface Conditions* for the Aerovox NTCRA, 740 Belleville Avenue, New Bedford, MA, Drawing 3A, dated March 6, 2013, and *As-Built Surface Conditions* for the Aerovox NTCRA, 740 Belleville Avenue, New Bedford, MA, Drawing 3B, dated March 7, 2013. The utilities will be marked with spray paint where the ground surface is covered by asphalt pavement and stakes where vegetation is present.

All known utilities present within the boundaries of the former Aerovox property were decommissioned during the 2011 NTCRA. While the utility piping may still be present, no known utilities are active.

The surveyor will also complete an updated base plan survey, including field-marking the elevation of MHW along the Precix and Titleist properties, as well as along the Aerovox property to the north and south of the sheet pile wall. MHW will be marked with PK nails in areas covered by asphalt, with drill holes where concrete is present, and with stakes in vegetated areas. The top of the sheet pile wall and monitoring wells (PVC or steel casing, as applicable) will be surveyed. As part of the design, an elevation survey and field marking will be completed to illustrate Wetland Protection Act defined resource areas including the bank, bank buffer zone and FEMA100-year floodplain. The schedule for this survey and mark-out will be dependent upon EPA's demobilization date.



## 2.3 Operable Unit 1 – Titleist Area Assessment

The selected remedial action components for the Titleist property include excavation and removal of approximately 9,700 cubic yards (cy) of surface soils with concentrations of polychlorinated biphenyls (PCBs) greater than 1 mg/kg, backfill and restoration on the Titleist property, and consolidation of excavated material back to its original source within a consolidation cell to be constructed on the Property. Excavation areas and depths have previously been delineated. The majority of excavation areas are shallow and above the water table, but some excavation cells will require support of the excavation walls based on their depth.

A soil stabilization/geotechnical assessment will be completed including advancement of seven geotechnical borings along the Titleist building foundation and within the excavation footprints for the 5-foot-, 6-foot-, and 7-foot-deep excavation areas to 20 feet bgs. Refer to Figure 6 for the proposed locations for the Titleist geotechnical borings.

After the Site has been marked for Dig Safe® and utilities have been marked by the surveyor, the six geotechnical boring locations on the Titleist property will be pre-cleared with soft digging methods, including hand digging and/or air knife with vacuum soil extraction to a depth of 5-feet bgs. The geotechnical soil borings will be advanced using hollow-stem auger (HSA) drilling techniques. Soil samples will be collected using standard penetration test (SPT) methodology and continuously logged for lithology using the Unified Soil Classification System (USCS). One sample per boring will be submitted to a geotechnical lab for grain size analysis, moisture content, and stabilization testing to meet required consolidation cell criteria.

Refer to Table 1 for a summary of the soil samples to be collected, and Section 3 of this Work Plan for the geotechnical drilling methods and procedures.

## 2.4 Operable Unit 2 – Precix Area Assessment

The Precix property selected remedial action includes monitored natural attenuation of groundwater CVOCs and associated sub-slab soil vapor and indoor air impacts.

A site visit will be scheduled with Precix representatives to complete a walkthrough of the eastern end of the property where groundwater CVOC concentrations are known to exceed the Method 1 GW-2 standards. During the site visit, BC will evaluate the condition of the existing soil vapor points. The exterior road box condition (seal and cover) will be assessed, and the road box cover will be removed to enable evaluation of the fixed soil vapor point. Building operations throughout the east end of the building will be reviewed with Precix representatives to evaluate any changes in use since the existing soil vapor points were installed. A site plan or schematic of the building will be used to note observations of cracks in the foundation, utility penetrations, or other openings with the potential to allow vapor intrusion from beneath the concrete slab. Proposed locations for new soil vapor points will also be annotated on the site plan.

## 2.5 Operable Unit 3/4 – Aerovox Assessment

The selected remedial action for the Property, defined in the Phase III RAP as OU-3 (overburden) and OU-4 (bedrock), includes multiple remedial measures, which collectively comprise the bulk of the work proposed for the Site. A breakdown of the selected full-scale remedial measures for the Aerovox property under the proposed remedial action includes:

- Excavation, off-site disposal and backfill of approximately 4,300 cy of Highly Impacted Soils located adjacent to the shoreline to depths of between 10 feet to 30 feet bgs (an additional 1,200 cy of soils will be excavated during construction of the pilot PRB and disposed off-site, as detailed in the Pilot Study Release Abatement Measure (RAM) Plan)

- Excavation, on-site consolidation, and backfill of approximately 2,500 cy of additional shallow overburden soils located within 25 feet of shoreline to depths of 10 feet to 13 feet bgs
- Construction of an engineered barrier over areas with PCB concentrations greater than 100 milligrams per kilogram (mg/kg)
- Construction of asphalt cap over areas with PCB concentrations greater than 2 mg/kg
- Installation of a vertical hydraulic barrier along the northern and southern sides of the impacted areas
- Installation of a permeable reactive barrier (PRB) along the eastern site boundary approximately 22 feet to 25 feet west of the shoreline (existing sheet pile wall)
- ISCO groundwater treatment in the overburden and bedrock

The scope of work for the Aerovox property PDI is summarized below. Refer to Section 3 of this PDI WP for the methods and procedures to be used in the investigation.

### 2.5.1 Geotechnical Evaluation

The drill rig will be mobilized to the Aerovox Site to complete geotechnical borings needed for the pilot and full-scale PRB design. Up to 15 soil borings will be advanced to bedrock along the alignment of the PRB (Figure 7). The drill rig will subsequently proceed along the hydraulic barrier alignment for additional geotechnical assessment. A total of 21 soil borings will be advanced to the bedrock surface along the hydraulic barrier alignment to create a refined bedrock profile (Figure 8). Of these 21 soil borings, soil samples will be collected from 17, with the remaining 4 drilled until refusal on the bedrock surface only.

All the geotechnical soil borings will be advanced using hollow-stem auger (HSA) drilling techniques. Soil samples will be collected using SPT methodology and logged for lithology using the USCS. Select samples will be submitted to a geotechnical lab (Kemron) for grain size analysis, compaction testing, and stabilization testing to meet moisture content (paint filter) test criteria. Shelby tubes will be used to collect soil samples from the 15 PRB borings for hydraulic conductivity testing. If field conditions limit the use of Shelby tubes, bulk samples may be collected and prepared by laboratory under simulated in-situ conditions. Refer to Table 1 for a summary of the soil sample collection.

The alignments for the proposed PRB and hydraulic barriers will be evaluated for the presence of obstructions by review of known Site utilities and former Site structures. A desktop assessment will be completed to identify potential obstructions prior to advancing the borings in the field.

### 2.5.2 Hydraulic Barrier Evaluation

#### 2.5.2.1 Bench-Scale Testing

To support selection of the most effective, feasible type of hydraulic barrier, samples of the five soil types found at the site (fill, silt, sand, sand and gravel, silty sand) will be collected from four geotechnical soil borings along the hydraulic barrier alignment for completion of a bench scale study to evaluate the use of soil-bentonite and cement-bentonite for potential use in the full-scale design. These tests will evaluate the ultimate bearing strength and permeability of the two types of walls. Each untreated sample will be tested for moisture content (ASTM D2216), Atterberg Limits (ASTM D4318), grain size with hydrometer (ASTM D422), pH (EPA 9045), loss on ignition (ASTM D2974), and soil classification (ASTM D2487). Each of the five soil types will be mixed with varying compositions of Portland cement, fly ash, and bentonite, up to a 20% cement slurry to 80% soil sample mix. A summary of the mixtures to be tested is included as Table 2. Twenty-eight (28) days after preparation, each mixture will be tested for unconfined compressive strength and permeability to assess viability for long term effectiveness.

### 2.5.2.2 Corrosivity Testing

In addition to the slurry wall assessment, a sheet pile barrier option will include a corrosion study along the eastern end of the north and south hydraulic barrier alignments to determine if the saline environment presents a corrosion issue to steel sheet pile materials. This corrosion study will be performed by Corrosion Probe, Inc. and will consist of performing in-situ resistivity testing every 100 feet along the proposed hydraulic barrier alignments. At each location, measurements will be acquired at two depths, and the soil at each depth will be categorized as either very severely corrosive, severely corrosive, moderately corrosive, mildly corrosive, or very mildly corrosive. In addition to the field study, eight soil samples and two groundwater samples will be collected near both ends of each alignment. Each soil sample will be tested for resistivity, water content, pH, alkalinity, acidity, redox potential, chloride, sulfate, and sulfide. Each water sample will be analyzed for pH, anions, total hardness, alkalinity, total dissolved solids and conductivity. If deemed feasible, based on the soils and groundwater corrosivity assessment, corrosion protection strategies for the sheet pile will be developed.

### 2.5.2.3 Test Pits

The alignments for the proposed PRB and hydraulic barriers will be evaluated for the presence of obstructions by review of known site utilities and former site structures. After completion of the initial desktop assessment, test pits will be advanced to the depth of peat (e.g., 9 feet bgs), to assess and characterize the obstructions, as well as to identify additional research or investigation needed to further assess or identify design methods for working around the identified obstructions.

Test pits in the northeast corner will be evaluated for potential off-gassing concerns. Odor-reducing foam will be evaluated (used in previous remedial activities conducted at the site) for reducing off-gassing during construction in the most impacted area of the site. If odor-control foam is unsuccessful in migrating vapors during construction, physical controls such as a sprung structure would likely be required during full-scale excavation activities.

## 2.5.3 Waste Characterization

After completion of the PRB geotechnical borings, two additional soil borings will be advanced between the east side of the pilot study PRB and the existing sheet pile wall for analysis of waste characterization parameters to assist with profiling the material for disposal after pilot-scale installation. These parameters include volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), PCBs, pesticides, herbicides, TAL metals, ignitability, reactivity, corrosivity, full TCLP, and paint filter. The soil borings will be advanced to the peat layer (9 feet bgs). In addition, one deep overburden soil sample will be collected each of these two borings to assess pre-existing conditions prior to PRB construction. The exact soil interval will be selected in the field based on PID measurements, and the samples will be analyzed for CVOCs and PCBs. Refer to Figure 7 for the location of the waste characterization and chemical characterization soil borings. In addition, soil samples for chemical characterization will be collected from the deep overburden in four of the planned PRB geotechnical borings.

## 2.5.4 Bedrock Characterization

Prior to mobilizing drilling equipment to the site, an evaluation was conducted to assess if the concentrations of TCE greater than the UCL encountered in packer and FLUTE port samples from the deeper bedrock well intervals (below approximately 92 ft bgs to 120 ft bgs) at MW-34B are representative of groundwater in the formation or were potentially influenced by the drilling and well installation process. Review of data for monitoring well MW-32B indicates that initial samples from the 135 to 145 ft bgs FLUTE port, collected on July 13, 2015 contained TCE concentrations above the UCL at 51,000 µg/L, whereas the subsequent two samples, collected on August 7, 2015 and April 17, 2017, showed a substantial decrease in the TCE levels, decreasing by an order of magnitude (5,100 µg/L) in

the most recent sample. Similarly, at well MW-33B, packer samples collected during the drilling process from the 232-252 ft bgs interval indicated TCE concentrations of TCE at 22,000 ug/L. Samples from the monitoring well installed to target this interval, screened from 240 to 250 ft bgs, show substantially lower and decreasing concentrations, with the most recent sample containing a TCE concentration of 2,100 ug/L, one order of magnitude less than the concentration in the packer sample. This data indicates the potential that initial samples from these wells were not representative of actual groundwater conditions in the formation but rather represented conditions proximal to the borehole that were still re-equilibrating from disturbances caused by the drilling and well installation process.

BC completed series groundwater sampling on the four FLUTe sample ports at MW-34B, positioned at 60-80 ft bgs, 92-112 ft bgs, 120-130 ft bgs, and 170-180 ft bgs to assess whether concentrations in the ports decrease with time and increasing purge volumes, which would indicate that the data from these ports to-date may overestimate the actual concentrations in the adjacent formation due to disturbances during drilling and FLUTe system installation, similar to what was encountered at MW-32B and MW-33B. The time-series sampling was completed on February 28, 2019 and March 1, 2019 and the results indicated that for MW-34B the concentrations of TCE in groundwater from the FLUTe sampling intervals did not decrease over time with increased purge volumes.

BC will install three (3) 100-foot bedrock characterization wells in the vicinity of MW-26B/MW-33B. Also, bedrock will be characterized to depths up to 250 feet bgs at up to (4) locations in the eastern part of the site in the vicinity of MW-34B, and between MW-26B and MW-34B. These locations are shown on Figure 9. Collection of fracture zone and geophysical data from these newly installed wells will inform the design (location, target fracture zones, injection parameters) for subsequent installation of the pilot test injection and extraction bedrock wells. Approximate locations for the bedrock ISCO injection and extraction wells are depicted on Figure 5; however, the final well locations will be dependent upon the results of the bedrock characterization data from the PDI. The additional bedrock characterization information will also support selection of two or three of the new 100-foot wells in the MW-26B area for retrofitting with multi-port sampling apparatus to facilitate performance monitoring of the ISCO pilot.

After completion of well development activities, the open borehole wells will be lined to minimize vertical cross contamination across the borehole and allow an assessment of the presence of DNAPL in fractures and vertical groundwater concentration profiles upon removal. The liners will be removed prior to completing geophysical borehole logging. At the completion of geophysical logging, the blank liners will be returned to the borehole to create vertical bedrock transmissivity and hydraulic head profiles. The collected data will be evaluated to assist with placement and identification of the wells to be used as part of the bedrock ISCO pilot study (i.e., extraction, injection and monitoring wells), as well as proposed locations for full scale bedrock ISCO remediation. Once the ISCO pilot study extraction, injection and monitoring wells have been identified, the extraction and injection wells will be installed as detailed in the *Plan for Application of Remedial Alternatives* and the identified monitoring wells will be retrofitted with multi-level sampling devices constructed to specification based on the presence of bedrock fractures and interpreted flow patterns.

Refer to Table 3 for a listing of the proposed bedrock wells and construction details.

## Section 3

# Methods and Procedures

This section describes the general methods to be used during implementation of the field work.

### 3.1 Health and Safety Plan

All field activities will be conducted in accordance with the Site-Specific Health and Safety Plan (HASP), dated August 1, 2018. The HASP identifies any potential hazards that may be encountered at the Site during PDI and pilot test implementation and the health and safety practices/measures to protect workers from such hazards. The HASP also identifies any air and dust monitoring requirements to monitor work zone air quality during construction, identify action levels, and establish appropriate response actions. The project specific HASP has been prepared in accordance with general industry (29 Code of Federal Regulations [CFR] 1910) and construction (29 CFR 1926) standards of the Federal Occupational Safety and Health Administration (OSHA), U.S. Department of Labor. The HASP will be updated annually, or sooner if scope of work and investigation activities change from those that are currently described within the HASP.

### 3.2 Construction Mobilization and Site Preparation

#### 3.2.1 Site Operations Management

On site operations will be managed throughout the period of time when pre-design and pilot study work is ongoing. Operations management will include the following:

**Security.** Site access and security will continue to be maintained through the existing system of fencing and gates. Gates will remain locked whenever staff are not on site throughout the duration of the pre-design and pilot study effort. Both Titleist and Precix maintain security measures on their respective properties and access will be arranged in advance with their respective security staff and in accordance with existing access agreements. (Access gate keys for Titleist are held by building security and must be obtained from their security building. Front desk notification at Precix is required prior to entering Precix property.) Site visitors will be managed consistent with HASP protocols.

**Operational zones.** The Aerovox property will be maintained and divided into operational zones consistent with the HASP. The support zone, centered around the existing conex box, has been established outside the floodplain. Equipment and material staging and waste storage (in anticipation of off-site disposal) will be located in this support area to the maximum extent possible. Equipment and material storage further east on the property will be allowed if and only to the extent necessary to accomplish efficient and timely completion of the specific task requiring such materials. Parking for staff and subcontractor vehicles will be limited to the area immediately adjacent to the existing trailer, or to the area along the southern fence line, west of the westernmost gate.

**Hours of Operation.** Normal hours of operation will be 7 AM to 5 PM Monday through Friday. Work outside of these hours may from time to time be necessary in order to take advantage of tide cycles or accommodate contractor availability. Work outside normal hours will be communicated in advance to the City of New Bedford.

**Communication/Coordination.** Project stakeholders (City of New Bedford, MassDEP, USEPA) will be notified in advance of significant mobilization events. Notification to abutting property owners for work



on those properties will be made in accordance with existing access agreements for work on those properties. Based on the level of ongoing work on-site, regular weekly status calls may be established as a courtesy during implementation to keep stakeholders apprised of the status and progress of the investigation and pilot work. Already established coordination procedures with the City of New Bedford for waste profiling and manifest signing will be maintained where off-site shipments are required.

### **3.2.2 Utility Mark Out**

Prior to advancement of the geotechnical borings on the Titleist property, where active subsurface utilities are known to be present, soft digging techniques, including vacuum extraction or hand digging, will be employed to clear the borings to a depth of approximately 5 ft. bgs. Soil samples will be collected from each foot during pre-clearance with a hand auger or post-hole digger for field classification of soil. Care shall be taken to use wet methods if soils are dry to mitigate mobilization of fugitive dust from the work area. Soft dig utility clearance is not anticipated to be necessary for the drilling locations on the Aerovox Property, as all known utilities were decommissioned the time of building demolition in 2011.

### **3.2.3 Potable Water Access**

BC will contact Michele Paul of the City of New Bedford to request approval to use the water hydrant on the northern adjacent property (Precix) as a potable water supply during this work. The fire hydrant is integral to the Precix fire suppression system, which will alarm if the system malfunctions. Therefore, once access is approved through the City of New Bedford, a contact at the Precix facility (to be determined) must be contacted prior to each use of the fire hydrant so that the alarm can be turned off. Immediately upon completing use of the fire hydrant, the Precix contact must again be contacted so that the fire suppression system alarm can be re-activated. Note that Precix employees are not available during the entire field day, as their availability is tied to the Precix work shifts.

## **3.3 Surveying**

All newly installed monitoring wells and soil boring locations will be surveyed by a surveyor licensed in the State of Massachusetts upon completion. All locations will be surveyed at a targeted precision of 0.1 foot referenced to the Massachusetts State Plane coordinate system using the North American Datum of 1983 in units of feet for horizontal locations. Elevations will be referenced to the National American Vertical Datum of 1988 with a targeted precision of 0.01 foot for vertical elevations. Ground surface elevations will be surveyed for monitoring wells and soil borings. Top of casing elevation will also be surveyed for monitoring wells at the north side of the PVC casing.

## **3.4 Identification of Boring Locations**

The PDI boring and monitoring well locations will be measured out in the field relative to other permanent site features using tape measurements. The sampling points will be established in the field using stakes, flags, surveyors paint, or similar methods before the sampling event. The sampling points will be marked clearly and staked securely until such time that the locations are either surveyed or recorded onto a scaled map of the site.

## **3.5 Time Series Groundwater Sampling at MW-34B**

Prior to mobilizing for the drilling portion of the PDI, time-series groundwater sampling was conducted on the four FLUTE sample ports at MW-34B, positioned to sample the following depth intervals: 60-80 ft bgs, 92-112 ft bgs, 120-130 ft bgs, and 170-180 ft bgs (see Section 2.5.4). The initial sample collection included purging each WaterFLUTE sample port four times (equivalent to approximately four gallons of discharge water), allowing the system to recharge after each purge. A sample was then collected from

each sample port (i.e., each depth interval). The system was then allowed to fully recharge following the sample collection, followed by purging an additional four times. Upon recovery from the second round of purging (total of 8 gallons purged), another set of samples was collected from the WaterFLUTE sample ports. This process of purging the systems four times and then collecting samples from each sample port was repeated until six (6) samples were collected from each port. The samples were analyzed for CVOCs. Purge water from each round of purging was containerized in a glass jar, warmed for 10-15 minutes in a vehicle and then agitated for a minimum of 10 seconds prior to collection of a jar headspace reading with a PID.

## 3.6 Drilling and Soil Sampling Methods

Samples will be collected from selected geotechnical borings for laboratory analysis and bench scale studies as discussed below.

### 3.6.1 Geotechnical Investigation

A total of 42 geotechnical borings will be completed by a Certified Massachusetts Well Driller using a Geoprobe 7822DT rig equipped with 4 1/4-inch inner diameter hollow stem augers and a 140-pound auto drop hammer. Geotechnical soil boring locations will be identified using a prefix specific to the type of geotechnical boring followed by a numerical designation beginning with 01 and increasing sequentially. As depicted on Figures 6 through 8, the Titleist geotechnical borings are identified as TB-01 through TB-06; Hydraulic barrier borings are identified as HB-01 through HB-21; and PRB geotechnical borings are identified as PRB-01 through PRB-15.

Unless noted, at each geotechnical soil boring location, standard penetration tests will be completed, and soil samples will be collected using split spoons from the ground surface down to the terminal depth. Blow counts for each 6-inch interval will be recorded in a dedicated field logbook or a soil boring log form (soil boring log), with reference made to the external forms if used. Soils in each split spoon will be field classified by the BC field engineer or geologist using the USCS. Soil classification and other pertinent observations will be recorded in the field logbook or soil boring log. At Hydraulic Barrier borings HB-02, HB-05, HB-07, and HB-16, only blow counts and depth to bedrock will be documented (e.g., no split spoon samples).

#### 3.6.1.1 Geotechnical Samples

Samples from each spoon will be screened in the field using a photo ionization detector (PID) equipped with a 10.6 electrovolt (eV) lamp. PID headspace readings will be collected by placing an aliquot of soil from the split spoon into a Ziploc®-type plastic bag or glass jar with screw-on lid. Soil samples exhibiting visual and/or olfactory signs of contamination be targeted at soil for soil headspace readings. In the absence of such indicators, a representative sample of soil from each split soon will be used. PID headspace readings will be recorded in the field logbook or on the soil boring log.

Soil samples will be collected for geotechnical analyses and bench scale studies as discussed in following sections.

During advancement of the hydraulic barrier, Titleist and PRB geotechnical borings, samples will be collected from each borehole at the depths outlined in Table 1. The geotechnical samples will be submitted to Kemron of Atlanta, Georgia for grain size analyses and compaction (Proctor) testing. In addition, soil samples collected from the Titleist and PRB geotechnical borings within the saturated zone will be submitted to Kemron for stabilization testing to meet moisture content (paint filter). Soil samples from borings HB-12 and PRB-15 will also be collected for treatability and preliminary waste characterization sampling in anticipation of off-site disposal. Chemical characterization samples will be collected from PRB geotechnical borings PRB-3, PRB-5, PRB-9 and PRB-13, and waste characterization borings (WC-PRB-01 and WC-PRB-02, discussed further below) from the one (1)-foot interval with the

highest PID reading at a depth of between the bottom of the peat layer and the bedrock surface and submitted for analysis of CVOCs and total PCBs to provide additional existing conditions analytical data during the geotechnical program.

Upon completion of each borehole, the boreholes will be sealed by the Well Driller using a bentonite-cement grout to minimize the potential for vertical cross contamination subsequent to completion of the borehole. The grout will be placed using a pump and tremie pipe. Once the grout has cured, the borehole will be finished at the ground surface according to the surrounding material.

The drilling rig will be set up and operated in accordance with standard drilling practices and in a manner that will promote the safe and efficient operation of the equipment. The project driller will be a certified test borer and Massachusetts-licensed well driller. Safety considerations during equipment operation are addressed in the site-specific HASP.

The equipment used in the drilling operations will be steam cleaned upon arrival at the site. The equipment and tools that come in contact with soil during drilling will be decontaminated before resampling, before moving to the next drilling location, or before leaving the project site. A source of water to be used for decontamination is summarized in Section 3.2.3. Decontamination procedures are described in Section 3.6.4.

#### **3.6.1.2 Hydraulic Conductivity Sample Collection**

Shelby tube soil samples will be collected from selected boring locations across the PRB alignment during geotechnical drilling. The depth at which collection of Shelby tube samples will be attempted is based on geological information obtained during prior site investigations. The Shelby tubes will be properly sealed upon collection and submitted to Kemron of Atlanta, Georgia for hydraulic conductivity analysis to evaluate the variability in hydraulic conductivity along the shoreline excavation. If field conditions limit the use of Shelby tubes, bulk samples may be collected and prepared by laboratory under simulated in-situ conditions.

### **3.6.2 Overburden Drilling**

A total of seven (7) intermediate (below the peat) overburden and nine (9) deep overburden monitoring wells will be installed during PDI field activities. Three (3) of the deep overburden wells will be used for monitoring the ISCO overburden pilot study, and the remaining shallow and deep overburden wells will be used to monitor the PRB pilot study. These monitoring wells will be installed using sonic drilling methods. Anticipated locations of these wells are shown on Figures 3 and 4.

The sonic drilling method utilizes high frequency vibration along with down pressure and rotation of the drilling tools to advance the borehole to the desired depth through various subsurface materials. All materials have a natural frequency(ies) at which they will vibrate when they are disturbed. The specific frequency is dependent upon the material properties and length of the object. Sonic energy is applied to the drilling string which causes the subsurface materials at the drill bit to be fractured, sheared, and/or displaced. In addition, the high frequency vibration causes the soil and drill cuttings in contact with the drill bit and drilling casing string to liquefy and to flow away allowing the penetration of the drill string. The drill string is rotated primarily to provide an even distribution of the applied sonic energy, to control bit wear, and to assist in borehole alignment.

The drilling string is typically advanced in a dual tube configuration. A drilling tube tipped with a core sampling tube is advanced into the formation to isolate a soil sample with the core tube. A larger diameter casing is then advanced around the inner sampling core tube to stabilize the borehole while the inner core tube is withdrawn to the surface. The soil sample is then extruded from the core tube for logging by the field geologist. The core tube is then decontaminated, reinserted into the borehole and advanced past the end of the outer casing into the formation to collect another sample interval.



Sonic drilling is normally used for subsurface environmental investigations and is well-suited for projects of a production-oriented nature given its rapid penetration rate. Sonic drilling creates substantially reduced drill cuttings and fluids in comparison to other drilling methods. In addition, the method by its nature, provides the removal of a continuous core, and provides a clean, cased borehole without the use of drilling fluids. This results in increased efficiency in the installation and use of borehole tools, instrumentation, and/or monitoring wells. The ability to cause vibration to the casing string eliminates the complication of the bridging of monitoring well backfill (e.g., filter pack). The clean borehole and lack of added drill fluid additives can also reduce monitoring well development effort. Multiple cased well casings can be used with the sonic method to prevent vertical aquifer cross contamination. Many different types of downhole sampling tools can be utilized in sonic boreholes, for sampling of environmental media and geotechnical testing. Likewise, various environmental and geotechnical installations, e.g., monitoring wells, inclinometers, vibrating wire piezometers, settlement gauges, can be readily constructed in a sonic borehole.

The PRB and ISCO pilot monitoring wells will be installed by initially advancing a 7-inch diameter sonic casing into the peat layer to isolate the soils above the peat layer. A 6-inch sonic casing will be telescoped through the 7-inch casing and drilled to the bedrock surface. The monitoring wells will be constructed with 10' screen intervals, as outlined in Table 3. The wells will be developed by purging a minimum of three (3) well volumes. Monitoring well development purge water will be temporarily containerized in 55-gallon drums or an on-site frac tank pending waste characterization, waste profiling and off-site disposal.

The drilling rig will be set up and operated in accordance with standard drilling practices and in a manner that will promote the safe and efficient operation of the equipment. The project driller will be a certified test borer and Massachusetts-licensed well driller. Safety considerations during equipment operation are addressed in the site-specific HASP.

The equipment used in the drilling operations will be steam cleaned upon arrival at the Site. The equipment and tools that come in contact with soil during drilling will be decontaminated before resampling, before moving to the next drilling location, or before leaving the project site. A source of water to be used for decontamination is summarized in Section 3.2.3. Decontamination procedures are described in Section 3.6.4.

### 3.6.3 Bedrock Characterization Drilling

At up to seven (7) locations, open bedrock borehole wells will be installed using a combination of sonic and air hammer drilling at the approximate locations depicted on Figure 9. Sonic drilling will be used to advance the borehole into the competent bedrock at the overburden/bedrock interface, and air hammer drilling techniques will be used to advance the borehole through the bedrock to the terminal borehole depth.

Three 100-foot bedrock wells will be installed in the approximate locations near MW-26B and MW-33B as identified on Figure 9. The borings will be advanced a minimum of three (3) feet into competent bedrock using an 8- or 9-inch diameter sonic casing. A five-inch diameter permanent casing will be tremie-grouted a minimum of 3-feet into competent bedrock as the sonic casing is withdrawn. The borehole will be advanced using a 4-inch diameter air hammer to the terminal depth of 100 feet bgs.

The remaining four locations for bedrock characterization borings are also shown on Figure 9 and are referenced herein as MW-34B bedrock characterization wells/well locations. The first of these four MW-34B bedrock characterization borings will be conducted to the northeast of MW-34B to further evaluate the level and vertical distribution of TCE in the deeper bedrock interval around MW-34B to confirm if the deeper bedrock will require ISCO treatment and if so, potentially optimize the approach to conducting subsequent deep bedrock borings and the implementation of ISCO in the deep bedrock.

At the first MW-34B bedrock characterization well location, the a 9-inch diameter casing will be set to isolate the overburden above the peat layer from the deeper portions of the borehole. A 7- or 8-inch diameter temporary casing will be driven a minimum of 3 feet into competent bedrock to create a socket for the permanent well casing. The permanent 5-inch casing will then be grouted into place. No sooner than 24-hours following installation of the permanent casing, the 4-inch diameter borehole will then be advanced via air hammering technology in 20-foot increments. During drilling, notes regarding changes in water production from the borehole and drilling rates versus depth will be noted. After each 20-foot increment, the bottom 20 feet of the borehole will be isolated with a packer. Groundwater from the packer-isolated interval will be pumped, and a sample of groundwater from the interval will be collected and submitted for laboratory analysis of CVOCs or analyzed with an on-site calibrated GC/PID. In addition, groundwater from each packer interval will be placed into a glass jar, observed for the presence of DNAPL, agitated for a minimum of 10 seconds, and screened with a PID. After removal of the packer, a weighted string or interface probe will be used to check the borehole for the presence of DNAPL. If indications of potential DNAPL are observed during drilling, the borehole will be terminated, and a second borehole will be advanced immediately adjacent to the first MW-34B bedrock characterization well.

The second well advanced immediately adjacent first MW-34B bedrock characterization well will be drilled using similar drilling techniques. However, the permanent casing will be grouted into place at a depth interval identified to be relatively free of transmissive fractures beneath the terminal depth of the initial borehole (using packer testing or wellbore geophysical logging). No sooner than 24-hours after installation of the permanent casing, drilling will continue using air hammer drilling techniques, packer installation, groundwater collection and analysis until groundwater concentrations in three subsequent packer intervals are below the Method 1 GW-3 standard for TCE (50,000 µg/L) or to a maximum depth of 250 feet bgs, whichever occurs first. If there are no observed indications of DNAPL in the initial MW-34B bedrock characterization well, the initial borehole will be installed to a maximum depth of 250 feet bgs (i.e., only one MW-34B bedrock characterization well will be installed at this location).

Upon completion of each boring, the wells will be developed and lined with a FLUTe liner as described in Section 3.8.1.

Findings from the initial bedrock characterization well location(s) will be used to evaluate whether the data from the deep bedrock intervals of MW-34B are representative of conditions in the formation or if the data were influenced by disturbances during the drilling and well installation process at MW-34B (e.g., vertical water flow within the borehole). In the case of the later, if this evaluation indicates TCE concentrations are below the UCL, additional characterization of the deeper bedrock is not warranted. The depths and drilling procedures used at each of the three subsequent MW-34B bedrock characterization wells will be selected based on the findings of the initial bedrock characterization well(s) drilled northeast of MW-34B.

### 3.6.4 Decontamination

Decontamination for sampling activities will be performed on non-dedicated sampling equipment (e.g., water level meter) and heavy equipment to prevent cross-contamination between investigation locations. When appropriate, dedicated or disposable sampling equipment, such as tubing or disposable pie plates/tin pans, will be used to assist in minimizing cross-contamination issues. After use, the disposable equipment and used personal protective equipment (PPE) will be containerized for off-site disposal at an approved facility.

Decontamination will be performed on-Site, in a designated area, and with appropriate containment of materials. Used sampling equipment (i.e., pumps, water level meters, etc.) will be decontaminated using a five-step process:

- 1) Solid material (soil, sludge, DNAPL) will be removed from the equipment to the extent possible using clean rags or paper towels
- 2) Wash using potable water and low phosphate soap
- 3) Rinse with potable water
- 4) Wipe with a clean rag soaked with a solvent known to remove PCBs (hexane or limonene)
- 5) Rinse with de-ionized or distilled water

Drilling equipment and/or down-hole tooling that contacts the ground surface (asphalt, soil, or vegetation), soil or groundwater will be decontaminated between each location using steps 1 through 3 between each investigation location (boring, excavation, test pit, etc.) over a temporary decontamination pad constructed by the driller. At the completion of all site activities associated with each piece of heavy equipment (drill rig, backhoe, excavator, skid steer, etc.), the equipment will be subjected to the entire decontamination process, including solvent wipe and/or rinse, as applicable. The equipment will then be wipe sampled by BC for the presence of PCBs and submitted to the laboratory for expedited analysis using Soxhlet extraction. Pickup of PCB wipe samples will be arranged for the same day they are collected to minimize equipment standby time.

Decontamination materials will be contained within a temporary decontamination pad constructed by the driller and will consist of steam cleaning followed by potable water rinses.

## 3.7 Waste Management

Wastes generated during the implementation of this PDI Work Plan will be managed in accordance with the procedures presented below. BC will provide field personal to document and field screen all materials which are generated for transportation off Site. All wastes transported off-site will be tracked via a bill of lading or manifest and be recorded during loading on material tracking logs prior to transportation and disposal off Site. These logs will be used to verify that the appropriate certificates of destruction receipts are received from the receiving facility.

### 3.7.1 General Investigation Derived Waste

Investigation-derived waste (IDW), which includes purge water, development water, decontamination water, and soil and rock cuttings generated during PDI activities will be temporarily containerized and staged on site to await characterization, profiling, and off-site transportation and disposal. A temporary waste solids stockpile management area will be constructed in conformance with Title 40 Part 761, *Polychlorinated Biphenyls (PCBs) Manufacturing Processing, Distribution in Commerce, and Use Prohibitions*, Section 761.65 *Storage for Disposal*. Liquid IDW generated during the PDI investigation will be temporarily stored in a 20,000-gallon frac tank, further discussed in Section 3.7.2 below. Both the waste solids stockpile management area and the frac tank will be located outside of the 100-year flood zone boundary and be properly labeled in accordance with Title 40 Part 761.40 *Marking Requirements*. IDW will be sampled for characterization as required by the disposal facilities, profiled, and transported for off-site disposal as facilities to be identified.

#### 3.7.1.1 Waste Characterization Sample Collection

Samples from the two waste characterization borings, identified as PRB-WC-1, PRB-WC-2 will be collected using direct-push drilling techniques. A 4- or 5-foot macrocore sampler will be used to collect continuous soil core from the existing ground surface to the bottom of the peat layer, and an aliquot of soil from each two-foot interval of the soil core will be used to create a composite waste characterization sample from each boring. In addition, PRB borings PRB-03 and PRB-05 will also be used to collect waste characterization samples. An aliquot of soil will be collected from each two (2) foot interval between the ground surface and the bottom of the peat layer in each of these borings and placed together. Similarly, an aliquot of soil will be collected from both PRB-03 and PRB-05 between the bottom of the peat layer

and the bedrock surface. These aliquots will also be combined to create one waste characterization sample from soils below the peat layer.

The waste characterization samples will be submitted for the following analyses:

- Volatile Organic Compounds by EPA Method 8260
- Semi-Volatile Organic Compounds by EPA Method 8270
- Herbicides by EPA Method 8151
- Pesticides by EPA Method 8081
- Toxicity Characteristic Leaching Procedure for RCRA 8 Metals using EPA Method 6010/7471
- pH by EPA SW846 9045C
- Ignitability by EPA SW846 1010/American Society of Testing and Materials D93
- Total and amendable cyanide and sulfide (Reactivity) by EPA Method 9010C and EPS Method SW-846

Each aliquot of soil will be placed into a stainless-steel bowl or disposable aluminum pan. The samples for VOC analysis will be collected from first, and then the soil will be homogenized using a stainless-steel spoon. After homogenization is complete, the remaining laboratory bottles will be filled. Waste characterization samples will be placed on ice to await shipment or pickup by laboratory. Samples will be maintained under chain-of-custody protocols.

As discussed above in the *Geotechnical Investigation* section (3.6.1) of this document, soil borings PRB-WC-1 and PRB-WC-2 will be extended to the bedrock surface for the purpose of collecting chemical characterization samples.

### 3.7.2 Groundwater and Construction Wastewater

Water collected during remediation activities (e.g., decontamination, dewatering, etc.) will be staged on Site in a 20,000-gallon portable tank or similar. A permitted hauler will be subcontracted to provide 5,000-gallon vacuum tankers to extract and transport construction wastewater at and appropriately licensed off-site disposal facility. The permitted transporter will be on notice and available to mobilize for removing liquids from the storage tank with ½-day of a request to transport. Samples will be collected, as necessary, for waste characterization and the water will be disposed of at the off-site facility selected dependent upon water sample results.

## 3.8 Well Profiling Methods

### 3.8.1 Vertical Bedrock Contaminant Profiling

After well development, each of the bedrock characterization boreholes will be lined with a FLUTe™ Activated Charcoal Technique (FACT) liner. The FACT liner will be installed to minimize borehole cross contamination by sealing the fractures with the liner, as well as provide a vertical profile of dissolved groundwater contamination and identify the presence and depth of DNAPL. The FLUTe™ liner is filled with potable water to use hydraulic head to sink to the bottom of the borehole and apply pressure to hold the liner against the borehole wall. The FACT liners will be left in place in each borehole for a minimum of 2 weeks. During this 2-week period, DNAPL present in the bedrock fractures along the borehole wall react with the NAPL covering and the dissolved phase VOCs will be adsorbed on the FACT through diffusion.

After the 2-week period has passed, the FACT liners will be removed from the borehole by FLUTe™. Any staining of the DNAPL covering will be recorded by depth as the liner is removed from the borehole. In

addition, the activated carbon strip will be sampled a maximum of every 2-feet along the complete length of the open borehole sections and submitted for analysis of VOCs by EPA Method 8260.

### 3.8.2 Transmissivity and Hydraulic Head Profiling

After completion of borehole logging, transmissivity and hydraulic head profiles will be generated by FLUTe™ for each bedrock characterization borehole. The transmissivity profile is generated by re-deploying the FLUTe™ liner. The FLUTe™ liner is deployed by everting the liner down the borehole such that the liner slowly seals the borehole from the top to the bottom. As the liner is deployed, the velocity of deployment decreases as outflow from the borehole decrease as a greater number of fractures are sealed off, reducing the number of fractures for flow out of the borehole. This allows flute to create a velocity profile for liner deployment, which is then used to calculate a borehole transmissivity profile.

([www.flute.com](http://www.flute.com))

A vertical head profile will be generated by removal of the liner using the FLUTe™ Reverse Head Profile method. As the FLUTe™ liner is removed from the borehole, it is temporarily stopped between flow zones identified during the transmissivity profile. With the use of a pressure transducer below the liner, measured borehole flow rates and transmissivity values obtained during liner deployment, the vertical borehole head distribution can be mapped. ([www.flute.com](http://www.flute.com))

### 3.8.3 Geophysical Borehole Logging

After the FLUTe™ liners have been removed, a suite of geophysical borehole logging techniques will be completed in each borehole. The geophysical logging methods will include optical televiewer, acoustic televiewer, acoustic caliper, fluid temperature, fluid conductivity, natural gamma ray, single-point resistance, spontaneous potential, and heat-pulse flow meter under ambient and pumping conditions.

### 3.8.4 Water Level Monitoring

During drilling of each borehole, one or more pressure transducers may be deployed to selected surrounding monitoring wells for the purpose of evaluating changes in pressure head that may result when a fracture in the borehole being drilled is hydraulically connected to surrounding boreholes. Prior to deployment of the pressure transducers, the clock on each transducer and the clock being used by the BC engineer or geologist will be synced such that changes in pressure head can be correlated between boreholes. A barometric pressure transducer will also be deployed to correct pressure head readings for barometric pressure at the time of water level gauging. After the groundwater in each borehole stabilizes after transducer deployment, manual water level measurements will be collected using an electronic water level meter accurate to the nearest 0.01-foot. Measurements will be recorded in the field logbook and will be used to correlate pressure head readings to groundwater elevation. Upon completion of drilling activities, manual water level measurements will be recorded for each well where a transducer has been deployed. Once removed from a monitoring well, the data will be downloaded and saved. Transducer data files will be named based on the well being monitored and the date of collection.

## 3.9 Additional Studies

### 3.9.1 Test Pitting

Test excavations will be used to confirm the alignment of the hydraulic barriers by locating any identifiable obstructions and former site features. The test excavations will be performed using a small backhoe, operated in a manner that will promote the safe and efficient operation of the equipment. The equipment used for the test excavations will be decontaminated prior to leaving the project site.



Decontamination procedures are described in Section 3.6.4. It is intended that the test excavations will be employed in the northeast portion of the Aerovox property to:

- Determine the depth of identified site obstructions that may impede the hydraulic barrier design, and
- Assess the potential of off-gas concerns and determine if odor control will be required for excavations in this area.

The general procedures for test excavations are provided below:

- Excavate the soil to the necessary depth to view the subsurface obstruction.
- For excavations below the water table, water that accumulates with the test excavation will be pumped out using a suitable pump, as required. Water will be managed in accordance with Section 3.7.2.
- Mark the location of the subsurface obstructions on the existing pavement.
- After the excavation is complete, place the soil back into the test excavation.
- Each excavation area will be temporarily patched to match the surrounding material (asphalt or HAC cap).
- Decontaminate the excavating equipment before it is removed from the site.

### 3.9.2 Corrosion Study

Soil samples to be collected for the corrosion study will follow the same procedures as Section 3.6.1.1. Groundwater samples will be collected using standard purge and sampling techniques already practiced at the site. Prior to collection of groundwater from each well, a minimum of three well volumes will be purged using a submersible pump. Water quality parameters, including dissolved oxygen, electrical conductivity, pH, oxidation-reduction potential, and temperature were collected during purging to evaluate groundwater stabilization.

Containerized soils and groundwater will be shipped under chain of custody seal by overnight shipment via Federal Express to Corrosion Probe, Inc. for analysis.

### 3.9.3 Treatment of Excavation Dewatering Fluids

Groundwater samples will be collected from monitoring wells RW-1D or MW-15D, MW-7D, MW-2D, and MW-17D and combined to create two representative dewatering water samples. The dewatering samples will be submitted for analysis of CVOCs, PCBs, metals, pH, alkalinity at a minimum, with additional analytical parameters to be added based on the anticipated discharge permit requirements for the two discharge options. The analytical results will be used to evaluate treatment alternatives for dewatering fluids to be generated during full scale remediation. The dewatering fluid alternatives to be evaluated for full scale design include application for discharge of the generated dewatering fluid to the Acushnet River under a NPDES RGP or to the City's POTW.

## 3.10 Sampling and Analysis QA/QC

Analytical data requested as part of this effort will be submitted under MCP "presumptive certainty" protocols using the Massachusetts Compendium of Analytical Methods (CAM). Data generated through the use of CAM will be subject to a representative evaluation and data usability assessment consistent with MCP requirements. Geotechnical and bench scale testing data will be reviewed for quality parameters.

A Plan for environmental monitoring, sampling and analysis and quality assurance (SAP/QAPP) has been developed for the assessment activities described in this PDI Work Plan as well as in the related Pilot Study Release Abatement Measure Plan (RAM Plan). The PDI and RAM Plan data will be evaluated for usability and applicability to the goals of the project. See Appendix B of the RAM Plan for a copy of the SAP/QAPP.

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## Section 4

# Schedule

A Gantt chart project schedule is provided in Appendix A which provides an estimate of the sequence and duration required to implement the assessment activities described in this PDI Work Plan. The schedule of the field work will largely be controlled by the timeframe required to engage subcontractor support and coordinate with the City of New Bedford and MassDEP, and by EPA's schedule for the New Bedford Harbor Superfund project and their occupancy of the former Aerovox Property.

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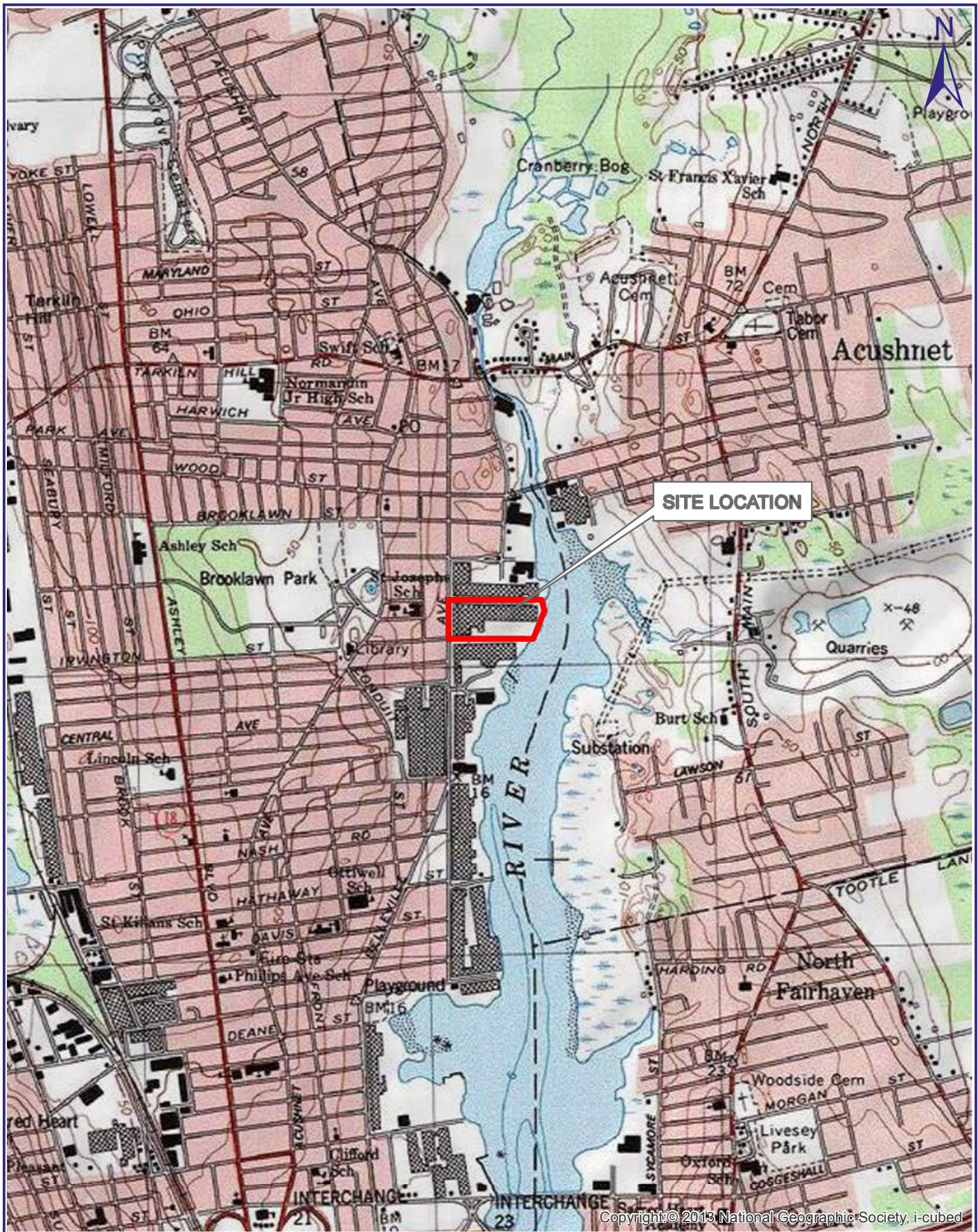


## Figures

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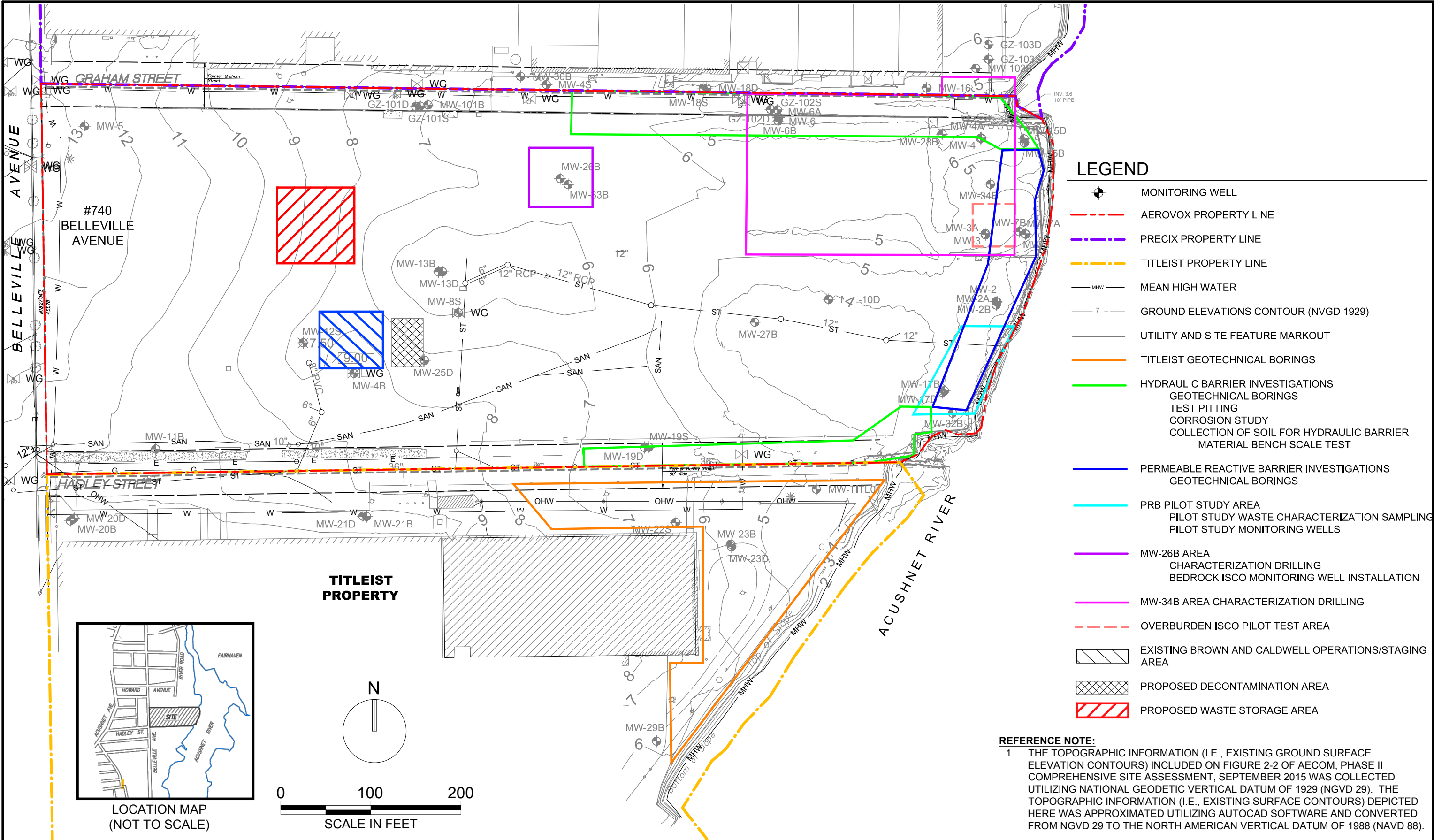
**Brown AND  
Caldwell**

**FIGURE 1**  
**SITE LOCATION MAP**  
**FORMER AEROVOX FACILITY**  
**740 BELLEVILLE AVENUE, NEW BEDFORD, MA**

0 1,000 2,000  
Feet



Path: \\bctaup01\projects\AVX\New\_Bedford\152448\_Aerovox Phase IV And Pilot\Draft\Reports\Pilot Study RAM\PD\Workplan\_CAD\2-SHEETS\C-CIVIL File Name: FIG 2 - AREAS OF INVESTIGATION Plot Date: April 22, 2019 8:19 AM Cadd User: Alan Santiago



SCALE: 1" = 100'  
152448  
DATE: April 22, 2019

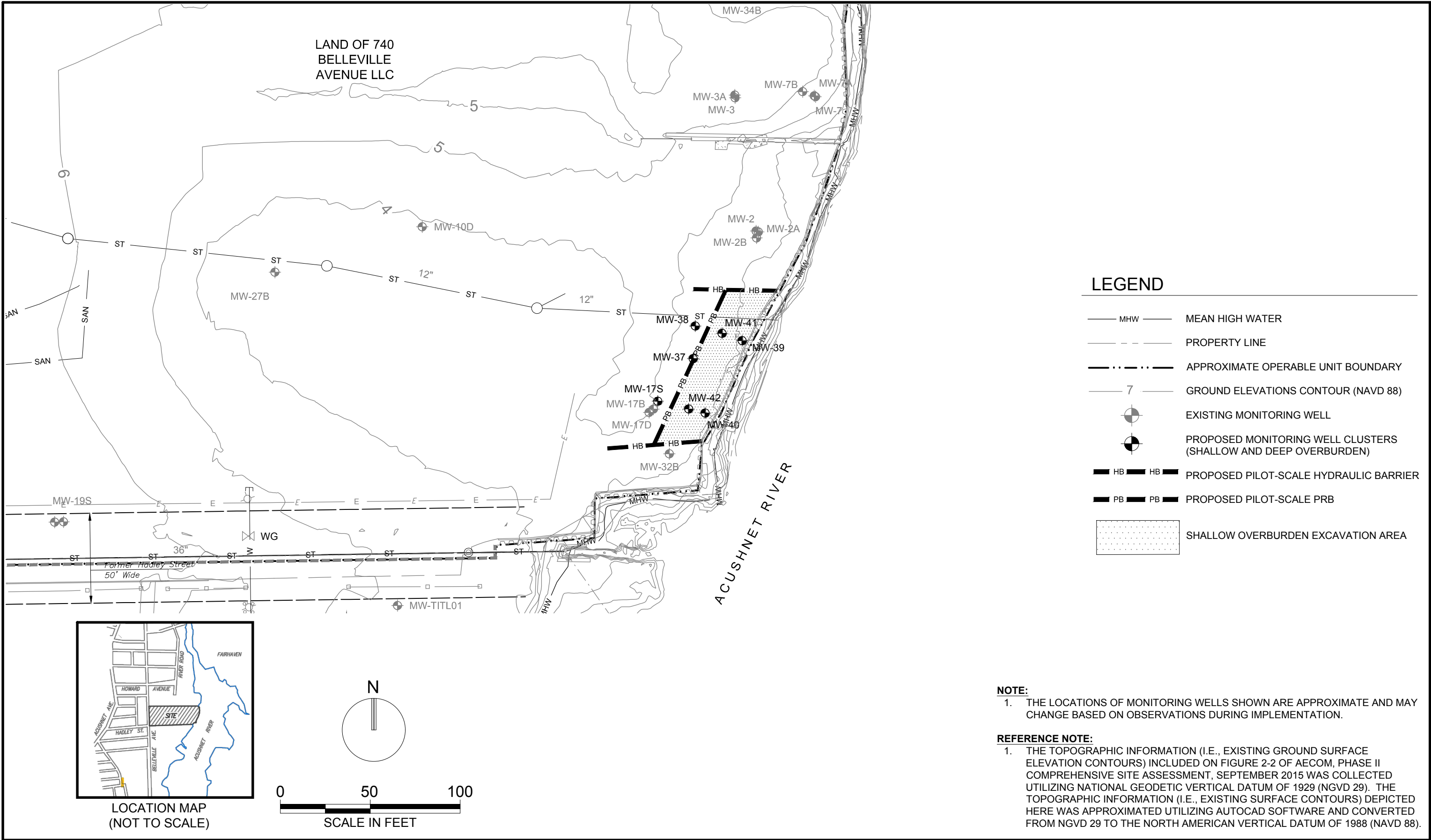
FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

AREAS OF INVESTIGATION AND PLANNED SITE  
STAGING AREAS FOR PRE-DESIGN INVESTIGATION

**DRAFT**

FIGURE  
**2**

Path: \\bcta\ufp01\projects\A\X\New\_Bedford\152448\_Aerovox Phase IV And Pilot\CADD\CAD12-SHEET\SC-CIVIL File Name: FIG 3 - PROPOSED PRB PILOT TEST LAYOUT Plot Date: April 3, 2019 2:44 PM Cadd User: Alan Santiago



SCALE: 1" = 50'  
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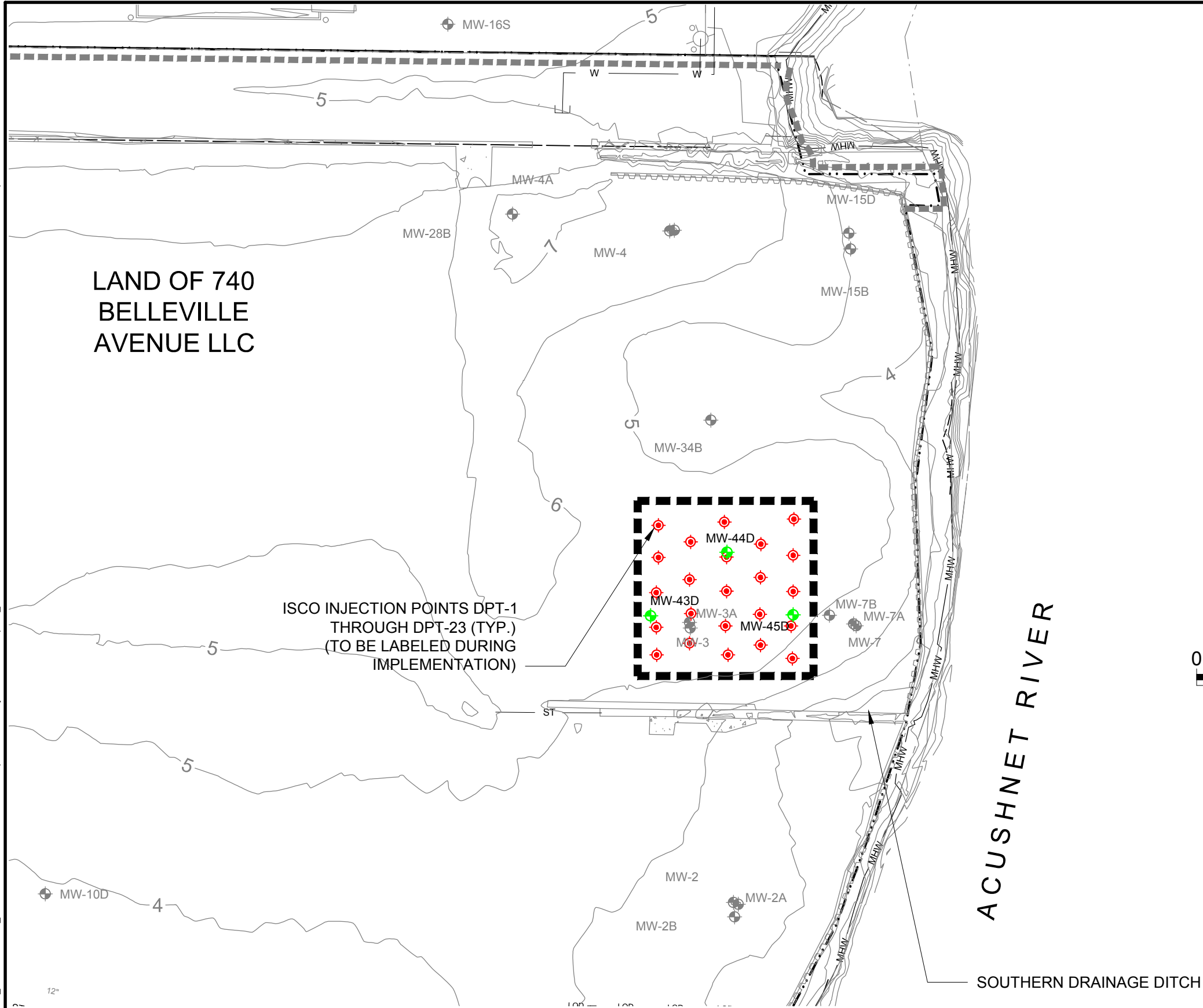
FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

PROPOSED PRB PILOT TEST LAYOUT








**DRAFT**

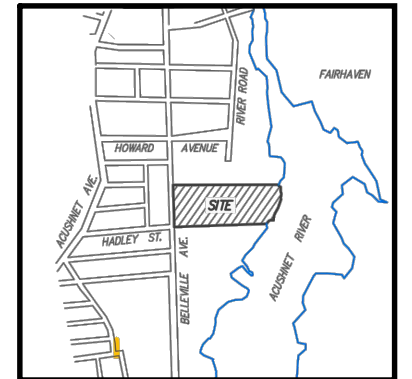
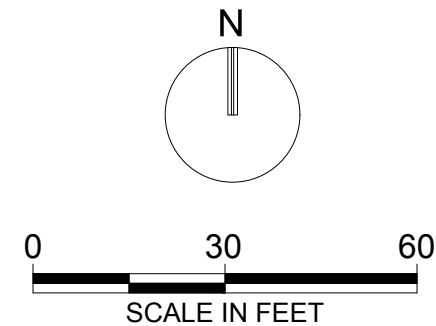
FIGURE  
3

Path: \\bctaup01\projects\AVX\New\_Bedford\152448\_Aerovox Phase IV And Pilot\Draft\Reports\Pilot Study RAM\PD\Workplan\_CAD\2-SHEETS\C-CIVIL File Name: FIG 4 - OVERBURDEN PILOT TEST LAYOUT Plot Date: April 21, 2019 3:37 PM Cadd User: Alan Santiago



## LEGEND

-  PROPOSED OVERBURDEN ISCO INJECTION POINT
-  PROPOSED OVERBURDEN ISCO MONITORING WELL
-  PROPOSED OVERBURDEN ISCO PILOT TEST TREATMENT AREA
-  EXISTING MONITORING WELL
-  AEROVOX PROPERTY LINE
-  MHW MEAN HIGH WATER
-  GROUND ELEVATIONS CONTOUR (NAVD 88)



LOCATION MAP  
(NOT TO SCALE)

### NOTES:

- THE LOCATIONS OF INJECTION POINTS AND MONITORING WELLS DEPICTED HERE ARE APPROXIMATE AND MAY CHANGE BASED ON OBSERVATIONS DURING IMPLEMENTATION.
- PROPOSED ISCO PILOT TEST INJECTIONS TO TREAT OVERBURDEN INTERVAL BETWEEN 13 AND 33 FEET BELOW GROUND SURFACE (BGS).
- PROPOSED ISCO OVERBURDEN MONITORING WELLS WILL BE INSTALLED WITH WELL SCREEN SET AT TOP OF BEDROCK (TOTAL DEPTH OF APPROXIMATELY 34 FEET BGS).

### REFERENCE NOTE:

- THE TOPOGRAPHIC INFORMATION (I.E., EXISTING GROUND SURFACE ELEVATION CONTOURS) INCLUDED ON FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER 2015 WAS COLLECTED UTILIZING NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29). THE TOPOGRAPHIC INFORMATION (I.E., EXISTING SURFACE CONTOURS) DEPICTED HERE WAS APPROXIMATED UTILIZING AUTOCAD SOFTWARE AND CONVERTED FROM NGVD 29 TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).



SCALE: 1" = 30'  
152448  
DATE: April 21, 2019

FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

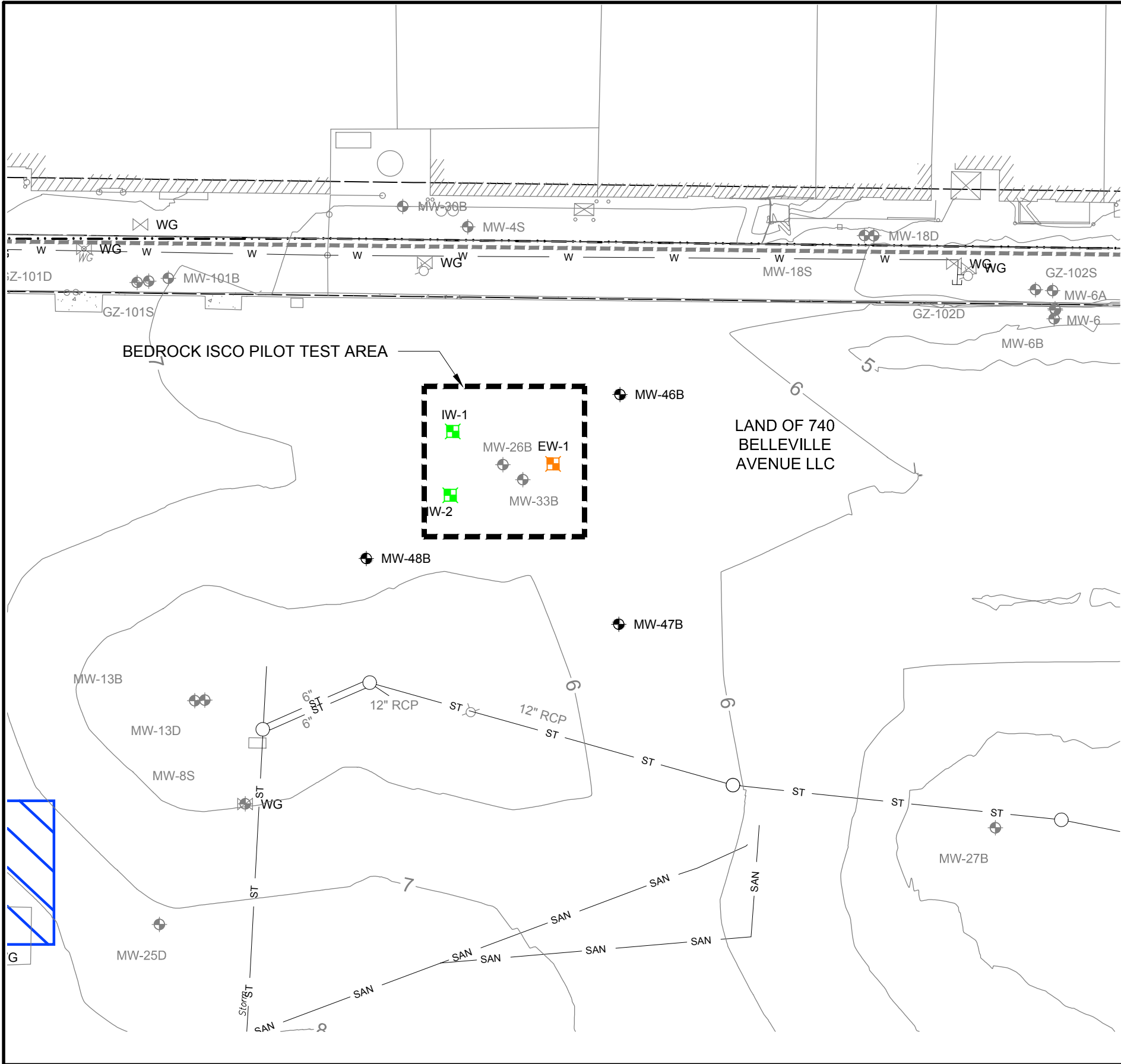
## OVERBURDEN ISCO PILOT TEST LAYOUT

**DRAFT**

FIGURE  
**4**

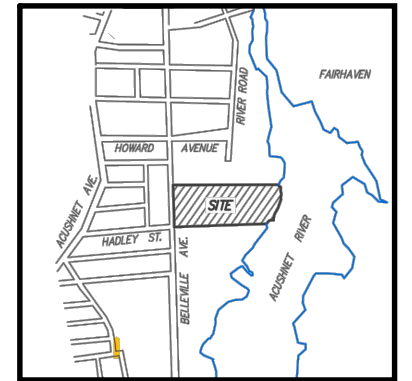
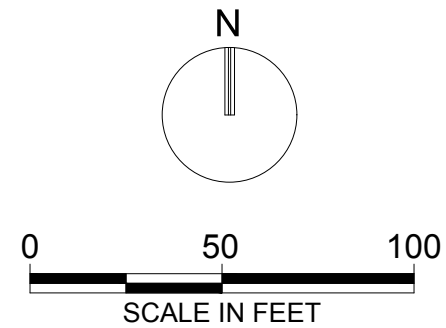


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## LEGEND

- PROPOSED OVERBURDEN ISCO PILOT TEST TREATMENT AREA
- EXISTING MONITORING WELL
- AEROVOX PROPERTY LINE
- GROUND ELEVATIONS CONTOUR (NAVD 88)
- PROPOSED BEDROCK ISCO INJECTION WELL
- PROPOSED BEDROCK ISCO EXTRACTION WELL
- PROPOSED BEDROCK ISCO MONITORING WELL



LOCATION MAP  
(NOT TO SCALE)

### NOTES:

- PROPOSED BEDROCK ISCO PILOT TEST INJECTION AND EXTRACTION WELLS WILL BE INSTALLED TO A TOTAL DEPTH OF APPROXIMATELY 100 FEET BELOW GROUND SURFACE.

### REFERENCE NOTE:

- THE TOPOGRAPHIC INFORMATION (I.E., EXISTING GROUND SURFACE ELEVATION CONTOURS) INCLUDED ON FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER 2015 WAS COLLECTED UTILIZING NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29). THE TOPOGRAPHIC INFORMATION (I.E., EXISTING SURFACE CONTOURS) DEPICTED HERE WAS APPROXIMATED UTILIZING AUTOCAD SOFTWARE AND CONVERTED FROM NGVD 29 TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).



SCALE: 1" = 50'  
152448  
DATE: April 21, 2019

FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

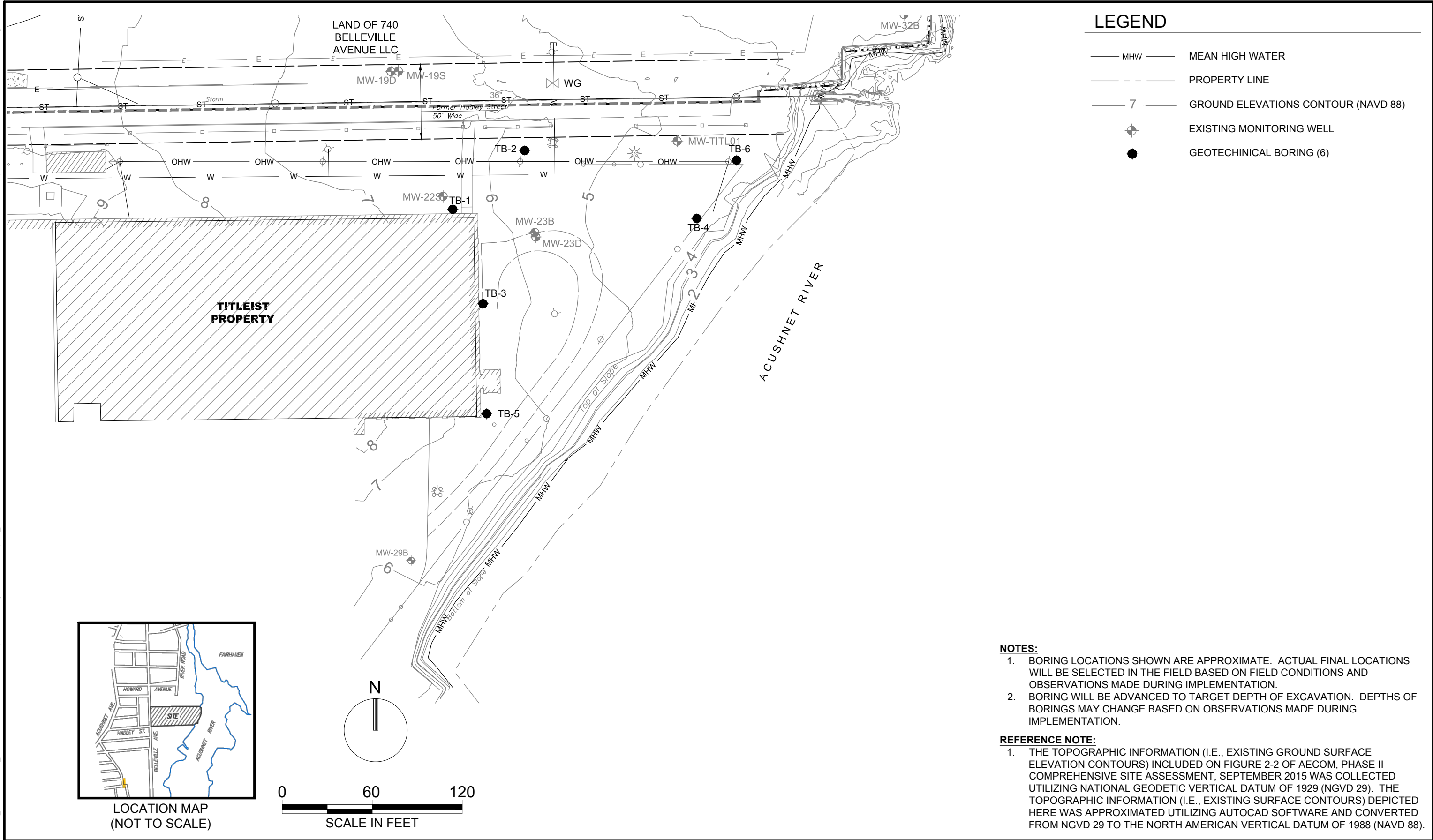
BEDROCK ISCO PILOT TEST LAYOUT

**DRAFT**

FIGURE

5

Path: \\bdaup01\projects\A\X\New\_Bedford\152448\_Aerovox Phase IV And Pilot Draft\Reports\Pilot Study RAM\PD\Workplan\_CAD\2-SHEETS\C-CIVIL File Name: FIG 6 - GEOTECHNICAL BORINGS TITLEIST PROPERTY Plot Date: April 3, 2019 4:44 PM Cadd User: Alan Santiago



SCALE: 1" = 60'  
152448  
DATE: April 3, 2019

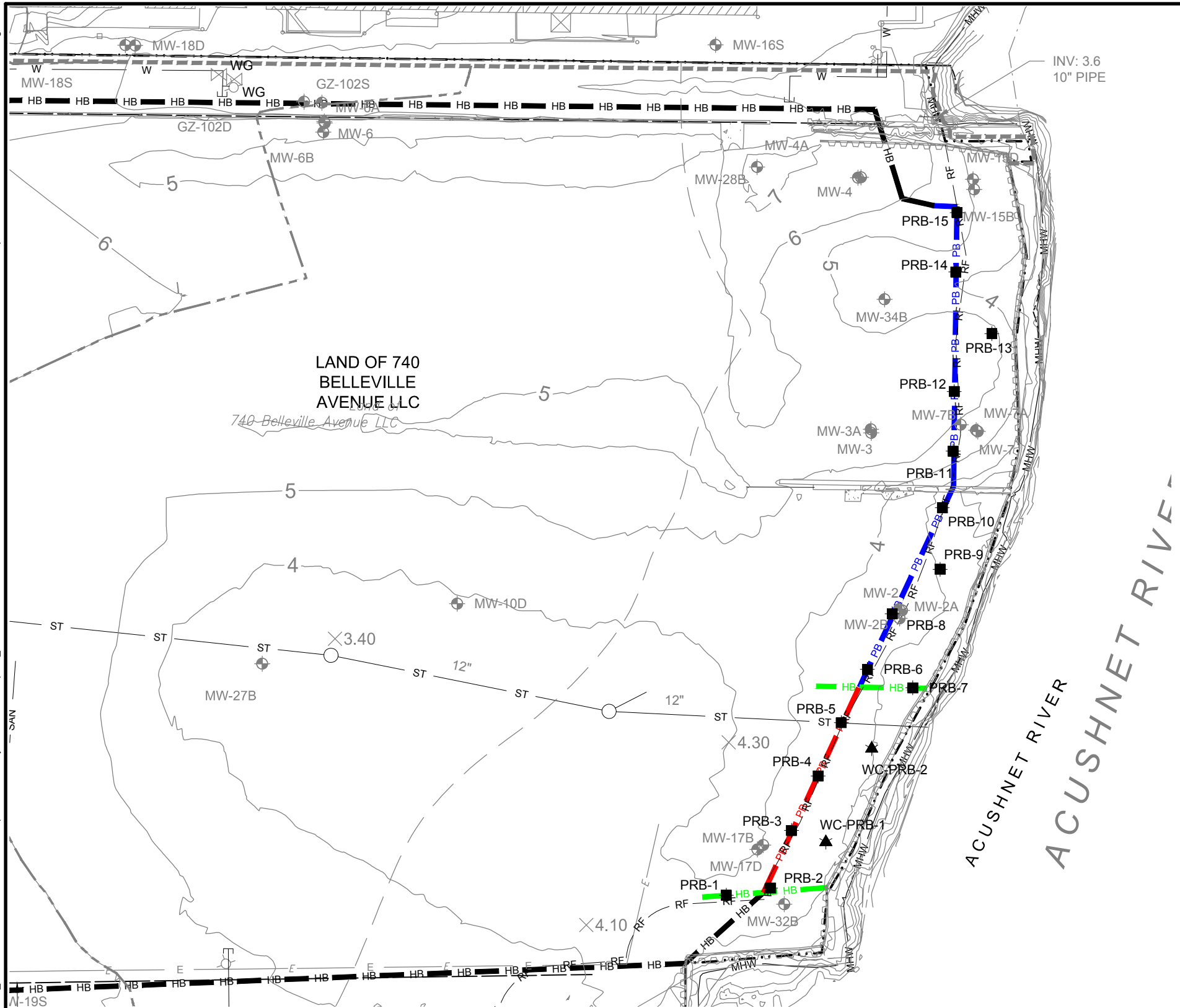
FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

PROPOSED GEOTECHNICAL BORING  
LOCATIONS: TITLEIST PROPERTY

**DRAFT**

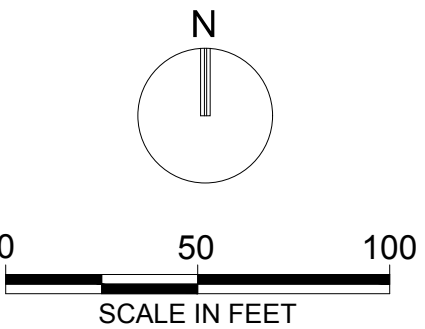
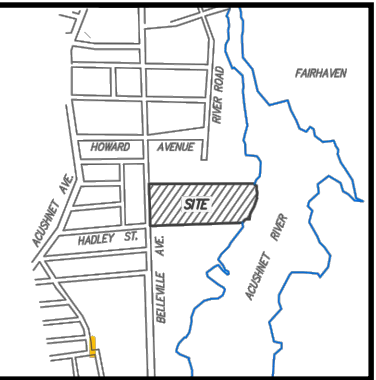
FIGURE  
**6**

Path: \\bctaup01\projects\AVX\New\_Bedford\152448\_Aerovox Phase IV And Pilot\Draft\Reports\Pilot Study RAM\PD\Workplan\_CAD\2-SHEETS\C-CIVIL File Name: FIG 7 - PRB ALIGNMENT BORINGS Plot Date: April 3, 2019 4:22 PM Cadd User: Alan Santiago



## LEGEND

- MHW — MEAN HIGH WATER
- - - - - PROPERTY LINE
- . . . - APPROXIMATE OPERABLE UNIT BOUNDARY
- 7 — GROUND ELEVATIONS CONTOUR (NAVD 88)
- ⊕ EXISTING MONITORING WELL
- PROPOSED GEOTECHNICAL BORING (15)
- ▲ PROPOSED WASTE CHARACTERIZATION BORING (2)
- HB — HB — PROPOSED HYDRAULIC BARRIER
- PB — PB — PROPOSED PRB
- HB — HB — PROPOSED PILOT-SCALE HYDRAULIC BARRIER
- PB — PB — PROPOSED PILOT-SCALE PRB



### NOTES:

- BORING LOCATIONS SHOWN ARE APPROXIMATE. ACTUAL FINAL LOCATIONS WILL BE SELECTED IN THE FIELD BASED ON FIELD CONDITIONS AND OBSERVATIONS MADE DURING IMPLEMENTATION.
- BORINGS WILL BE ADVANCED TO BEDROCK. DEPTHS OF BORINGS MAY CHANGE BASED ON OBSERVATIONS MADE DURING IMPLEMENTATION.

### REFERENCE NOTE:

- THE TOPOGRAPHIC INFORMATION (I.E., EXISTING GROUND SURFACE ELEVATION CONTOURS) INCLUDED ON FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER 2015 WAS COLLECTED UTILIZING NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29). THE TOPOGRAPHIC INFORMATION (I.E., EXISTING SURFACE CONTOURS) DEPICTED HERE WAS APPROXIMATED UTILIZING AUTOCAD SOFTWARE AND CONVERTED FROM NGVD 29 TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).



SCALE: 1" = 50'  
152448  
DATE: April 3, 2019

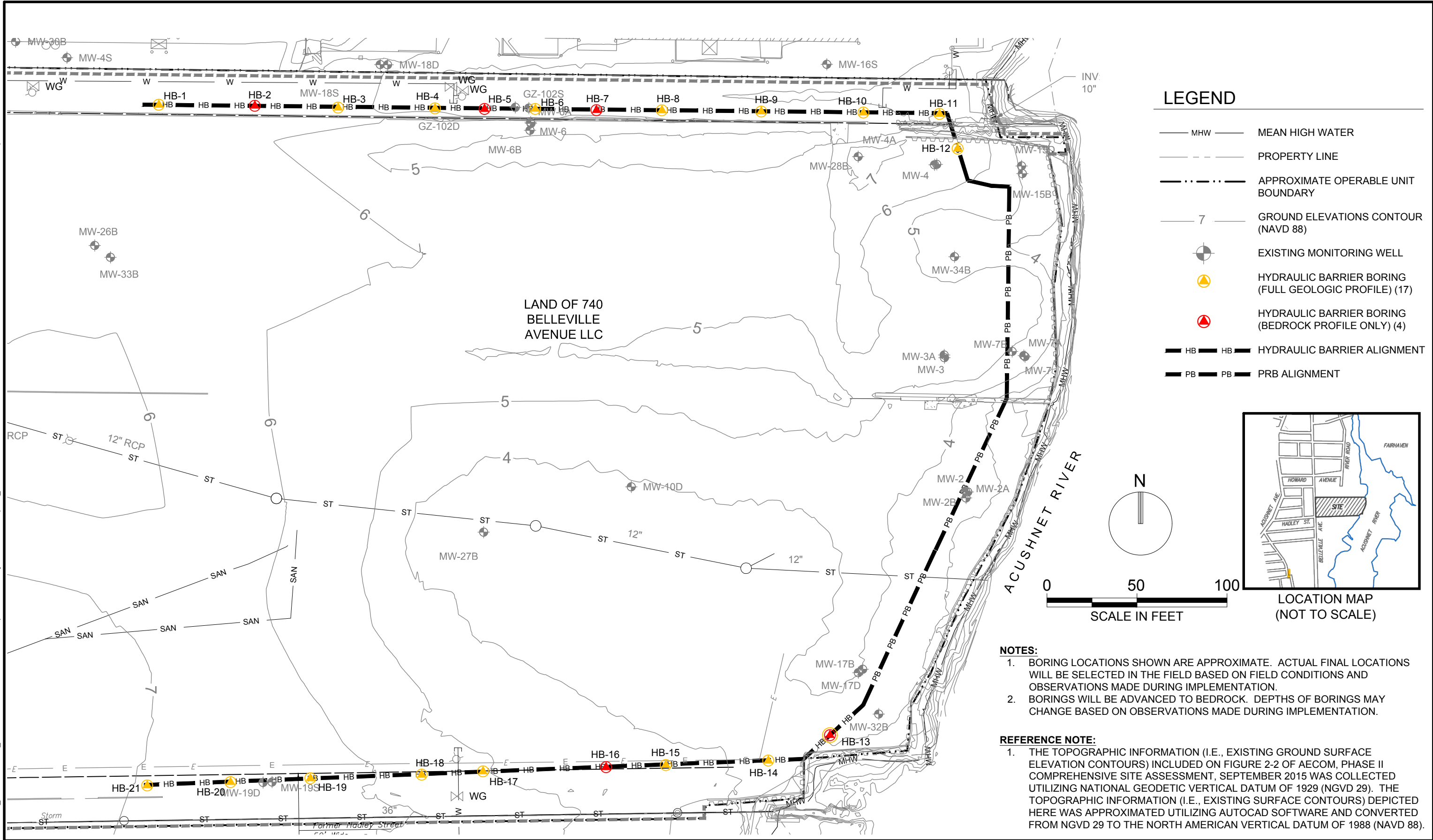
FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

PROPOSED GEOTECHNICAL BORING  
LOCATIONS: PRB ALIGNMENT

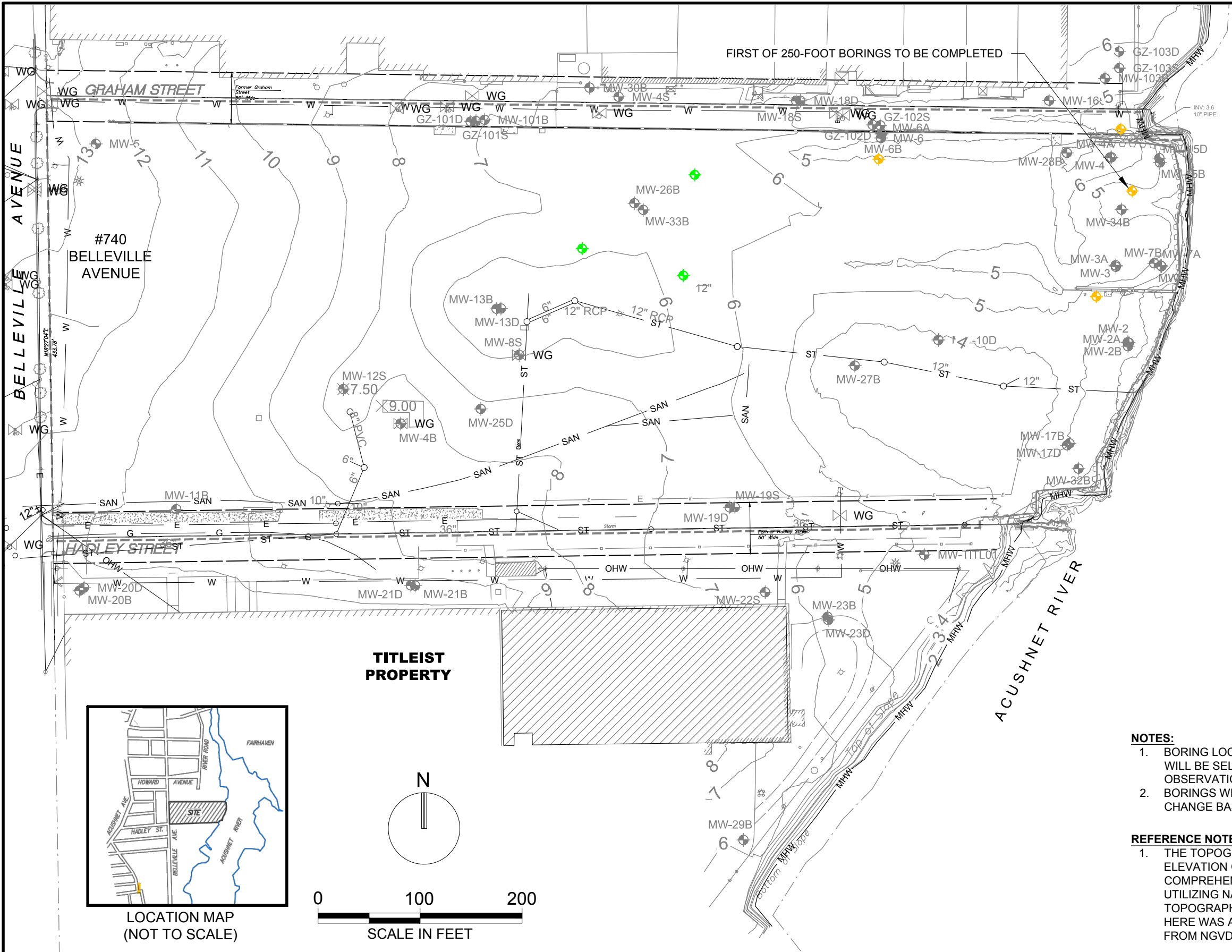
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Path: \\btaufp01\projects\AVX\New\_Bedford\152448\_Aerovox Phase IV And Pilot\Draft\Reports\Pilot Study RAM\PD\Workplan\_CAD\2-SHEETS\C-CIVIL File Name: FIG 9 - PROPOSED BEDROCK WELL LOCATIONS Plot Date: April 3, 2019 2:14 PM Cadd User: Alan Santia



LEGEND

- EXISTING MONITORING WELL
- BEDROCK CHARACTERIZATION WELL LOCATIONS (UP TO 100' BGS)
- BEDROCK CHARACTERIZATION WELL LOCATIONS (UP TO 250' BGS)
- AEROVOX PROPERTY LINE
- PRECIX PROPERTY LINE
- TITLEIST PROPERTY LINE
- MEAN HIGH WATER
- GROUND ELEVATIONS CONTOUR (NVGD 1929)

- NOTES:
- BORING LOCATIONS SHOWN ARE APPROXIMATE. ACTUAL FINAL LOCATIONS WILL BE SELECTED IN THE FIELD BASED ON FIELD CONDITIONS AND OBSERVATIONS MADE DURING IMPLEMENTATION.
  - BORINGS WILL BE ADVANCED TO BEDROCK. DEPTHS OF BORINGS MAY CHANGE BASED ON OBSERVATIONS MADE DURING IMPLEMENTATION.

- REFERENCE NOTE:
- THE TOPOGRAPHIC INFORMATION (I.E., EXISTING GROUND SURFACE ELEVATION CONTOURS) INCLUDED ON FIGURE 2-2 OF AECOM, PHASE II COMPREHENSIVE SITE ASSESSMENT, SEPTEMBER 2015 WAS COLLECTED UTILIZING NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29). THE TOPOGRAPHIC INFORMATION (I.E., EXISTING SURFACE CONTOURS) DEPICTED HERE WAS APPROXIMATED UTILIZING AUTOCAD SOFTWARE AND CONVERTED FROM NGVD 29 TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).



SCALE: 1" = 100'  
152448  
DATE: April 3, 2019

FORMER AEROVOX FACILITY  
740 BELLEVILLE AVENUE  
NEW BEDFORD, MA

PROPOSED BEDROCK CHARACTERIZATION  
WELL LOCATIONS

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## Tables

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DRAFT Table 1. Summary of Geotechnical, Waste Characterization and Chemical Characterization Data Collection																					
		Field Parameters						Geotechnical Parameters						Other Studies							
Activity / Boring ID	Est. Boring Depth (ft bgs)	SPT Blow Counts [1]	Lithology ASTM D5434 [1][2]	Bedrock Profile	Matrix	Geo. Qty	Est. Sample Depth(s) (ft bgs)	Grain Size ASTM D6913 [3]	Moisture Content ASTM D2216	Atterberg Limits ASTM D4318	pH USEPA 9045	Organic Content ASTM D2974	Hydraulic Conductivity ASTM D5084 [4]	Hydraulic Barrier Bench Study [5]	Stablization Study [6]	Corrosivity Testing [7]	Waste Profile [8]				
Hydraulic Barrier Borings																					
GTB-HB-01	35	X	X	X	soil	1	6	X	X							X					
GTB-HB-02	35	X		X	no sample																
GTB-HB-03	35	X	X	X	soil	1	10	X	X												
GTB-HB-04	35	X	X	X	soil	1	28	X	X					X							
					soil	5	TBD														
GTB-HB-05	35	X		X	no sample																
GTB-HB-06	35	X	X	X	soil	1	34	X	X												
GTB-HB-07	35	X		X	no sample																
GTB-HB-08	35	X	X	X	soil	1	22	X	X												
GTB-HB-09	35	X	X	X	soil	5	TBD							X							
GTB-HB-10	35	X	X	X	soil	1	18	X	X												
GTB-HB-11	35	X	X	X	no sample																
GTB-HB-12	35	X	X	X	soil	1	30	X	X												
					groundwater	1	10														
					soil	3	5,10,35,comp											X		X	X
GTB-HB-13	35	X	X	X	soil	1	8	X	X							X					
GTB-HB-14	35	X	X	X	soil	1	24	X	X					X							
					soil	5	TBD														
GTB-HB-15	35	X	X	X	no sample																
GTB-HB-16	35	X		X	no sample																
GTB-HB-17	35	X	X	X	no sample																
GTB-HB-18	35	X	X	X	soil	1	12	X	X												
GTB-HB-19	35	X	X	X	soil	1	20	X	X												
GTB-HB-20	35	X	X	X	soil	5	TBD							X							
GTB-HB-21	35	X	X	X	soil	1	4	X	X												
					groundwater	1	10													X	
					soil	3	5,10,35												X		
PRB Alignment Borings																					
GTB-PRB-01	35	X	X	X	soil	2	9, 12	X	X	X	X	X									
					soil	1	9												X		
					soil	1	12						X								
GTB-PRB-02	35	X	X	X	soil	2	6, 21	X	X	X	X	X									
					soil	1	6						X								
					soil	1	9											X			
GTB-PRB-03	35	X	X	X	soil	2	15, 30	X	X	X	X	X									
					soil	1	9												X		
					soil	1	30						X								
					soil	0	comp, 0-10 [10]														X [10]
					soil	0	comp, 10-35 [11]														X [10]
					soil	0	10-35, highest PID [12]														
GTB-PRB-04	35	X	X	X	soil	2	11, 22	X	X	X	X	X									
					soil	1	9												X		
					soil	1	22						X								
GTB-PRB-05	35	X	X	X	soil	2	4, 29	X	X	X	X	X		X							
					soil	1	9														
					soil	1	4						X								
					soil	1	comp, 0-10 [10]														X [10]
					soil	0	comp, 10-35 [11]														X [10]
					soil	0	10-35, highest PID [12]														
GTB-PRB-06	35	X	X	X	soil	2	13, 26	X	X	X	X	X									
					soil	1	9													X	
					soil	1	26						X								
GTB-PRB-07	35	X	X	X	soil	2	7, 18	X	X	X	X	X									
					soil	1	9													X	
					soil	1	18						X								
GTB-PRB-08	35	X	X	X	soil	2	2, 25	X	X	X	X	X									
					soil	1	2						X								
					soil	1	9											X			
GTB-PRB-09	35	X	X	X	soil	2	16, 31	X	X	X	X	X									
					soil	1	9													X	
					soil	1	16						X								
					soil	0	10-35, highest PID [12]														
GTB-PRB-10	35	X	X	X	soil	2	5, 24	X	X	X	X	X									
					soil	1	9													X	
					soil	1	24						X								
GTB-PRB-11	35	X	X	X	soil	2	10, 23	X	X	X	X	X									
					soil	1	9												X		
					soil	1	10						X								
GTB-PRB-12	35	X	X	X	soil	2	8, 27	X	X	X	X	X									
					soil	1	8						X								
					soil	1	9											X			
GTB-PRB-13	35	X	X	X	soil	2	3, 20	X	X	X	X	X									
					soil	1	9													X	
					soil	1	20						X								
					soil	0	10-35, highest PID [12]														
GTB-PRB-14	35	X	X	X	soil	2	14, 31	X	X	X	X	X									
					soil	1	9													X	
					soil	1	14						X								
GTB-PRB-15	35	X	X	X	soil	2	11, 28, comp	X	X	X	X	X									
					soil	1	9												X		
					soil	1	28						X								
WC-PRB-01	35				soil	0	comp, 0-10 [10]										X				
					soil	0	10-35, highest PID [12]														
WC-PRB-02	35				soil	0	comp, 0-10 [10]														
					soil	0	10-35, highest PID [12]														

DRAFT Table 1. Summary of Geotechnical, Waste Characterization and Chemical Characterization Data Collection																	
		Field Parameters						Geotechnical Parameters						Other Studies			
Activity / Boring ID	Est. Boring Depth (ft bgs)	SPT Blow Counts	Lithology ASTM D5434	Bedrock Profile		Geo. Qty	Est. Sample Depth(s) (ft bgs)	Grain Size ASTM D6913	Moisture Content ASTM D2216	Atterberg Limits ASTM D4318	pH USEPA 9045	Organic Content ASTM D2974	Hydraulic Conductivity ASTM D5084	Hydraulic Barrier Bench Study	Stablization Study	Corrosivity Testing	Waste Profile
		[1]	[1][2]		Matrix			[3]					[4]	[5]	[6]	[7]	[8]
Titleist Excavation Borings																	
GTB-TB-01	20	X	X		soil	1	5	X	X						X		
GTB-TB-02	20	X	X		soil	1	5	X	X						X		
GTB-TB-03	20	X	X		soil	1	5	X	X						X		
GTB-TB-04	20	X	X		soil	1	5	X	X						X		
GTB-TB-05	20	X	X		soil	1	7	X	X						X		
GTB-TB-06	20	X	X		soil	1	6	X	X						X		

[1] To be continuously logged through boring.

[2] Hydraulic barrier borings HB-02, HB-05, HB-07, and HB-13 will only be used for blow counts and depth to bedrock.

[3] Grain size samples collected at random intervals for reference during hydraulic barrier design.

[4] Hydraulic conductivity samples to be sampled using shelby tubes. If field conditions limit shelby tube effectiveness, samples may be collected in bulk and prepared by laboratory under simulated in-situ conditions.

[5] Hydraulic barrier study samples will be collected from the 5 different soil types associated with this site (fill, silt, sand, sand+gravel, silty sand). Since sand+gravel is most prevalent, two samples from these type will be collected.

Depth of sample to be determined in the field.

[6] Stabilization necessary for disposal areas. Samples collected from first 9 feet of boring (e.g., above peat layer)

[7] Corrosivity Testing will be performed by Corrosion Probe, Inc. Each soil sample will be tested for resistivity, water content, pH, alkalinity, acidity, redox potential, chloride, sulfate, and sulfide content. Each water sample will be tested for pH, anions, total hardness, alkalinity, total dissolved solids, and conductivity.

[8] Waste characterization package includes VOCs, SVOCs, PCBs, Pesticides, Herbicides, TAL Metals, Ignitability, Reactivity, Corrosivity (pH), Full TCLP (VOCs, SVOCs, RCRA Metals, Pesticides, Herbicides), and Paint Filter Test

[9] Samples will be collected to evaluate existing soil CVOC and PCB concentrations.

[10] Composite waste characterization sample composed of soil aliquots collected every two feet between the ground surface and bottom of peat layer (assumed to be 10' bgs) in boring PRB-03 and composited with 5 soil aliquots collected every two feet between the grou bottom of peat layer (assumed to be 10' bgs) in boring PRB-05.

[11] Composite waste characterization sample to be composed of soil aliquots collected every two feet between bottom of peat layer (assumed to be 10' bgs) and bedrock surface (assumed to be 35' bgs) in boring PRB-03 and composited with soil aliquots collected every bottom of peat layer (assumed to be 10' bgs) and bedrock surface (assumed to be 35' bgs) in boring PRB-05.

[12] The one-foot interval with the highest PID reading between the bottom of the peat layer (assumed to be 10' bgs) and the bedrock surface (assumed to be 35' bgs) will be submitted for analysis.

SPT = Standard Penetrometer Test

TBD = To be determined in the field

GTB = Geotechnical Boring

Groundwater is tidally influenced between 4 and 5 ft bgs



DRAFT Table 2. Hydraulic Barrier Bench Scale Composition Matrix					
	Site Soils	Additives			
		Portland Cement	Ash	Bentonite	Water
Composition 1	35%	5%		5%	55%
Composition 2	30%	10%		5%	55%
Composition 3	25%	15%		5%	55%
Composition 4	20%	20%		5%	55%
Composition 5	15%	25%		5%	55%
Composition 6	40%	5%	5%		50%
Composition 7	30%	10%	5%		55%
Composition 8	20%	15%	5%		60%
Composition 9	10%	20%	5%		65%
Composition 10	0%	25%	5%		70%
Composition 11	75%			0.5%	25%
Composition 12	74%			1.5%	25%
Composition 13	73%			2.5%	25%
Composition 14	72%			3.5%	25%
Composition 15	71%			4.5%	25%
Composition 16	80%	5%			15%

1. Percentage given by weight
2. Compositions to be prepared for each of the different site soils
3. Water addition should depend on moisture content of site soils.



DRAFT Table 3. Proposed Well Construction Details								
Well ID	Aquifer	Location	Drilling Methodology	Well Diameter (inches)	Well Material	Screen Length (feet)	Depth of Well (feet bgs)	Filter Sand
PRB Pilot Test								
MW-17S	Shallow Overburden	upgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-37S	Shallow Overburden	within PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-37D	Deep Overburden	within PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	34	#2
MW-38S	Shallow Overburden	upgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-38D	Deep Overburden	upgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	34	#2
MW-39S	Shallow Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-39D	Deep Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	34	#2
MW-40S	Shallow Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-40D	Deep Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	34	#2
MW-41S	Shallow Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-41D	Deep Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	34	#2
MW-42S	Shallow Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	22	#2
MW-42D	Deep Overburden	downgradient of PRB	Sonic/Air Hammer	2	Sch. 40 PVC	10	34	#2
ISCO Pilot Test - Overburden								
MW-43D	Deep Overburden	Near MW-7	Sonic/Air Hammer	2	SS	10	30	#2
MW-44D	Deep Overburden	Near MW-7	Sonic/Air Hammer	2	SS	10	30	#2
MW-45D	Deep Overburden	Near MW-7	Sonic/Air Hammer	2	SS	10	30	#2
Bedrock Characterization								
MW-46B	Bedrock	Near Existing MW-26B	Sonic/Air Hammer	4	Open, FLUTe	TBD	100	Open, FLUTe
MW-47B	Bedrock	Near Existing MW-26B	Sonic/Air Hammer	4	Open, FLUTe	TBD	100	Open, FLUTe
MW-48B	Bedrock	Near Existing MW-26B	Sonic/Air Hammer	4	Open, FLUTe	TBD	100	Open, FLUTe
MW-49B	Bedrock	Near MW-6/-6A/-6B cluster	Sonic/Air Hammer	4	Open, FLUTe	TBD	up to 250	Open, FLUTe
MW-50B	Bedrock	Northeast of MW-34B	Sonic/Air Hammer	4	Open, FLUTe	TBD	up to 250	Open, FLUTe
MW-50I	TBD Bedrock	Northeast of MW-34B; Possible intermediate depth bedrock well	Sonic/Air Hammer	4	Open, FLUTe	TBD	up to 120	Open, FLUTe
MW-51B	Bedrock	South of MW-103B cluster	Sonic/Air Hammer	4	Open, FLUTe	TBD	up to 250	Open, FLUTe
MW-52B	Bedrock	Near southern drainage ditch	Sonic/Air Hammer	4	Open, FLUTe	TBD	up to 250	Open, FLUTe
ISCO Pilot Test - Bedrock								
EW-1	Bedrock	Near Existing MW-26B	Sonic/Air Hammer	4	Open Bore	NA	100	Open Bore
IW-1	Bedrock	Near Existing MW-26B	Sonic/Air Hammer	4	Open Bore	NA	100	Open Bore
IW-2	Bedrock	Near Existing MW-26B	Sonic/Air Hammer	4	Open Bore	NA	100	Open Bore

**Notes:**

Well IDs will be assigned at the time of drilling/installation.

TBD - to be determined

SS - stainless steel

Sonic/Air Hammer - bedrock wells will be installed by sonic drilling to create a socket for installing permanent casing; air hammer will then be used to create the open borehole.

Open, FLUTe - The borehole will be left open and lined with a FLUTE™ FACT liner. Three of the open boreholes near MW-26B will be selected for installation of Water FLUTes for the purpose of monitoring bedrock groundwater concentrations as part of the bedrock ISCO pilot study.

Assumed well depths are included in table; actual well depths will be based on conditions encountered during the drilling program.

## **Appendix A: PDI Implementation Schedule**

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