SOIL AND GROUNDWATER MANAGEMENT PLAN (SGMP)

For

Charles C. Cashman and New Amesbury Elementary School
193 Lions Mouth Road
Amesbury, Massachusetts 01913
MassDEP RTN 3-36397

Prepared for:

DiNisco Design, Inc.
99 Chauncy Street
Boston, Massachusetts 02111

Prepared by:

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ECMS Project No. 1009.073

Environmental & Construction
Management Services, Inc.

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CERTIFICATION OF RESULTS

The evaluation was conducted on behalf of and for the exclusive use of *DiNisco Design* and their client, the *City of Amesbury* and all its successors and assigns, solely for use in an environmental evaluation of the Site. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party, in whole or in part, other than *DiNisco Design* or the *City of Amesbury* and all its successors and assigns, without the prior written consent of *Environmental & Construction Management Services, Inc. (ECMS).*

ECMS professional services have been performed, our findings obtained, and our recommendations prepared by an environmental professional and customary principles and practices in the fields of environmental science and engineering. This warranty is in lieu of all other warranties either expressed or implied. *ECMS* is not responsible for the independent conclusions, opinions or recommendations made by others based on the records review, site inspection, field exploration, and laboratory test data presented in this report.

Respectfully submitted this 15th day of October 2020.

For ***Environmental & Construction Management Services, Inc.*** by

Kevin J. Kavanaugh, L.S.P., CHMM
Principal Environmental Engineer

Stephen T. Weydt

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Principal Environmental Scientist

1.0 INTRODUCTION

This document provides a plan for the management of arsenic-impacted soil and groundwater that may be encountered during construction of a new elementary school building on the Site of the existing Cashman Elementary School. *DiNisco Design, Inc.* (*DiNisco*) is the architect supporting the City of Amesbury for the project at 193 Lions Mouth Road in Amesbury, Massachusetts (subject property). Refer to Figure 1, Site Locus/Location Plan for the general location of the Site.

This Soil and Groundwater Management Plan (SGMP) was prepared by *Environmental & Construction Management Services, Inc. (ECMS)* at the request of *DiNisco* to support construction of a new elementary school for PreK through 2nd grade students. Scope of work will also include a new parking lot, driveways, playground and planted areas on a portion of the subject property that is currently occupied by the Packer Field and wooded area. Renovations to the existing Cashman Elementary School parking lot and driveways will also be included in the scope. Site work covered by this SGMP is anticipated to include the following:

- clearing and grubbing;
- cutting, filling, and grading;
- excavation for utility installation;
- excavation for foundations and footings;
- excavation and grading for access roads and bioretention areas;
- dewatering as necessary to support excavation; and
- construction of a new building.

Based on known environmental conditions at the property, these activities will require handling and management of arsenic-impacted soil. All excavated and/or disturbed soil will be managed as specified in this SGMP. Although limited existing data does not indicate such, groundwater may contain elevated concentrations of arsenic.

2.0 BACKGROUND

ECMS conducted a Phase I Environmental Site Assessment (Phase I ESA) in September 2018 to identify and evaluate actual and potential environmental liabilities associated with the subject property. The Phase I ESA identified did not reveal any recognized environmental conditions (RECs).

In July 2020, *ECMS* completed the collection of loam/topsoil and subsoils samples from representative areas proximate to the Cashman School and from the fields adjacent to the school for laboratory analysis for potential oil and/or hazardous material (OHM) prior to proposed site construction activities. Soil sampling results indicated the presence of the metal arsenic, at concentrations above applicable standards in the shallow soil samples across the area of proposed construction. Based on the concentrations detected, the condition was reportable under the Massachusetts Contingency Plan (MCP) 310 CMR 40.0000.

Given the presence of school-aged children, an emergency assessment was performed to assess the presence of these arsenic in shallow soil in other areas of the site, including infield of Randall and Packer fields. As described in Section 2.4, *Environmental Site Characterization,* arsenic was not detected in the surface soil samples from the infield of Randall or Packer Fields at concentrations above applicable standards. Soil analytical results are presented in Tables 1 through 7 with initial arsenic analytical results presented in Table 1 – Summary of Topsoil/Loam/Subsoil Samples for pH, Reactivity, Ignitability, MassDEP 14 Metals, Polychlorinated Biphenyls (PCBs) & Total Petroleum Hydrocarbons (TPH) and additional soil sample analytical results for arsenic in Tables 5 – Summary of Baseball Infield Soil Samples for MassDEP 14 Metals, Table 6 – Summary of Background Soil Samples for MassDEP 14 Metals and Table 7 – Summary of MassDEP Collected Background Soil Samples for Arsenic and Lead. The soil sampling locations with surface arsenic concentrations are depicted on Figure 9 – Soil Sample Location Plan.

2.1 Location and Legal Description of the Site

The Site is an irregularly-shaped 35.32-acre parcel of land located at 193 Lions Mouth Road in Amesbury, Essex County, Massachusetts 01913. According to the City of Amesbury Assessor, the property is listed as parcel three (3) parcels including 50/6, 50/16 and 50/42. In addition, a portion of the adjacent Woodsom Farm (parcel 37/4) is part of the proposed project. The Site is occupied by the Charles C. Cashman Elementary School and associated athletic fields, playground, parking lots and landscaped areas. Refer to Figure 2 entitled Lot Location Plan.

The Site is depicted on the 7.5 x 15-minute U.S.G.S. topographic quadrangle for Newburyport, Massachusetts dated 1987. The Universal Transverse Mercator (UTM) coordinates of the Site within zone 19 are approximately 4,746,558 meters north latitude and 340,818.9 meters east longitude or 42° 51’ 26.06’’ north latitude and 70° 56’ 54.07’’ west longitude. Elevation at the site is approximately 105 feet above mean sea level (amsl). Figure 1 includes both a Site Locus Plan and a Street Location Map of the Site. The Site and surrounding properties are shown on Figure 2, Lot Location Plan attached to this report.

2.2 Site and Vicinity Characteristics

The Site is currently occupied by the City of Amesbury Cashman Elementary School housing grades Pre-kindergarten through 4th grade students (approximately 443 children). The Site is located within OSC – Open Space Conservancy. The school building is surrounded by a driveway and associated paved parking lots, a playground area and grass athletic field. Woodsom Farm is located to the west, and is accessed from Lions Mouth Road to the South. The north edge of the site is steeply sloping forested hill with an intermittent steam at the base. The Site is surrounded with pockets of densely settled residential neighborhoods.

2.3 Descriptions of Structures, Roads, Other Improvements on the Site

The 2-story school building is 61,472 gross square feet (GSF). The building is constructed of masonry block with brick veneer on slab on grade construction.

Assessor Office records indicate that the main Site building construction was completed in 1975. The school building is currently heated by natural gas and heated through forced air ducts. The roof is asphalt and on the roof are several HVAC units. Records indicate, the building is and always has been heated by natural gas.

The nearest surface water bodies to the Site is Lake Gardner that is located approximately 2,500 feet to the north-northeast. According to the City of Amesbury Health Department, there are no know public or private potable water supply wells in the vicinity of the Site.

The City of Amesbury obtains its drinking water from its watershed area that encompasses about 55 square miles; most of which reside in New Hampshire. Tuxbury Pond feeds the Powow River, which the treatment plant draws from. Lake Attitash and Meadowbrook also supplement the water source seasonally and in times of drought. All of Amesbury's wastewater empties into their municipal sewer system. The wastewater treatment facility is located at 19 Merrimac Street.

The site is currently supplied with natural gas and serviced by the municipal water and sewer systems. The existing Cashman School building has a sewage ejector system that was observed along the entrance driveway area south of the school.

2.4 Environmental Site Characterization

In July and August 2020, *ECMS* collected pre-construction surface and subsurface soil samples for laboratory analysis in order to characterize the soils that may require off-site disposal. Soil sampling results indicated the presence of arsenic at concentrations above applicable standards in every location sampled across the proposed work site. Additional surface soil samples were subsequently collected on July 31, 2020 from the two baseball infields (Randall and Packer Little League Fields) at the site to verify that arsenic was not present in the imported red clay soils on either field. No arsenic was detected over any reportable concentration in any of the eight (8) surface infield samples analyzed. In addition, one (1) soil sample collected on August 12, 2020 from the outfield on Randall field at a depth of approximately 2 feet below grade did not have arsenic above its reportable concentration.

The assessment revealed elevated arsenic concentrations in 28 of 28 shallow soil samples (excluding the soil samples collected from both infields and one (1) sample from the outfield of Randall Field). The concentrations of generally exceeded reportable thresholds of 20 milligrams per gram (mg/kg), and in some cases exceeded Imminent Hazard (IH) Threshold of 40 mg/kg. No soil sample had a concentration of arsenic detected over its applicable Upper Concentration Limits (UCL) of 500 mg/kg. Soil analytical results are presented in Tables 1 through 7 and soil sampling locations are depicted on Figure 3.

Though arsenic detected in the site soils are background condition associated with known elevated arsenic concentrations in bedrock, their presence in soil poses a potential risk to construction workers at the site. Based on estimated quantities of topsoil and subsoils that will be required to be disposed of off the site, additional soil sampling and laboratory analysis to characterize the soils are necessary to be completed prior to commencement of construction activities. This sampling can be best achieved during initial site preparation that includes the stripping and stockpiling of the topsoil/loam.

2.5 Release Notification Retraction

After extensive soil sampling, including sampling with the MassDEP, *ECMS* concluded that the presence of the arsenic detected on the site was from naturally occurring sources.

Consistent with the provisions of 310 CMR 40.0335(1)(c), this release notification was retracted on the basis that the subject "release" did not meet one or more of the sets of notification criteria specified in 310 CMR 40.0300. Specifically, releases of arsenic do not require notification pursuant to 310 CMR 40.0317(22) if they are in areas that are documented to have elevated arsenic measured in soil or groundwater that:

- is consistently present in the environment at and in the vicinity of the sampling location;
- is solely attributable to natural geologic or ecologic conditions; and
- has not been mobilized or transferred to another environmental medium or increased in concentration in an environmental medium as a result of anthropogenic activities.

The City of Amesbury lies within an area of Massachusetts that has been identified in studies by the United States Geological Survey (USGS) as being underlain by bedrock units, particularly the Merrimack and Nashoba formations, containing elevated arsenic concentrations (see *Arsenic and Uranium in Water from Private Well*

Completed in Bedrock of East-Central Massachusetts – Concentrations, Correlations with Bedrock Units, and Estimated Probability Maps, John A. Colman, USGS, Scientific Investigations Report 2011-5013).

Elevated concentrations of arsenic were detected in native soil across the site at all depths sampled, with the most elevated concentration detected just below the grass cover to a depth of 2 feet below grade. No field evidence was encountered that indicated soil had been disturbed or mobilized, or that an anthropogenic activity might have resulted in the elevated arsenic concentrations.

On September 17, 2020, *ECMS* submitted a Retraction of Release Notification dated September 17, 2020 in accordance MCP 310 MR 40.0335 to the MassDEP via eDEP.

In accordance with MCP 40.0335: Retracting a Notification "Submission of a notification retraction in conformance with the provisions of 310 CMR 40.0335 shall terminate all future response action requirements and submittals that would otherwise be necessitated by the reporting of said release or threat of release, unless written notice to the contrary is provided by the Department within 21 days of the Department's receipt of such retraction." Therefore, since of the writing of this SGMP has surpassed the 21 days, the *ECMS* Retraction of Release Notification dated September 17, 2020 has been conditionally accepted by MassDEP and RTN 3-36397 will be retracted and the site is not subject to the MCP at this time.

3.0 PURPOSE AND SCOPE

The objectives of this SGMP are to ensure that:

1. arsenic-impacted soil and groundwater, if encountered, are managed in accordance with applicable federal, state, and municipal laws and regulations;

2. although this site has been determined to be outside of the MCP, analytical testing and reporting are completed in accordance with Massachusetts MassDEP requirements stipulated under the MCP;

3. worker safety is preserved through awareness of potential exposure conditions;

4. the safety of the school children, workers and the general public is preserved throughout; and

5. access to excavated soil and excavation areas is limited to workers covered by an appropriate environmental Health and Safety Plan (HASP), and prevented for all others, including children, abutters, or accidental trespassers.

To achieve these objectives, this plan presents the procedures that will be followed during the management of soil and groundwater at the site. All soil and groundwater encountered within the work area will be subject to the provisions of this plan. In addition, the provisions of this plan can, and will be, extended to any other off-site areas where contaminants are detected via field screening, visual observation, or any other method.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

ECMS is the consultant responsible for the development of this Soil & Groundwater Management Plan (SGMP). Mr. Kevin J. Kavanaugh, LSP, CHMM is the primary point of contact for this project. All correspondence concerning the content or implementation of this plan should be directed to him [via email at kevin.kavanaugh@ecmsinc.com; or via telephone at (617) 338-2121 ext. 2].

This plan will be implemented by *ECMS*, the general contractor, and its subcontractors during earthwork in support of this project. The *ECMS* Project Manager, Mr. Kevin J. Kavanaugh, LSP, CHMM, is responsible for project team organization, supervision of all project tasks, and production of reports and deliverables.

An *ECMS* field scientist will be responsible for the execution of field activities, including monitoring, sampling, and stockpile management. *ECMS* field scientists have completed 40-hour OSHA Hazardous Waste Operations (HAZWOPER) training as well as 8-hour HAZWOPER Supervisor training and are experienced in excavation oversight and field screening techniques. Contact information for key contractors and individuals is as follows:

Client:	*DiNisco Design, Inc.*
Site Name:	Cashman and New Amesbury Elementary School
Site Location:	193 Lions Mouth Road, Amesbury, Massachusetts
General Contractor:	To Be Determined
Site work contractor:	To Be Determined
Field Safety Officer:	*ECMS* 288 Grove Street #391, Braintree, Massachusetts 02184 Field Scientist: To Be Determined Project Manager - LSP: Kevin J. Kavanaugh, LSP o: (617) 338-2121 c: (617) 212-9255

The general contractor's Superintendent will communicate with *ECMS* regarding this SGMP and be responsible for its implementation.

5.0 SITE MANAGEMENT

Soil will be excavated and/or disturbed for installation of subsurface features and to reach finished grades for the proposed construction project. Temporary construction fencing will be installed around construction areas to prevent access by unauthorized personnel. Stormwater and erosion control are not part of this plan, but will be implemented by the contractor in accordance with the approved construction drawings and specifications.

With the exception of the two Little League Fields (Randall and Packer), impacted soil has been found to be located from just below the grass surface to the maximum depths necessary for the proposed project. Based upon the historical use of the site, as well as site characterization data, arsenic appears to be present throughout the entire work area and the source is naturally occurring. The soil management provisions of this plan will be implemented during all soil intrusive work. The work includes handling and disposal of potentially-impacted soil for construction of new building, and appurtenant facilities, such as underground utilities. Dewatering may be required to facilitate utility and foundation installation.

During construction activities, workers will minimize contact with impacted soil (and groundwater) and practice appropriate work site hygiene. An environmental *Health and Safety Plan* (HASP) has been prepared separately and will be implemented for the project. Exclusion zones may be established based upon conditions observed during construction, and workers entering the exclusion zones during soil-intrusive activities will be required to have HAZWOPER training consistent with the requirements of 1910.120.

Materials that may be encountered during construction include, but are not limited to, the following:

- **Decontamination Water**: Water may be generated during decontamination of equipment and personal protective equipment (PPE) and, if generated, will require management.
- **Sediment:** Sediments removed from any erosion and sediment control devices (e.g., silt fence, inlet covers) or stormwater collection systems will be stockpiled in the primary stockpile area for assessment and potential off-site disposal/recycling.
- **Imported fill materials:** Clean fill materials will be brought to the site as needed. All imported materials will be inspected by the field scientist.
- **Arsenic-contaminated Soil**: The metal arsenic has been encountered in soil at concentrations exceeding applicable standards.

As only an estimated 25% of soil excavated during the project is expected to be reused on site; the project site will require additional material for cover and fill. However, excavated soil in excess or not suitable for reuse for geotechnical reasons will require off-site disposal. Soil that is suitable to be re-used on site will be placed beneath permanent structures such as buildings, concrete or asphalt paving, rubberized playground surface landscaped areas with a minimal non-arsenic-impacted soil and beneath unpaved recreational areas (such as playing fields) unless it is demonstrated by analytical testing that arsenic concentrations meet applicable standards for unrestricted use.

6.0 ENVIRONMENTAL MONITORING

Environmental monitoring will be performed by a qualified *ECMS* field scientist, who will be on site during all soil intrusive work. The field scientist will confirm compliance with this SGMP and the HASP. The scientist will monitor for dust concentrations in ambient air and will be the primary observer for potential conditions indicating the presence of contaminants other than arsenic. Conditions that may indicate the presence of contaminants in soil or groundwater may include stressed vegetation, odors, staining, buried structures such as tanks or pipelines, and elevated organic vapor concentrations. Findings will be communicated to the Site Superintendent regularly throughout each day. In addition, findings will be communicated to the workers who are handling the materials, both in real time and during follow-up tailgate meetings.

6.1 Ambient Air Monitoring

The air monitoring program is designed to protect human health and the environment surrounding the site and provide contingencies to mitigate off-property airborne particulate arsenic levels exceeding project action levels.

Ambient air within the area of excavation or soil disturbance will be monitored for total dust using a handheld meter to ensure that excavation does not create airborne particulate arsenic concentrations that pose health risks to site workers. Worker exposure monitoring is detailed in the HASP. Air monitoring will also be implemented at fixed monitoring stations at the site perimeter to evaluate air quality at the limits of the work area. One fixed monitoring station will be placed between the active work zone and the Cashman School building. Another will be placed in a location near the nearest residence at 201 and a final one if necessary, will be placed in a downwind direction (determined during construction). The fixed stations will log readings continuously and will be checked at least hourly throughout the day.

For total dust, a work zone action level of 0.02 milligrams per cubic meter (mg/m^3) has been established, as detailed in the HASP. This level is designed to be protective of workers via the inhalation pathway using exposure factors provided by MassDEP. A "fence line" or work perimeter action level for total dust will be set at 0.05 mg/m^3. This level is designed to be protective of residents in the area and students at the school. An airborne dust concentration of 15 mg/m^3 results in a visible dust cloud; therefore, the presence of visible dust will also be considered an action level.

Upon exceedance of an action level, work practices will be altered to reduce the generation of vapors or total dust. Work practice alterations may include:

- Reducing the pace of, or halting, excavation or soil handling.
- Covering areas of excavation and stockpiled soil with poly sheeting.
- Applying water or another vapor/dust suppressant.

Monitoring results will be conveyed to the Site Superintendent if results affect the selection of personal protective equipment (PPE) or require modification of construction practices (*e.g.*, work stoppage, dust-suppression).

6.2 Soil Screening

The presence of arsenic in soil is being assumed using pre-characterization soil data, which will be supplemented by additional data as work progresses as necessary. Depending upon project objectives, field screening for metals (arsenic) may be performed using a handheld x-ray fluorescence (XRF) analyzer. The use of an XRF is limited to "screening" level data but could be useful once conditions during construction are identified. Attached as Appendix A is a Review of Applications and Guidance on the Measurement of Arsenic in Soil Using XRF by the University of Florida (UF) dated June 20, 2013.

While not anticipated, if visual or olfactory observations suggest the presence contaminants other than arsenic, representative soil samples will be screened for organic vapors with a photoionization detector (PID) using the jar headspace procedure. At the beginning of each work day, the PID will be calibrated per the manufacturer's recommendations. The appropriate photosensitivity will be set on the instrument to read as isobutylene. Periodically throughout the day, background air concentrations will be noted, and calibration checks (zero and span gas) will be made. If field screening data suggest areas of significant contamination other than arsenic, excavation may be extended beyond construction requirements to remove impacted material.

7.0 MATERIAL STORAGE

Although other waste materials will be generated during execution of the project (*e.g.*, demolition building materials), this plan is limited to the management of soil and groundwater.

7.1 Soil Stockpiling and Storage

The air monitoring program is designed to protect human health and the environment surrounding the site and provide contingencies to mitigate off-property airborne particulate arsenic levels exceeding project action levels.

All excavated soil will be stockpiled pending determination of geotechnical suitability for re-use. To the extent possible, soil will be segregated based on field screening data and for planning purposes, it is presumed that elevated arsenic concentrations are ubiquitous at the site. Approximate quantities are identified in the bid documents.

This presumption will prevail until laboratory analytical data indicate otherwise. Additional soil samples will be collected prior to the initiation of construction activities and will be used to guide segregation of soil.

Although not anticipated based on pre-characterization soil sampling, the presence of significant volatile organic compounds (VOCs) or petroleum hydrocarbons can generally be detected using a combination of visual, olfactory, and PID field screening data. Any soil exhibiting characteristics that indicate contamination will be stockpiled separately.

A primary stockpile and storage location will be selected by the contractor. Temporary stockpile locations adjacent to excavations may also be designated based upon field conditions, site logistics, and project sequencing, but will be located exclusively within the subject property boundary. Soil may be temporarily stockpiled adjacent to a working excavation for backfill into that same excavation.

Up to three distinct stockpile areas will be created as follows:

- **Stockpile 1 – Arsenic-Impacted Soil** - All soil excavated from the site for potential re-use beneath buildings, rubberized playground or pavement, at depths of greater than 1 foot below grade in landscaped areas, and at depths of greater than 2 feet below grade in other unpaved recreational areas (such as playing fields).
- **Stockpile 2 - Contaminated Soil (other than arsenic)** - Excavated soil exhibiting characteristics that indicate contamination (elevated field screening data) will be characterized and disposed off-site. Soil contaminated with other than arsenic, if encountered, will not be reused on site.
- **Stockpile 3 – Non-Arsenic-Impacted Soil** - Excavated topsoil/loam that has been analyzed and is not arsenic-contaminated and can be reused unrestricted on the site.

Laboratory characterization is not required for soil being re-used on site that does not exhibit visual, olfactory, or field screening evidence of contamination.

All soil stockpiles will be securely covered by 6-mil (minimum) polyethylene sheeting at the end of each day and whenever the pile is not in active use. Run-on and run-off controls (*e.g.,* silt fence and hay bales) will be provided as needed to minimize migration of sediments to or from the pile. At no time will the generation of visible dust from the stockpiles be permitted.

Saturated materials may not be placed in stockpiles, and may not be transported from the site if free liquids are present or may be generated. All such materials will be drained or dewatered in a location near the point of generation so that drainage water is returned to the excavation.

Whenever possible, and as necessary, dewatering will be performed so that saturated soil is not generated.

7.2 Groundwater and Decontamination Water Storage

If encountered, groundwater recovered during excavation dewatering will be contained onsite pending proper characterization. If groundwater is determined to contain elevated concentrations of arsenic or other contaminants, water will be contained pending treatment and discharge (see Section 7.3) or offsite disposal. If groundwater concentrations are determined to be below applicable standards, the water can be discharged in accordance with the construction specifications.

Decontamination of construction equipment will be required prior to the equipment leaving the site. Where decontamination is required, equipment will be dry brushed to remove the majority of solids. If necessary, high pressure water and scrubbing will be used to remove remaining visible material. All decontamination rinsate will be contained on site or collected and managed for off-site disposal.

7.3 Groundwater and Decontamination Water Treatment and Discharge

If decontamination rinsate is generated or groundwater is encountered and removed from excavations, then treatment of the water under either a Construction General Permit (CGP) or a Remediation General Permit (RGP) will be required prior to on-Site discharge. Groundwater discharge must comply with construction specifications in addition to issued permits. Alternatively, if a small volume of water is generated, the water may be shipped off-site for proper treatment and disposal.

8.0 MATERIAL REUSE

Soil suitable for reuse (Stockpile 1 as defined in Section 7.1) will be backfilled into the excavation from which it was removed, to the maximum extent practicable, at the depth from which it was removed. Material that cannot be replaced into the initial excavation location will be backfilled in areas of similar characteristics and arsenic concentrations, and at appropriate depths, to the extent feasible.

Topsoil/loam suitable for reuse (Stockpile 3 as defined in Section 7.1) may be used unrestricted.

9.0 FINISHED GRADES

Due to the presence of the elevated concentrations of arsenic in the soil and the planned (and current) use of the site as an elementary school, final surface grade materials must be selected to minimize contact with arsenic impacted soil following completion of the project. In general, suitable barriers to contact included the following:

- Pavement;
- Buildings;
- Clean fill material approximately two (2) feet in thickness placed over arsenic impacted soils in recreational areas that will see more contact potential (such as a plying field);
- Clean fill material approximately one (1) foot in thickness placed over arsenic impacted soils in landscaped areas; and/or
- Gravel approximately 6 inches in thickness placed over a persistent demarcating layer within the utility corridors that have been backfilled with any arsenic containing soils.

As a result, cuts in areas that will be accessible will need to be adjusted to allow for the placement of clean base course, clean fill, and/or clean topsoil to attain finish grades.

10.0 MATERIAL CHARACTERIZATION

10.1 Soil Sampling and Analysis for Site Materials

Based upon discussions with *DiNisco*, approximately 25% of the excavated soil is anticipated to be re-used on site without laboratory analysis. However, the additional cut necessary to accommodate clean fill at finish grade may alter the cut/fill balance. For purposes of this plan, it is assumed that soil not suitable for re-use will be transported to an off-site disposal facility, or if approved by the City of Amesbury, to a City owned property that has similar arsenic concentrations under the Similar Soils Provision Guidance "Guidance for Identifying When Soil

Concentrations at a Receiving Location Are "Not Significantly Lower Than" Managed Soil Concentrations Pursuant to 310 CMR 40.0032(3) WSC#-13-500 dated September 4, 2014. The location of city owned property with similar arsenic concentrations has not been identified as of the writing of the plan. Based on the concentrations of naturally occurring arsenic found, disposal of this material is likely to be out of state. A copy of the Similar Soils Provision Guidance MassDEP Policy WSC#13-500 dated September 4, 2014 is attached as Appendix B.

Any soil transported off site should be transported under either a MassDEP Bill of Lading (BOL) or Material Shipping Record (MSR) and it is recommended that this be under the supervision of a Massachusetts Licensed Site Professional (LSP).

Currently 17 representative soil samples have been collected in-situ and analyzed for all necessary parameters for off-site disposal of excess soils generated during proposed construction. Based on a one sample per 500 cubic yards as specified in the MassDEP "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" MassDEP Policy # COMM-97-001 dated August 15, 1997. This would already cover approximately 8,500 cubic yards of soil that could be excavated and transported off-site to a disposal facility. Any additional representative samples of stockpiled soil requiring off-site recycling or disposal should be collected in accordance with the receiving facility requirements. For the purposes of this plan, the soil pre characterization requirements *ECMS* recommends that analysis be completed in accordance with the MassDEP "Reuse and Disposal of Contaminated Soil at Massachusetts Landfills" MassDEP Policy # COMM-97-001 dated August 15, 1997 unless a disposal facility is selected and requires a different list of laboratory analysis.

Stockpile samples for waste characterization will be collected as 9-point composites using clean, disposable sampling implement (*e.g.*, plastic scoop) and placed into a clean container for mixing. The aliquots will then be well-homogenized in the field in groups of three to create three 8-ounce composite sub-samples. The three (3) sub-samples will be composited by the analytical laboratory into a single sample. Each of the initial characterization samples will be submitted for analysis of polychlorinated biphenyls (EPA Method 8082), total RCRA 8 metals, VOCs (EPA Method 8260), semi-VOCs (EPA Method 8270), pH, and flashpoint. Samples will be analyzed for toxicity characteristic leaching procedure (TCLP) RCRA 8 metals as needed. Once initial characterization is complete, one soil samples is required to be analyzed for RCRA 8 metals per 500 tons of soil to be disposed. All samples will be placed on ice immediately after collection and transported to *Eurofins Spectrum Analytical Laboratory (Eurofins Spectrum)* in Rhode Island for analysis.

10.2 Soil Sampling and Analysis for Imported Materials

Clean fill that is brought into the site must be from a clean borrow site and certified to be free of contaminants. Clean fill will be characterized to confirm soil quality.

Initial loads of fill material will be fully characterized based on the origin of the material. Subsequently, samples will be collected at a minimum of one per 500 cubic yards and submitted for analysis of total arsenic.

10.3 Water Sampling and Analysis

If dewatering and water treatment are required, then water sampling and analysis requirements will be established to comply with the MCP and/or appropriate permits.

10.4 Quality Control

Given the intended re-use on site of the some of excavated soil, the assumed ubiquity and consistency of arsenic concentrations across the work area, and the lack of a need for site characterization analysis during excavation, field duplicates and equipment rinsate samples will not be prepared or submitted for this project. If contamination is discovered that triggers site characterization during this project, then the quality control requirements will be revised to reflect modified data quality objectives.

A trip blank will accompany all sample shipments that contain water samples for volatiles analysis. The trip blank will be prepared and supplied by the laboratory and will accompany the sample containers on the roundtrip from the laboratory to the site and back.

11.0 MATERIAL DISPOSAL/RECYCLING

11.1 Soil Transport and Disposal/Recycling

Whereas previously mentioned, only an estimated 25% of excavated soils will be re-used on the site. Excess soil and soil that is determined to be unsuitable for reuse (due to field screening indicating the likely presence of contaminants, geotechnical limitations, or excess volume) will be managed via off-site disposal or recycling. The soil will be transported to the receiving facility under an MCP Bill of Lading, or Uniform Hazardous Waste Manifest (if necessary), consistent with the facility permit requirements. A log of all loads shipped off site and copies of all disposal documents (including receiving facility weight slips) will be maintained by the field scientist.

The truck loading area and access road(s) will be kept free of soil. Prior to departing the site, all vehicles used to transport soil will be inspected by the field scientist to ensure that:

- The truck is licensed for hauling contaminated soil;
- A tarp has been placed over the load;

- The truck tires are free of potentially-contaminated soil; and
- The driver has the appropriate paperwork to transport the material.

If truck tires are observed to be coated with soil, decontamination will be required, as set forth in Section 12.0.

11.2 Groundwater Disposal/Recycling

If required, groundwater can be disposed off-site at a suitable facility based upon characterization data. Groundwater transported from the site must be transported under an MCP Bill of Lading or Uniform Hazardous Waste Manifest.

12.0 MATERIAL DISPOSAL/RECYCLING

Measures will be put in place to eliminate the potential for equipment to track soil off the site. A tracking pad will be installed at the site entrance/exit. All soil must be removed from equipment and vehicles prior to leaving the site.

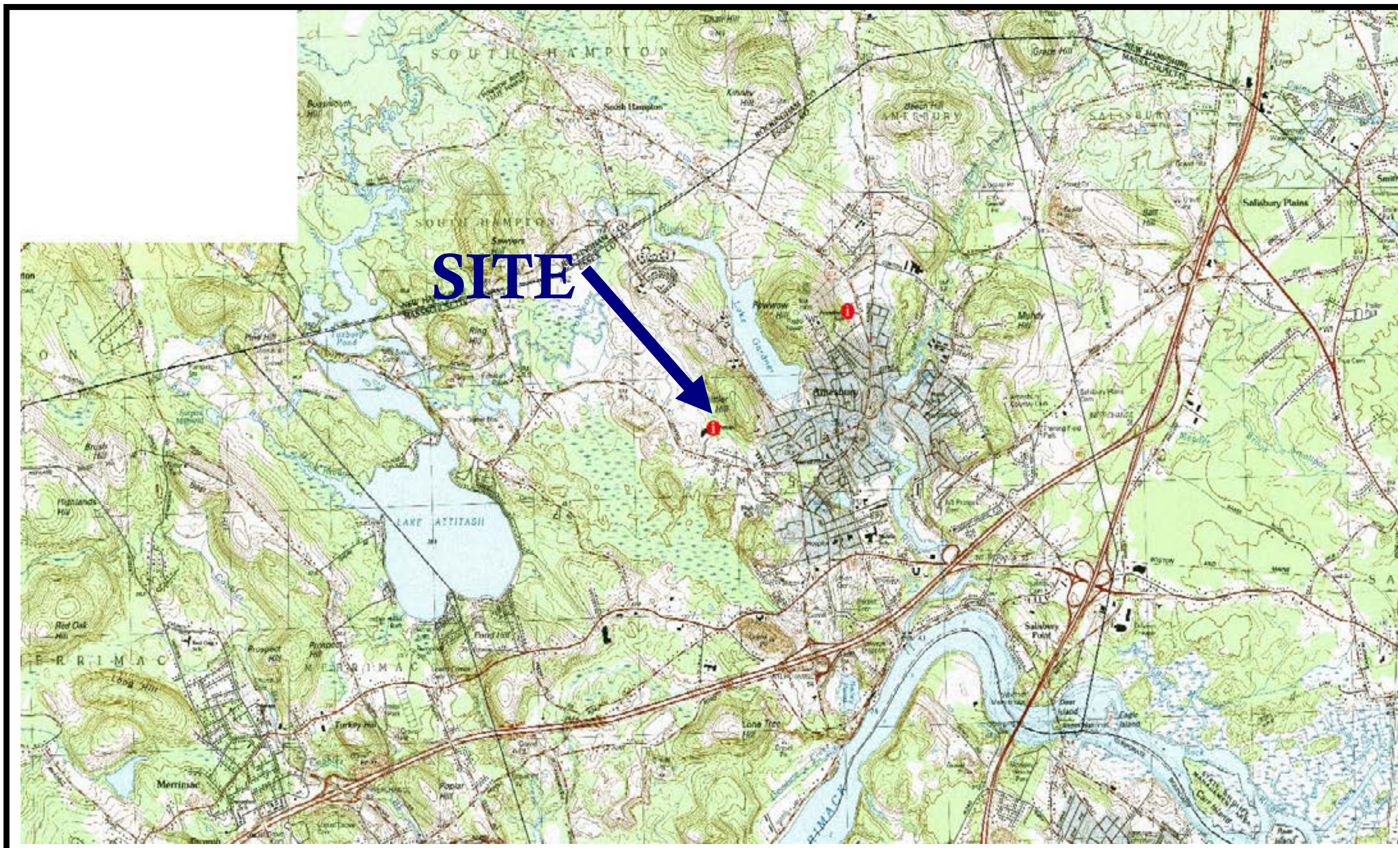
Decontamination of the equipment will be required prior to leaving the active work area. A decontamination area will be designated and constructed by the contractor in such a way as to contain decontamination liquids and/or solids to prevent them from leaving the site.

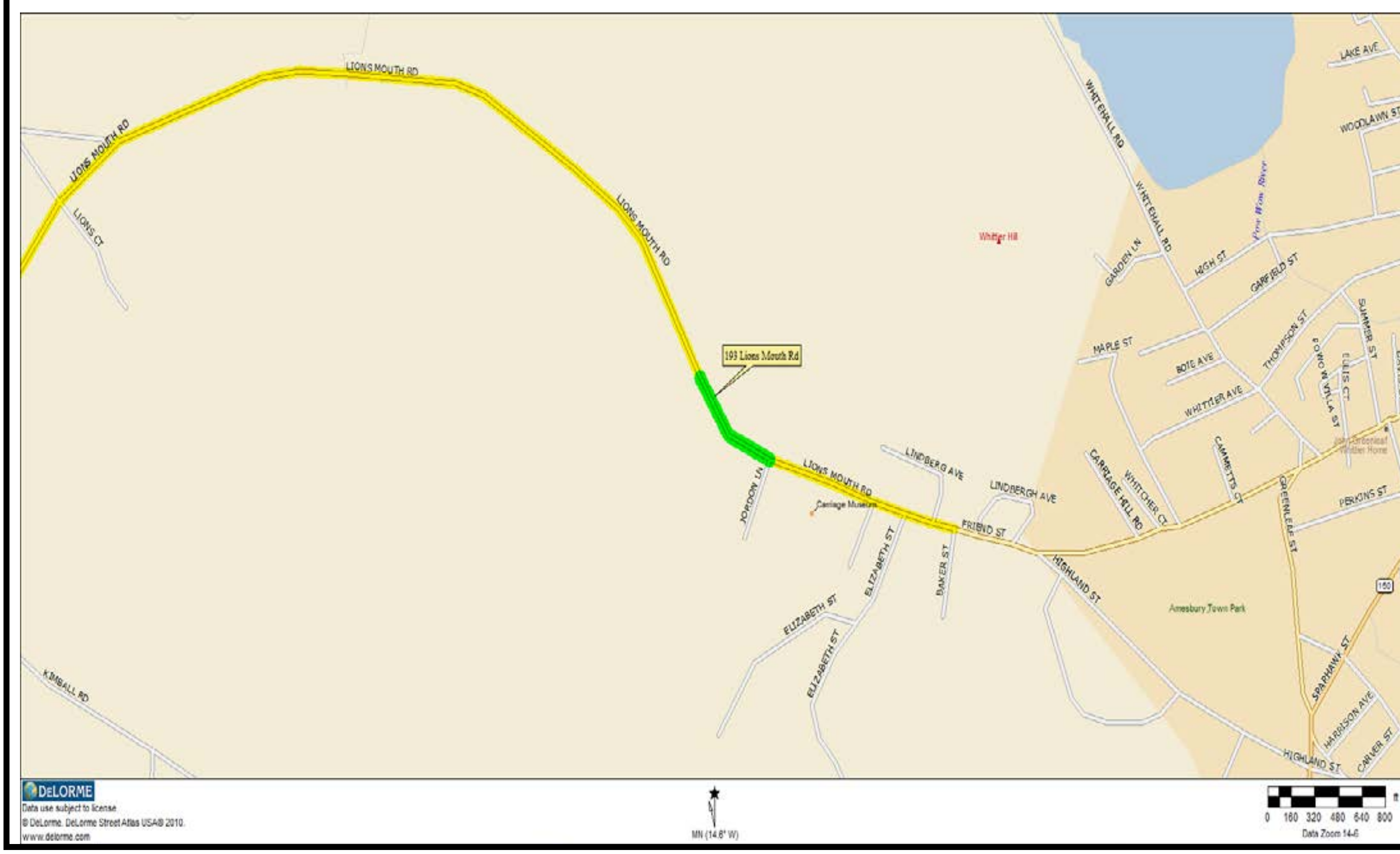
Equipment requiring decontamination will be brushed to remove adhered soil. If brushing cannot remove all visible soil, the equipment will be power washed or scrubbed and rinsed with fresh water to remove adhered soil and visible material. All decontamination rinsate will either be contained on site or be collected and managed consistent with the management of groundwater. Solids generated during decontamination must be field screened for contaminants prior to be being added to Stockpile 1.

13.0 HEALTH & SAFETY

All work under this plan will be performed in accordance with the applicable health and safety provisions for general construction established in 29 CFR 1926 and for uncontrolled hazardous waste sites as established in 29 CFR 1926.65 and 29 CFR 1910 when appropriate. A site-specific HASP has been prepared and will be implemented at the site. Health and safety monitoring of on-site operations will be performed by qualified personnel. At the onset of the project, and during weekly tailgate safety meetings, workers will be reminded of the potential for encountering contaminated soil. More frequent meetings will be held initially, with the frequency adjusted based on the variability of site conditions.

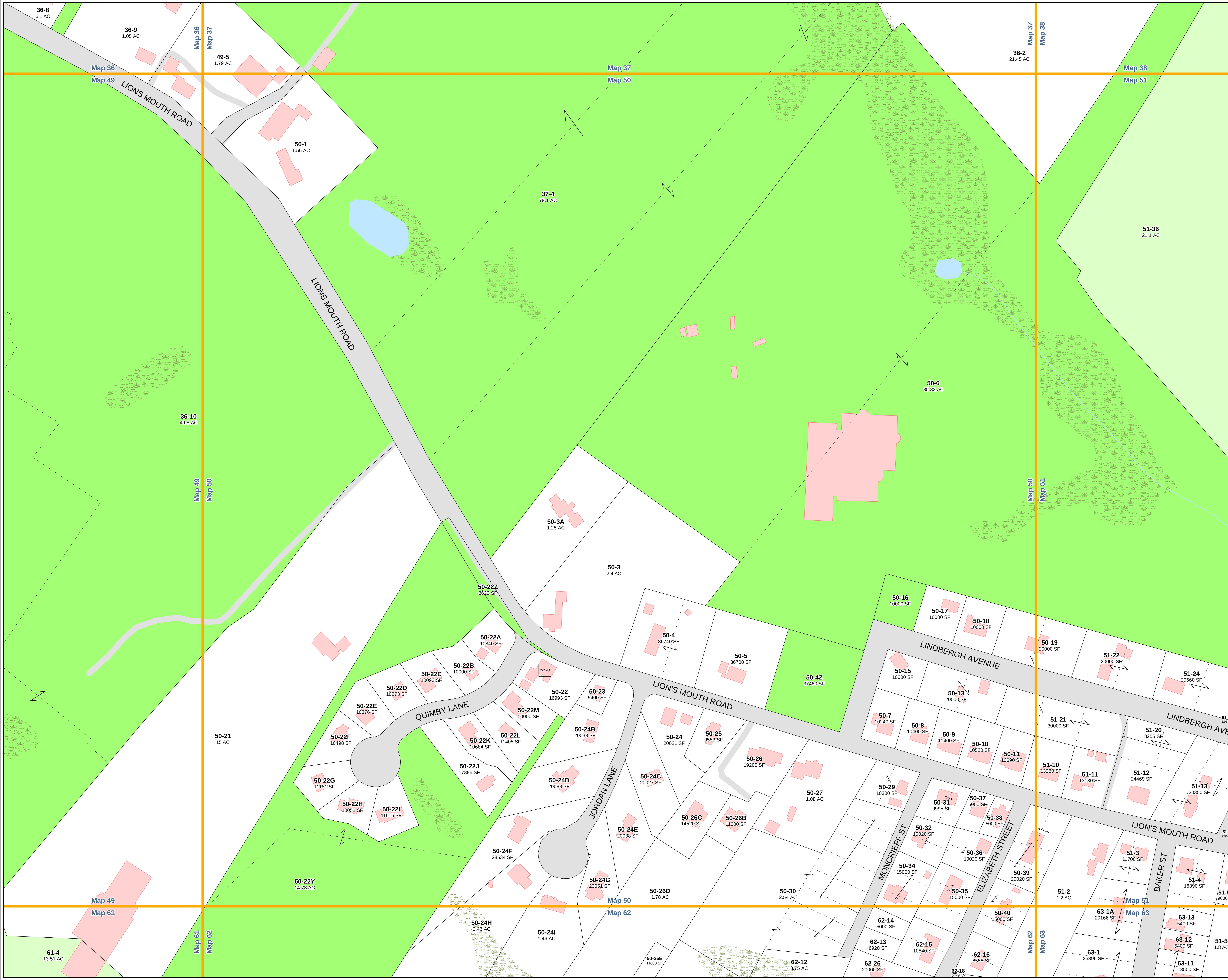
FIGURES





Cashman Elementary School **193 Lions Mouth Road** **Amesbury, Massachusetts** **01913**	**Environmental & Construction Management Services, Inc.**	**Project No.** 1009.073	**Figure 1**
		Site Locus / Street Location Plan	
		Drawn By: KJK	**Date:** 8/24/18

N



CITY OF AMESBURY, MASS.

Assessor Maps

CITY OF AMESBURY
Incorporated
1668
MASSACHUSETTS

LEGEND

- Parcel Line
- Building Footprints
- Prior Parcel Line with Common Ownership
- 5 Condo Unit Number
- Right of Way
- Map Index
- Town Boundaries
- Easements
- Hydrographic Features
- Streams
- Wetlands

Exempt Lands

- Federal
- State
- Municipal
- Private

N

SCALE: 1" = 100'

100 0 100 200 300 400

NOTE:
THE AREAS, BOUNDARIES, AND DIMENSIONS SHOWN ON THIS TAX MAP ARE DERIVED FROM AERIAL PHOTOGRAPHS, GROUND SURVEYS, AND RECORDED PLANS, MAPS, DEEDS, AND WILLS, AND ARE INTENDED TO BE USED FOR PROPERTY ASSESSMENT PURPOSES ONLY AND NOT FOR CONVEYANCE.

MAP REVISION DATE		
As of January 1, 2018		

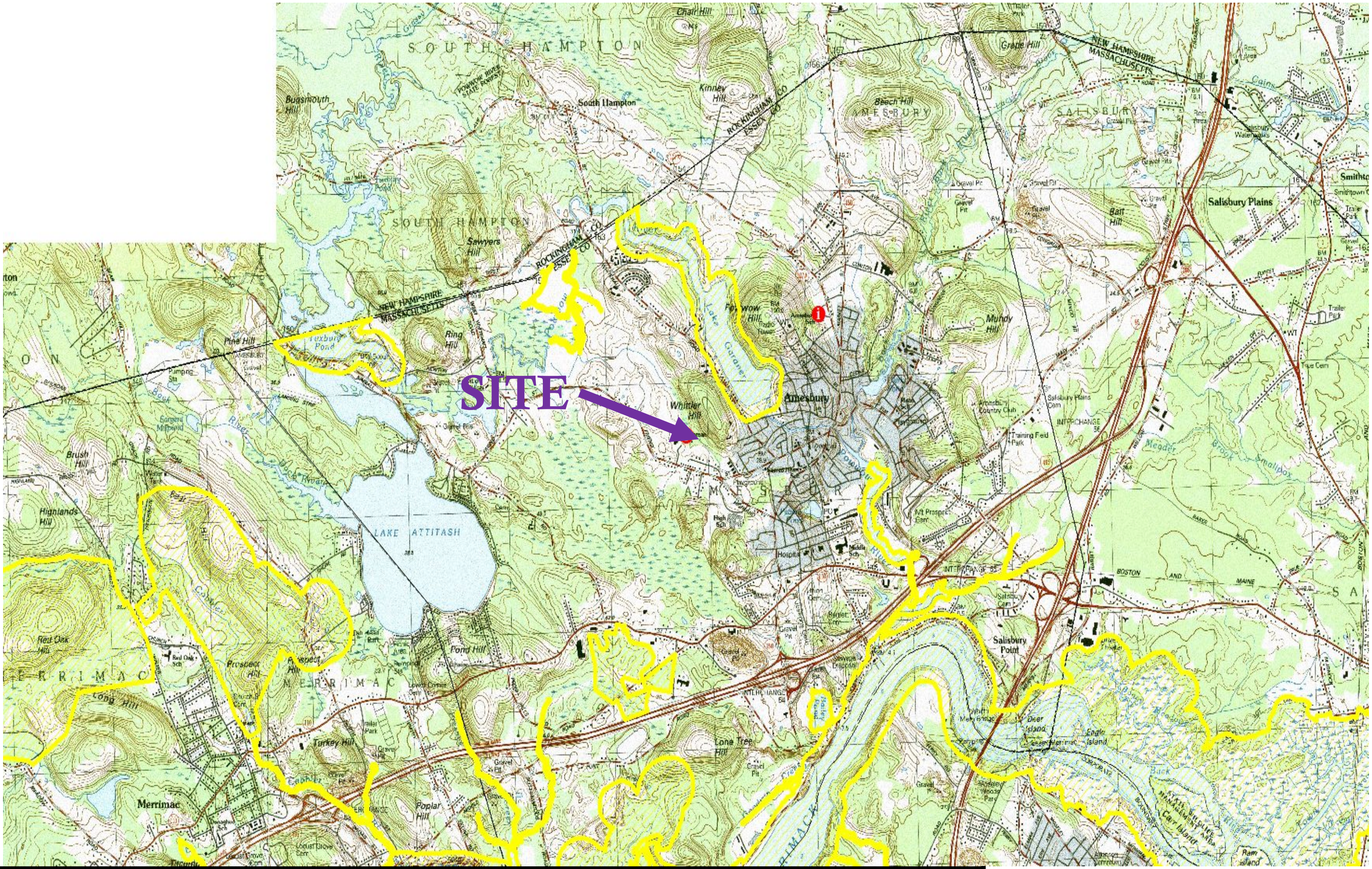
Data Sources: The data for this map was supplied by the Merrimack Valley Planning Commission, the Town of Amesbury and the Executive Office of Environmental Affairs/MassGIS.

Merrimack Valley Planning Commission
plan • develop • promote

J:\ArcGIS\Amesbury\AmesburyAssessorMap_24x36.mxd

INDEX

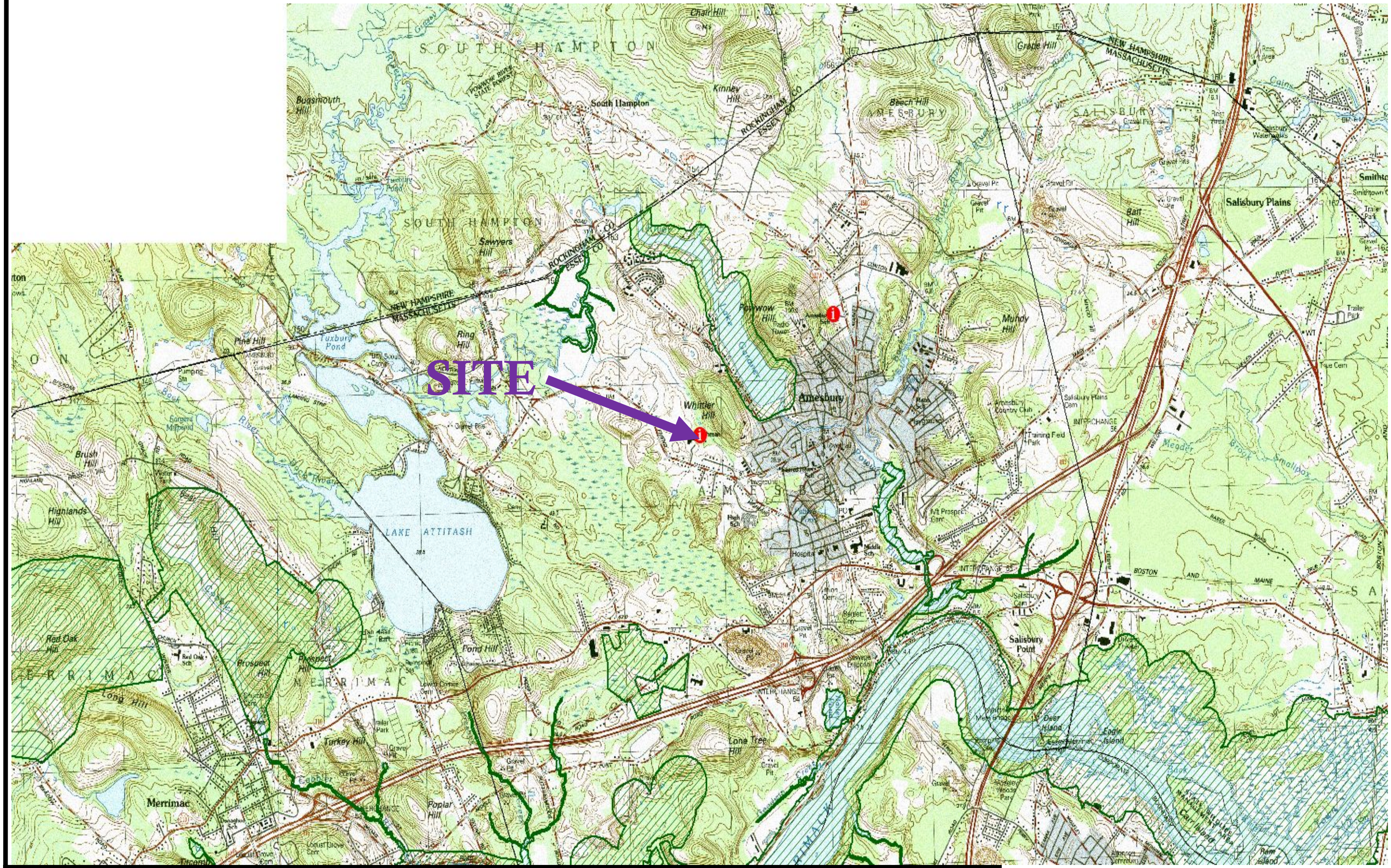
Map 50



Cashman Elementary School
193 Lions Mouth Road
Amesbury, Massachusetts
01913

Environmental & Construction Management Services, Inc.

Project No. 1009.073	Figure 3
Priority Habitats of Rare Species Plan	
Drawn By: KJK	Date: 8/23/18



Cashman Elementary School
193 Lions Mouth Road
Amesbury, Massachusetts
01913

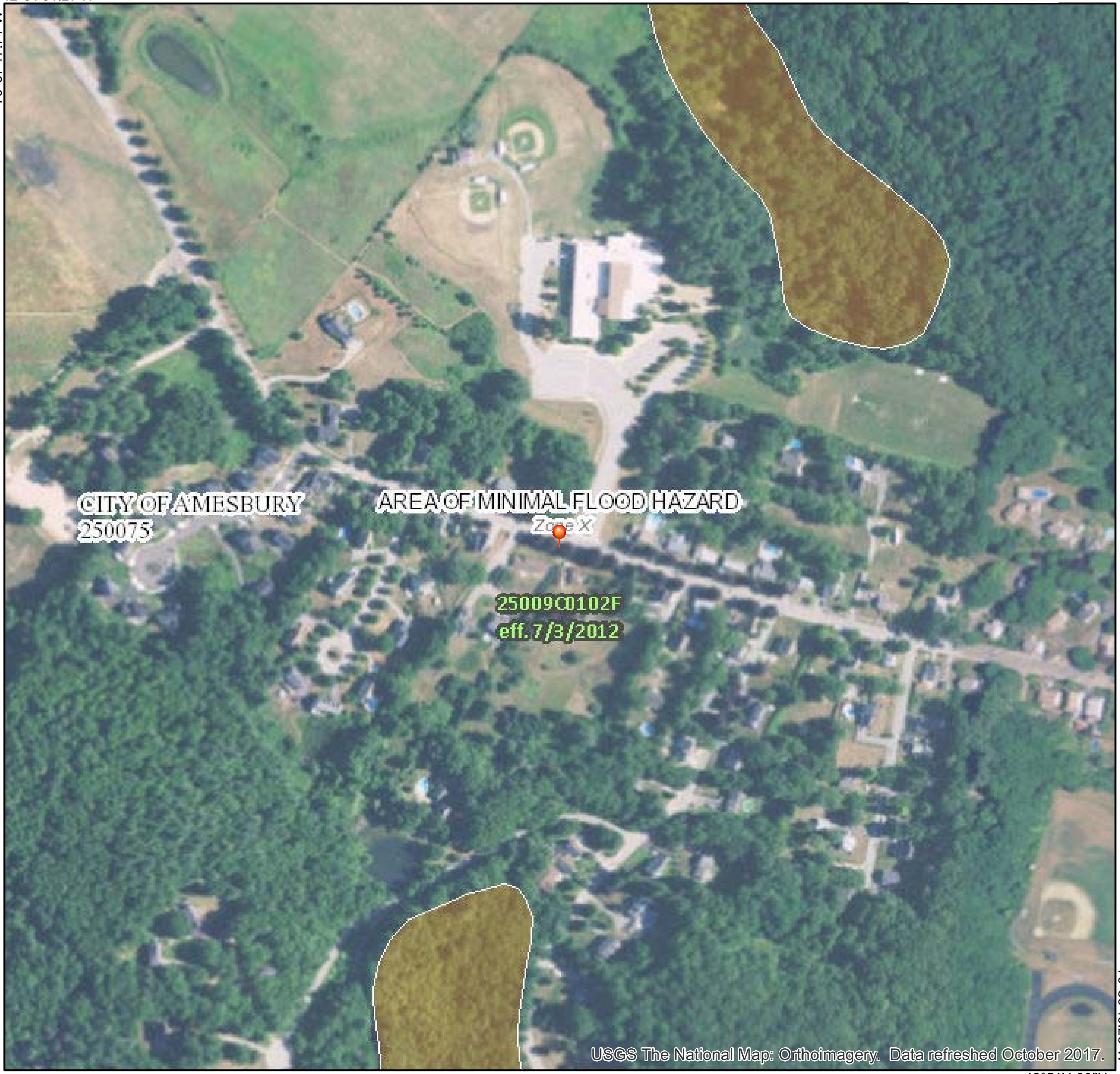
Environmental & Construction Management Services, Inc.

Project No. 1009.073	**Figure 4**
Map of Estimated Habitats of Rare Wildlife and Certified Vernal Pools	
Drawn By: KJK	**Date:** 8/23/18

Cashman Elementary School 193 Lions Mouth Road Amesbury, Massachusetts 01913	Environmental & Construction Management Services, Inc.	**Project No.** 1009.073	**Figure 5**
		Aerial Photograph Site Location Plan	
		Drawn By: KJK	**Date:** 8/24/2018

National Flood Hazard Layer FIRMette

FEMA



Legend

FIGURE 7

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

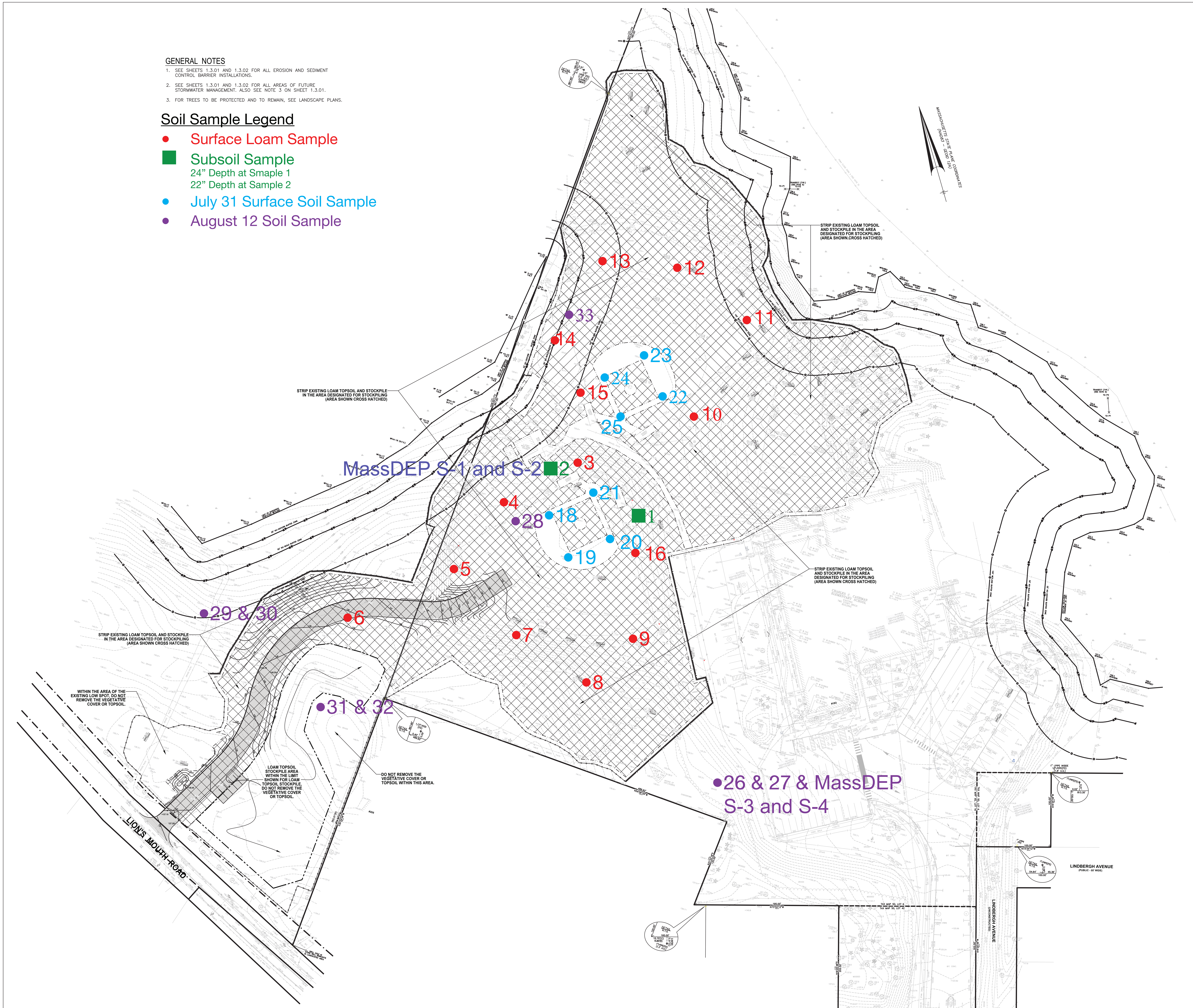
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/13/2018 at 3:39:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Cashman Elementary School 193 Lions Mouth Road Amesbury, Massachusetts 01913	Environmental & Construction Management Services, Inc.	**Project No.** 1009.073	**Figure 8**
		Site Plan	
		Drawn By: KJK	**Date:** 8/23/18



AMESBURY ELEMENTARY SCHOOL

EARLY SITE PREPARATION

AMESBURY, MA

DINISCO DESIGN
architects + planners

99 Chauncy Street, Suite 901
Boston, MA 02111
(617) 426-2858

DGT Associates
Surveying & Engineers
1071 Worcester Road
Framingham, MA 01701
(508) 879-0030

Brown Sardina, Inc.
Landscape Architects
24 Roland Street
Boston, MA 02129
(617) 482-4703

Thompson Engineering Company, Inc.
Electrical Engineers
89 Newbury Street, Suite 103
Danvers, MA 01923
(617) 866-9066

Hancock Associates
Surveyor
185 Centre Street
Danvers, MA 09123
(978) 777-3050

KEY PLAN

NORTH ARROW

STAMP

Date: 6 JULY 2020

Drawn By: KMR

Scale: 0 40 80

Revisions

Number	Date	Description

Figure 8 - Soil Sample Location Plan

TABLES

TABLE 1

SUMMARY OF TOPSOIL/LOAM/SUBSOIL SAMPLES FOR pH, REACTIVITY, IGNITABILITY, MASSDEP 14 METALS, POLCHLORINATED BIPHENYLS (PCBs) & TOTAL PETROLEUM HYDROCARBONS (TPH)

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		**SS-1**	**SS-2**	**SSS-3**	**SSS-4**	**SSS-5**	**SSS-6**	**SSS-7**	**SSS-8**	**SSS-9**	**MassDEP**	**MassDEP**
Laboratory ID		**SC58794-01**	**SC58794-02**	**SC58794-10**	**SC58794-11**	**SC58794-12**	**SC58794-13**	**SC58794-14**	**SC58794-15**	**SC58794-16**	**Reportable**	**Imminent**
Sample Date		**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**Concentrations**	**Hazard**
Sample Depth		**24"**	**22"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**RCS-1**	
SM2540 G (11) Mod. (%)												
solids	% Solids	89.3	88.8	82.7	88.9	85.8	92.6	83.4	86.1	78.7	NA	
SW846 9045D (pH Units)												
pH		5.99	6.08	6.13	5.58	5.57	5.74	5.71	5.56	5.41	NA	
SW846 Ch. 7.3 (mg/kg dry)												
Reactivity		Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative		
Reactive Cyanide		<6	<7	<7	<6	<6	<6	<7	<6	<7	30	
Reactive Sulfide		< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20		
SW846 1030 (N/A)												
NA	Ignitability by Definition	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	NA	
MassDEP 14 Metals - SW846 6010C (mg/kg)												
7440-36-0	Antimony	<5.59	<5.58	<5.98	<5.41	<6.27	<5.63	<6.01	<6.24	<6.28	20	
7440-38-2	Arsenic	**39.9**	**55.9**	**36.6**	**20.5**	**53.4**	**29.6**	**48.6**	**48.7**	**82.3**	**20**	40
7440-41-7	Beryllium	<0.559	<0.558	<0.598	<0.541	<0.627	<0.563	<0.601	<0.624	<0.628	90	
7440-43-9	Cadmium	<0.559	<0.558	<0.598	<0.541	<0.627	<0.563	<0.601	<0.624	<0.628	70	
7440-47-3	Chromium	22.6	19.4	21.8	18.8	25.0	30.0	65.9	31.6	24.7	100	
7439-92-1	Lead	8.42	19.3	17.0	18.6	17.0	15.8	28.6	21.0	22.9	200	
7440-02-0	Nickel	39.7	71.4	33.2	20.3	46.2	25.6	44.8	47.7	76.0	600	
7782-49-2	Selenium	<1.68	<1.67	<1.80	<1.62	<1.88	<1.69	<1.80	<1.87	<1.88	400	
7440-22-4	Silver	<3.35	<3.35	<3.59	<3.25	<3.76	<3.38	<3.60	<3.75	<3.77	100	
7440-28-0	Thallium	<3.35	<3.35	<3.59	<3.25	<3.76	<3.38	<3.60	<3.75	<3.77	8	
7440-62-2	Vanadium	22.7	24.5	30.1	24.5	33.9	35.8	46.7	36.0	39.4	400	
7440-66-6	Zinc	36.3	58.5	107	36.0	52.1	43.2	56.2	52.3	64.7	1000	
7440-39-3	Barium	18.4	22.5	30.0	29.5	30.3	28.6	34.6	33.0	29.1	1000	
RCRA Metals - SW846 7471B (mg/kg)												
7439-97-6	Mercury	<0.115	<0.127	<0.110	<0.116	<0.103	<0.120	<0.128	<0.115	<0.120	20	
Polychlorinated biphenyls (PCBs) - SW846 8082A (µg/kg)												
12674-11-2	Aroclor-1016	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
11104-28-2	Aroclor-1221	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
11141-16-5	Aroclor-1232	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
53469-21-9	Aroclor-1242	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
12672-29-6	Aroclor-1248	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
11097-69-1	Aroclor-1254	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
11096-82-5	Aroclor-1260	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	1000	
37324-23-5	Aroclor-1262	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	-	
11100-14-4	Aroclor-1268	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	-	
Total Petroleum Hydrocarbons (TPH) 8100 by GC (mg/kg)												
PH(TOT)	Total Petroleum Hydrocarbons	24.9	38.7	113	118	106	134	170	111	129	1000	

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazrdous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 1

SUMMARY OF TOPSOIL/LOAM/SUBSOIL SAMPLES FOR pH, REACTIVITY, IGNITABILITY, MASSDEP 14 METALS, POLCHLORINATED BIPHENYLS (PCBs) & TOTAL PETROLEUM HYDROCARBONS (TPH)

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		**SSS-10**	**SSS-11**	**SSS-12**	**SSS-13**	**SSS-14**	**SSS-15**	**SSS-16**	**SSS-17**	**MassDEP Reportable Concentrations RCS-1**	**MassDEP Imminent Hazard**
Laboratory ID		**SC58794-03**	**SC58794-04**	**SC58794-05**	**SC58794-06**	**SC58794-07**	**SC58794-17**	**SC58794-08**	**SC58794-09**		
Sample Date		**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**		
Sample Depth		**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**		
SM2540 G (11) Mod. (%)											
solids	% Solids	80.1	80.6	83.3	79.0	86.9	79.8	90.3	89.6	NA	
SW846 9045D (pH Units)											
pH		6.17	5.47	5.71	6.35	6.03	5.69	6.08	6.11		
SW846 Ch. 7.3 (mg/kg dry)											
Reactivity		Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative		
Reactive Cyanide		<7	<9	<6	<7	<6	<7	<6	<6	30	
Reactive Sulfide		< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20		
SW846 1030 (N/A)											
NA	Ignitability by Definition	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative	NA	
MassDEP 14 Metals - SW846 6010C (mg/kg)											
7440-36-0	Antimony	<5.89	<6.24	<5.56	<6.11	<5.63	<6.33	<5.58	<5.33	20	
7440-38-2	Arsenic	**25.4**	**33.6**	**39.2**	**49.1**	**23.7**	**37.8**	**36.6**	**21.9**	**20**	**40**
7440-41-7	Beryllium	<0.589	<0.624	<0.556	<0.611	<0.563	<0.633	<0.558	<0.533	90	
7440-43-9	Cadmium	<0.589	<0.624	<0.556	<0.611	<0.563	<0.633	<0.558	<0.533	70	
7440-47-3	Chromium	22.9	23.2	17.4	23.3	36.0	31.5	21.7	19.4	100	
7439-92-1	Lead	13.7	18.9	19.6	22.7	13.7	25.9	17.5	12.1	200	
7440-02-0	Nickel	28.2	30.4	26.9	37.2	26.1	37.7	30.6	27.9	600	
7782-49-2	Selenium	<1.77	<1.87	<1.67	<1.83	<1.69	<1.90	<1.67	<1.60	400	
7440-22-4	Silver	<3.53	<3.74	<3.34	<3.67	<3.38	<3.80	<3.35	<3.20	100	
7440-28-0	Thallium	<3.53	<3.74	<3.34	<3.67	<3.38	<3.80	<3.35	<3.20	8	
7440-62-2	Vanadium	29.6	38.3	33.5	34.6	41.9	36.3	30.6	8.48	400	
7440-66-6	Zinc	60.8	43.2	37.9	49.2	44.6	60.7	44.3	61.8	1000	
7440-39-3	Barium	26.5	24.8	21.7	28.9	44.1	46.3	24.0	113	1000	
RCRA Metals - SW846 7471B (mg/kg)											
7439-97-6	Mercury	<0.117	<0.126	<0.129	<0.133	<0.118	<0.123	<0.119	<0.116	20	
Polychlorinated biphenyls (PCBs) - SW846 8082A (µg/kg)											
12674-11-2	Aroclor-1016	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
11104-28-2	Aroclor-1221	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
11141-16-5	Aroclor-1232	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
53469-21-9	Aroclor-1242	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
12672-29-6	Aroclor-1248	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
11097-69-1	Aroclor-1254	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
11096-82-5	Aroclor-1260	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	1000	
37324-23-5	Aroclor-1262	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	-	
11100-14-4	Aroclor-1268	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	-	
Total Petroleum Hydrocarbons (TPH) 8100 by GC (mg/kg)											
PH(TOT)	Total Petroleum Hydrocarbons	109	184	180	93.0	116	168	93.6	49.7	1000	

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazrdous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 2

SUMMARY OF TOPSOIL/LOAM & SUBSOIL SAMPLES FOR VOLATILE ORGANIC COMPOUNDS (VOCs)

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		SS-1	SS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7	SSS-8	SSS-9	MassDEP Reportable Concentrations
Laboratory ID		SC58794-01	SC58794-02	SC58794-10	SC58794-11	SC58794-12	SC58794-13	SC58794-14	SC58794-15	SC58794-16	
Sample Date		7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	
Sample Depth		24"	22"	2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	RCS-1
Volatile Organic Compounds (VOCs) - SW846 8260B (µg/kg)											
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
67-64-1	Acetone	<532	<573	<711	<643	<662	<521	<594	<605	<760	6000
107-13-1	Acrylonitrile	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
71-43-2	Benzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	2000
108-86-1	Bromobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
74-97-5	Bromochloromethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
75-27-4	Bromodichloromethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
75-25-2	Bromoform	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
74-83-9	Bromomethane	<106	<115	<142	<129	<132	<104	<119	<121	<152	500
78-93-3	2-Butanone (MEK)	<106	<115	<142	<129	<132	<104	<119	<121	<152	4000
104-51-8	n-Butylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
135-98-8	sec-Butylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
98-06-6	tert-Butylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
75-15-0	Carbon disulfide	<106	<115	<142	<129	<132	<104	<119	<121	<152	100000
56-23-5	Carbon tetrachloride	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	5000
108-90-7	Chlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	1000
75-00-3	Chloroethane	<106	<115	<142	<129	<132	<104	<119	<121	<152	100000
67-66-3	Chloroform	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	200
74-87-3	Chloromethane	<106	<115	<142	<129	<132	<104	<119	<121	<152	100000
95-49-8	2-Chlorotoluene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
106-43-4	4-Chlorotoluene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
96-12-8	1,2-Dibromo-3-chloropropane	<106	<115	<142	<129	<132	<104	<119	<121	<152	10000
124-48-1	Dibromochloromethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	5
106-93-4	1,2-Dibromoethane (EDB)	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
74-95-3	Dibromomethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	500000
95-50-1	1,2-Dichlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	9000
541-73-1	1,3-Dichlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	3000
106-46-7	1,4-Dichlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	700
75-71-8	Dichlorodifluoromethane (Freon12)	<106	<115	<142	<129	<132	<104	<119	<121	<152	1000000
75-34-3	1,1-Dichloroethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	400
107-06-2	1,2-Dichloroethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
75-35-4	1,1-Dichloroethene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	3000
156-59-2	cis-1,2-Dichloroethene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	300
156-60-5	trans-1,2-Dichloroethene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	1000
78-87-5	1,2-Dichloropropane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
142-28-9	1,3-Dichloropropane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	500000
594-20-7	2,2-Dichloropropane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
563-58-6	1,1-Dichloropropene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
10061-01-5	cis-1,3-Dichloropropene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	10
10061-02-6	trans-1,3-Dichloropropene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	10
100-41-4	Ethylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	40000
87-68-3	Hexachlorobutadiene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	30000
591-78-6	2-Hexanone (MBK)	<106	<115	<142	<129	<132	<104	<119	<121	<152	100000
98-82-8	Isopropylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	1000000
99-87-6	4-Isopropyltoluene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
1634-04-4	Methyl tert-butyl ether	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
108-10-1	4-Methyl-2-pentanone (MIBK)	<106	<115	<142	<129	<132	<104	<119	<121	<152	400
75-09-2	Methylene chloride	<106	<115	<142	<129	<132	<104	<119	<121	<152	100
91-20-3	Naphthalene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	4000
103-65-1	n-Propylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
100-42-5	Styrene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	3000
630-20-6	1,1,1,2-Tetrachloroethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
79-34-5	1,1,2,2-Tetrachloroethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	5
127-18-4	Tetrachloroethene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	1000
108-88-3	Toluene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	30000
87-61-6	1,2,3-Trichlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
120-82-1	1,2,4-Trichlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	2000
108-70-3	1,3,5-Trichlorobenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	30000
71-55-6	1,1,1-Trichloroethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
79-00-5	1,1,2-Trichloroethane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100
79-01-6	Trichloroethene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	300
75-69-4	Trichlorofluoromethane (Freon 11)	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	1000000
96-18-4	1,2,3-Trichloropropane	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
95-63-6	1,2,4-Trimethylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	1000000
108-67-8	1,3,5-Trimethylbenzene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	10000
75-01-4	Vinyl chloride	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	700
179601-23-1	m,p-Xylene	<106	<115	<142	<129	<132	<104	<119	<121	<152	300000
95-47-6	o-Xylene	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	500000
109-99-9	Tetrahydrofuran	<106	<115	<142	<129	<132	<104	<119	<121	<152	500000
60-29-7	Ethyl ether	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
994-05-8	Tert-amyl methyl ether	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
637-92-3	Ethyl tert-butyl ether	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	
108-20-3	Di-isopropyl ether	<53.2	<57.3	<71.1	<64.3	<66.2	<52.1	<59.4	<60.5	<76.0	100000
75-65-0	Tert-Butanol / butyl alcohol	<1060	<1150	<1420	<1290	<1320	<1040	<1190	<1210	<1520	100000
123-91-1	1,4-Dioxane	<1060	<1150	<1420	<1290	<1320	<1040	<1190	<1210	<1520	10000
110-57-6	trans-1,4-Dichloro-2-butene	<266	<286	<356	<321	<331	<261	<297	<302	<380	200
64-17-5	Ethanol	<10600	<11500	<14200	<12900	<13200	<10400	<11900	<12100	<15200	100000

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazrdous Materials List (MOHML) revised (effective) February 14, 2008

Environmental & Construction Management Services, Inc.

TABLE 2

SUMMARY OF TOPSOIL/LOAM & SUBSOIL SAMPLES FOR VOLATILE ORGANIC COMPOUNDS (VOCs)

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		**SSS-10**	**SSS-11**	**SSS-12**	**SSS-13**	**SSS-14**	**SSS-15**	**SSS-16**	**SSS-17**	**MassDEP Reportable Concentrations**
Laboratory ID		**SC58794-03**	**SC58794-04**	**SC58794-05**	**SC58794-06**	**SC58794-07**	**SC58794-17**	**SC58794-08**	**SC58794-09**	
Sample Date		**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	
Sample Depth		**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**RCS-1**
Volatile Organic Compounds (VOCs) - SW846 8260B (µg/kg)										
76-13-1	1,1,2-Trichlorotrifluoroethane (Freon 113)	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
67-64-1	Acetone	<686	<693	<637	<695	<585	<695	<540	<529	6000
107-13-1	Acrylonitrile	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
71-43-2	Benzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	2000
108-86-1	Bromobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
74-97-5	Bromochloromethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
75-27-4	Bromodichloromethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
75-25-2	Bromoform	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
74-83-9	Bromomethane	<137	<139	<127	<139	<117	<139	<108	<106	500
78-93-3	2-Butanone (MEK)	<137	<139	<127	<139	<117	<139	<108	<106	4000
104-51-8	n-Butylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
135-98-8	sec-Butylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
98-06-6	tert-Butylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
75-15-0	Carbon disulfide	<137	<139	<127	<139	<117	<139	<108	<106	100000
56-23-5	Carbon tetrachloride	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	5000
108-90-7	Chlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	1000
75-00-3	Chloroethane	<137	<139	<127	<139	<117	<139	<108	<106	100000
67-66-3	Chloroform	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	200
74-87-3	Chloromethane	<137	<139	<127	<139	<117	<139	<108	<106	100000
95-49-8	2-Chlorotoluene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
106-43-4	4-Chlorotoluene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
96-12-8	1,2-Dibromo-3-chloropropane	<137	<139	<127	<139	<117	<139	<108	<106	10000
124-48-1	Dibromochloromethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	5
106-93-4	1,2-Dibromoethane (EDB)	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
74-95-3	Dibromomethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	500000
95-50-1	1,2-Dichlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	9000
541-73-1	1,3-Dichlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	3000
106-46-7	1,4-Dichlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	700
75-71-8	Dichlorodifluoromethane (Freon12)	<137	<139	<127	<139	<117	<139	<108	<106	1000000
75-34-3	1,1-Dichloroethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	400
107-06-2	1,2-Dichloroethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
75-35-4	1,1-Dichloroethene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	3000
156-59-2	cis-1,2-Dichloroethene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	300
156-60-5	trans-1,2-Dichloroethene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	1000
78-87-5	1,2-Dichloropropane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
142-28-9	1,3-Dichloropropane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	500000
594-20-7	2,2-Dichloropropane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
563-58-6	1,1-Dichloropropene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
10061-01-5	cis-1,3-Dichloropropene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	10
10061-02-6	trans-1,3-Dichloropropene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	10
100-41-4	Ethylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	40000
87-68-3	Hexachlorobutadiene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	30000
591-78-6	2-Hexanone (MBK)	<137	<139	<127	<139	<117	<139	<108	<106	100000
98-82-8	Isopropylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	1000000
99-87-6	4-Isopropyltoluene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
1634-04-4	Methyl tert-butyl ether	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
108-10-1	4-Methyl-2-pentanone (MIBK)	<137	<139	<127	<139	<117	<139	<108	<106	400
75-09-2	Methylene chloride	<137	<139	<127	<139	<117	<139	<108	<106	100
91-20-3	Naphthalene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	4000
103-65-1	n-Propylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
100-42-5	Styrene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	3000
630-20-6	1,1,1,2-Tetrachloroethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
79-34-5	1,1,2,2-Tetrachloroethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	5
127-18-4	Tetrachloroethene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	1000
108-88-3	Toluene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	30000
87-61-6	1,2,3-Trichlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
120-82-1	1,2,4-Trichlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	2000
108-70-3	1,3,5-Trichlorobenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	30000
71-55-6	1,1,1-Trichloroethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
79-00-5	1,1,2-Trichloroethane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100
79-01-6	Trichloroethene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	300
75-69-4	Trichlorofluoromethane (Freon 11)	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	1000000
96-18-4	1,2,3-Trichloropropane	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
95-63-6	1,2,4-Trimethylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	1000000
108-67-8	1,3,5-Trimethylbenzene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	10000
75-01-4	Vinyl chloride	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	700
179601-23-1	m,p-Xylene	<137	<139	<127	<139	<117	<139	<108	<106	300000
95-47-6	o-Xylene	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	500000
109-99-9	Tetrahydrofuran	<137	<139	<127	<139	<117	<139	<108	<106	500000
60-29-7	Ethyl ether	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
994-05-8	Tert-amyl methyl ether	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
637-92-3	Ethyl tert-butyl ether	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	
108-20-3	Di-isopropyl ether	<68.6	<69.3	<63.7	<69.5	<58.5	<69.5	<54.0	<52.9	100000
75-65-0	Tert-Butanol / butyl alcohol	<1370	<1390	<1270	<1390	<1170	<1390	<1080	<1060	100000
123-91-1	1,4-Dioxane	<1370	<1390	<1270	<1390	<1170	<1390	<1080	<1060	10000
110-57-6	trans-1,4-Dichloro-2-butene	<343	<347	<318	<348	<292	<347	<270	<264	200
64-17-5	Ethanol	<13700	<13900	<12700	<13900	<11700	<13900	<10800	<10600	100000

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazrdous Materials List (MOHML) revised (effective) February 14, 2008

Environmental & Construction Management Services, Inc.

TABLE 3

SUMMARY OF TOPSOIL/LOAM & SUBSOIL SAMPLES FOR SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		SS-1	SS-2	SSS-3	SSS-4	SSS-5	SSS-6	SSS-7	SSS-8	SSS-9	MassDEP Reportable Concentrations
Laboratory ID		SC58794-01	SC58794-02	SC58794-10	SC58794-11	SC58794-12	SC58794-13	SC58794-14	SC58794-15	SC58794-16	
Sample Date		7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	
Sample Depth		24"	22"	2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	RCS-1
Semi-Volatile Organic Compounds (SVOCs) - SW846 8270D (µg/kg)											
83-32-9	Acenaphthene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	4000
208-96-8	Acenaphthylene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000
62-53-3	Aniline	<368	<369	<396	<367	<379	<352	<394	<379	<415	100000
120-12-7	Anthracene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000000
103-33-3	Azobenzene/Diphenyldiazene	<368	<369	<396	<367	<379	<352	<394	<379	<415	50000
92-87-5	Benzidine	<736	<738	<792	<735	<759	<704	<787	<757	<829	10000
56-55-3	Benzo (a) anthracene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	7000
50-32-8	Benzo (a) pyrene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	2000
205-99-2	Benzo (b) fluoranthene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	7000
191-24-2	Benzo (g,h,i) perylene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000000
207-08-9	Benzo (k) fluoranthene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000000
65-85-0	Benzoic acid	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000000
100-51-6	Benzyl alcohol	<368	<369	<396	<367	<379	<352	<394	<379	<415	-
111-91-1	Bis(2-chloroethoxy)methane	<368	<369	<396	<367	<379	<352	<394	<379	<415	500000
111-44-4	Bis(2-chloroethyl)ether	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
108-60-1	Bis(2-chloroisopropyl)ether	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
117-81-7	Bis(2-ethylhexyl)phthalate	<186	<187	<201	<186	<192	<178	<199	<192	<210	200000
101-55-3	4-Bromophenyl phenyl ether	<368	<369	<396	<367	<379	<352	<394	<379	<415	100000
85-68-7	Butyl benzyl phthalate	<368	<369	<396	<367	<379	<352	<394	<379	<415	100000
86-74-8	Carbazole	<186	<187	<201	<186	<192	<178	<199	<192	<210	-
59-50-7	4-Chloro-3-methylphenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000000
106-47-8	4-Chloroaniline	<186	<187	<201	<186	<192	<178	<199	<192	<210	1000
91-58-7	2-Chloronaphthalene	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000000
95-57-8	2-Chlorophenol	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
7005-72-3	4-Chlorophenyl phenyl ether	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000000
218-01-9	Chrysene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	70000
53-70-3	Dibenzo (a,h) anthracene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	700
132-64-9	Dibenzofuran	<186	<187	<201	<186	<192	<178	<199	<192	<210	100000
95-50-1	1,2-Dichlorobenzene	<368	<369	<396	<367	<379	<352	<394	<379	<415	9000
541-73-1	1,3-Dichlorobenzene	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000
106-46-7	1,4-Dichlorobenzene	<368	<369	<396	<367	<379	<352	<394	<379	<415	700
91-94-1	3,3´-Dichlorobenzidine	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000
120-83-2	2,4-Dichlorophenol	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
84-66-2	Diethyl phthalate	<368	<369	<396	<367	<379	<352	<394	<379	<415	10000
131-11-3	Dimethyl phthalate	<368	<369	<396	<367	<379	<352	<394	<379	<415	30000
105-67-9	2,4-Dimethylphenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	700
84-74-2	Di-n-butyl phthalate	<368	<369	<396	<367	<379	<352	<394	<379	<415	50000
534-52-1	4,6-Dinitro-2-methylphenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	50000
51-28-5	2,4-Dinitrophenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	3000
121-14-2	2,4-Dinitrotoluene	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
606-20-2	2,6-Dinitrotoluene	<186	<187	<201	<186	<192	<178	<199	<192	<210	100000
117-84-0	Di-n-octyl phthalate	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000000
206-44-0	Fluoranthene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000000
86-73-7	Fluorene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000000
118-74-1	Hexachlorobenzene	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
87-68-3	Hexachlorobutadiene	<186	<187	<201	<186	<192	<178	<199	<192	<210	6000
77-47-4	Hexachlorocyclopentadiene	<186	<187	<201	<186	<192	<178	<199	<192	<210	50000
67-72-1	Hexachloroethane	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
193-39-5	Indeno (1,2,3-cd) pyrene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	7000
78-59-1	Isophorone	<186	<187	<201	<186	<192	<178	<199	<192	<210	100000
91-57-6	2-Methylnaphthalene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	700
95-48-7	2-Methylphenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	500000
108-39-4, 106-44-5	3 & 4-Methylphenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	500000
91-20-3	Naphthalene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	4000
88-74-4	2-Nitroaniline	<368	<369	<396	<367	<379	<352	<394	<379	<415	-
99-09-2	3-Nitroaniline	<368	<369	<396	<367	<379	<352	<394	<379	<415	-
100-01-6	4-Nitroaniline	<186	<187	<201	<186	<192	<178	<199	<192	<210	1000000
98-95-3	Nitrobenzene	<186	<187	<201	<186	<192	<178	<199	<192	<210	500000
88-75-5	2-Nitrophenol	<186	<187	<201	<186	<192	<178	<199	<192	<210	100000
100-02-7	4-Nitrophenol	<1470	<1480	<1580	<1470	<1520	<1410	<1570	<1510	<1660	100000
62-75-9	N-Nitrosodimethylamine	<186	<187	<201	<186	<192	<178	<199	<192	<210	50000
621-64-7	N-Nitrosodi-n-propylamine	<186	<187	<201	<186	<192	<178	<199	<192	<210	50000
86-30-6	N-Nitrosodiphenylamine	<368	<369	<396	<367	<379	<352	<394	<379	<415	100000
87-86-5	Pentachlorophenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	3000
85-01-8	Phenanthrene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	10000
108-95-2	Phenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000
129-00-0	Pyrene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	1000000
110-86-1	Pyridine	<368	<369	<396	<367	<379	<352	<394	<379	<415	500000
120-82-1	1,2,4-Trichlorobenzene	<368	<369	<396	<367	<379	<352	<394	<379	<415	2000
90-12-0	1-Methylnaphthalene	<74.4	<74.6	<80.1	<74.3	<76.7	<71.1	<79.6	<76.5	<83.8	-
95-95-4	2,4,5-Trichlorophenol	<368	<369	<396	<367	<379	<352	<394	<379	<415	3000
88-06-2	2,4,6-Trichlorophenol	<186	<187	<201	<186	<192	<178	<199	<192	<210	700
82-68-8	Pentachloronitrobenzene	<368	<369	<396	<367	<379	<352	<394	<379	<415	100000
95-94-3	1,2,4,5-Tetrachlorobenzene	<368	<369	<396	<367	<379	<352	<394	<379	<415	1000000

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Boldfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 3

SUMMARY OF TOPSOIL/LOAM & SUBSOIL SAMPLES FOR SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		SSS-10	SSS-11	SSS-12	SSS-13	SSS-14	SSS-15	SSS-16	SSS-17	MassDEP Reportable Concentrations
Laboratory ID		SC58794-03	SC58794-04	SC58794-05	SC58794-06	SC58794-07	SC58794-17	SC58794-08	SC58794-09	
Sample Date		7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	7/9/2020	
Sample Depth		2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	2-6"	RCS-1
Semi-Volatile Organic Compounds (SVOCs) - SW846 8270D (µg/kg)										
83-32-9	Acenaphthene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	4000
208-96-8	Acenaphthylene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000
62-53-3	Aniline	<407	<405	<385	<414	<375	<407	<361	<356	100000
120-12-7	Anthracene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000000
103-33-3	Azobenzene/Diphenyldiazene	<407	<405	<385	<414	<375	<407	<361	<356	50000
92-87-5	Benzidine	<815	<809	<771	<828	<750	<814	<722	<713	10000
56-55-3	Benzo (a) anthracene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	7000
50-32-8	Benzo (a) pyrene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	2000
205-99-2	Benzo (b) fluoranthene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	7000
191-24-2	Benzo (g,h,i) perylene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000000
207-08-9	Benzo (k) fluoranthene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000000
65-85-0	Benzoic acid	<407	<405	<385	<414	<375	<407	<361	<356	1000000
100-51-6	Benzyl alcohol	<407	<405	<385	<414	<375	<407	<361	<356	-
111-91-1	Bis(2-chloroethoxy)methane	<407	<405	<385	<414	<375	<407	<361	<356	500000
111-44-4	Bis(2-chloroethyl)ether	<206	<205	<195	<210	<190	<206	<183	<180	700
108-60-1	Bis(2-chloroisopropyl)ether	<206	<205	<195	<210	<190	<206	<183	<180	700
117-81-7	Bis(2-ethylhexyl)phthalate	305	<205	<195	<210	<190	<206	<183	<180	200000
101-55-3	4-Bromophenyl phenyl ether	<407	<405	<385	<414	<375	<407	<361	<356	100000
85-68-7	Butyl benzyl phthalate	<407	<405	<385	<414	<375	<407	<361	<356	100000
86-74-8	Carbazole	<206	<205	<195	<210	<190	<206	<183	<180	-
59-50-7	4-Chloro-3-methylphenol	<407	<405	<385	<414	<375	<407	<361	<356	1000000
106-47-8	4-Chloroaniline	<206	<205	<195	<210	<190	<206	<183	<180	1000
91-58-7	2-Chloronaphthalene	<407	<405	<385	<414	<375	<407	<361	<356	1000000
95-57-8	2-Chlorophenol	<206	<205	<195	<210	<190	<206	<183	<180	700
7005-72-3	4-Chlorophenyl phenyl ether	<407	<405	<385	<414	<375	<407	<361	<356	1000000
218-01-9	Chrysene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	70000
53-70-3	Dibenzo (a,h) anthracene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	700
132-64-9	Dibenzofuran	<206	<205	<195	<210	<190	<206	<183	<180	100000
95-50-1	1,2-Dichlorobenzene	<407	<405	<385	<414	<375	<407	<361	<356	9000
541-73-1	1,3-Dichlorobenzene	<407	<405	<385	<414	<375	<407	<361	<356	1000
106-46-7	1,4-Dichlorobenzene	<407	<405	<385	<414	<375	<407	<361	<356	700
91-94-1	3,3´-Dichlorobenzidine	<407	<405	<385	<414	<375	<407	<361	<356	1000
120-83-2	2,4-Dichlorophenol	<206	<205	<195	<210	<190	<206	<183	<180	700
84-66-2	Diethyl phthalate	<407	<405	<385	<414	<375	<407	<361	<356	10000
131-11-3	Dimethyl phthalate	<407	<405	<385	<414	<375	<407	<361	<356	30000
105-67-9	2,4-Dimethylphenol	<407	<405	<385	<414	<375	<407	<361	<356	700
84-74-2	Di-n-butyl phthalate	<407	<405	<385	<414	<375	<407	<361	<356	50000
534-52-1	4,6-Dinitro-2-methylphenol	<407	<405	<385	<414	<375	<407	<361	<356	50000
51-28-5	2,4-Dinitrophenol	<407	<405	<385	<414	<375	<407	<361	<356	3000
121-14-2	2,4-Dinitrotoluene	<206	<205	<195	<210	<190	<206	<183	<180	700
606-20-2	2,6-Dinitrotoluene	<206	<205	<195	<210	<190	<206	<183	<180	100000
117-84-0	Di-n-octyl phthalate	<407	<405	<385	<414	<375	<407	<361	<356	1000000
206-44-0	Fluoranthene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000000
86-73-7	Fluorene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000000
118-74-1	Hexachlorobenzene	<206	<205	<195	<210	<190	<206	<183	<180	700
87-68-3	Hexachlorobutadiene	<206	<205	<195	<210	<190	<206	<183	<180	6000
77-47-4	Hexachlorocyclopentadiene	<206	<205	<195	<210	<190	<206	<183	<180	50000
67-72-1	Hexachloroethane	<206	<205	<195	<210	<190	<206	<183	<180	700
193-39-5	Indeno (1,2,3-cd) pyrene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	7000
78-59-1	Isophorone	<206	<205	<195	<210	<190	<206	<183	<180	100000
91-57-6	2-Methylnaphthalene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	700
95-48-7	2-Methylphenol	<407	<405	<385	<414	<375	<407	<361	<356	500000
108-39-4, 106-44-5	3 & 4-Methylphenol	<407	<405	<385	<414	<375	<407	<361	<356	500000
91-20-3	Naphthalene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	4000
88-74-4	2-Nitroaniline	<407	<405	<385	<414	<375	<407	<361	<356	-
99-09-2	3-Nitroaniline	<407	<405	<385	<414	<375	<407	<361	<356	-
100-01-6	4-Nitroaniline	<206	<205	<195	<210	<190	<206	<183	<180	1000000
98-95-3	Nitrobenzene	<206	<205	<195	<210	<190	<206	<183	<180	500000
88-75-5	2-Nitrophenol	<206	<205	<195	<210	<190	<206	<183	<180	100000
100-02-7	4-Nitrophenol	<1630	<1620	<1540	<1660	<1500	<1630	<1440	<1430	100000
62-75-9	N-Nitrosodimethylamine	<206	<205	<195	<210	<190	<206	<183	<180	50000
621-64-7	N-Nitrosodi-n-propylamine	<206	<205	<195	<210	<190	<206	<183	<180	50000
86-30-6	N-Nitrosodiphenylamine	<407	<405	<385	<414	<375	<407	<361	<356	100000
87-86-5	Pentachlorophenol	<407	<405	<385	<414	<375	<407	<361	<356	3000
85-01-8	Phenanthrene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	10000
108-95-2	Phenol	<407	<405	<385	<414	<375	<407	<361	<356	1000
129-00-0	Pyrene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	1000000
110-86-1	Pyridine	<407	<405	<385	<414	<375	<407	<361	<356	500000
120-82-1	1,2,4-Trichlorobenzene	<407	<405	<385	<414	<375	<407	<361	<356	2000
90-12-0	1-Methylnaphthalene	<82.3	<81.8	<77.9	<83.7	<75.8	<82.3	<73.0	<72.0	-
95-95-4	2,4,5-Trichlorophenol	<407	<405	<385	<414	<375	<407	<361	<356	3000
88-06-2	2,4,6-Trichlorophenol	<206	<205	<195	<210	<190	<206	<183	<180	700
82-68-8	Pentachloronitrobenzene	<407	<405	<385	<414	<375	<407	<361	<356	100000
95-94-3	1,2,4,5-Tetrachlorobenzene	<407	<405	<385	<414	<375	<407	<361	<356	1000000

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Boldfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 4

SUMMARY OF TOPSOIL/LOAM & SUBSOIL SAMPLES FOR PESTICIDES AND HERBICIDES

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location Laboratory ID Sample Date Sample Depth		**SS-1 SC58794-01 7/9/2020 24"**	**SS-2 SC58794-02 7/9/2020 22"**	**SSS-3 SC58794-10 7/9/2020 2-6"**	**SSS-4 SC58794-11 7/9/2020 2-6"**	**SSS-5 SC58794-12 7/9/2020 2-6"**	**SSS-6 SC58794-13 7/9/2020 2-6"**	**SSS-7 SC58794-14 7/9/2020 2-6"**	**SSS-8 SC58794-15 7/9/2020 2-6"**	**SSS-9 SC58794-16 7/9/2020 2-6"**	**MCP Reportable Concentrations RCS-1**
Pesticides - SW846 8081B (µg/kg)											
319-84-6	a-BHC	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	50000
319-85-7	b-BHC	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	10000
319-86-8	d-BHC	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	10000
58-89-9	g-BHC (Lindane)	<3.32	<3.34	<3.46	<3.23	<3.46	<3.22	<3.57	<3.45	<3.80	3000
76-44-8	Heptachlor	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	200
309-00-2	Aldrin	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	100000
1024-57-3	Heptachlor epoxide	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	90
959-98-8	Endosulfan I	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	500
60-57-1	Dieldrin	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	50
72-55-9	4,4' -DDE	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	3000
72-20-8	Endrin	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	8000
33213-65-9	Endosulfan II	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	500
72-54-8	4,4' -DDD	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	4000
1031-07-8	Endosulfan sulfate	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	-
50-29-3	4,4' -DDT	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	-
72-43-5	Methoxychlor	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	200000
53494-70-5	Endrin ketone	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	8000
7421-93-4	Endrin aldehyde	<8.85	<8.90	<9.24	<8.60	<9.21	<8.58	<9.51	<9.19	<10.1	10000
5103-71-9	alpha-Chlordane	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	-
5103-74-2	gamma-Chlordane	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	-
8001-35-2	Toxaphene	<111	<111	<115	<108	<115	<107	<119	<115	<127	10000
57-74-9	Chlordane	<22.1	<22.3	<23.1	<21.5	<23.0	<21.4	<23.8	<23.0	<25.3	700
15972-60-8	Alachlor	<5.53	<5.56	<5.77	<5.38	<5.76	<5.36	<5.94	<5.75	<6.34	100
Herbicides - SW846 8151A (µg/kg)											
93-76-5	2,4,5-T	<80	<80	<80	<80	<80	<80	<80	<80	<80	100000
93-72-1	2,4,5-TP (Silvex)	<80	<80	<80	<80	<80	<80	<80	<80	<80	100000
94-75-7	2,4-D	<80	<80	<80	<80	<80	<80	<80	<80	<80	100000
94-82-6	2,4-DB	<80	<80	<80	<80	<80	<80	<80	<80	<80	100000
75-99-0	Dalapon	<80	<80	<80	<80	<80	<80	<80	<80	<80	1000000
1918-00-9	Dicamba	<80	<80	<80	<80	<80	<80	<80	<80	<80	500000
120-36-5	Dichloroprop	<80	<80	<80	<80	<80	<80	<80	<80	<80	-
88-85-7	Dinoseb	<80	<80	<80	<80	<80	<80	<80	<80	<80	500000
94-74-6	MCPA	<3300	<3300	<3300	<3300	<3300	<3300	<3300	<3300	<3300	100000
7085-19-0	MCPP	<3300	<3300	<3300	<3300	<3300	<3300	<3300	<3300	<3300	-

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Boldfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 4

SUMMARY OF TOPSOIL/LOAM & SUBSOIL SAMPLES FOR PESTICIDES AND HERBICIDES

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		**SSS-10**	**SSS-11**	**SSS-12**	**SSS-13**	**SSS-14**	**SSS-15**	**SSS-16**	**SSS-17**	**MCP**
Laboratory ID		**SC58794-03**	**SC58794-04**	**SC58794-05**	**SC58794-06**	**SC58794-07**	**SC58794-17**	**SC58794-08**	**SC58794-09**	**Reportable**
Sample Date		**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**7/9/2020**	**Concentrations**
Sample Depth		**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**2-6"**	**RCS-1**
Pesticides - SW846 8081B (µg/kg)										
319-84-6	a-BHC	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	4000
319-85-7	b-BHC	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	3000
319-86-8	d-BHC	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	3000
58-89-9	g-BHC (Lindane)	<3.64	<3.69	<3.51	<3.78	<3.38	<3.73	<3.26	<3.34	50000
76-44-8	Heptachlor	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	100
309-00-2	Aldrin	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	100000
1024-57-3	Heptachlor epoxide	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	10000
959-98-8	Endosulfan I	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	700
60-57-1	Dieldrin	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	10000
72-55-9	4,4' -DDE	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	50
72-20-8	Endrin	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	500
33213-65-9	Endosulfan II	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	500
72-54-8	4,4' -DDD	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	-
1031-07-8	Endosulfan sulfate	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	8000
50-29-3	4,4' -DDT	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	10000
72-43-5	Methoxychlor	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	8000
53494-70-5	Endrin ketone	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	3000
7421-93-4	Endrin aldehyde	<9.71	<9.84	<9.36	<10.1	<9.01	<9.95	<8.71	<8.92	200
5103-71-9	alpha-Chlordane	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	90
5103-74-2	gamma-Chlordane	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	700
8001-35-2	Toxaphene	<121	<123	<117	<126	<113	<124	<109	<111	200000
57-74-9	Chlordane	<24.3	<24.6	<23.4	<25.2	<22.5	<24.9	<21.8	<22.3	10000
15972-60-8	Alachlor	<6.07	<6.15	<5.85	<6.30	<5.63	<6.22	<5.44	<5.57	-
Herbicides - SW846 8151A (µg/kg)										
93-76-5	2,4,5-T	<80	<80	<80	<80	<80	<80	<80	<80	100000
93-72-1	2,4,5-TP (Silvex)	<80	<80	<80	<80	<80	<80	<80	<80	100000
94-75-7	2,4-D	<80	<80	<80	<80	<80	<80	<80	<80	100000
94-82-6	2,4-DB	<80	<80	<80	<80	<80	<80	<80	<80	100000
75-99-0	Dalapon	<80	<80	<80	<80	<80	<80	<80	<80	1000000
1918-00-9	Dicamba	<80	<80	<80	<80	<80	<80	<80	<80	500000
120-36-5	Dichloroprop	<80	<80	<80	<80	<80	<80	<80	<80	-
88-85-7	Dinoseb	<80	<80	<80	<80	<80	<80	<80	<80	500000
94-74-6	MCPA	<3300	<3300	<3300	<3300	<3300	<3300	<3300	<3300	100000
7085-19-0	MCPP	<3300	<3300	<3300	<3300	<3300	<3300	<3300	<3300	-

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Boldfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 5

SUMMARY OF BASEBALL INFIELD SOIL SAMPLES FOR MASSDEP 14 METALS

Cashman School
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		**SSS-18**	**SSS-19**	**SSS-20**	**SSS-21**	**SSS-22**	**SSS-23**	**SSS-24**	**SSS-25**	**MassDEP**	**MassDEP**
Laboratory ID		**SC58954-01**	**SC58954-02**	**SC58954-03**	**SC58954-04**	**SC58954-05**	**SC58954-06**	**SC58954-07**	**SC58954-08**	**Reportable**	**Imminent**
Sample Date		**7/31/2020**	**7/31/2020**	**7/31/2020**	**7/31/2020**	**7/31/2020**	**7/31/2020**	**7/31/2020**	**7/31/2020**	**Concentrations**	**Hazard**
Sample Location		**Randall Field - 1st Base**	**Randall Field - 2nd Base**	**Randall Field - 3rd Base**	**Randall Field - Home Plate**	**Packer Field - 1st Base**	**Packer Field - 2nd Base**	**Packer Field - 3rd Base**	**Packer Field - Home Plate**	**RCS-1**	
Sample Depth		**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**Surface**	**(mg/kg)**	
SM2540 G (11) Mod. (%)											
solids	% Solids	86.9	90.9	90.9	86.7	90.1	90.2	87.5	90.0	NA	
MassDEP 14 Metals - SW846 6010C (mg/kg)											
7440-36-0	Antimony	<5.90	<5.43	<5.43	<6.07	<5.13	<5.45	<5.68	<5.61	20	
7440-38-2	Arsenic	10.9	11.6	10.7	15.8	13.6	14.8	13.4	15.3	20	40
7440-41-7	Beryllium	<0.590	<0.543	<0.543	<0.607	<0.513	<0.545	<0.568	<0.561	90	
7440-43-9	Cadmium	<0.590	<0.543	<0.543	<0.607	<0.513	<0.545	<0.568	<0.561	70	
7440-47-3	Chromium	10.8	14.6	11.1	11.8	9.20	7.74	9.07	8.99	100	
7439-92-1	Lead	6.88	7.03	6.04	8.03	6.24	7.26	6.72	6.88	200	
7440-02-0	Nickel	5.65	6.67	6.73	6.81	5.25	5.20	4.90	5.42	600	
7782-49-2	Selenium	<1.77	<1.63	<1.63	<1.82	<1.54	<1.63	<1.70	<1.68	400	
7440-22-4	Silver	<3.54	<3.26	<3.26	<3.64	<3.08	<3.27	<3.41	<3.37	100	
7440-28-0	Thallium	<3.54	<3.26	<3.26	<3.64	<3.08	<3.27	<3.41	<3.37	8	
7440-62-2	Vanadium	13.6	14.4	14.6	17.2	15.6	15.8	16.2	15.5	400	
7440-66-6	Zinc	25.3	24.6	22.6	28.1	26.0	27.0	27.8	27.6	1000	
7440-39-3	Barium	31.4	33.2	27.0	45.7	29.4	25.4	31.5	29.2	1000	
RCRA Metals - SW846 7471B (mg/kg)											
7439-97-6	Mercury	<0.0323	<0.0363	<0.0310	<0.0305	<0.0388	<0.0321	<0.0319	<0.0330	20	

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014

Environmental & Construction Management Services, Inc.

TABLE 6

SUMMARY OF BACKGROUND SOIL SAMPLES FOR MASSDEP 14 METALS

Cashman School & Woodsom Farm Property
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location		SSS-26**	SSS-27**	SSS-28	SSS-29	SSS-30	SSS-31	SSS-32	SSS-33	MassDEP Reportable Concentrations RCS-1 (mg/kg)	MassDEP Imminent Hazard
Laboratory ID		SC59063-01	SC59063-02	SC59063-03	SC59063-04	SC59063-05	SC59063-06	SC59063-07	SC59063-08		
Sample Date		8/12/2020	8/12/2020	8/12/2020	8/12/2020	8/12/2020	8/12/2020	8/12/2020	8/12/2020		
Sample Location		Background-Woods	Background-Woods	Randall Field - Outfield	Background-Woodsom Farm	Background-Woodsom Farm	Background-Woodsom Farm	Background-Woodsom Farm	Packer Field - Outfield		
Sample Depth		0-6"	12"	18-24"	6"	18-22"	6"	18-22"	14-18"		
SM2540 G (11) Mod. (%)											
solids	% Solids	93.3	93.1	95.6	89.8	84.7	90.2	94.9	89.6	NA	
MassDEP 14 Metals - SW846 6010C (mg/kg)											
7440-36-0	Antimony	<5.34	<5.50	<4.92	<5.21	<5.68	<5.70	<5.25	<5.56	20	
7440-38-2	Arsenic	**56.1**	**65.5**	4.89	**27.7**	**31.2**	**74.8**	**89.6**	**62.3**	20	40
7440-41-7	Beryllium	<0.534	<0.550	<0.492	0.590	<0.568	<0.570	<0.525	<0.556	90	
7440-43-9	Cadmium	<0.534	<0.550	<0.492	<0.521	<0.568	<0.570	<0.525	<0.556	70	
7440-47-3	Chromium	32.0	32.8	7.71	35.6	32.3	60.3	50.5	24.7	100	
7439-92-1	Lead	40.0	35.4	2.80	29.6	25.9	32.3	30.7	13.7	200	
7440-02-0	Nickel	52.2	61.9	4.15	25.4	25.6	41.3	41.2	52.9	600	
7782-49-2	Selenium	<1.60	<1.65	<1.48	<1.56	<1.70	<1.71	<1.58	<1.67	400	
7440-22-4	Silver	<3.20	<3.30	<2.95	<3.13	<3.41	<3.42	<3.15	<3.33	100	
7440-28-0	Thallium	<3.20	<3.30	<2.95	<3.13	<3.41	<3.42	<3.15	<3.33	8	
7440-62-2	Vanadium	33.5	29.4	7.97	33.9	29.7	23.6	24.2	23.4	400	
7440-66-6	Zinc	56.6	57.7	7.36	44.5	38.6	66.2	62.2	64.5	1000	
7440-39-3	Barium	24.6	26.8	16.4	37.3	33.3	32.1	26.2	27.9	1000	
RCRA Metals - SW846 7471B (mg/kg)											
7439-97-6	Mercury	0.0764	0.0655	<0.0337	0.0650	0.0583	0.541	0.471	<0.0305	20	

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014
** MassDEP also collectd soil samples for laboratory analysis

Environmental & Construction Management Services, Inc.

TABLE 7

SUMMARY OF MASSDEP COLLECTED BACKGROUND SOIL SAMPLES FOR ARSENIC AND LEAD

Cashman School & Woodsom Farm Property
Amesbury, Massachusetts
***ECMS* Project No. 1009.073**
MassDEP RTN 3-36397

Sample Location Laboratory ID Sample Date Sample Location Sample Depth		DEP S-1 Little League Field L2033028-01 8/12/2020 Little League Field 0-6"	DEP S-2 Little League Field L2033028-02 8/12/2020 Background-Woods 12"	DEP S-3 Background L2033028-03 8/12/2020 Background 18-24"	DEP S-4 Background L2033028-04 8/12/2020 Background 14-18"	MassDEP Reportable Concentrations RCS-1 (mg/kg)	MassDEP Imminent Hazard
SM2540 G (11) Mod. (%)							
solids	% Solids	97	94	90	94	NA	
Metals - SW846 6010C (mg/kg)							
7440-38-2	Arsenic	**46.1**	**45.2**	**57.3**	**66.6**	20	40
7439-92-1	Lead	14.2	10.9	38.8	29.5	200	

< indicates less than the respective method detection limit.
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
Bolfaced type indicates an exceedance.
Pursuant to MCP 310 CMR 40.0975(6)(a-c): MCP Method 1 Soil Standards, and Massachusetts Oil and Hazardous Materials List (MOHML) revised (effective) 2014
** MassDEP collected and Alpha Analytical analyzed the above soil samples for laboratory analysis

Environmental & Construction Management Services, Inc.

APPENDIX A

REVIEW OF APPLICATIONS AND GUIDANCE ON THE MEASUREMENT OF ARSENIC IN SOIL USING XRF BY THE UNIVERSITY OF FLORIDA (UF) DATED JUNE 20, 2013

UF | UNIVERSITY of FLORIDA

Center for Environment & Human Toxicology

PO Box 110885
Gainesville, FL 32611-0885
352-392-2243 Tel
352-392-4707 Fax

June 20, 2013

Ligia Mora-Applegate
Bureau of Waste Cleanup
Florida Department of Environmental Protection
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Re: Review of Applications and Guidance on the Measurement of Arsenic in Soil Using XRF

Dear Ms. Mora-Applegate:

Recently there has been interest in an expanded role for the use of field-portable x-ray fluorescence (XRF) instruments to assess site soil contamination. XRF offers potential advantages over conventional fixed-based laboratory analyses in terms of cost and speed with which soil concentration data can be obtained. However, field portable XRF devices are currently considered to provide primarily screening level data, to be used in conjunction with confirmatory analysis by other U.S.EPA-approved methods. The ability of XRF-generated data alone to support decision-making at sites (e.g., whether or not remediation in specific areas is required), is dependent on the precision of the individual instrument and its ability to identify the specific analyte of concern and to determine the true concentration of the analyte in the specific matrix.. To facilitate Department review of any proposed expanded use of XRF beyond field screening, we have summarized existing guidance and relevant peer-reviewed literature with particular attention to methods for assessing the quality of data from XRF. We have included information specific to arsenic, as the use of XRF for assessment of arsenic soil contamination has been recently proposed.

General Recommendations on the Use of XRF

The portable XRF can be used in the field to assess metals in soil using three different procedures: 1) *in-situ* soil testing - the XRF measures the metal concentrations in soil directly by placing the instrument on the surface of the ground, without any sample processing, 2) bagged soil testing - the soil sample is placed in a thin plastic bag, the XRF is used to measure the metal concentrations through the bag and 3) prepared soil - the soil samples are dried (if necessary), sieved and homogenized prior to analysis by XRF. The prepared soil is considered the most accurate method, while the *in-situ* and bagged soil sample testing are considered field-screening methods (Innov-X Systems 2003; Olympus/Innov-X Systems 2010).

EPA Reference Method 6200 (U.S. EPA 2007) provides guidance on the use of XRF for measuring metals in soil and sediment. It indicates that XRF is intended as a screening method, recommending confirmatory analysis by a total-digestion EPA analytical protocol. However, if comparisons with laboratory-based measurements indicate that XRF meets definitive data quality objectives, it could potentially be used to make a decision based upon an action level with respect to site remediation.

Criteria Used to Evaluate XRF Field Performance

The applicability of field XRF technologies to measure trace elements in the soil have been previously evaluated by the U.S. EPA under the Superfund Innovative Technology Evaluation (SITE) Program (U.S. EPA 1998; U.S. EPA 2006). However, individual instrument performance is dependent on the analyte being measured as well as the physical and chemical properties of the matrix of concern, and therefor XRF performance should be characterized for the analyte of interest, under field-specific conditions.

Evaluation criteria used by the U.S. EPA to assess instrument performance based on method detection limit (MDL), accuracy and precision are summarized below.

Method Detection Limit

The usefulness of XRF for site characterization depends in part on the limits of detection for elements of interest. MDL of the instrument is dependent on a number of factors, including the sample matrix, the analyte being measured, inter-elemental interferences, and measuring time. The detection limits reported for each instrument by the manufacturer, are based on a clean spiked SiO_2 matrix, with a 1-2 min measuring time, in the absence of interfering elements (Olympus LOD brochure; U.S. EPA 2007). These detection limits will not necessarily apply to field samples due to potential matrix interferences. EPA Method 6200 indicates that limits of detection for a given instrument should to be established in the matrix of interest based upon spike recoveries. Alternatively, certified reference material from the appropriate matrix can be used.

Accuracy of the instrument

To evaluate the accuracy of the instrument, data obtained using XRF is compared with paired laboratory data obtained using EPA-approved analytical methods. The accuracy of the instrument is assessed based on the absolute value of the relative percent difference (RPD), and correlation plots between the XRF and laboratory data.

As an example, the U.S. EPA evaluated the accuracy of XRF measurements for several elements in soil (U.S. EPA, 1998). The RPD between the reference laboratory results and the paired XRF value was calculated for 70 samples, using the following equation:

$$RPD = \frac{(M_R - M_D)}{Average(M_R - M_D)}$$

M_R = mean reference laboratory measurement
M_D = mean XRF instrument measurement

The median and absolute RPD values were used to classify the data quality in the following categories:

Excellent- Median RPD 0%-10%
Good- Median RPD 10-25%
Fair- Median RPD 25-50%
Poor- Median RPD above 50%

To assess the effects of analyte concentrations on the accuracy of the instruments the data were grouped based on concentration ranges (ie. low, medium and high). Comparability of the XRF data with the laboratory results was also analyzed using linear correlation plots. The linear regression calculation and correlation coefficient (r^2) were used to assess general bias of the instrument.

Instrument Precision

The precision of the XRF instrument was evaluated for the target analytes by calculating the relative standard deviation (RSD) for replicate samples, using the equation below:

$$RSD = \left| \frac{SD}{\bar{C}} \right| * 100$$

RSD = Relative standard deviation
SD = Standard deviation
$\bar{C}$ = Mean concentration

In the U.S. EPA's evaluation of XRF instruments (U.S. EPA 1998), the precision of the XRF technology for each analyte was classified based on the median RSD from high to low, using the following criteria:

High- Median RSD: 0%-5%
Moderate- Median RSD 5%-10%
Low- Median RSD- 10%-20%
Very Low- Median RSD above 20%

U.S. EPA Method 6200 also has precision criteria. In order for XRF data to be considered adequately precise, the RSD should be no greater than 20%, with the exception of chromium (which should be no greater than 30%).

Data quality requirements

The 1998 U.S. EPA Technology Verification Report for field XRF analyzers categorized the data based on one of the following three data quality levels: 1) definitive, 2) quantitative screening and 3) qualitative screening (U.S. EPA 1998).

Definitive level data is considered analyte-specific, and has a high degree of quantitative accuracy. Quantitative screening data provide analyte-specific identification; however the concentration quantification is not precise. The Quality Assurance/Quality Control Guidance for Removal Activities (U.S. EPA 1990) recommends that a minimum of 10% of the screening level data samples be verified using an EPA-approved method with QA/QC criteria associated with definitive data. Qualitative screening level data provide information regarding the presence or absence of contaminants. They do not, however, provide accurate concentration estimates. The statistical requirements for each of these data quality levels are summarized in the table below.

Table1. Quality criteria used by the U.S. EPA to validate field XRF data based on confirmatory laboratory values.

Data Quality Level	Statistical requirements
Definitive Level	r^2 = 0.85 to 1.0. Relative standard deviation (RSD) less than or equal to 10%. Inferential statistics indicate that the two sets of data are statistically similar.
Quantitative Screening Level	r^2 = 0.70 to 1.0. Relative standard deviation (RSD) < 20%. Inferential statistics indicate that the two sets of data are statistically different.
Qualitative Screening Level	r^2 >0.70. Relative standard deviation (RSD) > 20%. The data should have less than 10% false negative rate.

From U.S. EPA 1998

Application of field- portable XRF technology to evaluate arsenic in soil

Portable XRF technology has been shown to be a promising method that can be used in the field to measure soil levels of arsenic (U.S. EPA 1990; U.S. EPA 1998; U.S. EPA 2004), even at trace concentrations (low ppm) (Parsons et al. 2012). The commercially available Delta Handheld XRF Analyzers report the limits of detection (LODs) for arsenic ranging between 1 and 4 ppm in a bulk SiO_2 matrix free of any interfering elements (Olympus 2013). The LOD for arsenic reported for the 2003 Delta XRF model is 9 ppm. The correlation between soil arsenic concentration measured using Delta XRF analyzer and laboratory results has a calculated r^2 value of 0.99 according to the manufacturer. However, the LODs and accuracy of the XRF devices for the analysis of arsenic in the field can be affected by different factors. Consequently, instrument performance should be evaluated on a site-specific basis.

A recent study by Parsons et al. (2012) evaluated the effects of instrument parameters, sample preparation techniques and matrix characteristics on the level of detection and the data quality for measuring trace levels of arsenic in a floodplain soil. The method for arsenic characterization *in situ,* where the soil was homogenized, sieved (<2 mm) and compacted in the field reported an estimated

MDL of 6.8 ppm with 14.4% RSD precision. Comparison between the paired field and laboratory data resulted in an r^2 of 0.93. Improvements in the MDL, precision and r^2 were observed with increased soil preparation steps, such as drying and homogenization and grinding the samples.

The lowest MDL for arsenic reported in this study was 5.8 ppm, with an r^2 = 0.96 when XRF results from extensively prepared samples were compared with measurements using ICP-MS. The soil preparation method with the lowest MDL involved homogenization, sieving (<2 mm), lyophilization, grinding to >63 μm, compaction, and measuring the arsenic concentrations using XRF sample cups. The study concluded that careful sample preparation and instrument calibration based on site-specific standards can improve the limits of detection for arsenic, accuracy and precision.

Lead interferences with arsenic measurements

The presence of lead in the soil interferes with arsenic measurements by overlapping the arsenic Kα spectral peak (U.S. EPA 2007; Olympus 2010). However, the instrument's software is designed to correct for the lead interference, and it may only be of concern when the arsenic concentrations measured are low, or if the lead to arsenic ratio is above 10. The presence of lead in soil is reported by the manufacturer to result in higher detection levels for arsenic, and decrease the precision of the instrument.

In summary, XRF instrument performance can vary depending upon the instrument, analyte, and site-specific conditions. The performance of the instrument on a site-specific basis, along with the data quality objectives for the site, determine the limits on the use of XRF data (i.e., screening versus definitive). The U.S. EPA provides guidance for determining XRF instrument accuracy, precision, and MDL, as well as data quality requirements for its intended uses.

We hope that this background information is helpful to the Department when considering proposals for expanded use of XRF, in particular for generating definitive data. Please let us know if you have any questions.

Sincerely,

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APPENDIX B

SIMILAR SOILS PROVISION GUIDANCE "GUIDANCE FOR IDENTIFYING WHEN SOIL CONCENTRATIONS AT A RECEIVING LOCATION ARE "NOT SIGNIFICANTLY LOWER THAN" MANAGED SOIL CONCENTRATIONS PURSUANT TO 310 CMR 40.0032(3) WSC#-13-500 DATED SEPTEMBER 4, 2014

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Similar Soils Provision Guidance

Guidance for Identifying When Soil Concentrations at a Receiving Location Are "Not Significantly Lower Than" Managed Soil Concentrations Pursuant to 310 CMR 40.0032(3)

September 4, 2014[1]
(Originally published October 2, 2013 and revised April 25, 2014[2])

WSC#-13-500

The information contained in this document is intended solely as guidance. This guidance does not create any substantive or procedural rights, and is not enforceable by any party in any administrative proceeding with the Commonwealth. Parties using this guidance should be aware that there may be other acceptable alternatives for achieving and documenting compliance with the applicable regulatory requirements and performance standards of the Massachusetts Contingency Plan.

I. Purpose and Scope

The Massachusetts Contingency Plan ("MCP", 310 CMR 40.0000) establishes conditions and requirements for the management of soil excavated at a disposal site. This guidance addresses the specific requirements of 310 CMR 40.0032(3) and the criteria by which a Licensed Site Professional ("LSP") may determine that soil may be moved without prior notice to or approval from the Department. Soil managed pursuant to 310 CMR 40.0032(3) may be transported using a Bill of Lading ("BOL"), but a BOL is <u>not</u> required. Attachment 1 provides a flowchart depiction of the Similar Soil regulations and guidance.

This guidance is not applicable to the excavation and movement of soil from locations other than M.G.L. Chapter 21E disposal sites, nor to the management of soils considered Remediation Waste under the MCP.

[1] Updated to revise an inaccurate RCS-1 concentration for lead in Table 2 and an inaccurate RCS-2 concentration for selenium in Table 3.
[2] Updated to reflect the 2014 revisions to the Massachusetts Contingency Plan, 310 CMR 40.0000

II. Relationship to Other Local, State or Federal Requirements

This guidance is intended to clarify and more fully describe regulatory requirements contained within the MCP. Nothing in this guidance eliminates, supersedes or otherwise modifies any local, state or federal requirements that apply to the management of soil, including any local, state or federal permits or approvals necessary before placing the soil at the receiving location, including, *but not limited to,* those related to placement of fill, noise, traffic, dust control, wetlands, groundwater or drinking water source protection.

III. Requirements of 310 CMR 40.0032(3)

The requirements specified in 310 CMR 40.0032(3) are:

> (3) Soils containing oil or waste oil at concentrations less than an otherwise applicable Reportable Concentration and that are not otherwise a hazardous waste, and soils that contain one or more hazardous materials at concentrations less than an otherwise applicable Reportable Concentration and that are not a hazardous waste, may be transported from a disposal site without notice to or approval from the Department under the provisions of this Contingency Plan, provided that such soils:
> (a) are not disposed or reused at locations where the concentrations of oil or hazardous materials in the soil would be in excess of a release notification threshold applicable at the receiving site, as delineated in 310 CMR 40.0300 and 40.1600; and
> (b) are not disposed or reused at locations where existing concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and/or hazardous materials present in the soil being disposed or reused.

There are therefore four requirements that must be met before the managed soil can be moved to and re-used (or disposed) at a new location without notice to or approval from MassDEP. Each requirement (A. through D.) is addressed below.

A. The Managed Soil Must Not Be a Hazardous Waste

310 CMR 40.0032(3) applies to soils containing oil or waste oil that are not otherwise a hazardous waste, and to soils containing hazardous materials that are not a hazardous waste. The MCP definition of hazardous waste (310 CMR 40.0006) refers to the definitions promulgated in the Massachusetts Hazardous Waste Regulations, 310 CMR 30.000.

Under the federal Resource Conservation and Recovery Act of 1976 ("RCRA", 42 U.S.C. §§6901 *et. seq.*), the Massachusetts Hazardous Waste Management Act (M.G.L. c.21C), and the Massachusetts Hazardous Waste Regulations (310 CMR 30.000), soil is considered to contain a hazardous waste (hazardous waste soil) if, when generated, it meets either or both of the following two conditions:

- the soil exhibits one or more of the characteristics of a hazardous waste pursuant to 310 CMR 30.120 [such as exhibiting a characteristic of toxicity under 310 CMR 30.125 and 30.155 (Toxicity Characteristic Leaching Procedure, or TCLP)]; or
- the soil contains hazardous constituents from a listed hazardous waste identified in 310 CMR 30.130 or Title 40, Chapter I, Part 261 (Identification and Listing of Hazardous Waste) of the Code of Federal Regulations.

MassDEP has published a Technical Update entitled: *Considerations for Managing Contaminated Soil: RCRA Land Disposal Restrictions and Contained-In Determinations* (August 2010, http://www.mass.gov/eea/docs/dep/cleanup/laws/contain.pdf) that focuses on the determination of whether contaminated soil must be managed as a hazardous waste subject to RCRA requirements, and the presumptive approval process an LSP/PRP can use to document such a determination.

B. The Managed Soil Must Be Less Than Reportable Concentrations (RCs).

This requirement is intended to ensure that the soil being excavated and relocated from a disposal site is not "Contaminated Soil" and therefore neither "Contaminated Media" nor "Remediation Waste" as those terms are defined in 310 CMR 40.0006[3].

310 CMR 40.0361 sets forth two reporting categories for soil (RCS-1 and RCS-2). Reporting Category RCS-1 applies to locations with the highest potential for exposure, such as residences, playgrounds and schools, and to locations within the boundaries of a groundwater resource area. Reporting Category RCS-2 applies to all other locations.

Note that the "applicable Reportable Concentrations" referred to in 310 CMR 40.0032(3) may be the RCS-1 or RCS-2 criteria, depending upon which category would apply to the soils being excavated *at the original disposal site location*, not the RCs applicable to the soils at the receiving location (see Section III.C. below).

> **EXAMPLE:** If soil is being excavated from a disposal site at an RCS-2 location and the soil contaminant concentrations are found to be less than the RCS-2 criteria, then the soil is not "Contaminated Soil" since the soil is less than the release notification threshold established for RCS-2 soil by 310 CMR 40.0300 and 40.1600. The RCS-2 soil in this example is not "Contaminated Soil" even if one or more constituent concentration is greater than an RCS-1 value.

Also, the language at 310 CMR 40.0032(3) specifies the *applicable* RCs. If a notification exemption (listed at 310 CMR 40.0317) applies to the OHM in soil at its original location, then the corresponding Reportable Concentration is not *applicable*. Thus 310 CMR 40.0032(3) should be read to apply to soils containing concentrations of oil or hazardous material ("OHM") less than the applicable RCs *or* covered by a notification exemption. This interpretation of the requirement is consistent with the definition of Contaminated Soil, which uses the term "notification threshold" rather than "Reportable Concentration."

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[3] Contaminated Soil - means soil containing oil and/or hazardous material at concentrations equal to or greater than a release notification threshold established by 310 CMR 40.0300 and 40.1600.

Contaminated Media - means Contaminated Groundwater, Contaminated Sediment, Contaminated Soil, and/or Contaminated Surface Water.

Remediation Waste - means any Uncontainerized Waste, Contaminated Media, and/or Contaminated Debris that is managed pursuant to 310 CMR 40.0030. The term "Remediation Waste" does not include Containerized Waste.

C. The Managed Soil Must Not Create a Notifiable Condition at the Receiving Location.

This requirement is intended to prevent the creation of new reportable releases that must be subsequently assessed and remediated.

If the contaminant concentrations in the soil being relocated are less than the RCS-1 criteria, then placement of the soil in any RCS-1 location would not create a new notifiable condition. There are, however, conditions that could result in a notifiable condition.

> First, if the soil is excavated from an RCS-2 location (as described in the example in Section III.B. above) with contaminant concentrations *between* the RCS-1 and RCS-2 criteria, then the placement of that soil at an RCS-1 receiving location would create a notifiable condition since one or more concentrations of OHM would then exceed the RCS-1 criteria in the RCS-1 receiving location.

> Second, a notification exemption that applies to the original location of the soil may not apply to the receiving location. (For example, the lead paint exemption at 310 CMR 40.0317(8) is specific to "the point of application.") In cases where a notification exemption applies only to the original location, the managed soil must be evaluated solely based on whether its OHM concentrations exceed the applicable RCs at the receiving location.

D. The Managed Soil Must Not Be Significantly More Contaminated Than the Soil at the Receiving Location.

This requirement has been referred to as the "anti-degradation provision" although it is more accurately described as the "Similar Soils Provision." 310 CMR 40.00032(3)(b) requires that the concentrations of OHM at the receiving location not be "significantly lower" than the relocated soil OHM concentrations. One could also say that the provision requires that "there is no significant difference between the relocated soil and the soil at the receiving location," or that "the soils being brought to the receiving location are similar to what is already there." This requirement embodies several considerations.

> First, as a general principle, M.G.L. c.21E is intended to clean up contaminated properties and leave them better than they started -- even to clean sites to background conditions, if feasible. It would be inconsistent with this principle to then raise the ambient levels of contamination in the environment as a consequence of a response action conducted under the MCP.

> Second, despite the three other requirements (A. through C. above) of 310 CMR 40.0032(3), decisions about the movement of the managed soil will be based upon sampling of soil that is likely to have significant heterogeneity. The Similar Soils Provision is an additional measure to minimize the adverse effects of soil characterization that may not be representative of such heterogeneity.

Third, none of the criteria of 310 CMR 40.0032(3) address the question of whether the soil poses a *risk* in its original or receiving location, although the hazardous waste- and notification-related requirements seem to *imply* risk-based decision making. Put simply, soil that is not a hazardous waste and does not require notification may still pose incremental risk at the receiving location. The Similar Soils Provision is intended to ensure that the managed soil does not increase risk of harm to health, safety, public welfare or the environment at the receiving location, since it will be similar to what is already there.

The "not… significantly lower" language of 310 CMR 40.0032(3)(b) can be interpreted to mean either a quantitative "not statistically different" analysis, or a semi-quantitative, albeit somewhat subjective, approach. MassDEP does not believe that a statistics-driven quantitative approach is necessary when comparing managed soil to known or assumed background conditions, given (a) the relatively low concentrations at issue and (b) the cost of such an analysis, driven by the quantity of sampling needed to show a statistical difference.

The regulations imply that the LSP must have knowledge about the concentrations of OHM in the soil at the receiving location in order to apply the Similar Soils Provision. The regulations also imply that the new soil may contain concentrations of OHM that are *somewhat* higher than those levels at the receiving location – just not "significantly" higher.

MassDEP recognizes that there may be several approaches to address this "knowledge" issue when implementing the Similar Soils Provision of the MCP.

- **Assume the soils at the receiving location are natural background**. Sampling of the soil at the receiving location is not necessary if it is assumed that the concentrations of OHM there are consistent with natural background conditions. MassDEP acknowledges that there is a range of background levels, and that the concentrations at any given location may be lower than the statewide levels published by the Department[4], but the costs associated with determining site-specific background are not justified by likely differences. Further, the published "natural background" levels are similarly used in several areas of the MCP as an acceptable endpoint, including site delineation and the development of the MCP cleanup standards.

  Of course, routine due diligence about the receiving location may still reveal factors that would make the location inappropriate to receive the proposed fill material. Nothing in this guidance relieves any party of the obligation to conduct such due diligence and appropriately consider and act on information thereby obtained.

[4] *See* Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (May, 2002) http://www.mass.gov/eea/docs/dep/cleanup/laws/backtu.pdf

- **<u>Sample the soils at the receiving location</u>**.
  The sampling plan should include a sufficient number of samples taken at locations selected to provide an understanding of the concentrations of OHM present and the distribution of OHM throughout the receiving location. In order to provide data appropriate for the Similar Soils comparison, the soil at the receiving location should be analyzed for constituents that are likely to be present there (e.g., naturally occurring metals) as well as any OHM known or likely to be present in the soil brought from the disposal site. If a receiving location has been adequately and comprehensively characterized, that data may then be used for comparison to the OHM concentrations in any subsequent soil deliveries - additional sampling is not required.

- **<u>Provide Technical Justification for an Alternative Approach</u>**
  There may be situations for which a different combination of analytical and non-analytical information available for both the source and receiving locations is sufficient to conclude that the nature and concentrations of OHM in the soils are not significantly different. Guidance on recognizing such conditions and the level of documentation that would be necessary to support such a technical justification is beyond the scope of this guidance.

Once the concentrations of OHM in the soils are known (or assumed consistent with this guidance), the LSP must compare the concentrations of the source and receiving locations and determine whether the concentrations at the receiving location are "significantly lower" than those in the soil proposed to be relocated from the disposal site. This comparison may be conducted in several ways, including analyses with appropriate statistical power and confidence. MassDEP has also developed a *rule-of-thumb* comparison to simplify this determination, as described in Section IV.

IV. Determining whether soils at the receiving location are "significantly lower" using a simplified approach

The simplified comparison shall be made using the *<u>maximum</u>* values of the OHM concentrations in both the soil at the receiving location and the soil proposed to be disposed of or reused.

Use of the maximum values is appropriate for several reasons. First, the provisions of 310 CMR 40.0032(3) include comparisons to Reportable Concentrations, and notification is triggered by any single value (i.e., maximum value) exceeding the RC. Second, soil is by its nature heterogeneous, and the use of maximum values is a means of minimizing sampling costs while addressing the expected variability of results. Third, if natural background levels are assumed at the receiving location, the MassDEP published background concentrations are upper percentile levels that are only appropriately compared to similar (e.g., maximum) values of the soil data set.

Note also that when using the maximum reported concentrations for comparison purposes, the typical or average concentration will be lower. This is important to recognize if/when the question of the risk posed by the soil is raised. For example, the RCS-1 and the Method 1 S-1 standard for arsenic are both 20 mg/kg. The Reportable Concentration is applied as a not-to-be-exceeded value, triggering the need to report the release and investigate further. However the S-1 standard is applied as an average value, considering exposure over time. At a location where the highest arsenic value found is less than 20 mg/kg, the average concentration would be well below the Method 1 S-1 standard.

The maximum concentration in the soil at the receiving location may be less than that in the proposed disposed/reused soil by some amount and not be considered “significantly lower.” The question is how much lower is “significantly lower”? In this guidance, MassDEP establishes a multiplying factor to be applied to the concentration in the soil at the receiving location. The multiplying factor varies depending upon the concentration in the soil at the receiving location, as shown in Table 1.

Table 1. Receiving Soil Concentration Multiplying Factors

If the concentration in soil at the receiving location for a given OHM is:	Then use a multiplying factor of:
< 10 mg/kg	10
10 mg/kg ≤ *x* <100 mg/kg	7.5
100 mg/kg ≤ *x* <1,000 mg/kg	5
≥ 1,000 mg/kg	2.5

EXAMPLE: The soil at a receiving location that is considered RCS-1 is appropriately sampled and the maximum concentration of silver is found to be 6 mg/kg. Using Table 1, the concentration of silver at the receiving location would not be considered “significantly lower” than *10 x 6 mg/kg = 60 mg/kg*. Since 60 mg/kg is less than the silver RCS-1 value of 100 mg/kg, soil containing a maximum concentration that is less than 60 mg/kg silver could be reused at this location.

EXAMPLE: The soil at a receiving location that is considered RCS-1 is assumed to be consistent with natural background. The MassDEP published natural background level for arsenic is 20 mg/kg. Using Table 1, the concentration of arsenic at the receiving location would not be considered “significantly lower” than *7.5 x 20 mg/kg = 150 mg/kg*. However, since 150 mg/kg is greater than the arsenic RCS-1 value of 20 mg/kg, only soil containing a maximum concentration that is less than 20 mg/kg arsenic could be reused at this location. [The managed soil must not create a notifiable condition at the receiving location, see Section III.C. above.]

> **EXAMPLE:** The soil at a receiving location that is considered RCS-2 is assumed to be consistent with natural background. The MassDEP published natural background level for benzo[a]anthracene is 2 mg/kg. Using Table 1, the concentration of benzo[a]anthracene at the receiving location would not be considered "significantly lower" than *10 x 2 mg/kg = 20 mg/kg*. Since 20 mg/kg is less than the benzo[a]anthracene RCS-2 value of 40 mg/kg, soil containing a maximum concentration that is less than 20 mg/kg benzo[a]anthracene could be reused at this location. [Note that due to the lower reportable concentration, RCS-1 receiving locations could only accept soil containing less than 7 mg/kg benzo[a]anthracene.]

The multiplying factors in Table 1 and the MassDEP published natural background levels can be used to establish concentrations of OHM in soil that would be acceptable for reuse at an RCS-1 receiving location, consistent with the requirements of 310 CMR 40.0032(3). Table 2 lists such concentrations. Note that soil that meets the criteria in Table 2 could be re-used at *any* location (RCS-1 or RCS-2). Similarly, Table 3 lists concentrations of OHM in soil that would be acceptable for reuse at an RCS-2 receiving location (but *not* RCS-1 locations).

If a chemical is not listed on these tables, then MassDEP has not established a natural background concentration[5]. This guidance is limited to the use of only MassDEP-published statewide background concentrations. Therefore an alternative approach, such as sampling the receiving location and comparing maximum reported concentrations, would be appropriate to meet the requirements of 310 CMR 40.0032(3).

[5] For example, MassDEP has not established natural background levels for PCBs, volatile organic compounds (VOCs) or petroleum-related constituents.

Table 2.
Limits to the Concentration of OHM In Soil for Re-Use
Assuming Natural Background Conditions at an RCS-1 Receiving Location

OIL OR HAZARDOUS MATERIAL	Concentration In "Natural" Soil mg/kg	Rule-of-Thumb Multiplier	Multiplied Value mg/kg	RCS-1 mg/kg	Limiting[1] Soil Concentration mg/kg	
ACENAPHTHENE	0.5	10	5	4	<	4
ACENAPHTHYLENE	0.5	10	5	1	<	1
ALUMINUM	10,000	2.5	25000		<	25000
ANTHRACENE	1	10	10	1000	<	10
ANTIMONY	1	10	10	20	<	10
ARSENIC	20	7.5	150	20	<	20
BARIUM	50	7.5	375	1000	<	375
BENZO(a)ANTHRACENE	2	10	20	7	<	7
BENZO(a)PYRENE	2	10	20	2	<	2
BENZO(b)FLUORANTHENE	2	10	20	7	<	7
BENZO(g,h,i)PERYLENE	1	10	10	1000	<	10
BENZO(k)FLUORANTHENE	1	10	10	70	<	10
BERYLLIUM	0.4	10	4	90	<	4
CADMIUM	2	10	20	70	<	20
CHROMIUM (TOTAL)	30	7.5	225	100	<	100
CHROMIUM(III)	30	7.5	225	1000	<	225
CHROMIUM(VI)	30	7.5	225	100	<	100
CHRYSENE	2	10	20	70	<	20
COBALT	4	10	40		<	40
COPPER	40	7.5	300		<	300
DIBENZO(a,h)ANTHRACENE	0.5	10	5	0.7	<	0.7
FLUORANTHENE	4	10	40	1000	<	40
FLUORENE	1	10	10	1000	<	10
INDENO(1,2,3-cd)PYRENE	1	10	10	7	<	7
IRON	20,000	2.5	50000		<	50000
LEAD	100	5	500	200	<	200
MAGNESIUM	5,000	2.5	12500		<	12500
MANGANESE	300	5	1500		<	1500
MERCURY	0.3	10	3	20	<	3
METHYLNAPHTHALENE, 2-	0.5	10	5	0.7	<	0.7
NAPHTHALENE	0.5	10	5	4	<	4
NICKEL	20	7.5	150	600	<	150
PHENANTHRENE	3	10	30	10	<	10
PYRENE	4	10	40	1000	<	40
SELENIUM	0.5	10	5	400	<	5
SILVER	0.6	10	6	100	<	6
THALLIUM	0.6	10	6	8	<	6
VANADIUM	30	7.5	225	400	<	225
ZINC	100	5	500	1000	<	500

[1] Concentration of OHM in soil must be LESS THAN (not equal or greater than) this value.

Table 3.
Limits to the Concentration of OHM In Soil for Re-Use
Assuming Natural Background Conditions at an RCS-2 Receiving Location

OIL OR HAZARDOUS MATERIAL	Concentration In "Natural" Soil mg/kg	Rule-of-Thumb Multiplier	Multiplied Value mg/kg	RCS-2 mg/kg	Limiting[1] Soil Concentration mg/kg	
ACENAPHTHENE	0.5	10	5	3000	<	5
ACENAPHTHYLENE	0.5	10	5	10	<	5
ALUMINUM	10,000	2.5	25000		<	25000
ANTHRACENE	1	10	10	3000	<	10
ANTIMONY	1	10	10	30	<	10
ARSENIC	20	7.5	150	20	<	20
BARIUM	50	7.5	375	3000	<	375
BENZO(a)ANTHRACENE	2	10	20	40	<	20
BENZO(a)PYRENE	2	10	20	7	<	7
BENZO(b)FLUORANTHENE	2	10	20	40	<	20
BENZO(g,h,i)PERYLENE	1	10	10	3000	<	10
BENZO(k)FLUORANTHENE	1	10	10	400	<	10
BERYLLIUM	0.4	10	4	200	<	4
CADMIUM	2	10	20	100	<	20
CHROMIUM (TOTAL)	30	7.5	225	200	<	200
CHROMIUM(III)	30	7.5	225	3000	<	225
CHROMIUM(VI)	30	7.5	225	200	<	200
CHRYSENE	2	10	20	400	<	20
COBALT	4	10	40		<	40
COPPER	40	7.5	300		<	300
DIBENZO(a,h)ANTHRACENE	0.5	10	5	4	<	4
FLUORANTHENE	4	10	40	3000	<	40
FLUORENE	1	10	10	3000	<	10
INDENO(1,2,3-cd)PYRENE	1	10	10	40	<	10
IRON	20,000	2.5	50000		<	50000
LEAD	100	5	500	600	<	500
MAGNESIUM	5,000	2.5	12500		<	12500
MANGANESE	300	5	1500		<	1500
MERCURY	0.3	10	3	30	<	3
METHYLNAPHTHALENE, 2-	0.5	10	5	80	<	5
NAPHTHALENE	0.5	10	5	20	<	5
NICKEL	20	7.5	150	1000	<	150
PHENANTHRENE	3	10	30	1000	<	30
PYRENE	4	10	40	3000	<	40
SELENIUM	0.5	10	5	700	<	5
SILVER	0.6	10	6	200	<	6
THALLIUM	0.6	10	6	60	<	6
VANADIUM	30	7.5	225	700	<	225
ZINC	100	5	500	3000	<	500

[1] Concentration of OHM in soil must be LESS THAN (not equal or greater than) this value.

V. Sampling Considerations

The soil proposed for disposal/re-use should be sampled at sufficient and adequately distributed locations so that the concentrations of the contaminants of concern in the soil are adequately characterized. This includes sampling for the purpose of MCP site assessment and sampling to characterize the soil in any given stockpile/shipment leaving the site. The factors listed below should be considered when developing and implementing such a sampling plan. Evaluation of release, source, and site specific conditions assist in developing the basis for the selection of field screening techniques, sampling methodologies, sampling frequencies, and the contaminants of concern (e.g., analytical parameters) used to characterize the soil. These include, but are not necessarily limited to the following:

- the type(s) and likely constituents known or suspected to be in the soil;
- current and former site uses, past incidents involving the spill or release of OHM, and past and present management practices of OHM at the site;
- the potential for the soil to contain listed hazardous waste or to be a characteristic hazardous waste;
- the presence or likelihood of any other OHM (e.g., chlorinated solvents, metals, polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs) , halogenated volatile organic compounds (VOCs));
- visual/olfactory observations, field screening, analytical data, and/or in-situ pre-characterization data;
- soil matrix type - naturally occurring soil or fill/soil mixtures (e.g., homogeneous or heterogeneous soil conditions);
- the identification and segregation of discrete "hot spots";
- the concentration variability in the soil;
- the volume of soil;
- the current and likely future exposure potential at the receiving location, including the potential for sensitive receptors, such as young children, to contact the soil (for example, more extensive sampling of the stockpiles would be warranted for soil slated to be moved to a residential setting than for soil being moved to a secure, low-exposure potential regulated receiving facility); and
- any sampling requirements stipulated by the receiving location.

The assessment of the soil, including the nature and concentrations of OHM therein, is a component of the MCP site assessment and therefore must meet all applicable performance standards, including those for environmental sample collection, analysis and data usability[6]. The assessment should address the precision, accuracy, completeness, representativeness, and comparability of the sampling and analytical results used to determine whether the soil

[6] Additional guidance on data usability is available in Policy #WSC-07-350, MCP Representativeness Evaluations and Data Usability Assessments. http://www.mass.gov/eea/docs/dep/cleanup/laws/07-350.pdf

stockpiles meet the Similar Soils Provision requirements. The representativeness of any site assessment sampling data if used to characterize contaminant concentrations in soil to be moved and reused offsite should be carefully evaluated. Additional guidance on soil sampling considerations is available from U.S. EPA and other state environmental agencies.[7]

VI. Segregation and Management of Soils of Different Known Quality

Soil containing concentrations of OHM equal to or greater than the values listed in Table 3 cannot be managed using the streamlined approach described in this guidance. Such soil must be managed in a manner consistent with its regulatory classification, which may include management as a hazardous waste, as a remediation waste, or under a case-specific Similar Soils determination.

Segregation of soil of different quality should occur based upon *in-situ* pre-characterization sampling results. Stockpiles of soil are mixtures that would require more extensive sampling to document the effectiveness of any attempted post-excavation segregation.

The known presence of soil that exceeds the Table 3 concentrations and the subsequent segregation of soil is one factor that would indicate the need for more frequent sampling (at least in that area of soil excavation) as described in Section V.

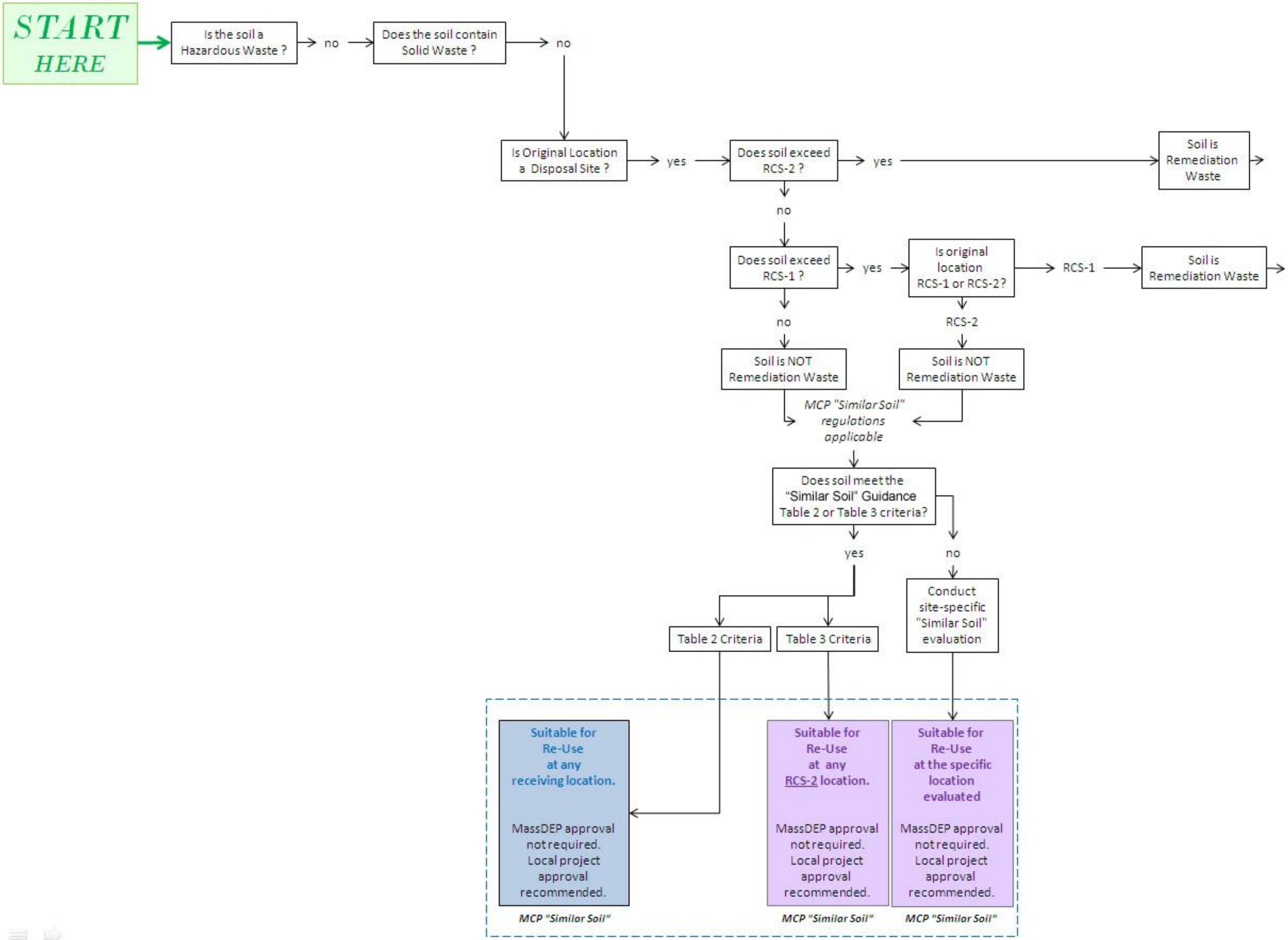
[7] Note that the guidance below are not specific to MGL Chapter 21E disposal sites and may not reflect MCP-specific considerations to determine the suitability of soils for offsite transport and use, such as for residential and other S-1 locations.

NJDEP. 2011. Alternative and Clean Fill Guidance for SRP Sites.
New Jersey Department of Environmental Protection Site Remediation Program
http://www.state.nj.us/dep/srp/guidance/srra/fill_protocol.pdf

USEPA. 1992. Supplemental Guidance to RAGS: Calculating the Concentration Term.
Office of Solid Waste and Emergency Response (OSWER), Washington, DC
http://www.epa.gov/oswer/riskassessment/pdf/1992_0622_concentrationterm.pdf

USEPA. 1995. Superfund Program Representative Sampling Guidance Volume 1: Soil.
OSWER. Washington, DC.
(Note that guidance for determining the number of samples for statistical analysis is addressed in Section 5.4.1).
http://www.epa.gov/tio/download/char/sf_rep_samp_guid_soil.pdf

Attachment 1 – Similar Soil Flowchart



APPENDIX C

QUALIFICATIONS/LIMITATIONS

QUALIFICATIONS/LIMITATIONS

Environmental & Construction Management Services, Inc. (ECMS) professional services have been performed, our findings obtained, and our recommendations prepared in accordance with customary principles and practices in the fields of environmental science and engineering. This warranty is in lieu of all other warranties either expressed or implied. *ECMS* is not responsible for the independent conclusions, opinions or recommendations made by others based on the records review, site inspection, field exploration, and laboratory test data presented in this report.

Factual information regarding on-site business operations, conditions, and historical data provided to *ECMS* is assumed to be correct and complete. *ECMS* assumes no responsibility for hidden or latent conditions or misrepresentation by the property owner, its representatives, public information officials or any authority consulted in connection with the compilation of this report.

The findings set forth in the attached Site assessment report are strictly limited in time and scope to the date of the evaluation(s). The conclusions presented in the Report are based solely on the services described therein, and not on scientific tasks or procedures beyond the scope of agreed upon services or the time and budgeting restraints imposed by the client.

The purpose of this report was to assess the physical characteristics of the subject Site with respect to the presence in the environment of hazardous material or oil. No specific attempt was made to check on the compliance of present or past owners or operators or of the Site with Federal, State or local laws and regulations, environmental, or otherwise.

Partial findings of this investigation are based on data provided by others. No warranty is expressed or implied with the usage of such data. Much of the information provided in this report is based upon personal interviews and research of all available documents, records and maps held by the appropriate government and private agencies. This is subject to the limitations of historical documentation, availability and accuracy of pertinent records, and the personal recollection of those persons contacted by *ECMS* personnel. *ECMS* is not a professional title insurance firm and makes no guarantee, explicit or implied that the listing, which was reviewed, represented a comprehensive delineation of past Site ownership or tenancy for legal purposes.

Observations were made of the Site and of structures on the Site as indicated within the Report. Where access to portions of the Site or to structures on the Site was unavailable or limited, *ECMS* is unable to render an opinion as to the presence of hazardous material or oil, or to the presence if indirect evidence relating to hazardous material or oil, in that portion of the Site or structure. In addition, *ECMS* renders no opinion as to the presence of hazardous material or oil, where direct observation of the interior walls, floor, or ceiling of a structure on a Site was obstructed by objects or coverings on or over these surfaces.

The initial site investigation took into account the natural and man-made features of the Site, including any unusual or suspect phenomenon. These factors combined with the Site's geology, hydrology, topography, and past and present land uses served as a basis for choosing a methodology and location for subsurface exploration as well as ground water and subsurface sampling, if done. The subsurface data, if provided, is meant as a representative overview of the Site.

The conclusions and recommendations contained in this report may be based in part upon various types of chemical data and are contingent upon their validity. As indicated within the Report, some of these data are preliminary "screening" level data, and should be confirmed with quantitative analyses if more specific information is necessary. It should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. Should additional data or variations of current data become available in the future, these data should be reviewed, and the conclusions and recommendations presented herein modified accordingly.

Chemical analyses may have been performed for specific parameters during the course of this Site assessment, as described in the text. However, it should be noted that additional chemical constituents not searched for during the current study might be present in soil and/or ground water at the Site.