IMMINENT HAZARD EVALUATION

For

Charles C. Cashman Elementary School
193 Lions Mouth Road
Amesbury, Massachusetts 01913

Prepared for:

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Boston, Massachusetts 02111

Prepared by:

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July 28, 2020

ECMS Project No. 1009.073

Environmental & Construction Management Services, Inc.

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ATTACHMENTS, CONTINUED:

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, Massachusetts* 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 28th day of July 2020.

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

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

Stephen T. Weydt
Principal Environmental Scientist

Environmental & Construction Management Services, Inc.

1.0 INTRODUCTION

An Imminent Hazard Evaluation (IHE) is presented in this report for the Cashman Elementary School, located at 193 Lions Mouth Road in Amesbury, Massachusetts [Release Tracking Number (RTN) 3-31833]. This IHE was performed in accordance with requirements of the Massachusetts Contingency Plan (MCP, 310 CMR 40.0000) and other relevant guidance developed by the Massachusetts Department of Environmental Protection (MassDEP).

2.0 PROPERTY DESCRIPTION

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 50/6. 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 4 (approximately 458 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 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.

No existing commercial printing facilities, gasoline filling/service stations, industrial properties or fuel depots were identified in the immediate vicinity of the subject site. The past uses of these surrounding properties do not pose recognized environmental concerns to the Site.

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. A copy of the Assessor Property Card is attached as Appendix D.

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 school building has a sewage ejector system that was observed along the entrance driveway area south of the school.

2.4 Site Ownership

According to City of Amesbury Assessor's records, the subject site is owned by the City of Amesbury as of December 30, 1971 (Book 5833, Page 124).

A Title Search was not supplied to *ECMS*, and therefore additional ownership information was not available.

2.5 Current Uses of the Site

The Site is currently utilized as the City of Amesbury Cashman Elementary School for grades Pre-K through Grade 4.

2.6 Current Uses of Surrounding Properties

The Site is located within an area primarily used for single-family residential homes, farmland and undeveloped wooded vacant land. There were no visual indications observed during *ECMS* visual inspection of nearby or abutting properties of conditions that would indicate a release or threat of release of oil and/or hazardous substances on, at, in, or to the Site.

2.7 Past Uses of the Site and Vicinity

Historical information was obtained from a review of the historical topographs (1932, 1934, 1943, 1944, 1947, 1950, 1956, 1952, 1968, 1973, 1979, 1971, 1985, 1987 and 2012), historical aerial photos (1953, 1960, 1966, 1973, 1978, 1986, 1992, 1998, 2006, 2009, 2012 and 2016), City Directory (1961, 1965, 1968, 1973, 1977, 1982, 1987, 1992, 1995, 2000, 2005, 2010 and 2014). Refer to Appendix A for copies of the above historic documents.

The historical aerial photo from 1978 shows the school building. Prior to construction of the school building, the Site land area was undeveloped and appears to be farmland as depicted in the aerial photographs from 1953 through 1973.

Properties surrounding the Site to the north, south, east and west were developed with sporadic residential properties and some may have been farmland.

The past uses of these surrounding properties do not pose recognized environmental concerns to the Site.

3.0 EVALUATION OF IMMINENT HAZARDS

The purpose of an IHE is to evaluate whether an immediate response action (IRA) is needed to control or reduce short-term exposure to a release of oil and/or hazardous material while comprehensive investigations and response actions are being evaluated. The need for comprehensive response actions (i.e., the ultimate actions for the release) is determined (in part) by a Risk Characterization, which is performed after all site investigations are completed.

For this IHE *ECMS* engaged *Mr. Peter LaGoy of LaGoy Risk Analysis, Inc. (LaGoy)* in Hopkinton, Massachusetts as a professional risk assessor to evaluate the recently obtained soil sample analytical results for samples collected on July 9, 2020. Excerpts from the *LaGoy* "Evaluation of Soil Data from the Charles C. Cashman Elementary School, 193 Lions Mouth Road, Amesbury, Massachusetts dated July 27, 2020" and attached as Appendix A are included in the ECMS IHE presented herein.

The MCP requires that IHEs be conducted separately for human health, the environment, and safety. These evaluations are presented in the following subsections.

3.1 Human Health Imminent Hazard Evaluation

According to 310 CMR 40.0321(1)(d) and (f), a release of oil and/or hazardous material that poses a significant risk of harm to human health when present even for a short period of time, or a release to the environment that produces readily apparent effects to human health, including respiratory distress or dermal irritation, constitutes an imminent hazard. A short period of time is defined as five (5) years, unless site circumstances indicate that a shorter period of time is appropriate [40 CMR 40.0953(1)]. Human health IHEs consider actual or likely exposures of humans under current site conditions and uses (§40.0953). IHEs are expected to be conservative [(§40.0953(7)], to consider "hot spots" [§40.0953(4)], to focus on soil between 0 and 1 foot in depth [§40.0953(2)], and can focus on the constituents that are likely to dominate the IHE [§40.0953(5)].

The MCP and MassDEP guidance specify criteria for identifying the presence of an imminent hazard to human health. For non-carcinogenic constituents, the Hazard Index (HI) defining an imminent hazard is greater than:

- one (1) for oil or hazardous materials that have the potential to cause serious effects (including but not limited to lethal, developmental, or neurological effects) following short-term exposures; or
- ten (10) for all other oil or hazardous materials [MCP 310 CMR 40.0955(2)(c)(1)].

For carcinogenic constituents, the excess lifetime cancer risk defining an imminent hazard is:

- greater than a risk of 1 in 100,000 (denoted as 1x10-5) for a short exposure period (e.g., a 5-year exposure period) [MCP 310 CMR 40.0995(2)(b)]; and,
- greater than a risk of 1 in 10,000 (denoted as 1x10-4) over a long exposure period (MassDEP 1995).

3.1.1 Compounds of Concern (COCs)

The recent subject sampling event consisted of collecting 15 soil samples from beneath the grass (2-6 inches in depth), and two additional samples of slightly deeper soil (2 feet in depth). Soil was analyzed for the presence of metals, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs, including the polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides and herbicides. The results of the sampling are presented in Table 1 of Appendix A.

Only arsenic was present at a concentration above a reportable concentration. TPH was also detected in most samples (concentrations around 100 mg/kg) but could be present as a result of it use as a binder (waxes) in various lawn care products. Maximum metal concentrations were compared with expected concentrations in soil in Massachusetts (Table 2 of Appendix A), and chromium, nickel, and vanadium were present at levels above expected background. The four metals, arsenic, chromium, nickel, and vanadium will be considered in the imminent hazard calculations.

3.1.2 Receptors and Exposure Pathways

Potentially exposed humans at the site under current site use include children including students, non-student users of the playing fields and adults including commercial (school) workers, construction/utility workers (potentially), and visitors (including parents attending sporting event games). Because intermittently exposed individuals, such visitors, will be exposed to a lesser extent (shorter duration of exposure and/or less frequently) than students, non-student users of the playing field, and school workers, visitor exposure is not assessed. School worker exposure conservatively represents potential visitor exposure.

3.1.3 Exposure Point Concentrations

Students, school workers, and non-student users of the playing fields are assumed exposed only to shallow soil (depths of 0-1 foot), per MCP guidance for performing IHEs. The soil exposure point concentration (EPC) for arsenic in soil applied to the IHE is the 95th percentile upper confidence limit (95% UCL) of the mean concentration of arsenic in shallow soil.

Construction/utility workers are assumed exposed to both shallow and deeper soil, consistent with the type of activities (e.g., soil excavation) potentially performed. The soil EPC for arsenic is the 95% UCL of the mean concentration of arsenic in shallow and deeper soil.

Maximum concentrations were used as EPCs for chromium, nickel, and vanadium. For this site, concentrations of arsenic in shallow soil were detected in a narrow range (21.9 mg/kg – 82.3 mg/kg), and the 95% Upper Confidence Limit (UCL) calculated using the EPA's ProUCL model version 5.1 was used to calculate an EPC of 46.4 mg/kg for arsenic, based on a normal distribution of data and the Student t-test.

3.1.4 Quantitative Exposure Assessment

In general, individuals are exposed to materials released into the environment in varying quantities and proportions via a wide variety of possible exposure routes. The actual amount of material to which an individual is exposed depends on the individual's frequency, extent, and duration of exposure, which in turn depend on many factors, including location of residence, age, body weight, sex, and activity patterns. Patterns of exposure are highly variable among individuals. This large potential variation in exposure to environmental conditions implies that a certain amount of uncertainty is inherent in risk assessment. This exposure assessment uses standard approaches and assumptions that are designed to be health protective, i.e., they are designed to produce estimates of exposure that overestimate, rather than underestimate, actual exposure and risk.

The purpose of a quantitative exposure assessment is to estimate the Chronic Daily Intake (CDI) of each contaminant of concern by an individual for each exposure route. For carcinogens, the CDI is averaged over the full lifetime (by convention, assumed to be 70 years; MassDEP 2008) and is termed the Lifetime Average Daily Dose or LADD for oral and dermal exposures. For noncarcinogens, the dose is only averaged over the period of exposure and is noted as the Average Daily Dose or ADD for oral and dermal exposure.

<u>Soil Exposure – Children</u>

Children are at school 180 days per year, and can also use the school facilities during the summer (roughly 70 days; end of June to end of August) but will use the outdoor play fields for only a fraction of that time and for short periods. Very young children (less than 2 year of age) are considered unlikely to be present on a regular basis. For the purposes of this assessment, contact by children is assumed for 109 days per year, which is the outdoor time assumed by MassDEP (1994) in initially establishing the S-1 soil standards. Exposure for a third of a year to a single outdoor play area is unlikely but provides a conservative estimate of exposure potential. People who contact soil may be exposed to constituents present in the soil by direct contact and subsequent ingestion of contaminated soil or by dermal absorption of constituents in soils adhering to the skin. Younger children are of greatest concern for soil contact, and therefore, assessment of exposure to younger children can be used to conservatively evaluate the potential for risks to older students. For this IHE, children are estimated to weigh an average of 15 kg (33 lbs.) based on the median weight for 5-year-old children (the youngest age likely to be regularly out on their own) determined in the NHANES II study for the US population in 1980 (MassDEP 1994). USEPA has reviewed more current data and has indicated average weights for humans have increased since that study.

<u>Soil Ingestion</u>: Children in regular contact with site soil are estimated to ingest 100 mg of soil per day (MassDEP 2002). All constituents in soil are assumed to be as available from the soil as from the media used in the toxicity studies and, consequently, a relative absorption factor or RAF of one is used for these constituents. Using this assumption and the others noted above, the ADD and LADD for soil ingestion by children can be estimated using the formula:

$$ADD/LADD = \frac{CS \times IR \times RAF \times EF \times ED}{BW \times 106\ (mg/kg) \times AT}$$

Where:

ADD =	Average daily intake of the constituent (mg/kg/day),
LADD=	Lifetime average daily dose (mg/kg/day),
CS =	Constituent concentration in soil (mg/kg),
IR =	Soil ingestion rate (100 mg/day; MassDEP 1995),
RAF =	Relative absorption factor (1),
EF =	Frequency of ingestion (109 days/year; MassDEP 1995),
ED =	Exposure Duration (5 years; MassDEP 1995),
BW =	Body weight (15 kg; EPA 1989), and
AT =	Averaging Time (365 days x 5 yrs. (ADD) or 365 x 70 (LADD) days).

The calculated ADD for children exposed to lead detected in soil at the property based on this equation is provided in Table 3 for ingestion exposure to the soil at the school.

Dermal Contact: Dermal exposure to constituents in soil can occur through direct physical contact with soil. The same assumptions as for soil ingestion are used, with the exceptions that in place of an ingestion rate, a soil adherence factor of 0.2 mg soil/cm2 of skin, an exposed skin surface area of 3000 cm2 (roughly a third of the body surface area for this age child; MassDEP 1994) and constituent-specific relative absorption factors were used. Using these assumptions, the ADD and LADD can be estimated using the formula:

$$ADD/LADD = \frac{CS \times AD \times SA \times RAF \times EF \times ED}{BW \times 106\ (mg/kg) \times AT}$$

Where:

ADD =	Average daily intake of the constituent (mg/kg/day),
LADD=	Lifetime average daily dose (mg/kg/day),
CS =	Constituent concentration in soil (mg/kg),
AD =	Soil adherence to skin (0.2 mg/cm2; MassDEP 1995),
SA =	Exposed skin surface area (3000 cm2; MassDEP 1995),
RAF =	Relative absorption factor (constituent-specific; MassDEP 2006),
EF =	Frequency of contact (109 days/year),
ED =	Exposure Duration (5 years),
BW =	Body weight (15 kg; EPA 1989), and
AT =	Averaging Time (365 days x 5 yrs. (ADD) or 365 days x 70 days (LADD)).

The calculated ADD for children exposed to lead in soil at the site based on this equation is provided in Table 3 for exposure via dermal contact to the soil EPCs.

While the primary purpose of this assessment is to calculate whether an imminent hazard exists, the same approach can be modified slightly to assess overall site risks, given the continued use of the school and playground for current purposes. The assumption that children are unlikely to use the facility for more than 109 days per year, and for more than 5 years seems likely, given the grades (pre-K to 4th) that currently use the school. However, as a conservative measure, risks are also assessed assuming that children play at the school for 100 days per year over the course of a 10-year period and that they weigh 24 kg (average body weight for 2-12 years) over this period. This exposure and risk are calculated in Table 4.

Soil Exposure - Adults

Adults that may use the area would include school landscape workers, teachers, and parents attending games. Of these groups, landscapers would be expected to have the highest potential for regular contact. In order to determine if such soil contact is safe, exposure and risks to landscapers were evaluated quantitatively, using the previously-established EPCs.

Landscapers who work site soil may be exposed to constituents present in the soil by direct contact and subsequent ingestion of contaminated soil or by dermal absorption of constituents in soils adhering to the skin. Workers may also be exposed to constituents that become airborne as a component of windborne dust. Exposure for these people is assumed to occur for 100 days over the course of a year, assuming that during the roughly 8-month landscaping season, these workers are outdoors roughly 3 days per week over the 240-day period. Adults are estimated to weigh 70 kg. It should be noted that these calculations are particularly conservative in that exposure estimates are compared with toxicity values designed to be protective for chronic (long-term) exposures; toxicity values for short-term exposure are generally lower by a factor of 10.

Soil Ingestion: Workers in frequent contact with site soil are estimated to ingest 100 mg of soil per day (MassDEP 2002) and this value will be used for landscape workers. Using these assumptions and the others noted above, the ADD and LADD for soil ingestion by workers can be estimated using the formula for soil ingestion noted above. The calculated ADD for the constituents in soil at the property based on this equation is provided in Table 5 in Appendix A for soil ingestion exposure to the site-wide exposure point concentration.

Dermal Contact: Dermal exposure to constituents in soil can occur through direct physical contact with soil. The same assumptions as for soil ingestion are used, with the exceptions that in place of an ingestion rate, a soil adherence factor of 0.29 mg soil/cm2 of skin, an exposed skin surface area of 3,500 cm^2, and constituent-specific relative absorption factors were used. Using these assumptions, the ADD and LADD can be estimated using the formula for dermal contact noted above. The calculated ADD for the constituents in soil at the property based on this equation is provided in Table 5 in Appendix A for exposure via dermal contact to the EPCs in soil.

Inhalation. Although unlikely considering the small area of uncovered soil, landscapers could be exposed via inhalation to constituents entrained in soil-derived dust (MassDEP 2002). To estimate exposure, the same assumptions provided above for body weight, lifetime exposure duration and frequency were used. It was assumed that the gardener inhaled 20 cubic meters (m3) of air during the time on site (essentially equal to the daily inhalation rate of 20 m^3/day; EPA, 1989 and corresponding to a full workday at an average moderate to heavy level of exertion; MassDEP 1995a).

In order to evaluate the potential for inhalation exposure to constituents entrained in the dust, it is necessary to estimate the amount of dust that would be present in the air, and the amount of air inhaled during the period that dust is present in the air. MassDEP (2002) suggests a value of 60 ug/m^3 for excavations and this value will be used in this evaluation, which is a conservative approach since excavation work would be expected to generate more dust than gardening. The value of 60 ug/m3 is based on the assumption that gardeners will only receive intermittent exposure to visible dust but that the average exposure level will be above that used by EPA for undisturbed sites.

MassDEP notes that exposure to constituents on airborne particulates can occur through either direct inhalation or via inhalation followed by movement of the particles from the upper respiratory tract to the gastrointestinal tract. For direct inhalation, MassDEP indicates that only approximately half of the inhaled particulate matter will actually reach the lungs. However, for this evaluation, it is assumed that all the agent inhaled is of concern, as many inhaled constituents act at sites along the respiratory tract and do not need to reach the lungs to have adverse effects. For the inhalation-to-oral pathway, the ingested dose is estimated to be twice the measured PM10 dose of 60 ug/m3. However, the total soil intake via this pathway (2 x 60 ug/m3 x 20 m3/day x 1 mg/1000 ug = 2.4 mg soil) is so low as to not add significantly to the soil dose calculated for direct ingestion and is not considered further in this assessment.

Exposure can be calculated using the equation:

$$ADE/LADE = \frac{EPC \times IF \times PM10 \times RAF \times EF \times ED}{BW \times AT}$$

Where:

ADE =	Average daily exposure to the constituent (mg/m3),
LADE=	Lifetime average daily dose (mg/m3),
EPC =	Constituent concentration in soil (mg/kg),
IF =	Inhalation Fraction (20 m3 / 20 m3day; MassDEP 2002),
PM10 =	Particulate air concentration (60 ug/m3; MassDEP 2002).

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RAF = Relative absorption factor (1 used to be conservative),
EF = Frequency of contact (100 days/year),
ED = Exposure Duration (5 years), and
AT = Averaging Time (365 days x 5 or 70 years).

Table 5 in Appendix A provides the estimated exposure and risk values for inhalation exposure to an adult landscaper, assuming no dust suppression measures are implemented. Exposure to other site users, including teachers and parents, would be expected to be lower.

3.1.5 Human Health Imminent Hazard Evaluation Results

Using the EPCs, exposure factors, and toxicity values discussed above, and using conventional risk characterization models, imminent hazard calculations were performed. The calculations are contained in *LaGoy Risk Analysis, Inc. (LaGoy)* "Evaluation of Soil Data from the Charles C. Cashman Elementary School, 193 Lions Mouth Road, Amesbury, Massachusetts dated July 27, 2020" and attached as Appendix A.

For noncarcinogenic (systemic) effects, EPA and MassDEP assume that there is a level below which no effects will occur (a threshold no effect concentration). To evaluate possible risk from exposure to noncarcinogenic contaminants, the average daily dose (ADD) is divided by the health criterion value [the reference dose (RfD)]. If the ADD:RfD ratio, also termed the hazard index or HI, is less than ten for all constituents (i.e., if the daily intake is below the health criterion), then the contaminant is considered unlikely to pose an Imminent Hazard (i.e., a significant risk under conditions of short-term exposure) to individuals exposed under the given scenario. If the HI is less than ten, the site does not pose an Imminent Hazard. For cancer risk, the exposure, termed the lifetime average daily dose or LADD is multiplied by the cancer slope factor to estimate cancer risk, and this risk is compared with a target risk level of 1 in 100,000 or 10-5.

Imminent hazards associated with short term exposure to site constituents in soil are estimated in Table 3 for children and in Table 5 for landscapers (and other adults). Based on these calculations, exposure by children to soil concentrations of site constituents results in a hazard index of 0.5 (soil ingestion plus dermal absorption risks combined) and a cancer risk of 1 x 10-5. Exposure by adults to soil concentrations of site constituents results in a hazard index of 0.08 (soil ingestion, dermal absorption, and inhalation exposures combined) and a cancer risk of 3 x 10-6. These levels do not exceed the Imminent Hazard criterion of an HI of ten and a cancer risk level of 10^{-5}, indicating that continued use of this site does not pose an imminent hazard.

Hazards and risks associated with longer term exposure to site constituents in soil are estimated in Table 4 in Appendix A for children and in Table 6 in Appendix A for landscapers (and other adults). Based on these calculations, exposure by children to soil concentrations of site constituents results in a hazard index of 0.3 and a cancer risk of 1 x 10-5. Exposure by adults to soil concentrations of site constituents results in a hazard index of 0.08 and a cancer risk of 1×10^{-5}. These levels do not exceed the long-term risk targets of a cancer risk of 10^{-5} and an HI of 1, indicating that continued long term exposure at these concentrations would not pose a significant risk.

Based on these results, an imminent hazard to human health does not exist at the site.

3.2 Environmental Imminent Hazard Evaluation

The site property is developed for educational use and is partially paved or built on and partially uncovered. The developed areas of the site possess little potential environmental habitat because of human use; however, undeveloped portions of the site may serve as habitat for native flora and fauna. According to 40 CMR 40.0955(3), the following conditions constitute an imminent hazard to the environment:

- evidence of stressed biota attributable to the release at the disposal site, including, without limitation, fish kills or abiotic conditions; or

- a release to the environment of oil or hazardous material which produces immediate or acute adverse impacts to freshwater or saltwater fish populations.

No such conditions are known to exist as a result of arsenic in site soil. Therefore, it is concluded that the site poses no imminent hazard to the environment.

3.3 Safety Imminent Hazard Evaluation

An imminent hazard to safety is evaluated by identifying conditions that could pose a threat of physical harm or bodily injury to existing receptors under current site conditions. Examples include the presence of an explosive environment or insecurely containerized waste.

No conditions representative of an imminent hazard to safety exist on the site. Based on these factors, it is concluded that no imminent hazard to safety exists at the site.

4.0 SUMMARY, CONCLUSION & RECOMMENDATIONS

An IHE was performed for the presence of arsenic in soil of the Cashman school property. The IHE examined potential imminent hazards to the health of students, non-student users of the playing fields, commercial (school) workers, and construction/utility workers not protected by conditions of an adequate Health and Safety Plan. The IHE also evaluated potential imminent hazards to the environment and safety. The IHE concludes the following:

- The site poses no imminent hazard to students, non-student users of the playing fields, school workers, and construction/utility workers.
- The site poses no imminent hazard to the environment.
- The site poses no imminent hazard to safety.

Soil was recently sampled by *ECMS* and analyzed with respect to the Cashman Elementary School property located at 193 Lions Mouth Road in Amesbury, Massachusetts. Arsenic and several other metals were detected at levels above a reportable concentration (arsenic) and above levels expected in background soil. However, no anthropogenic source of arsenic was present, the Amesbury area is known to have naturally-elevated arsenic levels in soil, and the source appears most likely to be natural. Further assessment will be required to determine if the source of arsenic detected on the Site is naturally occurring and presented with lines of evidence as part of the development of a Conceptual Site Model (CSM) for this "release". While the arsenic is assumed to be naturally occurring, calculations were performed to assess if a calculated risk was present for either short-term (IH) or longer-term exposure. Evaluation of the concentrations detected and of site-specific factors indicates that an Imminent Hazard condition does not exist at the site. Use of the site would also not pose a Significant Risks.

It should be noted that calculated risks did not exceed but were at the target risk levels. Therefore, although the area does not pose an Imminent Hazard or Significant Risk for current use, considering the use of the site as a school, it may be prudent to take measures to mitigate the potential for exposure. Such measures could include replacing natural soil in areas of exposed soil with imported soil containing lower levels of natural arsenic.

In order to ensure that public health is adequately protected, conservative assumptions (i.e., those unlikely to underestimate risk) were used in deriving both the exposure estimates and the toxicity values that are included in this letter report. Because of the use of these conservative assumptions, it is likely that the actual potential for non-cancer and cancer risks is lower than as is estimated in this report.

5.0 REFERENCES

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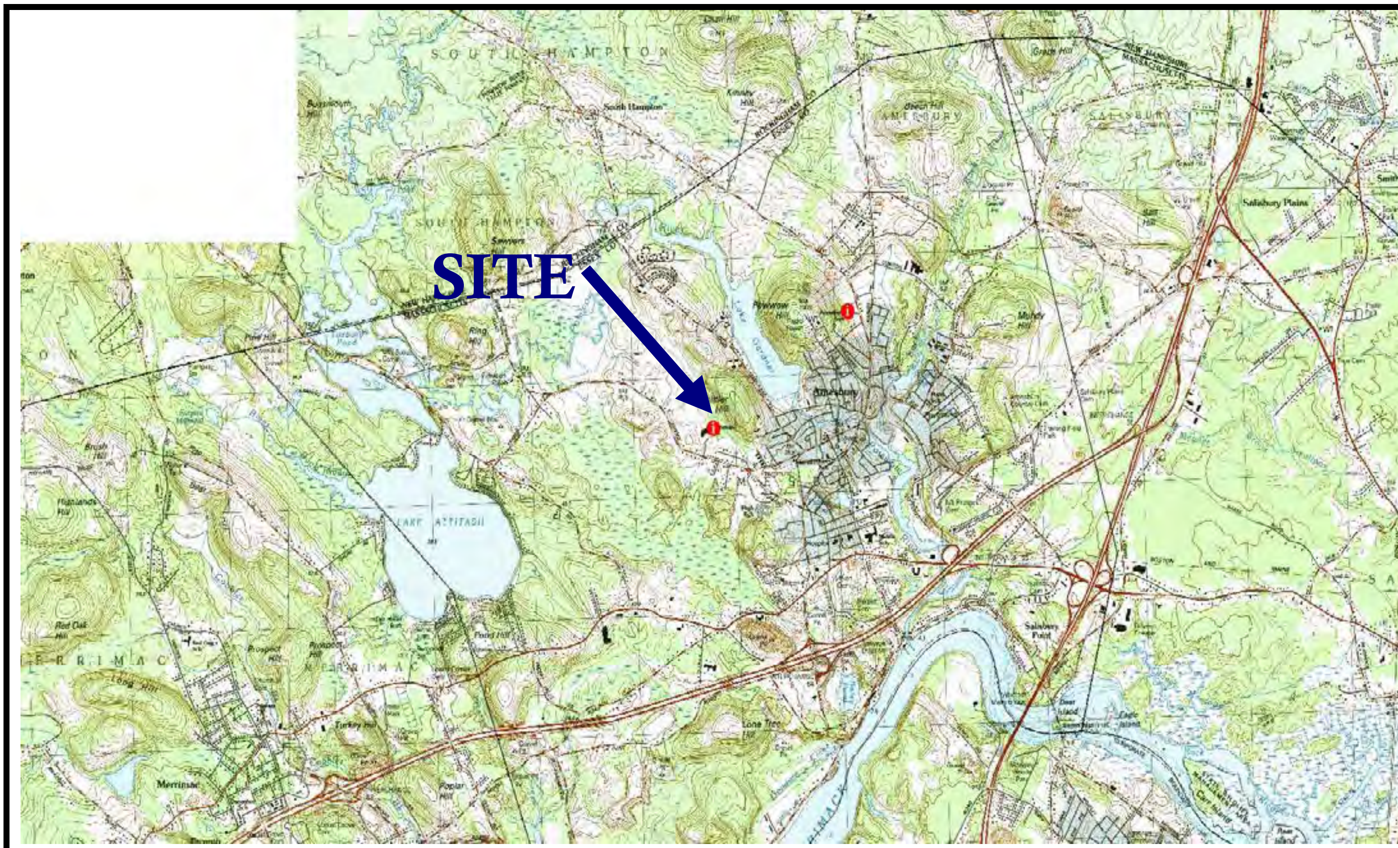
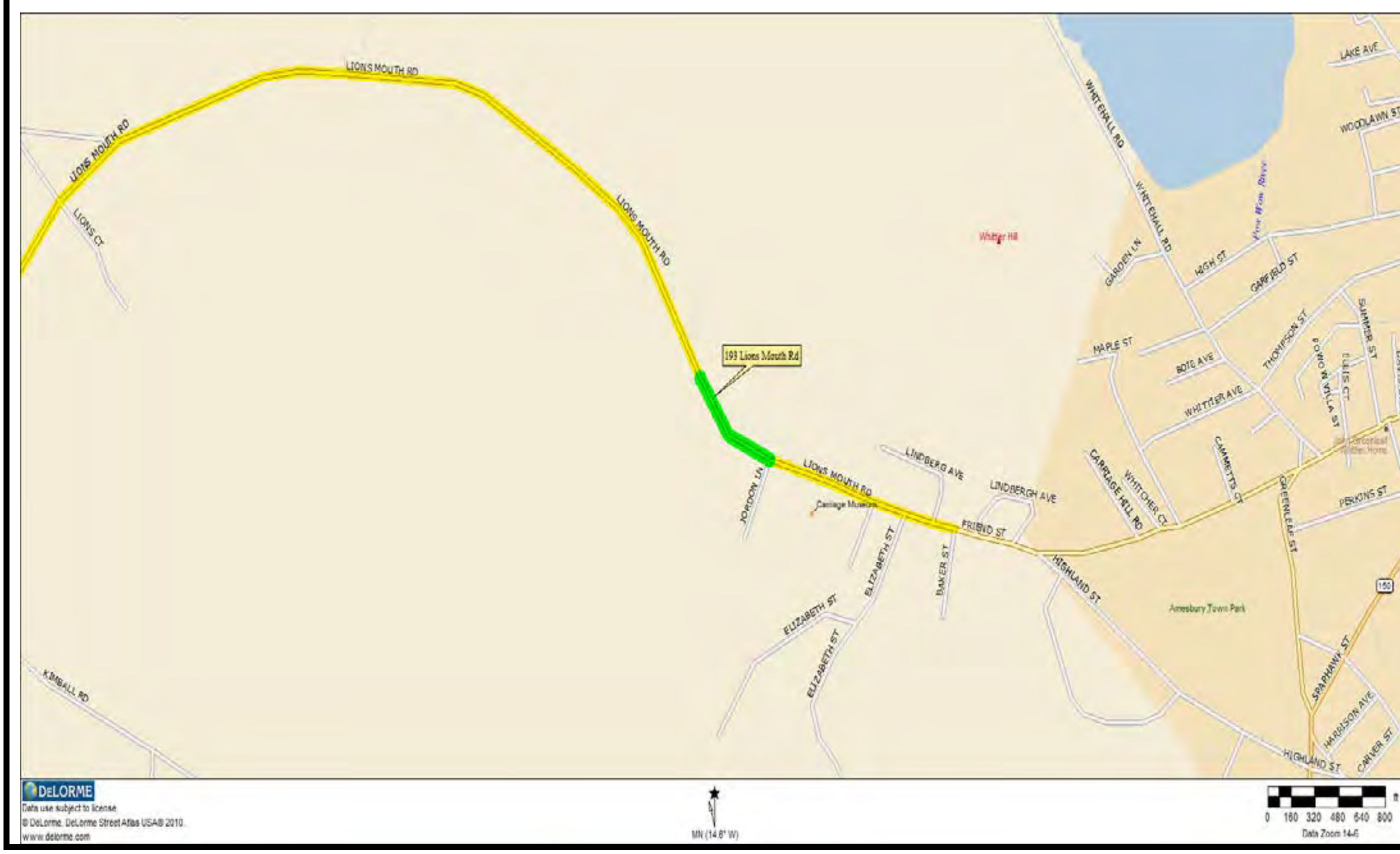
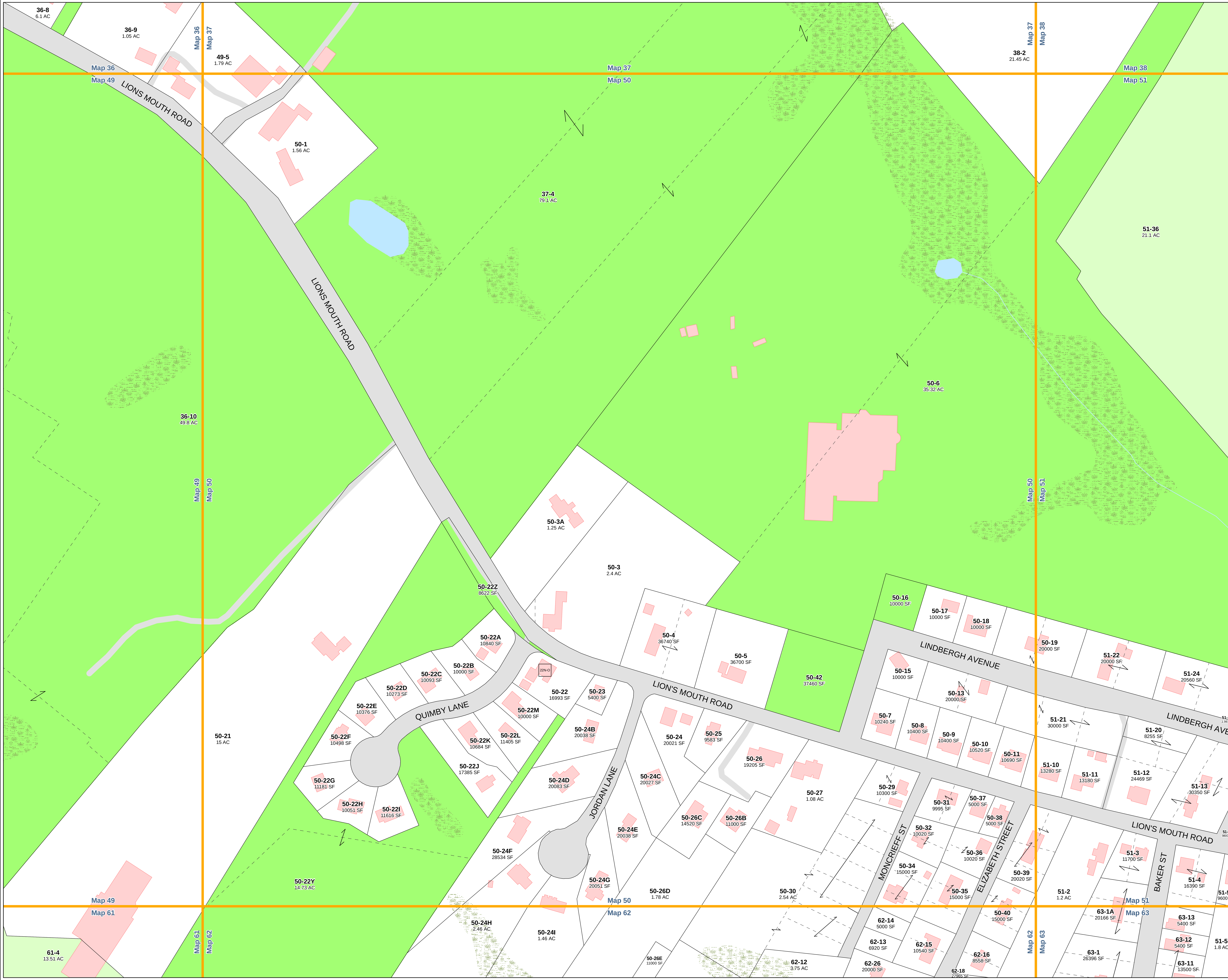
FIGURES





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



CITY OF AMESBURY, MASS.

Assessor Maps

CITY OF AMESBURY
Incorporated
1668
MASSACHUSETTS

LEGEND

- Parcel Line
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- Map Index
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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		

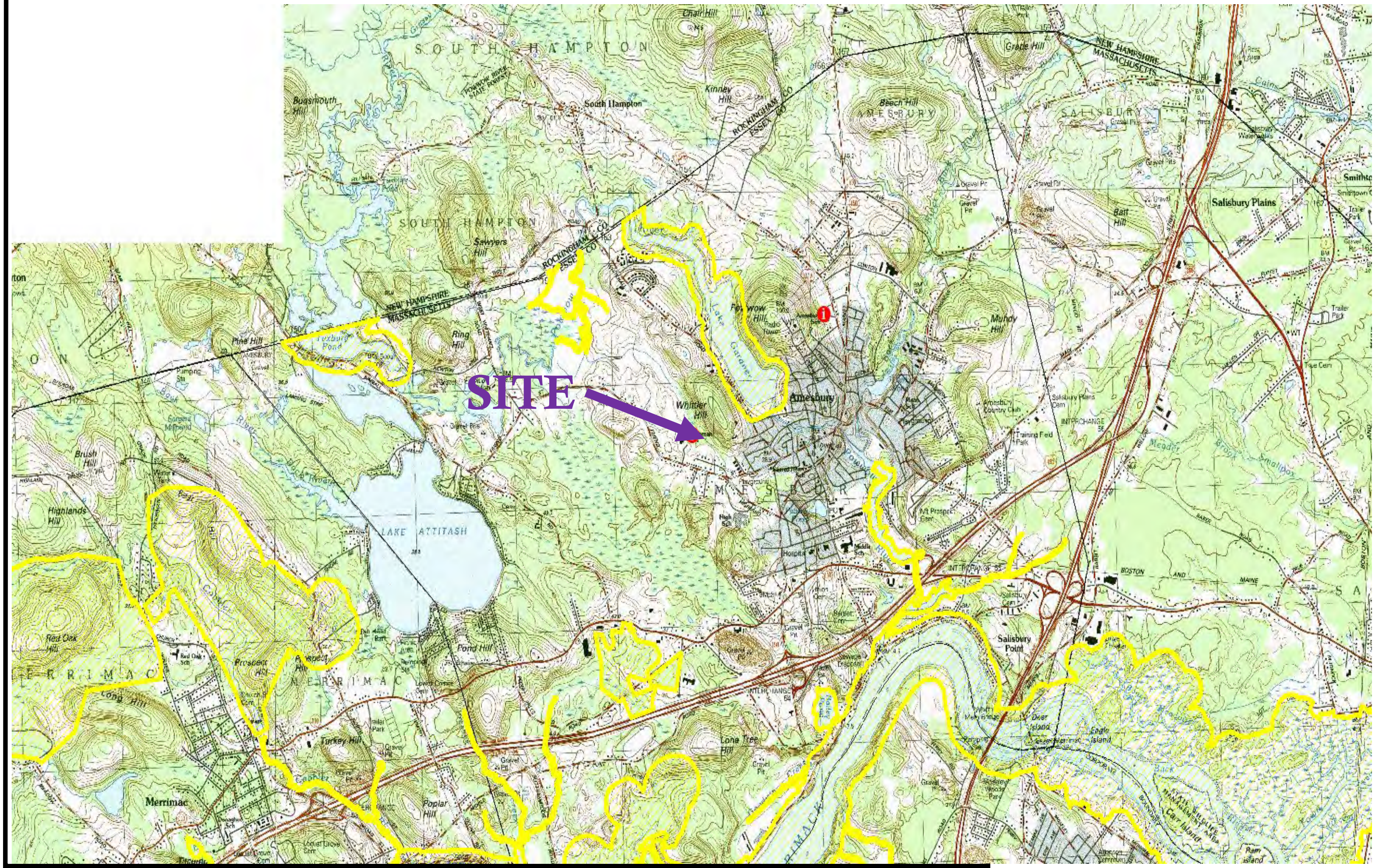
Data Sources: The data for this map was supplied by the Merrimack Valley Planning Commission, the Town of Amesbury and the Executive Office of Environmental Affairs/MassGIS.

Merrimack Valley Planning Commission
plan • develop • promote

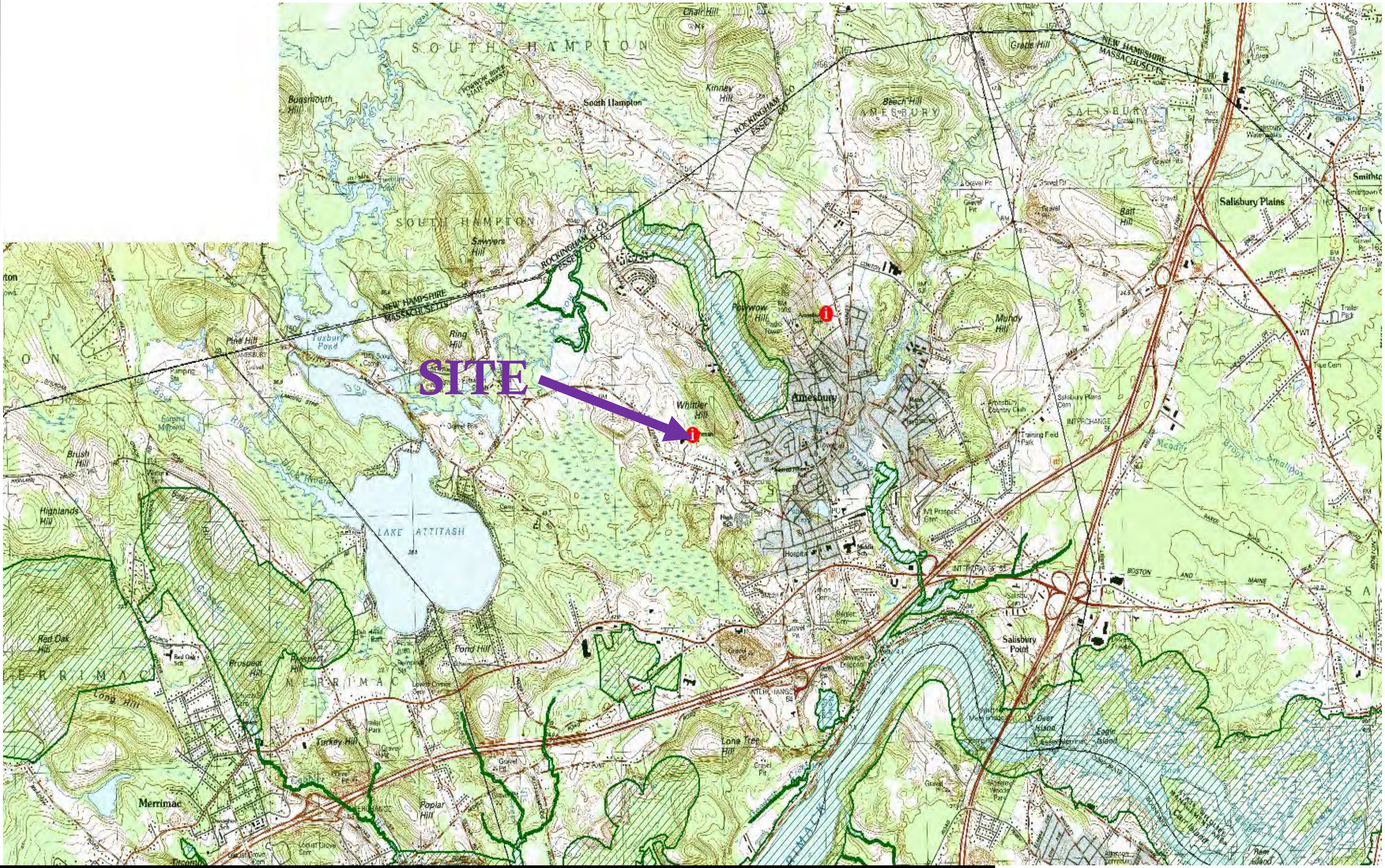
J:\ArcGIS\Amesbury\AmesburyAssessorMap_24x36.mxd

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

FIGURE 6

MassDEP - Bureau of Waste Site Cleanup

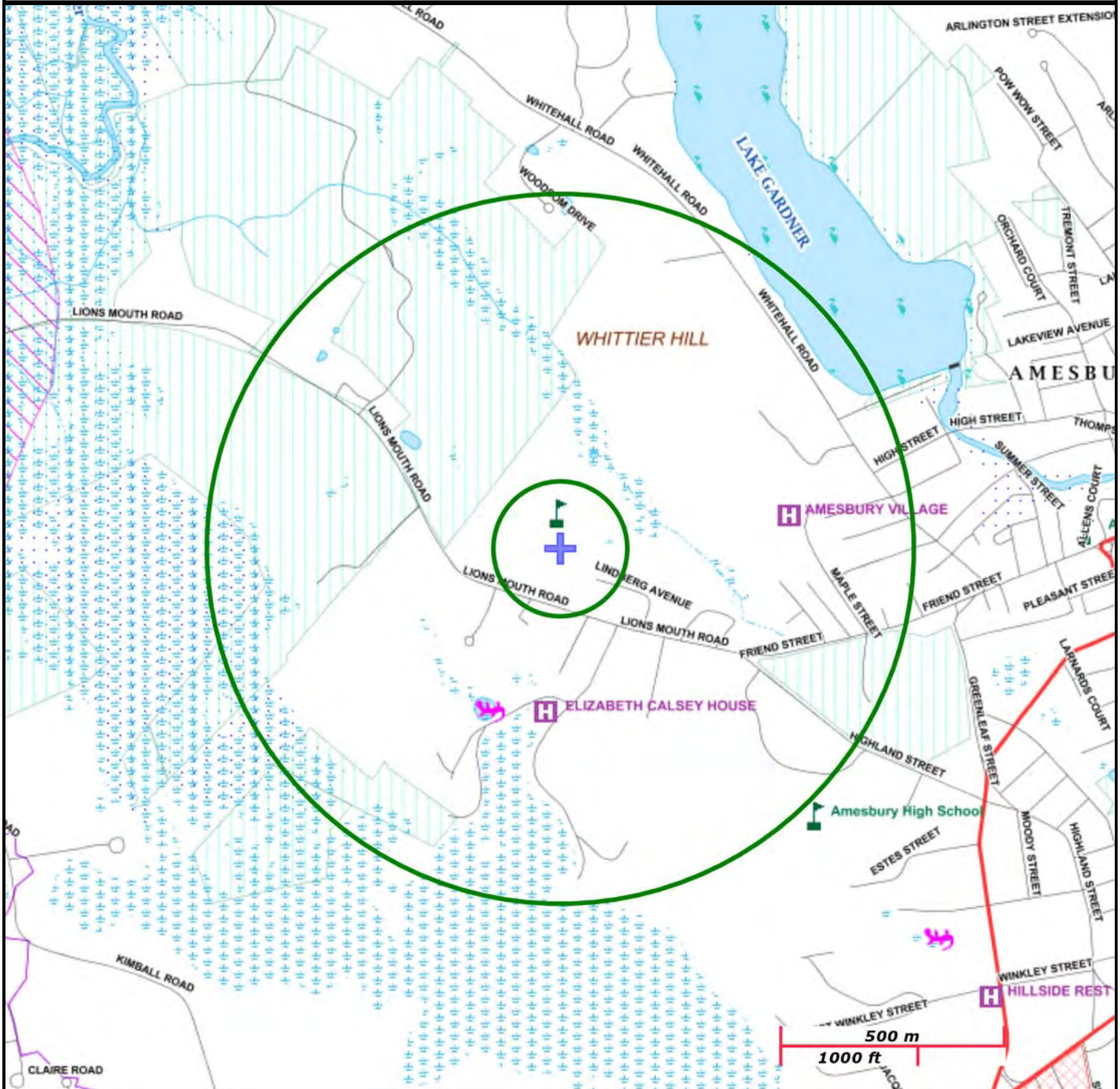
Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

Site Information:
CAHSMAN ELEMENTARY SCHOOL
193 LIONS MOUTH ROAD AMESBURY, MA

NAD83 UTM Meters:
4746679mN , 340744mE (Zone: 19)
September 13, 2018

The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail

Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct

Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam

Aquifers: Medium Yield, High Yield, EPA Sole Source.....

Non Potential Drinking Water Source Area: Medium, High (Yield)...

PWS Protection Areas: Zone II, IWPA, Zone A ....

Hydrography: Open Water, PWS Reservoir, Tidal Flat .....

Wetlands: Freshwater, Saltwater, Cranberry Bog ....

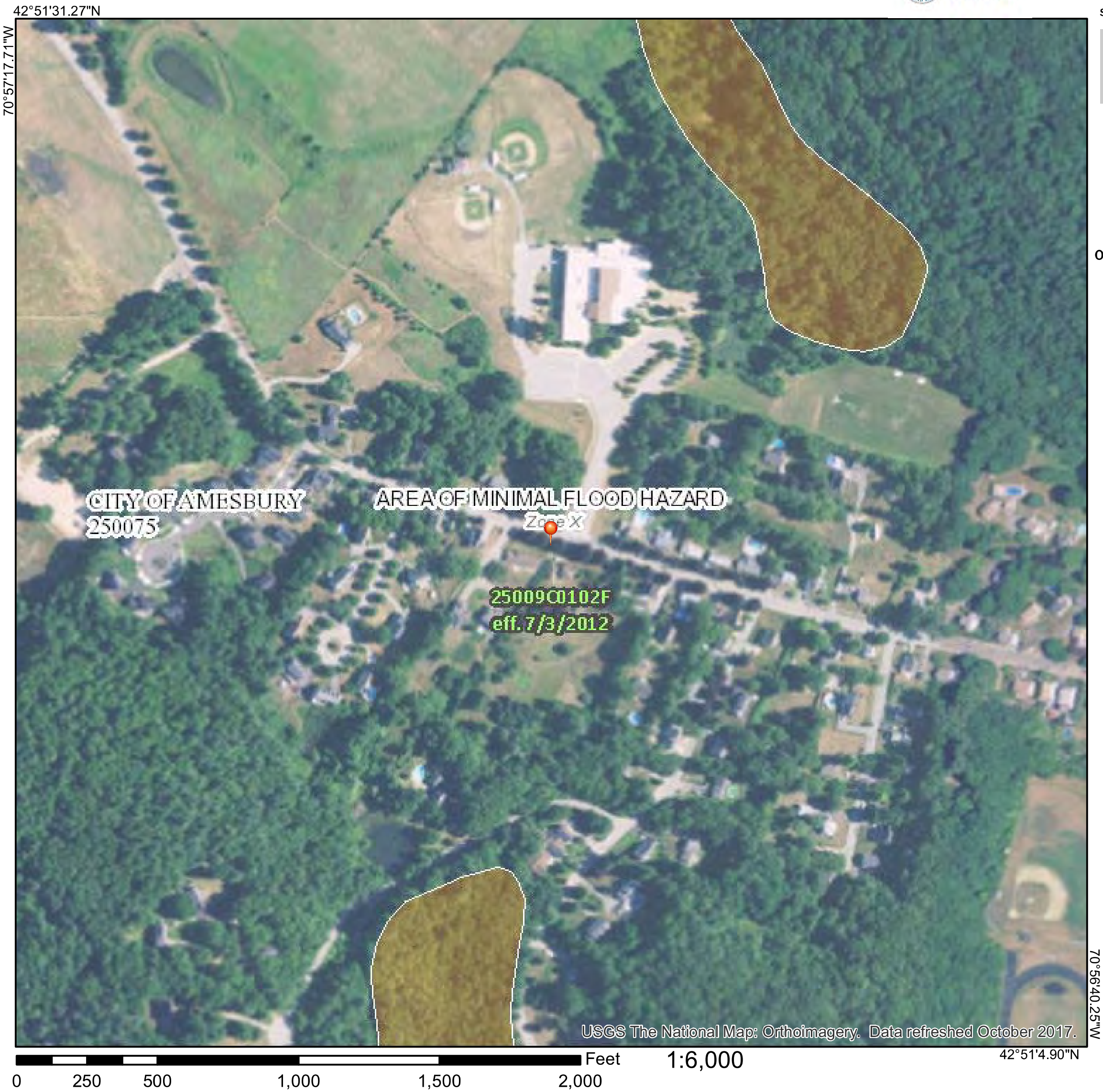
FEMA 100yr Floodplain; Protected Open Space; ACEC ....

Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential

Solid Waste Landfill; PWS: Com.GW,SW, Emerg.,Non-Com.

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
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 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

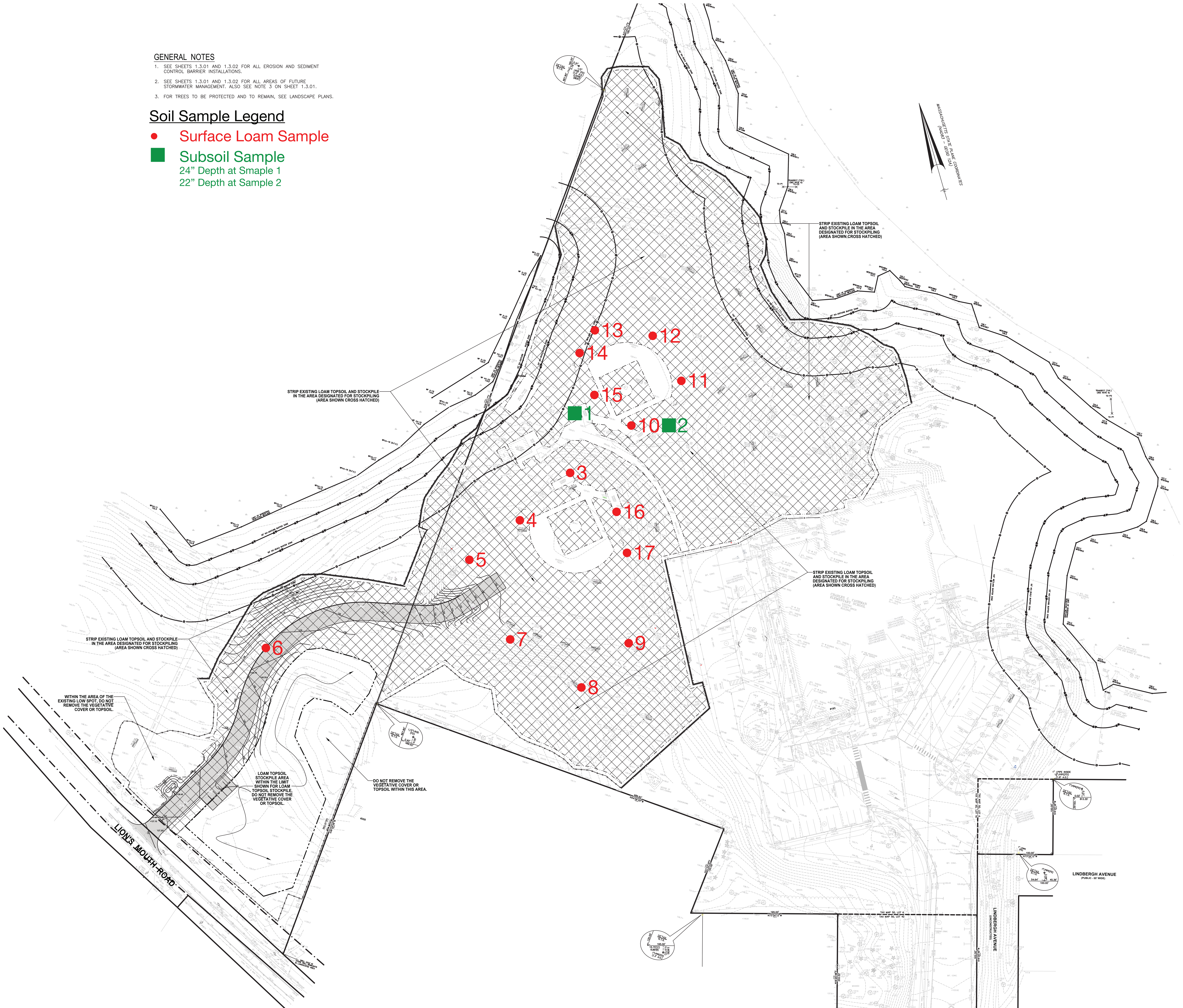
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

ECMS Figure 9
Soil Sample Location Plan

KEY PLAN

NORTH ARROW

STAMP

Date: 6 JULY 2020

Drawn By: KMR

Scale: 0 40 80

Revisions

Number	Date	Description

90% EARLY SITE PACKAGE

Proposed Topsoil Removal Limit Plan

1.3.06

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**

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"	MassDEP Reportable Concentrations RCS-1	MassDEP Imminent Hazard
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**

Sample Location Laboratory ID Sample Date Sample Depth		SSS-10 SC58794-03 7/9/2020 2-6"	SSS-11 SC58794-04 7/9/2020 2-6"	SSS-12 SC58794-05 7/9/2020 2-6"	SSS-13 SC58794-06 7/9/2020 2-6"	SSS-14 SC58794-07 7/9/2020 2-6"	SSS-15 SC58794-17 7/9/2020 2-6"	SSS-16 SC58794-08 7/9/2020 2-6"	SSS-17 SC58794-09 7/9/2020 2-6"	MassDEP Reportable Concentrations RCS-1	MassDEP Imminent Hazard
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**

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"	MassDEP Reportable Concentrations 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**

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**

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**

Sample Location Laboratory ID Sample Date Sample Depth		SSS-10 SC58794-03 7/9/2020 2-6"	SSS-11 SC58794-04 7/9/2020 2-6"	SSS-12 SC58794-05 7/9/2020 2-6"	SSS-13 SC58794-06 7/9/2020 2-6"	SSS-14 SC58794-07 7/9/2020 2-6"	SSS-15 SC58794-17 7/9/2020 2-6"	SSS-16 SC58794-08 7/9/2020 2-6"	SSS-17 SC58794-09 7/9/2020 2-6"	MassDEP Reportable Concentrations 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**

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**

Sample Location Laboratory ID Sample Date Sample Depth		SSS-10 SC58794-03 7/9/2020 2-6"	SSS-11 SC58794-04 7/9/2020 2-6"	SSS-12 SC58794-05 7/9/2020 2-6"	SSS-13 SC58794-06 7/9/2020 2-6"	SSS-14 SC58794-07 7/9/2020 2-6"	SSS-15 SC58794-17 7/9/2020 2-6"	SSS-16 SC58794-08 7/9/2020 2-6"	SSS-17 SC58794-09 7/9/2020 2-6"	MCP Reportable Concentrations 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
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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.

APPENDIX A

LAGOY RISK ANALYSIS "EVALUATION OF SOIL DATA FROM THE CHARLES C. CASHMAN ELEMENTARY SCHOOL, 193 LIONS MOUTH ROAD, AMESBURY, MASSACHUSETTS DATED JULY 27, 2020

LaGoy Risk Analysis, Inc.
P.O. Box 498
Hopkinton, MA 01748
(508) 208-9299
Peter_LaGoy@msn.com

July 27, 2020

Kevin Kavanaugh
ECMS, Inc.
288 Grove Street, #391
Braintree, MA 02184

RE: Evaluation of Soil Data from the Charles C. Cashman Elementary School, 193 Lions Mouth Road, Amesbury, Massachusetts

Dear Kevin:

I reviewed the soil data collected by Environmental & Construction Management Services, Inc. (ECMS) on July 9, 2020, from the Charles C. Cashman Elementary School property at 193 Lions Mouth Road in Amesbury, Massachusetts. I understand that samples were collected from loam and shallow (2 feet deep) subsoil near an existing baseball field on the property.

Based on my review and using standard calculations following the methodology required by the Massachusetts Department of Environmental Protection (MassDEP), the detected constituents do not pose an Imminent Hazard under the Massachusetts Contingency Plan (MCP), which is the relevant state regulatory program. Using the average concentration of arsenic and the maximum value of other metals that were detected above state-wide background levels for natural soil in Massachusetts as an exposure point concentration (EPC; the level of a constituent that an individual could regularly contact) and site-specific exposure assumptions provided on children and adults likely to use this field, the constituents that were detected do not pose an Imminent Hazard. I would also note that the use does not pose a calculated Significant Risk as that term is defined under the MCP, and that the arsenic appears to be present as a result of its presence in native soil. Although the site does not pose an Imminent Hazard under the MCP, steps to reduce or eliminate the potential for contact with these constituents and the associated soil at the site may still be prudent from both a risk management and MCP perspective.

Initial Evaluation

The Cashman school property in Amesbury, Massachusetts consists of a roughly 35-acre parcel that is currently used for pre-K through 4^{th} grade students. The results of explorations performed at the property indicate that fill material identified at the site contains varying amounts of ash and cinders and may also contain remnants of the former residential building that had occupied the property prior to the garden.

The recent subject sampling event consisted of collecting 15 soil samples from beneath the grass (2-6 inches in depth), and two additional samples of slightly deeper soil (2 feet in depth). Soil was analyzed for the presence of metals, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs, including the polycyclic aromatic hydrocarbons (PAHs), and pesticides and herbicides. The results of the sampling are presented in Table 1.

Only arsenic was present at a concentration above a reportable concentration. TPH was also detected in most samples (concentrations around 100 mg/kg) but could be present as a result of it use as a binder (waxes) in various lawn care products. Maximum metal concentrations were compared with expected concentrations in soil in Massachusetts (Table 2), and chromium, nickel, and vanadium were present at levels above expected background. The four metals, arsenic, chromium, nickel, and vanadium will be considered in the imminent hazard calculations.

The source of the arsenic is site soils does not appear to be associated with anthropogenic use but rather as a result of naturally-elevated arsenic concentrations. While arsenic was used widely for industrial purposes (e.g., for preservation of hides in tanning; as a pesticide as lead arsenates) the past use of the property is not consistent with these uses, and if the arsenic was present as a result of agricultural pesticide use, lead levels would be expected to be higher. Amesbury is in an area of Massachusetts known to have naturally elevated arsenic levels and consequently, its present is considered most likely to be attributable to natural sources. As such, its presence would not be regulated under the MCP but considering its location at a school, further assessment is prudent.

Imminent Hazard Calculations

An Imminent Hazard Evaluation (IHE) performed in accordance with the MCP evaluates whether constituents that are detected at a site could pose a risk of harm to human health, safety, public welfare, and the environment under current site conditions or for a short period of time (5 years, unless site conditions indicate a shorter time period is appropriate). For this site, the constituent of greatest concern, arsenic appears to be present as a result of natural background, and as such does not pose an imminent hazard. However, because of the use of the property as a school, further calculations are warranted to determine if some mitigation of the presence of even these natural soils may be warranted.

An Imminent Hazard does not exist if the cumulative cancer risk calculated for the short time period is below one in one hundred thousand (1×10^{-5} or 1E-05), the "hazard index" is below ten (10) for most constituents or below one (1) for constituents that have the potential to cause serious effects (specifically lead and cyanide, per a discussion with Nancy Bettinger of MassDEP BWSC ORS in January 2007, and trichloroethylene, per a discussion with Paul Locke of MassDEP in November 2012) following short-term exposures, and the site does not pose a risk to safety, public welfare, or the environment based on a consideration of site conditions and applicable standards. The results of the Imminent Hazard Risk Characterization are used as the basis for a decision as to whether or not an Immediate Response Action is necessary at the site.

This Imminent Hazard Evaluation has been conducted to specifically evaluate metals detected in soil at the Cashman Elementary School in Amesbury, Massachusetts. The purpose of this evaluation is to determine if a calculated Imminent Hazard to human health, as defined by the MCP, currently exists for the area for short-term exposure. Past exposure is likely to have been similar, so this IHE also provides information about possible past risks associated with use of the area.

This IHE focuses on human health. A consideration of site conditions indicates that the presence of the identified constituents does not pose an Imminent Hazard to public welfare, the environment, or safety.

Toxicity Assessment
The toxicity values for the metals are presented in Tables 3 and 5. Further description of the toxicity of arsenic, the metal of primary concern, is presented below.

Arsenic is a metalloid that has been shown to cause skin, bladder, and perhaps other cancers in individuals exposed through drinking water from wells with high arsenic levels. Arsenic has also been associated with an increased risk of lung cancer in exposed workers. Chronic exposure to arsenic at high levels causes adverse effects on the gastrointestinal tract. In addition, there is some evidence that exposure causes polyneuropathy. EPA has established an oral reference dose of 0.0003 mg/kg/day and an inhalation reference concentration of 2.5×10^{-5}mg/m^3. EPA has also established an oral cancer potency factor of 1.5 (mg/kg/day)$^{-1}$ and an inhalation unit risk of 0.003 (ug/m^3)$^{-1}$ and MassDEP uses these values.

Exposure Evaluation
As part of an IHE, concentrations of constituents detected in accessible surface soil can be used to evaluate the potential for actual exposure and risk with respect to current site uses and activities. The MCP defines accessible surface soil as soil that extends to a depth of 6 inches below the ground surface. As noted in MassDEP guidance, for an IHE, the focus is on short term risks, and maximum concentrations are typically used in the assessment as exposure point concentrations (EPCs; the concentration an individual could be exposed to on a regular basis). Maximum concentrations were used as EPCs for chromium, nickel, and vanadium. For this site, concentrations of arsenic in shallow soil

were detected in a narrow range (21.9 mg/kg – 82.3 mg/kg), and the 95% Upper Confidence Limit (UCL) calculated using the EPA's ProUCL model version 5.1 was used to calculate an EPC of 46.4 mg/kg for arsenic, based on a normal distribution of data and the Student t-test.

Quantitative Exposure Assessment

In general, individuals are exposed to materials released into the environment in varying quantities and proportions via a wide variety of possible exposure routes. The actual amount of material to which an individual is exposed depends on the individual's frequency, extent, and duration of exposure, which in turn depend on many factors, including location of residence, age, body weight, sex, and activity patterns. Patterns of exposure are highly variable among individuals. This large potential variation in exposure to environmental conditions implies that a certain amount of uncertainty is inherent in risk assessment. This exposure assessment uses standard approaches and assumptions that are designed to be health protective, i.e., they are designed to produce estimates of exposure that overestimate, rather than underestimate, actual exposure and risk.

The purpose of a quantitative exposure assessment is to estimate the Chronic Daily Intake (CDI) of each contaminant of concern by an individual for each exposure route. For carcinogens, the CDI is averaged over the full lifetime (by convention, assumed to be 70 years; MassDEP 2008) and is termed the Lifetime Average Daily Dose or LADD for oral and dermal exposures. For noncarcinogens, the dose is only averaged over the period of exposure and is noted as the Average Daily Dose or ADD for oral and dermal exposure.

<u>Soil Exposure - Children</u>

Children are at school 180 days per year, and can also use the school facilities during the summer (roughly 70 days; end of June to end of August) but will use the outdoor play fields for only a fraction of that time and for short periods. Very young children (less than 2 year of age) are considered unlikely to be present on a regular basis. For the purposes of this assessment, contact by children is assumed for 109 days per year, which is the outdoor time assumed by MassDEP (1994) in initially establishing the S-1 soil standards. Exposure for a third of a year to a single outdoor play area is unlikely but provides a conservative estimate of exposure potential. People who contact soil may be exposed to constituents present in the soil by direct contact and subsequent ingestion of contaminated soil or by dermal absorption of constituents in soils adhering to the skin. Younger children are of greatest concern for soil contact, and therefore, assessment of exposure to younger children can be used to conservatively evaluate the potential for risks to older students. For this IHE, children are estimated to weigh an average of 15 kg (33 lbs) based on the median weight for 5-year-old children (the youngest age likely to be regularly out on their own) determined in the NHANES II study for the US population in 1980 (MassDEP 1994). USEPA has reviewed more current data and has indicated average weights for humans have increased since that study.

<u>Soil Ingestion</u>: Children in regular contact with site soil are estimated to ingest 100 mg of soil per day (MassDEP 2002). All constituents in soil are assumed to be as available

from the soil as from the media used in the toxicity studies and, consequently, a relative absorption factor or RAF of one is used for these constituents. Using this assumption and the others noted above, the ADD and LADD for soil ingestion by children can be estimated using the formula:

$$ADD/LADD = \frac{CS \times IR \times RAF \times EF \times ED}{BW \times 10^6\,(mg/kg) \times AT}$$

Where:

ADD	=	Average daily intake of the constituent (mg/kg/day),
LADD	=	Lifetime average daily dose (mg/kg/day),
CS	=	Constituent concentration in soil (mg/kg),
IR	=	Soil ingestion rate (100 mg/day; MassDEP 1995),
RAF	=	Relative absorption factor (1),
EF	=	Frequency of ingestion (109 days/year; MassDEP 1995),
ED	=	Exposure Duration (5 years; MassDEP 1995),
BW	=	Body weight (15 kg; EPA 1989), and
AT	=	Averaging Time (365 days x 5 yrs (ADD) or 365 x 70 (LADD) days).

The calculated ADD for children exposed to lead detected in soil at the property based on this equation is provided in Table 3 for ingestion exposure to the soil at the school.

Dermal Contact: Dermal exposure to constituents in soil can occur through direct physical contact with soil. The same assumptions as for soil ingestion are used, with the exceptions that in place of an ingestion rate, a soil adherence factor of 0.2 mg soil/cm^2 of skin, an exposed skin surface area of 3000 cm^2 (roughly a third of the body surface area for this age child; MassDEP 1994) and constituent-specific relative absorption factors were used. Using these assumptions, the ADD and LADD can be estimated using the formula:

$$ADD/LADD = \frac{CS \times AD \times SA \times RAF \times EF \times ED}{BW \times 10^6\,(mg/kg) \times AT}$$

Where:

ADD	=	Average daily intake of the constituent (mg/kg/day),
LADD	=	Lifetime average daily dose (mg/kg/day),
CS	=	Constituent concentration in soil (mg/kg),
AD	=	Soil adherence to skin (0.2 mg/cm^2; MassDEP 1995),
SA	=	Exposed skin surface area (3000 cm^2; MassDEP 1995),
RAF	=	Relative absorption factor (constituent-specific; MassDEP 2006),
EF	=	Frequency of contact (109 days/year),
ED	=	Exposure Duration (5 years),
BW	=	Body weight (15 kg; EPA 1989), and
AT	=	Averaging Time (365 days x 5 yrs (ADD) or 365 days x 70 days (LADD)).

The calculated ADD for children exposed to lead in soil at the site based on this equation is provided in Table 3 for exposure via dermal contact to the soil EPCs.

While the primary purpose of this assessment is to calculate whether an imminent hazard exists, the same approach can be modified slightly to assess overall site risks, given the continued use of the school and playground for current purposes. The assumption that children are unlikely to use the facility for more than 109 days per year, and for more than 5 years seems likely, given the grades (pre-K to 4^{th}) that currently use the school. However, as a conservative measure, risks are also assessed assuming that children play at the school for 100 days per year over the course of a 10-year period and that they weigh 24 kg (average body weight for 2-12 years) over this period. This exposure and risk are calculated in Table 4.

Soil Exposure - Adults

Adults that may use the area would include school landscape workers, teachers, and parents attending games. Of these groups, landscapers would be expected to have the highest potential for regular contact. In order to determine if such soil contact is safe, exposure and risks to landscapers were evaluated quantitatively, using the previously-established EPCs.

Landscapers who work site soil may be exposed to constituents present in the soil by direct contact and subsequent ingestion of contaminated soil or by dermal absorption of constituents in soils adhering to the skin. Workers may also be exposed to constituents that become airborne as a component of windborne dust. Exposure for these people is assumed to occur for 100 days over the course of a year, assuming that during the roughly 8-month landscaping season, these workers are outdoors roughly 3 days per week over the 240-day period. Adults are estimated to weigh 70 kg. It should be noted that these calculations are particularly conservative in that exposure estimates are compared with toxicity values designed to be protective for chronic (long-term) exposures; toxicity values for short-term exposure are generally lower by a factor of 10.

Soil Ingestion: Workers in frequent contact with site soil are estimated to ingest 100 mg of soil per day (MassDEP 2002) and this value will be used for landscape workers. Using these assumptions and the others noted above, the ADD and LADD for soil ingestion by workers can be estimated using the formula for soil ingestion noted above. The calculated ADD for the constituents in soil at the property based on this equation is provided in Table 5 for soil ingestion exposure to the site-wide exposure point concentration.

Dermal Contact: Dermal exposure to constituents in soil can occur through direct physical contact with soil. The same assumptions as for soil ingestion are used, with the exceptions that in place of an ingestion rate, a soil adherence factor of 0.29 mg soil/cm^2 of skin, an exposed skin surface area of 3500 cm^2, and constituent-specific relative absorption factors were used. Using these assumptions, the ADD and LADD can be estimated using the formula for dermal contact noted above. The calculated ADD for the constituents in soil at the property based on this equation is provided in Table 5 for exposure via dermal contact to the EPCs in soil.

<u>Inhalation.</u> Although unlikely considering the small area of uncovered soil, landscapers could be exposed via inhalation to constituents entrained in soil-derived dust (MassDEP 2002). To estimate exposure, the same assumptions provided above for body weight, lifetime exposure duration and frequency were used. It was assumed that the gardener inhaled 20 cubic meters (m^3) of air during the time on site (essentially equal to the daily inhalation rate of 20 m^3/day; EPA, 1989 and corresponding to a full workday at an average moderate to heavy level of exertion; MassDEP 1995a).

In order to evaluate the potential for inhalation exposure to constituents entrained in the dust, it is necessary to estimate the amount of dust that would be present in the air, and the amount of air inhaled during the period that dust is present in the air. MassDEP (2002) suggests a value of 60 ug/m^3 for excavations and this value will be used in this evaluation, which is a conservative approach since excavation work would be expected to generate more dust than gardening. The value of 60 ug/m^3 is based on the assumption that gardeners will only receive intermittent exposure to visible dust but that the average exposure level will be above that used by EPA for undisturbed sites.

MassDEP notes that exposure to constituents on airborne particulates can occur through either direct inhalation or via inhalation followed by movement of the particles from the upper respiratory tract to the gastrointestinal tract. For direct inhalation, MassDEP indicates that only approximately half of the inhaled particulate matter will actually reach the lungs. However, for this evaluation, it is assumed that all the agent inhaled is of concern, as many inhaled constituents act at sites along the respiratory tract and do not need to reach the lungs to have adverse effects. For the inhalation-to-oral pathway, the ingested dose is estimated to be twice the measured PM_{10} dose of 60 ug/m^3. However, the total soil intake via this pathway (2 x 60 ug/m^3 x 20 m^3/day x 1 mg/1000 ug = 2.4 mg soil) is so low as to not add significantly to the soil dose calculated for direct ingestion and is not considered further in this assessment.

Exposure can be calculated using the equation:

$$\text{ADE/LADE} = \frac{\text{EPC x IF x PM10 x RAF x EF x ED}}{\text{BW x AT}}$$

Where:

ADE	=	Average daily exposure to the constituent (mg/m^3),
LADE	=	Lifetime average daily dose (mg/m^3),
EPC	=	Constituent concentration in soil (mg/kg),
IF	=	Inhalation Fraction (20 m^3 / 20 m^3day; MassDEP 2002),
PM10	=	Particulate air concentration (60 ug/m^3; MassDEP 2002).
RAF	=	Relative absorption factor (1 used to be conservative),

EF	=	Frequency of contact (100 days/year),
ED	=	Exposure Duration (5 years), and
AT	=	Averaging Time (365 days x 5 or 70 years).

Table 5 provides the estimated exposure and risk values for inhalation exposure to an adult landscaper, assuming no dust suppression measures are implemented. Exposure to other site users, including teachers and parents, would be expected to be lower.

Health Risks at the Site

In this section, information concerning the potential levels of exposure to contaminants is combined with information concerning the toxicity of the contaminants in order to determine the potential health risks at the property. For noncarcinogenic (systemic) effects, EPA and MassDEP assume that there is a level below which no effects will occur (a threshold no effect concentration). To evaluate possible risk from exposure to noncarcinogenic contaminants, the average daily dose (ADD) is divided by the health criterion value [the reference dose (RfD)]. If the ADD:RfD ratio, also termed the hazard index or HI, is less than ten for all constituents (i.e., if the daily intake is below the health criterion), then the contaminant is considered unlikely to pose an Imminent Hazard (i.e., a significant risk under conditions of short-term exposure) to individuals exposed under the given scenario. If the HI is less than ten, the site does not pose an Imminent Hazard. For cancer risk, the exposure, termed the lifetime average daily dose or LADD is multiplied by the cancer slope factor to estimate cancer risk, and this risk is compared with a target risk level of 1 in 100,000 or 10^{-5}.

Imminent hazards associated with short term exposure to site constituents in soil are estimated in Table 3 for children and in Table 5 for landscapers (and other adults). Based on these calculations, exposure by children to soil concentrations of site constituents results in a hazard index of 0.5 (soil ingestion plus dermal absorption risks combined) and a cancer risk of 1×10^{-5}. Exposure by adults to soil concentrations of site constituents results in a hazard index of 0.08 (soil ingestion, dermal absorption, and inhalation exposures combined) and a cancer risk of 3×10^{-6}. These levels do not exceed the Imminent Hazard criterion of an HI of ten and a cancer risk level of 10^{-5}, indicating that continued use of this site does not pose an imminent hazard.

Hazards and risks associated with longer term exposure to site constituents in soil are estimated in Table 4 for children and in Table 6 for landscapers (and other adults). Based on these calculations, exposure by children to soil concentrations of site constituents results in a hazard index of 0.3 and a cancer risk of 1×10^{-5}. Exposure by adults to soil concentrations of site constituents results in a hazard index of 0.08 and a cancer risk of 1×10^{-5}. These levels do not exceed the long-term risk targets of a cancer risk of 10^{-5} and an HI of 1, indicating that continued long term exposure at these concentrations would not pose a significant risk.

A number of assumptions were used in deriving the exposure estimates and toxicity criteria. While there is some uncertainty in the resulting hazard and risk estimates, conservative (health protective) assumptions were made so actual hazards and risks are likely to be lower than the calculated hazards and risks.

Conclusions and Recommendations

Soil was recently sampled by ECMS and analyzed with respect to the Cashman Elementary School property located at 193 Lions Mouth Road in Amesbury, Massachusetts. Arsenic and several other metals were detected at levels above a reportable concentration (arsenic) and above levels expected in background soil. However, no anthropogenic source of arsenic was present, the Amesbury area is known to have naturally-elevated arsenic levels in soil, and the source appears most likely to be natural. While the arsenic is assumed to be naturally occurring, calculations were performed to assess if a calculated risk was present for either short-term (IH) or longer-term exposure. Evaluation of the concentrations detected and of site-specific factors indicates that an Imminent Hazard condition does not exist at the site. Use of the site would also not pose a Significant Risks.

It should be noted that calculated risks did not exceed but were at the target risk levels. Therefore, although the area does not pose an Imminent Hazard or Significant Risk for current use, considering the use of the site as a school, it may be prudent to take measures to mitigate the potential for exposure. Such measures could include replacing natural soil in areas of exposed soil with imported soil containing lower levels of natural arsenic.

In order to ensure that public health is adequately protected, conservative assumptions (i.e., those unlikely to underestimate risk) were used in deriving both the exposure estimates and the toxicity values that are included in this letter report. Because of the use of these conservative assumptions, it is likely that the actual potential for non-cancer and cancer risks is lower than as is estimated in this report.

If you have any questions, please give me a call.

Sincerely,

Peter K. LaGoy
Principal

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Table 1
Exposure Point Concentrations for Soil
Cashman School
Amesbury, Massachusetts

	Number of Samples	Soil Average/a (mg/kg)	Soil Maximum (mg/kg)	EPC (mg/kg)	MCP RCS-1 Reportable Concentration (mg/kg)
Metals					
Antimony	17		ND	NC	20
Arsenic (0-1 ft)	15	46.4	82.3	46.4	20
Arsenic (2 ft)	2		55.9	NC	20
Barium	17		34.6	NC	1000
Beryllium	17		ND	NC	90
Cadmium	17		ND	NC	70
Chromium	17		65.9	66	100
Lead	17		28.6	NC	200
Mercury	17		ND	NC	20
Nickel	17		76	76	600
Selenium	17		ND	NC	400
Silver	17		ND	NC	100
Thallium	17		ND	NC	8
Vanadium	17		46.7	47	400
Zinc	17		107	NC	1000
TPH	17		184	NC	
VOCs	17		ND	NC	
SVOCs	17		ND	NC	
Pesticides/Herbicides	17		ND	NC	

Table 2
Comparison of Maximum Site Concentrations with Background Levels in Massachusetts Soil
Cashman School
Amesbury, Massachusetts

		Background Levels in MA/a		
ANALYTE	**Soil Maximum**	**Natural Soil**	**Fill Soil**	**Urban Maximum**
Metals (mg/kg)/a				
Antimony	ND	1	7	160
Arsenic	**82.3**	20	20	99
Barium	34.6	50	50	680
Beryllium	ND	0.4	0.9	7.5
Cadmium	ND	2	3	25
Chromium	**65.9**	30	40	530
Lead	28.6	100	600	11000
Mercury	ND	0.3	1	23
Nickel	**76**	20	30	220
Selenium	ND	0.5	1	57
Silver	ND	0.6	5	82
Thallium	ND	0.6	5	50
Vanadium	**46.7**	30	30	47
Zinc	107	100	300	5000

a/ "Natural soil" represent soils from non-urban areas with no visible ash.
"Fill soils" represent soils that have visible coal or wood ash and are associated with fill.
Maximum values are the maximum detected in several studies
Background values derived from MADEP 2002 Technical update: Background Levels of
Polycyclic Aromatic Hydrocarbons and Metals in Soil.
Values in bold exceed the "fill soil" background value.

Table 3
Exposure and Risk of Imminent Hazard for Children
Cashman School
Amesbury, Massachusetts

SOIL INGESTION

ANALYTE	Soil EPC mg/kg		ADD mg/kg/day	LADD mg/kg/day	Oral RfD mg/kg/day	Oral CSF 1/(mg/kg/day)	Hazard ADD/RfD	Risk LADD x CSF
Arsenic	46.4		9.24E-05	6.60E-06	0.0003	1.5	3.1E-01	9.9E-06
Chromium	66		1.31E-04		0.003		4.4E-02	
Nickel	76		1.51E-04		0.02		7.6E-03	
Vanadium	47		9.36E-05		0.009		1.0E-02	

DERMAL CONTACT

	Soil EPC mg/kg	Dermal RAF	ADD mg/kg/day	LADD mg/kg/day	Oral RfD mg/kg/day	Oral CSF 1/(mg/kg/day)	Hazard ADD/RfD	Risk LADD x CSF
Arsenic	46.4	0.03	1.66E-05	1.19E-06	0.0003	1.5	5.5E-02	1.8E-06
Chromium	66	0.1	7.88E-05		0.003		2.6E-02	
Nickel	76	0.2	1.82E-04		0.02		9.1E-03	
Vanadium	47	0.1	5.61E-05		0.009		6.2E-03	
						SUM	**0.5**	**1E-05**

Table 3
Exposure and Risk of Imminent Hazard for Children
Cashman School
Amesbury, Massachusetts

SOIL INGESTION

ANALYTE	Soil EPC mg/kg		ADD mg/kg/day	LADD mg/kg/day	Oral RfD mg/kg/day	Oral CSF 1/(mg/kg/day)	Hazard ADD/RfD	Risk LADD x CSF
Arsenic	46.4		5.30E-05	7.57E-06	0.0003	1.5	1.8E-01	1.1E-05
Chromium	66		7.53E-05		0.003		2.5E-02	
Nickel	76		8.68E-05		0.02		4.3E-03	
Vanadium	47		5.37E-05		0.009		6.0E-03	

DERMAL CONTACT

	Soil EPC mg/kg	Dermal RAF	ADD mg/kg/day	LADD mg/kg/day	Oral RfD mg/kg/day	Oral CSF 1/(mg/kg/day)	Hazard ADD/RfD	Risk LADD x CSF
Arsenic	46.4	0.03	9.53E-06	1.36E-06	0.0003	1.5	3.2E-02	2.0E-06
Chromium	66	0.1	4.52E-05		0.003		1.5E-02	
Nickel	76	0.2	1.04E-04		0.02		5.2E-03	
Vanadium	47	0.1	3.22E-05		0.009		3.6E-03	
						SUM	**0.3**	**1E-05**

Table 4
Exposure and Risk for Adult Gardeners
Cashman School
Amesbury, Massachusetts

ANALYTE					Oral	Oral		
	EPC		ADD	LADD	RfD	CSF	Hazard	Risk
SOIL INGESTION	mg/kg		mg/kg/day	mg/kg/day	mg/kg/day	1/(mg/kg/day)	ADD/RfD	LADD x CSF
Arsenic	46.4		1.91E-06	1.36E-06	0.0003	1.5	6.4E-03	2.0E-06
Chromium	66		2.71E-06		0.003		9.0E-04	
Nickel	76		3.12E-06		0.02		1.6E-04	
Vanadium	47		1.93E-06		0.009		2.1E-04	
	EPC	Dermal			Oral	Oral		
DERMAL CONTACT	mg/kg	RAF	ADD	LADD	RfD	CSF	Hazard	Risk
Arsenic	46.4	0.03	5.81E-06	4.15E-07	0.0003	1.5	1.9E-02	6.2E-07
Chromium	66	0.1	2.75E-05		0.003		9.2E-03	
Nickel	76	0.2	6.34E-05		0.02		3.2E-03	
Vanadium	47	0.1	1.96E-05		0.009		2.2E-03	
					Inhalation	Inhalation		
	EPC		ADE	LADE	RfC	URF	Hazard	Risk
DUST INHALATION	mg/kg		mg/m3	ug/m3/a	mg/m3	1/(ug/m3)	ADE/RfC	LADE x URF
Arsenic	46.4		8.01E-07	5.72E-08	0.000025	0.003	3.2E-02	1.7E-10
Chromium	66		1.14E-06	8.14E-08	0.0004	0.012	2.8E-03	9.8E-10
Nickel	76		1.31E-06	9.37E-08	0.001	0.00048	1.3E-03	4.5E-11
Vanadium	47		8.11E-07		0.001		8.1E-04	
						SUM	**0.08**	**2.7E-06**

Table 4
Exposure and Risk for Adult Gardeners
Cashman School
Amesbury, Massachusetts

ANALYTE					Oral	Oral		
	EPC		ADD	LADD	RfD	CSF	Hazard	Risk
SOIL INGESTION	mg/kg		mg/kg/day	mg/kg/day	mg/kg/day	1/(mg/kg/day)	ADD/RfD	LADD x CSF
Arsenic	46.4		1.91E-06	6.49E-06	0.0003	1.5	6.4E-03	9.7E-06
Chromium	66		2.71E-06		0.003		9.0E-04	
Nickel	76		3.12E-06		0.02		1.6E-04	
Vanadium	47		1.93E-06		0.009		2.1E-04	
	EPC	Dermal			Oral	Oral		
DERMAL CONTACT	mg/kg	RAF	ADD	LADD	RfD	CSF	Hazard	Risk
Arsenic	46.4	0.03	5.81E-06	1.97E-06	0.0003	1.5	1.9E-02	3.0E-06
Chromium	66	0.1	2.75E-05		0.003		9.2E-03	
Nickel	76	0.2	6.34E-05		0.02		3.2E-03	
Vanadium	47	0.1	1.96E-05		0.009		2.2E-03	
					Inhalation	Inhalation		
	EPC		ADE	LADE	RfC	URF	Hazard	Risk
DUST INHALATION	mg/kg		mg/m3	ug/m3/a	mg/m3	1/(ug/m3)	ADE/RfC	LADE x URF
Arsenic	46.4		8.01E-07	2.72E-07	0.000025	0.003	3.2E-02	8.2E-10
Chromium	66		1.14E-06	3.87E-07	0.0004	0.012	2.8E-03	4.6E-09
Nickel	76		1.31E-06	4.46E-07	0.001	0.00048	1.3E-03	2.1E-10
Vanadium	47		8.11E-07		0.001		8.1E-04	
						SUM	**0.08**	**1E-05**

APPENDIX B

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.