Phase III - Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives

882-892 Mass. Ave
Arlington, Massachusetts

MassDEP RTN: 3-0031392

AECOM Project Number 60615154

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Quality information

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1. Introduction

Pursuant to section 310 40.0850 of the Massachusetts Contingency Plan (MCP), AECOM Technical Services, Inc. (AECOM) is submitting this Phase III Identification, Evaluation and Selection of Comprehensive Remedial Action Alternatives Report (Phase III Report) for the site that encompasses a portion of the property located at 882-892 Massachusetts Avenue, Arlington, Massachusetts ("property"). The Department of Environmental Protection (MassDEP) Release Tracking Number (RTN) 3-31392 (and linked RTN 3-31723) apply to this disposal site ("site"). Attached **Figure 1** depicts the site location and **Figure 2** is a site plan.

AECOM was contracted in January 2020 to complete this Phase III Report. The site Responsible Party (RP), 882-892 Massachusetts Avenue LLC, executed an Administrative Consent Order (ACO) with MassDEP in December 2019. This MCP submittal meets the ACO requirement for a Phase III Report by April 30, 2020. On April 9, 2020, a Tier Classification Extension Submittal and Ownership/RP Transfer was submitted to MassDEP per the ACO.

All previous MCP work has been conducted by Lord Associates, Inc. The last MCP phase report submitted for the site, was a Revised Phase II Comprehensive Site Assessment and Immediate Response Action Completion Statement Report dated April 26, 2018 ("Phase II Report"). For this Phase III report, AECOM relies on data collected by Lord Associates, Inc. and others for the site and site vicinity. The owner of the property which encompasses the site is having plans prepared for municipal approval and working to arrange financing to demolish and remove the existing one-story commercial building at the site and construct a new building; which if that project goes forward would open access to the subsurface and area of highest impacts delineated to date. This Phase III Report and the selected remedial alternatives relies on the assumption that this project will go forward, and the ACO deadlines with MassDEP were negotiated with this in mind. Lastly, because of the removal of the existing building, recommended additional remedial investigations will be possible to facilitate the final design or feasibility study of the selected remedial alternative.

This Phase III Report is being submitted to MassDEP via eDEP with Transmittal Form BWSC-108, signed by Licensed Site Professional Mr. David Austin (#2062) and the RP.

2. Site Description, Release History, and Summary of Site Investigations and Remedial Actions

The site encompasses a portion of the property (882-892 Massachusetts Avenue, in Arlington, Massachusetts), which is currently an approximately 4,550 square foot commercial and office space building located on 0.147 acres. The Universal Transverse Mercator coordinates for the approximate center of the subject property are 4698379 meters north, and 321966 meters east. The site also includes a portion of Massachusetts Avenue to the north based upon Figure 2 of the Lord Associates, Inc. Phase II Report. In addition, Downgradient Property Status (DPS) filings have been submitted for properties north and east of the site. The DPS conclusion provided for 880 Massachusetts Avenue is refuted by Lord Associates, Inc. in the Phase II Report. The site is the current total area that has been impacted by the release of chlorinated hydrocarbons at the property, including perchloroethene (PCE) and trichloroethene (TCE), in the absence of other possible sources.

According to the Town of Arlington Assessor's office, the existing building at the property was constructed about 1910; however, the building does not appear on a 1923 Sanborn Fire Insurance Map according to the Lord Associates, Inc. Phase II Report. And it does appear on the 1927 Sanborn Map in its apparent current configuration with the exception of a small building extension to the south; the south side foundation and building appears on the 1973 Sanborn Map. The buildings at the property have always been used for commercial/retail or office use. According to the current owners (882-892 Massachusetts Avenue LLC), the property was purchased by the Fragio Realty Trust in 1964 (additional property history information is contained in the Phase II Report). Attached **Figure 2** depicts the building, property lines within the disposal site boundary, roadways, subsurface utilities, and soil vapor point/test boring/groundwater monitoring well locations used for site assessment and remedial work to date.

The site and property are located in an urban residential and commercial area of Arlington zoned B2 and is currently occupied by a commercial building comprised of five separate units including: Thai Kitchen Restaurant (882A Massachusetts Ave); 882B Massachusetts Ave. (currently vacant); Food Link at 888 Massachusetts Ave.; Toraya Japanese Restaurant (890 Massachusetts Ave.); and Arlington Community Media (892 Massachusetts Ave.). The land uses surrounding the property and site are primarily residential to the south and west. A former gasoline service station, now a commercial and residential property is located across Massachusetts Avenue to the north, and a printing shop (Arlington Lithography, Inc.) is located behind that property at 6 Schouler Court. An TD Bank business, that was the site of a former Sunoco gasoline service station is located across Lockeland Avenue to the east. The Arlington High School is located further east-northeast diagonally across Massachusetts Avenue.

The site and vicinity are generally level, based on site inspections and the topographic map, and there is a gentle slope to the east, and a rise to the south. According to the Phase II Report, surface water runoff has been observed to flow towards catch basins located in Massachusetts Avenue. The site and property are estimated to be approximately 80 feet above sea level.

As reported in the Phase II Report, according to the 2000 Massachusetts Census, as supplied by MassGIS, the estimated population density within half a mile from the site is greater than 1,000 people. Potential human receptors include employees and visitors of the building at the site, and children may be present under high frequency, but low intensity uses. The property and portion of site within Massachusetts Avenue are entirely paved or covered by a building. Therefore, soil is currently categorized as S-2 or S-3 per the MCP.

The foreseeable land use in the area of the site is expected to remain as commercial and residential (multi-unit buildings). Other than the Arlington High School, there are no known institutions within 500 feet of the property. Additionally, there are no surface waters, Areas of Critical Environmental Concern, fish habitats, and habitats of Species of Special Concern or Threatened or Endangered Species within 500 feet of the site as reported in the

Phase II Report. Relative to drinking water supplies, the site does not exist in a Zone II area, an Interim Wellhead Protection Area, or a Zone A area. According to the Town of Arlington, there are no known private water wells within 500 feet of the site as reported in the Phase II Report. Average depth to groundwater at the site is approximately 15-25 feet below grade; therefore, the groundwater at the site is categorized as GW-3. An area of protected open space exists approximately 300 feet to the south and 500 feet to the north of the site. A MassGIS Priority Resource Map is provided as Figure 3 in the Phase II Report.

2.1 Site Release History

As reported in the Phase II Report, in August of 2011, MassDEP undertook a series of investigative efforts at and near the Arlington High School located at 869 Massachusetts Avenue as the result of the finding of an industrial solvent, PCE in groundwater and indoor air near the school. The investigation included several nearby properties located across Massachusetts Avenue including a former Sunoco service station at 880 Massachusetts Avenue (currently a TD Bank branch), and the property at 882-892 Massachusetts Avenue that was formerly occupied by Arlington Tailors and Cleaning which used and stored PCE. In August 2012, MassDEP installed soil vapor monitoring points in the front sidewalk area of the site along Massachusetts Avenue (see Figure 2). Concentrations of PCE and other related chlorinated hydrocarbons were detected in the soil gas. MassDEP issued a Notice of Responsibility letter (NOR) to the Fragio Realty Trust (which previously had transferred its interest in the property to the Pasciuto Family Series LLC, the previous property owner) on February 21, 2013 and assigned the site RTN 3-31392. In the NOR, MassDEP summarized the results of a groundwater elevation survey that depicted groundwater flow at the Lockeland Avenue and 882-892 Massachusetts Avenue area as travelling in a north to northeast direction, towards the Arlington High School.

During May of 2013, additional soil vapor points were installed underneath the site building. The results of that testing identified concentrations of PCE and other related chlorinated hydrocarbons in the soil gas exceeding the sub slab screening levels published by MassDEP for potential vapor intrusion conditions. The PCE concentrations ranged from 14,000 micrograms per cubic meters (ug/m^3) to 124,000 ug/ m^3 under Arlington Tailors. Based upon these results, MassDEP issued Fragio Realty Trust a Notice of Need to Conduct an IRA on June 11, 2013. The required IRA actions included the testing of both soil gas and indoor air to determine if a complete vapor intrusion pathway was present at the site building (882-892 Massachusetts Avenue). On July 12, 2013, MassDEP issued Fragio Realty Trust a Modification to Requirements of IRAs and Request for Extension to Interim Deadlines letter. The letter stated that MassDEP approved the evaluation of a sub slab depressurization system (SSD) or soil vapor extraction system (SVE) in lieu of and/or in addition to the requested soil vapor and indoor air testing, and an extension to the July 11, 2013 interim deadline for the completion date was set at August 12, 2013.

During July and September 2013, the following was completed by Lord Associates, Inc.:

- Met with contractor concerning the design and installation of the SSD system.
- Collected 24-hour composite samples from the upstairs at each of the four units at the site building for analyses by EPA Method TO-15 for VOCs and provided the results to MassDEP in accordance with the Interim deadline set for initial testing. The results indicated that PCE was present in indoor air at concentrations exceeding the MassDEP Threshold Values for commercial settings and Lord Associates, Inc. stated that additional assessment would be required to evaluate the risk it presented to human health.
- The SSD system installations were completed between August 2 and 5, 2013, followed by system testing and sampling.
- MassDEP concluded, based on their review of the initial indoor air testing, that the levels of PCE in indoor air at two of the units (Arlington Media and Toyaya Restaurant) represented Imminent Hazards and assigned a second RTN (3-31723) on August 22, 2013. As reported in the Phase II Report, because of the presence of the functioning SSD systems, it was opined that the source of vapor intrusion into the building was not from any PCE release into the environment, but was more likely due to the presence of stored PCE in the Arlington Tailors. Therefore, the following was completed: removal of all PCE being stored in the building; increasing the fresh air makeup of each unit; additional assessment of the SSD systems and site conditions; and deploying air purification units at both Arlington Media and Toyaya Restaurant (it is assumed that this corrected the situation).

In a letter dated March 26, 2014, MassDEP conditionally approved a Phase II Work Plan and established interim deadlines to complete additional assessment work. Since that date, Lord Associates, Inc. completed multiple sampling events and implemented an IRA Plan to perform a program of In-Situ Chemical Oxidation (ISCO). The details of those response actions are provided in the following sections.

Multiple MCP submittals summarizing assessment and remedial work were filed with MassDEP by Lord Associates, Inc. starting in September 2013 with a Phase I Report and Tier Classification submittal and IRA Plan, followed by IRA Status Reports, Phase II Report and IRA Completion (January 2018), Revised Phase II Report and IRA Completion (April 2018), Tier Classification Extension (December 2018), and Notice of Delay (Mary 2019). As noted above, an ACO was executed in December 2019 between MassDEP and the RP with deadlines. On April 9, 2020, a Tier Classification Extension Submittal and Ownership/RP Transfer was submitted to MassDEP per the ACO. This submittal fulfills the requirement in the ACO for a Phase III Report by April 30, 2020.

2.2 Previous MCP Work

2.2.1 Assessment

The following is a summary of assessment work completed by MassDEP (as noted) and Lord Associates, Inc. (all other work except as noted) at the site:

- From August 2011 to August 2013, evaluation of site area, groundwater well installation (DEP-12 and DEP-13), and soil gas sample point installations and soil gas sampling for VOCs at the site (SV-1 through SV-10) by MassDEP; and installation of bedrock well MW-105B by Corporate Environmental Advisors.
- Soil borings and monitoring well installations (2-inch diameter) were completed in April and August 2014. Including five soil borings, which were completed as groundwater monitoring wells: borings/wells LB-1/MW and LB-2/MW were located in the sidewalk in front of the building at 882B and 890 Massachusetts Avenue; boring/well-3/MW was located behind the building near the dumpster at 888 Massachusetts Avenue; boring/well LB-6/MW was located in the sidewalk in front of the building at 892 Massachusetts Avenue unit and boring/well LB-7/MW was located behind the 892 Massachusetts Avenue unit. Soil boings LB-4, -5 and -8 were completed through the building basement floor according to site plans and data tables in previous MCP reports.

  The borings were completed to 14 ft. (LB-7/MW) and 24 ft. (LB-1/MW) below ground surface. Soil samples were collected continuously and screened for TVOCs with a PID meter, and select soil samples were sent to a laboratory for VOC analyses via EPA Method 8260C (except LB-6/MW and LB-7MW because of lack of field screening results).
- In January 2015, to further investigate the potential source of the chlorinated solvents, a series of shallow soil boings were completed underneath the building foundation at 882B & 888 Massachusetts Ave. where dry cleaning equipment was formally located, and in the adjacent space at 890 Massachusetts Ave. (LB-9 through LB-21). The borings were completed by coring the concrete slab and collecting soil from a depth of approximately one foot beneath the slab with a hand auger. Each boring hole and sample was screened in the field for TVOCs with a PID meter. No TVOCs were detected in the boring hole or headspace of the samples. Eight of the ten samples were preserved in methanol containing vials and sent to a laboratory for VOC analyses via EPA Method 8260C.
- In September 2015, three injection wells were installed (INJ-1 through INJ-3).
- Collection of general groundwater parameters from five wells between April 2014 and April 2018: LB-1/MW, LB-2/MW, LB-3/MW, DEP-13 and MASC-1 or EMW-2 (across Massachusetts Ave. from property – north). Most of the data was collected from wells LB-2/MW, LB-3/MW and DEP-13.
- Groundwater sampling for VOC analyses from wells LB-1/MW (April 2014); LB-2/MW (nine rounds between April 2014 and April 2018); LB-3/MW (eight rounds between April 2014 and July 2017); LB-6/MW (April 2014); DEP-13 (six rounds between April 2014 and July 2017); and MASC-1 (four rounds between August 2011 and December 2015 – three of rounds completed by others).

- Indoor air sampling for VOCs: within Arlington Community Media (892 Massachusetts Ave.) with 7 samples between August 2013 and January 2019 (all first floor, except one basement sample, and with and without SSD operational); Former Arlington Tailoring and Cleaning (888 Massachusetts Ave.) and Thai Kitchen Restaurant (882A Massachusetts Ave) with 5 samples at each between August 2013 and January 2019 (all first floor, except one basement sample, and with and without SSD operational); and Toraya Japanese Restaurant (890 Massachusetts Ave.) with 6 samples between August 2013 and January 2019 (all first floor, except one basement sample, and with and without SSD operational).
- Monitoring of SSD system parameters via suction points SSD-1, -2A, -2B, -3 and -4 between August 2013 and April 2018, including air sample analyses for VOCs (August 2013 and November 2014).
- Ten rounds of groundwater elevation gauging between April 2014 and April 2018.

In addition to the assessment work at the site, assessment work in the site vicinity has been completed for two DPS submittals: one at 880 Massachusetts Avenue (RTN 3-30665) and one at 887 Massachusetts Avenue (RTN 3-33740). The DPS conclusion provided for 880 Massachusetts Avenue is refuted by Lord Associates, Inc. in the Phase II Report.

2.2.2 Remediation

Besides the operation of the SSD systems and APUs, Lord Associates, Inc. completed an ISCO remedial program beneath the building at the property. The remedial program beyond the operation of the SSD systems and APUs, which is detailed in multiple MCP submittals for the site included the following:

- Pre-ISCO groundwater monitoring;
- Four injection events between September 2015 and August 2017, including 8,757 pounds of persulfate and 1,588 pounds of iron. The injections were made in injection wells INJ-1 through INJ-3 and wells LB-2/MW and LB-3/MW (combination of these wells were used, depending upon the injection event); and
- Post-ISCO groundwater monitoring.

2.3 Site Subsurface Conditions and Conceptual Site Model

2.3.1 Hydrogeology

Based upon numerous drilling events at the site and in the site vicinity, including work at 880 Massachusetts Avenue (Cardno/ATC, Phase I Initial Site Investigation, Tier Classification and Phase II Scope of Work Report RTN 3-30665, February 15, 2013) and at 887 Massachusetts Ave. by GEI, the following information was presented in the Phase II Report:

- GEI's attempts to install five wells at 887 Massachusetts Avenue but did not encounter sufficient water to a depth of 25 feet below grade to make them feasible.
- Soil underlying the site consists of a dense fine sand with coarse to fine gravel and cobbles (glacial till). Boulders were encountered at several depths below grade, and refusal was encountered between 24-31 below grade, which was interpreted as the top of bedrock at 880 Massachusetts Avenue, and between 14-26 feet below ground surface at 887 Massachusetts Avenue. At the site, refusal was encountered between 15-31 feet below grade, indicating a drop in elevation of approximately 9-16 feet between the rear and front of the building at the property.
- Bedrock wells installed at the 880 Massachusetts Avenue cored into a fine grained igneous rock in the granite family, and the top of the bedrock surface was reported to be highly weathered and fractured. Fractures decreased with depth, and a bedrock surface elevation contour map developed by Cardno/ATC depicts bedrock rising to the west along Massachusetts Avenue and up to the south behind 880

Massachusetts Avenue (elevation 50-70 feet). It was reported that a low point was observed on Arlington High School property at wells ATC -9 & ATC-10 (elevation 40 feet). A cross section drawing of the wells located in front of the property at the site contained in the site Phase II Report shows a variability in depth to rock over approximately 5 feet between two wells (LB-2/MW & DEP-13) located approximately ten feet apart.

- Groundwater has been encountered at depths between 8-25 feet below grade at the site and site vicinity. The shallowest well, LB-3/MW, is located behind 888 Massachusetts Avenue at the site. Multiple elevation surveys completed by Cardno/ATC, MassDEP and Lord Associates, Inc. consistently depict a flow pattern similar to the surface of bedrock topography, with flow to the northeast, and with a shallow overburden aquifer flowing across the bedrock surface. Most of the wells sampled by Cardno/ATC in regard to 880 Massachusetts Avenue were noted to recharge quickly during development and sampling, and Lord Associate, Inc. noted that due to the low volume of water collected within the wells at the site, the wells typically go dry after a few minutes of pumping. Lord Associates, Inc. also noted that recharge is moderately good, and all remedial additive injections went well with no product surfacing.
- No aquifer testing has been completed at the site or adjacent properties to estimate the hydraulic conductivity of soils. Based upon site data and assumption, Lord Associates, Inc. estimated the average rate of groundwater movement or velocity as 0.009ft/day or 3 feet per year, with the note that the value is highly dependent on the assumed hydraulic conductivity values.

2.3.2 Extent of Impacts

The extent of soil, groundwater and air (soil gas and indoor ambient air) impacts at the site were presented in the Phase II Report and include (attached **Figure 3** depicts site data):

- The PID screening for total VOCs completed during the performance of test borings at the site detected no VOCs in the overburden (above the saturated zone). At boring LB-2/MW, no VOCs are detected until a depth of 19 ft. below ground surface (bgs) was reached where 70 part per million volume (ppmv) was recorded. The highest PID readings at the three other borings include 52.1 ppmv (DEP-12, 20 ft. bgs); 1.2 ppmv (DEP-13, 27 ft. bgs); and 1.2 ppmv (LB-3/MW, 11 ft. bgs). It was opined in the Phase II Report that the data does not indicate a surficial release of PCE at these locations.
- The laboratory results of the soil samples collected from inside the building underneath the concrete slab foundation detected PCE at concentrations ranging from below the laboratory reporting limit to 3.9 milligrams per kilogram (mg/kg) at LB-8. No other VOCs were detected in other samples analyzed, and one of the highest concentration (1.8 mg/kg) was found next to the former dry-cleaning foundation support at LB-14 located at 888 Massachusetts Avenue. PCE was not detected in sample LB-5 obtained from the boring located at 882B Massachusetts Avenue. It was opined in the Phase II Report that the data indicates a surficial release of PCE at the sampled locations.
- No VOCs above Method 1 GW-3 risk standards were detected in samples from wells LB-1/MW, LB-6/MW, DEP-13 and MASC-1 (some of these samples did contain TCE and PCE above the GW-2 standards). Samples from two groundwater monitoring wells (LB-3/MW and LB-2/MW) indicated exceedances of the applicable Method 1 groundwater standards. PCE, TCE and cis-1,2-dichloroethene (cis-DCE) exceed the GW-2 standards at well LB-3/MW (located behind the property building), and at well LB-2/MW (located on the sidewalk in front of the property building) the GW-3 standard is exceeded for PCE, along with the GW-2 standard for cis-DCE. PCE was most recently detected in July 2017 at well LB-3/MW at 410 micrograms per liter (ug/l) against a GW-2 standard of 50 ug/l; TCE at 200 ug/l against a GW-2 standard of 5 ug/L; and cis-DCE at 430 ug/l against a GW-2 standard of 20 ug/l. At well LB-2/MW, PCE was detected in groundwater samples prior to the ISCO injections at 55,000 ug/l (the GW-3 standard is 30,000 ug/l). Sampling of LB-2/MW following the last ISCO injection resulted in a detection of 40,000 ug/l in April 2018. Concentrations in samples collected from the deepest well (39 ft.) screened at the site (MW-105B), did not detect any VOCs.
- All other wells located at downgradient properties at 887 Massachusetts Avenue and Arlington High School appear to meet their applicable GW-3 standards. The groundwater surface has consistently been measured

below the depth of subsurface utilities: roughly 15 ft. bgs at 888 Massachusetts Avenue to 25 ft. bgs further east and north along Massachusetts Avenue.

- Pre-treatment PCE concentrations ranged from 11 to 124,000 ug/m^3 in samples of soil gas collected directly beneath the concrete foundation floor within the property building. A copy of a site plan with soil gas concentrations detected by MassDEP in May 2013 is provided in **Appendix A**. It was opined in the Phase II Report that the data presented on MassDEP figure indicated a concentration gradient from the front of the building at 888 Massachusetts Avenue to the rear near the former dry-cleaning machine support.
- Prior to 2018, air sampling indicated that the SSD systems had been effective in controlling potential vapor intrusion at the occupied businesses at the site. In 2018 and 2019, Lord Associates, Inc. completed an evaluation of indoor air conditions without the SSDs actively operational (after all dry-cleaning equipment and related operations were removed from the building in 2017). The results, as reported in the Phase II Report and Notice of Delay (May 2019), indicated no Substantial Hazard in 2018 (one sample location). Air testing was repeated in January of 2019 in five locations. And the results of that testing found no VOCs above the Commercial Threshold Values. The results are provided on Lord Associates, Inc. Table 7 in **Appendix A**.

2.3.3 Summary of Site Conditions

The property became a MCP site in 2012 due to a finding of elevated soil gas concentrations of PCE and its related daughter products by MassDEP as part of an investigation into impacts identified at the Arlington High School (northeast of the site). MassDEP noted the possibility of two PCE plumes; one travelling through the Massachusetts Ave. and Schouler Court intersection from the west, and one originating south of the school east of that intersection in a northeast direction.

The property has a history of being occupied by a dry cleaning facility, although only the business at 888 Massachusetts Avenue has a documented release of PCE dry cleaning fluid, which has been detected in groundwater, soil, soil gas and indoor air at the site. As part of site assessment and remedial activities, the highest concentrations of PCE found in groundwater, soil and soil gas were found in front of the former Arlington Tailor and Cleaning, at 888 Massachusetts Avenue. The site hydrogeology and extent of impacts are summarized in the two previous sections.

As part of the Phase II Report, a Method 3 Risk Characterization was completed for the site on the basis that potential exposure to site impacts are predominantly through inhalation of indoor air. Method 1 risk standards in groundwater are exceeded in samples from two locations as noted above. At LB-3/MW the standard that is protective of indoor air (GW-2) is exceeded, and at LB-2/MW, the standard that is protective of public welfare and the environment (GW-3) is exceeded. All soil sample results meet applicable cleanup standards, and recent indoor air results found levels below Commercial Threshold Values. During IRA activities, SSD systems and APUs were operational. As reported in the Phase II Report, no current downgradient exposure points or public welfare issues have been identified, and there are no Imminent Hazards or uncontrolled Substantial Hazards at the site. Although there are no current exposures, under reasonably foreseeable future site conditions, such as new construction, site use, or utility line maintenance, exposure potential may be different. It was concluded in the Phase II Report, based upon the site conditions at the time and the results of the risk characterization, that comprehensive Remedial Actions are necessary at the site to achieve a Permanent Solution. A condition of No Significant Risk of harm to safety does exist at the site.

The potential migration pathways at the site include air (vapor intrusion) into the existing property building and future building (there is evidence of impacts), soil (evidence of impacts, although deep), and groundwater (evidence of impacts); but not surface water or sediment. Potential human exposures include inhalation of air via vapor intrusion; and no expected dermal contact or ingestion of soil and groundwater. No environmental concerns were noted in the Phase II Report.

Multiple other potential sources for the observed contamination at the Arlington High School have been identified including a former gas station at 880 Massachusetts Avenue (RTN 3-22012/30665) that identified PCE in soil and groundwater in a 2003 report; a former gas station at 887 Massachusetts Avenue that identified PCE in groundwater in 1999; a shopping plaza at 905 Massachusetts Avenue that identified PCE in groundwater in 1995 (RTN 3-2004);

and a printing shop (Arlington Lithograph, Inc.) at 6 Schouler court. There was also a documented release of waste oil in the school auto repair shop that reported PCE being present. As previously noted, both former gas station properties have submitted DPS statements to the MassDEP alleging that the source of the contamination at their properties is from the upgradient subject property. However, as reported in the Phase II Report, there is evidence that conditions at these sites pre-existed Arlington Tailor and Cleaners dry cleaning operations and Phase II subsurface investigations conducted in support of this investigation do not support the property at 880 Massachusetts Avenue as being downgradient. With consideration that there are multiple sources for the observed groundwater contamination in the area, Lord Associates Inc. has drawn the site boundaries based on recorded groundwater concentrations, the inferred direction of groundwater flow, velocity, and a conservative estimate of the date of the known release at the site. No additional assessment work has been completed by AECOM, and it is expected that site conditions will be further refined when remedial investigations are completed (discussed in next section).

The IRA activities completed at the site included indoor air testing, and installation and operation of SSD systems and APUs. When operational, the systems were reported in the Phase II Report as being effective in controlling and preventing a vapor intrusion pathway at the site building, and the risk characterization evaluation considering exposure to indoor air under the condition of the systems being operational found a condition of No Significant Risk. The last air sampling conducted by Lord Associates, Inc. in 2018 and 2019 without the systems operating, indicated no Imminent Hazards. As presented above, a remedial program of ISCO was implemented to target the presumed area of the release under the building at 888 Massachusetts Avenue. The remedial work included four injection events totaling approximately 9,000 pounds of iron-catalyzed sodium persulfate. As reported in the Phase II Report, results indicated improvements in some of the wells, with concentrations re-bounding at several locations.

It was concluded in the Phase II Report that in the absence of an evaluation of post-remedial efforts that finds that the source is decreasing and has been controlled, and that site conditions represent a condition of No Significant Risk under reasonably foreseeable future site conditions, it is not possible to support a Permanent Solution Statement, and that additional comprehensive remedial actions were required pursuant to 310 CMR 40.0840.

3. Phase III Objectives

The MCP requires that a Phase III RAP be prepared for a site where a Phase II CSA has been completed and a Permanent Solution has not yet been achieved (310 CMR 40.0852). Phase III performance standards require that a Phase III evaluation result in the recommendation of a remedial action alternative (RAA) as described in 310 CMR 40.0861 that is either a Permanent or Temporary Solution.

Per the MCP, a Phase III evaluation shall result in:

- The identification and evaluation of remedial action alternatives which are reasonably likely to achieve a level of No Significant Risk considering the oil and hazardous material present, media contaminated, and site characteristics; and
- The recommendation of a remedial action alternative that is a Permanent or Temporary Solution, where a Permanent Solution includes measures that reduce, to the extent feasible, the concentrations of oil and hazardous material in the environment to levels that achieve or approach background.

Consistent with the requirements of the MCP, the risks to human health and the environment under current and future site use scenarios were evaluated, and a Method 3 Risk Characterization was conducted for the site as summarized in the Phase II Report. Based on the results of the Method 3 Risk Characterization a condition of No Significant Risk does not exist at the site. To achieve a Permanent Solution, the following site-specific remedial objectives were identified:

- Mitigate potential inhalation exposures to achieve a condition of No Significant Risk for human health.
- Mitigate potential sources of contamination at the site, to the extent feasible.
- Minimize waste generation during the work through the use in-situ technologies or other appropriate measures.

The performance standards of the MCP require consideration of remedial actions that would reduce the overall mass and volume of impacts at a disposal site to the extent feasible (310 CMR 40.0191). The feasibility of reducing the overall mass to approach or achieve background depends on the site-specific cleanup method selected to achieve a Permanent Solution and is evaluated in **Section 4.0**.

4. Phase III Remedial Plan

4.1 Identification and Initial Evaluation of Remedial Technology Alternatives

AECOM prepared this Phase III RAP in accordance with the requirements of the MCP (310 CMR 40.0850). The purpose of the RAP was to evaluate feasible remedial options and to identify and select a comprehensive RAA to achieve a condition of No Significant Risk and support a Permanent Solution for the site. Based on the risk characterization presented in the Phase II Report by Lord Associates, Inc., a condition of No Significant Risk does not exist at the site due to the presence of the VOC impacted subsurface and reasonably foreseeable future site conditions (i.e., new construction, site use, utility line maintenance) as the exposure potential may be different compared to current conditions.

The Phase III RAP documents the identification, evaluation and selection of the comprehensive RAA for the site. The evaluation consisted of two steps: an initial screening step to identify feasible remedial technologies followed by a detailed evaluation step where comprehensive RAAs developed based on the initial screening results are evaluated relative to MCP evaluation criteria specified under 310 CMR 40.0858.

4.1.1 Initial Screening of Remedial Technologies for the Site

In accordance with the MCP (310 CMR 40.0856), the objective of the Initial Screening Evaluation is to identify remedial technologies that would likely meet the remedial objectives presented in **Section 3.0** and in turn achieve a Permanent Solution for the site. The initial screening identifies potentially feasible remedial technologies for the site and evaluates them based on their relative effectiveness with site impacts and subsurface conditions, implementability and overall cost. For the initial screening, AECOM considered various technical resources, and evaluated proven and innovative remedial technologies.

The site-specific considerations for remedial technologies include the results of previous remedial measures and the current assumption that the current property building will be removed and replaced. If this assumption changes, modification to a chosen remedy may be documented in the Phase IV Remedy Implementation Plan due by May 2021 per the ACO. As the investigatory information below the site building is limited because of site constraints (i.e., lack of groundwater data, no soil results deeper than 1 foot below the building foundation), the development of the remedial alternatives considers varying levels of impacts in soils (i.e., large impacts, small impacts, minimal impacts). Based on available groundwater data upgradient and downgradient of the building, it is assumed impacts are located in groundwater underneath the building.

Based upon the initial screening of remedial technologies, remedial components that appear to be the most effective and readily implementable technologies for remediating site conditions are identified below. The eventual selected remedial action alternative may include multiple components identified in this initial screening. Note that ISCO was retained as a remedial alternative because this is a proven technology for chlorinated solvent VOCs (CVOCs) treatment with success based on contact with contaminants, with varying strengths of oxidants available. It is anticipated that increased success will occur for ISCO with better delineation of site subsurface below the building and potentially with a more aggressive injection design, which can be accomplished more readily with removal of the site building.

Soil

- Excavation and off-site disposal
- In-situ thermal remediation (ISTR)
- Soil vapor extraction (SVE)

- In-situ soil flushing

Groundwater

- Air sparging (AS)
- In-situ Treatment
  - ISCO
  - In-situ Chemical Reduction (ISCR)
  - Bioremediation

A summary of the initial screening results is presented in **Table 1**. A brief description of the technologies included in the initial screening and an assessment of the effectiveness, implementability and cost for each technology are provided below. The eventual selected remedial action alternative may include several components identified in the initial screening to comprehensively mitigate risk and achieve a level of No Significant Risk at the site.

4.1.1.1 Excavation and Off-Site Disposal

This technology involves excavating impacted soils to remove the potential source of impacts to groundwater and soil gas. Soil excavation and off-site disposal utilizes heavy machinery to excavate contaminated soil, which is loaded on trucks and transported off-site for treatment, recycling or disposal (as appropriate).

Excavation and off-site disposal is effective for remediating soils with organic contaminants. This technology is typically the most straight forward option for source removal in soils and has a rapid completion time-frame without long-term expenses.

Excavation and disposal is readily implementable given that it is assumed that the site building will be removed prior to remedial actions are implemented. Implementing this technology requires extensive engineering controls (e.g., dust control, excavation stabilization measures) to protect on-site workers and off-site receptors during remediation. The engineering controls increase with increase in depth of the excavation. Short-term impacts on the surrounding community, including increased truck traffic and noise, would also occur. The requirements for engineering controls, potential dewatering with a deep excavation, costs associated with transportation and disposal of contaminated soils, make the costs moderate to high depending on the soil impacts at the site.

Despite the high costs and implementation of the engineering controls, excavation and off-site disposal was retained for detailed evaluation because this technology is proven effective for reducing source impacts in soils at the site within a fast timeframe. In addition, the excavation and removal of soil can easily be implemented in combination with other technologies as part of a comprehensive remedial alternative.

4.1.1.2 In Situ Thermal Treatment

In Situ Thermal Remediation (ISTR) is suitable for treating sites with significant contaminant mass (i.e., a source zone, free product, NAPL or hot spots). The ISTR remedial approach has been proven to successfully treat a wide variety of contaminants, including CVOCs. ISTR removes CVOCs from subsurface soil and groundwater by raising the temperature in the subsurface to a desired temperature (typically ~100ºC or greater). ISTR can achieve up to 99% reduction in a relatively short period of time (i.e., 6 to 12 months). As the soil is heated, CVOC are vaporized and/or destroyed by a number of mechanisms, including: (1) evaporation into the subsurface air stream; (2) steam distillation; and (3) hydrolysis. The volatilized CVOCs and evaporated water as steam are captured by a vapor recovery (VR) system or multi-phase extraction (MPE) system for above ground treatment. Extracted materials are separated in the treatment system and treated prior to discharge to the atmosphere for vapor and approved location for water (i.e., public sewer, private facility). The ISTR options include steam enhanced extraction (SEE), electrical resistivity heating (ERH) and thermal conductive heating (TCH), where SEE is generally more applicable to permeable soil types.

ISTR would be protective of human health and the environment by reducing the mass of COC contamination in both subsurface soil and groundwater in the treatment area providing long-term effectiveness and permanence. Achieving these reductions will substantially reduce contaminants so that downgradient groundwater concentrations would decrease at a more rapid rate. ISTR is significantly more expensive than other in-situ treatment processes however the treatment of CVOC source areas is effective and completed in a relatively quick timeframe. This technology typically applies to sites with significant soil and groundwater impacts behaving as a source of contamination. Applying ISTR to sites with only groundwater impacts is not an effective application of this technology due to the added energy input required in heating vadose zone soils which are not impacted to achieve removal.

ISTR is potentially implementable at the site as there are several logistical considerations. The technology would involve logistical challenges due to the urban location of the site, but this would likely be manageable based on previous ISRT implementation experience. Items required to implement this technology include permitting, high maintenance and infrastructure, and spacing requirements would need to be acceptable for ex-situ treatment system for vapor and condensed water. An approved location would need to be determined for treated water discharge as well. Controls of the ISTR system would be required for health and safety of the public and site workers. Also, due to the elevated temperatures the type and location of all subsurface structures (e.g., utilities, basements) in the area of treatment, as well as potential preferential pathways to sensitive receptors should be considered. This technology would require follow-up monitoring during the design phase to evaluate groundwater concentrations over time, which is implementable.

Despite the high costs and requirements for the implementation of the several engineering controls, ISTR was retained for detailed evaluation because this technology is proven effective for reducing source impacts in soils and groundwater at the site within a fast timeframe. In addition, this treatment technology would address both soil and groundwater impacts making this a more streamlined approach regarding the design as only one technology would be implemented.

4.1.1.3 Soil Vapor Extraction

A very common technique for in-situ soil remediation is soil vapor extraction which involves the installation of a series of vertical extraction vents (“wells”) in the contaminated soil above the water table and placing a negative pressure (i.e., vacuum) on wells in the vadose zone to pull contaminated soil vapors from the subsurface soils. The target contaminant groups for in situ SVE are VOCs and some fuels. SVE alone is not considered to be an optimal remedial technology to address impacts in the saturated zone. The vapor extraction wells are typically connected via a header system to collect the contaminated vapors for discharge to the atmosphere, with or without first being treated, depending on the quantity emitted and local/state air discharge regulations. For the soil surface, geomembrane covers are often placed over soil surface to prevent short circuiting and to increase the radius of influence of the wells. In situ SVE projects are typically completed in 1 to 3 years.

The application of SVE would be effective for the treatment of PCE in site soils as PCE has a high Henry’s Law Constant. A bench-scale or pilot would be conducted to obtain information necessary to design and configure the system as SVE treatment rates are site specific. The site subsurface soil type of dense fine sand with coarse to fine gravel and cobbles (glacial till) is favorable for this technology; SVE is not very effective in low permeability soils such as silts and clays.

This technology is implementable at the site. SVE poses low risk to community and site workers and can be a cost-effective approach to remove contaminants from unsaturated soils. This is often used in conjunction with other treatment such as air sparging for groundwater impacts. The technology would involve logistical challenges due to the urban location of the site, but this would be manageable. A location for the ex-situ treatment system appears to be available (e.g., parking area behind the building) or could be incorporated into new building design, as this requires minimal space. Items required to implement this technology include permitting, maintenance and infrastructure. As known utilities are 15 ft bgs, installation of infrastructure for this technology likely not be problematic.

This technology is considered an option for active site remediation due to moderate cost, because it is amenable to treating CVOCs and the site soil type is amenable for SVE treatment. The timeframe to achieve the S-2 site criteria in soils would be determined based on the extent of impact in soils to be assessed via pre-remediation delineation investigations. In general, the timeframe for SVE systems range from 1 to 3 years with subsequent groundwater monitoring.

4.1.1.4 Air Sparging

Air sparging is the injection of air or other gases into the aquifer in an attempt to volatilize the contaminants, which then enter the unsaturated zone where they are captured via soil vapor extraction methods and treated ex-situ. Injected air traverses horizontally and vertically in channels through the soil column, creating an underground stripper that removes contaminants by volatilization. This injected air helps to flush (bubble) the contaminants up into the unsaturated zone where a vapor extraction system is usually implemented in conjunction with air sparging to remove the generated vapor phase contamination. This technology is designed to operate at high flow rates to maintain increased contact between ground water and soil and strip more ground water by sparging. Air sparging has a medium to long duration which may last, generally, up to a few years.

The application of AS for groundwater treatment would be effective for the treatment of PCE as PCE has a high Henry's Law Constant. AS can be a cost-effective approach to remove contaminants from groundwater. A pilot test would be conducted to define site specific design parameters. Subsurface soil type of glacial till and weathered bedrock in the estimated top 5 feet of the saturated zone, based on existing boring log data, is favorable for this technology. There are concerns of whether the injection points would be able to extend below the CVOC impacts due to the presence of weathered bedrock/bedrock.

This technology is implementable at the site. AS poses low risk to community and site workers to remove contaminants from unsaturated soils. This is used in conjunction with SVE to extract vapors resulting from AS activities, which also poses low risk to community and site workers. The technology would involve logistical challenges due to the urban location of the site, but this would be manageable. A location for the ex-situ treatment system appears to be available (e.g., parking area behind the building) or could be incorporated into new building design, as this requires minimal space. Items required to implement this technology include permitting, maintenance and infrastructure. As known utilities are 15 ft bgs, installation of infrastructure for this technology may be problematic depending on the location of the impacted materials as the AS injection wells would need to extend into the saturated zone. Also, if utilities are present in the treatment zone, management for the potential of short circuiting of vapors would need to be conducted.

This technology is considered a viable option for active site remediation for groundwater impacts due to moderate cost and since it is amenable to treating CVOCs. The timeframe to achieve the S-2 site criteria in soils would be determined based on the extent of impact in the saturated zone, which would be assessed via pre-remediation delineation investigations. In general, the timeframe for AS/SVE systems range from 1 to 3 years dependent on the volume of impacts with subsequent groundwater monitoring.

4.1.1.5 In-Situ Treatment - ISCO

Chemical oxidation has been demonstrated within the industry to directly treat CVOCs and has been proven to be a robust technology. ISCO acts to reduce the mass of organic contaminants through the direct injection of a strong oxidizing agent into the subsurface. Successful delivery of the oxidant to the contaminant, the primary factor controlling performance of the remedy, is dependent on geologic conditions, injection location, transport, and natural oxidant demand in the subsurface. Several chemical oxidants are available for contaminant remediation, including permanganate, persulfate, percarbonate, Fenton's reagent, and ozone. Each of the oxidants described below are effective for destruction of the most CVOCs:

- Ozone is a gaseous oxidant. ISCO using ozone requires a continuously operating ozone generator on-site, which consumes large amounts of electricity and requires more maintenance than ISCO with other oxidants. Also, delivery of a gaseous oxidant would be difficult and the propagation of the oxidant would most likely be slow and the half-life of ozone is relatively short compared to other oxidants.
- Persulfate is a robust oxidant that is fairly persistent in the subsurface, albeit slightly less than permanganate. Persulfate is a commonly used reagent and is slightly less stable than permanganate. The natural oxidant demand for persulfate has been observed to be less than that for permanganate (Huling and

Pivetz 2006). Sodium persulfate needs to be activated to be used for remedial chemical oxidation with iron, base, acid, and heat as potential activators.

- Permanganate is a persistent oxidant in the subsurface that has a characteristic deep purple color, which can be observed in downgradient areas. Potassium permanganate is a commonly used reagent that is more fully developed than other oxidants. It is highly soluble, so high concentrations of the oxidant can be injected and has been successful in a wide range of hydrogeologic environments (Huling and Pivetz 2006). Also, the cost to use permanganate vs. persulfate for this proposed injection program was assumed to be lower as a catalyst is required to be used for persulfate.

This technology is considered to be effective for the site since it is a proven technology which reduces CVOC concentrations. The effectiveness is dependent upon additional site delineation to the extent feasible, as with the other technologies. Additional delineation would increase the likelihood of contact of the oxidant with the contaminant. Also, a bench scale treatability study/pilot study would be conducted to determine appropriate design parameters. For this Phase III ISCO with permanganate will be evaluated based on lower cost and higher persistence and solubility.

This technology is implementable at the site. The technology would involve logistical challenges due to the urban location of the site, but this would be manageable. Items required to implement this technology include permitting and groundwater monitoring. As known utilities are 15 ft bgs, installation of injection points may be problematic depending on the location of the impacted materials.

Technology was retained for detailed evaluation because it is a proven and effective method in reducing PCE in soils and groundwater with moderate costs. ISCO is also implementable at the site with minimal waste products as treatment occurs in-situ.

4.1.1.6 In-Situ Treatment - ISCR

In situ reduction is believed to have a high potential for meeting a variety of remediation goals when it is used on appropriate sites. The chemistry of the contaminant degradation reactions that this technology depends upon is well-documented and established. This technology has shown high potential for achieving mass removal, concentration reduction, mass flux reduction, reduction of source migration potential, and a substantial reduction in toxicity.

In situ remediation processes involve the injection of specific quantities of highly reactive iron powder directly into contaminant zones. Pneumatic or hydraulic injection have been successful in introducing reactants to contaminants in zones of low permeability. Injection by direct push rigs has been used successfully to introduce treatment media rapidly to the groundwater or a soil source area. Note that iron injected as part of a water emulsion can treat only contaminants that are accessible by water and will not treat free-phase contaminants directly.

Abiotic dechlorination can be achieved through a surface reaction on zero valent iron (ZVI) or/and on iron sulfur mineral. Bioaugmentation with dechlorinating bacteria and pH buffer are also assumed to optimize the reductive dechlorination treatment. This approach is capable of rapid reduction in CVOC concentrations, and the carbon substrates are persistent amendments that support reductive dechlorination for 3 to 5 years. A combination amendment of emulsified vegetable oil (EVO) and ZVI is a recommended product.

This technology is considered to be effective for the site as it is a proven technology which reduces CVOC concentrations. The effectiveness is dependent upon additional site delineation to the extent feasible, as with the other technologies. Also, a bench scale treatability study/pilot study would be conducted to determine appropriate design parameters.

This technology is implementable at the site. The technology would involve logistical challenges due to the urban location of the site, but this would be manageable. Items required to implement this technology include permitting and groundwater monitoring. As known utilities are 15 ft bgs, installation of injection points may be problematic depending on the location of the impacted materials.

Technology was retained for detailed evaluation because it is a proven and effective method in reducing PCE in soils and groundwater with moderate costs. ISCR is also implementable at the site with minimal waste products as treatment occurs in-situ.

4.1.1.7 In Situ Treatment - Bioremediation

This technology provides remediation of VOCs by amending the groundwater to create reducing groundwater conditions for reductive dechlorination of PCE and TCE by bacteria. Naturally-occurring microorganisms create hydrogen, which replaces chlorine on chlorinated ethenes. Natural biodegradation of chlorinated ethenes can be accelerated through the addition of a carbon source (as a food source and electron donor) and/or nutrients. Groundwater geochemical conditions becomes more reducing as aerobic microbes consume available dissolved oxygen (DO) through respiration of a portion of the high concentrations of carbon added. Proprietary microorganisms could be introduced into the subsurface to degrade PCE as well. Reductive dechlorination reduces PCE to the end daughter product of ethene.

Anaerobic bioremediation (reductive dechlorination) is a commonly applied treatment method that has been demonstrated to be effective for CVOCs in the industry. The biology/chemistry of reductive dechlorinating reactions is well understood and can often result in a very rapid decrease in contaminant concentrations. The effectiveness for the site depends on the ability to deliver carbon source to the location of the contaminant (as for other in situ technologies) and the ability to establish/maintain suitable reducing ("redox") conditions. Also, a potential complication of the reductive dechlorination process of PCE to ethene is the generation of the intermediary dechlorinating byproduct of vinyl chloride. Vinyl chloride is a chemical that has a lower GW-2 criteria than PCE.

This technology is implementable for the site. A bench scale treatability study/pilot study would be required to estimate remedy design parameters. In addition, the subsurface must be conditioned to establish an anaerobic environment, which may take 1-3 months before injections of the carbon source would begin.

Bioremediation is retained because of proven effectiveness in treating CVOCs in groundwater and it’s implementability at the site. This is a moderate cost technology for groundwater with minimal waste product which can be combined with vadose zone treatment options. The generation of dechlorination by-products for the site would be evaluated with a bench scale/pilot study.

4.1.1.8 In Situ Soil Flushing

In situ flushing involves flooding a zone of contamination with an appropriate solution to remove the contaminant from the soil. Water or a liquid solution is injected or infiltrated into the area of contamination. The contaminants are mobilized by solubilization, formation of emulsions, or a chemical reaction with the flushing solutions. After passing through the contamination zone, the contaminant-bearing fluid usually was traditionally collected and brought to the surface for disposal, recirculation, or on-site treatment and reinjection.

The effectiveness of flushing with water can be limited by the solubility of the contaminant, rate-limited desorption (i.e., when desorption of the contaminant from the solid phase to the aqueous phase is slow), and the presence of low-permeability zones and other subsurface heterogeneities. Chemically enhanced flushing solutions often can be tailored to address recalcitrant contaminants, and treatability studies are conducted to determine the feasibility of the approach; however, subsurface heterogeneities not detected during characterization or considered in implementation can still limit flushing effectiveness. Flushing solutions can be water, acidic aqueous solutions, basic solutions, chelating or complexing agents, reducing agents, cosolvents, or surfactants.

This technology is proven effective to enhance desorption of PCE sorbed to soils to increase available PCE for subsequent destructive treatment. Surfactants are effective for DNAPL mass removal but not useful for dissolved plume treatment, whereas ISCO is effective for plume control and treatment but can be less effective in areas where large masses of DNAPL are present. Coupling the two technologies offers new opportunities for source-zone treatment.

Soil Flushing is implementable at the site although high cost may make this option infeasible. Chemically enhanced flushing is an aggressive technique that is expected to achieve its goal fairly rapidly, ranging from months to a few years (ITRC 2009).

4.1.2 Development and Description of Remedial Alternatives

The RAAs have been developed based on varying levels of impact for soil (i.e., large, small, minimal) and based on available groundwater data for groundwater impacts. The area of groundwater impacted above GW-2/GW-3 criteria is assumed to be approximately 1,625 square feet (SF). This assumes an area of 25 feet x 65 feet extending from south of the site building to the north to the edge of the curb along Massachusetts Avenue. The soil impacted areas are based on the assumption that the point of release occurred in the area of the compressor/dry cleaner machine with resulting spreading with depth to the groundwater table. The large soil impacted area is assumed to extend approximately 10 feet south of point of release extending to the north of the site building with impacts from approximately 5 to 15 ft thickness within this area; approximately 850 square feet (SF) area with 500 cubic yard (CY) volume of total soils. The small soil impacted area is assumed to be located in a more isolated area in the overburden at point of release extending to the groundwater table; approximately 330 SF area with 175 CY volume of total soils. Minimal soil impacts indicate soils are generally below the S2/GW2 criteria and do not require treatment.

Additional site investigation information is needed to fully understand the site subsurface after the building is removed to better evaluate and design a proposed remedy. The estimation of remedial quantities is directly related to the existing site characterization data. For example, the estimated quantity of soil or groundwater that must be cleaned up to achieve a cleanup goal depends upon the data collected to determine the nature and extent of contamination. Likewise, the estimated soil vapor extraction rate or groundwater pumping rate depends on the methods used to estimate air permeability or hydraulic conductivity (e.g., estimated values based on soil type, field pumping tests), as well as the operating capacity of the equipment (e.g., sizing of pumps, blowers, etc.).

Because a combination of the above technologies can achieve a condition of No Significant Risk at the site, they were each considered in the development of comprehensive RAAs. The formation of comprehensive RAAs for the site strived to incorporate the most effective and implementable technologies, while cost-effectively balancing and reducing exposure to site contaminants. Based on these criteria, the following comprehensive RAAs for the site include:

Large Soil Impacts and Groundwater Impacts

- RAA 1: Soil excavation to below S2/GW2 criteria + in situ Groundwater Treatment
- RAA 2: ISCO with in situ Soil Flushing
- RAA 3: ISTR for Soil and Groundwater Treatment

Small/Minimal Soil Impacts and Groundwater Impacts

- RAA 4: SVE/AS for Soil and Groundwater
- RAA 5: Focused soil excavation to below S2/GW2 and In-Situ Groundwater Treatment (small soil impacts only)
- RAA 6: In-Situ Groundwater Treatment (minimal soil impacts only)

The RAAs are summarized in **Table 2** – Remedial Action Alternatives Comparison.

A description of each Remedial Alternative is provided below.

4.1.2.1 RAA 1: Soil excavation to below S2/GW2 criteria + In-Situ Groundwater Treatment

RAA 1 assumes a large impacted soil area for remediation. Complete removal of soils would be conducted down to the saturated zone with field/laboratory sampling methods implemented to identify impacted material above S2/GW2 criteria. Backfill would be conducted with clean material. Groundwater impacts would be addressed via in-situ treatment. For the purposes of this Phase III Report, the in-situ groundwater treatment technology represented in RAA 1 is the amendment combination of EVO and ZVI including bioaugmentation with dechlorinating bacteria and pH buffer. This approach is capable of rapid reduction in CVOC concentrations and the carbon substrates are persistent amendments that support reductive dechlorination for 3 to 5 years. Past implementation has shown that groundwater rebound is less common due to the extended lifespan of treatment.

RAA 1 would reduce the source of PCE in soil across the site within the vadose zone to below SW2/GW2 criteria. Groundwater impacts would be treated for reduction to below GW-2 criteria via in-situ treatment which would not require extensive infrastructure or generate ex-situ products requiring treatment or disposal. The estimated timeframe for this RAA is approximately 2 years, with 4.5 months estimated for excavation and 18 months estimated for groundwater reductions to below GW2 criteria. There would be 1 year of follow up performance groundwater monitoring after groundwater injections are complete. The initial phase of work would involve pre-remedial investigation. The investigation and excavation would be conducted without the site building present to obtain best coverage of the site, and in-situ treatment is capable of occurring within a site building present - this would be investigated during the design process.

RAA-1 consists of:

<u>Soils</u>

- Complete removal of soils within footprint of the impacted area based on pre-remedial investigations extending to the saturated zone (500 CY);
- Implement excavation stabilization measures as required;
- Conduct health and safety measures during excavation to be protective of the public and site-workers (i.e., dust control, fencing);
- Implementation of field/laboratory methods to evaluate RCRA subtitle D non-hazardous vs RCRA subtitle C hazardous materials for proper transport and disposal. It is estimated that 40% of soils would be hazardous;
- Proper transportation and disposal for excavated materials;
- Conduct confirmation soil sampling; and
- Backfilling with clean material.

<u>Groundwater</u>

- Conduct bench scale treatability study/pilot study;
- An injection system, complete with the necessary tanks, mixers, pumps, piping, fittings, and controls would be constructed to safely and effectively inject a solution of oxidant into the area of impacts at the site;
- ISCO injections would be performed via installed semi-permanent wells or Geoprobe direct-push rods;
- A site specific designed spaced grid system of injection points would be used to provide sufficient distribution of the oxidant in the subsurface;
- Three injection events are assumed; and
- Performance and compliance monitoring.

Work under this alternative would also include pre-remedial investigation, remedial design, site clearing as necessary, site restoration and a post-construction remedial action report. Excavation of PCE contaminated soil will result in the generation of a hazardous waste, triggering special waste management requirements (e.g., storage in containers).

4.1.2.2 RAA 2: ISCO with *in situ* Soil Flushing

RAA 2 assumes a large impacted soil area for remediation. Soil and groundwater impacts would be address via ISCO using permanganate and soil flushing using surfactants. In this approach a surfactant would be incorporated into the ISCO program to enhance desorption of PCE sorbed to soil in the saturated zone and promote dissolution of assumed PCE DNAPL. A long-lasting oxidant, such as sodium permanganate, would be selected as the oxidant to oxidize desorbed CVOCs and to achieve CVOC concentration reduction downgradient of the injection area. The oxidant would first be injected in downgradient impacted areas followed by the permanganate + surfactant injection in the upgradient area with highest concentrations. This will be followed up with 1 to 3 injections depending on results of the performance monitoring. The later injections may be for a smaller impacted area, therefore the injectate volume would be less than for the initial injections. The estimated timeframe between injection is 9-12 months. The estimated timeframe for this RAA is 2.5 years, with 1 year follow up performance/compliance monitoring. The initial phase of work would involve pre-remedial investigation. The investigation and initial injections would be conducted without the site building present to obtain best coverage of the site, and in-situ treatment is capable of occurring within a site building present - this would be investigated during the design process.

RAA 2 consists of:

Soils/Groundwater

- Conduct bench scale treatability study/pilot study;
- An injection system, complete with the necessary tanks, mixers, pumps, piping, fittings, and controls would be constructed to safely and effectively inject a solution of oxidant and surfactant or only oxidant into the impacted area of the site;
- ISCO injections would be performed via installed semi-permanent wells or Geoprobe direct-push rods;
- A site specific designed spaced grid system of injection points would be used to provide sufficient distribution of the oxidant in the subsurface;
- Up to four injection events are assumed including the injection including surfactant and oxidant; and
- Performance and compliance monitoring.

Work under this alternative would also include pre-remedial investigation, remedial design, site clearing as necessary, site restoration and a post-construction remedial action report. There would no ex-situ treatment of waste products for RAA 2.

4.1.2.3 RAA 3: ISTR for Soil and Groundwater Treatment

RAA 3 assumes a large impacted soil area for remediation. ISTR would be implemented for treatment of soil and groundwater to achieve concentrations below S2/GW2 criteria. This technology could achieve mass reduction of 99%. The use of ISTR would require extensive infrastructure and would generate ex-situ products requiring treatment or disposal (i.e., vapor, water, spent granular activated carbon (GAC)). The estimated timeframe for this RAA is 9 – 18 months.

RAA 3 consists of:

Soils and Groundwater

- Conduct pilot test;
- Permitting;

- Establish utility feeds for operation of the system (i.e., including electricity, water, communication lines, and/or natural gas);
- Installation of ISTR system including heater elements throughout the target treatment zone, steam and vapor recovery system, trenching/piping/wiring, temperature/pressure monitoring points;
- Installation of power cables, communication lines, and water lines are placed in buried trenches or laid on the ground surface;
- Installation of the vapor and condensate processing and treatment system;
- The grid spacing is determined by the ISTT technology used, the target temperatures desired, and site specific characteristics;
- Startup/Testing of the ISTR system;
- System operation and operation and maintenance; and
- Performance and compliance monitoring.

Work under this alternative would also include pre-remedial investigation, remedial design, site clearing as necessary, site restoration and a post-construction remedial action report. ISTR treatment of PCE impacts in soil and groundwater would require treatment and discharge of extracted vapors and water from the subsurface. Also, GAC is a common ex-situ vapor and water treatment which would require regeneration or disposal of spent carbon.

4.1.2.4 RAA 4: SVE/AS for Soil and Groundwater

RAA 4 would be conducted for remediation of soil and groundwater for a small impacted area. Soil and groundwater impacts would be treated for reduction to below S2/GW-2 criteria via AS/SVE which would require infrastructure, extraction wells in the vadose zone, and would generate ex-situ products requiring treatment or disposal (i.e., vapor, spent granular activated carbon (GAC)). AS/SVE is considered an effective, proven technology to treat PCE impacted soil and groundwater. Note the concerns regarding AS injection wells being able to be placed sufficiently within the contaminated zone due to the presence of weathered bedrock/bedrock. Also, even though the soil impact is small, the groundwater impacted area is still 1,625 SF which requires treatment and extraction with SVE wells.

The estimated timeframe for this RAA is 23 months (2 years) with 1 year follow up performance/compliance monitoring.

RAA 4 consists of:

- Conduct pilot test
- Installation of AS/SVE system including AS injection wells, SVE extraction wells, trenching/piping and AS/SVE system;
- Startup/Testing of AS SVE system;
- Operations and maintenance; and
- Performance and compliance monitoring

Work under this alternative would also include pre-remedial investigation, remedial design, site clearing and grubbing and erosion controls as necessary, site restoration and a post-construction remedial action report.

4.1.2.5 RAA 5: Focused soil excavation to below S2/GW2 and In-Situ Groundwater Treatment (small soil impacts only)

RAA 5 would be the same as for soil remediation in RAA 1 except that remediation would be for a small impacted area. Groundwater treatment would be the same as for RAA 1. The estimated timeframe for excavation is 3 months and for in-situ treatment is 18 months, for a total 21 months, with 1 year of follow on performance/compliance monitoring.

RAA 5 consists of:

Soils

- Complete removal of soils within footprint of the impacted area based on pre-remedial investigations extending to the saturated zone (estimated at 330 SF with volume of 175 CY);
- Implement excavation stabilization measures as required;
- Conduct health and safety measures during excavation to be protective of the public and site-workers (i.e., dust control, fencing);
- Implementation of field/laboratory methods to evaluate RCRA subtitle D non-hazardous vs RCRA subtitle C hazardous materials for proper transport and disposal. It is estimated that 60% of soils would be hazardous;
- Proper transportation and disposal for excavated materials;
- Conduct confirmation soil sampling; and
- Backfilling with clean material.

Groundwater Same as RAA 1

Work under this alternative would also include pre-remedial investigation, remedial design, site clearing as necessary, site restoration and a post-construction remedial action report. Excavation of PCE contaminated soil will result in the generation of a hazardous waste, triggering special waste management requirements (e.g., storage in containers).

4.1.2.6 RAA 6: In-Situ Groundwater Treatment (minimal soil impacts only)

RAA 6 would be the same as for groundwater remediation in RAA 1. It is assumed that there are minimal soil impacts below S2/GW2 criteria which would not require active remediation.

RAA 6 would treat groundwater impacts to achieve PCE reduction to below GW-2 criteria via in-situ remediation (assumed ISCO for this Phase III). This option would not require extensive infrastructure or generate ex-situ products requiring treatment or disposal. The estimated timeframe for this RAA is 18 months with 1 year of follow on performance/compliance monitoring.

Work under this alternative would also include pre-remedial investigation, remedial design, site clearing as necessary, site restoration and a post-construction remedial action report.

4.2 Detailed Evaluation of Remedial Alternatives

This section presents the development and detailed evaluation of RAAs using remedial technologies retained from the initial screening evaluation. The RAAs consist of technologies, or a combination of technologies, that are likely to reduce, mitigate, or eliminate risks at the site to achieve a Permanent Solution.

4.2.1 Effectiveness

The comparative effectiveness of the remedial alternatives is evaluated by assessing the opportunity for reusing, recycling, destroying, detoxifying, or treating contaminated media at the site, and reducing levels of untreated groundwater at the site to concentrations that achieve or approach “background” conditions. With respect to soils, all RAA’s are considered effective at addressing potential future direct contact exposure and achieving a Permanent Solution. RAA 1 and RAA 5 are considered the most effective alternatives to reduce the overall mass of CVOCs in site soils as they all involve excavation of impacted site soils to below S2/GW2 and excavation is a highly available and proven method for soil impact removal. RAA 3 is a very effective, proven method of source reduction in soils for CVOCs, however it is a more complex, innovative technology requiring pilot testing. RAA 4 is effective for soil COC reductions, but the process to achieve a permanent solution is more complex than excavation and a treatability study/pilot study is needed. RAA 2 is effective to enhance desorption of PCE from soils for subsequent treatment, however it can be limited depending on factors in the subsurface (i.e., subsurface heterogeneities). RAA 6 assumes soils are not impacted so it is not compared here.

With respect to groundwater, all RAA's are considered effective for groundwater CVOC reduction at the site to achieve a permanent solution. All RAA's include technologies which are proven to treat and reduce elevated levels of CVOC's. RAA 1, RAA 2, RAA 3, RAA 5 and RAA 6 are considered slightly more effective than RAA 4 in the event air sparge point are not able to be placed at an appropriate depth to treat impacts due to difficult drilling.

4.2.2 Reliability

The comparative short-term and long-term reliability of the alternatives is evaluated by the degree of certainty that the alternative will be successful, and the effectiveness of any measures required to manage residues or remaining wastes. RAA 1 and RAA 5 are considered to have the highest long-term reliability, with respect to soils, as the impacted soils will be physically removed from the site. However, short-term reliability is less for these RAA's due to the potential for accidental release of soils during transport of the soils. The groundwater remedies for RAA 1 and RAA 5 are both proven technologies and thus have potential high long-term reliability and do not generate large amounts of waste materials, with results in high short-term reliability. RAA 2 is a proven technology which also has a high long-term reliability for reduction of soils and groundwater. Issues with RAA2 is the ensuring contact of the surfactant to desorb sufficient mass for subsequent treatment in groundwater.

The soil and groundwater remedy for RAA 4 does have long-term reliability as reduction of groundwater via air sparging is a common, proven method, and ex-situ vapor treatment is required. RAA 3 is considered to be reliable over the long-term because treatment would reduce soils and groundwater to below criteria as this is an aggressive, proven technology. Over the short-term RAA 3 and RAA 4 require ex-situ treatment of vapor and/or water, which could result in exceedances. Also, RAA 3 has potential issues regarding elevated temperatures that would need to be considered.

4.2.3 Implementability

The comparative difficulty in implementing each alternative is evaluated by the technical complexity of the alternative; any necessary monitoring, operations, maintenance or site access requirements or limitations; availability of necessary services, materials, equipment or specialists; and the availability, capacity and location of necessary off-site treatment, storage and disposal facilities (if necessary).

RAA 3 would be the most complex alternative to implement in regard to technical complexity with respect to required infrastructure, permitting, operations and maintenance and potential site limitations for treatment system placement. RAA 2 for groundwater only and RAA 4 would be complex in the sense of infrastructure/equipment and pilot testing requirements. With respect to soils, RAA 1 and RAA 5 would be the least complex alternatives albeit shoring within the urban location of the site may result in some technical complexities. With respect to groundwater, RAA 1, RAA 2, RAA 5 and RAA 6 would easily implemented because remedial actions are limited to injection and monitoring. However, complexities may arise in achieving contact of injectate with impacted area. This complexity regarding contact is also associated for RAA 2 for soils.

4.2.4 Cost

AECOM developed preliminary cost estimates for implementing each RAA. These estimates are based on existing site investigation and remedial activities completed to date and are provided for comparison purposes only; they are not based on final engineering design and do not include certain required site specific items that might be needed currently or in the future. The costs provide a range of +/- 30%. The costs do not include demolition of the site building. Refer to **Table 2** for a cost summary, which splits out soil and groundwater remediation costs where applicable. Also refer to **Appendix B** for a general itemization of the costs. The estimated cost range for each alternative is provided below:

<u>Large Soil Impacts and Groundwater Impacts</u>

- RAA 1: $790,000 to $1,466,000
- RAA 2: $502,000 to $932,000
- RAA 3: $944,000 to $1,754,000

<u>Small/Minimal Soil Impacts and Groundwater Impacts</u>

- RAA 4: $516,000 to $958,000 (small or minimal soil impact area)
- RAA 5: $607,000 to $1,127,000 (small soil impact area only)
- RAA 6: $338,000 to $628,000 (minimal soil impact only)

4.2.5 Risk

The comparative risks in implementing each alternative is evaluated by the short-term on-site and offsite risks posed during implementation of the alternative. These risks include:

- Excavation, transport, disposal, containment, construction, operation or maintenance activities;
- On-site and off-site risks posed over the period of time required for the alternative to attain applicable remedial standards, including risks associated with ongoing transport, disposal, containment, construction, operation or maintenance activities; and
- The potential risk of harm to health, safety, public welfare or the environment posed to human or environmental receptors by any oil and/or hazardous material remaining at the disposal site after the completion of the remedial action.

During implementation, each alternative will require similar engineering controls for the protection of on-site workers and off-site receptors. Engineering controls include fencing, dust control/monitoring, and stormwater runoff management. RAA-1 and RAA-5 will pose a short-term risk during construction due to the excavation, handling, transportation and disposal of contaminated soil. RAA-4 will pose a short-term risk during operations due to requirement for ex-situ treatment of vapor extracted from the subsurface. RAA-3 will pose a high short-term risk during operations due to ex-situ treatment of vapor and water extracted from the subsurface and elevated temperatures generated. All the RAA's eliminate long-term risk. RAA 2 and RAA 4 achieve the permanent solution in a longer timeframe, resulting in longer short-term exposure risk during operations than for other RAA's.

4.2.6 Benefits

The comparative benefits in implementing each alternative is evaluated by the benefit of restoring natural resources, providing a productive reuse of the site, avoiding relocation costs, and avoiding lost value of the site.

The benefits for the RAAs are similar; each RAA reduces site impacts to below SW2/GW2 criteria, avoid relocation of people and businesses, and will avoid lost value of the site. All of the alternatives would achieve a Condition of No Significant Risk for the site by minimizing and/or eliminating exposure risks related to contaminated soils and groundwater, and all can be implemented following site building demolition, and coordinated with new construction, with additional injections and monitoring if needed taking place following construction.

4.2.7 Timeline

The timeframe to achieve a level of condition of No Significant Risk for large scale soil impacts is 1 – 2.5 years for RAA 1 and RAA 3. For RAA 1, soil and groundwater active treatment timeframe will be approximately 1 – 2 years, with approximately 1 year of compliance groundwater monitoring. For RAA 2, soil and groundwater treatment timeframe will be approximately 2.5-2.5 years with approximately 1 year of compliance groundwater monitoring. RAA 3 is estimated to 1 to 1.5 years with 1 year of compliance groundwater monitoring as well.

The timeframe to achieve a condition of No Significant Risk for small scale impacts is approximately 2.5 years for RAA 4, 2 years for RAA 5 and 1.5 years for RAA 6. All require approximately 1 year of compliance groundwater monitoring.

4.3 Selected Remedial Action Alternative

Based on the detailed evaluation of remedial technologies and the remedial objectives to reduce the amount of waste generation during the work, the selected RAA for large and small scale soil impacts with site groundwater impacts is RAA 2. RAA 2 involves the injection of surfactants with oxidants to desorb soil impacts for subsequent treatment with ISCO. This alternative involves minor infrastructure with no on-site ex-situ treatment requirements. As there are some uncertainties to ensure contact with soil impacts and injectate, actions including pre-remedial investigation and a treatability study/pilot study would be recommended. The implementation of in-situ soil and groundwater treatment is more implementable in the urban setting of the site as well.

RAA 1 and RAA 5 were considered as the selected RAA due to the certainty of soil source removal and relatively rapid completion, however the cost and generation of waste soils requiring transport and disposal ruled out these remedies. Also, in the event that soil impacts are minimal, in-situ groundwater treatment via the method specified in RAA 6 would be considered for the site.

4.4 Feasibility Evaluation

As part of the selection of the Comprehensive Remedial Alternative, the feasibility of achieving a Permanent Solution and achieving background conditions at the site was evaluated.

4.4.1 Feasibility of Achieving a Permanent Solution

Implementing the selected RAA will result in achieving a Permanent Solution. This RAA would include desorbing soil impacts with ISCO amended with surfactant. This would be followed by several additional oxidant injections to ensure with tight spacing to ensure contact of oxidant with contaminants in soil and groundwater. This method has been shown to significantly reduce PCE concentrations.

4.4.2 Feasibility of Achieving Background

In accordance with the MassDEP guidance, the feasibility of achieving background considers the technological feasibility and cost-benefit of achieving background.

ISCO with in-situ soil flushing (RAA 2) are proven remedial technologies capable of reducing contaminant concentrations at the site to achieve a Permanent Solution. However, it is not feasible to achieve or approach background at the site with this method because of the challenges involved to reach these levels. Both the treatment timeframe and cost would increase substantially due to 1) the need for closer spaced injection wells and/or additional injections to increase certainty of delivery to impacted subsurface locations and 2) extended timeframe and volume of injectate required as COC concentrations reach lower concentrations as the efficiency of the treatment process decreases with lower concentrations.

MassDEP has indicated in their guidance document on conducting feasibility evaluations that it is not feasible to achieve or approach background if the additional costs to remediate beyond a condition of No Significant Risk are more than 20 percent of the cost to remediate to a condition of No Significant Risk. The estimated cost to achieve background conditions across the site with RAA 2 is approximately $960,000, which is greater than 20%. The cost differential is the result of the following assumptions: one additional surfactant injection, 1-2 additional injections, extended treatment timeframe and additional labor on-site and in the office. Additional complications may result in additional costs such as treatment of groundwater downgradient of the site underneath Massachusetts Avenue, a greater treatment footprint, difficulty in treatment of potential COCs within bedrock fractures.

RAA 1 (excavation plus in-situ groundwater treatment) and RAA 3 (ISTR) were also reviewed for the possibility to achieve background as excavation offers complete removal of soil impacts and ISTR is successful at achieving 95-99% removal of source materials. However, these costs were also evaluated to be greater than 20% than the selected RAA. In the event excavation was conducted into the saturated zone, excavation would be difficult due to the presence of weathered bedrock/bedrock, required excavation depth and cost/risk increases to manage dewatered impacted groundwater. Likely additional groundwater treatment would be needed for groundwater post excavation as well.

The costs, effort and timeframe to achieve or approach background is disproportionate to the benefits that might accrue from such extensive remedial actions, and therefore, is not feasible.

4.5 Greener Cleanup Evaluation

Consideration of greener remediation approaches that eliminate or reduce the environmental footprint of the proposed construction activities to the maximum extent possible was completed pursuant to the MCP in 310 CMR 40.0191(3)(e), and is contained in **Appendix C**. The greener cleanup evaluation will be re-evaluated when additional remedial investigations are completed and final design of a remedy is taking place.

4.6 Schedule and Public Involvement

The Phase III report is planned for submittal to MassDEP on April 30, 2020. The Phase IV Remedy Implementation Plan is due by May 2021. The anticipated period for treatment implementation of the selected RAA is expected to last 1 to 2.5 years. The initial phase of work would involve pre-remedial investigation to obtain a more comprehensive understanding of subsurface conditions for development of a more fine-tuned design and the initial and second injections. The investigation and preferably the injections would be conducted without the site building present to obtain best coverage of the site, which is estimated to be approximately 1 to 1.5 years time. Note that in-situ treatment is capable of occurring within a site building present and this would be investigated during the design process. It is assumed follow up injections and performance monitoring would be conducted with a site structure present. Coordination and cooperation with stakeholders and contractors (environmental and structural) would need to occur in the event building construction occurs so that remediation work can continue according to design plan or be adjusted as necessary. A Temporary or Permanent Solution Statement or Remedy Operation Status Submittal is due by December 2021.

The required public notification letter noting the availability of this report is attached in **Appendix D**.

5. Phase III Remedial Action Plan Requirements and Conclusions

The Phase III RAP was prepared to evaluate remedial alternatives for the site located at 882-892 Massachusetts Avenue. This Phase III RAP includes the identification, evaluation, and selection of six comprehensive RAAs for the site based on regulatory requirements. A combination of these technologies or RAAs was selected as the comprehensive remedial action alternative for the site; these technologies include:

Large Soil Impacts and Groundwater Impacts

- RAA 1: Soil excavation to below S2/GW2 criteria + In-Situ Groundwater Treatment
- RAA 2: ISCO + Surfactants
- RAA 3: ISTR for Soil and Groundwater Treatment

Small/Minimal Soil Impacts and Groundwater Impacts

- RAA 4: SVE/AS for Soil and Groundwater
- RAA 5: Focused soil excavation to below S2/GW2 and In-Situ Groundwater Treatment [small soil impacts only]
- RAA 6: In-Situ Groundwater Treatment [minimal soil impacts only]

It is expected that the selected remedial action alternative for the site (RAA 2) will result in attaining a Permanent Solution at the site. The site-specific considerations for the remedial technologies evaluated included the results of previous remedial measures and the current assumption that the current property building will be removed and replaced. If this assumption changes, modification to a chosen remedy may be documented in the Phase IV Remedy Implementation Plan due by May 2021 per the ACO. Additional site investigation information is needed to fully understand the site subsurface after the building is removed to better evaluate and design the proposed remedy. The estimation of remedial quantities used herein is directly related to the existing site characterization data. The next step is completion of a remedial investigation once the building is removed, and a Phase IV Remedy Implementation Plan to provide the design for the selected alternative. The Remedy Implementation Plan includes the engineering design, construction plans and specifications, and an Operation, Maintenance, and/or Monitoring Plan for the selected remedial action.

Under the chosen RAA, ground water contamination must be stable or declining in concentration at the site, and should be confined to the source area property, such that ground water standards are met at the site boundary to ensure that human health and the environment continues to be protected, both now and in the future.

6. References

310 CMR 40.0000. The Massachusetts Contingency Plan. Bureau of Waste Site Cleanup. Boston, MA. April 25, 2014 and June 20, 2014.

MCP Documents for the site at –

https://eeaonline.eea.state.ma.us/EEA/fileviewer/Rtn.aspx?rtn=3-0031392