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PHASE III REMEDIAL ACTION PLAN
284 Winter Street
Haverhill, Massachusetts

RTNs 3-32792 and 3-32875

July 2022
File No. 01.0172397.10

PREPARED FOR:
Boston Gas Company d/b/a National Grid
Waltham, Massachusetts

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July 13, 2022
File No. 0172397.10

Massachusetts Department of Environmental Protection
Northeast Regional Office
Bureau of Waste Site Cleanup
205B Lowell Street
Wilmington, Massachusetts 01887

Re: Phase III Remedial Action Plan (RAP)
284 Winter Street
Haverhill, Massachusetts
Release Tracking Numbers (RTNs) 3-32792 and 3-32875

Dear Sir/Madam:

On behalf of Boston Gas Company d/b/a National Grid (National Grid), GZA GeoEnvironmental, Inc. (GZA) is pleased to submit this Phase III Remedial Action Plan (RAP) for the above referenced Site. The Site has been designated by Massachusetts Department of Environmental Protection (MassDEP) as Release Tracking Numbers 3-32792 and 3-32875. This RAP has been prepared by GZA in accordance with Section 310 CMR 40.0861 of the Massachusetts Contingency Plan (MCP) to describe the selection of a Comprehensive Remedial Alternative for this property. A RAP has also been prepared by Anchor QEA for the Little River portion of the Site and is included as Appendix C.

Should you have any questions, please contact Mr. Charles Lindberg, LSP, at 781-278-3830.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Justin Ivas
Assistant Project Manager

John A. Colbert
Consultant/Reviewer

Charles A. Lindberg, LSP
Senior Principal

Attachment: Phase III RAP

cc: Jesse Edmands, National Grid

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

On behalf of Boston Gas Company d/b/a National Grid (National Grid), GZA GeoEnvironmental, Inc. (GZA) has prepared this Phase III Remedial Action Plan (RAP) for the Disposal Site located at 284 Winter Street in Haverhill, Massachusetts (the "Site"). The primary Massachusetts Department of Environmental Protection (MassDEP) release tracking number (RTN) for the Site is 3-32792. RTN-3-32875, which was assigned in connection with a notification condition requiring an Immediate Response Action (IRA) also remains active for the Site. A Site Locus Plan is included as Figure 1, and Figure 2 presents the disposal site boundary and other pertinent site features.

The 284 Winter Street property (Property) is currently owned by Haffner Realty Trust (Haffner) and is occupied by a gasoline service station and car wash facility. In March 2015, Haffner filed a Release Notification Form (RNF) notifying the MassDEP that concentrations of certain Oil and/or Hazardous Materials (OHM) in soil samples exceeded the Reportable Concentrations (RCs) established by the Massachusetts Contingency Plan (MCP, 310 CMR 40.0000). MassDEP issued a Notice of Responsibility (NOR) to Haffner in April 2015, and assigned RTN 3-32792 to this 120-day reporting condition. Subsequently, in May 2015, MassDEP assigned RTN 3-32875 to a 2-hour reporting condition associated with a petroleum sheen on the surface water of the Little River adjacent to the Property[1].

Between 2015 and 2019, response actions associated with both RTNs were conducted by Ramboll US Corporation, formerly known as Ramboll Environ, of Westford, Massachusetts (Ramboll) on behalf of Haffner. As required by the MCP, Ramboll submitted a Phase I Initial Site Investigation (ISI) and Tier Classification in April 2016, based on which the Site was classified as a Tier I Site. The Phase I ISI documented that the Site had been the location of a former Manufactured Gas Plant (MGP) operated by Haverhill Gas Works.

In November 2016, MassDEP issued an NOR to National Grid, a successor company to a former owner of the Property, noting that the liability was joint and several between Haffner and National Grid. In November 2019, following Haffner's signing of a settlement agreement between the two potentially responsible parties (PRPs), National Grid assumed the role of Responsible Party for the two RTNs via a Tier Classification Transfer. GZA submitted a Phase II Comprehensive Site Assessment (Phase II) report on behalf of National Grid in April 2022.

The RAP has been organized as follows:

- Section 2.0 summarizes the Site history and describes conditions requiring remediation;
- Section 3.0 summarizes remedial objectives and outlines the goals of the Phase III RAP;
- Section 4.0 contains a discussion of general classes of remedial technologies that are typically applicable at similar sites, and presents a preliminary screening of technologies to address the Site conditions, as appropriate;
- Section 5.0 identifies potential Remedial Action Alternatives (RAAs) comprised of one or more technologies retained during the initial screening and evaluates the RAAs using criteria established by the MCP and presents the Remedial Action Plan, i.e. a description of the selected RAA(s) and a discussion of how they will be implemented.

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[1] A third RTN (3-34906) was assigned to the property in May 2018, when an elevated headspace reading was detected in a soil sample during the removal of an underground storage tank (UST).

- Section 6.0 provides the supporting information required by the MCP, including feasibility evaluation(s); the Phase III Completion Statement; and documentation of public notifications; and

- Section 7.0 summarizes the conclusions of the Phase III RAP.

This submittal is subject to the limitations in Appendix A. In accordance with MassDEP policy, the report and transmittal form BWSC-108 were submitted electronically via eDEP. A copy of the transmittal form is included in Appendix B.

2.0 BACKGROUND

The Disposal Site consists of the property located at 284 Winter Street in Haverhill, Massachusetts, which is currently occupied by a gasoline service station and car wash, along with surrounding areas to the southeast, southwest, west and northwest. An adjacent vacant property to the southeast of the 284 Winter Street parcel, a portion of the Little River which flows along the Property's western boundary, and a portion of the Winter Street right-of-way to the north of the Property all lie within the Disposal Site boundary. The Site occupies 1.6 acres of land with a relatively level upland area separated from the Little River (at an elevation approximately 15 feet below that of the upland area) by a masonry retaining wall.

The Site lies within a commercial/industrial area in the downtown portion of Haverhill. No water supplies are located in the vicinity of the Site and other environmentally sensitive areas other than the Little River have not been identified in the Site area. The Little River has been channelized in the Site area and it enters a concrete flood conduit at the downstream edge of the Disposal Site; this conduit flows beneath downtown Haverhill and discharges to the Merrimack River.

An MGP operated at the 284 Winter Street property between approximately 1853 and 1970, with various manufactured gas production processes utilized over this period. The Property has been used as a gasoline service station, fuel oil distribution facility and a car wash since 1977.

During a site assessment for a planned real estate transaction in November 2014, certain constituents were reported in soil and groundwater samples at concentrations exceeding the MCP RCs. The owner of the property (Haffner) notified the MassDEP regarding this finding in March 2015 and RTN 3-32792 was assigned. During assessment of this RTN in May 2015, Haffner's consultant (Ramboll) noted a sheen on the Little River that appeared to be emanating from the Property. An additional notification to MassDEP was made and an additional RTN (3-32875) was assigned. IRA activities were initiated in May 2015 in response to this finding and included gauging and recovery of NAPL in Site monitoring wells and installation of absorbent booms in the Little River. A semi-permanent boom system was installed within the River in November 2016 and has been maintained through the present under the IRA.

Ramboll completed a Phase I ISI on behalf of Haffner in April 2016 for RTNs 3-32792 and 3-32875 and continued IRA activities through October 2019. The Phase II work required under the MCP was not completed by the specified deadline and MassDEP issued a Notice of Noncompliance (NON). National Grid assumed responsibility for the MCP response actions for the two RTNs in November 2019 with the filing of a Tier Classification transfer. National Grid and MassDEP signed an Administrative Consent Order (ACO) in October 2020 which established a deadline of April 6, 2022 for submittal of the Phase II report.

The Site is underlain by an historic fill layer of varying thickness and composition which overlies a fine-grained deposit consisting of silt or silty sand. The fill underlying the 284 Winter Street property is typical of an historic urban fill, composed of reworked natural soils with significant quantities of debris, including concrete, asphalt, brick, wood, coal, and glass. Remnants of former structures were encountered at a number of locations during subsurface explorations at the Site. Geologic cross-sections of the Site are depicted on Figures 3A and 3B.

Groundwater flow at the Site is generally toward the west/southwest, with the Little River as the main discharge point. A "perched" groundwater condition exists within the footprint of the historical manufactured gas relief holder in the central portion of the Site, with groundwater elevations typically 7 to 8 feet higher than elsewhere within the property and within 4 feet of ground surface. Total groundwater flow through the Site is estimated to be approximately 1 gallon per minute (gpm), with flow rates restricted by the relatively low permeability of Site soils. The estimated transport velocity for groundwater at the Site is approximately 0.1 feet/day (37 feet/year).

Petroleum and MGP-related constituents including naphthalene, other polycyclic aromatic hydrocarbons (PAHs), extractable petroleum hydrocarbon (EPH) and volatile petroleum hydrocarbon (VPH) fractions and aromatic volatile organic compounds (VOCs) are present in soils throughout the Property, with the most significant impacts found at the 5- to 20-foot depth range below ground surface. While constituent of concern (COC) concentrations in soil exceeded the MCP Method 1 cleanup standards at a number of locations, they were generally below upper concentration limits (UCLs).

The primary COCs detected in groundwater samples at levels above the Method 1 standards included naphthalene, C9-C10 aromatics and benzene, with the highest concentrations reported in the central, western and southern portions of the Property. Significant impacts to groundwater extend from the eastern portion of the Property to the Little River; wells installed on the western side of the river to the southwest of the 284 Winter Street property did not indicate detectable levels of the primary Site COCs.

Concentrations of constituents detected in soil gas at the Site appear to be primarily related to incidental emissions and spills associated with the active gasoline and diesel storage and dispensing operations. GZA's evaluation concluded that the reported concentrations do not indicate significant potential for vapor intrusion into occupied structures at the Site.

Non-aqueous Phase Liquid (NAPL) has been observed at several locations across the western, central, and southern portions of the Site, but significant accumulations of separate-phase materials have only been observed at two locations in the upland area, one of which is within the historical relief gas holder. Evaluations of NAPL mobility and recoverability completed under MassDEP guidance concluded that these materials are not feasible to recover. NAPL has historically migrated to the Little River and has been periodically observed seeping from the retaining wall at the edge of the Property under certain conditions.

Significant impacts were observed to the sediments beneath the Little River adjacent to the Property, including elevated concentrations of Site COCs and the presence of visible oil and/or tar (VOT) over a substantial area. Anchor QEA LLC of Amesbury, Massachusetts (Anchor) completed an evaluation of the Little River portion of the Site under contract to National Grid; that assessment was documented in the April 2022 Phase II report. Anchor has also completed a separate Phase III RAP for the Little River portion of the Site which is included as Appendix C of this submittal.

The Phase II Report identified the need for additional response actions in the following areas of the Site:

- A Method 3 Risk Characterization has indicated that quantitative human health risk estimates were above the relevant MCP criteria for one receptor group/exposure scenario: construction/utility workers excavating below the water table within the former holder area. The risk estimate for this scenario was driven by benzene and naphthalene concentrations in the perched groundwater within the former holder, where an active electrical line (believed to be powering an exterior light pole) is apparently present.

- Sediment conditions within the Little River adjacent to the Site pose a risk of environmental harm and represent a condition of Readily Apparent Harm (RAH) to environmental receptors due to the widespread VOT.

With the exception of these issues, the Phase II study concluded that conditions within the Disposal Site did not pose a significant risk to human health or public welfare assuming the filing of an Activity and Use Limitation (AUL) that would restrict certain future Site uses (e.g., residential use). Accordingly, this Phase III evaluation focuses on the two items above (sediment conditions evaluated in Appendix C).

3.0 REMEDIAL OBJECTIVES

In accordance with the MCP, a Phase III evaluation must be conducted if a Permanent Solution is not achieved following the completion of a Phase II investigation. The goal of the Phase III evaluation is to identify and evaluate RAAs which:

1. are likely to achieve a condition of No Significant Risk (NSR) at the Site;
2. eliminate Substantial Hazards; and
3. result in a Permanent or Temporary Solution, where a Permanent Solution includes measures that reduce, to the extent feasible, the concentrations of oil and/or hazardous materials to levels that achieve or approach background.

3.1 SITE CLOSURE CATEGORIES

Section 310 CMR 40.1000 of the MCP establishes two types of closure documentation for disposal sites – Permanent Solutions and Temporary Solutions. Permanent Solutions are further subdivided based on the need for conditions. This section describes each of the closure categories that may be applicable at the Site. The MCP requires that a Phase III evaluation result in the selection of a RAA that is likely to result in a Permanent Solution, except where it is demonstrated to be infeasible and the implementation of a Temporary Solution is more cost effective and timely.

3.1.1 Permanent Solution

As described previously, the MCP requires that remedial actions be evaluated based on their ability to reach a Permanent Solution, if feasible. The achievement of a Permanent Solution requires the elimination to the extent feasible, or control of all sources of OHM and control of the subsurface migration of OHM such that plumes of dissolved OHM in groundwater and vapor-phase OHM in the vadose zone are stable or contracting. Assessment of the nature, extent and mobility of any NAPL that is present at the Site and completion of non-stable NAPL and NAPL with micro-scale mobility removal, to the extent feasible, are also required for Permanent Solutions. Permanent Solutions apply to sites where:

- a level of No Significant Risk (in accordance with 310 CMR 40.0900) exists or has been achieved;
- all source of OHM have been eliminated or controlled;
- control of plumes of dissolved OHM in groundwater and vapor-phase OHM in the vadose zone has been achieved;

- NAPL, if present, has been addressed as specified in 310 CMR 40.1003(6)(a);
- all threats of release have been eliminated; and
- the level of OHM concentrations in the environment have been reduced, as close to background concentrations as feasible.

Permanent Solutions with Conditions is the closure category that applies to sites that meet the criteria above and the NSR finding relies on an AUL or other assumed limitation on current or future activities. These other assumed limitations include:

- the recommendation of Best Management Practices for non-commercial gardening in a residential setting to minimize and control potential risk;
- concentrations of OHM at the disposal site are consistent with Anthropogenic Background levels;
- the location of residual contamination within a public way or within a rail right-of-way; or
- the absence of an occupied building or structure in an area in which the groundwater would otherwise be classified as GW-2 and where the residual concentrations of OHM in the groundwater exceed the GW-2 standards.

In the absence of these assumed limitations on site activities, Permanent Solutions are considered "Permanent Solutions with No Conditions".

Permanent Solutions do not apply to disposal sites where average groundwater and/or soil concentrations exceed UCLs unless the impacted soil has been permanently immobilized or fixated as part of a remedial action, is located at a depth greater than 15 feet below ground surface (bgs) or is located beneath an Engineered Barrier. Additionally, a Permanent Solution cannot be achieved if groundwater concentrations exceed an applicable standard where groundwater is categorized as GW-1.

3.1.2 <u>Temporary Solution</u>

A Temporary Solution is an acceptable remedy under the MCP if a Permanent Solution is shown to be infeasible or if a Temporary Solution is shown to be more cost effective and timely than a Permanent Solution, as long as enterprising steps are taken towards achieving a Permanent Solution. A Temporary Solution is defined in the MCP as (310 CMR 40.0006) follows:

…any measure or combination of measures which will, when implemented, eliminate any substantial hazard which is presented by a disposal site or by any oil and/or hazardous material at or from such site in the environment until a Permanent Solution is achieved.

Under a Temporary Solution, OHM concentrations may exceed UCLs; also, OHM concentrations may exceed applicable or suitably analogous standards as long as such concentrations do not pose a Substantial Hazard.

In addition to eliminating Substantial Hazards, a Temporary Solution must, to the extent feasible, eliminate, control or mitigate all sources of OHM, control or mitigate subsurface OHM migration and address non-stable NAPL. The MCP requires periodic evaluation and definitive and enterprising steps towards achieving a Permanent Solution if a Temporary Solution is implemented.

3.2 IDENTIFICATION OF REMEDIAL OBJECTIVES

This section identifies remedial objectives for the upland portion of the Site, based on the potential risks described above and in the Phase II CSA, and the applicable closure criteria. Remedial objectives encompass those related to risk, including addressing both Substantial Hazards and Significant Risks, and the other criteria for demonstrating a Permanent or Temporary Solution, including:

- Elimination or control of sources of OHM;
- Control of the subsurface migration of OHM; and
- Addressing NAPL.

While specific residual sources of OHM have not been identified on the upland portion of the Site, the historical relief holder was observed to contain NAPL and dissolved concentrations of certain COCs in groundwater higher than those found elsewhere at the Site. However, the former relief holder area is presently mostly covered by asphalt pavement or the car wash building and GZA's review of groundwater quality data indicates that concentrations are not increasing over time. Accordingly, it is GZA's opinion that this possible residual source of OHM has been controlled under current Site conditions. Concentrations of Site COCs in groundwater appear to be stable or decreasing over time and there is no indication that plumes of dissolved OHM are expanding at the Site. Accordingly, control of the subsurface migration of OHM is not a specific remedial objective. Nonstable NAPL has not been observed in the upland portion of the Site and the NAPL with micro-scale mobility (as that term is defined under the MCP) detected in several monitoring wells has been deemed infeasible to recover in accordance with MassDEP guidance. Accordingly, addressing NAPL in the upland area is not a specific remedial goal for this Phase III evaluation.

The exceedance of the MCP risk criteria for construction/utility workers excavating below the water table within the former holder area may also constitute a Substantial Hazard since it could theoretically pose short-term risk over the next several years. Accordingly, that condition would need to be addressed to achieve a Temporary Solution for the upland portion of the Site. As described above, a condition of NSR cannot be demonstrated for the relief holder area due primarily to benzene and naphthalene concentrations in the perched groundwater in this portion of the Site. Therefore, remedial actions are required to address this condition.

4.0 INITIAL SCREENING OF REMEDIAL TECHNOLOGIES (310 CMR 40.0861(2)(a))

As required by Section 310 CMR 40.0856 of the MCP, GZA performed an initial screening of available remedial technologies to assist in identifying those technologies suitable for inclusion as RAAs. Depending on the nature of OHM and Site media, RAAs may be comprised of one or more technologies that are implemented concurrently or sequentially to attain remedial goals. Technologies were retained for possible inclusion as RAAs if they were deemed reasonably likely to be feasible based on the OHM present, impacted media, and Site characteristics. Per 310 CMR 40.0856, RAAs (which may comprise one or more technologies) are reasonably likely to be feasible if the following is true:

- The technologies to be employed by the alternative are reasonably likely to achieve a Permanent Solution or Temporary Solution; and
- Individuals with the expertise needed to effectively implement available solutions would be available, regardless of arrangements for securing their services.

The initial screening for this Phase III focused on technologies that could address the COCs in soil and groundwater within the former relief holder area. These technology categories included:

- No Further Action;
- Institutional Controls;
- Natural attenuation;
- Containment;
- NAPL Recovery
- In-situ treatment; and
- Ex-situ treatment.

Table 1 provides a summary of the preliminary screening, which was based on state and federal guidance for evaluation of remedial technologies; a discussion of the results is provided below. Within each section, the description of the remedial technology is followed by a conclusion that presents the viability of the screened technology relative to upland Site conditions and identifies those technologies retained for further evaluation as part of a RAA.

For this RAP, GZA judged a remedial technology to be potentially feasible if: (1) it was likely to reduce risks to levels that would permit the achievement of a Permanent Solution; and (2) the technology appeared to be technically and economically implementable at the Site. It was recognized that a remedial approach involving a combination of technologies would likely be necessary to attain remedial goals across the upland portion of the Property.

4.1 NO FURTHER ACTION

The "no further action" alternative assumes no additional efforts are made to reduce the mass and concentration of OHM at the Site. This alternative does not reduce Site risks associated with OHM currently present, and provides no additional protection to safety, public welfare or the environment. However, it does provide a basis for assessing the effects of performing remedial actions, and a baseline against which other remedial technologies can be compared.

No further action is not applicable at the Site because the calculated non-cancer risk estimate for construction workers working within the former relief holder area exceeds the MCP non-cancer risk limit of 1. Therefore, it was not retained for further consideration in this Phase III RAP.

4.2 INSTITUTIONAL CONTROLS

Institutional controls are mechanisms to limit access to impacted media, and include alternatives such as site fencing and AULs (i.e., deed restrictions). The primary purpose of institutional controls is to limit future site activities and uses and, as a result, potential human exposures to site OHM. While institutional controls do not eliminate contamination, they can provide an effective, reasonable approach for reducing human health exposure potential, and thus risk, if properly maintained and enforced.

Institutional controls, such as the use of AULs to restrict future use, would be a key component of any remedy designed to achieve a Permanent Solution at this Site, based on GZA's evaluation. Therefore, this technology was retained for further evaluation.

4.3 NATURAL ATTENUATION

Natural attenuation relies on naturally occurring processes such as volatilization, adsorption, dilution, oxidation, reduction, and biodegradation to reduce the mass, concentration, and/or toxicity of contaminants.

Volatilization, and thus off-gassing, of COCs from groundwater into vadose zone soil, reduces the concentrations of those compounds in the groundwater. Chemicals with vapor pressures greater than 10 millimeters of mercury (mm Hg), such as the C_5-C_8 aliphatic hydrocarbons, are generally considered to be volatile, whereas the PAHs and heavier EPH-range compounds have low to intermediate vapor pressure and are considered non-volatile. As another measure of volatility, compounds with dimensionless Henry's Law constants of greater than 1, such as benzene, the C_5-C_8 and C_9-C_{12} aliphatic fractions in the VPH range and the C_9-C_{18} aliphatic fraction in the EPH range, are more likely to partition into air than remain in groundwater, whereas the C_9-C_{10} aromatic hydrocarbons, C_{11}-C_{22} aromatic hydrocarbons and naphthalene present at the Site tend to remain in the groundwater. Volatilization may be a significant attenuation mechanism for benzene in groundwater within the relief holder but would not be a factor for certain other COCs at this property.

The likelihood of a compound adsorbing to soil versus leaching into groundwater, where concentrations might be reduced via dilution, can be predicted based on its organic carbon partitioning coefficient (Koc). Koc values of less than 100 ml/g (e.g., benzene) indicate that a chemical has a high potential to leach into groundwater. Conversely, compounds with Koc values greater than 1,000 ml/g have a higher affinity (partitioning) for solids and are less mobile in the groundwater environment. Within the VPH/EPH ranges, the Koc increases from 1.7×10^3 ml/g for the C_9-C_{10} aromatic hydrocarbons to 6.8×10^5 ml/g for the C_9-C_{18} aliphatic hydrocarbons, indicating that hydrocarbons are in general more likely to sorb to soil than leach into groundwater, and that their tendency to leach into groundwater decreases as their molecular weight increases. The adsorptive nature of the COCs at this property means that dilution is unlikely to be a significant attenuation mechanism.

Biodegradation is the transformation of organic compounds via metabolism by microorganisms. Biodegradation of hydrocarbons occurs naturally in the environment and results from the aerobic metabolism of compounds by heterotrophic microorganisms (primarily bacteria). The ultimate end products of biodegradation are carbon dioxide and water. Microbial species capable of degrading hydrocarbons are usually found in some capacity as indigenous populations in soils and groundwater in the environment. The rate of biodegradation is governed by several factors related to the availability of required constituents (e.g., carbon and oxygen, in the case of aerobic biodegradation processes), nutrients (e.g., nitrogen and phosphorus), and organic growth factors necessary for the growth of the microbial population. With the exception of naphthalene, PAH compounds are not readily biodegraded and are considered persistent compounds in the environment.

Natural attenuation, which may occur via any or all of the processes described above, is considered a passive remedial technology in that no active remediation is performed. Often, the rate and progress of natural attenuation is assessed via routine soil and/or groundwater monitoring (i.e., monitored natural attenuation [MNA]) to assess the natural reduction in contaminant concentrations and to monitor potential migration; such monitoring may include the assessment of surrogate indicators of attenuation processes.

Based on the concentrations of benzene and other COCs observed in groundwater within the relief holder more than 50 years after MGP operations ceased, it does not appear that these constituents are amenable to natural attenuation via volatilization, dilution, or biodegradation. This approach has been eliminated as a primary remedial technology. Biodegradation of some compounds in groundwater is likely to occur, resulting in lowered dissolved concentrations over time; however, the rate of such degradation is unlikely to result in a condition of NSR within the foreseeable future.

Therefore, although natural attenuation is likely to be a de facto component of any remedial alternative, it was not retained for further evaluation.

4.4 CONTAINMENT TECHNOLOGIES

Containment technologies can be used to limit exposure via dermal contact with, ingestion of, and/or inhalation of impacted media, and/or to limit leaching of OHM from soils by reducing water infiltration into, or flow through, the impacted soil medium. These technologies can consist of horizontal or vertical barriers as described further below. In addition, groundwater extraction, which is an effective hydrodynamic means of limiting groundwater migration, is also discussed in this section. Note that the residual OHM present within the former relief holder appears to be partially contained by the former structure in its current state; these conditions impact the utility of some of the technologies described below.

4.4.1 Horizontal Barriers

Horizontal barriers such as soil caps or engineered barriers are the most commonly used horizontal containment technologies. Soil capping, in its most basic form, consists of the placement of clean soil material over a demarcation layer, with long term maintenance of this cap. Use of low-permeability material (a layer of asphalt pavement, concrete, polymeric membrane or natural low permeability material such as clay) within the cap can mitigate infiltration of surface water into the subsurface and thus limit the potential for OHM migration; however, the existing groundwater flow patterns and potential need for stormwater management must then be taken into consideration. Implementation of a cap must also take into account the likely future activities in the area, and the potential need for additional institutional controls such as fencing or signage.

An engineered barrier, as defined in 310 CMR 40.0996, is a cap specifically designed to support a Permanent Solution that:

- Prevents direct contact with contaminated media;
- Controls vapors or dust emanating from contaminated media;
- Prevents erosion and infiltration of precipitation or run-off that could jeopardize the integrity of the barrier or result in the potential mobilization and migration of contaminants;
- Is comprised of materials that are resistant to degradation;
- Is consistent with the technical standards of RCRA Subpart N, 40 CFR 264.300, 310 CMR 30.600 or equivalent standards;
- Includes a demarcation layer that visually identifies the beginning of the barrier; and
- Is appropriately monitored and maintained to ensure its long-term integrity and performance in accordance with a monitoring and maintenance plan submitted to MassDEP, with one or more financial assurance mechanism(s) to provide for ongoing future monitoring, maintenance and (if necessary) replacement of the barrier.

Horizontal barriers do not result in source removal nor do they remediate the environmental medium. Once installed, they must be indefinitely maintained; therefore, an AUL requiring barrier inspection and long-term maintenance must be implemented in conjunction with any barriers that are relied upon to maintain a condition of NSR or No Substantial Hazard.

The Phase II report concluded that average soil concentrations at the Site did not exceed UCLs; accordingly, an engineered barrier is not required or appropriate for this Site. While capping may serve to limit potential exposures for facility workers to residual OHM in shallow soils, it would not address the potential construction/utility exposures associated with the existing electrical line. Therefore, horizontal barriers were eliminated as a primary technology.

4.4.2 Vertical Barriers

Vertical barriers consist of low-permeability material installed to impede the flow of groundwater and limit the lateral migration of OHM within the subsurface. Such barriers must be designed to account for potential groundwater mounding. Cutoff walls have been used for decades as vertical barriers to provide long-term solutions for controlling the horizontal transport of groundwater. Examples of these subsurface barriers consist of driven sheet piling, concrete walls and vertical “slurry-trenches” excavated under slurry head and subsequently filled with a low permeability backfill. In the case of “slurry-trenches”, the slurry hydraulically supports the trench excavation during construction to prevent collapse, and in some cases can be used in a mixture with the native soil to form the low permeability “backfill” that inhibits groundwater flow.

A vertical low-permeability barrier would not be appropriate for the former relief holder area as the existing holder walls appear to be performing this function and restricting groundwater outflow. Therefore, this alternative was not retained for further evaluation.

4.4.3 Groundwater Extraction

In addition to horizontal and vertical barriers, another technology included in the “containment” category is groundwater extraction, which is best suited to providing plume containment and/or capture, rather than remediating dissolved constituents. The technology utilizes groundwater depression pumps, typically set in extraction wells or sumps below the groundwater table, that depress the groundwater table providing containment of the impacted groundwater. Following treatment, the groundwater may be discharged back into the aquifer using injection wells or recharge galleries, discharged to surface water, discharged to a sanitary sewer system or transported off-site for treatment/disposal.

Groundwater depression is most effective in homogeneous saturated soils with moderate to high hydraulic conductivity. The impacted groundwater addressed by this Phase III is within the former relief holder which was filled with miscellaneous fill exhibiting highly variable hydraulic conductivities. Additionally, groundwater extraction alone would be unlikely to reduce COC concentrations to below risk-based criteria due to the presence of impacted fill within the relief holder. Therefore, groundwater extraction was not retained as a stand-alone technology for further evaluation. However, it should be noted that groundwater extraction may be an element of RAAs that use other technologies, e.g., temporary groundwater dewatering may be required in conjunction with alternatives such as excavation.

4.5 NAPL RECOVERY

NAPL recovery can consist of either passive or active removal of separate phase materials from the subsurface, where active removal systems are differentiated from passive systems by the addition of continuous groundwater extraction to enhance the gradients used to induce the NAPL to flow toward the removal location.

Active NAPL removal systems are designed to control the migration of NAPL (typically only effective for Light NAPL or LNAPL) by imposing an additional groundwater gradient toward one or more collection locations. This process results in the capture of LNAPL within the resulting groundwater “drawdown cone” which extends some distance from the removal location. An advantage of active removal technologies, as opposed to the passive technologies described above, is that the mass of contaminants in the subsurface is also reduced via the removal, collection, and/or treatment of impacted groundwater. However, although LNAPL product recovery technologies have been used extensively for light fuel oils, and their successes are well documented, active NAPL removal is generally considered difficult, if not infeasible, at MGP sites. This is because MGP NAPLs are not easily induced to flow through the subsurface along groundwater gradients due to their typical viscous, tar-like consistency. In addition, groundwater extraction is generally ineffective at inducing Dense NAPL (DNAPL) flow towards collection points, and in fact, can cause unintended DNAPL migration to points deeper into the subsurface. Therefore, active NAPL removal was not retained for further evaluation at this Site.

Examples of passive NAPL removal technologies include the use of adsorbent materials within recovery wells, systems that skim LNAPL from the water surface within a well, total fluid pumps specifically positioned to extract DNAPL (and collaterally, often some limited groundwater) from the bottom of a well, and manual bailing or pumping of LNAPL and/or DNAPL from wells. While such technologies may be effective for the NAPL at the Site and are being implemented as part of the ongoing IRA, the Phase II concluded that continued NAPL recovery is not feasible under MassDEP's guidance. Therefore, NAPL recovery has been eliminated as a primary remedial technology.

4.6 IN SITU TREATMENT TECHNOLOGIES

In situ treatment destroys, neutralizes, or reduces the toxicity of contaminants while leaving the environmental medium in place. In situ technologies result in limited site disturbance with limited need for excavation, treatment and/or handling of contaminated media. This limits risks to remedial construction workers, on-site employees, and site abutters that can occur during more intrusive removal activities. The following in situ treatment technologies were included in the initial screening.

4.6.1 Soil Vapor Extraction (SVE) and/or Air Sparging (AS)

Soil vapor extraction (SVE) is an in situ physical treatment technology that is fully developed and widely utilized. An SVE system applies a vacuum to the unsaturated zone to induce a controlled flow of air to remove VOCs and some semi-volatile organic compounds (SVOCs) from soil. In the case of petroleum-based OHM, an added benefit of SVE is that it generally increases the level of oxygen in the subsurface, and, therefore, the rate of aerobic biodegradation. The extracted soil gas may be treated using activated carbon or catalytic or thermal oxidation to remove organic contaminants from the system discharge.

SVE is applicable only in the unsaturated zone, but can be supplemented by the addition of air sparging (AS) to remediate volatile compounds in saturated zone soil and groundwater. AS requires the installation of air injection wells extending below the water table to inject air into the saturated zone, following which SVE wells screened in the unsaturated zone are used to capture the resulting vapors. As in the case of SVE, volatile compounds liberated from the saturated zone are typically treated prior to atmospheric discharge using activated carbon or catalytic or thermal oxidation. In addition to removing constituents via volatilization, an AS system can also promote biodegradation (i.e., "bioventing") by stimulating indigenous bacterial growth and associated aerobic biodegradation through the introduction of oxygen into the formation.

Due to their low volatility and slow rate of aerobic biodegradation, the SVOCs and NAPL at the Site would likely not be remediated sufficiently to consider AS/SVE an effective technology. In addition, the heterogeneous nature of the fill within the former relief holder and the presence of obstructions would significantly limit the effectiveness of AS/SVE. Further, the presence of buried MGP infrastructure and the associated potential for short-circuiting may result in preferential air flow pathways that could result in incomplete capture of VOCs by the SVE system and allow impacted vapors to migrate away from the treatment area. Therefore, AS/SVE was not deemed a suitable technology and was not retained for further evaluation.

4.6.2 Soil Flushing

Soil flushing is a method of in situ chemical treatment in which solvents or surfactants are added to the soil matrix to desorb contaminants. According to the Federal Remediation Technologies Roundtable web site, soil flushing is most effective at remediating VOCs and inorganic compounds, and is only moderately effective at desorbing SVOCs and heavier hydrocarbons from soils. In the target remedial area at the Site, the presence of fill and buried infrastructure in the vadose zone, the limited effectiveness of the technology in remediating the primary COCs, and the presence of DNAPL make this an unsuitable technology. Therefore, soil flushing is not retained for use at the Site.

4.6.3 Chemical Oxidation

Chemical oxidation is an in situ chemical treatment technology that involves the injection of an oxidizing agent, such as permanganate, hydrogen peroxide, persulfate, or ozone, to break down OHM through a series of oxidation reactions. The oxidizing agents are typically injected in liquid or gaseous form into soils and groundwater. Factors that limit the effectiveness of this technology include distribution of oxidant into the subsurface and incomplete oxidation, which can occur depending on the contaminants and oxidizing agents used. The persistence and migration of the oxidant in the subsurface must also be evaluated under site-specific conditions.

Although in situ chemical oxidation can be successfully used to treat a wide range of contaminants, including halogenated VOCs and SVOCs, it is generally less effective on heavier-end petroleum compounds and NAPL (or NAPL-saturated soils). Its effectiveness would also be limited by similar considerations to those stated above, i.e., the nature of the fill material and the presence of buried MGP infrastructure beneath the Site. Therefore, chemical oxidation is not retained for evaluation in this Phase III RAP for the Site.

4.6.4 In Situ Solidification/Stabilization

Solidification and/or stabilization reduces the mobility of OHM in the environment through chemical or physical means. Chemical stabilization alters contaminants by converting them into less bioavailable, less mobile, or less toxic forms; e.g., it can be used to reduce the solubility of metals through the control of pH and alkalinity. Physical immobilization involves the addition of binders such as Portland cement, furnace slag, fly ash, bentonite, and/or limestone to encapsulate contaminated soil or sediments within a solid and stable matrix. The process, which can be performed either ex situ or in situ, results in blocks of material with high structural integrity that are resistant to weathering and aqueous leaching. Selection of this technology must take into account the effects of the resultant low-permeability monolith on groundwater flow at a Site.

In situ solidification/stabilization (ISS) uses auger/caisson systems and injector head systems to add polymer-, clay- and/or cement-based binders to the impacted soil without excavation, leaving the resultant stabilized material in place. Alternatively, the binder material can be mixed in with an excavator bucket where the OHM is present at shallower depths; this method is generally more cost effective as it is typically faster than an auger/caisson system approach and can also penetrate and excavate out potential subsurface obstructions.

ISS has been successfully implemented at several MGP sites to physically immobilize residual coal tar and can be an effective remedial technology. However, observations of the fill within the former relief holder footprint indicate the presence of large pieces of concrete and other obstructions within a heterogeneous fill mixture containing wood, glass, brick, and other debris. Additionally, there is limited area available within the Site to accommodate the large footprint of an ISS operation. These subsurface conditions and space constraints would limit the effectiveness of ISS and complicate implementation of this technology. Based on this evaluation, solidification/stabilization approaches (including ISS) were eliminated from consideration.

4.6.5 Bioremediation

Bioremediation is a managed process in which microbiological activity results in the transformation of chemical constituents in soil and/or groundwater to other compounds. The microorganisms, which may be either naturally occurring or injected as part of a managed bioremediation process, require carbon sources and nutrients to provide energy for growth and survival. Degradation of natural substances in soil, and carbon from the COCs, provide food for the development of microbial populations in these media. Under aerobic conditions, bioremediation results in the conversion of many organic COCs to carbon dioxide, water, and microbial cell mass; under anaerobic conditions, the by-products of bioremediation include methane and carbon dioxide. For the purposes of this RAP, biological natural attenuation processes are considered different than bioremediation in that bioremediation relies on intentional initiation and management of the biological treatment processes.

In situ bioremediation of soil or groundwater typically involves the addition of water containing dissolved oxygen, nutrients, electron acceptors and/or specific contaminant degrading microorganisms to the subsurface. Bioventing, i.e., the addition of oxygen to the subsurface, can also be performed to enhance naturally occurring biodegradation. VOCs and light hydrocarbons are readily degraded under aerobic conditions, but MGP-related DNAPL and high molecular weight PAHs, such as those present at this property, are extremely slow to biodegrade and are generally deemed persistent in the environment. In addition, the multi-ring high molecular weight PAHs that are some of the risk drivers at MGP sites often degrade only partially, with the resulting intermediate compounds posing equal or greater risk than the original COCs. Therefore, in situ bioremediation was not retained for further evaluation.

4.6.6 Thermal Treatment

Thermal treatment involves the application of steam or hot air injection, or the use of electrical resistance, conductive, electromagnetic, or radio frequency heating. This technology can be used to enhance SVE by increasing the rate of volatilization of VOCs and SVOCs (and thereby increasing vapor extraction rates). Thermal treatment may also be used to heat NAPL into a less viscous state where it can be recovered via active extraction wells or trenches. Thermal treatment above the boiling point of water would decrease the viscosity of coal tar NAPL, potentially resulting in its effective removal through active extraction. Due to the limitations associated with SVE and active extraction, as described above, and the safety considerations associated with implementing such technology in close proximity to active gasoline dispensing operations, and occupied structures, thermal treatment was not deemed appropriate at this Site and was eliminated from further consideration.

4.7 EX SITU TREATMENT TECHNOLOGIES (REMOVAL, MANAGEMENT, AND DISPOSAL)

Ex situ treatment technologies apply to the treatment of environmental media following removal from the subsurface. The approach can be used for both soil (excavation), and groundwater (extraction).

Excavation has been successfully used at many MGP sites to remove soil with localized elevated OHM concentrations, typically from relatively shallow depths (<15 feet bgs). Complicating factors in areas of the Site include the presence of subsurface utilities, historical MGP infrastructure, building foundations, and/or DNAPL. Each of these factors can be addressed, but add significantly to the technical complexity of this option. Excavation has been retained for additional evaluation, and issues related to the handling and management of materials that may be removed from the Site are discussed in the following sections.

Due to the odor issues associated with MGP constituents, primarily naphthalene but also reduced sulfur compounds, air monitoring and odor management would need to be an integral part of an excavation operation. Air monitoring parameters and action levels would be established prior to the initiation of excavation, and ambient air in the work zone and at the perimeter would be monitored for some or all of the following parameters: carbon monoxide, percent oxygen, lower explosive limit, hydrogen sulfide, hydrogen cyanide gas, dust, and/or VOCs. The use of odor- and VOC-suppressing foam may be required to limit olfactory impacts on facility workers, customers and other potential human receptors. It is anticipated that standard dust control techniques, such as watering down unpaved surfaces in areas of heavy equipment traffic or watering uncovered dry soils, would also be implemented.

Once the soil has been removed from the subsurface, thermal treatment is a generally accepted means of treatment for coal tar-impacted soil. The physical destruction of the coal tar through thermal treatment allows the soils to be reused as fill after treatment, which is a more sustainable approach for the remediation of these materials. The Clean Earth – ESMI (ESMI) thermal treatment facility in Loudon, New Hampshire is within reasonable trucking distance to the Site and would typically be the preferred destination for any soil that is excavated. However, past experience has indicated that certain soils excavated from within the former holder may not meet ESMI's acceptance criteria and could also have hazardous waste characteristics requiring additional consideration for off-site disposal. Therefore, alternatives such as transportation of the soil to a landfill facility such as the Waste Management Turnkey landfill in Rochester, New Hampshire or an out-of-state hazardous waste receiving facility must also be considered as a potential option.

In the case of excavation below groundwater, dewatering and groundwater management would be required. It is likely that standard techniques for control of groundwater (e.g., excavation sumps) could be employed. Extracted groundwater could be collected for off-site treatment/disposal, although costs could be prohibitive if large quantities of liquids are generated. Dewatering effluent could also be treated to remove Site COCs and then discharged to the ground, the Little River, or the sanitary sewer system. Discharge to the ground surface would be regulated under 310 CMR 40.0045 and would likely be impractical at this Site given the high water table within the former holder and the logistical constraints. Surface water discharges would require permitting under the successor program to the USEPA's National Pollutant Discharge Elimination System (NPDES) Remediation General Permit (RGP). As an alternate approach, treated effluent could be discharged to the sanitary sewer system[2] at the Site under an appropriate permit.

5.0 SELECTION AND JUSTIFICATION OF A COMPREHENSIVE REMEDIAL ALTERNATIVE (310 CMR 40.0861(2)(b))

As noted above, potential risks to construction/utility workers within the footprint of the former relief holder area estimated using conservative exposure assumptions exceeded the MCP risk criteria. These risk estimates were driven primarily by benzene and naphthalene concentrations in groundwater within the former structure. Due to the presence of an active utility (electric line) within the holder footprint, exposures to workers without the benefit of typical health and safety procedures has to be assumed. NAPL observed in one location within the structure was deemed to be infeasible to recover and soil and groundwater concentrations in this area were below UCLs. However, the observed groundwater concentrations at well MW-1, the presence of separate phase product at B107, and the perched groundwater conditions

[2] Note that discharge of groundwater to sanitary sewer systems is prohibited within the Massachusetts Water Resource Authority (MWRA) jurisdiction but Haverhill has its own treatment system which allows such discharges.

(representing a mechanism for radial flow outward from the former holder structure) could be indicative of a residual source of OHM under conservative assumptions. Remedial action alternatives were developed to address these two items – potential risks to utility/construction workers and the possibility of conditions within the former holder constituting a residual OHM source.

Section 5.1 describes each of the evaluation criteria to provide context for the Phase III evaluation process, and Section 5.2 describes how these criteria were used to evaluate RAAs that were developed to address conditions at the Site. In general, the technologies retained following the initial screening were combined to develop RAAs to achieve a Permanent Solution. The RAAs were then evaluated in terms of the MCP-established criteria, as documented in Table 2.

5.1 EVALUATION CRITERIA

Section 310 CMR 40.0858 of the MCP lists the following specific criteria that must be evaluated to evaluate the potential feasibility of RAAs at a site. Descriptions of each of the criteria are presented below:

Effectiveness: the effectiveness of achieving a Permanent or Temporary Solution; reusing, recycling, detoxifying or treating OHM; and reducing OHM levels at the Site to concentrations that achieve or approach background levels.

Reliability: the degree of certainty of successfully attaining remedial goals, as well as the effectiveness of associated measures required to manage residues or remaining wastes, or to control emissions or discharges to the environment.

Difficulty of implementation: technical complexity in terms of integration with existing facility operations or other current/potential remedial actions; any necessary monitoring, operating and maintenance or Site access requirements or limitations; the availability of materials, services, equipment or specialists; the availability of off-site treatment storage or disposal facilities; and whether the alternative meets regulatory requirements.

Relative cost: costs of implementation, the costs of environmental restoration and potential damages to natural resources, and the relative consumption of energy resources in the operation of the alternative.

Risks: short-term on-site and off-site risks posed during implementation/operation and during the period of attaining applicable standards, and the potential risks of harm to health, safety, public welfare or the environment at the Site after completion of the remedial action.

Benefits: comparative benefits, including restoration of natural resources, providing for the productive reuse of the Site, avoided costs of relocating people and businesses, and increased value of the Site; also, the relative effect of each alternative on non-pecuniary interests, such as aesthetic values.

Timeliness: the length of time required to achieve a level of No Significant Risk.

5.2 DEVELOPMENT AND EVALUATION OF REMEDIAL ACTION ALTERNATIVES

This section outlines the two potential remedial alternatives developed for the upland portion of the 284 Winter Street property:

1. Relocation of Utility Line within the Holder Footprint (**RAA-1**)

2. Focused Excavation of Impacted Soil/Fill within the Holder with Dewatering (**RAA-2**).

Note that full-scale excavation of the material within the holder footprint was considered but deemed to be infeasible due the substantial disruption to property operations that would occur and the costs involved. Note that the former holder extends beneath the southwestern portion of the existing car wash building; significant demolition and reconstruction and business disruption including temporary closure would be required for that alternative.

Development, screening, and evaluation of remedial alternatives for the Little River portion of the Site is documented in Appendix C.

RAA-1: Relocation of Utility Line

Based on geophysical studies and Site observations, an active subsurface electrical line runs roughly north-south through the eastern/central portion of the former holder, just west of the car wash building (See Figure 4). Under this alternative, the existing line within the holder would be abandoned and rerouted below grade outside of the structure's footprint. This would eliminate the potential exposure pathway that resulted in the risk limit exceedances. Potential exposures to future construction workers would be controlled via the filing of an AUL requiring appropriate health and safety and soil management procedures for excavations in this area. The AUL would also prohibit installation of new subsurface utilities within the footprint of the former holder.

This RAA would also include an evaluation of the potential for other subsurface utility lines within the holder footprint, incorporating both surface geophysical methods and vacuum excavation probes. Supplemental assessment of subsurface conditions within the holder would also be part of this remedial option; up to four additional explorations would be advanced within the limits of the holder (as determined from historical plans and geophysical work) to observe and document soil and groundwater conditions for consistency with existing data. If the supplemental assessment work confirms that conditions within the holder are not indicative of a continuing source of OHM that would warrant supplemental remedial action, rerouting of the electrical line would proceed. If conditions in other portions of the holder footprint are observed to vary significantly from existing data, a supplemental Phase III evaluation may be required. The line would be routed from the light pole just south of the car wash building to the southeast corner of the structure within a shallow trench (Figure 4). Excavated soils would be reused as backfill to the extent feasible and the surface cover would be restored. Excess soils would be transported off-site for appropriate treatment/disposal, preferably for thermal treatment and recycling. We anticipate that the volume of soils requiring off-site treatment/recycling under this alternative would be negligible (less than 10 cubic yards).

RAA-2: Focused Excavation of Impacted Soil/Fill within the Holder with Dewatering

This approach would involve focused excavation of impacted fill within the holder which exhibits evidence of the potential presence of "residual source" material. Soils within the 10 to 14 foot bgs range at exploration B107 (outside and west of the car wash building) which indicated coal tar saturation would be the primary target of this excavation program; the excavation may be expanded based on the results of supplemental assessment activities[3]. Excavated soils would be placed in lined and covered roll-off containers pending off-site treatment/disposal. We estimate that up to 100 to 200 cubic yards of soil/fill would be excavated under this option. Dewatering would be required to support the excavation activities and lower the perched groundwater level (approximately 3 feet bgs) within this portion of the holder. Groundwater would be pumped from sumps within the excavation to a fractionation (frac) tank staged within the Site. Depending upon the quality of the extracted groundwater, it would either be transported off-site directly for treatment/disposal via tanker

[3] The supplemental assessment program for the former relief holder outlined under RAA-1 above would be completed for RAA-2 also.

trucks or pre-treated on-site with a mobile system and then trucked off-site for disposal. We estimate that 20,000 gallons of groundwater will be generated for treatment/disposal as part of this remedial option.

During the focused excavation, a portion of the northern wall of the former holder will be excavated and observed. Under the assumption that the holder wall is sustaining the perched groundwater condition, the portion of the wall exposed in the excavation will be removed or breached to a depth of approximately 6 feet bgs. This would limit any future mounding of groundwater following the excavation/dewatering work, eliminate the shallow groundwater condition driving the emergency utility worker risk exceedance and further eliminate/control any residual source conditions by reducing COC concentrations in this portion of the Site. The excavation would then be backfilled with any suitable materials segregated during excavation supplemented by off-site borrow. Following backfilling, the pavement surface will be restored and any obvious cracks or holes in the asphalt pavement or concrete overlying the former holder footprint will be sealed to limit future infiltration. An AUL restricting future residential usage of the Site (along with certain other activities and usage) and requiring appropriate health and safety and soil management procedures for excavations would also be filed for the property under this alternative.

A comparative evaluation of both RAAs using the criteria established by the MCP is summarized in Table 2 and discussed below.

5.2.1 Effectiveness

Both RAA-1 and RAA-2 would lead to a Permanent Solution with Conditions for the upland portion of the Site. Under RAA-1, the only exposure pathway that could pose a significant risk (construction/utility workers exposure to COCs in air within a trench originating from shallow groundwater) would be addressed, resulting in a condition of No Significant Risk. An AUL would also be required to prohibit installation of new utilities within the former holder footprint, restrict residential use and require appropriate health and safety procedures for excavations. Under RAA-2, the focused soil removal, dewatering and modifications to the former holder wall would eliminate the shallow groundwater condition driving the risk exceedance and reduce COC concentrations in groundwater. An AUL restricting future residential usage of the Site and requiring appropriate health and safety procedures for excavations would also be required under this option.

Based on available data on Site soils, it is assumed that material excavated under either alternative would be transported to ESMI or a similar facility for off-Site treatment by thermal desorption and/or recycling. Under RAA-2, it is likely that some portion of the excavated soil will not be accepted for thermal treatment and recycling at ESMI; instead, landfill disposal may be required for these materials based on prior experience at similar sites. Accordingly, OHM would be destroyed or recycled under RAA-2 but not all OHM generated under RAA-2 would be destroyed/recycled. Neither RAA would achieve or approach background in the near future.

5.2.2 Reliability

Both RAA-1 and RAA-2 represent reliable approaches to achieving a condition of No Significant Risk. RAA-1 would eliminate the emergency utility repair exposure scenario that could pose a significant risk but would rely on an AUL to properly manage future excavation in this area. RAA-2 would also rely on an AUL to limit exposures via future excavations across the Site, although estimated risk limits were not exceeded outside of the holder area. RAA-2 would include excavation of only a small fraction of the material within the former holder; the reliability of this approach in eliminating/controlling a potential OHM source would be limited. This option would also include handling and removal of significantly higher volumes of waste (soil, groundwater, and debris) with accompanying generation of emissions; in contrast, RAA-1 will generate a negligible volume of soil with no significant potential for air emissions. The wastes and emissions generated under either RAA can be managed under the MCP and in accordance with standard practice at MGP sites.

5.2.3 Comparative Difficulty

RAA-2 would be a technically and logistically complex operation involving excavation and dewatering near existing gasoline station and car wash operations and infrastructure on a relatively small property in an urban setting. It would be substantially more complex than RAA-1, because it would require deep excavations, associated dewatering and water treatment or disposal, and management of larger volumes of impacted remediation waste. Both RAAs would have some impact on facility operations, but the adverse impact of RAA-2 would be significantly greater because it would likely require that facility operations be suspended during implementation. Air monitoring and odor control would be required during both RAAs, but would be much more extensive under RAA-2 because of the greater volumes of excavation involved and the higher COC concentrations in the excavated material. Experienced personnel and equipment are anticipated to be readily available to implement either RAA, and arrangements exist between National Grid and disposal facilities for the treatment or recycling of remediation waste. For either alternative, the work would be conducted on property that is not owned or occupied by National Grid, so access arrangements would be required with the current property owner.

5.2.4 Comparative Costs

RAA-2 is estimated to be substantially more costly than RAA-1, with an estimated cost of approximately $228,000[4] compared to an estimated cost of approximately $61,000 for RAA-1. Cost estimates for each option are summarized on Table 3. The RAA-2 costs are higher due to a larger volume of material required to be excavated and disposed of (10 CY for RAA-1 versus 200 CY for RAA-2), the requirement for dewatering and water treatment or disposal , additional duration of the remedial work, and additional odor control required for RAA-2.

5.2.5 Comparative Risks

There would be short-term risks associated with both RAAs, including soil management and odor control, and transportation of remediation wastes, but these would be minimal under RAA-1 due to the shallow excavation depths and small quantity of soil for excavation. RAA-2 has additional short-term risks that RAA-1 does not, including risks associated with groundwater management, additional truck traffic for transportation of larger volumes of remediation waste, and higher potential for exposure to MGP-impacted soils. Based on experience at other sites, these short-term risks can be managed using best management practices and established protocols. More significantly, however, under RAA-2 there would be moderately high risk associated with deeper excavations near existing infrastructure, along with the risk of interruption of the car wash operations.

The known longer-term risks associated with residual OHM would be higher under RAA-1, under which residual OHM concentrations in the holder area would not be addressed. However, there is moderate risk of mobilizing NAPL in the subsurface under RAA-2 while excavating and dismantling a portion of the holder wall.

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[4] Note that this estimate does not include business disruption costs for the car wash.

5.2.6 Comparative Benefits, including Non-Pecuniary Benefits

Both RAAs would allow for productive continued use of the property. RAA-1 has the benefit of limiting disruption of current facility operations, while RAA-2 has lower potential lost value associated with restrictions on possible future property usage. Restoration of natural resources is not an applicable criterion in this heavily developed location, and neither RAA would offer significant non-pecuniary or aesthetic benefits. Note, however, that RAA-2 would generate a significantly larger volume of remediation waste, and higher emissions of greenhouse gases associated with the transportation of impacted soils and groundwater from the Site to treatment/disposal facilities, and would therefore have a substantially higher carbon footprint.

5.2.7 Comparative Timeliness

In the short-term, RAA-2 would take longer to complete than RAA-1 due to the larger volume of excavation and dewatering and associated water treatment/disposal. The design phase for RAA-2 would also be considerably longer than that of RAA-1. However, we anticipate that either option could be completed within 1 year.

5.2.8 Summary of Detailed Evaluation

Both RAA-1 and RAA-2 represent effective and reliable approaches to achieving a condition of No Significant Risk in the upland portion of the property. The two alternatives are comparable in terms of benefits. However, RAA-2 is substantially more complex, both logistically and technically, due to the deeper excavation and dewatering required, which also results in significant additional short-term risks during remediation compared to RAA-1. RAA-2 would have higher greenhouse gas emissions associated with the additional transportation of remedial waste and is estimated to be significantly more costly than RAA-1. RAA-2 will also take longer to complete than RAA-1 due to design requirements and the larger and more complex scope. Therefore, based on the criteria of comparative difficulty, cost, risks, and green benefits, RAA-1 was selected as the preferred remedial alternative for the 284 Winter Street upland area.

5.3 LITTLE RIVER REMEDIAL EVALUATION

A Phase III evaluation conducted by Anchor for the impacted portion of the Little River and the retaining wall separating the river from the upland portion of the 284 Winter Street property is included as Appendix C of this submittal. Anchor selected partial dredging and capping of sediments within the Little River and sealing of any preferential migration pathways in the retaining wall as the preferred remedial alternative for this area.

5.4 SELECTED COMPREHENSIVE REMEDIAL ALTERNATIVE

The selected CRA for the 284 Winter Street Site includes the following RAAs:

- Relocation of the electrical line that presently runs through the former relief holder;
- Implementation of an AUL that prohibits installation of new underground utility lines within the footprint of the relief holder and restricts residential and certain other future uses of the Site;
- Sealing/removal of historical piping and penetrations in the retaining wall that separates the upland portion of the Site from the Little River; and
- Focused dredging and capping of the sediments within the Little River adjacent to the Site.

5.5 GREEN REMEDIATION EVALUATION

The June 2014 MCP revisions included requirements to include assessment of "green" remediation approaches when evaluating and selecting remedial alternatives under the MCP. MassDEP issued guidance for implementing this requirement in October 2014 ("Greener Cleanup Guidance, WSC#14-150). This guidance references the USEPA definition of "green" remediation as "the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of cleanup actions". As indicated in the guidance, the principal regulatory authority relevant to green remediation is part of the Response Action Performance Standards (RAPS) of the MCP (310 CMR 40.0191(3)(e)). The RAPS citation follows:

(3) The application of RAPS shall be protective of health, safety, public welfare, and the environment and shall include, without limitation, in the context of meeting the requirements of this Contingency Plan, consideration of the following:

(e) eliminating or reducing, to the extent practicable and consistent with response action requirements and objectives, total energy use, air pollutant emissions, greenhouse gases, water use, materials consumption, and ecosystem and water resources impacts, resulting from the performance of response actions through energy efficiency, renewable energy use, materials management, waste reduction, land management, and ecosystem protection.

The green remediation requirements are also incorporated into the detailed evaluation of remedial alternatives under the comparative cost criteria (310 CMR 40.0858(4)).

MassDEP's guidance is directed at supporting environmental professionals in the consideration and use of approaches that eliminate or reduce the environmental footprint of cleanup activities to the extent possible. Five core elements to be addressed by such approaches are identified within the guidance:

- Minimizing total energy use while maximizing the use of renewable energy;
- Minimizing emissions of greenhouse gases and other air pollutants;
- Minimizing water use and impacts to water resources;
- Reducing, reusing, and recycling materials and waste; and
- Avoiding or reducing adverse impacts to ecosystems and land resources.

RAAs that limit the volume of soil or groundwater removed from the Site result in smaller volumes of remediation waste. This in turn results in significantly fewer truckloads of material to be transported from the Site and backfill material imported to the Site, resulting in a lower carbon footprint associated with such transportation. These objectives will be achieved by the selection of RAAs that are targeted to Site-specific conditions in each area of the property; these include the relocation of the electrical line rather than excavating a portion of the former holder area and a focused sediment dredging and capping approach in place of full-scale sediment removal. The combination of these efforts will limit the volume of waste generation, greenhouse gas emissions, and water and energy use while still addressing the appropriate MGP-impacted media and resulting in a condition of No Significant Risk at the Site.

To manage the limited but unavoidable effects of the selected CRA implementation, rigorous controls will be implemented to limit air and dust emissions, runoff and noise throughout the remedial process. Construction vehicle idling and emissions will be limited to the extent feasible. The project schedule will be arranged to combine tasks, where appropriate, and limit trips to the Site.

It is GZA's opinion that the proposed remedial plan addresses the relevant requirements of 310 CMR 40.0191(3)(e). Details regarding the implementation of the selected CRA will be provided in an upcoming Phase IV Remedy Implementation Plan (RIP) to be submitted to MassDEP.

6.0 ADDITIONAL PHASE III RAP REQUIREMENTS

Following the selection of a CRA, the MCP prescribes certain evaluations that must be documented in a Phase III RAP. The requirements listed under Sections 310 CMR 40.0861(2)(d), (f) and (h) are only required in cases where the selected CRA will result in a Temporary Solution and hence do not apply to the upland remediation documented in this report. The following sections address the remaining requirements of Section 310 CMR 40.0861. These requirements are addressed in Section 7.2 of Anchor's Phase III report in Appendix C for the selected RAA for the Little River portion of the Site.

6.1 DISCUSSION OF PERMANENT SOLUTION (310 CMR 40.0861(2)(E))

Section 310 CMR 40.0861(2)(e) requires that, if a Permanent Solution is selected as the Comprehensive Remedial Alternative, the Phase III RAP include a discussion of (i) how the alternative is likely to achieve a level of No Significant Risk and (ii) the projected timeframe, based on available information, for meeting the requirements for a Permanent Solution.

RAA-1 can be implemented expeditiously to achieve a Condition of No Significant Risk (assuming the filing of an AUL prior to the PSS). Specifically, the electrical line can be relocated in a timely fashion to eliminate the potential exposure to emergency utility workers at the Site. It is anticipated this RAA can be implemented within the next 12 to 18 months.

6.2 FEASIBILITY OF ACHIEVING/APPROACHING BACKGROUND (310 CMR 40.0861(2)(G))

Under Section 310 CMR 40.0861(2)(g), if a Permanent Solution is selected, the RAP must include the results of the evaluation under 310 CMR 40.0860 of the feasibility of reducing the concentrations of OHM material in the environment at the disposal site to levels that achieve or approach background, unless it includes a demonstration that the selected alternative is designed to achieve background.

In the upland portion of 284 Winter Street, approaching background would require that soil across the property, including soil beneath the car wash building, be excavated to a depth of 10 to 20 feet bgs and replaced with clean fill material. The costs for demolition and restoration of the building, and excavation of an approximately 45,000 square foot area to a depth of 15 feet with associated retaining wall reconstruction, groundwater management and soil disposal costs, and temporary business closure are estimated to exceed $10,000,000. In contrast, the cost for the selected CRA is estimated at $68,000. MassDEP policy has established that the incremental costs of remediation to achieve or approach background may be deemed substantial and disproportionate (i.e., economically infeasible) if they exceed 20 percent of the cost to remediate to a condition of NSR; accordingly, achieving background is deemed infeasible at the Site.

6.3 PROJECTED SCHEDULE FOR IMPLEMENTATION OF PHASE IV ACTIVITIES (310 CMR 40.0861(2)(I))

Design and permitting efforts for the Little River portion of the remedy will govern the remedial schedule for the Site. It is anticipated that a package of plans and specifications will be developed over the next eleven months, and will be presented to MassDEP with a Phase IV Remedy Implementation Plan (RIP) in June 2023 in accordance with the Administrative Consent Order. Initiation of Little River remedy implementation will be largely dependent on the permitting process and property owner access negotiations and approvals. Upland remediation may be completed in advance of the Little River work.

Following completion of remedy implementation, a Phase IV completion statement will be filed. It is anticipated that some level of inspection and monitoring may be required under the MCP following submittal of the Phase IV completion statement.

6.4 PHASE III COMPLETION STATEMENT (310 CMR 40.0862)

In accordance with Section 310 CMR 40.0862 of the MCP, GZA hereby provides this LSP Opinion that:

- the selected Comprehensive Remedial Alternative is likely to achieve a Permanent Solution for both the upland and Little River portions of the Site, and
- the Phase III conforms with applicable Phase III performance standards and requirements.

The certification required by 310 CMR 40.0009 is provided on the accompanying BWSC-108 form (copy in Appendix B).

6.5 PUBLIC NOTIFICATION (310 CMR 40.0863)

In keeping with the public notification requirements established by Section 310 CMR 40.1403(3)(e) of the MCP, the Chief Municipal Officer and Board of Health for the City of Haverhill have been notified of the availability of this Phase III Remedial Action Plan. Copies of the notification letters, which included the conclusions from this evaluation, are included in Appendix D.

7.0 CONCLUSIONS

This Phase III Remedial Action Plan (RAP) selects the following Remedial Action Alternatives for the 284 Winter Street Site (RTN 3-32792):

- Relocation of the electrical line that presently runs through the former relief holder;
- Implementation of an AUL that prohibits installation of new underground utility lines within the footprint of the relief holder and restricts residential and certain other future uses of the Site;
- Sealing/removal of historical piping and penetrations in the retaining wall that separates the upland portion of the Site from the Little River; and
- Focused dredging and capping of the sediments within the Little River adjacent to the Property.

The design of the relevant components of these RAAs will be documented in a Phase IV Remedy Implementation Plan.

J:\170,000-179,999\172397\172397-10.KM\Reports\Phase III\Winter Street Phase III RAP (Internal Review).docx

Tables

TABLE 1
INITIAL SCREENING OF REMEDIAL TECHNOLOGIES
284 WINTER STREET SITE
HAVERHILL, MASSACHUSETTS
MASSDEP RTN 3-32792

Technology	Description	Feasibility and Effectiveness of Technology	Conclusion
No Further Action	No additional efforts made to mitigate or monitor contamination beyond that which may have already been performed.	Not applicable in areas with uncontrolled sources, substantial hazard, or condition of significant risk to current receptors. Due to the presence of a risk exceedance (construction/utility workers), this would not result in a Permanent Solution at the Site.	Not retained for further consideration.
Institutional Controls	Fence or otherwise isolate impacted areas; implement Activity and Use Limitation (AUL) to minimize or manage potential human exposure to impacted area.	AULs are considered appropriate for this Site and it is anticipated that one or more AULs will be implemented as part of the Permanent Solution.	Retained for further consideration as part of a Permanent Solution for the Site.
Natural Attenuation	Relies on naturally occurring processes such as volatilization, adsorption, dilution, oxidation, reduction, and biodegradation to reduce the mass, concentration, and/or toxicity of contaminants.	Natural attenuation has apparently not been effective at reducing concentrations within the former holder over the last 50 years; therefore, it was not deemed feasible for remediation.	Not retained for further consideration.
Containment			
• Cap/Engineered Barrier	Construct and maintain an engineered barrier as defined in 310 CMR 40.0996, or place a clean soil cap over impacted soils.	Capping reduces human or environmental to oil and/or hazardous material (OHM), but would not eliminate the potential risks to emergency utility workers.	Capping is not retained for further consideration.
• Vertical Barrier	Construct low permeability barriers to impede migration of groundwater (e.g., via adsorptive organo-clay).	Not an appropriate technology given that groundwater migration is not posing a significant risk.	Not retained for further evaluation.
• Groundwater Extraction	Pump groundwater from subsurface and either treat at surface and re-inject, discharge under a NPDES permit or dispose of at an off-Site facility.	Groundwater extraction is not an effective means for removing source materials but is effective as a support technology for deeper excavations.	Retained as a support technology for excavation.
NAPL Recovery			
• NAPL Recovery	Recovery of Dense or Light Non-aqueous Liquids using passive approaches	Effective in some scenarios, but NAPL has been deemed infeasible to recover at this Site	Not retained for further evaluation.
In-Situ Treatment			
• Soil Vapor Extraction (SVE) and/or Air Sparging (AS)	SVE: Extract and treat soil vapors from unsaturated zone. SVE/AS: Inject air below the water table to promote removal of volatile organic compounds (VOCs) from groundwater via volatilization and enhanced aerobic degradation, and capture sparge air in the unsaturated zone for treatment, if necessary.	Best suited to light hydrocarbons (e.g., gasoline); less effective for treatment of heavier hydrocarbons. The presence of heterogeneous fill material, as well as higher molecular weight manufactured gas plant (MGP) residuals, would limit the effectiveness of AS/SVE.	Not retained for further evaluation.
• Soil Flushing/Surfactants	Add surfactants to the soil matrix to desorb and capture constituents of concern (COCs)	Most effective at remediating VOCs and inorganic compounds; only moderately effective at desorbing Semi-VOCs from soils. The heterogeneity of the vadose zone/fill materials and the limited effectiveness in remediating the primary COCs make this an unsuitable technology. Therefore, soil flushing/surfactant addition is not retained for further evaluation.	Not retained for further evaluation.

TABLE 1
INITIAL SCREENING OF REMEDIAL TECHNOLOGIES
284 WINTER STREET SITE
HAVERHILL, MASSACHUSETTS
MASSDEP RTN 3-32792

Technology	Description	Feasibility and Effectiveness of Technology	Conclusion
In-Situ Treatment Cont'd			
• Chemical Oxidation	Inject chemical oxidizers such as ozone, hydrogen peroxide, permanganate, or persulfate into unsaturated soil or groundwater. Oxidation chemically converts hazardous compounds to less toxic compounds that are more stable, less mobile, and/or inert.	Oxidation would be difficult to implement due to heterogeneous fill and is less effective on heavier-end compounds. Because of its limited effectiveness at treating Site COCs, its inability to address source materials, and its primary use as a saturated zone technology, chemical oxidation was not retained for further evaluation.	Not retained for further evaluation.
• Solidification/ Stabilization	Add binders to the soil to encapsulate COCs in place and prevent migration.	Difficult to implement due to heterogeneous conditions, space constraints and the presence of numerous obstructions in the subsurface at the Site.	Not retained for further evaluation.
• In-situ Biotreatment	For unsaturated zone soil treatment, a vacuum blower draws air from trenches or wells screened in the unsaturated zone, enhancing aerobic biodegradation. For soil or groundwater treatment, water and nutrients can be added as needed to enhance biological degradation.	Less effective at degrading heavier hydrocarbons which are generally persistent in the environment. Less effective at remediating isolated pockets of COCs and source material within the soils.	Not retained for further evaluation.
• In-Situ Thermal Treatment	Introduce heat into the subsurface to volatilize contaminants and decrease nonaqueous phase liquid (NAPL) viscosity.	Thermal treatment is incompatible with current site usage as a gasoline service station.	Not retained for further evaluation.
Ex-Situ Treatment			
• Excavation	Excavate impacted soils and fill. Dewatering with treatment may be required.	Effective for addressing most OHM and reducing residual sources by removal of impacted materials. Typically most favorable at depths of less than 20 feet below grade, and in areas with limited subsurface utilities/buried infrastructure.	Retained for further consideration.
• On-Site Treatment following Removal	Excavated soil and sediment can be treated on-Site via biological, physical, chemical or thermal means, following which it can be re-used as backfill.	Installation and operation of an on-site soil or treatment process was deemed logistically infeasible given the limited size and active use of the potential work areas.	Not retained for further evaluation.
• Off-Site Disposal following Removal	Soil and sediment can be transported off -Site for disposal or recycling via a variety of processes, including thermal desorption, incineration, asphalt batch treatment, or landfilling.	Facilities for off-Site disposal or recycling are readily available, and arrangements are in place for remedial waste from National Grid sites to be transported to these facilities.	Retained for further consideration.
• Solidification/ Stabilization	Add binders to the soil to encapsulate COCs in place and prevent migration.	Difficult to implement due to heterogeneous conditions, space constraints and the presence of numerous obstructions in the subsurface at the Site.	Not retained for further evaluation.
• In-situ Biotreatment	For unsaturated zone soil treatment, a vacuum blower draws air from trenches or wells screened in the unsaturated zone, enhancing aerobic biodegradation. For soil or groundwater treatment, water and nutrients can be added as needed to enhance biological degradation.	Less effective at degrading heavier hydrocarbons which are generally persistent in the environment. Less effective at remediating isolated pockets of COCs and source material within the soils.	Not retained for further evaluation.
• In-Situ Thermal Treatment	Introduce heat into the subsurface to volatilize contaminants and decrease nonaqueous phase liquid (NAPL) viscosity.	Thermal treatment is incompatible with current site usage as a gasoline service station.	Not retained for further evaluation.

TABLE 2
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
284 WINTER STREET SITE
HAVERHILL, MASSACHUSETTS
MASSDEP RTN 3-32792

Evaluation Criterion	Remedial Action Alternative 1 Relocate Utility Lines and Implement Activity and Use Limitation	Remedial Action Alternative 2 Focused Soil Excavation with Dewatering and Implement Activity and Use Limitation
1. Comparative Effectiveness		
a) Ability to achieve a Permanent or Temporary Solution	Would lead to a Permanent Solution.	Would lead to a Permanent Solution.
(b) Ability to reuse, recycle, destroy, detoxify, or treat oil and/or hazardous materials (OHM)	OHM would not be removed, destroyed or treated.	Some OHM, including potential residual source material would be removed and destroyed/treated off site. Most impacted soils and groundwater would be left in place.
(c) Ability to reduce OHM levels to concentrations that achieve or approach background.	Would not achieve or approach background in the near future; natural attenuation would result in decreased concentrations over time.	Not likely to achieve or approach background; natural attenuation would result in decreased concentrations over time.
2. Comparative Reliability		
(a) The degree of certainty that the alternative will be successful	Strong degree of certainty that exposure pathway that could lead to significant risk would be eliminated.	The alternative should eliminate the key exposure pathway and effectively control risk but may not be effective in eliminating/controlling the potential residual OHM source.
(b) Residue/waste/emissions/discharge control or management	The limited excavation required would generate a small quantity of soil for management with accompanying dust and odor monitoring and control requirements.	Soil management, dust and odor monitoring and control, and groundwater management required.
3. Comparative Difficulty		
(a) Technical complexity	Low technical complexity. Shallow excavation and conventional electrical line installation protocols.	Moderate technical complexity due to the high water table, the need for dewatering and the proximity of existing site infrastructure. Additionally, modifying the holder wall to eliminate groundwater monitoring may be a complex undertaking.
(b) Integration with existing operations and other remedial actions	Would have to be coordinated with property owner, as an electrical outage may be required and the work is being done in access road to the car wash.	Would have to be coordinated with property owner, as work is being done in the parking lot of an active facility. Due to the need for excavated soil and extracted groundwater storage, the footprint of the work area would be expanded.
(c) Monitoring, operations, maintenance or site access requirements or limitations	Only limited air monitoring and odor control required. Potential property access issues are described above.	Air monitoring and odor control required. Potential property access issues are described above. Long-term monitoring or maintenance not required.
(d) Availability of necessary services, materials, equipment, or specialists	Equipment, materials, and personnel readily available.	Equipment, materials, and personnel readily available.
(e) Availability, capacity and location of off-site treatment, storage and disposal facilities	Remediation waste can be readily disposed of under existing arrangements between National Grid and off-site facilities.	Remediation waste can be readily disposed of under existing arrangements between National Grid and off-site facilities.
(f) Likelihood of alternative being permitted/approved by regulatory agencies	Work is within the 100-foot buffer zone for the Little River so a filing with Haverhill Conservation Commission would be required. Approval is likely based on previous experience.	Work is within the 100-foot buffer zone for the Little River so a filing with Haverhill Conservation Commission would be required. Approval is likely based on previous experience.
4. Comparative Costs	$68,000	$210,000

TABLE 2
DETAILED EVALUATION OF REMEDIAL ACTION ALTERNATIVES
284 WINTER STREET SITE
HAVERHILL, MASSACHUSETTS
MASSDEP RTN 3-32792

Evaluation Criterion	Remedial Action Alternative 1 Relocate Utility Lines and Implement Activity and Use Limitation	Remedial Action Alternative 2 Focused Soil Excavation with Dewatering and Implement Activity and Use Limitation
5. Comparative Risks		
(a) Short-term risks associated with implementation	The limited potential risks including soil management, odor control, and transportation of remediation wastes, can be readily managed based on experience at other sites.	The limited potential risks including soil management, odor control, water management, traffic issues, and transportation of remediation wastes, can be readily managed based on experience at other sites.
(b) Long-term risks associated with implementation	None anticipated.	None anticipated
(c) Potential risk of harm to health, safety, public welfare or the environment by residual OHM	Risks associated with residual OHM (e.g. via violation of the AUL) would remain.	OHM concentrations would be reduced, as would the potential for exposure, but residual OHM would remain in soil and groundwater.
6. Comparative Benefits		
(a) Benefit of restoring natural resources	The upland portion of the property has limited value as a natural resource due to current and historical usage.	Removal of soils and possible residual source material would provide some benefit but upland portion of property has limited value as a natural resource..
(b) Providing for the productive reuse of the site	No change in the current productive use of the area is anticipated.	No change in the current productive use of the area is anticipated.
(d) Avoided lost value of the site.	No lost value and no change in use of property.	No change in use of property.
7. Comparative Timeliness	Can be performed in a timely manner.	Can be performed in a timely manner but time frame would be longer that RAA-1.
8. Effect on Non-pecuniary Interests	No effects on non-pecuniary interests were identified for this property.	No effects on non-pecuniary interests were identified for this property.

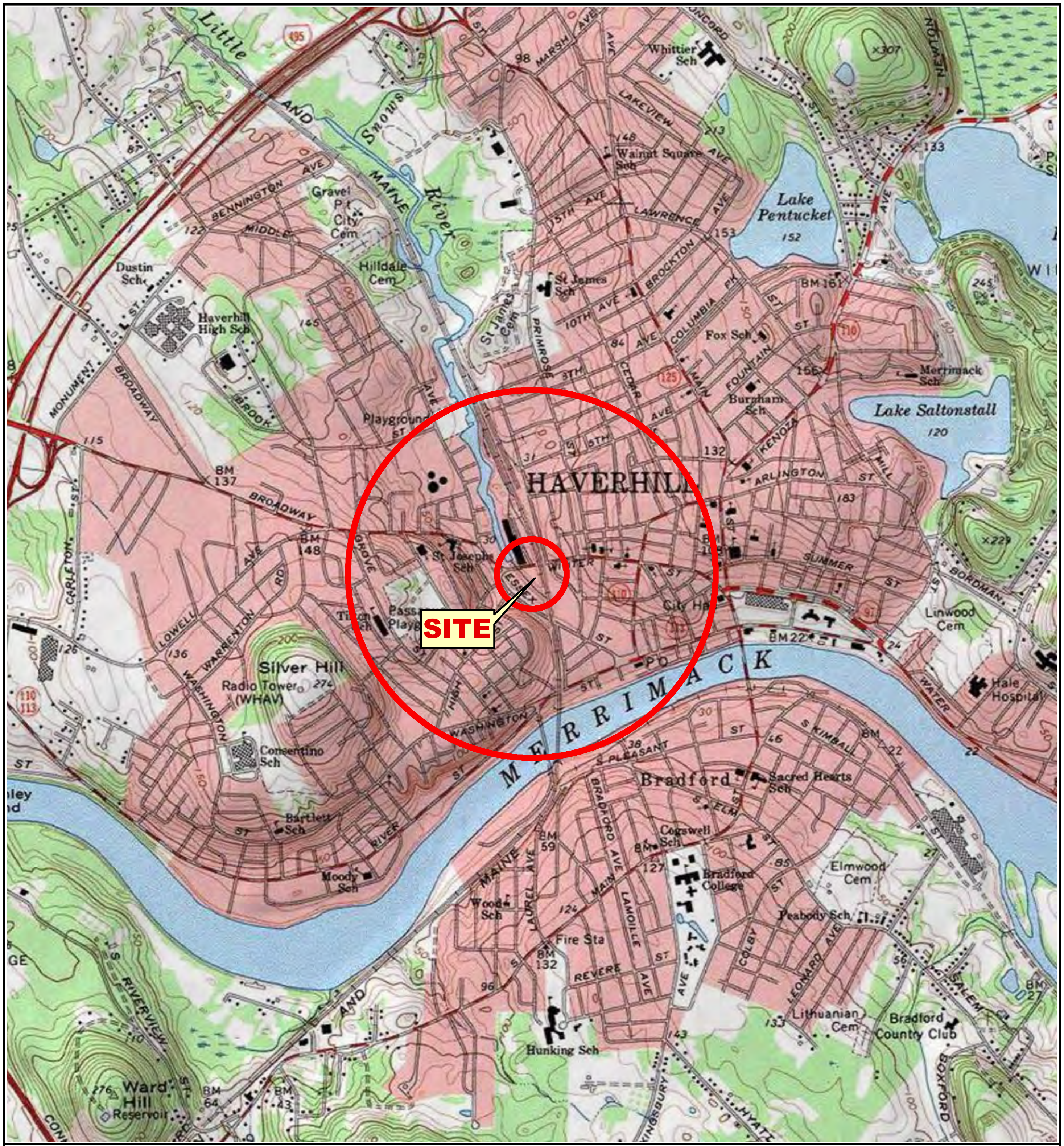
TABLE 3
COST ESTIMATE SUMMARY
284 WINTER STREET
HAVERHILL, MASSACHUSETTS

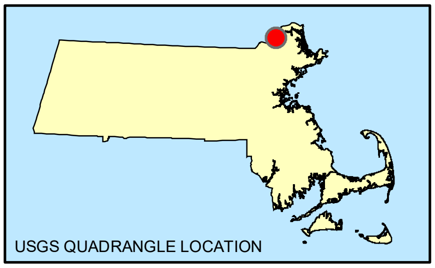
Item	RAA-1	RAA-2
Permitting, Engineering & Procurement	$8,000	$30,000
Supplemental Assessment	$15,000	$15,000
Mobilization/Site Preparation	$2,000	$10,000
Soil Excavation and Disposal	$5,000	$60,000
Groundwater Treatment/Disposal	$0	$50,000
Electrical Line Rerouting	$5,000	$0
Site Restoration	$2,000	$10,000
Activity and Use Limitation	$10,000	$10,000
Partial Permanent Solution Statement	$10,000	$10,000
Contingency - 25% (Construction Costs)	$4,000	$33,000
Total	$61,000	$228,000

Notes:

1. RAA-1 involves relocating the electrical line that passes through the former holder. RAA-2 includes a focused excavation and dewatering program to address soils near B107 (200 cubic yards).
2. This estimate of probable costs is based on a conceptual level design and should be considered preliminary and subject to future revision based on design refinement. Estimate is not to be considered for construction purposes.
3. The estimate presented is developed using current and generally accepted engineering cost estimation methods. Note that these estimates are based on assumptions concerning future events and actual costs may be affected by known and unknown risks. Actual costs may vary from these estimates and such variations may be material.
4. Costs are rounded as appropriate.
5. Soil excavation and disposal costs include the excavation, dewatering and treatment of extracted water, off-Site soil disposal, field oversight staffing, and equipment, analysis, and staffing required for environmental monitoring.
6. Permitting, engineering and procurement costs include design development, bid specification document preparation and procurement support, project management and the preparation of the Phase IV Remedy Implementation Plan.
7. A streamlined procurement effort was assumed for both options.

Figures





SOURCE : THIS MAP CONTAINS THE ESRI ARCGIS ONLINE USA TOPOGRAPHIC MAP SERVICE, PUBLISHED JUNE 19, 2019 BY ESRI ARCIMS SERVICES AND UPDATED AS NEEDED. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.

Data Supplied by : esri

0 1,000 2,000 4,000 6,000

SCALE IN FEET

N E S W

GZA	PROJ. MGR.: KFM DESIGNED BY: KFM REVIEWED BY: CAL OPERATOR: SMW/EMD DATE: 06-22-2022	LOCUS PLAN SHOWING 500 FOOT & 1/2 MILE RADII PHASE III REMEDIAL ACTION PLAN 284 WINTER STREET HAVERHILL, MASSACHUSETTS	JOB NO. 01.0172397.10 FIGURE NO. 1

LEGEND

- AQSS-04 — APPROXIMATE SEDIMENT CORE LOCATION (ANCHOR QEA - 2021)
- VE-1 — VACUUM EXCAVATION PROBE PERFORMED BY GEOSEARCH AUGUST 11, 2021
- GZ-1 — MONITORING WELL INSTALLED BY GEOSEARCH AUGUST 31 - SEPTEMBER 1, 2020
- 1A — SEDIMENT SAMPLE COLLECTED BY GZA ON JUNE 8-10, 2020
- P1 — PIPE OR SEEP LOCATION
- SG-1 — SOIL GAS POINT PERFORMED BY GZA ON FEBRUARY 5, 2020
- B102 — MONITORING WELL INSTALLED BY GEOSEARCH JANUARY 21-23, 2020 AND OBSERVED BY GZA
- B101 — SOIL BORING PERFORMED BY GEOSEARCH (2020) AND OBSERVED BY GZA
- NFNP-01 — NAPL SAMPLE COLLECTED BY GZA PERSONNEL NOVEMBER 1, 2016
- NFSB-01 (MW) — MONITORING WELL INSTALLED BY TECHNICAL DRILLING SERVICES OCTOBER 20-25, 2016 AND OBSERVED BY GZA
- NFSB-05 — SOIL BORING PERFORMED BY TECHNICAL DRILLING SERVICES OCTOBER 20-25, 2016 AND OBSERVED BY GZA
- NFAA-01 — AMBIENT AIR SAMPLE COLLECTED BY GZA PERSONNEL OCTOBER 19, 2016
- NFSV-01 — SOIL VAPOR SAMPLE COLLECTED BY GZA PERSONNEL OCTOBER 18-19, 2016
- NFCB-01 — CATCH BASIN SEDIMENT SAMPLE COLLECTED BY GZA PERSONNEL OCTOBER 18-19, 2016
- ENV-1MW — MONITORING WELL INSTALLED BY RAMBOLL ENVIRON APRIL 27-28, 2015
- ENV-2B(A) — SOIL BORING COMPLETED BY RAMBOLL ENVIRON APRIL 27-28, 2015
- MW-1 — MONITORING WELL INSTALLED BY LESSARD ENVIRONMENTAL
- DISPOSAL SITE BOUNDARY
- 284 WINTER STREET PROPERTY BOUNDARY AS RECORDED ON ALTA/ACSM LAND TITLE SURVEY PLAN PERFORMED BY MHF DESIGN CONSULTANTS (STAMPED FEBRUARY 12, 2015) NOTE: THIS BOUNDARY DIFFERS FROM THE MASSGIS ASSESSORS PARCEL DATA.
- ASSESSORS PARCEL DATA PROVIDED BY MASSGIS ON SEPTEMBER 1, 2020

SOURCE

1) THIS MAP CONTAINS THE ESRI ArcGIS ONLINE BING MAPS AERIAL LAYER PACKAGE, PUBLISHED APRIL 13, 2020 BY ESRI ARCIMS SERVICES AND UPDATED MONTHLY. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.
2) THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY GEOSEARCH AUGUST 31 - SEPTEMBER 1, 2020 WERE LOCATED FROM A SURVEY PERFORMED BY THE MORIN-CAMERON GROUP, INC. ON SEPTEMBER 29, 2020. THE LOCATIONS OF THE SEDIMENT SAMPLES COLLECTED BY GZA IN JUNE 2020 AND THE PIPE LOCATIONS WERE APPROXIMATELY DETERMINED USING A TRIMBLE GEO-7X HAND-HELD GPS ON 06-10-2020. THE LOCATIONS OF THE MONITORING WELLS AND SOIL BORINGS PERFORMED BY GEOSEARCH IN JANUARY 2020 WERE APPROXIMATELY DETERMINED USING A TRIMBLE GEO-7X HAND-HELD GPS ON 05-07-2020. THE LOCATIONS OF THE NF SERIES OF EXPLORATIONS AND SAMPLING LOCATIONS WERE APPROXIMATELY DETERMINED USING A TRIMBLE GEO-XH HAND-HELD GPS ON 10-18-2016. THE LOCATIONS OF THE SOIL GAS POINTS INSTALLED BY GZA IN FEBRUARY 2020, SOIL BORING INSTALLED BY GEOSEARCH AUGUST 31, 2021 (GZA-2A), AND THE VACUUM EXCAVATION PROBES PERFORMED BY GEOSEARCH AUGUST 11, 2021 WERE APPROXIMATELY DETERMINED BY LINE OF SIGHT FROM EXISTING TOPOGRAPHIC AND MAN-MADE FEATURES. THESE DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
3) THE LOCATIONS OF THE SOIL BORINGS AND MONITORING WELLS PERFORMED BY RAMBOLL AND THE MONITORING WELLS PERFORMED BY LESSARD WERE APPROXIMATELY DETERMINED FROM A PLAN PREPARED BY RAMBOLL ENTITLED: "SITE LAYOUT", FIGURE 2, DATED: 02-10-2017, PROJECT.: 1690005598.
4) THE LOCATIONS OF THE APPROXIMATE SEDIMENT CORE LOCATIONS PERFORMED BY ANCHOR QEA IN 2021 WERE DETERMINED FROM A GEODATABASE FILE PROVIDED BY ANCHOR QEA ON MARCH 29, 2022, FILE: AQ SAMPLE LOCATIONS 20220329.GDB.
5) THE HISTORIC RELIEF GAS HOLDER WAS APPROXIMATELY LOCATED FROM AN "UNDATED HISTORICAL PLAN" IN THE RAMBOLL ENVIRON PHASE I INITIAL SITE INVESTIGATION REPORT, DATED APRIL 2016.

0 25 50 100
SCALE IN FEET

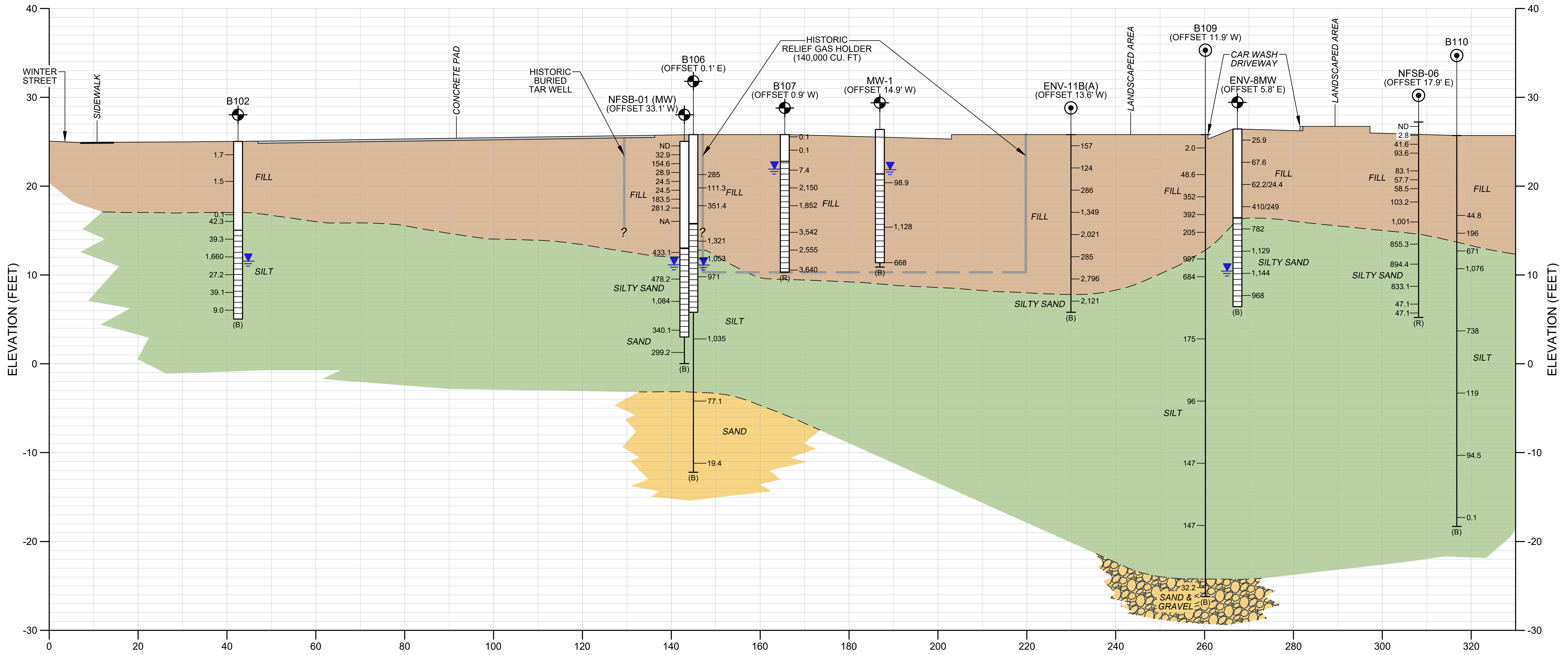
PHASE III REMEDIAL ACTION PLAN
284 WINTER STREET
HAVERHILL, MASSACHUSETTS

EXPLORATION LOCATION PLAN

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: nationalgrid

PROJ MGR: KFM	REVIEWED BY: CAL	CHECKED BY: KFM	FIGURE 2
DESIGNED BY: KFM	DRAWN BY: SMW/EMD	SCALE: 1 " = 50 FEET	
DATE: 06/22/2022	PROJECT NO. 01.0172397.10	REVISION NO.	



GEOLOGIC CROSS-SECTION A-A'

LEGEND

B106 — MONITORING WELL DESIGNATION
(OFFSET 0.1' E) — OFFSET DIRECTION & DISTANCE
GROUND SURFACE
WELL CASING
285 — PID RESULT (PPMV)
WELL SCREEN
GROUNDWATER ELEVATION IN FEET (SEPTEMBER 15, 2020 GAUGING)
APPROXIMATE STRATUM CHANGE
(B) — BOTTOM OF BORING

(R) - REFUSAL OF BORING
PID - PHOTOIONIZATION DETECTOR
PPMV - PARTS PER MILLION BY VOLUME
ND - INDICATES NOT DETECTED ABOVE INSTRUMENT DETECTION LIMIT (<0.1 PPMV)
NA - INDICATES NOT ANALYZED

STRATUM KEY

- FILL
- SILTY SAND / SILT
- SAND
- SAND & GRAVEL

NOTES:

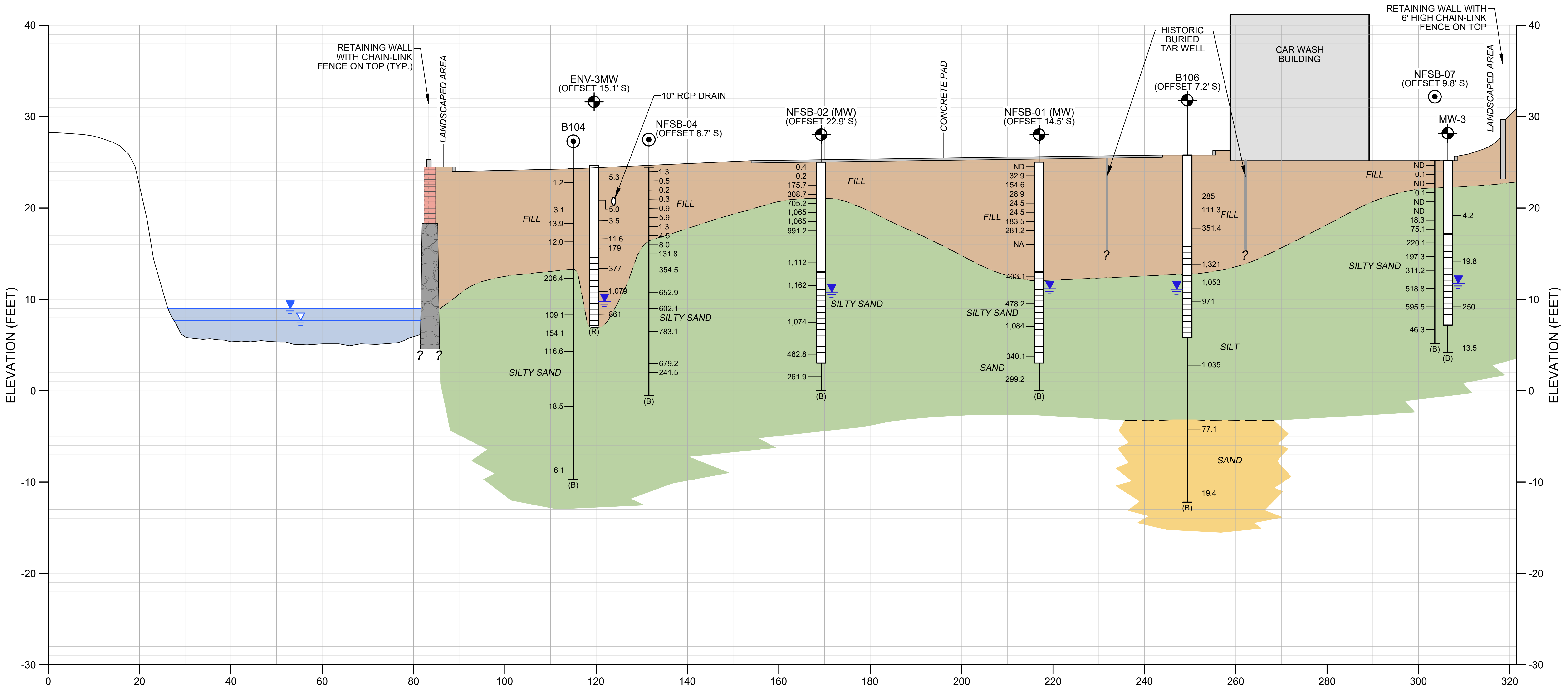
1. THE STRATIFICATION LINES ARE APPROXIMATE, BASED UPON DATA FROM A LIMITED NUMBER OF WIDELY SPACED EXPLORATIONS AND THUS REPRESENT APPROXIMATE BOUNDARIES BETWEEN STRATUM TYPES. THE ACTUAL TRANSITIONS ARE EXPECTED TO BE MORE GRADUAL AND VARY FROM THOSE SHOWN.

VERTICAL SCALE IN FEET: 0, 5', 10', 20'
HORIZONTAL SCALE IN FEET: 0, 10', 20', 40'

PHASE III REMEDIAL ACTION PLAN
284 WINTER STREET
HAVERHILL, MASSACHUSETTS

GEOLOGIC CROSS-SECTION A-A'

PREPARED BY:		PREPARED FOR:	
GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com		nationalgrid	
PROJ MGR: KFM	REVIEWED BY: CAL	CHECKED BY: KFM	FIGURE
DESIGNED BY: KFM	DRAWN BY: EMD	SCALE: AS NOTED	3A
DATE: 06-22-2022	PROJECT NO. 01.0172397.10	REVISION NO.	



GEOLOGIC CROSS-SECTION B-B'

LEGEND

- B106 — MONITORING WELL DESIGNATION
- (OFFSET 7.2' S) — OFFSET DIRECTION & DISTANCE
- GROUND SURFACE
- WELL CASING
- 285 — PID RESULT (PPMV)
- WELL SCREEN
- GROUNDWATER ELEVATION IN FEET (SEPTEMBER 15, 2020 GAUGING)
- APPROXIMATE STRATUM CHANGE
- (B) — BOTTOM OF BORING

(R) - REFUSAL OF BORING
PID - PHOTOIONIZATION DETECTOR
PPMV - PARTS PER MILLION BY VOLUME
ND - INDICATES NOT DETECTED ABOVE INSTRUMENT DETECTION LIMIT (<0.1 PPMV)
NA - INDICATES NOT ANALYZED

STRATUM KEY

- FILL
- SILTY SAND / SILT
- SAND

NOTES:

1. THE STRATIFICATION LINES ARE APPROXIMATE, BASED UPON DATA FROM A LIMITED NUMBER OF WIDELY SPACED EXPLORATIONS AND THUS REPRESENT APPROXIMATE BOUNDARIES BETWEEN STRATUM TYPES. THE ACTUAL TRANSITIONS ARE EXPECTED TO BE MORE GRADUAL AND VARY FROM THOSE SHOWN.

VERTICAL SCALE IN FEET: 0, 5', 10', 20'

HORIZONTAL SCALE IN FEET: 0, 10', 20', 40'

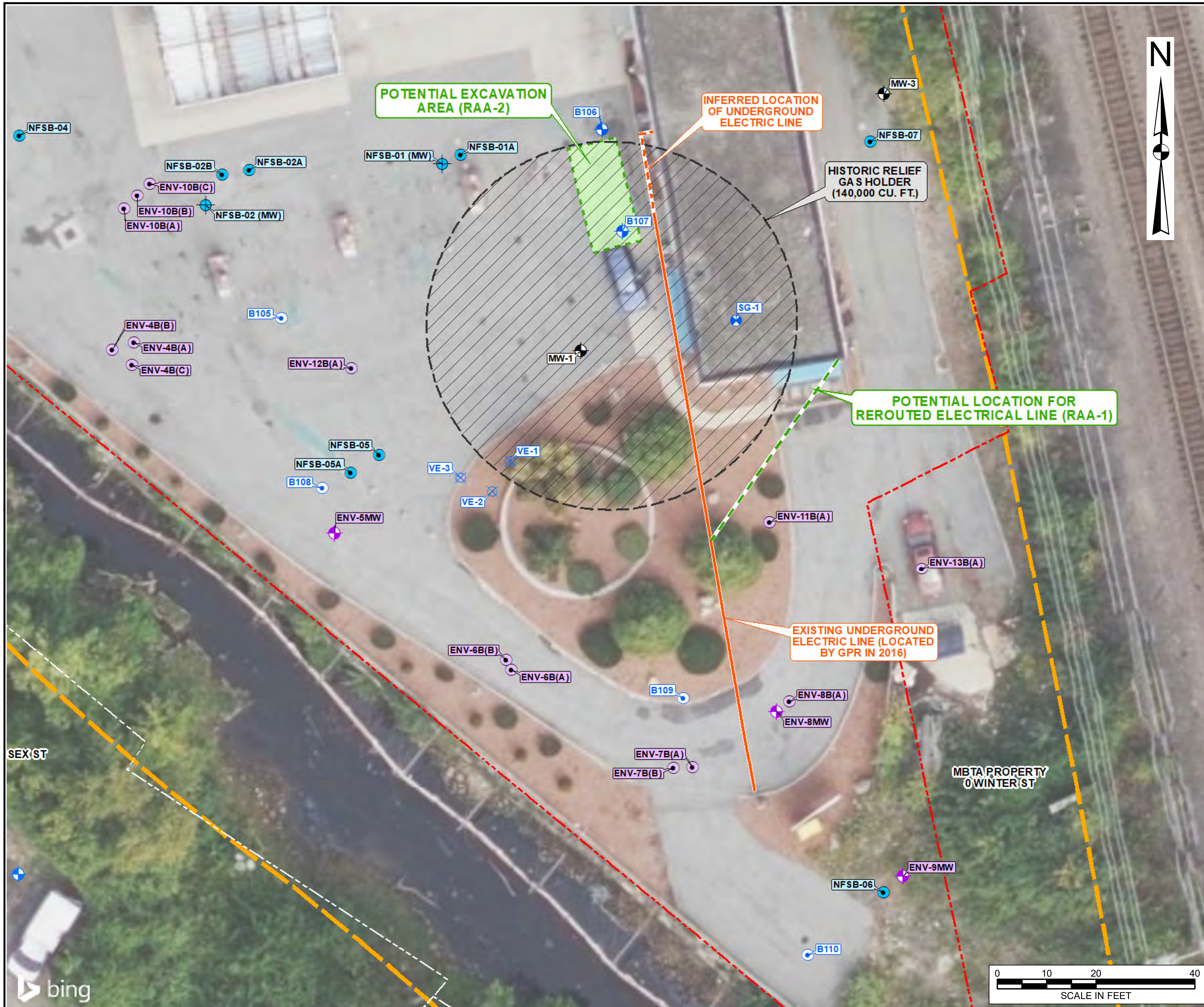
PHASE III REMEDIAL ACTION PLAN
284 WINTER STREET
HAVERHILL, MASSACHUSETTS

GEOLOGIC CROSS-SECTION B-B'

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: nationalgrid

PROJ MGR: KFM	REVIEWED BY: CAL	CHECKED BY: KFM	FIGURE
DESIGNED BY: KFM	DRAWN BY: EMD	SCALE: AS NOTED	3B
DATE: 06-22-2022	PROJECT NO. 01.0172397.10	REVISION NO.	



LEGEND

- VE-1 — VACUUM EXCAVATION PROBE PERFORMED BY GEOSEARCH AUGUST 11, 2021
- GZ-1 — MONITORING WELL INSTALLED BY GEOSEARCH AUGUST 31 - SEPTEMBER 1, 2020
- SG-1 — SOIL GAS POINT PERFORMED BY GZA ON FEBRUARY 5, 2020
- B102 — MONITORING WELL INSTALLED BY GEOSEARCH JANUARY 21-23, 2020 AND OBSERVED BY GZA
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- NFSB-01 (MW) — MONITORING WELL INSTALLED BY TECHNICAL DRILLING SERVICES OCTOBER 20-25, 2016 AND OBSERVED BY GZA
- NFSB-05 — SOIL BORING PERFORMED BY TECHNICAL DRILLING SERVICES OCTOBER 20-25, 2016 AND OBSERVED BY GZA
- ENV-1MW — MONITORING WELL INSTALLED BY RAMBOLL ENVIRON APRIL 27-28, 2015
- ENV-2B(A) — SOIL BORING COMPLETED BY RAMBOLL ENVIRON APRIL 27-28, 2015
- MW-1 — MONITORING WELL INSTALLED BY LESSARD ENVIRONMENTAL
- DISPOSAL SITE BOUNDARY
- 284 WINTER STREET PROPERTY BOUNDARY ON AS RECORDED ALTA/ACSM LAND TITLE SURVEY PLAN PERFORMED BY MHF DESIGN CONSULTANTS (STAMPED FEBRUARY 12, 2015) NOTE: THIS BOUNDARY DIFFERS FROM THE MASSGIS ASSESSORS PARCEL DATA.
- ASSESSORS PARCEL DATA PROVIDED BY MASSGIS ON SEPTEMBER 1, 2020

SOURCE

1) THIS MAP CONTAINS THE ESRI ArcGIS ONLINE BING MAPS AERIAL LAYER PACKAGE, PUBLISHED APRIL 13, 2020 BY ESRI ARCIMS SERVICES AND UPDATED MONTHLY. THIS SERVICE USES UNIFORM NATIONALLY RECOGNIZED DATUM AND CARTOGRAPHY STANDARDS AND A VARIETY OF AVAILABLE SOURCES FROM SEVERAL DATA PROVIDERS.
2) THE LOCATIONS OF THE MONITORING WELLS INSTALLED BY GEOSEARCH AUGUST 31 - SEPTEMBER 1, 2020 WERE LOCATED FROM A SURVEY PERFORMED BY THE MORIN-CAMERON GROUP, INC. ON SEPTEMBER 29, 2020. THE LOCATIONS OF THE MONITORING WELLS AND SOIL BORINGS PERFORMED BY GEOSEARCH IN JANUARY 2020 WERE APPROXIMATELY DETERMINED USING A TRIMBLE GEO-7X HAND-HELD GPS ON 05-07-2020. THE LOCATIONS OF THE NF SERIES OF EXPLORATIONS AND SAMPLING LOCATIONS WERE APPROXIMATELY DETERMINED USING A TRIMBLE GEO-XH HAND-HELD GPS ON 10-18-2016. THE LOCATIONS OF THE SOIL GAS POINTS INSTALLED BY GZA IN FEBRUARY 2020, SOIL BORING INSTALLED BY GEOSEARCH AUGUST 31, 2021 (GZA-2A), AND THE VACUUM EXCAVATION PROBES PERFORMED BY GEOSEARCH AUGUST 11, 2021 WERE APPROXIMATELY DETERMINED BY LINE OF SIGHT FROM EXISTING TOPOGRAPHIC AND MAN-MADE FEATURES. THESE DATA SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
3) THE LOCATIONS OF THE SOIL BORINGS AND MONITORING WELLS PERFORMED BY RAMBOLL AND THE MONITORING WELLS PERFORMED BY LESSARD WERE APPROXIMATELY DETERMINED FROM A PLAN PREPARED BY RAMBOLL ENTITLED: "SITE LAYOUT", FIGURE 2, DATED: 02-10-2017, PROJECT.: 1690005598.
4) THE HISTORIC RELIEF GAS HOLDER WAS APPROXIMATELY LOCATED FROM AN "UNDATED HISTORICAL PLAN" IN THE RAMBOLL ENVIRON PHASE I INITIAL SITE INVESTIGATION REPORT, DATED APRIL 2016.

PHASE III REMEDIAL ACTION PLAN
284 WINTER STREET
HAVERHILL, MASSACHUSETTS

REMEDIAL ALTERNATIVES

PREPARED BY: GZA GeoEnvironmental, Inc. Engineers and Scientists www.gza.com

PREPARED FOR: nationalgrid

PROJ MGR: KFM	REVIEWED BY: CAL	CHECKED BY: KFM	FIGURE
DESIGNED BY: KFM	DRAWN BY: SMW/EMD	SCALE: 1" = 20 FEET	4
DATE: 06/23/2022	PROJECT NO. 01.0172397.10	REVISION NO.	

Appendix A

Limitations

LIMITATIONS

1. This revised Phase III Remedial Action Plan has been prepared on behalf of and for the exclusive use of Boston Gas Company d/b/a National Grid (National Grid) , solely for use in summarizing recent remedial evaluations completed at the 284 Winter Street property located in Haverhill, Massachusetts (Release Tracking Number 3-32792) under the Massachusetts Contingency Plan (MCP - 310 CMR 40.0000). This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without the prior written consent of GZA or National Grid. However, GZA acknowledges and agrees that the report may be conveyed to the Massachusetts Department of Environmental Protection (MassDEP).

2. GZA's work was performed in accordance with generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area, and GZA observed that degree of care and skill generally exercised by other consultants under similar circumstances and conditions. GZA's findings and conclusions must be considered not as scientific certainties, but rather as our professional opinion concerning the significance of the limited data gathered during the course of the study. No other warranty, express or implied is made. Specifically, GZA does not and cannot represent that the Site contains no hazardous material, oil, or other latent condition beyond that observed by GZA during completion of Phase IV remedial work.

3. The observations described in this report were made under the conditions stated therein. The conclusions presented in the report were based upon services performed and observations made by GZA.

4. In the event that National Grid or others authorized to use this report obtain information on environmental or hazardous waste issues at the Site not contained in this report, such information shall be brought to GZA's attention forthwith. GZA will evaluate such information and, on the basis of this evaluation, may modify the conclusions stated in this report.

5. The conclusions and recommendations contained in this report are based in part upon the data obtained from environmental samples obtained from relatively widely spread subsurface explorations. The nature and extent of variations between these explorations may not become evident until further exploration. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the boring logs.

7. In the event this work included the collection of water level data, these readings have been made in the test pits, borings and/or observation wells at times and under conditions stated on the exploration logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall and other factors different from those prevailing at the time measurements were made.

8. The conclusions contained in this report are based in part upon various types of chemical data and are contingent upon their validity. These data have been reviewed and interpretations made in the report. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. Should additional chemical data become available in the future, these data should be reviewed by GZA and the conclusions and recommendations presented herein modified accordingly.

9. In the event this work included the performance of a risk evaluation, GZA's risk evaluation was performed in accordance with generally accepted practices of the Massachusetts Contingency Plan and other consultants undertaking similar studies. The findings of the risk evaluation are dependent on numerous assumptions and uncertainties inherent in the risk assessment process. Sources of uncertainty may include the description of Site conditions and the nature and extent of chemical distribution and the use of toxicity information. Consequently, the findings of the risk assessment are not an absolute characterization of actual risks, but rather serve to highlight potential sources of risk at the Site. Although the range of uncertainties has not been quantified, the use of conservative assumptions and parameters throughout the assessment would be expected to err on the side of protection of human health and the environment.

10. This report contains approximate cost estimates for purposes of evaluating alternative remedial programs. These estimates involve approximate quantity evaluations. A preliminary estimate of this nature is likely to vary substantially from Contractors' Bid Prices and is not to be considered the equivalent of nor as reliable as Contractors' Bid Prices. Prices for similar work undertaken in the future will be subject to general and sometimes erratic price increases

Appendix B

Transmittal Form BWSC108

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM & PHASE I COMPLETION STATEMENT
Pursuant to 310 CMR 40.0484 (Subpart D) and 40.0800 (Subpart H)

BWSC 108

Release Tracking Number
3 - 32792

A. SITE LOCATION:

1. Site Name: HAFFNER'S

2. Street Address: 284 WINTER STREET

3. City/Town: HAVERHILL 4. ZIP Code: 018300000

☑ 5. Check here if the disposal site that is the source of the release is Tier Classified. Check the current Tier Classification Category:

☑ a. Tier I ☐ b. Tier ID ☐ c. Tier II

B. THIS FORM IS BEING USED TO: (check all that apply)

☐ 1. Submit a **Phase I Completion Statement,** pursuant to 310 CMR 40.0484.

☐ 2. Submit a **Revised Phase I Completion Statement,** pursuant to 310 CMR 40.0484.

☐ 3. Submit a **Phase II Scope of Work,** pursuant to 310 CMR 40.0834.

☐ 4. Submit an **interim Phase II Report.** This report does not satisfy the response action deadline requirements in 310 CMR 40.0500.

☐ 5. Submit a **final Phase II Report and Completion Statement,** pursuant to 310 CMR 40.0836.

☐ 6. Submit a **Revised Phase II Report and Completion Statement,** pursuant to 310 CMR 40.0836.

☑ 7. Submit a **Phase III Remedial Action Plan and Completion Statement,** pursuant to 310 CMR 40.0862.

☐ 8. Submit a **Revised Phase III Remedial Action Plan and Completion Statement,** pursuant to 310 CMR 40.0862.

☐ 9. Submit a **Phase IV Remedy Implementation Plan,** pursuant to 310 CMR 40.0874.

☐ 10. Submit a **Modified Phase IV Remedy Implementation Plan,** pursuant to 310 CMR 40.0874.

☐ 11. Submit an **As-Built Construction Report,** pursuant to 310 CMR 40.0875.

☐ 12. Submit a **Phase IV Status Report,** pursuant to 310 CMR 40.0877.

☐ 13. Submit a **Phase IV Completion Statement,** pursuant to 310 CMR 40.0878 and 40.0879.

Specify the outcome of Phase IV activities: (check one)

☐ a. Phase V Operation, Maintenance or Monitoring of the Comprehensive Remedial Action is necessary to achieve a Permanent or Temporary Solution.

☐ b. The requirements of a Permanent Solution have been met. A completed Permanent Solution Statement and Report (BWSC104) will be submitted to DEP.

☐ c. The requirements of a Temporary Solution have been met. A completed Temporary Solution Statement and Report (BWSC104) will be submitted to DEP.

B. THIS FORM IS BEING USED TO (cont.): (check all that apply)

☐ 14. Submit a **Revised Phase IV Completion Statement,** pursuant to 310 CMR 40.0878 and 40.0879.

☐ 15. Submit a **Phase V Status Report,** pursuant to 310 CMR 40.0892.

☐ 16. Submit a **Remedial Monitoring Report.** (This report can only be submitted through eDEP.)

a. Type of Report: (check one) ☐ i. Initial Report ☐ ii. Interim Report ☐ iii. Final Report

b. Frequency of Submittal: (check all that apply)

☐ i. A Remedial Monitoring Report(s) submitted monthly to address an Imminent Hazard.

☐ ii. A Remedial Monitoring Report(s) submitted monthly to address a Condition of Substantial Release Migration.

☐ iii. A Remedial Monitoring Report(s) submitted every six months, concurrent with a Status Report.

☐ iv. A Remedial Monitoring Report(s) submitted annually, concurrent with a Status Report.

c. Status of Site: (check one) ☐ i. Phase IV ☐ ii. Phase V ☐ iii. Remedy Operation Status ☐ iv. Temporary Solution

d. Number of Remedial Systems and/or Monitoring Programs: ________________

A separate BWSC108A, CRA Remedial Monitoring Report, must be filled out for each Remedial System and/or Monitoring Program addressed by this transmittal form.

☐ 17. Submit a **Remedy Operation Status,** pursuant to 310 CMR 40.0893.

☐ 18. Submit a **Status Report to maintain a Remedy Operation Status,** pursuant to 310 CMR 40.0893(2).

☐ 19. Submit a **Transfer and/or a Modification of Persons Maintaining a Remedy Operation Status (ROS),** pursuant to 310 CMR 40.0893(5) (check one, or both, if applicable).

☐ a. Submit a Transfer of Persons Maintaining an ROS (the transferee should be the person listed in Section D, "Person Undertaking Response Actions").

☐ b. Submit a Modification of Persons Maintaining an ROS (the primary representative should be the person listed in Section D, "Person Undertaking Response Actions").

c. Number of Persons Maintaining an ROS not including the primary representative: ________________

☐ 20. Submit a **Termination of a Remedy Operation Status,** pursuant to 310 CMR 40.0893(6).(check one)

☐ a. Submit a notice indicating ROS performance standards have not been met. A plan and timetable pursuant to 310 CMR 40.0893(6)(b) for resuming the ROS are attached.

☐ b. Submit a notice of Termination of ROS.

☐ 21. Submit a **Phase V Completion Statement,** pursuant to 310 CMR 40.0894.

Specify the outcome of Phase V activities: (check one)

☐ a. The requirements of a Permanent Solution have been met. A completed Permanent Solution Statement and Report (BWSC104) will be submitted to DEP.

☐ b. The requirements for a Temporary Solution have been met. A completed Temporary Solution Statement and Report (BWSC104) will be submitted to DEP.

☐ 22. Submit a **Revised Phase V Completion Statement,** pursuant to 310 CMR 40.0894.

☐ 23. Submit a **Temporary Solution Status Report,** pursuant to 310 CMR 40.0898.

☐ 24. Submit a **Plan for the Application of Remedial Additives** near a sensitive receptor, pursuant to 310 CMR 40.0046(3).

a. Status of Site: (check one)

☐ i. Phase IV ☐ ii. Phase V ☐ iii. Remedy Operation Status ☐ iv. Temporary Solution

C. LSP SIGNATURE AND STAMP:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and 309 CMR 4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> *if Section B indicates that a* ***Phase I, Phase II, Phase III, Phase IV or Phase V Completion Statement*** *and/or a* ***Termination of a Remedy Operation Status*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B indicates that a* ***Phase II Scope of Work*** *or a* ***Phase IV Remedy Implementation Plan*** *is being submitted,* the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B indicates that an* ***As-Built Construction Report,*** *a* ***Remedy Operation Status,*** *a* ***Phase IV, Phase V or Temporary Solution Status Report,*** *a* ***Status Report to Maintain a Remedy Operation Status,*** *a* ***Transfer or Modification of Persons Maintaining a Remedy Operation Status*** *and/or a* ***Remedial Monitoring Report*** *is being submitted,* the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

1. LSP#: 6891

2. First Name: CHARLES A 3. Last Name: LINDBERG

4. Telephone: 7812783830 5. Ext.: ______ 6. Email: charles.lindberg@gza.com

7. Signature: ______________________

8. Date: ______________ (mm/dd/yyyy) 9. LSP Stamp:

D. PERSON UNDERTAKING RESPONSE ACTIONS:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person undertaking response actions

2. Name of Organization: BOSTON GAS CO D/B/A NATIONAL GRID

3. Contact First Name: JESSE 4. Last Name: EDMANDS

5. Street: 40 SYLVAN RD 6. Title: PROGRAM MANAGER

7. City/Town: WALTHAM 8. State: MA 9. ZIP Code: 024511120

10. Telephone: 7819073682 11. Ext: 12. Email: jesse.edmands@nationalgrid.com

E. RELATIONSHIP TO SITE OF PERSON UNDERTAKING RESPONSE ACTIONS: ☐ Check here to change relationship

☑ 1. RP or PRP ☐ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☑ e. Other RP or PRP Specify: OTHER PRPS

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Undertaking Response Actions Specify Relationship:

F. REQUIRED ATTACHMENT AND SUBMITTALS:

☑ 1. Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

☑ 2. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the submittal of any Phase Reports to DEP.

☑ 3. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the availability of a Phase III Remedial Action Plan.

☐ 4. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the availability of a Phase IV Remedy Implementation Plan.

☐ 5. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of any field work involving the implementation of a Phase IV Remedial Action.

☐ 6. If submitting a Transfer of a Remedy Operation Status (as per 310 CMR 40.0893(5)), check here to certify that a statement detailing the compliance history for the person making this submittal (transferee) is attached.

☐ 7. If submitting a Modification of a Remedy Operation Status (as per 310 CMR 40.0893(5)), check here to certify that a statement detailing the compliance history for each new person making this submittal is attached.

☐ 8. Check here if any non-updatable information provided on this form is incorrect, e.g. Release Address/Location Aid. Send corrections to: BWSC.eDEP@state.ma.us.

☑ 9. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.

G. CERTIFICATION OF PERSON UNDERTAKING RESPONSE ACTIONS:

1. I, ________________________, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

>*if Section B indicates that this is a* **Modification of a Remedy Operation Status (ROS),** I attest under the pains and penalties of perjury that I am fully authorized to act on behalf of all persons performing response actions under the ROS as stated in 310 CMR 40.0893(5)(d) to receive oral and written correspondence from MassDEP with respect to performance of response actions under the ROS, and to receive a statement of fee amount as per 4.03(3).

I understand that any material received by the Primary Representative from MassDEP shall be deemed received by all the persons performing response actions under the ROS, and I am aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate or incomplete information.

2. By: ____________________ (Signature) 3. Title: PROGRAM MANAGER

4. For: BOSTON GAS CO D/B/A NATIONAL GRID (Name of person or entity recorded in Section D) 5. Date: ________ (mm/dd/yyyy)

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section D.

7. Street: ____________________

8. City/Town: ________ 9. State: ________ 10. ZIP Code: ________

11. Telephone: ________ 12. Ext.: ________ 13. Email: ________

YOU ARE SUBJECT TO AN ANNUAL COMPLIANCE ASSURANCE FEE OF UP TO $10,000 PER BILLABLE YEAR FOR THIS DISPOSAL SITE. YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

Date Stamp (DEP USE ONLY:)

Appendix C

Anchor Phase III RAP – Little River

Appendix D

Public Notices

Known for excellence.
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GEOTECHNICAL
ENVIRONMENTAL
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WATER
CONSTRUCTION MANAGEMENT

249 Vanderbilt Avenue
Norwood, MA 02062
T: 781.278.3700
F: 781.278.5701
F: 781.278.5702
www.gza.com

July 13, 2022
GZA File No. 01.0172397.10

The Honorable James J. Fiorentini
Mayor of Haverhill
Haverhill City Hall
4 Summer Street, Room 100
Haverhill, MA 01830

Peter Carbone, Chairperson
Haverhill Board of Health
4 Summer Street, Room 210
Haverhill, MA 01830

Re: Phase III Remedial Action Plan
284 Winter Street, Haverhill, Massachusetts
Release Tracking Number (RTN) 3-32792

To Whom It May Concern:

On behalf of Boston Gas Company d/b/a National Grid, GZA GeoEnvironmental, Inc. (GZA) is providing notification in accordance with 310 CMR 40.1403(3)(e) of the Massachusetts Contingency Plan (MCP) that a Phase III Remedial Action Plan (RAP) for the above-referenced Site is being submitted to the Massachusetts Department of Environmental Protection (MassDEP). As required by the MCP, a copy of the Phase III RAP conclusions is attached.

A copy of the Phase III RAP submittal can be viewed under RTN 3-32792 at the MassDEP website: http://eeaonline.eea.state.ma.us/DEP/wsc_viewer/main.aspx after July __, 2022. Copies of the report can also be obtained by contacting Jesse Edmands of National Grid at (781) 907-3682 / jesse.edmands@nationalgrid.com or the undersigned at 781-278-3700 or Charles.lindberg@gza.com.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Charles Lindberg, LSP
Senior Principal

cc: Jesse Edmands, National Grid
MassDEP, NERO (via eDEP)

Attachments: Phase III RAP Conclusions

J:\170,000-179,999\172397\172397-10.KM\Reports\Phase III\Winter St Phase III City Notice (Final).docx

CONCLUSIONS

This Phase III Remedial Action Plan (RAP) selects the following Remedial Action Alternatives for the 284 Winter Street Site (RTN 3-32792):

- Relocation of the electrical line that presently runs through the former relief holder;
- Implementation of an AUL that prohibits installation of new underground utility lines within the footprint of the relief holder and restricts residential and certain other future uses of the Site;
- Sealing/removal of historical piping and penetrations in the retaining wall that separates the upland portion of the Site from the Little River; and
- Focused dredging and capping of the sediments within the Little River adjacent to the Property.

The design of the relevant components of these RAAs will be documented in a Phase IV Remedy Implementation Plan.

GZA GeoEnvironmental, Inc.