Analysis of Brownfields Cleanup Alternatives
Former Advanced Recycling Site, Rochester, New Hampshire
NHDES Site No. 200309133

I. Introduction & Background

a. Site Location

The property consists of two developed parcels comprising approximately 0.95 acres located at 10-16 Wallace Street in Rochester, New Hampshire. The property had been improved with one 1,590 ± square foot single story building (Building A), one 1,280± square foot single story building (Building B), and one 7,170± square foot warehouse building with a partial second floor (Building C). All buildings were commercial/industrial style with slab-on-grade foundations. The buildings were reportedly razed in 2010. The remaining 32,313 square feet of the property is mostly covered with concrete or asphalt pavement. The property and vicinity are serviced by municipal water and sewer. One water well is known to exist 700± feet southeast of the property. The City of Rochester Assessors' Office identifies the properties on Map 120 as Lots 306 (10 Wallace Street) and 308 (16 Wallace Street). Assessors' Office records indicate that the City of Rochester is the owner of both lots.

The general vicinity of the subject property is heavily developed for primarily commercial/industrial use. Topography of the subject property and adjoining properties is generally flat. Local topography slopes gently towards the Cocheco River to the west. No surface water features were identified on the property. The Cocheco River is situated 1,750± feet west of the site. According to the USGS topographic quadrangle depicting Rochester, the former Wardley Brook, now referred to as Willow Brook, is located 1,350± feet east of the subject property. Both the Cocheco River and Willow Brook flow in a general southerly direction.

a.1 Forecasted Climate Conditions

The preferred remedial alternative for cleanup of the Site includes soil excavation and disposal, and not treatment technologies that could be adversely impacted by increased flooding resulting from sea level rise in the area. The Site is not located within the 100- or 500-year floodplain. Final grading and placement of impervious surfaces such as pavement or building, will be engineered in a manner to allow for proper drainage and stormwater runoff that may result from changing climate conditions in the Northeast including increased precipitation.

b. Previous Site Use(s) and any previous cleanup/contamination

Historical uses of the Site based on aerial photographs and Sanborn maps have included industrial/commercial uses such as a foundry, machine shop, and a scrap metal company prior to use by Max Cohen and Sons/Advanced Recycling.

The New Hampshire Department of Environmental Services (NHDES) investigated a complaint from an adjoining property owner in April 1996 regarding apparent staining on the property line adjoining the Site. Personnel on the property believed that cutting oil from the metal shavings stored in a nearby building had leaked out and caused the staining. A total of 2.04 tons of soil was excavated from the adjoining property on July 11, 1996 and transported for disposal. No additional work was requested by NHDES.

c. Site Assessment Findings

A Site Investigation (SI) was performed at the Site in 2007. The following conclusions were presented:

- One water supply well was identified 700± feet southeast of the site in an inferred hydrologically downgradient location relative to the subject site at 7 Furbush Street.
- Historic records indicate that the site and vicinity have been developed for industrial usage for more than 100 years. A foundry, machine shop, match company and scrap metal businesses have operated on the site. Properties within the vicinity of the site are a mix of residential and commercial in nature.
- The site and vicinity are serviced by municipal water and sewer.
- Sixteen test borings were performed on the subject site. Four borings were completed as monitoring wells MW-1, MW-2, MW-3, and MW-4. Overburden beneath the site consists generally of poorly graded sand, poorly graded sand with gravel, well graded

sand with gravel, and poorly graded sand with silt interpreted as fill underlain by poorly graded sand, poorly graded sand with silt, and silty sand interpreted as fluvial / glacial fluvial sediment;

- Unsaturated soil samples from twelve test borings were collected for multiple analyses. Analytical results for soil samples indicate that PCE, indeno(1,2,3-c,d)pyrene, benzo(a)pyrene, benzo(g,h,i)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and arsenic were detected at concentrations exceeding the then current Env-Or 600 Soil Remediation Standards.
- PCE, methyl tertiary-butyl ether (MtBE), and dibenzo(a,h)anthracene were detected in groundwater samples at concentrations exceeding Ambient Groundwater Quality Standards. Dieldrin was reported at concentrations exceeding applicable standards, however, the result was qualified due to the detection of dieldrin in the laboratory method blank.
- Groundwater level measurements inferred a general south-southeasterly groundwater flow beneath the site. Local topography slopes gently to the south.
- The primary migration pathway for dissolved contamination at the site is inferred to be the fluvial /glacial fluvial sediment.
- The volume of soil potentially requiring remediation and/or off-site disposal could not be determined with the data collected for the SI. The SI recommended further subsurface investigations and water quality monitoring.

The sections below present the laboratory analytical results from soil samples collected during field investigations conducted during the 2007 SI.

Soil:

The laboratory results were compared to the NHDES Soil Remediation Standards established in Env-Or 600. PCE was detected in the samples collected from B-22 (22 ppm), B-23 (14 ppm), and B-24 (6.7 ppm) at concentrations exceeding the Soil Remediation Standard of 2 ppm. No other VOCs were present at concentrations exceeding applicable standards. No PAHs were detected above Env-Or 600 Soil Remediation Standards in the soil samples submitted for analysis.

Groundwater:

Results of laboratory analyses of the groundwater samples were compared to NHDES Ambient

Groundwater Quality Standards (AGQS)3 and NHDES Risk Characterization and Management Policy (RCMP) GW-2 standards (vapor intrusion threshold). Laboratory results indicated no VOCs were present above the laboratory detection limits in the groundwater samples collected from MW-2. Low concentrations of VOCs, SVOCs, and dissolved metals have been detected in groundwater samples collected from on-site monitoring wells. Based these results, groundwater at the Site has not been adversely impacted by historical Site operations or historical releases.

d. Project Goal

The City of Rochester is redeveloping this site to expand economic opportunity and investment taking into consideration community needs by introducing light industrial/commercial. This remediated property will attract businesses such as a sole proprietor electrician, a small lumber supply shop, and other similar contractors. These are the types of businesses well-suited to providing good, quality employment to residents without substantial post-secondary education. This kind of economic development is essential to meeting the current-day needs of Rochester's lower-income residents without four-year post-secondary degrees, for whom factory jobs have largely been replaced with lower-paying service sector employment.

II. Applicable Regulations and Cleanup Standards

a. Cleanup Oversight Responsibility

The City will retain a Qualified Environmental Professional (QEP) with experienced personnel to design, oversee, and document remediation activities at the site as required by NHDES. In addition, all documents prepared for this site are submitted electronically to the NHDES.

b. Cleanup Standards

The City of Rochester currently anticipates that NHDES Soil Remediation Standards, NHDES Ambient Groundwater Quality Standards (AGQS), and NHDES Risk Characterization and Management Policy (RCMP) GW-2 standards (vapor intrusion threshold) will be used as the cleanup standards. However, it is possible that risk-based cleanup standards will be generated for compounds of concern, in accordance with state regulations.

c. Laws and Regulations

Laws and regulations that are applicable to this cleanup include the Federal Small Business Liability Relief and Brownfields Revitalization Act, the Federal Davis-Bacon Act, state environmental law, and town by-laws. Federal, state, and local laws regarding procurement of contractors to conduct the cleanup will be followed. In addition, all appropriate permits (*e.g.*, Dig Safe, soil transport/disposal manifests) will be obtained prior to the work commencing.

III. Evaluation of Cleanup Alternatives

a. Cleanup Up Alternatives Considered

Five cleanup alternatives were considered to address contamination at the site:

Alternative #1: No Action

Alternative #2: Excavation and Off-Site Disposal

Based on the analytical data collected to date, an estimated 705± tons of PCE contaminated soil may exist in the MW-5/B-2 area and 132± tons of PCE contaminated soil may exist in the B-9 area. Further delineation would be required to define the extent of the soil plume in the MW-5/B-2 area. For the purposes of this RAP, a total of 900± tons of soil requiring excavation and off-site disposal are estimated. It is anticipated that field screening methods in conjunction with field observations during excavation will be adequate to identify the contaminated soil in the portions of the source area not defined by the existing data.

The concrete slab foundation in the MW-5/B-2 area and asphalt pavement in the B-9 area will need to be cut and removed to access the soil below. While the concrete is presumed to be uncontaminated, the analytical data suggests that PCE contamination may exist in soil directly in contact with the concrete. Based on this assumption, the soil contact side of the concrete will likely require gross decontamination in the form of pressure-washing. It is anticipated that the concrete can be cleaned on the ground surface in the area to be excavated without generating enough fluids to result in saturated soil. The material washed off will then be removed along with the rest of the impacted soils. Likewise, the asphalt may need gross decontamination to enable disposal at an asphalt recycling facility.

It is assumed that the PCE-impacted soils will be disposed of at a licensed soil recycling facility located in New Hampshire and that the soils are classified as non-hazardous material. Should analytical results indicate that the impacted soil is classified as hazardous waste, the transportation and disposal costs would be higher. Analytical data collected during the 2007 SI is included in Appendix I and will be used along with the SSI data for disposal facility acceptance of site soils. Based on the vertical distribution of contaminated soil suggested by the analytical data, soil in the B-9 area will likely be excavated to a depth of ±3 feet below site grade. Soil in the MW-5/B-2 area may be excavated to a depth of up to ±12 feet below site grade. The soil would likely be excavated and stockpiled on site and subsequently loaded on to trucks for transport to the licensed disposal facility. The return time or the trucks is a limiting factor. For the purposes of this RAP, eight 25-ton loads per day are anticipated. Between loads, other on-site activities such as further soil excavation, backfilling and compacting, and site restoration can be completed. Samples of remaining in-ground soil for confirmatory analyses will be collected from each of the two excavation areas. This RAP assumes one day of site preparation including concrete and asphalt cutting and removal, one day of concrete and asphalt cleaning and loading, five days of soil excavation and loading, and two days of site restoration for a total field effort of nine days.

As a component of Excavation and Off-Site Disposal, a limited groundwater monitoring program is proposed to monitor cleanup of groundwater based on removal of the source area. We anticipate that GMZ Delineation with some additional off-site monitoring wells will be required. As shown in Table 10B, it is anticipated that annual monitoring would occur for a 10-year period. The estimated capital cost for the Excavation and Off-Site Disposal option includes the site activities outlined above, development of bid specifications, engineering oversight, laboratory analysis of soil samples, project management, and preparation of a report summarizing remedial activities is $209,400. The associated present-worth annual groundwater monitoring would be $56,500. The Present Worth Budget estimate for this alternative is $265,800.

Alternative #3: Soil Vapor Extraction Treatment

In-Situ Soil Vapor Extraction (SVE) is a well-established remedial technology that has a demonstrated effectiveness in reducing residual source chlorinated VOC soil contamination. By removing air under vacuum from the soil, volatile organic compounds are also removed. As more air is removed, more volatilization of the compounds takes place, ultimately reducing the volume of the compounds. The technology has been demonstrated at a number of sites since the early 1990s and is readily available.

The intrinsic soil air permeability for the vadose zone and saturated zone sand and gravel is estimated to be above 1 x 10-8 cm2 (typical of unconsolidated sand and gravel) and, therefore, well within the range generally considered to be favorable to SVE vacuum propagation. The paved and/or concrete covered surface of the proposed SVE treatment zones will also assist in vacuum propagation and VOC recovery.

The radius of influence of SVE is dependent on the thickness of the unsaturated treatment zone. Due to the vacuum pressures that are applied to the unsaturated zone, groundwater mounding can occur in the vicinity of SVE wells that reduces the unsaturated thickness of the treatment area. Since the estimated thickness of the unsaturated zone within the two treatment areas plume is ≥8 feet, potential groundwater mounding should not significantly reduce the unsaturated treatment zone. Since the SVE will not be used in conjunction with Air Sparging, induced migration of dissolved and vapor phase VOCs is unlikely. The vacuum created by the SVE should also assist in limiting vapor migration. Additional measures such as a vapor cutoff wall and vapor monitoring points to assess and control vapor migration to nearby occupied structures will not be necessary. A pilot study would be used to evaluate the site-specific effectiveness, potential negative effects, and preliminary design basis of the final SVE treatment system. SVE will likely not reduce site contaminants to background levels because of subsurface variability or other limiting factors and the application of an SVE system must be balanced against the significant operation and maintenance costs of continued treatment. Redevelopment of the site will likely include a building and asphalt parking that will make remaining soil contamination inaccessible.

SVE points in the site soil would have an assumed radius of influence of approximately 20 feet. This estimate results in a requirement of two SVE wells to treat the MW-5/B-2 area and one well to treat the B-9 area. SVE wells would consist of 3-inch-diameter PVC. The actual layout of SVE wells would be determined during pilot studies, remedial design and, to a lesser degree, during system startup. Based on similar SVE installations at other sites in New Hampshire, it is anticipated that off-gas treatment would be required in the initial four months of operation of the SVE system.

A three-year time frame for active SVE treatment is estimated. Removal rates will decline during SVE treatment as the more volatile compounds are removed, and as the VOC concentrations decrease. If performance monitoring indicates that remedial goals have been achieved prior to the estimated 3-year treatment time, the system can be shut down or modified, thereby reducing the total estimated remedial costs presented below. A groundwater monitoring program similar to that described in the Soil Excavation alternative discussion would be required for the SVE alternative.

The estimated capital cost for the design and installation for the SVE option is $186,732, including site-scale pilot study, engineering design, permitting and oversight, site work and restoration, treatment and monitoring system materials, and installation and startup. The estimated three-year SVE O&M cost for the option, including system decommissioning after three years is $99,440 and the groundwater monitoring program would be $56,500. Assuming a 5% interest rate, the total Present Worth cost estimate for the option is $342,700.

<u>Alternative #4</u>: Monitored Natural Attenuation (MNA)

The effect of natural attenuation is the gradual reduction over time of dissolved VOC concentrations in groundwater by the physical and chemical processes of dispersion, diffusion, sorption, dilution/mixing, volatilization, and biodegradation. Natural attenuation does not address off-site dissolved contaminant migration and will not reduce the risks to potential downgradient receptors. In this case, however, no downgradient receptors were identified by the SI, the contamination exceeding the GW-2 vapor intrusion threshold is ±130 feet from the nearest off-site occupied structure (upgradient), and contamination identified at the downgradient property boundary is well below the GW-2 vapor intrusion threshold. It is assumed that the site soil source area would be treated by one of the alternatives described above, eliminating the source of groundwater contamination. To proceed with MNA, the following measures will be required:

- Completion of a Dissolved Contaminant Plume / GMZ Delineation report to identify the downgradient extent of the contaminant plume exceeding AGQS and propose a GMZ.
- Completion of a GMP application identifying the GMZ and detailing the monitoring schedule.
- Issuance of the GMP by NHDES.
- Groundwater quality monitoring (anticipated tri-annual) and periodic (anticipated annual) update reports.

It is currently anticipated that the GMZ for the site will include at least one adjoining property. As applied to the contaminants present at the site, natural attenuation would be used in conjunction with groundwater monitoring to assess the contaminant migration and distribution. The MNA option does not include groundwater plume containment and treatment beyond existing natural processes. Based on the conditions identified to date and the other remedial measures proposed, no further evaluation of natural attenuation processes at the site are anticipated. The data collected during tri-annual monitoring will be used to evaluate seasonal impacts, potential risks related to vapor intrusion, assess the effectiveness of natural attenuation processes at the site, and assess the effectiveness of the other remedial measures proposed. Based on the historical site groundwater analytical data, if no soil remediation is performed it is estimated that monitoring of the site would be necessary for a period of at least 30± years before the presence of contamination is below the NHDES AGQS for the VOCs present in groundwater at the site. Given that the source of the PCE contaminated groundwater would remain in place, there is not a certainty that MNA would be completed in 30 years, therefore this cost may be higher. The annual reporting will include evaluation of the groundwater contaminant concentration trends and, if necessary, propose additional remedial actions.

The estimated capital cost for the MNA option includes completion of the Dissolved Contaminant Plume / GMZ Delineation (and associated access agreements and subcontractor cost) and GMP application, monitoring on a tri-annual basis (up to eleven monitoring wells), and annual reporting. It is assumed that the seven existing on-site monitoring wells will be destroyed during future redevelopment and need to be replaced; the cost of this is also included. For a 30-year time period and 5% interest rate, the Present Worth Budget estimate for this alternative is $254,300.

Alternative #5: Vapor Mitigation
Due to the presence of dissolved phase PCE in groundwater at concentrations exceeding the GW-2 vapor intrusion threshold, as well as the potential for pockets of PCE contaminated soil not identified during subsurface investigations, redevelopment of the site may require vapor mitigation for any structures proposed for occupancy.

As discussed with NHDES, a cost estimate has been developed for vapor mitigation. In accordance with the NHDES Vapor Intrusion Guidance7 a vapor intrusion investigation would generally be conducted prior to implementing a mitigation system. A presumptive remedy, however, could proceed without the investigation phase. For this RAP, only evaluation and cost estimation for vapor mitigation was completed.

A passive barrier system such as Liquid Boot® is a cost effective and low maintenance option with a high probability of successfully limiting or eliminating vapor migration from groundwater or potential remaining sources. According to the vendor, CETCO Liquid Boot Company (CLB) of Santa Ana, California, the Liquid Boot® Membrane is a cold, sprayapplied membrane that provides an impermeable barrier against vapor intrusion into structures. Liquid Boot® is sprayed directly to penetrations, footings, grade beams, pile caps, etc., providing a fully-adhered and seamless membrane. The Quick Installation Process for Liquid Boot® accelerates construction time while providing the indoor air quality protection and assurance needed. For the preparation of this RAP, CLB provided an estimate of $4.50 per square foot for installation of the Liquid Boot® Membrane vapor barrier for new construction. Based on the lot size, a maximum suitable building footprint of 15,000 square feet is assumed. The cost of Liquid Boot® installation for a building this size is estimated at $67,500. In addition, the cost for engineering oversight and reporting for installation is estimated at $4,000. To confirm proper installation of the membrane and verify that vapor migration to the interior of the new building is not occurring, one round of indoor air sample collection and analysis for VOCs is included. This cost is estimated at $5,000. The estimated cost of vapor mitigation, therefore, is $76,500.

b. Evaluation of Cleanup Up Alternatives

To satisfy EPA requirements, the effectiveness, implementability, and cost of each alternative must be considered prior to selecting a recommended cleanup alternative.

Effectiveness

No Action is not effective in controlling or preventing the exposure of receptors to contamination at the Site. Excavation and Off-Site Disposal and SVE are expected to be effective, although, since there is more potential for unanticipated subsurface conditions to negatively impact SVE performance, SVE may be slightly less effective.

Implementability

No Action is easy to implement since no actions will be conducted. Excavation and Off-Site Disposal would be the most feasible alternative and easiest to implement given that soil is removed from the sub-surface, loaded into trucks, and transported off-site for treatment. SVE would be less feasible based on the need for sub-surface piping and treatment system equipment that would need to be installed on the site.

<u>Cost</u>

Based on the total preliminary cost estimates shown above, Excavation and Off-Site Disposal received the best cost rating based on the impact to the site relative to capital expenditure. The operation and maintenance cost of SVE over time makes it less cost effective than Excavation and Off-Site Disposal. There are no costs associated with the No Action Alternative.

c. Recommended Cleanup Up Alternative

Based on the above conclusions, recommendations are as follows:

- A GMZ delineation should be completed to define the extent of VOC contamination in groundwater. Up to four off-site monitoring wells (one upgradient and three downgradient) are anticipated to be necessary to define the dissolved contaminant plume.

- Given the inactive status of the site and the distance to off-site occupied structures, indoor air quality assessment is not currently recommended.

- A GMP application should be completed subsequent to defining the extent of the groundwater contamination. The GMP will establish the groundwater quality monitoring schedule for the site.

- Source removal in the two defined PCE soil contamination areas should be conducted by Excavation and Off-Site Disposal followed by limited groundwater monitoring under the previously-mentioned GMP.

- Vapor Mitigation measures in the form of Liquid Boot® Membrane or similar barrier are recommended for any new construction on the site during redevelopment.

This cleanup plan will be compliant with state and federal regulations, be protective of human health and the environment, and facilitate redevelopment of the Site for a wide range of potential uses.