# Analysis of Brownfields Clean-up Alternatives

*Former Racing Oil Service Station*
*City of Chicopee, Massachusetts*

## Introduction and Background

***Site Location***: Former Racing Oil Service Station
181 Center Street
Chicopee, MA 01013
Owner: City of Chicopee

***Previous Uses of the Site***: *The Former Racing Oil Service Station property* consists of approximately 0.28 acres of land, originally developed during the 1920s. Former business names included Pride Convenience and Republic Oil. Racing Oil was the most recent company to have operated the Site as a gasoline service station. Site improvements consisted of a single-story kiosk, pump dispensers and a paved parking area. According to Chicopee Fire Department records, three 10,000-gallon gasoline underground storage tanks (USTs) were installed on the property in 1974. These USTs were upgraded with cathodic protection in December 1998 and ultimately removed in December 2004.

The City took ownership of the Site on December 14, 2011 through the tax foreclosure, initiated on November 19, 2009. The Racing Oil property is part of the City's West End neighborhood and was identified as a key redevelopment property in the *Chicopee West End Brownfields Area-wide Plan* (AWP) completed in June 2012 with funding from an U.S. Environmental Protection Agency (U.S. EPA) Brownfields Area-wide Planning Pilot grant awarded to the Pioneer Valley Planning Commission (PVPC), the City's project partner.

***Past Assessment Findings***: Several releases of petroleum products have been reported to the Massachusetts Department of Environmental Protection (MassDEP) since 1987. Gasoline-related compounds have been detected in soil and groundwater samples collected from the former UST area and from downgradient areas beyond the northwest border of the property. Contaminants of Concern (COCs) include gasoline-related constituents such as benzene, toluene, ethylbenzene, xylenes (BTEX), naphthalene, methyl tert-butyl ether (MtBE), volatile petroleum hydrocarbon (VPH) ranges as well as metals in soil and groundwater.

Due to contaminant releases encountered at the Site during the 1980s and 1990s, several investigations were undertaken. The following provides a summary of Release Tracking Numbers (RTNs) that have been assigned by MassDEP to the Site since 1987:

- ***RTN 1-00044*** was assigned in 1987 after a release of gasoline from a leaking UST impacted soil and groundwater. A Class B-1 Response Action Outcome (RAO) was submitted to MassDEP in February 1997 for this release, indicating that the release no longer poses a significant risk to human health or the environment.

- ***RTN 1-12664*** was assigned in October 1998 after an operator discovered a 422-gallon inventory discrepancy. Additionally, approximately six inches of light non-aqueous phase liquid (LNAPL) were discovered in a monitoring well downgradient from the pump islands and volatile organic compounds (VOCs) were detected above five milligrams per liter (mg/L) in a monitoring well located within 30 feet of a residence.

- ***RTN 1-12892*** was assigned in 1999 when a pressure drop detected in one of the product lines represented a threat of release. Subsequent UST and product line testing failed to identify the source of the pressure drop, as no leaks were detected.

- ***RTN 1-19116*** was assigned in June 2013 following completion of a Targeted Brownfield Assessment (TBA) at the Site, funded by Region 1 of the U.S. EPA. Reportable concentrations of chromium, nickel and chloroform were detected in soils at the Site. The City complied with all required MassDEP reporting requirements.

Prior to the TBA completed in May 2013 with support from Region 1 of the U.S. EPA, site characterization efforts included installation of approximately 28 soil borings and 27 monitoring wells within and downgradient to the Site. Soil sampling results detected the presence of BTEX, naphthalene, MtBE and VPH. VPH concentrations (C9-C10 aromatics) were detected in soils above Massachusetts Contingency Plan (MCP) Method 1 Standards for Category S-1/GW-2 and S-1/GW-3 soil.

Several rounds of groundwater sampling were completed as part of the initial characterization of the Site. Gasoline-related contaminants were detected in groundwater samples above MCP Method 1 Standards for Category GW-2 and GW-3 groundwater. The extent of the contaminant plume was delineated to extend west below Center Street to Park Street. Prior to the TBA, the most recent groundwater data had been collected during the summer of 2005.

***Past Cleanup Activities:*** On December 9, 1998, 73.27 tons of gasoline-impacted soil were generated during the underground storage tank (UST) system upgrade and removed from the Site under a Bill of Lading (BOL). The excavation activities were approved by MassDEP under the IRA for RTN 1-12664.

A Phase III Remedial Action Plan (RAP) and Phase IV Remedial Implementation Plan (RIP) were submitted to MassDEP in 2003 recommending high vacuum extraction (HVE) and monitored natural attenuation (MNA) as the Site remedy to address petroleum contamination in groundwater.

In November 2004, the Chicopee Fire Department reportedly ordered the Site owner to remove three USTs present on-site and in December 2004, those tanks were removed.

In 2006, a Revised Phase III/Phase IV was submitted to MassDEP by Racing Oil, LLC's consultant. The revised remedy included biosparging, monitored natural attenuation (MNA) and an Activity and Use Limitation (AUL). It appears that this remedy was never implemented at the Site, since the MassDEP files do not contain any further documentation of response actions and a series of financial inability applications are located in the MassDEP file for the Site.

In November 2006, an Administrative Consent Order was signed by MassDEP and the Site owner (Racing Oil, LLC) requiring the completion of additional response actions or the submittal of Financial Inability (FI)

status. The FI paperwork was submitted and approved by MassDEP in April 2007. The most recent renewal of Racing Oil's FI status expired in October 2013.

***Project Goals***: The former Racing Oil Service Station is a Brownfields property, identified and studied for redevelopment as part of the City's West End Brownfields Area-wide Plannnig (AWP) pilot project funded by the U.S. EPA. The City of Chicopee in collaboration with the Pioneer Valley Planning Commission was successful in securing funding through the pilot program and completed work with professional consultants in June 2012.

The West End Brownfields AWP seeks to reinvigorate and spark reinvestment in the West End by re-branding the area as an attractive, green neighborhood where people can live, work, learn and play. An overall market assessment identifies potential demand for industrail/commercial space and rental housing units, while identfying niche market commercial uses as well as appropriate target segments for mill building residences. Through realistic strategies and market-driven initiatives, this plan aims to return key West End Brownfields to productive use over the next three to five years. The plan also addresses limitations in the neighborhood's infrastructure and recommends public improvements that will facilitate private property redevelopment in the West End.

The West End Vision, as defined by the AWP, calls for the creation of a distinctive, attractive, hip, affordable and safe downtown neighborhood and is based on market findings, public input, existing conditions and successful case studies of Brownfields redevelopment across the Commonwealth. Noted as part of the plan, the revitalization of older urban centers should encompass a scale and development type that is distinctive from residential and commercial spaces available in suburban and rural locations within the area's larger geographic region. Older urban centers appeal to businesses and residents who desire an environment that offers distinctive buildings and spaces, walkable streets, density and amenities that cannot be replicated in other city neighborhoods or suburban areas, all qualities the West End exhibits.

Based on this Vision, the project team developed concepts for the West End that focused on five primary areas: Mill properties, Delta Park/former Hampden Steam Plant, the Riverfront, Residential and the Gateway. Focusing efforts on these key areas will have significant synergistic effects on the redevelopment potential of other properties in the West End.

The former Racing Oil Service Station is most closely associated with the Gateway Area - located just a few parcels away from the boundary of the Gateway. The property is defined in the AWP plan as an 'infill' site with potential reuse for small office, retail space or an electric car charging station/related transportation use or greenspace in support of the Gateway's reuse strategies, as the neighborhood's market demands shift with redevelopment of the larger priority areas. While these priority areas are tackled, the AWP suggests short term improvements to these infill sites including assessment, completion of any required clean-up activities and improving the aesthetics and marketability of these sites to showcase the City's commitment to redevelopment. This land banking strategy will provide a visible City commitment to the property until the market provides an appropriate redevelopment demand to move forward with the recommended reuse strategy.

***Summary of Targeted Brownfields Assessment, May 2013***: Nobis Engineering, Inc. completed Targeted Brownfields Assessment efforts at the Racing Oil property for the U.S. EPA under Contract No. EP-S1-06-

03, Task Order No. 0082-SI-BZ-0010. The TBA's objective was to fill data gaps associated with historic environmental assessment activities conducted at the Site and to assess the current extent of soil and groundwater contamination. Soil and groundwater sampling data collected during the TBA were compared to Massachusetts Contingency Plan (MCP) criteria to evaluate the nature and extent of contamination and to estimate potential risks associated with contaminated environmental media. TBA investigation activities and reporting were conducted in accordance with a U.S. EPA approved Field Task Work Plan/Quality Assurance Project Plan (FTWP/QAPPA) prepared by Nobis on November 29, 2012 and approved by U.S. EPA on December 14, 2012.

Nobis conducted TBA field activities in January and April 2013. Soil boring advancement, soil sampling and monitoring well installation were completed on January 22 & 23, 2013. A monitoring well inventory, well development, groundwater level measurements, groundwater sample collection and monitoring well elevation survey were conducted between April 8 & 11, 2013.

Historical releases of petroleum hydrocarbons occurring because of former Site operations have resulted in soil and groundwater contamination at levels that could pose a risk to human health and the environment. The primary source of contamination is believed to be within the former UST area, where historical releases of gasoline reportedly occurred. Soil sampling data and field screening information collected during the TBA identified a zone of contaminated soil within the former UST area that appears to be residual contamination from historical releases from the tanks. This zone of contaminated soil extends vertically from the bottom of the backfill material placed after tank removal to the top of a silt layer that is encountered at approximately 8 feet below ground surface (bgs) in the east (upgradient) portion of the Site to approximately 16 feet bgs in the west (downgradient) portion of the Site. The horizontal extent of soil contamination appears to extend from the easternmost UST and the former concrete pad toward the west and northwest property boundaries (paved parking area and Center Street, respectively). The total estimated volume of contaminated soil present in this area is 800 cubic yards (1,200 tons).

Petroleum constituents released to the environment in the UST area migrated downward to the water table and dissolved into Site groundwater. Dissolved contaminants subsequently migrated horizontally with the flow of groundwater to create a contaminant plume extending to the northwest across Center Street. The horizontal extent of C5-C8 aliphatics contamination in groundwater exceeding MCP Method 1 GW-2 risk assessment standards extends from the former UST area to the northwest approximately 250 feet past the northwest wall of the commercial building at 178 Center Street and is approximately 125 feet wide. A portion of the volatile petroleum hydrocarbon (VPH) plume extends beneath the commercial building located at 178 Center Street.

The following is a summary of the comparison of analytical data collected during the TBA to MCP Method 1 risk assessment standards:

- Fuel-related compounds detected above Method 1 S-1/GW-2/GW-3 standards in soil samples included C5-C8 aliphatics, C9-C10 aromatics, C9-C18 aliphatics and chloroform. These exceedances of MCP Method 1 risk assessment standards for fuel related compounds in soil were limited to soil samples collected from soil borings advanced within the former UST area.

- The heavy metals chromium and nickel were detected above Method 1 S-1/GW-3 risk assessment standards in soil samples collected from the former UST area and from borings advanced in the downgradient plume area. These metals were also detected above Reportable

Concentrations for Category RCS-1 Soil, which represented a new 120-day release condition that was reported to MassDEP (RTN 1-19116) by the City on June 12, 2013. These metals are not believed to be associated with the release of gasoline that occurred at the Site.

- Groundwater contaminants detected above Method 1 GW-2/GW-3 standards include C5-C8 aliphatics, C9-C12 aliphatics, and total xylenes. Method 1 standards were exceeded in groundwater samples collected from MW-SA-1, CEA-4, and MW-A.

Based on the environmental data collected during the TBA and a comparison to MCP Method 1 risk assessment standards, soil and groundwater remediation is necessary to reduce contaminant levels so that a Condition of No Significant Risk can be achieved.

## Applicable Regulations and Cleanup

***Cleanup Oversight Responsibility***: The Commonwealth requires property owners to hire a Licensed Site Professional (LSP) if cleanup activities are deemed necessary. As defined by the Commonwealth, the LSP "ensures that actions taken to address contaminated property comply with Massachusetts regulations and protect public health, safety, welfare and the environment." In Massachusetts, LSPs are licensed by the state Board of Registration of Hazardous Waste Site Cleanup Professionals.

Should the U.S. EPA fund this cleanup proposal, the City will release a Request for Proposals for Licensed Site Professional Services for the Racing Oil Site. The City will follow all federal (40 CFR 31.36) and state public procurement guidelines during the process and will retain a qualified LSP to provide LSP services related to oversight, assessment and cleanup of petroleum contamination at the Site. The environmental regulation governing cleanup of the Site is the Massachusetts Contingency Plan (MCP).

The retained LSP will report directly to the City's Office of Community Development. Any additional contractors needed to perform the proposed cleanup project will be retained following all federal (40 CFR 31.36) and state public procurement guidelines.

***Laws & Regulations Applicable to the Cleanup:*** The MCP is the state regulation that governs the cleanup of petroleum constituents that are released to the environment. In addition to these regulations, MassDEP has developed numerous guidance documents and policies that govern the manner in which the presence of contaminated environmental media are determined and the manner in which they are removed, handled and disposed. Such regulations are very prescriptive and close adherence to the requirements is required, except in unusual circumstances when site-specific requirements are waived by state regulators. In this case, the LSP has jurisdiction over most activities involving the assessment and remediation of contaminated soil and groundwater, with MassDEP providing an oversight role.

There are numerous policy and guidance documents that also regulate the assessment and remediation of contaminated environmental media. The following is a summary of guidance documents published by MassDEP with a specific focus on the assessment and remediation of sites contaminated with petroleum constituents as well as disposal sites located in urban areas:

- MassDEP WSC-02-411 Characterizing Risks Posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach;
- MassDEP WSC-94-400 Interim Remediation Waste Management Policy for Petroleum Contaminated Soils;
- MassDEP Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology (2004);
- MassDEP Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil

**Evaluation of Clean-up Alternatives**

As part of the TBA process, Nobis Engineering evaluated potential cleanup alternatives based on contaminant sources and groundwater plume extents delineated during the TBA and in previous investigations. Nobis focused this evaluation on potential cleanup alternatives that: (1) are likely to achieve a level of No Significant Risk (NSR) at the Site and enable the achievement of an MCP Permanent Solution; (2) address MCP requirements regarding source elimination/control and restoration to background; and (3) appeared to be technically and economically feasible.

**Clean-up Alternative A – Monitored Natural Attenuation**

This option would consist solely of continued groundwater monitoring to evaluate concentration trends throughout the plume until contaminant levels were reduced to cleanup goals through natural processes. This option would include no active remediation of soil or groundwater.

***Effectiveness:*** Based on a review of historical groundwater sampling data from the contaminant plume, this option would not likely be effective and would not achieve a Permanent Solution within a reasonable timeframe. Contaminant concentrations in monitoring wells throughout the plume area have remained high since the mid-1990s, with no discernible downward trend, suggesting either the subsurface conditions in the plume area are not amenable to natural degradation of petroleum constituents or that petroleum constituents are leaching from contaminated soils into the groundwater at a rate that is equal to or greater than the rate of natural degradation. This alternative would also not address potential risks associated with soil contamination.

***Implementability:*** This option would be implementable using readily available resources and traditional environmental sampling and analytical methods.

***Impacts from Regional Climate Change Projections:*** The Northeast region is projected to see increased temperatures in addition to increase in the magnitude and frequency of heavy precipitation events should changes to regional climate characteristics continue. An increase in heavy precipitation events increases the potential of flooding. The impact to Monitored Natural Attenuation would be minimal in nature, as the groundwater vadose zone naturally increases and decreased based on weather patterns and precipitation events. Groundwater would continue to respond as such even under increased magnitude and frequency. The potential for flooding is also minimal as the Site is not located within or near any identified flood zones within the City.

**Clean-up Alternative B – Soil Excavation & Off-Site Disposal with Monitored Natural Attenuation**
This option would include the excavation and off-site disposal of contaminated soil from the former UST area and monitored natural attenuation for the groundwater plume. Alternative B would include the following activities:

- Excavation and off-site disposal of 1,200 tons of contaminated soil;
- Dewatering of the excavation area and on-site treatment of contaminated groundwater;
- Collection of post-excavation soil samples for laboratory analysis;
- Backfilling of the excavation area with clean soil; and
- Long-term monitoring of groundwater.

***Effectiveness:*** Excavation and off-site disposal of contaminated soil would be an effective and permanent measure to eliminate potential future exposure to contamination. Post-excavation confirmatory soil sampling would be performed to verify achievement of cleanup goals and to support evaluations of risk. The removal of contaminated soil in the former UST area would also prevent further leaching of contaminants into the groundwater, accelerating the progress of groundwater cleanup.

The effectiveness of soil excavation may be limited by the Site's physical boundaries. Elevated levels of petroleum contamination are present along the northern site boundary; therefore, soil contamination may extend beneath Center Street. Nobis assumed that excavation of soils beneath Center Street is not feasible; therefore, it is possible that some contaminated soil would remain after completion of excavation activities. However, removal of contaminated soils up to the parcel boundary would be expected to address the vast majority of soil contamination and be sufficient to achieve a Permanent Solution.

After removal of the primary source of contamination to the groundwater (i.e. soils in the former UST area), monitored natural attenuation may be an effective strategy for achievement of a Permanent Solution for groundwater. Petroleum hydrocarbons tend to be amenable to degradation through natural physical, chemical and biological processes. Without a continuing source of contamination leaching into the groundwater, concentration levels throughout the plume area may permanently decrease to acceptable levels without any active treatment. The long-term effectiveness of natural attenuation would need to be more fully evaluated prior to implementation through the collection of additional geochemical data from the aquifer to verify local conditions are amenable to natural degradation of petroleum hydrocarbons.

***Implementability:*** This option would involve the removal and disposal of all accessible contaminated soil within the former UST area. While the geography and hydrogeology of the Site would create some technical challenges, this option would be implementable using traditional excavation methods and engineering controls. Removal of soils would be made more complex (and costly) because the limits of contaminated soil extend vertically to below the water table. This would necessitate dewatering of the excavation area to enable excavation of dry soils. Groundwater that is pumped from the excavation would then need to be treated prior to ultimate disposal, either on or off site. Additionally, excavation of soils adjacent to Center Street may require special measures to stabilize the roadway, depending upon the depth and proximity of excavation activities to Center Street.

Monitored natural attenuation would consist of periodic monitoring of groundwater to evaluate temporal variations in contaminant concentrations and geochemical conditions in the aquifer. Typically, monitoring would commence on a quarterly schedule for two or three years, after which time the progress toward cleanup objectives is evaluated. If a downward trend in concentrations can be documented and a

reasonable timeframe for achievement of cleanup goals is anticipated, monitoring frequency could be reduced to semi-annual or annual. Additional monitoring wells may be added to the existing well network to gain a more comprehensive understanding of concentration trends throughout the plume area. All of these measures would be readily implementable using traditional environmental sampling and analytical methods.

***Impacts from Regional Climate Change Projections:*** The Northeast region is projected to see increased temperatures in addition to increase in the magnitude and frequency of heavy precipitation events should changes to regional climate characteristics continue. An increase in heavy precipitation events increases the potential of flooding. The impact to Soil Excavation & Off-Site Disposal with Monitored Natural Attenuation would be minimal in nature, as the groundwater vadose zone naturally increases and decreased based on weather patterns and precipitation events. Groundwater would continue to respond as such even under increased magnitude and frequency. The potential for flooding is also minimal as the Site is not located within or near any identified flood zones within the City.

**Clean-up Alternative C – Soil Excavation & Off-Site Disposal with *In Situ* Groundwater Remediation**
This option would include the excavation and off-site disposal of contaminated soil from the former UST area, as described in Alternative B, but with active treatment of the groundwater plume instead of monitored natural attenuation. Alternative C would include the following activities:

- Excavation and off-site disposal of 1,200 cubic yards of contaminated soil;
- Dewatering of the excavation area and on-site treatment of contaminated groundwater;
- Collection of post-excavation soil samples for laboratory analysis;
- Backfilling of the excavation area with clean soil;
- Advancement of soil borings within the contaminant plume area (along the northern Site boundary and across Center Street) for the purpose of injecting treatment reagents;
- Injection of treatment reagents into the subsurface to promote *in situ* chemical oxidation (ISCO) or *in situ* bioremediation (ISB); and
- Post-injection monitoring of groundwater to evaluate progress toward cleanup.

**Effectiveness:** The effectiveness of this alternative with respect to soil cleanup is identical to Alternative B, which is described above. With respect to groundwater, additional data collection would be required to evaluate which type of *in situ* treatment technology would be most effective given the subsurface conditions at the Site. However, it is likely that at least one of these technologies would be effective to reduce contaminant levels in groundwater to achieve a Permanent Solution. It is also likely that *in situ* treatment would enable a Permanent Solution to be achieved in a shorter timeframe than natural attenuation and could be used as a contingency in the event that monitored natural attenuation does not meet the objectives of the cleanup.

**Implementability:** The implementability of this alternative with respect to soil cleanup is identical to Alternative B, which is described above. With respect to groundwater, *in situ* treatment would be readily implementable from a technical standpoint. *In situ* groundwater treatment technologies are well developed, commercially available and flexible enough to be implemented in an urban setting such as this one. The plume core is present beneath paved driveways and parking areas and therefore accessible to drilling equipment needed to inject treatment reagents into the subsurface. The only potential implementability concern for this option would be the ability to obtain access agreements from adjacent property owners,

since the core of the contaminant plume and therefore the focus of *in situ* treatment efforts, is located beyond the parcel boundaries and on property that is not owned by the City.

***Impacts from Regional Climate Change Projections:*** The Northeast region is projected to see increased temperatures in addition to increase in the magnitude and frequency of heavy precipitation events should changes to regional climate characteristics continue. An increase in heavy precipitation events increases the potential of flooding. The impact to Soil Excavation & Off-Site Disposal with *In Situ* Groundwater Remediation would be minimal in nature, as the groundwater vadose zone naturally increases and decreased based on weather patterns and precipitation events. Groundwater would continue to respond as such even under increased magnitude and frequency. The potential for flooding is also minimal as the Site is not located within or near any identified flood zones within the City.

## ***Cost Estimates for Each Alternative***

**Clean-up Alternative A – Monitored Natural Attenuation**
There would be ***no initial capital costs to implement this option***. Annual groundwater monitoring costs would be approximately $47,000 for quarterly sampling. Groundwater monitoring would be expected to continue for the foreseeable future, since contaminant concentrations are not likely to decrease significantly unless some active soil or groundwater remediation is performed.

**Clean-up Alternative B – Soil Excavation & Off-Site Disposal with Monitored Natural Attenuation**
The estimated capital costs for this alternative would be approximately ***$160,000***. Capital costs would include equipment, labor, and material costs required to excavate, transport, and dispose of contaminated soil within the former UST area; collect soil samples to characterize post-excavation soil concentrations; dewater the excavation during soil removal operations; and backfill the excavation with clean fill. Annual monitoring costs for this option would be approximately $47,000 for quarterly sampling. After two to three years of quarterly sampling, the frequency of monitoring would likely decrease to a semi-annual or annual basis, resulting in a proportional decrease in cost. Under this cleanup option, groundwater monitoring would continue until contaminant concentrations reduced to acceptable levels due to natural processes. Additional data is needed to accurately estimate the cleanup timeframe, but it is likely to be greater than five years.

**Clean-up Alternative C – Soil Excavation & Off-Site Disposal with *In Situ* Groundwater Remediation**
The estimated capital costs for this alternative would be approximately ***$200,000***. Capital costs would include all the costs discussed under Alternative B plus equipment, labor and material costs required to design and install an *in situ* groundwater remediation system (either chemical oxidation or bioremediation, depending upon the findings of future treatability evaluations). Annual monitoring costs for this option would be approximately $47,000 for quarterly sampling. After two to three years of quarterly sampling, the frequency of monitoring would likely decrease to an annual basis, resulting in a proportional decrease in cost. Under this cleanup option, groundwater monitoring would continue until contaminant concentrations reduced to acceptable levels. Additional data is needed to accurately estimate the cleanup timeframe, but it is possible that cleanup goals could be achieved in less than three years.

***Recommended Clean-up Alternative***:
We recommend that Alternative C, Soil Excavation & Off-Site Disposal with In Situ Groundwater Remediation be the selected Clean-up Alternative.

After an initial screening of potential remedial technologies, Nobis identified excavation and offsite disposal as the most effective and permanent cleanup alternative for soils. Soil excavation and off-site disposal is feasible and cost effective for this Site due to the depth and lateral extent of contamination in the former UST area, which are amenable to removal using traditional excavation techniques.

The initial screening of potential remedial technologies for groundwater determined that monitored natural attenuation and *in situ* groundwater treatment would both be effective, implementable and economically feasible alternatives for groundwater cleanup given the concentration levels and lateral extent of the groundwater contaminant plume. However, to minimize the cleanup timeframe and allow for redevelopment as soon as possible, the City would need to move forward with in-situ groundwater remediation.