Adirondack Regional Business Incubator Site
36 Elm Street
City of Glens Falls, New York

Environmental Restoration Project

Remedial Alternatives Report

New York State Assistance
Contract No. C303163
ERP Project No. E557019

May 2008

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects

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1.0 Remedial Alternatives Report

1.1 Introduction

This Remedial Alternatives report accompanies the May 2008 Site Investigation report prepared by Barton & Loguidice, P.C. (B&L) for the 36 Elm Street property in Glens Falls, New York. Specifically, this report reviews the applicable Remedial Alternatives for the 36 Elm Street site, and addresses the area and contaminants of concern identified in the above referenced May 2008 Site Investigation report prepared by B&L. As discussed in the Site Investigation report, following interim remedial measures (IRMs), the remaining contaminants of concern are the semi-volatile organic compounds (SVOCs) detected in subsurface soils at off-site boring location B&L-6. This Remedial Alternatives report addresses the off-site subsurface soil impacts in the southern property corner adjacent to off-site boring location B&L-6.

In this report, specific remedial actions are proposed to address the identified area of concern, and remedial alternatives have been developed and analyzed for:

- Protection of human health and the environment,
- Compliance with NYSDEC Cleanup Objectives,
- Short- and long-term effectiveness,
- Reduction of contaminant toxicity, mobility and volume,
- Feasibility, and
- Community Acceptance.

Although the results of the previously referenced Site Investigation did not identify a significant risk to human or environmental health, remedial alternatives have been evaluated that would further reduce the residual contaminant mass at the Site and off-site, thereby limiting (or eradicating) the potential for a complete contaminant pathway. These remedial alternatives are evaluated against the preferred alternative of the GGFLDC (i.e., No Further Remedial Action).

1.2 Areas and Contaminants of Concern

The Site Investigation identified PAH-impacted subsurface soils at an off-site boring location (B&L-6) near the southern property corner. The subsurface contamination consists of SVOCs [(benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene] indicative of a weathered coal tar source.

1.2.1 Remediation Goals

The GGFLDC purchased the 36 Elm Street property with the intent of renovating the building for use as an incubator facility for privately-owned start-up technology businesses. The incubator will serve as a central location where new companies can lease space and share common facilities in order to save operating costs, and focus on the growth and expansion of their businesses for the benefit of the local and regional economy. Accordingly, the goal for remediation at the property is to allow the GGFLDC to return the Site to productive use as commercial property.

To achieve these goals, the remediation completed at the Site must either meet NYSDEC Part 375 Soil Cleanup Objectives for Commercial Use, or, if the Cleanup Objectives cannot be economically achieved, be evaluated for No Further Remedial Action Status on the basis of potential exposure risk scenarios related to the future Site use.

1.3 General Response Actions

The following section discusses the general response actions that may be used to achieve the remedial objectives described above.

1.3.1 Soil

Source Removal – The excavation of contaminated soils is an effective method to quickly and permanently remove areas of concern from a site. Source removal requires prior delineation of the boundaries of the area of concern, and clearance sampling following removal to verify that all contaminated soil was removed. Costs associated with delineating the boundaries of concern consist of additional subsurface investigation, including drilling, sampling, and laboratory costs. Costs associated with source removal include capital costs for the excavation equipment, disposal costs for the treatment or disposal site, laboratory costs for clearance sampling, and costs for replacement backfill, as well as any costs associated with groundwater control and/or treatment

Capping – The placement of a "cap" above an area of contaminated soil is a remedial method to contain and limit contact with the soil. A cap can be constructed of soil, asphalt pavement, clay, or a synthetic geomembrane. Depending on the material of construction, the cap may shed or limit water infiltration into the area of concern. The majority of the Site area is already capped with pavement and concrete associated with the Site construction and the development of adjoining properties. This remedial strategy, therefore, can be incorporated into the "no further action" alternative.

<u>In-situ Remediation</u> – There are several technologies available to achieve reductions in soil contaminant mass while leaving the subsurface soil in place. These technologies include active phase treatment such as soil vapor extraction, air sparging or dual phase extraction, or passive treatments such as enhanced bioremediation.

Active treatment technologies such as soil vapor extraction are effective at sites exhibiting impacts with volatile organic compounds, but are less successful with SVOCs. The cost of active systems is high; however, remedial timeframes are typically short (1-2 years). However, the Site contaminants are not conducive to in-situ active treatment, and therefore further consideration of this technology is not warranted for the remediation of subsurface soils.

In-situ soil bioremediation is effective when microbial action is enhanced or invigorated through the introduction of limiting substrates to the subsurface environment. Typically, oxygen is the primary limiting substrate within older spill areas. Oxygen enhancement technologies have been available within the remedial marketplace for the past decade. In-situ bioremediation with oxygen enhancement is most effective in the saturated zone. Since the subsurface soil impacts appear to be in the vadose zone, further consideration of this technology will not be conducted for the remediation of subsurface soils.

In situ chemical oxidation involves injecting oxidants directly into contaminated soil and groundwater in order to destroy the contaminants in place. The oxidants react with the contaminants, ultimately producing innocuous substances such as carbon dioxide and water. The oxidants applied in this process are typically hydrogen peroxide (H_2O_2), potassium permanganate ($KMnO_4$), or ozone. The oxidation process proposed to be evaluated as a remedial alternative is known commercially as RegenOx™. This process is a two-part system: a solid alkaline oxidant in powdered form that contains sodium percarbonate (also known as "dry peroxide" and the primary active ingredient in OxyClean), and a liquid catalyst that contains aqueous ferrous sulfate. The oxidizer and catalyst are mixed with water to form slurry that is injected into the contaminated soil. In the subsurface, the combined product produces a surface-mediated oxidation reaction that consumes residual petroleum compounds. This remedial practice works in both the saturated and vadose zone, therefore it will be further evaluated for the subsurface soil impacts near the south property corner.

1.4 <u>Estimation of Areas of Concern</u>

This section reviews the areas of concern and presents the areal or volumetric estimates for the contaminants and media requiring further evaluation.

Subsurface soil SVOC concentrations in excess of NYSDEC Part 375 Soil Cleanup Objectives for Commercial Use were identified at off-site boring location B&L-6, immediately adjacent to the southern property corner. These exceedances were present from 4 to 8 feet below grade. Based on the groundwater flow direction, it is likely that the subsurface impacts extend beyond the boring location. It is assumed that contamination extends approximately twenty (20) feet in all directions from the boring location. Not including the areas below the building, this results in a total affected off-site surface area of approximately 716 square feet.

1.5 Development of Remedial Alternatives

This section proposes the remedial alternatives for the Site. These alternatives are subsequently evaluated against the ERP program criteria. Three remedial alternatives have been evaluated for the subsurface soil impacts located near the south property corner. The remedial alternatives include:

a. Excavation;
b. Chemical Oxidation; and
c. No Further Remedial Action.

Alternative 1 will include removal of contaminated soils within the vadose zone located off-site near the southern property corner. It is assumed that access would be granted for off-site excavation. Inaccessible areas, including below the existing Site building, would not be excavated. It is not anticipated that groundwater management in the area would be necessary due to the depth of groundwater, which is greater than 11 feet below grade. Upon removal of the contaminated soils, the excavation pit would be backfilled with clean soil. The excavation area would be covered with an asphalt or soil cap. Confirmation soil sampling at the edges of the excavation pit and clearance groundwater monitoring would be included in the alternative.

Alternative 2 includes the injection of chemical oxidants. The remediation would take place in-situ and does not require a mechanical treatment system. In order to be effective, the oxidant must come into direct contact with the contamination. Accordingly, repeated injections would likely be required to ensure adequate distribution of the oxidant and catalyst. The presence of contamination solely in the vadose zone makes the dispersion of the oxidant more difficult, but not impractical. Oxidant dispersion is most readily achieved below the water table. Dispersion of the oxidant is more difficult, but can be achieved, in the unsaturated zone. Periodic monitoring would be required to determine if additional oxidant is required to be injected and to monitor contaminant degradation.

Alternative 3 will result in No Further Remedial Action. This alternative does not require any additional remedial actions at the Site. Although residual subsurface soil contaminants were noted above NYSDEC cleanup criteria, the impacted area is localized in nature and natural attenuation processes will continue to reduce the contaminant burden at the Site. In addition, the existing paved Site conditions will continue to limit infiltration and minimize the potential for direct contact with contaminated soil. When considered against the current absence of completed exposure pathways for the contaminants, this Alternative is the most cost-effective.

1.6 Detailed Analysis of Remedial Alternatives

This section evaluates the feasibility and cost-effectiveness of the proposed remedial alternatives developed for the Site. Three remedial alternatives were evaluated to address the residual subsurface soil contamination located near the south property corner. Each alternative is evaluated against the ERP program criteria, including:

- Overall protection of human health and the environment;
- Compliance with standards, criteria and guidance (SCG);
- Short-term effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility and volume;
- Feasibility; and
- Cost-benefit and Community acceptance.

1.6.1 Alternative 1 – Soil Excavation with Off-Site Disposal

Alternative 1 addresses the excavation of unsaturated soils with residual contaminants above the Part 375 Soil Cleanup Criteria for Commercial Use. It is assumed that off-site access will be granted for the purpose of evaluating this alternative. It is also assumed that contaminated soils below the existing building slab, if present, will not be excavated. Based on the site lithology and contaminant concentrations, it is assumed that the excavation area will extend approximately 20 feet from off-site boring location B&L-6, excluding the area below the building. The excavation area, therefore, would result in the removal of soil from an off-site area of approximately 716 square feet, from a depth of 3 to 10 feet below grade. This includes a slight over-excavation of the estimated contaminated zone (4-8 feet below grade). This will result in the removal of 186 cubic yards (286 tons) of additional soil from the off-site area. Figure 9 shows the approximate limits of the proposed excavation area under this alternative.

The actual horizontal and vertical limits of off-site excavation will be defined in the field with instrumentation and field screening techniques. Confirmatory soil samples will be collected from the side walls and excavation pit bottom to verify that the affected soils are removed.

It has been assumed that the soil removal will occur under similar conditions to that encountered during the IRM project. Site constraints would limit benching sidewalls of the excavation, making shoring necessary. Shoring of the excavation would be required adjacent to the on-site building and off-site Off-Track Betting (OTB) and commercial buildings. Following soil excavation, the entire work area would be backfilled with clean materials and capped with asphalt or soil.

The alternative includes two (2) subsequent rounds of groundwater sampling and analysis to monitor the reduction in groundwater contaminant concentrations following the soil removal.

1.6.1.1 Overall Protection of Human Health and the Environment

Based on the Site investigation, the Site does not pose an immediate threat to human health or the environment. Nonetheless, this alternative would remove a significant mass of contaminants from off-site areas adjacent to the Site (at accessible locations), and would therefore decrease soil concentrations in this off-site area to within NYSDEC standards. Portions of the remaining contaminated soil below the building foundation, however, would not be removed under this alternative. This Alternative is protective of human health and the environment, but does not completely eliminate the source material.

1.6.1.2 Compliance with Standards, Criteria and Guidance (SCG)

The removal of the contaminated soil will immediately result in accessible off-site soils meeting Part 375 soil cleanup objectives. Clearance sampling of the excavation sidewalls and bottom will confirm that the objectives are met. With the removal of contaminant mass from the area of concern, the concentrations of contaminants in the groundwater would also be expected to fall, eventually to below groundwater standards. The additional groundwater monitoring proposed as part of this Alternative would confirm compliance with these standards. There is the potential, however, that some contaminated soils would not be removed due to access issues (i.e., contaminants may remain beneath the building slab and below the groundwater table), or that additional off-site sources may be present upgradient of the area of concern. Groundwater contour mapping developed as part of the Site Investigation shows that the off-site remedial area (B&L-6) is cross-gradient from the contamination. The contamination at B&L-6 is likely from an off-site source that may continue to exist upgradient from this area, i.e., in the vicinity of the OTB building (and former auto repair facility). Therefore, it is possible that the off-site B&L-6 area will be re-contaminated from the upgradient source. The presence of a residual source could substantially increase the time it takes for the groundwater concentrations to reach compliance with State standards.

1.6.1.3 Short-Term Effectiveness

This remedial action is of short duration and utilizes standard construction techniques. Since the Alternative would involve open excavation, the Contractor would employ construction barricades and signage to warn and prevent access by the public. Community Air Monitoring Plan (CAMP) requirements would be in effect, monitoring the ambient air for contaminants of concern. The Alternative would impact the Site and adjacent properties on a short-term basis.

Since this alternative includes the removal of the residual off-site contaminated soil, immediate Site improvements are likely. However, the possible continued existence of contaminated soil below the on-site building slab, below the groundwater table and potentially upgradient and off-site, could reduce the overall short-term effectiveness of this option. Reductions in groundwater concentrations following a source removal are expected, although the measurement of the reduction may not immediately be observed.

The field work for this Alternative could be completed within two (2) work weeks. Receipt and analysis of clearance soil sampling data would require approximately one (1) month. Post-closure monitoring would be conducted over two (2) sampling periods representing a total period of six (6) months. The effects of the residual soil contamination below the building foundation could potentially alter closure time frames from short-term to long-term.

1.6.1.4 Long-Term Effectiveness and Permanence

The long-term effectiveness of Alternative 1 is good, assuming all contaminated soils are accessible and no upgradient source is present. The Alternative and the post closure monitoring could be completed within six (6) months of selection. The removal of impacted off-site soils represents a permanent condition for the Site. Following the off-site source removal, groundwater contaminant concentrations at the Site will naturally attenuate and eventually would approach groundwater quality standards. Since the adjacent off-site contaminants would be removed under this Alternative, residual risks would not be present with this Alternative, and following completion of the post-closure monitoring period, no further Site controls would be required. If contaminated soils are present beneath the building slab, below the groundwater table, or in an upgradient, off-site source, however, the Site contaminants have the potential to rebound. This rebound would decrease the effectiveness of this alternative, and potentially significantly increase the remedial timeframe.

1.6.1.5 Reduction of Toxicity, Mobility and Volume

This Alternative will result in the removal of approximately 286 tons of contaminated soils from off-site. Due to the removal of the off-site contaminant mass, limited further mobilization of contaminants into groundwater is expected. Groundwater concentrations have the potential to rebound if contaminated soils below the building foundation, beneath the groundwater table, or in an upgradient, off-site source, if present, are not remediated. The removal of the adjacent off-site contaminants would be permanent. Natural degradation would continue to reduce dissolved phase hydrocarbons in the groundwater, thereby limiting further expansion of a plume at the Site (assuming insignificant contaminant rebound from sub-slab, saturated soils, and off-site sources).

1.6.1.6 Feasibility

The techniques described in this remedial alternative are commonly practiced among remediation contractors. Therefore the implementability of this Alternative at the Site is known. The feasibility for the methods to be employed under this Alternative is high. If all Site contaminants are not removed, including those inaccessible due to existing buildings, the presence of groundwater, or associated with an upgradient, off-site source, the feasibility of this alternative would be questionable.

1.6.1.7 Community Acceptance

Given that the Site is currently vacant, community disruption as part of the remedial practice is not expected. However, the current business operations at buildings adjacent to the Site would be disrupted during the excavation activities. In addition, it would be necessary to obtain permission from the affected property owners to conduct soil excavation and removal activities. The adjacent apartment dwellers would also be inconvenienced during the off-site remedial activities. An increase in truck traffic for the hauling of contaminated soils and clean backfill materials would also have a temporary impact on traffic patterns within the City, but should not be a limiting factor in consideration of this alternative. The public would have an opportunity to discuss these activities in an open forum prior to the commencement of this work if this Alternative were to be selected.

1.6.1.8 Cost-Benefit Analysis

The estimated capital expenditure associated with this alternative is approximately $68,000. With the inclusion of engineering, laboratory, annual operation and maintenance costs, and a 15% contingency, the estimated total for this remedial alternative is approximately $100,000. Since the work involved under this Alternative is intended to permanently remediate the area of contamination, there would be no post-remediation maintenance and operational costs once the work is complete. Post-closure groundwater monitoring is considered part of the Alternative and not a maintenance item. As a result, the relative cost-benefit associated with this Alternative is moderate. This is indicative of the higher capital costs, with the greatest benefit associated with the negligible O&M costs. The potential presence of residual contamination below the building slab and/or the groundwater table, however, leaves some uncertainty as to the effectiveness of this alternative.

Under the present guidelines of the Environmental Restoration Program, up to 90% of the remediation costs would be eligible for reimbursement from the State for on-site activities. Off-site activities would be eligible for up to 100% of the remediation costs. Given the geographic location of the contaminated soil, 100% of the surface area is located off-site and would be eligible for 100% reimbursement. A detailed breakdown of the estimated cost to implement this alternative is presented in Appendix O. Table 2-1 (included as part of section 2.1 – Analysis of Cost-Benefit Relationship) summarizes the estimated capital costs associated with each alternative.

1.6.2 Alternative 2 – In-Situ Chemical Oxidation (ISCO)

In-situ chemical oxidation involves injecting oxidants directly into contaminated soil in order to destroy the contaminants in place. The oxidants react with the contaminants, ultimately producing innocuous substances such as carbon dioxide and water. The ISCO process proposed to be evaluated is known commercially as RegenOx™. This process utilizes sodium percarbonate and a ferrous sulfate liquid catalyst. The oxidizer and catalyst are mixed with water to form a slurry that is injected into the contaminated soil. Site conditions appear favorable for the application of this technology. These Site conditions include:

- The contaminants are located within relatively high permeability, relatively homogeneous sand.
- The naturally-occurring organic content of the subsurface materials present in the area is expected to be low.
- The carbonate content of the subsurface material present in the area is expected to be low.
- Free product has not been observed.

Given these factors, the ISCO process would likely be an effective remedy for the Site. The treatment area would be approximately 900 square feet in area, with an average treatment depth of 3 to 10 feet below grade. Based on manufacturer supplied information, typical degradation rates of SVOCs in vadose zone soils range from 40 to 60%. Assuming a conservative degradation rate of 40% per injection, it would require seven (7) rounds of chemical oxidant injections in a total of 35 injection borings for all site-observed SVOCs to meet Part 375 Standards. Following treatment, clearance soil sampling would be required to confirm that the standards are achieved. Again, the successful final mass degradation assumes no upgradient source that would recontaminate the remediation area.

Estimated Soil Contaminant Reduction (ug/kg, ppb)

Parameter	Part 375	Site Concentration (B&L-6)	Estimated Contaminant loadings following additional injections (assumes 40% reduction)						
			Injection Number						
			1	**2**	**3**	**4**	**5**	**6**	**7**
Benzo(a)anthracene	5600	51000	30600	18360	11016	6610	3966	Concentration below standards	
Benzo(b)fluoranthene	5600	43000	25800	15480	9288	5573	Concentration below standards		
Benzo(a)pyrene	1000	32000	19200	11520	6912	4147	2488	1493	896
Indeno(1,2,3-cd)pyrene	5600	15000	9000	5400	Concentration below standards				
Dibenzo(a,h)anthracene	560	5100	3060	1836	1102	661	397	Concentration below standards	

1.6.2.1 Overall Protection of Human Health and the Environment

This alternative would reduce the residual contaminant burden at the Site, and remove the potential for human or environmental exposure. Successful chemical oxidation provides contaminant destruction, so there would be no residual contamination following successful treatment.

1.6.2.2 Compliance with Standards, Criteria and Guidance (SCG)

Successful in-situ ISCO of the residual subsurface soil contaminants would bring the concentrations of these contaminants below NYSDEC Part 375 Criteria. Compliance with the criteria would be measured by ongoing monitoring during active remediation and confirmatory subsurface soil and groundwater sampling. It is expected that Part 375 Criteria will be met within one year following the initial injection of the chemical oxidants

1.6.2.3 Short-Term Effectiveness

This remedial action is of short to moderate duration, and utilizes a rapid and proven delivery technology. Since the Alternative utilizes small-diameter boring and grout injection techniques, there is no exposure to the subsurface contaminants during the process. In addition, the above grade equipment would consist of several construction vehicles, which would not interfere with the public thoroughfares in the City. The Alternative is not expected to result in short-term impacts to the public.

The field work for each injection period can be completed within one work week. Periodic monitoring would be required to track the effectiveness of the ISCO treatment. It is anticipated that a 12-month timeframe would be required to measure success with this technology.

1.6.2.4 Long-Term Effectiveness and Permanence

The long-term effectiveness of Alternative 2 is good. If successful, the reduction in contaminant burden that would occur within the 12 month remediation period would be permanent. If additional reduction in contaminant loading is required after the first year, then additional ISCO injections could occur. Since successful implementation of the technology destroys SVOCs, achievement of the standards is expected to be final (assuming no up-gradient, off-site source). Following completion of the post-injection monitoring, no further Site controls would be required. Again, there is the potential that additional off-site sources may be present upgradient of the area of concern which could cause a rebound of contamination.

1.6.2.5 Reduction of Toxicity, Mobility and Volume

This Alternative would result in the destruction of subsurface contaminants harbored within a soil volume of approximately 186 cubic yards. Available literature describes the successful reduction of SVOC concentrations under similar conditions as observed at the Site. ISCO destruction of contaminants is permanent.

1.6.2.6 Feasibility

Although a relatively new technology, the techniques described in this remedial alternative are practiced among remediation contractors and should not pose significant implementation issues. Dispersal of the chemical oxidant in the unsaturated zone can be difficult, but this can be overcome by injecting a larger quantity of oxidant at more closely spaced intervals. Minimal surface disruption is required at the Site, and the technology is suitable for use at the Site. ISCO injection can be completed by several available remedial contractors.

1.6.2.7 Community Acceptance

The use of a technology with minimal Site disruption that achieves further reduction in the contaminant loading at the Site would be accepted by the Community. The cost of the technology would be required to be considered against other remedial options and the low-level residual contaminant load at the Site.

1.6.2.8 Cost-Benefit Analysis

With the inclusion of capital costs, engineering, monitoring, laboratory and a 15% contingency the estimated total of this remedial alternative is approximately $187,000 (assuming seven rounds of injections). Since the work involved under this alternative is intended to permanently remediate the zone of contamination, there post-remediation maintenance and operational costs would not be incurred once the work is complete. The relative cost-benefit associated with this Alternative is high due to the limited area requiring remediation. However, under the present guidelines of the ERP Program, a majority of this cost would be eligible for 100% reimbursement from the State because the bulk of the contamination is located off-site, with the remaining costs still eligible for up to 90% reimbursement for the on-site remediation. A detailed breakdown of the estimated cost to implement this Alternative is presented in Appendix O. Table 2-1 summarizes the estimated capital costs associated with each alternative.

1.6.3 Alternative 3 – No Further Remedial Action

This alternative is founded principally on the absence of a current or future theoretical risk to humans and the environment, despite the residual concentrations of subsurface soil contaminants in excess of State soil cleanup guidance criteria. Due to the depth of groundwater and isolation of contaminants in the vadose zone, there are limited potential routes of exposure. The appeal of this alternative is in its obvious cost-effectiveness. In time, the contaminants remaining in the subsurface will undergo further natural attenuation through dispersion, adsorption and bioremediation.

1.6.3.1 Overall Protection of Human Health and the Environment

At present, the Site does not pose an immediate threat to human health or the environment. The baseline risk assessment discussed in the Site Investigation Report did not identify currently completed exposure pathways for the remaining off-site contaminants due to lack of Site development. Over time, this

Alternative would reduce the residual off-site contamination, and further reduce the potential for human or environmental exposure. Since this Alternative does not utilize a technology to enhance reduction in contaminants, their reduction will be solely dependent on natural attenuation processes. Residual off-site contaminants would remain adjacent to the Site for several years.

1.6.3.2 Compliance with Standards, Criteria and Guidance (SCG)

Since there are no actions that will cause an immediate reduction in residual off-site contaminant concentrations, this Alternative will not immediately comply with SCGs regarding soil and groundwater quality. Due to the currently incomplete exposure pathways for the contaminants of concern, strict adherence to the SCGs is not critical in protection of the public and environmental health.

1.6.3.3 Short-Term Effectiveness

This Alternative does not involve a remedial action; therefore there is no effect on the community related to remedial processes. Although there will be no short-term change in the concentration of residual contaminants in the off-site area adjacent to B&L-6, their presence is not causing environmental or public harm. The residual contaminants will continue to degrade with time by natural attenuation mechanisms.

1.6.3.4 Long-Term Effectiveness and Permanence

The time required for the residual off-site contaminants to degrade below NYSDEC criteria is difficult to determine. Based on the concentration of semi-volatile organic compounds remaining adjacent to the Site, a 10 to 20 year window is a reasonable minimum estimate to allow for natural processes to degrade the compounds to below NYSDEC criteria.

Although this Alternative results in a period of continued natural degradation of the off-site contaminants, the residual risk also remains low. This is due to the fact that the off-site contaminants are located from 4 to 8 feet below grade. Other than during Site construction or utility work, during which engineering controls would be employed if the off-site areas of concern are to be disturbed, direct contact with the contaminants will not be a potential exposure pathway.

1.6.3.5 Reduction of Toxicity, Mobility and Volume

This Alternative relies upon natural attenuation processes to achieve a reduction in contaminant volume and is considered potentially viable based on the absence of existing exposure pathways. The mass and concentration of residual contaminants within the off-site area of concern will slowly decrease, but the time involved is much greater than for the other alternatives. Once attenuated, there is no concern for reoccurrence, since the natural attenuation mechanisms result in destruction of the hydrocarbon compounds.

1.6.3.6 Feasibility

A determination of feasibility does not apply to this "No Further Remedial Action" alternative.

1.6.3.7 <u>Community Acceptance</u>

The community acceptance of this alternative is high. This is based on the absence of completed exposure pathways for the off-site contaminants and the economic benefit of this alternative. The public will be given the opportunity to discuss this action in an open forum prior to the final decision on the preferred alternative chosen for the Site.

1.6.3.8 Cost-Benefit Analysis

There would be no capital expenditures associated with this Alternative. Since the Site does not pose an immediate threat to human health or the environment, the practical cost-benefit relationship for this Alternative is very desirable. Table 2-1 summarizes the estimated capital costs associated with each alternative.

2.0 Analysis of Cost-Benefit Relationship

The capital costs associated with each alternative are summarized below in Table 2-1. As shown, with the exception of the "No-Action" alternative, Alternative 1 and 2 represent similar expenditures. Detailed cost estimates are presented in Appendix A.

Table 2-1
Summary of Remedial Alternative Costs

Remedial Alternative	Capital Costs	Operation and Maintenance	Contingency Costs	Total Estimated Costs
Alternative 1 – Soil Excavation	$68,000	$5,000	$27,000	$100,000
Alternative 2 – In-Situ Chemical Oxidation	$126,000	$11,000	$50,000	$187,000
Alternative 3 – "No Further Remedial Action"	$0	$0	$0	$0

Since the Site conditions do not represent an immediate or future threat to human health or the environment, the implementation of _any_ remedial action at the Site does not appear justified for the following reasons:

- The chemical signature of the constituents detected at off-site boring location B&L-6 indicates the presence of weathered coal tar. Historical use of the neighboring property as an automotive repair facility is the likely source of contamination responsible for the detections of residual petroleum-based contaminants at off-site boring location B&L-6. As such, the source of contamination is believed to have originated off-site, the affected area is located off-site, and therefore there is no justification for any remedial action to be taken at the Site.

- Contamination has been identified in unsaturated soils ranging from 4-8 feet below grade. None of the soil boring logs collected indicate the presence of any contamination below a depth of 8 feet. Groundwater is not present until approximately 11 feet below grade.
- Persistent contamination is not present in groundwater. Detected constituents in the groundwater were attributed to the collection of turbid samples and were not considered representative of actual groundwater quality. Even if present in the groundwater in the dissolved phase, these constituents are not considered mobile and would have very limited potential for migration.
- Overlying clean soils are present, minimizing the potential for ingestion or dermal contact.
- Exposure pathways for future on-site utility or construction work can be mitigated with engineering controls.
- There is no significant further migration potential in soil, groundwater, or soil vapor.

Therefore, from a risk assessment and cost-benefit perspective, the "No Further Remedial Action" alternative is recommended as the preferred remedial alternative.

3.0 Summary of Remedial Alternatives Evaluation

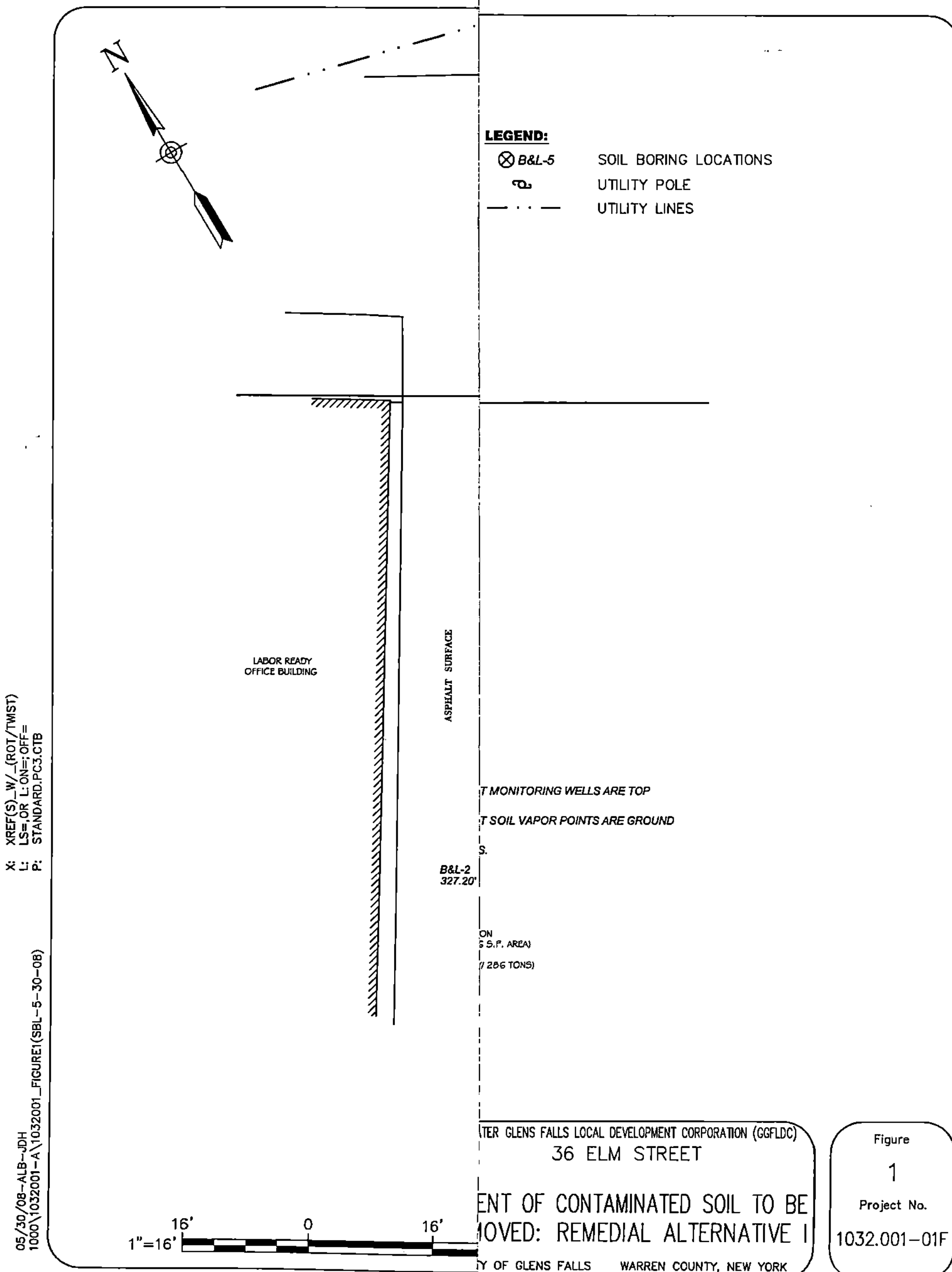
Two (2) remedial alternatives were evaluated to address the remedial objectives at the Site. A third "No Further Remedial Action" alternative was also included, as a baseline for the cost-benefit analysis portion of this evaluation.

Contaminants of concern included SVOCs in the subsurface soil at a single off-site area of concern. Each of the two (2) "action-based" alternatives included technologies aimed at mitigating (or lowering to within acceptable standards) contaminants in the off-site area of concern. The soil excavation and in-situ chemical oxidation alternatives are both anticipated to take between one (1) and two (2) years to meet compliance standards. The total cost for cleanup to compliance standards would be at least $100,000 (much more if the in-situ chemical oxidation method is selected).

A key factor in the analysis of possible remedial alternatives was to determine if the resulting benefit to human health and the environment warranted an additional expenditure of State and GGFLDC costs, with respect to a "No Action" alternative. While each of the two alternatives would effectively reduce off-site contaminant concentrations to within acceptable standards or cleanup guidelines, the absence of completed exposure pathways under current conditions (i.e., an undeveloped site), and the negligible risks associated with future theoretical exposure scenarios indicates that no additional remedial action is warranted at the Site. Therefore, although both of the "action alternatives" are proven technologies that are feasible for employment at the Site, the absence of risk associated with the residual Site contaminants indicates that the "No Further Action" alternative should be selected.

Figure 1

Extent of Contaminated Soil to be Removed: Remedial Alternative I


N
LEGEND:
B&L-5 SOIL BORING LOCATIONS
UTILITY POLE
UTILITY LINES
LABOR READY
OFFICE BUILDING
ASPHALT SURFACE
T MONITORING WELLS ARE TOP
T SOIL VAPOR POINTS ARE GROUND
S.
B&L-2
327.20'
ON
S.F. AREA)
/ 286 TONS)
TER GLENS FALLS LOCAL DEVELOPMENT CORPORATION (GGFLDC)
36 ELM STREET
ENT OF CONTAMINATED SOIL TO BE
OVED: REMEDIAL ALTERNATIVE I
Y OF GLENS FALLS WARREN COUNTY, NEW YORK
Figure
1
Project No.
1032.001-01F
16' 0 16'
1"=16'
X: XREF(S)_W/_(ROT/TWIST)
L: LS=,OR L:ON=;OFF=
P: STANDARD.PC3.CTB
05/30/08-ALB-JDH
1000\1032001-A\1032001_FIGURE1(SBL-5-30-08)

Appendix A

Remedial Alternative Cost Estimates

ALTERNATIVE 1 COST ESTIMATE

"Soil Excavation & Removal with Confirmatory Groundwater Monitoring"
Greater Glens Falls Local Development Corporation - Environmental Restoration Project
Site Investigation/Remedial Alternatives Report

Item	Unit cost	Unit	Quantity	Cost
Site Prep				
Mobilization	$1,000.00	ls	1	$1,000
Saw cut pavement	$2.50	lf	130	$325
Excavation				
Hydraulic Excavator (1.5 cy bucket)	$3,500.00	week	1	$3,500
Excavation of clean materials	$12.00	cy	80	$960
Contaminated Soil Excavation Transport and Disposal	$70.00	ton	286	$20,020
Excavation Stabilization (Sheet Piling Shoring)				
36 Elm Street (13' 12')	$14.00	sf	156	$2,184
OTB (24' x 12')	$14.00	sf	286	$4,004
2-3 Brace Frame	$30,000.00	LS	1	$30,000
Restoration				
Backfill Materials	$8.00	cy	286	$2,288
Backfill Compaction (Vibratory Plate)	$1.66	cy	286	$475
Density Testing (nuclear method)	$39.00	ea	10	$390
Paving restoration	$26.00	sy	27	$702
Sampling				
EPA Method 8270 (SVOCs) - includes all QA/QC	$250.00	sample	8	$2,000
Subtotal:				$67,848
ANNUAL OPERATIONAL & MAINTENANCE COSTS				
Groundwater Monitoring				
Sampling	$1,082.90	round	2	$2,165.80
Laboratory Services	$800	round	2	$1,600.00
Annual Report	$1,383.00	lump sum	1	$1,383.00
Rounded Subtotal:				$5,149
			Subtotal (without O&M)	$67,848
			Annual O&M	$5,149
			Engineering (20% w/o O&M)	$13,570
			Contingency (15%)	$12,985
			Total Estimated Costs	**$99,551**

Barton & Loguidice, P.C.
Consulting Engineers

ALTERNATIVE II COST ESTIMATE

"Chemical Oxidation with Pavement Capping"
Greater Glens Falls Local Development Corporation - 36 Elm Street
Site Investigation/Remedial Alternatives Report

Item	Unit cost	Unit	Quantity	Cost
Oxidant and Activator Injection (Assume 7 Rounds)				
Round 1 (22 lb/ft)				
Injection of 10,780 lbs oxidant/activator (inc s/h)	$2.50	lb	5,390	$13,475
Direct Push Contractor	$2,200.00	day	5	$11,000
Field Oversight	$800.00	day	5	$4,000
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Round 2 (15 lb/ft)				
Injection of 8,085 lbs oxidant/activator (inc s/h)	$2.50	lb	3,675	$9,188
Direct Push Contractor	$2,200.00	day	3	$6,600
Field Oversight	$800.00	day	3	$2,400
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Round 3 (15 lb/ft)				
Injection of 8,085 lbs oxidant/activator (inc s/h)	$2.50	lb	3,675	$9,188
Direct Push Contractor	$2,200.00	day	3	$6,600
Field Oversight	$800.00	day	3	$2,400
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Round 4 (10 lb/ft)				
Injection of 2,100 lbs oxidant/activator (inc s/h)	$2.50	lb	1,400	$3,500
Direct Push Contractor	$2,200.00	day	1	$2,200
Field Oversight	$800.00	day	1	$800
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Round 5 (10 lb/ft)				
Injection of 2,100 lbs oxidant/activator (inc s/h)	$2.50	lb	1,400	$3,500
Direct Push Contractor	$2,200.00	day	1	$2,200
Field Oversight	$800.00	day	1	$800
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Round 6 (10 lb/ft)				
Injection of 2,100 lbs oxidant/activator (inc s/h)	$2.50	lb	1,400	$3,500
Direct Push Contractor	$2,200.00	day	1	$2,200
Field Oversight	$800.00	day	1	$800
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Round 7 (10 lb/ft)				
Injection of 2,100 lbs oxidant/activator (inc s/h)	$2.50	lb	1,400	$3,500
Direct Push Contractor	$2,200.00	day	1	$2,200
Field Oversight	$800.00	day	1	$800
Biweekly Post-Injection Field Monitoring	$650.00	round	3	$1,950
Post-Injection Sampling (3 wells)	$700.00	round	1	$700
Laboratory (8270, metals, TOD, field parameters)	$450.00	sample	3	$1,350
Off-Site Storage of Oxidant	$5,000.00	ea	1	$5,000
Injection Subtotal				*$123,850*
Site Restoration				
Site Restoration Subtotal:				*$2,000*
ANNUAL OPERATIONAL & MAINTENANCE COSTS				
Groundwater Monitoring (Perimeter Wells)				
Sampling	$700.00	round	4	$2,800.00
Laboratory Services	$1,400	round	4	$5,600.00
Semi-annual Report	$1,383.00	lump sum	2	$2,766.00
Annual Monitoring Subtotal				*$11,166.00*
			Subtotal (without O&M)	$125,850
			Annual O&M	$11,166
			Engineering (20% w/o O&M)	$25,170
			Contingency (15%)	$24,328
			Total Estimated Costs	**$186,514**

Injections are @ 22 lb/ft, 15 lb/ft and
Assumed injection interval is 5' (3-10 fbg)
Assumed 10 ft ROI