ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES

USEPA Brownfield Grant Cleanup Project
62 – 64 Scio Street
Rochester, New York

USEPA Assistance ID No. BF97219700

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Prepared By: City of Rochester
Department of Environmental Services
Division of Environmental Quality
City Hall, Room 300B
30 Church Street
Rochester, New York 14614

1.0 INTRODUCTION

In accordance with the May 2005 Brownfield Grant Cleanup Work Plan prepared by the City of Rochester (City) and approved by the United States Environmental Protection Agency (EPA), the City has developed this Analysis of Brownfields Cleanup Alternatives (ABCA) report for the property located at 62-64 Scio Street (Site), Rochester, New York (Figure 1).

The cleanup of the Site includes the development and implementation of a Corrective Action Plan (CAP) to remediate the petroleum contamination attributed to former on-site petroleum underground storage tanks (USTs). The remedial measures in the CAP will be consistent with the proposed future use of the Site, and may need to be tailored to a Site-specific detailed redevelopment plan if one is identified by the City during the course of the Project. All cleanup activities will be performed under a Stipulation Agreement between the City and the New York State Department of Environmental Conservation (NYSDEC). The cleanup will be performed under the oversight of the NYSDEC Region 8 petroleum spills program. Mr. Michael Zamiarski is the anticipated Project Manager for NYSDEC Region 8.

In preparing the ABCA, the City considered subsurface conditions and environmental factors, various site characteristics, surrounding properties, land use restrictions, potential future uses of the Scio Street property, and cleanup goals. The City also reviewed the following environmental reports and documents:

- Rizzo Associates Inc. Preliminary Site Assessment Update/Limited Subsurface Investigation Report, dated May 1993.
- DAY Environmental Inc. (DAY) Phase I Environmental Site Assessment Report, dated May 1995.
- DAY Environmental Inc. (DAY) Phase II Environmental Site Assessment Report, dated August 1995.
- DAY Underground Storage Tank Closure and Limited Subsurface Study Report, dated December 2006.
- DAY Data Package Limited Groundwater Study Report dated June 2007.
- Lu Engineers Phase I Environmental Site Assessment Report, dated October 2009.

The City's ABCA report includes information regarding:

- Information about characteristics of the Scio Street property (Site) and the contamination previously documented on the Site (e.g., identification of contaminants, potential exposure pathways, sources of contamination, applicable or relevant and appropriate laws or standards, etc.);

- Information and analysis of several potential cleanup alternatives considered for remediating the Site, including "No-Action" as an alternative;

- A discussion of the proposed scope and factors considered in evaluating and selecting a recommended cleanup method (long and short-term effectiveness, implementability, duration, estimated costs, etc.).

- Determination whether land use restrictions, controls, or limitations (e.g., institutional controls, engineering controls) will be required.

2.0 BACKGROUND

The property, located at 62-64 Scio Street (Site), is owned by the City and is zoned as vacant commercial land measuring approximately 0.25 acres (Figure 2).

2.1 Site Land Use History

The Site is located in the City's desirable East End District. A 22,000 square foot, two-story, brick building was built in approximately 1920. The building was mainly used as a warehouse from the date of construction, until approximately 1990. The City took ownership of the property in 1996, and the building was demolished in November 2002. The Site has remained vacant since demolition.

Detailed development plans for the Site have not been prepared yet. Adjacent properties are used for a combination of commercial and residential development, including the successful Chevy Place apartment and townhouse development located directly across from the Site. It is anticipated that the redevelopment of the Site will include both green space and/or recreational space with a potential for mixed use, restricted residential or commercial expansion. Future uses may include bike parking and an access corridor from Matthews to Scio Street, which may potentially involve a paved walking trail, landscaped areas and bike parking facilities. At the current time the City is not partnering with any other public or private parties to facilitate the cleanup of the Site.

2.2 Environmental Conditions

A Phase I Environmental Site Assessments (ESAs) was completed at the 62-64 Scio Street Site in May 1995 and also in October 2010. The Phase I ESAs identified recognized environmental conditions at the Site due the presence of former petroleum underground storage tanks (USTs) which resulted in subsurface soil and groundwater petroleum contamination at the Site.

An abandoned UST suspected of containing fuel oil was removed from the northeastern portion of the Site after the building was demolished in 2002. In January of 2003, an abandoned 5,000 gallon UST was excavated and removed from the Site following building demolition. This tank was used for gasoline storage and at the time of removal contained a mixture of gasoline and oil. Petroleum contaminated soil was observed beneath the removed UST and a soil sample was obtained from the bottom of the excavation for analytical testing. Analytical testing results indicated the presence of various gasoline constituents and the NYSDEC was notified and spill file #0270542 was opened for the Site. In May of 2004 a groundwater monitoring well was installed adjacent to the former UST location and a groundwater sample collected from the well showed numerous gasoline related volatile organic compounds (VOCs) including benzene, ethylbenzene, toluene, xylenes above NYSDEC groundwater quality standards. No semi-VOCs, chlorinated VOCs or PCBs were reported above laboratory detection limits.

A second abandoned 2,000-gallon UST suspected of containing gasoline was determined to be located on the southeast portion of the Site. The 2,000-gallon UST was permanently closed in accordance with applicable regulations and was found to be in poor condition. During the UST removal, petroleum-impacted soil was observed below and adjacent to the UST and 30.27 tons of grossly contaminated soil was removed from the tank excavation and disposed of off-site at a permitted landfill. Upon observation of impacted materials, a City of representative notified the NYSDEC, and the NYSDEC generated Spill File #0650898 for the Site.

Subsequent to the permanent closure of the two USTs, a subsurface investigation was completed to evaluate subsurface conditions at the Site, including the areas around the two former UST locations. A total of 14 test borings were advanced on the Site using direct-push drilling equipment on October 26, 2006. The test borings were advanced to depths between approximately 9.0 feet and 14.0 feet below the existing ground surface when equipment refusal, presumed to be the top of bedrock, was encountered. Indigenous soils generally consisting of sandy silts, clayey silts, and silty sands were encountered beneath the fill materials in each of the test borings advanced during this study. Peak PID readings in the test borings advanced during this study ranged from 0.0 ppm (i.e., TB-4, TB-5, and TB-6) to 1,848 ppm (i.e., TB-2). Nine of the fourteen test borings had PID readings exceeding 1,000 ppm, and petroleum-type odors and/or staining were noted on soils from most of the test borings. With the exception of acetone (generally used as a solvent) in two of the samples, laboratory testing of soil samples detected VOCs generally associated with petroleum products. The concentration of one or more VOC detected in each of the five soil samples exceeded their respective NYSDEC TAGM 4046 Recommended Soil Cleanup Objectives (RSCOs).

In general, petroleum-impacted soils are present on the eastern half of the Site encompassing an area of approximately 5,000 square feet and generally present at depths ranging from 8 to 12 feet below grade. The average thickness of petroleum contaminated soil over the eastern portion of the Site appears to be approximately two feet.

Two additional bedrock interface groundwater wells were installed at the Site in 2007 to further evaluate groundwater quality and the groundwater flow direction at the Site. Groundwater sampling and analysis from well MW-3 documented one area of relatively high VOC contaminated groundwater in the southeastern corner of the Site in relatively close proximity to the former gasoline UST. Total VOCs detected in well MW-3 were 11,019 µg/L (ppb) and benzene was detected at 1,660 µg/L in this well (NYSDEC groundwater standard = 1.0 µg/L). A second monitoring well (MW-2) installed approximately 95 feet west of MW-3 did not contain any detectable VOCs, indicating the areal extent of VOC-contaminated groundwater appears defined in the southwestern direction.

Soil and groundwater characterization tables from previous environmental studies are included in Appendix A and Appendix B, respectively.

2.3 Proposed Future Use of Site & Adjoining Properties

It is anticipated that the redevelopment of the Site will include both green space and/or recreational space with a potential for mixed use, restricted residential or commercial expansion. Future uses may include bike parking and an access corridor from Matthews to Scio Street, which may potentially involve a paved walking trail, landscaped areas and bike parking facilities. At the current time the City is not partnering with any other public or private parties to facilitate the cleanup of the Site.

3.0 ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES (ABCA)

Since petroleum is the primary contaminant of concern at the Site, and since metals in soil and fill can be properly managed via soil management plans and through the use of environmental institutional and engineering controls, the ABCA report focuses on the cleanup of the petroleum-contaminated soil and groundwater. This ABCA report was prepared by City of Rochester Division of Environmental Quality (DEQ) staff. The ABCA report evaluated exposure pathways, Applicable or Relevant and Appropriate Requirements (ARARs), and provided an analysis of the following four potential cleanup alternatives:

- Alternative #1 - No Action
- Alternative #2 - Soil Removal and Off-site Disposal
- Alternative #3 – Alternative #2 and In-Situ Groundwater Treatment Through Direct Oxygen Injection
- Alternative #4 - In-Situ Air Sparging and Soil Vapor Extraction

For each of the four alternatives listed above, a soil management plan and environmental institutional and engineering controls are assumed to be implemented as part of the selected cleanup alternative.

3.1 Exposure Pathways

The Site currently consists of a single unimproved parcel zoned as vacant commercial land with a lot size of approximately 55 ft x 200 ft (~0.25 acres). The primary source of contamination is petroleum contaminated soil and groundwater associated with the former petroleum USTs. The resulting secondary sources of contamination are also present at the Site:

- Dissolved Phase Groundwater Contamination
- Contaminated Soil Gas Vapors and Odors

Potential transport mechanisms at the Site include:

- Wind and Atmospheric Dispersion
- Volatilization to Enclosed Spaces (e.g., indoor air entering future on-site buildings)

- Leaching of Contaminants to Groundwater and Transport/Migration via Groundwater

Complete or potentially complete exposure pathways and routes of exposure at the Site include:

- Soil via dermal contact or ingestion, including direct contact during the remedial work
- Air via inhalation of vapors or particulates from soil or groundwater
- Groundwater via dermal contact during the cleanup

Currently the Site contains an unimproved lot and does not contain any buildings or structures. Based on the Site's current land use, potential receptors include utility or construction workers performing excavations for subsurface work at the Site. If the Site is developed in the future, future potential receptors include construction workers, utility workers, and depending upon the final redevelopment potential commercial and/or residential users of the Site.

Given the Site's current use as an unimproved lot, dermal contact with contaminated sub-surface soils and volatilization to indoor air are not considered completed exposure pathways. Since the Site is in an urban setting and potable water at the Site and adjacent properties is provided by the City's municipal water supply, it is not anticipated that ingestion of groundwater is a completed exposure pathway. The potential exposure pathways and routes of exposure identified above can be mitigated and properly managed during the remedial work through the use of a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP), which will be designed to protect and prevent exposures to Site workers and the public.

3.2 Applicable or Relevant and Appropriate Requirements (ARARs)

The proposed or anticipated Applicable or Relevant and Appropriate Requirements (ARARs) for the Site are identified below:

Soil ARARs: Generally, impacted soil will be remediated to the Recommended Soil Cleanup Objectives (RSCOs) referenced in the NYSDEC CP-51 / Soil Cleanup Guidance document (effective December 3, 2010). Impacted soil or fill containing contaminants above RSCOs that are left in-place will be managed with a Site Management Plan (SMP) for potential future disturbances (e.g., utility repair work), and with environmental engineering and institutional controls (e.g., flagging the Site in the City's Building Information System).

Groundwater ARARs: Contamination in groundwater will be evaluated using NYSDEC *Technical and Operational Guidance Series 1.1.1: Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (TOGS 1.1.1) dated June 1998.

Soil Gas Vapors ARARs: Evaluation of post-remedial soil gas sampling results will be based on provisions set forth in the Human Health Risk Assessment guidelines outlined in NYSDEC DER-10 and/or the New York State Department of Health (NYSDOH) *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* dated October 2006.

4.0 ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

The ABCA focuses on remediation of petroleum-impacted soil and groundwater present at the Site. The cleanup alternatives for the Site evaluated the City in the screening process included:

- Alternative #1 - No Action
- Alternative #2 - Soil Removal and Off-site Disposal
- Alternative #3 - Alternative #2 and In-Situ Groundwater Treatment Through Direct Oxygen Injection
- Alternative #4 - In-Situ Air Sparging and Soil Vapor Extraction

For each of the four alternatives identified above, the proposed cleanup remedy assumes a vapor barrier and venting systems will be required for any new buildings constructed on the Site. Also, the proposed remedy will include development and implementation of an environmental soil management plan in order to manage potential future disturbances of residual contamination left in-place.

In order to evaluate the effectiveness of remedial alternatives for this Site, the following general and site-specific remediation criteria (i.e., threshold criteria) were developed in accordance with the provisions set forth in DER-10. The first two evaluation criteria listed below are threshold criteria and must be satisfied in order for an alternative to be considered for selection. The subsequent evaluation criteria are primary balancing criteria which are used to compare the positive and negative aspects of each remedial alternative that first meets the threshold criteria:

- Protection of Human Health and the Environment: This criterion is an evaluation of the remedy's ability to protect public health and the environment, and assesses how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, engineering controls or institutional controls. The remedy's ability to achieve each of the RAOs is evaluated.
- Compliance with Standards, Criteria and Guidance Values: Compliance with SCG values addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance.
- Long-Term Effectiveness and Permanence: This criterion evaluates the long-term effectiveness of the remedy after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated:
    - Whether residual contamination will pose significant threats, exposure pathways, or risks to the community and environment;
    - The adequacy of the engineering and institutional controls intended to limit the risk;
    - The reliability of these controls; and,
    - The ability of the remedy to continue to meet RAOs in the future.

- Reduction of Toxicity, Mobility and Volume: The remedy's ability to reduce the toxicity, mobility or volume of site contamination is evaluated. Preference is given to remedies that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the Site.
- Short-Term Impacts and Effectiveness: The potential short-term adverse impacts and risks of the remedy upon the community, the workers and the environment during its construction and/or its implementation are evaluated. This includes identification of short-term adverse impacts and health risks, the effectiveness of any engineering controls, and the length of time needed to achieve the remedial objectives.
- Implementability: The technical and administrative feasibility of implementing the remedy is evaluated. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. Administrative feasibility includes the availability of the necessary personnel and material, the evaluation of potential difficulties in obtaining specific operating approvals, access for construction, etc.
- Land Use: This criterion is intended to evaluate the remedial alternatives in relation to the planned future use of the Site.
- Cost: Capital, operation, maintenance and monitoring costs are estimated for the remedy and presented on a present worth basis.
- Community Acceptance: This criterion is intended to select a remedial alternative that is acceptable to the community. The public's comments, concerns and overall perception of the remedy are later addressed through the Citizen Participation Plan (CPP) that was developed under the NYSDEC ERP. The CPP provides a mechanism for the public to review and comment on project documents as the project progresses. As such, community acceptance is not discussed in this report.

Listed below is a summary of each of the four alternatives evaluated. Cost estimate tables for each of the four approaches are included in Appendix C.

4.1 Cleanup Alternative #1 - No Action

The No Action alternative does not include any active remedial actions, and leaves the Site in its current condition. This alternative does not significantly reduce toxicity, mobility or volume of contamination, would not meet ARARs, and therefore would not be protective of the environmental or human health if the Site is disturbed or redeveloped. Under this alternative, some limited natural attenuation of contamination may occur in portions of the Site to reduce contaminant concentrations over very long periods of time; however, the timeframe, degree and extent of natural attenuation would be unknown and difficult to quantify.

Under this alternative, any redevelopment of the Site would encounter contamination above ARARs, and thus have the potential to expose construction workers and the public to contaminants. If remedial actions and/or institutional and engineering controls are not developed and properly implemented, potential migration of contaminants off-site may occur under this alternative. Therefore, while the No Action alternative is the least costly alternative, it does not appear to be protective of human health or the environment, will not meet ARARs, and will limit

or restrict redevelopment and use of the Site. The estimated cost range to implement this alternative is $0.

4.2 Cleanup Alternative #2 - Soil Removal and Off-site Disposal

The Soil Removal and Disposal alternative includes the excavation of petroleum impacted soil and fill materials present between an average depths of 8 to 12 feet below ground surface (bgs) from an area encompassing approximately 5,000 square feet (Primary Source Area). The average thickness of the impacted soil over the eastern portion of the Site is two (2) feet. Approximately 1,000 to 1,500 tons of petroleum-impacted soil will be removed from the Site and disposed of off-Site at a permitted landfill. Due to the relatively small size of the Site and close proximity of off-site receptors, on-site treatment of contaminated soil was determined to be impractical and cost prohibitive. If groundwater is encountered during soil removal activities, dewatering of the excavation will be conducted as necessary, which would assist in remediating contaminated groundwater in the Primary Source area. Post-removal confirmatory soil samples would be collected in order to ensure that the soil removal has adequately meet ARARs, and to evaluate concentrations of contaminants left in-place. During the soil removal work, air monitoring would be performed as specified in a HASP and a CAMP to ensure that off-site receptors will not be impacted by vapors, odors, or particulates.

Under this alternative, the removal of the primary source of contamination leaching to groundwater should result in a significant improvement in groundwater quality. However, limitations to the extent of full excavation of the Primary Source Area are encountered at the eastern, northern and southern property borders where public right-of-way and adjacent property surface parking lots' integrity could be potentially compromised. It is also possible that contamination may exist beneath these areas that would not be addressed by this alternative.

After the removal of the primary source area, monitoring of Site groundwater will be conducted in order to evaluate and track trends in groundwater quality over time. This alternative includes the installation of several groundwater monitoring wells and four rounds of sampling over a period of one year. Based on the laboratory results of the post source removal groundwater sampling, groundwater remediation may be recommended. Residual soil vapor intrusion issues would also need to be controlled with the installation of a sub-slab depressurization system (SSDS) or equivalent engineering control.

Excavation and Off-site Disposal is a well-established cleanup alternative for petroleum-impacted soils. This alternative is easily implemented, permanently removes the greatest amount of contaminant volume and mass, reduces toxicity and mobility of contaminants, can be completed in a relatively short period of time, and is cost competitive with other remedial alternatives. However, the physical limitations of the Site, specifically, the proximity of neighboring properties and right-of-way, necessitates incomplete removal of source area soils that could continue to impact groundwater and soil vapor at the Site and surrounding properties in the future. Total costs for the Excavation and Off-site Disposal alternative are estimated to be approximately $155,000. Additional costs for installation, operation and maintenance of a SSDS could range from $50,000. The estimated cost range to implement this alternative is approximately $205,000.

4.3 Cleanup Alternative #3 – Alternative #2 and In-Situ Groundwater Treatment Through Direct Oxygen Injection

The Soil Removal and Off-Site Disposal (Alternative #2) with Oxygen Injection alternative includes all activities described in Alternative #2. Subsequent to source area soil removal, a direct Oxygen Injection system would be designed, based on post-source removal groundwater quality sampling and analysis, and installed to treat approximately 5,000 square feet of the Site saturated zone. The Oxygen Injection system can be designed to remediate groundwater present in both the overburden and within the upper 5 feet of bedrock. Since dissolved phase oxygen can be dispersed via molecular diffusion as well as groundwater advection, the Oxygen Injection system can also be designed to remediate contaminated groundwater near property lines, acting as an effective bioremediation barrier to address contaminated groundwater that may be migrating off-site. The injection of pure oxygen into groundwater using oxygen generators is a patented groundwater remediation process (US. Patent No. 5,874,001) developed by Matrix Environmental. Oxygen injection rapidly enhances the biodegradation of organic contaminants such as petroleum hydrocarbons and most chlorinated solvents that are biodegradable under aerobic conditions. The O2 injection method does not require groundwater extraction and/ or off-site treatment and disposal and does not generate any vapors or odors. It is a proven remediation technique for Sites in which physical remediation processes are not practical or efficient. The estimated cost range to implement this alternative is approximately $230,000.

This process is a proven remedial option, is easily implemented, permanently removes the greatest amount of contaminant volume and mass, reduces toxicity and mobility of contaminants, and is cost competitive with other remedial alternatives. This Alternative is protective of human health and the environment, but would require a longer timeframe than Alternative #2 (Soil Removal and Disposal). However, continued use of the property as a surface parking lot would be possible while the Oxygen Injection system is operating. Access to the Site would be required for periodic operation, maintenance and monitoring throughout the cleanup process, which may impede or limit other redevelopment options during the groundwater treatment period, which may be one to two years.

4.4 Cleanup Alternative #4 - In-Situ Air Sparging and Soil Vapor Extraction

The In-Situ Air Sparging and Soil Vapor Extraction (AS/SVE) alternative is a proven cleanup alterative used at petroleum-contaminated sites to remediate soil, and to a lesser degree, groundwater impacted with petroleum contamination. This alternative involves the construction of an air sparging system to inject atmospheric air under pressure to volatilize or strip volatile organic compounds (VOCs) present in petroleum-contaminated soil. The soil vapor extraction system SVE system contains a series of perforated pipes connected to a blower and operating under a vacuum to collect or extract the VOCs and vapors from the contaminated subsurface media. The system would consist of a series of air injection and vapor extraction wells throughout the petroleum-impacted area and would be operated for approximately five years until asymptotic conditions are documented. Monitoring of the groundwater would be conducted in order to evaluate the effects of the remedial work on the concentrations of contaminants in the groundwater. The estimated cost range to implement this alternative is approximately $260,000.

Several factors would limit the applicability, effectiveness, and desirability of this alterative at the Site. Site soils contain relatively low permeability glacial till and some of the contamination is present in or near the saturated zone. These conditions will likely limit the overall effectiveness of AS/SVE process (i.e., reduction in the radius of influence) and may not result in a decrease in leaching of contamination to groundwater. Heterogeneous fill materials at the Site (i.e., fill materials/debris, potential former building basements, etc.) may lead to channeling of the AS/SVE (i.e., preferential pathways), which may result in contamination left in-place that will not meet ARARs. SVE systems require the discharge or emission of VOCs to atmospheric air, which can produce nuisance odors and noise from the SVE equipment. Some SVE systems require costly treatment of emissions prior to discharge. This process would require a longer timeframe than Alternative #2 and Alternative #3.

Redevelopment of the property would be possible while the AS/SVE system is operating; however, redevelopment would be limited in certain areas since the AS/SVE system requires an underground piping network, a small building or sheds to house the working components of the AS/SVE system. Access to the Site would be required for periodic operation, maintenance and monitoring throughout the cleanup process, which may impede or limit redevelopment options.

5.0 RECOMMENDED CLEANUP ALTERNATIVE

Table 5.1 details a comparison of the four (4) proposed remedial alternative approaches.

Remediation Criteria	**Alternative #1 (No Action)**	**Alternative #2 (Impacted Soil Removal)**	**Alternative #3 (Impacted Soil Removal & GW Remediation)**	**Alternative #4 (Air Sparging and Soil Vapor Extraction)**
Implementability	Easy	Easy	Moderate	Difficult
Short Term Impacts & Effectiveness	Impacts – No Effectiveness - No	Impacts – Yes Effectiveness - No	Impacts – Yes Effectiveness - Yes	Impacts – No Effectiveness - Yes
Long Term Effectiveness & Permanence	No	No	Yes	Yes
Reduction of Toxicity, mobility and volume	No	Some	Yes	Yes
Compliance with ARARs	No	No	Yes	Yes
Protection of Human Health and the Environment	No	Yes	Yes	Yes
Acceptable for Planned Future Use	No	No	Yes	No
Estimated Cost	$0	$205,000	$230,000	$260,000

Alternative #1 (No Action) will not remediate contamination at the Site, will not meet ARARs, and will limit or prohibit redevelopment activities.

Alternative #2 (Soil Removal and Off-Site Disposal) is a proven remedial option and is protective of human health and the environment. This alternative permanently removes the greatest amount of contaminant mass and volume, which in turn will immediately reduce contaminant toxicity and mobility. Soil Excavation and Disposal can be implemented in a relatively short period of time which will facilitate the timely redevelopment and reuse of the Site. The Removal and Off-site Disposal alternative effectively physically removes the primary source of contamination leaching to groundwater, and will ultimately assist in attenuation of contaminants in groundwater, and has the greatest potential to meet both soil and groundwater ARARs. However, the physical limitations of the Site, specifically, the proximity of neighboring improved surface lots and the public right-of-way, necessitates incomplete removal of source area soils that could continue to impact groundwater and soil vapor at the Site and surrounding properties in the future.

Alternative #4 (In-Situ Air Sparging and Soil Vapor Extraction) does not include the excavation and removal of grossly contaminated soils and instead employs a combination of In-Situ Air Sparging and Soil Vapor Extraction (AS/SVE). While this alternative is a proven remedial option, protective of human health and the environment, the effectiveness of the option may be limited by subsurface and/or other physical Site conditions. In addition, this alternative requires a longer timeframe than the Soil Removal and Disposal Alternative or the Soil Removal and Disposal and In-Situ Groundwater Treatment Through Direct Oxygen Injection Alternative and may greatly increase the risk of soil vapor intrusion impacts at the neighboring buildings. The effectiveness of the option to degrade source area contamination in the saturated zone may be limited, potentially leaving portions of the Primary Source untreated, resulting in pockets of contamination left in-place. The uncertainty of the effectiveness of Alternative #4 could necessitate that additional remedial measures be completed increasing the final cost of Site remediation.

In conclusion, based on the location and extent of contamination, the remedial objectives and the intended future use of the Site, Alternative #3 – consisting of Alternative #2 (Soil Removal and Off-site Disposal) and In-Situ Groundwater Treatment Through Direct Oxygen Injection is recommended.

Soil removal and off-site disposal is a proven remedial alternative that can immediately and permanently removed significant contaminant mass and volume, and can effectively remove petroleum-contaminated soils present in the unsaturated zone leaching to groundwater. Oxygen injection is a proven remedial alternative documented to rapidly enhance the biodegradation of organic contaminants such as petroleum hydrocarbons that are biodegradable under aerobic conditions. The system produces oxygen at purity up to 95%, which is injected at low pressure to disperse oxygen into the formation without causing contaminant volatilization and does not require the pumping or evacuation of groundwater. The primary mechanisms of oxygen transport are advection and dispersion, the same mechanisms that facilitated contaminant migration. Oxygen injection is suitable for shallow groundwater conditions since there is no generation of hazardous vapors or the need for vapor control, and does not require the disposal of contaminated groundwater. Alternative #3 reduces toxicity, mobility and volume of contamination, should meet ARARs, and therefore would be protective of the environmental or human health

FIGURES

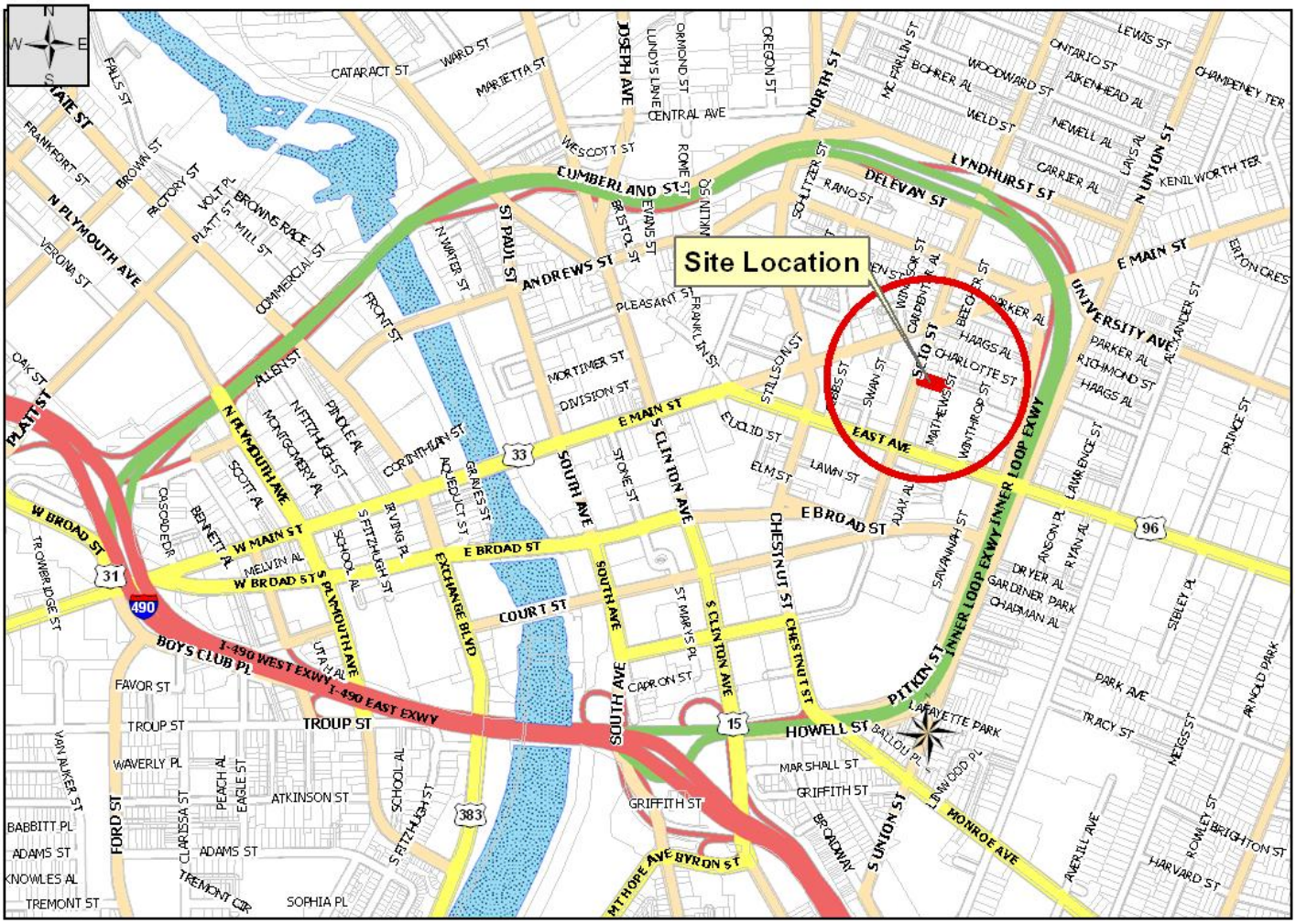

Figure 1 - Site Location Map - 62-64 Scio Street, Rochester, New York

62-64 Scio Street Site
Test Boring and Monitoring Well Locations

62-64 Scio Street Site
Potential Source Removal Area

APPENDIX A

SOIL CHARACTERISTICS DATA TABLES

TABLE 1

62-64 SCIO STREET
ROCHESTER, NEW YORK

SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS (VOCS)
AND NAPHTHALENE
IN UG/KG or PARTS PER BILLION (PPB)

SOIL SAMPLES

DETECTED VOCS	SAMPLE AND LOCATION						TAGM 4046 RSCO[1] (PPB)	BCP SCO[2] (PPB)
	3869-TK1 TK1/F(11')	3869S-01 TB-9(8-9')	3869S-02 TB-11(10-11')	3869S-03 TB-1(8-10')	3869S-04 TB-3(8-11')	3869S-05 TB-7(11-12')		
Acetone	ND	ND	ND	ND	**290**	**625**	60 or MDL	50
sec-Butylbenzene	**2,570**	**647**	**1,080**	ND	ND	ND	25	11,000
Ethylbenzene	**57,700**	4,910	**8,500**	551	22.6	ND	5,500	1,000
n-Propylbenzene	**22,100**	**6,440**	**7,580**	735	91.1	ND	3,700	3,900
Isopropylbenzene	**7,500**	2,120	**2,390**	217	19.2	ND	2,300	NA
p-Isopropyltoluene	2,250	634	1,250	ND	ND	ND	NA	NA
Toluene	**80,700**	ND	730	ND	ND	ND	1,500	700
1,2,4-Trimethylbenzene	**132,000**	**40,200[E]**	**51,700[E]**	6,480	720	240	10,000	3,600
1,3,5-Trimethylbenzene	**41,000**	**11,100**	**14,600**	1,830	176	65.7	3,500	8,400
m,p-Xylene	**231,000**	**11,400**	**33,500**	**3,090**	106	ND	1,200	260
o-Xylene	**65,300**	ND	**8,630**	284	ND	ND	1,200	260
Naphthalene	**35,500**	5,920	**16,200**	2,740	186	ND	13,000	12,000

(1) = Recommended soil cleanup objective (RSCO) as referenced in NYSDEC TAGM 4046 dated January 24, 1994 as amended by the NYSDEC's supplemental Tables dated August 22, 2001.

(2) = Brownfield Cleanup Program soil cleanup objective (BCP SCO) for Track 2 (unrestricted use) as referenced in 6 NYCRR Part 375 Environmental Remedial Programs dated December 14, 2006.

ND = Not Detected at concentration above reported analytical laboratory detection limit. Refer to analytical laboratory report for the detection limits utilized.

E = Estimated value due to calibration limit being exceeded.

NA = Not Applicable.

57,700 = Exceeds RSCO

TABLE 2

62-64 SCIO STREET
ROCHESTER, NEW YORK

SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS)
IN UG/KG or PARTS PER BILLION (PPB)

SOIL SAMPLES

DETECTED SVOCS	SAMPLE AND LOCATION		NYSDEC TAGM 4046 RSCO(1) (PPB)	BCP SCO(2) (PPB)
	3869S-01 TB-9(8-9')	3869S-02 TB-11(10-11')		
Acenaphthene	516	ND	50,000	20,000
Anthracene	556	ND	50,000	100,000
Benzo(a)anthracene	**1,300**	ND	224 or MDL	1,000
Benzo(a)pyrene	**1,080**	ND	61 or MDL	1,000
Benzo(b)fluoranthene	1,000	ND	1,100	1,000
Benzo(g,h,i)perylene	777	ND	50,000	100,000
Benzo(k)fluoranthene	726	ND	1,100	800
Chrysene	**1,400**	ND	400	1,000
Fluoranthene	3,980	ND	50,000	100,000
Indeno(1,2,3-cd)pyrene	765	ND	3,200	500
Naphthalene	775	4,590	13,000	12,000
Phenanthrene	2,550	ND	50,000	100,000
Pyrene	2,690	ND	50,000	100,000

(1) = Recommended soil cleanup objective (RSCO) as referenced in NYSDEC TAGM 4046 dated January 24, 1994 as amended by the NYSDEC's supplemental Tables dated August 22, 2001.

(2) = Brownfield Cleanup Program soil cleanup objective (BCP SCO) for Track 2 (unrestricted use) as referenced in 6 NYCRR Part 375 Environmental Remedial Programs dated December 14, 2006.

ND = Not Detected at concentration above reported analytical laboratory detection limit. Refer to a report for the detection limits utilized.

765 = Exceeds RSCO

TABLE 3

62-64 SCIO STREET
ROCHESTER, NEW YORK

RCRA METALS TEST RESULTS
IN MG/KG or PARTS PER MILLION (PPM)

SOIL SAMPLES

RCRA METALS	SAMPLE AND LOCATION		NYSDEC TAGM 4046 RSCO (1)	NYSDEC TAGM 4046 Typical Background Range (2)	BCP SCO (5)
	TB-7 (1-2')	TB-11 (0-4')			
Arsenic	5.01	6.24	7.5 or SB	3-12	13
Barium	58.5	83.1	300 or SB	15-600	350
Cadmium	ND	ND	1 or SB (10)(3)	0.1-1	2.5
Chromium	7.86	8.92	10 or SB (50)(4)	1.5-40	30
Lead	179	217	SB	200-500**	63
Mercury	**0.6348**	**0.4255**	0.1	0.001-0.2	0.18
Selenium	ND	ND	2 or SB	0.1-3.9	3.9
Silver	1.28	1.32	SB	NA	2

SB = Site background.

1) = Recommended soil cleanup objective (RSCO) as referenced in NYSDEC TAGM 4046 dated January 24, 1994.
- Cadmium results also compared to RSCO of 10 ppm listed in the 1995 “proposed” TAGM 4046.
- Chromium results also compared to RSCO of 50 ppm listed in the 1995 “proposed” TAGM 4046.

2) = Typical background range as referenced in NYSDEC TAGM 4046 dated January 24, 1994.

3) = 1995 TAGM 4046 "proposed" RSCO for cadmium of 10 ppm.

4) = 1995 TAGM 4046 "proposed" RSCO for chromium of 50 ppm.

(5) = Brownfield Cleanup Program soil cleanup objective (BCP SCO) for Track 2 (unrestricted use) as referenced in 6 NYCRR Part 375 Environmental Remedial Programs dated December 14, 2006.

ND = Not Detected at concentration above reported analytical laboratory detection limit. Refer to analytical laboratory report for the detection limits utilized.

NA = Not Available

** = Background range for metropolitan or suburban areas or near highways referenced in NYSDEC TAGM 4046.

0.6348 = Exceeds TAGM 4046 Typical Background Range

APPENDIX B

GROUNDWATER CHARACTERISTICS DATA TABLES

Table 1
62-64 Scio Street
Rochester, New York

Coordinate System and Groundwater Elevations for May 30, 2007

Elevations in Feet Above Mean Sea Level

Monitoring Well	Northing*	Easting*	Ground Elevation**	TOC Elevation**	Static Water Level (from TOC)	Groundwater Elevation**
MW-1	1152076.93	1410981.82	518.96	518.65	8.19	510.46
MW-2	1152065.44	1410912.48	522.27	522.09	10.41	511.68
MW-3	1152031.08	1411002.98	518.43	518.29	8.15	510.14

TOC = Top of Casing

* = NAD83 Coordinates

** = NAVD88 Coordinates

Coordinate system and elevations obtained from a land survey by James M. Parker Land Surveying in May 2007.

Table 2
62-64 Scio Street
Rochester, New York

Summary of Detected Volatile Organic Compounds (VOCs) and Naphthalene in ug/L or Parts per Billion (ppb)

May 30, 2007 Groundwater Samples

Detected Compound	Groundwater Standard or Guidance Value (1)	MW-1	MW-2	MW-3
Benzene	1	**24.1**	ND	**1,660**
Toluene	5	**31.4**	ND	**1,260**
Ethylbenzene	5	**385**	ND	**1,530**
Xylene (total)	5	**231.4**	ND	**4,876**
n-Propylbenzene	5	**95**	ND	**154**
Isopropylbenzene	5	**38.3**	ND	**79.9**
1,2,4-Trimethylbenzene	5	**156**	ND	**1,210**
1,3,5-Trimethylbenzene	5	ND	ND	**249**
TOTAL VOCS	NA	961.2	ND	11,018.9
Naphthalene	10	ND	ND	**438**

NA = Not available

(1) = Groundwater standard or guidance value as referenced in NYSDEC TOGS 1.1.1dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000

95 = Exceeds groundwater standard or guidance value

ND = Not detected at concentration above reported analytical laboratory detection limit

Table 3
62-64 Scio Street
Rochester, New York

Summary of Detected Semi-Volatile Organic Compounds (SVOCs)
in ug/L or Parts per Billion (ppb)

May 30, 2007 Groundwater Samples

Detected Compound	Groundwater Standard or Guidance Value (1)	MW-1	MW-2	MW-3
Naphthalene	10	**16.7**	ND	**254**
TOTAL SVOCS*	NA	16.7	ND	254

NA = Not Available

(1) = Groundwater standard or guidance value as referenced in NYSDEC TOGS 1.1.1dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000

254 = Exceeds groundwater standard or guidance value

ND = Not detected at concentration above reported analytical laboratory detection limit

APPENDIX C

PROPOSED ALTERNATIVE COST ESTIMATE TABLES

62-64 Scio Street
City of Rochester Brownfield Site Cleanup, Lu Engineers' Proposed Cost Data
No Action

Salary Costs

Objective 1 - Corrective Action Plan and Analysis of Brownfield Alternatives	
Lump Sum Cost Objective 1	$ -
Objective 2 - Citizen's Participation Plan	
Lump Sum Cost Objective 2	$ -
Objective 3 - Implement Corrective Action Plan	
Lump Sum Cost Objective 3	$ -
Objective 4 - Post Source Removal Groundwater Monitoring	
Lump Sum Cost Objective 4	$ -
Objective 5 - Post Remedial Construction/Closure Report	
Lump Sum Cost Objective 5	$ -
Objective 6 - Environmental Management Plan and Environmental Control	
Lump Sum Cost Objective 6	$ -
Total Labor Costs	$ -

Expenses and Subcontractor Costs[1]

Item	Unit Cost	Unit[2]	of Units	Cost
Expenses				
Miscellaneous Expenses Incl. PPE	$ 450.00	Lump Sum	0	$ -
Equipment Rental	$ 1,950.00	Lump Sum	0	$ -
Total Expenses				$ -
Subcontracted Services[1]				
Excavation, Backfill and Disposal	$ 101,000.00	Lump Sum	0	$ -
Lab Fees VOCs	$ 60.00	Sample	0	$ -
Lab Fees Remedial Parameters and Misc.	$ 1,200.00	Lump Sum	0	$ -
Water Handling & Treatment	$ 5,500.00	Lump Sum	0	$ -
Well Installations	$ 1,250.00	Each	0	$ -
Application of Remedial Agent in Backfill	$ 3,500.00	Each	0	$ -
Restoration	$ 1,000.00	Lump Sum	0	$ -
Sub-Slab Depressurization System[2]	$ 50,000.00	Lump Sum	0	$ -
Total Subcontracted Services				$ -
Total Expenses and Subcontractor Costs				$ -

TOTAL	**$ -**

1 - Subcontracted Costs Include Max 5% Markup

2 - Includes design and installation costs

62-64 Scio Street
City of Rochester Brownfield Site Cleanup, Lu Engineers' Proposed Cost Data
Soil Excavation Only

Salary Costs		
Objective 1 - Corrective Action Plan and Analysis of Brownfield Alternatives		
Lump Sum Cost Objective 1	$	4,730.00
Objective 2 - Citizen's Participation Plan		
Lump Sum Cost Objective 2	$	1,485.00
Objective 3 - Implement Corrective Action Plan		
Lump Sum Cost Objective 3	$	10,843.00
Objective 4 - Post Source Removal Groundwater Monitoring		
Lump Sum Cost Objective 4	$	4,000.00
Objective 5 - Post Remedial Construction/Closure Report		
Lump Sum Cost Objective 5	$	5,000.00
Objective 6 - Environmental Management Plan and Environmental Control		
Lump Sum Cost Objective 6	$	6,000.00
Total Labor Costs	$	32,058.00

Expenses and Subcontractor Costs[1]

Item	**Unit Cost**	**Unit[2]**	**Number of Units**	**Total Estimated Cost**
Expenses				
Miscellaneous Expenses Incl. PPE	$ 450.00	Lump Sum	1	$ 450.00
Equipment Rental	$ 1,950.00	Lump Sum	1	$ 1,950.00
Total Expenses				$ 2,400.00
Subcontracted Services[1]				
Excavation, Backfill and Disposal	$ 101,000.00	Lump Sum	1	$ 101,000.00
Lab Fees VOCs	$ 60.00	Sample	60	$ 3,600.00
Lab Fees Remedial Parameters and Misc.	$ 1,200.00	Lump Sum	1	$ 1,200.00
Water Handling & Treatment	$ 5,500.00	Lump Sum	1	$ 5,500.00
Well Installations	$ 1,250.00	Each	3	$ 3,750.00
Application of Remedial Agent in Backfill	$ 3,500.00	Each	1	$ 3,500.00
Restoration	$ 1,000.00	Lump Sum	1	$ 1,000.00
Sub-Slab Depressurization System[2]	$ 50,000.00	Lump Sum	1	$ 50,000.00
Total Subcontracted Services				$ 169,550.00
Total Expenses and Subcontractor Costs				$ 171,950.00

TOTAL	**$**	**204,008.00**

1 - Subcontracted Costs Include Max 5% Markup

2 - Includes design and installation costs

62-64 Scio Street
City of Rochester Brownfield Site Cleanup, Lu Engineers' Proposed Cost Data
Soil Excavation and Oxygen Injection

Salary Costs

Objective 1 - Corrective Action Plan and Analysis of Brownfield Alternatives		
Lump Sum Cost Objective 1	$	4,730.00
Objective 2 - Citizen's Participation Plan		
Lump Sum Cost Objective 2	$	1,485.00
Objective 3 - Implement Corrective Action Plan		
Lump Sum Cost Objective 3	$	10,843.00
Objective 4 - Post Source Removal Groundwater Monitoring		
Lump Sum Cost Objective 4	$	8,496.00
Objective 5 - Post Remedial Construction/Closure Report		
Lump Sum Cost Objective 5	$	7,589.00
Objective 6 - Environmental Management Plan and Environmental Control		
Lump Sum Cost Objective 6	$	8,202.00
Total Labor Costs	$	41,345.00

Expenses and Subcontractor Costs[1]

Item		Unit Cost	Unit[2]	Number of Units		Total Estimated Cost
Expenses						
Miscellaneous Expenses Incl. PPE	$	450.00	Lump Sum	1	$	450.00
Equipment Rental	$	1,950.00	Lump Sum	1	$	1,950.00
Total Expenses					$	2,400.00
Subcontracted Services[1]						
Electrician	$	550.00	Per Day	1	$	550.00
Excavation, Backfill and Disposal	$	101,000.00	Lump Sum	1	$	101,000.00
Lab Fees VOCs	$	60.00	Sample	60	$	3,600.00
Lab Fees Remedial Parameters and Misc.	$	1,200.00	Lump Sum	1	$	1,200.00
Water Handling & Treatment	$	5,500.00	Lump Sum	1	$	5,500.00
Well Installations	$	1,250.00	Each	3	$	3,750.00
Injection Point Installations	$	470.00	Each	21	$	9,870.00
Application of Remedial Agent in Backfill	$	3,500.00	Each	1	$	3,500.00
Oxygen System Hookup/Electrical Svc.	$	3,250.00	Lump Sum	1	$	3,250.00
Restoration	$	1,000.00	Lump Sum	1	$	1,000.00
Oxygen System Hookup/Piping	$	2,750.00	Lump Sum	1	$	2,750.00
Sub-Slab Depressurization System[2]	$	50,000.00	Lump Sum	1	$	50,000.00
Total Subcontracted Services					$	185,970.00
Total Expenses and Subcontractor Costs					$	188,370.00

TOTAL	**$**	**229,715.00**

1 - Subcontracted Costs Include Max 5% Markup

2 - Includes design and installation costs

Lu Engineers
ENVIRONMENTAL • TRANSPORTATION • CIVIL

62-64 Scio Street
City of Rochester Brownfield Site Cleanup, Lu Engineers' Proposed Cost Data
Air Sparging and SVE

Salary Costs

Objective 1 - Corrective Action Plan and Analysis of Brownfield Alternatives		
Lump Sum Cost Objective 1	$	4,730.00
Objective 2 - Citizen's Participation Plan		
Lump Sum Cost Objective 2	$	1,485.00
Objective 3 - Implement Corrective Action Plan		
Lump Sum Cost Objective 3	$	10,843.00
Objective 4 - Post Source Removal Groundwater and System Monitoring		
Lump Sum Cost Objective 4	$	25,000.00
Objective 5 - Post Remedial Construction/Closure Report		
Lump Sum Cost Objective 5	$	7,589.00
Objective 6 - Environmental Management Plan and Environmental Control		
Lump Sum Cost Objective 6	$	8,202.00
Total Labor Costs	$	57,849.00

Expenses and Subcontractor Costs[1]

Item	Unit Cost	Unit[2]	Number of Units	Total Estimated Cost
Expenses				
Miscellaneous Expenses Incl. PPE	$ 450.00	Lump Sum	1	$ 450.00
Equipment Rental	$ 750.00	Lump Sum	1	$ 750.00
Total Expenses				$ 1,200.00
Subcontracted Services[1]				
Electrician	$ 550.00	Per Day	2	$ 1,100.00
Lab Fees VOCs	$ 60.00	Sample	40	$ 2,400.00
Electrical Costs (5 years)	$ 3,800.00	Each	5	$ 19,000.00
Water Handling & Treatment	$ 5,000.00	Lump Sum	1	$ 5,000.00
Well Installations	$ 1,250.00	Each	3	$ 3,750.00
Sparge Point Installations	$ 500.00	Each	20	$ 10,000.00
Vapor Extraction Trenches	$ 10,000.00	Lump Sum	1	$ 10,000.00
Sparge/SVE System Hookup/Electrical Svc.	$ 7,500.00	Lump Sum	1	$ 7,500.00
System Lease (5-years)	$ 16,000.00	Each	5	$ 80,000.00
Maintenace	$ 10,000.00	Lump Sum	1	$ 10,000.00
Sub-Slab Depressurization System[2]	$ 50,000.00	Lump Sum	1	$ 50,000.00
Total Subcontracted Services				$ 198,750.00
Total Expenses and Subcontractor Costs				$ 199,950.00

TOTAL	**$**	**257,799.00**

1 - Subcontracted Costs Include Max 5% Markup

2 - Includes design and installation costs

3 - Costs based on a 5-year remediation period