FORMER MARLOU FORMAL WEAR FOCUSED FEASIBILITY STUDY

Site Number 447040
1108 State Street
Schenectady, NY 12304

SEPTEMBER 14, 2017

PREPARED BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION
625 BROADWAY, ALBANY, NY 12233

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P.E. Certification

Focused Feasibility Study
Former Marlou Formal Wear Site No. 447040

I, John Durnin, certify that I am currently a NYS registered professional engineer and that this Focused Feasibility Study was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

072814	9/15/2017	
NYS Professional Engineer #	Date	Signature

1. Introduction

This Focused Feasibility Study (FFS) has been prepared to evaluate remedial alternatives for Chlorinated Volatile Organic Compounds (CVOCs) in groundwater and soil vapor at the Former Marlou Formal Wear site, in Schenectady, Schenectady County, New York (site No. 447040) (Figures 1 and 2). The FFS has been prepared by the New York State Department of Environmental Conservation (NYSDEC). The purpose of this report is to evaluate potential remedial alternatives based on the nine evaluation criteria listed in 6NYCRR Part 375-1.8(f) and the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

After approval of this FFS, the NYSDEC will issue a Proposed Remedial Action Plan (PRAP) which is open to public comment. Following the public comment period, the NYSDEC will issue a Record of Decision (ROD) for the site.

This FFS was completed in accordance with DER-10, NYSDEC DER program policy for Presumptive/Proven Remedial Technologies (DER-15), NYSDEC DER program policy for Green Remediation (DER-31), and other appropriate NYSDEC and United States Environmental Protection Agency (USEPA) guidance.

1.1 Site Location and Background

The site is a 0.12 acre portion of 1108 State Street in the city of Schenectady (Figure 2). The land surfaces of the site are generally covered with asphalt, landscaped areas or lawn areas. The site is bound by South Brandywine Street to the northwest, Albany Street to the southwest, State Street to the northeast, and mixed commercial and residential properties to the southeast.

Currently, the site is occupied by a pharmacy store and asphalt parking lot that was constructed in 1999. The parking lot covers the majority of the former Marlou Formal Wear building footprint, while the store covers the remaining portion.

The site was utilized as a tuxedo rental business that reportedly performed on-site dry cleaning beginning in 1958. Site operation continued until the demolition of the building in July 1998. The city block bound by Albany Street, Kelton Avenue, State Street, and Brandywine Avenue historically was mixed commercial and residential properties. The area is primarily residential with commercial lots on Kelton Avenue and two dry cleaners, one located on State Street (Midtowne Laundry) and former Marlou located on Brandywine Avenue.

1.2 Previous Investigations

In October 1997, Land Tech Remedial, Inc. was retained by NYSDEC to install five monitoring wells surrounding the then proposed Brandywine Avenue Retail site. The proposed Brandywine Avenue Retail site covered approximately one-third of a city block bound by Brandywine Avenue, State Street, and Albany Street in the city of Schenectady. This investigation was conducted to determine groundwater flow direction and potential source areas after a Phase 2 investigation performed by William Going & Associates, Inc. in May 1997 identified tetrachloroethene (PCE), trichloroethene (TCE), and petroleum compounds in soil and groundwater. From this October investigation it was determined that groundwater flows to the southwest in this area (Land Tech Remedial, Inc. 1997).

The owner of the property submitted an application to the Voluntary Cleanup Program (VCP) in October 1997 (Site No. V00268 - State, Brandywine & Albany St. Properties). Eight soil and groundwater sampling points were installed during environmental investigations. Results indicated that there was low level CVOC and petroleum compound contamination in soil and groundwater. To supplement the groundwater sampling results thirty-eight soil gas sampling points were also installed in December 1997 in order to confirm and delineate the contamination, however no source of contamination was identified within the property boundary and low level contamination was delineated to the surrounding properties. As a result of these findings, it was determined that no further cleanup action was required for this site and the project was rejected from the program (International Technical Corporation, 1997 & William L. Going Associates, Inc. 1997).

A new environmental investigation was started in this area in 2009 as the Brandywine Avenue Plume Track Down project encompassing about 8 acres of residential and commercial properties in the city of Schenectady, and focusing on Marlou and another former dry cleaner, Mid-Town Laundry (Site No. 447048).

Work was conducted by Precision Environmental Services, Inc. (PES) for NYSDEC as part of the plume track down. Samples were collected and analyzed from soil, groundwater, and soil vapor in an attempt to delineate the VOC plume(s). A series of supplemental surface investigations (SSI) were conducted in 2009, 2010, and 2011. Each of these investigations sequentially expanded the site characterization data.

During the June 2009 SSI, thirty-seven soil borings were completed and thirty temporary groundwater monitoring wells were developed. Results of the samples collected show contamination to soil and groundwater consistent with the results reported during previous investigations (PES, 2010a).

During the March 2010 SSI completed by PES for NYSDEC, seven soil borings and temporary groundwater monitoring wells were installed. To expand upon previously completed investigations, twelve soil vapor points were also installed. Contaminant levels observed in soil and groundwater during this study were similar to those seen in previous investigations. The soil vapor samples collected also demonstrated contamination of PCE, TCE, and cis-1,2-dichloroethene (cis-1,2-DCE) above reportable levels (PES, 2010b). PCE was detected in all seven soil vapor samples ranging from 23.1 to 501.8 micrograms per cubic meter (µg/m3). TCE was detected in five of seven samples collected at concentrations ranging from 14.4 to 628.8 µg/m3 and cis-1,2-DCE was detected in four samples collected at concentrations ranging from 1.1 to 598.8 µg/m3

During the June 2011 SSI work completed by PES, four new soil borings were completed, three temporary groundwater monitoring wells and three soil vapor points were installed. Similar compounds were identified in the soil and groundwater samples collected during this sampling work (PES, 2011).

In December 2011, as a result of the SSIs, the site was classified as a Class 2 inactive hazardous waste remediation site and entered into the State Superfund Program (SSP).

Based on the investigations completed it was determined the primary contaminants of concern at Former Marlou are PCE (NYS TOGS is 5 μg/l), TCE (NYS TOGS is 5 μg/l), cis-1,2-DCE (NYS TOGS is 5 μg/l), and vinyl chloride (VC) (NYS TOGS is 2 μg/l) in groundwater and soil vapor. Throughout the investigations PCE has been detected in groundwater on the order of 50 parts per billion (ppb). Areas surrounding the site are serviced by public water supply lowering the potential exposure and public health concerns in reference to the identified groundwater contamination. While no significant soil contamination was identified it is likely that an undefined source area is located on the property.

PCE was identified in soil vapor samples during these earlier investigations as high as 50,000 micrograms per cubic meter (µg/m3) and TCE was detected as high as 60 µg/m3. These concentrations indicated a significant threat to human health and were further characterized in the RI completed in 2016 and submitted to NYSDEC in March 2016. The listing of the former Marlou site and the subsequent remedial investigation (RI) are discussed further in Section 2 of this report.

1.3 Geology/Hydrogeology

1.3.1 Regional Geology

The site is located within the Hudson Mohawk Lowland Physiographic Province. The overburden soils in the surrounding area have been characterized as lacustrine deltaic deposits, composed predominantly of well sorted, stratified coarse to fine gravel and sand (Cadwell et al, 1987). These deposits make up a portion of the Albany-Schenectady sand plain, which ranges in thickness from 10 to 100 feet and overlies beds of silt, clay, and till (Halberg, H.N., Hunt, O.P., and Pauszek, F.H., 1964).

The bedrock geology underlying the Site and RI Study Area is the Austin Glen Formation, which consists of greywacke and shale that is of Middle to Upper Ordovician origin (Fisher et al, 1970).

1.3.2 Local Geology

Soils encountered during investigations were generally composed of fine to course brown sand underlain by an apparent confining or low permeability layer of dense, dry, gray, silty sand with little clay. The depth of soil investigation reached a maximum of 32-feet and bedrock was not encountered.

1.3.3 Regional Hydrogeology

The Albany-Schenectady sand plain extends from southern Schenectady southeastward toward Albany and covers part of the buried Mohawk, Alplaus, and Colonie channels. The sands are not highly permeable, yielding water sufficient for household supplies, and in some places the sand is sufficiently thick to sustain small industrial supplies (Halberg, H.N., Hunt, O.P., and Pauszek, F.H., 1964).

Water also occurs in the bedrock formations underlying the Schenectady area. The yields in these and other bedrock formations in the Albany-Schenectady-Troy area vary widely, but the median yields of wells in all formations seem to be about the same, from 2 to 4 gallons per minute (gpm), based on reported yields of about 240 wells (Halberg, H.N., Hunt, O.P., and Pauszek, F.H., 1964).

1.3.4 Local Hydrology

Groundwater was consistently encountered at approximately nine to thirteen feet below grade during investigation. An apparent low permeability layer consisting of dry, gray, silt with little clay was seen in most borings at 25 to 32-feet below ground surface. Data collected indicates that groundwater is flowing generally in a south-southwesterly direction.

1.3.5 Surface Water Hydrology

The nearest surface water body, Iroquois Lake, is located approximately 3,200 feet east relative to the Site (PES, 2010a). The Mohawk River is located approximately 8,900 feet northwest of the Site.

2. Remedial Investigation Summary

2.1 Remedial Investigation

The Remedial Investigation (RI) for the former Marlou Formal Wear site was conducted between July 2013 and October 2015 by O'Brien & Gere Engineers, Inc. with oversight by NYSDEC. The purpose of this investigation was to evaluate the possible presence of a remaining source of the Contaminants of Concern

(COC), PCE, TCE, cis-1,2-DCE and vinyl chloride (VC), within the vicinity of the former Marlou Formal Wear building. The investigation also assessed the presence or absence of vapor intrusion in the RI Study Area and assessed potential exposure pathways.

Based on review of investigation data collected during the RI and previous investigations site-related COCs, PCE, TCE, cis-1,2-DCE, and VC, are affecting on-site and off-site groundwater and soil vapor. The source area, however, was not identified during the investigation.

It has been determined that site overburden soil is composed of fine to coarse brown sand with varying amounts of silt to depths ranging between 19-ft bgs to greater than 24-ft bgs. These soils are then underlain by an apparent confining or low permeability layer of dense, gray, silty sand with little clay. These finer-grained soils are assumed to extend to approximately 45-ft bgs based on information gathered during the on-going investigation at the Mid-Town Laundry site, located approximately 300 feet southeast of the site.

The primary contaminant transport mechanism is as a dissolved constituent plume in the groundwater within the sand unit, 12 to 15-feet bgs. The groundwater plume originates from the site and extends approximately 800-feet to the southwest with groundwater flow. The plume geometry has not changed substantially since the start of the 2009 SSI and is therefore considered to be in steady-state condition. The decline of PCE concentration in the downgradient monitoring wells and the presence of PCE degradation products suggests that degradation of PCE in groundwater is occurring.

The extent of Soil Cleanup Objectives (SCO) exceedances of the site-related COCs have been substantially defined at the conclusion of these investigations. The vapor intrusion data collected does not suggest that there is currently a pathway for sub-slab vapors to migrate into indoor air for on-site commercial buildings or the off-site residential buildings. This conclusion, however, does not preclude the potential for vapor intrusion to the structures sampled or additional structures in the future, should the slabs deteriorate over time.

Groundwater samples were collected from fourteen total on-site and off-site locations. PCE was detected on-site at 5.2 µg/L, slightly above the Class GA standard of 5 µg/L. Other VOCs detected on-site included acetone at approximately 3.7 µg/L, below the class GA standard of 50 µg/L. Other detections of site related COCs, PCE, TCE, and cis-1,2-DCE were below Class GA standards. Off-site groundwater sampling was conducted upgradient and downgradient of the site. Upgradient VOC detections were of petroleum related constituents, not the site-related COCs.

Soil vapor samples were collected from ten on- and off-site locations during the RI, nine existing sampling points and one additional point installed during the investigation. Samples collected on-site displayed the highest concentrations of site-related COCs. PCE, TCE and cis-1,2-DCE were detected at concentrations of 120,000 µg/m3, 2,700 µg/m3, and 390 µg/m3, respectively. Site-related COCs were also detected at the off-site sampling locations upgradient and downgradient of the groundwater plume. The highest concentrations were detected immediately downgradient of the groundwater plume. PCE was detected in all off-site sampling locations at concentrations ranging from 6.2 µg/m3 to 69,000 µg/m3. TCE was detected off-site at concentrations ranging from 0.3 µg/m3 to 1,300 µg/m3. Cis-1,2-DCE was only detected in two of the off-site sampling locations at concentrations of 400 µg/m3 and 39 µg/m3, both locations were immediately downgradient of the groundwater plume.

Soil samples were collected during the installation of monitoring wells MW-1301. MW-1302, and MW-1401 during the RI. All samples collected lacked visual, olfactory, and field screening evidence that would suggest presence of source material and were not sent for laboratory screening. Field screening was completed using a Photoionization Detector (PID). One on-site soil sample was collected during the advancement of SB-AB from 12-ft bgs to 14-ft bgs. Acetone and methylene chloride were detected in the sample at 16 ug/kg and 10 ug/kg, respectively. In the RI Report it is noted that no laboratory qualifiers were applied to the methylene chloride and acetone detections and that both solvents are utilized in the laboratory and may be laboratory artifacts. Sixteen off-site locations were also sampled, VOCs were detected in six of the samples collected at depths ranging from 12-ft to 22-ft bgs. Detections were of PCE, acetone, cyclohexane, ethylbenzene, methylcycohexane, methylene chloride, o-xylene, and toluene. All detections were below Unrestricted, Residential, and Commercial SCOs.

2.2 Conceptual Site Model

With the conclusion of the RI sampling activities, the current conceptual site model is as follows:

The site, Former Marlou Formal Wear is a 0.12-acre portion of 1108 State Street in the city of Schenectady, NY (Figure 2). The 0.12-acre portion was formerly utilized as a tuxedo rental business that reportedly performed on-site dry cleaning beginning in 1958.

The historical operations at the site resulted in the release of tetrachloroethene (PCE) to the subsurface. Although no releases are documented, it is likely that the release of site related Contaminants of Concern (COCs) occurred when the property was operating as a dry cleaner (1958-1998), and is likely that the releases occurred within the site boundaries. The COCs can be described as relatively dense, highly volatile, and moderately to highly soluble in water.

Based on historical soil and groundwater sampling data and subsequent Remedial Investigation (RI) results, the source of VOCs was not encountered on the site, or in soil in the immediate vicinity of the site.

The limited extent of soil impacts around the perimeter of the current lot and the presence of elevated concentrations of PCE beneath the slab of the building indicate VOC contamination beneath the building or within the lot, possibly trapped within the unsaturated soil and/or saturated soil acting as a continuing remaining source.

COCs likely entered the subsurface at the site, percolated through the unsaturated soils downward to the water table and then, as a dissolved-phase constituent, migrated laterally with the groundwater flow for approximately 800-ft to the southwest. However, preferential pathways in the soil may exist that allow contamination to migrate to other areas or structures.

The overall areal extent of this plume does not appear to have changed since the initial investigation was completed in 2009 and CVOC concentrations have decreased during that time. Figure 3 shows the decrease in concentrations of PCE and its degradation products in downgradient locations.

Request for Access letters were sent to twenty-five nearby property owners to perform Soil Vapor Intrusion (SVI) sampling of which five owners granted access.

The presence of COCs in soil vapor, sub-slab vapor, and indoor air samples is dependent on factors such as the condition of the basement foundation, the type of subsurface soils, and the distance between the foundation and groundwater. COCs in the unsaturated soils and/or groundwater can act as a source to the COC concentrations in soil vapor and/or indoor air.

Results of the sub-slab and indoor air samples collected from the five properties over the course of three heating seasons from 2013 to 2015 did not indicate that vapor intrusion is occurring within the RI study area. In addition, nine soil vapor points were sampled in 2014. Based off of the results, low concentrations of site COCs were detected. This is consistent with not having a VI problem resulting from the site.

Over the course of sampling, concentrations in the groundwater have been trending downward due to environmental degradation of the COCs. The plume has not shown to expanding. This declining trend of concentrations is expected to continue over time.

3. Exposure/Risk Assessment

3.1 Exposure Pathways

A qualitative exposure assessment was performed using the data collected during the RI. The qualitative exposure assessment consists of characterizing the exposure setting, identifying potential exposure pathways, and evaluating contaminant fate and transport. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from the site. An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanism; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population.

Based on the current zoning, commercial/business and residential land use, it is reasonable to anticipate that the site and nearby off-site areas will continue to be used for commercial and residential purposes in the future. The most likely future exposure scenarios assume that the buildings, building slabs, and pavement/ground cover will remain in place for the foreseeable future.

3.1.1 Soil

PCE was detected in an offsite residential area below regulatory values. Petroleum based compounds were detected as well at off-site commercial properties at values above 6 NYCRR Part 375 Unrestricted use and Groundwater Protection. All soil contamination uncovered through investigation occured greater than 10-ft bgs limiting the direct exposure point or route. However, contact with contamination is possible for future construction or utility workers. Contact from leaching of contamination in soil is expected to be minimal due to asphalt and concrete above reducing the infiltration of surface runoff.

3.1.2 Groundwater

Groundwater at the site contains contamination greater than the NYSDEC Class GA Standards. Contamination has migrated approximately 800-ft southwest of the site. The area is serviced by public water supply and downgradient structures do not utilized groundwater as a drinking water source. However, no institutional control exists to prevent the use of groundwater in the area; therefore, ingestion of contaminated groundwater is a potential exposure pathway.

Future construction workers or utility workers involved in any construction or utility related activities may be exposed to the COCs through direct dermal contact with groundwater. In the event that a structures foundation or slab is cracked or removed, contamination may be contacted indirectly via inhalation of groundwater-derived vapors. Construction and utility workers may also be exposed to the groundwater derived vapors during work related activities.

3.1.3 Soil Vapor

Groundwater contamination extends southwest of the site, beneath residential and commercial properties. Based on the sub-slab sampling completed during the RI soil vapor intrusion for future buildings within the groundwater plume area represents a potential exposure pathway.

4. Remedial Action Objectives and Evaluation Criteria

4.1 Remedial Action Objectives

4.1.1 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation exposure to contaminants volatilizing from soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater contamination.

4.1.2 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

4.1.3 Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.
- Remove the source of soil vapor contamination.

Generally, these RAOs may be achieved by minimizing:

- Magnitude and extent of contamination in media;
- Migratory potential of the contaminants; and
- Potential for human exposure to in-situ contaminated media.

4.2 Evaluation Criteria

In accordance with 6NYCRR Part 375-1.8(f) and DER-10 Technical Guidance for Site Investigation and Remediation (DER-10) (NYSDEC, 2010), the remedial measure alternatives developed in this Feasibility Study will be screened based on an evaluation of the following criteria:

- Overall protection of human health and the environment;

- Compliance with Standards, Criteria, and Guidance (SCGs);
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Short-term impacts and effectiveness;
- Implementability;
- Land use;
- Cost-effectiveness; and
- Community acceptance.

4.2.1 Overall Protection of Human Health and the Environment

This criterion serves as a final check to assess whether each alternative meets the requirements that are protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria; especially long-term effectiveness and performance, short-term effectiveness; and compliance with SCGs. The evaluation focuses on how a specific alternative achieves protection over time and how site risks are reduced. The analysis includes how each source of contamination is to be eliminated, reduced, or controlled for each alternative.

4.2.2 Compliance with SCGs

This evaluation criterion assesses how each alternative complies with 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives, 6 NYCRR Part 375 Residential Soil Cleanup Objectives, NYSDEC Class GA Standards, and the guidelines set forth in the NYSDOH October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York.

4.2.3 Long-Term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the waste remaining at the site and operating system necessary for the remedy to remain effective. The factors being evaluated include the permanence of the remedial alternative, magnitude of the risk, adequacy of controls used to manage remaining waste, and reliability of controls used to manage remaining waste.

4.2.4 Reduction of Toxicity, Mobility, and Volume

This evaluation criterion assesses the remedial alternative's use of the technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous wastes as their principal element. The NYSDEC's policy is to give preference to alternatives that eliminate any significant threats at the site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in the contaminants mobility, or reduction of the total volume of contaminated media. This evaluation includes: the amount of the hazardous materials that would be destroyed or treated, the degree of expected reduction in toxicity, mobility, or volume measured as a percentage, the degree in which the treatment would be irreversible, and the type and quantity of COCs that would remain following treatment.

4.2.5 Short-Term Impacts and Effectiveness

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase. Alternatives are evaluated with respect to the effects on human health and the environment during implementation of the remedial action. The aspects evaluated include: protection of the community during remedial actions, environmental impacts as a result of remedial actions, time until the remedial response objectives are achieved, and protection of workers during the remedial action.

4.2.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The evaluation includes: feasibility of construction and operation and maintenance; the reliability of the technology; the ease of undertaking additional remedial action; monitoring considerations; activities needed to coordinate with other offices or agencies; availability of adequate off-site treatment, storage, and disposal services; availability of equipment; and the availability of services and materials.

4.2.7 Land Use

The land use criterion assess the current and anticipated future land use of the property in evaluating the feasibility of an alternative. This evaluation includes, but is not limited to: current and historical use, recent development patterns, applicable zoning laws and maps, proximity to and use of real property, population growth patterns, vulnerability of groundwater contamination that may emanate from the site, geography and geology, and current institutional controls applicable to the site.

4.2.8 Cost

Cost estimates are prepared and evaluated for each alternative. The cost estimates include capital costs, operation and maintenance (O&M) costs, and future capital costs. A cost sensitivity analysis is performed which includes the following factors: the effective life of the remedial action, the O&M costs, the duration of the cleanup, the volume of contaminated material, other design parameters, and the discount rate. Cost estimates developed at the detailed analysis of alternatives phase of a feasibility study generally have an expected accuracy range of -30 to +50 percent (USEPA, 2000).

4.2.9 Community Acceptance

Following submission of this report and the generation of the Proposed Remedial Action Plan (PRAP) by the NYSDEC, a summary of the proposed remedial action will be sent to the project's contact list, which will include the date, time, and location of the public meeting, and announcement of the 30-day period for submission of written comments from the public. A Responsiveness Summary will be prepared to address public comments on the PRAP. After the submission of Responsiveness Summary, a final remedy will be selected and publicized. If the final remedy differs significantly from the proposed remedy, public notices will include descriptions of the differences and the reason for the changes.

5. Remedial Alternatives Analysis

Based upon the site characteristics, the following remedial alternatives were considered to be potentially applicable to the soil and groundwater contamination at the site:

Alternative 1: No Action

Alternative 2: Institutional Controls and Long-Term Monitoring

Alternative 3 Soil Vapor Extraction

Alternative 4: Chemical Oxidation

This section presents an analysis of the potential remedial alternatives for remediation of the Former Marlou Formal Wear dry-cleaning site in accordance with the criteria described in Section 4.2.

5.1 Remedial Alternatives Evaluation

5.1.1 Alternative 1: No Action

5.1.1.1 Description

The no action alternative, by definition, involves no further institutional controls, environmental monitoring, or remedial action, and therefore, includes no technological barriers. In accordance with DER10, this alternative serves as a baseline, defining the minimum steps that would be taken at the site in the absence of any type of action directed at the existing contamination.

5.1.1.2 Overall Protection of Human Health and the Environment

No action as an alternative may not be protective of public health or the environment. Contamination remains in the groundwater and soil vapor. Contamination may exist in the remaining soil not encountered through investigation. The ingestion of groundwater is not a concern because the surrounding properties are serviced by public water. Exposure to groundwater and soil may be a concern to workers with no Institutional Controls (ICs) in place. Exposure to soil vapor could be a problem without future monitoring.

5.1.1.3 Compliance with SCGs

While current conditions of the lot are not in compliance with SCGs set forth in 6 NYCRR Part 375, NYSDEC Class GA Standards, and NYSDOH Soil Vapor Intrusion Guidance may be achieved through natural degradation processes. Due to the location and depth of remaining contamination, exposure to soil and groundwater is unlikely. This, however, would potentially be a long-term process due to the uncertainty of remaining COCs beneath the on-site building.

5.1.1.4 Long-Term Effectiveness and Permanence

The no action alternative involves no remedial action and the contamination being left in place. While natural attenuation and volatilization of the contaminants in groundwater would slowly decrease CVOC concentrations in the subsurface there would still be a long term risk of vapor intrusion to structures near the groundwater plume. Although contamination would eventually degrade and break down over time, this is not an effective alternative. Without ICs and future sampling events, there are no avenues to measure the degradation or migration of contaminants in the subsurface.

5.1.1.5 Reduction of Toxicity, Mobility, and Volume with Treatment

The No action alternative would not actively reduce the toxicity, mobility, or volume of the contamination.

5.1.1.6 Short-Term Impacts and Effectiveness

The no action alternative would have no short term impact to public health or the environment caused by the development and installation of a remedial system as no action is being taken. Impacts to workers and time needed to achieve remedial response objectives is not applicable as there is no site work to be conducted.

5.1.1.7 Implementability

No action is easily implemented.

5.1.1.8 Land Use

The current land use in the area is commercial/business and residential and it is reasonable to anticipate that this land use would continue to be used as such. It is also reasonable to assume that buildings, building slabs, pavement, and other forms of groundcover would remain in place for the foreseeable future. This alternative would not affect the land use.

5.1.1.9 Cost

The no action alternative would have no costs associated with implementation.

5.1.2 Alternative 2: Institutional Controls and Long-Term Monitoring

5.1.2.1 Description

Institutional controls are not technologies, but rather, are legal actions that reduce or prevent exposure of the human population to the contaminated soil and/or groundwater (e.g., deed restrictions, fencing/signs, health advisories). Institutional controls can be used as a stand-alone alternative or can be used in conjunction with other technologies to achieve RAOs. Long-term monitoring of volatile organic compounds in groundwater would be used to assess the performance and effectiveness of the remedy. It would document the groundwater concentrations both on and off-site, upgradient and downgradient.

Alternative 2 would include the following items:

- Imposition of an institutional control in the form of an environmental easement or an environmental notice for the controlled property which would restrict the land use to commercial/industrial; and
- The institutional restrict would control the use of groundwater as a source of potable or process water without necessary water quality treatment as determined by the NYSDOH or County DOH;
- Implementation of a groundwater and vapor intrusion monitoring plan, both on-site and off-site; and
- Compliance with a Department-approved Site Management Plan. This plan would include a provision for evaluation of the potential for soil vapor intrusion for future buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion.

This alternative would not actively reduce contaminant concentrations; however, by prohibiting the use of groundwater as a drinking water source, this alternative would be effective in preventing ingestion of groundwater that contains contaminants. Because contamination would remain both on- and off-site, a Site Management Plan (SMP) would be required. A long-term monitoring program would be implemented at the site to evaluate the extent of contaminant migration and attenuation. Periodic groundwater monitoring of the existing groundwater monitoring well network and continued soil vapor intrusion testing would be part of the long-term monitoring program.

5.1.2.2 Overall Protection of Human Health and the Environment

Alternative 2 would be protective of human health and the environment. Groundwater contamination is present to the southwest beneath residential properties. Although current sampling results do not indicate vapor intrusion is occurring, there is the potential for future vapor intrusion threats. Continued monitoring would provide means to evaluate vapor intrusion impacts and the extent contamination is traveling and/or degrading. The area is currently service by public water and the installation of public wells is not permitted. The continued disallowance of groundwater use would prevent future exposure to contaminated groundwater via ingestion. Therefore, potential future exposure to contaminated groundwater would only be applicable to construction and excavation activities in the area of contamination or utility right-of-way. Exposure pathways could be mitigated through the use of proper safety protocols during this type of work.

5.1.2.3 Compliance with SCGs

While current groundwater concentrations at the lot do not meet SCGs, contamination is at depth. ICs would limit access to contaminated media. No SVI has been occurring, but future monitoring would ensure public safety. Alternative 2 may meet SCGs over the long term as no contamination was identified in the soil in samples collected at the site and soil vapor contamination seems to be volatilizing from the groundwater contamination. Compliance with SCGs set forth in 6 NYCRR Part 375, NYSDEC Class GA Standards, and NYSDOH Soil Vapor Intrusion Guidance may be achieved through natural degradation processes while long-term monitoring occurs with mitigation, if necessary. Compliance with SCGs would be confirmed with the monitoring events to track the natural attenuation processes occurring over time.

5.1.2.4 Long-Term Effectiveness and Permanence

Alternative 2 requires the implementation of institutional controls and long-term monitoring due to the contamination being left in place. While natural attenuation and volatilization of the contaminants in groundwater would slowly decrease CVOC concentrations in the subsurface, there would still be a long term risk of vapor intrusion to structures near the groundwater plume. Long term monitoring would be conducted to evaluate on- and off-site buildings for vapor intrusion impacts. In the event vapor intrusion is identified in a building, monitoring would continue and action would be taken if found to be necessary. The institutional controls that would be put into place would restrict potential exposure pathways at the site.

5.1.2.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 2 would not actively reduce the toxicity or mobility of the contaminants. Long-term monitoring would be conducted to document any potential reduction of contaminant volume over time.

5.1.2.6 Short-Term Impacts and Effectiveness

This alternative would have limited impact to the community. Access to off-site properties would be requested to conduct indoor air sampling as necessary. Applying institutional controls to the property to restrict groundwater use would eliminate exposure through ingestion and would have limited impacts to the community.

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any sampling activities in the affected area.

The sampling wells already in place would be utilized during sampling events and no new sampling points would be necessary at this time. This alternative would likely take less than a year to implement.

Soil vapor intrusion would be monitored and mitigated as necessary.

5.1.2.7 Implementability

Alternative 2 could be easily implemented however the property owner must agree to place an environmental easement. If the owner does not agree NYSDEC can place an environmental notice on the property. Using readily available technologies, sampling would be done by applying all applicable rules and regulations to ensure worker safety and using consistent methods. Terms of the institutional controls would need to be coordinated with appropriate offices and would primarily require administrative tasks to be completed.

5.1.2.8 Land Use

The current land use in the area is commercial/business and residential and it is reasonable to anticipate that this land use would continue to be used as such. It is also reasonable to assume that buildings, building slabs, pavement, and other forms of groundcover would remain in place for the foreseeable future. This alternative is not expected to affect current land usage.

5.1.2.9 Cost

The present worth of Alternative 2 is estimated to be $99,855 This includes the cost of the site management plan and environmental easement development, annual sampling of 9 points, costs associated with conducting off-site vapor intrusion evaluations, and all associated reporting and data evaluation. This alternative was estimated assuming sampling activities would continue for 30-years.

The off-site soil vapor intrusion sampling plan was estimated to be an ongoing activity for the 30-year lifetime of the project. The sampling plan is designed for three years of annual evaluations followed by periodic evaluations for the remainder of the project. It is unlikely to receive consistent volunteers for the vapor intrusion evaluations during each planned event, however, this aspect of the project has been costed expecting three buildings to be sampled and evaluated during each event.

The total present worth of Alternative 2 is $99,855 (Table 2).

5.1.3 Alternative 3: Soil Vapor Extraction

5.1.3.1 Description

Soil vapor extraction (SVE) is used to remediate unsaturated (vadose) zone soil. A vacuum is applied to the soil to induce the controlled flow of air and remove volatile and some semi-volatile organic contaminants from the soil. SVE can be utilized as an in-situ or ex-situ technology. For this application SVE would be used in situ. Prior to air discharge contaminants are typically destroyed through thermal or catalytic oxidation or adsorbed to activated carbon to control air pollution.

Based on the size of the current lot, 1.22 acres, and using the assumption that the extraction wells would achieve a radius of influence of fifty-feet, this remedial element would require the installation of four extraction wells. The extraction wells would be strategically placed in the western area of the lot and surrounding the perimeter of the on-site building. This placement is intended to address the area of highest soil vapor and groundwater contamination and also address a potential source area located beneath the existing building.

5.1.3.2 Overall Protection of Human Health and the Environment

Alternative 3 would be protective of human health and the environment. Soil vapor contamination was detected during the RI and thought to be caused by the volatilization of groundwater contamination. SVE would help to control potential vapor intrusion being caused by the natural attenuation and volatilization of the groundwater contamination.

5.1.3.3 Compliance with SCGs

This alternative would reach compliance with SCGs by reducing the soil vapor contamination caused by volatilization from groundwater and potential soil contamination beneath the current building. Once it is verified that contaminants have been remediated below SCGs remedial action would stop.

5.1.3.4 Long-Term Effectiveness and Permanence

Typically an SVE system is effective and is a permanent remedy. A properly designed system would effectively remove a significant amount of contamination from source areas. At this site the groundwater levels are not very high and the area of contamination is well-defined and not expansive. It is possible that Alternative 3 would leave some remaining contamination trapped in low permeability formations. The system would be operated to meet applicable SCGs to mitigate human exposure to soil vapor contamination.

5.1.3.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternative 3 would effectively reduce the toxicity contamination and the volume of soil vapor contamination in the subsurface. Groundwater contamination is expected to decrease over time via volatilization of contaminants.

5.1.3.6 Short-Term Impacts and Effectiveness

This alternative would cause limited disturbance to the community during the construction of extraction wells. SVE system operation can be disruptive due to noise concerns. Noise can be mitigated if there is an issue.

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

This alternative could be implemented in several months following the necessary steps to design an adequate treatment system.

5.1.3.7 Implementability

Alternative 3 is a widely used technology but would require additional study and pilot testing on site to determine its feasibility. Once access is granted to the property for the installation and operation of a system, the technology is easily implementable within several months of a successful pilot test, well installation, remedial system design and build, and installation of the system. This technology is implemented and successful at various remediation sites and could achieve SCGs in 1-3 years. No pilot test have been performed on site. These technologies may not be feasible due to the nature of the soils.

5.1.3.8 Land Use

The current land use in the area is commercial/business and residential and it is reasonable to anticipate that this land use would continue to be used as such. It is also reasonable to assume that buildings, building slabs, pavement, and other forms of groundcover would remain in place for the foreseeable future.

5.1.3.9 Cost

The present value of Alternative 3 is estimated to be $298,645. This cost includes the site management plan and environmental easement development, annual sampling of 9 points, system design and predesign sampling, costs associated with conducting off-site vapor intrusion evaluations, and all associated reporting and data evaluation. This alternative was estimated assuming three years of system operation and annual sampling with rebound sampling to be conducted six-months after system shutdown.

The off-site soil vapor intrusion sampling plan was estimated to be an ongoing activity for the 30-year lifetime of the project. The sampling plan is designed for three years of annual evaluations followed by periodic evaluations for the remainder of the project. It is unlikely to receive consistent volunteers for the vapor intrusion evaluations during each planned event, however, this aspect of the project has been costed expecting three buildings to be sampled and evaluated during each event.

The total present worth of Alternative 3 is $298,645 (Table 2).

5.1.4 Alternative 4: Chemical Oxidation

5.1.4.1 Description

In situ chemical oxidation (ISCO) is an aggressive remediation technology that has been applied to a wide range of volatile and semi volatile hazardous contaminants, including source zones and dissolved phase chemicals emanating from the source zones. ISCO typically involves reduction/oxidation (redox) reactions; hydrogen peroxide, catalyzed hydrogen peroxide, potassium permanganate, sodium permanganate, sodium per sulfate, and ozone are all commonly used oxidizers for reactions. These oxidants each have advantages and limitations, and while used primarily in treating groundwater can also be used to treat soil.

Of the possible oxidizing chemicals to use sodium per sulfate, sodium permanganate, potassium permanganate, ozone, and peroxide have proven to be effective in treating PCE contamination and its associated degradation byproducts. The most stable oxidizing agents are sodium per sulfate and sodium permanganate, which do not require inhibitors to reduce the potential for rapid degradation of the agent when in contact with soil or groundwater. Sodium permanganate was used as the oxidizing chemical to estimate the cost of this alternative.

5.1.4.2 Overall Protection of Human Health and the Environment

Alternative 4 would be moderately protective of human health and the environment. Due to the need for the oxidant to contact contamination and the unpredictable nature of geology and preferential pathways, it cannot be guaranteed that contamination would be fully mitigated to levels that are protective of human health. However, it is likely there would be a noticeable reduction if the oxidizing chemical is injected into the groundwater contamination.

It is possible for an oxidizing agent to reduce subsurface permeability and aquifer geochemistry through precipitation of minerals into pore spaces. If the oxidizing agent is unable to contact contamination there is also an increased possibility, depending on the oxidant chosen, for varying adverse impacts to the environment via off gassing.

5.1.4.3 Compliance with SCGs

Compliance with SCGs set forth in 6 NYCRR Part 375, NYSDEC Class GA Standards, and NYSDOH Soil Vapor Intrusion Guidance may be achieved through chemical oxidation. When ISCO is properly designed and oxidizing agents are able to react with contamination there is high success rates for reaching compliance with SCGs. Once it is verified that contaminants have been remediated below SCGs, remedial action would stop.

5.1.4.4 Long-Term Effectiveness and Permanence

Alternative 4 has proven to provide long-term effectiveness and permanence in remedial application. ISCO is limited in its ability to treat contamination trapped in low permeability formations which may result in contaminant rebound in the future. Due to the inability to collect soil sample data from beneath the on-site building there is uncertainty if a system is designed to treat any remaining contamination that may exist below the building. Due to the uncertainty of contamination within underlying soils beneath the building, direct implementation of this technology may not be effective.

5.1.4.5 Reduction of Toxicity, Mobility, and Volume with Treatment

ISCO is able to destroy contaminant mass, therefore reducing the mobility and volume during treatment. Injection to soil is dependent on preferential pathways and soil permeability implying that soil contamination may remain following treatment.

5.1.4.6 Short-Term Impacts and Effectiveness

This alternative would cause limited short term impacts to the public. Impacts would primarily occur during the construction of a remedial system and would be monitored accordingly. The storage of oxidizing chemicals may also be required and would be stored and transported in compliance with all applicable rules and regulations so as not to pose a threat to the community. If the proper precautions are not put into place during the injection events there is potential for off gassing of vapors to occur, exposing the community to harmful vapors. The potential oxidizing chemicals have varying reactivity and in turn varying exothermic characteristics. These exothermic reactions, if controlled, would be able to desorb and mobilize persistent source zone areas that slowly and continuously release contamination to the subsurface of the site. If the exothermic reaction is not controlled, however, it may cause the now stable contaminant plume to mobilize resulting in a more complicated remedial effort.

Implementation of this alternative would be undertaken using standard procedures for worker protection including the establishment of a health and safety plan which would outline the appropriate protective measures which should be undertaken during any subsurface activities in the affected area.

5.1.4.7 Implementability

Alternative 4 would require an in-depth design to determine the appropriate oxidizing chemical to use and the proper placement of injection points. The coarse to fine sand observed during previous investigations may cause unpredictable dispersion of the oxidizing chemical if injected to treat remaining soil contamination; however, the technology has proven effective for treating groundwater. Other considerations for this technology include any transport or storage restrictions established by the Department of Defense for the oxidizing agent that has been chosen for treatment. Access agreement would also be established for the injection well installation and associated storage and use of the oxidizing agents.

It is common to design bench-scale studies prior to implementing full scale remedial action, extending the time required to design and implement this technology. Factors including oxidant dosing amount, injection method, treatment well spacing, tools and techniques, and equipment that would work effectively with the oxidant chosen must be decided in this time. This alternative would require several months for bench-scale testing and system design to be completed prior to implementation. One or more applications of oxidant would have to be applied and subsequent monitoring would have to be done. It would likely take 2-3 years to implement this remedy.

5.1.4.8 Land Use

The current land use in the area is commercial/business and residential and it is reasonable to anticipate that this land use would continue to be used as such. It is also reasonable to assume that buildings, building slabs, pavement, and other forms of groundcover would remain in place for the foreseeable future.

5.1.5.9 Cost

The present worth of Alternative 4 is estimated to be $435,188. This cost includes the costs of the site management plan and environmental easement development, pre-design sampling and quarterly sampling of 3 points, two permanganate injections, off-site vapor intrusion evaluations, and all associated reporting and data evaluation. This alternative was estimated assuming the first injection would be 12,000 gallons of 10% permanganate using temporary injection points followed by a second injections to be used as a polishing step. The second injection would be approximately 8,000 gallons of 10% permanganate. The sampling plan accounts for three quarterly sampling events following the first injection and six quarterly sampling events following the second injection.

The off-site soil vapor intrusion sampling plan was estimated to be an ongoing activity for the 30-year lifetime of the project. The sampling plan is designed for three years of annual evaluations followed by periodic evaluations for the remainder of the project. It is unlikely to receive consistent volunteers for the vapor intrusion evaluations during each planned event, however, this aspect of the project has been costed expecting three buildings to be sampled and evaluated during each event.

The total future value of Alternative 4 is $435,188 (Table 2).

5.2 Comparative Analysis

5.2.1 Overview

The RAOs for this site are concerned with the prevention of contact with contaminated soil, groundwater, and soil vapor and the remediation of the affected media to pre-release conditions of the Unrestricted Use SCOs and NYSDEC Class GA Standards for soil and groundwater, respectively, to the extent practicable. The alternatives presented for this site provide varying levels of remedial actions.

Alternative 1, No Action, defines the minimum steps to be taken for remediation of the site. This alternative alone, may meet RAOs over time, but provides no protection to human health and does not address any exposure pathways that exist or may exist in the future.

Alternative 2, Institutional Controls and Long-Term Monitoring includes a site management plan and environmental easement along with long-term monitoring of groundwater and soil vapor to track the contamination over time. The environmental easement placed on the site would require future compliance with the SMP and ensure that future land owners are knowledgeable of the site conditions and restrictions. Continued monitoring would ensure continued involvement. Involvement and monitoring would ensure that if future SVI issues were to arise, they would be mitigated.

Alternative 3, Soil Vapor Extraction, would likely meet the SCOs and NYSDEC Class GA Standards over time and also add a level of protection for public health by reducing the potential for vapor intrusion. This alternative also requires the development of a site management plan and environmental easement.

Alternative 4, In Situ Chemical Oxidation, would likely meet the groundwater standards, however, due to the difficulty of injecting into soil, this alternative may be less effective in achieving soil SCOs than Alternative 3.

5.2.2 Overall Protectiveness of Public Health

Alternative 1 is not protective of public health as no contamination is actively removed nor monitored. The lack of action leads to the potential for exposure through groundwater ingestion and soil vapor intrusion. Exposure to potentially contaminated soil may be controlled however, through the implementation of proper health and safety protocols for work in the area as utilized in Alternative 2.

Alternative 2 provides more protection than Alternative 1 through the establishment of an environmental easement that would restrict the use of groundwater at the site. A site management plan would also be utilized to reduce future exposure should work be performed at the site. Exposure pathways would also be monitored over time through the long-term monitoring program and monitoring of degrading contamination. Monitoring would ensure public health and mitigation of soil vapor would be utilized, if necessary. The remaining contamination is at depth and would not be easily accessible to the public.

Alternative 3 provides more protection that Alternative 2 in that soil vapor and over time contaminant mass is being removed from the site. A pilot study is necessary to confirm hydrogeological compliance with the technology. Off-site soil vapor would also be addressed by applying vacuum to the subsurface and reducing the likelihood of off-site migration of soil vapor. The groundwater contamination would be addressed by natural attenuation over time.

Alternative 4 provides more protection to public health than Alternative 2 in that there is an active remediation occurring given site conditions are compliant with the technology. ISCO has proven to be effective in treatment of groundwater contamination, but is less reliable when treating soil contamination. This alternative would be effective in treating the groundwater plume and may also be designed to be injected to the suspect area of soil contamination, but would not provide protection to public health in reference to the potential off-site soil vapor intrusion in the way that Alternative 2 and 3 would be protective.

5.2.3 Compliance with SCGs

While alternatives 1 and 2 would not immediately reach SCGs, alternative 2 would protect the public and workers from exposure. Alternatives 3 and 4 could theoretically meet SCGs but must be proven with pilot studies or bench tests.

5.2.4 Long-Term Effectiveness and Permanence

Alternative 1 is not effective in the long term. Alternative 2 is not effective in the long term but would ensure public health through Institutional Controls and continued monitoring. Alternatives 3 and 4 may be effective long term and permanent if the hydrogeological structures on site are compatible with available technologies.

5.2.5 Reduction of Toxicity, Mobility, and Volume with Treatment

Alternatives 1 and 2 would not actively reduce the toxicity or mobility of contamination over time, but contaminants would reduce over time through degradation. Alternative 3 would reduce the volume of contamination provided that current technologies are feasible considering the hydrogeological conditions on site. Alternative 4 would actively reduce the toxicity, mobility, and volume of contamination with treatment if hydrogeological conditions are compatible with available technologies.

5.2.6 Short-Term Impacts and Effectiveness

The alternatives are ranked below in the order of short-term impacts and effectiveness from most disruptive to human health and the community to least disruptive:

1. Alternative 4 – In situ Chemical Oxidation
2. Alternative 3 – Soil Vapor Extraction
3. Alternatives 2 – Institutional Controls and Long-Term Monitoring
4. Alternative 1 – No Action

5.2.7 Implementability

Alternatives 1 and 2 are the most easily implementable. Alternatives 3 and 4 are also implementable using readily available resources and technologies given site conditions are compatible. Alternatives 3 and 4 would require ground intrusive activities and cooperation with the site owner for the remedial action to be carried out. Alternative 3 would require additional pilot testing to assure current technologies are feasible considering site hydrogeological conditions. Alternative 4 would also have to be conducted under all relevant rules and regulations for the use and transport of the oxidizing chemical. A bench test to determine the appropriate oxidizing agent would be necessary prior to implementation.

5.2.8 Land Use

All alternatives would be in compliance with the current and reasonably anticipated land use of the site and surrounding area.

5.2.9 Cost

A comparison of the costs for each alternative is provided in Table 2. The ranking of each of the alternatives, from lowest to highest cost, is shown below.

Costs for alternatives 3 and 4 are priced given assumed site conditions. Due to the nature of these alternatives, additional pilot studies must be conducted to assure current technologies could be utilized on site.

Because contamination is at depth and exposure is unlikely, public health would be protected through continued components of alternative 2 such as indoor air testing and mitigation, if necessary. Alternative 2 is effective, and relatively inexpensive.

1. Alternative 1 – No Action: $0
2. Alternative 2 – Institutional Controls and Long-Term Monitoring: $99,855
3. Alternative 3 – Soil Vapor Extraction: $298,645
4. Alternative 4, In Situ Chemical Oxidation: $435,188

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Figures

Figure 1: Site Location

Site Number 447040
Former Marlou Formal Wear
1108 State Street, Schenectady, NY

1,000 500 0 1,000 Feet

N W E S

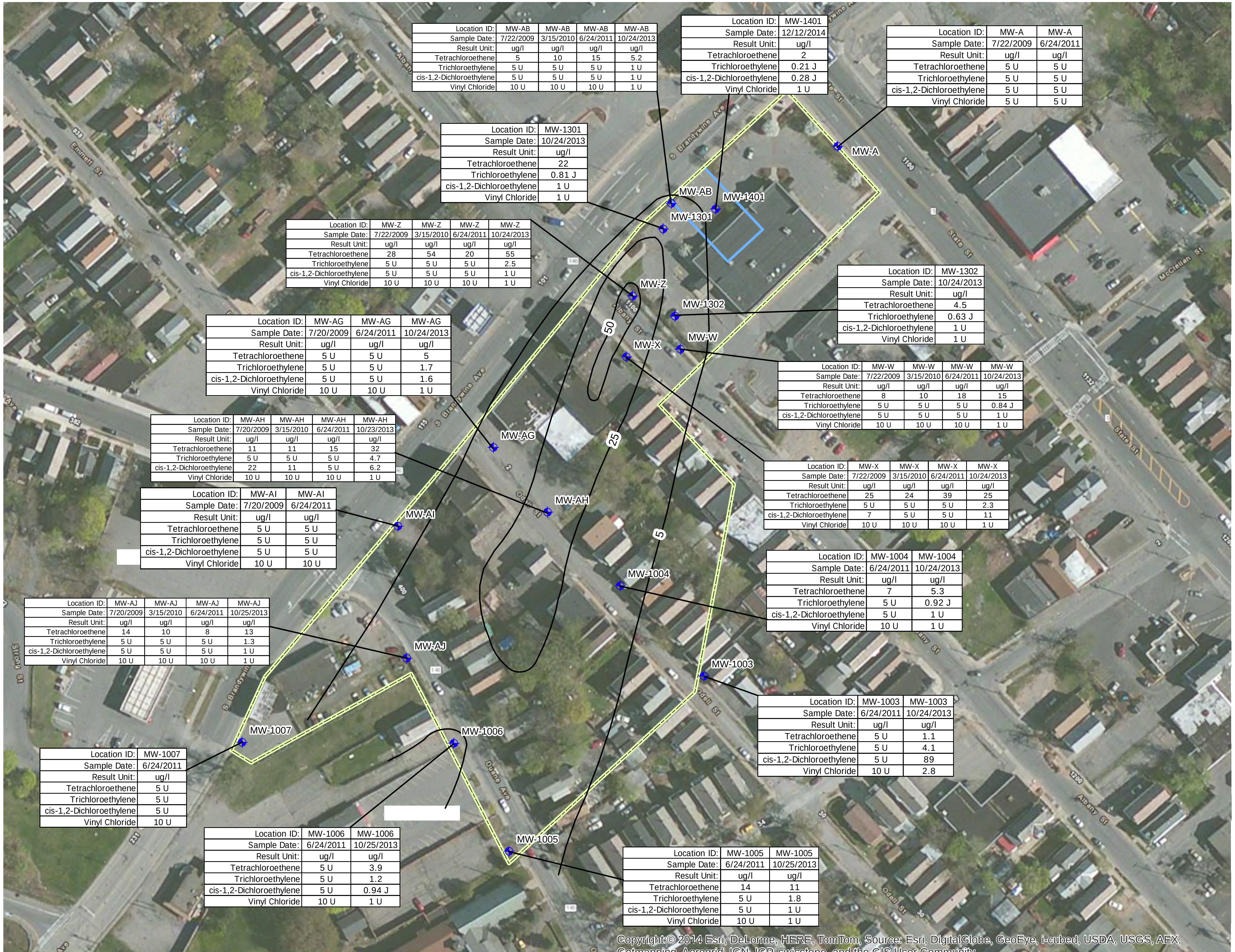
Figure 2: Site Boundary

Site Number 447040
Former Marlou Formal Wear
1108 State Street, Schenectady, NY

40 20 0 40 Feet

N
W E
S

FIGURE 3



Location ID:	MW-AB	MW-AB	MW-AB	MW-AB
Sample Date:	7/22/2009	3/15/2010	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l	ug/l	ug/l
Tetrachloroethene	5	10	15	5.2
Trichloroethylene	5 U	5 U	5 U	1 U
cis-1,2-Dichloroethylene	5 U	5 U	5 U	1 U
Vinyl Chloride	10 U	10 U	10 U	1 U

Location ID:	MW-1401
Sample Date:	12/12/2014
Result Unit:	ug/l
Tetrachloroethene	2
Trichloroethylene	0.21 J
cis-1,2-Dichloroethylene	0.28 J
Vinyl Chloride	1 U

Location ID:	MW-A	MW-A
Sample Date:	7/22/2009	6/24/2011
Result Unit:	ug/l	ug/l
Tetrachloroethene	5 U	5 U
Trichloroethylene	5 U	5 U
cis-1,2-Dichloroethylene	5 U	5 U
Vinyl Chloride	5 U	5 U

Location ID:	MW-1301
Sample Date:	10/24/2013
Result Unit:	ug/l
Tetrachloroethene	22
Trichloroethylene	0.81 J
cis-1,2-Dichloroethylene	1 U
Vinyl Chloride	1 U

Location ID:	MW-Z	MW-Z	MW-Z	MW-Z
Sample Date:	7/22/2009	3/15/2010	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l	ug/l	ug/l
Tetrachloroethene	28	54	20	55
Trichloroethylene	5 U	5 U	5 U	2.5
cis-1,2-Dichloroethylene	5 U	5 U	5 U	1 U
Vinyl Chloride	10 U	10 U	10 U	1 U

Location ID:	MW-1302
Sample Date:	10/24/2013
Result Unit:	ug/l
Tetrachloroethene	4.5
Trichloroethylene	0.63 J
cis-1,2-Dichloroethylene	1 U
Vinyl Chloride	1 U

Location ID:	MW-AG	MW-AG	MW-AG
Sample Date:	7/20/2009	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l	ug/l
Tetrachloroethene	5 U	5 U	5
Trichloroethylene	5 U	5 U	1.7
cis-1,2-Dichloroethylene	5 U	5 U	1.6
Vinyl Chloride	10 U	10 U	1 U

Location ID:	MW-W	MW-W	MW-W	MW-W
Sample Date:	7/22/2009	3/15/2010	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l	ug/l	ug/l
Tetrachloroethene	8	10	18	15
Trichloroethylene	5 U	5 U	5 U	0.84 J
cis-1,2-Dichloroethylene	5 U	5 U	5 U	1 U
Vinyl Chloride	10 U	10 U	10 U	1 U

Location ID:	MW-AH	MW-AH	MW-AH	MW-AH
Sample Date:	7/20/2009	3/15/2010	6/24/2011	10/23/2013
Result Unit:	ug/l	ug/l	ug/l	ug/l
Tetrachloroethene	11	11	15	32
Trichloroethylene	5 U	5 U	5 U	4.7
cis-1,2-Dichloroethylene	22	11	5 U	6.2
Vinyl Chloride	10 U	10 U	10 U	1 U

Location ID:	MW-X	MW-X	MW-X	MW-X
Sample Date:	7/22/2009	3/15/2010	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l	ug/l	ug/l
Tetrachloroethene	25	24	39	25
Trichloroethylene	5 U	5 U	5 U	2.3
cis-1,2-Dichloroethylene	7	5 U	5 U	11
Vinyl Chloride	10 U	10 U	10 U	1 U

Location ID:	MW-AI	MW-AI
Sample Date:	7/20/2009	6/24/2011
Result Unit:	ug/l	ug/l
Tetrachloroethene	5 U	5 U
Trichloroethylene	5 U	5 U
cis-1,2-Dichloroethylene	5 U	5 U
Vinyl Chloride	10 U	10 U

Location ID:	MW-1004	MW-1004
Sample Date:	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l
Tetrachloroethene	7	5.3
Trichloroethylene	5 U	0.92 J
cis-1,2-Dichloroethylene	5 U	1 U
Vinyl Chloride	10 U	1 U

Location ID:	MW-AJ	MW-AJ	MW-AJ	MW-AJ
Sample Date:	7/20/2009	3/15/2010	6/24/2011	10/25/2013
Result Unit:	ug/l	ug/l	ug/l	ug/l
Tetrachloroethene	14	10	8	13
Trichloroethylene	5 U	5 U	5 U	1.3
cis-1,2-Dichloroethylene	5 U	5 U	5 U	1 U
Vinyl Chloride	10 U	10 U	10 U	1 U

Location ID:	MW-1003	MW-1003
Sample Date:	6/24/2011	10/24/2013
Result Unit:	ug/l	ug/l
Tetrachloroethene	5 U	1.1
Trichloroethylene	5 U	4.1
cis-1,2-Dichloroethylene	5 U	89
Vinyl Chloride	10 U	2.8

Location ID:	MW-1007
Sample Date:	6/24/2011
Result Unit:	ug/l
Tetrachloroethene	5 U
Trichloroethylene	5 U
cis-1,2-Dichloroethylene	5 U
Vinyl Chloride	10 U

Location ID:	MW-1006	MW-1006
Sample Date:	6/24/2011	10/25/2013
Result Unit:	ug/l	ug/l
Tetrachloroethene	5 U	3.9
Trichloroethylene	5 U	1.2
cis-1,2-Dichloroethylene	5 U	0.94 J
Vinyl Chloride	10 U	1 U

Location ID:	MW-1005	MW-1005
Sample Date:	6/24/2011	10/25/2013
Result Unit:	ug/l	ug/l
Tetrachloroethene	14	11
Trichloroethylene	5 U	1.8
cis-1,2-Dichloroethylene	5 U	1 U
Vinyl Chloride	10 U	1 U

This document was developed in color. Reproduction in B/W may not represent the data as intended.

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LEGEND

- FORMER MARLOU FORMAL WEAR
- RI STUDY AREA
- MONITORING WELL
- TOTAL COC ISOCONCENTRATIONS (ug/L)

NYSDEC
FORMER MARLOU FORMAL WEAR
1108 STATE STREET
SCHENECTADY, NEW YORK

COC CONCENTRATIONS - GROUNDWATER

0 60 120 240
Feet

MARCH 2016
8653.50285

O'BRIEN & GERE ENGINEERS, INC.

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Tables

Table 1

Potentially Applicable Standards, Criteria, and Guidance

Division/Agency	Title	Standard or Guidance	Requirements
DER/NYSDEC	6 NYCRR Part 375 Inactive Hazardous Waste Disposal Site Remediation Program	Standard	Remedial program requirements. Private party programs; state funded programs; state assistance to municipalities
DER/NYSDEC	Draft DER-10 – Technical Guidance for Site Investigation and remediation, December 2002	Guidance	Site investigation and remediation
DOW/NYSDEC	6 NYCRR Part 700-705 NYSDEC Water Quality Regulations for Surface Waters and Groundwater	Standard	700 – Definitions, Samples and Tests; 701 – Classifications for Surface Waters and Groundwaters; 702 – Derivation and Use of Standards and Guidance Values; 703 – Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards

Table 2

Summary of Remedial Alternatives Cost Estimates; Former Marlou Formal Wear Site

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Capital Costs	$0.00	$42,000	$224,760	$290,280
Annual System Operation, monitoring, and maintenance	$0.00	$0.00	$15,000	$0*
Annual Monitoring (vapor intrusion, groundwater, soil vapor) and reporting	$0.00	$10,250	$11,000	$10,250
Present Worth System Operations	$0.00	$0.00	$40,849	$0*
Present Worth Monitoring	$0.00	$57,855	$33,036	$64,620
Present Worth OM&M	$0.00	$0	$72,765	$144,908
Years of Operation	0	0	3	3
Years of Monitoring	0	30	30	30
Total Present Worth	$0.00	$99,855	$298,645	$435,188

* If a second round of injections is needed, the cost is $100,000. Present Worth is $80,000 for a grand total of $509,000

Appendices

Appendix A: Cost Summary Tables

Alternative 1						
ITEM	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL ITEM COST	PRESENT VALUE
	ESTIMATED CAPITAL COSTS					
1	**Site Mob/Demob**	0	Site			$0
2	**Design/Install**	0	System			$0
3	**Pre-design sampling**	0	Design			$0
4	**SMP development**	0	Report	$15,000		$0
5	**Environmental Easement**	0	EE	$20,000		$0
	SUBTOTAL CAPITAL COSTS					$0.00
	CONTINGENCY					20%
	SUBTOTAL CAPITAL COSTS w/ CONTINGENCY					$0.00
	ESTIMATEED OM&M Costs					
6	**Vapor Intrution Evaluation**					
	Administrative Cost	0	Event	$1,500	$0	$0
	Vapor Intrusion Sampling	0	Building	$900	$0	$0
7	**Goundwater Sampling**	0	Samples/Event		$0	$0
	Groundwater Sample	0	Event	$300	$0	$0
8	**Soil Vapor Sampling**	0	Samples/Event	$0	$0	$0
	Soil Vapor Sample	0	Event	$300	$0	$0
9	**Sampling Report/Travel/Administrative Cost**	0	Event	$5,000	$0	$0
	SUBTOTAL OM&M COSTS					$0
	TOTAL PRESENT VALUE OF ALTERNATIVE					$0

Alternative 2						
ITEM	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL ITEM COST	PRESENT VALUE
	ESTIMATED CAPITAL COSTS					
1	**Site Mob/Demob**	0	Site	NA	$0	$0
2	**Design/Install**	0	System	$0	$0	$0
3	**Pre-design sampling**	0	Design	NA	$0	$0
4	**SMP development**	1	Report	$15,000	$15,000	$15,000
5	**Environmental Easement**	1	EE	$20,000	$20,000	$20,000
	SUBTOTAL CAPITAL COSTS					$35,000.00
	CONTINGENCY					20%
	SUBTOTAL CAPITAL COSTS w/ CONTINGENCY					$42,000.00
	ESTIMATEED OM&M Costs					
6	**Vapor Intrution Evaluation**	9	Events			
	Travel/Administrative Cost	27	Building	$1,500	$40,500	$8,466.56
	Vapor Intrusion Sampling	27	Building	$900	$24,300	$5,079.94
7	**Goundwater Sampling**	9	Samples/Event			
	Groundwater Sample	9	Event	$750	$6,750	$4,233.28
8	**Soil Vapor Sampling**	9	Samples/Event			
	Soil Vapor Sample	9	Event	$2,100	$18,900	$11,853.19
9	**Sampling Report/Travel/Administrative Cost**	9	Event	$5,000	$45,000	$28,221.88
	SUBTOTAL OM&M COSTS				$135,450	$57,855
	TOTAL PRESENT VALUE OF ALTERNATIVE					$99,855

Alternative 3						
ITEM	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL ITEM COST	PRESENT VALUE
	ESTIMATED CAPITAL COSTS					
1	Site Mob/Demob	0	Site		$0	$0
2	Design/Install	1	System	$150,000	$150,000	$150,000
3	Pre-design sampling	1	Design	$2,300	$2,300	$2,300
4	SMP development	1	Report	$15,000	$15,000	$15,000
5	Environmental Easement	1	EE	$20,000	$20,000	$20,000
	SUBTOTAL CAPITAL COSTS					$187,300
	CONTINGENCY					20%
	SUBTOTAL CAPITAL COSTS w/ CONTINGENCY					$224,760
	ESTIMATEED OM&M Costs					
	System OM&M Cost	3	Year	$15,000	$45,000	$40,848.72
6	**Vapor Intrution Evaluation**					
	Administrative Cost	27	Event	$1,500	$40,500	$8,466.56
	Vapor Intrusion Sampling	27	Building	$900	$24,300	$5,079.94
7	**Goundwater Sampling**	9	Samples/Event			
	Groundwater Sample	3	Event	$750	$2,250	$1,328.15
8	**Soil Vapor Sampling**	9	Samples/Event			
	Soil Vapor Sample	3	Event	$2,100	$6,300	$3,718.82
9	**Rebound Vapor Sampling**	1	Sample/Event			
	Rebound Sample	1	Event	$300	$300	$253
10	Sampling Report/Travel/Administrative Cost	3	Event	$5,000	$15,000	$13,069.43
11	Derived Waste	1	Drums/Year			
		3	Year	$450	$1,350	$1,120.67
	SUBTOTAL OM&M COSTS				$135,000	$73,885
	TOTAL PRESENT VALUE OF ALTERNATIVE					$298,645

Alternative 4						
ITEM	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT COST	TOTAL ITEM COST	PRESENT VALUE
	ESTIMATED CAPITAL COSTS					
1	Site Mob/Demob	0	Site		$0	$0
2	Design/Install	1	System	$200,000	$200,000	$200,000
3	Pre-design sampling	1	Design	$6,900	$6,900	$6,900
4	SMP development	1	Report	$15,000	$15,000	$15,000
5	Environmental Easement	1	EE	$20,000	$20,000	$20,000
	SUBTOTAL CAPITAL COSTS					$241,900
	CONTINGENCY SUBTOTAL CAPITAL COSTS w/ CONTINGENCY					20% $290,280
	ESTIMATEED OM&M Costs					
	2nd Injection	1	Injection	$100,000	$100,000	$80,287.54
6	**Vapor Intrution Evaluation**					
	Administrative Cost	9	Event	$1,500	$13,500	$8,467
	Vapor Intrusion Sampling	27	Building	$900	$24,300	$5,080
7	**Goundwater Sampling**	9	Sample/Event			
	Groundwater Sample	8	Event	$750	$6,000	$4,879.67
8	**Soil Vapor Sampling**	9	Sample/Event			
	Soil Vapor Sample	8	Event	$2,100	$16,800	$13,663.08
9	Sampling Report/Travel/Administrative Cost	8	Event	$5,000	$40,000	$32,531.15
	SUBTOTAL OM&M COSTS				$200,600	$144,908
	TOTAL PRESENT VALUE OF ALTERNATIVE					$435,188