NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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June 13, 2024

Transmitted Via Email
Michael Grifasi
Project manager
Ramboll
333 West Washington Street
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Subject: Whitesboro Dry Cleaners, NYS DEC site no 633054
130 Oriskany Blvd. Village of Whitesboro, Oneida County, NY
Feasibility Report

Dear Mr. Grifasi

The New York State Department of Environmental Conservation (NYS DEC) and the New York State Department of Health (NYS DOH) have reviewed the Whitesboro Dry Cleaners Feasibility Study Report dated April 2024. Based on our review we approve the report, please finalize, and return it to me.

If you have any questions or comments, please contact me at 518-402-0031 or Elyse.Dubois@dec.ny.gov.

Sincerely,

Elyse DuBois
Project Manager
Remedial Section A, Remedial Bureau E,
Division of Environmental Remediation

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NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Intended for

New York State Department of Environmental Protection

Document type

Report

Date

June 2024

Former Whitesboro Dry Cleaners (Site ID 633054) Feasibility Study

RAMBOLL Bright ideas. Sustainable change.

FORMER WHITESBORO DRY CLEANERS (SITE ID 633054)
FEASIBILITY STUDY

Project name	**Former Whitesboro Dry Cleaners**
Project no.	**1940100088**
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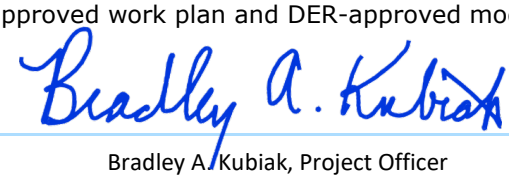
Description	**Feasibility Study**

I, Bradley A. Kubiak, certify that I am currently a NYS registered professional engineer and that this Feasibility Study was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that activities were performed in accordance with the DER-approved work plan and DER-approved modifications.



Bradley A. Kubiak, Project Officer
Professional Engineer License No. NY 081039
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List of Acronyms

bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CVOC	chlorinated volatile organic compound
CY	cubic yards
BMP	best management practice
DCE	dichloroethene
DER	Division of Environmental Remediation
EISD	enhanced *in situ* dechlorination
ft	feet or foot
FWRIA	Fish and Wildlife Resource Impact Assessment
gpm	gallons per minute
GRA	general response action
IRM	interim remedial measure
ISCO	*in situ* chemical oxidation
mg/kg	milligrams per kilogram
MIP	membrane interface probe
MNA	monitored natural attenuation
MtCO2e	metric tons of carbon dioxide equivalent
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
6 NYCRR	Title 6 of the New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
OBG	O'Brien & Gere Engineers, Inc
PCE	tetrachloroethene
PDI	pre-design investigation
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid
PMIA	post-mitigation indoor air
PRAP	Proposed Remedial Action Plan
QHHRA	Qualitative Human Health Risk Assessment
RAO	remedial action objective
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCG	standards, criteria and guidance
SCO	Soil Cleanup Objective
SGV	Standards or Guidance Values
SMP	Site Management Plan
SSDS	sub-slab depressurization systems

SVOC	semi-volatile organic compound
sq ft	square feet
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
VI	vapor intrusion
VOC	volatile organic compound
ZVI	zero valent iron

1. Introduction

1.1 Background

The purpose of this report is to present the Feasibility Study for the former Whitesboro Dry Cleaners site (Site) located in the Village of Whitesboro, Town of Whitestown, Oneida County, New York (Site #633054)**.** A Site location map is provided as **Figure 1-1.** This FS Report has been developed by Ramboll Americas Engineering Solutions, Inc. (Ramboll) on behalf of the New York State Department of Environmental Conservation (NYSDEC) under Engineering Services Standby Contract Work Assignment#D009810-09.

The FS was performed in general accordance with the following regulations and guidance documents:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA);
- National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Federal Register 1990);
- United States Environmental Protection Agency's (USEPA's) Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA 1988);
- NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) (NYSDEC 2010a, errata last revised in April 2019);
- Commissioner Policy (CP-51) Soil Cleanup Guidance Document, Table 1, prepared by NYSDEC, dated October 21, 2010 (NYSDEC 2010b);
- New York State's regulations for Environmental Remedial Programs (Title 6 of the New York Codes, Rules and Regulation [6 NYCRR] Part 375); and
- NYSDEC DER Program Policy on Green Remediation (DER-31; NYSDEC 2011).

This FS Report contains five sections. This section presents a brief description of the Site and its history. **Section 2** presents a summary of Remedial Investigation (RI) activities, the risk assessments and description of geologic and hydrogeologic conditions. The nature and extent of site-related constituents in soils, groundwater, soil vapor, and indoor air and a summary of the conceptual site model are also documented in **Section 2.** The development and screening of remedial alternatives and the detailed analysis of alternatives are documented in **Sections 3** and **4**, respectively. The recommended alternative that addresses the evaluation criteria and represents a cost-effective balance among the evaluation criteria is presented in **Section 5**.

1.2 Site Description

For the purpose of this report, the former Whitesboro Dry Cleaners property is considered the "Site". The Site is approximately 0.21 acres in size (tax parcel ID 305.014-2-33), is zoned for commercial use and contains two buildings: a commercial structure (130-134 Oriskany Boulevard) and a residential structure that is leased to tenants (8 Owens Place) (**Figure 1-2**). The commercial building, approximately 3,300 square feet (sq ft) in area, has three tenant spaces. Two tenant spaces within the commercial building are currently occupied by a thrift store and a dog groomer.

The property is located in a suburban area, surrounded by properties of mixed use. Adjacent properties include private residences and parking lots that are presently considered "off-Site" properties as follows:

- Adirondack Bank and Clinton Street to the north
- Mixed commercial and residential to the south
- Owens Place and residential buildings to the east, and
- Oriskany Boulevard and commercial buildings to the west

Off-Site private residences will only be referred to by a code (e.g., 334W) to protect the identity of the property owners. NYSDEC and New York State Department of Health (NYSDOH) have been provided a key that defines coded off-Site residences. The Site and off-Site properties are presented in **Figure 1-2**, where appropriate. The combined Site and off-Site properties will be discussed as the "Remedial Investigation Study Area."

The Sauquoit Creek is located approximately 1,800 feet (ft) to the south of the Site. The Mohawk River is located approximately 3,900 ft to the northeast of the Site (identified as "River" on **Figure 1-1**). The majority of the Site is paved or covered by buildings. Surface water drainage from the Site flows east towards Owens Place and west towards Oriskany Boulevard where it is collected in the storm sewer system. The storm sewer then discharges to the Sauquoit Creek without treatment. Drinking water is supplied to the area by the Mohawk Valley Water Authority. There are no known uses of groundwater as drinking water at or in the area surrounding the Site.

The on-Site topography is primarily flat but does slope slightly to the southeast. Much of the Site is either covered with pavement, gravel or structures. Site drainage can be divided into two areas: drainage west of the commercial building and drainage east of the commercial building. Site drainage along the west side of the commercial building flows to the south along the building to a catch basin at the southern border of the property. Site drainage on the east side of the commercial building flow primarily east toward Owens Place where catch basins are present. Catch basins in Owens Place and Oriskany Boulevard reportedly discharge to Sauquoit Creek.

The Adirondack Bank property to the north sits approximately 2-ft higher than the Site. Due to this elevation difference, it is assumed that surface drainage flows along the parking lot surface from the Adirondack Bank property to catch basins in nearby streets.

1.3 Site History

The commercial building reportedly operated as a dry-cleaning operation from 1966 or earlier until at least 1994 (Mokry, 2010). The property was purchased in 2011 by Joseph S. Bravo, the current owner.

Between 2006 and 2010, environmental investigations were conducted by NYSDEC at the Site and at the former Farrell's Garage site, located north of the Site on the current Adirondack Bank property. Initial investigations were conducted in 2006 as a result of a petroleum release at the former Farrell's Garage (NYSDEC Spill #86-02108). As documented in the *November 2006 Quarterly Site Monitoring Report* (Nature's Way Environmental Consultants & Contractors, Inc. 2006), potential subsurface chlorinated volatile organic compounds (CVOCs) impacts were identified in groundwater monitoring wells located adjacent to the former Whitesboro Dry Cleaners.

A follow-up investigation was conducted to evaluate whether CVOCs observed at the former Farrell's Garage site originated at the former Whitesboro Dry Cleaners. As documented in a

Subsurface Investigation Letter Report, Former Dry Cleaners Site (OP-TECH Environmental Services, Inc. 2010), soil and groundwater sampling results identified CVOCs at concentrations exceeding relevant NYSDEC screening criteria at sample locations closest to the former Whitesboro Dry Cleaners.

As discussed below in **Section 2**, Remedial Investigation (RI) field activities were conducted at and in the vicinity of the Site between March 2013 through October 2014 and March 2022 for the purpose of collecting additional data necessary to evaluate the nature and extent of CVOCs detected during previous investigations as well as evaluate constituent fate and transport in the subsurface.

Ramboll implemented RI activities in several phases at the Site and off-Site properties. Investigation activities included the evaluation of soil, groundwater, and potential for vapor intrusion (VI). The evaluation of potential for VI were separated from the evaluation of soil and groundwater RI activities to accommodate the need to conduct VI sampling during the 2013-2014 and 2021-2022 heating seasons and access as granted by residences. Additional VI sampling was conducted in 2022-2023. Following VI sampling, mitigation systems in the form of sub-slab depressurization systems (SSDS) were installed at select locations as identified by NYSDOH based on the data collected.

In July 2021, three soil samples and one groundwater sample were collected and were submitted to In-Situ Oxidative Technologies, Inc (ISOTEC) in Lawrenceville, New Jersey for the purpose of conducting a laboratory bench-scale treatability study. The treatability study objective was to evaluate chemical oxidant usage for potential *in situ* injection.

2. Site Characterization

A RI was performed in accordance with the Engineering Services Standby Contract Work Assignment #D007623-06 and #D009810-09. The *RI Report (RIR)* was developed by Ramboll Americas Engineering Solutions, Inc. (Ramboll), formerly known as O'Brien & Gere Engineers, Inc. (OBG), and submitted to NYSDEC on June 1, 2023. NYSDEC approved the RIR on October 11, 2023 (Ramboll 2023b).

2.1 Previous Investigations

As described in **Section 1**, investigations at the Site and adjacent Farrell's Garage site, were completed by NYSDEC between 2006 and 2010. Previous investigations identified CVOCs in soil and groundwater at concentrations exceeding applicable NYSDEC screening criteria at sample locations closest to the former Whitesboro Dry Cleaners Site. The following environmental investigations were conducted at or adjacent to the Site and are documented in Exhibit A of the *RIR*:

- *November 2006 Quarterly Site Monitoring Report, Farrell's Garage (Formerly), 136 Oriskany Boulevard, Whitesboro, New York* by Nature's Way Environmental Consultants & Contractors, Inc., 7 Zuk Pierce Drive, Central Square, New York, dated December 12, 2006
- *Subsurface Investigation Letter Report, Former Dry Cleaners Site, 103 Oriskany Boulevard, Whitesboro, New York* by OP-TECH Environmental Services, Inc., 1 Adler Drive, East Syracuse, New York, dated January 7, 2010

2.2 Remedial Investigation

The objectives of the RI activities conducted in the RI Study Area (which includes the Site and off-Site properties) were to:

- Collect data necessary to evaluate the nature and extent of CVOCs that had been detected previously in soil, groundwater, and sub-slab soil vapor associated with the former dry-cleaning operations at 130-134 Oriskany Boulevard (Site #633054)
- Evaluate the direction of groundwater flow in the overburden beneath and adjacent to the Site
- Evaluate air, surface soil, subsurface soil, and overburden groundwater quality at the Site and/or off-site locations
- Evaluate potential migration pathways
- Evaluate potential VI to nearby residences and mitigate as necessary
- Evaluate the relationship between the contaminant source(s) and potentially exposed human receptor populations
- Complete a qualitative evaluation of actual or potential impacts to fish and wildlife resources from site-related constituents
- Gather data to support the FS

2.3 Geologic and Hydrogeologic Conditions

2.3.1 Geologic Conditions

The Site is in the Mohawk Valley geologic region of New York State, which is within the Erie-Ontario Lowlands physiographic region. The valley separates the Adirondack Mountains to the north from the Allegheny Plateau to the south. Regionally the surficial geology consists of recent alluvium, lacustrine sand, glacial outwash sand and gravel, and till (Cadwell, 1987). The till is a

well graded, heterogeneous deposit consisting of clays, silts, sands, gravels, cobbles and boulders deposited beneath the glacier ice during the advancement of the continental ice sheet during the Wisconsin Glaciation. Overlying the till are glacial outwashes, kame deposits, lacustrine clays, silts, sands, and more recent alluvium. Deposition of these materials mainly occurred during the glacial retreat, while alluvium deposition continues today. Overburden thickness in the region varies based on topography and has a maximum thickness of 70 to 150 ft in the areas between Rome and Frankfort (Halberg et al., 1962). Bedrock is reportedly Upper Ordovician, Frankfort and Utica shales (Halberg et al., 1962). Bedrock was not encountered at the site during the RI or during previous investigations.

2.3.2 Hydrogeologic Conditions

Regional groundwater flow through the overburden is to the northeast towards the Mohawk River, which ultimately discharges to the Hudson River to the east. The most productive aquifers in the region are the glacial outwash deposits commonly found in the river valleys across the region with an average yield of 80 gallons per minute (gpm) (Halberg et al., 1962). Drinking water is supplied to the area by the Mohawk Water Valley Authority and there are no known uses of groundwater as drinking water in the RI Study Area.

Regional groundwater flow in the bedrock is generally along the joints and bedding planes. The existing bedrock wells in the region have an average yield of less than 8 gpm (Halberg et al., 1962).

Depth to groundwater on Site is approximately 6 to 8 ft below ground surface (bgs) and flows primarily to the southeast towards Owen's Place.

2.4 Nature and Extent of Contamination

The nature and extent of contamination at the Site is described in Section 5 of the RIR and within associated RIR figures and tables. A summary for each of the Site media is presented below.

2.4.1 Soil

2.4.1.1 Surface Soil

Volatile organic compounds (VOCs) did not exceed applicable 6 NYCRR Part 375-6 Soil Cleanup Objectives (SCOs) in surface soil. Semi-volatile organic compounds (SVOCs) exceeded Unrestricted, Residential and Protection of Groundwater SCOs in surface soil at two of three locations at the on-Site residence and the one sample at one off-Site residence (SS-4). polychlorinated biphenyls (PCBs) did not exceed applicable SCOs in surface soil. Pesticides exceeded Unrestricted SCOs in surface soil at one location behind the on-Site residence. Herbicides were not detected in surface soils.

Inorganics exceeded Unrestricted, Residential, and Protection of Groundwater SCOs at four surface soil locations at the on-Site residence. Lead was detected in the four soil samples. Lead was observed (up to 1,440 milligrams per kilogram [mg/kg]) exceeding Unrestricted, Residential, and Protection of Groundwater SCOs in samples from SS-1 and SS-5 in the 0.0-0.17 ft interval. Lead was also observed above Unrestricted SCOs at SS-2 and SS-3 in the 0.0-0.17 ft interval. Iron was observed at concentrations of up to 30,200 mg/kg, which exceeds the New York State (NYS) CP-51 Residential SCO (NYSDEC, 2010b). Zinc was detected above Unrestricted SCOs at

concentrations up to 408 J mg/kg at SS-1, SS-2, and SS-3 in the 0.0-0.17 ft interval samples. Mercury was also detected above Unrestricted SCOs at 0.647 mg/kg at SS-1 in the 0.0-0.17 ft interval sample. No other constituents from these samples were detected at concentrations above SCOs.

2.4.1.2 Subsurface Soil

Tetrachloroethene (PCE) and its associated degradation products exceed Unrestricted SCOs in on-Site soil under the eastern parking lot, western parking lot, and between the on-Site residence and commercial building at depths up to 13.5 ft bgs. PCE and degradation products also exceeded Unrestricted, Residential, and Protection of Groundwater SCOs in on-Site soil between the on-Site residence and commercial building at depths up to 12.0 ft bgs. The only exceedances of Commercial SCOs were PCE and trichloroethene (TCE) in on-Site soil under the eastern parking lot, up to 5 ft bgs in borings SB-15 and MW-19 which are located adjacent to the pipe end observed in the building foundation (**Figure 2-1**). PCE and degradation products did not exceed SCOs at off-Site locations.

Cross sections showing Zones A and B are presented in **Figures 2-2** and **2-3**. In Zone A (shallower zone), membrane interface probe (MIP) results indicate that halogen specific detector values above background are confined to the Site with the exception of elevated MIP readings at one location along the northern property boundary.

SVOCs did not exceed SCOs in subsurface soil samples.

Lead concentrations exceeded Unrestricted and Protection of Groundwater SCOs in subsurface soil at one on-Site location beneath the eastern parking lot. Lead also exceeded Unrestricted, Residential, and Protection of Groundwater SCOs in subsurface soil at three on-Site locations adjacent to the on-Site residence. Other inorganics such as iron, silver, zinc and mercury and pesticides had limited exceedances above Residential and Unrestricted SCOs in locations adjacent to the on-Site residence.

2.4.2 Groundwater

SVOCs, PCBs, pesticides, and herbicides were not detected above Class GA Standards or Guidance Values (SGVs) during the RI.

VOC impacts to the groundwater have been observed in both the on-Site and off-Site wells. Site-related CVOCs, PCE, and associated degradation byproducts TCE, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, and vinyl chloride, have been detected above Class GA SGVs in all three on-Site wells (MW-19, MW-20, MW-21), two wells on the adjacent northern property (B-19NWMW-3, MW-14), one well immediately east of the Site in the Owens Place ROW (MW-23), and one well on the adjacent southern property (MW-16S). However, CVOCs were not detected in the deep well (MW-16D) associated with MW-16S. The highest concentrations of PCE were observed in the on-Site wells (MW-19, MW-20, and MW-21) in the vicinity of the suspected source area. PCE was also present above the Class GA Standard in well MW-21, which is located on the west side of the on-Site structures.

The horizontal extent of CVOCs are defined to the north, west, and east. The horizontal extent has not been fully defined to the south based on the exceedance of Class GA SGVs at MW-21 (southwest property boundary) and MW-16S (south of Site).

Additional VOCs observed above Class GA SGVs are petroleum related constituents that are likely related to the adjacent former Farrell's Garage site.

Per- and polyfluoroalkyl substances (PFAS) compounds perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) were detected above their respective Class GA SGVs at on-Site well MW-19. PFOA was detected at upgradient well MW-21 but below the corresponding Class GA SGV. Neither PFOA or PFOS were detected at downgradient well MW-23.

1,4-Dioxane exceedances were not detected in the RI Study Area.

PCBs, pesticides, and herbicides were not detected in groundwater.

2.4.3 Vapor Intrusion

Sub-slab PCE and breakdown products exceeding NYSDOH Decision Matrices were observed beneath both on-Site buildings (commercial and residence) and one off-Site residence.

The maximum on-Site sub-slab concentration of PCE was observed beneath the commercial building (sampled by others) followed by the on-Site residence. A sub-slab depressurization system (SSDS) was installed as an interim remedial measure (IRM) by NYSDEC at the on-Site residence on June 14, 2013. Follow-up post-mitigation indoor air (PMIA) sampling was performed on March 12, 2014 to confirm the effectiveness of the system.

Additionally, a SSDS was installed at the on-Site commercial building by the property owner. Due to a lack of information provided by the property owner, NYSDEC and NYSDOH subsequently requested Ramboll perform additional PMIA sampling to evaluate its effectiveness of the SSDS. PMIA sampling conducted on September 20, 2013 indicated that the original SSDS install was insufficient to mitigate the indoor air concentrations and, as a result, the existing SSDS was expanded to include a second fan on December 9, 2013. After modification, NYSDEC requested additional indoor air sampling. PCE was detected in the March 2014 indoor air samples at concentrations below the NYSDOH air guideline value, confirming effective SSDS operation.

Indoor air and sub-slab sampling was also completed at seven off-Site residences to evaluate the potential for vapor intrusion. Based on sampling results, and at the direction of NYSDEC and NYSDOH, a partial SSDS was installed at one off-Site residence (340W) on August 26, 2015. PMIA sampling was completed on February 2, 2016 and confirmed the effectiveness of the SSDS installed at the off-Site residence (340W).

2.5 Summary of Exposure Assessments

2.5.1 Fish and Wildlife Resources Impact Analysis

A Fish and Wildlife Resources Impact Analysis (FWRIA) was completed for the Site in accordance with Steps I and II of the NYSDEC's FWRIA guidance document (NYSDEC 1994) (OBG, 2014]. Step I included a Site description in terms of topography, cover types, drainage, fish and wildlife

resources and value, and identification of potentially applicable fish and wildlife criteria. Step II was performed to evaluate potential impacts of Site-related constituents on the identified fish and wildlife resources, including a Pathway Analysis (Step II-A) and Criteria-specific Analysis (Step II-B).

No wetland or aquatic habitats are present on or in the immediate vicinity of the Site. Available on-Site ecological habitat is limited to mowed lawn terrestrial habitat. This habitat is of relatively poor quality due to the lack of vegetative diversity and relatively small size and location. Wildlife which may utilize the Site includes songbirds and small mammals. However, periodic maintenance and monitoring of the mowed lawn area and the developed nature of the adjacent areas significantly limits the utilization of the Site by wildlife.

The findings of the FWRIA concluded that Site-related impacts to ecological receptors are minimal or non-existent and further assessment of potential ecological impact is not warranted.

2.5.2 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment (QHHEA) Report was completed to evaluate potential human exposure to Site-related contaminants of concern (COCs) under current and reasonably anticipated future use scenarios (Ramboll, 2023a). The primary COCs are PCE, its associated breakdown products, and PFAS. Dry cleaning operations at the Site contributed to the release of PCE, its degradation products, and PFAS to environmental media at the Site. Based on the results of VI investigations at select off-Site properties, migration of COCs off-Site appears to have occurred.

It is reasonable to anticipate that commercial building and parking lot on the Site will continue to be used for commercial purposes in the future. However, a portion of the site is currently being used as a residence and will likely continue to be used as such. The most likely future exposure scenario assumes that the buildings, building slabs, and pavement/groundcover will remain in place for the foreseeable future.

Potential receptors and potentially complete exposure pathways under the current and reasonably foreseeable future scenario include:

- Current/future residents (child and adult) on-Site, which could be potentially exposed to COCs in surface soil through incidental ingestion, dermal contact, and inhalation of fugitive dust and vapor in ambient air and indirect exposure to groundwater-derived and/or soil-derived vapors via inhalation in the interior spaces of the on-Site residence.
- Current/future commercial workers that work within the existing commercial building or, under a hypothetical future use scenario, another building in its place may be exposed indirectly to groundwater-derived and/or soil-derived vapors via inhalation in the interior spaces of the Site commercial building.
- Future construction workers that could be involved with facility construction-related activities, could potentially be exposed to COCs in surface and subsurface soil through incidental ingestion, dermal contact, and inhalation of ambient vapors/fugitive dust, as well as dermal contact with affected groundwater.
- Current/future utility workers that could be involved with future utility-related activities, could potentially be exposed to COCs in surface and subsurface soil through incidental ingestion,

dermal contact, and inhalation of ambient vapors/fugitive dust, as well as dermal contact with affected groundwater.

- Current/future residents (child and adult) that live off-Site, could potentially be exposed to Site-related COCs in indoor air in their respective residences.

Mitigation systems are presently operating at on-Site buildings and at one off-Site residence, 340W. Under current operating conditions, these systems address the exposure pathway for groundwater-derived and/or soil-derived vapors via inhalation in the interior spaces.

3. Development of Remedial Alternatives

This section documents the development of remedial alternatives for Site soil, groundwater, and indoor air/sub-slab vapor consistent with the Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act; USEPA 1988) and NYSDEC's Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10) (NYSDEC 2010a). As part of the development of remedial alternatives, remedial action objectives (RAOs) and general response actions (GRAs) were identified for the FS. In addition, this section documents the areas and volumes of media to be addressed by the remedial alternatives and specific remedial technologies that, following screening, were used to develop the range of remedial alternatives evaluated in this FS. Consistent with NYSDEC's DER-31 – Green Remediation (NYSDEC 2011) and USEPA's Superfund Green Remediation Strategy (September 2010), green remediation concepts were considered during the development of alternatives in this FS.

3.1 Development of Remedial Action Objectives (RAOs)

RAOs are media-specific goals for protecting public health and the environment. RAOs form the basis for the FS by providing overall goals for site remediation. The RAOs are considered during the identification of appropriate remedial technologies and development of remedial alternatives for the Site, and later during the evaluation of remedial alternatives.

RAOs are based on professional and engineering judgment, risks identified in the FWRIA and QHHEA Reports, potential Standards, Criteria and Guidance (SCGs), and migration potential. Additionally, the current, intended and reasonably anticipated future land use of the Site and its surroundings and the nature and extent of COCs exceeding chemical-specific SCGs were considered during the development of the RAOs. Documentation of the rationale employed in the development of RAOs for Site media is presented below.

3.1.1 Identification of Potential Standards, Criteria and Guidance

There are three types of SCGs: chemical-specific, location-specific, and action-specific. Chemical-specific SCGs are health- or risk-based numerical values, or methodologies which when applied to site-specific conditions result in numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. Location-specific SCGs set restrictions on activities based on the characteristics of the site and immediate environment on which the activity is to be performed. Action-specific SCGs set controls or restrictions on particular types of remedial actions once the remedial actions have been identified as part of a remedial alternative. The identification of potential SCGs is documented in **Table 3-1**. The rationale for the selection of chemical-specific SCGs related to 6 NYCRR 375 SCOs and land use is further described below.

3.1.2 Land Use and Selection of Soil Cleanup Objectives

Consistent with 6 NYCRR Part 375-1.8(f) and DER-10 4.2(i), the current, intended and reasonably anticipated future land use of the Site are considered when selecting SCOs. The Site consists of approximately 0.21 acres containing one commercial building and a residential building, a gravel area, a paved parking lot, and exposed soil/grassy areas immediately adjacent to the on-Site residence. The commercial and residential buildings cover areas of approximately 3,300 sq ft and 1,100 sq ft, respectively. The Site is located in an area zoned for commercial use

in the Village of Whitesboro, New York and is bounded by Adirondack Bank and Clinton Street to the north; mixed commercial and residential properties to the south; Owens Place and residential properties to the east; and Oriskany Boulevard and commercial properties to the west.

The commercial building reportedly operated as a dry-cleaning operation until the early 1990's (NYSDEC 2012). The commercial building currently contains three tenant spaces. Two tenant spaces were occupied by a financial planner and a dog groomer while the third was vacant. Currently, the commercial building has two tenant spaces that are occupied by a thrift store and a dog groomer. A small residence, approximate footprint of 1,100 sq ft, is located on the southeast corner of the Site. Currently the small on-Site residence is occupied.

Given that the reasonably anticipated future use for the Site will be for mixed commercial and residential uses, the following 6 NYCRR Part 375 Restricted Use SCOs are identified as appropriate SCOs for portions of the Site:

- 6 NYCRR Part 375 SCOs for Commercial Use (Commercial SCOs)
    - Commercial use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iv), anticipates use by businesses with the primary purpose of buying, selling or trading of merchandise or services.
    - Commercial SCOs are proposed for soil from the parking lot to the east of the commercial building and within the right-of-way of Oriskany Boulevard.
- 6 NYCRR Part 375 SCOs for Residential Use (Residential SCOs)
    - Residential use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iv), allows a site to be used for any use other than raising live-stock or producing animal products for human consumption. Restrictions on the use of groundwater are allowed, but no other institutional or engineering controls are allowed relative to the residential use soil cleanup objectives. This is the land use category which will be considered for single family housing.
    - Residential SCOs were applied to soil from the exposed soil/grassy areas immediately to the west and east of the on-Site residence.

For purposes of evaluating a required pre-disposal conditions alternative, analytical results for subsurface soil were also compared to Unrestricted SCOs.

Consistent with 6 NYCRR Part 375-1.8(d), groundwater protection and control measures were also considered when selecting SCOs. The 6 NYCRR Part 375-6.8(b) as amended with NYSDEC CP-51 restricted use SCOs for the Protection of Groundwater Resources (Protection of Groundwater SCOs), presented in Table 375-6.8(b), were used as criteria to identify soil impacts potentially affecting groundwater quality.

As detailed in **Section 2.4**, surface and subsurface soil data were screened against 6 NYCRR Part 375-6.8(a) Unrestricted Use SCOs (Unrestricted SCOs) and 6 NYCRR Part 375-6.8(b) Restricted Use SCOs for Commercial Use and Residential Use in the RIR.

3.1.3 Remedial Action Objectives

Potential chemical-specific SCGs and public health exposure pathways identified for soil and groundwater at the Site were considered during the development of RAOs and remedial alternatives. As described in **Section 2.4**, soil and groundwater samples exhibit concentrations above chemical-specific SCGs in certain areas of the Site. Though groundwater in the RI Study Area is not used as drinking water, groundwater exceedances to SCGs were considered. Potential human exposures to Site-related COCs in soil and groundwater were identified for current/future residents, commercial workers, construction workers and utility workers. As described in **Section 2.4**, vapor intrusion mitigation systems are presently operating at on-Site buildings and at one off-Site residence (340W). Under current conditions, these systems address the exposure pathway for groundwater-derived and/or soil-derived vapors via inhalation in the interior spaces. Accordingly, based on the findings of the RIR, the following RAOs were developed for soil and groundwater at the Site.

3.1.3.1 RAOs for Soil

As presented in **Section 2** of this report and Section 5 of the RIR, COC concentrations in overburden soil at the Site exceed soil SCGs. Potentially complete human health exposure pathways were identified for ingestion and dermal contact with soil and inhalation of dust at the Site. Due to the developed nature of the Site and adjacent properties and the lack of ecological receptors, ecological pathways are not considered complete. Accordingly, RAOs identified for Site soils are as follows:

<u>RAOs for Public Health Protection</u>

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

<u>RAOs for Environmental Protection</u>

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

3.1.3.2 RAOs for Groundwater

As presented in **Section 2** of this report and Section 5 of the RIR, concentrations of Site-related COCs in groundwater exceed SCGs. Potentially complete human health exposure pathways were identified for ingestion and dermal contact with groundwater and inhalation of vapors from groundwater at the Site. Accordingly, RAOs identified for Site groundwater are as follows:

<u>RAOs for Public Health Protection</u>

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

<u>RAOs for Environmental Protection</u>

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

3.1.3.3 RAOs for Indoor Air/Sub-Slab Vapor

As presented in **Section 2** of this report and Section 5 of the RIR, indoor air and sub-slab vapor COC concentrations exceed SCGs. Accordingly, RAOs identified for indoor air/Site soil vapor are as follows:

RAOs for Public Health Protection

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

3.2 Development of General Response Actions

GRAs are media-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs and SCOs. GRAs identified for soil and groundwater, based on the RAOs, are summarized as follows:

Soil

- **No further action.** No action must be considered in the FS, as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Part 300.430) and DER-10 Sections 4.1(d) and (b), as a baseline against which other actions are evaluated.
- **Institutional controls/limited actions.** Actions that provide Site access and use restrictions and provisions for continued operation of the remedy.
- **Natural recovery.** Actions that rely on natural processes to attenuate contaminants in soil.
- **Containment actions.** Actions that minimize the potential for direct contact with and erosion of surface soil.
- ***In situ* treatment actions.** Actions that treat soil in place to reduce mobility or toxicity.
- **Removal actions.** Actions to excavate soil.
- ***Ex situ* treatment actions.** Actions that treat soil following removal, to reduce mobility or toxicity.
- **Disposal actions.** Actions that dispose of soil on-site or off-site.

Groundwater

- **No further action.** No action must be considered in the FS, as required by NCP (40 CFR Part 300.430) and DER-10 Sections 4.1 (d) and 4.4 (b), as a baseline against which other actions are evaluated.
- **Institutional controls/limited actions.** Actions that provide use restrictions, monitoring, and provisions for continued operation of the remedy.
- **Natural recovery.** Actions that rely on natural processes to attenuate contaminants in groundwater.
- **Hydraulic control.** Actions that collect and/or control groundwater flow, minimizing further migration.
- ***In situ* treatment actions.** Actions that treat groundwater in place to reduce mobility or toxicity.
- ***Ex situ* treatment actions.** Actions that treat groundwater following extraction, to reduce mobility or toxicity.

The GRAs for this FS are identified in **Tables 3-2 and 3-3**.

3.3 Identification of Volumes and Areas of Media

Volumes and areas of soil and groundwater to be addressed in this FS were estimated based on Site conditions, the nature and extent of contamination, RAOs, and potential chemical-specific SCGs.

The areal extents of surface and subsurface soil to be addressed are described in detail and shown on figures in the RIR and summarized below.

Surface Soil (On-Site Residential Area)

Based on findings presented in the RIR, surface soil concentrations of PAHs and metals were detected above the respective Residential SCOs in samples in the vicinity of the on-Site residence. Specifically, surface soil (between 0 and 2 ft bgs) exhibit concentrations of lead and other constituents that are greater than Residential SCOs over approximately 1,350 sq ft.

Surface and Subsurface Soil (On-Site Commercial Area)

Based on findings presented in the RIR, PCE and TCE were detected at concentrations above Commercial SCOs in the area of the eastern parking lot. It is estimated that surface and subsurface soils up to 15 ft bgs exceed Commercial SCOs within the Site boundary over approximately 1,500 sq ft.

Surface and Subsurface Soil (Site-wide)

In accordance with DER-10, this FS evaluates remedial options to address subsurface soil with respect to restoration to unrestricted use conditions. Based on findings presented in the RIR, it is estimated that surface and subsurface soils up to 15 ft bgs exceed Unrestricted SCOs within the Site boundary over approximately 9,850 sq ft.

The horizontal limits of Unrestricted SCO exceedances of CVOCs are defined to the north and south property boundary. Horizontal limits are not defined at the western and eastern property boundary. Vertical limits of CVOCs exceeding Unrestricted SCOs are not defined at several locations immediately adjacent to the commercial building. The highest XSD readings were observed adjacent to the suspected source area at locations SB-15 from 4 to 5 ft bgs (609,607 µV) and SB-28 from 2.5 to 4.5 ft bgs (657,445 µV). However, in general, MIP readings decrease with depth indicating concentrations likely decrease with depth.

Groundwater

Based on findings presented in the RIR, the horizontal limits of CVOCs in groundwater are defined to the north, west, and east. Groundwater with dissolved CVOCs migrates downgradient from the Site, generally from west to east. The horizontal limits have not been fully defined to the south based on the exceedance of Class GA SGVs at MW-21 (southwest property boundary) and MW-16S (south of Site).

3.4 Identification, Screening, and Evaluation of Remedial Technologies and Process Options

Potentially applicable remedial technologies and process options for each GRA were identified and then screened on the basis of technical implementability. Technical implementability for each identified process option was evaluated with respect to contaminant information, physical

characteristics, and areas and volumes of affected media summarized in **Section 3.3**. Remedial technologies and process options for soil and groundwater are further described below.

3.4.1 Identification of Remedial Technologies and Process Options

Descriptions of retained technologies and process options identified for the FS are presented in **Tables 3-2 and 3-3** and summarized as follows:

Soil

- No further action
- Access/use restrictions/administrative control(s) (institutional controls)
- Site controls (site management plan [SMP])
- Periodic reviews (periodic site reviews)
- Natural attenuation
- Cover system (engineered cover, low permeability cover)
- *In situ* treatment (enhanced bioremediation, chemical oxidation, chemical reduction, electrical resistance heating, and radio frequency heating)
- Excavation (mechanical excavation)
- Off-site disposal (off-site commercial landfill, off-site treatment facility)

Groundwater

- No further action
- Use restrictions (environmental easement, SMP)
- Periodic reviews (periodic site reviews)
- Groundwater monitoring
- Natural attenuation (natural attenuation, monitored natural attenuation [MNA])
- Extraction (extraction wells, collection trench, multi-phase extraction)
- *In situ* treatment (enhanced bioremediation, enhanced *in situ* dechlorination [EISD], chemical oxidation, chemical reduction)
- *Ex situ* off-site treatment (publicly owned treatment works)

3.4.2 Screening and Evaluation of Remedial Technologies and Process Options

The remedial technologies and process options were evaluated further according to the criteria of effectiveness, implementability, and cost. The effectiveness criterion included the evaluation of:

- Potential effectiveness of the process option in meeting the RAOs and accommodating the estimated areas and/or volumes of media summarized in **Section 3.3**
- Potential effects on public health and the environment during implementation (including, as appropriate, construction and operation)
- Reliability of the process options for Site-related COCs and conditions

Technical and institutional aspects of implementing the process options were assessed for the implementability criterion. The capital and operation and maintenance (O&M) costs of each process option were evaluated as to whether they were high, medium, or low relative to the other process options of the same technology type. Based on the evaluation, the more favorable process options of each technology type were chosen as representative process options. The selection of representative process options simplifies the assembly and evaluation of potential remedial alternatives but does not eliminate other process options for consideration. The representative process option provides a basis for conceptual design during the FS, without

limiting flexibility during the remedial design phase. An alternative process option may be selected during the remedial design phase as a result of design evaluations, treatability studies, or pilot testing. The screening and evaluation of technologies addressing soil is summarized in **Table 3-2**. The screening and evaluation of technologies addressing groundwater is summarized in **Table 3-3**.

Soil

The screening and evaluation of containment technologies for soil (**Table 3-2**) resulted in the vegetation enhancement process option being evaluated, but not retained due to limited implementability due to the current and reasonably anticipated future commercial Site use.

The screening and evaluation of technologies for soil (**Table 3-2**) resulted in the following *in situ* technologies/process options being evaluated, but not retained because of limited implementability and/or effectiveness due heterogeneity of subsurface materials and presence of subsurface utilities:

- *In situ* biological treatment via bioventing and phytoremediation
- *In situ* physical/chemical treatment via soil vapor extraction, multi-phase extraction, solidification/stabilization, flushing, and electrokinetic separation
- *In situ* thermal treatment via hot water injection, steam injection, thermal conduction, and vitrification.

Ex situ treatment technologies addressing soil were not retained because of limitations in implementability and practicability of addressing Site-wide volumes of material and associated restoration in conjunction with insufficient space on-site for treatment processes and staging of materials. Additionally, excavation and *ex situ* treatment of soil would not support future anticipated Site use. Based on the screening and evaluation of technologies for soil (**Table 3-2**), the following technologies/process options were evaluated, but not retained:

- *Ex situ* biological treatment via biopiles, landfarming, and slurry-phase bioreactor
- *Ex situ* chemical treatment via chemical oxidation and extraction/washing
- *Ex situ* physical treatment via particle size separation and solidification/stabilization
- *Ex situ* thermal treatment via low temperature thermal desorption, pyrolysis, and incineration

Groundwater

In situ treatment technologies addressing groundwater were not retained because of limited implementability and/or effectiveness due to heterogeneity of subsurface materials. Based on the screening and evaluation of technologies for groundwater (**Table 3-3**), the following technologies/process options were evaluated, but not retained:

- *In situ* biological treatment via enhanced bioremediation (aerobic)
- *In situ* physical treatment via air sparging and circulation wells
- *In situ* treatment via a permeable reactive barrier

3.4.3 Representative Process Options

A description of the representative process options for retained technologies, by GRA and technology for soil and groundwater, is presented in the following sections.

No Further Action

No further action was identified as a representative process option for soil and groundwater. The no further action alternative must be considered in the FS, as required by the NCP (40 CFR Part 300.430) and DER-10 Section 4.4(b)3 (NYSDEC 2010a). Under this process option, no additional remedial actions addressing Site soil and groundwater would be conducted.

Institutional Controls/Limited Actions

Institutional controls, SMP, and periodic site reviews were identified as representative process options associated with the institutional controls/limited actions GRA for soil and groundwater.

- **Institutional controls.** Access/use restrictions (i.e., institutional controls) would be recorded for the Site documenting land use restrictions and requiring that activities that would potentially expose contaminated materials (and require health and safety precautions) be performed in accordance with the SMP. The institutional controls would also provide provisions to evaluate and address, if necessary, potential VI if additional buildings are constructed at the Site and/or as requested by NYSDOH for on- and/or off-Site structures.
- **SMP.** A SMP would document Site institutional and engineering controls and any physical components of the selected remedy requiring operation, maintenance, and monitoring to provide for continued effectiveness of the remedy. As defined in 6 NYCRR Part 375-1.2(o), engineering controls include, but are not limited to, pavement, caps, covers, subsurface barriers, vapor barriers, slurry walls, building ventilation systems, fences, access controls, provision of alternative water supplies via connection to an existing public water supply, adding treatment technologies to such water supplies, and installing filtration devices on private water supplies. The SMP would also present provisions for periodic site reviews.
- **Periodic site reviews.** Periodic reviews and certification are required by 6 NYCRR Part 375 where institutional and engineering controls, monitoring, and/or O&M activities are required at the Site. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC.

Monitoring

Groundwater monitoring was identified as a representative process options associated with the institutional controls/limited actions GRA for groundwater.

- **Groundwater monitoring.** Groundwater monitoring would involve periodic sampling and analysis of groundwater. Groundwater monitoring would provide a means of detecting changes in constituent concentrations in groundwater. Groundwater levels would be obtained at the time of groundwater sampling to evaluate groundwater flow direction.

Natural Recovery

Natural attenuation was identified as the representative process option associated with the natural recovery GRA for soil and groundwater

- **Natural attenuation.** Natural attenuation results from naturally occurring processes reducing the mass, mobility, volume, or concentration of organic constituents in groundwater over time. *In situ* processes include biotic and/or abiotic degradation, sorption, dilution, volatilization and/or transformation.

MNA was identified as the representative process option associated with the natural recovery GRA for groundwater.

- **MNA**. MNA adds a monitoring component to natural attenuation. This would involve implementation of a long-term groundwater monitoring program to monitor the natural attenuation of VOCs.

Containment
An engineered cover was identified as the representative process option associated with the containment GRA for soil. Containment systems provide a means of minimizing erosion of soil and the potential for contact with the soil on the Site.

- **Engineered cover.** An engineered cover would consist of a soil layer of an appropriate thickness, or other surface such as gravel, pavement or buildings, over existing soil. A paved cover currently exists in areas of the commercial property where soil exhibits concentrations above applicable 6 NYCRR Part 375 SCOs. A residence and commercial building are also on-Site. Engineered covers prevents erosion of and contact with impacted surface soil. Routine cover maintenance, including repairs to paving and gravel and inspections for integrity, would be necessary. A vegetative cover would require seasonal mowing, inspections, and periodic reseeding to maintain integrity.

In situ Treatment
In situ chemical oxidation (ISCO) and EISD were identified as the representative process options associated with the *in situ* treatment GRA for saturated soil and groundwater.

- **ISCO.** ISCO would involve injection or mixing of chemical oxidants (e.g., permanganate, persulfate, hydrogen peroxide) into the subsurface to chemically convert contaminants in soil and groundwater to reduce their toxicity. A bench scale treatability study was conducted in October 2021 and concluded that permanganate would be a viable oxidizing agent for treatment of soil and groundwater at the Site.

  EISD. EISD would involve treatment of contaminants in saturated soil and groundwater through injection of carbon substrate electron donor(s), zero valent iron (ZVI), and dechlorinating bacteria to support biotic processes resulting in the dechlorination and degradation of organic contaminants. Iron sulfide minerals may also be added to promote abiotic reductive dechlorination of organic contaminants.

Removal
Mechanical excavation was identified as the representative process option associated with the removal GRA for soil.

- **Mechanical excavation.** Mechanical excavation of soil is generally implemented using construction equipment such as backhoes and front-end loaders. Excavated areas are backfilled, graded, and restored based on restoration requirements. Sloping techniques,

benching, and/or engineering controls (e.g., sheet piling) would be necessary during excavation to maintain stability of excavation walls. Dewatering of excavations and management of water would also be necessary.

Disposal
Disposal at off-site commercial treatment/disposal facilities were identified as representative process options associated with the disposal GRA for soil.

- **Off-site commercial landfill.** Coupled with mechanical removal, excavated soil would be transported to regulated, commercial off-site landfill for subsequent disposal, if it meets land disposal restrictions. Waste characterization sampling and analysis would be completed, and a Waste Manifest would be submitted to, and approved by the landfills prior to disposal.

3.5 Assembly of Remedial Alternatives

Five remedial alternatives were developed by assembling GRAs and representative process options into combinations that address RAOs for Site media. A summary of the alternatives and their components is presented in **Tables 1 and 2** below. A description of each alternative is included in the following subsections.

Table 1 – Site Remedial Alternatives

Alternative 1 No Further Action	**Alternative 2** Targeted surface soil excavation, engineered cover and MNA	**Alternative 3** Targeted surface and subsurface soil excavation, *in situ* chemical oxidation and MNA	**Alternative 4** Targeted surface and subsurface soil excavation, *in situ* chemical reduction and MNA	**Alternatives 5** Site-wide excavation with off-Site disposal

Table 2 – Remedial Alternative Components

General Response Action	**Remedial Technology/Process Option**	**Remedial Alternative**				
		1	**2**	**3**	**4**	**5**
No further action	No further action	•				
Institutional controls/	Institutional controls		•	•	•	•
	SMP		•	•	•	•

General Response Action	Remedial Technology/Process Option	Remedial Alternative				
		1	2	3	4	5
limited controls	Periodic reviews		•	•	•	•
Monitoring	Groundwater monitoring		•	•	•	•
Natural recovery	Natural attenuation of soil and groundwater	•	•	•	•	•
	MNA of groundwater		•	•	•	
IRMs	Continued operation of SSDSs – on-Site residence and commercial building	•	•	•	•	
	Continued operation of SSDS – off-Site residence (340W)	•	•	•	•	•
Containment	Engineered cover		•	•	•	
Removal	Mechanical excavation – shallow soil		•	•	•	
	Mechanical excavation – targeted source soil			•	•	
	Mechanical excavation – site-wide					•
***In situ* Treatment**	*In situ* chemical oxidation			•		
	Enhanced *in situ* dechlorination				•	
Disposal	Off-site commercial landfill		•	•	•	•

3.5.1 Alternative 1 – No Further Action

Alternative 1 is a no further action alternative. A no further action alternative is required by the NCP and NYSDEC's DER-10 Section 4.4(b)3 (NYSDEC, 2010a) and serves as a benchmark for the evaluation of action alternatives. This alternative provides for an assessment of the environmental conditions if no further remedial actions are implemented beyond the on-Site and off-Site vapor intrusion IRMs. Under this alternative, O&M of the on-Site and off-Site SSDSs would continue. Alternative 1 could be implemented immediately.

3.5.2 Alternative 2 – Targeted Surface Soil Excavation, Engineered Cover and MNA

Alternative 2 includes targeted excavation of surface soil (up to 2 ft bgs) in the area of the on-Site residence. This shallow excavation would address soil exceeding SCOs for Residential use and mitigate potential exposure risks for on-Site residents, construction, or utility workers. Alternative 2 also includes maintenance of existing Site covers (i.e., buildings, asphalt pavement, gravel). In addition, this alternative would include institutional controls, a SMP, periodic reviews, groundwater MNA, and continued operation and maintenance of the on- and off-Site vapor

intrusion IRMs. A conceptual illustration of Alternative 2 is presented on **Figure 3-1**. A description of the elements of this alternative is presented as follows:

Targeted Surface Soil Excavation with Off-Site Disposal
Targeted areas of surface soil to the east and west of the on-Site residential building exhibiting concentrations above Residential SCOs, as illustrated on **Figure 3-1**, would be excavated to a depth of up to 2 ft bgs. For the purpose of estimating cost, it is assumed that approximately 100 cubic yards (CY) of soil would be removed from this area. Excavated soil would be transported to an off-Site disposal facility. Following excavation, the disturbed areas would be restored to their original surfaces (e.g., vegetation, gravel, asphalt).

Existing Site Covers
On-Site surfaces are currently covered by the commercial and residential buildings, and a combination of asphalt pavement, gravel and soil/vegetative surfaces. The existing cover surfaces (i.e., building, asphalt pavement, gravel) would be maintained to provide a physical barrier to direct contact with surface soil. Proper maintenance of the existing cover surfaces would be provided for in the SMP, including provisions for routine maintenance and inspection to maintain integrity and function.

Institutional Controls
Administrative control(s) such as institutional controls (e.g., environmental easements, deed restrictions, and environmental notices) would be recorded for the Site to require the continued management of engineering controls to maintain protectiveness of public health and the environment. The institutional controls would also limit Site and groundwater use and require maintenance of remedial elements.

Where necessary, preventative measures may be included in the design and construction of new buildings at the Site to mitigate the potential for exposure to constituents that may be present in soil vapor. Institutional controls would also include provisions for additional vapor intrusion evaluation and mitigation, if requested by NYSDOH. Mitigation measures may include the use of a vapor barrier or the installation of a vapor intrusion mitigation system. Restrictions would preclude activities that would potentially expose soil and soil vapor that might cause vapor intrusion, without prior review and approval by NYSDEC. In addition, institutional controls would include provision for maintenance of cover systems. The reasonably anticipated future land use for the Site is for both commercial and residential use. The institutional controls would reflect this Site use.

Site Management Plan
A SMP would guide future activities at the Site by documenting institutional and engineering controls and by developing requirements for periodic site reviews, the implementation of required O&M activities for the selected remedy, and future development on the Site. In addition, consistent with 6 NYCRR Part 375-1.8(h)(3), annual certification of institutional and engineering controls would be required in the SMP.

Periodic Site Reviews
Periodic site reviews would be conducted in accordance with the SMP to evaluate the Site with regard to continuing protection of public health and the environment as evidenced by information

such as documentation of field inspections. 6 NYCRR Part 375-1.8(h)(3) specifies that the frequency of periodic site reviews and certification of institutional and engineering controls should be annual, unless a different frequency is approved by NYSDEC; it is assumed that annual reviews would be conducted at the Site. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

Groundwater Monitoring with MNA

Periodic sampling and analysis of groundwater would be included as a means of detecting changes in groundwater concentrations and evaluating natural attenuation in groundwater. Specific monitoring locations, parameters, and frequencies would be established during remedial design. For the purpose of estimating cost, it was assumed that the monitoring program would comprise bi-annual sampling of existing wells both on-Site and off-Site within the RI Study Area for VOCs and MNA parameters. For purposes of estimating cost, it was assumed that a sampling event would occur once annually at six monitoring wells across the Site.

Continued O&M of SSDSs

As part of this alternative, O&M of the on- and off-Site vapor intrusion mitigation systems (SSDSs) would continue. O&M activities would include periodic inspection of SSDS components, with repair, modification, or replacement of system components as necessary.

3.5.3 Alternative 3 – Targeted Surface and Subsurface Soil Excavation, *In Situ* Chemical Oxidation and MNA

Alternative 3 includes the components of Alternative 2 with targeted mechanical excavation of soil exceeding Commercial SCOs and ISCO of the possible residual source area adjacent to and below the existing commercial building and within the on-Site downgradient groundwater plume, as illustrated on **Figures 3-2A** and **3-2B**. **Figures 3-2A** and **3-2B** are split to show the unsaturated zone (Zone A) and saturated zone (Zone B) treatment approaches, respectively.

Targeted Soil Excavation with Off-Site Disposal

Soil in the source area exhibiting concentrations above Commercial SCOs would be excavated to a depth up to 15 ft bgs (e.g., Zone A), as illustrated on **Figure 3-2A**. The excavation would require temporary shoring and/or other stabilization mechanisms to support the excavation and the existing commercial building that would remain in-place. The excavation would be backfilled and restored to match surrounding grade and surfaces (e.g., vegetation, gravel, asphalt). For the purpose of estimating cost, it is assumed that approximately 560 CY of unsaturated soil would be removed from this area at depths ranging from approximately 5 to 15-ft bgs. Excavated soil would be transported to an off-Site disposal facility. A pre-design investigation (PDI) would be performed to refine the extent of soil exceeding Commercial SCOs and complete a geotechnical evaluation for the purpose of excavation support (i.e., sheet piles) design.

***In Situ* Chemical Oxidation**

In situ chemical oxidation would treat groundwater using oxidants injected within the saturated Zone B, as depicted on **Figure 3-2B**. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. ISCO reagents would be applied via injection to the saturated zone in the source area and immediately downgradient, comprising a total treatment area of approximately 2,780 sq ft. Injections may be performed via direct push technology using a geoprobe or via vertical injection wells.

The effectiveness of ISCO is limited by subsurface hydrogeologic and geochemical conditions and ability to effectively deliver oxidants to the treatment zone. A treatability study (ISOTEC, 2021) was conducted by ISOTEC, in October 2021, and indicated viability of permanganate usage as an oxidizing agent.

The results of the ISOTEC bench scale treatability study indicated that both 2 grams per kilogram (g/kg) and 5 g/kg doses of permanganate would result in VOC/PCE mass reduction. For Zone B soils, the optimal permanganate dose identified would be approximately 2-2.5 g/kg. Alternative chemical oxidants could include activated sodium persulfate and/or modified Fenton's reagent (hydrogen peroxide catalyzed by chelated iron).

The ISCO component of Alternative 3 focuses treatment of saturated soil and groundwater within the approximately 2,780 square feet area shown on **Figure 3-2B**. From environmental data collected from the Site, including MIP points, it is assumed that the till acts as a contamination aquitard. However, CVOCs can migrate into the top 6 to 12 inches of a till layer. Therefore, this preliminary remediation evaluation assumes that the top of the till is included in the vertical treatment zone. For the purpose of developing cost estimates, it has been assumed that the oxidant would be applied to Zone B, between 6 and 8 ft bgs and down to 12 to 15 ft bgs, by low-pressure direct push injection techniques. The average vertical treatment interval is approximately 7 ft. For purposes of estimating cost, a total of two injection events are assumed and injections would be performed using temporary direct-push injection points. A PDI field pilot study would be performed for evaluate injection techniques and effectiveness under Site conditions.

A groundwater monitoring program would be implemented to establish baseline groundwater conditions and periodically monitor groundwater concentrations between and following ISCO injection events. Additional ISCO injections events may be implemented based on groundwater concentrations. For the purpose of developing cost estimates, four groundwater monitoring events are assumed, including baseline monitoring, one round of groundwater monitoring following each of the two assumed injection events, and a final groundwater monitoring event one year post-injection. Groundwater samples would be collected from up to six monitoring wells for VOC analysis.

3.5.4 Alternative 4 – Targeted Surface and Subsurface Soil Excavation, Enhanced *In Situ* Dechlorination and MNA

Alternative 4 is similar to Alternative 3, with targeted mechanical excavation of soil exceeding Commercial SCOs and *in situ* treatment. However, EISD would be implemented in lieu of ISCO to address the possible residual source area adjacent to and below the existing commercial building and within the on-Site downgradient groundwater plume as illustrated on **Figures 3-2A** and **3-2B**. **Figures 3-2A** and **3-2B** are split to show the unsaturated zone (Zone A) and saturated zone (Zone B) treatment approaches, respectively.

Enhanced *In Situ* Dechlorination
EISD treatment would consist of treatment amendments being applied via injection to the saturated zone in the source area, comprising a total of approximately 2,780 sq ft. Injections may be performed via direct push technology using a geoprobe or via vertical injection wells.

EISD is a chemical/biological treatment technology which combines multiple treatment mechanisms. For cost estimating purposes it is assumed that treatment would be achieved via EISD which would treat groundwater using reductive dichlorination by injecting a mixture of carbon substrate electron donor(s)and ZVI within the affected saturated areas, identified as Zone B. CVOCs are degraded through dechlorination reactions where chloride atoms are replaced by hydrogen atoms by bacteria under reducing conditions (biotic dechlorination) and chemical dechlorination reactions on the surface of the ZVI (abiotic dechlorination, without bacteria).

The EISD portion of Alternative 4 focuses treatment of saturated soil and groundwater within the approximately 2,780 square feet area shown on **Figure 3-2B**. From environmental data collected from the Site, including MIP points, it is assumed that the till acts a contamination aquitard. However, CVOCs can migrate into the top 6 to 12 inches of a till layer. Therefore, this preliminary remediation evaluation assumes that the top of the till is included in the vertical treatment zone. It has been assumed that the EISD Amendments would be applied to Zone B, between 6 and 8-ft and down to 12 to 15-ft below grade, by low-pressure direct push injection techniques. The average vertical treatment interval is approximately 7 ft. For purposes of estimating cost is it assumed that EISD includes bioaugmentation with dechlorinating bacteria and pH buffer are applied to optimize the EISD treatment. One injection event is assumed, and injection would be performed using temporary direct-push injection points. A PDI bench-scale treatability study would be complete to evaluate ESID injection solutions and concentrations effective for treatment of Site groundwater. If the treatability study presents favorable results for Site groundwater treatment vis ESID, a field pilot study would be performed for evaluate injection techniques and effectiveness under Site conditions.

A groundwater monitoring program would be implemented to establish baseline groundwater conditions and periodically monitor groundwater concentrations following the EISD injection event. Additional EISD injections may be implemented based on groundwater concentrations. For the purpose of developing cost estimates, three groundwater monitoring events are assumed, including baseline monitoring, one round of groundwater monitoring following the one assumed injection event, and a final groundwater monitoring event one year post-injection. Groundwater samples would be collected from 6 monitoring wells for VOC analysis.

3.5.5 Alternative 5 – Site-Wide Excavation with Off-Site Disposal
As required pursuant to 6 NYCRR 375-2.8(c)(2)(i), where the remedial investigation identifies soil contamination above the Unrestricted SCOs, the FS shall develop and evaluate one or more alternatives that achieve that SCOs. As such, Alternative 5 includes mechanical excavation of soil exhibiting concentrations greater than the Unrestricted SCOs, to the extent practicable. A conceptual illustration of Alternative 5 is presented on **Figure 3-3**. It is assumed that demolition of existing on-Site residential and commercial buildings would be required to implement soil excavation activities.

This alternative would also include institutional controls, a SMP, periodic reviews, and groundwater monitoring, as described under Alternative 2, including continued operation and maintenance of VI mitigation systems (off-Site residential system). This alternative would also include ongoing natural attenuation of groundwater.

Soil Excavation with Off-Site Disposal

Alternative 5 includes excavation of soil exceeding Unrestricted SCOs, to the extent practicable. Demolition of the existing on-Site residential and commercial buildings would be required to implement this alternative. For purposes of estimating cost, it is assumed that the area of excavation would be defined by the Site property boundary and soil would be excavated to a depth of approximately 15-ft bgs, resulting in a total volume of approximately 148,850 cu ft of soil removed and managed off-Site at an appropriate disposal facility. The approximate area to be excavated is depicted on **Figure 3-3**.

Because of the limited size of the Site, the proximity of residences, public roads and utilities to the Site boundary, and the anticipated depth of excavation, temporary excavation support (e.g., sheet piles) would be necessary to complete excavation activities. Excavation support would be further evaluated during the remedial design phase. Temporary interruption or rerouting of existing public utilities at the street may be necessary to complete excavation.

For remedial alternative cost estimation purposes, a total of approximately 190 tons of construction and demolition material (e.g., asphalt, building materials) would be transported to an off-Site disposal facility. Additionally, approximately 3,310 tons (5,620 CY) of soil would be transported to an off-Site treatment, storage and disposal facility. Due to the depths of anticipated excavation, continuous dewatering is assumed to manage groundwater infiltration into the excavation areas. For the purpose of cost estimation, it is assumed the construction water would be collected, treated on-Site and discharged directly to a publicly owned treatment works. Following excavation, the Site would be backfilled in accordance with DER-10 Section 5.4(e)4 to match adjacent grade and restored with a gravel surface layer.

Alternative 5 is anticipated to present constructability and community impact concerns. Due to the depth of excavation and challenges of working within a developed multi-use area, Site-wide excavation would necessitate use of off-Site areas for support, staging, and dewatering activities. Additionally, significant dewatering and water treatment would be required. Transportation considerations would include significantly increased traffic, fuel usage, and adverse effects on both air quality and community safety.

4. Detailed Analysis of Alternatives

This section documents the detailed analysis of five remedial alternatives developed during the assembly of remedial alternatives. The detailed analysis of the remedial alternatives was conducted consistent with NYSDEC's *DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010a) and the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988). This section describes the individual and comparative analysis of the remedial alternatives with respect to nine evaluation criteria that embody the specific statutory requirements that must be evaluated to satisfy the CERCLA remedy selection process.

4.1 Individual Analysis of Alternatives

NYSDEC DER-10 Section 4.2 indicates that, during remedy selection, ten evaluation criteria should be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to balance the differences between the alternatives. The modifying criteria are formally considered during the NYSDEC review of, and public comment on, the Proposed Remedial Action Plan (PRAP). The criteria are described below:

Table 3 – Remedial Alternative Evaluation Criteria

Criterion	Considerations
Threshold Criteria	
Overall protectiveness of public health and the environment	• Achievement and maintenance of adequate protection • Elimination, reduction, or control of site risks through removal, treatment, containment, engineering, or institutional controls • Ability to achieve RAOs
Compliance with SCGs	• Attainment of chemical-, location-, and action-specific SCGs • Grounds for invoking a waiver, if necessary.
Primary Balancing Criteria	
Long-term effectiveness and permanence	• Magnitude of potential residual risk to human and ecological receptors and the environment from materials remaining at the conclusion of the remedial activities. • Adequacy and reliability of controls necessary to manage materials left on Site.
Reduction of toxicity, mobility, or volume of contamination through treatment	• Treatment or recycling processes employed, and materials treated • Amount of hazardous substances, pollutants, or contaminants treated or recycled • Degree of expected reduction of mobility, toxicity, or volume of the waste due to treatment or recycling • Degree to which treatment would be irreversible • Type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate

Criterion	Considerations
	• Degree to which treatment would reduce the inherent hazards posed by the Site.
Short-term impact and effectiveness	• Short-term potential risks to the community during implementation • Potential impacts to workers and effectiveness/reliability of protective measures • Potential environmental impacts and the effectiveness/reliability of mitigative measures • Time until protection would be achieved.
Implementability	• Technical feasibility and constructability • Reliability of the technology • Ease of undertaking additional remedial actions • Ability to monitor the effectiveness of the remedy • Activities needed to coordinate with other offices and agencies • Ability and time required to obtain any necessary agency approvals and permits • Availability of adequate off-site treatment, storage, and disposal capacity/services • Availability of necessary equipment and specialists • Provisions to obtain necessary additional resources • Availability of prospective technologies.
Cost Effectiveness	• Capital costs • Annual O&M costs • Periodic O&M costs • Present worth cost.
Land Use	• Consistency with current and reasonably anticipated future land use • Consistency with applicable zoning laws • Consistency with applicable community master plans, local waterfront revitalization plans, or other applicable land-use plan adopted by a municipality
Modifying Criteria	
Community acceptance	• Summarizes the public's general response to the response measures described in the PRAP and the RI/FS reports. Community acceptance will be assessed in the record of decision (ROD) and includes determining which of the response measures the community supports, opposes, and/or has reservations about.

The objective of the detailed analysis of alternatives was to analyze and present sufficient information to allow the alternatives to be compared. The analysis consisted of an individual assessment of each alternative with respect to the evaluation criteria that encompass statutory requirements and overall feasibility and acceptability. The summary of this analysis is presented in **Table 4-1**.

4.2 Comparative Analysis of Alternatives

The detailed analysis of alternatives also included a comparative evaluation designed to consider the relative performance of the alternatives and identify major trade-offs among them. The comparative evaluation of the alternatives is presented in the following subsections. In the comparative analysis of alternatives, the performance of each alternative relative to the others was evaluated for each criterion. As noted in **Section 4.1**, the detailed evaluation with respect to the FS criteria for each of the alternatives is presented in **Table 4-1**.

4.2.1 Overall Protection of Public Health and the Environment

Alternative 1, the no further action alternative, would not be protective of public health and the environment, as it would not actively address impacted soil and groundwater, which pose a potential risk to public health and the environment. Alternatives 2 through 5 would provide for public health protection relative to potential exposure to soil, groundwater, and indoor air/soil vapor through engineering and institutional controls. Under Alternative 1, the existing Site covers provide protection from public exposure to surface soil; however, this alternative does not include institutional controls and a SMP as means for long-term maintenance and monitoring of cover system protectiveness. Alternative 1 would be protective of potential public exposure to soil vapor/indoor air through continued O&M of the existing on- and off-Site SSDSs. Alternative 1 relies on natural attenuation to address groundwater impacts. Because groundwater monitoring is not included in Alternative 1, there is no means of evaluating groundwater concentrations and the potential for off-site migration of constituents in groundwater. Alternative 1 would not be as protective as the other alternatives, which include groundwater monitoring, active treatment of the groundwater and/or removal of potential source material.

Protection of public health related to exposure to impacted groundwater would be provided under Alternatives 2 through 5 through institutional controls and existing public water supply connections. Institutional controls, a SMP and periodic site reviews would also provide a means to monitor effectiveness of the remedy under Alternatives 2 through 5. Alternative 2 would be protective of public health and the environment through removal of surface soil around the on-Site residence with O&M of existing Site covers and the on- and off-Site SSDSs.

Alternatives 3 through 5 each address on-site soil/groundwater exposure and off-site migration of constituents in groundwater through removal and/or treatment, engineered covers and natural attenuation. Alternatives 3 and 4 include treatment of areas of elevated COC concentrations to further address potential impacts to on-Site and off-Site groundwater. Alternative 5 would be protective of public health and the environment through removal of source material.

In summary, Alternatives 3 through 5 provide protection to public health and the environment through treatment or removal of source material and address each of the RAOs. Alternatives 1 and 2 would not address the RAO associated with removal of the source of contamination to groundwater. Alternative 1 is not protective of soil exposures due to lack of institutional controls and O&M of existing Site covers. Alternatives 1 and 2 also rely solely on natural attenuation to address constituents in groundwater. In addition, Alternative 1 does not include monitoring to evaluate attenuation. All alternatives would be protective of potential public health exposures to indoor air/soil vapor through continued operation of SSDS IRMs.

4.2.2 Compliance with SCGs

As summarized in Table 3-1, chemical-specific SCGs were identified for groundwater and soil. With the exception of Alternative 1 each alternative would address groundwater exceeding SCGs through institutional controls. Alternatives 1 and 2 rely on natural attenuation alone to meet chemical-specific SCGs in groundwater. Alternatives 3 through 5 provide a means of reducing on-Site and off-Site groundwater concentrations through groundwater treatment, and/or excavation of source area soils.

For Alternatives 3 through 5, it is anticipated that treatment of the source zone and/or removal of impacted soils would shorten the timeframe needed for attainment of groundwater RAOs following execution and limiting off-Site migration of groundwater in excess of NYS Class GA as compared to Alternatives 1 and 2. Groundwater monitoring included in Alternatives 2 through 5 would provide a means of evaluating attainment of groundwater SCGs and remedy effectiveness.

With the exception of Alternatives 1 each alternative would address soil exceeding SCGs through institutional controls. Alternative 1 would not actively address chemical-specific SCGs relative to potential releases from or exposure to contaminated soil. The combination of components under Alternative 2 (targeted excavation, engineered cover, and MNA) would address soil SCGs through containment and removal. Alternative 5 (Site-wide excavation) would also address the SCGs through removal of impacted soil exceeding Unrestricted SCOs.

No location-specific or action-specific SCGs were identified for Alternative 1. For location-specific SCGs Alternatives 2 through 5 would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources. Action-specific SCGs related to the Occupational Safety and Health Administration's requirements were identified for Alternatives 2 through 5 and would be met during construction and O&M activities. With respect to action-specific SCGs, *in situ* treatment activities and excavation would be conducted consistent with applicable standards; earth moving/excavation activities would be conducted consistent with air quality standards (i.e., compliance with fugitive dust regulations); and transportation and disposal activities would be conducted in accordance with applicable State and Federal requirements, by licensed and permitted haulers under Alternatives 2 through 5.

4.2.3 Long-term Effectiveness and Permanence

With the exception of Alternative 1, each alternative would provide long-term effectiveness and permanence through continued maintenance of adequate and reliable controls of exposures to soil and groundwater through institutional and engineering controls. Alternatives 1 through 5 would provide long-term effectiveness and permanence through continue O&M of the SSDS IRMs. In Alternative 1, the residual risks associated with exposure to both soil and groundwater would remain as there would be no additional controls or long-term maintenance of existing covers under this alternative. In Alternatives 2 through 5, residual risks following excavation would be adequately managed through an SMP, institutional and engineering controls, periodic reviews and O&M of remedy components. In Alternatives 2 through 5, residual risks due to groundwater would be addressed by institutional controls and the existing public water supply, while groundwater monitoring would provide a means of evaluating attainment of groundwater SCGs and remedy effectiveness. Although Alternatives 3 and 4 would provide added long-term effectiveness and permanence through the treatment of saturated soils and groundwater within the Site boundaries, Alternative 5 removes the greatest quantity of impact soils. For Alternatives

3, 4 and 5, it is anticipated that the treatment and/or removal of impacted soils would better support attainment of groundwater RAOs following execution as compared to natural attenuation included in Alternatives 1 and 2. Apart from Alternative 1, controls included in each alternative are both adequate and reliable.

When compared to each other, Alternatives 2 through 5 would provide long-term effectiveness with minimal residual risk through continued operation, maintenance and monitoring of existing IRM components; adequate and reliable institutional controls for groundwater and soil; *in situ* treatment of groundwater in areas of elevated VOCs (Alternatives 3 and 4); soil excavation and off-site disposal; and engineered covers. There is some degree of added permanence for Alternatives 3, 4 and 5 due to the greater volume of soil removed and source treatment.

4.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction in toxicity, mobility, or volume through treatment provided in Alternatives 1 or 2. Alternatives 3 and 4 are the only alternatives that result in reduction in toxicity, mobility and volume through active treatment. It is expected that Alternatives 3 and 4 would have similar levels of reduction in toxicity, mobility and volume. Alternatives 2 through 4 would provide a reduction in volume of impacted soil present at the Site through the surface soil excavation portion of those remedies. Alternative 5 would result in the largest reduction in volume of impacted soil through Site-wide removal of soil exceeding Unrestricted SCOs.

4.2.5 Short-term Effectiveness

There are no short-term impacts associated with Alternative 1 since this alternative does not include active remedial components beyond continued O&M of SSDS IRMs and, therefore, would not present potentially adverse impacts to remediation workers or the community as a result of its implementation. Alternatives 2 through 5 would be protective of the community and workers during implementation through the use of appropriate protective equipment and accepted health and safety and construction practices to manage risks to on-Site workers, and proper precautions and monitoring to be protective of the general public and the environment.

Similarly, nuisance conditions such as dust, odor, noise, and traffic that are anticipated with Alternatives 2 through 5 could be controlled through accepted community health and safety awareness and construction practices (e.g., community air monitoring for dust and VOCs). Potential environmental impacts related to dust, volatile emission, surface runoff, and sediment would be mitigated through appropriate control measures.

Potential risks to construction workers in areas of contamination in Alternative 2 through 6 through dermal contact, incidental ingestion and inhalation related to the removal, handling, and processing of groundwater and surface soil would be mitigated by utilizing proper protective equipment. In addition, construction activities would be conducted in accordance with OSHA requirements. Excavation activities associated with surface soil excavation in Alternatives 2 through 4 and subsurface soil excavation in Alternatives 3, 4 and 5 would meet air quality requirements. Alternative 2 includes the least amount of subsurface disturbance and would result in the least odor, dust and vapor exposures, and the least impact on the Site owner and tenants, in comparison to Alternatives 3 and 4 which have moderately more subsurface disturbance. Alternative 5 commercial and residential building demolition activities and Site-wide soil removal

would present a present the most substantial potential impact for on-Site workers and neighboring residences/businesses.

Alternatives 2 through 5 would address exposure related RAOs upon implementation. Removal and/or treatment of impacted soils included in Alternatives 3, 4 and 5 and 3 are anticipated to reduce the timeframe for attainment of groundwater RAOs and groundwater monitoring would provide the means of evaluating remedy effectiveness.

Alternative 2 is anticipated to take approximately 1 month or less and could be completed with a single construction season. Alternatives 3 and 4 are anticipated to be completed within 1 to 2 construction seasons, with excavation activities taking approximately 2 to 3 months over 1 construction season and *in situ* treatment implemented over a period of 1 to 3 weeks either during the same or additional construction season(s). Due to the volume of soil exceeding Unrestricted SCOs, Alternative 5 would require a longer timeframe to attain RAOs, as excavation is estimated to take place over a duration of 5 to 6 months and could span multiple construction seasons.

4.2.5.1 Environmental Footprint Considerations

There is an environmental footprint inherent in implementation of each alternative as it relates to construction and operation. The greenhouse gas emissions and other environmental footprint metrics associated with the implementation/construction of each alternative was estimated using the SiteWise Environmental Footprint Tool (Sitewise™, 2018)[1]. The SiteWise™ results are included in **Appendix A** and summarized below for key metrics. Long term monitoring environmental impacts were not evaluated since the same monitoring effort/period was assumed for each remedial alternative.

There would be some short-term environmental and sustainability impacts associated with the implementation of Alternatives 2 through 5. Specifically, construction activities would generate greenhouse gases and have other environmental impacts. The estimated greenhouse gas emissions generated by construction activities to implement these alternatives ranges from approximately 10 metric tons CO_2 equivalent ($MTCO_2e$) for Alternative 2 to 1624 $MTCO_2e$ for Alternative 5 (SiteWise™ 2018). Alternatives 3 and 4 have a similar greenhouse gas footprint of 246 $MTCO_2e$ and 237 $MTCO_2e$ respectively. Increased truck traffic and noise for the duration of construction is also anticipated under Alternatives 3, 4 and 5 due to the nature of the construction performed for each alternative. Alternative 5, given the greatest amount of construction required, would result in the most environmental and sustainability impacts, followed by Alternatives 3 and 4. The total energy use for Alternative 5 is an order of magnitude higher than Alternative 3 and 4 and two orders of magnitude higher than Alternative 2.

[1] SiteWise™ is a series of publicly available Microsoft Excel spreadsheets used to estimate the environmental footprint of remediation activities in terms of sustainability metrics. This tool is a spreadsheet footprint estimator based on life cycle equivalents used to quantify common environmental metrics such as greenhouse gas emissions, energy use, and waste quantities, as well as worker safety metrics. SiteWise™ was developed in a joint effort by Battelle Memorial Institute, the US Navy, and the US Army Corps of Engineers.

SiteWise™ quantifies environmental metrics associated with materials production (i.e., construction/treatment materials); transportation of materials, personnel, and equipment to the site; on-site construction activities (i.e., equipment operation); on-site labor; transportation of waste for off-site disposal; and management of landfills proportional to the quantity of waste disposed. The emissions factors in SiteWise™ are reflective of the full life cycle of materials and waste; there impacts are inclusive of material production and management of waste at the landfill, even though these activities are conducted off-site.

Additionally Alternative 5 utilizes the highest amount of landfill space. Implementation of Alternative 1 would result in the smallest environmental footprint; however, this alternative does not address potential risks due to potential exposure to contaminated soil and groundwater.

Green remediation techniques and best management practices (BMPs), as detailed in NYSDEC DER-31, would be considered during implementation to reduce the short-term impacts of the selected remedy. A preliminary BMP assessment, included in **Appendix B**, was conducted as part of this FS list identify example BMPs to that could be implemented for each potential remedial alternative. BMP selection and implementation will be refined following the remedy selection and design of the remedial approach.

4.2.6 Implementability

All five potential remedial alternatives would be readily implementable. The technologies being used in Alternatives 2 through 5 are reliable and readily constructible. Each alternative would allow for additional remedial actions to be implemented, if necessary, and with the exception of Alternative 1, would be readily monitored for effectiveness of the remedy.

Alternative 1 would be the easiest alternatives to implement, as there are no construction activities to undertake. Alternatives 2 through 5 incorporate reliable technologies and could be readily constructed. The equipment, specialists and materials necessary for the implementation of these alternatives are readily available. Alternatives 2 is the next easiest alternative to implement with short-term disruption to the on-Site commercial and residence anticipated during targeted surface soil excavation around the on-Site residence. Alternatives 3 and 4 would result greater disruption to the on-Site commercial and residential tenants during implementation of the surface soil excavation (residential area) and excavation and *in situ* treatment on the northeast portion of the Site. For Alternatives 3 through 5 the presence of underground utilities could pose a challenge during implementation and would need to be considered. Additionally, excavation activities included in Alternatives 3 through 5 may require off-Site staging of soil, materials and equipment (i.e., adjacent property to the south) due to on-Site space limitations.

Alternative 5 would have the greatest impacts and be the most challenging to implement due to the need to demolish the on-Site commercial building and residence. Additional excavation challenges would be present under Alternative 5, including limited space for staging materials and conducting excavation dewatering operations. Truck traffic in and out of the Site would require traffic control and possible lane closures on roads surrounding the Site for the approximately 6-month-long duration of the construction. In addition to the potentially significant effects on local air quality and community traffic patterns, traffic of this magnitude is anticipated to result in significant effects on conditions of roadways. Additionally, this alternative would present require relocation of residents and businesses prior to demolition of the on-site buildings.

The implementation of institutional controls would be relatively straightforward under Alternatives 2 through 5. Alternatives 2 through 5 would require coordination with other agencies including, NYSDEC, Village of Whitesboro, Town of Whitestown, Oneida County, and property owner/tenants. Off-site permitted facilities for disposal of excavated soil would be readily available for each alternative.

4.2.7 Cost

The estimated present-worth costs were calculated using a discount factor of 7% and a thirty-year time interval for post-construction monitoring and maintenance period (although O&M would continue as needed beyond the thirty-year period, this is the typical period used when estimating costs for a comparative analysis). Detailed cost estimates for the alternatives are included as **Tables 4-2 through 4-6**. The costs associated with Alternatives 1 through 5 are summarized as follows:

Table 4 – Summary of Remedial Alternative Cost Estimates

Alternative	Total estimated capital cost	Total estimated present worth of O&M (30 years)	Total estimated net present worth cost
1 – No Further Action	$0	$0.13 M	$0.13 M
2 – Targeted Surface Soil Excavation, Engineered Cover and MNA	$0.23 M	$0.18 M	$0.41 M
3 – Targeted Surface and Subsurface Soil Removal, ISCO and MNA	$2.40 M	$0.18 M	$2.58 M
4 – Targeted Surface and Subsurface Soil Removal, *in situ* chemical reduction and MNA	$2.18 M	$0.18 M	$2.36 M
5 - Alternative 5 - Site-Wide Excavation with Off-Site Disposal	$5.78 M	$0.21 M	$5.99 M

4.2.8 Land Use

The Site is located in a suburban area, surrounded by properties of mixed use. The Site is zoned for commercial use and includes two buildings, one of which is occupied by commercial businesses and one of which is a leased residential building. Alternative 1 would not be consistent with the current, intended and reasonably anticipated future uses of the Site since Site impacts are not addressed. Alternatives 2 through 4 would temporarily disrupt commercial operations and the residential tenants. On-going Site uses and considerations for property occupants during remedy implementation would be evaluated during the remedial design. The engineered cover systems included in Alternatives 2 through 4 would be consistent with the current, intended and reasonably anticipated future uses of the Site. Alternative 5 would involve displacement of active businesses and residents to implement and would disrupt current land use and traffic patterns.

4.2.9 Community Acceptance

Evaluation of the community acceptance criterion summarizes the public's general response to the response measures described in the PRAP and in the RIR and FS reports. Community acceptance will be assessed in the ROD and includes determining which of the response measures the community supports, opposes, and/or has reservations about.

5. Conclusions

This FS was conducted consistent with the requirements of 6 NYCRR Part 375 and NYSDEC's DER-10, and consistent with the current and anticipated future use of the property. Accordingly, RAOs were identified to address the elimination or mitigation of significant threats to public health and the environment. Five alternatives were developed and evaluated for this FS. Each alternative was evaluated via individual and comparative analysis with respect to nine evaluation criteria in accordance with the DER-10 remedy selection process.

Of the five alternatives evaluated, alternative 4 would provide a cost-effective balance of the evaluation criteria while achieving the RAOs set forth in this FS and would be consistent with current and anticipated future use of the Site.

Alternative 4 would include the following remedial elements:

- Targeted excavation of surface soil exceeding Residential SCOs
- Targeted excavation of unsaturated (Zone A) source area soils exceeding Commercial SCOs
- *In situ* groundwater treatment within the source area Zone B via EISD
- O&M of existing Site covers (i.e., commercial and residential buildings asphalt pavement and gravel)
- O&M of existing on- and off-Site SSDSs installed as IRMs
- Institutional controls
- SMP
- Periodic site reviews
- Groundwater monitoring with MNA

Alternative 4 provides for protection of public health and the environment and attainment of RAOs relative to potential exposure to and migration of soil, groundwater, and indoor air/soil vapor through engineering and institutional controls. Targeted excavation of surface soil around the on-Site residence would mitigate potential exposure to and erosion of surface soil exceeding Residential SCOs. Additional protectiveness relative to soil is provided in Alternative 4 through targeted excavation of unsaturated source area soil (Zone A) to the east of the Commercial Building that exceeding Commercial SCOs.

Under Alternative 4, *in situ* treatment of groundwater within the source area (Zone B) would be accomplished through injection of EISD treatment amendments (i.e., electron donor, ZVI, and dechlorinating bacteria) resulting in the reductive dechlorination of CVOCs in saturated soil and groundwater. Source area excavation in combination with EISD would provide for attainment of the source removal RAO and shorten the timeframe for attainment of groundwater SCGs. Groundwater performance monitoring and long-term groundwater monitoring would provide a means to monitoring remedy effectiveness following EISD injections as well as over the long-term.

Protection of public health related to exposure to impacted groundwater and soil would also be provided under Alternative 4 through institutional controls and existing public water supply

connections. Institutional controls, a SMP and periodic site reviews would also provide a means to maintain and monitor effectiveness of the remedy.

Alternative 4, which meets the RAOs and provides similar protectiveness as Alternatives 3 and 5, would provide overall protection of human health and the environment, attain RAOs, and comply with SCGs. When comparing Alternative 4 with Alternatives 3 and 5 using the primary balancing criteria, equal protectiveness would be provided under Alternative 4 at a lower cost.

References

Cadwell, D.H. and Dineen, R.J. 1987. Surficial Geologic Map of New York: Hudson-Mohawk Sheet. 1:250,000 New York State Museum Map and Chart Series 40, The University of the State of New York, Albany, New York.

Federal Register. 1990. National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 40 Code of Federal Regulations 300. March 8, 1990.

Halberg, HN, OP Hunt, and FH Pauszek, 1962, Water Resources of the Utica-Rome Area, New York; USGS Water Supply Paper 1499-C.

In-Situ Oxidative Technologies, Inc. (ISOTEC). 2021. Bench Scale Treatability Study Report. Dry Cleaners Site Whitesboro, New York. October 12, 2021.

Mokry, L., OP-TECH, Syracuse, NY. 2010. Letter. Re: Subsurface Investigation Letter Report, Former Fry Cleaners Site, 103 Oriskany Boulevard, Whitesboro, New York, Site ID.: 633054. Fcnher, L. NYSDEC, Watertown, NY. January 7, 2010.

Nature's Way Environmental Consultants & Contractors, Inc. 2006. Quarterly Site Monitoring Report. November 2006.

NYSDEC. 1994. Division of Fish and Wildlife, Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA). October 1, 1994.

NYSDEC. 2006. Part 375 Environmental Remediation Programs. New York Code of Rules and Regulations (NYCRR). December 14, 2006.

NYSDEC. 2010a. Technical Guidance for Site Investigation and Remediation (DER-10). NYSDEC Division of Environmental Remediation; May 3, 2010.

NYSDEC. 2010b. CP-51 Soil Cleanup Guidance. Division of Environmental Remediation. October 21, 2010.

NYSDEC. 2013. Generic Remedial Action Objectives (RAOs). October 18, 2013. http://www.dec.ny.gov/regulations/67560.html

NYSDOH. 2006. *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. Updated Decision Matrices May 2017.

NYSDEC. 2011. DER-31 Green Remediation. NYSDEC Program Policy. August 11, 2010. Revised January 20, 2011.

O'Brien & Gere Engineers, Inc. (OBG). 2014. Draft Fish and Wildlife Impact Analysis. O'Brien & Gere Engineers, Inc. Syracuse, NY. April 25, 2014.

OP-TECH Environmental Services, Inc. 2010. Subsurface Investigation Letter Report, Former Dry Cleaners Site.

Ramboll Americas Engineering Solutions, Inc. (Ramboll). 2023a. Draft Qualitative Human Health Exposure Assessment. April 26, 2023.

Ramboll Americas Engineering Solutions, Inc. (Ramboll). 2023b. Former Whitesboro Dry Cleaners Remedial Investigation Report. October 11, 2023.

SiteWise™. 2018. Tool for Green and Sustainable Remediation. Version 3.2. https://www.sustainableremediation.org/guidance-tools-and-other-resources

USEPA. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Office of Emergency and Remedial Response, USEPA, October 1988.

TABLES

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Soil	6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives (SCOs)	Promulgated state regulation that provides guidance for SCOs for various restricted property uses (industrial, commercial, restricted residential, and residential), for the protection of groundwater and ecological resources, and for unrestricted property use. A site designated for unrestricted use is a site subject to no imposed institutional or engineering controls, such as an environmental easement or deed restriction [DER-10 (NYSDEC 2010)].	SCOs for restricted use (residential, commercial) are potentially applicable to site soil given the current and reasonably anticipated future land to include both residential occupancy and commercial use. SCOs for the protection of groundwater may be applicable. SCOs for unrestricted use may not be applicable given the current and reasonably anticipated future land use of the Site; however, were considered for the purpose of evaluating pre-disposal conditions.	Yes
	NYSDEC CP-51 Soil Cleanup Guidance	Guidance that provides framework and procedures for the selection of soil cleanup levels appropriate for each of the remedial programs in the NYSDEC DER.	SCOs for restricted use (residential, commercial) are potentially applicable to site soil given the current and reasonably anticipated future land to include both residential occupancy and commercial use. SCOs for the protection of groundwater may be applicable. SCOs for unrestricted use may not be applicable given the current and reasonably anticipated future land use of the Site; however, were considered for the purpose of evaluating pre-disposal conditions.	Yes
Groundwater	6 NYCRR Part 703 – Class GA Groundwater Quality Standards	Promulgated water quality standards for fresh groundwater, including narrative and constituent-specific standards.	Potentially applicable for groundwater on-Site and within the RI Study Area.	Yes
	NYS TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations	Guidance that summarizes groundwater standards and guidance values. Guidance values are provided where standards are not available.	Potentially applicable for groundwater on-Site and within the RI Study Area.	Yes
	40 CFR Part 141 – Drinking Water Standards	Promulgated federal regulation that establishes primary drinking water regulations applicable to public water systems.	Potentially applicable for groundwater on-Site and within the RI Study Area. Groundwater is not used as a drinking water source; municipal water is available.	Yes
Air/Sub-slab Vapor	NYSDOH's October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, as amended in May 2017	Guidance document that provides thresholds for indoor air and sub-slab soil vapor above which vapor mitigation is required.	Potentially applicable, occupied residential and commercial buildings present on-Site and residential buildings present within the RI Study Area.	Yes
	OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154, June 2015	Technical guidance that provides recommendations on assessment of vapor intrusion pathways that pose an unacceptable risk to human health.	Potentially applicable, occupied residential and commercial buildings present on-Site and residential buildings present within the RI Study Area.	Yes
Water bodies	6 NYCRR 608 – Use and Protection of Waters Program	Regulatory and permit requirements for work affecting New York State lakes, rivers, streams, and ponds.	Not applicable.	No
	Article 15 – Water Resources – New York Environmental Conservation Law	Regulatory and permit requirements for work affecting New York State lakes, rivers, streams, and ponds.		No
	33 CFR 320 - 330 - Navigation and Navigable Waters	Regulatory policies and permit requirements for work affecting waters of the United States and navigable waterways.		No
	16 USC 661 - Fish and Wildlife Coordination Act	Requires protection of fish and wildlife in a stream or other water body when performing activities that modify a stream or river.		No

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Wetlands	6 NYCRR 663 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 feet) must be approved by NYSDEC or its designee. Activities occurring adjacent to freshwater wetlands must: be compatible with preservation, protection, and conservation of wetlands and benefits; result in no more than insubstantial degradation to or loss of any part of the wetland; and be compatible with public health and welfare.	Not applicable. The Site is not within 100 feet of wetlands as designated freshwater wetlands regulated by NYSDEC.	No
	Clean Water Act Section 404 33 CFR Parts 320 - 330	Regulatory policies and permit requirements for work affecting waters of the United States, including wetlands.	Not applicable. There are no delineated wetlands on-Site.	No
	Clean Water Act Section 404 40 CFR Parts 230-231	Provides for restoration and maintenance of integrity of waters of the United States, including wetlands, through the control of dredged or fill material discharge.		
	Executive Order 11990 - Protection of Wetlands	Executive order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or loss of wetlands if a practical alternative exists.		
Wetlands & floodplains	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-2; 1985)	Policy and guidance requiring Superfund actions to meet substantive requirements of Executive Orders 11988 and 11990. Describes requirements for floodplain assessment during remedial action planning.	Not applicable. There are no delineated wetlands on-Site and the Site is not within a 100-year floodplain	No
	40 CFR Part 6, Appendix A - Statement of Procedures on Floodplains Management and Wetlands Protection (January 5, 1979)	Policy and guidance for implementing Executive Orders 11988 and 11990. Requires federal agencies to evaluate the potential effects of action proposed in wetlands and floodplains to avoid, to the extent possible, adverse effects. Federal agencies are required to evaluate alternatives to actions in wetlands or floodplains and to avoid or minimize adverse impacts if not practical alternatives exist.		
Floodplains	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities -100-yr floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable. The Site is not within the 100-year floodplain.	No
	40 CFR Part 264.18(b) - Location Standards - Floodplains	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.		

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
	Executive Order 11988 - Floodplain Management	USEPA is required to conduct activities to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupation or modification of floodplains. The procedures also require USEPA to avoid direct or indirect support of floodplain development wherever there are practicable alternatives and minimize potential harm to floodplains when there are no practicable alternatives.		
	Executive Order 13690 - Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input	Executive order establishes a Federal Flood Risk Management Standard (FFRMS), a Process for Further Soliciting and Considering Stakeholder Input, and amends Executive Order 11988. The FFRMS establishes a construction standard and framework for Federally funded projects constructed in, and affecting, floodplains, to reduce the risks and cost of floods. Under the FFRMS, federal agency management is expanded from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk to increase resiliency of projects funded with federal funds. The Executive Order also sets forth a process for solicitation and consideration of public input, prior to implementation of the FFRMS.		
	6 NYCRR 500 - Floodplain Management Regulations Development Permits	Promulgated state regulations providing permit requirements for development in areas of special flood hazard (floodplain within a community subject to a one percent or greater chance of flooding in any given year).		
Within 61 meters (200 feet) of a fault displaced in Holocene time	40 CFR Part 264.18(a) - Location Standards - Seismic considerations	New treatment, storage, or disposal of hazardous waste is not allowed.	Not applicable. Site is not located within 200 feet of a fault displaced in Holocene time, as listed in 40 CFR 264 Appendix VI. None listed in New York State.	No
Within salt dome or bed formation, underground mine, or cave	40 CFR Part 264.18 (c) - Location standards; salt dome formations, salt bed formations, underground mines and caves.	Placement of non-containerized or bulk liquid hazardous waste is not allowed.	Not applicable. No salt dome formations, salt bed formations, underground mines, or caves present at Site.	No
Habitat of an endangered or threatened species	6 NYCRR 182	Promulgated state regulation that provides requirements to minimize damage to habitat of an endangered species.	Not applicable. No endangered or threatened wildlife species, rare plants, or significant habitats were identified at the Site.	No
	Endangered Species Act	Provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction.		No
	50 CFR Part 17 - Endangered and Threatened Wildlife and Plants and 50 CFR Part 402 - Interagency Cooperation	Promulgated federal regulation that requires that federal agencies ensure authorized, funded, or executed actions will not destroy or have adverse modification of critical habitat.		No

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Historical property or district	National Historic Preservation Act 36 CFR 800- Preservation of Historic Properties Owned by a Federal Agency	Remedial actions are required to account for the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places.	Potentially applicable. Historic, architectural, archeological and/or cultural resources present at or near the Site would be evaluated, as necessary, during the design phase.	Yes
	National Historic Preservation Act 36 CFR Part 65 - National Historic Landmarks Program	Promulgated federal regulation requiring that actions must be taken to preserve and recover historical/archeological artifacts found.		Yes
	New York State Historic Preservation Act of 1980 9 NYCRR Parts 426 - 428	State law and regulations requiring the protection of historic, architectural, archeological and cultural property.		Yes
Wilderness area	Wilderness Act 50 CFR Part 35 - Wilderness Preservation and Management	Provides for protection of federally-owned designated wilderness areas.	Not applicable. Site not located in wilderness area.	No
Wild, scenic, or recreational river	Wild and Scenic Rivers Act	Provides for protection of areas specified as wild, scenic, or recreational.	Not applicable. Site not located near wild, scenic or recreational river.	No
Coastal zone	Coastal Zone Management Act	Requires activities be conducted consistent with approved State management programs.	Not applicable. Site not located in coastal zone.	No
Coastal barrier	Coastal Barrier Resources Act	Prohibits any new Federal expenditure within the Coastal Barrier Resource System.	Not applicable. Site not located in coastal barrier.	No
Protection of waters	33 U.S.C. 1341 - Clean Water Act Section 401, State Water Quality Certification Program	States have the authority to veto or place conditions on federally permitted activities that may result in water pollution.	Potentially applicable to the Site.	Yes
Institutional controls	NYSDEC DER-33 Institutional Controls: A Guide to Drafting and Recording Institutional Controls, December 2010	Technical guidance document that provides guidelines for proper development and recording of institutional controls as part of a site remedial program.	Potentially applicable when institutional controls are implemented as a component of the selected remedy.	Yes
Cover systems	NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010	Technical guidance document that provides guidelines for cover thicknesses as they relate to property use in areas where exposed surface soil exceeds NYCRR Part 375 SCOs. Specifically, where the exposed surface soil at the site exceeds the applicable soil cleanup objective for protection of human health and/or ecological resources, the soil cover for restricted residential use, is to be two feet; for commercial or industrial use, is to be one foot; or when an ecological resource has been identified is to be a minimum of two feet; and when such a concern is identified by NYSDEC, consideration should be given to supplementing the demarcation layer to serve as an impediment to burrowing.	Potentially applicable for cover alternatives.	Yes

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Landfill	40 CFR Part 257 - Criteria for Classification of Solid Waste Disposal Facilities and Practices	Promulgated federal regulation that provides criteria for solid waste disposal facilities to protect health and the environment.	Landfilling of wastes may be applicable for the Site.	Yes
	40 CFR Parts 264 and 265, Subpart N – Landfills	Promulgated federal regulation that provides requirements for hazardous waste landfill units.		Yes
Generation and management of solid waste	6 NYCRR 360 - Solid Waste Management Facilities	Promulgated state regulation that provides requirements for management of solid wastes, including disposal and closure of disposal facilities.	Potentially applicable to alternatives including disposal of residuals generated by treatment processes as well as capping alternatives.	Yes
Land disposal	6 NYCRR 376 - Land Disposal Restrictions 40 CFR Part 268 - Land Disposal Restrictions 62 CFR 25997 - Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes	Promulgated federal and state regulations that provide treatment standards to be met prior to land disposal of hazardous wastes.	Potentially applicable to residuals generated by treatment processes if found to be hazardous waste and disposed at a landfill. Applicable for off-site treatment and disposal if excavated soil does not meet land disposal restrictions.	Yes
Green remediation	NYSDEC DER-31 Green Remediation Program Policy, January 2011 Superfund Green Remediation Strategy, September 2010	State and federal technical guidance documents that provide guidelines for the development of site remediation strategies in a manner that minimizes environmental impacts and applies green remediation concepts (e*.g.,* reduction in greenhouse gas emissions, energy consumption and resource use, promotion of recycling of materials and conservations of water, land and habitat).	Potentially applicable.	Yes
General excavation	6 NYCRR 200-203, 211-212 - Prevention and Control of Air Contamination and Air Pollution	Provides requirements for air emission sources.	Portions potentially applicable to volatile emissions during excavation	Yes
	6 NYCRR 257 - Air Quality Standards	Promulgated state regulation that provides specific limits on generation of SO_2, particulates, CO_2, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides, beryllium and H2S from point sources.	Not applicable. Dust emissions would not be generated from a point source.	No
	40 CFR Part 50.1 - 50.12 - National Ambient Air Quality Standards	Promulgated federal regulation that provides air quality standards for pollutants considered harmful to public health and the environment. The six principal pollutants are carbon monoxide, lead, nitrogen dioxide, particulates, ozone, and sulfur oxides.	Potentially applicable to alternatives during which dust generation may result, such as during earth moving, grading, and excavation.	Yes

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
	NYS TAGM 4031 - Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites	State guidance document that provides limitations on dust emissions.		
Construction	29 CFR Part 1910.120 - Occupational Safety and Health Standards - Hazardous Waste Operations and Emergency Response	Promulgated federal regulation requiring that remedial activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes
	29 CFR Part 1926 - Safety and Health Regulations for Construction	Promulgated federal regulation requiring that remedial construction activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes
Discharge to surface water and injection to groundwater	6 NYCRR 750 through 758 – State Pollutant Discharge Elimination System (SPDES) Regulations	Substantive requirements associated with discharge to a water body (limitations and monitoring requirements) would be set by NYSDEC.	Not applicable.	No
	6 NYCRR 701 – Classifications – Surface Waters and Groundwaters	Promulgated state regulation that establishes classifications of surface water and groundwater in New York State. Provides general condition that discharges shall not cause impairment of the best usages of the receiving water as specified by the water classifications at the location of discharge and at other locations that may be affected by such discharge. Also establishes that groundwater classifications apply to all groundwaters of the state.	Potentially applicable.	Yes
	6 NYCRR 703 – Surface Water and Groundwater Quality Standards and Groundwater Effluent	Promulgated state regulation that provides water quality standards for surface water and groundwater. Also provides Maximum Allowable Concentrations for discharge to Class GA groundwaters of the state.	Potentially applicable.	Yes
	40 CFR 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants	Federal guidance providing test procedures for NPDES programs.	Not applicable.	No
	40 CFR 144 – Underground Injection Control (UIC) Program	Permit not required for Class V wells, which are approved by rule under federal UIC program. Substantial compliance with Class V permit requirements must be demonstrated.	Potentially applicable. Injection of in situ treatment amendments included as part of alternatives.	Yes
Discharge to publicly owned treatment works (POTW)	Clean Water Act Pretreatment Regulations (40 CFR Part 403)	Pretreatment requirements for discharges to POTWs.	Potentially applicable for treated groundwater discharged to POTW.	Yes
Construction storm water management	NYSDEC General permit for storm water discharges associated with construction activities. Pursuant to Article 17 Titles 7 and 8 and Article 70 of the Environmental Conservation Law.	The regulation prohibits discharge of materials other than storm water and all discharges that contain a hazardous substance in excess of reportable quantities established by 40 CFR 117.3 or 40 CFR 302.4, unless a separate NPDES permit has been issued to regulate those discharges. A permit must be acquired if activities involve disturbance of 5 acres or more. If the project is covered under the general permit, the following are required: development and implementation of a storm water pollution prevention plan; development and implementation of a monitoring program; all records must be retained for a period of at least 3 years after construction is complete.	Not applicable. Construction would not result in clearing/disturbance of more than 5 acres.	No

TABLE 3-1. POTENTIAL STANDARDS, CRITERIA, AND GUIDANCE (SCGs)

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Transportation	6 NYCRR 364 - Waste Transporter Permits	Promulgated state regulation requiring that hazardous waste transport must be conducted by a hauler permitted under 6 NYCRR 364.	Potentially applicable for off-site transport of hazardous waste.	Yes
	49 CFR 107, 171-174 and 177-179 - Department of Transportation Regulations	Promulgated federal regulation requiring that hazardous waste transport to off-site disposal facilities must be conducted in accordance with applicable Department of Transportation requirements.	Potentially applicable for off-site transport of hazardous waste to off-site treatment/disposal facilities.	Yes

Notes:

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations
DER - Division of Environmental Remediation
FFRMS – Federal Flood Risk Management Standard
FS - Feasibility Study
NYCRR - New York Code of Rules and Regulations
NYS - New York State
NYSDEC - New York State Department of Environmental Conservation
NYSDOH - New York State Department of Health
OSWER - Office of Solid Waste and Emergency Response
SCOs - Soil Cleanup Objectives
SCGs – Standards, Criteria and Guidance
TAGM - Technical and Administrative Guidance Memorandum (NYSDEC)
TOGS – Technical and Operational Guidance Series
UIC - Underground Injection Control
USC - United States Code
USEPA or EPA - United States Environmental Protection Agency
VI – Vapor Intrusion

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
No further action	No further action	No further action*	No further remedial action addressing soil would be conducted. Continuation of O&M for existing Vapor Intrusion (VI) IRM elements.	Readily implementable.	Not effective in mitigating the potential for erosion of or contact with exposed soil.	No capital Low O&M	Potentially applicable. Retained for further consideration. Required for consideration by the NCP (40 CFR Part 300.430) and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.
Institutional controls/ Limited actions	Access/use restrictions/ administrative control(s)	Institutional controls*	Implementation and documentation of access and land use restrictions that would require activities that would potentially disturb or expose contaminated soil (and require health and safety precautions) be conducted in accordance with the site management plan. Continuing and effective operation of VI mitigation systems would be required to mitigate VI exposures and would be specified in the institutional controls. Institutional controls would also include preventative measures for the design and construction of new buildings at the Site to mitigate the potential for exposure to constituents that may be present in soil vapor. Institutional controls would also provide provisions to evaluate and address potential soil vapor intrusion, as necessary.	Readily implementable	Effective means of controlling site use for the protection of human health.	Low capital No O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.
	Site controls	Site management plan*	Documentation of site restrictions and provisions for continued operation and maintenance of the remedy. Presents site engineering and institutional controls and physical components of the selected remedy requiring operation, maintenance and monitoring to provide continued effectiveness. The site management plan would also present provisions for periodic site reviews.	Readily implementable	Effective means of controlling site use for protection of human health. Effective means of communicating soil management/handling procedures, site use restrictions and remedy components, including operation, maintenance, and monitoring requirements.	Low capital No O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Institutional controls/ Limited actions (continued)	Periodic reviews	Periodic site reviews*	Periodic reviews are required by 6 NYCRR Part 375 and DER-10 where institutional and engineering controls, monitoring plans, and/or operations and maintenance activities are implemented on a site. The purpose of the reviews is to evaluate the study area in regard to the continuing protection of human health and the environment and to provide documentation of remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved the by NYSDEC. Periodic site reviews would include performance of supplemental Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.	Readily implementable.	Effective means of evaluating continued protection to human health and the environment.	No capital Low O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.
Natural Recovery	Natural attenuation	Natural attenuation*	The natural degradation of organic contaminants by *in situ* physical, chemical and/or biological processes. Over time, contaminants' toxicity, mobility and/or volume can be reduced by processes that include biodegradation, sorption, dilution, volatilization, and/or transformation.	Potentially implementable	Potentially effective over the long-term for reduction of contaminant concentrations. Evaluation of attenuation mechanisms would be necessary.	Low capital No O&M	Potentially applicable. Evaluation of naturally occurring attenuation processes would be required. Retained for further consideration.
Containment	Cover system	Vegetation enhancement	Use of enhanced vegetative growth to reduce erosion of surface soil. Can be applied using hydroseeding techniques (*i.e.*, blown or sprayed on), and can be mixed with wood or paper mulch during application.	Limited implementability due to the anticipated commercial future Site use.	Effective for reducing surface soil erosion due to surface water/storm water flow or wind. Thick vegetation is effective at inhibiting contact with soil. Potentially effective means of improving evapotranspiration. Effectiveness relies on maintaining integrity of cover system.	Low capital Low O&M	Limited implementability. Not retained for further consideration.
		Engineered cover*	Use of vegetated soil/granular material, gravel or asphalt to reduce erosion of surface soil and prevent direct contact with soil. Grading would be performed such that drainage is promoted, erosion is minimized, and cover integrity is protected.	Implementable. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Effective means of minimizing erosion of and contact with exposed soil. Potentially effective means of improving evapotranspiration. Effectiveness relies on maintaining integrity of cover system. May result in reduction in infiltration that could reduce leaching of contaminants in soil to groundwater and reduce mobilization of contaminants.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration in area where soil exhibit constituent concentrations above NYCRR Part 375 SCOs corresponding to the site use.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Containment (continued)	Cover system (continued)	Low permeability cover	Use of a low permeability cover to minimize surface water infiltration, encourage runoff and control erosion, and isolate and contain impacted soil. Low permeability cover components may consist of low permeability clay or a geomembrane system. Vegetation, asphalt, or gravel may be utilized as the top layer based upon site use and restoration requirements within the covered area.	Implementable. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Effective means of minimizing erosion of, and contact with, exposed soil. Results in reduction in infiltration that could reduce leaching of contaminants in soil to groundwater and reduce mobilization of contaminants. Potentially effective means of improving evapotranspiration. Effectiveness relies on maintaining integrity of cover system.	High capital Med O&M	Potentially applicable. Retained for further consideration in areas where soil exhibit concentrations above NYCRR Part 375 SCOs corresponding to site use.
In situ treatment	Biological	Enhanced bioremediation	Injection of microbial populations and potential nutrient sources/electron donors into subsurface to enhance biological degradation of organic constituents.	Potentially implementable. Nutrient addition and/or altering of soil redox conditions may be needed to facilitate biodegradation. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for degradation of VOCs in saturated and unsaturated soil. Not effective for treatment of organics. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven distribution and limited contact of electron donors and/or microorganisms, resulting in areas of untreated contaminants. Treatability study would be required.	Medium capital Low O&M	Not applicable for treatment of inorganics. Subsurface conditions may limit treatment effectiveness. Retained for further consideration.
		Bioventing	Introduction of low air flow rates to the subsurface to provide enough oxygen to sustain microbial activity, thereby stimulating the natural *in situ* biodegradation of aerobically degradable compounds in soil.	Implementability limited. Heterogeneity of subsurface materials would result in uneven oxygen flow. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Effectiveness potentially limited by heterogeneous subsurface conditions, which could limit effective distribution of air flow within the, resulting in areas of untreated soil. Effectiveness also potentially limited by presence of underground utilities and obstructions, which may provide preferential pathways or obstructions to air flow. Treatability study would be required.	Medium capital Low O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness.
		Phytoremediation	Use of plants to remove, transfer, stabilize, or destroy contaminants in shallow soil.	Limited implementability due to the anticipated commercial future Site use.	Potentially effective for reducing VOCs, SVOCs and inorganics in shallow soil. Potentially effective for providing habitat and erosion control. Not effective at depths below plant root zone. Treatability study would be required.	Low capital Low O&M	Not retained for further consideration. Seasonal and land use limitations and depth of root zone limit implementability and effectiveness.
	Physical/ Chemical	Chemical oxidation*	*In situ* treatment of soil using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Oxidation agents can be applied to the subsurface via injection points, deep soil mixing, or soil fracturing.	Potentially implementable. Soil saturation potentially required for implementation. Large quantities of oxidant potentially required. Limitations to implementability would exist in the immediate vicinity of subsurface utilities. TS conducted by ISOTEC, in October 2021, indicated viability of permanganate usage as an oxidizing agent.	Potentially effective for treatment of VOCs in saturated and unsaturated soil. Not effective for treatment of inorganics. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven distribution and limited contact of oxidant, resulting in areas of untreated contaminants. Potential for mobilization of contamination with injection of fluids.	High capital Low to medium O&M	*In situ* treatment potentially implementable. Subsurface conditions may limit treatment effectiveness. Retained for further consideration.
		Chemical reduction*	*In situ* treatment of soil using reducing compounds (e.g., zero valent iron [ZVI]). Reduction reactions chemically convert constituents to non-hazardous or less toxic compounds. Reducing agents can be	Potentially implementable. Soil saturation potentially required for implementation. Large quantities of reducing compound potentially required. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for treatment of VOCs in saturated and unsaturated soil. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven distribution and limited	Medium capital Medium O&M	*In situ* treatment potentially implementable. Subsurface conditions may limit treatment effectiveness. Retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
			applied to soil via mixing, injection points, or soil fracturing.		contact of reducing compound, resulting in areas of untreated contaminants.		
In situ treatment (continued)	Physical/ Chemical (continued)	Soil-vapor extraction (SVE)	Vacuum is applied through extraction wells within the vadose zone to create a pressure/concentration gradient that induces organics sorbed on the soil, and/or dissolved in pore water to volatilize. Extracted vapors are removed through extraction wells and treated *ex situ* as needed.	Implementability limited. Heterogeneous subsurface conditions could limit radius of influence of SVE points. Not implementable below the water table. A pilot/pumping test would be necessary to identify radius of influence and implementability in heterogeneous soil. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for treatment of VOCs and in the unsaturated zone. Not effective for treatment of inorganics. Effectiveness limited by heterogeneous subsurface conditions which could limit effective distribution of air flow, resulting in areas of untreated soil. Underground utilities may provide preferential pathways for vapor migration, potentially causing short circuiting, and affecting treatment effectiveness. Effectiveness dependent on application of pressure/concentration gradient, which would be limited by subsurface heterogeneity. Treatability study would be required.	Medium capital Medium O&M	Not retained for further consideration, subsurface conditions likely to limit implementability and treatment effectiveness.
		Multi-phase extraction	Vacuum is applied to remove various combinations of contaminated groundwater, separate-phase petroleum product, and vapors from the subsurface. The system lowers the water table around the well, exposing more of the formation. Contaminants in the newly exposed vadose zone are then accessible to vapor extraction. Once above ground, vapors are treated.	Implementability limited. Heterogeneous subsurface conditions could limit radius of influence of MPE points. A pilot/pumping test would be necessary to identify radius of influence and implementability in heterogeneous soil. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for treatment of VOCs and in the saturated and unsaturated zone. Not effective for treatment of inorganics. Effectiveness limited by heterogeneous subsurface conditions, which could limit effective distribution of air flow, resulting in areas of untreated soil. Underground utilities may provide preferential pathways for vapor migration, potentially causing short circuiting, and affecting treatment effectiveness. Effectiveness dependent on application of pressure/concentration gradient, which would be limited by subsurface heterogeneity. Treatability study would be required.	Medium capital Medium O&M	Not retained for further consideration, subsurface conditions likely to limit implementability and treatment effectiveness.
		Solidification/ Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), and/or chemical reactions are induced between stabilizing agent and contaminants to reduce their mobility (stabilization), toxicity, and leachability.	Potentially implementable. Not implementable for saturated soil without dewatering. Volume increases with agent addition. Advanced delivery techniques would likely be required due to heterogeneous subsurface material (i.e., in situ mixing, tight injection well spacing). Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for in situ stabilization and reduction in mobility of VOCs and for reducing the permeability of the treatment zone. Effectiveness limited by heterogeneous subsurface conditions, which could limit effective distribution of reagents. Treatability study would be required to evaluate effectiveness and selection of reagents.	Medium capital No O&M	Not retained for further consideration, subsurface conditions likely to limit implementability and treatment effectiveness.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
In situ treatment (continued)	Physical/ Chemical (continued)	Flushing	Water, aqueous solution, surfactants, or cosolvents are injected into the soil or groundwater. The extraction fluid is utilized to enhance contaminant solubility. Contaminants are leached into the groundwater and subsequently removed through a collection system and treated *ex situ.*	Implementability limited due to presence of heterogeneous subsurface conditions. Recovery, management and treatment of flushing fluids and mobilized contaminants would be required. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for treatment of VOCs in saturated and unsaturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited due to presence of heterogeneous soil which could result in uneven distribution and recovery of the flushing solution.	Medium capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness.
		Electrokinetic separation	A low-intensity current is passed through the contaminated soil between ceramic electrodes. Electrochemical and electrokinetic processes cause inorganics and organic contaminants to desorb from low permeability materials. A processing solution, concentrated with contaminants, is then extracted and treated *ex situ.*	Implementability limited due to presence of heterogeneous subsurface conditions. Mobilized contaminants would require recovery and treatment/management. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Potentially effective for treatment of polar organics and inorganics in the saturated and unsaturated zones. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven recovery of processing solution and/or mobilized contaminants.	Medium capital Medium O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness.
	Thermal	Hot water injection	Injection of hot water through injection wells to enhance the recovery of organic constituents. The injected hot water heats the subsurface, increasing dissolution of organic contaminants, with subsequent collection and treatment through a series of groundwater and vapor extraction wells.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions, resulting in areas of untreated soil and unrecovered vapor and/or mobilized contaminants.	Very High capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness Not retained due to risk of uncontrolled migration of contaminants.
		Steam injection	Injection of steam through injection wells to enhance the recovery of organic contaminants. The injected steam heats the surrounding subsurface, volatilizing, mobilizing, or oxidizing organic contaminants, with subsequent collection and treatment through a series of water and vapor extraction wells.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions, resulting in areas of untreated soil and unrecovered vapor and/or mobilized contaminants.	Very high capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness. Not retained due to risk of uncontrolled migration of contaminants.
		Electrical resistance heating	A series of electrodes are installed around a central neutral electrode. Volatilized contaminants, produced by the heating of the subsurface surrounding the electrodes, are recovered using extraction wells and subsequently treated at the surface.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities. *In* situ heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs and in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions, resulting in areas of untreated soil and unrecovered vapor and/or mobilized contaminants.	High capital No O&M	Potentially implementable. Subsurface conditions may limit treatment effectiveness.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
In situ treatment (continued)	Thermal (continued)	Radio frequency heating	Heating of soil using a configuration of electrodes to enhance the recovery of organic constituents. Heated soil is bound by two rows of electrodes that act as ground electrodes. A third row of electrodes is implanted halfway between the ground rows, acting as a capacitor. Electromagnetic energy is applied, heating the surrounding soil volume, causing organic contaminants to vaporize. Extraction wells remove contaminant vapors for *ex situ* treatment.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities. *In situ* heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs in the unsaturated zone. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions, resulting in areas of untreated soil and unrecovered vapor and/or mobilized contaminants.	High capital No O&M	Potentially implementable. Subsurface conditions may limit treatment effectiveness. Retained for further consideration.
		Thermal conduction	Heat is applied to the subsurface through steel wells or thermal blankets. Organic contaminants are volatilized through heating, and subsequently collected for treatment at the surface.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities. *In situ* soil heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions, resulting in areas of untreated soil and unrecovered vapor and/or mobilized contaminants.	High capital No O&M	Not retained for further consideration, because not practicable for site-wide treatment of constituents exceeding SCOs, and subsurface conditions likely to limit implementability and treatment effectiveness and risk of uncontrolled migration of contaminants.
		Vitrification	An electric current is utilized to melt soil at extremely high temperatures (2,900 to 3,650 °F) and thereby immobilize most inorganics and destroy organics by pyrolysis.	Implementability limited due to access limitations and underground utilities. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities. *In situ* soil heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Potentially effective for treatment of VOCs in the unsaturated zone. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions, resulting in areas of untreated soil and unrecovered vapor and/or mobilized contaminants.	Very high capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness and risk of uncontrolled migration of contaminants.
Removal	Excavation	Mechanical excavation*	Use of construction equipment to remove soil. Due to physical characteristics of soil and presence below groundwater table, dewatering and water treatment would likely be required. It is anticipated that in addition to dewatering, sludge management may also be required to render the excavated material sufficiently dry for management and transportation. Excavated areas would be backfilled, graded and restored based on restoration requirements. Soil would be transported and disposed off-site. Treated water would be discharged locally.	Implementable for soil. Implementability of excavations limited by depth of impacted materials. Shoring or side slopes required for deep excavations. Water management required for saturated soil. Further management of excavated soil required. Limitations to implementability would exist in the immediate vicinity of subsurface utilities.	Effective means of reducing the toxicity, mobility, and volume of impacted soil (where accessible). Dewatering and/or stabilization may be required prior to management, treatment, and disposal.	High capital No O&M	Limitations to implementability in the immediate vicinity of subsurface utilities. Retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Ex situ treatment	Biological	Biopiles	Excavated soil is mixed with soil amendments and placed in aboveground enclosures. Compost is formed into piles and aerated with blowers or vacuum pumps using an aerated static pile composting process.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for degradation of VOCs and SVOCs in excavated soil. Not effective for treatment of inorganics. A treatability study and identification of effective soil amendments would be required.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Not retained for further consideration.
		Landfarming	Contaminated soil is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for degradation of VOCs in excavated soil. Not effective for treatment of inorganics. A treatability study and identification of effective soil amendments would be required.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Not retained for further consideration.
	Biological (continued)	Slurry-phase bioreactor	An aqueous slurry is created by combining soil with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. The slurry is dewatered and the treated soil disposed of upon completion of the process.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for removal of VOCs. Treatability study would be required. Not effective for inorganics. A treatability study and identification of effective soil amendments would be required.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Not retained for further consideration.
	Chemical	Chemical Oxidation	*Ex situ* treatment of contaminated soil using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or persulfate. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for treatment of VOCs in excavated soil. Not effective for treatment of inorganics. A treatability study and oxidant demand study would be necessary to evaluate effectiveness.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Not retained for further consideration.
		Extraction/ washing	Soil and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use. Fine materials containing organics are also separated from coarse materials using this	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil would require further off-site	Potentially effective for removal of VOCs and inorganics from excavated soil. Heterogeneous soil may reduce effectiveness. A treatability study would be necessary to evaluate effectiveness.	Medium capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Not retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
			process. Treated soil could be re-used as backfill.	management unless allowed to be re-used as fill material and/or consolidated on-site. Extraction solution treatment/management would also be required. Design, construction and testing of a pilot system would be necessary to evaluate implementability.			
Ex situ treatment (continued)	Physical	Particle size separation	Sieves and screens of different sizes are used to concentrate contaminants in smaller volumes. Most organic and inorganic contaminants tend to bind, either chemically or physically, to other soil/fill particles. Separating the fine particles from the coarser particles will effectively concentrate the contaminants into a smaller volume of soil that could be further treated or disposed.	Potentially implementable. Further treatment and management of separated soil would be required.	Effective for separation of particle sizes and debris removal for further treatment and disposal. A treatability study would be necessary to evaluate effectiveness.	Low capital Low O&M	Not practicable for site-wide treatment constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Soil would require further treatment. Not retained for further consideration.
		Solidification/ stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between stabilizing agent and contaminants to reduce their mobility (stabilization). Solidification and stabilization involve mixing treatment agents with the contaminated soil yielding a crystalline, glassy, or polymeric framework around the contaminants.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Potentially effective for reducing the mobility of VOCs and inorganics. A treatability study would be necessary to evaluate effectiveness.	Medium capital Low O&M	Not practicable for site-wide treatment constituents exceeding SCOs. Ex situ soil treatment potentially incompatible with anticipated Site use. Soil would require further treatment. Not retained for further consideration.
	Thermal	Low temperature thermal desorption	Use of direct or indirect heat to volatilize organic contaminants at temperatures generally between 200 and 600 °F. Further treatment of vapor phase potentially required.	Control and treatment of emissions from thermal treatment processes would be required for organics and mercury. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Potentially effective for treatment of VOCs. Not effective for treatment of inorganics. A treatability study would be necessary to evaluate effectiveness.	Medium capital Medium O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Variety of contaminant types in soil would limit effectiveness. Not retained for further consideration.
		Pyrolysis	Chemical decomposition of organic materials is induced by heat in the absence of oxygen at temperatures around 800 °F. Organic materials are transformed into gaseous components and solid residue (coke) containing fixed carbon and ash.	Control and treatment of emissions from thermal treatment processes would be required. Control of mercury emissions is difficult. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Likely effective for treatment of VOCs. Not effective for treatment of inorganics. A treatability study would be necessary to evaluate effectiveness.	High capital High O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated Site use. Variety of contaminant types in soil would limit effectiveness. Not retained for further consideration.
		Incineration	Combustion of organic contaminants present in soil in commercial incinerator at temperature generally between 1,600 and 2,200 °F.	Control and treatment of emissions from thermal treatment processes would be required. Control of mercury emissions is difficult. Significant permitting issues and potential community and local government	Likely effective for destruction of VOCs. Not effective for treatment of inorganics. A treatability study would be necessary to evaluate effectiveness.	High capital High O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated Site use.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
				acceptance issues related to noise, and odor/dust/emissions. Treated soil would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.			Variety of contaminant types in soil would limit effectiveness. Not retained for further consideration.
Disposal	On-site disposal	On-site consolidation/ reuse	Placement of excavated soil in an on-site containment system (*i.e.,* consolidation) or reused on-site (*e.g.,* fill material for site development).	Potentially implementable for limited quantities of excavated/treated soil that meet Part 375 SCOs based on land use.	Effective means for management of excavated/treated soil on-site. Excavated soil may require treatment prior to on-site consolidation/reuse.	Medium capital Medium O&M	Not retained due to implementability limitations.
	Off-site disposal	Off-site commercial landfill*	Excavated soil would be transported to a permitted commercial landfill if it meets land disposal restriction requirements. Due to physical characteristics of soil and presence below groundwater table, dewatering and water treatment would likely be required.	Potentially implementable for limited quantities of soil that meets land disposal restrictions.	Effective for management of excavated soil.	High capital No O&M	Potentially applicable. Retained for further consideration for targeted quantities of soil.
	Off-site treatment/ disposal	Off-site treatment facility	Excavated soil would be transported to a permitted hazardous commercial landfill. Soil that does not meet land disposal restriction requirements would be treated prior to disposal. Due to physical characteristics of soil and presence below groundwater table, dewatering and water treatment would likely be required.	Potentially implementable for limited quantities of soil that does not meet land disposal restrictions.	Effective for treatment and management of excavated soil. A treatability study would be required to evaluate treatment capabilities and capacities of off-site commercial treatment/disposal facilities.	High capital No O&M	Potentially applicable. Retained for further consideration for targeted quantities of soil.

Notes:
* Representative Process Option
Shaded cells – Process option not retained for further consideration.

Abbreviations/Acronyms:
CFR - Code of Federal Regulations
DER - Division of Environmental Remediation
°F - degrees Fahrenheit
MPE – Multi-phase extraction
NYCRR - New York Code of Rules and Regulations
NYSDEC – New York State Department of Environmental Conservation
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
O&M – Operation and Maintenance
SCO – Soil cleanup objective
SVOC – Semi-Volatile Organic Compound
VI – Vapor Intrusion
VOC – Volatile Organic Compound

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
No further action	No further action	No further action*	No further remedial action addressing groundwater would be conducted. Continuation of O&M for existing Vapor Intrusion (VI) Interim Remedial Measure (IRM) elements.	Readily implementable.	Effectiveness relies on natural attenuation.	No capital Medium O&M	Required for consideration by the NCP (40 CFR Part 300.430).
Institutional controls/limited actions	Use restrictions	Environmental easement *	Restrictions of groundwater use where applicable. Would also provide for evaluation and mitigation of vapor intrusion, if necessary, for new building(s) constructed within the Site, or at the request of New York State Department of Health.	Readily implementable. Would require property owner agreement.	Effective means of documenting Site groundwater and use restrictions. Limits future Site groundwater and uses.	Low capital No O&M	Potentially applicable. Would require access agreements with property owners. Retained for further consideration.
		Site management plan*	Documentation of site restrictions and provisions for continued operation and maintenance of the remedy. Presents requirements for monitoring and includes a provision for five-year site reviews.	Readily implementable.	Effective means of documenting institutional controls, site restrictions and remedy components, including operation, maintenance, and monitoring (OM&M) requirements.	Low capital Low O&M	Potentially applicable. Would require coordination and access agreements with property owners. Retained for further consideration.
	Periodic reviews	Five-year site reviews*	Five-year site reviews are required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) where hazardous substances remain in place above levels which permit unrestricted use and unlimited exposure. The purpose of the periodic reviews is to evaluate the Site with regard to continuing protection of human health and the environment and to provide documentation of remedy effectiveness.	Readily implementable.	Effective means of documenting status and progress of remedies requiring long-term operation and maintenance.	No capital Low O&M	Potentially applicable. Retained for further consideration.
	Monitoring	Groundwater monitoring*	Periodic sampling and analyses of groundwater as a means of detecting changes in constituent concentrations in groundwater. Groundwater monitoring also provides a means of monitoring remedy effectiveness. Groundwater levels would be obtained at the time of groundwater sampling to evaluate groundwater flow direction.	Readily implementable.	Effective method for monitoring changes in constituent concentrations over time. Useful for evaluating remedy effectiveness. Additional monitoring wells could be included in the groundwater monitoring plan if warranted, and the plan could be optimized through time; additional monitoring wells could also be installed as necessary.	Low capital Low O&M	Groundwater quality monitoring is currently conducted. Would require access agreements with property owners. Retained for further consideration.
Natural recovery	Natural attenuation	Natural attenuation*	Ongoing natural degradation of organic contaminants by *in situ* physical, chemical and/or biological processes. Over time, contaminants' toxicity, mobility, and/or volume can be reduced by processes that include biodegradation, sorption, dilution, volatilization, and/or transformation.	Natural attenuation is an on-going natural process. Readily implementable.	Natural attenuation is effective for long-term reduction of contaminant concentrations. For example, high concentrations of chlorinated volatile organics (cVOCs) (i.e., source area) often naturally undergo anaerobic reductive dichlorination, while lower concentration cVOCs often undergo aerobic biodegradation. An important and effective degradation process can be anaerobic, *in situ* reductive dechlorination (IRD), which can degrade cVOCs. Evaluation of attenuation mechanisms may be necessary.	No capital No O&M	Potentially applicable. Evaluation of naturally occurring attenuation processes may be required. Retained for further consideration.
		Monitored natural attenuation*	Long-term monitoring of natural degradation of organic contaminants by in situ physical, chemical and/or biological processes.	Potentially implementable. Long-term monitoring of groundwater could be included to evaluate natural attenuation.	Potentially effective method for monitoring the natural degradation of organic contaminants over time.	Low capital Low O&M	Potentially applicable. Retained for further consideration.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Hydraulic control	Single phase extraction	Extraction wells (vertical or horizontal)	Removal of groundwater by pumping from existing recovery wells.	Potentially implementable. A pilot/pumping test would be necessary to design extraction wells. Recovered groundwater would require management (i.e., on-site or off-site treatment, or discharge to a publicly owner treatment works). Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities.	Effective means of collecting and hydraulically controlling groundwater discharge.	High capital Medium O&M	Potentially applicable. Retained for further consideration.
		Collection trench	Collection trench installed to intercept and collect groundwater.	Potentially implementable. Recovered groundwater would require management (i.e., on-site or off-site treatment, or discharge to a publicly owner treatment works). Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities.	Effective means of extraction and control of groundwater.	Medium capital Medium O&M	Potentially applicable. Access limitations and surrounding infrastructure would limit implementability. Retained for further consideration.
	Multi-phase extraction (MPE)	MPE	Simultaneous extraction of groundwater and/or soil vapor from one or more MPE wells.	Potentially implementable. Recovered groundwater and/or soil vapor would require management. A pilot/pumping test would be necessary to identify radius of influence and implementability. Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities.	Potentially effective for removal of VOCs in the unsaturated and saturated zone. A treatability study would be required.	Medium capital High O&M	Potentially applicable. Access limitations and surrounding infrastructure would limit implementability. Retained for further consideration.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
In Situ Treatment	Biological treatment	Enhanced bioremediation (aerobic)	Injection of microbial populations and potentially nutrient sources/electron donors into groundwater to enhance biological degradation of organic constituents.	Potentially implementable. Groundwater would likely require addition of oxygen and/or nutrients to facilitate degradation. A variety of injection techniques (*i.e.*, forced or passive injection, recirculation) could be implemented to enhance delivery of amendments.	Limited effectiveness for treatment of CVOCs. A treatability study would likely be necessary, prior to or during design, to evaluate effectiveness.	Medium capital High O&M	Not applicable; limited effectiveness. Not retained for further consideration.
		Enhanced bioremediation (anaerobic)	*In situ* treatment of groundwater using addition of electron donor, nutrients, and or bacteria to stimulate anaerobic biodegradation. Anaerobic bacteria convert constituents to non-hazardous compounds.	Potentially implementable. Groundwater would likely require addition of electron donors, nutrients and/or microbes to facilitate degradation. A variety of injection techniques (*i.e.*, forced or passive injection, recirculation) could be implemented to enhance delivery of amendments.	Potentially effective for VOC mass removal in groundwater via enhancement of anaerobic biodegradation processes (i.e., biostimulation and/or bioaugmentation). Potential for incomplete degradation of VOCs. Laboratory and field scale testing would likely be necessary, prior to or during design, to evaluate effectiveness.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration.
		Enhanced *in situ* dechlorination (EISD)*	Injection of electron donors (*i.e.,* a carbon source such as lactate or EVO), zero valent iron (ZVI), and bioaugmentation with dechlorinating bacteria to support biotic process resulting in the dechlorination and degradation of organic contaminants. Iron sulfide minerals may also be added to promote abiotic reductive dechlorination of organic contaminants.	Potentially implementable. Groundwater would likely require addition of nutrients to enhance degradation. A variety of injection techniques (*i.e.*, forced or passive injection, recirculation) could be implemented to enhance delivery of electron donors, nutrients and/or other amendments.	Potentially effective for VOC mass removal in groundwater via enhancement of biotic/abiotic degradation processes. Laboratory and field scale testing would likely be necessary, prior to or during design, to evaluate effectiveness.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration.
	Chemical treatment	Chemical oxidation*	*In situ* treatment of groundwater using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, persulfate. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds.	Potentially implementable. A variety of injection techniques (*i.e.*, mixing, forced or passive injection, recirculation) could be implemented to enhance delivery of oxidants. Large quantities of oxidant potentially required. Treatability study conducted by ISOTEC, in October 2021, indicated viability of permanganate usage as an oxidizing agent.	Potentially effective for oxidation of VOCs in groundwater. Field scale testing would likely be necessary, prior to or during design, to evaluate treatment effectiveness.	Medium capital High O&M	Potentially applicable. Retained for further consideration.
		Chemical reduction	*In situ* treatment of groundwater using reducing compounds (*e.g.,* ZVI). Reduction reactions chemically convert constituents to non-hazardous or less toxic compounds.	Potentially implementable. A variety of injection techniques (*i.e.*, forced or passive injection, recirculation) could be implemented to enhance delivery of reductants.	Potentially effective for reduction of chlorinated VOCs in groundwater. Requires the ability to distribute reductants. Laboratory and field scale testing would likely be necessary, prior to or during design, to evaluate treatment effectiveness.	Medium capital Medium O&M	Potentially applicable Retained for further consideration.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
	Physical treatment	Air sparging	Injection of air into the saturated zone to volatilize constituents within groundwater. Emissions are then collected in the unsaturated zone using a soil vapor extraction system and treated as necessary.	Limited implementability. Injection of air could result in precipitation of ionic constituents that would further reduce permeability. Limitations to implementability would also exist in areas in the immediate vicinity of subsurface utilities.	Potentially effective for volatilizing VOCs in groundwater. Effectiveness is limited by distribution of air and recovery of volatilized contaminants. A pilot study would likely be necessary, prior to or during design, to evaluate effectiveness. Potential exists for uncontrolled movement of vapors. Subsurface heterogeneity could result in untreated zones. Collection of volatilized contaminants may be difficult due to heterogeneity of unsaturated zone.	Medium capital High O&M	Not applicable; limited implementability and effectiveness. Not retained for further evaluation.
		Circulation wells	Air is injected into the water column to volatilize contaminants. Groundwater is circulated in situ, with groundwater entering the well at one screen and discharging through a second screen. Air is collected and treated if necessary.	Implementability limited due potential for fouling and variability of geochemical conditions. Limitations to implementability would also exist in areas in the immediate vicinity of subsurface utilities.	Potentially effective for volatilizing VOCs in groundwater. Limited effectiveness in groundwater due to heterogeneous conditions A pilot study would likely be necessary, prior to or during design, to evaluate effectiveness.	High capital High O&M	Not applicable; limited implementability and effectiveness. Not retained for further evaluation.
	Treatment wall	Permeable reactive barrier	Construction of a reactive material wall, air sparging zone, or bio barrier to treat groundwater as it flows through the treatment zone.	Potentially implementable. Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities.	Potentially effective for treatment of chlorinated VOCs. Periodic replacement of reactive material would be anticipated. A treatability study would likely be necessary, prior to or during design, to evaluate effectiveness.	High capital Low O&M	Not applicable. Not retained for further evaluation.
Ex Situ Treatment	Off-site Physical/Chemical	Publicly Owned Treatment Works (POTW)	Treatment of collected groundwater at the POTW.	Potentially implementable in conjunction with groundwater recovery technology. Limitations to implementability include routing of discharge piping. Discharge of treated water the POTW would need to comply with pretreatment requirements.	Effective for treating VOCs.	High capital Medium O&M	Potentially applicable. Limitations to implementability would exist due to access limitations and in the immediate vicinity of roadways, subsurface utilities. Retained for further consideration.

Notes:
* Representative Process Option
Shaded cells – Process option not retained for further consideration.

Abbreviations/Acronyms:
CFR - Code of Federal Regulations
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
cVOC – Chlorinated Volatile Organic Compound
IRD – *In Situ* Reductive Dechlorination
IRM – Interim Remedial Measure
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
O&M – Operation and Maintenance
POTW-Publicly Owned Treatment Works
RAO – Remedial Action Objective
RI – Remedial Investigation
VI – Vapor Intrusion
VOC – Volatile Organic Compound
ZVI – Zero Valent Iron

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 Targeted surface soil excavation, engineered cover and MNA	Alternative 3 Targeted surface and subsurface soil excavation, *In situ* chemical oxidation of soil/groundwater and MNA	Alternative 4 Targeted surface and subsurface soil excavation, enhanced *in situ* dechlorination treatment of soil/groundwater and MNA	Alternative 5 Site-wide excavation with off-Site disposal and MNA
		Common Remedial Components for Alternatives 2 through 5: Institutional controls, Site Management Plan (SMP), periodic reviews, groundwater monitoring with monitored natural attenuation (MNA)			
	• No further action • Continued operation and maintenance (O&M) of on- and off-Site sub-slab depressurization systems (SSDSs)	• Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence • Off-Site transportation and disposal of excavated surface soil • Existing Site cover O&M • Continued O&M of on- and off-Site SSDSs	• Pre-Design Investigation (PDI) for Zone A soil excavation limits and geotechnical considerations - east of commercial building • Excavation of soil (targeted in Zone A) east of the commercial building • Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence • *In situ* chemical oxidation (ISCO, Zone B) • Off-Site transportation and disposal of excavated soil • Existing Site cover O&M • Continued O&M of on- and off-Site SSDSs	• PDI for Zone A soil excavation limits and geotechnical considerations - east of commercial building • Excavation of soil (targeted in Zone A) east of the commercial building • Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence • Enhanced *In situ* dechlorination (EISD, Zone B) • Off-Site transportation and disposal of excavated soil • Existing Site cover O&M • Continued O&M of on- and off-Site SSDSs	• Site-wide excavation of soil exceeding Unrestricted Use soil cleanup objectives (SCOs) • Off-Site transportation and disposal of excavated soil • Continued O&M of off-Site SSDS
Overall Protection of Public Health and the Environment					
Overall protection of public health	Not protective of public health due to potential for exposure to impacted soil and groundwater. Existing Site buildings and covers (asphalt and gravel) and public water supply would limit exposure; however, institutional controls are not included in this alternative to provide for long-term maintenance and protectiveness. Continued O&M of SSDSs would be provide protection of public health relative to potential exposure to soil vapor.	Protection of public health would be provided. Excavation of surface soil in the area of the on-Site residence would address potentially unacceptable risks to public health associated with exposure to surface soil. Additional protection of public health would be provided by O&M of existing Site covers (asphalt and gravel). Continued O&M of SSDSs would be provide protection of public health relative to potential exposure to soil vapor. Protection of public health relative to ingestion of groundwater exceeding standards, criteria, and guidance (SCGs) is provided through public water supply connections for the Site and surrounding properties and groundwater use restrictions. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Access restrictions, SMP and periodic Site reviews would limit Site use and minimize potentially unacceptable risks to public health associated with impacted soil and groundwater remaining on-Site.	Protection of public health would be provided. Excavation of surface soil in the area of the on-Site residence would address potentially unacceptable risks to public health associated with exposure to surface soil, while excavation of surface and subsurface soil in the area east of the commercial building would provide additional protectiveness. Additional protection of public health would be provided by O&M of existing Site covers (asphalt and gravel). ISCO would address soil and groundwater impacts and would provide added protection of public health. Continued O&M of SSDSs would be provide protection of public health relative to potential exposure to soil vapor. Protection of public health relative to ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties and groundwater use restrictions. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Access restrictions, SMP and periodic Site reviews would	Protection of public health would be provided. Excavation of surface soil in the area of the on-Site residence would address potentially unacceptable risks to public health associated with exposure to surface soil, while excavation of surface and subsurface soil in the area east of the commercial building would provide additional protectiveness. Additional protection of public health would be provided by O&M of existing Site covers (asphalt and gravel). EISD would address soil and groundwater impacts and would provide added protection of public health. Continued O&M of SSDSs would be provide protection of public health relative to potential exposure to soil vapor. Protection of public health relative to ingestion of groundwater exceeding SCGs is provided through public water supply connections for the Site and surrounding properties and groundwater use restrictions. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Access restrictions, SMP and periodic Site reviews would	Protection of public health would be provided. Site-wide excavation of soil, including demolition of the on-Site buildings and excavation below the structures, would address potentially unacceptable risks to public health associated with exposure to soil. Continued O&M of the off-Site SSDS would be provide protection of public health relative to potential exposure to soil vapor. Residual groundwater impacts and potential for human exposure would be provided through public water supply connections for the Site and surrounding properties. Groundwater use restrictions, groundwater monitoring, institutional controls, SMP, and periodic Site reviews minimize potentially unacceptable risks to public health associated with impacted soil and groundwater remaining on-Site.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 Targeted surface soil excavation, engineered cover and MNA	Alternative 3 Targeted surface and subsurface soil excavation, *In situ* chemical oxidation of soil/groundwater and MNA	Alternative 4 Targeted surface and subsurface soil excavation, enhanced *in situ* dechlorination treatment of soil/groundwater and MNA	Alternative 5 Site-wide excavation with off-Site disposal and MNA
			limit Site use and minimize potentially unacceptable risks to public health associated with impacted soil and groundwater remaining on-Site.	limit Site use and minimize potentially unacceptable risks to public health associated with impacted soil and groundwater remaining on-Site.	
Overall protection of the environment	Not protective of the environment. Relies on natural attenuation to address migration of impacted groundwater, to attain groundwater SCGs, and to mitigate sources of soil and groundwater contamination. Limited protection of the environment associated with erosion and migration of soil would be provided by existing Site buildings and covers. However, maintenance of these existing cover surfaces is not included in this Alternative. Alternative does not provide a means for monitoring constituent concentrations, the progress of natural attenuation, and the protection of ecological resources.	Some protection of the environment would be provided. Existing Site covers including Site buildings and pavement provide protection of the environment, including reducing infiltration, and thereby reducing erosion and contaminant migration. Additional protection would be afforded through excavation of surface soil in the area of the on-Site residence. Maintenance of remedy components, site management plan, and periodic reviews would minimize potentially unacceptable risks to the environment associated with soil. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.	Protection of the environment would be provided. Existing Site covers including Site buildings and pavement provide protection of the environment, including reducing infiltration, and thereby reducing erosion and contaminant migration. Targeted excavation of soil (both for commercial and residential areas) provides additional protection of the environment through excavation of contaminants in soil. Mitigation of soil/ groundwater contamination is provided through active treatment of soil and groundwater on-Site via ISCO injections (Zone B). Maintenance of remedy components, site management plan, and periodic reviews would minimize potentially unacceptable risks to the environment associated with soil. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.	Protection of the environment would be provided. Existing Site covers including Site buildings and pavement provide protection of the environment, including reducing infiltration, and thereby reducing erosion and contaminant migration. Targeted excavation of soil (both for commercial and residential areas) provides additional protection of the environment through excavation of contaminants in soil. Mitigation of soil/ groundwater contamination is provided through active treatment of soil and groundwater on-Site via EISD via injections (Zone B). Maintenance of remedy components, site management plan, and periodic reviews would minimize potentially unacceptable risks to the environment associated with soil. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.	Protection of the environment would be provided. Site-wide excavation of soil, including demolition of the on-Site buildings and excavation below the structures, would address potentially unacceptable risks to the environment associated with sources of soil and groundwater contamination. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Periodic Site reviews would provide for evaluation of continued protectiveness of the environment.
Attainment of Remedial Action Objectives (RAOs)	Alternative 1 would address the RAO related to mitigation of public health impacts due to contaminants volatilizing from soil through continue O&M of the SSDSs. Alternative 1 would not address the remaining RAOs for the protection of public health and the environmental. While covers and public water supply exist, they are not required to be maintained under this alternative. Alternative 1 does not address the RAO related to removal of the sources of contamination to groundwater. Alternative 1 relies on natural attenuation to address the	Alternative 2 would address RAOs for the protection of public health and the environment through excavation of surface soil (residential area) and existing Site cover covers, continued operation of SSDSs, and groundwater monitoring with MNA, and through maintenance of remedy components including maintenance of existing covers and public water supply, SMP, and periodic Site reviews. Alternative 2 does not address the RAO related to removal of the sources of contamination to groundwater. Alternative 2 relies on natural attenuation to address the RAO related to groundwater restoration.	Alternative 3 would address RAOs for the protection of public health and the environment through excavation of surface soil (residential area), excavation of soil (commercial area), ISCO (commercial area Zones A and B), and existing Site cover covers, continued operation of SSDSs, and groundwater monitoring with MNA, and through maintenance of remedy components including maintenance of existing covers and public water supply, SMP, and periodic Site reviews. Alternative 3 addresses RAOs related to groundwater restoration and sources of	Alternative 3 would address RAOs for the protection of public health and the environment through excavation of surface soil (residential area), excavation of soil (commercial area), EISD (commercial area Zones A and B), and existing Site cover covers, continued operation of SSDSs, and groundwater monitoring with MNA, and through maintenance of remedy components including maintenance of existing covers and public water supply, SMP, and periodic Site reviews. Alternative 4 addresses RAOs related to groundwater restoration and sources of groundwater contamination through treatment and removal.	Alternative 5 would address RAOs for the protection of public health and protection of the environment through excavation of on-Site soil exceeding Unrestricted Use SCOs. Alternative 5 addresses RAOs related to groundwater restoration and sources of groundwater contamination through removal.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 Targeted surface soil excavation, engineered cover and MNA	Alternative 3 Targeted surface and subsurface soil excavation, *In situ* chemical oxidation of soil/groundwater and MNA	Alternative 4 Targeted surface and subsurface soil excavation, enhanced *in situ* dechlorination treatment of soil/groundwater and MNA	Alternative 5 Site-wide excavation with off-Site disposal and MNA
	RAO related to groundwater restoration.		groundwater contamination through treatment and removal.		
Compliance with Standards, Criteria and Guidance (SCGs)					
Compliance with chemical-specific SCGs	Alternative 1 does not actively address chemical-specific SCGs, other than through existing covers and SSDSs.	Targeted excavation of surface soil that exceeds Residential Use SCOs, existing Site covers and continued operation of SSDSs would address potential exposure to soil, groundwater and sub-slab soil vapor/indoor air exceeding SCGs. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring and MNA and maintenance of remedy components including SMP, and periodic Site reviews.	Targeted excavation of surface soil that exceeds Residential Use SCOs, targeted excavation of soil exceeding Commercial SCOs, ISCO treatment, existing Site covers and continued operation of SSDSs would address potential exposure to soil, groundwater and sub-slab soil vapor/indoor air exceeding SCGs. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring and MNA and maintenance of remedy components including SMP, and periodic Site reviews.	Targeted excavation of surface soil that exceeds Residential Use SCOs, targeted excavation of soil exceeding Commercial SCOs, EISD, existing Site covers and continued operation of SSDSs would address potential exposure to soil, groundwater and sub-slab soil vapor/indoor air exceeding SCGs. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring and MNA and maintenance of remedy components including SMP, and periodic Site reviews.	Excavation of soil exceeding Unrestricted Use SCOs, including the demolition of the existing buildings, would address potential exposure to soil, groundwater and sub-slab soil vapor/indoor air exceeding SCGs. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring and maintenance of off-Site SSDS including SMP, and periodic Site reviews.
Compliance with location-specific SCGs	No location-specific SCGs triggered for this alternative.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with Federal and State requirements for cultural, archeological, and historical resources.
Compliance with action-specific SCGs	No action-specific SCGs triggered for this alternative.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Construction activities, system operation and monitoring would be performed in accordance with OSHA requirements. Institutional controls would be implemented in accordance with New York State Department of Environmental Conservation (NYSDEC) DER-33 and United States Environmental Protection Agency (USEPA) guidance and policy.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Construction activities, system operation and monitoring would be performed in accordance with OSHA requirements. Injections would be performed in accordance with Federal underground injection control regulations. Institutional controls would be implemented in accordance with NYSDEC DER-33 and USEPA guidance and policy.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Construction activities, system operation and monitoring would be performed in accordance with OSHA requirements. Injections would be performed in accordance with Federal underground injection control regulations. Institutional controls would be implemented in accordance with NYSDEC DER-33 and USEPA guidance and policy.	Excavated soil would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Management, transportation, and disposal of waste generated during site remediation activities would be in accordance with applicable State and Federal requirements. Demolition/excavation activities and monitoring would be performed in accordance with OSHA requirements. Institutional controls would be implemented in general conformance with NYSDEC DER-33 and USEPA guidance and policy.
Long-Term Effectiveness and Permanence					
Magnitude of residual risk	Risks associated with soil and groundwater exceeding chemical-	Targeted excavation of surface soil (residential area) and existing Site	Targeted excavation of surface soil (residential area) and soil (commercial	Targeted excavation of surface soil (residential area) and soil (commercial	Excavation of soil that exceeds Unrestricted Use SCOs would mitigate

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	specific SCGs would remain unchanged. Risks associated with sub-slab soil vapor/indoor air exceeding chemical-specific SCGs would be address through continued O&M of SSDSs.	covers would minimize risk associated with exposed surface soil erosion and migration. Residual risks associated with groundwater would be addressed through groundwater monitoring. Residual risks associated with soil vapor exposure would be addressed through continued O&M of SSDSs. Residual risks would also be managed by continued maintenance of remedy components including SMP, and periodic Site reviews.	area), ISCO, and existing Site covers would minimize risk associated with exposed surface soil erosion and migration, including contaminant migration from the source area. Residual risks associated with groundwater would be addressed through ISCO and groundwater monitoring. Residual risks associated with soil vapor exposure would be addressed through continued O&M of SSDSs. Residual risks would also be managed by continued maintenance of remedy components including SMP, and periodic Site reviews.	area), EISD, and existing Site covers would minimize risk associated with exposed surface soil erosion and migration, including contaminant migration from the source area. Residual risks associated with groundwater would be addressed through EISD and groundwater monitoring. Residual risks associated with soil vapor exposure would be addressed through continued O&M of SSDSs. Residual risks would also be managed by continued maintenance of remedy components including SMP, and periodic Site reviews.	risk associated with soil and minimize contaminant migration in groundwater from the source area. Residual risks associated with groundwater would be addressed through groundwater monitoring. Residual risks associated with soil vapor exposure would be addressed through continued O&M of the off-Site SSDS.
Adequacy and reliability of controls	The on-Site buildings and existing Site covers are an adequate means of controlling direct contact with soil. A public water supply is an adequate and reliable means of controlling exposures to groundwater (as a potable water source). On- and off-Site SSDSs provide an adequate and reliable means of addressing sub-slab soil vapor/indoor air exposure and O&M of these systems would continue under this alternative. Alternative does not provide adequate and reliable means of restricting activities resulting in potential human or ecological exposure to soil, or damage to remedy elements. Alternative does not provide a means for monitoring constituent concentrations and the progress of natural attenuation.	Maintenance of existing Site covers provide adequate and reliable means of controlling erosion and exposure to soil. Excavation is an adequate and reliable means of addressing contaminated surface soil. O&M of on- and off-Site SSDSs provide an adequate and reliable means of addressing sub-slab soil vapor/indoor air exposure. Institutional controls are an adequate and reliable means of controlling Site us and direct contact with soil, groundwater and soil vapor. Groundwater monitoring would provide adequate and reliable means for monitoring groundwater conditions and the progress of natural attenuation.	Maintenance of existing Site covers provide adequate and reliable means of controlling erosion and exposure to soil. Excavation is an adequate and reliable means of addressing contaminated soil. ISCO is an adequate and reliable means of addressing contaminants in soil and groundwater. O&M of on- and off-Site SSDSs provide an adequate and reliable means of addressing sub-slab soil vapor/indoor air exposure. Institutional controls are an adequate and reliable means of controlling Site us and direct contact with soil, groundwater and soil vapor. Groundwater monitoring would provide adequate and reliable means for monitoring groundwater conditions and the progress of natural attenuation.	Maintenance of existing Site covers provide adequate and reliable means of controlling erosion and exposure to soil. Excavation is an adequate and reliable means of addressing contaminated soil. EISD is an adequate and reliable means of addressing contaminants in soil and groundwater. O&M of on- and off-Site SSDSs provide an adequate and reliable means of addressing sub-slab soil vapor/indoor air exposure. Institutional controls are an adequate and reliable means of controlling Site us and direct contact with soil, groundwater and soil vapor. Groundwater monitoring would provide adequate and reliable means for monitoring groundwater conditions and the progress of natural attenuation.	Excavation is an adequate and reliable means of addressing contaminated soil. O&M of the off-Site SSDSs provide an adequate and reliable means of addressing sub-slab soil vapor/indoor air exposure. Institutional controls are an adequate and reliable means of controlling Site us and direct contact with soil, groundwater and soil vapor. Groundwater monitoring would provide adequate and reliable means for monitoring groundwater conditions and the progress of natural attenuation.
Long-term sustainability	Maintenance of on- and off-Site SSDSs is included under this alternative. Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring. No impacts to water or ecology.	Maintenance of on- and off-Site SSDSs and Site covers with groundwater monitoring is included under this alternative. Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring.	Maintenance of on- and off-Site SSDSs and Site covers with groundwater monitoring is included under this alternative. Periodic ISCO injections and monitoring may also be implemented. Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring.	Maintenance of on- and off-Site SSDSs and Site covers with groundwater monitoring is included under this alternative. Periodic EISD injections and monitoring may also be implemented. Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring.	Maintenance of the off-Site SSDS with groundwater monitoring is included under this alternative. Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring.
Reduction of Toxicity, Mobility or Volume through Treatment					
Treatment process used and materials treated	Treatment is not included under this alternative.	Treatment is not included under this alternative.	ISCO treatment of Site contaminants in soil and groundwater.	EISD of Site contaminants in soil and groundwater.	Treatment is not included under this alternative.

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Amount of hazardous material destroyed or treated	None.	No treatment is included under this alternative, however, approximately 100 cubic yards of soil would be excavated and disposed off-Site.	Approximately 2,780 square feet of saturated soil would be treated using ISCO, including contaminants in groundwater in the source area. In addition, approximately 660 cubic yards of soil would be excavated and disposed off-Site.	Approximately 2,780 square feet of saturated soil would be treated using EISD, including contaminants in groundwater in the source area. In addition, approximately 660 cubic yards of soil would be excavated and disposed off-Site.	No treatment is included under this alternative, however, approximately 5,620 cubic yards of soil would be excavated and disposed off-Site.
Degree of expected reduction in toxicity, mobility, or volume	Existing Site covers would reduce mobility of contaminants in soil; however these covers are not maintained under this alternative. Natural attenuation is expected to reduce contaminant concentrations over the long-term. On- and off-Site SSDSs would address mobility of soil vapor from entering structures. This alternative does not actively reduce the toxicity, mobility or volume of soil or groundwater.	Excavation of surface soil (residential area) would reduce toxicity, mobility and volume of contaminants in soil. Existing Site covers would reduce mobility of contaminants in soil. On- and off-Site SSDSs would address mobility of soil vapor from entering structures. Natural attenuation is expected to reduce contaminant concentrations over the long-term.	ISCO would reduce toxicity, mobility and volume of contaminants in groundwater and soil. Targeted soil excavation (commercial area) and excavation of surface soil (residential area) would also reduce toxicity, mobility and volume of contaminants in soil. Existing Site covers would reduce mobility of contaminants in soil. On- and off-Site SSDSs would address mobility of soil vapor from entering structures. Natural attenuation is expected to reduce contaminant concentrations over the long-term.	EISD would reduce toxicity, mobility and volume of contaminants in groundwater and soil. Targeted soil excavation (commercial area) and excavation of surface soil (residential area) would also reduce toxicity, mobility and volume of contaminants in soil. Existing Site covers would reduce mobility of contaminants in soil. On- and off-Site SSDSs would address mobility of soil vapor from entering structures. Natural attenuation is expected to reduce contaminant concentrations over the long-term.	Toxicity, mobility, and volume of soil would be reduced through Site-wide excavation. Natural attenuation is expected to reduce contaminant concentrations over the long-term.
Degree to which treatment is irreversible	Alternative 1 does not include treatment or removal actions.	Alternative 2 does not include treatment actions. Excavation is considered irreversible.	Excavation and ISCO are considered irreversible.	Excavation and EISD are considered irreversible.	Alternative 5 does not include treatment actions. Excavation is considered irreversible.
Type and quantity of residuals remaining after treatment	Alternative 1 does not include treatment actions.	Alternative 2 does not include treatment actions.	Minimal treatment residuals would be anticipated following ISCO injection(s).	Minimal treatment residuals would be anticipated following EISD injection(s).	Alternative 5 does not include treatment actions.
Short-Term Effectiveness					
Protection of community during remedial actions	Except for continued O&M of on- and off-Site SSDSs, there are no active remedial components under this alternative.	Dust and volatile emissions, if any, would be controlled during construction activities. Excavation of soil and off-Site transport/disposal of soil would result in limited impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Minimal community impacts expected from ISCO. Excavation of soil and off-Site transport/disposal of soil would result in impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Minimal community impacts expected from EISD. Excavation of soil and off-Site transport/disposal of soil would result in impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Building demolition, excavation of soil, and off-Site transport/disposal would result in significant impacts to the community relative to truck traffic and noise during the construction.
Protection of workers during remedial actions	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.
Environmental impacts	Except for continued O&M of on- and off-Site SSDSs, there are no active remedial components under this alternative. Environmental impacts are not anticipated.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of soil excavation. Minimal clearing would be required prior to excavation.	Proper protocols would be followed for the storage and use of the ISCO treatment chemicals. Amendment application, dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation.	Proper protocols would be followed for the storage and use of the EISD chemicals. Amendment application, dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation. Dust, volatile	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Demolition of the commercial and residential buildings would be required prior to excavation.

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			Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of soil excavation. Minimal clearing would be required prior to excavation.	emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of soil excavation. Minimal clearing would be required prior to excavation.	
Time until RAOs are achieved	Other than through natural attenuation, RAOs related to public health and environmental protection for soil and groundwater would not be met with this alternative. The RAO related to mitigation of public health impacts due to contaminants volatilizing from soil through continued O&M of the SSDSs would be achieved.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be addressed upon completion of the remedy. Contaminant concentrations in groundwater within the Remedial Investigation (RI) Study Area and source area would be reduced over time through natural attenuation.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be addressed upon completion of the remedy. Contaminant concentrations in groundwater within the RI Study Area and source area would be reduced over time through source removal/treatment and natural attenuation.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be addressed upon completion of the remedy. Contaminant concentrations in groundwater within the RI Study Area and source area would be reduced over time through source removal/treatment and natural attenuation.	RAOs related to public health and environmental protection for soil, groundwater and sub-slab soil vapor/indoor air would be addressed upon completion of the remedy. Contaminant concentrations in groundwater within the RI Study Area and source area would be reduced over time through source removal and natural attenuation.
Short-term sustainability	Maintenance of on-and off-Site SSDSs is proposed under this alternative. Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring. No impacts to water or ecology.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-Site during remedy implementation is estimated at approximately 10 $MTCO_2e$.	Greenhouse gas emissions associated with fuel/energy use by construction equipment, ISCO applications, and transportation of materials on- and off-Site during remedy implementation is estimated at approximately 246 $MTCO_2e$.	Greenhouse gas emissions associated with fuel/energy use by construction equipment, EISD applications, and transportation of materials on- and off-Site during remedy implementation is estimated at approximately 237 $MTCO_2e$.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-Site during remedy implementation is estimated at approximately 1624 $MTCO_2e$.
Implementability					
Ability to construct and operate the technology	The on- and off-Site SSDSs are readily maintained and operated.	Excavation of surface soil in combination with off-Site transport and disposal is readily implementable and constructible. Monitoring and institutional controls are readily implemented. The on- and off-Site SSDSs are readily maintained and operated.	ISCO injection well network readily constructed and operated. Application of ISCO amendments require additional health and safety measures. Excavation of soil in combination with off-Site transport and disposal is readily implementable and constructible. Monitoring and institutional controls are readily implemented. The on- and off-Site SSDSs are readily maintained and operated.	EISD injection well network readily constructed and operated. Excavation of soil in combination with off-Site transport and disposal is readily implementable and constructible. Monitoring and institutional controls are readily implemented. The on- and off-Site SSDSs are readily maintained and operated.	Implementability of Site-wide excavation and off-Site disposal of 5,620 cubic yards of material is limited due to the depth of excavation and challenges of working within a developed multi-use area. Site-wide excavation, as proposed, would require use of off-Site areas for support, soil staging, dewatering, water treatment, etc., as well as sheeting for excavation support of off-Site areas. Additionally, significant dewatering and water treatment would be required. Recovered water would require both pre-treatment and discharge to municipal facilities. Transportation considerations related to the implementation of Alternative 5 include: significantly increased traffic, fuel usage, and potential adverse effects on both air quality and community safety.
Reliability of technology	SSDSs are reliable technologies to address soil vapor.	Excavation and off-Site disposal are reliable technologies to address soil contamination. Maintained covers are	ISCO is expected to be a reliable method of reducing contaminants and minimizing migration. The reliability would be confirmed during the	EISD is expected to be a reliable method of reducing contaminants and minimizing migration. The reliability would be confirmed during the	Excavation and disposal are reliable technologies. SSDSs are reliable technologies to address soil vapor.

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		considered reliable. SSDSs are reliable technologies to address soil vapor.	treatability testing. Excavation and off-Site disposal are reliable technologies. Maintained covers are considered reliable. SSDSs are reliable technologies to address soil vapor.	treatability testing. Excavation and off-Site disposal are reliable technologies. Maintained covers are considered reliable. SSDSs are reliable technologies to address soil vapor.	
Ease of undertaking additional remedial actions, if necessary	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.
Ability to monitor effectiveness of remedy	No monitoring components are related to this alternative.	Effectiveness of remedy could be monitored through inspection and maintenance of engineering controls, including covers and SSDSs. A site management plan, periodic reviews, and groundwater monitoring in RI Study would provide means for monitoring remedy effectiveness.	Effectiveness of remedy could be monitored through inspection and maintenance of engineering controls, including covers and SSDSs. A site management plan, periodic reviews, and groundwater monitoring in RI Study would provide means for monitoring remedy effectiveness. Groundwater monitoring would indicate effectiveness of ISCO.	Effectiveness of remedy could be monitored through inspection and maintenance of engineering controls, including covers and SSDSs. A site management plan, periodic reviews, and groundwater monitoring in RI Study would provide means for monitoring remedy effectiveness. Groundwater monitoring would indicate effectiveness of EISD.	A site management plan, periodic reviews, and groundwater monitoring in RI Study would provide means for monitoring remedy effectiveness.
Coordination with other agencies and property owners	Coordination with property owners would be necessary.	Coordination with other agencies including New York State Department of Health (NYSDOH), New York State Department of Transportation (NYSDOT), Village of Whitesboro, Town of Whitestown and Oneida County would be necessary. Coordination with property owners would be necessary.	Coordination with other agencies including NYSDOH, NYSDOT, Village of Whitesboro, Town of Whitestown and Oneida County would be necessary. Coordination with property owners would be necessary.	Coordination with other agencies including NYSDOH, NYSDOT, Village of Whitesboro, Town of Whitestown and Oneida County would be necessary. Coordination with property owners would be necessary.	Coordination with other agencies including NYSDOH, NYSDOT, Village of Whitesboro, Town of Whitestown and Oneida County would be necessary. Coordination with property owners would be necessary.
Availability of off-Site treatment storage and disposal services and capacities	None included in this Alternative.	Capacity for off-Site disposal of approximately 59 tons of soil and 1.6 tons of C&D material is readily available.	Capacity for off-Site disposal of approximately 380 tons of soil and 110 tons of C&D material is readily available.	Capacity for off-Site disposal of approximately 380 tons of soil and 110 tons of C&D material is readily available.	Capacity for off-Site disposal of approximately 3,310 tons of soil and 190 tons of C&D material would require evaluation during the remedial design.
Availability of necessary equipment, specialists, and materials	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.
Cost					

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Further Action	Alternative 2 Targeted surface soil excavation, engineered cover and MNA	Alternative 3 Targeted surface and subsurface soil excavation, *In situ* chemical oxidation of soil/groundwater and MNA	Alternative 4 Targeted surface and subsurface soil excavation, enhanced *in situ* dechlorination treatment of soil/groundwater and MNA	Alternative 5 Site-wide excavation with off-Site disposal and MNA
Total estimated capital cost	$0	$0.23 M	$2.40 M	$2.18 M	$5.78 M
Present worth of operation and maintenance cost (30 years, 7% discount factor)	$0.13 M	$0.18 M	$0.18 M	$0.18 M	$0.21 M
Total estimated net present worth cost	$0.13 M	$0.41 M	$2.58 M	$2.36 M	$5.99 M
Land Use					
Consistency with proposed future use	Not protective for current, intended, and reasonably anticipated future uses of the Site.	Excavation may cause temporary disruption to current land use in the residential area. Following restoration and implementation of remedy, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.	Excavation and *in situ* treatment may cause temporary disruption to current land use in the residential and commercial areas. Following restoration and implementation of remedy, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.	Excavation and *in situ* treatment may cause disruption to current land use in the residential and commercial areas. Following restoration and implementation of remedy, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.	Site-wide excavation would cause significant disruption to current land use and require demolition of the Site commercial and residential buildings. Following restoration, conditions would be consistent with current, intended, and reasonably anticipated future uses of the Site.

Table 4-2. Alternative 1, No Further Action

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: No further action
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Direct Capital Cost					
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$0**	Rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$0**	
			Engineering/Management, Construction Oversight, OH&P:	**$0**	15%, 8%, and 10% respectively
			Contingency:	**$0**	Scope Contingency at 30%
			TOTAL ESTIMATED CAPITAL COST:	**$0**	Rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-30					
SSDS					
Inspections	EA	1	$7,500	$7,500	Assumes 2 scientists/engineers, 1 day, 8 hours/day, once annually, includes PM
Reporting and Recordkeeping	EA	1	$2,000	$2,000	Assumes annual report to document O&M activities
Years 5, 10, 15, 20, 25, 30					
SSDS					
Periodic Preventative Maintenance	EA	1	$7,000	$7,000	Allowance; may include replacing fans, repairs and/or adjustment
PRESENT WORTH ANALYSIS (YEARS 1-30)			DISCOUNT FACTOR	PRESENT WORTH	
		Cost	Df=7	(rounded)	
ESTIMATED CAPITAL COST - Year 0		$0	$1	$0	
ANNUAL O&M - YEARS 1-30		$9,500	$0.41	$118,000	Average discount factor for years 1-30
PERIODIC O&M - YEARS 5, 10, 15, 20, 25, 30		$7,000	$0.36	$15,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
			TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:	**$133,000**	Rounded

Table 4-3. Alternative 2, Targeted Surface Soil Excavation, Engineered Cover and MNA

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence
Off-Site transportation and disposal of excavated surface soil
Existing Site cover O&M
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Direct Capital Cost					General Conditions costs (e.g., trailer, fuel, tools, small tools, consumables, safety) are accounted for within direct capital cost unit rates.
Mobilization/Demobilization	EA	2	$4,000	$8,000	
Air Monitoring	MO	1	$14,200	$14,200	Community Air Monitoring Program (CAMP)
Surveys and Layouts					
Utility Survey	LS	1	$7,600	$7,600	GPR/Existing UG Conditions Survey
Excavation Limits and Depths	LS	1	$9,000	$9,000	Preconstruction, Post Excavation, and Post Backfill Locations
Dust Control	WK	2	$1,200	$2,400	Water tank and sprayer rental and labor
Site Preparation					
Erosion and Sediment Control	LF	400	$19	$7,600	Silt fence
Demolition					
Sidewalk	SF	64	$9	$576	Remove sidewalk to on-Site residence
QA/QC					
Confirmation Sampling	EA	8	$250	$2,000	Sidewall sampling every 30LF and bottom sampling every 900SF; VOCs
Import Materials	EA	1	$2,600	$2,600	In accordance with Table 5.4(e)10 of NYSDEC DER-10 and PFAs requirements - 1 every 500 CY
Excavation					
Surface Soil Excavation and Handling	CY	100	$68	$6,800	By conventional equipment; 100 CY excavation in the area of the on-Site residence; labor included
Backfill and Restoration					
Place Imported Backfill	CY	100	$230	$23,000	Place, spread, and compact; labor and equipment included
Demarcation Layer	SF	1,350	$1.25	$1,688	Single layer geotextile
Topsoil and Seeding	SF	1,350	$3	$4,050	Residential area
Irrigation	WK	4	$500	$2,000	
Sidewalk	SF	64	$16	$1,024	Replace sidewalk to on-Site residence
Transportation and Disposal					
Waste Characterization	EA	1	$2,600	$2,600	Characterize excavated materials
T&D by Truck - Non-Hazardous	TON	59	$100	$5,882	100 BCY, 1.7 tons per CY; live loading
T&D by Truck - C&D	TON	1.6	$74	$117	Concrete sidewalk; live loading
	TOTAL ESTIMATED DIRECT CAPITAL COST:			**$101,000**	Rounded

Table 4-3. Alternative 2, Targeted Surface Soil Excavation, Engineered Cover and MNA

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence
Off-Site transportation and disposal of excavated surface soil
Existing Site cover O&M
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$101,000**	
			Engineering/Management, Construction Oversight, OH&P:	**$33,300**	15%, 8%, and 10% respectively
			Contingency:	**$20,200**	Scope Contingency at 20%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
			TOTAL ESTIMATED CAPITAL COST:	**$230,000**	Rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-30					
Groundwater Monitoring					
Reporting and Recordkeeping	LS	1	$15,000	$15,000	Annual groundwater monitoring report, data management
Sampling and Analysis	EA	2	$18,000	$36,000	Biannual sampling of existing wells both on-Site and off-Site (6 wells)
Site Covers					
Inspections	EA	2	$1,000	$2,000	Assumes 2 scientists/engineers, 1 hour, twice annually
Reporting and Recordkeeping	LS	1	$5,000	$5,000	
Maintenance and Incidental Repairs	LS	1	$7,000	$7,000	Mowing; spot repair of topsoil/seeding; annual sealing of asphalt
SSDS					
Inspections	EA	1	$7,500	$7,500	Assumes 2 scientists/engineers, 1 day, 8 hours/day, once annually, includes PM
Reporting and Recordkeeping	LS	1	$2,000	$2,000	Assumes annual report to document O&M activities
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$20,000	$20,000	
SSDS					
Periodic Preventative Maintenance	EA	1	$7,000	$7,000	Allowance; may include replacing fans, repairs and/or adjustment

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$230,000	1.00	$230,000	
ANNUAL O&M COST - Years 1-30	$74,500	0.41	$123,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 5, 10, 15, 20, 25, 30	$27,000	0.36	$58,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
		TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:	**$411,000**	Rounded

Table 4-4. Alternative 3, Targeted Surface and Subsurface Excavation, In Situ Chemical Oxidation and MNA

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: PDI for Zone A soil excavation limits and geotechnical considerations - east of commercial bu
Excavation of soil (targeted Zone A) east of commercial building
Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence
Off-Site transportation and disposal of excavated soil
In situ chemical oxidations (ISCO; Zone B) with pilot study PDI
Existing Site cover O&M
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Direct Capital Cost					General Conditions costs (e.g., trailer, fuel, tools, small tools, consumables, safety) are accounted for within direct capital cost unit rates.
Mobilization/Demobilization	EA	2	$8,000	$16,000	
Air Monitoring	MO	2	$14,200	$28,400	Community Air Monitoring Program (CAMP)
Odor Control	MO	1	$22,600	$22,600	
Surveys and Layouts					
Utility Survey	LS	1	$11,400	$11,400	GPR/Existing UG Conditions Survey
Excavation Limits and Depths	LS	1	$38,000	$38,000	Preconstruction, Post Excavation, Post Backfill Locations, Injection Well Locations
Dust Control	WK	6	$2,400	$14,400	5,000 gallon water truck rental and operation
Water Management	WK	6	$5,000	$30,000	Dewatering system, including water testing; assume discharge to active storm sewer
Site Preparation					
PDI - Excavation Limits, Geotechnical	LS	1	$85,000	$85,000	PDI to refine extent of subsurface soil excavation, geotechnical evaluation for excavation and building support; includes work plan and summary reporting
PDI - ISCO Pilot Study	LS	1	$50,000	$50,000	Allowance for ISCO PDI Pilot Study; treatability study conducted by ISOTEC in 2021
Temporary Fencing	LF	550	$30	$16,500	During construction activities for site safety/control
Temporary Construction Entrance	LS	1	$13,200	$13,200	Installation and demo of construction entrance; supply, disposal, and transport of stone
Temporary Decontamination Pad	LS	1	$62,100	$62,100	
Temporary Staging Area	LS	1	$71,700	$71,700	Stabilization fabric, HDPE liner, collection sump, and import stone
Street Closure	LS	1	$13,070	$13,070	Assumes road closure, barricades, and signage; no flaggers
Demolition					
Sidewalk	SF	64	$9	$576	Remove sidewalk to on-Site residence
Asphalt	SF	3,000	$6	$19,200	
Commercial Building - Cut, Cap Utilities	EA	4	$1,890	$7,560	Cut and cap utility services to commercial building
Erosion and Sediment Control	LF	550	$20	$11,000	Silt fence
Excavation					
Soil Excavation and Handling	CY	660	$68	$44,880	By conventional equipment and benching/sloping/sheeting techniques for excavation stability; 590CY of deep soils (5% fail samples) and 105CY of shallow soils; labor included
Excavation Support	SF	6,000	$34	$204,000	Sheeting (200'L x 30'D)
Soil Mixing and Loading					
Amended Soils	DAY	15	$3,600	$54,000	Mix and load amended soils at staging area to trucks for offsite disposal
LKD Amendment Material	CY	30	$200	$6,000	Supply lime kiln dust (LKD)
Groundwater Treatment					
In Situ Chemical Oxidation (ISCO)	EA	2	$120,000	$240,000	Assumes 2 injection events using temporary direct-push injection points; estimate provided by ISOTEC
Groundwater Performance Monitoring	EA	4	$18,000	$72,000	Assumes 4 events (Baseline, 1 round of sampling following each injection, and a final post-injection monitoring event)
QA/QC					
Confirmation Sampling	EA	15	$250	$3,750	Sidewall sampling every 30LF and bottom sampling every 900SF
Import Materials	EA	2	$2,600	$5,200	In accordance with Table 5.4(e)10 of NYSDEC DER-10 and PFAs requirements - 1 every 500CY
Water Samples - Discharge to POTW	EA	6	$1,500	$9,000	Assumes 1 per week
Backfill and Restoration					
Place Imported Backfill	CY	660	$130	$85,800	Place, spread, and compact; labor and equipment included
Demarcation Layer	SF	2,850	$1.25	$3,560	Single layer geotextile
Asphalt Pavement	SF	3,000	$10	$30,000	Excavated area to road
Gravel Surfaces	SF	5,600	$3	$15,120	Staging area outside of excavated area
Topsoil and Seeding	SF	1,350	$3	$4,050	Residential area
Irrigation	WK	4	$500	$2,000	
Utility Relocations	LS	1	$46,100	$46,100	Sanitary, gas and water
Pre-Design Investigation					
Pre-Design Investigation	LS	1	$95,000	$95,000	Source area excavation / in situ treatment area; allowances to be refined during PDI scoping

Table 4-4. Alternative 3, Targeted Surface and Subsurface Excavation, In Situ Chemical Oxidation and MNA

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: PDI for Zone A soil excavation limits and geotechnical considerations - east of commercial bu
Excavation of soil (targeted Zone A) east of commercial building
Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence
Off-Site transportation and disposal of excavated soil
In situ chemical oxidations (ISCO; Zone B) with pilot study PDI
Existing Site cover O&M
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Transportation and Disposal					
Waste Characterization	EA	1	$2,600	$2,600	Assumes 1 per 1000CY
T&D by Truck - Non-Hazardous	TON	220	$100	$22,000	100BCY residential soil, half commercial soil volume (280 CY), 1.7 T/CY
T&D by Truck - Hazardous	TON	160	$250	$40,000	280BCY (half commercial soil volume), 1.7 T/CY
T&D by Truck - C&D	TON	110	$74	$8,140	Asphalt parking lot/driveway, concrete sidewalk
Monitoring Well Installation					
Monitoring Well Installation	EA	2	$8,000	$16,000	Replace MW-19 and MW-20, removed during excavation
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$1,520,000**	Rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$1,520,000**	
			Engineering/Management, Construction Oversight, OH&P:	**$501,600**	15%, 8%, and 10% respectively
			Contingency:	**$380,000**	Scope Contingency at 25%
			TOTAL ESTIMATED CAPITAL COST:	**$2,400,000**	Rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-30					
Groundwater Monitoring					
Reporting and Recordkeeping	LS	1	$15,000	$15,000	Annual groundwater monitoring report, data management
Sampling and Analysis	EA	2	$18,000	$36,000	Biannual sampling of existing wells both on-Site and off-Site (6 wells)
Site Covers					
Inspections	EA	2	$1,000	$2,000	Assumes 2 scientists/engineers, 1 hour, twice annually
Reporting and Recordkeeping	LS	1	$5,000	$5,000	
Maintenance and incidental repairs	LS	1	$7,000	$7,000	Mowing; spot repair of topsoil/seeding; annual sealing of asphalt
SSDS					
Inspections	EA	1	$7,500	$7,500	Assumes 2 scientists/engineers, 1 day, 8 hours/day, once annually, includes PM
Reporting and Recordkeeping	LS	1	$2,000	$2,000	Assumes annual report to document O&M activities
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$20,000	$20,000	
SSDS					
Periodic Preventative Maintenance	EA	1	$7,000	$7,000	Allowance; may include replacing fans, repairs and/or adjustment

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$2,400,000	1.00	$2,400,000	
ANNUAL O&M COST - Years 1-30	$74,500	0.41	$123,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 5, 10, 15, 20, 25, 30	$27,000	0.36	$58,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$2,581,000**	Rounded

Table 4-5. Alternative 4, Targeted Surface and Subsurface Excavation, Enhanced In Situ Dichlorination and MNA

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: PDI for Zone A soil excavation limits and geotechnical considerations - east of commercial bu
Excavation of soil (targeted Zone A) east of commercial building
Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence
Off-Site transportation and disposal of excavated soil
Enhanced in situ dichlorination (EISD; Zone B) with treatability study and pilot study PDIs
Existing Site cover O&M
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Direct Capital Cost					General Conditions costs (e.g., trailer, fuel, tools, small tools, consumables, safety) are accounted for within direct capital cost unit rates.
Mobilization/Demobilization	EA	2	$8,000	$16,000	
Air Monitoring	MO	2	$14,200	$28,400	Community Air Monitoring Program (CAMP)
Odor Control	MO	1	$22,600	$22,600	
Surveys and Layouts					
Utility Survey	LS	1	$11,400	$11,400	GPR/Existing UG Conditions Survey
Excavation Limits and Depths	LS	1	$38,000	$38,000	Preconstruction, Post Excavation, and Post Backfill Locations
Dust Control	WK	6	$2,400	$14,400	5,000 gallon water truck rental and operation
Water Management	WK	6	$5,000	$30,000	Dewatering system, including water testing; assume discharge to active storm sewer
Site Preparation					
PDI - Excavation Limits, Geotechnical	LS	1	$85,000	$85,000	PDI to refine extent of subsurface soil excavation, geotechnical evaluation for excavation and building support; includes work plan and summary reporting
PDI - IESD Treatability Study	LS	1	$30,000	$30,000	Allowance for IESD treatability study
PDI - IESD Pilot Study	LS	1	$50,000	$50,000	Allowance for IESD pilot study
Temporary Fencing	LF	550	$30	$16,500	During construction activities for site safety/control
Temporary Construction Entrance	LS	1	$13,200	$13,200	Installation and demo of construction entrance; supply, disposal, and transport of stone
Temporary Decontamination Pad	LS	1	$62,100	$62,100	
Temporary Staging Area	LS	1	$71,700	$71,700	Stabilization fabric, HDPE liner, collection sump, and import stone
Street Closure	LS	1	$13,070	$13,070	Assumes road closure, barricades, and signage; no flaggers
Demolition					
Sidewalk	SF	64	$9	$576	Remove sidewalk to on-Site residence
Asphalt	SF	3,000	$6	$19,200	
Commercial Building - Cut, Cap Utilities	EA	4	$1,890	$7,560	Cut and cap utility services to commercial building
Erosion and Sediment Control	LF	550	$20	$11,000	Silt fence
Excavation					
Soil Excavation and Handling	CY	660	$68	$44,880	By conventional equipment and benching/sloping/sheeting techniques for excavation stability; 590CY of deep soils (5% fail samples) and 105CY of shallow soils; labor included
Excavation Support	SF	6,000	$34	$204,000	Sheeting (200'L x 30'D)
Soil Mixing and Loading					
Amended Soils	DAY	15	$3,600	$54,000	Mix and load amended soils at staging area to trucks for offsite disposal
LKD Amendment Material	CY	30	$200	$6,000	Supply lime kiln dust (LKD)
Groundwater Treatment					
Enhanced In Situ Dichlorination	EA	1	$90,000	$90,000	Assumes 1 injection event using temporary direct-push injections; estimate provided by ISOTEC
Groundwater Performance Monitoring	EA	3	$18,000	$54,000	Assumes 3 events, including baseline and two post-injection monitoring events
QA/QC					
Confirmation Sampling	EA	15	$250	$3,750	Sidewall sampling every 30LF and bottom sampling every 900SF
Import Materials	EA	2	$2,600	$5,200	In accordance with Table 5.4(e)10 of NYSDEC DER-10 and PFAs requirements - 1 every 500CY
Water Samples - Discharge to POTW	EA	6	$1,500	$9,000	Assumes 1 per week
Backfill and Restoration					
Place Imported Backfill	CY	660	$130	$85,800	Place, spread, and compact; labor and equipment included
Demarcation Layer	SF	2,850	$1.25	$3,560	Single layer geotextile
Asphalt Pavement	SF	3,000	$10	$30,000	Excavated area to road
Gravel Surfaces	SF	5,600	$3	$15,120	Staging area outside of excavated area
Topsoil and Seeding	SF	1,350	$3	$4,050	Residential area
Irrigation	WK	4	$500	$2,000	
Utility Relocations	LS	1	$46,100	$46,100	Sanitary, gas and water
Pre-Design Investigation					
Pre-Design Investigation	LS	1	$95,000	$95,000	Source area excavation / in situ treatment area; allowances to be refined during PDI scoping

Table 4-5. Alternative 4, Targeted Surface and Subsurface Excavation, Enhanced In Situ Dichlorination and MNA

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: PDI for Zone A soil excavation limits and geotechnical considerations - east of commercial bu
Excavation of soil (targeted Zone A) east of commercial building
Targeted surface soil excavation (0 to 2 ft bgs) in the area of the on-Site residence
Off-Site transportation and disposal of excavated soil
Enhanced in situ dichlorination (EISD; Zone B) with treatability study and pilot study PDIs
Existing Site cover O&M
Continued O&M of existing on- and off-Site sub-slab depressurization systems (SSDSs)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Transportation and Disposal					
Waste Characterization	EA	1	$2,600	$2,600	Assumes 1 per 1000CY
T&D by Truck - Non-Hazardous	TON	220	$100	$22,000	100BCY residential soil, half commercial soil volume (280 CY), 1.7 T/CY
T&D by Truck - Hazardous	TON	160	$250	$40,000	280BCY (half commercial soil volume), 1.7 T/CY
T&D by Truck - C&D	TON	110	$74	$8,140	Asphalt parking lot/driveway, concrete sidewalk
Monitoring Well Installation					
Monitoring Well Installation	EA	2	$8,000	$16,000	Replace MW-19 and MW-20, removed during excavation
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$1,382,000**	Rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$1,382,000**	
			Engineering/Management, Construction Oversight, OH&P:	**$456,100**	15%, 8%, and 10% respectively
			Contingency:	**$345,500**	Scope Contingency at 25%
			TOTAL ESTIMATED CAPITAL COST:	**$2,180,000**	Rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-30					
Groundwater Monitoring					
Reporting and Recordkeeping	LS	1	$15,000	$15,000	Annual groundwater monitoring report, data management
Sampling and Analysis	EA	2	$18,000	$36,000	Biannual sampling of existing wells both on-Site and off-Site (6 wells)
Site Covers					
Inspections	EA	2	$1,000	$2,000	Assumes 2 scientists/engineers, 1 hour, twice annually
Reporting and Recordkeeping	LS	1	$5,000	$5,000	
Maintenance and incidental repairs	LS	1	$7,000	$7,000	Mowing; spot repair of topsoil/seeding; annual sealing of asphalt
SSDS					
Inspections	EA	1	$7,500	$7,500	Assumes 2 scientists/engineers, 1 day, 8 hours/day, once annually, includes PM
Reporting and Recordkeeping	LS	1	$2,000	$2,000	Assumes annual report to document O&M activities
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$20,000	$20,000	
SSDS					
Periodic Preventative Maintenance	EA	1	$7,000	$7,000	Allowance; may include replacing fans, repairs and/or adjustment

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$2,180,000	1.00	$2,180,000	
ANNUAL O&M COST - Years 1-30	$74,500	0.41	$123,000	Average discount factor for years 1-30
PERIODIC O&M COST - Years 5, 10, 15, 20, 25, 30	$27,000	0.36	$58,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$2,361,000**	Rounded

Table 4-6. Alternative 5, Site-Wide Excavation with Off-Site Disposal

Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: Site-wide excavation of soil exceeding Part 374 Unrestricted Use SCOs
Off-Site transportation and disposal of excavated soil
Backfill with clean material, restore with gravel
Continued O&M of existing off-Site sub-slab depressurization system (SSDS)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Direct Capital Cost					General Conditions costs (e.g., trailer, fuel, tools, small tools, consumables, safety) are accounted for within direct capital cost unit rates.
Mobilization/Demobilization	EA	2	$10,000	$20,000	
Air Monitoring	MO	6	$14,200	$85,200	Community Air Monitoring Program (CAMP)
Odor Control	MO	5	$22,600	$113,000	
Surveys and Layouts					
Utility Survey	LS	1	$15,200	$15,200	GPR/Existing UG Conditions Survey
Excavation Limits and Depths	LS	1	$76,100	$76,100	Preconstruction, Post Excavation, and Post Backfill Locations
Dust Control	WK	12	$2,400	$28,800	5,000 gallon water truck rental and operation
Water Management	WK	12	$7,500	$90,000	Dewatering system, including water testing; assume discharge to active storm sewer
Site Preparation					
PDI - Excavation Limits, Geotechnical	LS	1	$100,000	$100,000	PDI to refine extent of subsurface soil excavation, geotechnical evaluation for excavation support; includes work plan and summary reporting
Temporary Fencing	LF	550	$30	$16,500	During construction activities for site safety/control
Temporary Construction Entrance	LS	1	$13,200	$13,200	Installation and demo of construction entrance; supply, disposal, and transport of stone
Temporary Decontamination Pad	LS	1	$62,100	$62,100	
Temporary Staging Area	LS	1	$71,700	$71,700	Stabilization fabric, HDPE liner, collection sump, and import stone
Street Closure	LS	1	$40,500	$40,500	Assumes road closure, barricades, and signage; no flaggers
Demolition					
Sidewalk	SF	64	$9	$576	Remove sidewalk to on-Site residence
Asphalt	SF	5,400	$6	$32,400	
Commercial Building - Utilities	EA	8	$1,890	$15,120	Cut and cap utility services to commercial building
Existing Residence	LS	1	$95,360	$95,360	Foundations, stairs, and walkways
Commercial Building	LS	1	$190,700	$190,700	Building and foundations
Erosion and Sediment Control	LF	550	$20	$11,000	Silt fence
Excavation					
Soil Excavation and Handling	CY	5,620	$68	$382,160	By conventional equipment and benching/sloping/sheeting techniques for excavation stability; 5350CY of deep soils (5% fail samples) and 50CY of shallow soils; labor included
Excavation Support	SF	16,200	$35	$567,000	Sheeting (405'L x 40'D)
Soil Mixing and Loading					
Amended Soils	DAY	55	$3,600	$198,000	Mix and load amended soils at staging area to trucks for offsite disposal
LKD Amendment Material	CY	100	$200	$20,000	Supply
QA/QC					
Confirmation Sampling	EA	35	$250	$8,750	Sidewall sampling every 30LF and bottom sampling every 900SF
Import Materials	EA	11	$2,600	$29,224	In accordance with Table 5.4(e)10 of NYSDEC DER-10 and PFAs requirements - 1 every 500CY
Water Samples - Discharge to POTW	EA	26	$1,500	$39,000	Assumes 1 per week
Backfill and Restoration					
Place Imported Backfill	CY	5,620	$80	$449,600	
Asphalt Pavement	SF	650	$164	$106,600	Excavated area road
Gravel Surfaces	SF	15,450	$1	$15,450	On-Site restoration and staging area outside of excavated area

Table 4-6. Alternative 5, Site-Wide Excavation with Off-Site Disposal

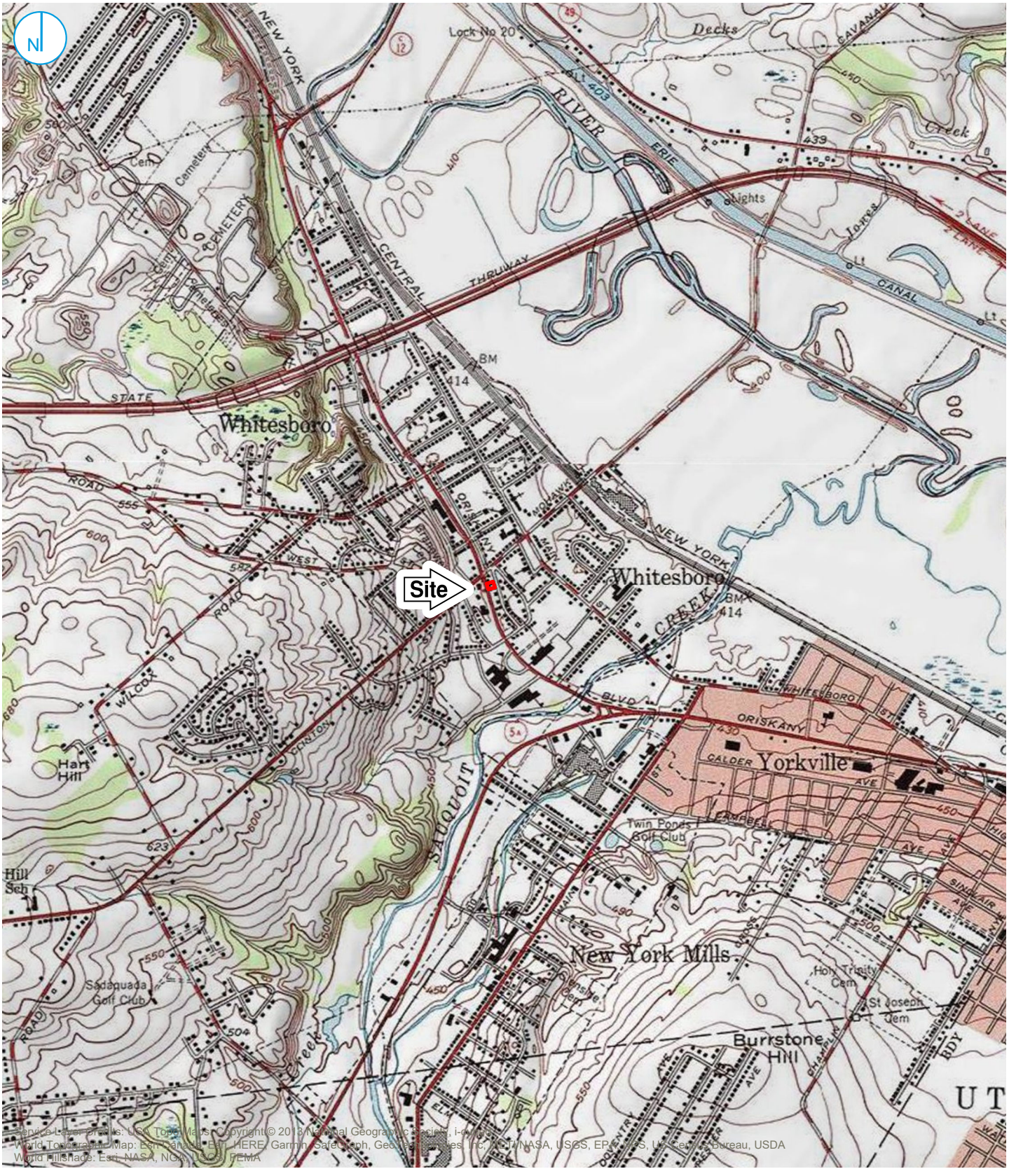
Site: Former Whitesboro Dry Cleaners
Location: Whitesboro, NY
Phase: Feasibility Phase (+50% / -30%)
Base Year: 2023

Conceptual Basis: Site-wide excavation of soil exceeding Part 374 Unrestricted Use SCOs
Off-Site transportation and disposal of excavated soil
Backfill with clean material, restore with gravel
Continued O&M of existing off-Site sub-slab depressurization system (SSDS)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Transportation and Disposal					
Waste Characterization	EA	7	$2,600	$18,200	Assumes 1 per 1000CY
T&D by Truck - Non-Hazardous	TON	2,480	$150	$372,000	Assume 75% soil non-hazardous, 1.7 T/CY
T&D by Truck - Hazardous	TON	830	$250	$207,500	Assume 25% soil hazardous, 1.7 T/CY
T&D by Truck - C&D	TON	190	$74	$14,060	Building materials, asphalt parking lot/driveway, concrete sidewalk
Monitoring Well Installation					
Monitoring Well Installation	EA	5	$8,000	$40,000	Assume 5 wells will be replaced following excavation
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$3,545,000**	Rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$3,545,000**	
			Engineering/Management, Construction Oversight, OH&P:	**$1,169,800**	15%, 8%, and 10% respectively
			Contingency:	**$1,063,500**	Scope Contingency at 30%
			TOTAL ESTIMATED CAPITAL COST:	**$5,780,000**	Rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-10					
Groundwater Monitoring					
Reporting and Recordkeeping	LS	1	$15,000	$15,000	Annual groundwater monitoring report, data management
Sampling and Analysis	EA	2	$15,000	$30,000	Biannual sampling of replacement wells (4 wells)
SSDS O&M					
Inspections	EA	1	$3,000	$3,000	Assumes 2 scientists/engineers, 1 day, 3 hrs/day, once annually, off-Site SSDS, includes PM
Reporting and Recordkeeping	LS	1	$1,500	$1,500	Assumes annual report to document O&M activities
Years 5, 10, 15					
Five Year Review	EA	1	$20,000	$20,000	
SSDS O&M					
Periodic Preventative Maintenance	EA	1	$3,000	$3,000	Allowance; may include replacing fans, repairs and/or adjustment

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$5,780,000	1.00	$5,780,000	
ANNUAL O&M COST - Years 1-10	$49,500	0.70	$139,000	Average discount factor for years 1-10
PERIODIC O&M COST - Years 5, 10, 15	$23,000	0.53	$73,000	Average discount factor for noted years
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$5,992,000**	Rounded

FIGURES



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Map Scale: 1:24,000 | Map Center: 75°17'32"W 43°7'12"N

ADAPTED FROM: (ORISKANY AND UTICA WEST) USGS QUADRANGLE

KEY MAP (not to scale)

0 1,000 2,000 Feet

SITE LOCATION

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

SITE 633054 (TAX PARCEL ZONED COMMERCIAL)
RESIDENTIAL SUB-PARCEL
NEW GRAVEL LOT AS OF WINTER 2013/2014

Notes
Tax parcels provided in GIS format by Herkimer Oneida Counties Comprehensive Planning Program (HOCCPP)

0 40 80
Feet

RI STUDY AREA

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

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PROJECT: 1940100088 | DATED: 10/18/2023 | DESIGNER: COOPERSA

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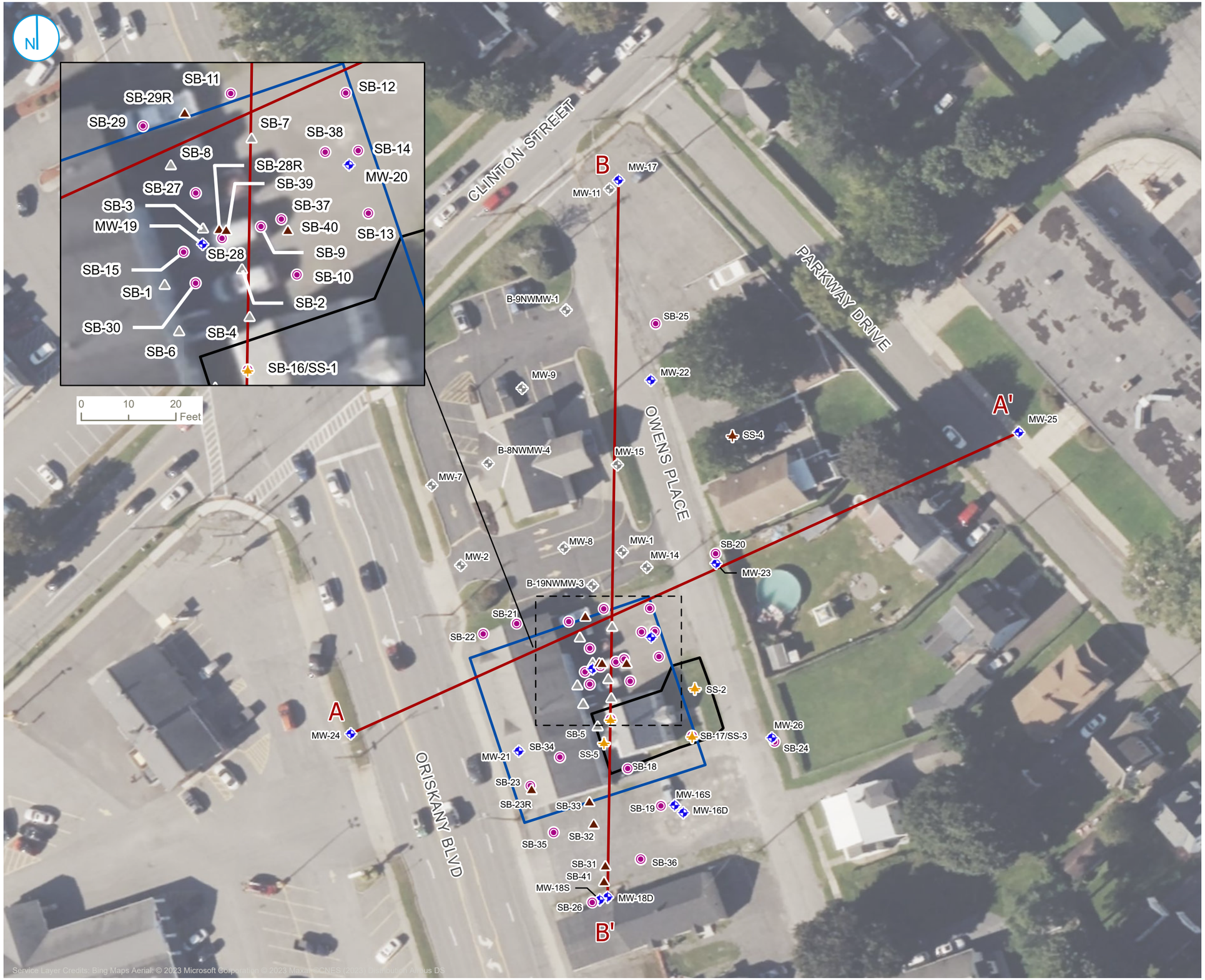


HISTORIC SAMPLE LOCATION
- MONITORING WELL
- SOIL BORING

RI SAMPLE LOCATION
- MIP
- MONITORING WELL
- SOIL BORING
- SOIL BORING/SURFACE SOIL
- SURFACE SOIL

SITE FEATURES
- SITE 633054 (TAX PARCEL ZONED COMMERCIAL)
- RESIDENTIAL SUB-PARCEL

Notes
- SB-19 is GPS located
- MIP - Membrane Interface Probe
- SB-16 and SS-1 are in the same location

0 25 50 Feet

SAMPLE LOCATIONS

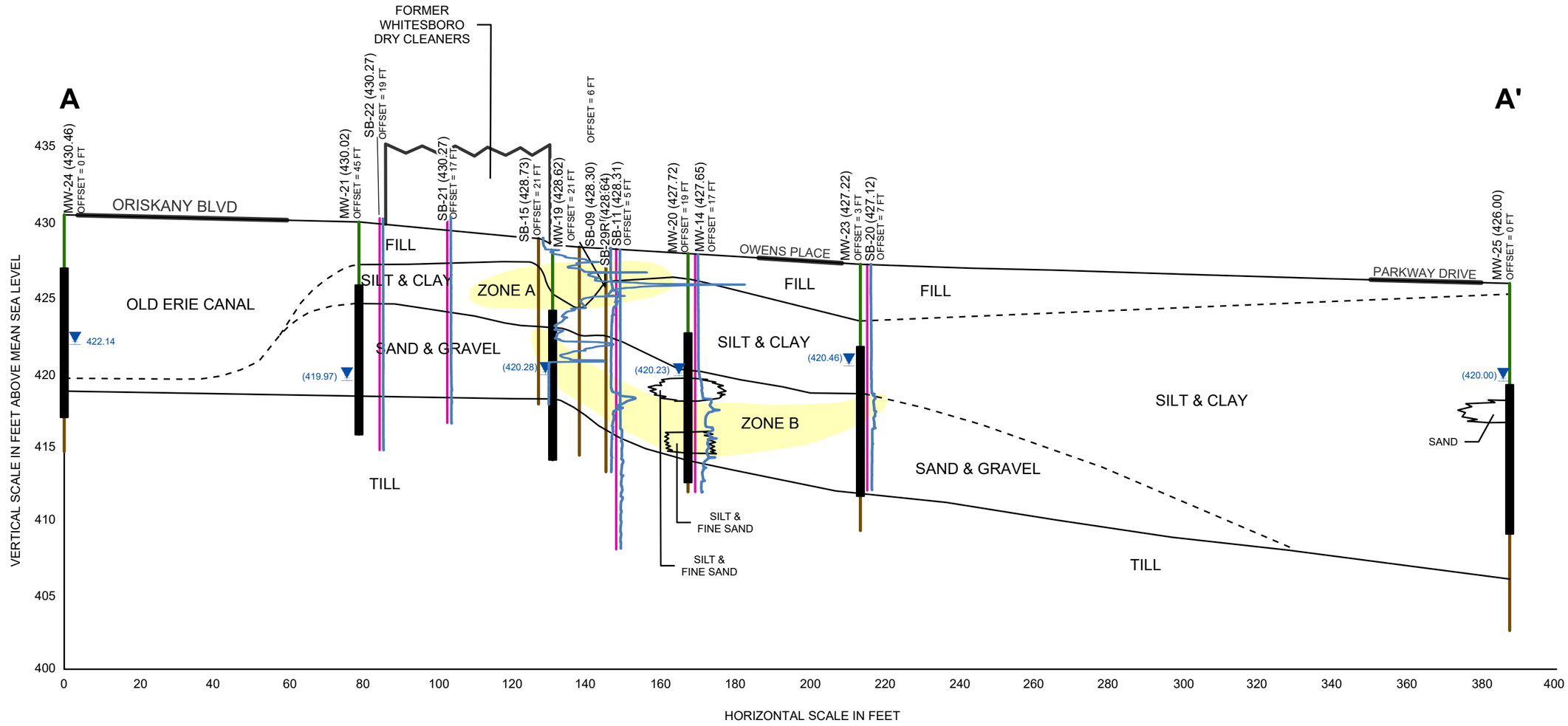
NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

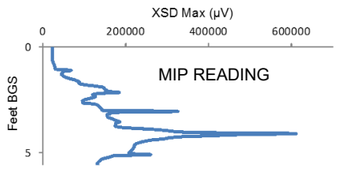
FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690001940100088 | DATED: 5/4/2023 | DESIGNER: SSOULE





NOTE:
- LOCATION OF ROADS AND BUILDINGS HAVE BEEN ESTIMATED FROM AERIAL IMAGES.
- OFFSET = HORIZONTAL DISTANCE FROM CROSS SECTION LINE IN FEET.
- GROUND SURFACE NOT SURVEYED. SURFACE BASED ON SURFACE ELEVATION OF NEARBY BORINGS AND WELLS.
- SOME BORINGS MAY BEGIN ABOVE OR BELOW GROUND SURFACE DUE TO PROJECTION.

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

WELL SCREEN
WELL CASING
SOIL BORING
MIP ONLY

(420.00) GROUNDWATER ELEVATION (9/30/14)

MIP ELEVATED CVOC ZONES OF IMPACT

MW-24 (430.46)
BORING ID — SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL)

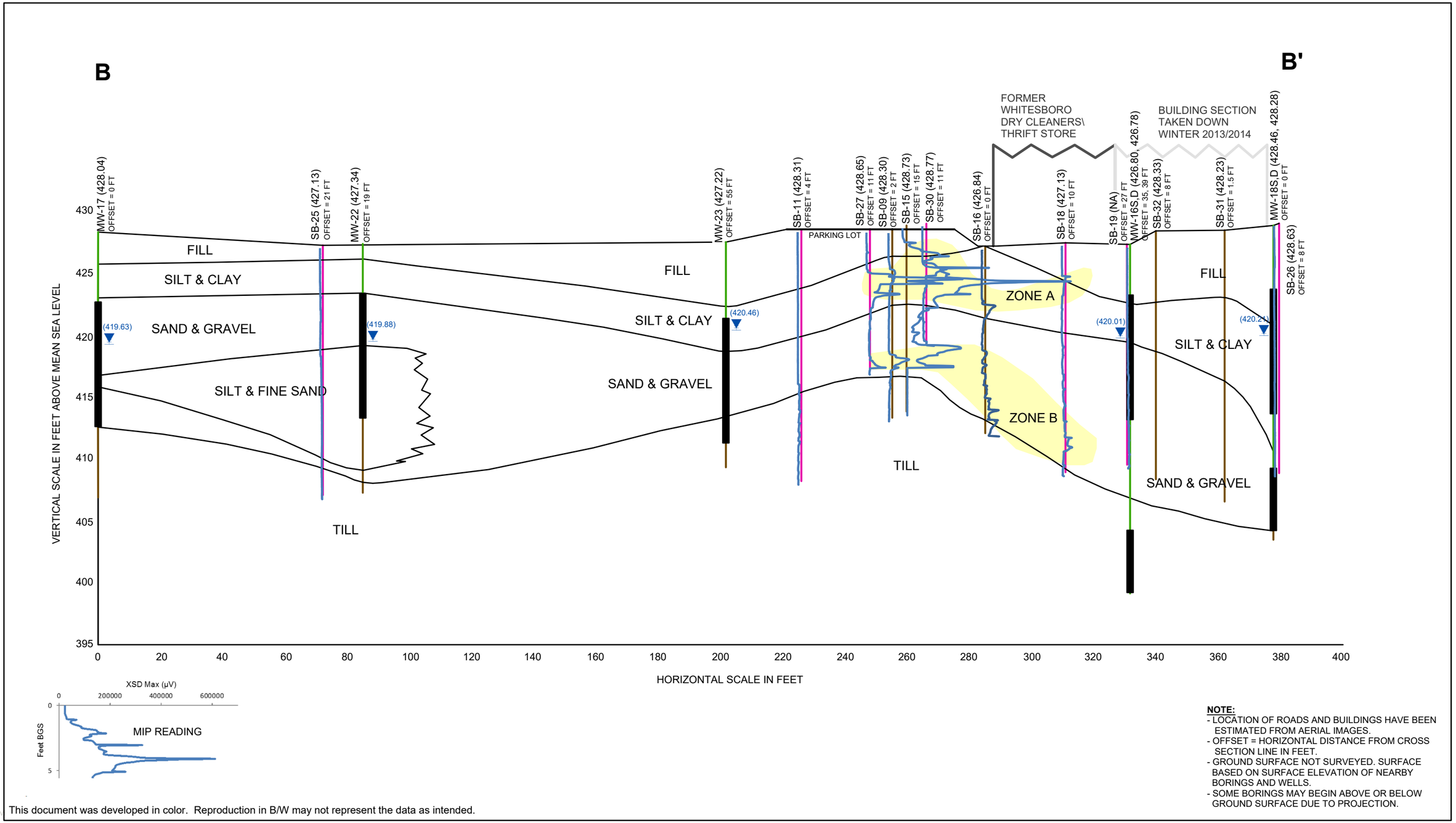
GEOLOGIC CROSS SECTION A-A'

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 2-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY
RAMBOLL

PROJECT: 1690001940100088 | DATED: 6/23/2022 | DESIGNER: SSOULE



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

NOTE:
- LOCATION OF ROADS AND BUILDINGS HAVE BEEN ESTIMATED FROM AERIAL IMAGES.
- OFFSET = HORIZONTAL DISTANCE FROM CROSS SECTION LINE IN FEET.
- GROUNDWATER SURFACE NOT SURVEYED. SURFACE BASED ON SURFACE ELEVATION OF NEARBY BORINGS AND WELLS.
- SOME BORINGS MAY BEGIN ABOVE OR BELOW GROUND SURFACE DUE TO PROJECTION.

WELL SCREEN
WELL CASING
SOIL BORING
MIP ONLY

(420.00) GROUNDWATER ELEVATION (9/30/14)

MIP ELEVATED CVOC ZONES OF IMPACT

MW-24 (430.46)
BORING ID — SURFACE ELEVATION (FEET ABOVE MEAN SEA LEVEL)

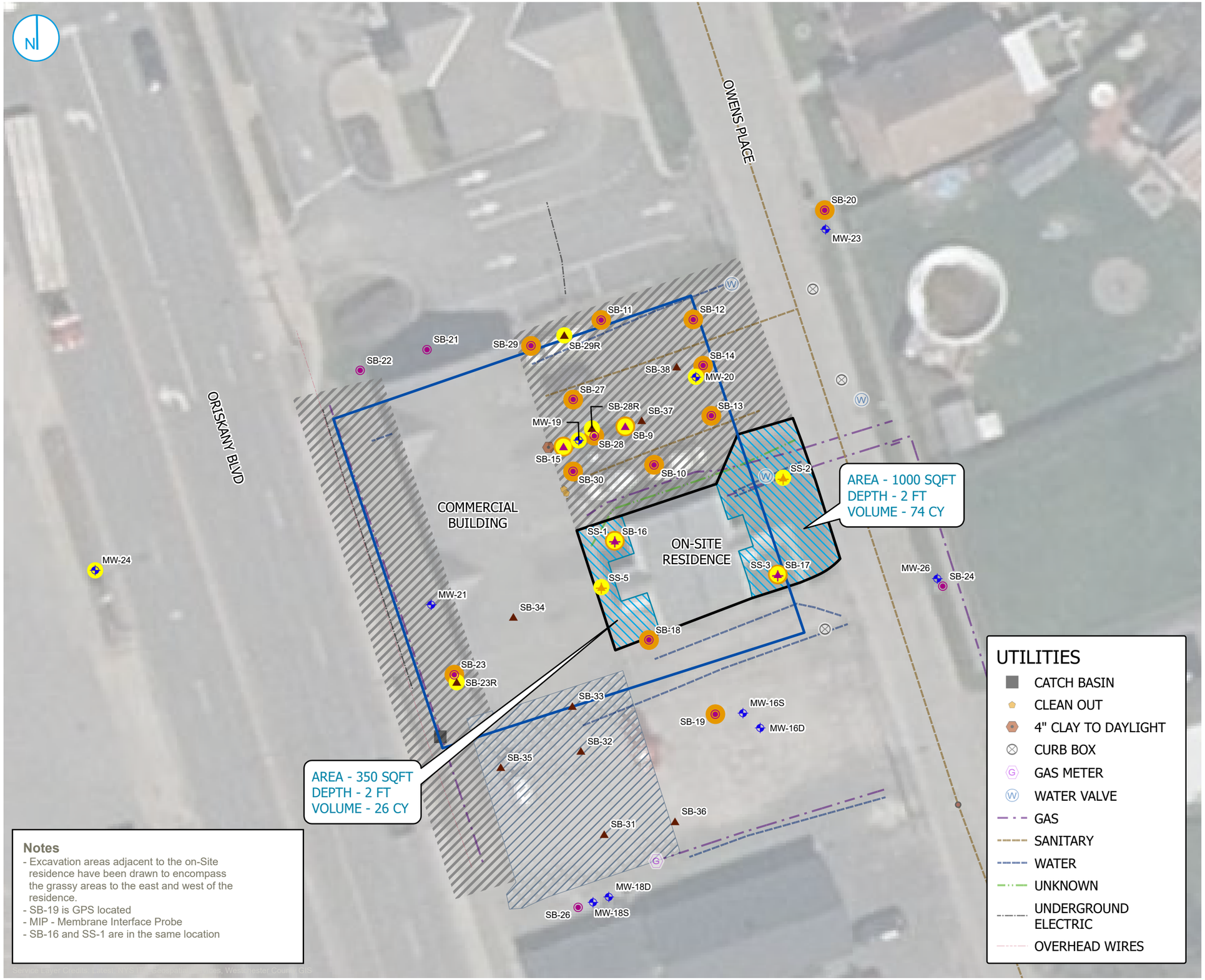
GEOLOGIC CROSS SECTION B-B'

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

I:\Parsons-Eng.8653\STDS\GIS\Whitesbor-DryPRO\Whitesboro_FS\ALTERNATIVE 4



SITE 633054 (TAX PARCEL ZONED COMMERCIAL)

RESIDENTIAL SUB-PARCEL

ASPHALT PAVEMENT (ENGINEERED COVER)

NEW GRAVEL LOT AS OF WINTER 2013/2014

EXCAVATE TO 2 FEET BELOW GROUND SURFACE

SOIL EXCEEDING PART 375 UNRESTRICTED SCOs

MAXIMUM XSD RESULT>20,000 µV

RI SAMPLE LOCATION

- MONITORING WELL
- MIP
- SOIL BORING
- SURFACE SOIL
- SOIL BORING/SURFACE SOIL
- SOIL BORING/MIP
- SOIL BORING/SURFACE SOIL/MIP

0 12.5 25 Feet

ALTERNATIVE 2
SHALLOW EXCAVATION

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

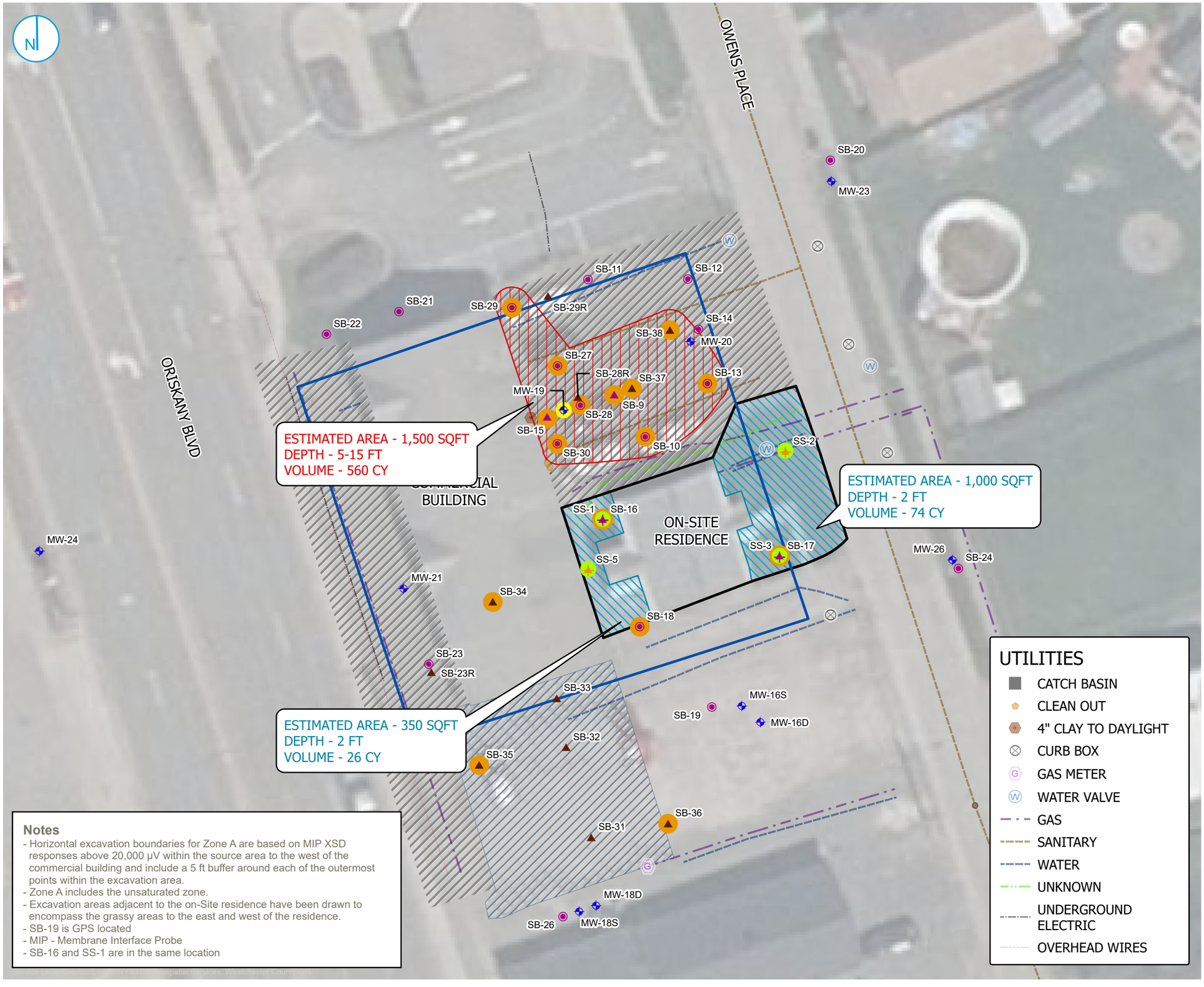
FIGURE 3-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690001940100088 | DATED: 10/18/2023 | DESIGNER: COOPERSA

I:\Parsons-Eng.8653\STDS\GIS\Whitesbor-Dry\PRO\Whitesboro_FSALTERNATIVE 3_Zone_A



Notes
- Horizontal excavation boundaries for Zone A are based on MIP XSD responses above 20,000 µV within the source area to the west of the commercial building and include a 5 ft buffer around each of the outermost points within the excavation area.
- Zone A includes the unsaturated zone.
- Excavation areas adjacent to the on-Site residence have been drawn to encompass the grassy areas to the east and west of the residence.
- SB-19 is GPS located
- MIP - Membrane Interface Probe
- SB-16 and SS-1 are in the same location

- SITE 633054 (TAX PARCEL ZONED COMMERCIAL)
- RESIDENTIAL SUB-PARCEL
- ASPHALT PAVEMENT (ENGINEERED COVER)
- NEW GRAVEL LOT AS OF WINTER 2013/2014
- CONCEPTUAL EXCAVATION AREA TO TOP OF CLAY (~5-15FT BELOW GROUND SURFACE)
- EXCAVATE TO 2 FEET BELOW GROUND SURFACE
- SOIL EXCEEDING PART 375 COMMERCIAL SCOs
- SOIL EXCEEDING PART 375 RESIDENTIAL SCOs
- MAXIMUM XSD RESULT>20,000 µV

RI SAMPLE LOCATION

- MIP
- MONITORING WELL
- SOIL BORING
- SOIL BORING/MIP
- SOIL BORING/SURFACE SOIL/MIP
- SOIL BORING/SURFACE SOIL
- SURFACE SOIL

UTILITIES

- CATCH BASIN
- CLEAN OUT
- 4" CLAY TO DAYLIGHT
- CURB BOX
- GAS METER
- WATER VALVE
- GAS
- SANITARY
- WATER
- UNKNOWN
- UNDERGROUND ELECTRIC
- OVERHEAD WIRES

0 12.5 25 Feet

ALTERNATIVES 3 AND 4 - ZONE A

TARGETED SURFACE AND SUBSURFACE SOIL EXCAVATION, IN SITU CHEMICAL TREATMENT OR IN SITU BIOLOGICAL TREATMENT OF SOIL/GROUNDWATER AND MNA

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 3-2A

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690001940100088 | DATED: 10/19/2023 | DESIGNER: COOPERSA

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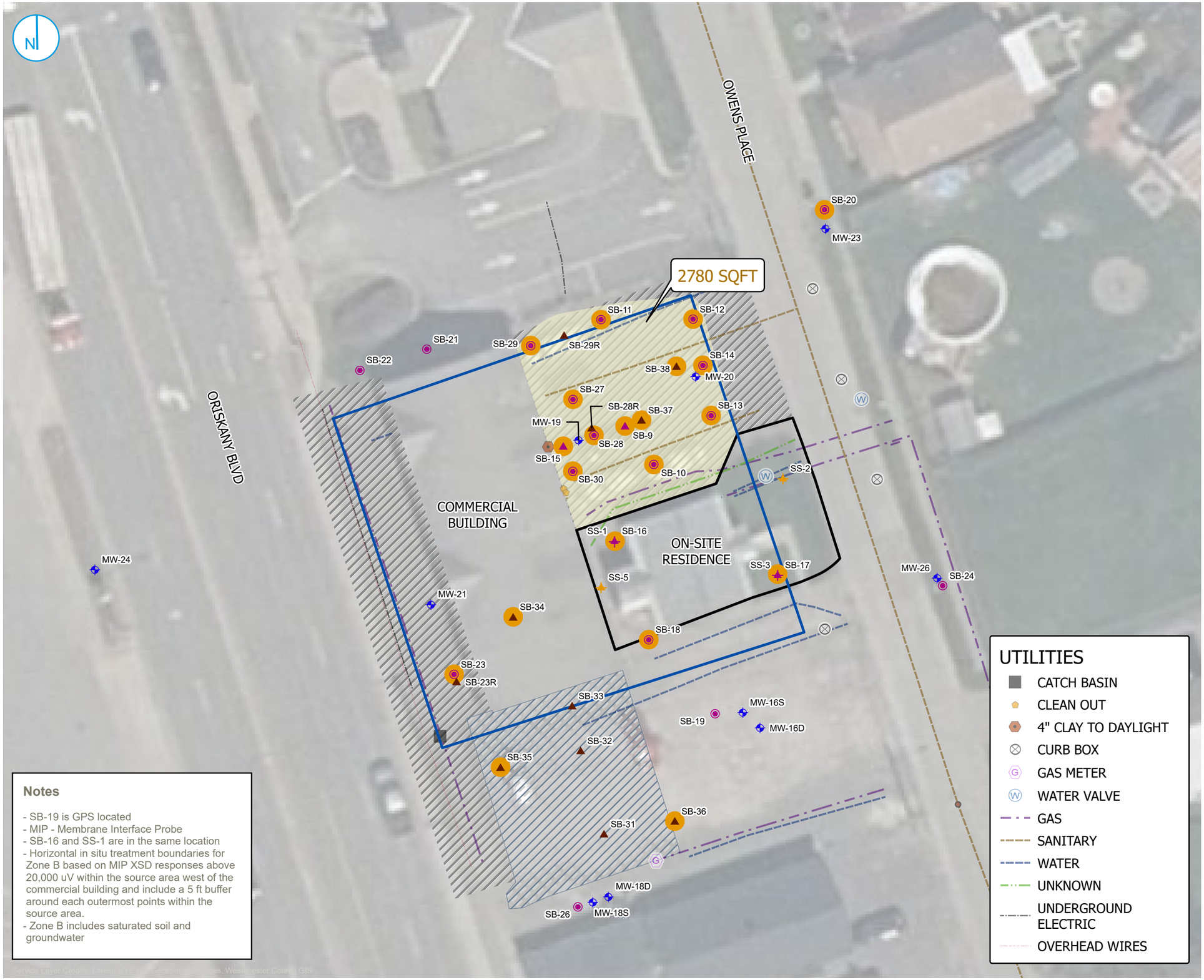

SITE 633054 (TAX PARCEL ZONED COMMERCIAL)

RESIDENTIAL SUB-PARCEL

ASPHALT PAVEMENT (ENGINEERED COVER)

NEW GRAVEL LOT AS OF WINTER 2013/2014

CONCEPTUAL ISCO APPLICATION AREA

MAXIMUM XSD RESULT>20,000 µV

RI SAMPLE LOCATION

- MIP
- MONITORING WELL
- SOIL BORING
- SOIL BORING/MIP
- SOIL BORING/SURFACE SOIL/MIP
- SOIL BORING/SURFACE SOIL
- SURFACE SOIL

0 12.5 25 Feet

ALTERNATIVES 3 AND 4 - ZONE B

TARGETED SURFACE AND SUBSURFACE SOIL EXCAVATION, IN SITU CHEMICAL TREATMENT OR IN SITU BIOLOGICAL TREATMENT OF SOIL/GROUNDWATER AND MNA

ALTERNATIVE 3 - IN SITU CHEMICAL OXIDATION
ALTERNATIVE 4 - ENHANCED IN SITU DECHLORINATION

NYSDEC SITE NO. 633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 3-2B

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690001940100088 | DATED: 10/20/2023 | DESIGNER: COOPERSA

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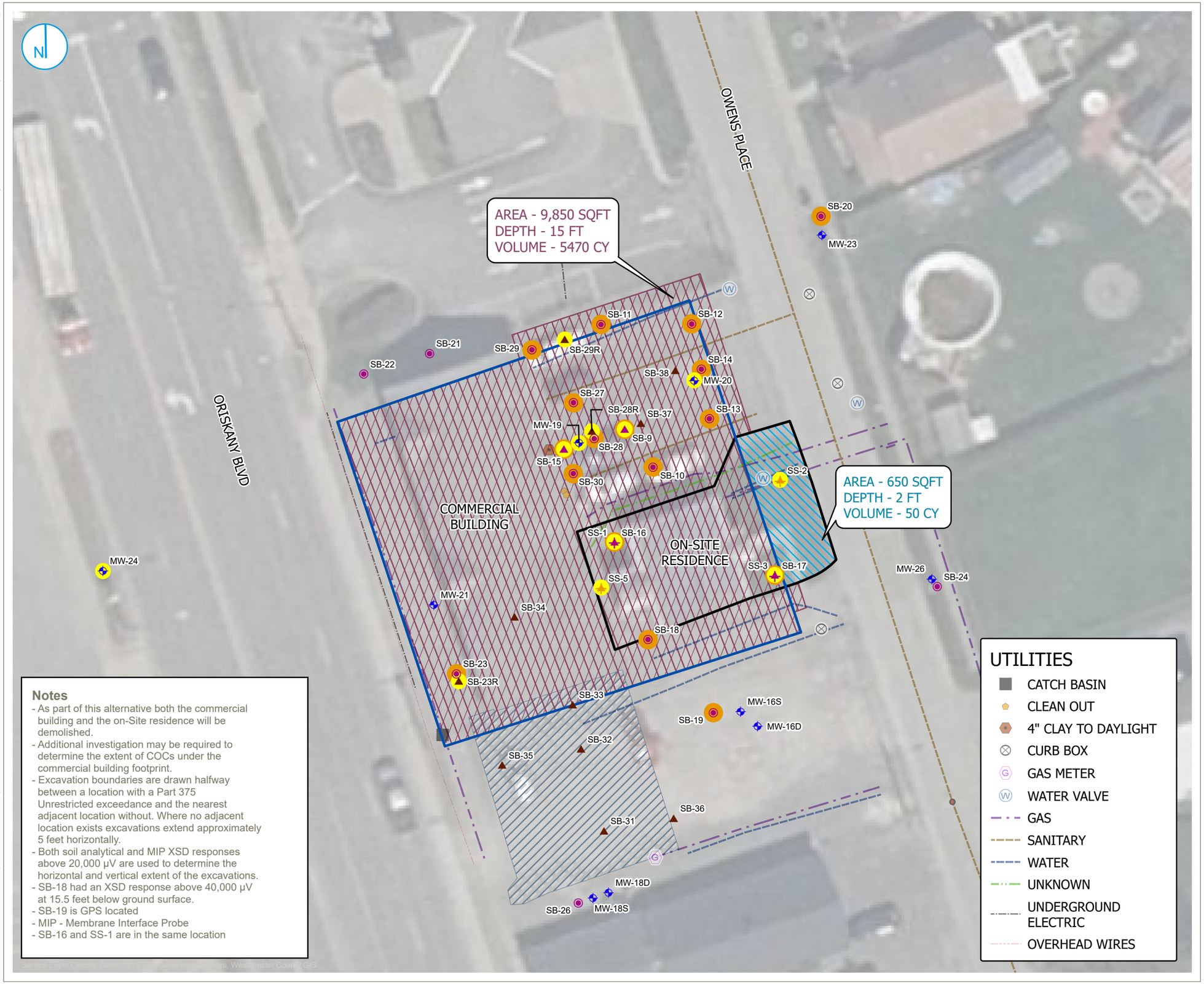


Notes

- As part of this alternative both the commercial building and the on-Site residence will be demolished.
- Additional investigation may be required to determine the extent of COCs under the commercial building footprint.
- Excavation boundaries are drawn halfway between a location with a Part 375 Unrestricted exceedance and the nearest adjacent location without. Where no adjacent location exists excavations extend approximately 5 feet horizontally.
- Both soil analytical and MIP XSD responses above 20,000 µV are used to determine the horizontal and vertical extent of the excavations.
- SB-18 had an XSD response above 40,000 µV at 15.5 feet below ground surface.
- SB-19 is GPS located
- MIP - Membrane Interface Probe
- SB-16 and SS-1 are in the same location

UTILITIES

- CATCH BASIN
- CLEAN OUT
- 4" CLAY TO DAYLIGHT
- CURB BOX
- GAS METER
- WATER VALVE
- GAS
- SANITARY
- WATER
- UNKNOWN
- UNDERGROUND ELECTRIC
- OVERHEAD WIRES

- SITE 633054 (TAX PARCEL ZONED COMMERCIAL)
- RESIDENTIAL SUB-PARCEL
- EXCAVATE TO 14 FEET BELOW GROUND SURFACE
- EXCAVATE TO 2 FEET BELOW GROUND SURFACE
- NEW GRAVEL LOT AS OF WINTER 2013/2014
- SOIL EXCEEDING PART 375 UNRESTRICTED SCOs
- MAXIMUM XSD RESULT>20,000 µV

RI SAMPLE LOCATION

- MONITORING WELL
- MIP
- SOIL BORING
- SURFACE SOIL
- SOIL BORING/SURFACE SOIL
- SOIL BORING/MIP
- SOIL BORING/SURFACE SOIL/MIP

0 12.5 25 Feet

ALTERNATIVE 5
SITE-WIDE EXCAVATION WITH OFF-SITE DISPOSAL

NYSDEC SITE NO.633054
WHITESBORO DRY CLEANERS
130-134 ORISKANY BLVD
WHITESBORO, NEW YORK

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690001940100088 | DATED: 10/20/2023 | DESIGNER: COOPERSA

APPENDIX A: SITEWISE ASSESSMENT RESULTS

NYSDEC
Former Whitesboro Dry Cleaners Site
Appendix A Environmental Footprint Assessment - SiteWise Results

Remedial Alternatives	GHG Emissions	Total energy Used	Water Consumption	Electricity Usage	Onsite NO_x Emissions	Onsite SO_x Emissions	Onsite PM_{10} Emissions	Total NO_x Emissions	Total SO_x Emissions	Total PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Alternative 2	11	173	0	0.00	0.0023	0.0006	0.0002	0.0309	0.0267	0.0390	2.75E-05	2.32E-03
Alternative 3	246	3573	16326	3.04	0.0627	0.0095	0.0041	0.3509	0.2538	0.3147	8.14E-04	6.75E-02
Alternative 4	237	3438	6233	3.04	0.0622	0.0094	0.0040	0.3418	0.2464	0.3139	7.98E-04	6.61E-02
Alternative 5	1624	24845	6937	13.60	0.2205	0.0402	0.0147	2.9917	3.3489	2.9310	3.54E-03	2.90E-01

Additional Sustainability Metrics

Remedial Alternatives	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent Electricity from Renewable Sources	Final Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	$
Alternative 2	168	0	0	0	0	0.0%	0
Alternative 3	279	944	0	0	1	6.1%	0
Alternative 4	279	944	0	0	1	6.1%	0
Alternative 5	6870	4280	0	0	2	6.1%	0

Relative Impact

Remedial Alternatives	GHG Emissions	Energy Usage	Water Usage	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx emissions	Total SOx Emissions	Total PM10 Emissions	*Accident Risk Fatality	*Accident Risk Injury	Community Impacts	Resources Lost
Alternative 2	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	user select	user select
Alternative 3	Low	Low	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	user select	user select
Alternative 4	Low	Low	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	user select	user select
Alternative 5	High	High	Medium	High	High	High	High	High	High	High	Low	Low	user select	user select

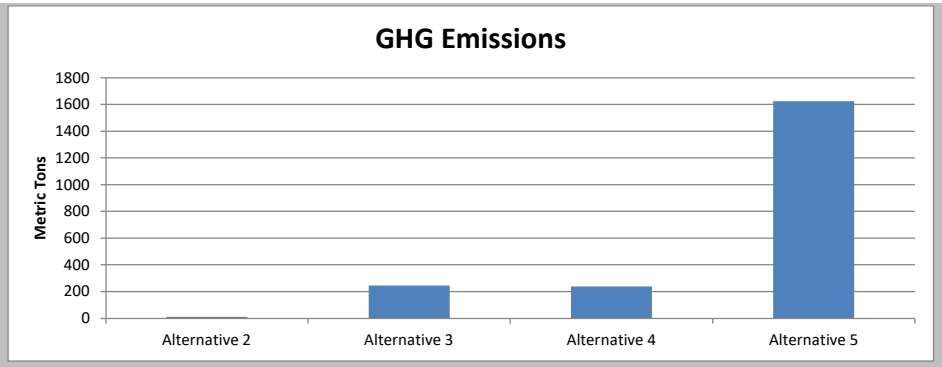
Relative Impact (User Override)

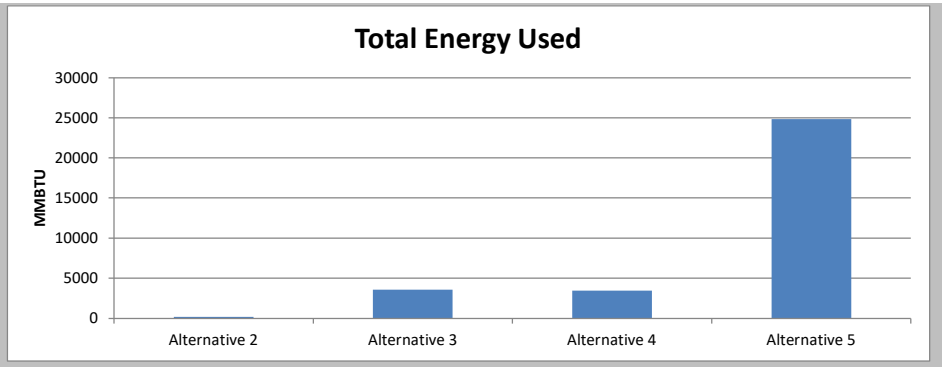
NYSDEC
Former Whitesboro Dry Cleaners Site
Environmental Footprint Assessment - SiteWise Results

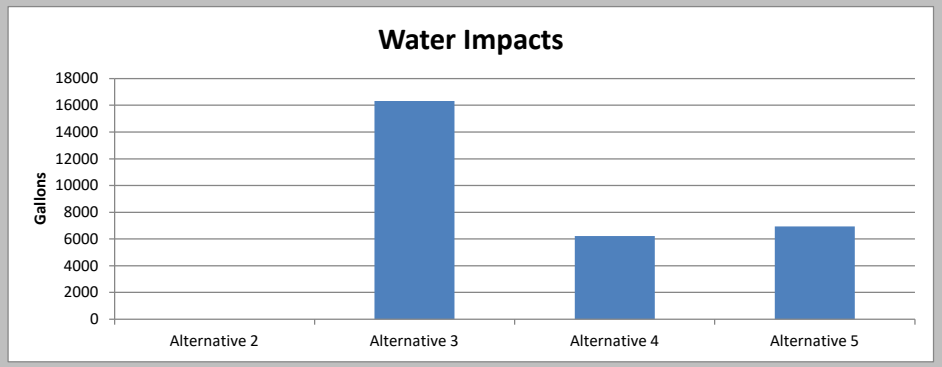
Remedial Alternatives	GHG Emissions	Energy Usage	Water Usage	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	*Accident Risk Fatality	*Accident Risk Injury	Community Impacts	Resources Lost
Alternative 2	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	user select	user select
Alternative 3	Low	Low	High	Low	Low	Low	Low	Low	Low	Low	Low	Low	user select	user select
Alternative 4	Low	Low	Medium	Low	Low	Low	Low	Low	Low	Low	Low	Low	user select	user select
Alternative 5	High	High	Medium	High	High	High	High	High	High	High	Low	Low	user select	user select

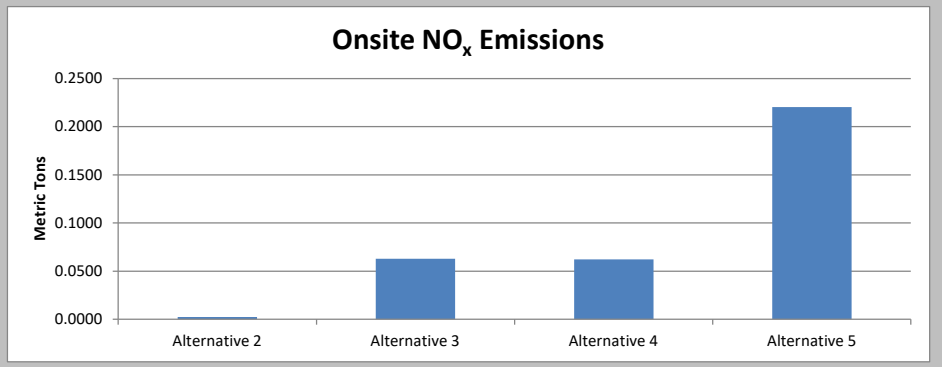
*Accident Risk is an estimate of how many accidents may occur. This risk is not the same as Cancer Risk, which is the probablity (for a single person) of getting cancer. Accident risk is not comparable to Cancer Risk due to inherent fundamental differences.

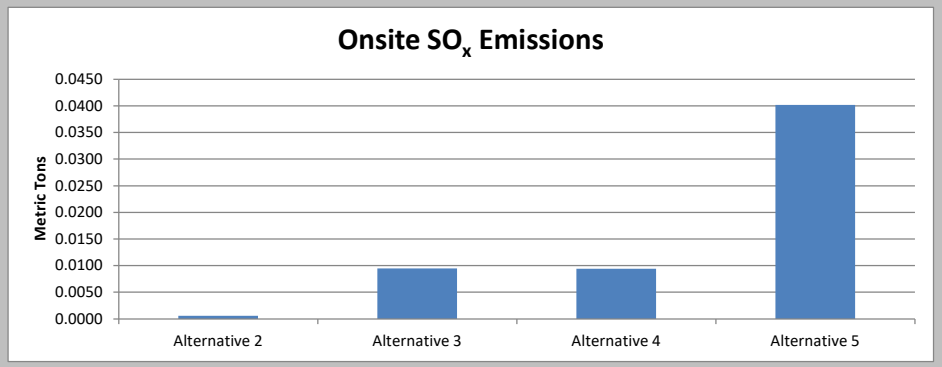
NYSDEC
Former Whitesboro Dry Cleaners Site
Environmental Footprint Assessment - SiteWise Results

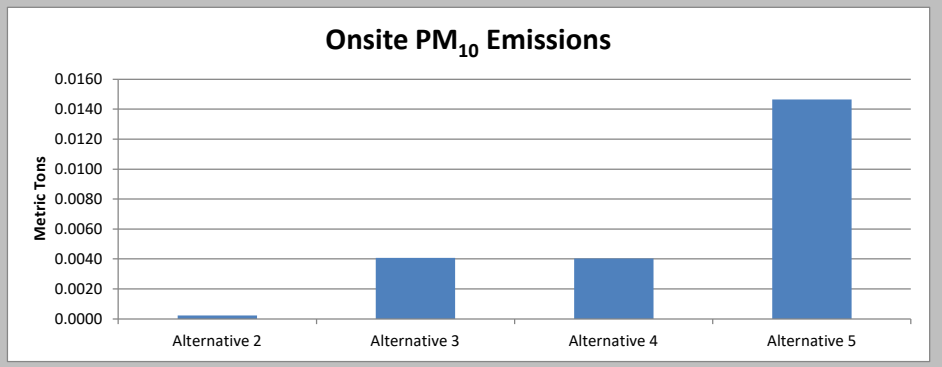




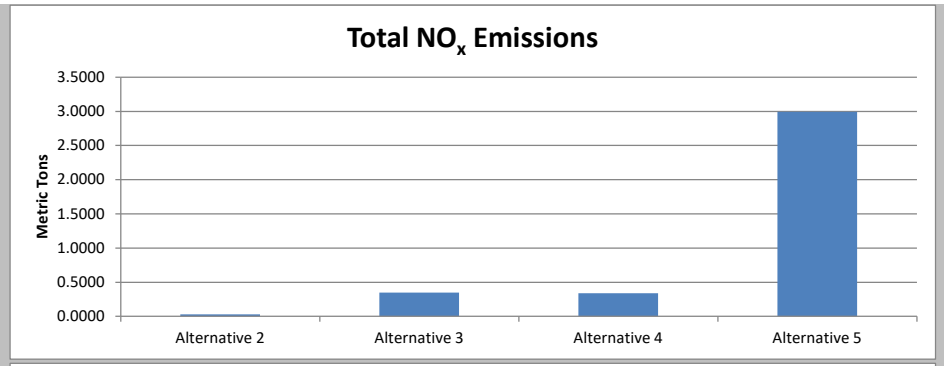


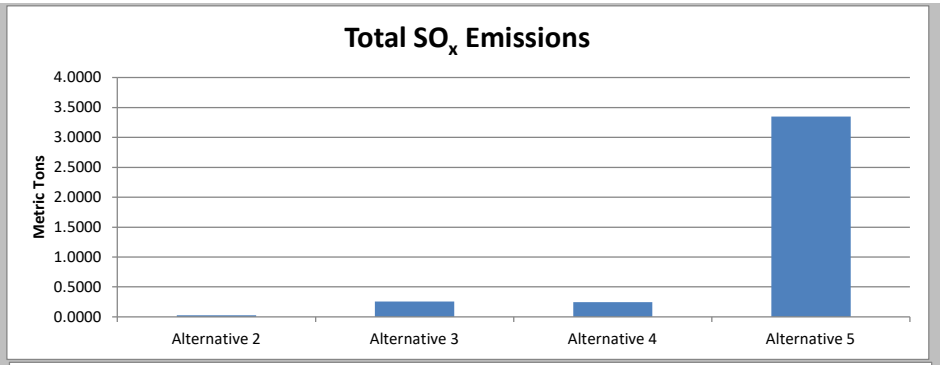


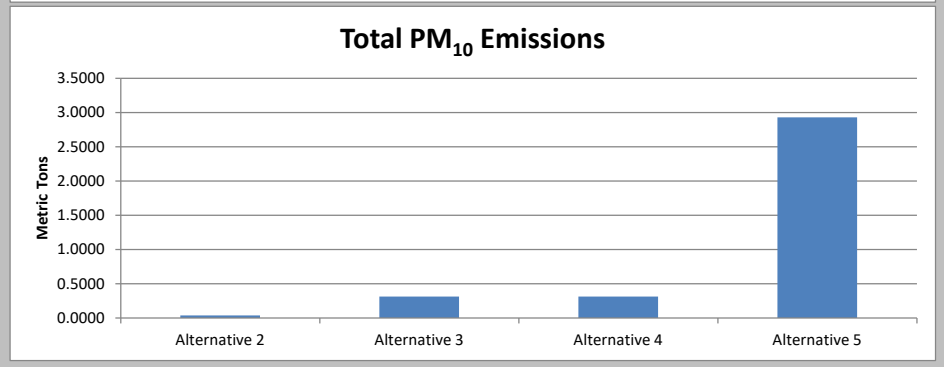


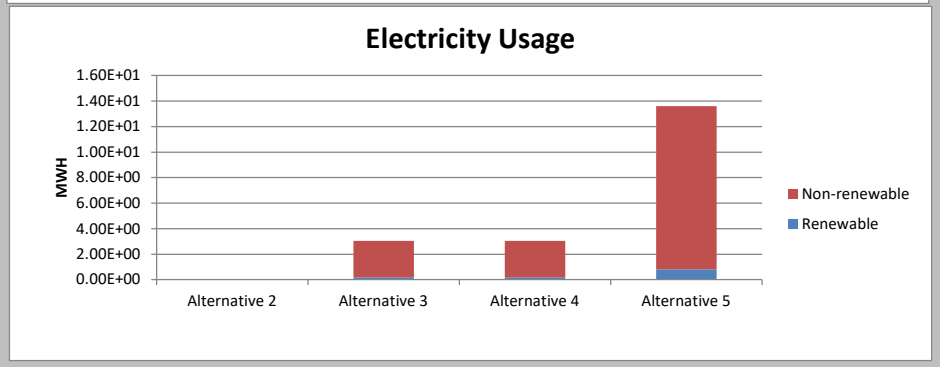


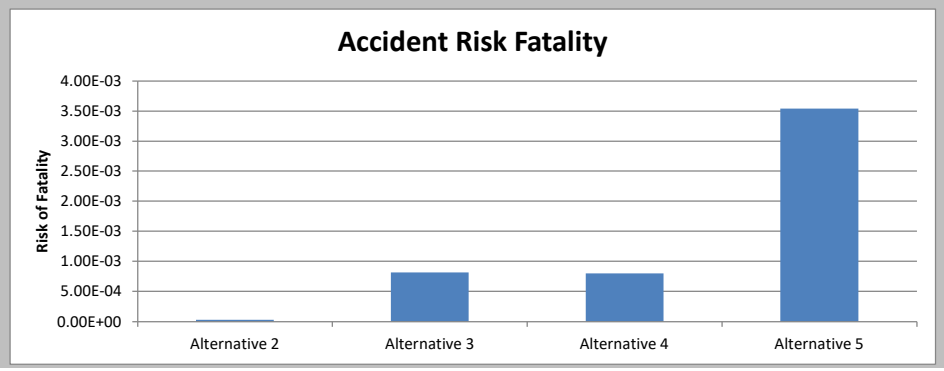
NYSDEC
Former Whitesboro Dry Cleaners Site
Environmental Footprint Assessment - SiteWise Results

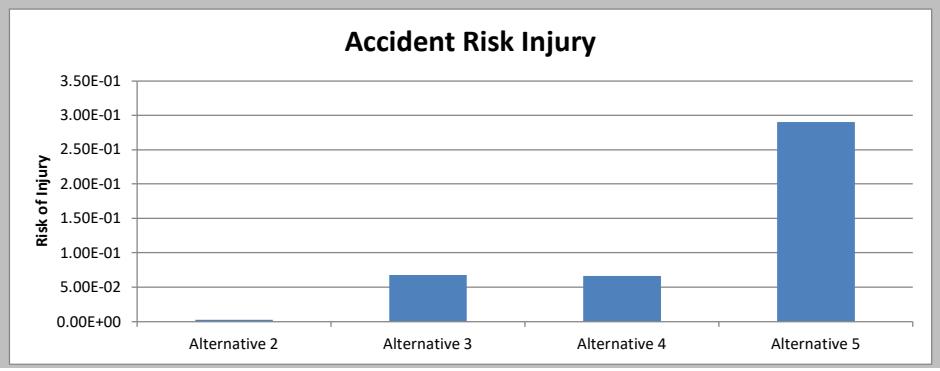




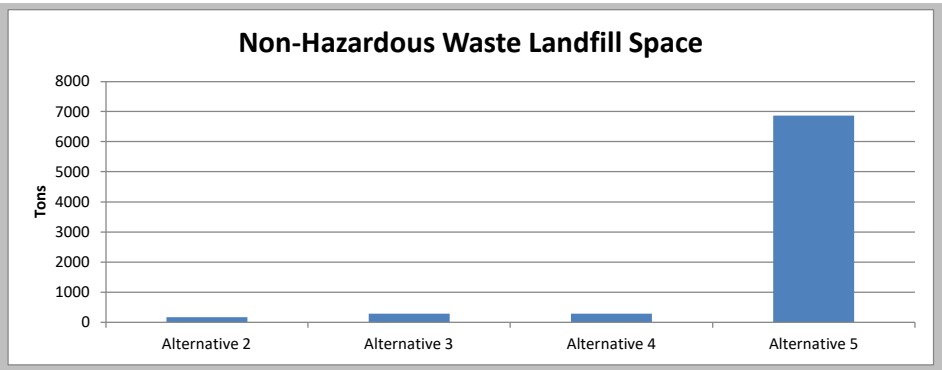


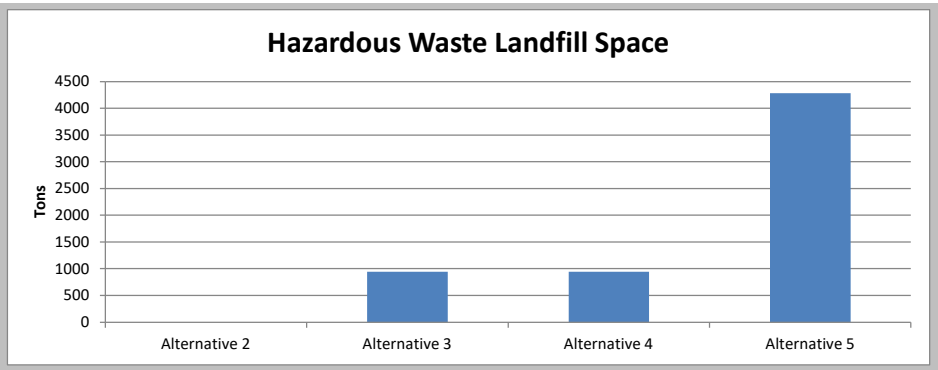


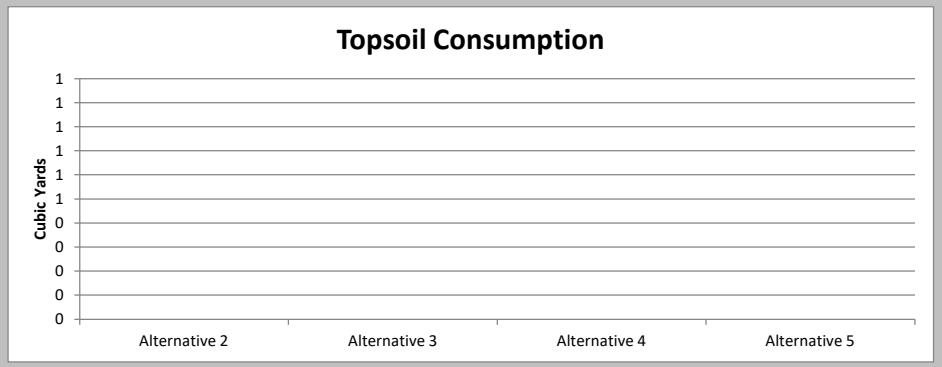


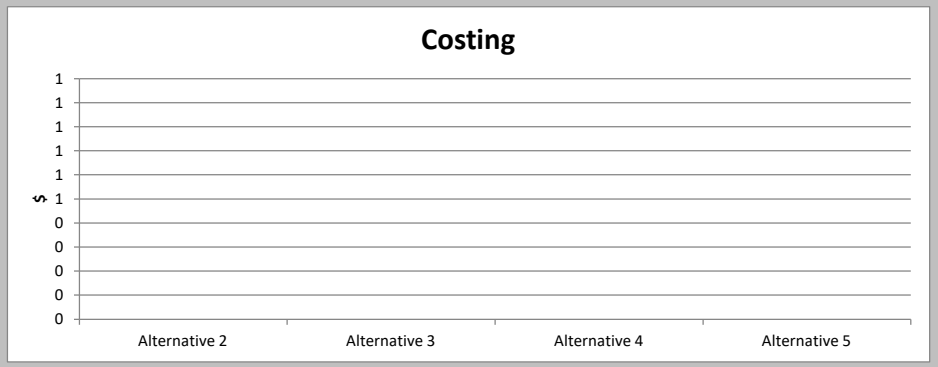


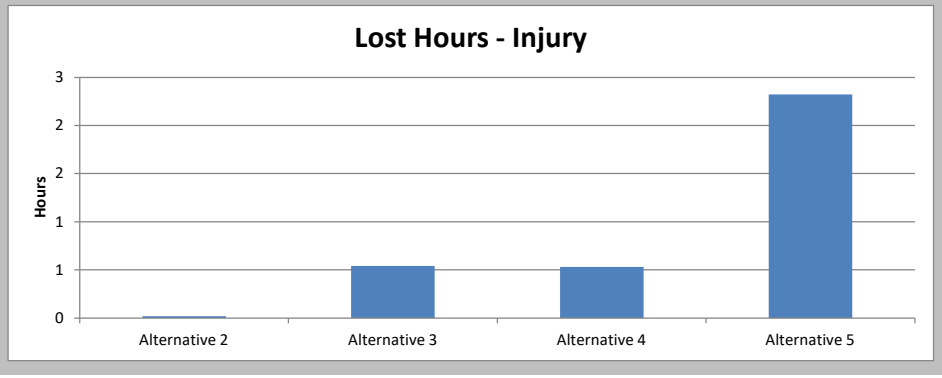
NYSDEC
Former Whitesboro Dry Cleaners Site
Environmental Footprint Assessment - SiteWise Results

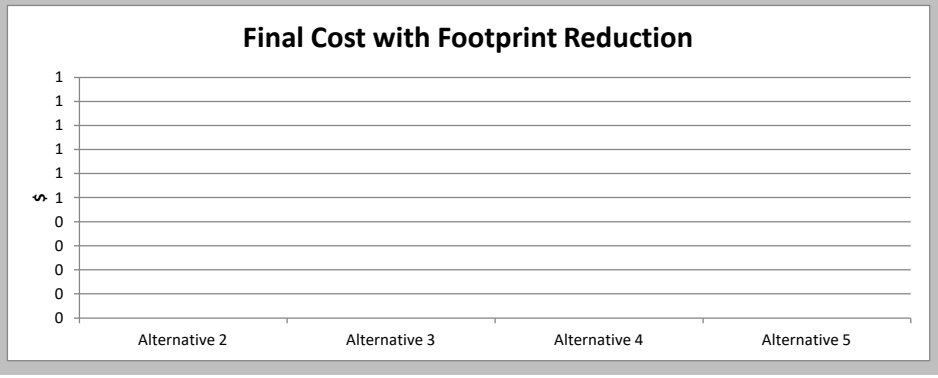




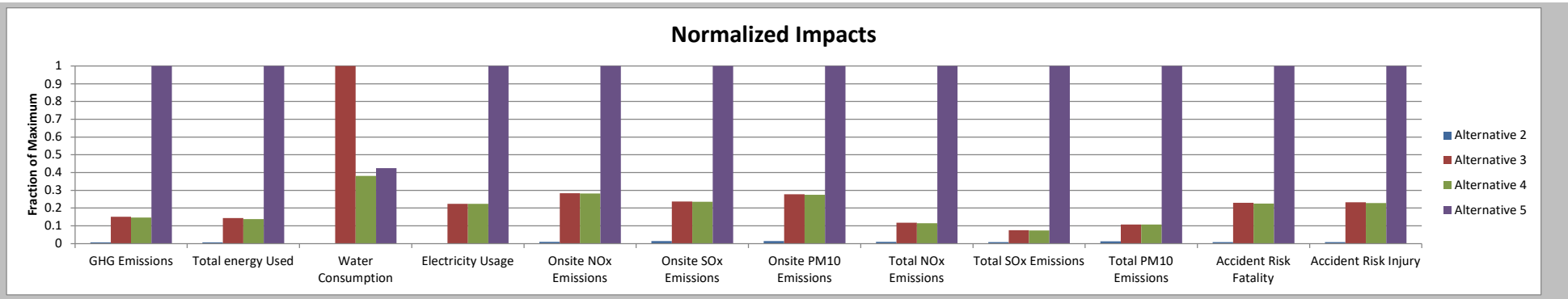








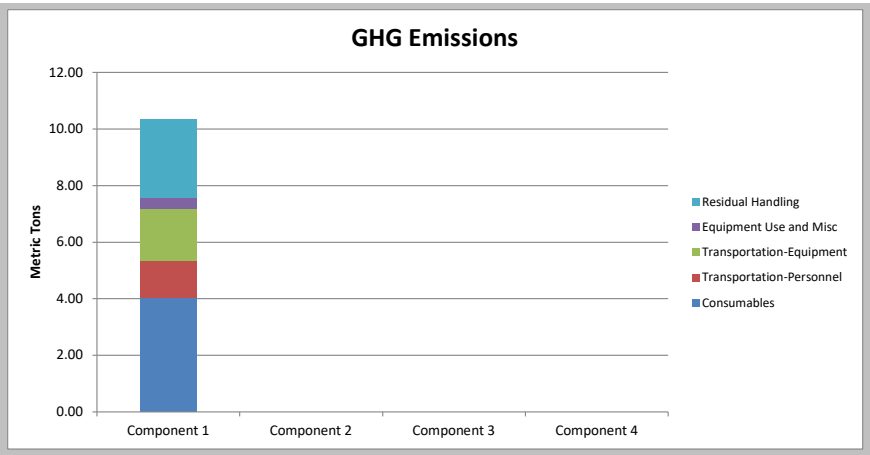
NYSDEC
Former Whitesboro Dry Cleaners Site
Environmental Footprint Assessment - SiteWise Results

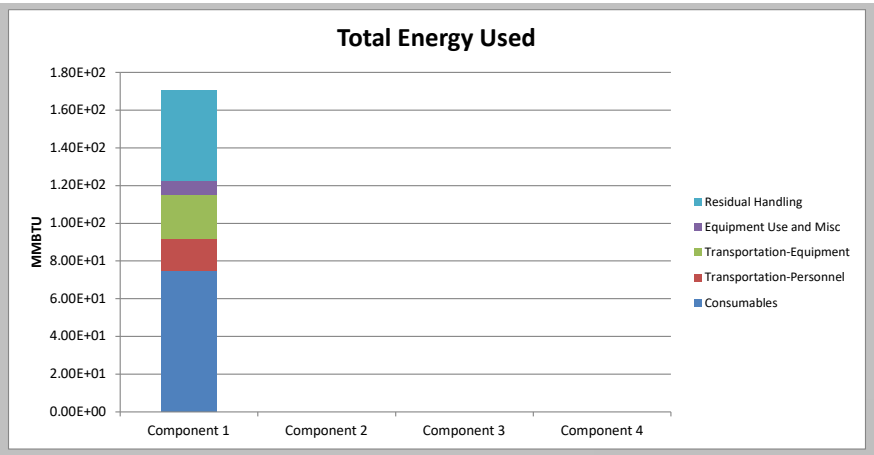


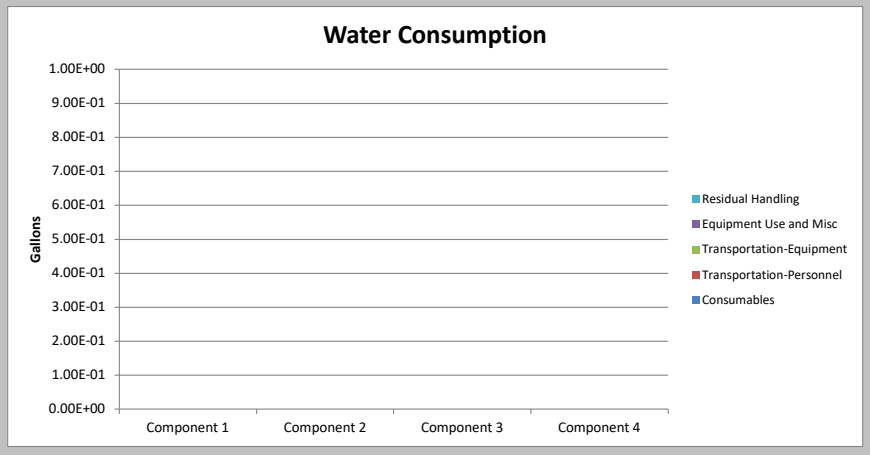
Sustainable Remediation - Environmental Footprint Summary
NYSDEC Whitesboro Drycleaners Alternative 2

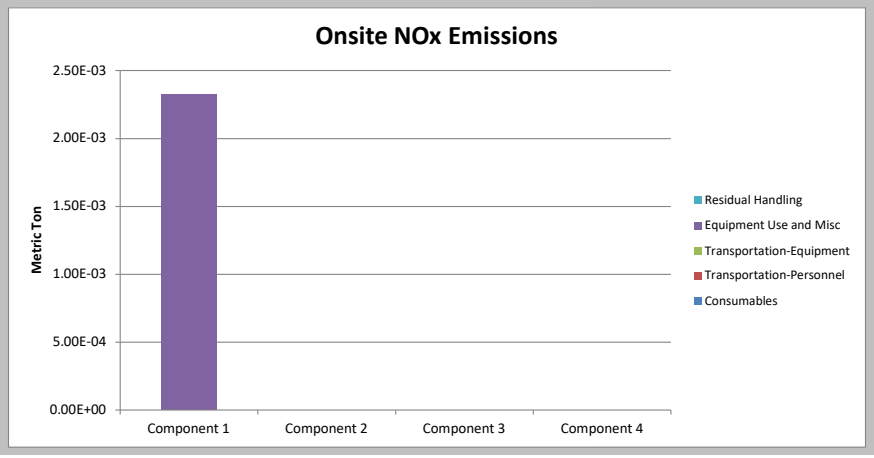
Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Component 1	Consumables	4.04	74.91	NA	NA	NA	NA	NA	1.6E-02	2.0E-02	8.1E-03	NA	NA
	Transportation-Personnel	1.32	16.68	NA	NA	NA	NA	NA	5.5E-04	1.7E-05	7.8E-05	1.9E-05	1.5E-03
	Transportation-Equipment	1.81	23.62	NA	NA	NA	NA	NA	5.7E-04	1.0E-05	5.1E-05	4.2E-06	3.4E-04
	Equipment Use and Misc	0.40	7.33	0.0E+00	0.0E+00	2.3E-03	6.0E-04	2.2E-04	2.7E-03	7.7E-04	2.7E-04	6.2E-07	1.6E-04
	Residual Handling	2.78	47.81	NA	NA	0.0E+00	0.0E+00	0.0E+00	1.1E-02	5.7E-03	3.1E-02	3.5E-06	2.8E-04
	Sub-Total	10.35	170.35	0.00E+00	0.00E+00	2.32E-03	6.01E-04	2.18E-04	3.09E-02	2.67E-02	3.90E-02	2.71E-05	2.29E-03
Component 2	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 3	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 4	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**1.0E+01**	**1.7E+02**	**0.0E+00**	**0.0E+00**	**2.3E-03**	**6.0E-04**	**2.2E-04**	**3.1E-02**	**2.7E-02**	**3.9E-02**	**2.7E-05**	**2.3E-03**

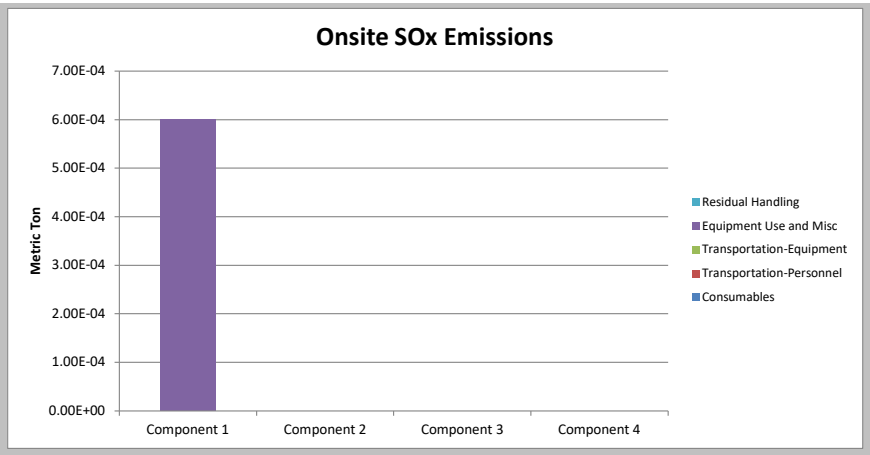
Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	
Component 1	1.7E+02	0.0E+00	0.0E+00	0	1.8E-02	0.0%	$0
Component 2	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 3	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 4	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Total	1.7E+02	0.0E+00	0.0E+00	$0	1.8E-02	0.0%	

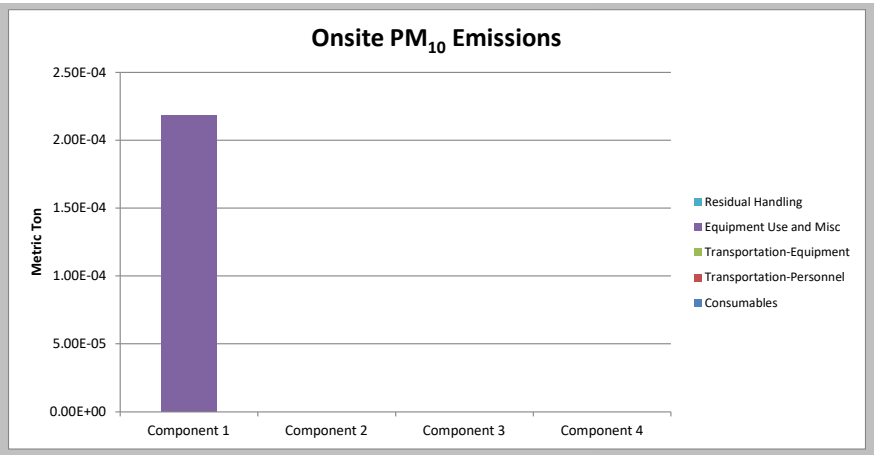

GHG Emissions
Metric Tons
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

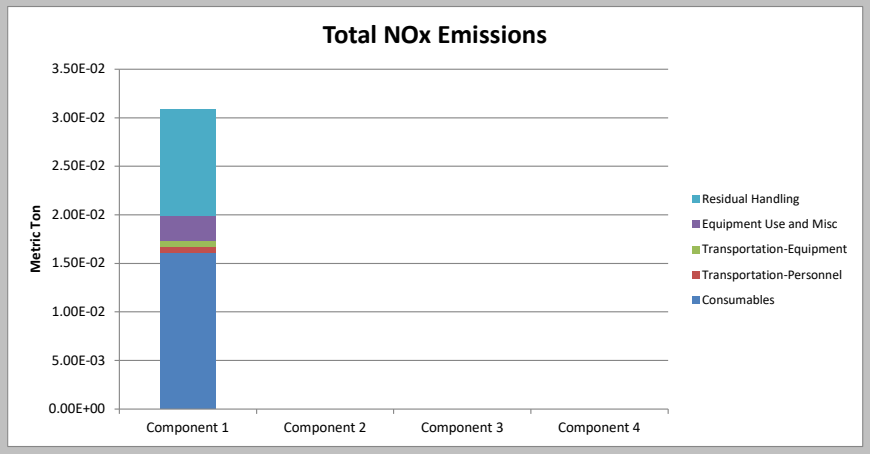

Total Energy Used
MMBTU
1.80E+02
1.60E+02
1.40E+02
1.20E+02
1.00E+02
8.00E+01
6.00E+01
4.00E+01
2.00E+01
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

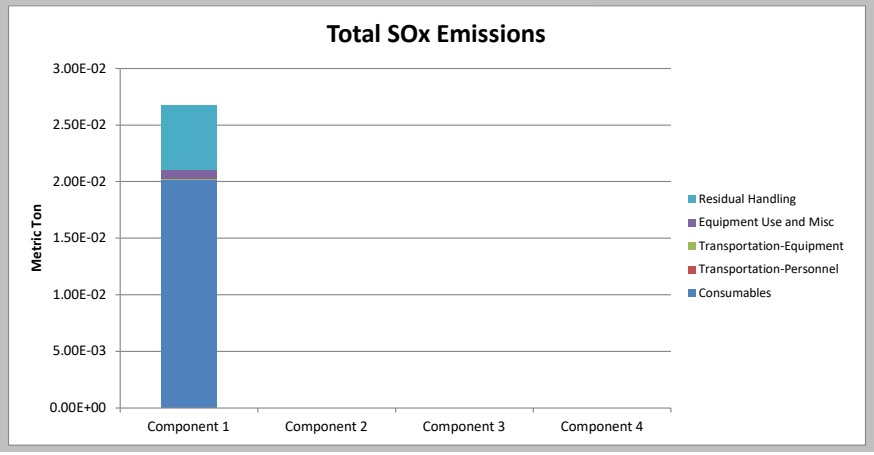

Water Consumption
Gallons
1.00E+00
9.00E-01
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

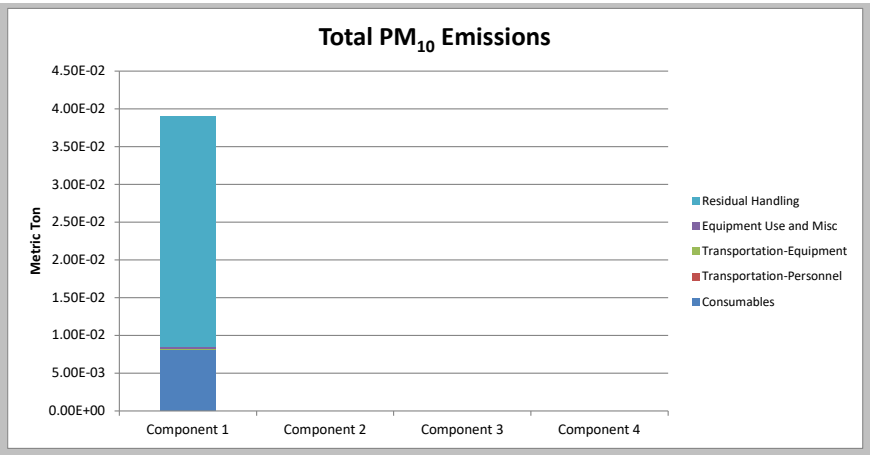

Onsite NOx Emissions
Metric Ton
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

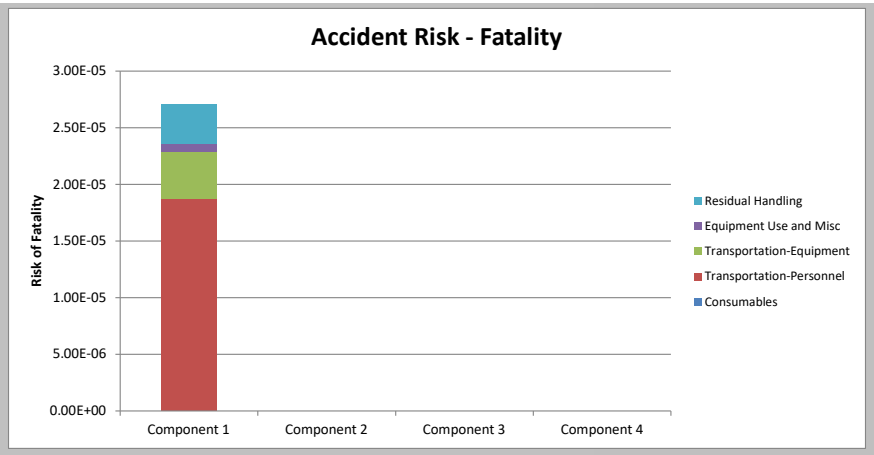

Onsite SOx Emissions
Metric Ton
7.00E-04
6.00E-04
5.00E-04
4.00E-04
3.00E-04
2.00E-04
1.00E-04
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

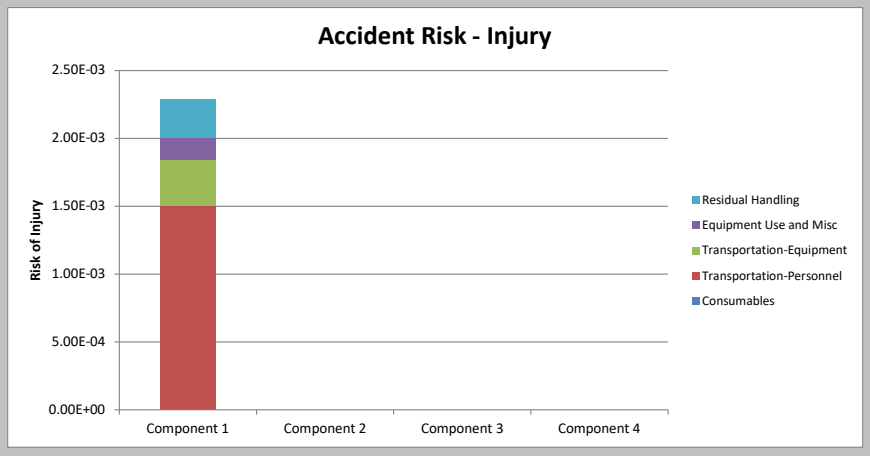

Onsite PM10 Emissions
Metric Ton
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

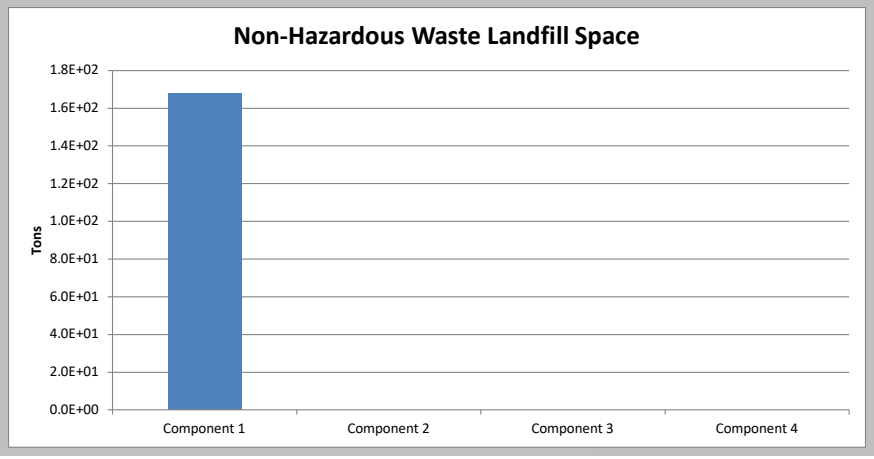

Total NOx Emissions
Metric Ton
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

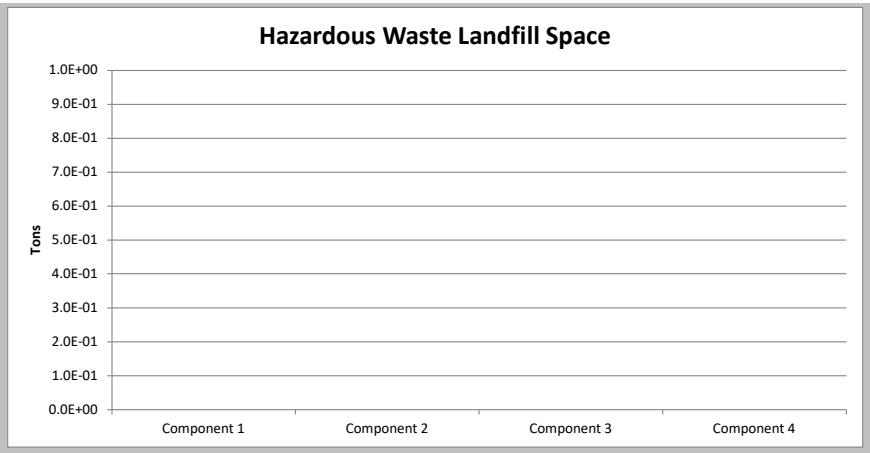

Total SOx Emissions
Metric Ton
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

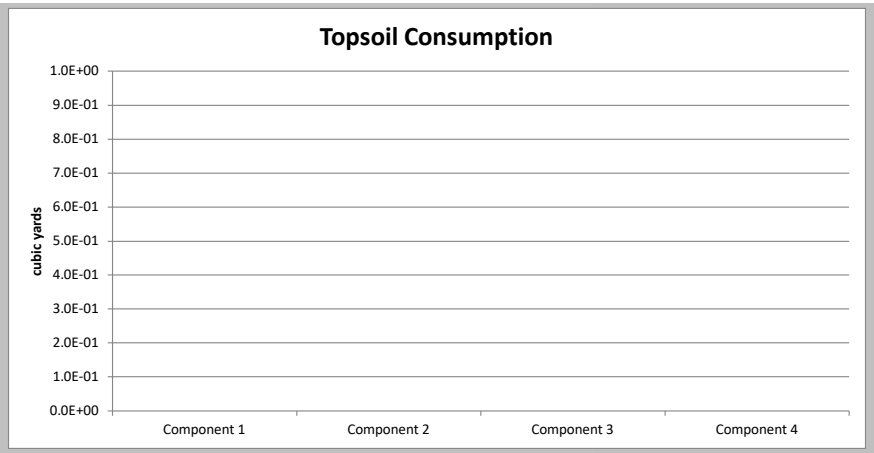

Total PM10 Emissions
Metric Ton
4.50E-02
4.00E-02
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

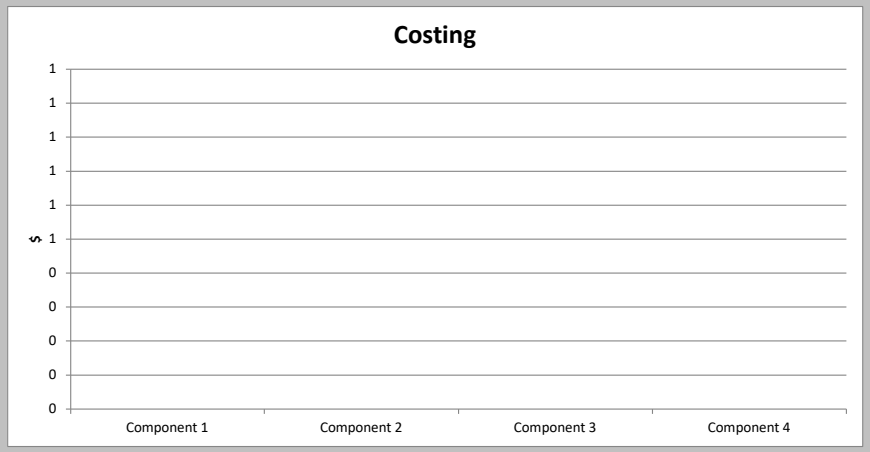

Accident Risk - Fatality
Risk of Fatality
3.00E-05
2.50E-05
2.00E-05
1.50E-05
1.00E-05
5.00E-06
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

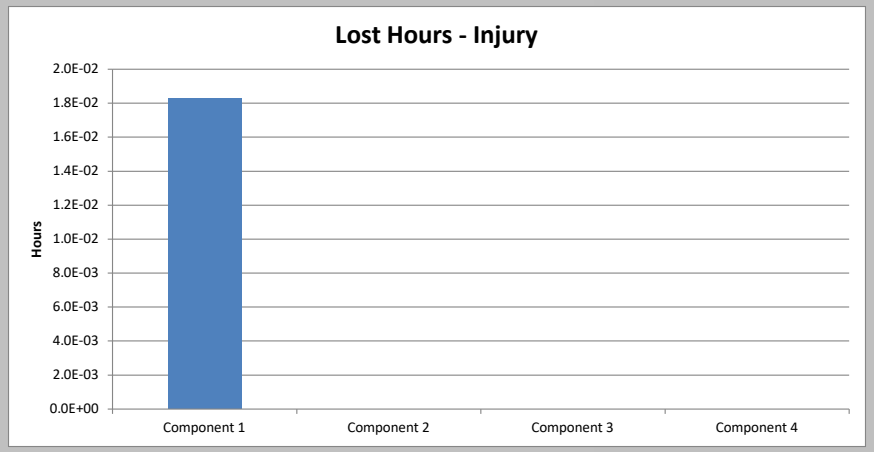

Accident Risk - Injury
Risk of Injury
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Non-Hazardous Waste Landfill Space
Tons
1.8E+02
1.6E+02
1.4E+02
1.2E+02
1.0E+02
8.0E+01
6.0E+01
4.0E+01
2.0E+01
0.0E+00
Component 1
Component 2
Component 3
Component 4


Hazardous Waste Landfill Space
Tons
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Component 1
Component 2
Component 3
Component 4


Topsoil Consumption
cubic yards
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Component 1
Component 2
Component 3
Component 4

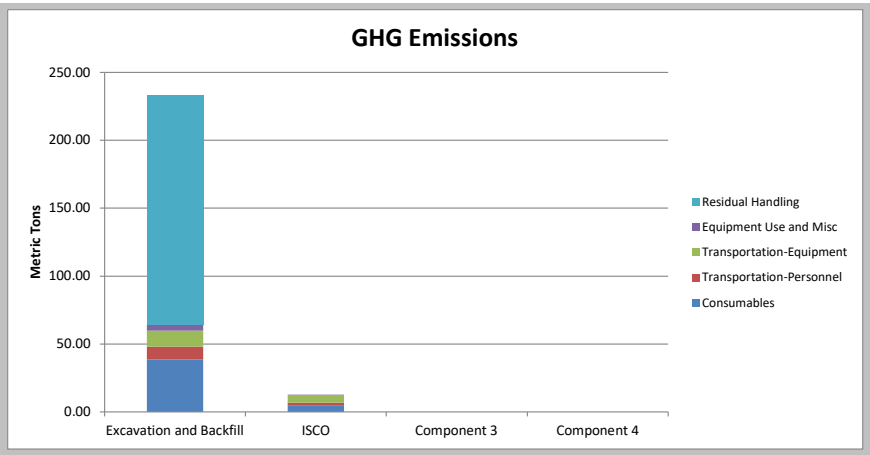

Costing
$
1
1
1
1
1
1
0
0
0
0
0
Component 1
Component 2
Component 3
Component 4

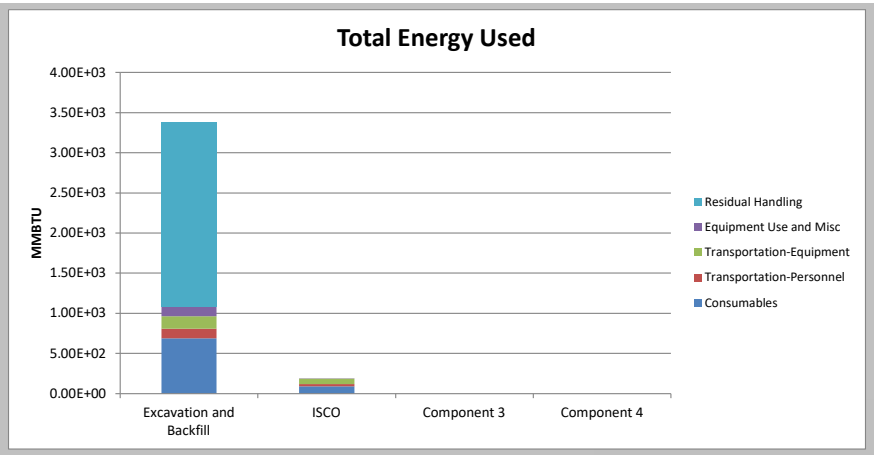

Lost Hours - Injury
Hours
2.0E-02
1.8E-02
1.6E-02
1.4E-02
1.2E-02
1.0E-02
8.0E-03
6.0E-03
4.0E-03
2.0E-03
0.0E+00
Component 1
Component 2
Component 3
Component 4

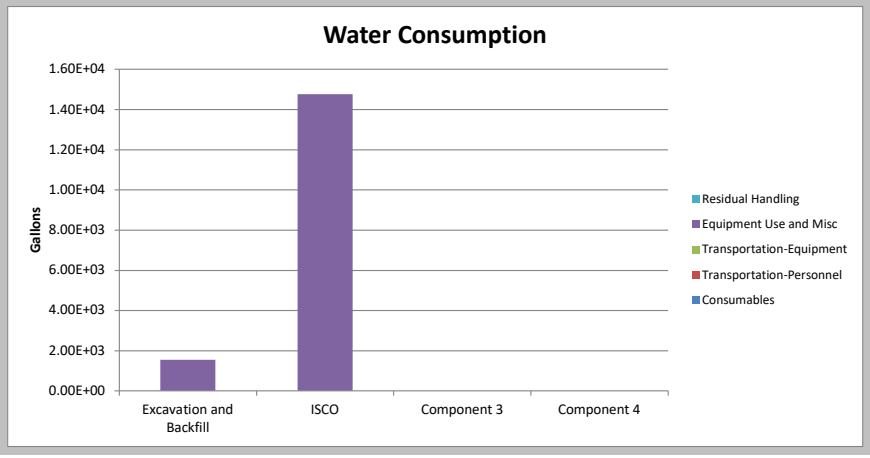
Sustainable Remediation - Environmental Footprint Summary
NYSDEC Whitesboro Drycleaners Alternative 3

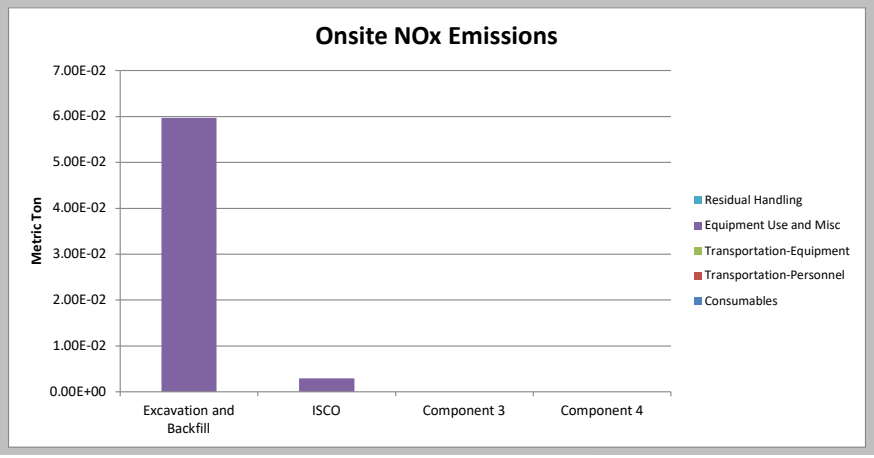
Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Excavation and Backfill	Consumables	38.58	688.85	NA	NA	NA	NA	NA	1.3E-01	1.8E-01	6.3E-02	NA	NA
	Transportation-Personnel	9.47	119.55	NA	NA	NA	NA	NA	3.9E-03	1.2E-04	5.6E-04	1.3E-04	1.1E-02
	Transportation-Equipment	11.77	153.59	NA	NA	NA	NA	NA	3.7E-03	6.5E-05	3.3E-04	2.7E-05	2.2E-03
	Equipment Use and Misc	4.51	122.02	1.6E+03	3.0E+00	6.0E-02	9.2E-03	3.8E-03	6.5E-02	1.3E-02	5.2E-03	8.5E-06	2.1E-03
	Residual Handling	168.91	2295.16	NA	NA	0.0E+00	0.0E+00	0.0E+00	1.3E-01	4.6E-02	2.4E-01	6.2E-04	5.0E-02
	Sub-Total	233.24	3379.18	1.55E+03	3.04E+00	5.97E-02	9.19E-03	3.80E-03	3.35E-01	2.40E-01	3.12E-01	7.88E-04	6.49E-02
ISCO	Consumables	4.98	92.69	NA	NA	NA	NA	NA	1.0E-02	1.4E-02	1.8E-03	NA	NA
	Transportation-Personnel	1.91	24.97	NA	NA	NA	NA	NA	6.0E-04	1.1E-05	5.3E-05	1.1E-05	8.5E-04
	Transportation-Equipment	5.36	69.98	NA	NA	NA	NA	NA	1.7E-03	3.0E-05	1.5E-04	1.2E-05	1.0E-03
	Equipment Use and Misc	0.34	3.89	1.5E+04	0.0E+00	3.0E-03	3.0E-04	2.7E-04	3.2E-03	4.3E-04	4.0E-04	3.2E-06	7.9E-04
	Residual Handling	0.00	0.00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	12.59	191.53	1.48E+04	0.00E+00	2.97E-03	3.03E-04	2.67E-04	1.55E-02	1.42E-02	2.41E-03	2.62E-05	2.65E-03
Component 3	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 4	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**2.5E+02**	**3.6E+03**	**1.6E+04**	**3.0E+00**	**6.3E-02**	**9.5E-03**	**4.1E-03**	**3.5E-01**	**2.5E-01**	**3.1E-01**	**8.1E-04**	**6.8E-02**

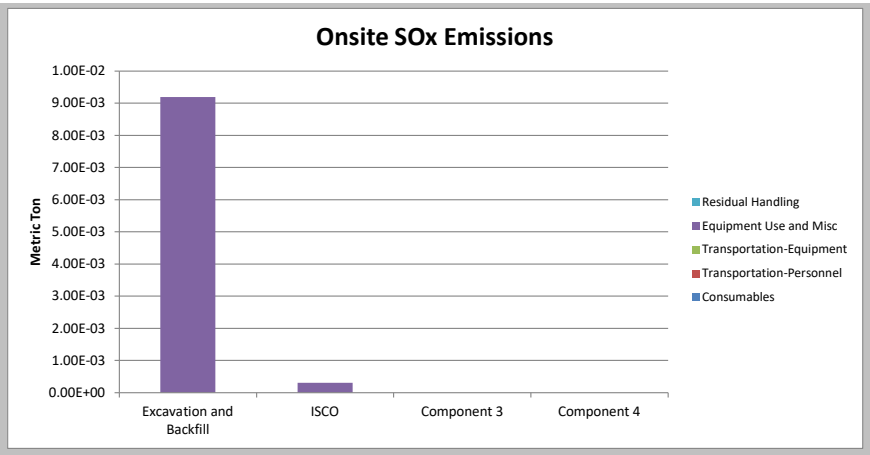
Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	
Excavation and Backfill	2.8E+02	9.4E+02	0.0E+00	0	5.2E-01	24.2%	$0
ISCO	0.0E+00	0.0E+00	0.0E+00	0	2.1E-02	0.0%	
Component 3	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 4	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Total	**2.8E+02**	**9.4E+02**	**0.0E+00**	**$0**	**5.4E-01**	**6.1%**	

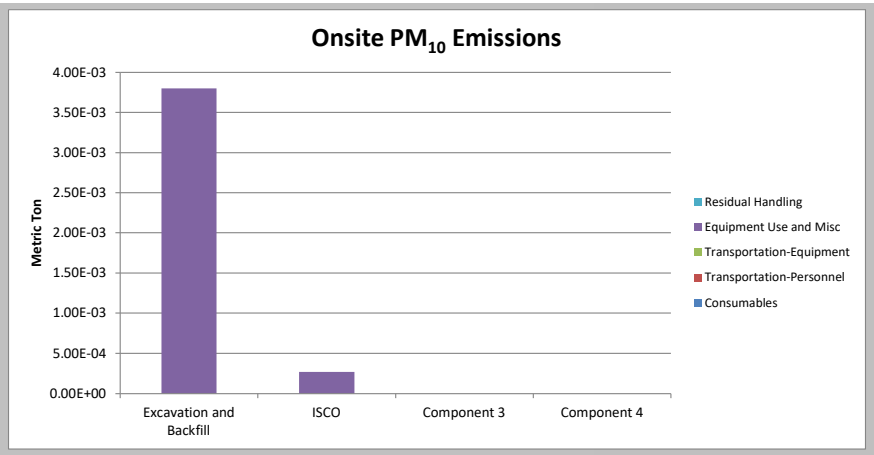

GHG Emissions
Metric Tons
250.00
200.00
150.00
100.00
50.00
0.00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

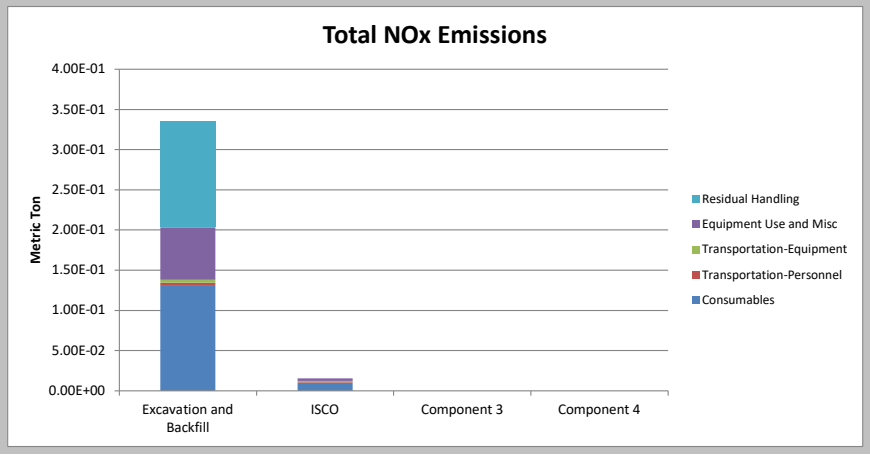

Total Energy Used
MMBTU
4.00E+03
3.50E+03
3.00E+03
2.50E+03
2.00E+03
1.50E+03
1.00E+03
5.00E+02
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

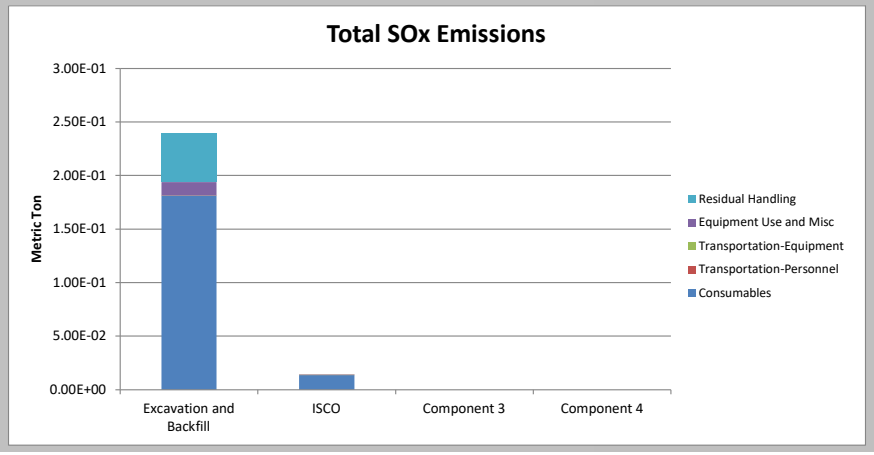

Water Consumption
Gallons
1.60E+04
1.40E+04
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

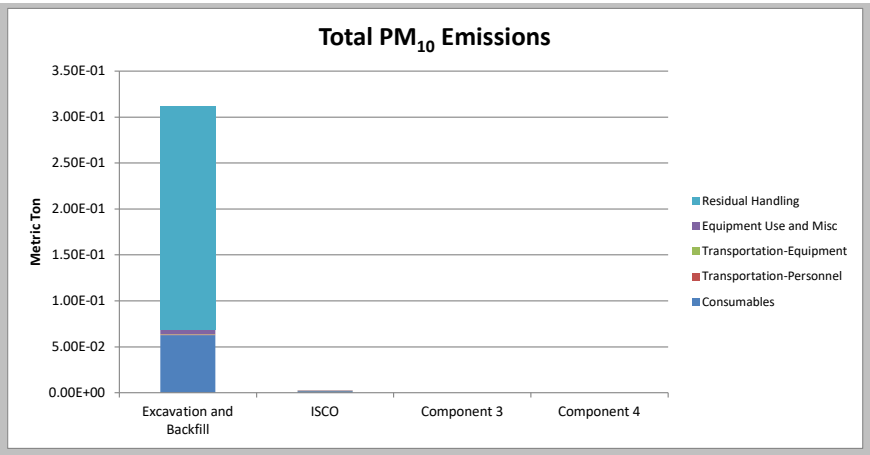

Onsite NOx Emissions
Metric Ton
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

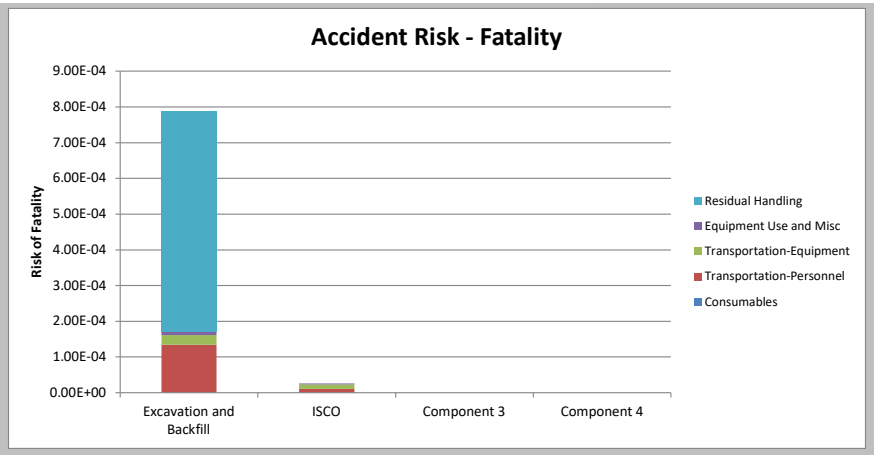

Onsite SOx Emissions
Metric Ton
1.00E-02
9.00E-03
8.00E-03
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

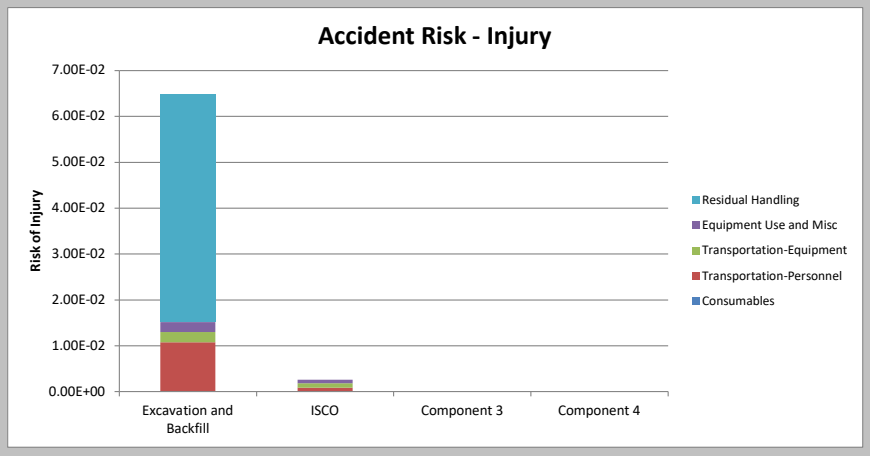

Onsite PM10 Emissions
Metric Ton
4.00E-03
3.50E-03
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

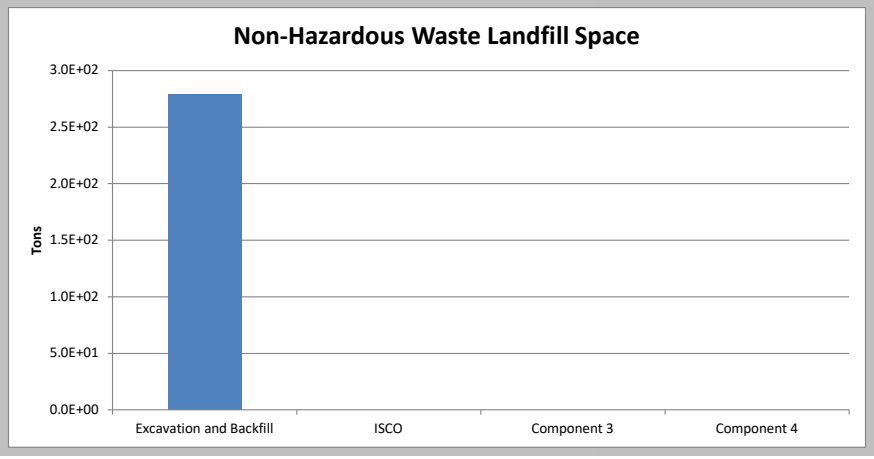

Total NOx Emissions
Metric Ton
4.00E-01
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

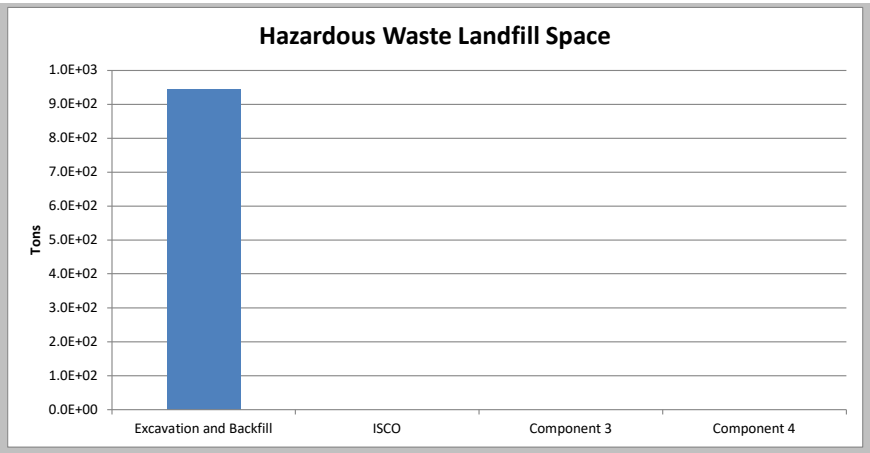

Total SOx Emissions
Metric Ton
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

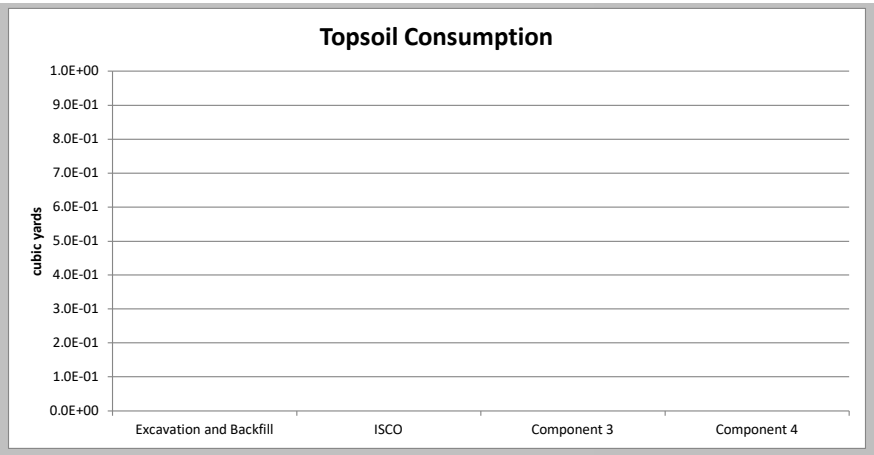

Total PM10 Emissions
Metric Ton
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

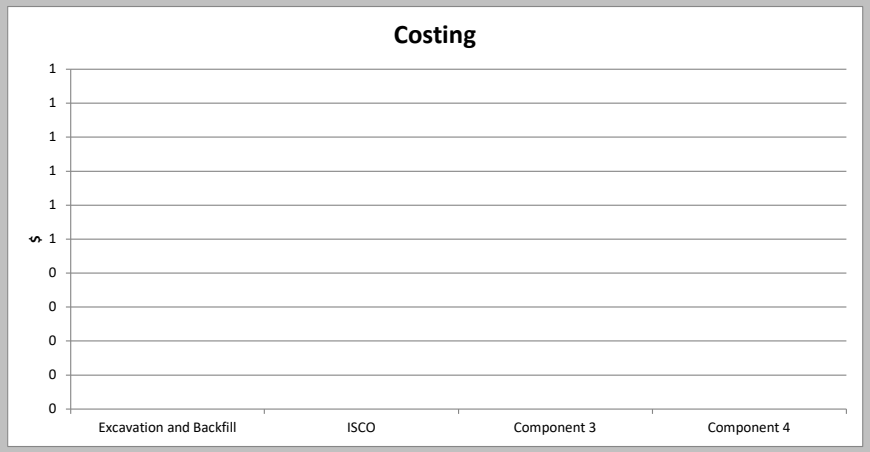

Accident Risk - Fatality
Risk of Fatality
9.00E-04
8.00E-04
7.00E-04
6.00E-04
5.00E-04
4.00E-04
3.00E-04
2.00E-04
1.00E-04
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

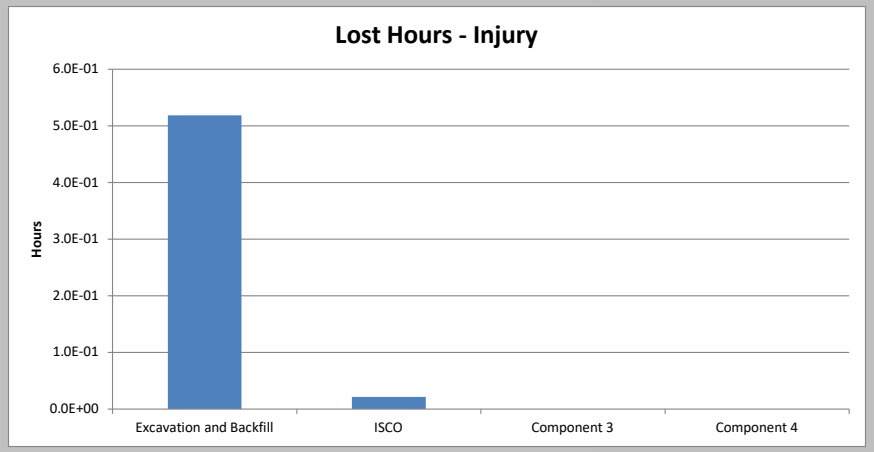

Accident Risk - Injury
Risk of Injury
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Excavation and Backfill
ISCO
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Non-Hazardous Waste Landfill Space
Tons
3.0E+02
2.5E+02
2.0E+02
1.5E+02
1.0E+02
5.0E+01
0.0E+00
Excavation and Backfill
ISCO
Component 3
Component 4


Hazardous Waste Landfill Space
Tons
1.0E+03
9.0E+02
8.0E+02
7.0E+02
6.0E+02
5.0E+02
4.0E+02
3.0E+02
2.0E+02
1.0E+02
0.0E+00
Excavation and Backfill
ISCO
Component 3
Component 4


Topsoil Consumption
cubic yards
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Excavation and Backfill
ISCO
Component 3
Component 4

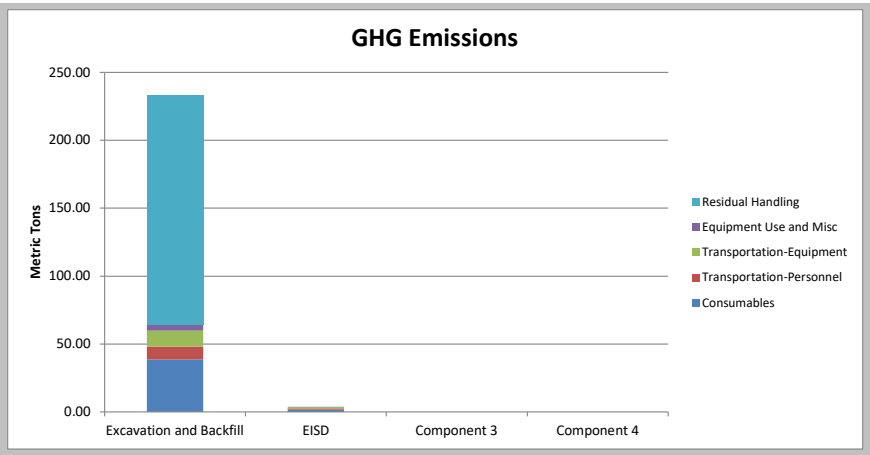

Costing
$
Excavation and Backfill
ISCO
Component 3
Component 4

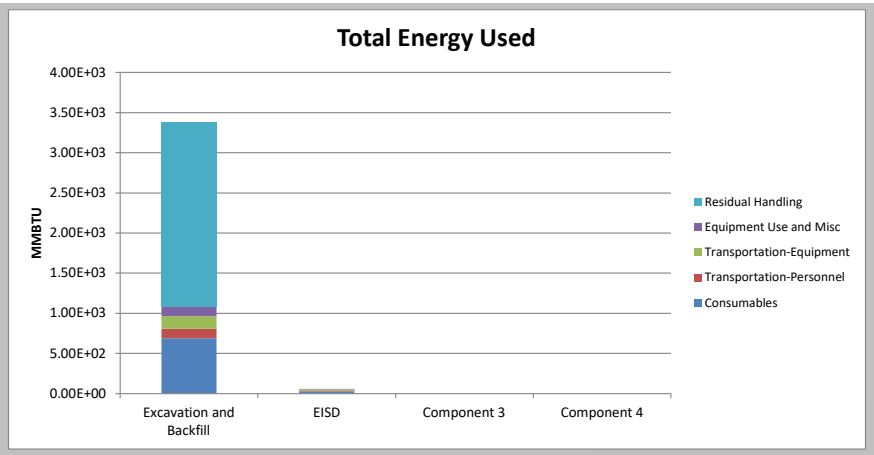

Lost Hours - Injury
Hours
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Excavation and Backfill
ISCO
Component 3
Component 4

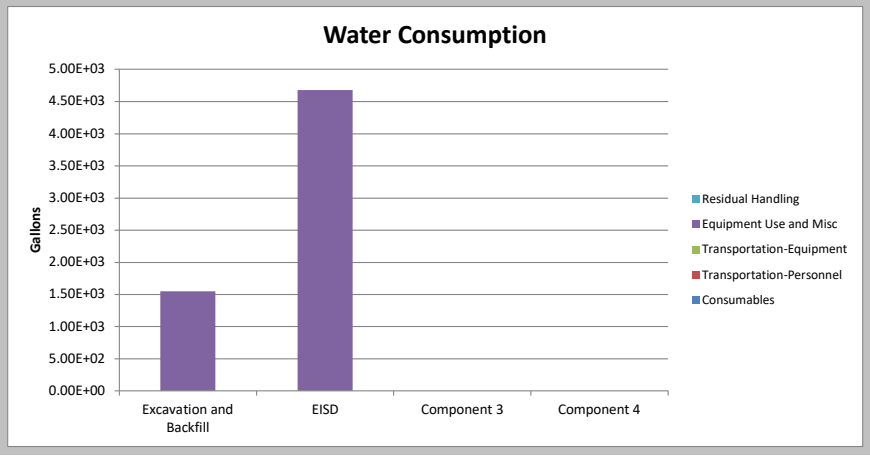
Sustainable Remediation - Environmental Footprint Summary
NYSDEC Whitesboro Drycleaners Alternative 4

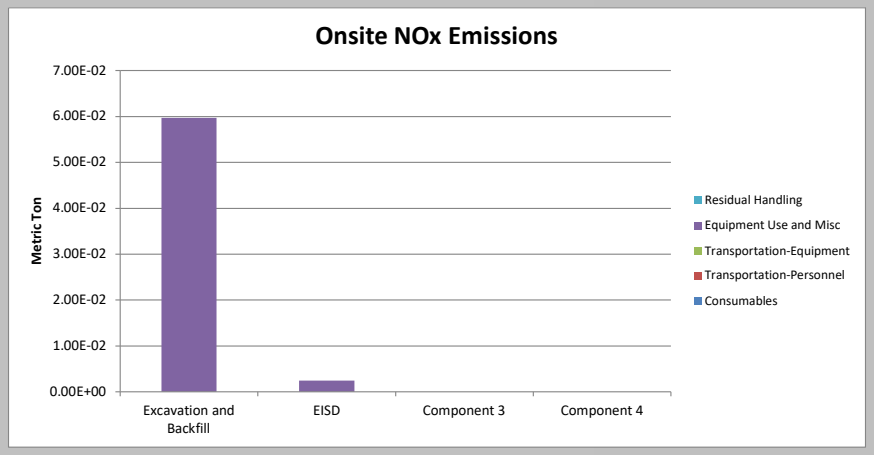
Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Excavation and Backfill	Consumables	38.58	688.85	NA	NA	NA	NA	NA	1.3E-01	1.8E-01	6.3E-02	NA	NA
	Transportation-Personnel	9.47	119.55	NA	NA	NA	NA	NA	3.9E-03	1.2E-04	5.6E-04	1.3E-04	1.1E-02
	Transportation-Equipment	11.77	153.59	NA	NA	NA	NA	NA	3.7E-03	6.5E-05	3.3E-04	2.7E-05	2.2E-03
	Equipment Use and Misc	4.51	122.02	1.6E+03	3.0E+00	6.0E-02	9.2E-03	3.8E-03	6.5E-02	1.3E-02	5.2E-03	8.5E-06	2.1E-03
	Residual Handling	168.91	2295.16	NA	NA	0.0E+00	0.0E+00	0.0E+00	1.3E-01	4.6E-02	2.4E-01	6.2E-04	5.0E-02
	Sub-Total	233.24	3379.18	1.55E+03	3.04E+00	5.97E-02	9.19E-03	3.80E-03	3.35E-01	2.40E-01	3.12E-01	7.88E-04	6.49E-02
EISD	Consumables	1.59	28.53	NA	NA	NA	NA	NA	3.2E-03	6.4E-03	1.3E-03	NA	NA
	Transportation-Personnel	0.93	12.12	NA	NA	NA	NA	NA	2.9E-04	5.2E-06	2.6E-05	5.1E-06	4.1E-04
	Transportation-Equipment	0.97	12.68	NA	NA	NA	NA	NA	3.1E-04	5.4E-06	2.7E-05	2.3E-06	1.8E-04
	Equipment Use and Misc	0.27	3.17	4.7E+03	0.0E+00	2.5E-03	2.5E-04	2.2E-04	2.6E-03	3.4E-04	2.8E-04	2.6E-06	6.6E-04
	Residual Handling	0.00	0.00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	3.76	56.50	4.68E+03	0.00E+00	2.47E-03	2.53E-04	2.23E-04	6.41E-03	6.70E-03	1.60E-03	1.00E-05	1.26E-03
Component 3	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 4	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**2.4E+02**	**3.4E+03**	**6.2E+03**	**3.0E+00**	**6.2E-02**	**9.4E-03**	**4.0E-03**	**3.4E-01**	**2.5E-01**	**3.1E-01**	**8.0E-04**	**6.6E-02**

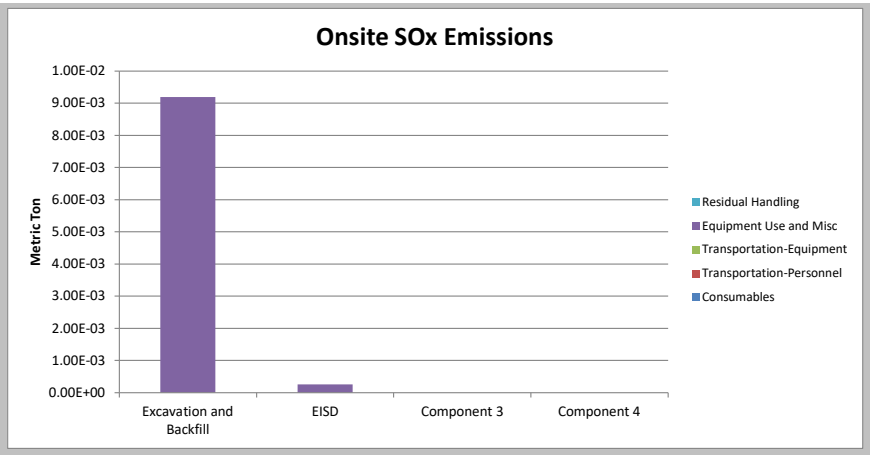
Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	
Excavation and Backfill	2.8E+02	9.4E+02	0.0E+00	0	5.2E-01	24.2%	$0
EISD	0.0E+00	0.0E+00	0.0E+00	0	1.0E-02	0.0%	
Component 3	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 4	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Total	**2.8E+02**	**9.4E+02**	**0.0E+00**	**$0**	**5.3E-01**	**6.1%**	

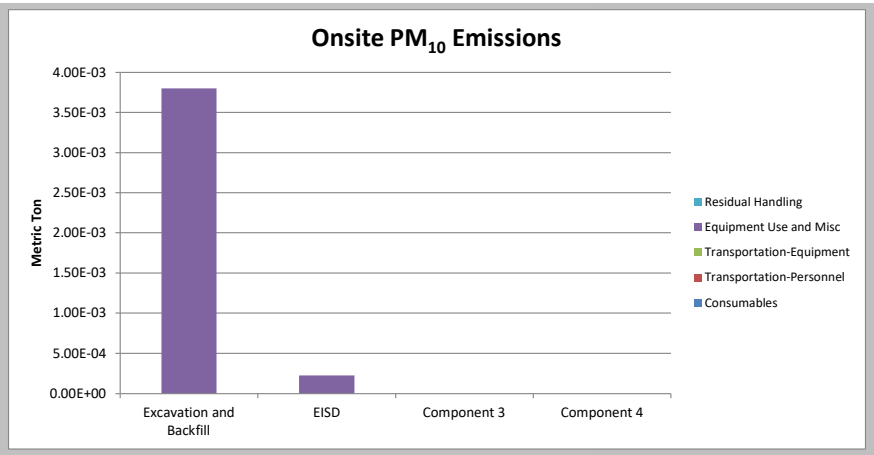

GHG Emissions
Metric Tons
250.00
200.00
150.00
100.00
50.00
0.00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

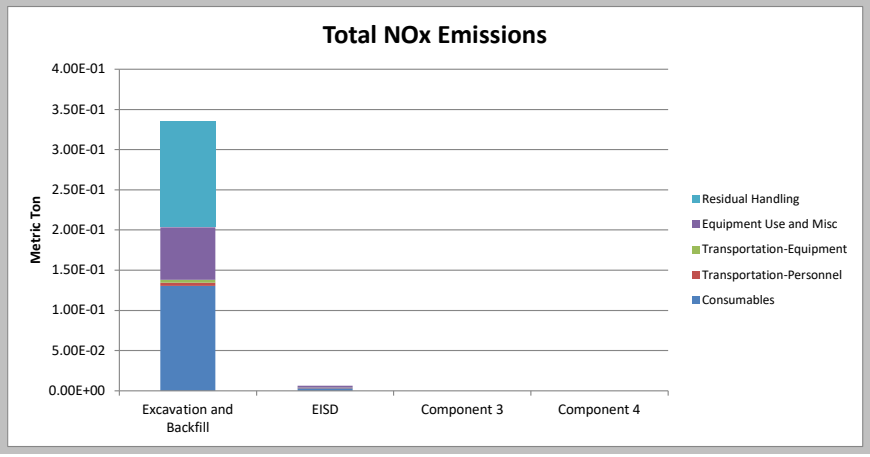

Total Energy Used
MMBTU
4.00E+03
3.50E+03
3.00E+03
2.50E+03
2.00E+03
1.50E+03
1.00E+03
5.00E+02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

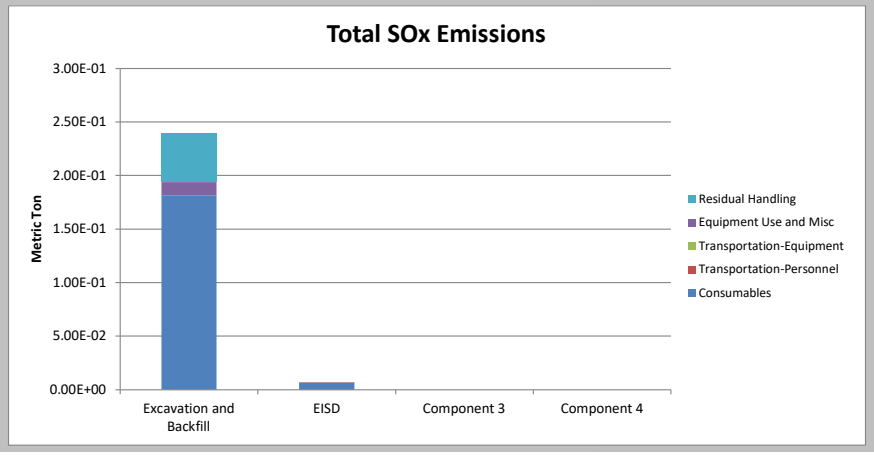

Water Consumption
Gallons
5.00E+03
4.50E+03
4.00E+03
3.50E+03
3.00E+03
2.50E+03
2.00E+03
1.50E+03
1.00E+03
5.00E+02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

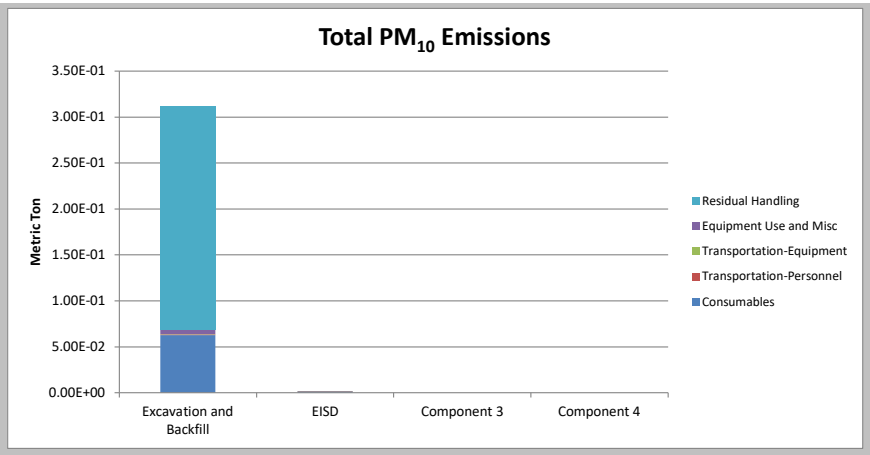

Onsite NOx Emissions
Metric Ton
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

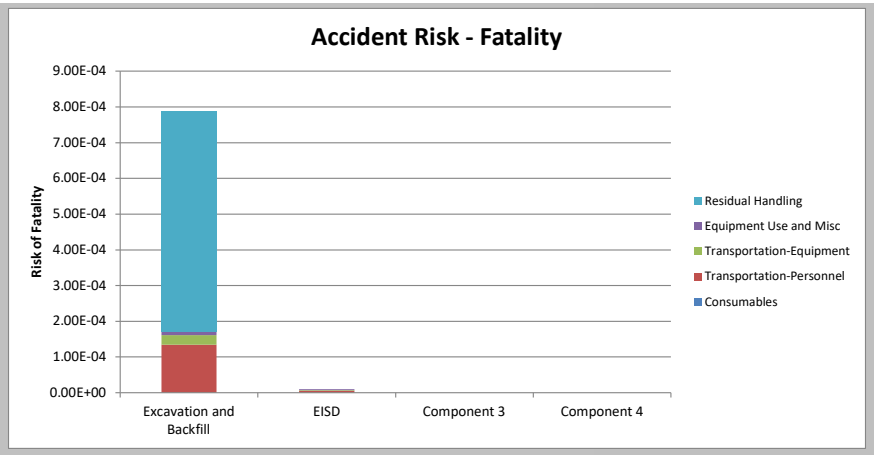

Onsite SOx Emissions
Metric Ton
1.00E-02
9.00E-03
8.00E-03
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

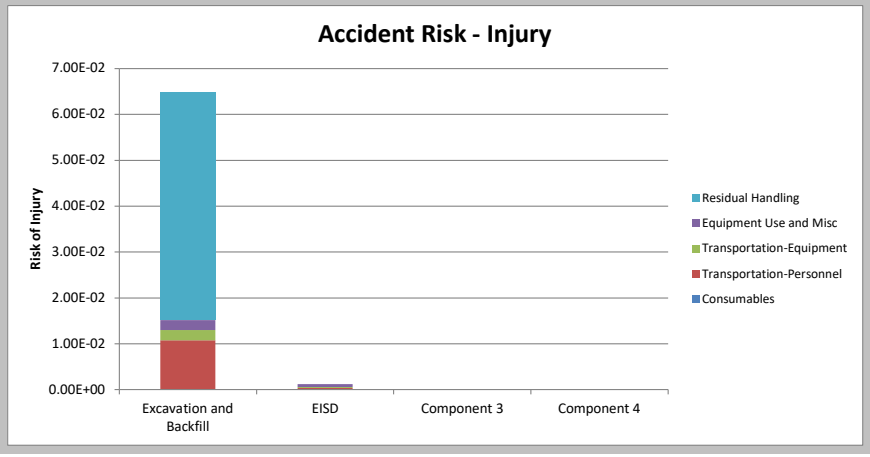

Onsite PM10 Emissions
Metric Ton
4.00E-03
3.50E-03
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

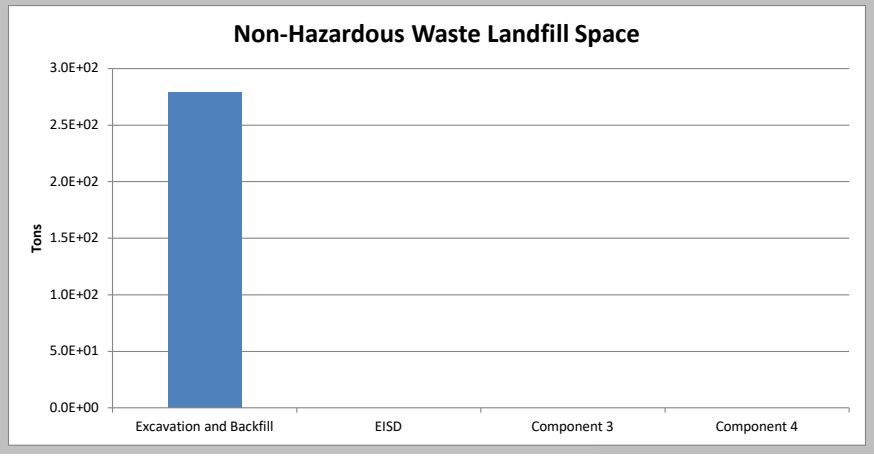

Total NOx Emissions
Metric Ton
4.00E-01
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

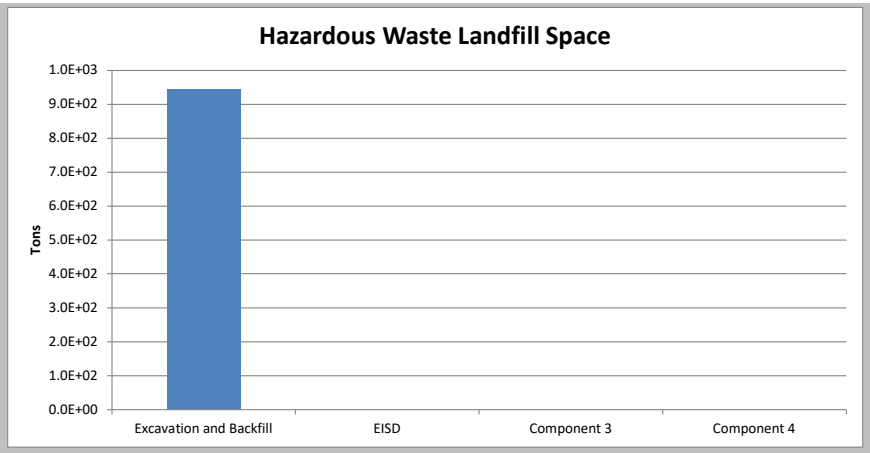

Total SOx Emissions
Metric Ton
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

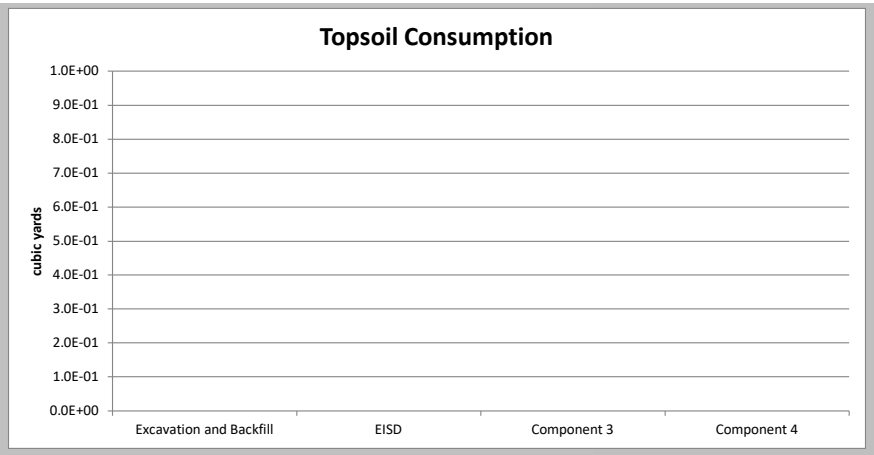

Total PM10 Emissions
Metric Ton
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

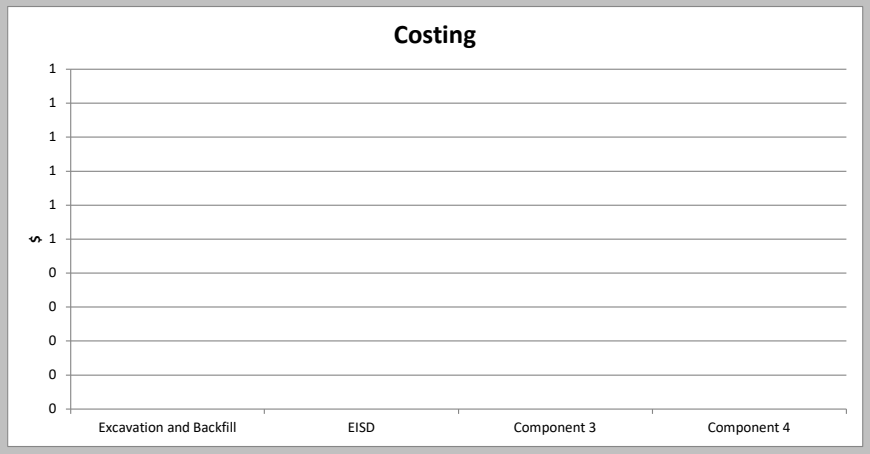

Accident Risk - Fatality
Risk of Fatality
9.00E-04
8.00E-04
7.00E-04
6.00E-04
5.00E-04
4.00E-04
3.00E-04
2.00E-04
1.00E-04
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

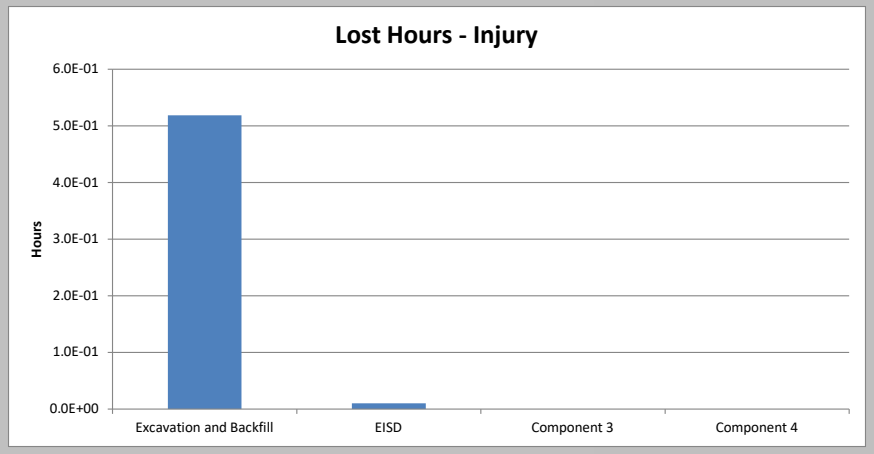

Accident Risk - Injury
Risk of Injury
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Excavation and Backfill
EISD
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Non-Hazardous Waste Landfill Space
Tons
3.0E+02
2.5E+02
2.0E+02
1.5E+02
1.0E+02
5.0E+01
0.0E+00
Excavation and Backfill
EISD
Component 3
Component 4


Hazardous Waste Landfill Space
Tons
1.0E+03
9.0E+02
8.0E+02
7.0E+02
6.0E+02
5.0E+02
4.0E+02
3.0E+02
2.0E+02
1.0E+02
0.0E+00
Excavation and Backfill
EISD
Component 3
Component 4


Topsoil Consumption
cubic yards
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Excavation and Backfill
EISD
Component 3
Component 4

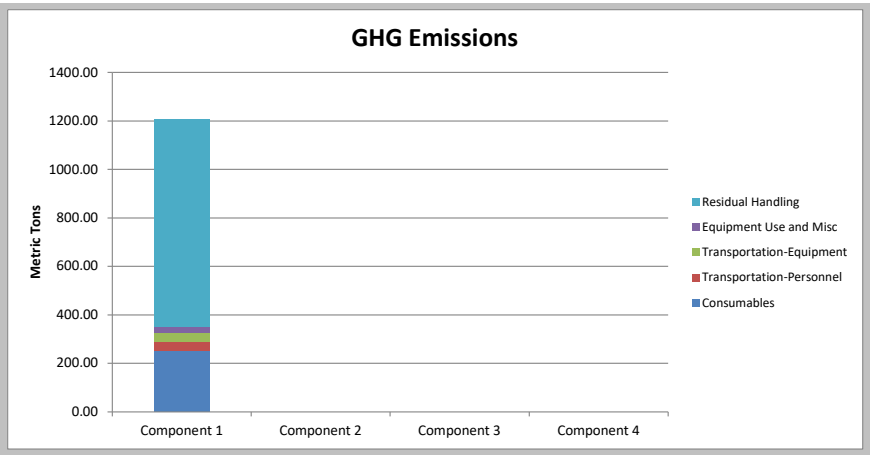

Costing
$
Excavation and Backfill
EISD
Component 3
Component 4

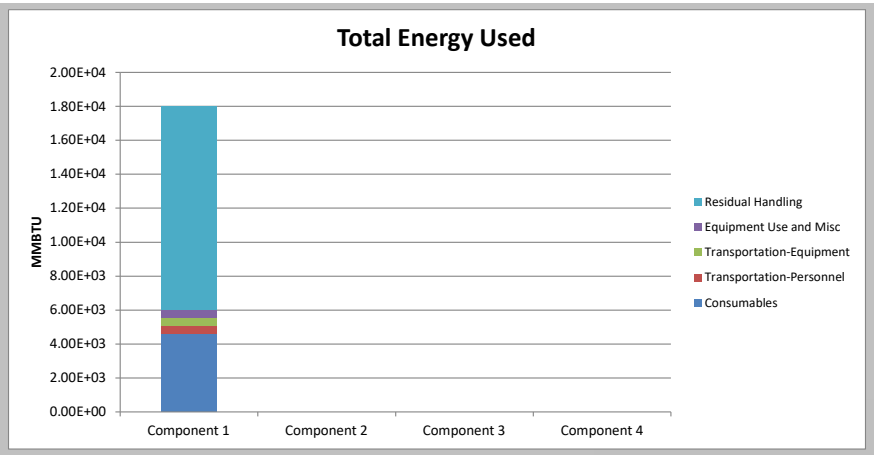

Lost Hours - Injury
Hours
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Excavation and Backfill
EISD
Component 3
Component 4

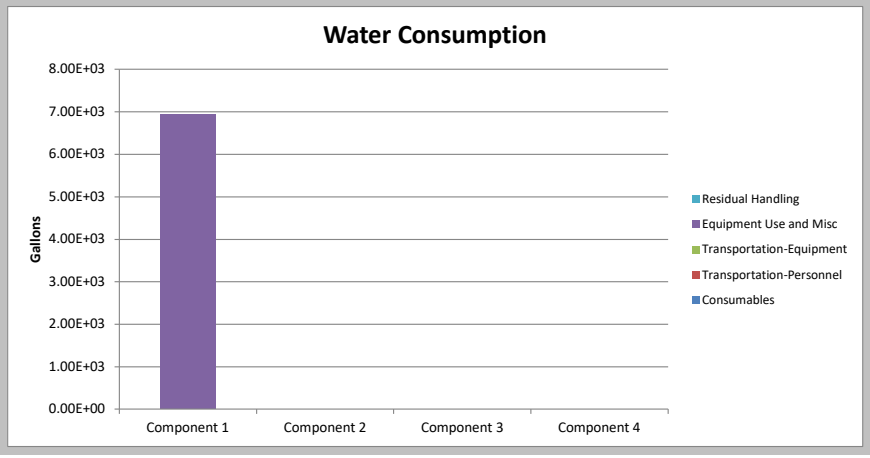
Sustainable Remediation - Environmental Footprint Summary
NYSDEC Whitesboro Drycleaners Alternative 5

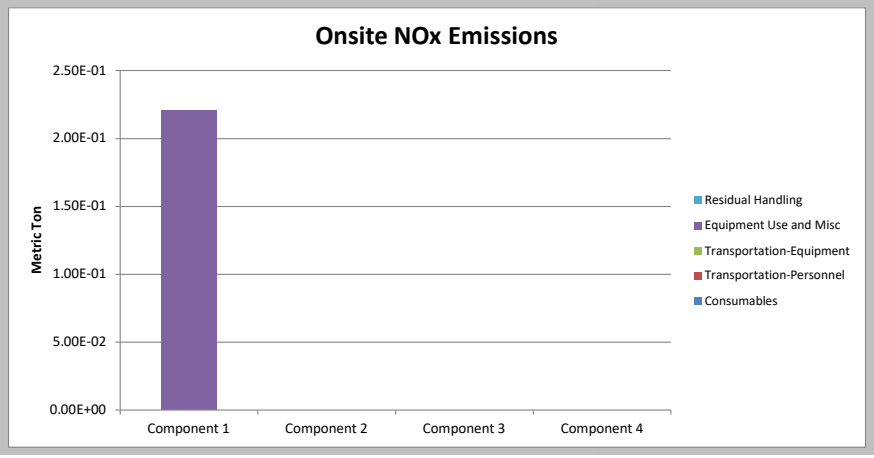
Phase	Activities	GHG Emissions	Total Energy Used	Water Consumption	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions	Onsite PM10 Emissions	Total NOx Emissions	Total SOx Emissions	Total PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	MWH	metric ton	metric ton	metric ton	metric ton	metric ton	metric ton		
Component 1	Consumables	253.70	4601.32	NA	NA	NA	NA	NA	9.2E-01	1.2E+00	4.5E-01	NA	NA
	Transportation-Personnel	37.02	467.09	NA	NA	NA	NA	NA	1.5E-02	4.8E-04	2.2E-03	5.2E-04	4.2E-02
	Transportation-Equipment	34.89	455.35	NA	NA	NA	NA	NA	1.1E-02	1.9E-04	9.7E-04	8.1E-05	6.5E-03
	Equipment Use and Misc	23.73	525.44	6.9E+03	1.4E+01	2.2E-01	4.0E-02	1.5E-02	2.4E-01	5.6E-02	2.1E-02	3.0E-05	7.5E-03
	Residual Handling	856.38	11972.21	NA	NA	0.0E+00	0.0E+00	0.0E+00	9.6E-01	4.0E-01	2.1E+00	2.9E-03	2.3E-01
	Sub-Total	1205.72	18021.42	6.94E+03	1.36E+01	2.21E-01	4.02E-02	1.47E-02	2.16E+00	1.68E+00	2.60E+00	3.54E-03	2.90E-01
Component 2	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 3	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Component 4	Consumables	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Transportation-Personnel	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Transportation-Equipment	0.00	0.0E+00	NA	NA	NA	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Residual Handling	0.00	0.0E+00	NA	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		**1.2E+03**	**1.8E+04**	**6.9E+03**	**1.4E+01**	**2.2E-01**	**4.0E-02**	**1.5E-02**	**2.2E+00**	**1.7E+00**	**2.6E+00**	**3.5E-03**	**2.9E-01**

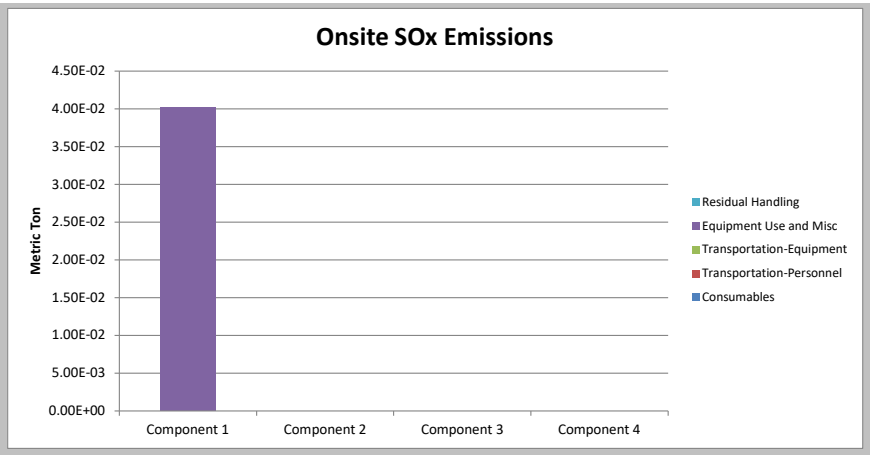
Remedial Alternative Phase	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Percent electricity from renewable sources	Total Cost with Footprint Reduction
	tons	tons	cubic yards	$		%	
Component 1	6.9E+03	4.3E+03	0.0E+00	0	2.3E+00	24.2%	$0
Component 2	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 3	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Component 4	0.0E+00	0.0E+00	0.0E+00	0	0.0E+00	0.0%	
Total	**6.9E+03**	**4.3E+03**	**0.0E+00**	**$0**	**2.3E+00**	**6.1%**	

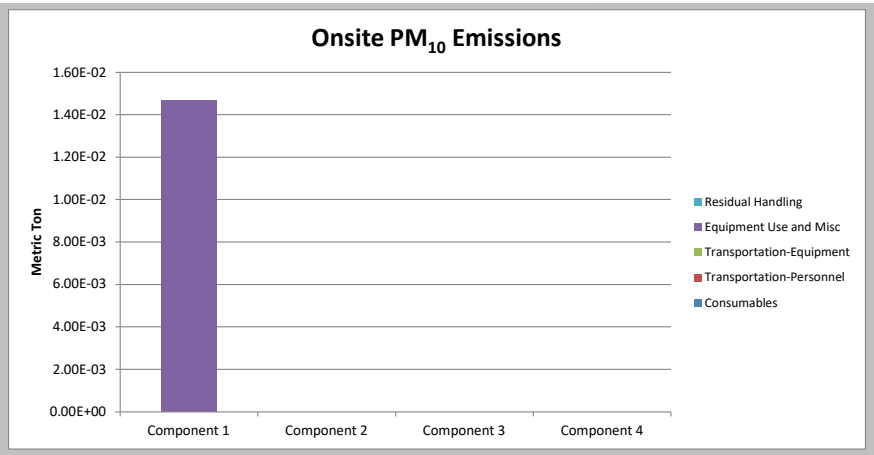

GHG Emissions
Metric Tons
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

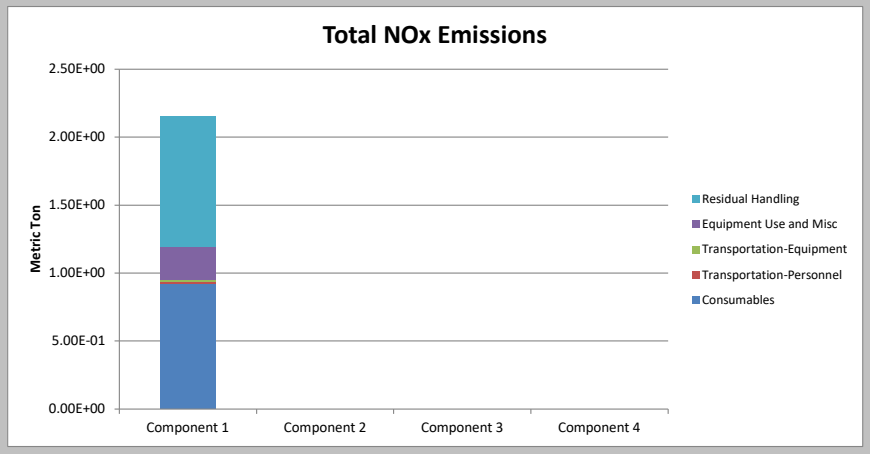

Total Energy Used
MMBTU
2.00E+04
1.80E+04
1.60E+04
1.40E+04
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

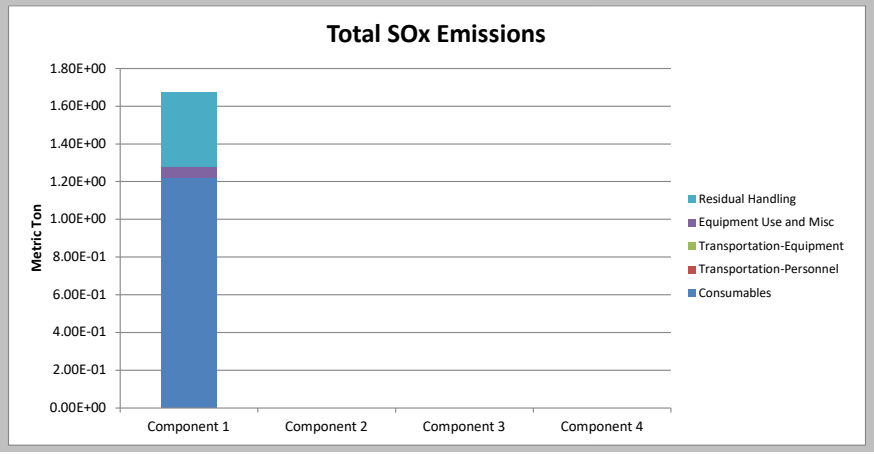

Water Consumption
Gallons
8.00E+03
7.00E+03
6.00E+03
5.00E+03
4.00E+03
3.00E+03
2.00E+03
1.00E+03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

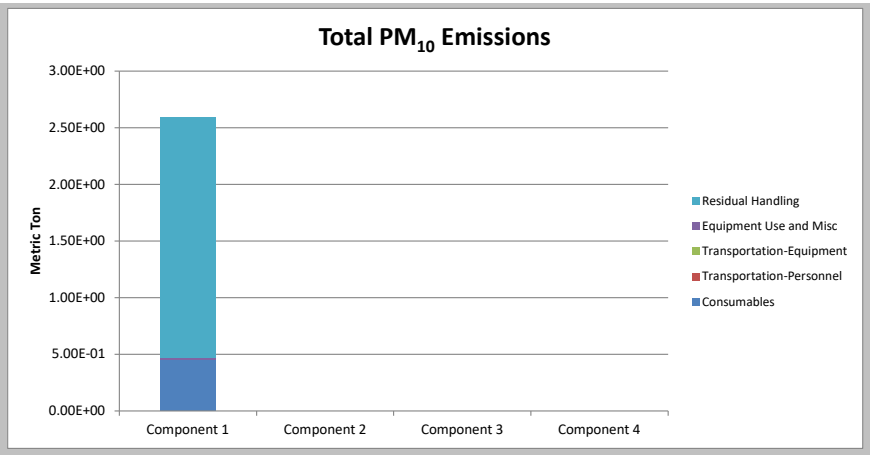

Onsite NOx Emissions
Metric Ton
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

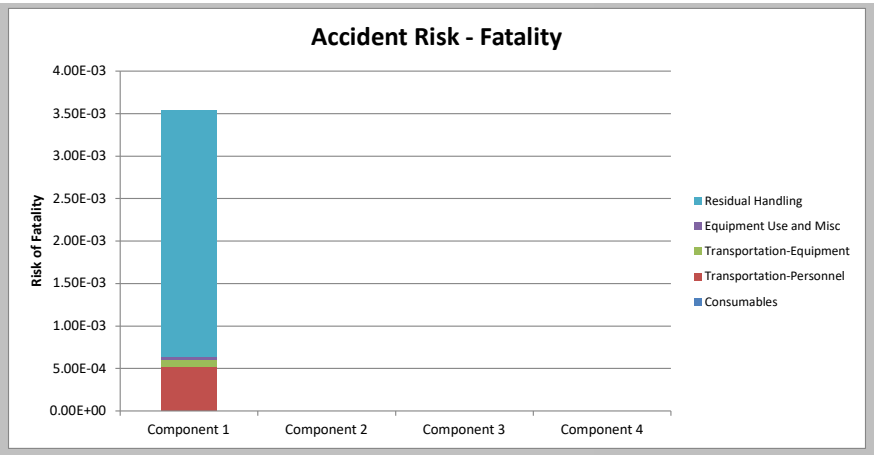

Onsite SOx Emissions
Metric Ton
4.50E-02
4.00E-02
3.50E-02
3.00E-02
2.50E-02
2.00E-02
1.50E-02
1.00E-02
5.00E-03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

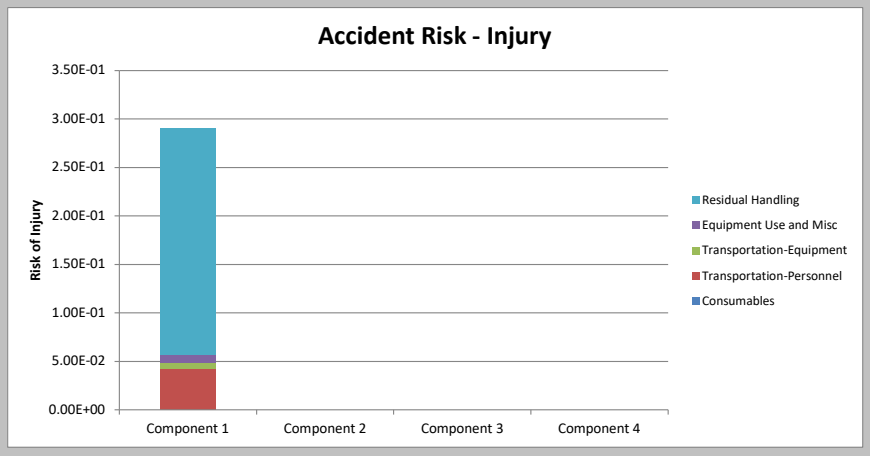

Onsite PM10 Emissions
Metric Ton
1.60E-02
1.40E-02
1.20E-02
1.00E-02
8.00E-03
6.00E-03
4.00E-03
2.00E-03
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

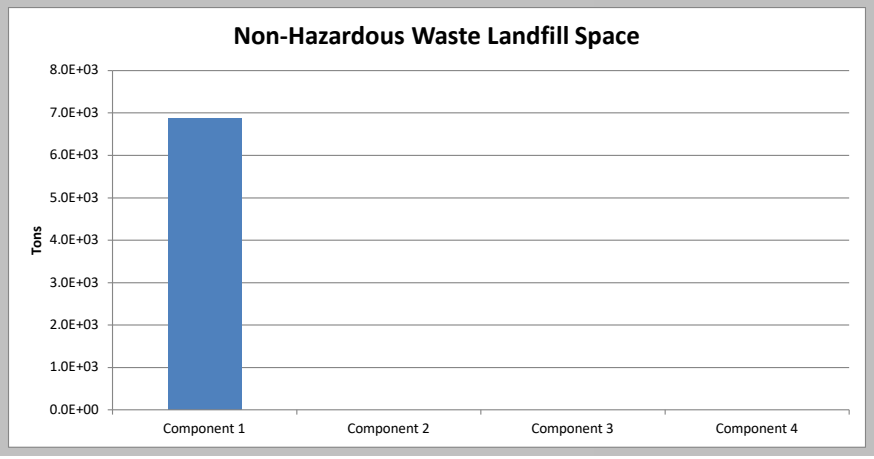

Total NOx Emissions
Metric Ton
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

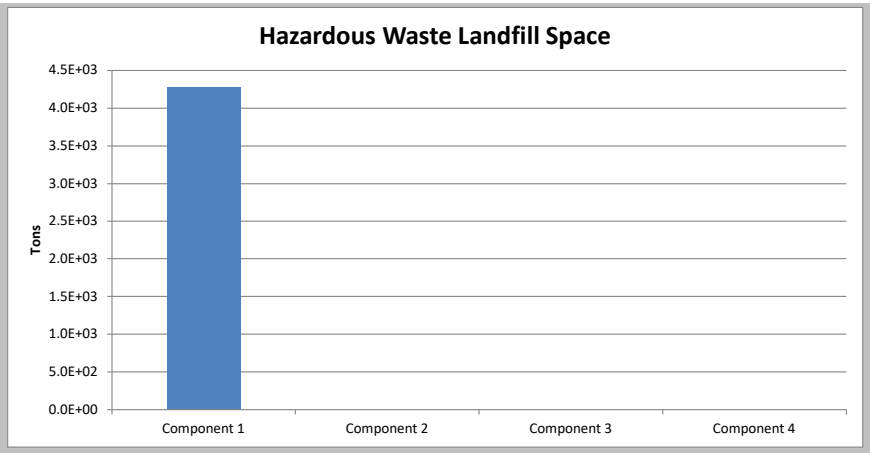

Total SOx Emissions
Metric Ton
1.80E+00
1.60E+00
1.40E+00
1.20E+00
1.00E+00
8.00E-01
6.00E-01
4.00E-01
2.00E-01
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

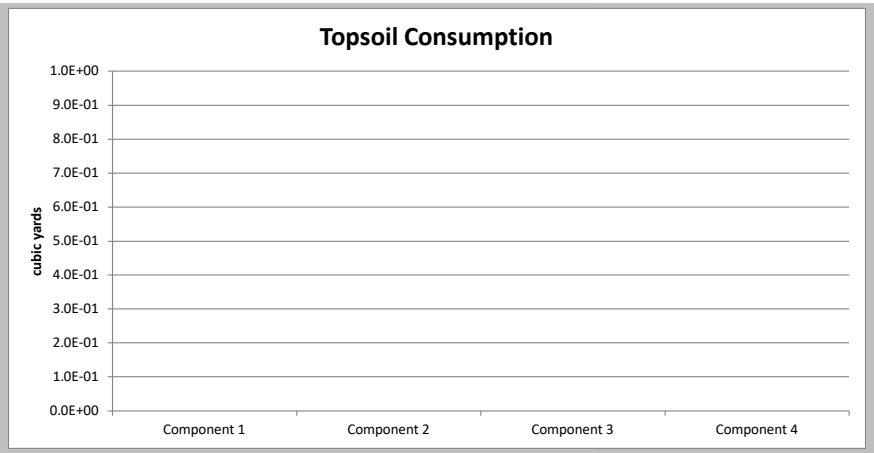

Total PM10 Emissions
Metric Ton
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

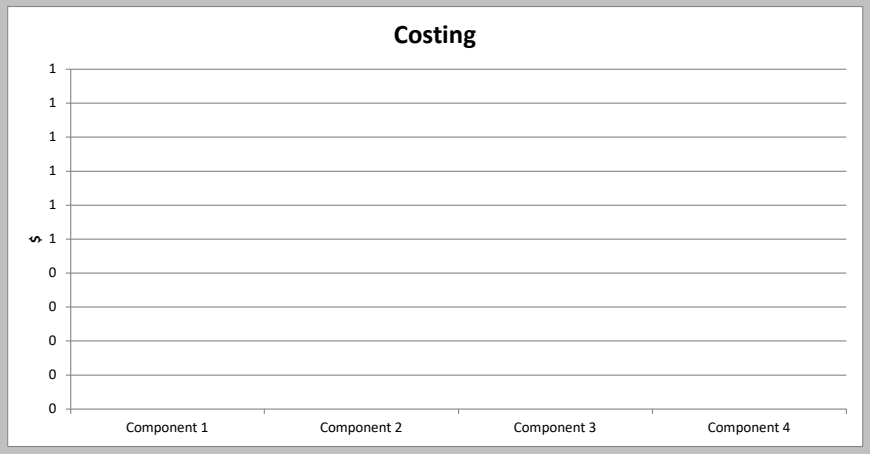

Accident Risk - Fatality
Risk of Fatality
4.00E-03
3.50E-03
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

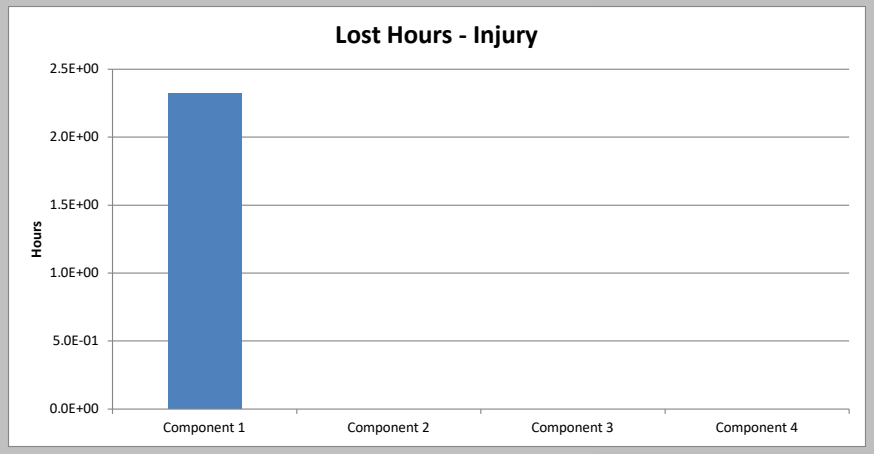

Accident Risk - Injury
Risk of Injury
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Component 1
Component 2
Component 3
Component 4
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Non-Hazardous Waste Landfill Space
Tons
8.0E+03
7.0E+03
6.0E+03
5.0E+03
4.0E+03
3.0E+03
2.0E+03
1.0E+03
0.0E+00
Component 1
Component 2
Component 3
Component 4


Hazardous Waste Landfill Space
Tons
4.5E+03
4.0E+03
3.5E+03
3.0E+03
2.5E+03
2.0E+03
1.5E+03
1.0E+03
5.0E+02
0.0E+00
Component 1
Component 2
Component 3
Component 4


Topsoil Consumption
cubic yards
1.0E+00
9.0E-01
8.0E-01
7.0E-01
6.0E-01
5.0E-01
4.0E-01
3.0E-01
2.0E-01
1.0E-01
0.0E+00
Component 1
Component 2
Component 3
Component 4


Costing
$
Component 1
Component 2
Component 3
Component 4


Lost Hours - Injury
Hours
2.5E+00
2.0E+00
1.5E+00
1.0E+00
5.0E-01
0.0E+00
Component 1
Component 2
Component 3
Component 4

APPENDIX B: SUSTAINABLE BEST MANAGEMENT PRACTICE ASSESSMENT

Appendix B - Best Management Practices						
Best Management Practice	**Implementation Responsibility**	**Project Phase**	**Alternative 2** **Targeted surface soil excavation, engineered cover and MNA**	**Alternative 3** **Targeted surface and subsurface soil excavation, In situ chemical oxidation of soil/groundwater and MNA**	**Alternative 4** **Targeted surface and subsurface soil excavation, enhanced in situ dechlorination treatment of soil/groundwater and MNA**	**Alternative 5** **Site-wide excavation with off-Site disposal and MNA**
Implement an idle reduction plan for vehicles and machinery during site operations	NYSDEC/Consultant/Subcontractor	Equipment	●	●	●	●
Consider the use of clean fuel alternatives such as ultra-low sulfur diesel, biodiesel, or alternative energy sources such as wind and solar	Subcontractor	Planning and Scoping	●	●	●	●
Use local disposal facilities when possible to minimize transportation	NYSDEC/Subcontractor	Disposal	●	●	●	●
Sequence remedial work phases to reduce or limit double handling of materials at the site	Subcontractor	Means and Methods	●	●	●	●
Source topsoil locally for backfill and restoration	Consultant/Subcontractor	Planning/Restoration	●	●	●	●
Complete comprehensive delineation to limit the excavation volume	Consultant	Planning	●	●	●	●
Incorporate direct push sampling to save energy	NYSDEC/Consultant	Planning	●	●	●	●
Allow for solids to dewater prior to shipping off-site to minimize transportation weight	Subcontractor	Disposal				●
Sequence work and traffic patterns to minimize local traffic congestions	Subcontractor	Means and Methods				●
Minimize waste designated for landfills by segregating and reusing uncontaminated material (ie construction/demolition materials/soil) on-site or for resale/recycling including organic material, gravel, metal scrap, and clean soil	Subcontractor	Means and Methods				●
Conduct pre-design investigation (PDI) to define treatment area well before injection design	Consultant	Planning and Scoping		●	●	
Conduct bench or pilot scale testing as possible to gain site specific design data including flow rates, loading rates and radius of influence (ROI)	NYSDEC/Consultant	Planning and Scoping		●	●	
Use permanent injection wells in source areas/zones where multiple rounds of injections are expected	Consultant/Subcontractor	Means and Methods		●	●	
Maximizing reuse of existing or new wells and boreholes for injections to avoid a range of wasted resources	NYSDEC/Consultant	Planning and Scoping		●	●	
Using direct-push technology for constructing temporary or permanent wells rather than typical rotary methods, wherever feasible, to eliminate the need for disposal of cuttings and improve efficiency of substrate delivery into discrete vertical intervals	NYSDEC/Consultant	Means and Methods		●	●	
Use gravity feed when appropriate to reduce operating equipment	Consultant/Subcontractor	Means and Methods		●	●	
When possible, select amendments made from recycled materials or renewable resources	NYSDEC/Consultant	Planning and Scoping			●	
Consider the use of dedicated sampling equipment such as tubing	Consultant	Means and Methods	●	●	●	●
Consider the use of passive / no purge groundwater monitoring techniques	NYSDEC/Consultant	Monitoring	●	●	●	●
Use local resources/staff for monitoring events	NYSDEC/Consultant	Monitoring	●	●	●	●
Request for proposals include a mandatory response on sustainable practices (ie greener cleanup BMPs) proposed for the work	NYSDEC/Consultant	Planning and Scoping	●	●	●	●
Incorporate sustainability and resiliency related requirements into project specifications and contract documents for subcontractors when applicable	NYSDEC/Consultant	Planning and Scoping	●	●	●	●
Actively monitor and record water/energy/greenhouse gas emissions throughout the lifespan of the project and continually evaluate opportunities to minimize usages and impacts	Consultant/Subcontractor	Means and Methods	●	●	●	●