# Remedial Design Work Plan

## Former Coyne Textile Facility
## 140 Cortland Avenue
## Syracuse, New York

## NYSDEC BCP Site No. C734144

*CHA Project Number: 059294.001*

***Prepared for:***
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I, the undersigned, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Remedial Design Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law. I, the undersigned, of CHA Consulting, Inc. have been designated by the Site owner to sign this certification for the Site.

**For CHA Consulting, Inc.:**

(Professional Seal)


Scott M. Smith, P.E.
Printed Name of Certifying Engineer

Signature of Certifying Engineer

July 27, 2020
Date of Certification

083885
NYS Professional Engineer Registration Number

CHA Consulting, Inc.
Company

Associate Vice President
Title

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| | |
|---|---|
| 1,2 -DCE | 1,2 -Dichloroethene |
| 3D | Three-Dimensional |
| AAR | Alternatives Analysis Report |
| ARA | Absolute Resource Associates, LLC |
| AST | Aboveground Storage Tank |
| ASTM | American Society of Testing & Materials |
| AWQS | Ambient Water Quality Standard |
| BCA | Brownfield Cleanup Agreement |
| BCP | Brownfield Cleanup Program |
| bgs | Below the Ground Surface |
| C&D | Construction & Demolition |
| CAMP | Community Air Monitoring Plan |
| Cascade | Cascade Environmental |
| CCR | Construction Completion Report |
| CERP | Community & Environmental Response Plan |
| CHA | CHA Consulting, Inc. |
| COC | Contaminant of Concern |
| DER | Division of Environmental Remediation |
| DPT | Direct Push Technology |
| ELAP | Environmental Laboratory Approval Program |
| ESA | Environmental Site Assessment |
| FER | Final Engineering Report |
| FID | Flame Ionization Detector |
| FSP | Field Sampling Plan |
| GAC | Granulated Activated Carbon |
| GEC | GEC Consulting, LLC |
| GZA | GZA GeoEnvironmental of New York |
| HASP | Health and Safety Plan |
| HVAC | Heating, Ventilation & Air-Conditioning |
| IRM | Interim Remedial Measure |
| IRMWP | Interim Remedial Measure Work Plan |
| ISCO | In-situ Chemical Oxidation |
| ISCR | In-situ Chemical Reduction |
| JMA | JMA Wireless |
| LGAC | Liquid-phase Granular Activated Carbon |
| MIHPT | Membrane Interface Hydraulic Profiling Tool |
| MIP | Membrane Interface Probe |
| NTU | Nephelometric Turbidity Unit |
| NYCRR | New York Code, Rules and Regulations |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| OCDWEP | Onondaga County Department of Water Environment Protection |
| PBS | Petroleum Bulk Storage |
| PCB | Polychlorinated Biphenyl |

| | |
|---|---|
| PCE | Tetrachloroethylene |
| PDWP | Pre-Design Work Plan |
| PEC | Paragon Environmental Protection, Inc. |
| PFAS | Per- and Polyflouroalkyl Substances |
| PID | Photoionization Detector |
| PPE | Personal Protective Equipment |
| PVC | Polyvinyl Chloride |
| QA | Quality Assurance |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |
| RAO | Remedial Action Objective |
| RCRA | Resource Conservation Recovery Act |
| RDWP | Remedial Design Work Plan |
| REC | Recognized Environmental Condition |
| RI | Remedial Investigation |
| ROI | Radius of Influence |
| SBR | Sequencing Batch Reactor |
| SCG | Standards, Criteria and Guidance |
| SCO | Soil Cleanup Objective |
| SMI | Seneca Meadows, Inc. |
| SMP | Site Management Plan |
| SOP | Standard Operating Procedure |
| SSDS | Sub-slab Depressurization System |
| SVOC | Semivolatile Organic Compound |
| SWPPP | Stormwater Pollution Prevention Plan |
| TAL | Target Analyte List |
| TCE | Trichloroethene |
| TCL | Target Compound List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TMP | Tax Map Parcel |
| TOD | Total Oxidant Demand |
| TOGS | Technical and Operational Guidance Series |
| USDA | United States Department of Agriculture |
| USDOT | United States Department of Transportation |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compound |
| XDD | XDD Environmental, Inc. |
| XSD | Halogen Specific Detector |
| ZVI | Zero Valence Iron |

# LIST OF UNIT ABBREVIATIONS

| | |
|---|---|
| °C | Degrees Celsius |
| CY | Cubic Yard |
| g/kg | Grams per Kilogram |
| g/L | Grams per Liter |
| gpm | Gallons per Minute |
| mg/Kg | Milligram per Kilogram |
| $NaMnO_4$ | Sodium Permanganate |
| psi | Pounds per Square Inch |
| SF | Square Feet |
| µg/L | Microgram per Liter |
| $\mu g/m^3$ | Microgram per Cubic Meter |
| µm | Micron (micrometer) |

# 1.0 INTRODUCTION

The Former Coyne Textile Facility (Site) is located at 140 Cortland Avenue in Syracuse, New York (Figure 1). The Site owner, Ranalli/Taylor St., LLC (Ranalli/Taylor St.), entered into a Brownfield Cleanup Agreement (BCA) in September 2017 through the New York State Department of Environmental Conservation's (NYSDEC's) Brownfield Cleanup Program (BCP). The Site consists of three tax map parcels (TMP's) as shown on Figure 2 and is registered as BCP Site No. C734144. In December 2019, JMA Wireless (JMA) doing business as GEC Consulting, LLC (GEC), purchased Ranalli/Taylor St. LLC. The remainder of the BCP work will still be completed under the Ranalli/Taylor St. LLC entity, as a volunteer as defined in Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375. New owner contact information has been provided to the NYSDEC following the transfer of the corporate ownership.

CHA Consulting, Inc. (CHA) was retained by GEC to prepare a Remedial Design Work Plan (RDWP) to develop the recommended remedial approach outlined in the Alternatives Analysis Report (AAR) prepared by CHA, dated January 2020 and last revised on March 26, 2020. After reviewing the AAR for completeness, the NYSDEC issued a fact sheet and opened the public comment period for the AAR document from May 13, 2020 through June 27, 2020. To expedite the BCP process, CHA began development of the remedial design concurrent with the public comment period. This remedial design includes the details and specifications for addressing contamination within three primary treatment zones, as further described in Section 2.3.

## 1.1 REPORT ORGANIZATION

The RDWP is divided into seven (7) major sections, including:

- Section 1: Provides an introduction of the project along with a summary of the Site background and past investigations.
- Section 2: Provides a summary of the selected remedy for the Site.
- Section 3: Provides a summary of the pre-design investigation activities conducted to provide design data, including bench scale studies, pilot testing results, and sub-slab communication testing.
- Section 4: Provides a summary of each major element of the remedial design, including the documents that will be utilized for implementation of the remedy.
- Section 5: Provides a summary of required permits and authorizations.
- Section 6: Provides a summary of the anticipated scheduled for implementation of the remedy.

Section 7: Provides a description of post construction plans and reports that will be required for the long-term use and monitoring of the Site.

## 1.2 SITE BACKGROUND

### 1.2.1 Site Description

The Former Coyne Textile Facility is located in an urban area at 140 Cortland Avenue in the City of Syracuse, Onondaga County, New York (Figure 1). The Site is currently unoccupied, contains one building with an approximately 52,000-square foot (SF) footprint, and is zoned for commercial use. The Site is identified as two non-contiguous areas (Figure 2) as described below:

- The former main laundry facility and offices are known as 140 Cortland Avenue (Tax Map No. 094.-05-06.0) and consists of one parcel of land totaling approximately 1.75-acres in size. This parcel will be referred to as the main parcel. The parcel consists of the currently vacant former laundering facility and offices, and concrete sidewalks. The building is a concrete block building with a slab-on-grade foundation.
- The park area and employee parking area are known as 1002-1022 South Salina Street/Cortland Avenue (Tax Map No. 094.-20-01.0) and 10247-1040 South Salina Street/Tallman Street (Tax Map No. 094.-20-02.0) and consist of two parcels totaling approximately 1.70-acres (0.57 and 1.13 acres, respectively) in size. These parcels consist of a small park and a fenced in asphalt parking lot, referred to as Coyne Park and the former employee parking area, respectively.

### 1.2.2 Site History

The 140 Cortland Avenue property was historically utilized as an industrial laundering facility since the mid-1930s under various entities of Coyne Textile Services. Coyne Textile Services filed for bankruptcy and ceased operations in late 2015.

Dry-cleaning activities using tetrachloroethylene (PCE) and Stoddard solvent (a petroleum mixture made from distilled alkanes, cycloalkanes (naphthenes) and aromatic compounds) were conducted at the property until 2000. These dry-cleaning liquids were noted to be stored in aboveground storage tanks (ASTs). Additionally, three underground storage tanks (USTs) were located beneath the dry-cleaning room floor (containing Stoddard solvent) and the boiler room at 140 Cortland Avenue. A gasoline filling station was present in the southern portion of the Site in the 1980s.

The former employee parking lot and park located east of the former laundering facility was owned by Coyne Textile Services from 1989 to 2016. Prior to Coyne Textile Services, previous Site uses included bus storage and repairs, the Syracuse Streetcar Barn, retail stores, and a gasoline filling station (circa 1950-1970).

### 1.2.3 Site Geology & Hydrogeology

According to the United States Department of Agriculture (USDA) Web Soil Survey, the soil beneath the Site is indicative of Urban Land, which is soil material having a non-agricultural, manmade surface layer that has been produced by mixing and filling in urban and suburban areas. Surficial geology consists mostly of lacustrine silts and clays. Bedrock at the Site is mapped by the United States Geological Survey (USGS) as the Syracuse formation, which consists of dolostone, shale, gypsum, and salts.

Field observations and stratigraphic cross sections provided in the Remedial Investigation Report (RI Report) (CHA, February 2019) confirmed the presence of urban fill to a depth of approximately 8 to 10 feet below ground surface (bgs). Generally, silts and clays are present beneath the urban fill to a depth of approximately 13 to 15 feet bgs. Alternating lacustrine silts and clays, then sands and gravel, were encountered beneath the fill material to the end of each boring. At least two silt and clay layers, one below the urban fill and one at varying depths, but approximately 26 to 30 feet bgs, are likely to act as semi-confining layers to impede the vertical transport of groundwater and contamination, however they may not act as impermeable barriers.

Based on groundwater elevations measured on April 19, 2018, the depth to groundwater at the Site is typically less than 10 feet bgs. Beneath the building, groundwater contours are at a nearly flat gradient, apart from the northwestern portion of the building where slightly elevated groundwater levels indicates a localized flow path from the north-western portion of the building toward the center of the building.  Regional groundwater flow is westerly towards Onondaga Creek, located approximately 0.2 miles west of the Site.

### 1.2.4 Previous Reports and Investigations

#### 1.2.4.1 Phase I Environmental Site Assessment

A Phase I Environmental Site Assessment (ESA) was prepared in 2014 by GZA GeoEnvironmental of New York (GZA) in general accordance with the American Society for Testing and Materials (ASTM) Standard Practice E 1527-13. Based on historic use and conditions observed during the Phase I ESA, recognized environmental conditions (RECs) were identified and subsequent investigation activities were completed.

#### 1.2.4.2 Initial Subsurface Investigations

Under the direction of the previous Site owner, multiple Site investigations were conducted in 2014 and 2015. The results of these investigations were detailed in the RI Report prepared by CHA and dated February 7, 2019. In short, these investigations are summarized as follows:

1. *November 2014 Phase II Subsurface Investigation by GZA:* Based on the results including high vapor concentrations as indicated by elevated photoionization detector (PID) readings, petroleum odors, black stained soil, and an oil-like sheen on groundwater samples from the Phase II, GZA recommended additional soil and groundwater sampling to further define the extent of contamination at the Site. Additionally, it was suggested to pursue additional sampling in areas where boring installation was unsuccessful, particularly where floor trenches and drains are located in the former chemical storage and distribution room, and near the laundry machines. The primary contaminants of concern identified in the subsurface soil and groundwater included chlorinated solvents (e.g., PCE and trichloroethene (TCE)) and benzene.
2. *March 2015 Phase III Subsurface Investigation by GZA:* This investigation focused on delineation of the vertical and horizontal extent of petroleum contamination near temporary monitoring well TMW-2 and to further evaluate the soil and groundwater conditions near the boiler room and dry-cleaning area.
3. *2015 Vapor Intrusion Investigation by GZA:* A total of ten indoor air, samples were collected approximately four to five feet above the concrete floor, ten sub-slab vapor samples were collected within ten feet of the indoor air samples, and one outdoor air sample was collected from an exterior upwind location. The investigation revealed that PCE and its breakdown daughter products were present in the northern portion of the existing building on the Site where the laundering activities were conducted. The vapors were detected at concentrations that would require mitigation under New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion, dated 2006 guidelines. Monitoring and/or source identification and exposure measures were determined to be necessary throughout the remainder of the Site building. GZA recommended the installation of a vapor mitigation system, to address the potential vapor intrusion conditions.

The historical sample locations referenced above are shown on Figures 3 through 5.

#### 1.2.4.3 Remedial Investigation

Ranalli/Taylor St. retained CHA to conduct a RI at the Site in 2018 to identify environmental concerns and provide additional information necessary for the AAR. The RI used the data provided in the GZA reports to identify locations where additional investigation was required. The RI included a geophysical survey, surface soil sampling at Coyne Park, subsurface soil sampling at 24 boring locations (Figure 3), the installation and subsequent sampling of groundwater from six permanent groundwater monitoring wells, groundwater sampling from three existing permanent monitoring wells (Figure 4), indoor air sampling at two locations, and vapor intrusion sampling from six temporary sub-slab vapor points (Figure 5). The following summarizes the findings of the investigation:

- Human exposure to Site media such as soil and groundwater is limited due to the Site being primarily covered with buildings and paved asphalt parking areas and the presence of municipal water and sewer at and in the vicinity of the Site.
- The presence of two silty clay layers (beneath the fill material and at a depth of approximately 26 to 30 feet bgs) which have a relatively low hydraulic conductivity and have acted as a confining later to impede the vertical migration of contamination into the more permeable sand and gravel layers at depth.
- Subsurface soils are impacted with volatile organic compounds (VOCs) exceeding the Part 375 Commercial soil cleanup objectives (SCOs) in the approximate location of historical USTs near the northwest corner of the building (Source Area).
- Semivolatile organic compounds (SVOCs) were not detected in soil at concentrations exceeding the Part 375 Commercial SCOs since 2014. These historical exceedances were located beneath the northeastern portion of building and the former employee parking area.
- Metals in soil, detected at concentrations exceeding the Part 375 Commercial SCO, were located beneath the central portion of the building (barium in 2018) and the former employee parking lot area (arsenic in 2014).
- Polychlorinated biphenyls (PCBs) were detected at concentrations less than the Part 375 Commercial SCO beneath the central/northern portion of the building.
- VOCs, including PCE, were detected at concentrations exceeding the Class GA ambient water quality standards provided in the NYSDEC's Division of Water Technical and Operational Guidance Series *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (TOGS 1.1.1). in groundwater. The highest concentrations of VOCs were adjacent to or downgradient of where historical USTs containing dry cleaning solvents were reportedly "closed in place". However, there was a lack of appropriate closure documentation for these USTs.
- Breakdown "daughter" products of PCE, including TCE, 1,2-dichloroethene (1,2-DCE), and vinyl chloride, were detected in groundwater beneath the building at concentrations exceeding TOGS 1.1.1 and are considered the contaminants of concern (COC) for the Site.
- A plume of VOC groundwater contamination originates from the northwestern portion of the building and has spread laterally beneath the building. This investigation was completed at a time of year when the groundwater table is typically high. Additionally, the location of physical structures beneath the slab are not well known. While there are many floor drains and vaults visible along the north end of the building, there is the potential that additional vaults or drains may be present throughout the building that have been filled in place and could be potential preferential pathways influencing the direction of groundwater flow beneath the slab.

- Metals, including aluminum, iron, magnesium, and manganese, were detected in groundwater at concentrations exceeding the TOGS 1.1.1. These compounds are commonly identified in groundwater and are relatively non-toxic.
- Per-and polyfluoroalkyl substances (PFAS) and 1,4-dioxane were detected at select groundwater monitoring wells.
- Elevated concentrations of PCE and TCE were identified in all ambient vapor and sub-slab vapor points. As a result, the sub-slab vapor and indoor air quality in the Building has been impacted by soil vapor intrusion. According to the NYSDOH Decision Matrices (including the May 2017 updates), mitigation is the recommended action.
- Soil vapor points in the employee parking lot and asphalt area to the north of the building were not found to have contaminants associated with the NYSDOH Decision Matrices. Therefore, the parking areas are not impacted by soil vapor intrusion.

Based on the RI and the proposed Site redevelopment plans, CHA recommended the development of an interim remedial measure work plan (IRMWP) to address the soil contamination in the Source Area (refer to Section 1.4 for additional detail) as well as to mitigate the soil vapor intrusion in both the Office and Warehouse areas.

## 1.3 AREAS OF CONCERN

As a result of the RI four primary AOCs were identified, as shown on Figure 6. The four AOCs are defined as: (1) the Former UST Area (Source Area); (2)Site-wide groundwater; (3) Office vapor; and (4) Warehouse vapor. A discussion of the nature and extent of contamination in the soil, groundwater, and sub-surface vapor within these AOCs is provided in the following sections.

### 1.3.1 Former UST Area (Source Area)

The Former UST Area is in the northwestern portion of the building. Several subsurface soil samples, several groundwater samples, and soil vapor samples have been collected in this area.

Historical subsurface soil sampling identified the presence of chlorinated VOC contamination, namely PCE, 1,2-DCE, and vinyl chloride, in soil samples SB-32 and SB-33, at concentrations exceeding their respective Part 375 Commercial SCO, which is consistent with the findings of the RI. During the RI, PCE was identified at concentrations exceeding its respective Part 375 Commercial SCO in sample SOIL-116 and lesser concentrations of TCE, 1,2-DCE, and vinyl chloride in samples SOIL-116 and SOIL-119. PCE was detected in excess of the Part 375 Commercial SCO throughout this area. Metals (mercury and lead) and total PCBs exceeded the

Part 375 Unrestricted SCOs in this area but were detected at concentrations that are less than the respective Part 375 Commercial SCOs.

Historical groundwater sampling in this area identified the presence of chlorinated VOC contamination, including PCE, TCE, 1,2-DCE, and vinyl chloride, in the wells directly adjacent to the Former UST Area. During the RI, well Temp-GW001 and the well cluster at GW-103 were located within and adjacent to the Former UST Area, respectively. COC concentrations of PCE, TCE, 1,2-DCE, and vinyl chloride, among others, were detected at concentrations exceeding their applicable TOGS 1.1.1 groundwater standards and guidance values.

### 1.3.2 Site-Wide Groundwater

The groundwater samples collected as part of the RI confirmed the presence of VOCs and metals at concentrations exceeding their respective TOGS 1.1.1 groundwater standards and guidance values within the northwestern portion of the building. Chlorinated VOCs in groundwater were primarily found in the location of the former dry-cleaning room (Former UST Area/Source Area) and are consistent with the findings from historical Site investigations. The most recent analytical results for PCE indicates a decrease from the historical high of 2,420,000 micrograms per liter (µg/L) in well SB-32 to 21,400 µg/L in nearby temporary well Temp GW-001, and 7.1µg/L in GW-103S. While the concentration of PCE has decreased since the historical investigation, the concentrations of daughter products TCE, DCE, and vinyl chloride have increased, likely due to some natural attenuation. SVOCs were not detected in groundwater during the RI, apart from bis(2-Elthylhexyl)phthalate, which was detected at a concentration exceeding the TOGS 1.1.1. groundwater standards and guidance values for ambient water quality in temporary well Temp-GW001.

The groundwater samples collected as part of the RI confirmed the presence of VOCs, SVOCs and metals at concentrations exceeding their respective TOGS 1.1.1 groundwater standards and guidance values beneath the building.

The shallow monitoring well (GW-101S) was found to have groundwater contamination exceeding applicable TOGS 1.1.1 groundwater standards and guidance values, but the deeper wells (GW-101I and GW-101D) were found to have either no appreciable contamination or are at levels not exceeding applicable TOGS 1.1.1 groundwater standards and guidance values. The silty clay layer was relatively uniform across the Site and has most likely impeded contamination from reaching the intermediate and deeper portions of the aquifer.

The groundwater samples collected from the employee parking lot as part of the RI confirmed the presence of VOCs and metals. However, the concentrations exceeding the applicable TOGS 1.1.1 groundwater standards and guidance values in the employee parking lot are petroleum compounds, notably benzene, isopropyl benzene, and xylene, rather than chlorinated VOCs identified beneath the Site building. Additionally, the presence of contaminants in well GW-105D indicates that deep groundwater may be impacted from an off-site source.

#### 1.3.3 Office Vapor

As shown on Figure 6, the soil vapor impacts to the Office area is another AOC. It is located on the southern portion of the Site where there was an expansion (circa 1980) of the building. This area is in the location of the former gasoline station and historically contained offices on the second and third floors while Coyne Textile was in operation. A concrete block wall with an overhead door and a wall cut-out separates the open space on the first floor from the Warehouse in the older section of the building. One man-door separates the lobby entrance from the Warehouse in the older section of the building.

Current and historical soil vapor intrusion samples indicate that the presence of VOCs is impacting the indoor air quality in the office portion of the building. Ambient indoor air quality sampling identified PCE at a concentration of 34.1 micrograms per cubic meter ($\mu g/m^3$), which exceeds the NYSDOH guidance value for indoor air. Although the concentration does not require immediate action, reasonable and practical actions to reduce exposure should be taken, and therefore, it was recommended that an active sub-slab depressurization system (SSDS) be installed in this portion of the building prior to occupancy.

#### 1.3.4 Warehouse Vapor

The soil vapor impacts to the Warehouse area is the last AOC, located within the older portion of the building (Figure 6), is currently separated from the Office by a concrete block wall with an overhead door, a wall cut-out, and a man-door.

Current and historical soil vapor intrusion sampling indicates that the presence of VOCs is impacting the indoor air quality in the warehouse portion of the building as well. Ambient indoor air quality sampling identified PCE concentration of 50.9 $\mu g/m^3$, which exceed the NYSDOH guidance value for indoor air. Concentrations of TCE were identified at 1.1 µg/m³, which does not exceed the guidance value. Although the concentration of PCE does not require immediate action, reasonable and practical actions to reduce exposure should be taken, and therefore, it was recommended that an active SSDS be installed under this portion of the building as well prior to building occupancy.

## 1.4 INTERIM REMEDIAL MEASURES

### 1.4.1 Source Removal IRM

A Source Removal IRMWP (CHA, May 2019) was approved by the NYSDEC in June 2019 that addressed contaminant source removal via excavation within the Former UST/Source Area. In late June 2019, three USTs within the Former UST/Source Area were removed and transported off-site at a disposal facility, along with approximately 253.9 tons of contaminated material. Excavation of contaminated soil within the area was limited to maintain structural integrity of the building. Prior to backfilling, confirmation samples were collected along the sidewalls and bottom of the excavation, and indicate residual contamination exceeding Commercial SCOs remains. A complete summary of the work completed can be found within the Construction Completion Report (CCR) submitted and approved by the NYSDEC in October 2019. The remaining contamination in the Source Area is addressed as part of this RDWP.

### 1.4.2 Office Vapor IRM

In April 2019 diagnostic pressure field testing was conducted within the office area AOC to determine the most effective system components, pressure gradient, installation methods, and vapor extraction locations for the vapor mitigation design. The Office Vapor IRMWP (CHA, June 2019), was approved by the NYSDEC in June 2019 and provides a design for an active SSDS for that portion of the building. The design includes three active systems, each having its' own extraction fan and dedicated exhaust stack. The SSDS is designed to be operated in its entirety or in any combinations of sub-systems, thus enabling certain sub-systems to be shut down over time as conditions allow and with NYSDEC/NYSDOH approval.

The IRMWP also outlines post-installation testing, sampling, and monitoring as well as the requirements to be included in the CCR to be prepared after the installation of the SSDS and the post-installation system testing. At this time, the SSDS has not yet been installed at the Site. Since the submission of the Office Vapor IRMWP, the owner has decided that the they will be raising the elevation of the floor in the Office area by adding fill, and therefore, a redesigned SSDS for the Office area is discussed as part of this RDWP.

# 2.0 SUMMARY OF SELECTED REMEDY

## 2.1 REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) for the Site are media-specific objectives that are established for the protection of human health and the environment. RAOs are typically narrative statements that identify the contaminants and environmental media of concern, the potential exposure pathways to be addressed by remedial actions relative to the exposed populations and environmental receptors to be protected, as well as the acceptable contaminant concentrations/remediation goals for each environmental medium. The RAOs for this Site are described in the following sections.

### 2.1.1 Surface & Subsurface Soil

***RAOs for Public Health Protection***

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

***RAOs for Environmental Protection***

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

### 2.1.2 Groundwater

***RAOs for Public Health Protection***

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

***RAOs for Environmental Protection***

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

### 2.1.3 Soil Vapor

***RAOs for Public Health Protection***

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

## 2.2 REMEDIAL GOALS

Remedial goals (or targets) are often considered the maximum acceptable contaminant concentrations in each environmental medium that the remedial actions must meet. Remedial goals are usually based on the 6 NYCRR Part 375 applicable standards, criteria and guidance (SCGs) unless SCGs are not available for a particular chemical or media, or the SCGs are not considered sufficiently protective of human health and the environment. For this project, the appropriate SCGs for soil remediation are the Part 375 Commercial SCOs, which is consistent with the zoning of the property, the proposed reuse of the Site as a manufacturing facility, and the anticipated future institutional controls that will be placed on the Site. Similarly, the SCGs for groundwater are the NYSDEC's TOGS 1.1.1 ambient water quality standards and guidance values for Class GA groundwaters.

The goal of the remediation is to reduce or eliminate human exposure to the extent practical in a timely manner. In addition, the remediation should remove the source material and significantly reduce contaminant migration to groundwater, soil vapor migration into the subsoil, and migration of contaminated groundwater to downgradient surface water bodies.

Remedial goals focus on chlorinated VOCs, namely PCE and its breakdown compounds TCE, 1,2-DCE, and vinyl chloride, in sub-slab vapor, subsurface soil, and groundwater. The maximum remediation target depth is estimated at 26 feet below the surface where the first confining layer was observed during the RI. Given that contamination in exceedance of Unrestricted SCOs may still exist in the top 15 feet of the subsurface soils immediately following the implementation of the remedy, the overall goal of the remedial action is to achieve a Track 4 cleanup in accordance with 6 NYCRR Part 375.

## 2.3 DESCRIPTION OF SITE REMEDY

Though not initially anticipated, the discovery of a petroleum AST within the former boiler room and potential associated contamination will be addressed as part of the remedial activities. Treatment Zone 1 will include the removal of an approximately 10,000-gallon fuel oil tank and associated contamination. To address the AOCs identified in Section 1.3, two different remedial activities will take place; Treatment Zone 2 will consist of soil mixing with ZVI injection to address the additional contamination within the Former UST/Source Area AOC, and groundwater recirculation with permanganate injection within Treatment Zone 3 will address the groundwater AOC. The treatment zones are further described in the following sections. As mentioned in later sections, the warehouse and office vapor AOCs will also be discussed as part of this report, however the design for mitigation systems will be provided upon a more defined building layout for the redevelopment of the building and Site.

### 2.3.1 Petroleum Tank & Contaminated Soil Removal – Treatment Zone 1

As further discussed in Section 3.1.1, petroleum contamination was identified during the pre-design subsurface investigation activities related to delineation of the chlorinated compounds at the Site. After a detailed site walk, a fill port was identified in the boiler room and is anticipated to be associated with a former fuel tank. While this discovery was made following submission of the AAR, the previously closed in-place tank along with any grossly contaminated soils around the tank will be excavated and removed for off-site disposal as part of the remedial action, as detailed in Section 4.2.

### 2.3.2 Source Area Treatment with Soil Mixing – Treatment Zone 2

As shown on Figure 7, the Source Area consists of an area approximately 4,925 square feet in size. Within this area, soil contamination was observed above Part 375 Commercial SCOs and groundwater was observed above TOGS 1.1.1 ambient water quality standards (AWQS) and guidance values for Class GA waters. The Source Area extends beyond the previous IRM excavation both vertically and horizontally, but further removal was not feasible at the time without undermining the existing building foundation.

Soil mixing will be utilized and involves the mechanical agitation of subsurface soils while blending in the treatment reagents. The mechanical agitation breaks apart the natural soil structure, homogenizes the soils, and helps to distribute the chemical additive, establishing more uniform contact between chemical additive and the contaminants. Given the heterogenous soils on Site, including silts and clays, soil mixing is considered a particularly useful strategy for successful treatment and provides a high certainty of effective treatment. Success of this remedy is dependent on contact with the contaminant mass and does not require advection or diffusion to distribute the oxidant to the contaminant. In an area such as the Source Area, this is a critical component to effectively treating the high levels of soil and groundwater contaminants and reduce further migration of contamination.

Soil within the Source Area will be remediated via soil mixing while injecting a slurry of zero valent iron (ZVI). While the AAR considered injection of sodium permanganate in this area to treat the contaminants via in-situ chemical oxidation (ISCO), , results of the bench scale treatability study (see Section 3.1.2) indicated that excessive chemical additives would be necessary to treat this area. Therefore, a second bench scale study was completed using ZVI to treat the contaminants via in-situ chemical reduction (ISCR) and it was determined that ISCR was a more practical approach to address this area. The soil mixing area has been divided into three sub-areas with different initial excavation depths and mixing intervals as further described in Section 4.3.

### 2.3.3 Groundwater Treatment & Recirculation – Treatment Zone 3

As indicated on Figure 7, an approximately 20,300-square foot plume area (outside of the Source Area footprint) along the east side of the main property is proposed to be treated using ISCO chemistry. Specifically, this area of the Site will be treated via groundwater recirculation with the addition of sodium permanganate. Using this strategy, contaminated groundwater will be removed through extraction wells, mixed with the sodium permanganate, and reinjected into the subsurface through a series of injection wells. However, prior to mixing the water with sodium permanganate, the water will pass through liquid-phase granular activated carbon (LGAC) to remove benzene and other contaminants that may not be treated via permanganate. The LGAC units must be placed in front of the permanganate introduction to avoid the adverse impacts the permanganate would have on the carbon beds.

### 2.3.4 Soil Vapor Mitigation

Elevated soil vapor concentrations were detected beneath the existing building sub-slab during previous investigation activities. As previously indicated, the vapor concentrations beneath the building warrant mitigation. Perforated vapor collection pipes and/or suction points will be distributed throughout the footprint of the new building and vertical exhaust stacks will be routed above the roof where extraction fans will be installed to draw vacuum beneath the slab. Additionally, a vapor barrier will be installed beneath the new concrete slab systems. Additional details regarding the vapor mitigation systems are described in Section 4.5 of this report.

### 2.3.5 Soil Cover Systems

Only the main property with the existing building will be modified at this time. Specifically, the approximately northern two-thirds of the existing building (e.g. the warehouse) is scheduled for demolition but the impervious concrete floor will be restored or replaced as part of the construction. Portions of the existing asphalt lot north of the building will remain in place but some areas will be removed and replaced. All portions of the Site that are *disturbed* will meet the following minimum cover system requirements:

1. Impervious Areas: All impervious surfaces will include concrete or asphalt pavement installed at a minimum of four inches in thickness. The impervious surfaces will act as a surface cover to significantly reduce infiltration and limit exposure to future Site occupants.
2. Green Space Areas: All green space areas will include a minimum of a one-foot thick layer of imported, clean material (e.g. topsoil) placed above a demarcation barrier that will provide a physical barrier to any potential remaining contamination in existing Site soils. The demarcation barrier will consist of a 6-ounch non-woven geotextile or similar.

No remedial action is planned for some portions of the Site, and therefore, the following existing cover systems will remain in place and will be maintained as part of the remedial work:

1. Coyne Park parcel: The existing soil and vegetation will be maintained in this area.
2. Employee Parking Lot: The existing asphalt pavement will be maintained in this area.
3. Office Building: The south end of the existing building is scheduled for renovation. Any penetrations made through the existing concrete slab in this area will be patched as part of the redevelopment construction.

If these areas are to be disturbed during Site redevelopment, prior to the approval of a Site Management Plan (SMP), the following procedures, at a minimum will be followed:

- Excavation of Site soil will be managed with 40-hour trained HAZWOPER personnel
- Site soil will be characterized and hauled off-Site to a permitted facility
- Cover systems will be installed as discussed above

# 3.0 PRE-DESIGN INVESTIGATIONS

The Pre-Design Investigation activities were performed in accordance with the *Pre-Design Work Plan* (PDWP) prepared by CHA and dated February 2020. The results from these investigative activities were utilized to provide additional information necessary for completing the remedial design.

### 3.1.1 MIPHT Investigation

To more accurately define the horizontal and vertical extents of contamination within the groundwater plume, CHA conducted additional investigation using Membrane Interface Hydraulic Profiling Tool (MIHPT) technology. CHA retained Cascade Environmental (Cascade) to implement MIHPT using a membrane interface probe (MIP) inserted using direct-push technology (DPT) in the form of a Geoprobe®. The locations shown on Figure 8 were chosen for purposes of further delineating the plume area.

The MIP system operates by heating the soil and groundwater adjacent to the probe to 120-degrees Celsius (°C) to volatilize VOCs in the immediate vicinity of the MIP membrane. The volatilized VOCs diffuse across the membrane into a closed, inert gas loop that carries the vapors to a series of detectors housed at the surface. Each detector produces a continuous profile, plotted with respect to depth, to indicate the presence of various VOC compounds. The MIP continuously measures halogens with a halogen specific detector (XSD), VOCs with a PID and/or flame ionization detector (FID), and electrical conductivity. Additionally, the system is designed to evaluate the hydraulic behavior of unconsolidated materials by injecting clean water into the subsurface and recording changes in the associated pressure to calculate hydraulic conductivity. The MIHPT system provided real-time information that allowed CHA and Cascade the ability to make field-based decisions and more accurately delineate the plume. As data was obtained from each of the points in the transect, CHA worked with Cascade to determine representative "step-out" locations to complete the delineation. Upon completion of the investigation, the data was converted into a three-dimensional (3D) model and vertical profiles which are provided in Appendix A.

During the investigation, evidence of petroleum-based contamination, indicated by significantly high PID and FID readings near the top of the water table, was identified at several locations including MIP-2, MIP-3, MIP-11, and MIP-17. A record review for the Site identified the presence of an approximately 10,000-gallon tank used to store No. 6 fuel oil located in a subterranean vault with physical access for inspections that was utilized for the storage of No. 6 fuel oil. Upon further inspection, a fill port was observed within the former boiler room but no vault or manway for access could be located. Previous investigations primarily identified chlorinated solvents as the Site-wide contaminant of concern, so the presence of petroleum contamination identified during the MIHPT investigation altered the overall design to include the removal of the fuel oil tank and excavation of petroleum contaminated soils to the depth of groundwater, as further discussed in Section 4.2.

Vertical profile information from the XSD, which identifies chlorinated solvents, was used to verify the depth of contamination within and adjacent to the Source Area. This information assisted with the design of soil mixing treatment zones by expanding the soil mixing area and identifying appropriate target depths for treatment.

Additionally, the groundwater plume treatment area was better constrained through the information gathered during the MIHPT investigation. Impacts from chlorinated solvents were not identified at MIP-9 and MIP-15. This information was compared to the results of previous investigations and it was determined the impacted groundwater plume is smaller than previously estimated, thus reducing the size of the required treatment area.

### 3.1.2 Bench-Scale Treatability Study

After completion of the MIHPT investigation, CHA collected soil and groundwater samples from the Site for use in a bench-scale treatability study conducted by XDD Environmental, LLC (XDD). The purpose of the bench test was to evaluate the following:

- Permanganate stability and total oxidant demand (TOD) in the Source Area; and,
- Permanganate stability and groundwater kinetics in the plume area.

#### 3.1.2.1 Permanganate Stability and TOD

The stability test evaluated the persistence of permanganate in the presence of Site soil and groundwater in a series of duplicate test reactors. The stability test was performed using sodium permanganate at two initial target concentrations and potassium permanganate at one initial target concentration. Approximately 1.5 pore volumes of reagent were applied to the soil. The residual permanganate in each reactor was evaluated at 1, 7, and 14 days. Throughout the test, the soil was periodically mixed in a manner to simulate soil mixing in field application. XDD used the data generated during the permanganate stability test to evaluate oxidant demand. TOD includes the demand from the contaminants, reduced metals, and any additional non-target demand on the oxidant that may be present in the soils. Therefore, the TOD of the oxidant in the presence of a representative contaminated soil sample was used to determine oxidant loading for the remedial design.

Soil collected from the Source Area was found to have a substantially higher TOD than anticipated, with an estimated value of 250 grams per kilogram (g/kg). TOD for a second soil sample with similar soil classification but from an area known to be less contaminated was analyzed for comparison. This sample was found to have an estimated TOD of 150 g/kg. Therefore, a significant portion of the TOD is from natural oxidant demand. Typically, a TOD less than 20 g/kg is appropriate for permanganate to be effective. The unusually high TOD for Site soils and the excessive quantity of permanganate needed to satisfy the TOD resulted in a determination that the use of permanganate in the Source Area would cost over $5,000,000 in chemicals alone, and therefore, was considered impractical.

Based on this information, CHA requested XDD evaluate the use of ZVI in lieu of the permanganate as the additive for the soil mixing treatment of the Source Area. ZVI is considered a chemical reducing agent which can initiate an abiotic oxidation-reduction reaction, which often bypasses the reduction to more harmful daughter products (e.g. vinyl chloride). When PCE, or other ions/molecules like oxygen (i.e., the "oxidizing agent"), meet ZVI, the ZVI loses electrons and PCE gains electrons. This electron transfer causes the breakdown of PCE. As the ZVI is exposed to target contaminants, as well as other non-target constituents in the groundwater, the ZVI surface will eventually become oxidized (typically forming surficial ferric oxide or ferric oxyhydroxide). This can be seen visually as corrosion or rust formation on the surface of the ZVI. As the iron oxide film forms on the surface of the ZVI particle, it will start to impact the performance of the ZVI. This oxidation-reduction process will lead to the eventual passivation of the ZVI surface, at which point the capacity of the ZVI will be exhausted.

As discussed in the AAR, ZVI was eliminated as an option for groundwater plume remediation due to the required direct contact between the ZVI surface and contaminant mass and longer timeframe needed for treatment due to inefficiencies during injection. However, direct contact is more easily achieved in soil mixing compared to injection. Due to direct contact between the fine-grained ZVI and contaminated soil, it is estimated the reduction reactions will begin to occur quickly (a matter of days or weeks) and ZVI will remain in the subsurface for up to seven years.

#### 3.1.2.2 ZVI Bench Test

The objective of the bench scale testing was to determine the required ZVI material loading for direct source treatment via soil mixing and to account for contaminant mass and non-target constituents that could passivate the ZVI and reduce long-term efficacy. XDD evaluated two loadings of Ferox Flow, 2 percent and 4 percent by weight of soil, and one loading of Ferox Target, 2 percent by weight of soil. Both Ferox Flow and Ferox Target ZVI materials are trade names of Hepure Technologies, Inc., a ZVI vendor headquartered in Hillsborough, New Jersey. The difference between these two types of ZVI is the particle size/available surface area of the iron particles. Ferox Flow has an average particle size of 125 microns (µm) while Ferox Target has an average particle size of 44 µm. In general, the smaller the particle size the more available surface area on the iron is available to expedite the reduction reactions; however, with a smaller particle size, the ZVI is also consumed in a shorter timeframe. Typically, the kinetics of ZVI is a slower process than ISCO as the reactions require time for the contaminants to reach the surface of the ZVI.

Soil from the Source Area was provided to XDD for the bench scale testing. Baseline analysis of VOCs showed lower than typical concentrations found in the Source Area, so the soil was spiked to approximate concentrations of historical samples. XDD spiked the soil sample with approximately 2,500 milligrams per kilogram (mg/kg) PCE and approximately 300 mg/kg 1,2-DCE.

The bench testing was conducted in a series of batch reactors at approximately 20 °C. Each batch reactor consisted of Source Area soil saturated with one pore volume of groundwater to be representative of the lower, saturated soil layer. This simulated a conservative, worst-case scenario for the Source Area soil mixing since some of the contaminants in groundwater are expected to partition onto soil. Two loadings of Ferox Flow (2 percent and 4 percent by weight of soil) and one loading of Ferox Target (2 percent by weight of soil) was applied to the treated test conditions. Control reactors consisted of saturated soil without ZVI and were carried through the same procedures as the test reactors. The reactors were periodically mixed over the four-week test period. After four weeks, all reactors were sacrificed for the laboratory analysis of VOCs by United States Environmental Protection Agency (USEPA) Method 8260.

The results of the ZVI treatability study are shown on Table 1 included in Appendix B. In summary, the greatest reduction in PCE concentrations was observed at a 4 percent loading of Ferox Flow ZVI. The PCE concentration was reduced by over 52 percent in approximately 37 days of operation. CHA notes that while the cis-1,2-DCE concentration only decreased by 2.8 percent during this time, it is expected that some of the PCE degraded to cis-1,2-DCE during the course of the evaluation and that results are only indicative of a net decrease. CHA also considered utilizing a higher dose of the Ferox Target ZVI; however, CHA selected Ferox Flow for this project to reduce the potential for passivation of the ZVI to occur too soon following the soil mixing.

#### 3.1.2.3 Groundwater Kinetics for Permanganate

In-situ chemical oxidation using recirculation was proposed as part of the AAR for treating the groundwater plume. In a recirculation system, groundwater is extracted and mixed with a chemical oxidant in an aboveground treatment tank. The extracted groundwater and the oxidant are allowed sufficient contact time to treat the VOCs before re-injection into the subsurface. The minimum residence time will vary depending on the oxidant concentration, and the concentration of VOCs in groundwater.

To determine the residence time and the quantity of oxidant required CHA provided XDD with 2.5 liters of groundwater collected from the Site. XDD then submitted a baseline sample of Site groundwater for VOC analysis by Absolute Resource Associates, LLC (ARA) using USEPA Method 8260. Baseline analytical results indicated the concentration of VOCs was lower than typically identified on the Site. Therefore, XDD spiked the groundwater with cis-1,2-DCE to a concentration of approximately 154 µg/L and benzene to a concentration of approximately 70 µg/L, which are the average results observed from historical samples collected on Site. XDD tested the kinetics of Site groundwater with three concentrations of sodium permanganate: 5 grams per liter (g/L), 10 g/L, and 20 g/L.

XDD evaluated the rate of degradation of VOCs in groundwater for each oxidant concentration tested. The residual concentrations of permanganate and VOCs were evaluated at 0, 10, 30 and 60 minutes of contact time for each oxidant concentration. At each time point, the permanganate oxidation reaction was stopped by adding ascorbic acid to duplicate sacrificial reactors. The neutralized reactors were submitted for laboratory analysis of VOCs by USEPA Method 8260. Residual permanganate concentrations for each test condition were also measured at each time point using iodometric titration.

Results of the groundwater kinetics study are provided in Table 3.1. The results indicate the lowest concentration of sodium permanganate (5 g/L) was capable of reducing the concentration of cis-1,2-DCE to below the analytical method detection limit of 2 µg/L in the shortest amount of contact time (10 minutes). Note that the analytical method detection limit for1,2-DCE is lower than the TOGS 1.1.1 ambient groundwater quality limit of 5 µg/L. Therefore, the aboveground treatment system can be designed to sufficiently treat the contaminated groundwater while continuously recirculating given the short contact time. Additionally, the results indicate benzene is unaffected by sodium permanganate treatment even at the highest concentration and longest contact time. This confirms the requirement to add a granular activated carbon step in the overall treatment system prior to re-injection in order to meet TOGS 1.1.1. standards.

**Table 3.1 Groundwater Kinetics Results**

| Test Condition | Time Point | Concentration of Spiked COC (µg/L) | |
|---|---|---|---|
| | | cis-1,2-DCE | Benzene |
| Control | 0 | 180 | 35 |
| | 10 | 170 | 30 |
| | 30 | 180 | 28 |
| | 60 | 175 | 33 |
| Sodium Permanganate 5 g/L | 10 | <2.0 | 34 |
| | 30 | <2.0 | 32 |
| | 60 | <2.0 | 34 |
| Sodium Permanganate 10 g/L | 10 | <2.0 | 34 |
| | 30 | <2.0 | 33 |
| | 60 | <2.0 | 34 |
| Sodium Permanganate 20 g/L | 10 | <2.0 | 34 |
| | 30 | <2.0 | 29 |
| | 60 | <2.0 | 32 |

### 3.1.3 Groundwater Recirculation Pilot Test

After completion of the MIHPT investigation, two pilot test wells (wells PT-MW-01 and PW-MW-02) were installed at representative areas within the target groundwater treatment zone. Additionally, a piezometer (PT-PZ-01) was installed approximately 6.2 feet southeast of well PT-MW-02 in order to monitor drawdown or mounding in the subsurface. The previously installed well GW-102 used for the same purpose adjacent to well PT-MW-01 and was located approximately 13.7 feet southwest of the test well.

The objectives of the pilot test were to evaluate Site-specific hydraulics to develop full-scale design parameters including:

- Injection and extraction radius of influence (ROI) to determine the number and spacing of injection and extraction wells.
- Achievable injection and extraction rates (without significant mounding or drawdown) to determine estimated duration, cost of the permanganate application, and identify potential failure points (i.e., oxidant surfacing or short-circuiting).
- Potential impact of subsurface heterogeneities that may impact chemical distribution.

The pilot test was specifically completed to determine the maximum injection flow rate that can be sustained at the Site without oxidant solution surfacing and to determine if a comparable extraction rate can be sustained without excessive groundwater drawdown. Results of the pilot test were used to establish the optimal injection and extraction rates for the full-scale ISCO design, as further discussed in Section 4.4.

During the injection phase of the pilot test, approximately 2,000 gallons of potable water was injected into the two test wells simultaneously from a polyethylene storage tank. The rate of injection started at approximately 2.5 gallons per minute (gpm) and was gradually increased to approximately 4.5 gpm. No significant mounding of the groundwater table and short-circuiting of the subsurface soils was observed. Generally, during the course of the test, the groundwater elevation in the nearby monitoring wells GW-102 and PT-PZ-100 increased by 2.01 feet and 1.61 feet, respectively. The injection phase was completed over an approximately five-hour period.

Following injection, the extraction phase of the pilot test was conducted. Approximately 2,000 gallons of groundwater was extracted from the two test wells simultaneously and pumped into a polyethylene storage tank. The rate of extraction started at approximately 2.5 gpm and was increased to a maximum flow of approximately 4.6 gpm. Groundwater elevation in the nearby monitoring wells GW-102 and PT-PZ-100 decreased by 2.27 feet and 2.43 feet, respectively. The extraction phase was complete over an approximately six-hour period.

Overall, no significant mounding or draw-down and short-circuiting were encountered during the pilot study. The results indicate that both the injection and extraction rates of 4 gpm or more was sustainable and could be used for the design of the full-scale system. CHA does not expect more significant groundwater mounding or drawdown due to the fact that injection and extraction will be performed simultaneously during full scale operations.

The groundwater collected in the polyethylene tank during the extraction phase was sampled for waste disposal parameters guided by the Onondaga County Department of Water Environment

Protection (OCDWEP) requirements. Paragon Environmental Construction, Inc. (PEC) was retained to remove the groundwater from the tank using a vacuum truck and dispose of the groundwater at an OCDWEP permitted facility. A fully executed manifest for the groundwater disposal from the pilot study is provided in Appendix C.

### 3.1.4 Sub-Slab Communication Test

Sub-slab communication testing for the installation of a sub-slab depressurization system using suction points was conducted by Alpine Environmental for the office and warehouse sections of the building on April 8th and 9th, 2019 and February 11th and 12th, 2020, respectively. However, due to changes in the Site redevelopment and the plan to import clean fill to raise the Site grades, the results of the communication testing are no longer valid and will not be utilized for design purposes.

# 4.0 REMEDIAL DESIGN

The following subsections outline the major elements of the remedial design. The design drawings associated with the design are included in Appendix D and the technical specifications have been included in Appendix E.

## 4.1 SITE PREPARATION

### 4.1.1 Site Controls

Site controls including site access, site security and work zones will be established during the Site preparation activities as detailed below.

#### 4.1.1.1 Site Access

Site access is currently restricted by a combination of secured doorways on the existing building and perimeter fencing with locked gates. As portions of the existing building are demolished, additional perimeter fencing will be installed, and access will be limited through secured gates to the areas of active remedial construction. If access to the remedial areas encroaches into the adjacent right of ways for access to the remedial areas, the construction manager will be responsible for securing the appropriate permits from the City of Syracuse.

#### 4.1.1.2 Site Security

The need for additional site security beyond site fencing (e.g. security cameras, overnight guards) will be provided at the discretion of the construction manager.

#### 4.1.1.3 Work Zone Establishment

Exclusion Zone

An exclusion zone will be established around the areas of intrusive construction activities (excavation activities, drilling of wells, soil mixing, etc.) but the limits of the exclusion zone will be adjusted throughout the remedial construction to limit the size of the exclusion zone and allow other non-remedial construction activities to occur on the Site outside the exclusion zone. Orange construction fencing or other similar moveable barricades, along with appropriate signage (e.g. “Restricted Area – Authorized Personnel Only”), will be installed around the perimeter of exclusion zone to keep unauthorized personnel away from intrusive and/or excavation activities. If possible, soil will be pre-characterized by the remedial contractor and direct loaded into dump trucks for off-site disposal at a permitted facility. However, smaller quantities of soil requiring off-site disposal (e.g. drill cuttings) will be placed into roll-off containers, or similar, and covered while awaiting waste characterization and disposal. If necessary, temporary soil containment pads will be constructed within the exclusion zone to stage materials awaiting characterization and/or off-site disposal. Soil containment pads are further described in the Technical Specifications included in Appendix E.

Contamination Reduction Zone

A Contamination Reduction Zone will be established in a location immediately adjacent to the work area to facilitate the decontamination of the personnel and equipment that encounter contaminated soils. Personnel working inside the exclusion zone will decontaminate or dispose of soiled clothing in the contamination reduction zone each time the exclusion zone is exited.

Appropriate equipment, supplies, and personal protective equipment (PPE) will be made available in the contamination reduction zone to facilitate the protection and decontamination of personnel working in the exclusion zone. Decontamination of equipment and personnel will be handled in accordance with CHA Standard Operating Procedures (SOPs) Nos. 501, 503, 505, and 507 included in Appendix F. Other SOPs have been included for items such as documentation requirements, collection of samples, etc. CHA SOPs are to be followed by CHA personnel and are considered guidance for Contractors.

Prior to commencing intrusive activities, the heavy equipment will be visually inspected for cleanliness. At the discretion of CHA's site representative, additional decontamination of the equipment will be performed in accordance with the protocols established in the SOPs included in Appendix F prior to start of the intrusive actives. Additionally, equipment will be decontaminated at the conclusion of intrusive activities and prior to demobilizing equipment from the project Site. Appropriate precautions will be taken throughout the intrusive processes to limit contact with contaminated soil. Only parts of equipment that have contacted the soil will require decontamination. Examples of such precautions for the soil excavation activities include:

- Efforts will be made to advance the excavation face towards the excavator such that the tracks on the machine do not track impacted soils across the Site.
- Where possible, all roll-off containers or trucks will be loaded adjacent to the excavation. Care will be taken such that impacted soil is not spilled on the sides of the containers/trucks as they are loaded and that the trucks do not drive through contaminated soils. If wet soils are encountered, dry soils will be placed near the swing gate of the container (rear tailgate of the truck) and wetter soils will be placed near the front of the container/truck. If the soils are saturated, either polyethylene sheeting or tub liners will need to be installed in the

container or truck dump boxes or the soils will be stabilized on containment pads prior to loading to avoid spillage or liquids dripping out of the truck/container during the hauling process.

- Efforts will be made to minimize the amount of equipment and machinery that contacts the impacted soils. This includes placing polyethylene sheeting between the excavation and the container/truck during loading to limit incidental spillage onto a clean surface.

Non-disposable personal protective clothing will be decontaminated by first washing the soiled items with a non-phosphate detergent and potable water mixture, followed by potable water and distilled water rinse. Disposable/expendable clothing will be placed into plastic trash bags for off-site disposal at a solid waste facility. Equipment that contacts contaminated soil will be decontaminated with a high-pressure steam cleaner.

The Contamination Reduction Zone setup will involve the construction of up to two temporary decontamination pads. The primary decontamination pad will be used for decontaminating large equipment. The pad will be constructed with a minimum of two-layers of 10-mil polyethylene sheeting with raised berms and overspray guards around the perimeter to maintain wash fluids on the pad. A portable spill containment pad with drive through berms and side panels or similar equipment may be used in lieu of the building a temporary equipment decontamination pad. All wash water from the decontamination pads will be collected in a low spot and managed in accordance with the Technical Specifications included in Appendix E. A second, smaller decontamination pad will be constructed, if necessary, for the decontamination of personnel and small hand tools.

#### 4.1.1.4 Erosion & Sediment Controls

Work surfaces for the proposed remedial construction activities consists of existing concrete slabs on grade. The area of disturbance will be maintained to less than one acre during the remedy. Therefore, a full Stormwater Pollution Prevention Plan (SWPPP) will not be prepared for the Site and only semi-permanent erosion control measures and best management practices will be utilized. These include:

- The installation of SiltSoxx™ around the perimeter of open excavations associated with the removal of an existing fuel oil storage tank and the soil mixing areas.
- Placement of filter fabric or other inlet protection around any catch basins within the work zone (e.g. potential catch basins along South Clinton Street).
- Soil cuttings associated with the installation of the injection and extraction wells will be contained on the concrete slab and transferred to a roll-off container, drums, or soil

containment pad. Given that the wells will be installed with surface seals and the cuttings will be placed within containment while awaiting disposal, no special erosion and sediment controls will be required for the well installation.

Erosion and sediment controls associated with the overall redevelopment construction as well as permanent erosion and sediment controls will be addressed under a separate set of contract documents.

#### 4.1.1.5 Truck Routing

Truck traffic leaving the Site will typically be along Cortland Avenue on the east side of the Site to South Salina Street. From there, trucks are expected to travel north on South Salina Street approximately 0.5-miles to Adams Street. Truck traffic is then expected to follow the following routes:

- **Westbound traffic:**
  - Turn left on West Adams Street and travel approximately 0.2 miles to the traffic light.
  - Continue straight onto Seymour Street for approximately 0.2 miles.
  - Turn right on South West Street and continue approximately 0.9 miles northward to Interstate 690 West.
- **Eastbound/Northbound/Southbound traffic:**
  - Turn right onto East Adams Street and travel approximately 0.5 miles eastward.
  - Southbound traffic will turn right onto the on Interstate 81 South ramp.
  - Northbound and eastbound traffic will turn left onto the I-690 Westbound ramp and then follow the signs for Interstate 81 North and Interstate 690 East, respectively.

Incoming truck traffic is expected to follow the same general routes in reverse.

### 4.1.2 Remedial Action Project Plans

The following project plans are incorporated within the RDWP as appendices:

- Health and Safety Plan (HASP)
- Community and Environmental Response Plan (CERP) and Community Air Monitoring Plan (CAMP)
- Field Sampling Plan (FSP)
- Quality Assurance Project Plan (QAPP)
- Monitoring Well Decommissioning Specification

#### 4.1.2.1 Health and Safety Plan

A site-specific HASP was prepared to provide specific guidelines and establish procedures for the protection of on-site personnel during remedial construction activities. The HASP is included in Appendix G. Contractors and subcontractors on-site during the remedial activities will develop, implement, and maintain their own site-specific HASP in accordance with the specifications included in Appendix E. While the HASP in Appendix G provides the minimum guidelines for worker safety for the project, each contractor must develop a detailed plan that addresses the specific job hazards their personnel will encounter during implementation of the remedy.

#### 4.1.2.2 Community and Environmental Response Plan and Community Air Monitoring Plan

A combination CERP and CAMP was prepared to address the potential for short-term impacts to the surrounding community or environmental resources. In summary, air monitoring will be performed during the intrusive remedial activities in accordance with the NYSDOH *Generic Community Air Monitoring Plan*. The CERP/CAMP plan includes measures for monitoring both fugitive dust and organic vapors. In addition, the CERP/CAMP identifies action levels during construction and appropriate mitigation methods to address any exceedances of the action levels. A copy of the CAMP is included in Appendix H.

#### 4.1.2.3 Field Sampling Plan

Field sampling will be conducted during the remedial activities in accordance with the field sampling procedures including progress monitoring and end point sampling included in the QAPP. A copy of the FSP is included in Appendix I.

#### 4.1.2.4 Quality Assurance Project Plan

A QAPP has been prepared to present the policies, organization, objectives, functional activities and specific Quality Assurance (QA) and Quality Control (QC) activities designed to achieve the specific data quality goals associated with the Site. The QAPP identifies the procedures for sample preparation and handling, sample chain-of-custody, laboratory analyses, and reporting requirements to confirm the accuracy and integrity of the data generated during the investigation. The QAPP is provided in Appendix J.

4.1.2.5 Monitoring Well Decommissioning Plan

Eight existing monitoring wells require decommissioning as part of the remedial action and proposed Site redevelopment. Two of the existing monitoring wells are located within Treatment Zone 2 and the bottom depths of the monitoring wells are at a higher elevation than the targeted soil mixing zone as subsequently discussed in this RDWP. Therefore, these shallow wells will be completely removed/destroyed as part of the soil mixing process, but the remaining six existing monitoring wells will be decommissioned in accordance with the latest version of the NYSDEC's Policy "CP-43: Groundwater Monitoring Well Decommissioning Policy." Currently, it is anticipated that each monitoring well will be decommissioned by grouting in-place. A well decommissioning specification is included in Appendix E. Additionally, all extraction (32) and injection (29) locations will be decommissioned upon completion of the remedial action prior to Site redevelopment in accordance with the same procedures.

### 4.1.3 Utility Services

Electrical Service

A temporary electrical service will be made available for the remedial contractor's use during the remedial construction. The electrical service will be used for providing power to miscellaneous transfer pumps and the contractor's power tools. However, the pumps included in the ISCO recirculation system will consist of air-driven double diaphragm pumps. The remedial contractor will be responsible for mobilizing an air compressor to operate these pumps.

Water Service

The Site is currently serviced with water service from the City of Syracuse. Any potable water required for the remedial construction (e.g. mixing of grout for the injection/extraction wells, decontamination, etc.) will be provided from a water service within the office building. Alternatively, the remedial contractor may secure a hydrant permit from the City of Syracuse to obtain potable water from a hydrant adjacent to the Site. The use of a City hydrant, if required, will require a backflow prevention device to be connected directly to the hydrant and any hoses to be connected to the backflow prevention device.

Sanitary Sewer Service

No dedicated sanitary service is anticipated to be necessary for this phase of the project. If existing restrooms in the office building are not available during the remedial construction, temporary, portable toilets will be setup at the Site.

## 4.2 TREATMENT ZONE 1 - EXCAVATION AND REMOVAL OF FUEL OIL TANK

### 4.2.1 Soil Excavation

Upon completion of Site preparation activities, soil removal will commence in Treatment Zone 1 as shown on Figure 7 to prepare for the removal of the estimated 10,000-gallon tank. As part of the preparation for Treatment Zone1, the existing concrete slab within an approximately 5,750-square foot (SF) area will be sawcut and removed exposing the Site soils beneath. The removed concrete will be disposed of off-site at a properly permitted facility as construction and demolition (C&D) debris. Following the removal of the concrete, the Site soils will be excavated to expose the top and sides of the AST and/or the vault. The tank and a portion of the vault will them be removed in accordance with Section 4.2.2.

Following removal of the tank, petroleum-contaminated soils are expected to be encountered based upon previous investigation results. Therefore, additional soil will be excavated beneath the tank to approximate depth of nine feet below the ground surface where the groundwater table has previously been encountered. However, the remedial contractor will be directed to attempt to remove the “smear zone” at the interface of the vadose and saturated zones if significant contamination is observed. The exact limits of the excavation will be based upon field screening of the soils for visual, olfactory and photoionic evidence of contamination in accordance with the Technical Specifications included in Appendix E. However, it estimated that a maximum of approximately 1,900 cubic yards (CY) of soil will be removed from Treatment Zone 1. Additional excavation may be necessary to provide safe slopes such that personnel can access the excavation to inspect the subgrade and complete in-place nuclear density testing prior to and during the backfill operations.

All excavated soil will be directly loaded into dump trucks and/or roll off containers for off-site disposal if pre-excavation waste characterization samples are collected and a waste profile is accepted by the disposal facility prior to commencing the excavation activities. In the event soils cannot be directly loaded into dump trucks/containers, soil will be staged on temporary soil containment pads in accordance with the Technical Specifications included in Appendix E. Stockpiles will be limited to the extent practical while awaiting analytical for off-site disposal. Each temporary soil containment pad will be of sufficient size to store up to the maximum amount of soil that can be excavated in one day and will be lined with a minimum of 20-mil polyethylene sheeting. A one-foot high berm will be constructed around the perimeter of the pads to control runoff/run-on to and from the stockpiles. All stockpiles will be covered with 10-mil thick polyethylene sheeting while awaiting loading and off-site disposal to prevent the contaminants from volatilizing into the air and/or causing potential odor problems around the project Site and/or to prevent surface water from potentially conveying contaminants away from the project Site. All sheeting used to cover stockpiles will be properly weighted down to prevent tearing and wind damage.

#### 4.2.2 Tank Removal

The former Coyne Textile Services facility is identified a Petroleum Bulk Storage (PBS) Site No. 7-072842 by the NYSDEC. Based upon the registration, Tank No. 001 is a 10,000-gallon No. 6 fuel oil tank that is listed as closed in-place. No detailed information regarding the tank closure was made available to CHA. Therefore, it is unknown how the tank was decommissioned (e.g. whether sludge was removed prior to filling, type of fill material, etc.) and the current condition of the vault.

As part of the excavation process in Treatment Zone 1, the existing fuel oil tank will be decommissioned and removed in accordance with the Technical Specifications included in Appendix E. In summary, removal of the tank will include:

- Purging of any product lines back to the tank
- Cutting and capping of any utilities and product pipelines connected to the tank
- Inerting of the tank headspace
- Removal and disposal of fill material (if present), remaining product, and sludge from the tank
- Cleaning of the inside of the tank and proper off-site disposal of decontamination fluids
- Removal of the tank
- Cutting and/or crushing of the tank to render it unusable
- Off-site disposal/recycling of the tank carcass

#### 4.2.3 Fluids Management

While dewatering of the Site will not be necessary as part of the remedial construction activities, construction-derived wastewater/fluids collected from soil containment pads and decontamination pads will required collection and proper characterization for off-site disposal. Any fluids generated during the remedial processes will be placed in United States Department of Transportation (USDOT)-approved containers, labelled, characterized/profiled and properly disposed off-site.

All wastewater shall be managed in accordance with applicable federal, state and local regulations. The Contractor will provide a container (e.g., drums, polyethylene tanks, frac tank or similar) for temporary on-site water storage followed by transport to an off-site disposal facility. Following collection, the Contractor will be responsible for the collection of appropriate waste characterization samples. Water samples will be analyzed, at a minimum, for the following:

- Target Compound List (TCL) VOCs by USEPA Method 8260;
- TCL SVOCs by USEPA Method 8270;
- TCL PCBs by USEPA Method 8082;
- Target Analyte List (TAL) metals and cyanide by USEPA Methods 6010, 7471 and 9012;
- Pesticides via USEPA method 8081;
- Herbicides via USEPA method 8151; and,
- pH.

Additional characterization may be necessary prior to transporting for off-site disposal and will be confirmed by the remedial contractor prior to sampling. Samples will be stored in a cooler with ice and submitted to an Environmental Laboratory Approval Program (ELAP) certified laboratory under chain-of-custody protocols. Water will be transported for disposal in accordance with all USDOT requirements as well as NYSDEC Part 364 requirements.

Appropriate controls will be used to prevent spills and overflows, including but not limited to, monitoring, gauging, quick-close shut-off valves, and secondary containment. Storage containers will be decontaminated following disposal or discharge activities. Residual sediment in the storage containers will be dewatered/stabilized, if necessary, and disposed of off-site in a similar manner as the contaminated soils being disposed of off-site.

### 4.2.4 Waste Characterization Sampling

As previously indicated, all soils requiring off-site disposal will require appropriate waste characterization and profiling prior to transport. The specific analytical waste characterization requirements of the waste disposal facility may vary and will be verified prior to sampling. Sampling frequency is anticipated to be one sample for every 1,000 CY of soil disposed. The waste characterization samples will be submitted to a laboratory certified under the NYSDOH's ELAP for analysis following appropriate chain-of-custody protocols. The parameters likely required by the waste disposal facility may include the following:

- Toxicity Characterization Leaching Procedure (TCLP) VOCs by USEPA Method 8260;

- TCLP SVOCs by USEPA Method 8270;
- TCLP Resource Conservation and Recovery Act (RCRA) 8 Metals by USEPA Methods 6010;
- TCLP Pesticides via USEPA Method 8081;
- TCLP Herbicides via USEPA Method 8151;
- Total PCBs via USEPA Method 8082;
- Ignitability (flashpoint);
- Corrosivity (pH);
- Reactivity; and,
- Percent Solids.

#### 4.2.5 Material Transport & Disposal Off-Site

Following characterization and receipt of an approved waste profile from the selected disposal facility, the soil excavated for off-site disposal will be transported and disposed of in accordance with all local, State (including 6 NYCRR Part 360) and Federal regulations. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Final Engineering Report (FER). This documentation will include waste profiles, test results, facility acceptance letters, manifests/bills of lading and facility receipts/weight tickets.

All transport of materials requiring off-site disposal at a permitted facility will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and loaded vehicles leaving the Site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, and local requirements. Material transported by trucks exiting the Site will be secured with tight-fitting covers. Loose-fitting canvas and/or mesh-type truck covers will be prohibited. Trucks will be prohibited from transporting saturated soil. Rather, saturated soil should be placed on a containment pad to facilitate dewatering prior to shipment.

#### 4.2.6 Confirmation Sampling

Once soil is removed from the excavation, confirmation soil sampling will be conducted in accordance with the NYSDEC Division of Environmental Remediation Program Policy 10 (DER-10), Section 5.5. One soil sample will be collected from near the bottom of the sidewalls from the interior area of the excavation support system, for every 30 linear feet of sidewall. A minimum of one bottom of excavation sample will be collected at a depth from zero to two feet below the bottom of excavation for every 900 square feet of the excavation. Based on estimated size of the excavation, approximately 17 confirmation soil samples will be collection from the excavation at completion, including approximately ten sidewall samples and six bottom samples. It is noted that the required number of bottom samples is based upon the areal extent of the excavation rather than the length of tank given that the extent of the excavation is intended to extend beyond the footprint of the tank. Based upon the conditions encountered following tank removal and contaminated soil excavation, additional samples may be required based upon several factors, including but not limited to, observed contamination remaining in the excavation. All samples will be submitted to an ELAP approved laboratory, following proper chain-of-custody protocols and analyzed for the following parameters:

- TCL VOCs via USEPA Method 8260;
- TCL SVOCs via USEPA Method 8270;

Analytical methods, sample volumes, preservation techniques and holding times associated with the above samples are provided in the QAPP included as Appendix J.

The analytical results of the confirmation sampling will be provided to the NYSDEC and NYSDOH once available from the laboratory. The decision to backfill the excavation will be determined in consultation with the NYSDEC based upon the analytical results meeting the 6 NYCRR Part 375 Commercial SCOs and/or the feasibility of continued excavation (e.g., proximity to building foundation footers, property boundaries, etc.).

#### 4.2.7 Imported Material

Material proposed for import onto the Site will meet the requirements set forth in NYSDEC DER-10 prior to receipt at the Site. Material from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the Site. The types of clean fill that will need to be imported as part of the project include:

- Structural fill material for general backfill material and pavement subbase.
- Topsoil for restoration of green space areas.
- Asphalt (binder and top courses) for restoration of paved areas.

Before fill materials are brought onto the Site, the Contractor will supply the Engineer with the name, location, a brief site operational history, and certified analytical test results for soils originating at the proposed site or facility for review and approval. No imported soils or fill will be allowed onto the Site before they are accepted by the Engineer. The fill must be free of organic matter, wood, trash, etc. which cannot be properly compacted in accordance with the Technical Specifications. Materials containing less than ten percent passing a No. 80 sieve (fines), such as washed gravels, will not require analytical testing if the material originates from a permitted quarry and a letter from the facility owner is submitted indicating that the facility processes virgin material only and is not known to have ever supported commercial or industrial use.

Sampling is required for all imported soil for use as backfill or cover material that has ten or more percent of the material by weight passing the No. 80 sieve. In accordance with NYSDEC DER-10, Table 5.4(e)10, the following table indicates the number of samples required for importation of soil to the Site.

**Table 4.1 Imported Fill Sample Quantity Requirements**

| Soil Quantity (cubic yards) | Grab Sample | Composite Sample |
|---|---|---|
| 0-50 | 1 | 1 |
| 50-100 | 2 | 1 |
| 100-200 | 3 | 1 |
| 200-300 | 4 | 1 |
| 300-400 | 4 | 2 |
| 400-500 | 5 | 2 |
| 500-800 | 6 | 2 |
| 800-1,000 | 7 | 2 |
| >1,000 | 2 additional grab samples every 1,000 cubic yards or consult with NYSDEC | 1 additional composite sample every 1,000 cubic yards or consult with NYSDEC |

Samples will be analyzed for the same parameters as virgin soils, each grab sample will be analyzed for TCL VOCs and each composite sample will be analyzed for TCL SVOCs, TCL pesticides, TCL herbicides, PCBs, PFAS, 1,4-Dioxane, and TAL metals.

## 4.3 TREATMENT ZONE 2 - SOURCE AREA TREATMENT WITH SOIL MIXING

### 4.3.1 Excavation & Handling of Clean Stone

As mentioned previously to address the contamination within the Former UST/Source Area AOC during the implementation of the Source Removal IRM near the northwest corner of the existing building, approximately 253.9 tons of non-hazardous soil was excavated and disposed of off-site at Seneca Meadows, Inc. (SMI), as documented in the Source Removal IRM CCR prepared by CHA and dated October 14, 2019. The limits of excavation were approximately 21.5 feet by 24.5 feet, which was the footprint of the Former UST Area room less approximately 18-inches around the perimeter of room and is considered Treatment Zone 2B, as shown on Figure 7. The depth of excavation was nine feet bgs, several feet below a footer that was exposed. To prevent damage to the building foundation from potential undermining, the excavation was terminated at this depth.

Following completion of the excavation, the contractor placed an eight-ounce non-woven geotextile across the bottom and along the sides of the excavation to serve as a demarcation barrier. The excavation was backfilled with approximately 218.1 tons of No. 2 stone containing less than ten percent by weight of material passing through a No. 80 sieve as well as 42.3 tons of crusher run imported from T.H. Kinsella, Inc.'s quarry located in Jamesville, New York.

Prior to commencing with the soil mixing activities in this area of the Site, this virgin aggregate placed above the demarcation barrier will be excavated and staged in an area of the Site away from the remedial activities for eventual reuse. While the demarcation barrier will reduce comingling of the this imported material from Site soils, any material that does become cross-contaminated with Site soils will be segregated and disposed of off-site with the other material removed from the Source Area. Additionally, while the virgin aggregate is anticipated to have been placed above the groundwater table, any material below the water table will be left in place or disposed of off-site due to the potential for cross-contamination.

#### 4.3.2 Excavation & Handling of Overburden Site Soil

As indicated on Figure 7, Treatment Zone 2 has been divided into three sub-treatment zones. Treatment Zone 2A borders the south and west sides of the former Source Area excavation and will be pre-excavated to a depth of two feet below the ground surface (approximately 6-inches of concrete and 18-inches of soil) to accommodate swelling during the soil mixing process which will include the addition of ZVI as further described in subsequent sections of this report. Treatment Zone 2C is located along the north side of Treatment Zones 2A and 2B and will also be pre-excavated to a depth of two feet (approximately 6-inches of concrete and 18-inches of soil) to accommodate the anticipated swelling during the soil mixing process. A portion this material will be stockpiled in accordance with the Drawings and Technical Specifications for re-use as backfill in Treatment Zone 2B. Soil not used as backfill will be sampled for waste characterization purposes, profiled and disposed of at a properly permitted off-site facility as previously described in Sections 4.2.1 and 4.2.5.

#### 4.3.3 Zero-Valent Iron Treatment & Mixing

As result of the bench scale testing, it was determined that reduction chemistry was a more effective strategy for addressing the remaining contamination in Treatment Zone 2. The Ferox

Flow ZVI (or equivalent sized ZVI) will be mixed into the existing soil using soil mixing techniques. The means and methods for the soil mixing implementation will ultimately be determined by the Contractor; however, it is anticipated that ZVI will be delivered to the Site in a dry powder form in either super sacks (1,000 kilograms each) or drums. The material will be batched with potable water so that it is sufficiently fluidized for pumping and injected at the target depth at the mixing head. The soil mixing with ZVI treatment zones will include the following:

- Treatment Zone 2A – 2,450 SF area mixed from 9 to 16 feet bgs (approximately 640 CY)
- Treatment Zone 2B – 450 SF area mixed from 9 to 16 feet bgs (approximately 120 CY)
- Treatment Zone 2C – 2,025 SF area mixed from 9 to 26 feet bgs (approximately 1,275 CY)

As indicated above, the vertical extent of most of the contamination is a maximum of 16 feet bgs. However, the maximum depth of the contamination in Treatment Zone 2C extends to a depth of up to 26 feet bgs.

The typical methods for mixing the ZVI with the existing Site soils includes either a single shaft vertical auger system or a traverse rotary tool blender (e.g. Alpine & Lang mixing tools). With the auger system, the drilling shaft typically includes a cutting head with a bottom discharge for the injection of the ZVI mixture, discontinuous auger flights and/or mixing paddles to improve the mixing efficiency. With a rotary tool blender, the main drill stem turns on a vertical axis while the drums on the bottom of the drill stem counter-rotate on a horizontal axis creating a powerful mixing action. The ZVI would be injected through the main drill stem to the mixing head to maximize contact with the Site soils. With both approaches, the treatment zones will each be divided into cells, which are typically sized based upon the amount of area that can be treated in one workday. Within each column, the soil will be mixed with the ZVI in an overlapping column pattern to obtain the desired dosing and distribution of the ZVI. By working in columns/grids, the amount of soil that is exposed at one time will be limited. The anticipated cell size is approximately 20-feet by 18-feet in size. Additionally, the soil being mixed with ZVI is located within the saturated zone, and therefore, water at the surface of the mixing zone is anticipated to also reduce the rate of volatilization within the mixing area. VOC emissions will be monitored via handheld PID and CAMP stations in accordance with the CAMP included in Appendix H.

To add compressive strength to the unsaturated zone soils (approximately 2 to 9 feet bgs) following the ZVI mixing process in the saturated zone and provide a reasonably stable surface to facilitate construction for the Site redevelopment, Portland cement will be added to the soil within the unsaturated zone. A temporary batch plant will be erected on Site and will consist of fresh water in poly tanks and bulk cement. The cement will be stored in silos or hoppers and fed through a calibrated valve for agitation and circulation. The mixing system will be calibrated against time to deliver a predetermined weight, water will be controlled by flow meter(s) and volume indicators within the colloidal mixer. The soil mixing with cement treatment zones will include the following:

- Treatment Zone 2A – 2,450 SF area mixed from 2 to 9 feet bgs (approximately 640 CY)
- Treatment Zone 2B – 450 SF area mixed from 2 to 9 feet bgs (approximately 120 CY)
- Treatment Zone 2C – 2,025 SF area mixed from 2 to 9 feet bgs (approximately 525 CY)

Given that cement will not be added within the ZVI treatment interval, the geotechnical engineering design is currently planning to utilize deep foundation techniques for the new building construction within this area of the Site.

#### 4.3.4 Unconfined Compressive Strength Testing & Core Drilling

Per the Technical Specifications included in Appendix E, at least one set of mixed soil/cement samples will be collected for each active day of mixing whenever cement is used. Each sample will be tested for unconfined compressive strength via ASTM Method C-39. The Portland cement and soil mixture will be required to achieve a minimum unconfined compressive strength of 50 pounds per square inch (psi) at 7 days and 75 psi at 28 days.

### 4.4 TREATMENT ZONE 3 - GROUNDWATER TREATMENT & RECIRCULATION

Treatment Zone 3 is an approximately 20,000 SF area that encompasses a large portion of the existing building footprint as shown on Figure 7. To address the VOC groundwater contamination in this area a groundwater recirculation system with ISCO will be used. The remedial action for Treatment Zone 3 will include the installation of 32 extraction wells and 29 injection wells installed within the plume area. The groundwater will be pumped from the extraction wells, passed through bag filters to remove larger soil particles that may be extracted through the wells, run through LGAC, mixed with sodium permanganate ($NaMnO_4$), and then reinjected into the subsurface following treatment, as further detailed below. It is anticipated that approximately 22 days of recirculation and treatment would be required to complete the treatment of the groundwater in Treatment Zone 3, which excludes startup calibration time, equipment change overs, anticipated downtime, etc.

### 4.4.1 Installation of Groundwater Extraction/Injection Wells

As previously indicated, all equipment will be decontaminated prior to demobilization from the Site; however, decontamination of equipment between each borehole will not be required for this project. Soil cuttings will be collected and placed into a covered roll-off container or drums for characterization and off-site disposal. Soil cuttings from drilling operations will not be used as backfill in any of the monitoring wells.

The extraction and injection wells will be constructed in accordance with the Drawings included in Appendix D and will include the following:

- A minimum 6-inch dimeter borehole will be advanced to a depth of 25 feet bgs
- 2-inch diameter, 0.010-inch slot Schedule 40 polyvinyl chloride (PVC) well screen with a screened interval of 15 to 25 feet bgs
- 2-inch diameter, Schedule 40 PVC riser extended approximately 30 to 36 inches above the ground surface
- Following installation of the riser, it will be immediately capped to keep out foreign debris until other equipment associated with the recirculation system is installed
- A No. 0 sand pack will be installed in the annular space around the well screen to an elevation of approximately one foot above the well screen and a one-foot layer of fine choke sand will be placed over the sand pack
- A 12-inch layer of hydrated bentonite chips will be placed over the sand back and fine sand choke
- The remaining annular space with be tremie grouted to the ground surface using a cement-bentonite grout

The newly installed wells will be developed until the turbidity of the groundwater is less than 50 nephelometric turbidity unit (NTUs), or for a maximum of two hours each, whichever comes first.

### 4.4.2 Groundwater Recirculation & Treatment

#### 4.4.2.1 Design Parameters & Operational Sequencing

Based upon the bench scale results as previously described in Section 3.0 of this report and the calculations provided in Tables K-1 through K-5 in Appendix K, the following design parameters were selected for the recirculation and treatment system:

1. Pore volume: 336,623 gallons (based upon effective porosity)
2. No. pore volumes to treat: 2 each
3. Total volume treated: 673,246 gallons

4. No. of injection wells: 32 each
5. No. of extraction wells: 29 each
6. No. wells in operation: 16 extraction/16 injection (simultaneously)
7. Minimum injection rate: 4 gpm per well
8. Total min. injection rate: 64 gpm
9. Hours of injection per day: 8 hours
10. Volume injected per day: 30,720 gallons (4 batches of 7,680 gallons each)
11. Expected injection duration: 11 days (for 16 wells and two pore volumes)
12. Total injection duration: 22 days (for all 32 wells and two pore volumes)
13. $NaMnO_4$ injection conc.: 5.0 grams per liter (g/L)
14. Mass of $NaMnO_4$ required: 28,968 pounds (normalized to 275-gallon totes)

Since only 16 extraction wells (half of the well field) and 16 injection wells will be operated at one time, it will be necessary to operate the injection/extraction system for approximately 22 days, not including the time for making switchovers in the wellfield. However, to allow for reaction time between each pore volume, the system will be operated in the following sequence:

1. The first set of 16 extraction wells and 16 of the injection wells will be operated simultaneously to treat the *first pore volume* in the first half of the wellfield.
2. The second set of 16 extraction wells and 16 of the injection wells will be operated simultaneously to treat the *first pore volume* in the second half of the wellfield.
3. The first set of 16 extraction wells and 16 of the injection wells will be operated simultaneously to treat the *second pore volume* in the first half of the wellfield.
4. The second set of 16 extraction wells and 16 of the injection wells will be operated simultaneously to treat the *second pore volume* in the second half of the wellfield.

Since only 29 injection wells will be installed in the wellfield, it will be necessary to utilize three of the injection wells when treating both halves of the wellfield.

#### 4.4.2.2 Groundwater Extraction & Treatment System Overview

Groundwater from Treatment Zone 3 will be pumped from the plume area through 32 extraction wells. The well field extraction equipment will include:

1. A ¾-inch diameter suction line consisting of braided/reinforced tubing with a check valve/screen located at the end of the tube and approximately 12-inches off of the bottom of the well.

2. Two ¾-inch diameter suction tubes will be connected to ¾-inch diameter Schedule 80 PVC pipe via quick-connect camlocks. The PVC piping will be equipped with ball valves that are then connected to a pump. One of the ball valves on each branch would be “normally open” to allow withdraw of water from the well connected to the pump while the other ball valve would be “normally closed” in an off position. This configuration will allow the contractor to control which wells are operated during each phase of the recirculation and treatment process. A total of 16 extraction pumps will be installed as part of the extraction side of the recirculation system.
3. The rigid Schedule 80 PVC pipe will be connected to an air-driven double diaphragm pump. The pumps will be Sandpiper® S1F non-metallic pumps fitted with chemically compatible seals or equal. Each pump will be equipped with a regulator to control the air pressure delivered to the pump and a needle valve to control the air flow rate to the pump.
4. The pump discharge will be connected to 3/4-inch diameter Schedule 80 PVC pipe and include:
    a. Ball valves to allow isolation of a particular extraction system branch
    b. A flow meter (Signet 2551 Magmeter by GF Piping Systems © or equal) to monitor the discharge flow rate from each pump and allow field adjustments to each individual branch of the well field
    c. A gate valve to allow adjustments to the discharge flow rate from the pump and provide back pressure if need to improve the pump operation
    d. A check valve to prevent water from backflowing into a well should it run dry
    e. A sight glass to allow for visual observation of significant turbidity that may be coming from a particular well and the visual evidence of the recirculation of the sodium permanganate (e.g. purple coloration of the water)
5. A group of four pumps will be connected to a two-inch diameter Schedule 80 PVC sub-header. A total of four sub-headers will then be connected to a two-inch Schedule 80 PVC header. The header piping will receive water from up to 16 pumps within the well field at one time. At the proposed extraction rate of approximately 4 gpm per well based upon the results of the pilot study, the design rate for the treatment train is a minimum of 64 gpm.
6. The suction hoses will be grouped together on one end of the containment area and a minimum of an eight-foot wide temporary ramp system will be installed over the hoses to protect them from small equipment traffic as well as reduce the tripping hazards immediately adjacent to the treatment train.

#### 4.4.2.3 Bag Filter System

The header pipe conveying the combined flow from the extraction wells will first pass through a flow meter and a 25- µm bag filter system to reduce the amount of any solids that come from any extraction wells. While only one bag filter will be utilized at a time, two bag filters will be installed in parallel such that the system can remain operation when the filter on one of the units is being replaced. Each bag filter will be able to be isolated via ball valves.

#### 4.4.2.4 Activated Carbon Treatment

Following the filtration, the water will flow through two LGAC vessels to remove certain VOC compounds (e.g. petroleum-related compounds, PFAS, and 1,4-dioxane) that will not be oxidized by the sodium permanganate oxidation chemistry. The LGAC units will be plumbed in series so that they can be operated in a lead/lag pattern. Each LGAC unit will include a 2,000-lb carbon bed that will accommodate the design flow rate of 64 gpm and provide a residence time of approximately 7.8 minutes. CHA has specified that Model No. TW 72 GAC units as manufactured by Calgon Carbon Corporation, or equal, will be utilized as part of the treatment system. At the design flow of 64 gpm, the estimated pressure drop for each carbon vessel is approximately 1.6 pounds per square inch (psi). The LGAC units have been sized for 26 days of constant (i.e. 24/7) use before breakthrough. Given that the estimated time for the remedy is 22 days breakthrough is not anticipated. However, if the lead unit has breakthrough, it will be switched to the lag position and the granular activated carbon (GAC) in the lead vessel will be replaced. Once the carbon is changed, the lead vessel will become the new lag vessel.

The GAC will also remove some of the 1,2-DCE (vinyl chloride adsorption is anticipated to be negligible) therefore, the units have been upsized to accommodate the removal of this compound. While CHA had initially planned to install the GAC units following the addition of the sodium permanganate, a quick bench scale study indicated that the GAC would significantly reduce any residual permanganate concentration after completion of one batch (batching is discussed in the next section), and thus, the design was modified to include the GAC units ahead of the sodium permanganate. While much of the sodium permanganate will be consumed during the batching process, there is a benefit to having a residual concentration in the water that is injected into the subsurface to address any contamination that is bound to soil particles.

#### 4.4.2.5 Sodium Permanganate Treatment

A solution of 40-percent sodium permanganate will be injected into the water piping following the bag filter system using another double-diaphragm pump and the chemical will be mixed with the raw water by passing it through an in-line static mixer. Based upon the bench scale treatability study and average contaminant concentrations, it was determined that the addition of sodium permanganate at a dosage rate of 5 g/L with an exchange of two pore volumes within the plume area will reduce the target contaminants by approximately 85 percent overall.

The average starting concentrations of VOCs utilized in the treatability study were artificially high due to the fact that the water provided from the predesign investigation had little VOCs present and XDD had to spike the water utilized in the study. Based upon the actual average groundwater VOC concentrations anticipated to be present in the plume and the fact that there will be residual permanganate in the groundwater that is reinjected into the plume, the actual percent mass reduction is expected to be higher. CHA notes that as part of the bench scale study, all of the VOCs were reduced below the applicable groundwater standards and guidance values with the exception of vinyl chloride. The concentration of vinyl chloride was reduced to 3.3 µg/L versus a groundwater standard of 2 µg/L overall. However, while the vinyl chloride concentration was reduced during the study, it is expected that there was some creation of vinyl chloride during the oxidation process as vinyl chloride is a daughter product of some of the Site COCs.

CHA has selected a sequencing batch reactor (SBR) approach for the treatment process to simplify the controls required for the remedial system as well as to facilitate closer monitoring of the dosing of the sodium permanganate mixed with the raw water from the plume. At a targeted flow rate of 64 gpm, a two-hour batch would generate 7,680-gallons of water per batch that will be pumped into an approximately 8,400-gallon polyethylene reaction tank that is properly vented. To achieve the targeted injection concentration of 5 g/L, approximately 70.5-gallons of 40 percent $NaMnO_4$ will be added to the extracted water via piping and passed through a static mixer to blend the chemical and water together. Following the static mixer, the combined flow will be injected into the reaction tank for a total batch volume of 7,750.5 gallons. To treat two full pore volumes (673,246 gallons), the recirculation operation will include 88 batches. The tank inlet will be located approximately six inches off the bottom of the tank and will be horizontal such that the water stream will create additional mixing (i.e. swirling) within the tank.

Two polyethylene reaction tanks will be necessary for efficiency in the recirculation system. As one batch tank is being filled, the mixed water in a second reaction tank will be injected into the wellfield. The 40 percent sodium permanganate solution will be delivered to the Site in 275-gallon totes (263 gallons per tote) and a maximum of 14-totes will be included per shipment. Based upon the total volume of 40 percent sodium permanganate solution required to treat two pore volumes within the plume area (see Table K-5 in Appendix K), a minimum of 24 totes will be necessary to complete the Treatment Zone 3 remediation.

#### 4.4.2.6 Groundwater Injection

After each batch is completed and allowed a reaction time of up to ten minutes following the addition of water and chemical into the tank, a double-diaphragm pump (S20 Non-Metallic 2-inch pump as manufactured by Sandpiper® pump, or equal) will be utilized to inject the mixed water back into the wellfield utilizing 16-injection wells simultaneously. A nozzle located on the bottom of each tank will be plumbed to the pump with a ball valve system to control flow from only one tank at a time. To direct flow to each of the injection wells, the treated water will pass into to a three-inch Schedule 80 PVC well header where the flow will be split to direct flow to the desired injection wells. Each branch of the injection header will include:

1. A flow meter that will be utilized to estimate the flow rate into each branch.
2. A ¾-inch tee fitting and 90-degree elbows to split the flow from the flow meter two different wellheads.
3. A ball valve on each sub-branch. Typically, one valve would be “normally open” and one valve would be “normally closed” so that only half of the wells are being utilized for injection at one time.
4. A gate valve would be included on each leg as well so that the flow can be controlled for each leg and create backpressure of the pump, if necessary.
5. Following the valves, ¾-inch diameter braided/reinforced injection tubing will be attached to the PVC piping via a quick-connect camlock and each tube will be connected to a wellhead.
6. At each injection wellhead, the tubing will be connected to a rigid pipe assembly, including a check valve, a pressure gauge, a sample port that can be utilized to bleed air in the line if necessary, a clear sight glass, and a threaded coupling for attachment to the well riser.
7. The injection hoses will be grouped together on one end of the containment area and a minimum of an eight-foot wide temporary ramp system will be installed over the hoses to protect them from small equipment traffic as well as reduce the tripping hazards immediately adjacent to the treatment train.

### 4.4.3 Confirmation Sampling

Although grab water samples may be collected during the operation of the of the recirculation system to evaluate the removal efficiency of the targeted VOC compounds, no confirmation sampling will be utilized to determine when the recirculation operation is complete. Rather, the end point will be based upon the time required to treat two pore volumes within the groundwater plume at the targeted injection concentration of 5 g/L as previously described. Long-term groundwater monitoring will be conducted following the completion of the remedial action to facilitate evaluation of the reduction of the VOC mass over time. However, the long-term groundwater monitoring will be included as a requirement in the SMP that is developed after the implementation of the remedy and is not detailed in this document.

## 4.5 SOIL VAPOR MITIGATION

As previously indicated, the planned redevelopment construction at the Site includes raising the existing Site grades by at least two feet with imported fill, including a top layer of open-graded stone as further discussed below. Therefore, the soil vapor mitigation system(s) will be designed for new construction rather than a system that would be consistent with a building retrofit system. Specifically, to reduce the number of overall systems and the number of vertical exhaust stacks required to mitigate the entire building footprint, the system will include perforated, horizontal pipe runs in lieu of suction points only. The system is anticipated to be an active system which will include system fans and alarms.

The SSDS design will be comprised of multiple sub-systems, each of which will have a system fan and distinct exhaust stack. The system can be operated in its entirety or in any combination of sub-systems, thus enabling certain sub-systems to be shut down over time, as conditions allow and as the NYSDEC/NYSDOH approve such modifications. Monitoring points for evaluating the system will be evaluated and presented with the SSDS design which will be submitted under a separate cover to NYSDEC/NYSDOH once the foundation plans for the new building are finalized.

Prior to the installation of the SSDS, the Owner will be consulted for the most recent floor plan of the new building. That layout will then be used to design the SSDS and identify and evaluate any potential conflicts. Though not anticipated, conflicts will be resolved prior to installation of the system, and any changes made that impact the system layout/configuration as designed will be presented to NYSDEC/NYSDOH for approval prior to installation. Given that the building redevelopment plans are still currently underway, the SSDS design is not included in this RDWP. CHA will submit the SSDS design plan showing each sub-system to NYSDEC/NYSDOH under separate cover. The sections below provide an overview of the minimum components anticipated to be included as part of the SSDS system. The SSDS design will comply with the latest ANSI CC-1000 Standard.

### 4.5.1 Venting Stone

A minimum of a 12-inch thick gas venting layer of crushed stone will be installed immediately beneath the floor slabs of the structure(s). A crushed stone with 10 percent or less fines (material passing a No. 200 sieve) is required to facilitate air movement and good communication beneath the building slab(s). A mixture of 50 percent NYSDOT, Size No. 1 and 50 percent NYSDOT, Size No. 2 stone will be specified for this project.

### 4.5.2 Vapor Barrier

A Class A, 15-mil polyethylene resin vapor barrier meeting or exceeding all requirements of ASTM 1745-17 will be specified above the gas vapor collection system and beneath the slab-on-grade. The vapor will be in direct contact with the slab beneath the office areas and manufacturing areas. A combination of vapor barrier boots, pressure sensitive seam tape, and mastic, as specified, will be utilized to seal the barrier around penetrations in the vapor barrier. It should also be noted that the vapor barrier is sufficiently puncture- resistant to allow the placement of reinforcing steel directly on the barrier prior to the placement of concrete.

### 4.5.3 Piping and Extraction Points

The SSDS piping and extraction points will be installed in accordance with the following procedures:

<u>Horizontal Piping</u>

- A minimum of a 4-inch diameter, perforated Schedule 40 PVC piping will be installed beneath the proposed slab-on-grade to facilitate the extraction of vapors beneath the slab. The piping network will include horizontal laterals with a spacing of one pipe every 40 feet on center. Appropriate PVC tees, bends, etc. will be incorporated into the design to complete the pipe network. All pipe, fittings, and valve connections will be solvent welded.
- The horizontal pipe runs shall be no more than six inches beneath the concrete slab. Other utilities will be installed beneath the collection system so that the collection pipes are closest to the slab where vapor accumulation is most likely. A minimum of four inches of stone will be placed above and below the PVC pipe to protect the pipe from excessive stresses. A heavier duty pipe (e.g. Schedule 80 PVC, HDPE pipe, etc.) will be required where the venting stone is not maintained at the minimum 12-inches in thickness.
- The horizontal pipes will be laid flat.
- The proposed layout attempts to maintain the collection pipes five feet from exterior walls to minimize the potential for drawing air into the system from beyond the building footprint.
- If grade beams or other subsurface obstructions exist, a six-inch steel sleeve or similar will be cast in the concrete to allow the perforated pipe to be installed following form removal and reduce the potential for isolated areas that are not mitigated. Continuity of the stone media is crucial to maintain airflow beneath the entire building footprint. Additional vertical exhaust stacks may be added in areas where maintaining continuity is not possible (e.g. obstructions, foundation walls, etc.).

<u>Vertical Piping/Exhaust Stacks</u>

- Exhaust stacks will consist of a minimum of 4-inch diameter, solid Schedule 40 PVC pipe and shall be included approximately every 150 linear feet along the horizontal pipe runs. All pipe, fittings, and valve connections will be solvent welded, with the exception of fan connections, which will be connected utilizing flexible rubber couplings.
- A minimum of a 12'x12"x12" (one cubic foot) stone sump will be installed at the bottom of each vertical exhaust stack beneath the slab to facilitate percolation of any condensate draining downward from the exhaust stack.
- Vertical exhaust pipes shall be enclosed within a pipe chase within the office space and are not permissible in the occupied/habitable space. Exposed pipes within the manufacturing and warehouse areas of the building are permissible as long as the pipes are appropriate protected from damage (e.g. within the web of a steel column).
- If horizontal pipe runs are needed abovegrade (e.g. below the roof deck) to route the exhaust stack penetration to a different location on the roof or if the stacks are grouped prior to penetration through the roof, the horizontal pipe(s) will be sloped back towards the extraction point in the slab to facilitate drainage of condensate.
    - All bends, if necessary, will be fabricated form 45-degree bends to reduce frictional losses in the piping network.
    - Horizontal pipe runs will be sloped toward the extraction points or a moisture discharge point at a minimum of 1/16-inch per linear foot (0.5 percent). No water traps will be permissible.
- Horizontal and vertical pipes will be secured to the roofing system and walls at intervals in accordance with the New York State Building codes. At a minimum, pipes will be supported every eight feet vertically and every six feet horizontally.
- To avoid entry of subsurface vapors into the building, the exhaust/discharge pipe shall be:
    - A minimum of 18 to 24 inches above the surface of the roof (preferably above the highest level of the roof)
    - At least ten feet above the ground level
    - At least ten feet away from any opening that is less than 2 feet below the exhaust point
    - At least ten feet from any adjoining or adjacent buildings, or heating, ventilation and air conditioning (HVAC) intakes or supply registers
    - All exhaust pipes will be fitted with a protective screen or cover to reduce the potential for water and vector intrusion.
    - All pipes will be properly supported to prevent potential wind damage, such as constructing a uni-strut system to mount the fans onto.

### 4.5.4 Pathway Sealing

All joints, penetrations, and termination points within the concrete slab will be sealed with self-leveling polyurethane caulking (Sikaflex® - 1c SL, Geocel 3300 or equivalent) to make the slab airtight.  Gaps up to 5/8-inches wide may be sealed with caulk only; however, gaps larger than 5/8-inches wide will be sealed with at least two rows of closed-cell foam backer rod followed by caulking.  Hydraulic cement can be used to seal gaps wider than one inch in the slab(s).

#### 4.5.5 System Fans

Each sub-system will include a fan which, together will be installed to induce a vacuum beneath the entire floor slab and induce a pressure gradient between the sub-slab of the building and the interior space.  The fan specified for each sub-system will be the Fantech Rn4 Inline Radon Fan, or similar.  All fans will be installed on the exterior of the building and will be installed in accordance with the manufacturers' installation instructions.

#### 4.5.6 System Monitoring

The systems will be monitored via monitoring panels.  The monitoring systems will include a pressure gauge for each of the sub-system fans that will measure the real time pressure after each extraction point.  The pressure gauges and low-pressure alarms will be connected to a monitoring panel and will be powered with one 110-volt electrical receptacle.

#### 4.5.7 System Labeling

Vapor mitigation system piping and components will be clearly labeled as follows to facilitate accurate identification for operation, maintenance and monitoring purposes:

- Exhaust stacks will be labeled with permanent stick-on labels which will correspond to an as-built drawing.  Additionally, each pressure gauge/alarm pair will be labelled at the monitoring panel and each fan will be labelled with a weather and ultraviolet resistant label that corresponds with the exhaust stack number/extraction point number.
- Above slab piping will be labeled at least once every 20-feet, at least once per room, and at least once every floor.  The label will state "Vapor Mitigation System" and will be readable from a distance of three (3) feet.
- Electrical circuit breakers will be labeled "Vapor Mitigation Fan #" (# will be replaced by the corresponding sub-system).
- A label stating the name of the system installer, date of the system installation, and a phone number for system service shall be affixed on or immediately adjacent to each monitoring panel.

#### 4.5.8 Electrical Service

Electrical service and connection work associated with the electrical components of the SSDS will be conducted as follows:

- Electrical connection of all electrical components will comply with local electrical code and manufacturer requirements.

- Each fan will include an electrical disconnect within six feet of the fan mounting location.
- Electrical inspection will be obtained by the SSDS installer and all necessary conditions will be met to obtain satisfactory inspection and permit closing.
- Fan electrical connection will comply with manufacturer requirements.
- A dedicated electrical circuit breaker will be installed for the fan electrical connections, although multiple fans can be on the same circuit, provided the circuit has sufficient capacity.
- One 110-volt electrical outlet with four-outlet connections will be installed within two feet of the monitoring panel and must be connected to a circuit that is separate from the mitigation fans.

## 4.6 SITE RESTORATION

### 4.6.1 Injection/Extraction Well Decommissioning

The injection and extraction wells installed in Treatment Zone 3 will be decommissioned in accordance with NYSDEC's Policy CP-43 as previously described in Section 4.1.2.5 following completion of the recirculation program.

### 4.6.2 New Monitoring Well Installation

Following completion of the Treatment Zone 3 remedial action, two permanent monitoring wells will be installed within or as close to the plume area as possible without inhibiting future Site operations in order to facilitate long-term groundwater monitoring. The details of the long-term groundwater plan will be further described in the SMP prepared following the remedial construction. The exact location of the post-remediation monitoring wells will be identified in the FER; however, given that the wells will be within the footprint of the building and the floor plans were not finalized at the time the design report was completed, the locations of the new monitoring wells have not been shown on the Design Drawings included in Appendix D.

### 4.6.3 Surface Restoration & Cover Systems

As previously indicated, the existing cover systems will be maintained on the Coyne Park parcel as well as the employee parking lot during the remedial construction. While much of the existing building will be demolished prior to commencement of the remedial action, the current owner of the Site intends to renovate the office building and reconstruct the northern approximately two-thirds of the building. As part of these construction efforts, additional fill will be placed on the

Site to raise the existing grades and a new concrete slab will be constructed above the remnants of the existing slab. The new concrete slab will be a minimum of four inches thick.

As previously indicated, should other areas of the Site be disturbed as part of the Site redevelopment, the cover systems will include:

1. Impervious Areas: All impervious surfaces will include concrete or asphalt pavement installed at a minimum of four inches in thickness. The impervious surfaces will act as a surface cover to significantly reduce infiltration and limit exposure to future Site occupants.
2. Green Space Areas: All green space areas will include a minimum of a one-foot thick layer of imported, clean material (e.g. topsoil) placed above a demarcation barrier that will provide a physical barrier to any potential remaining contamination in existing Site soils. The demarcation barrier will consist of a 6-ounch non-woven geotextile or similar.

If the Site redevelopment commences prior to the approval of a Site Management Plan (SMP), the following procedures, at a minimum will be followed:

- Excavation of Site soil will be managed with 40-hour trained HAZWOPER personnel
- Site soil will be characterized and hauled off-Site to a permitted facility
- Cover systems will be installed as discussed above

# 5.0 REQUIRED PERMITS

In accordance with DER-10, this document identifies the required permits and/or exempted permits, or other authorizations required to implement the remedial action at the Site. The necessary permits are summarized in the subsections below.

## 5.1 LOCAL PERMITS

### 5.1.1 Tank Removal Permit

An *Application for Tank Removal* will be submitted to the Syracuse Fire Department Fire Prevention Bureau located at 201 East Washington Street in Syracuse, New York prior to commencement of the remedial action. The technical specifications for the tank decommissioning will meet or exceed the Bureau's requirements for closure as well as the New York State Uniform Fire Prevention and Building Code, Chapter C, Article 2, Part 1164, Section 1164.5.

### 5.1.2 Demolition Permit

The contractor completing the building demolition will be responsible for obtaining a demolition permit from the City of Syracuse Division of Code Enforcement prior to commencing the demolition of a portion of the existing building. The remedial contractor will not be required to obtain a separate demolition permit for the removal of the concrete slab and foundations in Treatment Zones 2 and 3.

### 5.1.3 Hydrant Permit for Potable Water

Potable water will be required for a number of the remedial construction activities, including:

1. Mixing of the soil and ZVI prior to injection into Treatment Zone 2
2. Hydrating of grout and mixing grout for the extraction/injection wells
3. Decontamination

If the existing water service(s) to the Site are terminated prior to the start of the remedial construction or if the remaining service is inadequate for the remedial construction activities, the contractor will be responsible for obtaining a hydrant permit from the City of Syracuse Water Department prior to use of the hydrant. If a hydrant is used for a water source, a backflow prevention device will be connected to the hydrant prior to any hoses. Use of the hydrant without a backflow prevention device will not be permitted.

### 5.1.4 Stormwater Pollution Prevention Plan

As previously indicated, the area of disturbance for the remedial construction will be maintained to less than one acre during the remedy. Therefore, a full SWPPP will not be prepared for the Site and only semi-permanent erosion control measures and best management practices will be implemented as part of the remedial construction.

## 5.2 STATE PERMITS

The NYSDEC will be advised of the intent to permanently close the fuel oil tank in Treatment Zone 1 by review and approval of this Remedial Design Report. A separate 30-day notification is not required as this action is in response to a corrective action. Within 30 days following permeant closure and removal of the tank, CHA will submit a PBS registration application to the Department indicating that the tank status is changed from “closed in-place” to “closed – removed.”

## 6.0 SCHEDULE

The following table provides the anticipated schedule for the completion of the remedial activities identified in this RDWP.

**Table 7.1 Project Schedule**

| Description | Anticipated Start Date | Anticipated Completion Date |
|---|---|---|
| Completion of the AAR Public Comment Period | -- | June 27, 2020 |
| NYSDEC issues a Decision Document following the public comment period on the AAR | -- | June 27, 2020 |
| Submission to the Remedial Design to NYSDEC | -- | June 25, 2020 |
| NYSDEC Review of the RDWP | June 26, 2020 | July 24, 2020 |
| Preparation of Bid Packages | July 1, 2020 | July 10, 2020 |
| Bidding Phase | July 13, 2020 | July 17, 2020 |
| Design of SSDS Systems | July 1, 2020 | July 17, 2020 |
| Submission of SSDS Design to NYSDEC | -- | July 17, 2020 |
| Review of Bids | July 17, 2020 | July 20, 2020 |
| Notice of Award | -- | July 20, 2020 |
| Execution of Contract Documents | July 20, 2020 | July 22, 2020 |
| Notice to Proceed | July 27, 2020 | July 30, 2020 |
| Remedial Construction | August 3, 2020 | November 27, 2020 |
| Preparation of Final Engineering Report | November 2, 2020 | January 29, 2021 |
| Preparation of Site Management Plan | November 2, 2020 | January 29, 2021 |
| NYSDEC Review of Final Engineering Report and Site Management Plan | February 1, 2021 | March 12, 2021 |
| NYSDEC Issues Certificate of Completion | -- | March 30, 2021 |

The overall progress of the remedial activities will be dependent upon several factors including, but not limited to: NYSDEC review periods, weather conditions at the time of construction, the rate at which vapor concentrations reach targeted concentrations, etc. The schedule for the installation of the SSDS systems is still being evaluated at this time. The underground components (e.g. stone media, piping and vapor barrier), will be installed and observed for compliance with the design prior to pouring the new concrete slabs. However, the complete systems and commissioning of the systems will not be completed until the building construction is nearing completion but prior to the owner's occupancy.

The NYSDEC will be notified at least seven days prior to the proposed initiation of the remedial action.

# 7.0 POST-CONSTRUCTION PLANS

This section details plans and reports to be submitted following completion of Site remediation.

## 7.1 SITE MANAGEMENT PLAN

Since the selected remedial action will result in contamination remaining at the Site, a SMP will be prepared to manage the remaining contamination at the Site. The SMP will be updated in accordance with:

- The requirements outlined in NYSDEC "DER-10: Technical Guidance for Site Investigation and Remediation" (May 2010); and
- The guidance provided by NYSDEC.

The SMP will include an Institutional and Engineering Control Plan (e.g. environmental easement and excavation work plan), a Site Monitoring Plan (e.g. groundwater monitoring and Site-wide inspections), and an Operational and Maintenance Plan (e.g. operation and maintenance of SSDS systems). The implementation of the SMP will allow for the safe use of the Site.

The SMP will also provide information on the cover systems installed to allow for industrial use of the Site. The cover currently consists either of pavement or a soil cover in areas where the upper one foot of exposed surface soil exceeds the commercial SCOs. Where the soil cover is required, it will be a minimum of one foot of soil, meeting the SCOs for cover material specified in 6 NYCRR Part 375-6.8(b). The soil cover would be placed over a demarcation layer. The upper six inches of the soil would be of sufficient quality to maintain a vegetation layer. Pavement areas will be covered by either a paving system or concrete at least four inches thick.

## 7.2 FINAL ENGINEERING REPORT

A FER will be prepared to document implementation of the remedial actions completed at the Site. The Source Removal CCR will be incorporated into the FER as an appendix and the major elements of the CCR will be summarized in the text of the FER. The FER will include:

- Certification requirements in accordance with applicable statute and/or regulations;
- Remedial action objectives;
- Description of the selected remedy;
- Remedial contracts;
- Description of remedial actions performed;

- Governing documents;
- Elements of the remedial program;
- Summary of contaminated materials removal, including manifests documenting off-site transport of waste material for trench spoils and auger cuttings;
- Summary of remedial performance/documentation sampling;
- Details of imported backfill;
- Remaining contamination;
- Other Engineering Controls;
- As-built drawings;
- A summary of deviations from the RDWP.

**FIGURES**

## APPENDIX A

## MIHPT Results

# APPENDIX B

## ZVI Treatability

# APPENDIX C

## Pilot Test Groundwater Disposal Manifest

# APPENDIX D

## Design Drawings

# APPENDIX E

## Technical Specifications

# APPENDIX F

## Standard Operating Procedures

# APPENDIX G

# Health and Safety Plan

# APPENDIX H

# CAMP/CERP

**APPENDIX I**

**Field Sampling Plan**

# APPENDIX J

# QAPP

# APPENDIX K

## Recirculation Calculations

CHA