Alternatives Analysis Report and Remedial Action Work Plan
Brownfield Cleanup Program Site #C828184
Former Carriage Factory
33 Litchfield Street
Rochester, Monroe County, New York

***Prepared for*:**

New York State Department of
Environmental Conservation
6274 Avon-Lima Road
Rochester, New York 14414

***Prepared on behalf of*:**

Carriage Factory Special Needs Apartments, L.P.
1931 Buffalo Road
Rochester, New York 14624

***Prepared by*:**

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December 2014

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December 12, 2014
File: 190500751

Mr. Todd Caffoe
New York State Department of Environmental Conservation
6247 East Avon-Lima Road
Avon, New York 14414-2466

RE: Alternatives Analysis Report and Remedial Action Work Plan
Brownfield Cleanup Program Site # C828184
Former Carriage Factory
33 Litchfield Street, Rochester, NY

Dear Todd:

On behalf of Carriage Factory Special Needs Apartments, L.P. (CFSNA), Stantec Consulting Services Inc., has prepared this Remedial Alternatives Analysis Report and Remedial Action Work Plan for the former Carriage Factory site, located at 33 Litchfield Street in the City of Rochester, Monroe County, New York. The report presents the results of Stantec's evaluation of potential remedial actions for soil and groundwater impacts at the site identified in the Remedial Investigation, and takes into account the Interim Remedial Measures (IRMs) implemented at the site in 2013-2014.

Please contact us at any time with questions.

Sincerely,

STANTEC CONSULTING SERVICES INC.

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Stantec

Alternatives Analysis Report and Remedial Action Work Plan Former Carriage Factory Rochester, New York

CERTIFICATIONS

- **Remedial Alternatives Analysis Report**

  I, Peter Nielsen, certify that I am currently a New York State-registered professional engineer and that this Alternatives Analysis 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."

  STATE OF NEW YORK PETER NIELSEN No. 061499-1 LICENSED PROFESSIONAL ENGINEER

  Signature 12/11/14 Date

- **Remedial Action Work Plan**

  I, Peter Nielsen, certify that I am currently a New York State-registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

  STATE OF NEW YORK PETER NIELSEN No. 061499-1 LICENSED PROFESSIONAL ENGINEER

  Signature 12/11/14 Date

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1.0 Introduction

In accordance with the New York State Department of Environmental Conservation's (NYSDEC) draft Brownfield Cleanup Program Guide (May 2004) and DER 10, Technical Guidance for Site Investigation and Remediation, (May 2010) Stantec Consulting Services Inc. (Stantec) has prepared this Alternatives Analysis Report (AAR) and Remedial Action Work Plan (RAWP) for the Former Carriage Factory site (Site) located at 33 Litchfield Street in the city of Rochester, Monroe County, New York (see Site Location Map, Figure 1). The Site is owned by Carriage Factory Special Needs Apartments, L.P., which has entered into an agreement as a Volunteer for the Site with NYSDEC under the Brownfield Cleanup Program (BCP). The Brownfield Cleanup Agreement between Carriage Factory Special Needs Apartments, L.P. and NYSDEC was executed in February 2013.

This AAR/RAWP includes the following elements:

- A brief summary of Site history and investigative activities performed;
- A summary of contaminants identified during the Remedial Investigation (RI);
- A description of Interim Remedial Measures (IRMs) performed;
- Remedial Action Goals and the proposed BCP Cleanup Track for cleanup of the Site;
- Evaluation of remedial technology alternatives with regard to effectiveness, practicality of implementation, cost effectiveness and other factors. The analysis was based on conditions as they existed before implementation of the IRMs but the recommendations take into account the IRMs already completed to address interior and exterior contamination;
- Recommendations for final Site actions; and
- Institutional and Engineering Controls.

1.1 SITE DESCRIPTION AND HISTORY

1.1.1 Site Description

The Site is a 1.5±-acre parcel located at 33 Litchfield Street in the City of Rochester, Monroe County, New York (see Site Plan, Figure 2). The property (Tax Parcel No. 120.36-2-20) was occupied by a vacant, 5-story brick building with a basement. Redevelopment of the Site into the Carriage Factory Apartments, a mixed-use residential building, began in 2013 and was completed on November 19, 2014. The facility contains 71 affordable housing units and residences for clients with special needs. The total square footage of the building is approximately 71,600 square feet. Access to the Site is via Litchfield Street to a surface parking area south of the building. The Site includes six-foot high ornamental perimeter fences with brick piers along the Litchfield Street side of the Site. Utilities are provided by public utility companies and are currently available to the new residents.

Site ground surface elevations (el.) prior to Site development ranged from approximately el. 518 to el. 525 feet above mean sea level. Surface water drainage was generally to the south away from the building; recent Site development has changed surface drainage patterns to direct runoff to newly-installed catch basins.

Native soils underlying the Site consist of glacial till. Urban fill soils overlie the native soils; these fill soils generally consist of granular materials with variable mixtures or layers of ash, cinders, slag, brick, concrete and other miscellaneous materials. Bedrock underlying the subject property consists of dolostone of the Eramosa Formation (Lockport Group).

1.1.2 Site History

The building was originally built in 1900 for the production of horse-drawn carriages, and is one of the oldest manufacturing plants in Rochester. Historical Site operations included manufacture of wood trim/accent-related products for the automotive industry, other automotive parts, and clothing washers and dryers. Operations at the Site ceased in approximately 1993 and the Site has reportedly been essentially vacant since then. A more detailed account of the historical operations at the Site can be found in the *Remedial Investigation Report, Former Carriage Factory, Brownfield Cleanup Program Site #C828184, 33 Litchfield Street, Rochester, Monroe County, New York (RI),* dated October 2014 and prepared by Stantec.

In early 2013, construction began to renovate the existing building for use as apartments and to facilitate IRMs (further discussed below). The renovations were completed by November 19, 2014 when the Certificate of Occupancy for the Site was issued by the City of Rochester.

2.0 Summary of Site Investigations

This section briefly summarizes the investigations performed prior to the Site being entered into the BCA, and project milestones in the BCP process leading up to this Alternatives Analysis Report and Remedial Work Plan (AAR/RAWP). A more detailed description of these investigations can be found in the Remedial Investigation (RI) Work Plan and RI Report.

2.1 PRE-BCA PHASE I & II ESAS

A Phase I Environmental Site Assessment (ESA) associated with real estate due diligence was completed by DECI in September 2010 which identified several recognized environmental conditions (RECs) at the Site. These included floor drains with unknown discharge points; abandoned and potentially leaking drums in the basement and on the third floor; and apparent petroleum staining near the loading dock and in the southern portion of the Site. Further investigation was recommended to evaluate the potential for historic releases of petroleum and/or hazardous materials to have occurred.

DECI conducted a series of Phase II ESAs in February 2011, November 2011, and March, April, and June 2012. 17 soil test borings and 12 groundwater monitoring wells were installed to collect soil and groundwater samples in the basement of the building and at exterior locations both onsite and offsite. Results indicated the presence of the chlorinated volatile organic compounds (CVOCs) tetrachloroethene (PCE), trichloroethene (TCE) and related CVOCs in 9 out of 12 groundwater wells at levels above NYSDEC's soil cleanup objectives (SCOs) and groundwater standards. The water table was encountered at depths of approximately 3 ft below the building basement floor and approximately 5 to 10 feet below ground surface in exterior areas.

Total groundwater CVOC levels in onsite wells ranged up to 224 µg/L, with the highest concentration observed in well RW-3, located near the center of the building footprint. The compound with the highest concentration in these well samples was TCE. Total CVOC levels in offsite wells ranged up to 888 µg/L, with the highest concentration observed in well RW-6, located on the north side of Wiley Street. The compound with the highest concentration in this well was PCE.

Other CVOC compounds detected in the impacted onsite and offsite wells included cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride (VC). This combination of compounds indicated that natural attenuation of the chlorinated ethenes, PCE and TCE, was occurring via reductive dechlorination. Reductive dechlorination is a natural process in which native bacteria present in the subsurface degrade chlorinated ethenes anaerobically. PCE and TCE are susceptible to degradation through this process into the daughter products cis-1,2-DCE, trans-1,2-DCE and VC.

Urban fill was encountered at depths from 1.8 to 4.4 feet below ground surface (bgs) at exterior locations and consisted of ash, slag, cinders, bricks, concrete, and variable amounts of silt, sand, and gravel.

A total of nine soil samples were obtained from below the basement slab by DECI in June 2012. Trace levels of one or more CVOCs were detected in each sample, including PCE, TCE, cis-1,2-DCE and trans-1,2-DCE. All concentrations were below the Unrestricted Use SCOs. Soil and water samples were taken around a sump discovered in the basement floor in August 2012 and tested for VOCs, SVOCs, and metals. Two SVOC compounds (phenanthrene and pyrene) and two VOC compounds (m,p- and o-xylene) were detected in the sump sediment sample; however, the concentrations were below their respective Restricted Residential (RR) Use SCOs.

2.2 BCP AGREEMENT

Based on the results of the Phase II ESAs and supplemental basement sampling, plans for redevelopment of the site beginning during the summer of 2012 were postponed. Stantec (on behalf of Carriage Factory Special Needs Apartments, L.P.) prepared and submitted an application in November 2012 to NYSDEC to enter the Site into the BCP. The Department accepted the application and executed a Brownfield Cleanup Agreement (BCA) on February 26, 2013.

2.3 REMEDIAL INVESTIGATION (RI)

Concurrent with the review and approval for the BCP application Stantec also prepared a Remedial Investigation Work Plan (RIWP) detailing the intended investigation scope and methodology. The RIWP was submitted in November 2012. Based on NYSDEC comments a revised RIWP was submitted in April 2013, which was approved by the Department on May 23, 2013. The primary elements of the RI included (further detail on investigation activities and methodology is provided in the RI report):

- A passive soil gas (PSG) survey across the Site and in adjacent rights-of-way (ROWs) to assess potential source areas for volatile organic compound (VOC) contamination;
- A geophysical survey in exterior and interior areas and in the Wiley Street ROW to assess the potential for underground storage tanks, piping or other subsurface structures;
- Excavation of test pits to further assess anomalies identified by the geophysical survey;
- Drilling of test borings in soil and bedrock at interior and exterior locations chosen to further evaluate areas of previously-identified or suspected VOC presence and to provide site-wide coverage;
- Installation of four bedrock groundwater monitoring wells;
- Hydraulic conductivity testing of selected wells;
- Surface soil sampling in exterior areas;
- Laboratory analysis of soil samples;
- Sampling of previously-installed Phase II investigation wells and newly-installed RI wells;
- Laboratory analysis of groundwater samples; and

- Sampling and bench-scale testing of soil and groundwater samples to evaluate the potential for using Enhanced Reductive Dechlorination (ERD) as an IRM for groundwater.

Remedial Investigation activities were conducted during the period December 2012 through May 2013. The findings of the RI are summarized in the RI report which was submitted to NYSDEC on October 23, 2014. The following is a summary of the primary findings of the RI:

1. *Soil Gas*: The PSG survey identified areas of elevated CVOC presence in soil gas beneath the west side of the building and adjacent to the loading dock on the south side of the building. The primary compounds were TCE and PCE, which are common constituents of degreasing solvents likely used in historical operations at the Site. Impacts by petroleum-related compounds were also observed in interior and exterior areas, most notably in the Atrium portion of the building.

   Elevated CVOCs were also observed in offsite areas north of the Site limits, in the Wiley Street ROW; however, these compounds appeared to be at least in part from offsite sources.

2. *Geophysical Survey*: An EM-61 magnetometer survey identified four exterior locations south of the building where anomalous results indicated the potential presence of buried metallic objects. Test pits excavated at these locations found miscellaneous metallic objects but no evidence of underground tanks or drums. Survey results inside the building indicated numerous buried pipe runs. Most, but not all of the pipes were related to roof drainage, as determined during subsequent excavation and removal.

3. *Surface Soil*: Surface soil samples exhibited concentrations of several metals (including lead, mercury, arsenic and barium) at levels in excess of NYSDEC RR Use and/or Protection of Groundwater (POGW) Soil Cleanup Objectives (SCOs). Subsequent soil sampling during the IRM program identified additional metals occurrences; this is discussed in greater detail in the IRM Construction Completion Report and Final Engineering Report (IRMCCR-FER). PCBs were also present in the RI surface soil samples at low concentrations below RR SCOs. These samples included urban fill materials, which were encountered across much of the Site to depths ranging up to approximately 4 ft. in thickness.

4. *Subsurface Soil*: Relatively low levels of petroleum-related compounds were detected in basement soils samples. The results were indicative of highly-weathered petroleum products. This was confirmed by additional sampling during the IRM program.

   CVOC presence in RI samples for both interior and exterior areas was generally at low levels and not in excess of SCOs, except for one location, B-108, where cis-1,2-dichloroethene was reported above the POGW SCO. Subsequent sampling during IRM activities revealed additional significant VOC presence; this is discussed in the IRMCCR-FER.

5. *Hydrogeology*: The groundwater table was generally at or below the top of bedrock. Groundwater levels were highest beneath the building and flow direction is generally

radially away from this groundwater high with the predominant flow to the northeast. “Slug” testing performed in selected wells indicated hydraulic conductivity values ranged from 1.2 x 10^{-3} to 3.8 x10^{-3} centimeters per second (cm/sec).

6. _Groundwater Quality_: The sampling did not detect the presence of SVOCs, PCBs, or pesticides. Sodium and manganese were detected at levels in excess of NYSDEC groundwater standards; however these are naturally-occurring elements and are not indicative of a site contamination concern.

   Samples from thirteen of the sixteen monitoring wells exceeded groundwater standards for one or more CVOC (primarily PCE and TCE). The highest onsite VOC concentrations were observed generally beneath the northern portion of the building; the highest overall concentrations were detected in a well located to the north of the property across Wiley Street.

   The types and concentration distribution of CVOCs indicated that reductive dechlorination of these contaminants was occurring. This naturally-occurring process occurs when biochemical activity by microorganisms breaks down CVOCs into non-toxic by-products. Further, bench testing of soil and groundwater samples indicated that conditions were favorable for ERD to effectively provide *in situ* remediation of groundwater. Sodium lactate was identified as the most effective amendment product tested to facilitate ERD.

3.0 Interim Remedial Measures

3.1 INTRODUCTION

The RI identified CVOC contamination in soil and groundwater in the basement and in the vicinity of the building at levels in excess of NYSDEC cleanup criteria. In addition, petroleum-impacts and nuisance odors were found in shallow soil in the Atrium area of the basement. Elevated lead and mercury concentrations were found in select samples of urban fill in the central and southern portion of the property. Accordingly, a program of Interim Remedial Measures (IRMs) was proposed to NYSDEC to provide a timely response to the findings of the RI, minimize the potential for further spread of contaminants, and facilitate timely site development activities.

In addition to the findings of the RI, additional impacts to soil were identified as excavations were performed for Site development construction. Stained soil and elevated PID readings were obtained in interior excavations made for new stairway foundations and removal of buried piping. As excavations progressed and additional sampling was performed, PCE was detected in soil at 371,000 µg/Kg (equivalent to ppb) in the vicinity of a former crock in the northeast portion of the basement. Additional staining and elevated PID readings were encountered in other basement excavations, and generally low-level detections of CVOCs were exhibited by several soil samples.

Detections of petroleum-related VOCs in soils in the Atrium and other areas appeared to be the result of the presence of highly-weathered petroleum. Although the contaminant concentrations were below SCOs, nuisance odors were apparent in some of these soils.

These findings resulted in ongoing segregation and onsite stockpiling (where appropriate) of apparently-impacted soils, analysis of soils samples from excavations to further delineate the impacts and analysis of stockpile samples for disposal characterization. Detailed drawings depicting excavation limits and sample locations were included in the IRMCCR-FER.

3.2 IRM WORK PLAN

Based on the RI investigation results and observations in the early stages of Site development activities, an Interim Remedial Measures Work Plan (IRMWP) describing the proposed IRMs was submitted to NYSDEC on May 24, 2013 and approved on August 30, 2013. The Work Plan proposed the following remedial measures:

- _Soil_: Continued field screening of excavated soils and confirmatory soil sampling/analysis. In addition, impacted soils remaining below proposed final exterior Site grades would be covered with either 16± in. of crushed stone and asphalt or 2 ft. of clean soil in landscaped areas where appropriate.
- _Groundwater_: Based on the findings of the RI, in-situ groundwater remediation through ERD was recommended, and bench testing of soil and groundwater samples had been initiated. Since the area of impacted groundwater was primarily beneath the building, a

series of horizontal piping runs was proposed for installation during site construction to supplement existing wells for injection of the sodium lactate amendment.

- *Soil Vapor Mitigation*: Due to the presence of known VOC contamination in soil and groundwater beneath the building, the project would include installation of a vapor barrier (Liquid Boot) and a Geovent sub-slab depressurization system for the building (a system design had been submitted previously to the Department).
- *Soil Management*: Impacted soils would be segregated and stockpiled onsite for additional sampling/analysis to characterize the material for disposal. Non-impacted concrete and asphalt would be recycled offsite. At the time the IRMWP was submitted a Contained-In Demonstration Work Plan (CIDWP) was also being prepared for NYSDEC review/approval; this Work Plan proposed sampling/analysis for characterization and provided comparison values for disposal of waste-solvent (TCE and PCE) impacted soils, in accordance with NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) 3028. Approximately 100 cubic yards (cy) of basement soils had been stockpiled at the time the IRMWP was submitted; disposal was pending the submittal and approval of the CIDWP.

3.3 SUPPLEMENTAL IRM – ELEVATOR PIT

Subsequent to submittal of the IRMWP, as Site development activities continued, an additional environmental issue was encountered. The building elevator shaft terminated in a pit which extended to approximately 3 to 4 ft. below the building's floor grade and was constructed into the top of bedrock. The pit was found to contain up to 4 ft of accumulated debris (wood, metal, trash, etc.). This debris was partially submerged in water that had accumulated in the pit. The water accumulation was apparently a combination of infiltration of groundwater and accumulation of rainwater, since no roof had been present over the shaft for several years.

Removal of the debris and water was required to allow deepening and reconfiguration of the pit to accommodate a new elevator system and other appurtenances. Prior to removal the water was sampled and analyzed and found to contain relatively low levels of VOCs (including TCE at 3.08 µg/L), Pesticides (alpha BHC at 0.343 µg/L), copper, lead and zinc. Based on these results, a short-term discharge permit was obtained from the Monroe County Department of Environmental Services (MCDES) that allowed periodic discharge of the water to the municipal sewer.

3.4 IRM IMPLEMENTATION

The implementation of the IRMs essentially commenced in May 2013 when Site development-related excavations began. At the time this AAR/RAWP was prepared, IRM activities involving generation of waste (i.e. excavation, backfilling and grading) were complete. Quarterly groundwater monitoring is ongoing and is currently scheduled to continue into the first half of 2015. Future monitoring is anticipated at a frequency to be agreed upon with NYSDEC and further remedial action may be required depending on the success of the ERD program and observed groundwater contaminant levels. Periodic pumping of water from the elevator pit is anticipated to continue indefinitely into the future; accordingly a long-term discharge permit has been obtained from MCDES, and routine sampling and reporting will be performed. This is discussed further in Section 8.2 below.

Detailed descriptions and summaries of specific IRM activities, observations and findings, work plan modifications, analytical results, waste disposal, NYSDEC reviews and approvals, and other relevant information has routinely been provided to NYSDEC in monthly progress reports prepared between March 2013 and the present. In addition, periodic site meetings were held with the NYSDEC project manager throughout the program to review progress and provide updates on work performed and conditions encountered.

The IRMCCR-FER which has been submitted under separate cover provides more comprehensive and detailed documentation of the IRM activities; a generalized summary is provided herein to provide context for this remedial alternatives analysis.

Stantec performed, arranged or oversaw the following activities during the IRM program:

- Observed soil excavations performed in interior and exterior areas, and performed field screening of soils with a PID;
- Collected and submitted soil samples from excavations for contaminant delineation and confirmatory analyses, and from stockpiles for waste disposal characterization, as appropriate;
- Performed required sampling/analysis of impacted interior and exterior soils in accordance with the CIDWP requirements and DER-10 guidance;
- Arranged disposal of 8507.5 tons of non-hazardous soil excavated from interior and exterior areas offsite at a permitted landfill;
- Performed 19 test borings in exterior soils immediately south of the building for the purpose of pre-characterization of impacted soils that was planned for excavation (to facilitate potential direct loading of soils for offsite disposal), and to further characterize the nature and extent of urban fill in proposed landscape areas.
- Oversaw placement of either clean soil cover, or impervious materials (asphalt or concrete) cap in all exterior areas (see Figure 3). A fabric demarcation layer was installed prior to placement of the cover or cap materials at all locations.
- Designed and oversaw installation of a horizontal piping system at or near the bedrock-overburden interface below the building (See Piping Plan, Figure 4), to facilitate in-situ groundwater remediation through enhanced reductive dechlorination (utilizing injected sodium lactate solution);
- Injected approximately 33,304 gallons of sodium lactate solution into the piping and selected monitoring wells;
- Performed monthly or quarterly post-injection groundwater sampling in up to 13 onsite and offsite monitoring wells;

- Designed and oversaw installation of a sub-slab depressurization system (SSDS) to mitigate potential VOC vapor intrusion into the building from impacted soil and groundwater beneath the structure (see SSDS Layout, Figure 5);
- Performed required sampling/analysis and oversaw disposal of wastewater pumped from the elevator pit and some basement excavations in accordance with short-term discharge permits obtained from MCDES; and
- Performed required sampling/analysis and disposed of debris and sludge wastes removed from the elevator pit.
- Arranged disposal of approximately 20.2 tons of non-hazardous debris from the elevator pit at a permitted landfill;
- Arranged disposal of approximately 8.7 tons of non-hazardous sludge with a vacuum truck from the elevator pit at a permitted landfill;
- Arranged disposal of 3 drums of hazardous waste (sludge and debris) from the elevator pit at a permitted treatment facility; and
- Performed air quality monitoring in accordance with requirements of the project's community air monitoring program (CAMP) during exterior Site activities and excavations.

4.0 Remedial Goals and Objectives

4.1 FUTURE USE OF SITE

The site development included renovations to the existing building which was converted into a mixed-use apartment facility for clients with special needs as well as other "affordable housing" units. There is no commercial space. The Site has connections to all of the typical utilities including electrical, power, water, natural gas, and sewer (combined).

4.2 REMEDIAL GOAL AND REMEDIAL ACTION OBJECTIVES

The general remedial goal for sites in the NYS Brownfield Cleanup Program is to eliminate or mitigate significant threats to the public and the environment posed by the Site contaminants through the proper application of scientific and engineering principles. Accordingly, the identified sources of contamination at the Site have been or will be eliminated or mitigated to a condition acceptable to the NYSDEC under the BCP using appropriate remedial technologies, engineering controls (ECs) and institutional controls (ICs).

Based on the information presented in the preceding sections, the remedial action objectives (RAOs) for the site include:

Soil and Soil Vapor

- Prevent ingestion, inhalation, or contact with Site contaminants of concern (COCs) that exceed Standards, Criteria and Guidance (SCGs; discussed further in Section 3.3.1) in impacted areas identified;
- Prevent ingestion, inhalation, or contact with "nuisance characteristics" (i.e. petroleum odors) in soils;
- Prevent exposure to post-remediation residual contamination using institutional controls as needed; and
- Prevent exposure to post-remediation residual COCs via ECs and ICs, including execution of a NYSDEC Environmental Easement (EE) and Site Management Plan (SMP) limiting the Site usage to Restricted Residential, Commercial or Industrial. Unrestricted and Residential Use will not be allowed.

Groundwater

- Prevent ingestion, inhalation, or contact with COCs that exceed SCGs.
- Prevent exposure to post-remediation residual COCs via institutional controls, including execution of a NYSDEC EE and SMP limiting the Site usage to Restricted Residential, Commercial or Industrial. Unrestricted and Residential Use will not be allowed.

4.3 SOIL & GROUNDWATER CLEANUP OBJECTIVES AND BCP CLEANUP TRACK

4.3.1 Soil & Groundwater Cleanup Objectives

This section describes the Standards, Criteria and Guidance (SCGs) used for comparison of COC concentration results for sampled/analyzed media at the site.

The applicable SCGs used for evaluation of the site investigation results include water quality standards and guidance values published by the NYSDEC Division of Water and SCOs published by the NYSDEC Division of Environmental Remediation.

The SCGs were provided by:

- *Technical Guidance for Site Investigation and Remediation*, NYSDEC, Division of Environmental Remediation (DER-10), May 2010;
- *Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations,* NYSDEC, October 1993, Reissued June 1998 (with addenda dated April 2000 and June 2004);
- 6 NYCRR Part 375-6 SCOs, NYSDEC, Division of Environmental Remediation, 14 December 2006; and
- *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, NYSDOH, Bureau of Environmental Exposure Investigation, October 2006.

Note that pursuant to 6 NYCRR 375-6.5, the POGW SCOs are considered not to be applicable for the Site at this time because: 1) the use of groundwater for potable purposes within the limits of the city of Rochester is prohibited by the City Code; and 2) Site groundwater is undergoing *in situ* remediation, as described in this report.

4.3.2 Brownfield Cleanup Track

Four cleanup tracks are available for consideration at BCP sites which need remediation. Track 1 cleanups achieve conditions that allow for Unrestricted Use, achieve Unrestricted Use SCOs in the soil component of the remedy, and do not rely on implementation of site use restrictions or long-term ICs or ECs. The requirements for Cleanup Tracks 2, 3 and 4 have provisions that contemplate limitations on the future use where appropriate based on current uses and likely future uses:

- In Track 2, the soil component of the remedial program must achieve the lowest of the applicable contaminant specific SCOs set forth in 6 NYCRR Subpart 375-6.
- Track 3 allows for modifying the generic Subpart 6 SCOs to account for site-specific conditions that may vary from the generic conditions that were the basis for the Department's SCO calculations.
- Track 4 requirements include a provision for development of site-specific SCOs that are protective of public health and the environment.

In Tracks 2 and 3, long-term ICs and ECs are permissible for media other than soil. ICs and ECs are allowed as part of the soil component of the remedy only in the short-term and only to provide protection of public health and the environment during the implementation and operation of remedial measures designed to achieve applicable SCOs.

Track 4 provisions allow for the use of long-term ICs and ECs to address all contaminated media.

This AA concludes that the remedial program which is most appropriate for the Site is found in the Track 4 provisions, and the remedial alternatives that are evaluated in the AA are amenable to the cleanup requirements of Track 4. The AA also includes evaluation of remedial alternatives that may be capable of meeting the requirements of Track 1. The Track 1 alternative is evaluated, as required by Part 375, in the event that the remedy selected by the Department is not included in the Department's current list of approved presumptive remedies.

The Site IRMs were completed under a BCP "Track 4" cleanup scenario, which is based on a Restricted Residential site use and which allows the application of ECs and ICs.

The intent to employ a Track 4 cleanup is based on the assumption that the IRMs performed, which included source-area impacted soil removal, placement of site cap/soil cover, *in situ* bioremediation of groundwater, and construction and operation of a sub-slab depressurization system will be successful in reducing onsite groundwater contamination and offsite contaminant migration and protecting human health of the occupants of, and visitors to, the site. In the event this does not occur a supplemental injection of sodium lactate in groundwater will be discussed with NYSDEC and implemented if appropriate.

5.0 Remedial Alternatives Analysis

5.1 INTRODUCTION

This section summarizes the alternatives evaluated for the remediation of Site conditions identified during the investigation as they existed prior to the implementation of the IRMs. The recommendations from this evaluation, however, take into account the IRM program executed during the spring 2013 through fall 2014 time period, which included all of the tasks listed above in Section 2.7.1.

These IRMs have removed the grossly-impacted soils inside and outside the building, capped remaining exterior impacted materials with an impervious asphalt or concrete surface or 2 ft of clean soil, and covered remaining impacted interior materials with a concrete floor slab, a vapor barrier and an SSDS. In addition, the *in situ* groundwater remediation program has already significantly reduced CVOC concentrations in source-area groundwater wells and further reductions are anticipated. Groundwater remediation and monitoring is ongoing.

The attached Table 1 (Remedial Alternatives Analysis Matrix) presents the remedial alternatives considered in the development of the IRMWP previously submitted and the Remedial Action Work Plan contained herein. The options considered included the following potential processes and technologies:

- No Action/Monitored Natural Attenuation (MNA): No direct remedial actions would be performed, however due to confirmed onsite and offsite groundwater impacts, a long-term groundwater monitoring program would be needed.
- In-Situ Treatment: In-situ treatment technologies for contaminated soil and groundwater include such processes as in-situ chemical oxidation, air sparging, enhanced in-situ bioremediation, thermal desorption, and soil vapor extraction.
- Ex-Situ Treatment (soil): Ex-situ treatment technologies for contaminated soils include excavation, on-site treatment and reuse of treated soils, low-temperature thermal desorption, ex-situ vapor extraction, biopiles, land farming and off-site disposal.
- Ex-situ treatment (groundwater): Involves groundwater removal and such treatment processes as granular activated carbon (GAC) adsorption, air stripping, oxidation and subsequent discharge; or off-site transport and discharge to a Publicly-Owned Treatment Works (POTW) or licensed treatment/storage/disposal (TSD) facility for treatment.
- Engineering Controls: ECs such as covering remaining impacted soil with clean soil or impervious cap materials and installation of a vapor barrier and SSDS were considered.
- Institutional Controls: ICs were also included as potential elements of the remedial options considered. ICs for the prevention of direct human contact with contaminated soil and groundwater include actions such as:

- A NYSDEC-enforced EE which would limit land use at the Site to Restricted Residential, Commercial or Industrial use and include appropriate restrictions on groundwater use; and
- Development of a SMP for to provide guidance for potential future activities that could disturb the subsurface within areas of known or potential residual impact.

5.2 PRELIMINARY SCREENING OF REMEDIATION METHODS, TECHNOLOGIES & APPROACHES

A number of on-site remedial technologies and approaches were pre-screened on the basis of feasibility, pertinence to the environmental conditions and remedial action objectives for the Site, and cost effectiveness. Remedial methods, technologies and approaches considered in this pre-screening process were included on the basis of Stantec's past experience with remedial work involving similar site characteristics and contaminants, and on the basis of information obtained from the review of resources such as Presumptive/Proven Remedial Technologies for New York State's Remedial Programs, NYSDEC Division of Environmental Remediation (DER-15), 27 February 2007.

Both proven and innovative technologies were considered. Since the Site had more than one impacted media and more than one contaminant "class," combinations of technologies were considered to form a single remedial approach.

It should be noted that technologies that have been documented to be generally slow in producing results were not considered desirable. This was because a primary goal of entering the Site into the BCP was to facilitate timely redevelopment and reoccupation of the property, which had been inactive and unoccupied for over 20 years and which was ready for redevelopment prior to entry in the BCP. Several methodologies were also eliminated from further consideration due to the following inadequacies or limitations:

- Unlikely to address site issues and attain remedial action objectives;
- Precluded by Site conditions or pre-empted by the IRMs already performed at the Site;
- Incompatible with Site contaminants;
- Previously not fully demonstrated, unreliable, or have performed poorly;
- Inappropriate based on engineering judgment; or
- Excessively costly without adding significant technical advantages.

The following Table 2 lists the methods, technologies and approaches that were excluded, based on the above criteria from more detailed evaluation of alternatives:

Table 2
Summary of Excluded Remediation Alternatives

Method, Technology or Approach	Description/Justification
Air Sparging & Soil Vapor Extraction	Not conducive to a site proposed for residential occupancy in the short term; Site groundwater is essentially in bedrock and not in overburden, thus sparging is not feasible since the injected air cannot be distributed in the bedrock mass without artificially enhancing the fracture network (e.g. blasting). In addition, enhanced aerobic biodegradation using air sparging is generally not effective for chlorinated compounds.
Groundwater Pump-and-Treat	Typically requires long time periods for completion; Systems are energy-intensive, with high capital and operating costs; Not applicable to vadose zone; and Can impact groundwater flow regime at distance from the Site.
Dual-Phase or Multi-Phase Extraction/Treatment	Dual-Phase systems extract and treat vapor and aqueous streams; The process can require long time periods for completion; Such a system would require equipment and piping in interior wells, would be energy-intensive and would have high capital and operating costs.
In-Situ Conductive Heating	Involves the heating of unsaturated soils to 212° F to 500° F (followed by soil vapor extraction) and is typically a treatment applicable only to the vadose zone – does not address impacts below the water table – therefore, area to be treated must be dewatered in order to be effective; and Also typically applied to larger sites due to the high overall costs.
In-Situ, Surfactant-Enhanced Aquifer Flushing	Involves injection of an aqueous surfactant solution into a contaminated zone coupled with simultaneous downgradient groundwater extraction/treatment (and potentially re-injection); and This approach is generally cost-prohibitive and has a high potential for exacerbating the spread of contaminants.
Iron Reactive Wall	High overall cost of approach versus a relatively limited area of groundwater impact; Physical Site limitations and radial groundwater flow preclude this approach.
Phytoremediation	Not applicable for bedrock groundwater.
Chemical Treatment/Soil Mixing	In-situ chemical treatment is accomplished by applying amendments to the subsurface via soil-mixing methods using large diameter augers. Effective treatment requires sufficient contact and residence time between the COC and the chemical reagent; Not desirable based on contamination located beneath building and limited soil volumes.

Method, Technology or Approach	Description/Justification
Soil Vapor Extraction and Thermal Desorption Soil Heating	Generally requires long time periods for completion; High capital and operating costs (electricity).
Steam Enhanced Extraction (SEE)	In-situ remediation method consisting of a combination of shallow soil vapor extraction, shallow steam injection and shallow groundwater extraction. Typically only cost effective for large-scale sites.

6.0 Evaluation of Remedial Alternatives

6.1 RETAINED ALTERNATIVES

The following remedial alternatives (in addition to the No Action alternative) were not excluded in the preliminary screening. These retained alternatives are summarized in Table 3 below and evaluated in more detail in the following sections based upon the screening criteria set forth in NYSDEC's DER-10 document.

As noted above, this evaluation of alternatives addresses conditions as they existed before the implementation of the IRMs, but also takes into account the IRMs that have been completed to date.

Table 3
Summary of Retained Alternatives

Evaluated Method, Technology, or Approach	Description
No Action / Monitored Natural Attenuation (MNA)	Generally only applied to groundwater. VOCs are capable of being degraded in place by naturally-occurring processes. Utilizes periodic sampling and analysis of contaminants and groundwater parameters to monitor the drop in contaminant levels and change in parameters with time, and the potential reduction in plume areal extent with time.
Soil:	
Removal/Off-Site Disposal of all Impacted Soil (Track 1)	This Track 1 alternative would require the removal of all soil beneath the building, and the removal of all urban fill, petroleum impacted soil, and CVOC impacted soil in the parking lot area to the south of the buildings.
Source Area Contaminated Soil Removal / Offsite Disposal	This alternative includes removal of the source-area soil with the greatest COC impact, disposal (at a permitted landfill), and replacement of the excavated soil with imported clean soil backfill.
Engineering Controls: Clean Soil Cover or Impervious Cap over Impacted Soil	Soil containing contaminants is allowed to remain buried onsite, if covered with an appropriate thickness of clean soil, other clean fill materials, or an impervious cap of asphalt or concrete to minimize the potential for inadvertent future exposures.

(continued next page)

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Evaluated Method, Technology, or Approach	Description
Groundwater:	
In-situ Chemical Oxidation (ISCO) of Impacted Groundwater (Track 1)	A contaminant-destructive technology involving the injection of chemical reagents into groundwater. Oxidation converts the contaminants into non-hazardous or less-toxic compounds that are more stable and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, sodium persulfate, or permanganate compounds.
In-situ Treatment of Impacted Groundwater (Bioremediation)	This alternative includes the direct application of a carbon substrate material that serves as an electron donor and accelerates naturally-occurring contaminant degradation in groundwater by indigenous bacteria. This method often includes ERD of chlorinated VOCs (using food-grade sodium lactate or other suitable material). It can also be effective in breakdown of petroleum-related VOCs and SVOCs by sulfate-reducing bacteria aided by a sulfate-rich additive (e.g. agricultural-grade gypsum).
Groundwater Extraction and Onsite/Ex-situ treatment or offsite discharge/disposal.	Groundwater entering a source-area excavation or interior elevator pit, or pumped from a well is retained in a storage tank and can then be treated on site via a portable treatment system (typically air stripping or granular activated carbon) that removes VOCs and is then discharged on site. Alternatively the water can be transported and treated or disposed of offsite. This would be intended for relatively minor volumes of water and is not intended as a source area pump-and-treat system, which was eliminated in the preliminary screening in Section 5.2 of this report
Engineering Control: Vapor Intrusion Mitigation (Vapor Barrier and Sub-slab Depressurization System)	Construction of vapor barrier (Liquid Boot membrane or equivalent) and a sub-slab depressurization system beneath occupied structures. System to operate in perpetuity until or unless contaminant levels in vapor decrease to acceptable levels, as demonstrated through vapor sample analysis.

6.2 DESCRIPTION OF POTENTIAL ALTERNATIVES

6.2.1 Potential Remedial Alternatives to address COC-Impacted Soil

The RI identified impacts to surface and subsurface soils in both interior and exterior areas, including petroleum-related VOCs, CVOCs, and metals that exceeded RR SCOs. This section provides a generalized description of each retained alternative.

6.2.1.1 Alternative 1.1: No Action

The No Action/Monitored Natural Attenuation response is considered as a remedial technology to provide a baseline effort for comparison to other technologies. With the exception of installing and maintaining a fence to keep trespassers off the site, no remedial actions would be taken for this area, and no future sampling would be performed.

6.2.1.2 Alternative 1.2: Impacted Soil Removal & Offsite Disposal (Track 1)

Alternative 1.2 consists of removal of all impacted soil exhibiting COC concentrations in excess of RR SCOs or nuisance characteristics (staining, odors, positive PID readings), and off-site disposal as non-hazardous waste at a permitted facility. The excavated areas would be backfilled or covered with either onsite or imported soil demonstrated to meet the requirements for potential COC presence using analytical testing (per DER-10) or covered with impervious materials such as asphalt or concrete. It is estimated this would involve removal of 14,500 tons (8,500 cy) of soil.

6.2.1.3 Alternative 1.3: Source Area Impacted Soil Removal & Offsite Disposal

Alternative 1.3 consists of removal of source impacted soil exhibiting COC concentrations in excess of RR SCOs or nuisance characteristics (staining, odors, positive PID readings), removal of only that soil required to meet design grades and/or to provide two feet of clean soil in landscaped areas, and off-site disposal as non-hazardous waste at a permitted facility. The excavated areas would be backfilled or covered with either onsite or imported soil demonstrated to meet the requirements for potential COC presence using analytical testing (per DER-10) or covered with impervious materials such as asphalt or concrete. It is estimated this would involve removal of 8,500 tons (5,000 cy) of soil. This alternative would require the ECs and ICs set forth in Alternative 1.4.

6.2.1.4 Alternative 1.4: Clean Soil Cover or Impervious Cap

Alternative 1.4 is an Engineering Control that would consist of covering remaining impacted soils left in place with either an impervious cap or a clean soil cover of sufficient thickness. An impervious cap could be asphalt, concrete or certain built structures. Clean soil cover would consist of either onsite surplus soil or imported soil; this material would be demonstrated to meet NYSDEC requirements for potential COC presence by performing analyses in accordance with DER-10 requirements. This material could also include topsoil placed in landscaped areas. Such areas would require seeding with grass or other plant species to stabilize against erosion.

6.2.2 Potential Remedial Alternatives to Address Groundwater Impacts

6.2.2.1 Alternative 2.1: No Action

The No Action/Monitored Natural Attenuation response is considered as a remedial technology to provide a baseline effort for comparison to other technologies. This alternative involves no remedial action(s); however because offsite groundwater impacts were identified, long-term groundwater quality monitoring would be included. This monitoring would be focused on determining what degree of contaminant attenuation in groundwater is occurring through natural processes such as biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological destruction.

6.2.2.2 Alternative 2.2: In-Situ Chemical Oxidation (ISCO) of Groundwater (Track 1)

Alternative 2.2 would consist of *in-situ* remediation of groundwater. This would be performed in conjunction with the removal of all impacted soil as described in Alternative 1.2 above to form a Track 1 cleanup. The ISCO would involve injection of a chemical oxidizer throughout the area of impacted groundwater, which should result in the eventual breakdown of COCs to harmless chemical bi-products such as carbon dioxide and water. Follow-up groundwater monitoring would be required to document the effectiveness of the remedial action. Multiple injections of the chemical oxidizer would be expected to achieve Track 1 remedial objectives.

6.2.2.3 Alternative 2.3: *Ex-Situ* Treatment of Groundwater

Alternative 2.3 consists of removal of groundwater and *ex-situ* treatment. For this project, this applies to groundwater removed from an excavation and water removed by the sump pump in the elevator pit, but does not include pumping and treating of groundwater from wells (pump-and-treat was eliminated from further consideration in the preliminary alternative screening process). Thus this alternative would need to be combined with other actions to fully address groundwater impacts at the Site. VOC-impacted groundwater would be extracted from an excavation or the interior elevator pit. This water could be either temporarily stored on site in tanks, and then either treated onsite and discharged to the ground onsite, discharged to a sanitary sewer under a discharge permit, or transported offsite for treatment.

6.2.2.4 Alternative 2.4: *In-Situ* Bioremediation (Enhanced Reductive Dechlorination) of Groundwater

Alternative 2.4 consists of *in-situ* treatment of groundwater by enhancing naturally-occurring breakdown of halogenated VOCs by indigenous bacteria such as *dehalococcoides, dehalobacter*, or others. Contaminant degradation is dependent on the presence of the appropriate nutrients and energy sources. The biochemical transformation of contaminants is the result of enzymes produced by the microorganisms that act as catalysts for the degradation reactions.

In reductive dechlorination, the chlorinated VOC (e.g. TCE) serves as an electron acceptor (or weak oxidizing agent) that is reduced by electrochemical reactions with other chemicals in the groundwater that serve as electron donors. Therefore an additional carbon source is required for the reaction to proceed.

Specialized laboratory testing is required to confirm that a population of bacteria capable of reducing the chlorinated VOCs exists, and that groundwater conditions are favorable to warrant the provision of enhancements to the process. Bench testing also is performed to identify a donor material that will provide optimum ERD results. Follow-up groundwater quality monitoring would be required to document the effectiveness of this remedial method. Supplemental injection of the donor solution could be performed if needed to achieve remedial objectives.

6.2.3 Engineering Control: SSDS Installation

Based on the presence of remaining VOC contamination in both soil and groundwater beneath the structure, and given that the structure will be continuously occupied, mitigation of potential soil vapor intrusion would be required and accomplished via installation of a sub-slab depressurization system. The system would incorporate a continuous vapor barrier beneath the building's first-floor slab, along with a system of piping connected to electric fans that evacuate air from beneath the slab, discharge those vapors above the building roof, and prevent potential buildup of VOC vapors that might enter the occupied space.

6.3 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR PROJECT SITE

This section provides a final evaluation of each of the retained alternatives, for each of the impacted media based on conditions that existed prior to the implementation of the IRM program. The alternatives are discussed in light of the nine evaluation criteria contained in DER-10, Section 4.2. Refer to the attached Remedial Alternatives Analysis Matrix (Table 1) for summaries of each alternative relative to each of those criteria; numerical scores for each alternative/criterion are also provided. Details on the estimated costs for each alternative are included in Appendix A.

6.3.1 Impacted Soil (interior and Exterior)

<u>**Alternative 1.1**</u> **(No Action)** is not considered viable primarily because it does not protect human health and the environment, it does not comply with SCGs, it does not reduce toxicity, mobility or volume of contaminants, it would likely not gain community acceptance, it would force the need for engineering and institutional controls and it would be a barrier to site re-development. Accordingly, this alternative is not considered further.

<u>**Alternative 1.2**</u> **(Removal & Offsite Disposal of All Impacted Soil):** Excavation and offsite disposal of all impacted soil (Track 1) scores very high as an alternative for several criteria, and would: provide immediate positive impact by eliminating all contaminated soil; rapidly achieve SCGs; have high implementability; have long-term effectiveness and permanence; and be likely to receive community acceptance due to its positive aspects. While this alternative scores high, due to its excessively high cost, it is not considered practical or cost effective and was not considered any further.

<u>**Alternative 1.3**</u> **(Removal & Offsite Disposal of Source Area Impacted Soil):** Excavation and offsite disposal of source area impacted soil scores very high as an alternative for several criteria, and would: provide immediate positive impact by eliminating contaminated material; rapidly

achieve many SCGs; have high implementability; have long-term effectiveness and permanence; and be likely to receive community acceptance due to its positive aspects. In addition capital costs are less than removing all impacted soil; however, reliance on ECs or ICs would be required since residual impacted soil is left in place.

Alternative 1.4 (Clean Soil Cover or Asphalt/Concrete Cap): This alternative is an EC typically used for soils that are impacted with COCs to allow them to remain onsite, while minimizing potential environmental impact and reducing the potential for exposure. It would be combined with Alternative 1.3.

6.3.2 Impacted Groundwater

Alternative 2.1 (No Action) is not considered viable primarily because it does not protect human health and the environment, it does not comply with SCGs, it would involve excessive long-term monitoring costs, and it would be a barrier to site re-development. Based on the identified contaminants, natural processes would likely not be capable of breaking down the contaminants to levels where exposure threats were reduced to acceptable levels within a reasonable time frame. This alternative is not considered further.

Alternative 2.2 (*In Situ* Chemical Oxidation in Groundwater): This alternative would be combined with Alternative 1.2 Removal and Disposal of All Impacted Soil to form a Track 1 Cleanup Alternative. Although this alternative scores high in some criteria for groundwater VOC remediation (compliance with SCGs, reduction in contaminant toxicity and volume, long-term effectiveness) its cost and the overall score of 73 out of 100 points indicates it is less desirable than other alternatives for groundwater. The primary drawbacks for this alternative are: 1) lower implementability due to the highly-specialized equipment and contractor requirements, 2) very high overall capital costs, 3) utilizes strong oxidizing chemicals in the process, 4) may have possible negative impacts to naturally-occurring dechlorination; and 5) may require multiple applications of the reagent. Based on these factors the Track 1 alternative is not considered practical or cost-effective and was not considered any further.

Alternative 2.3 (*Ex-situ* Treatment of Groundwater): This alternative is intended to partially address groundwater impacts by removing and treating (or disposing offsite) relatively minor volumes of groundwater from source-area excavations and the interior elevator pit sump. *Ex-situ* treatment of the CVOC-impacted groundwater could be accomplished with a portable air stripping unit, or a portable carbon absorption system, and the treated effluent discharged slowly to the ground surface on site in accordance with a permit from NYSDEC.

As an alternative to water treatment, discharge of untreated water to the Monroe County-operated sanitary sewer under a short-or long-term discharge permit would be a viable option, provided the COC levels are below the MCDES allowable discharge limits.

This alternative achieves high scores with most of the nine evaluation criteria, making it a favorable alternative for addressing initial groundwater impacts; however, it will need to be combined with other technologies to further address site-wide or offsite groundwater conditions.

Alternative 2.4 **(ERD in Groundwater):** This alternative would be combined with source-area soil removal. This alternative scores high in most criteria for groundwater VOC remediation and had an overall score of 86 out of 100. The most positive aspects include: 1) capitalizes on naturally-occurring dechlorination by indigenous bacteria; 2) will have good long-term effectiveness/permanence; 3) implementability is high – utilizes harmless food-grade additive (lactate); 4) reduces toxicity and volume of contaminants; 5) is cost effective; and 6) should have high degree of community acceptance.

Potential negative aspects include 1) the possibility of short-term, temporary increases in levels of TCE "daughter products" during the initial reductive dechlorination phase; and 2) additional application of the donor solution may be required.

Alternative 3 (Engineering Control – Vapor Intrusion Mitigation): This alternative provides direct mitigation of the potential for VOC vapors to impact continuously-occupied interior spaces occupied by residents. It counteracts the need to remove all impacted soil beneath the building and also provides protection from potential VOC vapors from soil and groundwater. Although the capital costs are significant, this alternative scores high for most other criteria, and is an essential part of the remedial action for the Site to allow for a Restricted Residential use.

7.0 AAR CONCLUSION: RECOMMENDED REMEDIES

7.1 IMPACTED AREAS

Impacted soil and groundwater were identified at the Site. COC presence was identified by pre-RI and RI investigations, and during site development-related construction activity, at levels that warranted remedial action; an IRM program has been conducted to address those impacts. Impacted media at the Site included groundwater, soil, soil vapor, and accumulated water and sludge in the building's elevator pit, as summarized below:

Table 4
Summary of Identified Site Impacts

Impacted Media	Contaminants of Concern	Remarks
Soil, interior	CVOCs	Primarily TCE and PCE, in localized areas.
	Petroleum VOCs	Primarily weathered petroleum with relatively low-level SCO exceedances in areas of buried piping; also soil with levels <SCOs but with 'nuisance characteristic' odors in Atrium area.
Elevator Pit Sludge	VOCs, SVOCs, Metals, PCBs	Three drums of sludge disposed as hazardous waste based on PCE concentration.
Elevator Pit Water	CVOCs and Petroleum-related VOCs, Pesticides	Water from precipitation (due to long-term lack of roof on elevator shaft) and groundwater infiltration.
Soil, exterior	Lead, Mercury, SVOCs	Shallow Urban Fill soils across site.
	Petroleum-related VOCs	Primarily TICs, near south side of building.
	CVOCs	Primarily TCE, near south side of building.
Groundwater	CVOCs	Primarily TCE and PCE, with lower concentrations of cis-1,2-DCE, trans-1,2-DCE and vinyl chloride and other non-chlorinated VOCs.
Soil Vapor	CVOCs	TCE, PCE, cis-1,2-DCE, and other non-chlorinated VOCs.

7.2 CHOSEN REMEDIES

Based on the depth and areal extent of impacted media, the identified COCs and concentrations, and Site geologic and hydrogeologic conditions, the remedial alternatives chosen to address the Site impacts include:

1. *Soil*:

a. Excavation and offsite disposal of source area CVOC-, petroleum-, and metals-impacted soils from the basement and exterior areas;

b. Installation of a clean soil cover or impervious cap over the entire Site exterior, including remaining impacted areas, as an EC. This includes a geotextile or filter fabric demarcation layer placed at the base of all excavations, and cover material consisting of either: two feet of clean soil backfill in landscaped areas; crushed stone and asphalt pavement/concrete sidewalks for remaining areas; and a concrete floor in the building basement.

2. _Groundwater_:

a. *In-situ* treatment of chlorinated CVOC-impacted groundwater via application of a bio-augmentation additive (sodium lactate) to the remedial piping system beneath the building's floor slab and eight monitoring wells to enhance natural attenuation through reductive dechlorination of CVOCs. This injection was performed during the period April to June of 2014.

b. Periodic pumping and discharge of impacted water from interior excavations and from the elevator pit to the municipal sewer. This was done in accordance with the conditions of short-term (excavation water and some elevator pit water) and long-term (permanent elevator pit sump) discharge permits from MCDES.

c. Post-injection groundwater monitoring to confirm that the enhanced bioremediation is occurring. This remedial action commenced in May 2014, and was still underway at the time this AAR was prepared. Monitoring will continue quarterly through at least two quarters of 2015 at which time the need for additional injection and/or monitoring will be reviewed with NYSDEC.

3. _Engineering Controls_:

Installation of a vapor barrier and an SSDS beneath the structure to preclude infiltration of VOC vapors into the residential facility from impacted soil and groundwater that may remain beneath the building. Installation of the active components of the SSDS was completed during October, 2014. Six vacuum monitoring points installed beneath the first floor slab were monitored and it was confirmed at each point that vacuum induced by the roof-mounted fans is sufficient to preclude the infiltration of sub-slab vapors into the residential facility.

4. _Institutional Controls_:

An EE for the Site that will:

- Preclude groundwater usage at the Site;
- Include a SMP to provide guidance regarding potential environmental and exposure concerns relative to future Site use and activities. The SMP also includes an Operations, Maintenance & Monitoring Plan for the SSDS; and
- Require periodic inspection of and reporting on maintenance of ECs.

7.3 REMEDIAL ACTIONS COMPLETED TO DATE (IRMS)

As mentioned above and discussed in detail in Section 3, a program of IRMs was implemented between spring of 2013 and fall of 2014 for the Site. These IRMs were deemed appropriate and necessary to: 1) provide timely response to the findings of the RI; 2) minimize the potential for further spread of contaminants; and 3) expedite redevelopment of the Site, which had been unoccupied for 20 years and was ready for redevelopment during the summer of 2012. The IRMs were completed in accordance with the *Interim Remedial Measures Work Plan, Former Carriage Factory, Brownfield Cleanup Program Site #C902019, 33 Litchfield Street, Rochester, Monroe County, New York*," dated May 24, 2013, prepared and submitted by Stantec on behalf of CFSNA, and approved by NYSDEC on August 30, 2013, with NYSDEC approved modifications as required.

The attached Table 5 (Summary of Completed and Potential Additional IRMS) indicates the remedial actions taken to date, and demonstrates that combinations of remedial alternatives were undertaken for some media. Each of the alternatives listed above has been completed as an element of the IRM program for interior and/or exterior areas. Alternative 2.4 b (Post-Injection Monitoring) has begun and additional groundwater sampling events are planned in 2015.

Monthly progress reports submitted to NYSDEC throughout the IRM process summarized the activities performed, disposal of wastes generated during the program, results of soil and groundwater sampling performed, and other pertinent data. An IRM Construction Completion Report and Final Engineering Report summarizing the IRM program performed at the site was submitted under separate cover to NYSDEC on December 10, 2014, and documents the IRM program in greater detail than this AAR.

8.0 Remedial Action Work Plan

This section describes the remedial actions to be performed in addition to those described in the previous section.

8.1 SITE GROUNDWATER MONITORING PROGRAM

The *in situ* groundwater treatment has been implemented via sodium lactate solution injection (April - June 2014) and quarterly groundwater monitoring is ongoing. Four post-injection sampling events have been performed to date (May, July, August, and October 2014; however, the October 2014 data are still undergoing review as they have not been validated). Analytical results to date have been favorable and indicate that reductive dechlorination is occurring. Sampling data have indicated that CVOC levels in the most-impacted wells decreased by up to an order of magnitude shortly after the lactate injection was performed. Certain monitoring wells exhibited initial increases in total CVOC levels. However, in all cases this was due to increased concentrations of the "daughter" products cis-1,2-DCE, trans-1,2-DCE and vinyl chloride, which are created during the process of reductive dechlorination. The average Oxidation-Reduction Potential value has continued its desired decrease from approximately -174 to -243 millivolts (mV) between the July and August sampling events, further indicating favorable ERD conditions have been created by the sodium lactate injections. It should be noted that there has been rebound of CVOC levels in selected wells; however, this is not an uncommon occurrence in ERD programs, and these concentrations are expected to ultimately reduce further with time.

The current quarterly sampling program will include two additional quarterly rounds in 2015, at which time the cumulative results will be reviewed with NYSDEC to assess the future monitoring schedule and potential need for additional application of sodium lactate to supplement the bioremediation effort.

These ongoing Site activities will be performed utilizing the measures provided in the project Health and Safety Plan, included in Appendix B. Air monitoring will continue to be performed in accordance with the Community Air Monitoring Program (Appendix C). Ongoing groundwater sampling and laboratory analyses will continue to be performed in accordance with the Quality Assurance Project Plan (Appendix D).

8.2 ELEVATOR PIT SUMP DISCHARGE

As described above, periodic pumping and discharge from the elevator pit sump will be required to keep the pit free of accumulated water. Due to the presence of CVOCs in the groundwater beneath the building, the accumulated water is likely to be impacted with these contaminants for the near-term. Accordingly, a long-term discharge permit has been obtained from MCDES to regulate this discharge, and the sump piping has been designed with a sampling port to accommodate the permit-required quarterly sampling. In accordance with the permit, samples will be analyzed for Halogenated VOCs, Cadmium, Copper, Lead and Zinc. The results will be submitted to MCDES as required by the permit conditions.

Because the groundwater is undergoing *in situ* bioremediation, and with continued groundwater removal of impacted groundwater by the sump, contaminant levels may eventually be sufficiently reduced such that cessation of the monitoring program may be allowable. Sampling and reporting will not cease without written approval from MCDES.

8.3 INSTITUTIONAL CONTROLS

8.3.1 Environmental Easement

The Environmental Easement (EE) was executed by the NYSDEC on November 5, 2014 and filed in the Monroe County Clerk's Office on November 18, 2014. The final recorded EE was submitted to the Department on December 2, 2014 and will remain with the property in perpetuity until or unless the remaining contamination on the Site is removed or remediated to a degree satisfactory to the NYSDEC.

The EE limits use of the Site to Restricted Residential, Commercial or Industrial Use, and includes:

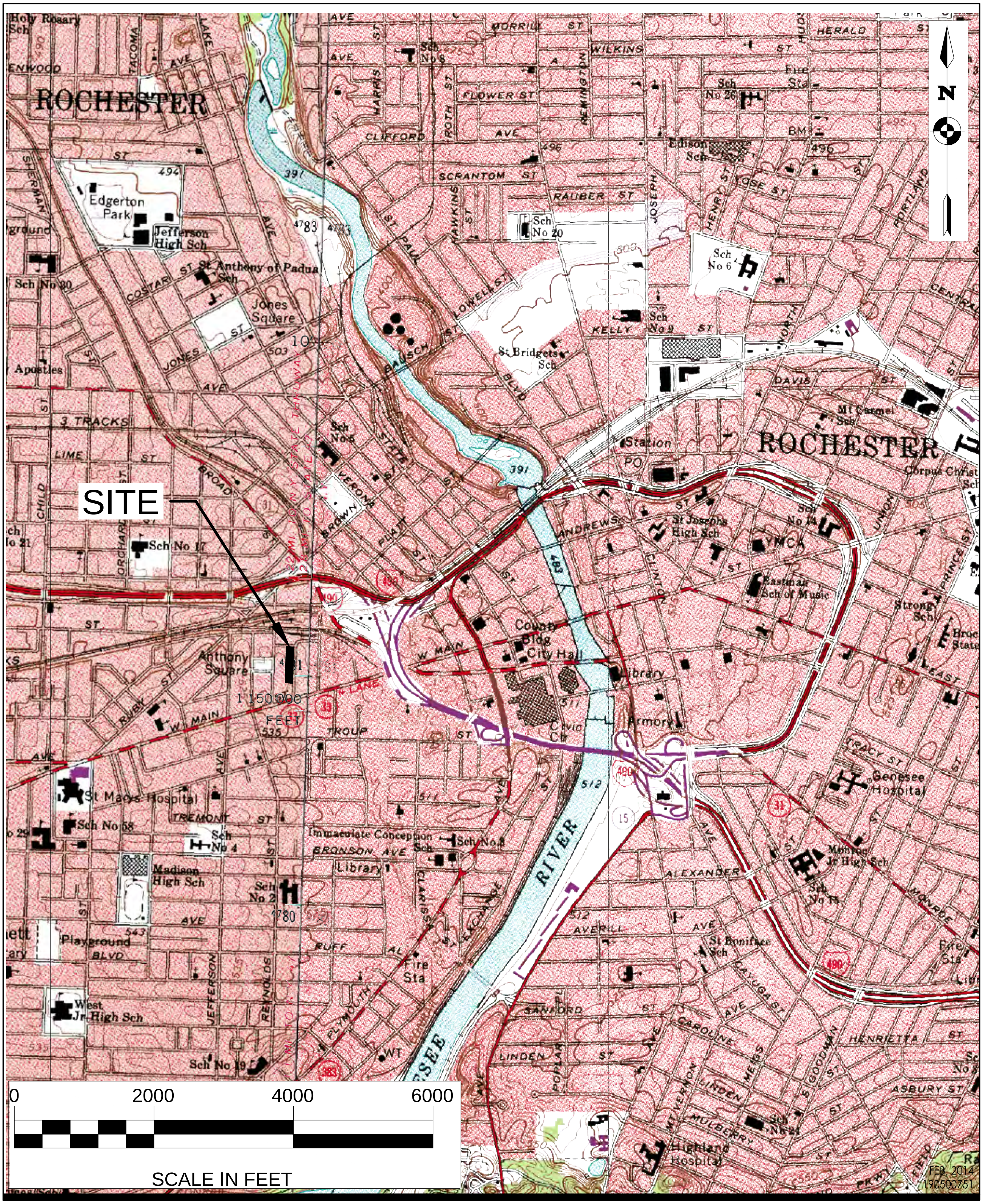
- A restriction preventing use of groundwater underlying the Site without treatment rendering it safe for the intended use (in accordance with City of Rochester Code);
- A SMP to provide guidance regarding potential environmental and exposure concerns relative to future Site use and activities; and
- Require periodic inspection of and reporting on maintenance of ECs.

8.3.2 Site Management Plan

Although an IRM program has been completed for the Site, some residual contamination will remain in soil and groundwater after remediation has been completed. In order to minimize the potential for future intrusive Site activities to exacerbate the spread of contamination or create potential exposure to impacted soil or groundwater, a SMP has been developed. The SMP was submitted as final on December 10, 2014 and approved by NYSDEC on December 11, 2014. The SMP documents subsurface conditions across the Site, and provides guidance for:

- Continuing the ongoing groundwater monitoring program to determine when the goals of the IRMs are met;
- Planning and executing future Site activities such as excavation, grading, drilling, construction of new or renovation of existing buildings or utilities, etc. that could encounter impacted soil or groundwater;
- Monitoring and screening soils and groundwater for potential COCs;
- Handling, characterizing, and disposing of impacted media, if encountered;
- Operating and maintaining the engineering controls in place at the Site, including the SSDS; and
- Ongoing Site inspection, monitoring and reporting requirements.

FIGURES



ORIGINAL SHEET - ANSI A
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Client/Project

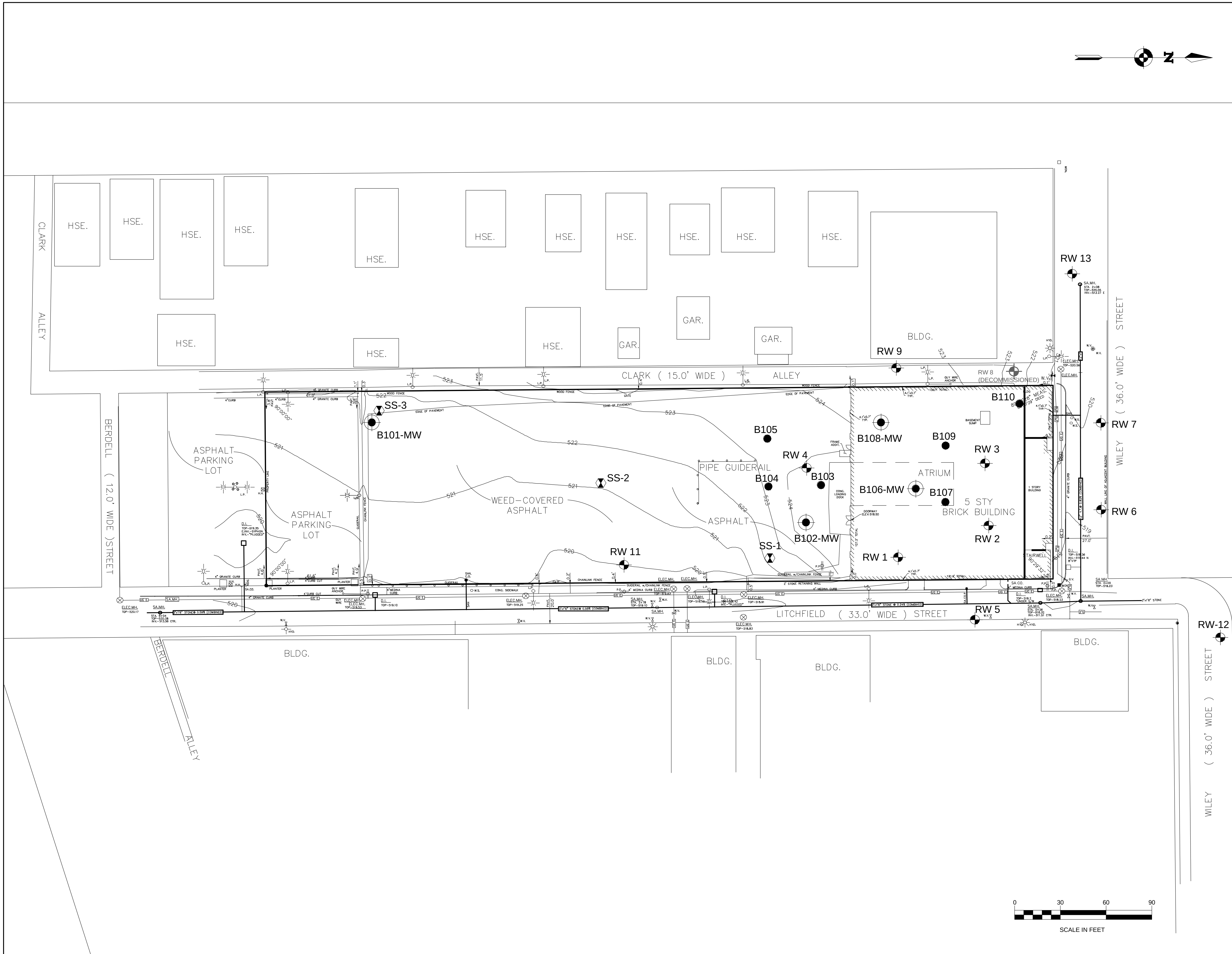
CARRIAGE FACTORY SPECIAL NEEDS APARTMENTS, L.P.
ALTERNATIVES ANALYSIS REPORT AND REMEDIAL ACTION WORK PLAN
BROWNFIELD CLEANUP PROGRAM
33 LITCHFIELD STREET, ROCHESTER , NY 14608

Figure No.

1

Title

SITE LOCATION MAP



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Legend

- 33 LITCHFIELD STREET BUILDING LIMITS
- RW 3 — LOCATIONS OF PRE-RI GROUNDWATER MONITORING WELL
- B101-MW — RI MONITORING WELL LOCATION (APPROX)
- SS-1 — RI SURFACE SOIL SAMPLE LOCATION (APPROX)
- B105 — RI SOIL TEST BORING LOCATION (APPROX)
- 522 — PRE-DEVELOPMENT GROUND SURFACE CONTOURS
- PROPERTY LINE
- SANITARY SEWER (SA MH=MANHOLE)

Notes

1. PLAN ADAPTED FROM BASE PLAN BY PARRONE ENGINEERING.
2. GROUND SURFACE ELEVATION CONTOURS OBTAINED FROM DRAWING ENTITLED "BORING LOCATION PLAN" BY FOUNDATION DESIGN, P.C., DATED JANUARY 26, 2011.

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name:	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

CARRIAGE FACTORY SPECIAL NEEDS APARTMENTS, L.P.
ALTERNATIVES ANALYSIS REPORT AND REMEDIAL ACTION WORK PLAN

BROWNFIELD CLEANUP PROGRAM
FORMER CARRIAGE FACTORY

33 LITCHFIELD STREET, ROCHESTER , NY

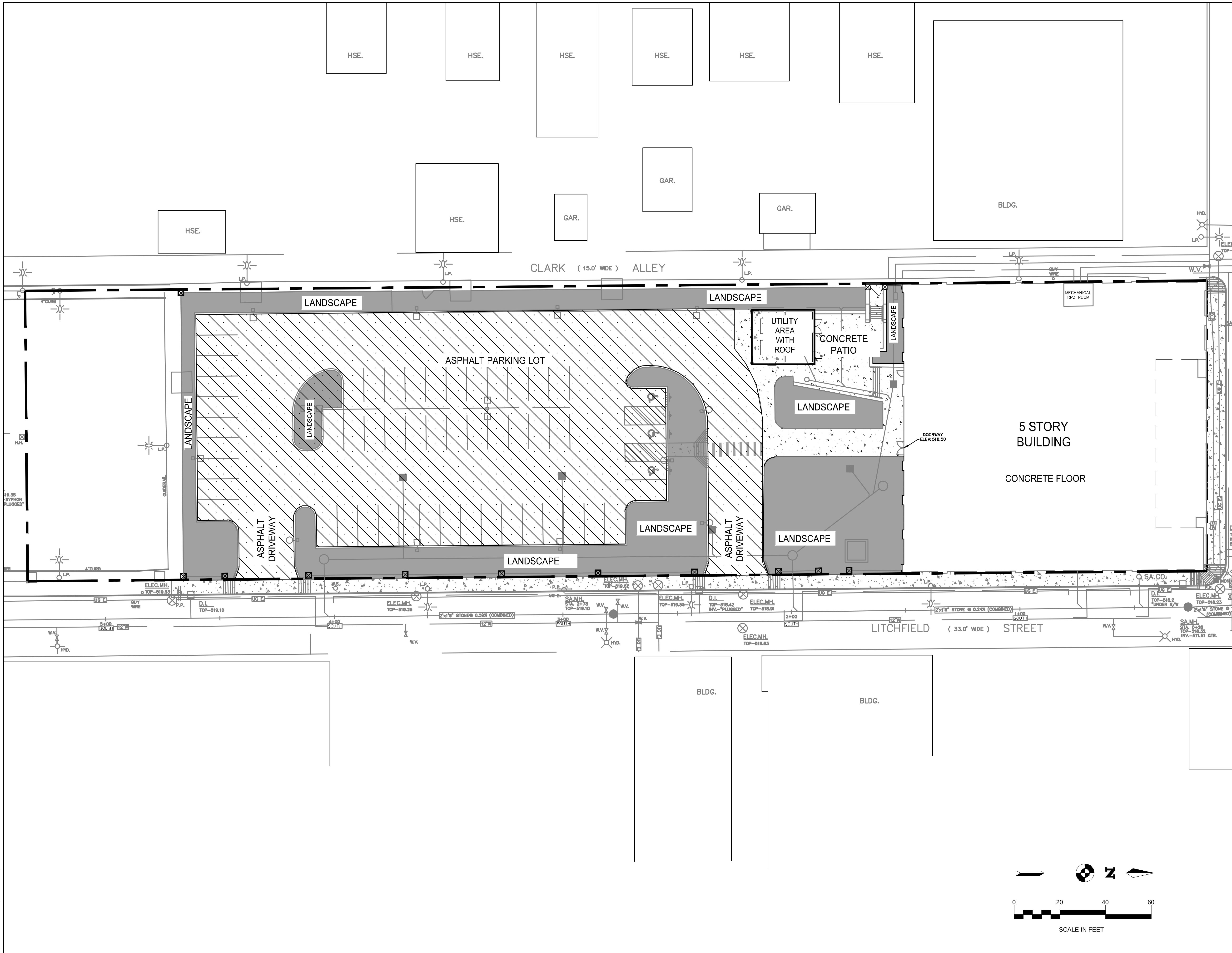
Title

SITE PLAN WITH REMEDIAL INVESTIGATION SAMPLE, BORING AND WELL LOCATIONS

Project No.	Scale
190500751	AS SHOWN

Drawing No.	Sheet	Revision
FIGURE 2	of	0

U:\190500751\drawing\CAD\AAR\Figure 2 Surface Soil Test Boring & Monitoring Locations .dwg
2014/09/18 7:20 AM By: Less, Andy



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Legend

- AREAS WITH ASPHALT CAP
- AREAS WITH CONCRETE CAP
- AREAS WITH MINIMUM 2-FT-THICK CLEAN SOIL COVER
- PROPERTY LINE

Notes

1. PLAN ADAPTED FROM BASE PLAN BY PARRONE ENGINEERING.

Revision	By	Appd.	YY.MM.DD

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Client/Project

CARRIAGE FACTORY SPECIAL NEEDS APARTMENTS, L.P.
ALTERNATIVES ANALYSIS REPORT AND REMEDIAL ACTION WORK PLAN

BROWNFIELD CLEANUP PROGRAM
FORMER CARRIAGE FACTORY

33 LITCHFIELD STREET, ROCHESTER, NY

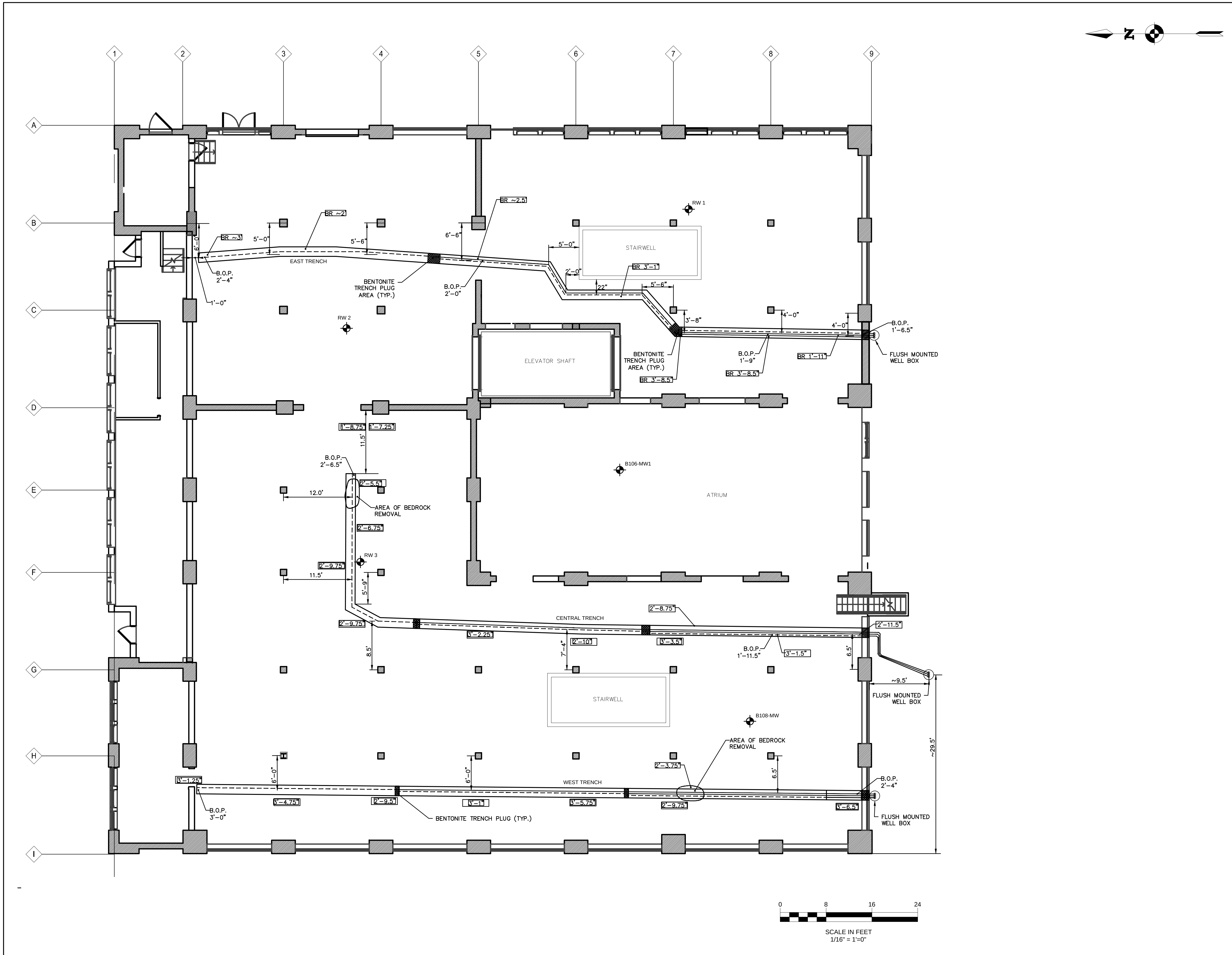
Title

SOIL COVER AND IMPERVIOUS SURFACE CAP AREAS

Project No.	Scale	
190500751	AS SHOWN	
Drawing No.	**Sheet**	**Revision**
FIGURE 3	of	0

U:\190500751\drawing\CAD\AAR\Figure 3 – Soil Cover And Surface Cap.dwg
2014/09/18 7:23 AM By: Less, Andy

ORIGINAL SHEET – ANSI D



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Legend

BUILDING COLUMN
3'-1.25" DEPTH TO THE TOP OF BEDROCK
AREA OF BEDROCK REMOVAL
APPROX. TRENCH LIMITS
2" I.D. SOILD PIPE
BENTONITE TRENCH PLUG
2" I.D. SLOTTED PIPE
B.O.P. BOTTOM OF PIPE

Notes

1. EXCAVATION LIMITS AND DIMENSIONS ARE APPROXIMATE ONLY.
2. DEPTHS RELATIVE TO BELOW FINISHED FLOOR ELEVATION (0'-0").

Revision	By	Appd.	YY.MM.DD
AS-BUILT DRAWINGS	BH/AL	PN	14.12.05
Issued	By	Appd.	YY.MM.DD

File Name: Dwn. Chkd. Dsgn. YY.MM.DD

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Client/Project

CARRIAGE FACTORY
ALTERNATIVES ANALYSIS REPORT AND
REMEDIAL ACTION WORK PLAN
BROWNFIELD CLEANUP PROGRAM
FORMER CARRIAGE FACTORY
33 LITCHFIELD STREET, ROCHESTER , NY

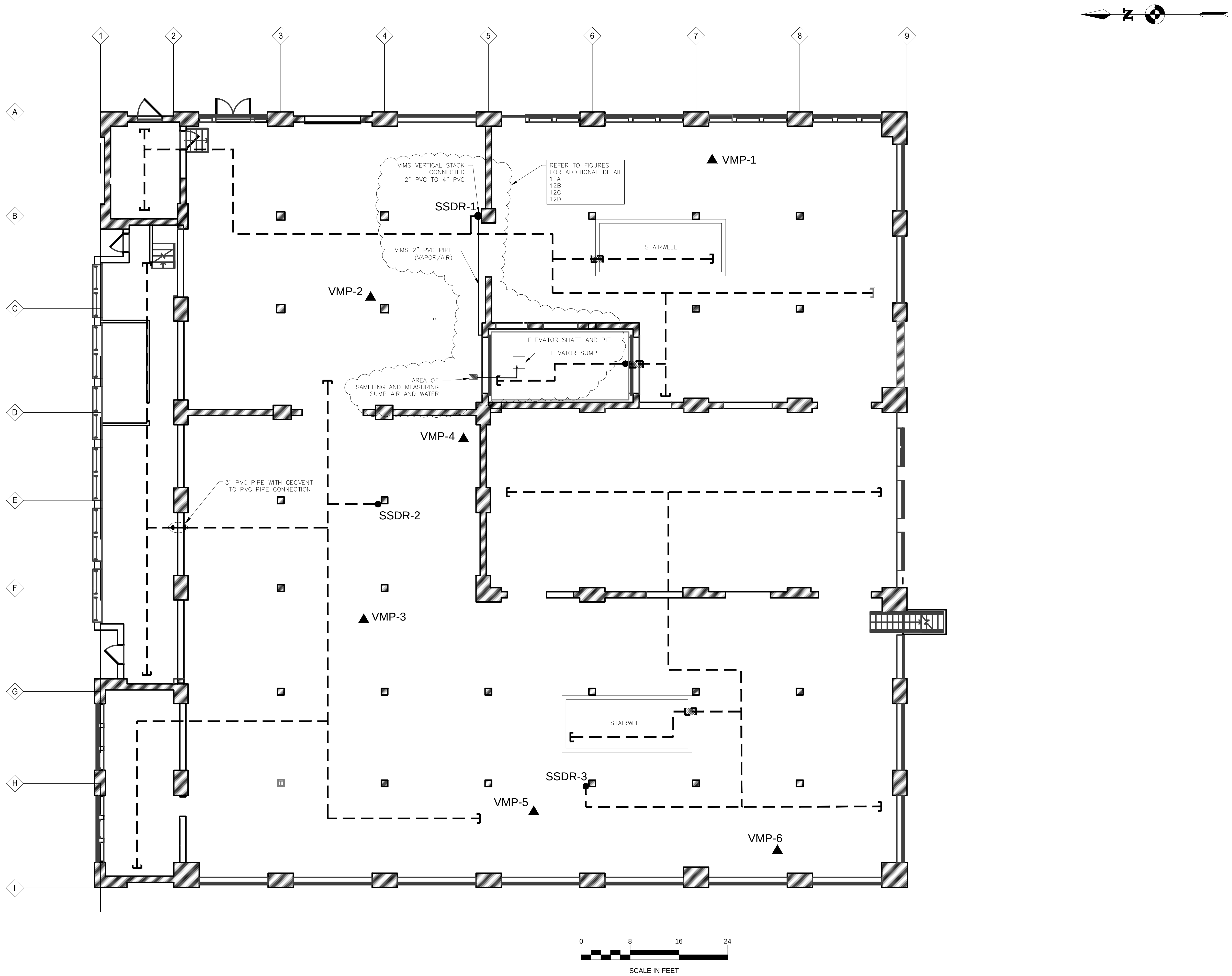
Title

AS-BUILT GROUNDWATER
REMEDIATION PIPING PLAN

Project No. 190500751
Scale AS SHOWN
Drawing No. Sheet Revision
FIGURE 4 of 0

U:\190500751\drawing\CAD\AAR\Figure 4 – AS-BUILT GROUNDWATER REMEDIATION PIPING PLAN.dwg
2014/12/10 2:16 PM By: Less, Andy

ORIGINAL SHEET – ANSI D



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Legend

- ▲ VACUUM MONITORING POINTS (VM)
- ● RISER PIPE (SSDR–1)
- GEOVENT WITH CAP
- SOLID PVC PIPE
- 3" PVC PIPE WITH GEOVENT TO PVC PIPE CONNECTION
- METAL SLEEVES

Notes

1.) VIMS (LIQUID BOOT MEMBRANE SECTION) APPLICATION UNDER ALL CONCRETE SLAB HORIZONTAL APPLICATION

Revision	By	Appd.	YY.MM.DD
AS-BUILT DRAWINGS	BH/AL	PN	14.12.05
Issued	By	Appd.	YY.MM.DD

File Name:	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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Client/Project

CARRIAGE FACTORY
ALTERNATIVES ANALYSIS REPORT AND REMEDIAL ACTION WORK PLAN
BROWNFIELD CLEANUP PROGRAM
FORMER CARRIAGE FACTORY
33 LITCHFIELD STREET, ROCHESTER , NY

Title

SUB-SLAB DEPRESSURIZATION SYSTEM LAYOUT

Project No.	Scale
190500751	AS SHOWN

Drawing No.	Sheet	Revision
FIGURE 5	of	0

U:\190500751\drawing\CAD\AAR\Figure 5 Sub-Slab Depressurization System Layout.dwg
2014/12/10 2:19 PM By: Less, Andy

ORIGINAL SHEET – ANSI D

TABLES

Former Carriage Factory
Alternatives Analysis Report

Table 1
Remedial Alternative Analysis Matrix

	Remedial Alternative		Description of Alternative	1 - Protection of Human Health and the Environment		2 - Standards, Criteria, & Guidance (SCG)		3 - Short-term Impacts		4 - Long-term Effectiveness & Permanence		5 - Reduction of Toxicity, Mobility, or Volume	
				Score	Discussion	Score	Discussion	Score	Discussion	Score	Discussion	Score	Discussion
			Scoring System	0 = Least protective 10 = Most protective		0 = Least likely to meet SCGs 10 = Most likely to meet SCGs		0 = Most short term impact 10 = Least short-term impact		0 = Least effective & permanent 10 = Most effective & permanent		0 = Least reduction 10 = Most reduction	
	1.1/2.1	**No Action / Monitored Natural Attenuation (MNA)**	**- Assume 30 years of quarterly groundwater monitoring and fence installation**	1	- Immediate risks associated with additional off-Site migration if VOCs are not mitigated in the short term. - Potential on-site exposure risks related to proposed immediate site development and use.	1	- Compliance with SCGs will not be achieved for an extended period of time, assuming natural mechanisms are in place to degrade contaminants;	3	- Hinders or precludes successful site re-development without also implementing significant engineering controls. - Does not address or monitor in areas of impacted soil above water table, or soil vapor.	2	Residual contamination would remain on-Site following implementation of MNA, but long-term reduction is expected. - Natural processes that induce attenuation of contaminant impacts to the subsurface are dependent upon several factors such as subsurface conditions, amount of contaminant present and presence of free product (NAPL). Given this uncertainty, exposure risks outlined in criteria 1 are most likely to persist for an undetermined period of time; - Monitoring alone will not mitigate exposure risks but will provide some quantification; - High degree of uncertainty associated with meeting remedial action objectives in the future. - Requires Engineering and Institutional Controls to protect from exposure to residual contamination.	2	- Mobility of contaminants not reduced, and may increase with time. - Volume very slowly reduced through natural degradation. - Toxicity would show temporary increase as Vinyl Chloride and other VOC daughter product concentrations in groundwater will temporarily rise due to natural degradation of TCE. - Metals and PAH impacts in Urban Fill would remain
SOIL	1.2	**All Impacted Soil Removal and Offsite Disposal (Track 1)**	**Excavate/dispose all petroleum and chlorinated VOC-contaminated soil and Urban Fill soils -Exterior** **- - - - - - - - - - - - - - - -** **Excavate/dispose all chlorinated and petroleum-impacted soil - Interior**	9	- Immediate positive impact through the removal of all contaminated soil.	9	- High degree of compliance with SCGs by replacing all impacted soil and replacing with clean backfill soil.	6	- Short term impacts include truck traffic (dump trucks for soil); potential for exposure due to dust generation and potential vapor release from soil.	9	- High degree of long-term effectiveness and permanence, since all contaminated soil is physically removed from the site.	9	- High degree of reduction of toxicity, mobility and volume, due to immediate physical removal of all contaminated soil.
	1.3	**Source Area Soil Removal and Offsite Disposal.**	**Excavate/dispose source area Chlorinated VOC-contaminated soil and Urban Fill soils -Exterior** **- - - - - - - - - - - - - - - -** **Excavate/dispose source area chlorinated and petroleum-impacted soil -Interior**	8	- Immediate positive impact through the removal of most contaminant source.	8	- Relatively high degree of compliance with SCGs by excavating source area soil.	6	- Short term impacts include truck traffic (dump trucks for soil); potential for exposure due to dust generation and potential vapor release from soil.	8	- High degree of long-term effectiveness and permanence, since source area contaminated soil is physically removed from the site.	8	- High degree of reduction of toxicity, mobility and volume, due to immediate physical removal of source area contaminants.
	1.4	**Engineering Controls: Covering Impacted Soil With Clean Soil or impervious surfaces.**	**- Place two-ft-thick cover of clean soil (onsite or imported) over selected areas of impacted soil. Cover would include sufficient topsoil to support vegetation.** **- Seed cover with appropriate vegetative cover.** **- Place asphalt or concrete over majority of site** **- Maintain/repair cover as necessary.**	8	- Clean cover eliminates contact with potentially-impacted soils; - Especially effective for metals, which are generally not mobile in the environment.	8	- Can result in potentially impacted soil being in compliance with SCGs.	7	- Short term impacts include: potential for dust generation during site grading & burial; minor truck traffic to import clean topsoil.	7	- Reasonable long-term effectiveness due to immobility of metals and slow breakdown of VOCs - Reasonable degree of permanence since potential impacted soil would be covered reducing likelihood of future disturbance. - Requires Institutional Controls to maintain ECs, protect public from exposure to potential residual contamination.	8	- Reduction of mobility is high since impactedsource material is removed and remaining soils will be covered in place. - Reduction in volume; - Reduction in toxicity over time through natural degradation of VOCs.
GROUNDWATER	2.2	**In-situ Chemical Oxidation (ISCO) of Impacted Groundwater (Track 1)**	**Introducing strong chemical oxidizers directly into groundwater to break down chemical contaminants in place.**	8	- Likely short-term increase in TCE /PERC daughter-product VOCs, followed by overall reduction of residual contaminant levels. - Oxidizing chemicals used in process (typically permanganate, hydrogen peroxide, persulfate or ozone) have exposure risks to workers and can be mildly harmful to the environment.	9	- Compliance with SCGs anticipated within relatively moderate time frame, following multiple application events.	6	- Short-term impacts may include short-term increase in Vinyl Chloride or other TCE "daughter" products; - Possible negatives impacts to natural attenuation processes that may already be occurring.	9	- Anticipated to effectively reduce VOCs in groundwater to levels below SCGs. - Ability to reach and treat impacted groundwater in bedrock is uncertain. - Generally achieves cleanup to low contaminant concentration levels. - Typically requires multiple applications.	9	Anticipated to be effective in reducing toxicity, mobility and volume of contaminant mass via breakdown of contaminant compounds to harmless byproducts through chemical oxidation, following multiple applications.
	2.3	**Ex-situ Treatment/Disposal of Source-area Groundwater.**	**Removal of limited volumes of source-area groundwater from excavations and elevator pit (via elevator pit sump pump);** **On-site treatment/discharge; or offsite treatment.**	8	Protective of health and the environment (if combined with source-area soil removal): combines removal and destruction of contaminants from subsurface.	5	Generally achieves "non-detect" levels of VOC contaminants prior to discharge, however, it will not reduce site-wide groundwater impacts	7	- Temporary storage in frac tanks; - Truck trips for tank mob/demob; - Temporary pumping system; - Water discharged slowly with no impacts.	6	- Generally applies to limited amount of source area groundwater; not entire plume. - High degree of permanence; - Partial removal of the most contaminated zone (source area) of groundwater when combined with source-area soil removal;	7	- Moderate reduction in toxicity and volume of contaminants by removal of limited source-area groundwater, when combined with source-area soils removal; - Little change to mobility of contaminants left in place.
	2.4	**In-situ Biological Treatment of Impacted Groundwater.**	**- Placement of electron donor material such as sodium lactate solution (for ERD of CVOCs) into source-area excavation and ground-water plume area.** **- - - - - - - - - - - - - - - - - -** **- 1 yr. of quarterly and 2 yrs. of semi-annual groundwater quality monitoring for each RAOC.**	9	- Electron donor materials are generally harmless in the environment. - Likely short-term increase in TCE and PERC daughter-product VOCs, followed by rapid overall reduction of residual contaminant levels.	9	- Compliance with SCGs anticipated within relatively short time frame.	7	- Short-term ERD impacts may include a temporary increase in or other TCE/PERC "daughter" products;	9	- Anticipated to effectively remove remaining residual VOCs in groundwater to levels below SCGs, with little to no long-term "rebound" effect. - Generally achieves cleanup to low contaminant concentration levels' may require more than one application of electron donor solution.	8	Anticipated to be effective in reducing toxicity, mobility and volume of contaminant mass via breakdown of contaminant compounds to harmless byproducts through biodegradation.
SOIL VAPOR	3.0	**Engineering Control: VOC Vapor Intrusion Mitigation using Vapor Barrier and Sub-slab Depressurization System**	**Liquid Boot vapor membrane and Sub-slab Depressurization System under entire occupied building.**	10	- Effectively prevents human exposure, provided system operation remains continuous.	8	- Good - Generally achieves "non-detect" levels of VOC contaminants in occupied spaces.	9	- No significant short-term impacts, since system design can be relatively easily incorporated into building development design.	7	- High degree of long-term effectiveness provided system remains in continuous operation. - Will likely require periodic replacement of blowers or other electrical components.	5	- Does not address or remove source of VOCs

Notes:
1 See text for more detailed discussion of criteria.

Former Carriage Factory
Alternatives Analysis Report

Table 1
Remedial Alternative Analysis Matrix

Media	No.	Remedial Alternative	Description of Alternative	6 - Implementability: Score	6 - Implementability: Discussion	7a - Cost Effectiveness - Capital: Score	7a: Opinion of Probable Costs (OPC)[2]	7a: Discussion	7b - Cost Effectiveness - OM&M: Score	7b: Opinion of Probable Costs (OPC)[2]	7b: Discussion	8 - Community Acceptance (see CPP): Score	8: Discussion	9 - Land Use: Score	9: Discussion	Overall (sum of all scores): Total Score	Total Opinion of Probable Cost	Conclusions and recommendations
			Scoring System	0 = Least implementable 10 = Most implementable		0 = Least cost effective 10 = Most cost effective			0 = Least cost effective 10 = Most cost effective			0 = Least accepted 10 = Most accepted		0 = Worst based on 15 criteria[1] 10 = Best based on 15 criteria[1]		0 = Worst overall 100 = Best overall		
	1.1/2.1	**No Action / Monitored Natural Attenuation (MNA)**	**- Assume 30 years of quarterly groundwater monitoring**	9	- Successful implementation depends largely on presence of natural organisms and processes that are degrading CVOC contaminants. - If natural degradation phenomena are observed, implementation would be straightforward, using existing monitoring well network. -Would require fence installation	5	$100,000	- Monitoring well network already exists, however, fence would be needed to keep people off the site	2	$859,000	- Highest OM&M costs of all alternatives, due to the 30-year duration of monitoring program, and maintenance of institutional/ engineering controls.	1	- Community acceptance for MNA is anticipated to be low due to the lack of control of off-Site contaminant migration. - To be completed following review of public comments	2	- Proposed land use is Restricted Residential. - Engineering and Institutional controls will be required at the Site under this alternative for an undetermined period of time. - Potential receptors (adjacent residential and commercial properties) are cross or downgradient with respect to groundwater flow.	**28**	**$959,000**	- Very costly alternative; - Least favorable alternative overall due to poor performance with the 'protection of human health and the environment', 'SCG', 'long-term effectiveness and permanence' and 'reduction of toxicity, mobility or volume' criteria. - Poor remedial 'value' : costs of this alternative approach versus that of an aggressive remedial program that is more likely to comply with regulatory agency requirements.
SOIL	**1.2**	**All Impacted Soil Removal and Offsite Disposal (Track 1)**	**Excavate/dispose all Chlorinated VOC-contaminated soil and Urban Fill soils -Exterior** **- - - - - - - - - - - - - - - -** **Excavate/dispose all chlorinated and petroleum-impacted soil - Interior**	9	- High implementability - no specialty contractor or highly-technical equipment required. - Year-round implementation feasible.	1	$1,245,000	- Much more costly than source area removal	9	$0	- No OM&M costs for soil due to removal of all contaminated soil	9	- Anticipated to be high due to relatively quick and permanent nature of the method.	9	- Proposed land use is Restricted Residential. Engineering and Institutional Controls would not be needed for soil due to removal of all impacted soil.	**79**	**$1,245,000**	Favorable alternative of those considered for chlorinated VOC-, Petroleum-, and metals impacted soil: High scores in many categories; however, much more costly than source area removal. Would still need to be used in conjunction with a groundwater remedial method.
SOIL	**1.3**	**Source Area Soil Removal and Offsite Disposal.**	**Excavate/dispose Chlorinated VOC-contaminated soil and Urban Fill soils -Exterior** **- - - - - - - - - - - - - - - -** **Excavate/dispose chlorinated and petroleum-impacted soil -Interior**	9	- High implementability - no specialty contractor or highly-technical equipment required. - Year-round implementation feasible.	9	$636,000	- Less costly and more effective compared to complete soil removal but would require Engineering Controls as per Alt. 1.4 for costs not included here.	8	$0	- OM&M costs would be required to maintain cover cap (see Alt. 1.4 for costs not included here)	8	- Anticipated to be high due to relatively quick and permanent nature of the method.	8	- Proposed land use is Restricted Residential. Engineering and Institutional Controls would be needed for remaining impacted soils.	**80**	**$636,000**	Best alternative of those considered for chlorinated VOC-, Petroleum-, and metals impacted soil: High scores in all categories and considerably less costly than removal of all impacted soil. Would need to be used in conjunction with an impervious cap and clean soil cover and a groundwater remedial method.
SOIL	**1.4**	**Engineering Controls: Covering Impacted Soil With Clean Soil or impervious surfaces.**	**- Place two-ft-thick cover of clean soil (onsite or imported) over selected areas of impacted soil. Cover would include sufficient topsoil to support vegetation.** **- Seed cover with appropriate vegetative cover.** **- Place asphalt or concrete over majority of site** **- Maintain/repair cover as necessary.**	8	- High implementability - no specialty contractor, technical equipment/methods required. Utilizes on site soil and readily-obtainable imported topsoil for final cover material.	8	$203,875	Lower cost than offsite disposal, high effectiveness.	9	$26,300	- Low OM&M costs, related primarily to periodic inspection and reporting. - Possible minor maintenance costs related to potential occasional cover material repair. - Assume 10 years of inspections (1 year of quarterly, 9 years of annual)	6	- Anticipated to be moderate due to low potential impacts and rapid implementation, but leaves residual contamination on site. - Does not address groundwater impacts.	7	- Proposed land use is Restricted Residential. - Potential receptors (adjacent residential and commercial properties) are cross or downgradient with respect to groundwater flow.	**76**	**$230,175**	Favorable alternative for areas of low-level metals impacts to soil (Urban Fill).
GROUNDWATER	**2.2**	**In-situ Chemical Oxidation (ISCO) of Impacted Groundwater (Track 1)**	**Introducing strong chemical oxidizers directly into groundwater to break down chemical contaminants in place.**	6	- Chemox additives are readily available. - Thorough groundwater chemistry understanding is critical and bench-scale testing would be required. - Requires specialized equipment, chemicals and experienced contractors. - Existing well network already in place in areas of concern; this would facilitate rapid implementation. - Typically requires multiple application events. - Ability to reach and treat bedrock groundwater uncertain	4	$625,000	- Capital cost associated with multiple applications of Chemox additives is high.	6	$182,000	- OM&M activities include: Bench-scale testing and analyses; Baseline groundwater sampling/analysis; quarterly post-injection groundwater sampling and analysis; results reporting. - Cost assumes the likely need for supplemental application(s) of oxidizer chemical.	8	- The anticipated improvement of groundwater quality likely makes this alternative acceptable; - Use of strong oxidizer chemical is a negative aspect.	8	- Proposed land use is Restricted Residential. - Potential receptors (adjacent residential and commercial properties) are cross or downgradient with respect to groundwater flow.	**73**	**$807,000**	Very costly alternative; lower score than other groundwater alternatives that should achieve similar results, at lower cost.
GROUNDWATER	**2.3**	**Ex-situ Treatment/Disposal of Source-area Groundwater.**	**Removal of source-area groundwater from excavations and elevator pit;** **On-site treatment/discharge; or offsite treatment.**	9	High degree of implementability: ready access to equipment and materials required (excavation, pumps and water storage equipment); - Sewer discharge is allowable in City of Rochester with within permit threshold limits.	9	$33,000	Capital costs include short-term expenses: pump and tank rental, fuel, lab analyses and labor, discharge permit.	7	$20,000	OM&M costs include long-term discharge monitoring; - See Alternative F for groundwater monitoring costs (not included in this alternative).	8	- High acceptance due to positive scores on most categories.	8	- Proposed land use is Restricted Residential. - Potential receptors (adjacent residential and commercial properties) are cross or downgradient with respect to groundwater flow.	**74**	**$53,000**	- Favorable groundwater alternative (for limited amounts of source-area groundwater) due to good overall performance, however it will not address larger site-wide issues.
GROUNDWATER	**2.4**	**In-situ Enhanced Reductive Dechlorination of Impacted Groundwater.**	**- Placement of electron donor material such as sodium lactate solution (for ERD of CVOCs) into source-area excavation and ground-water plume area.** **- - - - - - - - - - - - - - - - - -** **- 1 yr. of. quarterly and 2 yrs. of semi-annual groundwater quality monitoring for each RAOC.**	9	- Bench-scale test indicated site groundwater conditions favor effective ERD implementation for CVOCs; - Existing well network already in place in areas of concern, supplemental injection system under building would be advisable to provide more thorough source-area distribution.	9	$100,000	- Capital cost associated with placement of donor solution is moderate for bedrock applications. - Includes installation of new piping system under basement slab.	8	$200,000	- OM&M activities include: Baseline groundwater sampling/analysis; Bench-scale testing; quarterly post-injection groundwater sampling and analysis; results reporting. - potential need for injection of supplemental lactate material.	9	- The anticipated rapid improvement of groundwater quality likely makes this alternative acceptable; - More rapid closure of site likely makes this alternative acceptable. - To be completed following review of public comments	9	- Proposed land use at the Site is Restricted Residential. - Institutional controls, which are not currently in place, would be lessened due to greater compliance with SCGs; - Residential and commercial properties to the west are cross- or down-gradient to groundwater flow.	**86**	**$300,000**	- Very favorable groundwater alternative due to good overall performance and no low-scoring criteria.
SOIL VAPOR	**3.0**	**Engineering Control: VOC Vapor Intrusion Mitigation using Vapor Barrier and Sub slab Depressurization System**	**Liquid Boot vapor membrane and Sub-slab Depressurization System under entire occupied building.**	9	- Highly implementable with design and construction integrated into structure reconstruction.	8	$250,000	- Moderate design and construction fee but high degree of effectiveness.	7	$32,610	- Requires annual inspection, OM&M and reporting.	9	- High due to direct positive impact on potential human exposure.	9	- Proposed land use at the Site is Restricted Residential. - This Engineering Control facilitates occupancy as a residential facility in spite of residual contamination	**81**	**$282,610**	- Favorable alternative for vapor intrusion due to good overall performance and generally high-scoring criteria.

Notes:
1 See text for more detailed discussion of criteria.

Table 5
Summary of Completed and Potential IRMs

Impact	Location		Impacted Media		IRMs Completed to Date or In Progress						Potential Additional IRMs	
	Interior	Exterior	Soil	Ground-water	Impacted Soil Removal	Clean Soil Cap (Engrng Control)	Installation of SSDS and Vapor Barrier (Engrng Control)	Groundwater pumping (excavations and elevator pit)	In-Situ Ground-water Treatment	Ground-water Monitoring	Additional Injection (if needed)	Add'l. Groundwater Monitoring
CVOCs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Petroleum VOCs	✓	✓	✓		✓	✓	✓					
Metals, PAHs		✓	✓		✓	✓						

APPENDIX A

Alternatives Analysis – Estimated Cost Details

Former Carriage Factory
Brownfield Cleanup Program
Site #C828184
Alternatives Analysis Report

Appendix A
Remedial Alternatives Cost Summary

	Remedial Alternative		Description of Alternative	Capital	OM&M	Total
	1.1/2.1	No Action / Monitored Natural Attenuation (MNA)	- Assume 30 years of annual groundwater monitoring and installation and maintenance of fence around the site	$100,000	$859,000	**$959,000**
SOIL	1.2	All Impacted Soil Removal and Offsite Disposal (Track 1).	- Excavate/dispose of all Chlorinated VOC-, Petroleum-, and urban-fill-contaminated soils and backfill and restore to design grades (8,500 cy)	$1,245,000	$0	**$1,245,000**
SOIL	1.3	Impacted Source Area Soil Removal and Offsite Disposal.	- Excavate/dispose of source area Chlorinated VOC-, Petroleum-, and urban-fill-contaminated soils (5,000 cy)	$636,000	$0	**$636,000**
SOIL	1.4	Engineering Controls: Placement of a clean soil cover and pavement cap	- Place two-ft-thick cover of clean soil over selected areas of known shallow soil contamination. Cover would include sufficient topsoil to support vegetation. - Place 16-inch-thick pavement cap over remaining areas. - Seed cover with appropriate vegetative cover. - Maintain/repair cover as necessary.	$203,875	$26,300	**$230,175**
GROUNDWATER	2.2	In-situ Chemical Oxidation (ISCO) of Impacted Groundwater (Track 1)	- Introducing strong chemical oxidizers directly into groundwater to break down chemical contaminants in place.	$625,000	$182,000	**$807,000**
GROUNDWATER	2.3	Ex-situ Treatment/Disposal of Source-area Groundwater.	- Removal of limited volumes of source-area groundwater from excavations, elevator pit, and sump pump; - On-site discharge to sewer; and - Quarterly sampling of elevator discharge to sewer.	$33,000	$20,000	**$53,000**
GROUNDWATER	2.4	In-situ Biological Treatment of Impacted Groundwater.	- Installation of groundwater remediation lactate injection piping under the building; - Injection of electron donor material (sodium lactate solution for ERD of CVOCs) into sub-slab piping and selected groundwater monitoring wells; - Monthly groundwater quality monitoring for three months post-injection then Quarterly groundwater quality monitoring for two years, semi-annual for two years, and annual for two years; and -Design and installation of sub-slab depressurization system.	$100,000	$200,000	**$300,000**
SOIL VAPOR	3.0	Engineering Control: VOC Vapor Intrusion Mitigation using Vapor Barrier and Sub-slab Depressurization System	Liquid Boot vapor membrane and Sub-slab Depressurization System under entire occupied building.	$250,000	$32,610	**$282,610**

Notes:
1. See attached cost summary sheets for more detailed breakdown of costs for each alternative.
2. Groundwater monitoring included for each individual alternative. Combining alternatives will result in reduced monitoring costs.

Former Carriage Factory
Brownfield Cleanup Program
Alternatives Analysis Report

Remedial Alternative Cost Estimate Detail

Alternative 1.1/2.1: No Action / Monitored Natural Attenuation

	Cost Totals
I. Capital Costs	
Assumptions:	
- Monitoring wells already in place from Phase II and RI	
Costs:	
- Fence needed to keep trespassers off the site	$100,000
Capital Costs Subtotal	***$100,000***

II. Operation, Monitoring and Maintenance (OM&M)

Assumptions:	
- 30 year monitoring period; quarterly sampling of 14 wells	
- Analyses include VOCs, SVOCs, MNA parameters, field parameters	
- Low-flow sampling methodology	
- Quarterly report preparation	
- Periodic well and curb box repair, rehab and/or replacement	
Costs:	
- Fence repair	$10,000
- Well Maintenance and Repair (3 repair events x $3,000 per event)	$9,000
- Sampling Events and Reporting: 120 events x $7,000/event	$840,000
OM&M Costs Subtotal	***$859,000***
Remedial Alternatives 1.1/2.1 Total	***$959,000***

Remedial Alternative Cost Estimate Detail

Alternative 1.2: All Impacted Soil Removal / Offsite Disposal (Track 1)

Cost Totals

I. Capital Costs

Assumptions:

- 14,500 tons (8,500 cy) of impacted soil (CVOCs or Petroleum, Urban Fill)
- Primarily non-hazardous material; minor volume of hazardous
- Backfill with clean soil as needed
- Used in conjunction with other groundwater remediation technologies

Costs:

- Contractor Costs ($52/ton disposal plus excavation costs)	$1,015,000
- Backfill	$80,000
- Oversight and Reporting Costs	$75,000
- Laboratory Costs and Contained-In Demonstration Work Plan	$75,000
Capital Costs Subtotal	***$1,245,000***

II. Operation, Monitoring and Maintenance (OM&M)

Assumptions:

None required

Costs:

OM&M Costs Subtotal	***$0***

Remedial Alternative 1.2 Total	***$1,245,000***

Remedial Alternative Cost Estimate Detail

Alternative 1.3: Impacted Source Area Soil Removal / Offsite Disposal

	Cost Totals
I. Capital Costs	
Assumptions:	
- 8,500 tons (5,000 cy) of impacted soil (CVOCs or Petroleum, Urban Fill)	
- Primarily non-hazardous material; minor volume of hazardous	
- Used in conjunction with other groundwater remediation technologies	
Costs:	
- Contractor Costs ($52/ton disposal plus excavation costs)	$536,000
- Oversight and Reporting Costs	$50,000
- Laboratory Costs, Contained-In Demonstration Work Plan	$50,000
Capital Costs Subtotal	***$636,000***

II. Operation, Monitoring and Maintenance (OM&M)

Assumptions:

None included here. (Would require placement of a clean soil cover and impervious pavement cap and OM&M costs set forth in Alt. 1.4)

Costs:

OM&M Costs Subtotal	***$0***
Remedial Alternative 1.3 Total	***$636,000***

Remedial Alternative Cost Estimate Detail

Alternative 1.4: Placement of a Clean Soil Cover and Pavement Cap

	Cost Totals
I. Capital Costs	
Assumptions:	
- Clean soil cover placed over an area of approx. 16,000 sq ft.	
- Clean soil cover to consist of 18-in of clean on-site soil and 6-in of imported topsoil.	
- Hydroseed and establish vegetative cover	
- Impervious cap placed over an area of approx. 25,000 sq ft.	
- Cap to consist of 12" of crushed stone and 4" of asphalt or concrete	
Costs:	
- Regrading/18" clean soil placed	$57,000
- Import/place 6" topsoil (approx. 375 cy x $17 per cy)	$6,375
- Seed/mulch (16,000 sq ft)	$20,000
- Place impervious cap (approx. 25,000 sf x $4.50 per sf)	$112,500
- Oversight and reporting costs	$8,000
Capital Costs Subtotal	***$203,875***

II. Operation, Monitoring and Maintenance (OM&M)	
Assumptions:	
- Annual inspections for 10 years	
- Quarterly/Annual Reporting	
- Periodic asphalt cover repair/seeding/mulching required	
Costs:	
- Periodic Inspections and reporting (10 events x $2,000 per event)	$20,000
- Periodic Maintenance	$6,300
OM&M Costs Subtotal	***$26,300***
Remedial Alternative 1.4 Total	***$230,175***

Remedial Alternative Cost Estimate Detail

Alternative 2.2: InSitu Chemical Oxidation in Groundwater (Track 1)

	Cost Totals

I. Capital Costs

Assumptions:

- Application of Permanganate or other appropriate oxidizer
- Combined with removal of all impacted soil for Track 1 Cleanup
- Need for supplemental oxidizer application is likely

Costs:

- Contractor costs	$440,000
- Oversight and reporting costs	$160,000
- Laboratory Costs	$25,000
Capital Costs Subtotal	***$625,000***

II. Operation, Monitoring and Maintenance (OM&M)

Assumptions:

- Bench-scale testing and baseline GW sampling needed to determine appropriate chemical applications
- Quarterly monitoring for one year, followed by 2 years of semi-annual monitoring
- Analyses include VOCs, SVOCs, MNA parameters, field parameters.
- low-flow sampling methodology
- quarterly/semi-annual report preparation

Costs:

- Baseline sampling and bench testing	$80,000
- Sampling and reporting costs (8 events x $6,000 per event)	$48,000
- Laboratory Costs	$54,000
OM&M Costs Subtotal	***$182,000***

Remedial Alternative 2.2 Total $807,000

Remedial Alternative Cost Estimate Detail

Alternative 2.3: Groundwater Ex-Situ Treatment/Disposal

	Cost Totals
I. Capital Costs	
Assumptions:	
- Impacted groundwater pumped to on-site storage tanks or directly to sewer	
- Impacted water disposed offsite	
Costs:	
- Tank Rental	$7,000
- Pumping Equipment	$2,000
- Design/oversight, obtain permits to discharge	$12,000
- Laboratory Costs	$12,000
Capital Costs Subtotal	***$33,000***
II. Operation, Monitoring and Maintenance (OM&M)	
Assumptions:	
- Quarterly monitoring of elevator sump pump and reporting of data	
Costs:	
- $500 a quarter for 10 years	$20,000
OM&M Costs Subtotal	***$20,000***
Remedial Alternative 2.3 Total	***$53,000***

Remedial Alternative Cost Estimate Detail

Alternative 2.4: Groundwater In-Situ Bioremediation

	Cost Totals
I. Capital Costs	
Assumptions:	
- Perform ERD Bench testing	
- Install sodium lactate injection piping beneath building (3 three-interval runs).	
- Combined with contaminated soil removal	
- Enhanced Reductive Dechlorination (using sodium lactate) for CVOCs	
- Lactate injected into three sets of sub-slab injection piping runs, and selected monitoring wells	
Costs:	
- ERD Bench testing	$13,000
- Install injection piping (Contractor excavation and installation costs)	$30,000
- Sodium Lactate material (~ 7,900 lbs.)	$15,000
- Tank/pump/mixing equipment	$2,000
- Material Application	$10,000
-Design, Oversight & Reporting	$30,000
Capital Costs Subtotal	***$100,000***

II. Operation, Monitoring and Maintenance (OM&M)

Assumptions:	
- Baseline monitoring event, 2 monthly monitoring events, 2 years of quarterly monitoring, 2 years of semi-annual monitoring, 2 years of annual monitoring	
- Low-flow sampling methodology	
Costs:	
- Groundwater Monitoring (17 sampling events x $8,000 per event)	$136,000
- Supplemental ERD injection event	$64,000
OM&M Costs Subtotal	***$200,000***
Remedial Alternative 2.4 Total	***$300,000***

Remedial Alternative Cost Estimate Detail

<u>Alternative 3.0: Sub-slab Depressurization System (SSDS)</u>

I. Capital Costs	**<u>Cost Totals</u>**

<u>Assumptions:</u>

- Install SSDS including vapor retarding membrane and negative pressure system
- Requires applying waterproofing material to sub-grade basement and elevator shaft walls as well as the building basement floor
- Install piping to three fans on roof with monitoring panel at fifth floor

<u>Costs:</u>

- Design and install vapor barrier and SSDS system and components	<u>$250,000</u>
Capital Costs Subtotal	***$250,000***

II. Operation, Monitoring and Maintenance (OM&M)

<u>Assumptions:</u>

- continual running of fans for10 years
- quarterly monitoring and reporting
- periodic maintenance of fans and components

<u>Costs:</u>

- electric costs (3 fans x 24hrs/day x 10 years)	$2,610
- monitoring and reporting	$20,000
- periodic maintenance	<u>$10,000</u>
OM&M Costs Subtotal	***$32,610***

Remedial Alternative G. Total	***$282,610***

APPENDIX B – HEALTH AND SAFETY PLAN

APPENDIX E

HEALTH AND SAFETY PLAN
REMEDIAL INVESTIGATION

BCP SITE NO. C828184
FORMER CARRIAGE FACTORY
33 LITCHFIELD STREET
ROCHESTER, MONROE COUNTY, NEW YORK

November 2012

Prepared for:

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Stantec

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1.0 INTRODUCTION

The following Health and Safety Plan (HASP) describes personal safety protection standards and procedures to be followed by Stantec staff during planned Remedial Investigation activities at the Former Carriage Factory site located at 33 Litchfield Street in the City of Rochester, Monroe County, New York (Figure 1). This work will include a passive soil gas survey, drilling activities and associated soil sampling and monitoring well installation, groundwater sampling, and hydraulic conductivity testing.

This HASP establishes mandatory safety procedures and personal protection standards pursuant to the Occupational Safety and Health Administration (OSHA) regulations 29 Code of Federal Regulations (CFR) 1910.120. The HASP applies to all Stantec personnel conducting any site work, as defined in 29 CFR 1910.120(a). All personnel involved in the mentioned activities must familiarize themselves with this HASP, comply with its requirements and have completed the required health and safety training and medical surveillance program participation pursuant to 29 CFR 1910.120 prior to beginning any work on site.

THIS HASP IS FOR THE EXPRESS USE OF STANTEC EMPLOYEES. ALL OTHER CONTRACTORS TO BE WORKING IN THE EXCLUSION AREAS ARE REQUIRED BY LAW TO DEVELOP THEIR OWN HASP, AS WELL TO MEET ALL PERTINENT ASPECTS OF OSHA REGULATIONS. STANTEC RESERVES THE RIGHT TO STOP ANY SITE WORK WHICH IS DEEMED TO POSE A HEALTH AND SAFETY THREAT TO ITS STAFF.

1.1 Background

This project is being performed as part of a Brownfield Cleanup Program. The objectives of the proposed project include investigation of site soil, groundwater and soil vapor; utilizing the results from this investigation in order to perform a qualitative exposure assessment; establishing appropriate remedial objectives; and selecting effective remedial alternatives.

The Site is a 1.5±-acre parcel located at 33 Litchfield Street in the City of Rochester, Monroe County, New York (see Site Plan, Figure 2). The property (Tax Parcel No. 120.36-2-20) is currently occupied by a vacant, 5-story brick building. Operations at the Site ceased in approximately 1993 and the site has reportedly been essentially vacant since then. Planned redevelopment of the site is for restricted residential use.

Historical Site operations are reported to have included manufacture of wood trim/accent-related products for the automotive industry, other automotive parts, and clothing washers and dryers. Several “potential Recognized Environmental Conditions” (RECS) were identified during previous site assessments. These included: floor drains with unknown discharge points; abandoned and potentially leaking drums in the basement and on the third floor; and apparent petroleum staining near the loading dock and in the southern portion of the Site. Other environmental concerns were identified that do not necessarily constitute RECs, such as the potential presence of Asbestos-Containing Building Materials, Lead-Based Paint, and PCB-containing light ballasts. Excessive bird excrement was also observed in the building.

Chlorinated volatile organic compounds (CVOCs) including tetrachloroethene (PCE), trichloroethene (TCE), cis- and trans-1,2-dichloroethene (DCE) and vinyl chloride, were detected in samples of soil vapor, soil and groundwater during several rounds of previous investigation at the site. The soil and groundwater data obtained to date indicate a source for at least a portion of the CVOCs observed may exist on the site, since similar compounds were observed in both soil and groundwater. However, the distribution of CVOC concentrations are such that TCE is the primary CVOC in the onsite wells but PCE is the primary contaminant in the offsite, downgradient well RW-6 located north of the Site. This is strongly suggestive of a separate, offsite VOC source to the north of the 33 Litchfield Street site.

Several metals compounds were detected in soil samples, including aluminum, calcium, copper, iron, magnesium, manganese, lead, mercury nickel and zinc. Several semi-volatile organic compounds, all of which were poly-nuclear aromatic hydrocarbon (PAH) compounds such as benzo(a)pyrene, which are characteristic of samples containing coal ash and cinders, were detected in one soil sample. The concentrations reported are considered typical for naturally-occurring soils in this region and fill soils of the type observed in the site test borings in which ash, cinders, slag, concrete, and other typical urban fill material were noted.

Additional background information on environmental conditions and apparent contaminant impacts at the site is presented in the RI Work Plan.

1.2 Site-Specific Chemicals of Concern

VOCs

The primary VOCs of concern that are documented to be present in the soil and groundwater at the Site are listed in Table 1. Material Safety Data Sheets (MSDSs) for these compounds are presented in HASP Appendix A. The air monitoring action levels will be based on one-half of the current Threshold Limit Valve (TLV) or Permissible Exposure Limit (PEL) for vinyl chloride with a margin of safety built into the action levels to account for the non-specificity of the field monitoring instruments. Exposure limits for less hazardous compounds will be satisfied by meeting the more stringent exposure limits for vinyl chloride. Table 1 summarizes health and safety data for the volatile compounds of primary concern.

Table 1
Health and Safety Data for Volatile Contaminants of Concern

Compound	PEL/ TWA	Physical Description	Odor Threshold	Route of Exposure	Symptoms	Target Organs
cis- 1,2-Dichloroethene (cis-1,2-DCE)	200 ppm	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor	19.1 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system
Tetrachloroethene (aka Perchloroethene [PCE])	100 ppm	Colorless liquid with a mild chloroform-like odor	6.17 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system
Trichloroethylene (TCE)	100 ppm	Colorless liquid with a chloroform-like odor	1.36 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system
Vinyl chloride	1 ppm	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations.	0.253 ppm	inhalation, skin, and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Liver, central nervous system, blood, respiratory system, lymphatic system

Notes:
PEL - permissible exposure limits
TWA - time weighted average, 8-hour workday
mg/m^3 - milligrams per cubic meter.
ppm - parts per million, in air

2.0 STANTEC PERSONNEL ORGANIZATION

The following Stantec personnel will be involved in health and safety operations at the Former Allegany Bitumens Belmont Asphalt Plant Site:

2.1 Project Manager

Mr. Michael Storonsky, Managing Principal, is the Project Manager. Mr. Storonsky is responsible for ensuring that all Stantec procedures and methods are carried out, and that all Stantec personnel abide by the provisions of this Health and Safety Plan.

2.2 Site Safety Officer/Field Team Leader

Ms. Erin McCormick or Ms. Katherine Premo will serve as the field team leader (FTL) and Site Safety Officer (SSO) during this project. The FTL/SSO will report directly to the Project Manager and will be responsible for the implementation of this HASP as well as daily calibration of Stantec's safety monitoring instruments. The FTL/SSO will keep a log book of all calibration data and instrument readings for the Site.

2.3 Health and Safety Coordinator

Mr. Robert Mahoney will be the Health and Safety Coordinator. Mr. Mahoney will be responsible for overall coordination of Health and Safety issues on the project.

2.4 Daily Meetings

All Stantec personnel and contractors working within the exclusion zone will be required to read this document and sign off on the daily safety meeting form presented in HASP Appendix B.

3.0 MEDICAL SURVEILLANCE REQUIREMENTS

3.1 Introduction

A. Hazardous waste site workers can often experience high levels of physical and chemical stress. Their daily tasks may expose them to toxic chemicals, physical hazards, biologic hazards, or radiation. They may develop heat stress while wearing protective equipment or working under temperature extremes, or face life-threatening emergencies such as explosions and fires. Therefore, a medical program is essential to: assess and monitor worker's health and fitness both prior to employment and during the course of the work; provide emergency and other treatment as needed; and keep accurate records for future reference. In addition, OSHA requires a medical evaluation for employees that may be required to work on hazardous waste sites and/or wear a respirator (29 CFR Part 1910.120 and 1910.134), and certain OSHA standards include specific medical surveillance requirements (e.g., 29 CFR Part 1926.62, Part 1910.95 and Parts 1910.1001 through 1910.1045).

3.2 Medical Examinations

A. All Stantec personnel working in areas of the site where site-related contaminants may be present shall have been examined by a licensed physician as prescribed in 29 CFR Part 1910.120, and determined to be medically fit to perform their duties for work conditions which require respirators. Employees will be provided with medical examinations as outlined below:

- Pre-job physical examination
- Annually thereafter if contract duration exceeds 1 year;
- Termination of employment;
- Upon reassignment in accordance with CFR 29 Part 1910.120(e)(3)(i)(C);
- If the employee develops signs or symptoms of illness related to workplace exposures;
- If the physician determines examinations need to be conducted more often than once a year; and
- When an employee develops a lost time injury or illness during the Contract period.

B. Examinations will be performed by, or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and will be provided without cost to the employee, without loss of pay and at a reasonable time and place. Medical surveillance protocols and examination and test results shall be reviewed by the Occupational Physician.

4.0 ON-SITE HAZARDS

4.1 Chemical Hazards

The primary potential chemical hazards on-site are expected to be exposure to the VOCs detailed in Table 1. Material safety data sheets for the documented VOCs are presented in Appendix A.

The soil and groundwater contaminants are volatile; therefore, any activity at the site which causes physical disturbance of the soil can potentially allow the release of contaminants into the air. For volatiles, this can include release of organic vapors into the air. Such an occurrence may be recognized by noticeable chemical odors. Field personnel should be aware of the odor threshold for these chemicals and their relation to the action levels and Permissible Exposure Limits.

Symptoms of overexposure to primary compounds of concern are detailed in Table 1. To prevent exposure to these chemicals, dermal contact will be minimized by using disposable surgical gloves with work gloves (as appropriate) when handling soil, groundwater equipment or samples. Real time, breathing zone levels of total VOCs will be monitored using a portable photoionization detector (PID). If ambient levels exceed action levels, all site activities will be performed using level C personal protection until ambient concentrations dissipate. Where levels exceed 50 ppm, work will cease and the project manager will be notified immediately. Intrusive work may also be halted where required by action levels detailed in the Community Air Monitoring Plan (CAMP), Appendix D of the RI Work Plan.

In addition, depending on seasonal conditions, disturbance of the site soils may cause the particulate contaminants to become airborne as dust. Therefore, particulates will be monitored as discussed in Section 6.1 and dust-suppression methods used where appropriate as discussed in Section 6.2, or in the CAMP.

Finally, aeration of the groundwater may cause volatilization of chemicals into the air, particularly VOCs. Table 2 summarizes first aid instructions for exposure pathways for the compounds of concern.

Table 2
Exposure Pathways and First Aid Response for Contaminants of Concern

Substance	**Exposure Pathways**	**First-Aid Instructions**
VOCs listed in Table 1	Eye	irrigate immediately
	Dermal	soap wash promptly (soap flush immediately for 1,1-DCE)
	Inhalation	respiratory support
	Ingestion	medical attention immediately

4.2 Physical Hazards

Hazards typically encountered at construction sites with drilling and excavation activities will be a concern at this site. These hazards include slippery ground surfaces, holes, and operation of heavy machinery and equipment. Field team members will wear the basic safety apparel such as steel-toed shoes, hard hat and safety glasses during all appropriate activities.

Under no circumstances will Stantec personnel approach the borehole during active drilling operation. All field personnel working around the rig will be shown the location and operation of kill switches, which are to be tested daily.

Multi-purpose fire extinguishers, functional and within annual inspection period, will be staged and readily accessible for use.

The use of electrical equipment in any established exclusion zones will be limited to areas verified as containing non-explosive atmospheres (<10% LEL) prior to operation, unless the equipment has been previously demonstrated or designed to be FM or UL rated as intrinsically safe. Care will be taken to avoid an ignition source while working in the presence of vapors.

The driller shall make all necessary contacts with utilities and/or underground utility locator hotlines prior to drilling, and shall meet OSHA requirements for distances between the drilling rig and overhead utilities. No drilling work will be carried out where the drill rig chassis has not been stabilized and the rig is not to be moved between locations with its boom in a vertical position.

4.2.1 Noise

The use of heavy machinery/equipment and operation may result in noise exposures, which require hearing protection. Exposure to noise can result in temporary hearing losses, interference with speech communication, interference with complicated tasks or permanent hearing loss due to repeated exposure to noise.

During the investigative activities, all Stantec field team members will use hearing protection when sound levels are in excess of 90 dB TWA.

4.2.2 *Heat and Cold Stress Exposure*

Heat is a potential threat to the health and safety of site personnel. The Site Safety Officer under the direction of the Project Manager will determine the schedule of work and rest. These schedules will be employed as necessary so that personnel do not suffer adverse effects from heat. Table 3 summarizes exposure symptoms and first aid instructions for heat stress. Non-caffeinated, thirst replenishment liquids will be available on-site.

Cold stress is also a potential threat to the health and safety of site personnel. Symptoms of cold stress include, shivering, blanching of the extremities, numbness or burning sensations, blue, purple or gray discoloration of hands and feet, frostbite, hypothermia, and loss of consciousness. Cold stress can be prevented by acclimatizing one's self to the cold, increasing fluid intake, avoiding caffeine and alcohol, maintaining proper salt and electrolyte intake, eating a well-balanced diet, wearing proper clothing, building heated enclosures to work in, and taking regular breaks to warm up. If any of the above symptoms are encountered the person should be removed from the cold area. Depending on the severity of the cold stress, 911 should be contacted and first aid administered. No fluids should be given to an unconscious person.

Table 3
Exposure Symptoms and First Aid for Heat Exposure

Hazard	Exposure Symptoms	First-Aid Instructions
Heat Stress	Fatigue, sweating, irritability	rest; take fluids
	Dizziness, disorientation, perspiration ceases, loss of consciousness	remove from hot area, activate 911, administer first aid, no fluids to be administered to unconscious victim.

4.2.3 *Roadway Hazards*

Field activities are planned to take place near active roadways. Where such work zones are established, personnel shall assure that protective measures including signage, cones, and shielding through use of vehicles parked at workmen perimeter, are in place. All contractors shall be responsible for meeting signage requirements of DOT. Fluorescent safety vests shall be worn by all personnel during activities in or adjacent to roadways and driveways.

4.2.4 *Electrical Work*

Site work involving electrical installation or energized equipment must be performed by a qualified electrician. All electrical work will be performed in accordance with the OSHA electrical safety requirements found in 29 CFR 1926.400 through 1926.449. Workers are not permitted to work near electrical power circuits unless the worker is protected against electric shock by de-energizing and grounding the circuit or by guarding or barricading the circuit and providing proper personal protective equipment. All electrical installations must comply with NEC regulations. All electrical wiring and equipment used must be listed by a nationally recognized testing laboratory.

All electrical circuits and equipment must be grounded in accordance with the NEC regulations. The path to ground from circuits, equipment, and enclosures will be permanent and continuous. Ground fault circuit interrupters (GFCIs) are required on all 120-volt, single phase, 15- and 20-amp outlets in work areas that are not part of the permanent wiring of the building or structure. A GFCI is required when using an extension cord. GFCIs must be tested regularly with a GFCI tester.

Heavy-duty extension cords will be used; flat-type extension cords are not allowed. All extension cords must be the three-wire type, and designed for hard/extra hard usage. Electrical wire or cords passing through work areas must be protected from water and damage. Worn, frayed, or damaged cords and cables will not be used. Walkways and work spaces will be kept clear of cords and cables to prevent a tripping hazard. Extension cords and cables may not be secured with staples, hung from nails, or otherwise temporarily secured. Cords or cables passing through holes in covers, outlet boxes, etc., will be protected by bushings or fittings.

All lamps used in temporary lighting will be protected from accidental contact and breakage. Metal shell and paper-lined lamp holders are not permitted. Fixtures, lamp holders, lamps, receptacles, etc. are not permitted to have live parts. Workers must not have wet hands while plugging/unplugging energized equipment. Plugs and receptacles will be kept out of water (unless they are approved for submersion).

4.2.5 Lock-Out/Tag-Out

Before a worker sets up, services, or repairs a system where unexpected energizing (or release of stored energy) could occur and cause injury or electrocution, the circuits energizing the parts must be locked-out and tagged. Only authorized personnel will perform lock-out/tag-out procedures. All workers affected by the lock-out/tag-out will be notified prior to, and upon completion of, the lock-out/tag-out procedure.

Lock-out/tag-out devices must be capable of withstanding the environment to which they are exposed. Locks will be attached in such a way as to prevent other personnel from operating the equipment, circuit, or control, or from removing the lock unless they resort to excessive force. Tags will identify the worker who attached the device, and contain information, which warns against the hazardous condition that will result from the system's unauthorized start-up. Tags must be legible and understood by all affected workers and incidental personnel. The procedures for attaching and removing lock-out/tag-out devices include the steps outlined in the following table.

If maintenance work is required, the electrical supply to the equipment must be disconnected. Turning off the MAIN breaker using the disconnect switch will disconnect all power to the system. Once the disconnect switch has been turned off, the switch will be locked-out using the steps outlined below.

STEP	LOCK-OUT/TAG-OUT PROCEDURES
1	Disconnect the circuits and/or equipment to be worked on from all electrical energy sources.
2	Ensure that the system is completely isolated so that it cannot be operated at that shut-off point or at any other location.
3	Release stored electrical energy.
4	Block or relieve stored non-electrical energy.
5	Place a lock on each shut-off or disconnect point necessary to isolate all potential energy sources. Place the lock in such a manner that it will maintain the shut-off/disconnect in the off position.
6	Place a tag on each shut-off or disconnect point. The tag must contain a statement prohibiting the unauthorized re-start or re-connect of the energy source and the removal of the tag, and the identity of the individual performing the tag and lock-out.
7	Workers who will be working on the system must place their own lock and tag on each lock-out point.
8	A qualified person must verify the system cannot be re-started or re-connected, and de-energization of the system has been accomplished.

Once the service or repairs have been made on the system:	
1	A qualified person will conduct an inspection of the work area, to verify that all tools, jumpers, shorts, grounds, etc., have been removed so that the system can then be safely re-energized.
2	All workers stand clear of the system.
3	Each lock and tag will be removed by the worker who attached it. If the worker has left the site, then the lock and tag may be removed by a qualified person under the following circumstances:
	a. The qualified person ensures the worker who placed the lock and tag has left the site; and
	b. The qualified person ensures the worker is aware the lock and tag has been removed before the worker resumes work on-site.

4.2.6 Ladders

One-third of worker deaths in construction result from falls. Many falls occur because ladders are not placed or used safely. Ladder use will comply with OSHA 1926.1053 through 1926.1060, including the following safety requirements.

STEP	PROPER LADDER USE PROCEDURE
1	Choose the right ladder for the task--the proper type and size, with a sufficient rating for the task.
2	Check the condition of the ladder before climbing. • Do not use a ladder with broken, loose, or cracked rails or rungs. • Do not use a ladder with oil, grease, or dirt on its rungs. • The ladder should have safety feet.
3	Place the ladder on firm footing, with a four-to-one pitch.
4	Support the ladder by: • Tying it off; • Using ladder outrigger stabilizers; or • Have another worker hold the ladder at the bottom. If another worker holds the ladder, they must: • Wear a hard hat; • Hold the ladder with both hands; • Brace the ladder with their feet; and • Not look up.
5	Keep the areas around the top and bottom of the ladder clear.
6	Extend the top of the ladder at least 36 inches (3 feet) above the landing.
7	Climb the ladder carefully - facing it - and use both hands. • Use a tool belt and hand-line to carry material to the top or bottom of the ladder. • Wear shoes in good repair with clean soles.
8	Inspect the ladder every day, prior to use, for the following problems: • Rail or rung damage • Broken feet • Rope or pulley damage • Rung lock defects or damage • Excessive dirt, oil, or grease If the ladder fails inspection, it must be removed from service and tagged with a "Do Not Use" sign.

Ladders with non-conductive side rails must be used when working near electrical conductors, equipment, or other sources. Ladders will not be used horizontally for platforms, runways, or scaffolds.

4.2.7 Hand and Power Tools

All hand and power tools will be maintained in a safe condition and in good repair. Hand and power tools will be used in accordance with 29 CFR 1926, Subpart I (1926.300 through 1926.307). Neither Stantec or its subcontractors will issue unsafe tools, and workers are not permitted to bring unsafe tools on-site. All tools will be used, inspected, and maintained in accordance with the manufacturer's instructions. Throwing tools or dropping tools to lower levels is prohibited. Hand and power tools will be inspected, tested, and determined to be in safe operating condition prior to each use. Periodic safety inspections of all tools will be conducted to assure that the tools are in good condition, all guards are in place, and the tools are being properly maintained. Any tool that fails an inspection will be immediately removed from service and tagged with a "Do Not Use" sign.

Workers using hand and power tools, who are exposed to falling, flying, abrasive, or splashing hazards will be required to wear personal protective equipment (PPE). Eye protection must always be worn when working on-site. Additional eye and face protection, such as safety goggles or face shields, may also be required when working with specific hand and power tools. Workers, when on-site, will wear hard hats. Additional hearing protection may be required when working with certain power tools. Workers using tools, which may subject their hands to an injury, such as cuts, abrasions, punctures, or burns, will wear protective gloves. Loose or frayed clothing, dangling jewelry, or loose long hair will not be worn when working with power tools.

Electric power-operated tools will be double insulated or grounded, and equipped with an on/off switch. Guards must be provided to protect the operator and other nearby workers from hazards such as in-going nip points, rotating parts, flying chips, and sparks. All reciprocating, rotating and moving parts of tools will be guarded if contact is possible. Removing machine guards is prohibited.

Abrasive wheels will only be used on equipment provided with safety guards. Safety guards must be strong enough to withstand the effect of a bursting wheel. Abrasive wheels will not be operated in excess of their rated speed. Work or tool rests will not be adjusted while the wheel is in motion. All abrasive wheels will be closely inspected and ring tested before each use, and any cracked or damaged wheels will be removed immediately and destroyed.

Circular saws must be equipped with guards that completely enclose the cutting edges and have anti-kickback devices. All planer and joiner blades must be fully guarded. The use of cracked, bent, or otherwise defective parts is prohibited. Chain saws must have an automatic chain brake or kickback device. The worker operating the chain saw will hold it with both hands during cutting operations. A chain saw must never be used to cut above the operator's shoulder height. Chain saws will not be re-fueled while running or hot. Power saws will not be left unattended.

Only qualified workers will operate pneumatic tools, powder-actuated tools, and abrasive blasting tools.

4.2.8 Manual Lifting

Back injuries are among the leading occupational injuries reported by industrial workers. Back injuries such as pulls and disc impairments can be reduced by using proper manual lifting techniques. Leg muscles are stronger than back muscles, so workers should lift with their legs and not with their back. Proper manual lifting techniques include the following steps:

STEP	PROPER MANUAL LIFTING PROCEDURE
1	Plan the lift before lifting the load. Take into consideration the weight, size, and shape of the load.
2	Preview the intended path of travel and the destination to ensure there are no tripping hazards along the path.
3	Wear heavy-duty work gloves to protect hands and fingers from rough edges, sharp corners, and metal straps. Also, keep hands away from potential pinch points between the load and other objects.
4	Get the load close to your ankles, and spread your feet apart. Keep your back straight and do not bend your back too far; instead bend at your knees.
5	Feel the weight; test it.
6	Lift the load smoothly, and let your legs do the lifting. If you must pivot, do not swing just the load; instead, move your feet and body with the load.

If the load is too heavy, then do not lift it alone. Lifting is always easier when performed with another person. Assistance should always be used when it is available.

4.2.9 Weather-Related Hazards

Weather-related hazards include the potential for heat or cold stress, electrical storms, treacherous weather-related working conditions, or limited visibility. These hazards correlate with the season in which site activities occur. Outside work will be suspended during electrical storms. In the event of other adverse weather conditions, the Site Safety Officer will determine if work can continue without endangering the health and safety of site personnel.

5.0 SITE WORK ZONES

The following work zones will be physically delineated by Stantec during the investigation activities.

5.1 Control Zones

Control boundaries will be established within the areas of site activities. Examples of boundary zones include the exclusion and decontamination zone. All boundaries will be dynamic, and will be determined by the planned activities for the day. The Field Team Leader will record the names of any visitors to the site.

5.2 Exclusion Zone

The controlled portion of the site will be delineated to identify the exclusion zone, wherein a higher level of personal protective equipment may be required for entry during intrusive activities. The limits of the exclusion zone will be designated at each work location appropriately. A decontamination zone will be located immediately outside the entrance to the exclusion zone. All personnel leaving the exclusion zone will be required to adhere to proper decontamination procedures.

A "super exclusion" zone will be established around the borehole which will not be entered by Stantec personnel at any time during any active drilling, slambar, cathead, silica sand dumping, or other related activities. The drilling contractor will be directed to stop such activity when Stantec site team members have a need to enter this zone.

5.3 Decontamination Zone

The decontamination zone will be located immediately outside the entrance to the exclusion zone on its apparent upwind side, if feasible, and will be delineated with caution tape and traffic cones as needed. This zone will contain the necessary decontamination materials for personnel decontamination. Decontamination procedures are outlined in Section 8.0 of this plan.

6.0 SITE MONITORING/ACTION LEVELS

6.1 Site Monitoring

Field activities associated with drilling, excavation, and sampling may create potentially hazardous conditions due to the migration of contaminants into the breathing zone. These substances may be in the form of mists, vapors, dusts, or fumes that can enter the body through ingestion, inhalation, absorption, and direct dermal contact. Monitoring for VOCs and particulates will be performed as needed to ensure appropriate personal protective measures are employed during site activities.

A separate Community Air Monitoring Plan (CAMP) has also been developed (Appendix D of the Work Plan) to protect the surrounding neighborhood. It is assumed that continuous downwind particulate and VOC monitoring will not be required during indoor drilling and that air monitoring will not be required during the groundwater monitoring events.

The following describes the conditions that will be monitored for during the investigation activities. All background and site readings will be logged, and all instrument calibrations, etc., will be logged.

Organic Vapor Concentrations – During drilling, organic vapors will be monitored continuously in the breathing zone in the work area with a portable photoionization detector (PID), such as a miniRAE Model 2000 with a 10.2 eV lamp. The instrument will be calibrated daily or as per the manufacturer’s recommendations. PID readings will be used as the criteria for upgrading or downgrading protective equipment and for implementing additional precautions or procedures.

Split spoons or other soil sampling devices will be monitored using the PID at the time they are opened, with appropriate PPE to be used where soils exhibit measurable volatile organic compound levels.

Particulates - Should subsurface conditions be observed to be dry, Stantec will perform particulate monitoring with a MIE PDM-3 Miniram aerosol monitor (or similar), within the outdoor work area to monitor personal exposures to particulates and to compare work area readings with downwind and upwind readings. The first readings of the day will be obtained prior to the commencement of work to obtain a daily background reading, and the instrument will be zeroed daily and calibrated to manufacturer’s specifications. Readings will be recorded every 30 minutes thereafter. If the work area particulate levels exceed the background levels by more than 0.15 mg/m^3, the Contractor will be instructed to implement dust suppression measures.

6.2 Action Levels

During the course of any activity, as long as PID readings in the breathing zone are less than 5 ppm above background, Level D protection will be considered adequate. Level C protection will be required when VOC concentrations in ambient air in the work zone exceed 5 ppm total VOCs above background but remain below 50 ppm total VOCs.

If concentrations in the work zone exceed 50 ppm for a period of 5 minutes or longer, work will immediately be terminated by the Site Safety Officer. Options to allow continued drilling would then be discussed amongst all parties. Supplied-air respiratory protection is generally required for drilling to resume under these conditions. If Level B protection is not used, work may resume in Level C once monitoring concentrations have decreased below 50 ppm and conditions outlined in the CAMP are met.

If the monitoring of fugitive particulate levels within the work area exceeds 0.15 mg/m^3 above background, then the drilling Contractor will be directed to implement fugitive dust control measures which may include use of engineering controls such as water spray at the borehole.

7.0 PERSONAL PROTECTIVE EQUIPMENT

Based on an evaluation of the hazards at the site, personal protective equipment (PPE) will be required for all personnel and visitors entering the drilling exclusion zone(s). It is anticipated that all Stantec oversight work will be performed in Level D. All contractors will be responsible for selection and implementation of PPE for their personnel.

7.1 Protective Clothing/Respiratory Protection:

Protective equipment for each level of protection is as follows:

If PID readings are above 50 ppm, requiring an upgrade to Level B, site work will be halted pending review of conditions and options by Stantec and other involved parties.

When PID readings range between 5 and 50 ppm, upgrade to Level C:

<u>Level C</u>

- Full face, air purifying respirator with organic/HEPA cartridge;
- Disposable chemical resistant one-piece suit (Tyvek or Saranex, as appropriate);
- Inner and outer chemical resistant gloves;
- Hard hat;
- Steel-toed boots; and
- Disposable booties.

When PID readings range between background and 5 ppm use Level D:

<u>Level D</u>

- Safety glasses;
- Steel-toed boots;
- Protective cotton, latex or leather gloves depending on site duties;
- Hard hat; and
- Tyvek coverall (optional).

8.0 DECONTAMINATION

8.1 Personnel Decontamination

For complete decontamination, all personnel will observe the following procedures upon leaving the exclusion zone:

1. Remove disposable outer boots and outer gloves and place in disposal drum.

2. If using a respirator, remove respirator, dispose of cartridges if necessary, and set aside for later cleaning.

3. Remove disposable chemical resistant suits and dispose of in drum.

4. Remove and dispose of inner gloves.

Decontamination solutions shall be supplied at the decontamination zone. The wash solution will consist of water and detergent such as Alconox or trisodium phosphate (TSP), and the rinse solution will consist of clean water.

Contaminated wash solutions shall be collected in drums for disposal. All other disposable health and safety equipment will be decontaminated and disposed of as non-hazardous waste.

8.2 Equipment Decontamination

If equipment is used during field activities, it will be properly washed or steam-cleaned prior to exiting the decontamination zone. Pre- or post-use rinsing using solvents will be done wearing appropriate PPE.

When feasible, monitoring instruments will be either wrapped in plastic or carried by personnel not involved in handling contaminated materials, to reduce the need for decontamination. All instruments will be wet-wiped prior to removal from the work zone.

9.0 EMERGENCY PROCEDURES

The Site Safety Officer will coordinate emergency procedures and will be responsible for initiating emergency response activities. Emergency communications at the site will be conducted verbally and by means of an air or vehicle horn. All personnel will be informed of the location of the cellular telephone and horn. Three blasts on the air or vehicle horn will be used to signal distress.

9.1 List of Emergency Contacts

Ambulance: 911
Hospital: Strong Memorial Hospital, Rochester, NY: (585) 275-2100
Fire Department: 911
Police: 911
Poison Control Center: (585) 222-1222
RG&E Utility Emergency: 911 or (800) 743-1702

9.2 Directions to Hospital

A map presenting directions to the hospital is included in the back of the document (Figure 2). The route shall be reviewed at the initial site safety meeting on site.

9.3 Accident Investigation and Reporting

A. All accidents requiring first aid, which occur incidental to activities onsite, will be investigated. The investigation format will be as follows:

- interviews with witnesses,
- pictures, if applicable, and
- necessary actions to alleviate the problem.

B. In the event that an accident or some other incident such as an explosion or exposure to toxic chemicals occurs during the course of the project, the Project Health and Safety Officer will be telephoned as soon as possible and receive a written notification within 24 hours. The report will include the following items:

- Name of injured;
- Name and title of person(s) reporting;
- Date and time of accident/incident;
- Location of accident/incident, building number, facility name;
- Brief summary of accident/incident giving pertinent details including type of operation ongoing at the time of the accident/incident;
- Cause of accident/incident;
- Casualties (fatalities, disabling injuries), hospitalizations;
- Details of any existing chemical hazard or contamination;
- Estimated property damage, if applicable;
- Nature of damage; effect on contract schedule;
- Action taken to insure safety and security; and
- Other damage or injuries sustained (public or private).

Where reportable injuries, hospitalizations or fatalities occur amongst Stantec personnel, the necessary document required by OSHA will be submitted within timeframes allowed by law.

The accident report form is illustrated in Table 4.

TABLE 4
ACCIDENT REPORT

Project Former Carriage Factory Site Date of Occurrence_______________

Location __33 Litchfield Street, Rochester, NY_________________________________
____

Type of Occurrence: (check all that Apply)

- ☐ Disabling Injury
- ☐ Other Injury
- ☐ Property Damage
- ☐ Equip. Failure
- ☐ Chemical Exposure
- ☐ Fire
- ☐ Explosion
- ☐ Vehicle Accident
- ☐ Other (explain)____

____

Witnesses to Accident/Injury:

_______________________ _________________
_______________________ _________________
_______________________ _________________

Injuries:

Name of Injured ____

What was being done at the time of the accident/injury?

____
____

What corrective actions will be taken to prevent recurrence? ___________________________
____
____

SIGNATURES

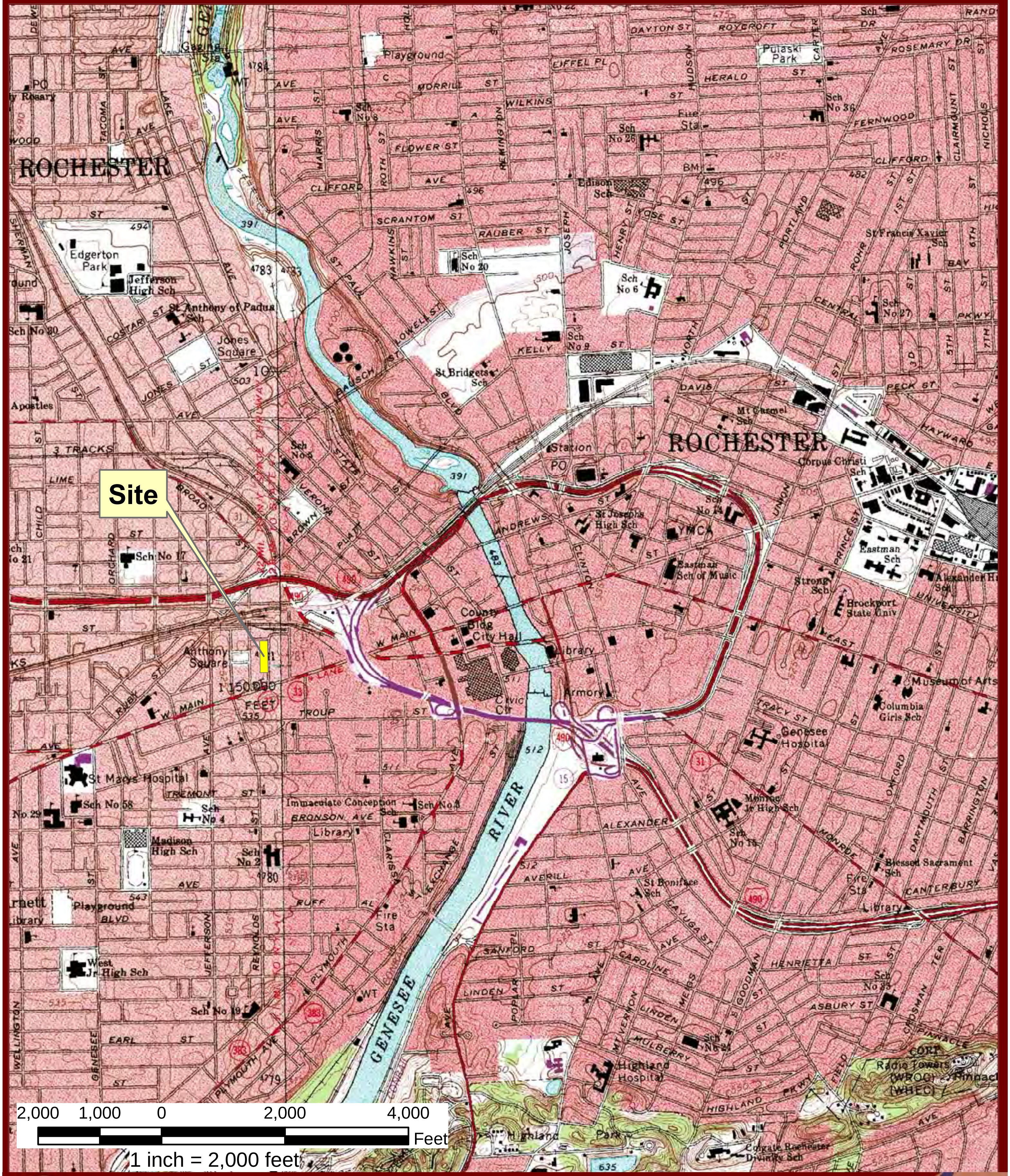
Health and Safety Officer ___________________ Date __________________________

Project Manager _________________________ Date __________________________

Reviewer _______________________________ Date __________________________

Comments by reviewer ____
____
____

FIGURES



Geographic Information Systems

Cartographic Design By: Andrew Less

Path: U:\190500751\drawing\CAD\RI Figures\Figure 1 Site Loca

Stantec Consulting Services
61 Commercial Street
Rochester , NY 14614

Reference Souce :
USGS Quadrangles from NYSGIS :
Rochester East / Rochester West

N

Figure 1 - Site Location Map

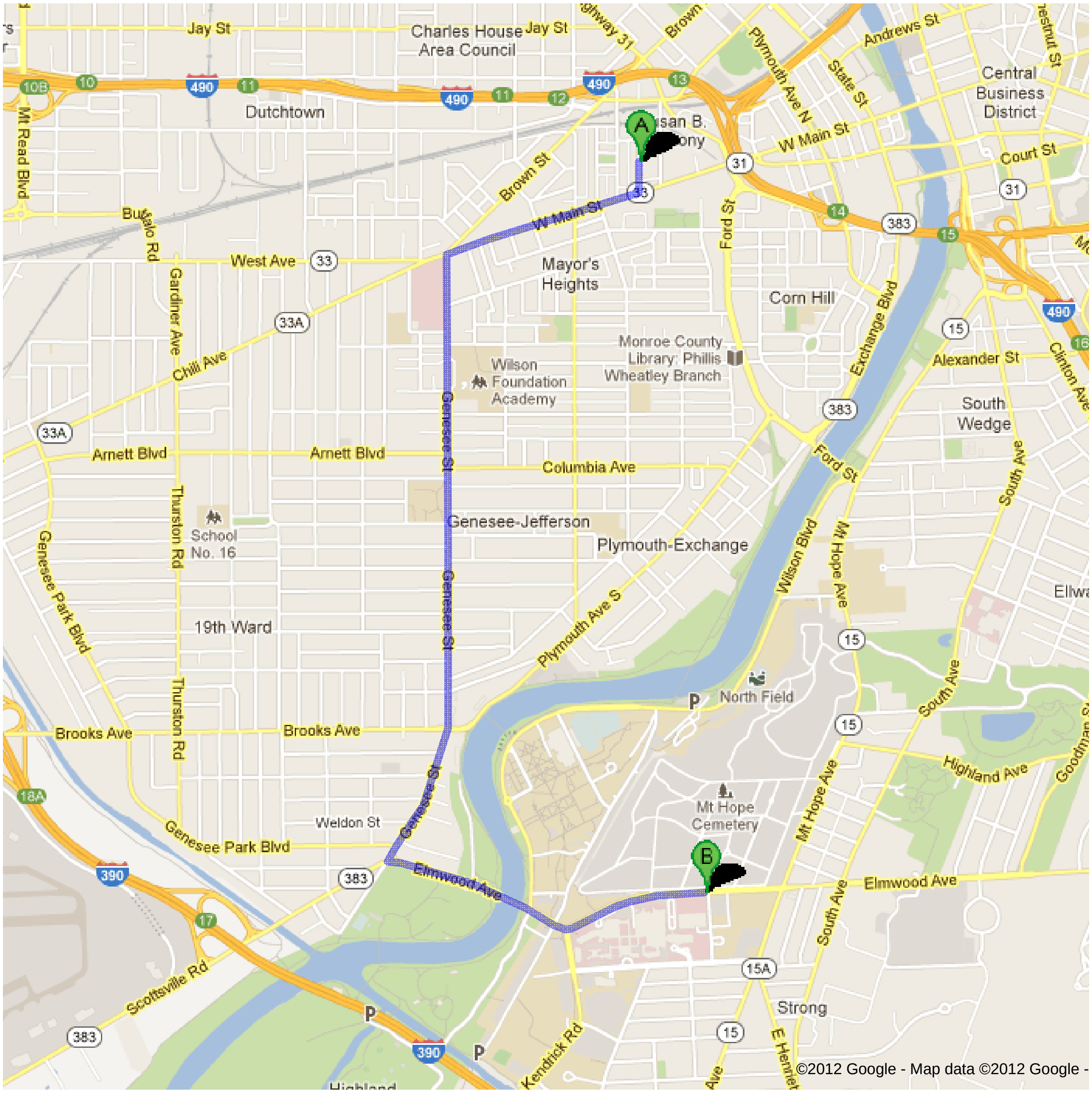
33 Litchfield Street
Rochester NY 14608

Stantec

FIGURE 2

Directions and Map from the Site to Strong Memorial Hospital, Rochester, NY

Directions to Strong Memorial Hospital
601 Elmwood Avenue, Rochester, NY 14620
3.3 mi – about **9 mins**



Health & Safety Plan
Former Carriage Factory Site
33 Litchfield Street
Rochester, NY

Driving Directions to Hospital
Figure 2

A 33 Litchfield St, Rochester, NY 14608

1.	Head **south** on **Litchfield St** toward **Berdell Alley**	go 449 ft total 449 ft
2.	Turn right onto **W Main St** About 2 mins	go 0.6 mi total 0.6 mi
3.	Turn left onto **Genesee St** About 4 mins	go 1.7 mi total 2.4 mi
4.	Turn left onto **Elmwood Ave** Destination will be on the right About 3 mins	go 0.9 mi total 3.3 mi

B **Strong Memorial Hospital**
601 Elmwood Avenue, Rochester, NY 14620

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

HEALTH & SAFETY PLAN

APPENDIX A

MATERIAL SAFETY DATA SHEETS

NIOSH Publication No. 2005-149: **September 2005**

NIOSH Pocket Guide to Chemical Hazards

1,2-Dichloroethylene

CAS

540-59-0

RTECS

KV9360000

DOT ID & Guide

1150 130P

ClCH=CHCl

Synonyms & Trade Names

Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

Exposure Limits

NIOSH REL: TWA 200 ppm (790 mg/m^3)

OSHA PEL: TWA 200 ppm (790 mg/m^3)

IDLH

1000 ppm See: 540590

Conversion

1 ppm = 3.97 mg/m^3

Physical Description

Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

MW: 97.0	BP: 118-140°F	FRZ: -57 to -115°F	Sol: 0.4%
VP: 180-265 mmHg	IP: 9.65 eV		Sp.Gr(77°F): 1.27
Fl.P: 36-39°F	UEL: 12.8%	LEL: 5.6%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities

Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

Measurement Methods

NIOSH 1003; OSHA 7
See: NMAM or OSHA Methods

Personal Protection & Sanitation

(See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid

(See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA
Up to 2000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)£
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes

inhalation, ingestion, skin and/or eye contact

Symptoms

Irritation eyes, respiratory system; central nervous system depression

Target Organs

Eyes, respiratory system, central nervous system

See also: INTRODUCTION See ICSC CARD: 0436

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Search the Pocket Guide

SEARCH

Enter search terms separated by spaces.

Tetrachloroethylene

Synonyms & Trade Names

Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

CAS No.

127-18-4

RTECS No.

KX3850000

DOT ID & Guide

1897 160

Formula

$Cl_2C{=}CCl_2$

Conversion

1 ppm = 6.78 mg/m^3

IDLH

Ca [150 ppm]
See: 127184

Exposure Limits

NIOSH REL

: Ca Minimize workplace exposure concentrations. See Appendix A

OSHA PEL

†: TWA 100 ppm
C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm

Measurement Methods

NIOSH 1003 ;
OSHA 1001
See: NMAM or OSHA Methods

Physical Description

Colorless liquid with a mild, chloroform-like odor.

MW:	BP:	FRZ:	Sol:	VP:	IP:
165.8	250°F	-2°F	0.02%	14 mmHg	9.32 eV
Sp.Gr:	**Fl.P:**	**UEL:**	**LEL:**		
1.62	NA	NA	NA		

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Incompatibilities & Reactivities

Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms

irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

Target Organs

Eyes, skin, respiratory system, liver, kidneys, central nervous system

Cancer Site

[in animals: liver tumors]

Personal Protection/Sanitation

(See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid

(See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection

See also: INTRODUCTION See ICSC CARD: 0076 See MEDICAL TESTS: 0179

Page last reviewed: April 4, 2011
Page last updated: November 18, 2010
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

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NIOSH Publication No. 2005-149: **September 2005**

NIOSH Pocket Guide to Chemical Hazards

NPG Home | Introduction | Synonyms & Trade Names | Chemical Names | CAS Numbers | RTECS Numbers | Appendices | Search

Trichloroethylene

$ClCH=CCl_2$

CAS

79-01-6

RTECS

KX4550000

Synonyms & Trade Names

Ethylene trichloride, TCE, Trichloroethene, Trilene

DOT ID & Guide

1710 160

Exposure Limits

NIOSH REL: Ca See Appendix A See Appendix C

OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)

IDLH

Ca [1000 ppm] See: 79016

Conversion

1 ppm = 5.37 mg/m^3

Physical Description

Colorless liquid (unless dyed blue) with a chloroform-like odor.

MW: 131.4	BP: 189°F	FRZ: -99°F	Sol(77°F): 0.1%
VP: 58 mmHg	IP: 9.45 eV		Sp.Gr: 1.46
Fl.P: ?	UEL(77°F): 10.5%	LEL(77°F): 8%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities

Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Measurement Methods

NIOSH 1022, 3800; OSHA 1001

See: NMAM or OSHA Methods

Personal Protection & Sanitation

(See protection)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid

(See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes

inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms

Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Target Organs

Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Cancer Site

[in animals: liver & kidney cancer]

See also: INTRODUCTION See ICSC CARD: 0081 See MEDICAL TESTS: 0236

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SEARCH

Enter search terms separated by spaces.

Vinyl chloride

Synonyms & Trade Names Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

CAS No. 75-01-4	**RTECS No.** KU9625000	**DOT ID & Guide** 1086 116P (inhibited)
Formula CH_2=CHCl	**Conversion** 1 ppm = 2.56 mg/m^3	**IDLH** Ca [N.D.] See: IDLH INDEX

Exposure Limits
NIOSH REL : Ca See Appendix A
OSHA PEL : [1910.1017] TWA 1 ppm C 5 ppm [15-minute]

Measurement Methods
NIOSH 1007 ;
OSHA 4 , 75
See: NMAM or OSHA Methods

Physical Description Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

MW: 62.5	**BP:** 7°F	**FRZ:** -256°F	Sol(77°F): 0.1%	**VP:** 3.3 atm	**IP:** 9.99 eV
	Fl.P: NA (Gas)	**UEL:** 33.0%	**LEL:** 3.6%	**RGasD:** 2.21	

Flammable Gas

Incompatibilities & Reactivities Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Exposure Routes inhalation, skin and/or eye contact (liquid)

Symptoms lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]

Target Organs Liver, central nervous system, blood, respiratory system, lymphatic system

Cancer Site [liver cancer]

Personal Protection/Sanitation (See protection codes)	First Aid (See procedures)
Skin: Frostbite **Eyes:** Frostbite **Wash skin:** No recommendation **Remove:** When wet (flammable) **Change:** No recommendation **Provide:** Frostbite wash	**Eye:** Frostbite **Skin:** Frostbite **Breathing:** Respiratory support

Respirator Recommendations
(See Appendix E)

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection

See also: INTRODUCTION See ICSC CARD: 0082 See MEDICAL TESTS: 0241

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HEALTH & SAFETY PLAN

APPENDIX B

ON-SITE SAFETY MEETING FORMS

ON-SITE SAFETY MEETING

Project: Former Carriage Factory Site
Date:________________ Time:________________ Job No.: 190500751
Address: 33 Litchfield Street, Rochester, NY

Scope of Work:____

Weather Temp:________________ Wind direction/speed: ______________________
Sky Conditions:______________________ Humidity:______________________
Weather Conditions affecting work: ______________________

Safety Topics Discussed

Protective Clothing/Equipment: Level D (steel toe boots, hard hat with overhead hazards, etc.)

Chemical Hazards: Chlorinated VOCs

Physical Hazardous: Slip/trip/fall; weather/heat/cold; overhead hazards during drilling rig and excavator Operation; and noise during drilling

Personnel/Equipment Decontamination: Alconox solution and water rinse or high pressure wash

Personnel/Job Functions:____

Emergency Procedures: Emergency will be signaled verbally or with air or vehicle horn. Appropriate authorities will be contacted and after event, accident reporting procedures will be followed, as appropriate.

Special Equipment:____

Other:____

Emergency Phone Numbers/Addresses

Ambulance: 911
Hospital: Strong Memorial Hospital (585) 475-2100
Police: 911
Fire Department: 911

On-Site Safety Meeting
ATTENDEES

Name Printed	Signature	Job Function
________________	________________	________________
________________	________________	________________
________________	________________	________________
________________	________________	________________

Meeting Conducted By: ______________________ ______________________

Name Printed Signature

Site Safety Officer ______________________ ______________________

Team Leader ______________________ ______________________

APPENDIX C – COMMUNITY AIR MONITORING PLAN

New York State Department of Health Generic Community Air Monitoring Plan

OVERVIEW

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

COMMUNITY AIR MONITORING PLAN

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. APeriodic@ monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

Appendix 1B

FUGITIVE DUST AND PARTICULATE MONITORING

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

   a) Objects to be measured: Dust, mists or aerosols;

   b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);

c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;

d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);

e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;

f) Particle Size Range of Maximum Response: 0.1-10;

g) Total Number of Data Points in Memory: 10,000;

h) Logged Data: Each data point with average concentration, time/date and data point number

i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;

j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;

k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;

l) Operating Temperature: -10 to 50o C (14 to 122o F);

m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative, this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The

notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

   a) Applying water on haul roads;

   b) Wetting equipment and excavation faces;

   c) Spraying water on buckets during excavation and dumping;

   d) Hauling materials in properly tarped or watertight containers;

   e) Restricting vehicle speeds to 10 mph;

   f) Covering excavated areas and material after excavation activity ceases; and

   g) Reducing the excavation size and/or number of excavations.

   Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

APPENDIX D - QUALITY ASSURANCE PROJECT PLAN

APPENDIX D

QUALITY ASSURANCE PROJECT PLAN
REMEDIAL INVESTIGATION

FORMER CARRIAGE FACTORY
33 LITCHFIELD STREET
ROCHESTER, MONROE COUNTY, NEW YORK

November 2012

Prepared for:

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
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Stantec

QUALITY ASSURANCE PROJECT PLAN
FOR
REMEDIAL INVESTIGATION WORK PLAN
FORMER CARRIAGE FACTORY
33 LITCHFIELD STREET
ROCHESTER, MONROE COUNTY, NEW YORK

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1.0 Introduction

This Quality Assurance Project Plan (QAPP) is to be used in conjunction with the Remedial Investigation (RI) Work Plan (Work Plan) for the Former Carriage Factory located at 33 Litchfield Street in the City of Rochester, Monroe County, New York (the “Site”; see Figure 1). This QAPP presents the policies, organization, objectives, functional activities, and specific quality assurance and quality control activities to ensure the validity of data generated in the completion of the investigation. The purpose of this QAPP program is to ensure that technical data generated are accurate and representative.

Quality assurance (QA) is a management system for ensuring that information, data, and decisions resulting from investigation and environmental monitoring programs are technically sound, and properly documented. Quality control (QC) is the functional mechanism through which quality assurance achieves its goals. Quality control programs, for example, define the frequency and methods of checks, audits, and reviews necessary to identify problems and dictate corrective actions to resolve these problems, thus ensuring high quality data. As such, a quality assurance and quality control program pertains to data collection, evaluation, and review activities which are part of the investigation.

QA/QC procedures will be in accordance with applicable professional technical standards, government regulations and guidelines, and specific project goals and requirements. This QAPP has been prepared in accordance with New York State Department of Environmental Conservation (NYSDEC) and United States Environmental Protection Agency (EPA) Region II guidance documents.

The QAPP incorporates the following activities:

- Sample collection, control, chain-of-custody, and analysis;
- Document control;
- Laboratory instrumentation, analysis, and control; and
- Review of project reports.

Laboratory analysis of project samples will be performed by an independent laboratory with the experience and certifications appropriate to the analyses to be performed. Analyses will be performed by laboratories accredited pursuant to the NYSDOH Environmental Laboratory Accreditation Program (ELAP) for the category of parameters to be analyzed by the laboratory. The specific environmental laboratory or laboratories to be used will be determined at the time the monitoring activities are scheduled.

Duplicates, replicates, and spiked samples will be used to identify the quality of the analytical data. Field audits may be conducted to verify that proper sampling techniques and chain-of-custody procedures are followed. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-field tasks will be reviewed by senior project personnel. Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures. Records of calibration and maintenance will be kept by assigned personnel. Field testing and data acquisition will be performed following guidelines as described herein.

Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of data collected during sampling tasks.

A Data Usability Summary Report (DUSR) will be prepared for analytical results from each monitoring activity, with the exception of sampling data utilized for screening and survey purposes only. These screening and survey samples will be specified in the RI Work Plan. The DUSR will be prepared by an independent consultant with the required experience, in accordance with NYSDEC's "Guidance for the Development of Data Usability Summary Reports," revised 1997 and NYSDEC’s DER-10 “Technical Guidance for Site Investigation and Remediation,” May 2010 (DER-10).

2.0 Project Description

This QAPP pertains to the completion of field activities and subsequent laboratory and data analysis associated with the RI of the Former Carriage Factory located at 33 Litchfield Street in the City of Rochester, Monroe County, New York. The investigation elements are described in detail in the Work Plan.

Carriage Factory Special Needs Apartments, L.P. has submitted an application for an agreement with the NYSDEC to conduct a Brownfield Cleanup Program (BCP) investigation of the facility. The Site is located in an area of mixed commercial and residential properties.

Previous environmental investigations have identified the relatively low-level presence of several contaminant compounds in soils, some of which were presence at concentrations that exceeded NYSDEC Soil Cleanup Objectives. In addition, chlorinated volatile organic compounds (CVOCs) in groundwater at concentrations in excess of New York State Department of Environmental Conservation (NYSDEC) groundwater standards. The need for an further investigation of the soil and groundwater conditions is the principal reason that a BCP remedial investigation is being proposed at the Site.

In accordance with DER-10, the primary goals of a BCP-related RI are to determine surface and subsurface characteristics of the site, assess the source(s) and determine the nature and extent of contamination on or migrating from the Site, and identify migration pathways and potential receptors. The additional goals of the RI will be to satisfy the requirements of the BCP for investigation of site-wide environmental conditions and further evaluation beyond that performed to date of potential environmental impacts from historical operations at the Site.

2.1 Site Description

The Site is located at 33 Litchfield Street in the City of Rochester, Monroe County, New York (see Figure 1). The property is currently occupied by a vacant, 4-story brick building with a basement. The building was originally built in 1900 for the production of horse-drawn carriages. Operations at the Site ceased in approximately 1993 and the site has reportedly been essentially vacant since then.

Planned redevelopment of the Site involves converting the building into the Carriage Factory Apartments. This mixed-use residential development will include apartments for clients with special needs as well as other affordable housing units. The total square footage of the building will be 71,559 square feet.

2.2 Previous Environmental Investigations

Previous environmental investigations of the Site are described in the RI Work Plan.

3.0 Project Organization and Responsibility

This QAPP provides for designated qualified personnel to review products and provide guidance on QA matters. This QAPP also outlines the approach to be followed to ensure that products of sufficient quality are obtained. This structure will provide for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The QA-related functions of the project positions are as follows:

<u>Project Manager</u>
The project manager will have overall responsibility for ensuring that the project meets the objectives and quality standards as presented in the RI Work Plan and this QAPP. He/She will be responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. The project manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The project manager will provide the major point of contact and control for matters concerning the project. In addition, he/she will be responsible for technical quality control and project oversight.

<u>Team Leaders</u>
The project manager will be supported by a team leader or leaders who will be responsible for leading and coordinating the day-to-day activities of the various resource specialists under their supervision. The team leader is a highly experienced environmental professional who will report directly to the project manager.

<u>Technical Staff</u>
The technical staff (team members) for this project will be drawn from corporate resources and appropriately qualified subcontractors. The technical team staff will be used to gather and analyze data, and to prepare various task reports and support materials. The designated technical team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

<u>Project QA Director</u>
The Project QA Director will be responsible for maintaining QA for the project.

<u>Laboratory Director</u>
The laboratory director will be responsible for analytical work and works in conjunction with the QA unit. He/She maintains liaison with the QA officer regarding QA and custody requirements.

Laboratory Manager
The laboratory manager will maintain liaison with the laboratory director regarding QA elements of specific sample analyses tasks. He/She will report to the laboratory director and work in conjunction with the laboratory QA unit.

Laboratory QA Coordinator
The Laboratory QA officer will be responsible for overseeing the QA program within the laboratory and for maintaining
QC documentation. He/She reports directly to the laboratory director.

Laboratory Staff
Each member of the laboratory staff will perform an assigned QA or analytical function that is pertinent to and within the scope of his or her knowledge, experience, training, and aptitude. An individual will be assigned the responsibility for checking, reviewing, or otherwise verifying that a sample analysis activity has been correctly performed.

Laboratory Facilities
Laboratory work will be performed in accordance with guidelines established by NYSDEC, United States Environmental Protection Agency (USEPA), the Water Pollution Control Federation, and/or the American Society for Testing and Materials (ASTM). In case of conflict, these guidelines and protocols will be considered in the order shown (i.e., NYSDEC criteria is of primary precedence). In addition, QA and QC programs will be maintained for the instruments and the analytical procedures used. A NYSDOH ELAP certified laboratory capable of providing (NYSDEC Analytical Services Protocol (ASP) Category B deliverables will be identified to provide laboratory services for this project. With the exception of data collected solely for screening and survey purposes, data will be reported with a NYSDEC ASP Category B deliverable. The laboratory's preventative maintenance procedures will be provided and outlined in their Laboratory Quality Assurance Manual.

4.0 QA Objectives for Data Measurement

Measurements will be made to ensure that analytical results are representative of the media and conditions measured. Unless otherwise specified, data will be calculated and reported in units consistent with other organizations who report similar data to allow comparability of databases among organizations.

The key considerations for the QA assessment of generated data are accuracy, precision, completeness, representativeness, and comparability. These characteristics are defined below:

Accuracy: Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system.

Precision: Precision is the degree of mutual agreement among individual measurements of a given parameter.

Completeness: Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct normal conditions.

Representativeness: Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Comparability: Comparability expresses the confidence with which one data set can be compared to another.

4.1 Goals

The QA/QC goal will focus on controlling measurement error within the limits established and will ultimately provide a database for estimating the actual uncertainty in the measurement data.

Target values for detection limit, percent spike recovery and percent "true" value of known check standards, and RPD of duplicates/replicates are provided in the referenced analytical procedures. It should be noted that target values are not always attainable. Instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achievement of target detection limits or other quality control criteria. In such instances, the laboratory will report reasons for deviations from these detection limits or noncompliance with quality control criteria.

5.0 Sampling Procedures

The sampling of various environmental media will be completed as part of the Remedial Investigation activities. The RI Work Plan presents the location, type, and analytical requirements of samples to be collected as part of the Remedial Investigation Activities.

5.1 Sampling Program

The sampling and field procedures for the following activities are described in the RI Work Plan:

- Passive Soil Gas sampling;
- Surface soil sampling;
- Test borings with soil sampling;
- Bedrock monitoring well installations and well development;
- Groundwater level measurement;
- Groundwater sampling from the existing and new monitoring wells;
- Hydraulic conductivity testing in selected new and existing wells; and
- Monitoring well and sampling point location and elevation survey.

The sample containers, preservation, and holding time that will be used are identified in Table 1. The sample containers will be labeled in accordance with Section 6.2. Sample handling, packaging and shipping procedures are presented in Section 6.3.

5.2 Field Quality Control Samples

Field quality control samples will consist of trip blanks, field blanks, field duplicates, matrix spikes and matrix spike duplicates, as shown on Table 2.

5.2.1 Field Duplicates

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained at a rate of one per 20 original field samples, as shown in Table 2.

5.2.2 Trip Blanks

Trip blanks will be used to assess whether groundwater, has been exposed to volatile constituents during sample storage and transport. The trip blanks for water samples will consist of a container filled by the laboratory with analyte-free water. The trip blanks will remain unopened throughout the sampling event and will only be analyzed for volatile organics. The trip blanks will be collected as shown in Table 2.

5.2.3 Matrix Spike/Matrix Spike Duplicates

Matrix Spike/Matrix Spike Duplicates (MS/MSD) will be obtained to determine if the matrix is interfering with the sample analysis. MS/MSDs will be collected at a rate of one per 20 original field samples, as shown on Table 2.

5.2.4 Rinsate Blanks

Rinsate blanks will be used to assess decontamination procedures for non-dedicated equipment. Rinse blanks will be collected as shown in Table 2.

5.2.5 Laboratory Quality Control Checks

Internal laboratory quality control checks will be used to monitor data integrity. These checks include method (equipment) blanks, spike blanks, internal standards, surrogate samples, calibration standards, and reference standards.

5.3 Sample Containers

The volumes and containers required for the sampling activities are included in Table 1. Pre-washed sample containers will be provided by the laboratory. All bottles are to be prepared in accordance with EPA bottle washing procedures.

5.4 Decontamination

Dedicated and/or disposable sampling equipment will be used to the extent possible to minimize decontamination requirements and the possibility of cross-contamination.

Split spoon samplers, hand augers, and sediment samplers are examples of sampling equipment to be used at more than one location. The water level indicator will be decontaminated between locations by using the following decontamination procedures:

- Initial cleaning of any foreign matter with paper towels, if needed;
- Low-phosphate detergent wash;
- De-ionized water rinse; and
- Air dry.

The samplers used for drilling and soil sampling in test borings will be decontaminated with a bucket wash consisting of a low-phosphate detergent wash followed by water rinse. The drill rig, augers, rods, and other related downhole equipment will be decontaminated using high-pressure steam prior to initiating the soil boring program. This decontamination procedure will also be used on the downhole equipment between boring locations. Steam cleaning will be performed in a designated on-site decontamination area. Throughout and after the cleaning processes, direct contact between the equipment and the ground surface will not be permitted. Decontamination waste water will be containerized. The drill rig and associated equipment will also be cleaned upon completion of the investigation prior to departure from the site using the following methods:

- Initial cleaning of foreign matter; and
- Wash down with high pressure, high-temperature spray to remove and/or volatilize organic contamination.

5.5 Levels of Protection/Site Safety

Sampling will be conducted under a written Health and Safety Plan. On the basis of air monitoring, the level of protection may be downgraded or upgraded at the discretion of the site safety officer. Crew members will stand upwind of open boreholes or wellheads during the collection of samples, when possible.

Work will initially be conducted in Level D (refer to Site Specific Health and Safety Plan). Air purifying respirators (APRs) will be available if monitoring indicates an upgrade to Level C is appropriate.

6.0 Sample Custody

This section describes standard operating procedures for sample identification and chain-of-custody to be used for field activities. The purpose of these procedures is to ensure that the quality of the samples is maintained during collection, transportation, storage, and analysis. Chain-of-custody requirements comply with standard operating procedures indicated in USEPA and NYSDEC sample-handling protocol.

Sample identification documents must be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include:

- Field records,
- Sample label,
- Custody seals, and
- Chain-of-custody records.

6.1 Chain-Of-Custody

The primary objective of the chain-of-custody procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of required analyses.

6.1.1 Sample Labels

Sample labels attached to, or affixed around, the sample container must be used to properly identify samples collected in the field. To the extent possible, the sample labels are to be placed on the bottles so as not to obscure any QA/QC lot numbers on the bottles. Sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the field sampling records or sample logbook. For chain-of-custody purposes, QC samples are subject to exactly the same custodial procedures and documentation as "real" samples.

6.1.2 Custody Seals

Custody seals are preprinted adhesive-backed seals often with security slots which are designed to break if the seals are disturbed. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. On receipt at the laboratory, the custodian must check (and certify, by completing logbook entries) that seals on shipping containers are intact. Strapping tape should be placed over the seals to ensure that seals on shipping containers are not accidentally broken during shipment.

6.1.3 Chain-Of-Custody Record

The chain-of-custody record must be fully completed at least in duplicate by the field technician who has been designated by the project manager as being responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the "Remarks" section of the custody record.

6.1.4 Field Custody Procedures

- As few persons as possible should handle samples.

- Sample bottles will be obtained pre-cleaned by the laboratory and shipped to the sampling personnel in charge of the field activities. Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use.

- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under chain-of-custody rules.

- The sample collector will record sample data in a controlled field notebook and/or on appropriate field sampling records.

- The site team leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

6.2 Documentation

6.2.1 Sample Identification

Containers of samples collected from the project will be identified using the following format on a label or tag fixed to the sample container:

CF-*XX-Y*

- "CF" - This set of initials indicates the Carriage Factory project.

- *"XX"* - These initials identify the sample. Actual sample locations will be recorded on the sampling record. Field duplicates, field blanks and rinsate blanks will be assigned unique sample numbers.

- *"Y"* - This initial will identify the sample matrix in accordance with the following abbreviations:

    - W: Water Sample
    - S: Soil Sample

Each sample will be labeled, chemically preserved, if required, and sealed immediately after collection. To minimize handling of sample containers, labels will be filled out prior to sample collection to the extent possible. The sample label will be filled out using waterproof ink and will be firmly affixed to the sample containers. The sample label will give the following information:

- Name or initials of sampler;
- Date (and time, if possible) of collection;
- Sample number;
- Intended analysis; and
- Preservation performed.

6.2.2 Daily Logs

Daily logs and data forms are necessary to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project. Daily logs will be kept in a notebook and consecutively numbered. Entries will be made in waterproof ink, dated, and signed. Sampling data will be recorded in the sampling records. Information will be completed in waterproof ink. Corrections will be made according to the procedures given at the end of this section.

6.3 Sample Handling, Packaging, and Shipping

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to the possible hazardous nature of samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

All chain-of-custody requirements must comply with standard operating procedures in the NYSDEC and USEPA sample handling protocol. Field personnel will make arrangements for transportation of samples to the laboratory. When custody is relinquished to a shipper, field personnel will ensure that the laboratory custodian or project manager is aware of the expected time of arrival of the sample shipment and of any time constraints on sample analysis(es). Samples will be delivered to the laboratory in a timely manner to help ensure that holding times are followed.

7.0 Calibration Procedures and Frequency

Instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set forth in the applicable analytical methodology references.

7.1 Field Instruments

A calibration program will be implemented to ensure that routine calibration is performed on field instruments. Field team members familiar with the field calibration and operations of the equipment will maintain proficiency and perform the prescribed calibration procedures outlined in the Operation and Field Manuals accompanying the respective instruments. Calibration records for each field instrument used on the project will be maintained on-site during the respective field activities and a copy will be kept in the project files.

7.1.1 Portable Total Organic Vapor Monitor

Any vapor monitor used will undergo routine maintenance and calibration prior to shipment to the project site. Daily calibration and instrument checks will be performed by a trained team member at the start of each day. Daily calibrations will be performed according to the manufacturer's specifications and are to include the following:

Battery check: If the equipment fails the battery check, recharge the battery.

- Gas standard: The gauge should display an accurate reading when a standard gas is used.

- Cleaning: If proper calibration cannot be achieved, then the instrument ports must be cleaned.

7.1.2 pH and Specific Conductance

The following steps should be observed by personnel engaged in groundwater sampling for pH and specific conductance:

- The operation of the instrument should be checked, and calibrated if needed, with fresh standard buffer solution (pH 4, pH 7 and pH 10) prior to each day's sampling.
- The specific conductance meter should be calibrated prior to each sampling event using a standard solution of known specific conductance.

More frequent calibrations may be performed as necessary to maintain analytical integrity. Calibration records for each field instrument used on the project should be maintained and a copy kept in the project files.

7.2 Laboratory Instruments

Laboratory calibration procedures are addressed in detail in the laboratory Quality Assurance Manual (QAM), which can be provided upon selection of a laboratory. Calibration procedures will be consistent with the method used for analysis.

8.0 Analytical Procedures

8.1 Field

On-site procedures for analysis of total organic vapor and other field parameters are addressed in the Remedial Investigation Work Plan.

8.2 Laboratory

Specific analytical methods for constituents of interest in soil and groundwater are listed in Table 1. The laboratory will maintain and have available for the appropriate operators standard operating procedures relating to sample preparation and analysis according to the methods stipulated in Table 1.

9.0 Data Reduction and Reporting

QA/QC requirements will be strictly adhered to during sampling and analytical work. Data generated will be reviewed by comparing and interpreting results from chromatograms (responses, stability of retention times), accuracy (mean percent recovery of spiked samples), and precision (reproducibility of results). Refer to Section 10 for a discussion of QA/QC protocol.

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. Analytical QC will be documented and included in the analytical testing report. A central file will be maintained for the sampling and analytical effort after the final laboratory report is issued.

Calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results. Prior to the submission of the report to the client, data will be evaluated for precision, accuracy, and completeness. Sections 4.0, 8.0, and 13.0 of this document include some of the QC criteria to be used in the data evaluation process.

Laboratory reports will be reviewed by the laboratory supervisor, the QA officer, laboratory manager and/or director, and the project manager. Analytical reports will contain a data tabulation including results and supporting QC information will be provided. Raw data will be available for later inspection, if required, and maintained in the control job file. With the exception of data collected solely for screening and survey purposes, data will be reported with a NYSDEC ASP Category B deliverable.

Data will be reported to NYSDEC in electronic format in accordance with DER-10 and the NYSDEC's Environmental Data Submission requirements.

10.0 Internal Quality Control Checks

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. The procedures to be followed for internal quality control checks are consistent with NYSDEC ASP protocols.

11.0 Performance and System Audits

11.1 Field Audits

The Project QA Director may conduct episodic audits of the operations at the site to ensure that work is being performed in accordance with the work plan and associated standard operating practice. The audit will cover, but not necessarily be limited to, such areas as:

- Conformance to standard operating procedures
- Completeness and accuracy of documentation
- Chain of custody procedures
- Construction specifications

11.2 Laboratory Audits

In addition to any audits required by the NYSDEC, the Project QA Director may chose to audit the laboratory. These additional audits may take the form of performance evaluation samples or on-site inspections of the laboratory. Performance evaluation samples may be either blind samples or samples of known origin to the laboratory. Reasonable notice will be provided if the audit is to include an on-site inspection of the laboratory.

12.0 Preventive Maintenance

12.1 Field

Field personnel assigned to complete the work will be responsible for preventative maintenance of field instruments. The field sampling personnel will protect the portable total organic vapor monitors, water quality meter, etc. by placing them in portable boxes and/or protective cases.

Field equipment will be subject to a routine maintenance program, prior to and after each use. The routine maintenance program for each piece of equipment will be in accordance with the manufacturer's operations and maintenance manual. Equipment will be cleaned and checked for integrity after each use. Necessary repairs will be performed immediately after any defects are observed, and before the item of equipment is used again. Equipment parts with a limited life (such as batteries, membranes and some electronic components) will be periodically checked and replaced or recharged as necessary according to the manufacturer's specifications.

12.2 Laboratory

The laboratory's preventative maintenance procedures can be provided as outlined in their Laboratory Quality Assurance Manual.

13.0 Data Assessment Procedures

Performance of the following calculations will be completed to evaluate the accuracy, precision and completeness of collected measurement data.

13.1 Precision

Precision of a particular analysis is measured by assessing its performance with duplicate or replicate samples. Duplicate samples are pairs of samples taken in the field and transported to the laboratory as distinct samples. Their identity as duplicates is sometimes not known to the laboratory and usually not known to bench analysts, so their usefulness for monitoring analytical precision at bench level is limited. For most purposes, precision is determined by the analysis of replicate pairs (i.e., two samples prepared at the laboratory from one original sample). Often in replicate analysis the sample chosen for replication does not contain target analytes so that quantification of precision is impossible. Replicate pairs of spiked samples, known as matrix spike/matrix spike duplicate samples, are used for precision studies. This has the advantage that two real positive values for a target analyte can be compared.

Precision is calculated in terms of Relative Percent Difference (RPD), which is expressed as follows:

$$RPD = \frac{(X_1 - X_2)}{(X1 + X2)/2} \times 100$$

where X_1 and X_2 represent the individual values found for the target analyte in the two replicate analyses or in the matrix spike/matrix spike duplicate analyses.

RPDs must be compared to the method RPD for the analysis. The analyst or his supervisor must investigate the cause of RPDs outside stated acceptance limits. This may include a visual inspection of the sample for non-homogeneity, analysis of check samples, etc. Follow-up action may include sample re-analysis or flagging of the data as suspect if problems cannot be resolved.

13.2 Accuracy

Accuracy of a particular analysis is measured by assessing its performance with "known" samples. These "knowns" can take the form of EPA or NBS traceable standards (usually spiked into a pure water matrix), or laboratory prepared solutions of target analytes into a pure water or sample matrix; or (in the case of GC or GC/MS analyses) solutions of surrogate compounds which can be spiked into every sample and are designed to mimic the behavior of target analytes without interfering with their determination. In each case the recovery of the analyte is measured as a percentage, corrected for analytes known to be present in the original sample if necessary, as in the case of a matrix spike analysis. For EPA or NBS supplied known solutions, this recovery is compared to the published data that accompany the solution. For prepared solutions, the recovery is compared to EPA-developed data or historical data as available. For surrogate compounds, recoveries are compared to USEPA CLP acceptable recovery tables. If recoveries do not meet required criteria, then the analytical data for the batch (or, in the case of surrogate compounds, for the individual sample) are considered potentially inaccurate.

For highly contaminated samples, recovery of matrix spike may depend on sample homogeneity. As a rule, analyses are not corrected for recovery of matrix spike or surrogate compounds.

13.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under normal conditions. Completeness for each parameter is calculated as:

$$\text{Completeness} = \frac{\text{Number of successful analyses} \times 100}{\text{Number of requested analyses}}$$

Target value for completeness for parameters is 100%. A completeness value of 95% will be considered acceptable. Incomplete results will be reported to the client project officer.

13.4 Representativeness

The characteristic of representativeness is not quantifiable. Subjective factors to be taken into account are as follows:

- The degree of homogeneity of a site;
- The degree of homogeneity of a sample taken from one point in a site; and
- The available information on which a sampling plan is based.

To maximize representativeness of results, sampling techniques and sample locations will be carefully chosen so that they provide laboratory samples representative of the site and the specific area.

14.0 Corrective Action

Corrective actions can be initiated as a result of performance and system audits, laboratory and interfield comparison studies, data validation, and/or a QA program audit. They may also be required as a result of a request from project representatives. Corrective action necessary to resolve analytical problems will be taken. Success or failure of corrective actions will be reported with an estimate of effect on data quality, if any.

Corrective actions may include altering procedures in the field, conducting subsequent audits, or modifying project protocol. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. The project manager is responsible for initiating corrective action and the team leader is responsible for its implementation in the correction of field non-conformance corrective actions.

15.0 Quality Assurance Reports

Upon completion of a project sampling effort, with the exception of sampling efforts conducted solely for screening and survey purposes, analytical and QC data will be included in a Data Usability Summary Report (DUSR) that summarizes the work and provides a data evaluation. A discussion of the usability of the results in the context of QA/QC procedures will be made, as well as a summation of the QA/QC activity. The DUSR will be performed in accordance with the DEC's "Guidance for the Development of Data Usability Summary Reports," revised 1997 and DER-10.

Serious analytical problems will be reported. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. Corrective actions may include altering procedures in the field, conducting an audit, or modifying laboratory protocol. Corrective action will be implemented after notification of the project representatives.

TABLES

33 Litchfield Street
Brownfield Cleanup Program
Remedial Investigation
Quality Assurance Project Plan

Table 1
Required Sample Containers, Volumes, Preservaton and Holding Times

Media	Type of Analysis	Required Container	Preferred Sample Volume (0z.)	Preservation	Maximum Holding Time
Soil	USEPA 8260B VOCs	4 oz.cwm	4	Cool 4°C	VSTR + 10 days
	USDEP 8270C SVOCs	4 oz.cwm	4	Cool 4°C	VSTR + 5 days
	USEPA 8081B Pesticides	4 oz.cwm	4	Cool 4°C	VSTR + 5 days
	USEPA 8082A PCBs	4 oz.cwm	4	Cool 4°C	VSTR + 5 days
	USEPA 6010/7000-series1TAL Metals	4 oz.cwm	4	Cool 4°C	VSTR + 6 Months
Groundwater	USEPA 8260B VOCs	(2) 40 ml glass vials	80 ml	pH<2, HCL	VTSR + 10 days if acidified with HCL
	USDEP 8270C SVOCs	1000 ml amber glass jar	1000 ml	pH<2, HCL	VTSR + 5 days if acidified with HCL
	USEPA 8081B Pesticides	1000 ml amber glass jar	1000 ml	Cool 4°C	VTSR + 5 days if acidified with HCL
	USEPA 8082A PCBs				
	USEPA 6010/7000-series1TAL Metals	500 ml plastic or glass jar	500 ml	pH<2, HNO3	VTSR + 6 Months

Notes:

1. Samples must be received by the lab within 48 hours of the first sample being taken.
2. VTSR = Validated Time of Sample Receipt at laboratory
3. cwm = clear wide mouth jar

33 Litchfield Street
Brownfield Cleanup Program
Remedial Investigation
Quality Assurance Project Plan

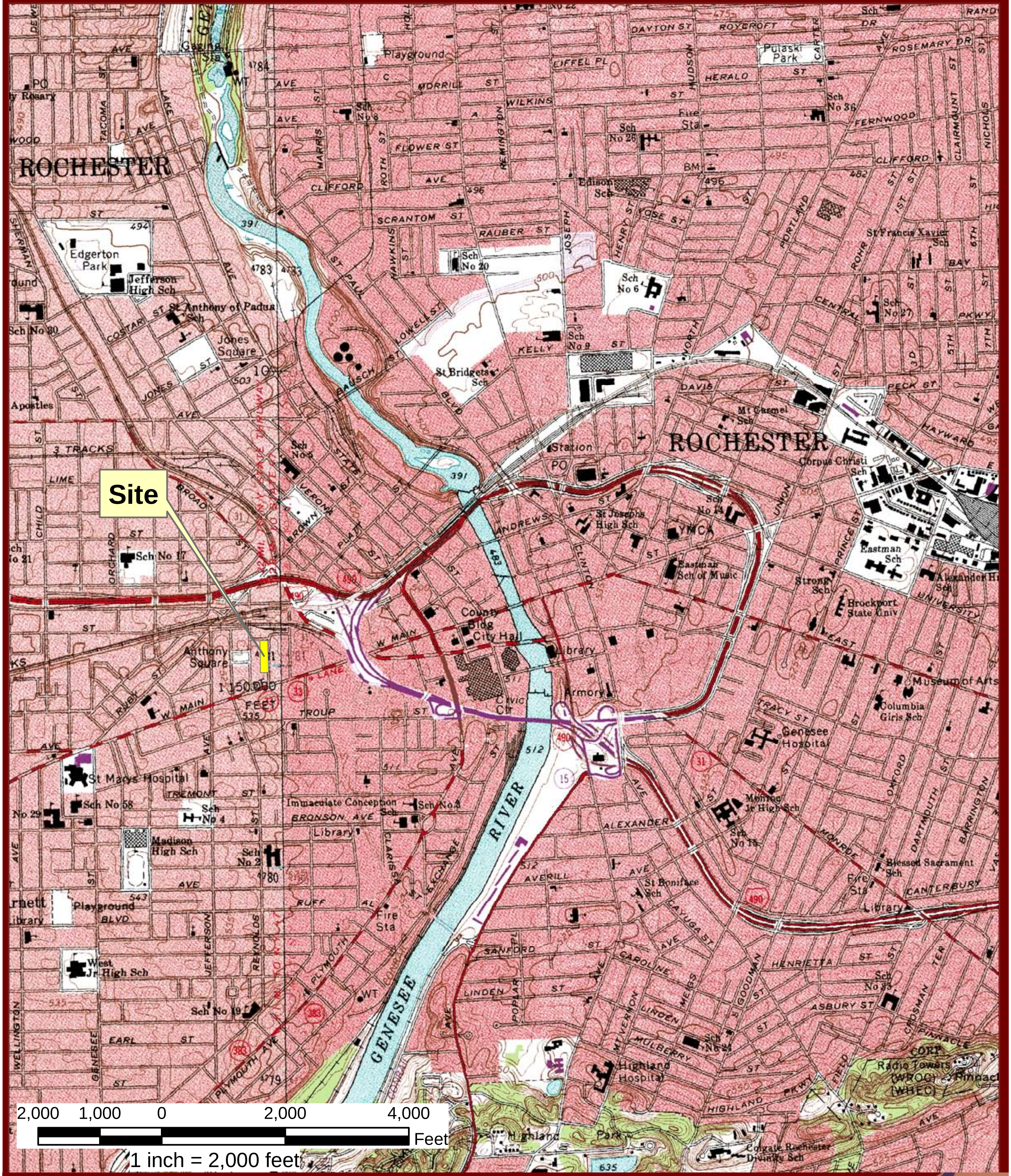
Table 2
Summary of Field Quality Control Samples

Analysis Parameters	Analysis Method (USEPA SW846 method number)	Estimated Number of Site Samples	QA/QC Samples				Total Number of Samples
			Field Duplicates	Trip Blanks	Rinsate Blanks	MS/MSD	
Passive Soil Gas							
TCL VOCs	8260B	27	2	1	0	0	30
Soil Sampling							
TCL VOCs	8260B	2	1	1	1	1	6
TCL SVOCs	8270C	5	1	0	2	1	9
TCL Pesticides	8081B/8082A	5	1	0	2	1	9
PCBs	8082A	5	1	0	2	1	9
TAL Metals	6010/7000-series	5	1	0	2	1	9
Groundwater Sampling							
TCL VOCs	8260B	14	1	2	0	1	18
TCL SVOCs	8270C	3	1	0	0	1	5
TCL Pesticides	8081B/8082A	3	1	0	0	1	5
PCBs	8082A	3	1	0	0	1	5
TAL Metals	6010/7000-series	3	1	0	0	1	5
ERD Assessment							
Sampling and analysis program to be determined							

Key:

MS/MSD = Matrix spike/matrix spike duplicate.
PCBs = Polychlorinated biphenyls.
QA/QC = Quality assurance/quality control.
SVOCs = Semivolatile organic compounds.
TAL = Target analyte list.
TCL = Target compound list.
VOCs = Volatile organic compounds.

FIGURES



Geographic Information Systems

Cartographic Design By: Andrew Less

Path: U:\190500751\drawing\CAD\RI Figures\Figure 1 Site Loca

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Stantec

Reference Souce :
USGS Quadrangles from NYSGIS :
Rochester East / Rochester West

N

Figure 1 - Site Location Map

33 Litchfield Street
Rochester NY 14608