REPORT

Remedial Investigation
Portion of Former Vacuum Oil Refinery
Site No. C828190

Rochester, New York

City of Rochester

November 2019

OBG
Part of Ramboll

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PORTION OF FORMER VACUUM OIL REFINERY

Site #C828190
1, 13, 31, 69, and 75 Cottage Street;
100 Riverview Place; 102 Violetta Street; and
1320 S. Plymouth Avenue
Rochester, New York

Prepared for: City of Rochester

I Doug Crawford, *certify that I am currently a NYS registered professional engineer and* that this Remedial Investigation Report was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications

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LIST OF ACRONYMS

ALS	ALS Environmental Laboratory
amsl	above mean seal level
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Act
BCP	Brownfield Cleanup Program
bgs	below ground surface
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Program
CFR	Code of Federal Regulations
COCs	constituents of concern
COECs	constituents of ecological concern
COPCs	constituents of potential concern
CP	Commissioner Policy
CPP	Citizens Participation Plan
cm/sec	centimeters per second
CSM	Conceptual Site Model
1,1-DCA	1,1-dichloroethane
DBMS	database management system
DER	Division of Environmental Remediation
DGEIS	Draft Generic Environmental Impact Statement
DO	dissolved oxygen
DUSR	Data Usability Summary Report
ECL	Environmental Conservation Law
EDD	electronic data deliverable
ELAP	Environmental Laboratory Approval Program
EM	ExxonMobil
ESA	Environmental Site Assessment
FB	Field blank
FD	Field duplicate
FSAP	Field Sampling and Analysis Plan
ft	feet
FWRIA	Fish and Wildlife Resources Impact Analysis
GIS	Geographic Information System
GPR	ground penetrating radar
GPS	Global Positioning System
HASP	Health and Safety Plan
HFM	historic fill material
IDW	investigative-derived waste
in	inches
J	Estimated value (for a complete list of laboratory qualifiers, refer to "Report Qualifiers and Definitions" pages with analytical laboratory reports (**Exhibit C**)
LNAPL	liquid non-aqueous phase liquid
MBK	Methyl butyl ketone (2-hexanone)
MCPW	Monroe County Pure Waters
MCWA	Monroe County Water Authority
MEK	Methyl ethyl ketone (2-butanone)
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
mg/L	milligrams per liter
MIBK	Methyl isobutyl ketone
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	not applicable, not analyzed for
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988

NC	no criteria exists
ND	not detected
NT	No TICs identified
NTU	nephelometric turbidity unit
NYCRR	New York Codes, Rules, and Regulations
NYS	New York State
NYSASP	New York State Analytical Service Protocol
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OBG	O'Brien & Gere
ORP	oxidation-reduction potential
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personnel protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance / quality control
QCP	Quality Control Plan
QHHEA	Qualitative Human Health Exposure Assessment
RAA	Remedial Alternatives Analysis
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
RQD	bedrock rock quality designation
SCG	Standards, criteria, or guidance value
SCO	Soil Cleanup Objective
SGV	Standard and guidance value
SVOC	semi-volatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
TAL	target analyte list
TCL	Target Compound List
TIC	Tentatively Identified Compound
124TMB	1,2,4-Trimethylbenzene
135TMB	1,3,5-Trimethylbenzene
TO-15	Toxic Organics TO-15 Method
UFPO	underground facilities protection organization
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
µg/L	microgram per liter
µg/kg	microgram per kilogram
VOC	volatile organic compound

1. INTRODUCTION

OBG, part of Ramboll, (OBG) has developed this Remedial Investigation (RI) Report on behalf of the City of Rochester (City) to summarize findings of the Remedial Investigation recently completed for a portion of the former Vacuum Oil Refinery on an approximate 15.4-acre section of eight City-owned parcels including: 1, 13, 31, 69, and 75 Cottage Street; 100 Riverview Place; 102 Violetta Street; and 1320 S. Plymouth Avenue (Site).

The Site was accepted into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) on September 24, 2014 as Site Number C828190 and the components of this investigation were based on the requirements of the NYSDEC Brownfield Cleanup Act (BCA) Agreement between the City and the NYSDEC dated April 6, 2015. The City entered the BCP as a Volunteer and the information generated during the RI was used to evaluate the nature and extent of contamination and evaluate potential risks to human health and the environment. The RI Work Plan, dated October 2015, prepared by OBG, was approved by the NYSDEC and New York State Department of Health (NYSDOH) on November 19, 2015.

1.1 PROJECT OBJECTIVES

The purpose of the RI was to further evaluate the nature and extent of contamination documented in prior investigations conducted at the Site (presented in Section 2.5). Data gaps remained from these prior investigations and required further evaluation of the horizontal and vertical extent of contamination and characterization of surface and subsurface impacts on the Site. Objectives of the RI included:

- Evaluation of the horizontal and vertical extent of contamination at the Site
- Identification of potential source(s) of contamination, migration pathways, and actual or potential receptors of contaminants
- Evaluation of the actual or potential threats to public health and environment
- Production of data of sufficient quantity and quality to support the evaluation of potential remedial alternatives to support future use.

1.2 REPORT ORGANIZATION

This report is organized as follows:

- Section 2 – Site Location and Description
- Section 3 – Remedial Investigation Methods
- Section 4 – Physical Characteristics of the Site
- Section 5 – Nature and Extent of Contamination
- Section 6 – Conceptual Site Model (CSM)
- Section 7 – Qualitative Exposure Assessment
- Section 8 – Fish and Wildlife Resource Impact Analysis
- Section 9 – Summary and Conclusions
- Section 10 – References.

2. SITE LOCATION AND DESCRIPTION

2.1 SITE LOCATION

The Site is located at 1, 13, 31, 69, and 75 Cottage Street; 100 Riverview Place; 102 Violetta Street; and 1320 S. Plymouth Avenue in Rochester, Monroe County, New York and encompasses approximately 15.4-acres. A Site Location map is presented as **Figure 1** and a Site Detail map depicting the Site parcels included in the RI is presented as **Figure 2**.

The Site is bordered by the Genesee River and adjacent western Genesee River concrete wall to the east/southeast/south beyond a narrow strip of New York State-owned land, residential property to the west, vacant land (formerly a junkyard addressed as 15 Flint Street) to the northwest, and Flint Street with commercial land to the north across Flint Street. Property addressed as 5 Flint Street, containing a single, vacant three-story building (associated with the former Vacuum Oil Refinery as described in Section 2.6) is also located near the north end of the Site. Although the 5 Flint Street parcel is located on the northern side of the Site, the Site also wraps around 5 Flint Street in a "U" shape.

2.2 SITE HISTORY

The following Site history summarizes information obtained from review of historic information. The Site was historically operated as a petroleum refinery, blending, and bulk oil storage facility from approximately 1866 to approximately 1930 that encompassed approximately 40-acres with a footprint spanning both north and south of Flint Street. The Vacuum Oil Company Refinery operated the petroleum refinery, blending operations, and bulk storage at portions of the Site (including several adjoining properties) from approximately 1866 to around the early 1890s. From the early 1890s until its closure in 1935, the Site operated as a blending facility. While most of the above-grade structures have been demolished and removed, some remnants of former structures remain, as detailed within Sections 2.3, 2.5, and 2.6. Since the time of refinery closure, the Site has remained vacant.

Crude oil, kerosene, naphtha, finished lubricants, and containers for these products (*e.g.*, wooden barrels, tin cans, and drums) were manufactured and stored on-Site. Operations and facilities that formerly occupied the Site include canal beds, rail yard, barrel manufacturing and storage, and underground facilities that previously serviced manufacturing operations (*e.g.*, utilities, sewers, and piping). The former canal was in operation from approximately 1840 to 1877. In approximately 1878, the canal was drained and was converted to the railbed for the Western New York & Pennsylvania Railroad. The railroad line was decommissioned in approximately 1971. An overview of historic Vacuum Oil Refinery building uses and footprints illustrated on the 1926 Plat Map are presented on **Figure 3**.

Two former railroad lines ran through the Site, including the Pennsylvania Railroad located approximately 100 feet (ft) northwest of the Genesee River and the Erie Railroad located approximately 200 ft to 400 ft northwest of the Genesee River along the Former Canal and Rail Area.

A structure, potentially a greenhouse/nursery, was depicted on the Site parcel identified as 1 Cottage Street in a 1926 aerial photograph. This structure is also present on the 1926 Plat Map presented on **Figure 3**, and on a 1938 Sanborn® Fire Insurance Map. The structure was also identified on the 1935 Plat Map as 'Western NY Nursery.' Some remnants of concrete remain; however, it is unknown if the concrete is associated with the former greenhouse/nursery, former railroad, or former canal. Most likely, the concrete remnants are related to either the former greenhouse/nursery or railroad as the former canal structures were reportedly constructed of wood.

Additionally, OBG's review of historical Site information as part of a Phase I Environmental Site Assessment documented in *Phase I Environmental Site Assessment Report, 1, 13, 31, 69, and 75 Cottage Street, 100 Riverview Place, 102 Violetta Street, and 1315 S. Plymouth Avenue, Rochester, New York*, dated December 2012 (located at

the document repository for this Site), identified 26 recognized environmental conditions. The following briefly summarizes a few of the on-Site recognized environmental conditions identified:

- Potential for impacts to soil and/or groundwater at the Site from releases that may have occurred during tank car loading/unloading; tank car cleaning with naphtha; and transport of products via railroad in association with the former oil refinery.
- The usage and storage on Site of naphtha, and the indication of widespread, multiple releases including discharge of naphtha and waste oil to the Genesee River, public sewer system, disposal in excavations on Site, burning in pits on Site, and broken pipelines, associated with the former oil refinery.
- From nearby, (upgradient) 27-31 Riverview Place (adjoining the northwestern most boundary of the 1 Cottage Street parcel potential presence of historic dry cleaning including the potential use of solvents, and the potential for groundwater migration onto the Site.
- A petroleum sludge pit was identified as being located on the southern adjacent parcel south of 13 Cottage Street (outside of the BCP property), the identification of the Site as a confirmed waste site, and the potential for several additional sludge pit locations on the southern portion of the Site and/or southern adjoining parcel, related to the former oil refinery.

2.2.1 Surrounding and Nearby Property History

Based on the property history described in the Remedial Alternatives Analysis (RAA) Report prepared by Ravi dated October 2016 (Ravi, 2016b), the adjacent 5 Flint Street property was reportedly vacant land until approximately 1875. In 1875, the parcel was developed with numerous buildings associated with the Vacuum Oil Refinery. The property served as a shipping and receiving yard between two railroad corridors along which raw materials were shipped and received. The property also operated as a lube blending facility, drum washing and storage, a paint shop, barrel manufacturing and/or storage, and several oil storage tanks were located in the southwestern portion of the parcel in the 1890s. The refinery continued operations until closing in approximately 1935. Since approximately 1942, the 5 Flint Street property has been operated as a scrap bailing company, and carting company. From approximately 1945 to 1985 the parcel was sold to individual owners, such as a food warehouse, two coffee companies, and an electric company.

Based on the property history described in the RAA Report (Ravi, 2016b), the *Day Environmental, Inc. (Day) Phase I Environmental Site Assessment Report, 15 Flint Street, dated 2007, and Stantec Consulting Services, Inc., (Stantec) Phase I Environmental Site Assessment, 15 Flint Street, dated April 2008*, the adjoining 15 Flint Street parcel was described as vacant land until approximately 1875, when the Vacuum Oil Refinery expanded to the parcel. The property was utilized for petroleum storage and processing until approximately 1892 and for lube oil blending until 1933 when the facility closed. Numerous refinery structures occupied nearly the entire 15 Flint Street parcel. Since approximately 1940, the 15 Flint Street property has been operated as a scrap metal salvage yard, an automobile wrecking and salvage yard, and an automotive junkyard until approximately 2008 when the operation was closed.

Additionally, OBG reviewed the property histories and site uses summarized in several *Phase I Environmental Site Assessments* for several nearby properties (see Section 10 for document references*)*. Other historic neighboring property uses include a former machine and/or tool and die operation at 950 Exchange Street, distilling and solvent tank storage at 936 Exchange Street, and vehicle/parts storage at 22 Flint Street.

2.3 CURRENT SITE CONDITIONS

2.3.1 Pedestrian Path

An asphalt-paved bike/pedestrian path runs through the eastern side of the Site from the north end of the property to the south end of the property and beyond in both directions. The path runs along the former Erie Railroad corridor. An approximate 1.2-acre grass-covered area is located on the eastern boundary of the Site along the Genesee River.

2.3.2 Undeveloped Woods

The remaining areas of the Site are undeveloped (except for the historic items mentioned above) and consist of vacant and undeveloped wooded and vegetative areas.

2.3.3 Indications of On-Site Waste Disposal or Landfilling

Miscellaneous trash piles and debris can be found throughout the wooded portions of the Site, depicted on **Figure 2**. Debris observed during the implementation of RI activities (both on the ground surface and below the ground surface, in varying quantities) included approximately half a dozen crushed 55-gallon steel drums, various sized piles of used automobile tires, concrete rubble, cinder blocks, miscellaneous trash, railroad timbers, bricks, and fill (including black granular material). A parts cleaner and metals shavings debris (which do not appear to be attributable to the refinery) were also observed as noted in Section 5 of this RI report. Locations where the miscellaneous trash/debris was observed are presented on **Figure 4**. Surface debris described herein was also observed during site visits performed by OBG as part of a Phase I Environmental Site Assessment documented in *Phase I Environmental Site Assessment Report, 1, 13, 31, 69, and 75 Cottage Street, 100 Riverview Place, 102 Violetta Street, and 1315 S. Plymouth Avenue, Rochester, New York*, dated December 2012 (located at the document repository for this Site.

2.3.4 Structures

While most of the above grade structures have been demolished and removed, some remnants of former concrete structures remain, as were observed during site visits performed by OBG as part of a Phase I Environmental Site Assessment documented in *Phase I Environmental Site Assessment Report, 1, 13, 31, 69, and 75 Cottage Street, 100 Riverview Place, 102 Violetta Street, and 1315 S. Plymouth Avenue, Rochester, New York*, dated December 2012 (located at the document repository for this Site).

Based on the information presented on the 1926 Plat Map (see **Figure 3**), a "Stave Storage Building" was situated on the City parcel identified as 13 Cottage Street, near the observed concrete structure remnants. It is unknown as to what subsurface structures components remain; however, subsurface structures were not generally encountered during the RI. Based on historic 1926 and 1958 aerial photographs, the structures were likely removed sometime between 1926 and 1958. An abandoned three-story building (associated with the former Vacuum Oil Refinery as described in Section 2.6) remains on an adjoining parcel identified as 5 Flint Street near the northern side of the Site.

As described in Section 3.1.3, a former Monroe County Pure Waters (MCPW) reinforced-concrete sewer line was identified within and adjacent to the west side of the former canal adjacent to an existing MCPW sewer line, and a former water line was identified on the east side of the former canal (associated with a former Vacuum Oil refinery hydrant system), during the pre-investigation activities. Active Monroe County Water Authority (MCWA) water lines are present underneath Flint Street and traverse the Genesee River.

A structure, potentially a greenhouse/nursery, was depicted on the Site parcel identified as 1 Cottage Street in a 1926 aerial photograph. This structure is also present on the 1926 Plat Map presented on **Figure 3**, and on a 1938 Sanborn® Fire Insurance Map. The structure was also identified on the 1935 Plat Map as 'Western NY Nursery.' Some remnants of concrete remain; however, it is unknown if the concrete is associated with the former greenhouse/nursery, former railroad, or former canal. Most likely, the concrete remnants are related to the former railroad as the former canal structures were reportedly constructed of wood.

A set of contract drawings provided by the City dated 1916, depict the location of the river wall running along the shoreline and ending near the southern end of the Site near the current pedestrian bridge. The structure is shown to extend to the bedrock surface. Cross-sections on the 1916 contract drawings also depict a concrete joint keyway that is only partially the height of the wall, wall joints spaced approximately 30 ft to 40 ft apart, and no waterstop was noted between the top of bedrock and concrete wall.

The entrance to the northern end of the former Erie-Lackawanna Railroad Bridge is located on the southern end of the City parcel identified as 102 Violetta Street. This bridge is currently part of the pedestrian trail and crosses the Genesee River.

2.4 LAND USE

The Site is currently zoned R-1 Low Density Residential. Residential, commercial, and light industrial manufacturing properties generally surround the Site within a one-half mile radius. Adjoining properties include the following:

- North – Commercial property (part of the former Vacuum Oil Refinery footprint), City-owned parkland and bike path, and the 5 Flint Street parcel (part of the former Vacuum Oil Refinery footprint)
- South – Undeveloped land, the Genesee River, and City-owned parkland and bike path
- East – Undeveloped land and the Genesee River
- West – Residential property and the 15 Flint Street parcel (part of the former Vacuum Oil Refinery footprint).

2.5 PREVIOUS INVESTIGATIONS

Previous investigations performed by ExxonMobil (EM), the NYSDEC, and the City on the Site and/or the adjoining 5 Flint Street and 15 Flint Street parcels (as referenced in this Section and Section 2.6) indicate the presence of contamination in surface soil, subsurface soil, and groundwater consisting of one or more of the following; concentrations of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), and/or pesticides exceeding their respective NYSDEC Technical and Administrative Guidance Memorandum #4046 Recommended Soil Cleanup Objectives, January 1994, amended December 20, 2000 (TAGM #4046).

Further details regarding the previous Site investigations are presented within the references identified in Section 10 and are summarized in OBG's report titled *Phase I Environmental Site Assessment Report, 1, 13, 31, 69, and 75 Cottage Street, 100 Riverview Place, 102 Violetta Street, and 1315 S. Plymouth Avenue, Rochester, New York*, dated December 2012 (located at the document repository for this Site).

During the 2008 EM investigation Roux collected 35 samples on-Site. As part of third-party oversight on behalf of the City, Labella Associates, P.C. (LaBella) collected six split soil samples from the same interval as Roux; two soil samples from two soil borings, but at different intervals than Roux; and three split groundwater samples. These seven soil samples and three groundwater samples were validated by a third-party validator and are depicted on Figure 3 of the RI Work Plan. A comparison of the LaBella soil samples and the Roux soil samples are presented on Table 1 of the RI Work Plan and a comparison of the LaBella groundwater samples and the Roux groundwater samples are presented on Table 2 of the RI Work Plan. LaBella's Data Usability Summary Report (DUSR) documentation is presented as Exhibit A of the RI Work Plan. Upon qualitative review of the validated and unvalidated analytical results for the split samples collected by both LaBella and Roux at the same intervals, there was no substantial difference in the results. However, due to the specific intervals only being available at only six locations for direct comparison, the recollection and reanalysis of a portion of ExxonMobil investigation locations was conducted. The following subsurface soil and groundwater samples were used to confirm the historic data:

- A comparison was performed for three soil samples with similar sample depths; historic sample SB-017A compared to SB-127, historic sample SB-048 compared to SB-108, and historic sample SB-071 compared to SB-113, respectively (with some variation in individual parameters analyzed for). Based on the results, the historic samples were generally comparable to the results obtained during the RI for VOCs, pesticides, and PCBs. Overall the SVOC comparison indicates much higher concentrations during the previous investigation where in several instances SVOCs from data collected during OBG's RI were not detected. A comparison of metals indicates some comparability; however, the historic data generally has larger concentrations than those observed during the RI.

- Comparison of two groundwater samples; historic sample SB-014 compared to OVR-117, and historic sample SB-046B compared to OVR-107, respectively (with some variation in individual parameters analyzed for). Concentrations of VOCs observed in the historic samples are higher than those observed in the OBG RI results, with concentrations in some cases differing by orders of magnitude. Concentrations of SVOCs, inorganics, and PCB are generally comparable between the two events.

2.6 RECENT INVESTIGATIONS

2.6.1 Adjoining 5 Flint Street and 15 Flint Street Remedial Investigation

On behalf of One Flint Street, LLC, a New York State Brownfield Cleanup Program (NYSBCP) RI was implemented by Ravi Engineering and Land Surveying, P.C. (Ravi) on two adjoining parcels, 5 Flint Street and 15 Flint Street starting in 2014. The 5 Flint Street and 15 Flint Street parcels (consisting of approximately 7.2 non-contiguous acres) are being investigated under the BCP (NYSDEC Site No. C828162). The adjoining 5 Flint Street and 15 Flint Street parcels are part of a portion of the former Vacuum Oil Refinery footprint and were also the location of several other business subsequent to the shut-down of operations between 1933 and 1935 as discussed in Section 2.2.1.

2.6.1.1 Remedial Investigation – Adjoining 5 Flint Street and 15 Flint Street

A Brownfield Cleanup Program Remedial Investigation Report was submitted by Ravi in October 2016 (Ravi, 2016a). A letter from NYSDEC to One Flint Street, LLC dated May 10, 2017 indicated the NYSDEC was in receipt of the RI Report, had no comments, but would not approve, disapprove, or modify until a Decision Document was issued (NYSDEC, 2017). The following is a summary of the findings of that investigation:

The purpose of the RI field activities performed by Ravi, were to investigate existing data gaps and to further define the nature and extent of the contaminants present on 5 Flint Street and 15 Flint Street. The results of the RI, including findings of previous work performed by Roux, Labella, and NYSDEC were used to evaluate remedial actions that might be required to render the property suitable for the intended use of the property.

The RI and previous investigations indicated subsurface soils with concentrations of VOCs, SVOCs, and metals in exceedance of NYSDEC Unrestricted Use and Restricted-Residential Use Soil Cleanup Objectives (SCOs) at depths ranging from 3 ft to 12 ft below ground surface (bgs) on both 5 Flint Street and 15 Flint Street in several locations.

SVOCs were detected in surficial soil at concentrations in exceedance of SCOs on the 5 Flint Street Site and numerous discrete locations on the 15 Flint Street parcel, with the highest concentrations located at the northwest end of the 15 Flint Street parcel. Arsenic, lead, mercury, and PCBs were also detected in surficial soils in exceedance of SCOs across the majority of the 5 Flint Street and 15 Flint Street parcels, with the highest concentrations of PCBs, lead, mercury, and arsenic being located at the north end of 15 Flint Street, and highest lead and PCB impacts in the central portion of 15 Flint Street. The area south of the building situated on the 5 Flint Street parcel exhibited the highest mercury and arsenic impacts, and the south end of the 5 Flint Street parcel with the highest lead, mercury, and arsenic concentrations.

VOCs, SVOCs, metals, pesticides, and PCBs were detected at concentrations in exceedance of New York State Class GA Groundwater Standards in groundwater samples collected throughout the 5 Flint Street and 15 Flint Street parcels. The highest concentrations of VOCs were collected from groundwater samples below the building situated on the 5 Flint Street parcel, southwest of the building, and on the northern portion of the 15 Flint Street parcel. Liquid non-aqueous phase liquid (LNAPL) was also encountered at various monitoring wells during the RI.

Based on the presence of contamination on the adjoining 5 Flint Street and 15 Flint Street properties, and the proximity to the Site, there is the potential for ongoing contaminant migration onto the Site, specifically via groundwater and potentially via surface runoff. This potential groundwater contamination could include VOCs, SVOCs, metals, pesticides, PCBs, and/or LNAPL. The RI Report (Ravi, 2016a) concluded that groundwater flow on the Site was to the east toward the Genesee River.

The RI Report (Ravi, 2016a) indicated there is little potential for human exposure to groundwater, and the primary source of potential human exposure to contaminants is through direct contact with contaminated soils.

Soil gas samples were collected along the adjoining 5 Flint Street and 15 Flint Street property boundaries. Results did not indicate the potential for off-Site vapor migration to adjoining buildings; however, on-Site exposure pathways do exist for potential vapor intrusion.

2.7 PROPOSED SITE USE AND REZONING

A *Draft Nomination Study, Vacuum Oil – South Genesee River Corridor City Brownfield Opportunity Area* (BOA) (BOA Master Plan) was prepared by Bergmann Associates (Bergmann), dated April 2013. This BCP Site is located within the BOA Study Area which encompasses approximately 148-acres along the Genesee River. The redevelopment of the Site will occur according to the BOA Master Plan to include multi-family residential, commercial/retail, and industrial facilities through a phased implementation.

Per a NYS Assembly Bill, a portion of the Site is also proposed to have a Change in Use implemented for approximately 5.27 acres to become dedicated parkland, a portion of which intersects with the site. The parkland has been officially dedicated by Rochester City Council; however, the dedicated parkland has not yet been rezoned to Open Space. The timing of the rezoning of the newly dedicate parkland has not been defined as of the date of this report. The new 5.27 acres of parkland is depicted on **Figure 3A**.

The eight, City-owned tax parcels are currently zoned R-1 Low Density Residential. The BOA Master Plan also discusses possible zoning modifications to accommodate the intended future use and redevelopment described above in this section.

The BOA Master Plan also aligns with the BOA Step 3 Implementation Plan as described in the *Vacuum Oil Brownfield Opportunity Area Draft Generic Environmental Impact Statement (DGEIS) & Brownfield Opportunity Area (BOA) Step 3 Implementation Plan*, prepared by Bergmann, dated September 29, 2017 (Bergmann, 2017). The following Step 3 components will be conducted, with the findings and recommendations incorporated into the redevelopment as appropriate:

- *Building Condition and Structural Assessments*
- *Housing Analysis and Reinvestment Strategy*
- *Land Appraisals*
- *Geotechnical Investigations*
- *Phase I Environmental Site Assessments*
- *Wetland and Invasive Species Assessment & Mitigation Planning*
- *Traffic Study and Transportation and Infrastructure Feasibility and Enhancement Studies*
- *Waterfront and Public Realm Concept Plan, including Neighborhood Pocket Park Site Selection & Conceptual Design.*

Future use of the site is contemplated to be consisted with the BOA Master Plan (with Site improvements described in Phase I and Phase II above). Future use also consists of rezoning a portion of parkland to Open Space via the Change In Use documentation referenced above.

A copy of the 15+ years 2035 Vision Plan from with the BOA documentation referenced above is presented as **Exhibit A**.

The two adjoining properties, 5 Flint Street and 15 Flint Street currently under remedial investigation by Ravi, have recently been rezoned from R-1 to R-3 High-Density Residential.

3. REMEDIAL INVESTIGATION METHODS

The RIWP (OBG, 2015) specified the scope of work for the RI activities. The RI Work Plan included a project-specific Quality Assurance Project Plan (QAPP), Health and Safety Plan (HASP), Community Air Monitoring Plan (CAMP), Field Sampling and Analysis Plan (FSAP), and Citizens Participation Plan (CPP) provided as Appendices to the RI Work Plan.

This section documents the procedures that were used during the RI to implement health and safety monitoring, Quality Assurance/Quality Control (QA/QC) protocols, collection of environmental samples, drilling, and groundwater monitoring well installation techniques, sampling techniques, equipment decontamination procedures, and handling of investigative-derived waste (IDW).

3.1 HEALTH AND SAFETY

A Site-specific Health and Safety Plan (HASP) (Appendix C of the RI Work Plan) was completed prior to the start of field activities. The HASP was implemented by personnel involved in the RI. Subcontractors working on the Site were responsible for the preparation and implementation of their own Site-specific HASP.

3.1.1 Personnel Air Monitoring

In accordance with the HASP, monitoring of the work areas and screening of Site media (*e.g.*, soil and sediment samples) was conducted throughout the duration of field activities to protect the safety of on-Site workers. Air monitoring of the work area breathing zone was conducted using an aerosol particulate meter (*i.e.*, TSI 8530 DusTrak II) and a photoionization detector (PID) calibrated each day prior to the start of field activities. Air monitoring was performed during implementation of the RI.

3.1.2 Community Air Monitoring

A Community Air Monitoring Program outlining the monitoring and response activities associated with monitoring VOCs and particulates at the property boundaries near the intrusive investigative activities was included in the HASP. The CAMP was prepared in accordance with Appendix 1A of Division of Environmental Remediation (DER) *Technical Guidance For Site Investigation and Remediation* (DER-10), issued May 3, 2010. As discussed in Section 3.4, a deviation letter to NYSDEC was approved on February 24, 2016 to modify the community air monitoring program from three stations (upwind, downwind, and work zone) to two stations (upwind and downwind). Intrusive activities included the advancement of soil borings, test pit excavations and backfilling, and installation of groundwater monitoring wells. Instrument readings and observations were recorded by City personnel on air monitoring logs provided as **Appendix A**.

The 15-minute average dust level exceeded the CAMP limit of 0.1 milligrams per cubic meter (mg/m^3) on six occasions and were recorded on the Work Zone monitor only, as follows:

Test Pit Excavation – Work Zone Monitor			
Date	**Time**	**15-minute average mg/m^3**	**Cause/Corrective Action**
1/15/2016	11:10 - 11:24	0.111	Excavator exhaust/ None, readings fell back below limit
1/29/2016	11:51 - 12:05	0.180	Excavator exhaust/ None, readings fell back below limit
1/29/2016	12:23 - 12:37	0.132	Monitor error while transporting to next location (TP-136)
Borings – Work Zone Monitor			
3/10/2016	8:09 - 8:23	0.111	Monitor error due to rain
4/6/2016	9:44 - 9:58	0.104	Boring OVR-124/ None, readings fell back below limit
4/27/2016	14:21 - 14:35	0.102	Boring BED1-100/ None, readings fell back below limit

At no point during these 15-minute exceedances was visible dust observed migrating downwind of the Work Zone nor was an exceedance observed at the downwind monitoring station. Engineering and administrative control measures were implemented to reduce particulate concentrations below action levels.

The organic vapor monitoring requirement of 15-minute average VOC level of 5 parts per million (ppm) was not exceeded during implementation of the RI field activities.

3.1.3 Subsurface Utility Clearance and Geophysical Survey

Prior to beginning subsurface sampling and testing, Dig Safely New York (DigSafely) was contacted to identify underground utilities in the vicinity (*i.e.*, rights-of-way or public areas) of the Site. DigSafely marked and/or flagged locations of the underground facilities prior to the start of work. An underground sewer line running the length of the Site through the parcel addressed as 1320 S. Plymouth Avenue was identified and marked.

The RI Work Plan indicated an electromagnetic survey unit would be used to locate magnetic anomalies and focus in areas where former Vacuum Oil buildings and operations were concentrated and in areas where present day utilities may be located. Prior to implementation of the geophysical survey, Site clearing was performed and approximately 15% to 20% of the Site was cleared of trees and other vegetation. OBG retained Underground Services, Inc. (SoftDig) to perform the geophysical survey. However, due to the unevenness of the ground surface and the presence of stumps, roots, rocks, and other debris - even in the areas cleared prior to performing the survey - the ground penetrating radar (GPR) unit was not able to be utilized except for the grass-covered areas near the Genesee River.

After discussion with the on-Site NYSDEC field representative, Mr. Robert Long, Jr., the use of the electromagnetic survey unit was discontinued. SoftDig then utilized a hand-held radio frequency detection device. This handheld device was used to check for utilities within an approximate five ft radius around each proposed sample location.

Subsurface items detected with the hand-held radio frequency detection device included the following:

- Former water line associated with a fire suppression system traversing the center of the majority of the former Vacuum Oil site. Hydrants are still present at the Site (see **Exhibit B** for a map depicting said water line).
- A MCPW sewer system was also detected and corresponds to its known location along the western side of the of the former canal. This sewer line location, provided electronically from MCPW, was not mapped by SoftDig. However, MCPW staked out the active sewer line twice for safety purposes during implementation of field activities, as requested by OBG. Both the active MCPW sewer line and the abandoned reinforced-concrete sewer line are depicted on MCPW drawings titled "Doran Street Interceptor," Sheets 40 of 80 and 41 of 89, dated March 1974. The abandoned sewer is also depicted on the 1888 Genesee River Valley Canal Sewer Extension drawing prepared by the City surveyor.

A square anomaly approximately 8 ft x 8 ft, was identified immediately south of the 5 Flint Street structure. This area was not within the working radius of a soil boring or monitoring well and was not investigated further as part of the utility locating efforts. The anomaly was investigated by the City on February 5, 2019. The metallic anomaly was uncovered using hand tools and consisted of an approximate 2 in wide by 1 in thick steel rail-like object embedded in concrete that formed two sides of an approximate 3 ft by 6 ft rectangle. The steel did not appear to be present on the other two sides. A shovel was used to scrape around the outside and the inside of the rectangular area. Material on the inside of the rectangle consisted of soil, stones, and bits of brick. No voids, pits, or other subsurface structures were observed at this location and this metallic object did not appear to be a cover for a structure. The origin of this rectangular area is unknown. No odors or staining were observed during this February 5, 2019 anomaly investigation.

A soil boring (SB-140) and overburden groundwater monitoring well (OVR-106) were completed in the vicinity of the anomaly area. Soil samples were not collected from these two locations. Field observations identified fill

material and petroleum odors were also noted in the subsurface. Low concentrations of VOCs, SVOCs, and metals were detected in groundwater collected from overburden groundwater monitoring well OVR-106; however, there were no exceedances of NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 Ambient Water Quality Standard and Guidance Values and Groundwater Effluent Limitations Ambient Water Quality Standards and Guidance Values for Class GA groundwater (Class GA SGVs) other than metals iron, magnesium, manganese, and sodium. PCBs were not detected in groundwater at overburden groundwater monitoring well OVR-106.

Following the completion of the GPR survey, the anomaly locations were labeled and flagged, and the horizontal locations were recorded utilizing a Trimble Geo-XH® Global Positioning System (GPS) unit for horizontal control. A map depicting an underground hydrant/water line located on-Site was generated and the location was imported into the geographic information system (GIS) database (presented as **Exhibit B**).

3.2 QUALITY CONTROL PROTOCOLS

A project specific Quality Control Plan (QCP) was prepared for this project and included in Appendix B of the RI Work Plan. The QCP provided QA/QC criteria for work efforts associated with the sampling and analysis of environmental media.

During execution of the RI, laboratory samples were submitted under appropriate chain of custody protocols to ALS Environmental Laboratory (ALS) located in Rochester, New York, a NYSDOH Environmental Laboratory Accreditation Program (ELAP)-certified laboratory. The laboratory provided Category B report packages. Copies of the laboratory reports are presented in **Exhibit C**. Data was validated by OBG. Copies of the Data Usability Summary Reports (DUSRs) are provided as **Appendix B**.

OBG maintained and managed the laboratory data in a relational database management system (DBMS) (*i.e.*, EQuIS). The DBMS was used to provide custom queries and reports to support data analysis and preparation of this Report.

3.3 SAMPLING AND FIELD ACTIVITIES

A Site-specific Field Sampling and Analysis Plan (FSAP) was prepared as part of the NYSDEC-approved RI Work Plan and provided information regarding field sampling methods and procedures used during the investigation.

This section documents the procedures that were used during the RI for the collection of environmental samples, drilling, and monitoring well installation techniques, equipment decontamination, and handling of IDW. The following items were the primary components of the RI field activities:

- Site Clearing
- Surface Soil and Existing Surface Cover sampling and analysis
- Advancement of Test Pits and Soil sampling and analysis
- Advancement of Soil Borings and Soil sampling and analysis
- Installation of Overburden and Bedrock Groundwater Monitoring Wells
- Collection and analysis of Groundwater Samples
- Collection and analysis of Soil Vapor Samples
- Survey of Sample Locations
- Decontamination (personnel and equipment)
- Management of IDW.

On behalf of ExxonMobil, personnel from Roux Associates, Inc. (Roux) of Woburn, Massachusetts, were on-Site during the groundwater sampling, surface soil sampling, soil vapor sampling, temporary well drilling and installation, and groundwater grab sampling. Roux observed the field activities performed and collected split samples for separate laboratory analysis. Roux was not on-Site during excavation of test pits, advancement of soil borings, installation of groundwater monitoring wells, groundwater monitoring well development activities, and hydraulic conductivity testing.

A photographic log for select photographs taken during the RI is presented as **Appendix C**.

3.3.1 Laboratory Analysis

Samples collected during the RI were assigned a unique sample identification code based on the sampling location and the date of collection. **Table 1** summarizes samples collected during the RI including the unique sample designation and the laboratory analysis for each sample. Sample locations are presented on **Figure 4**.

Laboratory samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS for one or more of the following analyses:

- Target Compound List (TCL) VOCs by United States Environmental Protection Agency (USEPA) Method 8260+ 10 Tentatively Identified Compounds (TICs)
- TCL SVOCs by USEPA Method 8270 + 20 TICs
- TAL Metals by USEPA Methods 6010/7470/7471
- Cyanide by USEPA Method 9012
- TCL PCBs by USEPA Method 8082
- TCL Pesticides by USEPA Method 8081
- VOCs by USEPA Toxic Organics-15 Method (TO-15).

Copies of the laboratory chain of custody documentation are presented as **Appendix C**. A summary of the samples that were submitted to the laboratory and requested analysis for each sample is presented on **Table 1**.

Category B report packages as described in the current New York State Analytical Service Protocol (NYSASP) are presented in **Exhibit C**. Data was validated and copies of the DUSRs are provided as **Appendix B**.

3.3.2 Partial Site Clearing

A Site Clearing Plan was prepared by OBG and submitted to NYSDEC on September 9, 2015 prior to performing Site work. This Plan described the areas to be cleared and requested NYSDEC approval. The NYSDEC approved this Plan on September 22, 2015. Lanes of brush and vegetation were cleared by TREC Environmental, Inc. (TREC) to allow access for the test pit and drilling subcontractors Nature's Way Environmental (Nature's Way) and Nothnagle Drilling, Inc. (Nothnagle) respectively, as needed to allow excavator and drill rig accessibility. To clear pathways for access to the investigation locations, trees less than 12 inches (in) in diameter were cut down only to the extent necessary. The cleared trees and brush were pushed to the side and left on-Site. Site clearing, soil rutting, and general disturbance was kept to the minimum extent necessary to allow access to the investigation locations.

3.3.3 Surface Soil Sampling

The objective of investigating surface soil was to evaluate the horizontal extent of constituents of concern (COCs) and fill in spatial data gaps identified from previous investigations as described within Section 1.1. The data was used in conjunction with the Qualitative Human Health Exposure Assessment (QHHEA) (see Section 7) and Fish and Wildlife Resource Impact Analysis (FWRIA) (see Section 8) to assess potential exposure. Sampling locations were selected in the field and adjusted as needed to avoid surface or subsurface structures or utilities.

Methodology and Procedures

A total of 34 surface soil samples (sample identification presented on **Table 2**) were collected using a dedicated disposable hand trowel from a depth of 0 to 2 in bgs. Samples were collected excluding vegetative cover, using methods in accordance with the FSAP included as Attachment A of the RI Work Plan. The 0 to 2 in bgs interval was evaluated for Human health exposures.

Soil samples that were collected from each location were classified using the Modified Wentworth Classification scale and Unified Soil Classification System (USCS) (*i.e.* color, consistency, moisture content, density, and grain size distribution). In addition, field observations including odors, staining, and discoloration were recorded. Soil Sample Logs were prepared for each sample detailing field observations, the types of materials encountered, and PID readings. Copies of the surface soil sample logs are presented as **Appendix E**. **Table 2** includes a summary of the surface soil samples collected for analysis including sample description and the presence of observed sheens, staining, and odors.

Collection and Analysis of Laboratory Samples

Laboratory samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS for analysis.

Copies of the laboratory chain of custody documentation are presented as **Appendix D**. A summary of the samples submitted to the laboratory as well as corresponding QA/QC samples and requested analysis for each sample is presented on **Table 1**.

A discussion of the results of the existing surface cover evaluation soil sampling is presented in Section 5.1.

3.3.4 Existing Surface Cover Sampling

The objective of investigating surface cover soil was to evaluate the horizontal extent of COCs and fill in spatial data gaps identified from previous investigations as described in Section 1.1. The data was used in conjunction with the QHHEA (see Section 7) and FWRIA (see Section 8) to assess potential exposure. Sampling locations were selected in the field and adjusted as needed to avoid surface or subsurface structures or utilities.

Methodology and Procedures

At the request of NYSDEC, a total of 20 existing surface cover samples (sample identification presented on **Table 2**) were collected using a hand-auger from a depth of 0 ft to 2 ft bgs. Samples were collected excluding vegetative cover, using methods outlined in the FSAP included as Attachment A of the RI Work Plan. The 0 ft to 2 ft bgs interval was evaluated for several purposes including the following:

- Human health exposure assessment
- Future Site cover evaluation in the RAA
- Off-Site contaminant migration evaluation
- Ecological resources evaluation
- Historic fill material (HFM) evaluation.

Soil samples that were collected from each location were classified using the Modified Wentworth Classification scale and USCS (*i.e.* color, consistency, moisture content, density, and grain size distribution). In addition, field observations including odors, staining, and discoloration were recorded. Soil Sample Logs were prepared for each sample detailing field observations, the types of materials encountered, and PID readings. Copies of the existing surface cover sample logs are presented as **Appendix E**. **Table 2** presents a summary of the existing surface cover evaluation soil samples collected for analysis including sample description and the presence of observed sheens, staining, and odors.

Collection and Analysis of Laboratory Samples

Laboratory samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS for analysis.

Copies of the laboratory chain of custody documentation are presented as **Appendix D**. A summary of the samples submitted to the laboratory as well as corresponding QA/QC samples and requested analysis for each sample is presented on **Table 1**.

A discussion of the results of the existing surface cover evaluation soil sampling is presented in Section 5.1.

3.3.5 Subsurface Soil Sampling (Borings and Test Pits)

The objective of investigating subsurface soil was to evaluate potential subsurface anomalies, the horizontal and vertical extent of COCs, fill in spatial data gaps identified from previous investigations, evaluate off-Site migration of contamination, verify select previous analytical results that were not validated, and to investigate and evaluate the location and extent of HFM (per Section 3.11 of DER-10).

Further objectives for the excavation of test pits included the following;

- Documentation of the depth and condition of former canal walls.
- Evaluation of potential contaminant migration across/under the vertical concrete walls observed on-Site (most likely possible concrete retaining walls associated with the former railroad).
- Identification of pipelines within the footprint of the former canal on the 1320 S. Plymouth Avenue parcel.

Methodology and Procedures

A total of 48 test pits (TP-100 through TP-110, TP-112 through TP-130, TP-132 through TP-138, TP-140 through TP-143, TP-145, TP-146, and TP-148 through TP-152) were advanced during the RI. Due to excavator limitations, sewer line location, and Site terrain, five test pit locations (TP-111, TP-131, TP-139, TP-144, and TP-147) were converted to soil boring sample locations due to limited accessibility.

Direct-push (*i.e.*, Geoprobe®) borings were completed at the Site using procedures outlined in the RI Work Plan. A total of 85 soil borings (SB-100 through SB-180) were advanced using a track-mounted Geoprobe® drill rig (which also included four locations that were previous test pit locations [SB-TP-131, SB-TP-139, SB-TP-144, and SB-TP-147], but were converted to soil borings as described in Section 3.4). Additionally, due to uneven Site terrain, test pit TP-111 was not accessible via Direct-push (*i.e.*, Geoprobe®) boring equipment, and was advanced utilizing a hand-auger.

Soil samples that were collected from each test pit or soil boring were classified using the Modified Wentworth Classification scale and Unified Soil Classification System (USCS) (*i.e.* color, consistency, moisture content, density, and grain size distribution). In addition, field observations including odors, staining, and discoloration were recorded. Soil Sample Logs were prepared for each sample detailing field observations, the types of materials encountered, and PID readings. Copies of the test pit sample logs are presented as **Appendix F** and copies of the soil boring logs are presented as **Appendix G**. **Table 2** presents a summary of the subsurface soil samples collected for analysis including sample description and the presence of observed sheens, staining, and odors.

Collection and Analysis of Laboratory Samples

Samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS for analysis.

Copies of the laboratory chain of custody documentation are presented as **Appendix D**. A summary of the samples submitted to the laboratory as well as corresponding QA/QC samples and requested analysis for each sample is presented on **Table 1**.

3.3.6 Groundwater Quality Investigation

The objective of investigating groundwater was to evaluate the horizontal and vertical extent of COCs in both overburden and bedrock groundwater and provide additional information to fill in spatial data gaps identified from previous investigations.

Methodology and Procedures

A total of 28 shallow overburden groundwater monitoring wells (OVR-105 through OVR-132) were installed and developed during RI investigation activities. Additionally, five nested bedrock groundwater monitoring well pairs were installed and developed. The groundwater monitoring well nests consisted of one groundwater monitoring well installed in the overburden (OVR-100 through OVR-104) and a second groundwater monitoring well installed within the bedrock (BED1-100 through BED1-104). The overburden groundwater monitoring well depths ranged from approximately 8 ft to 29 ft bgs. The bedrock groundwater monitoring well depths ranged from approximately 20 ft to 29 ft bgs (through overburden soil ranging from approximately 8 ft to 17 ft bgs).

Groundwater monitoring well construction is summarized in **Table 3**. Copies of the groundwater monitoring well boring logs, groundwater monitoring well construction logs, groundwater monitoring well development logs, and low-flow groundwater monitoring well sampling logs (for both the August 2016 and December 2016 sampling events) are presented as **Appendix H**, **Appendix I**, **Appendix J**, and **Appendix K**, respectively.

Upon completion of each groundwater monitoring well, the down-hole tooling was decontaminated using a steam cleaner and a potable water rinse. Sampling equipment that was reused during installation of each groundwater monitoring well (*e.g.,* split spoon samplers) was cleaned using a soapy water wash (*i.e.*, Alconox®), followed by a potable water rinse. Wash and rinse water were contained in two 550-gallon polyethylene tanks pending completion of sampling activities.

Collection and Analysis of Soil Samples

During installation of seven overburden groundwater monitoring wells (OVR-100, OVR-107, OVR-108, OVR-109, OVR-116, OVR-117, and OVR-118) one discrete soil sample was collected from each well location, based on visual and field observations, for laboratory analysis (at depths specified on **Table 1**). Samples were collected from the zone of highest PID readings or the zone with visual or olfactory evidence of contamination. QA/QC samples were collected as summarized on **Table 1**.

Laboratory samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS for analysis.

Copies of the laboratory chain of custody documentation are presented as **Appendix D**. A summary of the samples submitted to the laboratory as well as corresponding QA/QC samples and requested analysis for each sample is presented on **Table 1**.

Collection and Analysis of Groundwater Samples

The 28 overburden groundwater monitoring wells and five nested bedrock and overburden groundwater monitoring well pairs were sampled in accordance with the FSAP. The existing on-Site overburden groundwater monitoring well, MW-3 was also evaluated for use and sampled. Two rounds of groundwater sampling were completed to evaluate seasonal fluctuations, in August 2016 and December 2016.

Samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS for analysis.

Copies of the laboratory chain of custody documentation are presented as **Appendix D**. A summary of the samples that were submitted to the laboratory and requested analysis for each sample is presented on **Table 1**. Two groundwater sample analytical deviations during the first round of groundwater sampling at locations OVR-102 and OVR-113 were noted and are discussed further in Section 3.4.

3.3.7 Hydraulic Conductivity Testing

The purpose of the hydraulic conductivity testing at the Site was to gather information regarding the permeability of the water bearing zone(s).

Methodology and Procedures

Hydraulic conductivity "slug" testing was performed on 10 overburden groundwater monitoring wells, all five bedrock groundwater monitoring wells, and the existing on-Site overburden groundwater monitoring well (MW-3 installed by NYSDEC).

The tests were completed in two steps using the procedures outlined in the RI Work Plan. The first step was a falling head slug test when an inert rod of known volume was quickly introduced into the well to cause a water level rise. Following equilibration of the water level to static, a rising head slug test was initiated by removing the slug to instantaneously lower the water level. The type of test conducted at each location was determined based upon the following:

- If the screened interval of the well straddled the water table, only a rising head test was performed;
- If the screened interval of the well was fully submerged below the water, then both a rising and falling head test were conducted.

The data were interpreted using the Bouwer and Rice method (Bouwer and Rice, 1976). The Aquifer Win32, version 4.0, software package was used to support data analysis.

Copies of the Hydraulic Conductivity Logs the and data analysis sheets are presented as **Appendix L**. A summary of the results is provided on **Table 4**.

3.3.8 Soil Vapor and Proximal Media Sampling

Soil vapor samples were collected and analyzed to evaluate the potential for off-Site migration of soil vapor, specifically to the west and southwest near abutting residential properties at the perimeter of the Site. At the request of NYSDEC and NYSDOH and to further evaluate potential sources of constituents in soil vapor, samples of shallow soil and groundwater in the vicinity of the soil vapor samples were also collected concurrent with the soil vapor samples. The soil vapor sampling program was completed in August of 2017 following review of the soil and groundwater data from the main portion of the Site.

Methodology and Procedures

Eight soil gas samples were collected to evaluate for the potential of off-Site vapor migration. The SVI investigation was performed in accordance with NYSDOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.

The sampling points consisted of a stainless-steel sample point attached to an appropriate length of ¼ in outside diameter Teflon tubing. Each soil vapor sampling point was installed to a depth of approximately 3 ft bgs. Each temporary sampling point was installed using a slide hammer to manually drive rods to install the screened implant (*i.e.,* AMS Soil Vapor Probe drive rod tooling or equivalent). As the drive rods were removed, the annular space around the sampling point was packed with a porous, inert backfill material of glass beads to a point approximately 6 in above the screened interval of the implant. The annular space around the sample tubing was sealed with approximately 0.5 ft of dry granular bentonite to prevent water infiltration/infilling across the sample inlet. The remainder of the boring's annular space was sealed above the sampling zone to ground surface with a bentonite slurry to prevent ambient air infiltration.

Following installation of the soil vapor sample points and prior soil vapor sample collection, the sampling tubing was purged of ambient air. A minimum of one and a maximum of three volumes of air was purged from each sample point prior to sample collection. In addition, tracer gas screening was utilized to evaluate the adequacy of the sampling technique, as described in Section 2.7.5 of the NYSDOH *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.

The flow controllers were set to collect soil vapor samples for an approximate four-hour period, resulting in a sample rate of approximately 0.025 liters per minute.

Collection and Analysis of Laboratory Samples

Laboratory samples were collected in appropriate batch certified-clean 6-liter stainless steel SUMMA® vacuum canisters equipped with laboratory-calibrated fixed rate flow controllers. Each SUMMA® canister was labeled with the sample identification, the start and end time of sample collection, date, project identification, and required laboratory analysis. Samples were placed in appropriate containers and submitted under appropriate chain of custody protocols to ALS for VOCs by USEPA TO-15 analysis.

QA/QC samples were collected as summarized on **Table 1**. Copies of Soil Vapor Sampling logs are presented as **Appendix M**.

Groundwater grab sample points (*i.e.*, temporary piezometers) were also installed at eight locations along the western perimeter of the Site (GW-101 through GW-108) via direct-push (*i.e.*, Geoprobe®) boring. The sample points were constructed of 1 in inside diameter (ID) PVC with a 5 ft to 7 ft well screen placed to intersect the groundwater table. Groundwater at these locations was generally encountered between 4.5 ft and 11.5 ft bgs. Groundwater grab sample point construction logs are included as **Appendix G**. As stated in Section 3.4, a sample from GW-100 was not collected due to equipment (hand auger) refusal prior to encountering the water table. At locations accessible via Geoprobe®, equipment refusal ranged between 7.5 ft and 17.5 ft bgs. Prior to sampling, one monitoring well volume was removed from each location prior to sample collection using a dedicated polyethylene thimble bailer for each location.

Copies of the groundwater grab sampling logs and groundwater grab sample point decommissioning logs are presented as **Appendix N** and **Appendix O**, respectively. Subsurface soil samples were collected at select groundwater grab sample locations as well. Boring logs for these locations (GW-101 through GW-108, SB-112, SB-102, and SB-172 through SB-174) are also included in **Appendix N.**

Laboratory samples were collected in appropriate laboratory-supplied sample containers. Samples were placed in a plastic cooler pre-chilled with ice and submitted under appropriate chain of custody protocols to ALS analysis.

3.3.9 Survey

Following collection of the test pit, surface soil/existing surface cover, and subsurface soil samples each of the points was surveyed for horizontal control by the City survey crew and/or OBG. Also, each of the newly-installed groundwater monitoring well locations were surveyed for horizontal control by the City survey crew using the NYS Plane Coordinate System, Western Zone, NAD83 and vertical control using the North American Vertical Datum 1988 (NAVD88). Overburden and Bedrock groundwater monitoring well elevations were surveyed by the City survey crew to the nearest 0.01 ft at the top of the well's polyvinyl chloride (PVC) riser pipe (at the designated measuring point), and ground surface at each location. Temporary piezometers were surveyed for horizontal control by OBG but were not surveyed for vertical control.

The horizontal locations were recorded utilizing a Trimble Geo-XH® GPS (or equivalent) unit for horizontal control.

3.3.10 Field Equipment and Personnel Decontamination

The personnel, vehicular, and equipment decontamination area was located on City-owned land immediately north of Flint Street (a continuation of the 1320 S. Plymouth Avenue tax parcel). For ease of decontamination on the southern portion of the Site, a temporary decontamination pad was constructed on the 13 Cottage Street parcel as approved by NYSDEC.

Equipment and Vehicles

The following procedures were used to decontaminate equipment used during the RI activities:

- Drilling equipment such as augers, bits, rods, tools, split-spoon samplers, and backhoe/bucket were cleaned with a high-pressure, hot water pressure washing unit before beginning work, after completion of borings and groundwater monitoring wells, and prior to exiting the Site
- Tools, drill rods, and augers were placed on polyethylene plastic sheets following pressure washing
- Augers, rods, and tools were decontaminated between each drilling location according to the above procedures
- The back of the drill rig and tools, augers, and rods were decontaminated at the completion of the work and prior to leaving the Site
- In addition, visible soils on excavator chassis or other locations of the machinery were also decontaminated. During cold weather months, the use of water was not feasible, an air compressor was utilized to remove visible soils.

Sampling Equipment Decontamination

Prior to sampling, non-dedicated sampling equipment (*e.g.*, bowls, spoons, interface probes) were washed with potable water and soapy water (*e.g.*, Alconox). The sampling equipment was rinsed with potable water.

Personnel

All personnel leaving the Site performed footwear decontamination prior to leaving the Site; consisting of a boot wash using a soapy water (*e.g.*, Alconox) brushing of footwear, followed by a potable water rinse, and the removal of disposable overboots. The wash and rinse water and/or disposable overboots were containerized and managed as IDW.

3.3.11 Investigation-Derived Waste

The RI activities produced IDW, requiring appropriate management in accordance with state and federal regulations (Title 40 of the Code of Federal Regulations (CFR) Parts 239 through 279 and Title 6 of New York Codes, Rules and Regulations (6 NYCRR) Chapter IV, Subchapter B Parts 360 through 376). IDW produced included the following:

- Soil cuttings from soil boring and installation of groundwater monitoring wells
- Groundwater resulting from the development and sampling of monitoring wells
- Decontamination fluids resulting from decontamination of equipment and sampling tools, personnel boot wash
- Debris including polyethylene sheeting and disposable equipment resulting from the execution of field activities
- Dedicated sampling equipment, personnel protective equipment (PPE), and general refuse resulting from the execution of field activities.

The IDW soil cuttings were placed in a lined roll-off dumpster pending completion of sampling activities. General refuse and debris was disposed of by the City trash collection. Decontamination fluids and groundwater were containerized and analyzed prior to approval for discharge into the Monroe County Pure Waters (MCPW) discharge permit. The MCPW discharge permit is presented as **Appendix P** and the Disposal records for IDW generated during the RI are included as **Appendix Q**.

3.4 RI WORK PLAN DEVIATIONS

The following presents a summary of deviations from the RI Work Plan. Copies of the deviations requests and subsequent responses from the NYSDEC are presented as **Appendix R**.

- A *Proposed Deviations to Soil Boring/Monitoring Well Field Program* letter was submitted to the NYSDEC on February 11, 2016. This letter provided a list of proposed deviations to the RI Work Plan based on a review of

samples collected, and environmental conditions encountered, prior to the date of this letter at the Site. The letter requested the NSYDEC consider the removal, off-setting, and/or addition of several soil borings, groundwater monitoring wells, and test pits. The letter also requested to reduce the community air monitoring program from three stations (upwind, downwind, and work zone) to two stations (upwind and downwind).

  - A *Response to February 17, 2016 Conference Call Regarding Proposed Deviations to Soil Boring/Monitoring Well Field Program* letter was submitted to the NYSDEC on February 24, 2016. This letter provided a discussion on the conversation the City, OBG, and NYSDEC had regarding the February 11, 2016 letter described above. The proposed RI Work Plan deviations were listed, and the NYSDEC's response (whether approved, disapproved, or the City/OBG withdrew a proposed deviation) was provided to summarize the understanding as to whether the NYSDEC accepted or did not accept each proposed deviation. The acceptance or denial of each deviation was discussed during a February 17, 2016 conference call between the City, NYSDEC, and OBG.

- An email prepared by OBG was submitted to NYSDEC dated February 26, 2016. This email provided a proposed deviation of using hollow stem auger drilling techniques to also use direct-push technology. The NYSDEC approved this deviation via telephone on February 26, 2016.
- An email prepared by OBG was submitted to NYSDEC dated March 11, 2016. This email provided a list of requested modifications to the RI Work Plan and the current status of NYSDEC response. This email was provided to NYSDEC as a means to discuss the current understanding of each requested deviation. A response was not received from the NYSDEC regarding this request.
- A *Remedial Investigation Work Plan Modifications* letter was submitted to the City by NYSDEC dated March 14, 2016. This letter provided a summary of requested deviations to the RI Work Plan and the NYSDEC's official response to each proposed modification, including responses for each of the four bullets listed above.
- A *Proposed Deviations to October 2015 RI Work Plan* letter was submitted to the NYSDEC dated April 28, 2017. This letter presented a summary of work completed to date, and a summary of work remaining at the Site. This letter provided a list of proposed deviations to the scope of the RI Work Plan based on OBG's review of analytical results received from the work completed to date. A response was not received from the NYSDEC regarding this request.
- An email prepared by OBG was submitted to NYSDEC dated July 14, 2017. This email provided a list of requested deviations to the RI Work Plan based on a Site visit to check on vegetation conditions and topography of the Site. A response was not received from the NYSDEC regarding this request.
- As described in Section 3.1.3 above, a *Remedial Investigation – Geophysical Survey Results letter* was submitted to the City on August 4, 2017. This letter presented a deviation to the geophysical survey that was implemented due to the existing terrain at the Site. This deviation was approved by NYSDEC field staff during implementation of the field work in January 2016.
- A *Proposed Deviations to October 2015 RI Work Plan, April 28, 2017* letter, dated August 7, 2017 provided a response from the NYSDEC for the various unanswered OBG deviation requests described above. The NYSDEC provided a response indicating acceptance of the use of a hand auger to collect a sample at one test pit, and the off-setting of two other soil vapor locations due to topography/safety concerns. The remainder of proposed deviations were rejected, and the NYSDEC requested the City "take reasonable and appropriate measures" to safely collect remaining samples, including the ability to off-set or adjust proposed sample locations as necessary during implementation in the field.
- Due to equipment refusal prior to target depth (with several attempts undertaken), temporary piezometer GW-100 was not installed, and therefore, a groundwater sample was not collected at this location.
- Due to container breakage and miss-communication with the laboratory the following analyses were not performed as proposed:

- Test pit soil sample DUP-010-012816 for SVOCs,
- Groundwater sample OVR-102-081516 for PCBs (Round 1),
- Groundwater sample OVR-113-081916 for PCBs and SVOCs (Round 1), and
- Surface soil sample SS-121 for SVOCs.

4. PHYSICAL CHARACTERISTICS OF THE SITE

The following section includes a description of the physical characteristics of the Site based on field observations and data generated during implementation of the RI.

4.1 SITE TOPOGRAPHY AND DRAINAGE

The Site is generally located at approximately 515 ft to 520 ft above mean sea level (amsl). To the west of the Site the ground surface slopes upwards to elevations exceeding 550 ft amsl. This slope is closer to the Site boundary on the southern end of the Site. More detailed review of the site topography indicates that the main (central) portion of the Site is generally flat with a slight northward dip with elevations ranging from 519 ft amsl on the south end to 516 ft amsl on the north. Within the former canal that runs along the western border of the Site, the ground surface is 2 ft to 4 ft lower than the surrounding area. Elevations on the eastern side of the Site slope northward with elevations ranging from approximately 520 ft amsl on the south end of the Site to approximately 518 ft amsl on the north end of the Site. A levee or berm that parallels the Genesee River is located on the east side of the 13 Cottage Street parcel and adjoining 5 Flint Street parcel. The elevation of the top of this berm is approximately 525 ft amsl with a slightly higher elevation of approximately 530 ft amsl to the south. This berm was constructed for railroad access through the Site. Because the ground surface slopes upwards on the west and east sides of the Site, runoff from these areas would flow toward rather than away from the former production area on the main (central) portion of the Site. Under this scenario the Site would receive runoff from the adjoining 15 Flint Street parcel as well as nearby residential properties located along the western Site boundary and the levee or berm on the eastern side.

4.1.1 Wetlands/Drainage Ditches

Several federal wetlands and drainage ditches (present toward the northern end of 1320 S. Plymouth Avenue (in between the adjoining 5 Flint Street and 15 Flint Street parcels; and on the eastern side of the existing bike path (tow of slope) are located on the Site. These wetlands were identified within the *Final Wetland Assessment and Delineation, Ecological Screening & Invasive Species Report*, prepared by Shumaker Consulting Engineering & Land Surveying, D.P.C., dated June 2017 (Shumaker Report) (presented as **Exhibit D**). This document was prepared on behalf of the City and Bergmann Associates and identified four wetlands (totaling approximately 0.757-acres) and a non-Relatively Permanent Water (non-RPW) (*i.e.*, ephemeral channel) (378 linear ft) on the Site. The on-Site wetlands and channel are identified as follows:

Name	Description (paraphrased from Exhibit D)	Size
Wetland C	*Depression area, identified as the former Genesee River Canal bed, isolated*	0.364-acres
Wetland D	*Depression wetland, isolated.*	0.274-acres
Wetland E	*Depression area, adjacent to Genesee River Trail, likely excavated during construction of former railroad, connected to Wetland F*	0.078-acres
Wetland F	*Depression area, adjacent to Genesee River Trail, likely excavated during construction of former railroad, connected to Wetland E*	0.041-acres
Unnamed Non-RPW Trib 1	*Tributary begins as culvert outflow, connected to Wetland E, and serves as a connection between Wetland E and the Genesee River*	378 linear ft

An April 28, 2017 *Acceptance of Wetland Delineation* letter and Jurisdictional Determination (presented as **Exhibit D**) was prepared by the United States Army Corps of Engineers for the City in response to a wetland delineation submitted. These documents indicated the wetlands identified in the Shumaker Report (and presented on **Figure 4**) are regulated.

4.1.2 Site Runoff

The Site is generally located adjacent to a steep topographic gradient to the west, with surface water runoff generally draining to the on-Site wetlands and drainage ditches. These low-lying areas are generally isolated; however, portions are connected to each other and to the Genesee River via an unnamed Tributary. Portions of the Site are also situated within the Genesee River 100-year Floodplain.

The Genesee River is located near and parallels the eastern side of the Site. This river flows northward and discharges to Lake Ontario.

4.2 METEOROLOGY

The average temperature of the area typically ranges from a low of 18 degrees Fahrenheit during the month of January to a high of 81 degrees Fahrenheit during the month of July. Precipitation for the area ranges from 2.03 in in February to 3.47 in in August, with an annual average of 34 in. Precipitation in the first 5 months of 2016 was 28% lower than average. The total precipitation reported from January through July was 13.72 in, as compared to an average of 19.16 in. The latter part of 2016 was slightly wetter than normal, with a total precipitation from August through December 2016 of 16.98 in as compared to the average of 15.16 in. (www.usclimatedata.com).

4.3 SITE GEOLOGY AND HYDROGEOLOGY

4.3.1 Overburden and Surficial Geology

Both native and fill materials are present at the Site. Fill was encountered in many locations, and was predominantly fine sand and silt (presumably native materials) mixed with various amounts of cinders, brick, concrete, glass, and wood. In several locations, a black granular material was encountered (including test pits, soil borings, existing surface cover locations, etc.). This material was referred to in notes and logs by several names throughout the RI implementation, including brown-black granular material, “bone black” (typically a cattle bone charcoal used for filtering in historic oil refining processes), and “activated carbon.” The thickness of this material generally ranged from 1.5 ft to 8 ft and did not contain any noticeable odors or sheens. Several soil samples comprised of this material were analyzed, as discussed in Section 5.3,

Native soils underlying the fill consist of fine sand and silt which are alluvial in origin. In the borings and wells along the eastern side of the site near the river, a layer of fine to medium or fine to coarse sand and fine to medium or coarse, rounded gravel was noted on top of bedrock. These deposits were not noted in the other locations and are likely river deposits which were deposited under faster flow conditions than the shallower materials. Geologic cross-sections are depicted on **Figure 5**.

4.3.2 Bedrock Geology

Stratigraphically the bedrock units in the Site area as described in Zenger (1965) and later revised in Brett *et al*. (1995) include the middle Silurian Lockport Group and underlying Clinton Group. The Lockport Group is subdivided into the Eramosa Dolomite (Formation) and Penfield Formation (Brett et al. 1995). The upper portion of the Eramosa Dolomite was previously described by Zenger (1965) as the Oak Orchard formation. The Oak Orchard formation name has since been replaced by the Eramosa Dolomite. The Eramosa Dolomite was encountered beneath the Site. This rock is generally described as massive, pale brownish-weathering, vuggy, commonly biostromal dolomite with intervals of sparsely fossiliferous, medium-bedded, flaggy-weathering, brownish-gray, bituminous dolomite, and stromatolite bioherms.

Bedrock was generally encountered at approximately 10 ft to 19 ft bgs and cored approximately 10 ft at each location to facilitate installation of the bedrock monitoring wells. Bedrock rock quality designations (RQD) calculated from the five bedrock monitoring well locations ranged in value from 47% to 100%. In general, the upper 5 ft of rock had the lower RQD value. Bedrock quality encountered ranged from massive/slightly fractured to highly fractured; observed fractures were also lightly weathered to moderately weathered. Travertine and calcite inclusions were observed in several of the rock cores. Slight petroleum odors were noted

in the bedrock cores at two locations, BED1-101 approximately 16 ft to 20 ft bgs and BED1-104 approximately 24 ft to 29 ft bgs.

A contour map of the bedrock surface constructed from the depth to bedrock data (**Figure 6**) shows that the bedrock surface ranges from approximately 488 ft amsl to 506 ft amsl and generally slopes to the east with the lowest bedrock identified during the RI at OVR-121 located on the southeast corner of the Site.

4.3.3 Site Hydrogeology

Thirty-three overburden groundwater monitoring wells (OVR-100 through OVR-132) and five bedrock groundwater wells (BED1-100 through BED1-104) were installed at the Site to evaluate overburden and bedrock hydrology.

Groundwater measurements were collected from the on-Site groundwater monitoring wells on two occasions during the remedial investigations. The events occurred at the start of each of the two groundwater sampling events and were collected in a single day. The first measurements were recorded on August 15, 2016 and the second event was conducted on December 5, 2016. The measurements, summarized on **Table 3**, indicate that the water table at the Site occurs within the overburden materials at depths ranging from 3 ft to 4 ft below grade on the west side of the Site within the former canal to 10 ft to 12 ft in wells on the eastern boundary adjacent to the river.

Groundwater elevations within the overburden at the Site generally range from approximately 512 ft amsl on the southern end of the Site to between 502 ft amsl and 507 ft amsl on the northern side of the Site. Based on the Genesee River gauging station at the Ford Street bridge located approximately 2,200 ft north of the Site, the river level was at approximately 512.6 ft amsl at the time the water levels were measured.

Isopleth contours of the groundwater elevations in the overburden are provided on **Figures 7** and **8**. As illustrated, groundwater on the southern side of the Site flows northward at a gradient of 513 ft amsl to 505 ft amsl. The flow direction and elevations suggest that the groundwater is being fed by the river water on the south end of the site and is flowing northward. On the northern side of the Site the gradient is relatively flat and more than 5 ft lower than the river level. The groundwater elevations in overburden wells at or near the river are also more than 5 ft lower than the river level. This large difference suggests that there is limited hydraulic connection between the river and the overburden groundwater in this area of the site. Review of construction information in preparation for upgrading of the river wall in this area indicates that the existing river wall structure extends to the bedrock surface at least along the reach adjacent to the northern end of the Site (**Exhibit E**). This structure is suspected to limit the hydraulic connection between the groundwater at the Site and the river. Additionally, in August 2016 the groundwater elevations on the northern end of the site suggest a component of flow to the west and north within the former canal area. This condition is possibly influenced by the presence of the backfilled former canal as well as the sewer and water line that are currently present in this area.

The potentiometric surface of groundwater in the shallow bedrock for each of the water level monitoring events are presented on **Figures 9** and **10**. As illustrated the flow conditions during both events were similar and show a slight potential for flow to the northeast with elevations ranging from around 510 ft amsl in the center of the Site to between 508.5 ft and 509 ft amsl over most of the northern end of the Site.

Hydraulic conductivity tests were conducted on 11 of the overburden wells and 5 of the bedrock wells as discussed in Section 3.3.6 The test results, summarized on **Table 4** show that hydraulic conductivities of the overburden range from a low of 3.77×10^{-5} centimeters per second (cm/sec) to a high of 9.73×10^{-2} cm/sec. These values are typical of fine sand to silt which is consistent with the soil descriptions of the material encountered. The shallow bedrock hydraulic conductivity ranges from a low of 3.75×10^{-4} cm/sec to a high of 8.97×10^{-2} cm/sec.

5. NATURE AND EXTENT OF CONTAMINATION

This section presents the results of the data collected during the RI. The discussion is organized by medium that was analyzed (*i.e.,* surface soil, existing surface cover, soil vapor, subsurface soil, overburden and bedrock groundwater), and is subsequently broken down by the laboratory analysis (*i.e.*, VOCs, SVOCs, metals, pesticides, and PCBs).

5.1 SURFACE SOIL SAMPLE RESULTS

Surface soil sample results were compared to SCOs provided in 6 NYCRR Part 375 *Environmental Remediation Programs* (Part 375) (NYSDEC, 2006). Where applicable, Supplemental SCOs (NYSDEC Policy *CP-51/Soil Cleanup Guidance* [CP-51] dated October 2010) (NYSDEC, 2010) were also used. For comparison, SCOs are provided with the data summary tables.

Consistent with the current zoning as residential and future use scenarios as described in Section 2.7, the values used for screening analytical results include:

- Part 375 Unrestricted Use SCOs (Unrestricted Use SCOs)
- Part 375 Restricted Use Residential and CP-51 Residential Supplemental SCOs (Residential Use SCOs)
- Part 375 Restricted Use Restricted-Residential SCOs (Restricted Residential Use SCOs)
- Part 375 Restricted Use SCOs for Protection of Ecological Resources (Ecological SCOs).

EPA SW-846 Method 6010C provides total chromium concentrations without differentiation between the trivalent and hexavalent species. Using a conservative approach, the more stringent SCO for hexavalent chromium was used for comparison to total chromium values.

Surface soil samples were collected from 34 locations across the Site. Surface soil samples were collected from 0 in to 2 in. for one or more of the following analyses: VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Analytical results compared to the SCOs identified above are presented on **Tables 5A-5E,** and **6A-6E**. A figure illustrating analytical groups with one or more analyte exceeding a specific criterion, including the Restricted Use Commercial SCOs (Commercial Use SCOs) (Commercial Use SCOs to aid in future use planning) is presented as **Figure 11A**.

5.1.1 VOCs

Twelve VOCs were detected (including laboratory estimated values) in one or more surface soil samples. All but one VOC was detected below SCOs; Acetone was detected above Unrestricted Use SCOs at three locations (SS-100, SS-111, and SS-140). SS-100 and SS-101 are located on the 1 Cottage Street parcel and SS-140 is located proximal to the pedestrian path. Concentrations in these samples ranged from 53 µg/kg to 130 µg/kg.

In addition to the detected VOCs, a PID reading of 0.5 ppm was noted at one of the 34 surface soil locations (*i.e.,* SS-134).

5.1.2 SVOCs

Twenty-five (25) SVOCs were detected (including laboratory estimated values) in surface soil samples across the Site. Surface soil samples from 11 of 34 locations contained SVOCs at concentrations exceeding Unrestricted Use and/or Residential Use and/or Restricted Residential Use SCOs of two or more of the following polycyclic aromatic hydrocarbons (PAHs):

▪ Benzo[a]anthracene ▪ Benzo[a]pyrene ▪ Benzo[b]fluoranthene	▪ Chrysene ▪ Benzo[k]fluoranthene ▪ Dibenzo[a,h]anthracene	▪ Indeno[1,2,3-cd]pyrene ▪ 2-Methylnaphthalene

To further evaluate the nature of SVOCs in the surface soil the concentrations of quantified SVOCs were totaled and added together with the total SVOC tentatively identified compounds (TICs) presented on **Table 5B**. A figure illustrating total SVOC concentrations in surface soil and surface cover soil samples collected up to 2 ft below grade is presented as **Figure 12**. The sample from location (SS-112) on the 13 Cottage Street parcel contained total SVOC values greater than 100 ppm at 126 ppm. This sample contained evidence of fill material.

5.1.3 Inorganics (Metals and Cyanide)

Metals were detected at numerous sample locations across the Site. Twenty-six locations had detectable results (including laboratory estimated values) exceeding Unrestricted Use SCOs for one or more of nine metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc). Twelve locations had detected metals (including laboratory estimated values) exceeding Restricted Residential Use SCOs, with the exception of chromium. EPA SW-846 Method 6010C provides total chromium concentrations without differentiation between the trivalent and hexavalent species. Using a conservative approach, the more stringent SCO for hexavalent chromium was used for comparison to total chromium values on the data summary table. Although chromium was found to be present in each of the surface soil samples above the hexavalent chromium SCO of 1 mg/kg, only two samples exceeded the trivalent chromium value of 30 mg/kg. Cyanide was not detected over SCOs.

5.1.4 Pesticides/Herbicides

Pesticides were detected at eight surface soil sample locations across the Site (including laboratory estimated values and tentatively identified estimated values). Concentrations at seven locations exceeded both Unrestricted Use SCOs and Protection of Ecological SCOs for 4-4-DDE and/or 4-4-DDT. None of the concentrations exceeded the Residential Use or Restricted Residential Use SCOs.

5.1.5 PCBs

PCBs were detected at seven surface soil sample locations across the Site (including laboratory estimated values) at concentrations up to 4.7 mg/kg. Two locations (SS-126 and SS-128) exceeded Ecological SCOs, Residential Use, Restricted Residential Use, and/or Unrestricted Use SCOs. Locations SS-127 and SS-129 only exceeded the Unrestricted Use SCO of 0.1 mg/kg. The sample locations exceeding PCB SCOs are limited to the northern portion of the former canal adjacent to the 15 Flint Street property boundary.

5.1.6 Field Observations/Physical Characteristics

During completion of the surface soil sampling activities, soil at several sampling locations across the Site exhibited evidence of surface disposal of waste materials including observations of fragmented bricks, cinders, coal ash, and slag. Random dumping materials were also observed during the RI and the previous Phase I Environmental Site Assessment including approximately half a dozen crushed 55-gallon steel drums, various sized piles of used automobile tires, concrete rubble, cinder blocks, miscellaneous trash, railroad timbers, bricks, fill (including black granular material), and random dumping such as observed metal shavings and a parts cleaner as described above in Section 2.1.3. Sheens, staining, and/or petroleum-type odors were not encountered during surface soil sampling. **Table 2** presents a summary of the subsurface soil samples collected for analysis including sample description.

5.1.7 Surface Soil Impacts Summary

Summary statistics relating to constituents with concentrations exceeding Unrestricted Use, Residential Use, and/or Restricted Residential Use SCOs in one or more samples are presented on **Table 7A**.

VOCs were not identified above the Residential Use or Restricted-Residential Use SCOs in surface soils.

Target SVOCs exceeded one or more of Unrestricted Use SCOs, Residential Use SCOs, Restricted Residential Use SCOs, and/or Ecological SCOs at 11 locations across the Site. The majority of the locations exceeding Unrestricted Use, Restricted Use and/or Restricted Residential Use SCOs for SVOCs were located in the center of

the Site on 13 Cottage Street parcel and the former canal area of the 1320 S. Plymouth Avenue parcel. One location (SS-112) on the 13 Cottage Street parcel contained total SVOCs (including TICs) greater than 100 ppm. There was evidence of on-Site dumping in the vicinity of this sample location, including visual traces of brick and concrete fragments in the sample.

Metal concentrations exceeded Unrestricted Use SCOs, Residential Use SCOs, or Restricted Residential Use SCOs at 26 locations out of the 34 sample locations spread across the Site; however, cyanide was not detected above SCOs. The exceedances were most prevalent on the northern end of the 1320 S. Plymouth Avenue, 13 Cottage Street and 102 Violetta Street parcels. There were no exceedances on the 100 Riverview Place parcel. Twelve locations exceeded Residential Use and/or Restricted Residential Use SCOs for one or more metals. Twenty-six locations exceeded Unrestricted Use SCOs for one or more metals. Metals exceedances are presented on **Figure 11A**.

Pesticides were present in samples from seven locations at concentrations above the Unrestricted Use SCOs. The majority of exceedances occurring in the northern portion of the Site. None of the concentrations exceeded the Residential Use or Restricted Residential Use SCOs.

PCBs at two locations exceeded Residential Use, Restricted Residential Use, and/or Unrestricted Use SCOs. These two samples were located in close proximity to each other within the former canal. PCBs at four locations also exceeded Unrestricted Use SCOs. Sample locations exceeding PCB SCOs are limited to the former canal located on the northern portion of 1320 S. Plymouth Avenue, between the adjoining 5 Flint Street and 15 Flint Street parcels.

Samples from the 0 in to 2 in interval were not collected for analysis as part of the adjoining 5 Flint Street and 15 Flint Street RI (Ravi, October 2016) for comparison to the Site data.

5.2 EXISTING SURFACE COVER SAMPLE RESULTS

Existing surface cover soil sample results were compared to SCOs provided in 6 NYCRR Part 375 *Environmental Remediation Programs* (Part 375) (NYSDEC, 2006). Where applicable, Supplemental SCOs (NYSDEC Policy *CP-51/Soil Cleanup Guidance* [CP-51] dated October 2010) (NYSDEC, 2010) were also used. For comparison, SCOs are provided with the data summary tables.

Consistent with the current zoning as residential and future use scenarios as described in Section 2.7, the values used for screening analytical results include:

- Part 375 Unrestricted Use SCOs (Unrestricted Use SCOs)
- Part 375 Restricted Use Residential and CP-51 Residential Supplemental SCOs (Residential Use SCOs)
- Part 375 Restricted Use Restricted-Residential SCOs (Restricted Residential Use SCOs)
- Part 375 Restricted Use SCOs for Protection of Ecological Resources (Ecological SCOs).

EPA SW-846 Method 6010C provides total chromium concentrations without differentiation between the trivalent and hexavalent species. Using a conservative approach, the more stringent SCO for hexavalent chromium was used for comparison to total chromium values.

Existing surface cover soil samples were collected from 54 locations across the Site. Twenty surface cover samples were collected from the 0 in. to 2 ft bgs. depth, and 34 surface soil samples were collected from 0 in to 2 in., for one or more of the following analyses: VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Analytical results compared to the SCOs identified above are presented on **Tables 5A1, 5B1, 5C1, 5D1, 5E1, 6A1, 6B1, 6C1, 6D1,** and **6E1**. A figure illustrating analytical groups with one or more analyte exceeding a specific criterion, including the Restricted Use Commercial SCOs (Commercial Use SCOs) (Commercial Use SCOs to aid in future use planning) is presented as **Figure 11B**. Exceedances of SCOs were noted in samples along the

southern border of the Site parcels suggesting that similar exceedances may be present off-Site depending on topography.

5.2.1 VOCs

Twelve VOCs were detected (including laboratory estimated values) in one or more existing surface cover soil samples. All but one VOC was detected below SCOs; Acetone was detected above Unrestricted Use SCOs in samples collected from three locations (SS-100, SS-111, and SS-140) in the 0 to 2-inch sample interval. SS-100 and SS-101 are located on the 1 Cottage Street parcel and SS-140 is located proximal to the pedestrian path. None of the concentrations observed in the deeper sampling intervals exceeded SCOs.

PID readings of between 0.2 ppm and 0.6 ppm were noted at 10 of the 20 (0 in. to 2 ft bgs) sample locations. The majority of the PID readings correlated to samples where evidence of fill was observed.

5.2.2 SVOCs

Twenty-six SVOCs were detected (including laboratory estimated values) in existing surface cover soil samples across the Site. Samples from 20 of 47 surface cover locations contained two or more of the following polycyclic aromatic hydrocarbons (PAHs) SVOCs at concentrations exceeding Unrestricted Use and/or Residential Use and/or Restricted Residential Use SCOs:

▪ Anthracene	▪ Chrysene	▪ Naphthalene
▪ Benzo[a]anthracene	▪ Dibenzo[a,h]anthracene	▪ Phenanthrene
▪ Benzo[a]pyrene	▪ Dibenzofuran	▪ Phenol
▪ Benzo[b]fluoranthene	▪ Fluoranthene	▪ Pyrene
▪ Benzo[g,h,i]perylene	▪ Fluorene	
▪ Benzo[k]fluoranthene	▪ Indeno[1,2,3-cd]pyrene	

Sample SS-141 contained the highest concentrations of each PAH detected above criteria. This sample was collected from the 1 ft to 2 ft interval and is located near the southeast corner of the 5 Flint Street Parcel where surface debris that included a parts cleaner and metal shavings were observed. The description of this sample included the presence of brownish-black granular material. No detectable PID readings were noted in this sample.

Acenaphthene was also detected above Unrestricted Use SCOs at SS-141.

To further evaluate the nature of SVOCs in the existing surface cover soil the concentrations of quantified SVOCs were totaled and added together with the total SVOC tentatively identified compounds (TICs) presented on **Table 5B1**. A figure illustrating total SVOC concentrations in existing surface cover soils is presented as **Figure 12**. Samples from three locations on the 13 Cottage Street parcel contained total SVOC values greater than 100 ppm:

- SS-142; 304 ppm
- SS-141; 3,819 ppm
- SS-147; 880 ppm.

These samples were collected from the deeper intervals between 0.5 and 2 ft below grade.

5.2.3 Inorganics (Metals and Cyanide)

Metals were detected at numerous sample locations across the Site. All locations had detectable results (including laboratory estimated values) exceeding Unrestricted Use SCOs for one or more of nine metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, and zinc). Each location had detected metals (including laboratory estimated values) exceeding Restricted Residential Use SCOs, with the exception of

chromium. EPA SW-846 Method 6010C provides total chromium concentrations without differentiation between the trivalent and hexavalent species. Using a conservative approach, the more stringent SCO for hexavalent chromium was used for comparison to total chromium values on the data summary table. Although chromium was found to be present in all of the surface soil samples above the hexavalent chromium SCO of 1 mg/kg, only one sample (SS-141) exceeded the trivalent chromium value of 30 mg/kg. Cyanide was not detected over SCOs.

5.2.4 Pesticides/Herbicides

Pesticides were detected at thirteen existing surface cover soil sample locations across the Site (including laboratory estimated values and tentatively identified estimated values). Ten locations exceeded both Unrestricted Use SCOs and Protection of Ecological SCOs for one or more of the following: 4-4-DDE, 4-4-DDT, and/or Dieldrin. None of the concentrations exceeded the Residential Use or Restricted Residential Use SCOs.

5.2.5 PCBs

PCBs were detected at ten existing surface cover sample locations across the Site (including laboratory estimated values) at concentrations up to 4.7 mg/kg (SS-126). The Unrestricted SCO of 0.1 mg/kg was exceeded at five locations and the Residential and Restricted Residential SCO of 1 mg/kg was exceeded at two locations (SS-126 and SS 128). All of these samples were collected in the same general area, the northern portion of the former canal adjoining the 15 Flint Street property boundary. Four of these samples were collected from the top 2 inches and one was collected from the 1 ft to 2 ft interval.

5.2.6 Field Observations/Physical Characteristics

During completion of the existing surface cover sampling activities, soil at several sampling locations across the Site exhibited evidence of surface disposal of waste materials including observations of fragmented bricks, cinders, coal ash, and slag. **Table 2** presents a summary of the subsurface soil samples collected for analysis including sample description. Materials that were randomly dumped on the properties were also observed during the RI and the previous Phase I Environmental Site Assessment. These materials included approximately half a dozen crushed 55-gallon steel drums that appeared empty, various-sized piles of used automobile tires, concrete rubble, cinder blocks, miscellaneous trash, railroad timbers, bricks, fill (including black granular material), and random dumping such as observed metal shavings and a parts cleaner as described above in Section 2.1.3. Sheens, staining, and/or petroleum-type odors were not encountered during surface soil sampling. The general locations of these observations are presented on **Figure 4.**

5.2.7 Existing Surface Cover Impacts Summary

Summary statistics relating to constituents with concentrations exceeding Unrestricted Use, Residential Use, and/or Restricted Residential Use SCOs in one or more surface cover samples are presented on **Table 7B**,

Acetone was the only VOC detected above SCOs. in samples collected from three locations (SS-100, SS-111, and SS-140) in the 0 to 2-inch sample interval exceeded Unrestricted Use SCOs but not Residential or Restricted Residential SCOs.

Target SVOCs exceeded one or more of Unrestricted Use SCOs, Residential Use SCOs, Restricted Residential Use SCOs, and/or Ecological SCOs at 27 locations across the Site. The majority of the 20 locations exceeding Unrestricted Use, Restricted Use and/or Restricted Residential Use SCOs for SVOCs were located across the Site on 13 Cottage Street, the former canal area of the 1320 S. Plymouth Avenue parcel and 102 Violetta Street near the bike path. There were no exceedances on the 100 Riverview Place parcel. Four locations (SS-112, SS-142, SS-141, and SS-147) on the 13 Cottage Street parcel contained total SVOCs (including TICs) greater than 100 ppm. Of these four samples, with the exception of SS-112,the majority of the Total SVOC value consisted of target SVOCs. There was evidence of on-Site dumping including a parts cleaner, metal shavings debris, and concrete/brick debris in the vicinity of some of these sample locations.

Metal concentrations exceeded Unrestricted Use SCOs, Residential Use SCOs, or Restricted Residential Use SCOs at 36 locations out of the 54 sample locations spread across the Site; however, cyanide was not detected above SCOs. The exceedances distributed across the site in a manner similar to the SVOC exceedances with no exceedances on the 100 Riverview Place parcel on the western side of the site. Twenty-nine locations exceeded Residential Use and/or Restricted Residential Use SCOs for one or more metals. Thirty-six locations exceeded Unrestricted Use SCOs for one or more metals. Metals exceedances are presented on **Figure 11B**.

Pesticides were present in samples from 10 locations at concentrations above the Unrestricted Use SCOs. The majority of exceedances occurring in the northern portion of the Site. None of the concentrations exceeded the Residential Use or Restricted Residential Use SCOs.

PCBs at two locations exceeded Residential Use, Restricted Residential Use, and/or Unrestricted Use SCOs. PCBs at three locations also exceeded Unrestricted Use SCOs. Sample locations exceeding PCB SCOs are limited to the former canal located on the northern portion of 1320 S. Plymouth Avenue and adjacent to the adjoining 15 Flint Street parcel.

5.3 SUBSURFACE SOIL SAMPLE RESULTS

Subsurface soil sample results were compared to criteria provided in Part 375 (NYSDEC, 2006). Where applicable, CP-51 SCOs (NYSDEC, 2010) were also used. Consistent with the current zoning as residential and future use scenarios as described in Section 2.7, the values used for screening analytical results include:

- Unrestricted Use SCOs
- Residential Use SCOs
- Restricted Residential SCOs.

EPA SW-846 Method 6010C provides total chromium concentrations without differentiation between the trivalent and hexavalent species. Using a conservative approach, the more stringent SCO for hexavalent chromium was used for comparison to total chromium values.

Subsurface soil samples were collected from 140 locations across the Site. Samples were analyzed for one or more of the following: VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Samples of material described as bone black or granular activated carbon were also targeted for analysis. These samples were collected from SB-113, SB-143, SB-149, SB-TP-139 and test pit sample locations TP-109, TP-140, TP-149, and TP-150. Sample locations in which the "activated carbon" or "bone black" material was analyzed are also identified via a footnote on the corresponding analytical data tables.

Analytical results compared to SCOs are presented on **Tables 8A-8E,** and **9A-9E**. A figure illustrating analytical groups with one or more analyte exceeding a specific criterion, including the Commercial Use SCOs (Commercial Use SCOs to aid in future use planning) is presented as **Figure 13**.

Tables 7A-7C presents a numerical summary of the constituents identified above the Unrestricted Use, Residential Use, and Restricted Residential Use SCOs by constituent in one or more samples.

5.3.1 VOCs

Twenty-six VOCs were detected (including laboratory estimated values) in one of more subsurface soil samples. Eight VOCs were detected above the Unrestricted SCOs. The concentration of one VOC at a single location was above the Residential SCO. In the case of VOC SCOs, both the Residential Use and Restricted Residential Use SCOs are very similar in value. The compounds identified above SCOs can be placed in one of two categories as follows:

Petroleum-related VOCs	**Ketones**
▪ Benzene	▪ 2-Butanone (MEK)

▪ Toluene ▪ 1,2,4-Trimethylbenzene (124TMB) ▪ 1,3,5-Trimethylbenzene (135TMB) ▪ Ethylbenzene ▪ n-Propylbenzene	▪ Acetone

124TMB and 135TMB were detected above Unrestricted Use SCOs at three locations (OVR-117, SB-169, TP-129,). The sample from TP-134 only contained 124TMB above the Unrestricted Use SCO. OVR-117 is located on the 13 Cottage Street parcel and the other samples are located on the northern end of the 1320 S. Plymouth Street parcel on either the east or west side of the adjoining 5 Flint Street Parcel.

MEK was detected above Unrestricted Use SCOs at one location (TP-127) on the northern side of the 1320 S. Plymouth Street parcel, in between the adjoining 5 Flint Street and 15 Flint Street parcels.

Acetone was detected above Unrestricted Use SCOs at 13 locations (SB-105, SB-106, SB-115, SB-117 (duplicate sample), SB-121, SB-133, SB-135, SB-144, TP-103, TP-120, TP-130, TP-133, and TP-137), these locations are distributed across the Site.

Benzene was detected above both Unrestricted Use and Residential Use SCOs at one location OVR-117 (located on the 13 Cottage Street parcel near the central-northern portion of the Site) at 4,400 J micrograms per kilogram (µg/kg).

Ethylbenzene, n-propylbenzene, and toluene were detected above Unrestricted Use SCOs at one location (OVR-117) (located on the 13 Cottage Street Parcel near the central-northern portion of the Site).

Of the eight samples that contained bone black or granular activated carbon, none of the samples contained VOCs above SCOs. Total VOCs in the subsurface are presented on **Figure 14**.

5.3.2 SVOCs

Twenty-two SVOCs were detected in subsurface soils. SVOC compounds detected above corresponding SCOs in one or more of the subsurface soil samples are limited to the following PAHs:

▪ Benzo[a]anthracene ▪ Benzo[a]pyrene ▪ Benzo[b]fluoranthene ▪ Benzo[k]fluoranthene	▪ Chrysene ▪ Dibenzo[a,h]Anthracene ▪ Fluoranthene ▪ Indeno[1,2,3-cd]pyrene	▪ Naphthalene ▪ Phenanthrene ▪ Pyrene

SVOCs exceedances of either Unrestricted Use, Residential Use, or Restricted Residential Use SCOs were observed at 25 subsurface soil locations across the Site, with the majority of exceedances occurring in the central portion of the Site on the 13 Cottage Street parcel. Benzo[a]pyrene was also detected above Protection of Groundwater SCOs at one location (OVR-117) (located on the 13 Cottage Street parcel near the central-northern portion of the Site). In the case of SVOC SCOs, both the Residential Use and Restricted Residential Use SCOs are very similar in value. As illustrated on **Table 7C** the samples from OVR-117 and TP-117 contained the highest concentrations of individual SVOCs. Both of these samples were collected from the south-central portion of the 13 Cottage Street parcel where chemical odors and elevated PID readings were noted.

Similar to the surface soils, total SVOC values (target SVOCs plus TICs) were calculated for subsurface soil samples and presented on **Table 8B**. These values are plotted on **Figure 15** and used to provide a better understanding of the distribution of SVOCs in soil across the Site. The values in general were found to be in the

range of 10 ppm to 100 ppm. Five locations Site (SB-115, SB-148, SB-169, TP-102, and TP-106) contained total SVOCs between 100 ppm and 250 ppm. One location on the 1320 S. Plymouth Avenue parcel (TP-108) contained Total SVOC concentrations between 250 ppm and 500 ppm. Two locations in the central portion of the Site (OVR-117 and TP-117) contained total SVOC concentrations greater than 500 ppm. The sample locations with the greatest SVOC detections (greater than 250 ppm) were collected from fill material that contained coal, ash, cinders, bricks and/or other debris. Some samples also had an observed petroleum and/or chemical odors, however the odors did not necessarily equate to elevated concentrations of SVOCs in the samples.

Of the eight samples containing bone black or granular activated carbon, two samples contained SVOCs exceeding SCOs, as follows:

- SB-143 Restricted Residential Use SCOs for Dibenzo[a,h]Anthracene
- TP-140 Part 375 Residential, Restricted Residential SCOs for Benzo[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, and Indeno[1,2,3-cd]pyrene and Residential Use SCO listed in Part 375 or CP-51 for Chrysene.

5.3.3 Inorganics (Metals and Cyanide)

Numerous metals were detected in subsurface soil samples. Samples from 52 of the 110 locations analyzed contained concentrations (including laboratory estimated values) of one or more of nine metals (aluminum, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc) above the Unrestricted Use SCOs and/or seven metals (arsenic, cadmium, copper, lead, manganese, and mercury) above Residential Use SCOs. Several are likely naturally occurring elements in the local soil. Five of the eight samples (SB-143, SB-149, TP-140, TP-149, and TP-150) containing bone black or granulated activated carbon material contained arsenic above the Part 375 Residential, Restricted Residential SCOs and chromium above the Residential Use SCO listed in Part 375. The locations of these samples were scattered across the Site.

Iron, a naturally occurring element in soil, exceeded Residential Use SCOs at all subsurface soil sample locations on the Site.

Cyanide was detected at 85 subsurface soils samples at concentrations below Unrestricted Use SCOs.

5.3.4 Pesticides/Herbicides

Pesticides were detected (including laboratory estimated values and tentatively identified estimated values) at SB-105 and TP-105 at results below SCOs. Additionally, pesticides were detected at two locations exceeding Unrestricted Use SCOs and Protection of Ecological Resources Action levels at TP-132 for 4-4-DDD, 4-4-DDE, and 4-4-DDT; and TP-149 (sample contains bone black or granulated activated carbon material) for dieldrin.

5.3.5 PCBs

PCBs were detected at OVR-100, SB-126, SB-130, SB-TP-144, SB-172, and TP-107 at concentrations below SCOs. These locations are generally situated in the northern portion of the former canal on the 1320 S. Plymouth Avenue parcel and the south-central portion of the Site.

PCBs were also detected at SB-147 at 0.23 J mg/kg which exceeds the Unrestricted Use SCO of 0.1 mg/kg. SB-147 is located in the center of 13 Cottage Street. PCBs were not detected in the samples containing bone black or granulated activated carbon material.

5.3.6 Field Observations/Physical Characteristics

During completion of the field investigation activities, soil at several subsurface sampling locations exhibited sheens, staining, or odors. These locations are identified on **Table 2** and spatially depicted by depth and type on **Figure 16**. The maximum PID reading (in ppm) measured during field sampling at each location is also depicted on **Figure 17**. As illustrated on these figures the majority of the odors, staining, and sheens are located on the northern portion of the site within the former canal and on the east and west sides of the adjoining 5 Flint Street

parcel with a few locations also observed on the 13 Cottage Street parcel, south of the adjoining 5 Flint Street parcel. Similarly, the location with the highest PID readings are also located in the same general area. Fill and waste materials including observations of fragmented bricks, cinders, coal ash, slag, and black granular material were also noted at many of these locations.

Iridescent sheens and/or black staining were observed at the following locations:

- Test Pits: TP-119, TP-124, TP-127, TP-128, TP-130, TP-132, and TP-152,
- Soil Borings: SB-108, SB-124, SB-125, SB-129, SB-133, SB-134, SB-148, SB-TP-131, OVR-103, and OVR-112.

For the most part, sheens and staining were noted at locations within the northern portion of the former canal on the 1320 S. Plymouth Avenue parcel. Sheens were generally observed at or above the water table.

Petroleum and, in some cases, chemical odors were observed at numerous locations throughout the Site, including 19 test pit locations, 63 soil boring locations (including 13 overburden and four bedrock groundwater monitoring well locations).

Odors were generally observed from 1 ft to 10 ft bgs in the vicinity of the northern end of the former canal on the 1320 S. Plymouth Avenue parcel, and on the east and west sides of the 5 Flint Street parcel. Odors were detected greater than 16 ft below grade along the east end of the site near the river. Solvent or chemical type odors were noted at two locations; one on either side of the adjoining 5 Flint Street parcel near Flint Street.

Odors were also noted at some locations within the 13 Cottage Street parcel. The depth varied from grade to up to 16 ft bgs. At two of the locations, (SB-118 and OVR-117) the odors were noted to be more of a chemical nature than petroleum.

The sheens, staining, and odors generally correlate to the areas also observed to have the highest PID readings, on the northern side of the Site in the location of the former canal on 1320 S. Plymouth Avenue, on the east and west sides surrounding the adjoining 5 Flint Street parcel, and 13 Cottage Street located immediately south of the adjoining 5 Flint Street parcel.

5.3.7 Subsurface Soil Impacts Summary

VOCs, SVOCs, metals, pesticides, and PCBs were each detected above SCOs at one or more locations across the Site, with the majority of exceedances occurring in the northern portion of the Site. The majority of odors and sheens were generally located at shallow depths in the former canal area on the northern end of the 1320 S. Plymouth Avenue parcel and on the east and west side of the adjoining 5 Flint Street parcel. The impacts were observed slightly deeper on the 13 Cottage Street and the 102 Violetta Street parcels. There are limited exceedances on the western side of the site (102 Violette Street and 100 Riverview Place).and at the southern boundaries. However, there is the potential for fill material and associated constituents to extend off-Site within the former canal.

Acetone exceeded Unrestricted SCOs at 13 locations across the Site.

Three of the four VOC Unrestricted Use SCO exceedances for 124TMB and 135TMB were found at the northern end of the Site, along Flint Street. The soil sample from OVR-117, located near the center of the Site on the 13 Cottage Street parcel, contained concentrations of several petroleum-related VOCs exceeding both Unrestricted Use and Restricted Use SCOs as well. A chemical odor was observed during installation of the boring and sampling at location OVR-117.

Quantified SVOC concentrations exceeding SCOs were found at 25 locations across the Site. The locations with the highest concentrations of total SVOCs (target SVOCs plus total TICs) were near the center of the Site on the 13 Cottage Street parcel and near the center of the Site on the western 1320 S. Plymouth Avenue parcel.

The sheens, staining, and odors generally correlate to the areas also observed to have the highest PID readings, on the northern side of the Site in the former canal on 1320 S. Plymouth Avenue, on the east and west sides

surrounding the adjoining 5 Flint Street parcel, and 13 Cottage Street located immediately south of the adjoining 5 Flint Street parcel.

Fifty locations contained concentrations of one or more of nine metals (arsenic, cadmium, copper, lead, manganese, mercury, nickel, silver, and sodium) above the Unrestricted Use SCOs and/or seven metals (arsenic, cadmium, copper, lead, manganese, and mercury) above Residential Use SCOs and Restricted Residential Use SCOs. Iron exceeded Residential Use SCOs at all subsurface soil sample locations on the Site. Manganese, sodium, and iron are likely naturally occurring as the result of the soil types present.

PCB concentrations at one location, SB-147 (located near the center of the Site) exceeded Unrestricted Use SCOs (0.23 mg/kg vs. a SCO of 0.1 mg/kg).

The pesticide concentrations exceeding Unrestricted Use SCOs were collected from TP-132 and TP-149 that are located on the northern end of the Site and the 13 Cottage Street parcel, respectively.

Based on the analytical results of the samples containing bone black or granulated activated carbon material there is no distinct correlation to specific contaminants present in this material as compared to other subsurface samples across the Site.

5.4 GROUNDWATER SAMPLE RESULTS

Groundwater samples were collected from the overburden and bedrock wells installed as part of the RI in addition to MW-3 that was previously installed by the NYSDEC. Groundwater samples were collected in accordance with methods described in Section 3.3.5 in two separate events that occurred between August 17 and 24, 2016 and between December 5 and 13, 2016. The groundwater analytical results, compared to Class GA SGVs, are summarized on **Table 10A-10D. Tables 7C-7E** presents a numerical summary of the constituents identified above the Class GA SGVs by constituent in one or more samples. Groundwater exceedances are presented on **Figure 18**. The groundwater results are summarized below.

5.4.1 VOCs

VOCs exceeding Class GA SGVs in one or more groundwater monitoring wells on at least on occasion can be placed into three general groups as follows:

Petroleum-related VOCs	Chlorinated VOCs	Ketones
▪ Benzene	▪ 1,1-Dichoroethane (1,1,-DCA)	▪ MEK
▪ Isopropylbenzene	▪ Chloroethane	▪ 2-hexanone (MBK)
▪ Toluene	▪ Trichloroethene	▪ Acetone
▪ Xylenes	▪ Vinyl Chloride	
▪ 124TMB		
▪ 135TMB		

Petroleum-related compounds were identified above the Class GA SGVs during at least one sampling event in groundwater collected from groundwater monitoring wells OVR-107, OVR -110, OVR-117, and OVR-132. OVR-117 contained benzene, isopropylbenzene, toluene, xylenes, 124TMB, and 135TMB above criteria during the first sampling event. The concentrations were generally lower during the second sampling event and were below the Class GA SGVs with the exception of xylenes. This well is located to the southwest of the adjoining 5 Flint Street parcel. Benzene was the only VOC detected above the Class GA SGV in groundwater monitoring wells OVR-107, OVR-110, and OVR-132 and only occurred during the first sampling event. These groundwater monitoring wells are located to the west and east of the adjoining 5 Flint Street parcel. None of the concentrations observed exceeded 40 µg/L.

Chlorinated VOCs were detected in four groundwater monitoring wells located on the west and east sides of the 5 Flint Street Parcel; OVR-107, OVR-108, OVR-109, and OVR-132. OVR-132 contained 1,1-DCA (77 µg/L and 26 µg/L, respectively) and chloroethane (12 µg/L and 16 µg/L, respectively) above the Class GA SGVs during both events. Vinyl chloride was detected above criteria at groundwater monitoring well OVR-132 during the first event only (2.1 µg/L). OVR-107 contained only chloroethane above criteria during both events at concentrations of 54 µg/L and 11 µg/L respectively. OVR-109 contained trichloroethene during both events but the concentration only exceeded the class GA SGVs during the first sampling event (7.3 µg/L). Chloroethane was only detected at OVR-108 during the first sampling event and at 7.4 µg/L which is above the Class GA SGV.

OVR-117, located southwest of the adjoining 5 Flint Street Parcel, contained the three ketone compounds (MEK [150 µg/L], MBK [87 µg/L], and acetone [170 µg/L]) at concentrations above criteria during the first sampling event. Only acetone (54J µg/L) was detected above criteria during the second sampling event.

Four VOCs (carbon disulfide, methylcyclohexane, MTBE, and acetone) were detected in one or more (four) of the five bedrock monitoring wells. The concentrations of VOCs detected were below 0.63 J µg/L, with the exception of acetone which was detected in BED1-102 at 8.2 µg/L during round 2. None of the detected VOC concentrations were above their respective Class GA SGVs.

5.4.2 SVOCs

SVOCs were detected in a number of overburden well locations at concentrations below Class GA SGVs. SVOCs detected above criteria were noted at three locations: OVR-117, OVR-119, and OVR-130. At OVR -117 naphthalene was detected during both events (13.6 µg/L and 4.8 J µg/L, respectively), but, as shown was only above the Class GA SGV of 10 µg/L during the first sampling event. OVR-119 contained several PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) above the Class GA SGVs during both events. The concentrations of these compounds are less than 2 µg/L; however, the individual criteria are non-detect or 0.002 µg/L.

No SVOCs were detected in the groundwater samples collected from the bedrock groundwater monitoring wells.

5.4.3 Inorganics (Metals and Cyanide)

A variety of inorganic constituent were present in the groundwater samples collected from the Site with several detected at concentrations above Class GA SGVs. The constituents above criteria can be grouped into those detected above criteria in most of the wells and in both events and those that were detected above criteria during one of the events or at few locations.

Iron, manganese, magnesium, and sodium were detected above the Class GA SGVs at most locations during the RI program. Specifically, iron was detected above criteria in each of the overburden groundwater monitoring wells and bedrock groundwater monitoring wells BED-101 (first event) and BED-102 (both events). Similarly, magnesium was detected above criteria in all of the overburden groundwater monitoring wells and in bedrock groundwater monitoring wells BED-102 and BED 103 (first event). Magnesium was detected above criteria in both the overburden and bedrock groundwater monitoring wells. Sodium was detected above criteria in each of the bedrock groundwater monitoring wells and most of the overburden groundwater monitoring wells. These constituents are likely naturally occurring as the result of the bedrock and soil types present.

The groundwater sample from OVR-126, located on the southeast side of the Site adjacent to the river, contained a number of inorganic constituents during the first sampling event that were above the Class GA SGVs that were not detected or below criteria during the second sampling event. These constituents included arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, and selenium. The fact that these constituents were not present in the second event suggests that the constituents were likely constituents within suspended sediment rather than dissolved in groundwater.

Arsenic was detected in a number of overburden groundwater monitoring wells above the Class GA SGV of 25 µg/L. Three wells contained concentrations above the criteria during both events, these groundwater

monitoring wells included OVR-101, OVR-105, and OVR-130. Four other groundwater monitoring wells (OVR-102, OVR-103, OVR-107, and OVR-110) contained arsenic above criteria during one of the two sampling events. Each of these groundwater monitoring wells are located on the east or west side of the 5 Flint Street Parcel.

Thallium was identified above the Class GA SGV of 0.5 µg/L in eight overburden and one bedrock groundwater monitoring well during at least one sampling event. Thallium exceeded criteria during both events in wells OVR-112, OVR-119, and OVR-104. These groundwater monitoring wells are located on the south end of 5 Flint Street parcel and 13 Cottage Street parcel. Groundwater monitoring wells that contained thallium above criteria in one of the two events included OVR-105, OVR-117, OVR-123, OVR -124, MW-3, and BED-103.

Lead was detected above the Class GA SGV of 25 µg/L in groundwater monitoring well OVR-129 in one of the two sampling events. Selenium was detected above the class SGV of 10 µg/L in OVR-119 in one of the two sampling events.

5.4.4 PCBs

PCBs were only detected in one groundwater sample. OVR-100 located on the north end of the former canal near Flint Street, contained PCB Aroclors 1248 and 1254 at concentrations of 0.096 J µg/L and 0.075 µg/L, respectively during the second sampling event. The total PCB concentration of 0.171 µg/L as well as the individual concentration of Aroclor 1248 exceeded the Class GA SGV of 0.09 µg/L. PCBs were not detected at this location during the first sampling event.

No PCBs were detected in groundwater samples collected from the bedrock monitoring wells.

5.4.5 Physical Characteristics

During Round 1 of groundwater sampling the following locations had observed odors of petroleum in groundwater during sampling: OVR-100, OVR-101, OVR-105, OVR-108, OVR-130, and OVR-131.

During Round 2 of groundwater sampling the following locations had observed odors of petroleum in groundwater during sampling: OVR-100, OVR-101, OVR-120, OVR-130, and OVR-131.

Sheens were observed in the groundwater purged from locations OVR-101, OVR-130, and OVR-131 during both rounds of groundwater sampling. A strong unknown chemical odor was observed during both rounds of groundwater sampling at location OVR-117.

5.4.6 Groundwater Quality Summary

VOCS detected in the groundwater include petroleum-related VOCs, Chlorinated VOCs and Ketone compounds. Most of the compounds were only detected in one of the two sampling events. Petroleum-related VOCs and Chlorinated VOCs were present in wells bordering the 5 Flint Street parcel. Review of the RI Report for the adjoining 5 Flint Street and 15 Flint Street parcels (Ravi, October 2016) indicates that chlorinated VOCs and petroleum-related VOCs were present at higher concentrations in the groundwater on the west-central side of the adjoining 5 Flint Street parcel and some of the wells on the northern end of the 15 Flint Street parcel. OVR-117 located on the 13 Cottage Street parcel contained petroleum-related VOCs and ketones. This groundwater monitoring well contained naphthalene above criteria in the sample from one of the two events. Overburden groundwater monitoring well OVR-119, located in the vicinity of OVR-117 did not contain VOCs, but contained several SVOCs above criteria during both events. A limited number of VOCs were detected in the bedrock groundwater. VOC concentrations observed were less than 0.65 µg/L and well below the groundwater criteria.

Review of the groundwater data from the adjoining 5 Flint Street and 15 Flint Street RI (Ravi, October 2016) reveals that petroleum-related and chlorinated VOCs were present in groundwater at higher concentrations than this Site. The concentrations observed were above criteria at many locations that are primarily in the northern section of each parcel near Flint Street.

PCBs were detected in one ground water sample. The detection occurred in OVR-100 (situated between the adjoining 5 Flint Street and 15 Flint Street parcels) on the north end of the former canal during the second sampling event. The detected concentration exceeded the Class GA SGV.

Groundwater samples from several locations contained detectable concentrations of inorganics, including iron, manganese, magnesium, and sodium above the Class GA SGVs at most locations during both sampling events. It is likely that these are naturally occurring elements as they are components of soil and bedrock.

Arsenic was detected in a number of overburden wells above the Class GA SGV of 25 µg/L. Groundwater monitoring wells OVR-101, OVR-105, and OVR-130 contained concentrations above the criteria during both events. Two of these groundwater monitoring wells (OVR-101 and OVR-130) are located in the northern section of the former canal. OVR-105 is located on the northeast side of the adjoining 5 Flint Street parcel. Arsenic was detected in the groundwater samples at concentration above the Class GA SGV at two groundwater monitoring wells located on the south end of the adjoining 5 Flint Street parcel and arsenic was also detected at concentrations below criteria in a number of other groundwater monitoring wells on the same parcel as a few groundwater monitoring wells on the adjoining 15 Flint Street parcel. (Ravi, October 2016).

Thallium, selenium, and lead were detected at concentrations exceeding Class GA SGVs in a select number of groundwater monitoring wells in samples from one of the two sampling events.

5.5 SOIL VAPOR AND PROXIMAL MEDIA SAMPLE RESULTS

Soil vapor, subsurface soil, and groundwater grab samples were collected from locations located west and southwest near abutting residential properties at the perimeter of the Site (see **Figure 19**). Soil vapor location SV-100 was approximately 90 ft from the nearest residence, SV-107 was approximately 55 ft, and SV-106 approximately 70 ft, respectively. The remaining soil vapor locations ranged in distance from approximately 110 ft to approximately 200 ft to the nearest residence. The majority of samples were also situated topographically approximately 10 ft to 50 ft below the residences on the western slope of the Site.

A list of soil vapor locations and the nearest surface soil, subsurface soil, and groundwater sample locations is presented below on **Table 11**.

Table 11 – Soil Vapor and Proximal Media Sample Correlation

Soil Vapor Sample Location	Closest Surface Soil Sample Location	Closest Subsurface Soil Sample Location	Closest Groundwater Sample Location
SV-100	NA	NA	NA
SV-101	SS-101	NA	GW-101*
SV-102	SS-103	SB-172*	GW-101/GW-103*
SV-103	SS-104	SB-173*	GW-104*
SV-104	SS-105	SB-174*	GW-105*
SV-105	SS-106	NA	GW-106
SV-106	SS-107	NA	GW-107
SV-107	SS-108	NA	GW-108

NA = no sample in close proximity.
*** = Correlating sample is greater than 50 ft away.**

Eight temporary soil vapor points were installed for the collection of soil vapor samples and submitted for TO-15 analysis. Eight temporary piezometers were installed in the vicinity of the same Site boundary and used to collect groundwater grab samples that were analyzed for VOCs. Additionally, soil samples were collected in proximity to the soil vapor and/or temporary piezometer locations for analysis of VOCs and selected additional parameters for the RI. Analytical results for VOCs for all three media collected as part of the SV evaluation are presented on **Tables 12A-12C**.

5.5.1 Soil Vapor

Twenty-three VOCs were detected at one or more soil vapor sample locations. These compounds can be grouped into categories as follows:

Petroleum-related VOCs ■ Benzene ■ Toluene ■ Ethylbenzene ■ 4-Ethyltoluene ■ Xylenes ■ 124TMB ■ 135TMB ■ Styrene **Ketones** ■ Acetone ■ 4-Methyl-2-Pentanone (MIBK)	**Alkanes** ■ Heptane ■ Hexane **Chlorinated VOCs** ■ Trichloroethene ■ Dichlorodifluoromethane ■ Tetrachloroethene ■ Trichlorofluoromethane ■ 1,1,1-Trichloroethane	**PAHs** ■ Naphthalene **Trihalomethanes** ■ Bromoform ■ Chloroform **Other** ■ Methyl methacrylate ■ Carbon Disulfide ■ Tetrahydrofuran

Eight grab groundwater samples were collected from temporary groundwater monitoring well points installed in the vicinity of the western perimeter of the Site. One monitoring well volume was removed from each monitoring well point prior to sample collection using a dedicated polyethylene thimble bailer for each location. Samples were analyzed for VOCs only. Groundwater grab samples were compared to Class GA SGVs. These criteria are provided within in the data table. Analytical results and constituents identified above guidance values are presented on **Tables 10A-10D**.

Soil samples were collected at seven nearby locations to soil vapor sampling locations including SS-101, and SS-103 through SS-108. Surface soil sample results were compared to criteria provided in Part 375 (NYSDEC, 2006). Where applicable, Supplemental SCOs (CP-51) (NYSDEC, 2010) were also used. For comparison, SCOs are provided with the data summary tables.

Soil samples were collected at five select locations combined with the temporary groundwater monitoring wells, including SB-102, SB-112, SB-172, SB-173, and SB-174 and one converted test pit location, SB-TP-111. Subsurface soil sample results were compared to criteria provided in Part 375 (NYSDEC, 2006). Where applicable, Supplemental SCOs (CP-51) (NYSDEC, 2010) were also used. For comparison, SCOs are provided with the data summary tables.

Comparison of analytical data at each correlated area is described below.

5.5.2 Sample VOC Correlation

SV-100

The following VOCs were detected in the soil vapor analysis: acetone; benzene; bromoform; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; heptane; hexane; methylmethacrylate; MIBK; naphthalene; styrene; tetrachloroethene; toluene; trichlorofluoromethane; 124TMB; 135TMB; m,p-xylene; and o-xylene.

There were no correlated surface soil, subsurface soil, or groundwater samples in the proximity (*i.e.,* within approximately 50 ft or less) of SV-100.

SV-101

The following VOCs were detected in the soil vapor analysis: benzene, bromoform, dichlorodifluoromethane, ethylbenzene; 4-ethyltoluene; heptane; hexane; MIBK; methylmethacrylate; naphthalene; styrene;

tetrachloroethene; tetrahydrofuran; toluene; and trichlorofluoromethane; 124TMB; 135TMB; m,p-xylene; and o-xylene.

VOCs were not detected above analytical laboratory method detection limits at nearby surface soil sample location SS-101.

Of the constituents identified in SV-101, the following were also detected in the groundwater sample collected from GW-101: 124TMB; benzene; m,p-xylene; o-xylene; and toluene. Concentrations were generally less than 1 µg/L with the exception of benzene which was detected above the guidance value of 1 µg/L at 1.2 µg/L. This temporary piezometer is located over 50 ft from the soil vapor location and is situated approximately 20 ft topographically downgradient.

There were no correlated subsurface soil samples in the proximity (*i.e.,* within approximately 50 ft or less) of SV-101.

SV-102

The following VOCs were detected in the soil vapor analysis: acetone; benzene; bromoform; carbon disulfide; chloroform; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; methylmethacrylate; naphthalene; styrene; tetrachloroethene; toluene; trichlorofluoromethane; 124TMB; 135TMB; m,p-xylene; and o-xylene.

None of the constituents identified in the soil vapor sample were detected in surface soil sample SS-103.

Of the constituents identified in SV-102, the following were also detected in the groundwater sample collected from GW-101: 124TMB; benzene; m,p-xylene; o-xylene; and toluene. Concentrations were generally less than 1 µg/L with the exception of benzene which was detected above the guidance value of 1 µg/L at 1.2 µg/L. This temporary piezometer is located over 100 ft from the soil vapor location and is situated approximately 15 ft topographically downgradient.

Of the constituents identified in SV-102, acetone was also detected in the subsurface soil sample collected from SB-172, at a concentration of 0.024 µg/kg.

VOCs were not detected above analytical laboratory detection limits at temporary piezometer GW-103. This temporary piezometer is located over 100 ft from the soil vapor location, and is situated approximately 20 ft topographically downgradient.

SV-103

The following VOCs were detected in the soil vapor TO-15 analysis: benzene; chloroform; dichlorodifluoromethane; ethylbenzene; heptane; hexane; 124TMB; 135TMB; 4-ethyltoluene; bromoform; methylmethacrylate; naphthalene; styrene; tetrachloroethene; toluene; trichlorofluoromethane; m,p-xylene; and o-xylene.

Of the constituents identified in SV-103, none of these constituents were identified above analytical laboratory method detection limits in surface soil sample SS-104, subsurface soil sample SB-173, or the groundwater sample collected at temporary piezometer GW-104. This temporary piezometer is located over 100 ft from the soil vapor location and is situated approximately 40 ft topographically downgradient.

SV-104

The following VOCs were detected in the soil vapor analysis: acetone; benzene; dichlorodifluoromethane; ethylbenzene; heptane; hexane; methylmethacrylate; naphthalene; styrene; tetrachloroethene; toluene; trichloroethene; trichlorofluoromethane; and m,p-xylene.

Of the constituents identified in SV-104, only acetone was detected in surface soil sample SS-105, at a concentration of 42 µg/kg.

VOCs were not detected above analytical laboratory method detection limits at subsurface soil sample location SB-174 or the groundwater sample from temporary piezometer GW-105. The soil boring is located approximately 80 ft from the soil vapor location and is situated approximately 20 ft topographically downgradient. This temporary piezometer is located over 75 ft from the soil vapor location and is situated approximately 20 ft topographically downgradient.

SV-105

The following VOCs were detected in the soil vapor TO-15 analysis: benzene; bromoform; chloroform; dichlorodifluoromethane; ethylbenzene; heptane; hexane; 124TMB; 135TMB; 4-ethyltoluene; methylmethacrylate; naphthalene; styrene; tetrachloroethene; toluene; and trichlorofluoromethane; m,p-xylene; and o-xylene.

Of the constituents identified in SV-105, only acetone was detected in surface soil sample SS-106, at a concentration of 46 µg/kg.

There were no nearby subsurface soil samples collected in the proximity of SV-105. VOCs were not detected above analytical laboratory detection limits in the groundwater sample collected from temporary piezometer GW-106, located within a few ft of the soil vapor location.

SV-106

The following VOCs were detected in the soil vapor TO-15 analysis: acetone; benzene; bromoform; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; heptane; hexane; methylmethacrylate; MIBK; naphthalene; styrene; tetrachloroethene; toluene; trichloroethene; trichlorofluoromethane; 124TMB; 135TMB; m,p-xylene; and o-xylene.

There were no nearby subsurface soil samples collected in the proximity of SV-106.

VOCs were not detected above analytical laboratory detection limits at surface soil sample SS-107 or the groundwater sample collected from temporary piezometer GW-107, located within a few ft of the soil vapor location.

SV-107

The following VOCs were detected in the soil vapor TO-15 analysis: benzene; bromoform; chloroform; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; heptane; hexane; methylmethacrylate; naphthalene; styrene; tetrachloroethene; toluene; 1,1,1-trichloroethane; trichloroethene; trichlorofluoromethane; 124TMB; 135TMB; m,p-xylene; and o-xylene.

Of the constituents identified in SV-107, the following were also detected in the groundwater sample collected from temporary piezometer GW-108: 124TMB; benzene; m,p-xylene; and o-xylene, with concentrations below 0.77 µg/L. This temporary piezometer is located within a few ft of the soil vapor location and on the same general terrain.

There were no nearby subsurface soil samples collected in the proximity of SV-107.

VOCs were not detected above analytical laboratory detection limits at surface soil sample SS-108.

Soil Vapor Samples in Proximity to Residential Structures

The following three soil vapor samples, SV-100, SV-106, and SV-107 were located closest to western adjoining property residential structures as noted in Section 5.4 above. Remaining soil vapor samples were at a distance far enough from the western Site boundary and/or topographically separated so as to not be proximal to nearby structures as noted by the distances in Section 5.4 above.

Twenty-two VOCs were detected in one or more of these soil vapor samples including acetone, benzene, bromoform, chloroform; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; heptane; hexane; methylmethacrylate; MIBK; naphthalene; styrene; tetrachloroethene; toluene; 1,1,1-trichloroethane; trichloroethene; trichlorofluoromethane; 124TMB; 135TMB; m,p-xylene; and o-xylene. The concentrations detected were generally low, not indicative of a source, and generally consistent among soil vapor samples.

One of the RI objectives was to evaluate the potential presence of historic dry cleaning operations on a nearby property, 27-31 Riverview Place (adjoining the northwestern most boundary of the 1 Cottage Street parcel), including the potential for the presence of solvents and the potential for groundwater migration onto the Site. The analytical results of the soil vapor samples collected (and nearby groundwater sampling, as described in Section 6.4) are not indicative of subsurface impact by dry cleaning operations.

Currently there are no general USEPA standards, criteria, or guidance values (SCGs), to compare soil vapor sample analytical results against. NYSDOH has a guidance document for soil vapor concentrations attributable to vapor intrusion. NYSDOH states that volatile chemicals in soil vapor commonly detected and can be attributable to background interferences (not associated with the Site's former activities). NYSDOH recommends that soil vapor sampling results be reviewed in conjunction with the results of other environmental sampling and the CSM.

Analytical results for VOCs for media collected as part of the SV evaluation are presented on **Tables 12A-12C**.

The purpose of the soil vapor sampling was to evaluate the potential for vapor intrusion. The low concentrations of constituents detected in soil vapor suggest the probability for vapor intrusion into existing off-Site buildings is low. Constituents in nearby soil and groundwater samples were generally non-detect. Although there are low concentrations of VOCs identified in some of the groundwater samples collected from lower elevations, the limited constituents detected and the relative horizontal and vertical distance from the soil vapor sample locations suggests that these detections are not related to those identified in the soil vapor.

5.5.3 Field Observations/Physical Characteristics

During field implementation of the soil vapor evaluation, slight petroleum odors were detected at two soil boring locations SB-172/GW-103 and GW-106. The odors were generally observed at depths between 4.5 ft and 13 ft bgs. Observations of fill including black granular material, coal, fractured concrete, brick fragments were found at several sample locations, including SB-172/GW-103, SB-173/GW-104, SB-174/GW-105, GW-106, GW-107, and GW-108. A slight petroleum odor was detected in the groundwater at GW-103, though no sheens were observed. The locations where petroleum odors were observed are in low-lying areas and generally not in the vicinity of the soil vapor samples situated at higher terrain elevations on the western slope of the Site.

6. CONCEPTUAL SITE MODEL

A CSM was developed in the RI Work Plan (OBG, 2015) based on the data provided in the prior Site investigations, that are discussed in Section 2.6. This CSM has been updated as presented below based on the data and information collected during the RI.

6.1 HISTORIC OPERATIONS AND ASSOCIATED STRUCTURES

The Site was historically operated as a petroleum refinery, blending, and bulk oil storage facility from approximately 1866 to approximately 1930 that encompassed approximately 40-acres with a footprint spanning both north and south of Flint Street. The Vacuum Oil Company Refinery operated the petroleum refinery, blending operations, and bulk storage at portions of the Site (including several adjoining properties) from approximately 1866 to around the early 1890s. From the early 1890s until its closure in 1935, the Site operated as a blending facility. Crude oil, kerosene, naphtha, finished lubricants, and containers for these products (*e.g.*, wooden barrels, tin cans, and drums) were manufactured and stored on the facility properties. Operations and facilities that formerly occupied the Site include the former canal beds, rail yard, stave (barrel component) storage and potentially underground facilities that previously serviced related manufacturing operations.

Additionally, a structure, potentially a greenhouse/nursery, was depicted on the Site parcel identified as 1 Cottage Street in an aerial photograph and City Plat dated 1926, and a 1938 Sanborn® Fire Insurance Map. A former dry cleaning operation was noted to be located off-Site to the west at 27-31 Riverview Place, adjoining the northwestern most portion of the 1 Cottage Street parcel.

The former canal occupied the 1320 S. Plymouth Avenue parcel. The canal was later converted to the rail bed for the Western New York & Pennsylvania Railroad. The railroad line was decommissioned in approximately 1971. Concrete remnants associated with retaining walls for the railroad are still visible in some locations on this parcel (**Figure 4**). Canal wall structures that were originally thought to be in place were not identified during the investigation and reportedly constructed of wood.

Remnants of several buildings and the railroad are evident on the parcels that make up the Site. In addition, a former MCPW water line and an active sewer line were identified within and adjacent to the east side of the former canal during the pre-investigation activities. As described in Section 3.1.3, a former MCPW reinforced-concrete sewer line was identified within and adjacent to the west side of the former canal adjacent to an existing MCPW sewer line, and a former water line was identified on the east side of the former canal (associated with a former Vacuum Oil refinery hydrant system), during the pre-investigation activities. A product transfer line was initially thought to have been installed at the base of the former canal on the Site; however, investigation activities conducted to locate utilities did not identify the presence of this line and further information suggests that it was located on the properties to the north of Flint Street.

6.2 SITE GEOLOGY

The site is underlain by fill followed by native silt and sand deposits. Gravel lenses, most likely representative of alluvial channel deposits, are present at the top of bedrock in the vicinity of the Genesee River on the east side of the Site. Bedrock is present at depths ranging from 10 ft to 19 ft below grade. The bedrock surface dips to the southeast.

6.3 SITE HYDROGEOLOGY

Groundwater occurs at depths ranging from 3 ft to 4 ft within the former canal on the west side of the Site to 10 ft to 12 ft below grade on the east side of the site near the Genesee River. Based on these measurements, the groundwater table appears to be relatively flat with a north to northwest flow component within the former canal area of the site (1320 S. Plymouth Avenue). The northern flow component of groundwater within the former canal is partially driven by the higher ground water elevations noted on the southern end of the Site and

may also be indicative of preferential flow along the canal backfill and/or old sewer and water lines in this area of the site. Furthermore, the flow direction observed in wells completed during this RI is not consistent with the flow direction observed during the RI completed on the adjoining 5 Flint Street Parcel by Ravi (Ravi, 2016b).

The Genesee River staff gauge managed by USGS reports that gauged at 512.6 ft which is approximately 5 ft higher than that observed in the wells adjacent to the river suggesting that there is limited hydraulic connection between the overburden groundwater and the river across the northern end of the Site. Review of construction information in preparation for upgrading of the river wall in this area indicates that the existing river wall structure extends to the bedrock surface at least along the reach adjacent to the northern end of the Site. This structure is suspected to limit the hydraulic connection between the groundwater at the Site and the river. These conditions could change if the wall is removed in the future.

6.4 NATURE AND EXTENT OF SITE COCS

During the RI activities, samples of four media (surface soil, subsurface soil, groundwater, and soil vapor) were analyzed for a range of constituents that included VOCs, SVOCs, metals, cyanide, pesticides, and PCBs. The results of these analyses identified several COCs. A COC is a constituent that is sufficiently present in frequency and/or concentration to require evaluation of remedial action. **Tables 7A-7C** provide a summary of the frequency of exceedances of criteria for constituents in surface soil, cover soil, and subsurface soil samples, respectively. Groundwater COCs were identified if a constituent exceeded the Class GA criteria in both sampling events. Summaries of detections and frequency of exceedances of criteria for groundwater from overburden and bedrock wells is provided on **Tables 7D** and **7E**. Based on these criteria, the following COCs have been identified at the Site.

Surface Soil

VOCs were not identified above SCOs in surface soil. In general, SVOCs and metals were the constituents identified most frequently above one or more SCOs in surface soils. Exceedances of SCOs were noted in samples along the southern border of the Site parcels suggesting that similar exceedances may be present off-Site depending on topography.

SVOCs and specifically, one or more of PAH compounds were identified in at least 11 of 34 surface soil samples analyzed. The exceedances were scattered across the 13 Cottage Street parcel and the 1320 S. Plymouth Avenue parcel. Comparison of the distribution of the locations where quantifiable SVOCs exceeded SCOs to the total SVOCs generally show a similar correlation; however, there are many locations with total SVOC values between 10 ppm and 100 ppm that do not contain quantifiable SVOCs above criteria. One surface soil sample (SS-112) on the 13 Cottage Street parcel contained total SVOCs greater than 100 ppm. This location also correlates to locations with quantifiable SVOCs above criteria. This sample contained evidence of fill material.

Arsenic is present above each of the SCOs in up to 37% of the surface soil samples analyzed. The locations of elevated arsenic concentrations in surface soil are scattered across the 1320 S. Plymouth Avenue and 13 Cottage Street parcels with the predominant exceedances located on the southern portion (south of the adjoining 5 Flint Street parcel). The maximum concentration of 65.4 mg/kg is much less than that observed in the subsurface soil. Potential sources of arsenic may be crude oil, coal, ash, cinders, pressure-treated railroad timbers, or the use of pesticides at the Site, as these materials would have typically been placed or distributed at or near the surface.

Mercury was detected above the Unrestricted Use SCO in half of the samples analyzed; however, only two samples exceeded the Residential Use and Restricted Residential SCOs. The sample locations exceeding the Unrestricted SCO are distributed across the site to the west of the raised flood-protection berm. Review of the statistic tables (**Table 7A**) indicates that mercury exceeded the Unrestricted Use SCO in surface soil in 52 percent of the surface soil samples as compared to 21 percent in subsurface soil.

Surface Cover

Similar to surface soil, surface cover did not contain VOCs above SCOs. In general, SVOCs and metals were the constituents identified most frequently above one or more SCOs in surface soils. Exceedances of SCOs were noted in samples along the southern border of the parcels suggesting that similar exceedances may be present off-Site depending on topography.

SVOCs and specifically, one or more of PAH compounds benzo(a) anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene, were individually identified in at least 20 of 47 surface cover samples analyzed. The exceedances were scattered across the 13 Cottage Street parcel and the 1320 S. Plymouth Avenue parcel and general west of the elevated berm. Comparison of the distribution of the locations where quantifiable SVOCs exceeded SCOs to the total SVOCs generally show a similar correlation; however, there are many locations with total SVOC values between 10 ppm and 100 ppm that do not contain quantifiable SVOCs above criteria. Four locations (SS-112, SS-142, SS-141, and SS-147) on the 13 Cottage Street parcel contained total SVOCs greater than 100 ppm. These locations correlate to locations with quantifiable SVOCs above criteria. There was evidence of on-Site dumping including a parts cleaner and metals shavings debris in the vicinity of several of these sample locations.

Arsenic is present above each of the SCOs as much as 51% of the surface cover samples analyzed. The locations of elevated arsenic concentrations in surface cover samples are scattered across the 1320 S. Plymouth Avenue and 13 Cottage Street parcels with the predominant exceedances located on the southern portion (south of the adjoining 5 Flint Street parcel). Arsenic was observed above SCOs in up to 51 percent of the surface cover samples although the maximum concentration was much less than that observed in the subsurface soil samples. Similar to surface soil, potential sources of arsenic may be crude oil, coal, ash, cinders, pressure-treated railroad timbers, or the use of pesticides at the Site. These potential sources would also more likely result in surface soil impacts rather than subsurface soil impacts, as these materials would have typically been placed or distributed at or near the surface.

Mercury was also detected above the Unrestricted Use SCO in more than half of the samples analyzed; however, only five samples exceeded the Residential Use and Restricted Residential SCOs. The sample locations with concentrations exceeding the unrestricted SCO are distributed across the site to the west of the raised flood-protection berm. Review of the statistic tables (**Table 7B**) indicates that mercury exceeded the Unrestricted Use SCO in surface soil in 60 percent of the surface soil samples as compared to 21 percent in subsurface soil.

Subsurface Soil

Only a limited number of VOCs were detected above SCOs and the frequency and concentrations detected did not suggest that VOCs would be considered a COC at the Site. However, PID readings in soil borings completed in the area on both sides of the adjoining 5 Flint Street parcel were generally elevated. The elevated PID values coupled with the presence of VOC TICs and lack of elevated quantified VOC concentrations suggest that VOCs are present which are likely degradation compounds or non-targeted VOCs that are not on the standard analyte list and for which there are no applicable standards. The degradation of the compounds is understandable given the period of operation of the facility and the undeveloped nature of the Site.

Similar to the surface soil samples, SVOCs detected in the subsurface soil samples above SCOs were PAH compounds benzo(a) anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd) pyrene. Review of the sample matrix table shows that the elevated concentrations were identified in approximately 37 percent of the identified fill samples and primarily associated with samples that were gray to black in color and in some instances contained coal fragments and ash. The primary PAH compounds identified as COCs are located on the 13 Cottage Street parcel. This area is also the primary location of samples with the highest total SVOC concentrations. The location of the SVOCs above SCOs do not correlate to the location of observations of odors and sheens which are concentrated in the northern portion of the 1320 S. Plymouth Avenue parcel between the adjoining 5 Flint Street parcel and adjoining 15 Flint Street parcel and along the east side of the adjoining 5 Flint Street parcel. This suggests that the SCO exceedances were associated

with the coal and ash within the samples rather than petroleum residuals suggested by the odors, sheens, and elevated PID readings.

Arsenic was identified above SCOs in 31 of the 123 subsurface soil samples analyzed for metals (25 percent). Samples containing arsenic were located south of the adjoining 5 Flint Street Parcel on both the 1320 S. Plymouth Avenue and 13 Cottage Street parcels. Three of the samples containing the highest concentrations of arsenic were located in the northern end of the former canal near Flint Street.

Mercury was also detected above the Unrestricted SCOs in approximately a quarter of the samples analyzed. The sample locations exceeding one or more SCO are distributed across the site. Similar to arsenic, almost three quarters of the samples containing mercury above one or more SCO were described as containing ash, cinders, coal, or were black or dark gray in color and only a few were noted to have a petroleum or oily type of odor.

As discussed previously, odors and staining were noted in soils primarily in the north end of the canal (1320 S. Plymouth Avenue), both sides of the adjoining 5 Flint Street parcel and on the 13 Cottage Street parcel. The odors were noted from the surface to the base of the boring or test pit in most areas. In drilling locations situated closer to the river, only staining was noted at depth suggesting that this may be associated with migration with groundwater or be an older surface that was covered with unimpacted fill in areas such as the flood control berm. Consistent with the odors, PID readings were recorded in soil samples at levels ranging from background to more than 100 ppm. The highest concentrations were located on the north end of the former canal, and on both sides of the adjoining 5 Flint Street parcel. As these observations do not correlate to elevated concentrations of quantified VOCs and SVOCs, it is likely that they represent VOC or SVOC residuals due to degradation and/or non-target VOCs and SVOCs. There were no observances of non-aqueous phase liquids (NAPL) or grossly impacted soil suggestive of discharges of liquids to the surface or disposal by landfilling.

Groundwater

PCBs were only detected in a single sample from OVR-100 during the first sampling event. . Although the concentration was above the groundwater standard of 0.09 µg/L PCBs were not detected during the other sampling event and therefore, not considered a COC.

With the exception of four locations, the detection of VOCs and SVOCs at concentrations above criteria were limited in number and generally only found in one of the two groundwater sampling events. Chlorinated VOCs were identified in overburden groundwater monitoring wells OVR-107, and OVR-132 during both events. These wells are both located on the east side of the adjoining 5 Flint Street parcel. The location of these overburden groundwater monitoring wells with respect to the former dry cleaner located at 27-31 Riverview Place and other nearby historic operations described in Section2.2.1 do not suggest a relationship. Chlorinated VOCs were also detected on the south side of the building on the adjoining 5 Flint Street property during the Ravi investigation (Ravi, 2016a). Acetone and xylenes were the VOCs above criteria in overburden groundwater monitoring well OVR-117 located south of the adjoining 5 Flint Street property. The location and types of VOCs observed in the overburden groundwater monitoring wells OVR-132/OVR-107 and OVR-117 suggest different sources.

In addition to the VOCs, several SVOCs were identified to be above criteria in the groundwater samples collected from overburden groundwater monitoring well OVR-119. This well is also located south of the adjoining 5 Flint Street property. SVOCs were also reported to be present in several groundwater samples collected from wells on the south end of the adjoining 5 Flint Street property during the Ravi investigation suggesting that they could be related to the SVOCs identified in overburden groundwater monitoring well OVR 119.

Arsenic was detected in the groundwater above the Class GA groundwater standard in seven overburden groundwater monitoring wells located on the north end of the 1320 S. Plymouth Avenue parcel between the adjoining 5 Flint Street and adjoining 15 Flint Street parcels and the east side of the adjoining 5 Flint Street parcel. The 1320 Plymouth Avenue parcel was also where the subsurface soil samples with the highest arsenic were located. Given the groundwater flow directions observed in the northern part of the canal there is the

potential for off-Site migration in this area. No soil samples were analyzed for metals at overburden groundwater monitoring well OVR-105 although a soil sample from SB-171 contained arsenic at 9 mg/kg (below SCOs). Arsenic was detected above the criterion in both events in three of the groundwater monitoring wells and only during the one of the two events in four of the groundwater monitoring wells. Arsenic was also noted to be elevated in groundwater samples collected from the adjoining 5 Flint Street and adjoining 15 Flint Street parcels during the RI conducted by Ravi (Ravi, 2016a) suggesting similar source or communication of groundwater.

Iron, manganese, magnesium, and sodium were detected in the groundwater collected from most, if not all, of the groundwater monitoring wells above Class GA SGVs. These results are consistent with local geology and the widespread use of rock salt on area roads in the winter and do not appear to be associated with past operations. Therefore, these compounds are not considered COCs at this Site.

7. QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

A QHHEA was completed for the Site and is presented in this section. The QHHEA was conducted in accordance with New York Environmental Conservation Law (ECL) §27-1415(2)(b) and Section 3.3(c)(4) and Appendix 3B of DER-10. As presented in DER-10, the purpose of the QHHEA is to evaluate and document the potential exposure routes and pathways, and to identify and characterize the potentially exposed populations currently and under reasonably anticipated future use of the Site.

Environmental media assessed in the RI for potential impacts from historical Site operations and practices and potential human exposure include soil, groundwater, and soil vapor. The 15.4-acre Site is owned entirely by the City and is currently, as detailed in Section 2.4, undeveloped and covered by dense overstory and understory vegetation. A paved recreational bike path (Genesee Riverway Trail) traverses the Site near the Genesee River and parkland occupies a small area along the eastern part of the Site. The planned redevelopment of the Site and surrounding properties, which incorporates mixed commercial and restricted-residential use, is critical to the evaluation of future use and exposure scenarios. As stated in Section 2.7, redevelopment on the BCP Site would occur during the various BOA Master Plan phases.

7.1 HUMAN HEALTH CONSTITUENTS OF POTENTIAL CONCERN

The Site has been the subject of historical investigation and data collection efforts since the 1990's, as presented in Section 2. Media for which quantitative historical data are available include soil and groundwater, however, a portion of the data were un-validated, the sample size was low, and recollection and reanalysis efforts were completed as part of the RI for a portion of the samples. Therefore, only data collected during the RI are evaluated in this QHHEA.

As described in Section 2.7, the redevelopment of the Site will occur according to the BOA Master Plan to include multi-family residential, commercial/retail, and industrial facilities through a phased implementation. Given the reasonably anticipated future use of the Site for mixed-use, as well as current and likely future zoning, the soil and groundwater data have been evaluated against the following standards/guidance values:

- Restricted-Residential Use SCOs
- Class GA SGVs.

Constituents that were detected in each medium are designated as constituents of potential concern (COPCs) for evaluation of human health exposures if they exceed screening criteria that correspond with current and probable future land use. Although Unrestricted Use SCOs were included as a conservative measure to evaluate the nature and extent of contaminant impacts at the Site (Section 5), this QHHEA utilizes the Restricted-Residential SCOs given that the current and probable future use at the Site includes active recreational areas, likely redevelopment to support commercial use and multi-tenant residential housing. If current or future land use conditions were to change (*e.g.*, construction of single-family homes), alternative screening criteria (*e.g.*, Unrestricted Use SCOs) may be applicable. This QHHEA considers as a COPC any constituent that exceeds the Restricted Residential SCO regardless of frequency or concentration as a conservative assessment of potential for exposures.

In addition to soil and groundwater, soil gas samples were collected at eight locations adjacent to residential properties at the perimeter of the Site. There are no New York State numerical screening/cleanup values specific to soil vapor alone for evaluating indoor air exposures.

The exposure media evaluated for this QHHEA are surface soil, subsurface soil, shallow groundwater, and soil vapor. Additional details regarding the COPCs identified in these media are presented below.

7.1.1 Surface Soil

For the purposes of the QHHEA, surface soil is defined as soil collected from a depth of up to 2 ft bgs. Surface soil represents the environmental medium that is likely to be encountered by individuals engaged in activities that result in only modest soil disturbance and not in activities resulting in purposeful excavation or subsurface work activities.

Constituents were analyzed in the surface soil horizon for one or more of the following: VOCs, SVOCs, pesticides, PCBs, metals, and cyanide. Results are presented in detail in Section 5.1 and **Tables 5A-5E**, and are summarized below:

- No VOCs were detected above Restricted-Residential Use SCOs.
- Of the SVOCs analyzed, 14 COPCs were identified based on exceedances of Restricted-Residential Use SCOs in at least one sample. Only PAH compounds exceeded their respective cleanup levels.
- No organochlorine pesticides were detected at concentrations above their respective Restricted-Residential Use SCOs.
- Total PCBs exceeded its Restricted-Residential Use SCO in two surface soil samples.
- Arsenic was detected above the Restricted-Residential SCO in 23 of the 47 locations analyzed for metals. Five additional metals (barium, cadmium, copper, lead, and mercury) were detected above their corresponding Restricted-Residential Use SCO in at least one location. All cyanide sample concentrations were below the Restricted-Residential Use SCO.

As discussed in Section 6, constituents are present above SCOs in some samples collected in the vicinity of the southern border of the Site. This suggests that similar concentrations may be present off-Site.

7.1.2 Subsurface Soil

For the purposes of qualitatively evaluating human exposures to soil, subsurface soils are defined as those between 2 ft and the depth to which current and/or future subsurface utility lines are or will be located (typically 10 ft to 12 ft bgs). Consequently, soil boring and test pit data from 2 ft to 12 ft bgs were considered appropriate for assessment in the QHHEA. Subsurface soil within this interval can be encountered by human receptors during excavation and other subsurface work activities such as construction and/or utility line work. Consequently, all subsurface soil samples collected from 2 ft to 12 ft bgs were evaluated for potential human health COPCs.

Tables 8A-8E presents the comparison of constituent concentrations in subsurface soil to the Restricted-Residential SCOs. These tabulated results are discussed in Section 5.3, and are summarized below:

- No VOCs were detected above Restricted-Residential Use SCOs.
- Of the SVOCs analyzed, 13 human health COPCs were identified based on exceedances of Restricted-Residential Use SCOs in at least one sample. Semi-volatile chemicals exceeding Restricted-Residential Use SCOs were represented by PAH compounds.
- No organochlorine pesticides were detected at concentrations above their respective Restricted-Residential Use SCOs.
- Total PCBs did not exceed the Restricted -Residential Use SCO.
- Arsenic was detected above the Restricted-Residential SCO in 27 of the 123 locations analyzed for metals. Five additional metals (cadmium, copper, lead, manganese, and mercury) were detected above their corresponding SCO in at least one location. All cyanide sample concentrations were below the SCO.

In subsurface soil constituents exceeding criteria are observed at the northern end of the canal. These constituents could extend off-Site to the north, depending on the subsurface conditions.

7.1.3 Groundwater

As described in Section 4.3.3, a total of 33 overburden wells and five bedrock wells were installed at the Site to evaluate overburden and bedrock hydrogeology. Depth to overburden groundwater ranges from 3 ft to 4 ft bgs on the western portion of the Site within the former canal to 10 ft to 12 ft bgs on the eastern boundary adjacent to the river. Depth to water in shallow bedrock wells ranged from approximately 2 ft to 7 ft bgs. Groundwater occurs at depths across the Site that select human populations (*e.g.*, subsurface workers) could incur exposure via direct contact. Groundwater beneath the Site and in the general vicinity is not known to be used, and public water is available and in use. A screening of Site groundwater concentrations to Class GA SGVs for the protection of drinking water therefore is not appropriate. Class GA SGVs may be utilized to identify human health COPCs for the most likely exposure route for subsurface workers (dermal contact).

Tables 10A-10D presents the comparison of constituent concentrations in shallow groundwater to the Class GA SGVs. These tabulated results are discussed in Section 5.4, and are summarized below:

- A total of 14 VOCs were detected above SGVs in shallow groundwater in one of the two groundwater sampling events.
- Of the SVOCs analyzed, eight human health COPCs were identified based on exceedances of groundwater SGVs; seven of these compounds were PAHs. Bis(2-ethylhexyl) phthalate also exceeded its SGV.
- Aroclor-1248 exceeded its SGV in one overburden well in one of the two sampling events based on a "J"-qualified sample result.
- A total of 14 metals were detected above corresponding SGVs in at least one well. Eight of these metals (barium, beryllium, cadmium, chromium, copper, lead, nickel, and selenium) only exceeded their respective SGVs in a single groundwater sample. All cyanide sample concentrations were below the SGV.

Based on groundwater flow data collected during this RI, migration of groundwater to the river is not expected to occur. However, there is the potential for migration of groundwater to the north in the area of the former canal.

7.1.4 Soil Vapor

As discussed in Sections 5.4, there are no soil gas screening, cleanup, or guidance values to evaluate potential exposures via vapor intrusion based on this medium alone. The NYSDOH vapor intrusion guidance document recommends an approach utilizing multiple lines of evidence (*e.g.*, soil vapor, groundwater), Site geological conditions, and current and future land use to evaluate indoor air inhalation exposures attributable to vapor intrusion.

Soil vapor samples collected during the RI were located along the perimeter of the Site to assess the potential for off-site migration of soil vapor in the direction of adjoining western residential properties. A total of 20 VOCs were detected in at least one soil vapor sample (**Tables 12A-12C**). However, as discussed in Section 5.4 the concentrations were low and do not suggest off-Site migration.

7.2 POTENTIAL SITE-RELATED HUMAN HEALTH COPC MIGRATION PATHWAYS

The potential for migration of Site-related human health COPCs in soil, shallow groundwater, and soil vapor depends on the physical, chemical, and biological characteristics at the Site and the chemical and physical attributes of the COPCs. A discussion of potential migration pathways for human health COPCs in soil, groundwater, and soil vapor is presented below.

7.2.1 Surface Soil

Surface soil samples were collected from the 0 ft to 2 ft bgs depth interval in unpaved areas containing extensive vegetative cover that is present currently but that may be removed during future redevelopment activities. COPCs in Site surface soil are subject to physical and chemical processes that influence their mobility, including changes in valence state, adsorption, and transport via percolation and overland runoff. Transport of COPCs at the Site under current conditions is considered minimal given the presence of vegetation in most areas, particularly in areas of minimal topographic relief. Although the ground surface slopes upwards on the west and east sides of the Site, runoff from these areas would flow toward rather than away from the former production area on the northern and central portions of the Site. Under this scenario the Site would receive runoff from the adjoining 15 Flint Street parcel as well as nearby residential properties located along the western Site boundary. During periods of sufficient rainfall, COPCs in surface soils may be transported in stormwater via drainage ditches or sheet flow to low-lying areas such as the isolated wetlands described in Section 4.1.1.

Because the Site is slated for redevelopment to support commercial and restricted-residential use, excavation of surface (and subsurface) soils will likely occur. Migration of COPCs through the soil column may therefore be facilitated through reworking of Site soils during future redevelopment activities. This may result in higher or lower human exposures to COPCs in surface soil, depending on where excavation/construction is to occur and the types of receptors (*e.g.*, future residents, construction workers) present in the area where soil disturbance will have occurred. The placement of imported soils, topsoil, and/or engineered structures (sidewalks, parking lots, buildings) atop Site-associated soils would limit or potentially eliminate exposure to residual COPCs in surface soil.

7.2.2 Subsurface Soil

Subsurface soil, as defined for the QHHEA, ranges from 2 ft to 12 ft bgs. Migration of COPCs in subsurface soil by natural transport processes is likely to be minimal, as these soils are not subject to weathering or storm water runoff. Under current conditions, roots from the numerous trees on the Site parcels are likely to greatly restrict transport of COPCs in subsurface soils, even in areas characterized by sloping topography, mitigating the potential that subsurface COPCs could be unearthed and transported to the surface where they could be contacted by recreational or residential receptors. Subsurface soils may interact with groundwater in areas where a shallow water table is present; in this instance, lateral and vertical movement of COPCs is a potentially important migration process in the subsurface soil matrix.

As discussed above, reworking of soils will occur during future excavation, filling, construction, and other redevelopment activities, resulting in potential redistribution of COPCs in areas where these activities occur. Human exposures to subsurface soil COPCs in these re-worked soils may be lower or higher than those potentially incurred under current conditions.

7.2.3 Groundwater

Site groundwater contains concentrations of organic and inorganic constituents above Class GA SGVs in select wells. With the exception of four locations, the detection of VOCs and SVOCs at concentrations above criteria were limited in number and generally only found in one of the two groundwater sampling events. VOCs and SVOCs were identified above criterial in both events were wells located to the east and south of the 5 Flint Street parcel. VOCs were also identified in the groundwater on the adjoining 5 and 15 Flint Street parcels and, if these concentrations are persistent, they will tend to migrate downgradient with groundwater flow, while less mobile constituents such as SVOCs will adhere to organic ligands and fine particles within the saturated soil matrix. The general direction of shallow groundwater flow is to the north within the former canal, with components potentially flowing to the northeast or northwest depending on Site location. The groundwater quality data collected do not suggest that impacted groundwater discharges to the river or other river sensitive downgradient receptors where direct human contact could occur.

Transport of Site-related VOCs in groundwater can be affected by various processes that result in reduced concentrations, including volatilization, diffusion, sorption, and degradation. Inorganic constituents in

groundwater are potentially subject to biologically and physically induced chemical reactions (*e.g.*, oxidation/reduction), which can markedly affect their mobility.

7.2.4 Soil Vapor

Volatile compounds in soil and groundwater have the potential to migrate into the interstitial air spaces within soil. Where this occurs below hypothetical future buildings or structures, VOCs originating from soil and groundwater could enter indoor air of an occupiable space and subsequently be inhaled. The potential for vapor intrusion to future buildings is governed by several factors, including target building location, COPC concentration, pressure differentials, building properties, presence and width of cracks in a building's foundation, and vadose zone soil temperature. Attenuation processes described above for groundwater can also mitigate soil vapor concentrations and potential indoor air concentrations when soil vapors discharge to a building.

Depending on the location of the future buildings, the potential presence of VOCs in Site groundwater and detection of odors and elevated PID readings in soil suggests the potential that COPC VOCs could migrate as vapors in soil and into the indoor air of a future building. Because commercial and/or residential structures will be constructed on the Site property under the current redevelopment plan, the vapor intrusion pathway is potentially complete. The New York State Vapor Intrusion Guidance provides direction to evaluate this potential (NYSDOH 2006).

7.3 POTENTIALLY EXPOSED RECEPTORS AND EXPOSURE PATHWAYS

This section identifies the potential exposure pathways through which there may be exposure to Site-related human health COPCs. An exposure pathway analysis describes the transport of a COPC from the affected medium to the exposed receptor. An exposure pathway links the potential sources, exposure media, and receptor populations to identify potential pathways of human exposure.

As defined in DER-10 (Appendix 3B), an exposure pathway has five elements:

- A source and mechanism of COPC release to the environment
- An environmental transport medium (*e.g.*, soil) for the COPC and/or mechanism of transfer from one medium to another
- A point of contact with the impacted environmental medium (exposure point)
- An exposure route at the contact point (*i.e.*, ingestion, inhalation, or dermal contact)
- A characterization of the receptor populations who may be exposed.

A pathway is considered to be complete if all five conditions listed above are satisfied for that pathway. If one or more of these conditions are not met, there is no physical means by which a receptor may be exposed to the COPCs, and the pathway is considered incomplete.

The exposure pathways considered for evaluation in this QHHEA include direct contact with surface and/or subsurface soils via ingestion, dermal contact, and inhalation of ambient vapors and fugitive dust. Direct exposure (dermal contact and incidental ingestion) to overburden groundwater is also a potentially complete exposure pathway. Potential indirect exposure via inhalation of groundwater-derived vapors in indoor air is also considered a complete pathway. Public water is available in the Site area; therefore, groundwater is not considered a current or future source of potable water. Within the City of Rochester Codes, specifically Chapter 59, Article III, Section 59-27, only potable water authorized for public use by the City of Rochester may be used for drinking purposes or in the preparation of food intended for human consumption.

The demography of local populations and land use characteristics were considered in identifying the human receptor populations potentially exposed to impacted soil, groundwater, and soil vapor at the Site. The potential

exposure pathways associated with current and reasonably anticipated future receptors are discussed in the following section. As a conservative measure, these pathways and receptors may also apply to some of the properties adjoining the Site where constituents were identified above SCOs at the Site boundaries.

7.3.1 Receptors and Exposure Pathways

The exposure pathways and receptors considered in the QHHEA are as follows:

- ***Current/future recreators:*** Recreator users may utilize the Site for walking, running, biking, picnicking, traversing the bank of the Genesee River, or other recreational activity. Adult (>18 years old) recreators are anticipated to use the Site for multiple recreational uses. Young (0-<6 years old) and older (6-<18 years old) children likely may use the Site for general play activities. Potentially complete exposure pathways for child and adult recreators include incidental ingestion of surface soil, dermal exposure to surface soil, and inhalation of fugitive dust.

  It is noted that a recreational bike trail traverses the Site. While consideration was given to a bike trail recreator-specific exposure scenario, this current and future receptor would hypothetically be exposed to only a relatively narrow corridor of land at the Site, even under the assumption that a bike trail recreator may stop somewhere on the Site, dismount, and venture away from the bike trail a limited distance. Consequently, to provide sufficient protectiveness in the QHHEA, the recreator receptor is assumed to be exposed to surface soil across the entire Site.

- ***Current/future trespasser:*** A trespasser is a person that gains access to the Site without permission and may be of adolescent (12-18 years old) or adult (>18 years old) age. The Site contains no fencing or other boundary controls along its perimeter, therefore it is feasible that trespassers may access the entirety of the Site. The Site has limited impermeable surfaces and cover materials that would mitigate exposures to trespassers. Trespassers are unlikely to dig to depths greater than two ft below the surface, therefore incidental ingestion of and dermal contact with surface soil and inhalation of fugitive dust are possible exposure routes for this receptor group.

- ***Current/future utility worker:*** Subsurface utilities at the Site (*e.g.*, sewer line along the unpaved trail) may require periodic inspection, servicing, and maintenance both currently and in the foreseeable future. The utility worker is presumed to be of adult age (>18 years old) and may be exposed to Site-related COPCs in surface and subsurface soil through incidental ingestion, dermal contact, and soil dust inhalation. Utility workers could also inhale groundwater-derived soil vapors while engaging in subsurface work activities. Since groundwater is shallow (less than 10 ft in most places), the utility worker may also be directly exposed to groundwater via incidental ingestion and dermal contact.

- ***Future commercial /industrial worker:*** Commercial/industrial workers of adult age (>18 years old) are assumed to perform a variety of work functions associated with commercial or manufacturing activities. The activities of these workers at the Site would include working within future Site building spaces, working outside in storage areas and equipment yards, and taking breaks in communal spaces and outdoor rest areas. Based on these primary occupational activities, potential exposure pathways for this receptor include inhalation of groundwater-derived VOC vapors in the interior spaces of buildings, inhalation of fugitive soil dust, and incidental ingestion of, and dermal contact with, surficial soil.

  Future store or commercial business patrons were also considered as potential receptors given the likely re-use of at least a portion of the Site for commercial purposes. The store patron receptor is presumed to be more minimally exposed than the commercial/industrial worker since this receptor would likely use engineered features (*e.g.*, roads and sidewalks) to access future stores that may be constructed on the Site. Additionally, the exposure duration and frequency of a store patron would be less than that for a worker. As such, exposures incurred by commercial/industrial workers would conservatively address those for a store patron.

- ***Future construction worker:*** A construction worker is selected as a receptor for this QHHEA due to the potential for excavation and/or construction to occur across the Site in the future. The construction worker is an adult (>18 years old), and may be exposed to Site-related surface and subsurface soil COPCs via incidental ingestion, dermal contact, and incidental inhalation of groundwater-derived ambient vapors and fugitive dust. These workers may also be directly exposed to groundwater COPCs via dermal contact and incidental ingestion with affected groundwater.
- ***Future resident:*** Evaluations of resident exposures to chemicals are typically conducted on young children and adults. Therefore, the current/future resident exposure assessment is focused on young children (<6 years old) and adults (>18 years old). Under a future use scenario, child and adult residents' exposure routes include incidental ingestion of and dermal contact with surface soil, inhalation of fugitive dust, and inhalation of groundwater-derived VOC vapors in the interior space of residential buildings. As discussed previously, the Site and surrounding area is supplied potable water from an off-Site water source, and direct exposure to groundwater is unlikely.

Facility contractors/subcontractors associated with the potential collection and handling of future environmental samples and with the potential management of impacted soil and groundwater are not considered in this QHHEA. Contractor/subcontractor activities are typically covered under a facility-specific HASP, which provides for the use of PPE and includes preventative procedures for eliminating exposure and maximizing personal safety. Therefore, Site contractors/subcontractors are not considered a viable receptor population for the QHHEA.

7.3.2 Exposure Pathway Summary

A summary of the environmental media, exposure pathways, and potential human receptors relevant to the Facility Site QHHEA are presented in Table 7-1 below.

Table 7-1 Human Exposure Pathway Analysis.

Environmental Media and Exposure Pathway	Potential Receptors	Human Exposure Assessment
Direct contact with surface soils (0 ft to 2 ft bgs) via incidental ingestion, dermal contact, inhalation of soil dust.	■ Current/future recreator ■ Current/future trespasser ■ Current/future utility worker ■ Future construction worker ■ Future commercial/industrial worker ■ Future resident	■ Current/future recreators and trespassers may be exposed to COPCs in surface soils while traversing the Site through a publicly accessible trail (*i.e.*, Genesee Riverway Trail) or by venturing off-trail into nearby vegetated areas. ■ During underground utility line inspection, servicing, and maintenance activities, current/future utility workers could encounter COPCs in surface soil. ■ Future construction activities associated with redevelopment of the Site to support residential housing are presumed to occur on the Site, potentially exposing the construction worker to COPCs in surface soil. ■ Under a hypothetical future use scenario (BOA Master Plan) exposure to surface soil by future commercial/ industrial workers and residents is possible.
Direct contact with subsurface soils (2 ft to 12 ft bgs) via incidental ingestion, dermal contact, inhalation of soil dust.	■ Current/future utility worker ■ Future construction worker	■ During underground utility line inspection, servicing, and maintenance activities, current/future utility workers could come into contact with subsurface soil through incidental ingestion, dermal contact, and inhalation of soil dust. ■ Future construction workers may be exposed to subsurface soil during excavation/construction activities that may result in exposure via incidental ingestion, dermal contact, and inhalation of soil dust.

Environmental Media and Exposure Pathway	Potential Receptors	Human Exposure Assessment
Inhalation of groundwater-derived ambient vapors	■ Current/future utility worker ■ Future construction worker	■ During utility line inspection, servicing, and maintenance activities, current/future utility workers could inhale VOC vapors migrating from shallow groundwater to outdoor air. ■ Future construction workers may be indirectly exposed to volatile COPCs migrating from shallow groundwater to outdoor air during excavation/construction activities via inhalation of VOC vapors.
Direct contact with groundwater via incidental ingestion and dermal contact.	■ Current/future utility worker ■ Future construction worker	■ Utility line inspection, servicing, and maintenance activities could occur at or below the water table. Current/future utility workers could come into contact with groundwater through dermal contact and incidental ingestion. ■ Future construction workers may be exposed to shallow groundwater during excavation/construction activities via dermal contact and incidental ingestion.
Inhalation of soil and/or groundwater-derived vapors in indoor air	■ Current/future commercial/industrial worker ■ Future resident	■ RI soil vapor data indicate that the vapor intrusion pathway could potentially be complete under the probable future use scenarios depending on the location of the building. Future commercial/industrial workers and residents could inhale vapors that may enter the interior of a commercial or residential structure from sub-slab soil gas. If identified, the potential infiltration of VOCs to the interior space of a future Site building could be mitigated by a properly designed vapor barrier or other mitigation system.

7.4 QHHEA SUMMARY

The objective of this QHHEA was to evaluate potential human exposure to Site-related human health COPCs under current and reasonably anticipated future use scenarios. The Site currently consists of inactive vacant parcels consisting primarily of vegetated woodlands and a recreational bike trail. The Site is currently the subject of remedial investigation which has identified Site-related human health COPCs in surface soil, subsurface soil, soil vapor, and shallow groundwater that could be contacted by select human receptor populations under current and/or reasonably anticipated future land use scenarios.

Recreators, trespassers, and utility workers represent the current receptor exposure scenarios for this QHHEA. Commercial/industrial workers, construction workers, recreators, residents, trespassers, and utility workers represent possible future receptors. Under current conditions, direct exposure to COPCs in surface soil by recreators, trespassers, and utility workers is possible. Only utility workers are potentially exposed to subsurface soils under the current scenario.

Future commercial/industrial workers, construction workers, residents, trespassers, recreators, and utility workers are potentially exposed to COPCs in surface soil. Future utility workers and construction workers are potentially exposed to COPCs in surface and subsurface soil and shallow groundwater. Commercial/industrial workers and residents may also be exposed indirectly to volatile COPCs in groundwater through the vapor intrusion pathway based on the RI groundwater and soil vapor investigations. A properly designed vapor barrier or other vapor mitigation system could be installed to mitigate potential infiltration of VOCs to the interior space of a future building, if needed. Additionally, redevelopment of the Site that supports human occupancy in future buildings would likely entail construction not only of the buildings themselves, but also the installation of asphalt lots, sidewalks, and landscaping/vegetative cover materials, all of which will eliminate or reduce future soil exposures.

8. FISH AND WILDLIFE RESOURCE IMPACT ANALYSIS

A Fish and Wildlife Resource Impact Analysis (FWRIA) was developed for this Site in accordance with Part 1 of the FWRIA process as described in NYSDEC's DER-10 Section 3.10.1 (Part 1 – Resource Characterization; NYSDEC 2010). The objective of the FWRIA-Part 1 for the Site is to describe the terrestrial and aquatic environments in the study area in terms of topography, covertypes, fish and wildlife resources and their value, and to identify the actual or potential impacts to fish and wildlife resources from potential exposure to contaminants of ecological concern (COECs). The following presents the conclusions resulting from the FWRIA process. The full FWRIA is included as **Appendix S.**

The Site is located in an urban setting and is not a significant habitat for terrestrial wildlife. Due primarily to the surrounding residential, commercial, industrial, institutional and utility right-of-way land uses, the Site is not part of a larger corridor that is linked to other significant wildlife habitats. However, the Site likely offers a refuge to transient wildlife (primarily birds) as they migrate along the Genesee River corridor and utilize the forested Site areas. The ecological receptors present within the study area include floral and faunal terrestrial species that inhabit, forage, or otherwise require a mix of forested and open habitats for their life requirements. Terrestrial plants, soil invertebrates, some herptiles (frogs, turtles, snakes), and mammals are documented within the study area from prior investigations (Shumaker, 2017), and were observed during RI field activities. Additionally, transient birds such as songbirds, buteos (*e.g.*, hawks), herons and some shorebird species may utilize the site These organisms are potentially exposed to affected surface soil through direct contact, incidental ingestion, and/or consumption of affected prey.

Semi-aquatic birds may utilize the Site for roosting; however, it is likely that most ecological receptors of the Genesee River may be unable to access the Site due to the stone wall present along the Site boundary with the river. Excepting the intermittent presence of surface water within delineated emergent and scrub-shrub wetlands, aquatic pathways are not present on the Site. The presence of the trail/flood-protection berm and the wall along the shoreline likely prohibit surface runoff from flowing directly from the Site to the river.

Sheens and petroleum odors have been observed in shallow groundwater wells at the Site. However, these observations were typically observed at wells located in upland areas and shallow groundwater does not appear to be migrating directly toward the river thereby minimizing the potential for impacts to off-Site aquatic life. However, if the wall is to be removed, further evaluation of shallow groundwater flow and quality is recommended to reevaluate the potential for future impacts to ecological receptors of the river.

The most significant wildlife exposure pathway is potentially through direct contact, incidental ingestion and/or bioaccumulation of sporadic COECs in shallow soil. SVOCs (acenaphthene, benzo(a)pyrene, di-n-butyl phthalate, and fluorene), pesticides (4-4-DDE, 4-4-DDT, and dieldrin), PCBs and metals (aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, lead, mercury, nickel, and zinc) were detected in shallow soils at concentrations that exceed SCOs for the protection of ecological resources.

Although there is currently a potential exposure pathway for ecological receptors to COECs in surface and shallow soil, these exposures would likely be mitigated by the surface features that will be integrated into the redevelopment components identified in the BOA Master Plan for the Site.

9. SUMMARY AND CONCLUSIONS

The RI of a portion of the former Vacuum Oil Refinery located at 1, 13, 31, 69, and 75 Cottage Street; 100 Riverview Place; 102 Violetta Street; and 1320 S. Plymouth Avenue, encompassing approximately 15.4-acres, was conducted between January 2016 and September 2017 on behalf of the City.

The former Vacuum Oil Refinery initially consisted of an approximate 40-acre parcel spanning both north and south of Flint Street. It was subsequently subdivided into several parcels.

RI activities were implemented in several phases at the Site. Investigation activities included the evaluation of surface soil, subsurface soil, groundwater, and soil vapor.

Field activities consisted of:

- Soil characterization conducted through the collection of surface soil (Section 3.3.3), surface cover soil (Section 3.3.4) and subsurface soil (Section 3.3.5)
- Groundwater characterization conducted through the installation of overburden and bedrock groundwater monitoring wells (Section 3.3.6), groundwater monitoring well development (Section 3.3.6), collecting and analyzing groundwater samples from the groundwater monitoring wells (Section 3.3.6), and groundwater elevation monitoring (Section 3.3.6)
- Soil vapor characterization conducted through the installation of sample points (Section 3.3.8), collecting, and analyzing soil vapor samples from the sample locations (Section 5.2).

Based upon the investigation completed, the following conclusions have been developed and presented in the sections below.

9.1 SUBSURFACE STRUCTURES

In addition to identifying the nature and extent of contamination at the Site, several objectives of the RI focused on the assessment of subsurface structures that may influence distribution and/or migration of constituents of concern. These include various walls or concrete structures observed at the surface during previous investigation as well as subsurface utilities previously identified within the canal on 1320 Plymouth Avenue parcel.

Concrete structures observed at the surface along the eastern edge of the former Canal were originally thought to be walls of the former canal. Further research indicates that the canal walls were reportedly constructed of wood and these concrete walls are support structures associated with the former railroad.

An additional concrete wall is present along the western edge of the Genesee River. As discussed previously, research conducted as part of the river wall reconstruction project coupled with groundwater elevation data collected as part of the RI suggests that these walls extend to bedrock between the north end of the Site and the pedestrian bridge to the south. This wall appears to limit the hydraulic connection between the Genesee River and the groundwater at the Site.

As described in Section 3.1.3, a former Monroe County Pure Waters (MCPW) reinforced-concrete sewer line was identified within and adjacent to the west side of the former canal adjacent to an existing MCPW sewer line, and a former waterline was identified on the east side of the former canal (associated with a former Vacuum Oil refinery hydrant system), during the pre-investigation activities. A product transfer line was initially thought to have been installed at the base of the former canal on the Site; however, investigation activities conducted to locate utilities did not identify the presence of this line and further information suggests that it was located on the properties to the north of the Flint Street. Groundwater elevation data collected during the RI suggest that there may be a component of flow towards the north within the former canal which may be influenced by the utility lines and/or the canal backfill.

9.2 SURFACE SOIL

COCs in surface soil consist of PAHs and arsenic. The PAHs are scattered across the Site. The highest concentration of the individual PAHs is associated with a single surface soil sample, SS-141 which was located in an area where a parts cleaner and metal shavings were present. The predominant location of samples where arsenic was present above Unrestricted Use, Residential Use, and Restricted-Residential Use SCOs is on the southern portion of the Site (south of the adjoining 5 Flint Street parcel). Arsenic was observed above SCOs in up to 37% of the surface soil samples although the maximum concentration was much less than that observed in the subsurface soil samples suggesting that the arsenic may be attributable to residuals from materials such as crude oil, coal ash, cinders, pressure-treated railroad timbers or potentially pesticide use at the Site as these materials would have typically been placed or distributed at or near the ground surface.

Mercury was also detected above the Unrestricted Use SCOs in more than half of the samples analyzed; however, only five samples exceeded the Residential Use and Restricted Residential Use SCOs. Although there are no field descriptions of the surface soil samples, review of the summary statistics table (**Table 7A**) indicates that mercury exceeded the Unrestricted Use SCOs in surface soil in 52% of the samples as compared to 21% of the subsurface soil samples.

9.3 SURFACE COVER

COCs in surface cover consist of PAHs and arsenic. The PAHs are scattered across the Site. The highest concentration of the individual PAHs is associated with a single surface soil sample, SS-141 which was located in an area where a parts cleaner and metal shavings were present. The predominant location of samples where arsenic was present above Unrestricted Use, Residential Use, and Restricted-Residential Use SCOs is on the southern portion of the Site (south of the adjoining 5 Flint Street parcel). Arsenic was observed above SCOs in up to 51% of the surface cover samples although the maximum concentration was much less than that observed in the subsurface soil samples suggesting that the arsenic may be attributable to residuals from crude oil, coal ash, cinders, pressure-treated railroad timbers, or potential pesticide use at the Site, as these materials would have typically been placed or distributed at or near the ground surface.

Mercury was also detected above the Unrestricted Use SCOs in more than half of the samples analyzed; however, only five samples exceeded the Residential Use and Restricted Residential Use SCOs. Review of the summary statistics table (**Table 7B**) indicates that mercury exceeded the Unrestricted SCOs in surface soil in 60% of the samples as compared to 21% of the subsurface soil samples.

9.4 SUBSURFACE SOIL

A limited number of VOCs were detected above Unrestricted Use and Residential Use SCOs in subsurface soil samples and the frequency and concentrations detected did not suggest that specific VOCs would be considered a COC at the site. However, there are some localized areas where elevated VOCs are present. Additionally, PID readings observed in soil borings completed on both sides of the adjoining 5 Flint Street parcel were generally elevated. These elevated PID values coupled with odors, sheens, and the lack of quantified VOC concentrations suggests that some type of non-target petroleum VOCs are present within the soils that are potentially degradation byproducts or residual VOC compounds.

Similar to the surface soil samples, SVOCs detected in the subsurface soil samples above SCOs were PAH compounds. The primary PAH compounds identified as COCs are located on the 13 Cottage Street parcel which occupies the south-central portion of the Site. The location of the PAHs above SCOs do not correlate to the location of observations of odors and sheens which are concentrated in the northern portion of the 1320 S. Plymouth Avenue parcel between the adjoining 5 Flint Street and adjoining 15 Flint Street parcels and along the east side of the adjoining 5 Flint Street parcel. This suggests that the PAH exceedances are associated with the coal and ash observed within the samples rather than petroleum residuals suggested by the odors, sheens, and elevated PID reading.

Arsenic and mercury were the most prevalent metals detected above SCOs in subsurface soil although the frequency of exceedances was less than that observed in surface soil. The occurrences of the exceedances were generally associated with the presence of coal, ash, or cinders and some exhibited petroleum odors.

Odors, staining, and sheens were noted in many of the subsurface soil samples primarily in the north end of the canal, both sides of the adjoining 5 Flint Street parcel and on the 13 Cottage Street parcel. The odors were noted from the surface to the base of the boring in most locations. The presence of odors was noted to begin deeper in the borings located on the east side of the Site and closer to the river suggesting some horizontal migration of non-quantifiable organic compounds.

The potential source(s) of these compounds may be from historic use of the Site and surrounding properties as described in Sections 2.2 and 2.2.1.

Further objectives for the excavation of test pits included the following;

- Documentation of the depth and condition of former canal walls.
  - » Former canal walls were not observed during implementation of the RI.
- Evaluation of potential contaminant migration across/under the vertical concrete walls observed on-Site (most likely possible concrete retaining walls associated with the former railroad).
  - » A discussion regarding potential contaminant migration is in the CSM discussed in Section 6.
- Identification of pipelines within the footprint of the former canal on the 1320 S. Plymouth Avenue parcel.
  - » Pipelines were not observed during implementation of the RI.

9.5 GROUNDWATER

VOCs and SVOCs were only observed above criteria in one of the two sampling events and therefore, they do not suggest the presence of a groundwater plume. However, odors noted at several locations suggest the presence of non-target and/or weathered VOCs or SVOCs. The lack of a groundwater plume is consistent with the sporadic occurrence of VOCs and SVOCs above SCOs in the soils.

Arsenic was detected in the groundwater above the Class GA groundwater standard in seven overburden wells located on the north end of the 1320 S. Plymouth Avenue parcel between the adjoining 5 Flint Street and adjoining 15 Flint Street parcels and the east side of the adjoining 5 Flint Street parcel. These exceedances do not correlate to the locations of soil samples with elevated arsenic concentration. However, arsenic was also noted in the groundwater on the adjoining 5 Flint Street and 15 Flint Street parcels based on the findings of the RI conducted by Ravi (Ravi, 2016a).

The potential source(s) of these compounds may be from historic use of the Site and surrounding properties as described in Sections 2.2 and 2.2.1.

9.6 SOIL VAPOR

As described in Section 3.3.8, soil vapor samples were collected from eight locations. Analytical results are presented on **Tables 12A-12C**. The primary objective of the soil vapor sampling was to assess potential migration of vapors from the Site. A total of 23 compounds (listed in Section 5.2.1) were detected at one or more of the eight soil vapor sampling locations at concentrations below 10 µg/m^3. The purpose of the soil vapor sampling was to evaluate the potential for vapor intrusion. The low concentrations of constituents detected in soil vapor suggest the probability for vapor intrusion into existing off-Site buildings is low. Furthermore, the types of compounds detected are petroleum hydrocarbons such as benzene, toluene, xylene, hexane, and trimethylbenzenes and studies have shown that these compounds would be expected to biodegrade in the unsaturated zone through the actions of microorganisms found naturally in soil (USEPA OSWER, 2015).

9.7 QHHEA

The QHHEA completed for this Site concluded that under current conditions there are complete exposure pathways to human receptors to COPCs in soil and groundwater at this site. Recreators and trespassers would be exposed to surface soils while the exposure to subsurface soil and groundwater would be limited to utility workers. Under a future use scenario, the surface exposures would be mitigated through construction of surface covers associated with the redevelopment. Construction workers and utility workers could be exposed to COPCs within the subsurface soil and groundwater. Vapor intrusion is not a complete exposure pathway under current conditions as there are no on-site structures. The potential for vapor intrusion to structures constructed on the property in the future would be dependent on location and can be mitigated by the use of properly designed vapor barriers or vapor mitigation systems.

9.8 FWRIA

Although there is currently a potential exposure pathway for ecological receptors to COECs in surface and shallow soil, these exposures would likely be mitigated by the surface features that will be integrated into the redevelopment components identified in the BOA Master Plan for the Site.

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