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REMEDIAL ALTERNATIVES ANALYSIS REPORT

PORTION OF FORMER VACUUM OIL REFINERY SITE

NYSDEC SITE NO. C828190

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REMEDIAL ALTERNATIVES ANALYSIS REPORT
PORTION OF FORMER VACUUM OIL REFINERY SITE
NYSDEC SITE NO. C828190

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Prepared by	**Sarah Sauda**
Checked by	**Clare Leary, PE; Deborah Wright**
Approved by	**Bradley A Kubiak, PE**

Ramboll
333 West Washington Street
Syracuse, NY 13202
USA

T 315-956-6100
F 315-463-7554
https://ramboll.com

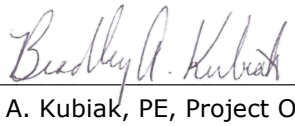
REMEDIAL ALTERNATIVES ANALYSIS REPORT
PORTION OF FORMER VACUUM OIL REFINERY SITE
NYSDEC Site No. C828190

13, 31, 49, 69, and 75 and Portions of 1 Cottage Street;
100 Riverview Place;
Portions of 102 Violetta Street;
Portions of 10 Flint Street; and
Portions of 1320 S. Plymouth Avenue

Rochester, New York
NYSDEC Site No. C828190

Prepared for:
City of Rochester

I, **Bradley A. Kubiak**, certify that I am currently a NYS registered professional engineer and that this Remedial Alternatives Analysis 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 activities were performed in accordance with the DER-approved work plan and DER-approved modifications.



Bradley A. Kubiak, PE, Project Officer
Professional Engineer License No. NY 081039
Ramboll Americas Engineering Solutions, Inc.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

BCP	Brownfiled Cleanup Program
bgs	below ground surface
BOA	Brownfield Opportunity Area
CFR	Code of Federal Regulations
City	City of Rochester
COCs	Constituents of Concern
COECs	Contaminants of Ecological Concern
CP	Commissioner Policy
CY	cubic yards
DER	Division of Environmental Remediation
ESA	Environmental Site Assessment
FEMA	Federal Emergency Management Agency
Ft	feet/foot
FWRIA	Fish and Wildlife Resource Impact Analysis
in	inch
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OBG	O'Brien & Gere Engineers, Inc.
O&M	Operation and Maintenance
PAH	polycyclic aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PDI	Pre-Design Investigation
PID	photoionization detector
QHHEA	Qualitative Human Health Exposure Assessment
RAAR	Remedial Alternatives Analysis Report
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RAOs	Remedial Action Objectives
RI	Remedial Investigation
SCOs	Soil Cleanup Objectives
SCGs	Standards, Criteria, and Guidance
SGVs	Standards and Guidance Values
SMP	Site Management Plan
SVOC	semi-volatile organic compound
TICs	tentatively identified compounds
TOGs	Technical and Operational Guidance Series
USGS	United States Geological Survey
VOC	volatile organic compound
WRW	West River Wall

1. INTRODUCTION

1.1 General

This Remedial Alternatives Analysis Report (RAAR) has been developed by Ramboll Americas Engineering Solutions, Inc. (Ramboll) for a portion of the former Vacuum Oil Refinery Site (Site). The Site is located on an approximate 15.4-acre section of 10 City of Rochester (City) owned parcels including: 13, 31, 49 (formally part of 13), 69, 75, and portions of 1 Cottage Street; 100 Riverview Place; portions of 102 Violetta Street; portions of 1320 S. Plymouth Avenue, and portions of 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) in the City of Rochester, New York (**Figure 1**). These 10 parcels (previously eight) were updated since Ramboll submitted the *Remedial Investigation, Portion of Former Vacuum Oil Refinery, Site No. C828190* in November 2019 (Ramboll 2019).

The Site was accepted in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) per Title 6 New York State Official Compilation of Codes, Rules, and Regulations (NYCRR) Part 375-3.4 (NYSDEC 2006) on September 24, 2014, as Site Number C828190. The boundaries of the Site parcels are shown on **Figure 2**.

1.2 Project Scope and Purpose

The purpose of the RAAR is to document the development and evaluation of remedial alternatives, as well as provide a recommendation and description of the recommended Site remedy.

2. SITE DESCRIPTION AND HISTORY

2.1 Site Location and Description

The Site encompasses 15.4-acres and comprises 10 parcels including 13, 31, 49 (formally part of 13), 69, 75, and portions of 1 Cottage Street; 100 Riverview Place; portions of 102 Violetta Street; portions of 1320 S. Plymouth Avenue, and portions of 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) (**Figure 2**). As shown on **Figure 2**, the Site is currently zoned R-1 Low Density Residential, while surrounding properties are zoned as residential, commercial, and light industrial manufacturing. The City Zoning Alignment Project is in progress with a tentative completion date in late 2022, which will result in rezoning of BCP parcels currently zoned R-1 (Low-Density Residential).

The Site is bordered by the Genesee River and adjacent western Genesee River concrete wall (also referred to herein as the West River Wall [WRW]) 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) 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.

The Site was historically operated as a petroleum refining, 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 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. Since the time of refinery closure, the Site has remained vacant.

Figure 2 presents the current Site features and configuration. As shown, 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. The remaining areas of the Site are undeveloped (except for the items mentioned above) and consist of vacant and undeveloped wooded and vegetative areas.

Future use of the Site is contemplated to be consistent with the *Draft Nomination Study, Vacuum Oil – South Genesee River Corridor City Brownfield Opportunity Area (BOA)* (BOA Master Plan), prepared by Bergmann Associates (Bergmann), dated April 2013, the *Vacuum Oil Preferred Parks, Open Space, Waterfront Concept Master Plan* (Bergman 2019a), and the *Vacuum Oil BOA Supplemental, Grading, Utilities and Wetland Mitigation Report* (Bergmann 2019b). The redevelopment plan includes multi-family residential, commercial/retail, and industrial facilities through a phased implementation. Future use also consists of rezoning a portion of parkland to Open Space as proposed via a NYS Assembly Bill Change in Use for approximately 5.27 acres to become dedicated parkland, a portion of which intersects with the Site. A proposed Site plan, depicting contemplated parkland and future development parcels, is provided in **Appendix A** (Bergman 2019a).

2.2 Summary of Historical Investigation

The Site has been the subject of historical investigation and data collection efforts since the 1990's. Various environmental investigations performed by ExxonMobil, the NYSDEC, and the City have taken place at the Site and/or the adjoining 5 Flint Street and 15 Flint Street parcels, including the following:

Historical Investigations

- Site Investigation Activities – 1999-2001
- Field Investigation Activities – 2008
- Subsurface Investigation – 2008-2009
- Phase I Environmental Site Assessment (ESA) Activities – 2012

Recent Investigations

- Remedial Investigation (RI) Activities – 2015-2018

A summary of previous investigations completed at the Site is presented in the *RI Report*, prepared by O'Brien & Gere Engineers, Inc. (OBG), dated November 2019 (OBG 2019). Further details regarding the previous Site investigations are summarized in OBG's report titled *Phase 1 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 (OBG 2012).

2.3 Site Characteristics

The Site comprises 10 City-owned parcels zoned for low-density residential use, which are currently undergoing rezoning under the City Zoning Alignment Project. The Former Vacuum Oil Refinery operations ceased in approximately 1935. With the exception of the asphalt-paved bike/pedestrian path, the Site remains vacant. Additional Site features and observations are presented on **Figure 3.**

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 Federal Emergency Management Agency (FEMA) 100-year Floodplain, as presented on **Figure 4**.

Several federal wetlands and draining ditches are present toward the northern end of 10 Flint Street (formerly part of 1320 S. Plymouth Avenue and in between the adjoining 5 Flint Street and 15 Flint Street parcels; and on the eastern side of the existing bike path (toe of slope)) are located on the Site. These wetlands are 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, which is provided as Exhibit D in the *RI Report* (OBG 2019). This wetland assessment identified four wetlands totaling approximately 0.757-acres on the Site as presented on **Figure 3**.

2.3.1 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 also encountered. Native soils underlying the fill consist of fine sand and silt which are alluvial in origin.

Bedrock was generally encountered at approximately 10 feet (ft) to 25 ft below ground surface (bgs), with an average depth of 19.5 ft bgs and a maximum depth of 61 ft bgs. Bedrock quality encountered ranged from massive/slightly fractured to highly fractured; observed fractures were also lightly weathered to moderately weathered. Stratigraphically the bedrock units in the Site area include the middle Silurian Lockport Group and underlying Clinton Group. The Lockport Group is subdivided into the Eramosa Dolomite (Formation) and Penfield Formation. The upper portion of the Eramosa Dolomite was previously described as the Oak Orchard formation. The Oak Orchard formation name has since been replaced by the Eramosa Dolomite.

2.3.2 Hydrogeology

The depth to the water table at the Site occurs within the overburden materials at depths ranging from 3 ft to 4 ft bgs 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 flow direction and elevations suggest that the groundwater is fed by the river water on the south end of the site and flows 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 some limitation in the hydraulic connection between the river and the overburden groundwater in this area of the site. As discussed in the *RI Report*, the existing segment of the WRW that borders the Site extends to bedrock and is limiting the hydraulic connection between the Site groundwater and the river.

The City is currently designing modifications to the WRW which will lower the height of the wall by approximately 2 ft (Bergmann 2021). This modification will result in the wall being approximately 1 ft lower than the typical water level of the Genesee River[1]. Conceptually, this will allow for river water to recharge the Site groundwater with the resulting rise of groundwater elevations within the Site to an elevation close to that of the river. **Appendix B** provides further details pertaining to the WRW modifications influence on Site conditions.

2.4 Nature and Extent of Site COCs

The information generated during the RI was used to evaluate the nature and extent of contamination at the Site. Section 5 of the *RI Report* (OBG 2019) presents the results of the data collected during the RI and is summarized in the subsections below. The discussion is organized by medium that was analyzed (*i.e.,* surface soil, existing surface cover, subsurface soil, and groundwater). Surface soil refers to the top two inches (in) of soil, while surface cover refers to the top two ft of soil. Sample locations are presented on **Figure 3**.

2.4.1 Soil

Analytical results for the surface soil (0-2 in), surface cover (0-2 ft), and subsurface soil obtained during the RI field activities were compared to applicable criteria provided in 6 NYCRR Part 375 *Environmental Remediation Programs* (NYSDEC 2006). Given the current residential zoning and planned development of the Site, the laboratory results were compared to Restricted-Residential and Protection of Groundwater Soil Cleanup Objectives (SCOs), in addition to Unrestricted SCOs, for the purpose of identifying nature and extent for this RAAR. The Protection of Groundwater SCO evaluation was limited to volatile organic compounds (VOCs) and arsenic which were identified in the groundwater.

[1] Water level data for the Genesee River at the Ford Street bridge river gage (No. 04231600) was obtained from United States Geological Survey (USGS). The gage is located approximately 1 mile north of the Site.

Surface Soil

Based on a comparison to SCOs, Site-related constituents of concern (COCs) were limited to semi-volatile organic compounds (SVOCs) and inorganics (arsenic and mercury). While less prevalent, polychlorinated biphenyls (PCBs), copper, lead, barium, and cadmium were also detected above Restricted-Residential SCOs in some samples and are also considered COCs. VOCs were not identified above Restricted-Residential SCOs in surface soil. SVOCs and metals were the constituents identified most frequently above Restricted-Residential SCOs in surface soils.

SVOCs, specifically, one or more of the polycyclic aromatic hydrocarbon (PAH) compound exceedances (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene), were scattered across the 13 Cottage Street parcel, the 102 Violetta Street parcel, and the former canal area of the 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) parcel. One location (SS-112) on the 49 Cottage Street parcel (formerly part of the 13 Cottage Street parcel) contained total SVOCs 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.

Arsenic was observed above Restricted-Residential and Protection of Groundwater SCOs in approximately half of the surface soil samples analyzed, although the maximum concentration was much less than that observed in subsurface soil samples. The locations of elevated arsenic concentrations in surface soil are scattered across the 10 Flint Street (formerly part of 1320 S. Plymouth Avenue), 102 Violetta Street, and 13 and 49 Cottage Street parcels with the predominant exceedances located on the southern portion (south of the adjoining 5 Flint Street parcel). Mercury was detected above the Restricted-Residential SCOs in only two samples.

Surface soil samples were screened using a photoionization detector (PID), and field observations including the presence of odors, staining, and discoloration were recorded. Sheens, staining, and/or petroleum-type odors were not encountered during surface soil sampling.

Surface Cover

Similar to surface soil, COCs in surface cover consist of PAHs (anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, dibenzofuran, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene), and metals (arsenic, and mercury). Similar to surface soil, less prevalent constituents considered COCs were detected above Restricted-Residential SCOs including PCBs, copper, lead, barium, and cadmium. The majority of surface cover samples exceeding Restricted-Residential Use SCOs for SVOCs were located across the Site on 13 Cottage Street, the former canal area of the 10 Flint Street (formerly part of 1320 S. Plymouth Avenue parcel, and 102 Violetta Street near the bike path. Four locations (SS-112, SS-142, SS-141, and SS-147) on the 13 and 49 Cottage Street parcels contained total SVOCs greater than 100 ppm. There was evidence of on-Site dumping including parts cleaner, metal shavings debris, and concrete/brick debris in the vicinity of some of these sample locations.

The predominant location of surface cover samples where arsenic was present above Restricted-Residential 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 detected above the Restricted-Residential SCOs in only five samples.

Surface cover samples were screened using a PID, and field observations including the presence of odors, staining, and discoloration were recorded. Sheens, staining, and/or petroleum-type odors were not encountered during surface soil sampling.

Subsurface Soils
Similar to surface soil and surface cover samples, SVOCs and metals were identified most frequently above Restricted-Residential SCOs in subsurface soil.

SVOCs detected in subsurface soil samples above Restricted-Residential SCOs and Protection of Groundwater SCOs were PAH compounds (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene). The locations with the highest concentrations of total SVOCs were near the center of the Site on the 13 Cottage Street parcel and the western 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) and 1320 S. Plymouth Avenue parcels.

Arsenic was identified above Restricted-Residential and Protection of Groundwater SCOs in 27 of the 123 locations analyzed for metals. Samples containing arsenic were located south of the adjoining 5 Flint Street Parcel on both the 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) and the 13 and 49 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.

Although VOCs were not found to be present above Restricted-Residential or Protection of Groundwater SCOs, subsurface soil samples were screened using a PID for indications of potential VOCs, and field observations including the presence of odors, staining, and discoloration were recorded. 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 10 Flint Street (formerly part of 1320 S. Plymouth Avenue), on the east and west sides of the adjoining 5 Flint Street parcel, and the 13 Cottage Street parcel, south of the adjoining 5 Flint Street parcel. Fill and waste materials including observations of fragmented bricks, cinders, coal ash, slag, and black granular material were also noted in many of these locations.

2.4.2 Groundwater
Analytical results for groundwater were compared to Class GA Standards and Guidance Values (SGVs) provided in NYSDEC's *Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (NYSDEC 1998). Groundwater samples obtained during the RI identified VOCs and SVOCs (primarily PAHs) exceeding Class GA SGVs, and most of the compounds were only detected in one of the two sampling events. VOCs detected in the groundwater include petroleum-related VOCs, chlorinated VOCs, and ketone compounds. 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 2016) indicates that chlorinated VOCs and petroleum-related VOCs were present in groundwater at higher concentrations than this Site.

Although iron, manganese, magnesium, and sodium were detected above Class GA SGVs, these constituents are considered to be naturally occurring and not related to historic site operations. Arsenic was detected in the groundwater above Class GA SGVs in seven overburden wells located on the north end of the 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) parcel between the adjoining 5 Flint Street and 15 Flint Street parcels and the east side of the adjoining 5 Flint Street parcel.

2.5 Fate and Transport of Site COCs

Surface soil and surface cover samples containing COCs (PAHs, arsenic, mercury, and other compounds) above the Restricted-Residential and Protection of Groundwater SCOs were scattered across the Site. Subsurface soil and fill material also contained COCs above the Restricted-Residential SCOs and petroleum-related compounds. The elevated PID values observed in subsurface soil correlate to elevated VOCs (primarily in the form of tentatively identified compounds [TICs]), sheens, staining, and odors; therefore, it is likely that they represent petroleum residuals resulting from degradation. During periods of sufficient rainfall, COCs in surface soils may be transported in stormwater via drainage ditches or sheet flow to low-lying areas such as the isolated wetlands.

Based on groundwater flow data collected during the RI, migration of groundwater to the Genesee River or other river sensitive downgradient receptors is not expected to occur. As described in Section 2.3.2, the existing segment of the WRW extends to the bedrock surface along the reach adjacent to the northern end of the Site and is suspected to limit the hydraulic connection between groundwater at the Site and the Genesee River. The current design for the WRW rehabilitation is not anticipated to significantly affect the current groundwater flow direction or the nature and extent of COCs as further described further in this RAAR and in **Appendix B**. Odors and sheens noted at several locations suggest the presence of petroleum-related weathered VOCs and SVOCs. Arsenic and petroleum can potentially migrate off-Site with groundwater flow. The degradation of VOC and SVOC compounds is understandable given the period of operation of the facility and the undeveloped nature of the Site.

Depending on the location of future buildings, the potential presence of VOCs in Site groundwater and detection of odors and elevated PID readings in soil suggests the potential that VOCs could migrate as vapors in soil and into the indoor air of a future building.

2.6 Exposure Assessments

2.6.1 Fish and Wildlife Resource Impact Analysis

A Fish and Wildlife Resource Impact Analysis (FWRIA) was developed for this Site 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 of the *RI Report* (OBG 2019).

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. These include terrestrial plants, soil invertebrates, some herptiles (frogs, turtles, snakes), and mammals. 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 WRW 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 trail/flood-protection berm and the wall along the shoreline likely prohibit surface runoff from flowing directly from the Site to the river and shallow groundwater does not appear to be migrating directly to the river which also minimizes the potential for impacts to off-site aquatic life.

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. It is anticipated that only the above-grade portion of the wall will be removed as part of Site redevelopment, thus the current groundwater conditions are not expected to change, and contaminant migration into the Genesee River is unlikely.

Summer roosting habitat for the northern long-eared bats (USFWS 2013) is potentially present in forested communities within the study area (*e.g.*, floodplain forest and successional northern hardwoods). If remedial activities for the Site are anticipated to impact the forested habitats, consultation with USFWS and adherence to bat-related conservation measures is required.

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.

2.6.2 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment (QHHEA) was completed for the Site to evaluate and document the potential exposure routes and pathways, and to identify and characterize the potentially exposed populations currently and under reasonable 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 following presents the conclusions resulting from the QHHEA process. The full QHHEA is presented in Section 7 of the *RI Report* (OBG 2019).

In summary, potential exposure pathways associated with human receptor scenarios at the Site include:

- Current/future adolescent and adult recreators and trespassers that may be exposed to COCs in Site surface soils through incidental ingestion, dermal contact, and inhalation of fugitive dust.
- Current/future utility workers that may be exposed to COCs in Site surface and subsurface soils through incidental ingestion, dermal contact, and inhalation of fugitive dust, and to

COCs in Site groundwater through inhalation of groundwater-derived ambient vapors, incidental ingestion, or dermal contact.

- Future construction workers that may be exposed to COCs in Site surface and subsurface soils through incidental ingestion, dermal contact, and inhalation of fugitive dust, and to COCs in Site groundwater through inhalation of groundwater-derived ambient vapors, incidental ingestion, or dermal contact.
- Future commercial/industrial workers that may be exposed to COCs in Site surface soils through incidental ingestion, dermal contact, or inhalation of fugitive dust;
- Current/future commercial/industrial workers that may be exposed to COCs in indoor air through inhalation of soil and/or groundwater-derived vapors;
- Future residents that may be exposed to COCs in Site surface soils through incidental ingestion, dermal contact, inhalation of fugitive dust, and to COCs in indoor air through inhalation of soil and/or groundwater-derived vapors.

Future human health exposure scenarios would be mitigated through institutional and engineering controls.

3. REMEDIAL GOALS AND REMEDIAL ACTION OBJECTIVES

Remedial goals and remedial action objectives (RAOs) are developed based on the findings of the RI and the future planned use of the Site. Concentrations of COCs in Site media are compared to standards, criteria and guidance (SCGs) and the findings of the QHHEA and FWRIA are used to assess impacts that may warrant remedial action. The identification of SCGs, remedial goals and RAOs is presented in the following subsections.

3.1 Identification of Standards, Criteria, and Guidance (SCGs)

There are three types of SCGs: chemical-, location-, and action-specific SCGs. Chemical-specific SCGs are health or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values that establish the acceptable amount or concentration of a COC. Location-specific SCGs set restrictions on activities based on the characteristics of the facility or immediate environment. Action-specific SCGs set controls or restrictions on particular types of remedial actions once the remedial actions have been identified as part of a remedial alternative. The identification of potential SCGs is documented in **Table 1**.

3.1.1 Site Use and the Selection of SCGs

For the purposes of this RAAR, and based on 6 NYCRR Part 375-6 and Commissioner Policy (CP)-51, Restricted-Residential Use and Protection of Groundwater SCOs were identified as potentially applicable chemical-specific SCGs for development of remedial alternatives for Site soils. The current, intended, and reasonably anticipated future land uses of the Site were considered when selecting SCOs. The Site is currently zoned for low-density residential use and much of the Site is currently vacant, with the planned construction of multi-family residential, commercial/retail, and industrial facilities as outlined in the BOA Master Plan (Bergmann 2013, 2019a, and 2019b), as well as rezoning a portion of parkland to Open Space via the Change in Use documentation. The reasonably anticipated use of the Site is assumed to incorporate mixed use, including restricted residential. Per NYSDEC requirements, restricted-residential use is considered when there is a common ownership or a single owner/managing entity of the Site. A public water supply system services residents and businesses in the areas surrounding the Site.

Given that the reasonably anticipated future Site includes the potential for multi-family residences and recreation areas, the 6 NYCRR Part 375 and CP-51 SCO for Restricted-Residential use was identified as the appropriate SCO for the Site, as Restricted-Residential SCOs would also be protective of other Site uses (*e.g.,* commercial, industrial, passive and active recreation). As a result of a comparison to these criteria for soils, the following COCs for soil were identified for the Site:

- Metals
  - Arsenic
  - Mercury
- SVOCs
  - PAHs
- Petroleum (in the form of grossly contaminated soil)

As a result of comparison to Class GA SGVs for groundwater, the following COCs for groundwater were identified for the Site:

- Metals
  - Arsenic
- VOCs
  - Benzene
  - Chloroethane

- 1,1-Dichloroethane
- Trichloroethene

3.2 Remedial Goals

The remedial goals for the Site are mitigation of potential human and ecological exposure, removal/treatment of source material (including grossly contaminated media) and nuisance conditions to the extent practicable, and containing remaining contaminants on the site to the extent practicable. Accomplishment of these goals will provide the basis for obtaining a Certificate of Completion under the BCP for the Site. Though groundwater within the Site boundaries is not used as a drinking or industrial water supply and is highly unlikely to be used as a drinking or industrial supply in the future, groundwater exceedances of SCGs were also considered.

3.3 Remedial Action Objectives

RAOs are medium-specific goals for protecting human health and the environment. RAOs form the basis for the RAAR by providing overall goals for Site remediation. The RAOs are considered during the development and evaluation of remedial alternatives for the Site. NYSDEC's Division of Environmental Remediation (DER)-10 specifies that NYSDEC's generic RAOs be used where applicable for Site media. Accordingly, based on the findings of the RI and the future planned use of the Site, applicable generic RAOs are presented below for soil at the Site.

3.3.1 Soil

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

3.3.2 Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the sources of groundwater contamination.
- Prevent the discharge of contaminants to surface water.

3.3.3 Soil Vapor

RAOs for Public Health Protection

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

4. DEVELOPMENT AND ANALYSIS OF ALTERNATIVES

This section documents the development and analysis of remedial alternatives for the Site.

4.1 Assembly of Remedial Alternatives

Per NYSDEC DER-10 Section 4.4 (d)2, three remedial alternatives were developed to address the RAOs; these are described in subsequent subsections. In addition to addressing RAOs, a goal of the RAAR, as stated in the NYSDEC DER-10 Section 4.4 (d), and consistent with 6 NYCRR Part 375-4.8(c), is to identify and evaluate alternatives that include restoration of the Site to pre-disposal or unrestricted conditions (with respect to soil), to the extent feasible.

Remedial alternative components are presented in Table 2. The alternatives are summarized in the following subsections.

Table 2: Components of Remedial Alternatives

Remedial Component	Alternative 1	Alternative 2	Alternative 3
No Action	•		
Institutional Controls/limited Actions Institutional controls, Site Management Plan (SMP), periodic reviews		•	•
Engineered cover System (11.9 acres)/Asphalt Cover (0.9 acres) in anticipation of Planned Site Redevelopment		•	
Targeted soil/fill material excavation and off-site disposal (1.1 acres)		•	
Off-site Wetland Mitigation (1.5 acres)		•	•
Site-Wide soil/fill material excavation and off-site disposal			•
Groundwater Monitoring		•	•

4.1.1 Alternative 1 – No Action

Alternative 1 consists of no remedial action at the Site. This alternative is required to be evaluated by the National Oil and Hazardous Substances Pollution Contingency Plan ([NCP] 40 Code of Federal Regulations (CFR) Part 300.430) and NYSDEC DER-10 Section 4.4(d) 1 (NYSDEC 2012) and serves as a benchmark for the evaluation of other action alternatives. Under this alternative, the following existing controls are present:

- A public water supply for the Site and surrounding properties alleviates the need to use Site groundwater as a source of potable water.

4.1.2 Alternative 2 – Engineered Soil Cover, Targeted Excavation and Off-Site Disposal, and Natural Attenuation of Groundwater (Restricted Residential – Track 4)

In addition to the existing control present at the Site described under Alternative 1, Alternative 2 consists of the following remedial alternative components:

- A remedial design program to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program.
- Institutional Controls
    - Implementation of an environmental easement that would restrict intrusive activities and future land use to restricted residential and restrict use of groundwater as a potable source. Groundwater use would be restricted unless applicable treatment and/or approval by New York State Department of Health (NYSDOH) and Monroe County Health Department was received.
    - Rezoning consistent with the intended and reasonably anticipated future use based on the planned redevelopment (*i.e.,* restricted-residential use).
    - Periodic Site reviews
    - Development and implementation of a SMP, including provisions for soil/cap management and requirements to limit exposure to soil and groundwater during site redevelopment and future construction activities. The SMP would also provide for evaluation and mitigation of potential vapor intrusion into planned buildings and long-term monitoring of groundwater and other media to evaluate the effectiveness of the remedy.
- In preparation for implementation of removal and containment actions, the following activities will be implemented:
    - Removal of remaining remnants of structures and the existing bike trail
    - Clearing and grubbing of heavy vegetation (*i.e.,* organic debris)
    - Site-wide grading
        - Assumes graded material (e*.g.,* berms along Genesee River) would be placed within low-lying areas. Additional soil may be removed/graded in preparation for soil cover installation to achieve target redevelopment elevations based on the *Vacuum Oil BOA Supplemental, Grading, Utilities and Wetland Mitigation Report* (Bergmann 2019b). Material that will be reused will be sampled in accordance with NYSDEC DER-10 and approved by NYSDEC prior to reuse.
    - Existing overburden monitoring wells and bedrock monitoring wells, as needed, will be removed and decommissioned, respectively, in accordance with NYSDEC regulations as part of excavation activities described below.
- Removal Actions
    - Targeted excavation of soil exhibiting indicators of potential soil impacts, including sheens, staining, odors, elevated PID readings, and/or elevated COCs concentrations (1.1 acres). For the purpose of this RAAR, the area and volume of soil proposed for excavation was developed based on RI analytical data and field observations. A pre-design investigation (PDI) will be implemented to refine the extent of targeted soil excavations.
    - The following areas, as shown on **Figure 1**, are proposed for targeted soil excavation (approximately 22,300 cubic yards [CY]):
        - 13 Cottage Street parcel in the area surrounding OVR-117 (1 area; assume excavation up to 13.4 ft)
        - 102 Violetta Street parcel in the areas surrounding SB-169 and SB-138 (2 areas; assume excavation up to 21 ft)

        - Northern end of 10 Flint Street (formerly part of 1320 S. Plymouth Avenue) parcel (1 area; assume excavation up to 11 ft)
    - Following excavation, backfill meeting NYSDEC DER-10 and Part 375 requirements[2] for imported material will be placed to match surrounding grade and the area restored with vegetation.
    - Additional soil may be excavated and disposed off-site based on presence of odors/staining, as encountered, during remedial actions and site redevelopment activities. For the purpose of developing the RAAR cost estimate, an additional 20 percent by volume (approximately 4,500 CY) soil was assumed for excavation and off-site disposal.
    - PDI will be performed to further define the extent of impacted soil (*i.e.,* soil exhibiting indicators of potential soil impacts, including sheens, staining, odors, elevated PID readings and/or elevated COC concentrations) for targeted excavations. It is assumed that PDI soil samples will serve as confirmatory soil samples following NYSDEC approval.
- Containment Actions
    - Engineered soil cover over approximately 12.6 acres of surface soil with concentrations exceeding Restricted-Residential SCOs.
        - Placement of a 2-ft thick soil cover with vegetation to prevent incidental exposure to impacted soils and reduce erosion and migration of impacted surface soils.
    - Asphalt cover over approximately 1.0 acre (1,800 linear ft) of area identified as future public roadway in the BOA Master Plan.
    - A demarcation layer will be installed below the engineered soil and asphalt covers to serve as a visual boundary between the cover system and potential soil impacts.
    - In anticipation of Site redevelopment, approximately 1,800 linear ft of clean utility corridors will be established and are assumed to align with the future asphalt public roadway.
- Disposal Actions
    - Off-site disposal of approximately 1,030 tons of organic debris
    - Off-site disposal of approximately 1,100 tons of construction and demolition debris
    - Off-site disposal of approximately 32,500 CY (55,300 tons) of soil as non-hazardous regulated waste
- Wetland Mitigation
    - Based on recommendations documented in the *Vacuum Oil BOA Supplemental, Grading, Utilities and Wetland Mitigation Report* (Bergmann 2019b), approximately 1.5 acres of compensatory wetland will be established via off-site wetland mitigation or wetland credits.
- Groundwater monitoring will be conducted using on-site wells for five years to evaluate remedy effectiveness. It is assumed that quarterly groundwater monitoring would be conducted for the first year after remediation and semi-annually after year one. Select groundwater monitoring wells removed or decommissioned as part of excavation activities and cover installation will be reinstalled, as needed, to conduct groundwater monitoring.

An illustration of the components of Alternative 2 is provided in **Figure 5.**

4.1.3 Alternative 3 – Pre-Disposal/Unrestricted Use (Track 1)

Alternative 3 consists of the following remedial alternative components:

[2] Including Per- and Polyfluoroalkyl Substances (PFAS) sampling and analysis (NYSDEC 2023).

- A remedial design program to provide the details necessary for the construction, operation, and optimization and monitoring of the remedial program.
- In preparation for implementation of removal actions, the following activities will be implemented:
    - Removal of remaining remnants of structures and the existing bike trail
    - Clearing and grubbing of heavy vegetation (*i.e.,* organic debris)
    - Existing overburden monitoring wells and bedrock monitoring wells, as needed, will be removed and decommissioned, respectively, in accordance with NYSDEC regulations as part of excavation activities described below.
- Removal Actions
    - Excavation of approximately 475,000 CY (807,500 tons) of impacted soils from over 15.4 acres of the Site
    - Following excavation, backfill meeting DER-10 and Part 375 requirements[2] for imported material will be placed to achieve existing grade and the area restored with vegetation.
- Disposal Actions
    - Off-site disposal of approximately 1,030 tons of organic debris
    - Off-site disposal of approximately 1,100 tons of construction and demolition debris
    - Off-site disposal of approximately 475,000 CY (807,500 tons) of soil as non-hazardous regulated waste
- Wetland Mitigation
    - Based on recommendations documented in the *Vacuum Oil BOA Supplemental, Grading, Utilities and Wetland Mitigation Report* (Bergmann 2019b), approximately 1.5 acres of compensatory wetland will be established via off-site wetland mitigation or wetland credits.
- Groundwater monitoring will be conducted using on-site wells for five years to evaluate remedy effectiveness. It is assumed that quarterly groundwater monitoring would be conducted for the first year after remediation and semi-annually after year one. Select groundwater monitoring wells removed or decommissioned as part of excavation activities would be reinstalled, as needed, to conduct groundwater monitoring.

An illustration of the components of Alternative 3 is provided in **Figure 6.**

4.2 Individual Analysis of Alternatives

This section documents the analysis of three remedial alternatives that were developed. The detailed analysis of the alternatives was conducted consistent with NYSDEC DER-10 Section 4.2 (NYSDEC 2010a) and 6 NYCRR Part 375-1.8(f). This section describes the individual and comparative analysis of the remedial alternatives with respect to nine evaluation criteria in accordance with the DER-10 remedy selection process. The criteria are categorized into three groups:

- Threshold Criteria
    - Overall protection of human health and the environment; and
    - Compliance with SCGs.
- Primary Balancing Criteria
    - Long-term effectiveness and permanence;
    - Reduction of toxicity, mobility, or volume through treatment;
    - Short-term impact and effectiveness;
    - Implementability;
    - Cost effectiveness; and
    - Land use.

- Modifying Criteria
    - Community Acceptance.

The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to evaluate the difference between alternatives. The modifying criterion is formally considered after public comment is received. The evaluation criteria are described below:

Table 3: Remedial Alternative Evaluation Criteria

Criterion	**Considerations**
Threshold Criteria	
Overall protectiveness of human health and the environment	Achievement and maintenance of adequate protection Elimination, reduction, or control of site risks through removal, treatment, containment, engineering, or institutional controls Ability to achieve RAOs
Conformance with SCGs	Attainment of chemical-, location-, and action-specific ARARs
Primary Balancing Criteria	
Long-term effectiveness and permanence	Magnitude of potential residual exposure pathways from materials remaining at the conclusion of the remedial activities. Adequacy and reliability of controls necessary to manage materials left on Site.
Reduction of toxicity, mobility, or volume through treatment	Treatment or recycling processes employed, and materials treated Amount of hazardous substances, pollutants, or contaminants treated or recycled Degree of expected reduction of mobility, toxicity, or volume of the waste due to treatment or recycling Degree to which treatment would be irreversible Type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate Degree to which treatment would reduce the inherent hazards posed by the Site.
Short-term effectiveness	Short-term potential risks to the community during implementation Potential impacts to workers and effectiveness/reliability of protective measures Potential environmental impacts and the effectiveness/reliability of mitigative measures Time until protection would be achieved.

Table 3: Remedial Alternative Evaluation Criteria

Criterion	Considerations
Implementability	Technical difficulties and unknowns Reliability of the technology Ease of undertaking additional remedial actions Ability to monitor the effectiveness of the remedy Activities needed to coordinate with other offices and agencies Ability and time required to obtain any necessary agency approvals and permits Availability of adequate off-site treatment, storage, and disposal capacity/services Availability of necessary equipment and specialists Provisions to obtain necessary additional resources Availability of prospective technologies.
Cost effectiveness	Capital costs Annual Operation and Maintenance (O&M) costs Periodic O&M costs Present worth cost.
Land Use	Consistency with land use Assessment relative to the current, intended, and reasonably anticipated future use of the Site and its surroundings.
Modifying Criteria	
Community acceptance	Summarizes the public's general response to the response measures described in the Proposed Plan and the RI/FS reports. Community acceptance will be assessed in the Record of Decision (ROD) and includes determining which of the response measures the community supports, opposes, and/or has reservations about.

Table 3 presents an evaluation of each of the three alternatives with respect to the above nine evaluation criteria.

4.3 Comparative Analysis of Alternatives

The detailed analysis of alternatives also included a comparative evaluation designed to consider the relative performance of the alternatives and identify major trade-offs among them. The comparative evaluation of alternatives is presented in the following subsections. In the comparative analysis of alternatives, the performance of each alternative relative to the others was evaluated for each criterion. The comparative analysis of alternatives relative to the nine evaluation criteria is presented below.

4.3.1 Overall Protection of Human Health and the Environment

Each alternative would provide for the overall protection of human health and the environment to varying degrees. A public water supply provides an alternate water supply and addresses groundwater exposures under Alternative 1; however, there are no institutional controls that would preclude exposures to soil and groundwater and large portions of the Site would remain without sufficient soil cover to meet the cover thickness required by DER-10 to provide protectiveness to human or ecological receptors. Additionally, Alternative 1 would not provide for

evaluation and mitigation, if necessary, of potential vapor intrusion in future buildings. Alternative 2 would provide protection of human health associated with soils and groundwater through the added use of institutional and engineering controls, placement of engineered soil cover, and targeted soil excavation. Protection of the environment relative to potential exposure and potential mobilization of COCs in soil would be afforded through targeted excavation and placement of the engineered soil cover. Alternative 3 would provide added protection of human health and the environment compared to Alternative 2 through additional soil removal. Alternatives 2 and 3 would provide for evaluation and mitigation, if necessary, of potential vapor intrusion in future buildings.

Each alternative would also address RAOs to varying degrees. Public water supply addresses groundwater RAOs under Alternative 1; however, there are no institutional controls that would address soil RAOs in Alternative 1. Alternative 2 would address direct contact RAOs through placement of engineered soil cover, targeted excavation, and institutional controls. Alternative 3 would address soil RAOs through removal of soil and would not rely on institutional and engineering controls to meet soil RAOs.

4.3.2 Compliance with Standards, Criteria, and Guidance (SCGs)

Each alternative would also address chemical-specific SCGs to varying degrees, through active components and/or monitoring. Alternative 1 would not achieve soil SCGs. Placement of engineered soil cover/targeted soil removal included in Alternative 2 and soil removal in Alternative 3 would directly address soil SCGs. The targeted soil removal and placement of engineering soil cover prescribed in Alternative 2 would meet restricted-residential use SCOs. Soil removal included in Alternative 3 would provide for attainment of unrestricted use soil SCGs. The cover system included under Alternative 2 would be consistent with soil cover guidance presented in NYSDEC's Part 375, DER-10 and CP-51 (NYSDEC 2006; NYSDEC 2010a; NYSDEC 2010b). Location-specific SCGs were not identified for Alternative 1. Alternatives 2 and 3 would be conducted in a manner consistent with state and federal wetland and floodplain requirements, with consideration for endangered/threatened species (*e.g.,* northern long-eared bat) and historic preservation to be considered during remedial design. Each alternative would achieve action-specific SCGs.

4.3.3 Long-Term Effectiveness and Permanence

With the exception of Alternative 1, residual risks associated with soil would be managed through institutional and engineering controls. Under Alternative 2, targeted soil/fill material exhibiting SCO exceedances and/or petroleum (in the form of grossly contaminated soil/fill material) would be excavated and disposed off-site at a permitted disposal facility. Any residual contamination remaining on-Site would be covered with a minimum of 2-ft of soil cover or asphalt cover, and if encountered during future ground intrusive activities (*e.g.,* during planned redevelopment), would be managed long-term under a SMP, in particular the Excavation Work Plan. Alternative 3 would result in the least residual risk since it would address the greatest quantity of impacted soil, however, with considerable effort. The placement of graded material (e.g., berms along Genesee River) in low-lying areas to raise the area out of the 100-year floodplain in Alternative 2 would provide an adequate and reliable means of controlling erosion of and exposures to soil material. For Alternative 2, residual risks following capping and targeted excavation would be adequately managed through institutional and engineering controls. With the exception of Alternative 1, controls included in each alternative are adequate and reliable.

4.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not provide for reduction in toxicity, mobility, and volume. No impacted material will be treated or destroyed under Alternatives 2 and 3; however, Alternative 2 includes

targeted soil removal and Alternative 3 includes full soil removal from the Site. The mobility of COCs (*i.e.,* associated with erosion) in soil would be reduced by excavation and off-site disposal in Alternatives 2 and 3, and by installation of the engineered cover system in Alternative 2. For each Alternative, the existing segment of the WRW is limiting the hydraulic connection (*i.e.,* off-site migration) of Site groundwater to the Genesee River as the WRW was constructed to the top of bedrock; therefore, providing a barrier to the off-site migration of overburden groundwater. As described in Section 2.5, the current design for the WRW rehabilitation will lower the wall height by approximately 2 ft resulting in a rise in groundwater levels, but the general groundwater flow path is expected to be consistent (**Appendix B**). The timing of removal actions will be coordinated to occur before the WRW modifications to minimize the potential for contact of the rising groundwater levels with impacted soil. To aid in flood protection and reduce the potential mobility of COCs (*i.e.,* associated with erosion), Alternative 2 assumes graded material (e*.g.,* berms along Genesee River) would be placed within low-lying areas to raise the area out of the 100-year floodplain as part of the planned redevelopment.

4.3.5 Short-Term Impact and Effectiveness

There are no short-term impacts associated with Alternative 1. Short-term impacts associated with physical hazards to workers and the community and impacts from emissions (*e.g.,* truck traffic and noise*)* and runoff would be addressed for Alternatives 2 and 3 through accepted health and safety, construction practices, and community air monitoring for dust and VOCs. Considerations for exposure-related concerns would be addressed during remedial design. Excavation activities in Alternative 3 would present a substantial impact for onsite workers and neighboring residences. RAOs would be addressed upon remedy implementation of Alternatives 2 and 3.

There would be some short-term environmental and sustainability impacts associated with the implementation of Alternatives 2 and 3. Specifically, construction activities would generate greenhouse gases (emissions from vehicles) and consume fossil fuels. Increased truck traffic and noise for the duration of construction is also anticipated under Alternatives 2 and 3. Green remediation techniques, as detailed in NYSDEC DER-31, would be considered to reduce the short-term impacts of the remedy. Alternative 3, given the greatest amount of construction required, would result in the most environmental and sustainability impacts, followed by Alternative 2.

4.3.6 Implementability

Each alternative is readily constructible and operable, and necessary equipment, specialists and materials are readily available. No difficulties are anticipated related to obtaining operating approvals; however, Site access would be contingent upon access agreements with neighboring properties, in order to execute the scope of remedies in Alternatives 2 and 3. Effectiveness of each alternative is readily monitored, though Alternative 1 does not include a monitoring component. Due to disruption to on-going business activities and nuisance to neighboring residences, as well as constructability, would render Alternative 3 less implementable than Alternatives 1 and 2. Excavation considerations (*e.g.,* construction water management and sheeting), also limit the implementability of Alternative 3 since large volumes are anticipated due to excavations in proximity to on-Site wetlands and the Genesee River. For Alternatives 2 and 3, sheet piling with tiebacks is assumed to provide excavation support, as well as building structure protection for the 5 Flint Street building should excavations be performed prior to the planned demolition of the building. It is assumed that construction water will be sampled and managed via frac tanks for permitted discharge into the active sewer on South Plymouth Avenue following NYSDEC-approval. Landfill capacity would also require confirmation prior to implementation of Alternatives 2 and 3.

4.3.7 Cost

Detailed cost estimates for the alternatives are included as **Tables 5A through 5C**. The costs associated with Alternatives 1 through 3 are summarized as follows:

Table 6: Remedial Alternative Cost Estimate Summary

Alternative	Total Estimated Capital Cost	Total Estimated Present Worth of O&M (30 Years)	Total Estimated Present Worth Cost
Alternative 1: No Action	$0	$0	$0
Alternative 2: Engineered Soil Cover, Targeted Excavation and Off-Site Disposal	$20.9 M	$1.7 M	$22.6 M
Alternative 3: Pre-Disposal/Unrestricted Use	$149.1 M	$0.8 M	$149.9 M

4.3.8 Land Use

Alternatives 2 and 3 can be implemented consistent with current, intended, and reasonably anticipated future use of the property, though implementation of Alternative 3 would be disruptive to users of the property and neighboring residences, and may not align with the scheduled development plan. Alternative 1 does not provide the required level of long-term protectiveness for current and reasonable anticipated future use of the property. Though not consistent with the current zoning, Alternative 2 is most conducive to the planned redevelopment of the Site, and will include rezoning as part of the remedy. As stated in Section 2, the City Zoning Alignment Project is in progress.

4.3.9 Community Acceptance

Community acceptance would be addressed during the public comment period prior to the Decision Document being finalized and issued.

5. ALTERNATIVES ANALYSIS SUMMARY AND RECOMMENDATION

This Remedial Alternatives Analysis was conducted consistent with the requirements of 6 NYCRR Part 375 and NYSDEC's DER-10, and consistent with the current and anticipated redevelopment plans. Accordingly, RAOs were identified to address the elimination or mitigation of potential threats to human health and the environment. Three alternatives were developed and evaluated for this RAAR. Each alternative was evaluated via individual and comparative analysis with respect to nine evaluation criteria in accordance with the DER-10 remedy selection process.

Based on the detailed evaluation of the alternatives, Alternative 2 is recommended as the final Site remedy. Alternative 2 would provide the best balance of the evaluation criteria while achieving the RAOs set forth in this RAAR and would be consistent with current and anticipated redevelopment plans.

Alternative 2 would include the following remedial elements:

- A remedial design program to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program.
- Institutional Controls
    - Implementation of an environmental easement that would restrict intrusive activities and future land use to restricted residential and restrict use of groundwater as a potable source. Groundwater use would be restricted unless applicable treatment and/or approval by NYSDOH and Monroe County Health Department was received.
    - Rezoning consistent with the intended and reasonably anticipated future use based on the planned redevelopment (*i.e.,* restricted-residential use).
    - Periodic Site reviews
    - Development and implementation of a SMP, including provisions for soil/cap management and requirements to limit exposure to soil and groundwater during site redevelopment and future construction activities. The SMP would also provide for evaluation and mitigation of potential vapor intrusion into planned buildings and long-term monitoring of groundwater and other media to evaluate the effectiveness of the remedy.
- In preparation for implementation of removal and containment actions, the following activities will be implemented:
    - Removal of remaining remnants of structures and the existing bike trail
    - Clearing and grubbing of heavy vegetation (*i.e.,* organic debris)
    - Site-wide grading
        - Assumes graded material (e*.g.,* berms along Genesee River) would be placed within low-lying areas. Additional soil may be removed/graded in preparation for soil cover installation to achieve target redevelopment elevations based on the *Vacuum Oil BOA Supplemental, Grading, Utilities and Wetland Mitigation Report* (Bergmann 2019b). Material that will be reused will be sampled in accordance with NYSDEC DER-10 and approved by NYSDEC prior to reuse.
    - Existing overburden monitoring wells and bedrock monitoring wells, as needed, will be removed and decommissioned, respectively, in accordance with NYSDEC regulations as part of excavation activities described below.
- Removal Actions

  - Targeted excavation of soil exhibiting indicators of potential soil impacts, including sheens, staining, odors, elevated PID readings, and/or elevated COC concentrations (1.1 acres). For the purpose of this RAAR, the area and volume of soil proposed for excavation was developed based on RI analytical data and field observations. A PDI will be implemented to refine the extent of targeted soil excavations.
  - The following areas, as shown on **Figure 1**, are proposed for targeted soil excavation (approximately 22,300 CY):
    - 13 Cottage Street parcel in the area surrounding OVR-117 (1 area; assume excavation up to 13.4 ft)
    - 102 Violetta Street parcel in the areas surrounding SB-169 and SB-138 (2 areas; assume excavation up to 21 ft)
    - Northern end of 10 Flint Street (formerly part of 1320 S. Plymouth Avenue parcel (1 area; assume excavation up to 11 ft)
  - Following excavation, backfill meeting NYSDEC DER-10 and Part 375 requirements[2] for imported material will be placed to match surrounding grade and the area restored with vegetation.
  - Additional soil may be excavated and disposed off-site based on presence of odors/staining, as encountered, during remedial actions and site redevelopment activities. For the purpose of developing the RAAR cost estimate, an additional 20 percent by volume (approximately 4,500 CY) soil was assumed for excavation and off-site disposal.
  - PDI will be performed to further define the extent of impacted soil (*i.e.,* soil exhibiting indicators of potential soil impacts, including sheens, staining, odors, elevated PID readings and/or elevated COC concentrations) for targeted excavations. It is assumed that PDI soil samples will serve as confirmatory soil samples following NYSDEC approval.
- Containment Actions
  - Engineered soil cover over approximately 12.6 acres of surface soil with concentrations exceeding Restricted-Residential SCOs.
    - Placement of a 2-ft thick soil cover with vegetation to prevent incidental exposure to impacted soils and reduce erosion and migration of impacted surface soils
  - Asphalt cover over approximately 1.0 acre (1,800 linear ft) of area identified as future public roadway in the BOA Master Plan.
  - A demarcation layer will be installed below the engineered soil and asphalt covers to serve as a visual boundary between the cover system and potential soil impacts.
  - In anticipate of Site redevelopment, approximately 1,800 linear ft of clean utility corridors will be established and are assumed to align with the future asphalt public roadway.
- Disposal Actions
  - Off-site disposal of approximately 1,030 tons of organic debris
  - Off-site disposal of approximately 1,100 tons of construction and demolition debris
  - Off-site disposal of approximately 32,500 CY (55,300 tons) of soil as non-hazardous regulated waste
- Wetland Mitigation
  - Based on recommendations documented in the *Vacuum Oil BOA Supplemental, Grading, Utilities and Wetland Mitigation Report* (Bergmann 2019b),

approximately 1.5 acres of compensatory wetland will be established via off-site wetland mitigation or wetland credits.

- Groundwater monitoring will be conducted using on-site wells for five years to evaluate remedy effectiveness. It is assumed that quarterly groundwater monitoring would be conducted for the first year after remediation and semi-annually after year one. Select groundwater monitoring wells removed or decommissioned as part of excavation activities and cover installation will be reinstalled, as needed, to conduct groundwater monitoring.

RAOs would be achieved by Alternative 2 as follows:

- Ingestion/direct contact with soil would be addressed through targeted removal, placement of engineered soil cover, maintenance and institutional controls.
- Inhalation of or exposure to COCs volatizing, if present as determined via a pre-construction evaluation for future redevelopment, would be addressed through engineering controls, if necessary.
- Migration of COCs in soil to surface water would be addressed through placement of an engineered soil cover.
- Direct contact with, inhalation of, or ingestion of groundwater with COC levels exceeding Class GA drinking water standards would be addressed through institutional controls and existing public water supply.

In addition to addressing the RAOs identified for this Site, the remedy components would provide for property use consistent with the proposed redevelopment for the Site.

The following green remediation techniques, as detailed in NYSDEC DER-31, would be considered during implementation of Alternative 2 remedy components:

- Use of renewable energy and/or purchase of renewable energy credits.
- Reduction in vehicle idling, including both on and off-road vehicles and construction equipment.
- Beneficial reuse of material that would otherwise be considered a waste.
- Use of ultra-low sulfur fuel for construction equipment.

In summary, Alternative 2 is the recommended alternative because it would address RAOs and provide overall protection of human health and the environment, and comply with SCGs. When comparing Alternative 2 with Alternatives 1 and 3 using the primary balancing criteria, it is evident that equal protectiveness would be provided using Alternative 2 at a much lower cost than Alternative 3, and greater protectiveness than Alternative 1. In addition, this level of protectiveness can be achieved with lower sustainability impacts than Alternative 3. Furthermore, Alternative 2 remedy components are consistent with the proposed Site development plans.

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Shumaker, 2017. *Final Wetland Assessment and Delineation. Ecological Screening & Invasive Species Report.* June 2017.

TABLES

Table 1: Potential Standards, Criteria, and Guidance			Portion of Former Vacuum Oil Refinery Site , Rochester, New York, Site No. C828190	
Medium Location/Action	**Citation**	**Requirements**	**Comments**	**Potential SCG**
Potential Chemical-Specific SCGs				
Soil/fill material	6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives (SCOs)	Promulgated state regulation that provides guidance for SCOs for various restricted property uses (industrial, commercial, restricted residential, and residential), for the protection of groundwater and ecological resources, and for unrestricted property use. A site designated for unrestricted use is a site subject to no imposed institutional or engineering controls, such as an environmental easement or deed restriction. [DER-10 (NYSDEC 2010)].	SCOs for restricted use (restricted-residential) are potentially applicable to site soil/fill material given the current and reasonably anticipated future use of the Site to include multi-family residential, commercial/retail, and industrial facilities. SCOs for the protection of groundwater may be applicable where groundwater impacts are consistent with the COCs in Site soils. SCOs for unrestricted use may not be applicable given the current and reasonably anticipated future use of the Site; however, were considered for the purpose of evaluating pre-disposal conditions.	Yes
	NYSDEC Commissioner's Policy 51 – Soil Cleanup Guidance	Guidance that provides framework and procedures for the selection of soil cleanup levels for each of the remedial programs in the NYSDEC DER.	SCOs for restricted use (restricted-residential) are potentially applicable to site soil/fill material given the current and reasonably anticipated future use of the Site to include multi-family residential, commercial/retail, and industrial facilities. SCOs for the protection of groundwater may be applicable where groundwater impacts are consistent with the COCs in Site soils. SCOs for unrestricted use may not be applicable given the current and reasonably anticipated future use of the Site; however, were considered for the purpose of evaluating pre-disposal conditions.	Yes
Groundwater	6 NYCRR Part 703 – Class GA Groundwater Quality Standards	Promulgated water quality standards for fresh groundwater, including narrative and constituent-specific standards.	Potentially applicable for Site groundwater.	Yes
	NYS TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations	Guidance that summarizes groundwater standards and guidance values. Guidance values are provided where standards are not available.	Potentially applicable for Site groundwater.	Yes
	40 CFR Part 141 – Drinking Water Standards	Promulgated federal regulation that establishes primary drinking water regulations applicable to public water systems.	Potentially applicable for Site groundwater. Groundwater is not used as a drinking water source as municipal water is available.	Yes
Potential Location-Specific SCGs				
Construction of buildings	NYSDOH's October 2006 Guidance for Evaluating Soil Vapor Intrusion in the State of New York	Guidance document that provides thresholds for indoor air and sub-slab soil vapor above which vapor mitigation is required.	Not currently applicable because no buildings are present at the Site. Potentially applicable if future buildings are constructed at the Site.	Yes
	OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154, June 2015	Technical guidance that provides recommendations on assessment of vapor intrusion pathways that pose an unacceptable risk to human health.	Not currently applicable because no buildings are present at the Site. Potentially applicable if future buildings are constructed at the Site.	Yes

Table 1: Potential Standards, Criteria, and Guidance — **Portion of Former Vacuum Oil Refinery Site , Rochester, New York, Site No. C828190**

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Water Bodies	33 CFR 320 - 330 - Navigation and Navigable Waters	Regulatory policies and permit requirements for work affecting waters of the United States and navigable waterways.	Substantive, non-administrative requirements potentially applicable to work affecting the Genesee River.	Yes
	16 USC 661 - Fish and Wildlife Coordination Act	Requires protection of fish and wildlife in a stream or other water body when performing activities that modify a stream or river.		
Wetlands	6 NYCRR 663 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 feet) must be approved by NYSDEC or its designee. Activities occurring adjacent to freshwater wetlands must: be compatible with preservation, protection, and conservation of wetlands and benefits; result in no more than insubstantial degradation to or loss of any part of the wetland; and be compatible with public health and welfare.	Several federal wetlands have been identified at the Site. Potentially applicable to remedial actions within 100 feet of Site wetlands.	Yes
	Clean Water Act Section 404 33 CFR Parts 320 - 330	Regulatory policies and permit requirements for work affecting waters of the United States, including wetlands.	Potentially applicable for Site wetlands.	Yes
	Clean Water Act Section 404 40 CFR Parts 230-231	Provides for restoration and maintenance of integrity of waters of the United States, including wetlands, through the control of dredged or fill material discharge.		
	Executive Order 11990 - Protection of Wetlands	Executive order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or loss of wetlands if a practical alternative exists.		
Wetlands & Floodplains	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-2; 1985)	Policy and guidance requiring Superfund actions to meet substantive requirements of Executive Orders 11988 and 11990. Describes requirements for floodplain assessment during remedial action planning.	Potentially applicable for Site wetlands. Potentially applicable as portions of the Site are also situated within the Genesee River 100-year floodplain.	Yes
	40 CFR Part 6, Appendix A - Statement of Procedures on Floodplains Management and Wetlands Protection (January 5, 1979, https://www.epa.gov/nepa/floodplain-management-and-wetland-guidance-national-environmental-policy-act-reviews)	Policy and guidance for implementing Executive Orders 11988 and 11990. Requires federal agencies to evaluate the potential effects of action proposed in wetlands and floodplains to avoid, to the extent possible, adverse effects. Federal agencies are required to evaluate alternatives to actions in wetlands or floodplains and to avoid or minimize adverse impacts if not practical alternatives exist.	Potentially applicable for Site wetlands. Potentially applicable as portions of the Site are also situated within the Genesee River 100-year floodplain. Requires a floodplain assessment if the selected alternative includes remedial activities that would potentially impact the floodplain.	Yes
Floodplains	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities -100-yr floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable. Portions of the Site are within the Genesee River 100-year floodplain; however, no hazardous waste treatment, storage, or disposal facilities are planned to be located on the Site.	No
	40 CFR Part 264.18(b) - Location Standards - Floodplains	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable. Portions of the Site are within the Genesee River 100-year floodplain; however, no hazardous waste treatment, storage, or disposal facilities are planned to be located on the Site.	No

Table 1: Potential Standards, Criteria, and Guidance — **Portion of Former Vacuum Oil Refinery Site , Rochester, New York, Site No. C828190**

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Floodplains (continued)	Executive Order 11988 - Floodplain Management	USEPA is required to conduct activities to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupation or modification of floodplains. The procedures also require USEPA to avoid direct or indirect support of floodplain development wherever there are practicable alternatives and minimize potential harm to floodplains when there are no practicable alternatives.	Potentially applicable. Portions of the Site are within the Genesee River 100-year floodplain. Requires a floodplain assessment if the selected alternative includes remedial activities that would potentially impact the floodplain.	Yes
	Executive Order 13690 - Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input	Executive order establishes a Federal Flood Risk Management Standard (FFRMS), a Process for Further Soliciting and Considering Stakeholder Input, and amends Executive Order 11988. The FFRMS establishes a construction standard and framework for Federally funded projects constructed in, and affecting, floodplains, to reduce the risks and cost of floods. Under the FFRMS, federal agency management is expanded from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk to increase resiliency of projects funded with federal funds. The Executive Order also sets forth a process for solicitation and consideration of public input, prior to implementation of the FFRMS.	Potentially applicable. Portions of the Site are within the Genesee River 100-year floodplain. Requires a floodplain assessment if the selected alternative includes remedial activities that would potentially impact the floodplain.	Yes
	6 NYCRR 500 - Floodplain Management Regulations Development Permits	Promulgated state regulations providing permit requirements for development in areas of special flood hazard (floodplain within a community subject to a one percent or greater chance of flooding in any given year).	Requires remedial activities to be conducted in accordance with the local and state statutory requirements if conducted within the 100-year and/or 500-year floodplains as defined by FEMA. The 100-year floodplain exists along the Genesee River and includes portions of the Site.	Yes
Within 61 Meters (200 feet) of a Fault Displaced in Holocene Time	40 CFR Part 264.18(a) - Location Standards - Seismic considerations	New treatment, storage, or disposal of hazardous waste is not allowed.	Not applicable. The Site is not located within 200 feet of a fault displaced in Holocene time, as listed in 40 CFR 264 Appendix VI. None listed in New York State.	No
Within Salt Dome or Bed Formation, Underground Mine, or Cave	40 CFR Part 264.18 (c) - Location standards; salt dome formations, salt bed formations, underground mines and caves.	Placement of non-containerized or bulk liquid hazardous waste is not allowed.	Not applicable. No salt dome formations, salt bed formations, underground mines or caves present at the Site.	No
Habitat of an Endangered or Threatened Species	6 NYCRR 182	Promulgated state regulation that provides requirements to minimize damage to habitat of an endangered species.	Potentially applicable. The northern long-eared bat, a state and federal-listed threatened species, potentially occurs within the study area (Fish and Wildlife Resource Impact Analysis, OBG 2019). A summer roosting habitat for the northern long-eared bats is potentially present in forested communities within the Site. Measures to ensure the continued integrity of the roost site will be considered.	Yes
	Endangered Species Act	Provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction.		
	50 CFR Part 17 - Endangered and Threatened Wildlife and Plants and 50 CFR Part 402 - Interagency Cooperation	Promulgated federal regulation that requires that federal agencies ensure authorized, funded, or executed actions will not destroy or have adverse modification of critical habitat.		

Table 1: Potential Standards, Criteria, and Guidance — **Portion of Former Vacuum Oil Refinery Site , Rochester, New York, Site No. C828190**

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Historical Property or District	National Historic Preservation Act 36 CFR 800- Preservation of Historic Properties Owned by a Federal Agency	Remedial actions are required to account for the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places.	Potentially applicable. To be considered during remedial design.	Yes
	National Historic Preservation Act 36 CFR Part 65 - National Historic Landmarks Program	Promulgated federal regulation requiring that actions must be taken to preserve and recover historical/archeological artifacts found.		
	New York State Historic Preservation Act of 1980 9 NYCRR Parts 426 - 428	State law and regulations requiring the protection of historic, architectural, archeological and cultural property.		
Wilderness Area	Wilderness Act 50 CFR Part 35 - Wilderness Preservation and Management	Provides for protection of federally-owned designated wilderness areas.	Not applicable. Site not located in wilderness area.	No
Wild, Scenic, or Recreational River	Wild and Scenic Rivers Act	Provides for protection of areas specified as wild, scenic, or recreational.	Not applicable. Site no located near wild, scenic, or recreational river.	No
Coastal Zone	Coastal Zone Management Act	Requires activities be conducted consistent with approved State management programs.	Not applicable. Site not located in coastal zone.	No
Coastal Barrier	Coastal Barrier Resources Act	Prohibits any new Federal expenditure within the Coastal Barrier Resource System.	Not applicable. Site not located in coastal barrier system or coastal zone.	No
Potential Action-Specific SCGs				
Institutional Controls	NYSDEC DER-33 Institutional Controls: A Guide to Drafting and Recording Institutional Controls, December 2010	Technical guidance document that provides guidelines for proper development and recording of institutional controls as part of a site remedial program.	Potentially applicable when institutional controls are implemented as a component of the selected remedy.	Yes
Cover Systems	NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010	Technical guidance document that provides guidelines for cover thicknesses as they relate to property use in areas where exposed surface soil exceeds NYCRR Part 375 SCOs. Specifically, where the exposed surface soil at the site exceeds the applicable soil cleanup objective for protection of human health and/or ecologic resources, the soil cover for restricted residential use, is to be two feet; for commercial or industrial use, is to be one foot; or when an ecological resource has been identified is to be a minimum of two feet; and when such a concern is identified by NYSDEC, consideration should be given to supplementing the demarcation layer to serve as an impediment to burrowing.	Potentially applicable for cover components of alternatives.	Yes
Landfill	40 CFR Parts 264 and 265, Subpart N – Landfills	Promulgated federal regulation that provides requirements for hazardous waste landfill units.	Landfilling of wastes may be applicable for the Site.	Yes
	40 CFR Part 257 – Criteria for Classification of Solid Waste Disposal Facilities and Practices	Promulgated federal regulation that provides criteria for solid waste disposal facilities to protect health and the environment.		

Table 1: Potential Standards, Criteria, and Guidance **Portion of Former Vacuum Oil Refinery Site , Rochester, New York, Site No. C828190**

Medium Location/Action	Citation	Requirements	Comments	Potential SCG
Generation and Management of Solid Waste	6 NYCRR 360 - Solid Waste Management Facilities	Promulgated state regulation that provides requirements for management of solid wastes, including disposal and closure of disposal facilities.	Potentially applicable to alternatives including disposal of solids wastes as well as capping alternatives.	Yes
Land Disposal	6 NYCRR 376 - Land Disposal Restrictions 40 CFR Part 268 - Land Disposal Restriction 62 CFR 25997 - Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes	Promulgated federal and state regulations that provide treatment standards to be met prior to land disposal of hazardous wastes.	Potentially applicable to excavated soil if found to be hazardous wastes and disposed at a landfill. Applicable for off-site treatment and disposal of soil/fill material.	Yes
Green Remediation	NYSDEC DER-31 Green Remediation Program Policy, January 2011 Superfund Green Remediation Strategy, September 2010	State technical guidance document that provides guidelines for the development of site remediation strategies in a manner that minimizes environmental impacts and applies green remediation concepts (e.*g.*, reduction in greenhouse gas emissions, energy consumption and resource use, promotion of recycling of materials and conservations of water, land and habitat).	Potentially applicable.	Yes
General Excavation	6 NYCRR 200-203, 211-212 - Prevention and Control of Air Contamination and Air Pollution	Provides requirements for air emission sources.	Portions potentially applicable to volatile emissions during excavation.	Yes
	6 NYCRR 257 - Air Quality Standards	Promulgated state regulation that provides specific limits on generation of SO_2, particulates, CO_2, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides, beryllium and H2S from point sources.	Not applicable. Dust emissions would not be generated from a point source.	No
	40 CFR Part 50.1 - 50.12 - National Ambient Air Quality Standards	Promulgated federal regulation that provides air quality standards for pollutants considered harmful to public health and the environment. The six principle pollutants are carbon monoxide, lead, nitrogen dioxide, particulates, ozone, and sulfur oxides.	Potentially applicable to alternatives during which dust generation may result, such as during earth moving, grading, and excavation.	Yes
	NYS TAGM 4031 - Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites	State guidance document that provides limitations on dust emissions.		
Construction	29 CFR Part 1910.120 - Occupational Safety and Health Standards - Hazardous Waste Operations and Emergency Response	Promulgated federal regulation requiring that remedial activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes
	29 CFR Part 1926 - Safety and Health Regulations for Construction	Promulgated federal regulation requiring that remedial construction activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes

Table 1: Potential Standards, Criteria, and Guidance **Portion of Former Vacuum Oil Refinery Site , Rochester, New York, Site No. C828190**

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

Notes:
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CFR – Code of Federal Regulations
COC – Constituents of Concern
DER – Division of Environmental Remediation
FEMA – Federal Emergency Management Agency
FFRMS – Federal Flood Risk Management Standard
NYCRR – New York Code of Rules and Regulations
NYS – New York State
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York State Department of Health
OSWER – Office of Solid Waste and Emergency Response
SCOs – Soil Cleanup Objectives
SCGs – Standards, Criteria, and Guidance
TAGM – Technical and Administrative Guidance Memorandum
TOGS – Technical and Operations Guidance Series
USC – United States Code
USEPA – United States Environmental Protection Agency
Shaded cells - not identified as Potential SCGs

Table 4: Detailed Analysis of Remedial Alternatives			Portion of Former Vacuum Oil Refinery Site Rochester, NY NYSDEC Site No. C828190
Criterion	**Alternative 1 No Action**	**Alternative 2 Engineered Soil Cover, Targeted Excavation, and Off-Site Disposal, and Groundwater Monitoring**	**Alternative 3 Pre-disposal/Unrestricted Use**
	• No Action	• Institutional controls • Targeted excavation and off-site disposal • Engineered cover • Groundwater monitoring • Periodic reviews • Off-site wetland mitigation	• Institutional controls • Excavation and off-site disposal • Groundwater monitoring • Site restoration • Off-site wetland mitigation
Overall Protection of Human Health and the Environment			
Overall Protection of Human Health	Not protective of human health. Alternative would not provide for mitigation of potentially unacceptable risks to human health associated with exposure to impacted soil and groundwater.	Protection of human health would be provided through removal of impacted soils and placement and maintenance of an engineered cover system. A cover system would address potentially unacceptable risks to human health associated with inhalation of dust and direct exposure to soil. Maintenance of covers, access restrictions, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with impacted soil. Protection of human health from groundwater impacts would be provided by groundwater monitoring and institutional controls.	Protection of human health would be provided through removal of impacted soils above the Site SCOs. Protection of human health from groundwater impacts would be provided by groundwater monitoring and institutional controls.
Overall Protection of the Environment	Not protective of the environment relative to potential migration of contaminants in soil. Relies on natural attenuation to address groundwater impacts.	Protection of the environment would be provided by the engineered cover system. A cover system would address potentially unacceptable risks to the environment related to dust, erosion, and direct contact with soil. Alternative 2 includes groundwater monitoring to address groundwater impacts.	Protection of the environment would be provided through removal of the impacted soils. Alternative 3 includes groundwater monitoring to address groundwater impacts.
Attainment of Remedial Action Objectives (RAOs)	Alternative 1 would not address RAOs for the protection of environmental and human health.	Alternative 2 would address soil and groundwater RAOs for the protection of human health and the environment through targeted removal of impacted soils, placement and maintenance of engineered cover, institutional controls, and groundwater monitoring.	Alternative 3 would address soil and groundwater RAOs for the protection of human health and the environment through removal of impacted soils, institutional controls, and groundwater monitoring.
Compliance with Site-Specific SCGs			
Compliance with Chemical-Specific SCGs	Alternative 1 does not actively address chemical-specific SCGs.	Targeted removal of impacted soils and installation of engineered cover system would address soil SCGs. Groundwater monitoring and institutional controls would address groundwater SCGs.	Removal of impacted soils would address soil SCGs. Groundwater monitoring and institutional controls would address groundwater SCGs.
Compliance with Location-Specific SCGs	No location-specific SCGs triggered for this alternative.	Proposed actions would be conducted in a manner consistent with federal and state requirements.	Proposed actions would be conducted in a manner consistent with federal and state requirements.
Compliance with Action-Specific SCGs	No action-specific SCGs triggered for this alternative.	Proposed actions would be constructed consistent with applicable standards. Solid wastes would be managed in accordance with applicable federal and state regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with	Proposed actions would be constructed consistent with applicable standards. Solid wastes would be managed in accordance with applicable federal and state regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable federal and state

Table 4: Detailed Analysis of Remedial Alternatives			Portion of Former Vacuum Oil Refinery Site Rochester, NY NYSDEC Site No. C828190
Criterion	**Alternative 1 No Action**	**Alternative 2 Engineered Soil Cover, Targeted Excavation, and Off-Site Disposal, and Groundwater Monitoring**	**Alternative 3 Pre-disposal/Unrestricted Use**
		applicable federal and state requirements, by licensed and permitted haulers. Institutional and engineering controls would be implemented in general conformance with NYSDEC guidance and policy.	requirements, by licensed and permitted haulers. Institutional and engineering controls would be implemented in general conformance with NYSDEC guidance and policy.
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risk	Residual risks associated with soil and groundwater exceeding chemical-specific SCGs would remain.	Moderate residual risk. Residual risks associated with soil material would be mitigated through the engineered cover system, institutional controls, periodic reviews, and O&M. Residual risks associated with groundwater would be addressed by groundwater monitoring and institutional controls.	Minimal residual risks. Residual risks associated with groundwater would be addressed by groundwater monitoring and institutional controls.
Adequacy and Reliability of Controls	No adequate and reliable controls under this alternative.	Targeted excavation and placement and maintenance of an engineered cover system would provide adequate and reliable means of controlling erosion of and exposures to soil material. Institutional controls are an adequate and reliable means of controlling direct contact with site soil and groundwater use.	Removal of soil above site-use SCOs and replacement with clean fill would provide adequate and reliable means of controlling erosion of and exposures to soil material. Institutional controls are an adequate and reliable means of controlling groundwater use.
Long-Term Sustainability	No long-term activities are proposed under this alternative.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance.	No long-term maintenance in this alternative.
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment Process Used and Materials Treated	No soil or groundwater would be treated in this alternative.	No soil or groundwater would be treated in this alternative.	No soil or groundwater would be treated in this alternative.
Amount of Hazardous Material Destroyed or Treated	No impacted material will be treated or destroyed in this alternative.	No impacted material will be treated or destroyed in this alternative; approximately 32,300 cy of soil would be removed from the Site.	No impacted material will be treated or destroyed in this alternative; approximately 480,000 cy of soil would be removed from the Site.
Degree of Expected Reduction in Toxicity, Mobility, or Volume	No reduction in toxicity, mobility, or volume will occur with this alternative.	The mobility of COCs (*i.e.,* associated with erosion) in soil would be reduced by excavation and off-site disposal and by installation of the engineered cover system. Approximately 32,300 cy of soil would be removed by excavation.	The mobility and volume of COCs (*i.e.,* associated with erosion) in soil material would be reduced by excavation and off-site disposal (approximately 480,000 cy).
Degree to Which Treatment is Irreversible	No soil or groundwater would be treated in this alternative.	No soil or groundwater would be treated in this alternative. Excavation and off-site disposal are considered irreversible.	No soil or groundwater would be treated in this alternative. Excavation and off-site disposal are considered irreversible.
Type and Quantity of Residuals Remaining After Treatment	No soil or groundwater would be treated in this alternative.	No soil or groundwater would be treated in this alternative.	No soil or groundwater would be treated in this alternative.
Short-Term Effectiveness			
Protection of Community During Remedial Actions	No active components are related to this alternative.	Dust and volatile emissions, if any, would be controlled during construction activities. Cover construction would result in impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Cover construction would result in impacts to the community relative to truck traffic and noise during the construction.

Table 4: Detailed Analysis of Remedial Alternatives			Portion of Former Vacuum Oil Refinery Site Rochester, NY NYSDEC Site No. C828190
Criterion	**Alternative 1 No Action**	**Alternative 2 Engineered Soil Cover, Targeted Excavation, and Off-Site Disposal, and Groundwater Monitoring**	**Alternative 3 Pre-disposal/Unrestricted Use**
Protection of Workers During Remedial Actions	No active components are related to this alternative.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.
Environmental Impacts	No active components are related to this alternative.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. In aggregate, heavy clearing would be required.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. In aggregate, heavy clearing would be required.
Time Until Remedial Action Objectives are Achieved	Remedial action objectives would not be met with this alternative	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately 1 construction season.	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately 4 construction seasons.
Short-Term Sustainability	No active components result in no fuel/energy consumption, greenhouse gas or pollutant emissions, no water or resource use, and no impacts to water or ecology from construction related activities.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-site during cover installation is estimated at approximately 3,000 $MTCO_2e$.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on- and off-site during cover installation is estimated at approximately 15,000 $MTCO_2e$.
Implementability			
Ability to Construct and Operate the Technology	There are no technologies to be constructed in this alternative.	Excavation and off-site disposal of 32,300 cy of material is readily implementable. Engineered cover systems are readily constructible and maintainable.	Not considered implementable. Excavation and offsite disposal of 480,000 cy of material up to depths of 16-ft bgs is not readily constructible. Construction water management and sheeting along the Genesee River shoreline would result in significant implementability challenges.
Reliability of Technology	There are no technologies to be constructed in this alternative.	An engineered cover system is a reliable technology. Excavation and disposal are reliable technologies. Institutional controls are reliable protection measures against exposure.	Excavation and off-site disposal are reliable technologies. Institutional controls are reliable protection measures against exposure.
Ease of Undertaking Additional Remedial Actions, if Necessary	Additional remedial actions, if necessary, would be readily implementable. It should be noted, that planned site development will limit range of additional remedial actions that can be implemented at the Site.	Additional remedial actions, if necessary, would be readily implementable. It should be noted, that planned site development will limit range of additional remedial actions that can be implemented at the Site.	Additional remedial actions, if necessary, would be readily implementable. It should be noted, that planned site development will limit range of additional remedial actions that can be implemented at the Site.
Ability to Monitor Effectiveness of Remedy	No monitoring is anticipated for this alternative.	Effectiveness of remedy would be documented through groundwater monitoring.	Effectiveness of remedy would be documented through groundwater monitoring.
Coordination with Other Agencies and Property Owners	None required.	Coordination with property owners and other agencies may be necessary. Property owners will need to approve deed notice and potential institutional controls.	Coordination with property owners and other agencies may be necessary. Property owners will need to approve deed notice and potential institutional controls.
Availability of Off-Site Treatment Storage and Disposal Services and Capacities	None required.	Capacity for off-site disposal of 32,300 cy of material is anticipated to be readily available.	Capacity for off-site disposal of 480,000 cy of material is anticipated to be readily available. Large quantities of material requiring off-site disposal may require use of multiple landfills.

Table 4: Detailed Analysis of Remedial Alternatives			Portion of Former Vacuum Oil Refinery Site Rochester, NY NYSDEC Site No. C828190
Criterion	**Alternative 1 No Action**	**Alternative 2 Engineered Soil Cover, Targeted Excavation, and Off-Site Disposal, and Groundwater Monitoring**	**Alternative 3 Pre-disposal/Unrestricted Use**
Availability of Necessary Equipment, Specialists, and Materials	None required.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are anticipated to be readily available.
Cost			
Total Estimated Capital Cost	$0	$20.9 M	$149.1 M
Present Worth of Operation and Maintenance Cost (30 years, 7% Discount Factor)	$0	$1.7 M	$0.8 M
Total Estimated Net Present Worth Cost	$0	$22.6 M	$149.9 M
Land Use			
Consistency with Proposed Future Use	Not consistent with reasonably anticipated land use.	Consistent with reasonably anticipated future land use. Though not consistent with the current zoning, Alternative 2 is most conducive to the planned redevelopment of the Site, and will include rezoning as part of the remedy.	Consistent with reasonable anticipated future land use, though may not align with planned schedule for anticipated development.
Notes:	cy – Cubic Yard COCs – Constituents of Concern $MTCO_2e$ – Metric tons of carbon dioxide equivalent NYSDEC – New York State Department of Environmental Conservation O&M – Operation and Maintenance RAOs – Remedial Action Objectives SCG – Standards, Criteria, and Guidance SCOs – Soil Cleanup Objectives		

Table 5A. Alternative 1, No Action

Site: Former Vacuum Oil Refinery Site
Location: Rochester, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2020

Conceptual Basis: No Further Action

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$0**	Rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$0**	
			Engineering/Management, Construction Oversight, OH&P	**$0**	6%, 5%, and 10% respectively
			Contingency	**$0**	Scope Contingency at 30%
			TOTAL ESTIMATED CAPITAL COST:	**$0**	Rounded
OPERATION AND MAINTENANCE COSTS					

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

Table 5B. Alternative 2, Engineered Soil Cover, Targeted Excavation and Off-Site Disposal

Site: Former Vacuum Oil Refinery Site
Location: Rochester, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2020

Conceptual Basis: Targeted excavation of impacted materials (1.1 ac)
Engineered Cover (2-ft) (12.6 ac)
Asphalt cover (1.0 ac)
Wetland Mitigation (1.5 ac)
Additional excavation of soil exhibiting sheens, staining, odor, elevated PID, as encountered (0.22 ac)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	40	$15,000	$600,000	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	2	$20,000	$40,000	Mobilization, Demobilization
Air Monitoring	LS	1	$35,000	$35,000	Community Air Monitoring
Surveys and Layouts	LS	1	$25,000	$25,000	Pre-construction, post-construction
Irrigation	WK	8	$5,000	$40,000	Following seeding, 4 weeks per season
Truck Wash/ Spoils control	WK	38	$12,000	$456,000	Wash rack and operation
Dust Suppression/Control	WK	38	$3,500	$133,000	5,000 gallon water truck and operation
Water Management	LS	1	$100,000	$100,000	Dewatering to frac tanks; assumes disposal to active sewer on S. Plymouth Street; includes testing of water
Utility Support	LS	1	$55,000	$55,000	Protection of active sewer line/utility poles, demo inactive sewer/water lines
Site Preparation					
Temporary Fencing	LF	6,000	$11	$66,000	During construction activities for site safety/control
Exterior Concrete Demolition	LS	1	$128,000	$128,000	Demo asphalt bike trail & remnants of foundations/concrete walls
Clearing and Grubbing	AC	15.4	$15,000	$231,000	
Heavy Grading	AC	9.73	$8,000	$77,840	Within redevelopment area; assume graded material placed in low-lying areas
Light Grading	AC	5.67	$5,000	$28,350	Light grading outside redevelopment area
Temporary access roads	SF	30,000	$9	$270,000	
Construction Entrance	LS	1	$8,100	$8,100	6-inch stone entrance
Erosion and Sediment Control	LF	4,000	$7	$28,000	Reinforced silt fence along perimeter
Sheeting	SF	32,700	$50	$1,635,000	Sheetpiling with tiebacks for excavation support and 5 Flint Street building support; various lengths
Existing Monitoring Wells					
Removal	EA	9	$3,100	$27,900	Remove overburden wells
Decomissioning	EA	5	$3,100	$15,500	Decomission bedrock wells grout-in-place/cut upper PVC
QA/QC					
Import Materials QA/QC Testing	EA	137	$2,600	$354,952	1/500 cy of imported materials; in accordance with NYSDEC DER-10 and PFAs requirements
Performance QA/QC - Compaction	WK	10	$1,400	$14,000	During material placement only
Targeted Excavation (1.1 ac)					
Targeted excavation	CY	22,300	$10	$223,000	1320 S. Plymouth Street, 102 Violetta Street and 13 Cottage Street parcels
Install Clean Utility Corridor	CY	800	$13	$10,400	Assume to align with roads
Backfill and Restoration (1.1 ac)					
Backfill subgrade	CY	21,300	$30	$639,000	
Place Imported Topsoil	CY	900	$58	$52,200	Placement by conventional equipment in 6-inch lifts; to approx. El. 395
Place Imported Fill	CY	900	$43	$38,700	Placement by conventional equipment in 6-inch lifts
Seeding	AC	1.1	$18,000	$19,800	Modified old field successional with fertilizer and hydromulch
Additional Excavation (0.22 ac)					
Targeted excavation	CY	4,500	$10	$45,000	Additional soil exhibiting sheens, staining, odor, elevated PID, as encountered
Additional Backfill and Restoration (0.22 ac)					
Backfill subgrade	CY	4,100	$30	$123,000	
Place Imported Topsoil	CY	200	$58	$11,600	Placement by conventional equipment in 6-inch lifts; to approx. El. 395
Place Imported Fill	CY	200	$43	$8,600	Placement by conventional equipment in 6-inch lifts
Seeding	AC	0.22	$18,000	$3,960	Modified old field successional with fertilizer and hydromulch
Place Engineered Vegetative Cover (2-ft) (12.6 ac)					
Place Imported Topsoil	CY	20,330	$58	$1,179,140	Placement by conventional equipment in 6-inch lifts
Place Imported Fill	CY	20,330	$43	$874,190	Placement by conventional equipment in 6-inch lifts
Seeding	AC	12.6	$18,000	$226,800	Modified old field successional with fertilizer and hydromulch
Demarcation layer	AC	12.6	$28,000	$352,800	Single layer geotextile below cap
Place Asphalt Cover (1.0 ac)					
Stone Base	CY	1,630	$30	$48,900	12-inches stone base
Paving	SF	44,000	$10	$440,000	Bituminous paving; future roadway in BOA Master Plan
Evaluate Fill and Amend					
Pre-design investigation	LS	1	$145,000	$145,000	PDI to refine extent of targeted excavations; includes work plan and summary reporting

Table 5B. Alternative 2, Engineered Soil Cover, Targeted Excavation and Off-Site Disposal

Site: Former Vacuum Oil Refinery Site
Location: Rochester, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2020

Conceptual Basis: Targeted excavation of impacted materials (1.1 ac)
Engineered Cover (2-ft) (12.6 ac)
Asphalt cover (1.0 ac)
Wetland Mitigation (1.5 ac)
Additional excavation of soil exhibiting sheens, staining, odor, elevated PID, as encountered (0.22 ac)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Off-Site Wetland Mitigation (1.5 ac)	AC	1.5	$250,000	$375,000	Approximately 1.5 acres of compensatory wetland; allowance
Transportation and Disposal					
Waste Characterization	EA	12	$700	$8,400	One composite sample from each excavation area
T&D by Truck - Organic Debris	TON	1,030	$45	$46,350	Assume 100 tons of trees per acre
T&D by Truck - Non-Hazardous	TON	55,400	$80	$4,432,000	Excavated materials at 1.7T/cy stabilized
T&D by Truck - C&D	TON	1,100	$72	$79,200	
Monitoring Well Installation					
Monitoring Well Installation	EA	4	$9,000	$36,000	
	TOTAL ESTIMATED DIRECT CAPITAL COST:			**$13,788,000**	Rounded
INDIRECT CAPITAL COST					
	Total Estimated Direct Capital Cost:			**$13,788,000**	
	Engineering/Management, Construction Oversight, OH&P			**$2,895,500**	6%, 5%, and 10% respectively
	Contingency			**$4,136,400**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
	TOTAL ESTIMATED CAPITAL COST:			**$20,900,000**	Rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-5					
Reporting and Recordkeeping	EA	1	$35,000	$35,000	
Cover inspection	LS	1	$2,500	$2,500	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Cover Maintenance					
Vegetation Maintenance	AC	0.7	$2,400	$1,644	Spot seeding (5% of all areas annually)
Cover maintenance and incidental repairs	AC	1	$300	$150	Topsoil repair, 5 cy/acre annually
On-site Wetland Maintenance					
Wetland Vegetation Maintenance	AC	0.1	$2,400	$180	Spot seeding (5% of all areas annually) and hand pulling invasive species
Cover maintenance and incidental repairs	AC	1	$17,500	$17,500	Topsoil repair, 5 cy/acre annually
Groundwater Monitoring					
Sampling and Analysis	EA	12	$25,000	$300,000	Quarterly GW monitoring for 1 year; semi-annual GW monitoring for 4 years (12 events, 15 wells)
Annual Years 6-30					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,500	$2,500	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$20,900,000	1.00	$20,900,000	
ANNUAL O&M COST - Years 1-5	$356,974	0.82	$1,464,000	Average discount factor for years 1-5
ANNUAL O&M COST - Years 6-30	$22,500	0.33	$187,000	Average discount factor for years 6-30
PERIODIC O&M COST - Years 5, 10, 15, 20, 25, 30	$15,000	0.36	$32,000	Average discount factor for noted years
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$22,600,000**	Rounded

Table 5C. Alternative 3, Pre-Disposal/Unrestricted Use

Site: Former Vacuum Oil Refinery Site
Location: Rochester, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2020

Conceptual Basis: Excavation of impacted materials
Backfill with clean materials

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	165	$20,000	$3,300,000	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	2	$40,000	$80,000	Mobilization, Demobilization
Air Monitoring	LS	1	$100,000	$100,000	
Surveys and Layouts	EA	1	$45,000	$45,000	Pre-construction, post-construction
Irrigation	WK	8	$5,000	$40,000	Following seeding, 4 weeks per season
Truck Wash/ Spoils control	WK	161	$12,000	$1,932,000	Wash rack and operation
Dust Suppression/Control	WK	161	$3,500	$563,500	5,000 gallon water truck and operation
Water Management	LS	1	$500,000	$500,000	
Utility Support	LS	1	$110,000	$110,000	Protection of active sewer line/utility poles, demo inactive sewer/water lines
Site Preparation					
Temporary Fencing	LF	6,000	$11	$66,000	During construction activities for site safety/control
Exterior Concrete Demolition	LS	1	$128,000	$128,000	Demo asphalt bike trail & remnants of foundations/concrete walls
Clearing and Grubbing	AC	15.4	$15,000	$231,000	Tree and underbrush chipped and left onsite.
Temporary access roads	SF	45,000	$9	$405,000	
Construction Entrance	LS	1	$8,100	$8,100	6-inch stone entrance
Erosion and Sediment Control	LF	10,000	$7	$70,000	Reinforced silt fence along perimeter
Sheeting	SF	60,000	$50	$3,000,000	Sheetpiling with tiebacks for excavation support, 5 Flint Street building support, and along waterway; various lengths
Existing Monitoring Wells					
Removal	EA	34	$3,100	$105,400	Remove overburden wells
Decomissioning	EA	5	$3,100	$15,500	Decomission bedrock wells grout-in-place/cut upper PVC
QA/QC					
Import Materials QA/QC Testing	EA	950	$2,600	$2,470,000	1/500 cy of imported materials; in accordance with NYSDEC DER-10 and PFAs requirements
Performance QA/QC - Compaction	WK	57	$1,400	$79,800	During material placement only
Remove Historic Fill Material					
Excavation up to 61-ft bgs (average 19.5 ft bgs)	CY	475,000	$10	$4,750,000	By conventional equipment and benching/sloping techniques; to approx. El. 358
Backfill and Restoration					
Backfill subgrade	CY	425,400	$30	$12,762,000	
Place Imported Topsoil	CY	24,800	$58	$1,438,400	Placement by conventional equipment in 6-inch lifts; to approx. El. 395
Place Imported Fill	CY	24,800	$43	$1,066,400	Placement by conventional equipment in 6-inch lifts
Seeding	AC	15.4	$18,000	$277,200	Modified old field successional with fertilizer and hydromulch
Off-Site Wetland Mitigation (1.5 ac)	AC	1.5	$250,000	$375,000	Approximately 1.5 acres of compensatory wetland; allowance
Transportation and Disposal					
T&D by Truck - Organic Debris	TON	1,030	$45	$46,350	Assume 100 tons of trees per acre
T&D by Truck - Non-Hazardous	TON	807,500	$80	$64,600,000	Excavated materials at 1.7T/cy stabilized
T&D by Truck - C&D	TON	1,100	$65	$71,500	
Monitoring Well Installation					
Monitoring Well Installation	EA	8	$9,000	$72,000	
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$98,708,000**	Rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$98,708,000**	
			Engineering/Management, Construction Oversight, OH&P	**$20,728,700**	6%, 5%, and 10% respectively
			Contingency	**$29,612,400**	Scope Contingency at 30%
			TOTAL ESTIMATED CAPITAL COST:	**$149,050,000**	Rounded

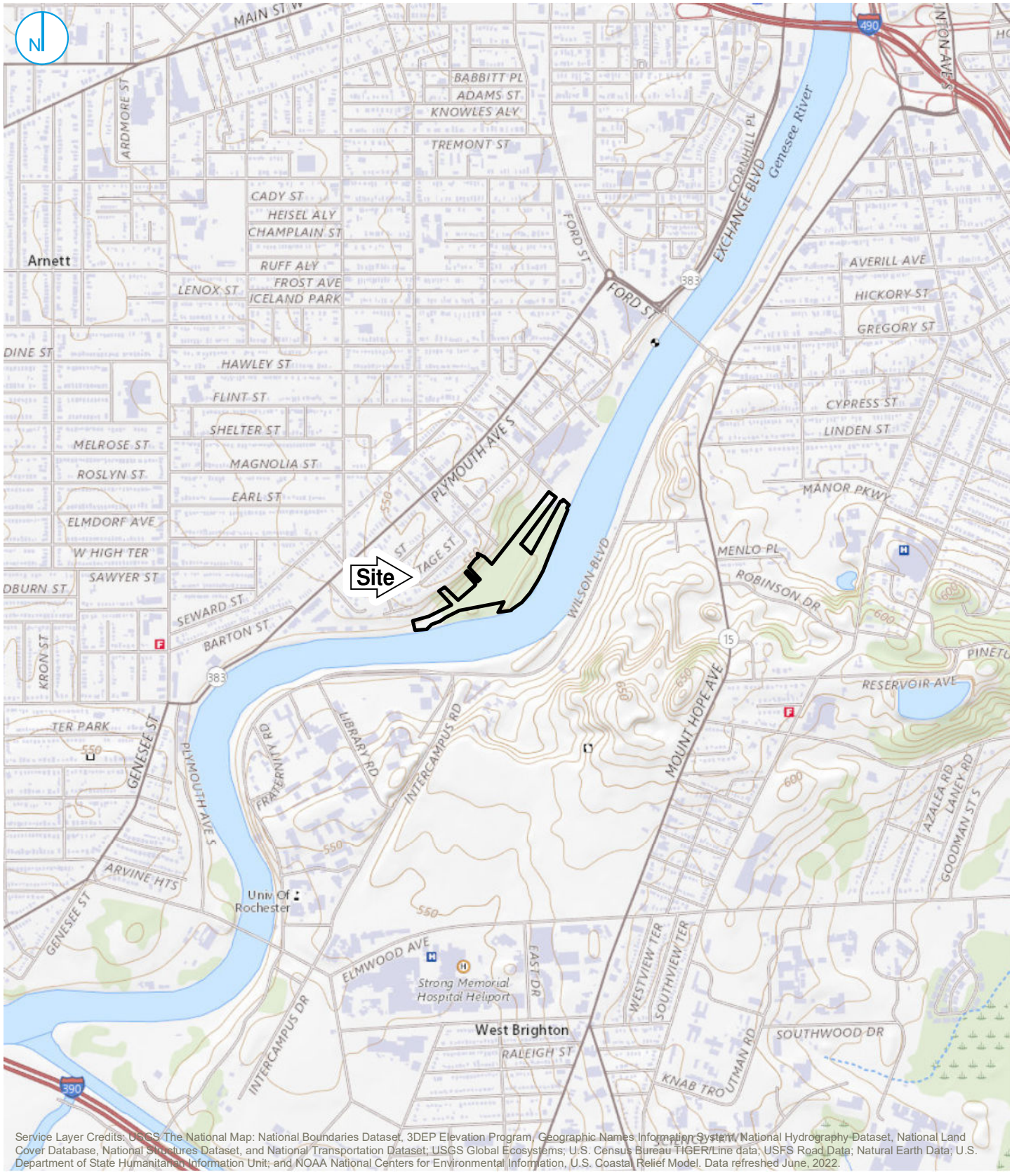
Table 5C. Alternative 3, Pre-Disposal/Unrestricted Use

Site: Former Vacuum Oil Refinery Site
Location: Rochester, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2020

Conceptual Basis: Excavation of impacted materials
Backfill with clean materials

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
OPERATION AND MAINTENANCE COSTS					
Annual Years 1-5					
Groundwater Monitoring					
Reporting and Recordkeeping	EA	1	$15,000	$15,000	
Sampling and Analysis	EA	12	$15,000	$180,000	Quarterly GW monitoring for 1 year; semi-annual GW monitoring for 4 years (12 events, 8 wells)
PRESENT WORTH ANALYSIS (YEARS 1-30)			DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
		Cost			
ESTIMATED CAPITAL COST - Year 0		$149,050,000	1.00	$149,050,000	
ANNUAL O&M COST - Years 1-5		$195,000	0.82	$800,000	Average discount factor for years 1-5
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:				**$149,850,000**	Rounded

FIGURES



Service Layer Credits: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed June, 2022.

Map Scale: 1:24,000 | Map Center: 77°37'20"W 43°8'4"N

0 1,000 2,000 Feet

BROWNFIELD CLEANUP PROGRAM
REMEDIAL ALTERNATIVES ANALYSIS REPORT

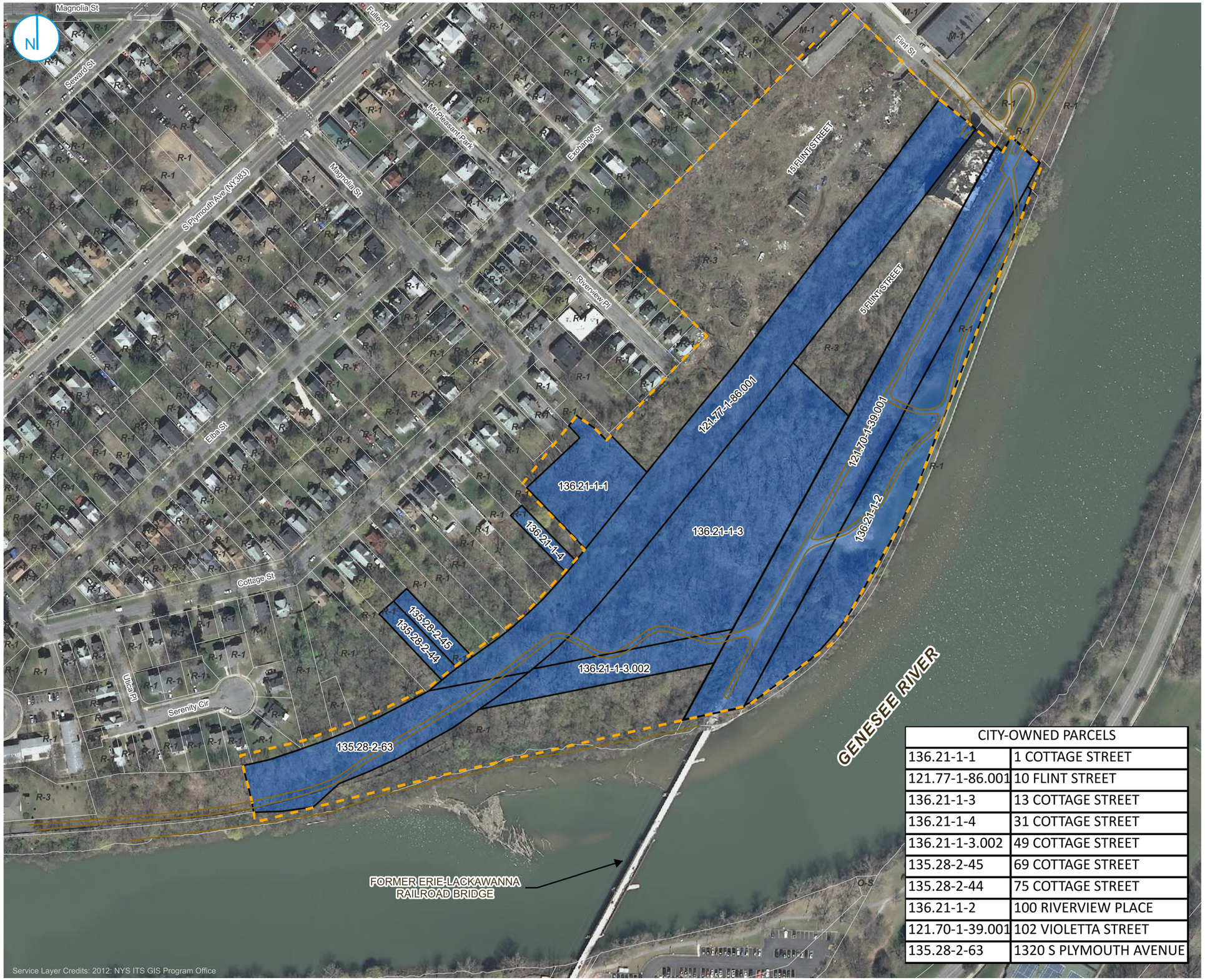
PORTION OF FORMER VACUUM OIL REFINERY
CITY OF ROCHESTER
ROCHESTER, NEW YORK

FIGURE 1
SITE LOCATION
JUNE 2023

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1940061157 | DATED: 6/7/2023 | DESIGNER: SSOULE \\ramrodfile01.ramboll.ramboll-group.global.network\projects\Rochester-C.11862\61157.Vacuum-Oil-Bcp\Docs\DWG\MXD\RIR_2017\JMN\SITE_LOCATION.mxd



CITY-OWNED PARCELS	
136.21-1-1	1 COTTAGE STREET
121.77-1-86.001	10 FLINT STREET
136.21-1-3	13 COTTAGE STREET
136.21-1-4	31 COTTAGE STREET
136.21-1-3.002	49 COTTAGE STREET
135.28-2-45	69 COTTAGE STREET
135.28-2-44	75 COTTAGE STREET
136.21-1-2	100 RIVERVIEW PLACE
121.70-1-39.001	102 VIOLETTA STREET
135.28-2-63	1320 S PLYMOUTH AVENUE

LEGEND

- FORMER VACUUM OIL REFINERY (APPROXIMATE)
- BROWNFIELD CLEANUP PROGRAM SITE LIMITS (APPROXIMATELY 15.4 ACRES)
- ASPHALT PAVED BIKE/PEDESTRIAN PATH

R-1

CITY OF ROCHESTER ZONING CODE:
M-1 = Industrial District
O-S = Open Space
R-1 = Low-Density Residential
R-3 = High-Density Residential

NOTE

1. TAX PARCELS PROVIDED BY MONROE COUNTY DES, MARCH 2010.
2. CITY PARCEL OWNERSHIP VERIFIED THROUGH THE CITY OF ROCHESTER PROPERTY INFORMATION WEBSITE ON JANUARY 11, 2022. (http://www.cityofrochester.gov/propinfo/)
3. AERIAL IMAGERY PROVIDED BY NYS GIS CLEARINGHOUSE, DATED SPRING 2012.
4. 10 FLINT STREET WAS FORMERLY IDENTIFIED AS 1320 S. PLYMOUTH AVENUE (TAX PARCEL 121.77-01-086) AND HAS SINCE BEEN DIVIDED INTO 2 PARCELS: 10 FLINT STREET (TAX PARCEL 121.77-1-86.001) AND 1320 S. PLYMOUTH AVENUE (TAX PARCEL 135.28-2-63). THESE PARCELS WERE FORMALLY IDENTIFIED AS 1315 S. PLYMOUTH AVENUE (TAX PARCEL 135.35-1-18.004).
5. 31, 69, AND 75 COTTAGE STREET ARE NOT CURRENTLY KNOWN TO HAVE BEEN SITUATED WITHIN THE FORMER VACUUM OIL REFINERY FOOTPRINT, BUT ARE INCLUDED IN THE BCP APPLICATION AND PROPOSED REMEDIAL INVESTIGATION.
6. 5 FLINT STREET AND 15 FLINT STREET INVESTIGATED BY OTHER ENTITIES (NYSDEC BCP SITE NO. C828162)

0 100 200 Feet

BROWNFIELD CLEANUP PROGRAM
REMEDIAL ALTERNATIVES ANALYSIS REPORT

PORTION OF FORMER VACUUM OIL REFINERY
13, 31, 49, 69, AND 75 COTTAGE STREET; 100 RIVERVIEW PLACE; AND PORTIONS OF 1 COTTAGE STREET; 10 FLINT STREET; 102 VIOLETTA STREET; AND 1320 S. PLYMOUTH AVENUE
ROCHESTER, NEW YORK

FIGURE 2
SITE PLAN

JUNE 2023

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 11862.61157 | DATED: 6/8/2023 | DESIGNER: SSOULE
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Location ID	Site Observations
1	Westernmost point of the Site along river bank. Miscellaneous trash. Overgrown vegetation.
2	Northwest portion of Site (backyards of Cottage Street properties visible).
3	Railroad timbers.
4	Automobile gas tank, crushed metal garbage can, 55-gallon drum.
5	Foundation walls. Former railroad bed foundation walls.
6	Railroad ties. Start of railroad bed. Foundation wall. Brick piles – approximately 50' L x 5' W.
7	Large foundation wall. Residential fuel oil tank. Tank is empty, no odors present, no signs of staining. Miscellaneous trash on top of property line.
8	Crushed metal drums. Scrap metal pile. Dark grey/black coal ash type debris.
9	Ravine facing river.
11	Culvert/drainage opening in ravine along river.
12	Two manholes, vent.
13	Former refinery building.
14	Crushed metal drums, debris in marsh area. Overgrown vegetation. Dozens of tires, concrete block.
15	Concrete rubble. Flagstone. Large culvert or pipe.
16	Metal piping. Fire hydrant #1.
17	Vehicle gasoline tank. Large crushed metal fuel oil tank.
18	Dozens of tires. Fire hydrant #2. Crushed metal Coca-Cola container. Concrete rubble/debris. Approximate 10'x10' area of cinder blocks (CMU). Rubble pile approximately 5' x 5'.
19	Scattered bricks throughout area. Metal tank approximately 5' diameter and 10' long. No odors or staining present. Few pieces of scrap metal.
20	Foundation wall. Concrete former sewage manhole (filled in). Second foundation wall. Approximately 2 dozen tires. Fire hydrant #3. Concrete rubble pile.
21	Concrete Wall.
22	Fire hydrant #4. Concrete wall.
23	Concrete wall. Secondary concrete wall parallel to first wall.
24	Tree and brush debris.
25	MCWA sanitary manhole.
27	Fire hydrant #5.
28	Metal well piping. Blue basin.
29	Stickup monitoring well. Concrete crescent shaped manhole. Concrete foundation.
30	Coal ash type debris pile.
31	Short fence.

- BEDROCK WELL BED1-100
- OVERBURDEN MONITORING WELL OVR-106
- TEST PIT TP-149
- SOIL BORING SB-100
- SURFACE SOIL SS-100
- SOIL VAPOR SV-100
- MANHOLE COVER
- BIKE PATH
- DELINEATED WETLANDS (BY OTHERS)
- BROWNFIELD CLEANUP PROGRAM
- FORMER VACUUM OIL REFINERY SITE
- NOT PART OF CITY OF ROCHESTER
- TANK CARCASS
- RETAINING WALL
- SLAG MOUND OR REEL-O-MATIC
- SHALLOW FLOOR PIT
- RUBBLE AND OR TIRE PILE
- MOLTEN PLASTIC
- SEWAGE PIPE
- CONCRETE BLOCKS
- MACHINERY
- FIRE HYDRANT
- FENCE POST
- 55 GALLON DRUM
- REMNANTS OF CIRCULAR FOOTINGS
- CULVERT
- WALL FOUNDATION
- PIPING
- DRAINAGE SWALE
- CONCRETE STRUCTURE
- WATER PIPE

0 40 80 Feet

CITY-OWNED PARCELS	
136.21-01-001	1 COTTAGE STREET
136.21-01-003	13 COTTAGE STREET
136.21-01-004	31 COTTAGE STREET
135.28-02-045	69 COTTAGE STREET
135.28-02-044	75 COTTAGE STREET
136.21-01-002	100 RIVERVIEW PLACE
121.70-01-039.1	102 VIOLETTA STREET
121.77-01-086	1320 S. PLYMOUTH AVENUE

NOTES:
1. LOCATIONS OF PARCEL BOUNDARIES ARE APPROXIMATE AND PROVIDED BY THE CITY OF ROCHESTER.
2. SOME SHAPEFILES OBTAINED FROM LABELLA ASSOCIATES, P.C. IN 2008/2009.
3. INFORMATION SOURCES:
   - DATA SUMMARY PACKAGE, FORMER VACUUM OIL REFINERY SITE - 15 FLINT STREET, OCTOBER 2008, LABELLA ASSOCIATES, P.C.
   - SUBSURFACE INVESTIGATION SUMMARY REPORT, FORMER VACUUM OIL COMPANY REFINERY AREA, JANUARY 12, 2009, ROUX ASSOCIATES, INC.
   - PHASE I ENVIRONMENTAL SITE ASSESSMENTS 1, 13, 31, 69, AND 75 COTTAGE STREET; 100 RIVERVIEW PLACE; 102 VIOLETTA STREET; AND 1315 S. PLYMOUTH AVENUE; ROCHESTER, NEW YORK, DECEMBER 2012, OBG.
4. 2015 AERIAL IMAGERY OBTAINED FROM NYS GIS CLEARINGHOUSE.
5. EXISTING MULTI-USE TRAIL SHAPEFILE PROVIDED BY GENESEE TRANSPORTATION COUNCIL, LOCATED IN ROCHESTER, NEW YORK ON MAY 28, 2015.
6. SAMPLE LOCATION COORDINATES RECORDED USING A GPS UNIT.
7. RECOGNIZED ENVIRONMENTAL CONDITIONS ARE DETAILED IN THE DECEMBER 2012 OBG PHASE I ESA REPORT.

BROWNFIELD CLEANUP PROGRAM
REMEDIAL ALTERNATIVES ANALYSIS REPORT

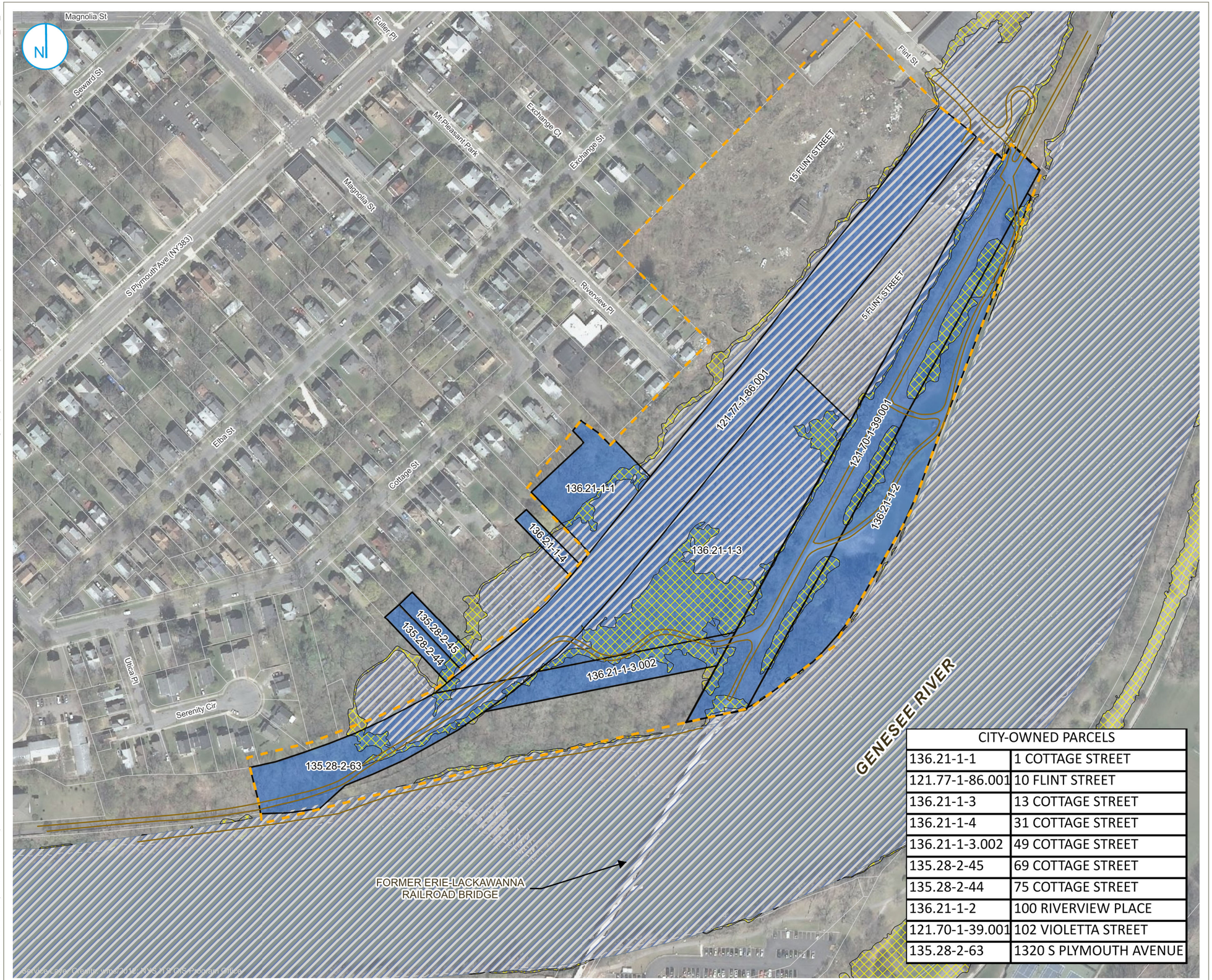
PORTION OF FORMER VACUUM OIL REFINERY
1, 13, 31, 69, AND 75 COTTAGE STREET;
100 RIVERVIEW PLACE;
102 VIOLETTA STREET;
AND PORTION OF 1320 S. PLYMOUTH AVENUE
ROCHESTER, NEW YORK

FIGURE 03
SAMPLE LOCATIONS AND SITE OBSERVATIONS

JUNE 2023

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL



CITY-OWNED PARCELS	
136.21-1-1	1 COTTAGE STREET
121.77-1-86.001	10 FLINT STREET
136.21-1-3	13 COTTAGE STREET
136.21-1-4	31 COTTAGE STREET
136.21-1-3.002	49 COTTAGE STREET
135.28-2-45	69 COTTAGE STREET
135.28-2-44	75 COTTAGE STREET
136.21-1-2	100 RIVERVIEW PLACE
121.70-1-39.001	102 VIOLETTA STREET
135.28-2-63	1320 S PLYMOUTH AVENUE

LEGEND

- FORMER VACUUM OIL REFINERY (APPROXIMATE)
- CITY-OWNED PARCEL (14.6 acres)
- ASPHALT PAVED BIKE/PEDESTRIAN PATH

FEMA FLOOD ZONE

- FEMA 100-YEAR FLOODPLAIN
- FEMA 500-YEAR FLOODPLAIN

NOTE

1. TAX PARCELS PROVIDED BY MONROE COUNTY DES, MARCH 2010.
2. CITY PARCEL OWNERSHIP VERIFIED THROUGH THE CITY OF ROCHESTER PROPERTY INFORMATION WEBSITE ON JANUARY 11, 2022. (http://www.cityofrochester.gov/propinfo/)
3. AERIAL IMAGERY PROVIDED BY NYS GIS CLEARINGHOUSE, DATED SPRING 2012.
4. 10 FLINT STREET WAS FORMERLY IDENTIFIED AS 1320 S. PLYMOUTH AVENUE (TAX PARCEL 121.77-01-086) AND HAS SINCE BEEN DIVIDED INTO 2 PARCELS: 10 FLINT STREET (TAX PARCEL 121.77-1-86.001) AND 1320 S. PLYMOUTH AVENUE (TAX PARCEL 135.28-2-63). THESE PARCELS WERE FORMALLY IDENTIFIED AS 1315 S. PLYMOUTH AVENUE (TAX PARCEL 135.35-1-18.004).
5. 31, 69, AND 75 COTTAGE STREET ARE NOT CURRENTLY KNOWN TO HAVE BEEN SITUATED WITHIN THE FORMER VACUUM OIL REFINERY FOOTPRINT, BUT ARE INCLUDED IN THE BCP APPLICATION AND PROPOSED REMEDIAL INVESTIGATION.
6. 5 FLINT STREET AND 15 FLINT STREET INVESTIGATED BY OTHER ENTITIES (NYSDEC BCP SITE NO. C828162)
7. 2008 FLOODPLAIN DATA PROVIDED BY FEMA.GOV

0 100 200 Feet

BROWNFIELD CLEANUP PROGRAM
REMEDIAL ALTERNATIVES ANALYSIS REPORT

PORTION OF FORMER VACUUM OIL REFINERY

13, 31, 49, 69, AND 75 COTTAGE STREET; 100 RIVERVIEW PLACE; AND PORTIONS OF 1 COTTAGE STREET; 10 FLINT STREET; 102 VIOLETTA STREET; AND 1320 S. PLYMOUTH AVENUE
ROCHESTER, NEW YORK

FIGURE 4
FEMA 100-YEAR FLOODPLAIN

JUNE 2023

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

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PROJECT: 11862.61157 | DATED: 6/8/2023 | DESIGNER: SSOULE

LEGEND

- FORMER VACUUM OIL REFINERY (APPROXIMATE)
- BROWNFIELD CLEANUP PROGRAM SITE LIMITS (APPROXIMATELY 15.4 ACRES)
- 2 FOOT VEGETATED COVER (12.6 AC)
- ASPHALT COVER (1 AC)

APPROXIMATE OVERBURDEN THICKNESS (FT) FOR TARGETED EXCAVATION (APPROXIMATELY 1.1 AC, 22,300 CUBIC YARDS)

- TARGRETED EXCAVATION, 11' - 20'
- TARGETED EXCAVATION, UP TO 21'

Notes

Additional soil may be excavated and disposed off-site based on presence of odors/staining, as encountered, during remedial actions and site redevelopment activities. For the purpose of developing the RAAR, an additional 20 percent by volume soil (approximately 4,500 cubic yards) was assumed for excavation and off-site disposal.

0 100 200 Feet

BROWNFIELD CLEANUP PROGRAM
REMEDIAL ALTERNATIVES ANALYSIS REPORT

PORTION OF FORMER VACUUM OIL REFINERY

13, 31, 49, 69, AND 75 COTTAGE STREET; 100 RIVERVIEW PLACE; AND PORTIONS OF 1 COTTAGE STREET; 10 FLINT STREET; 102 VIOLETTA STREET; AND 1320 S. PLYMOUTH AVENUE
ROCHESTER, NEW YORK

FIGURE 5
ALTERNATIVE - 2

JUNE 2023

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ENGINEERING SOLUTIONS, INC.
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PROJECT: 1940061157 | DATED: 6/9/2023 | DESIGNER: SSOULE

LEGEND

- APPROXIMATE OVERBURDEN THICKNESS CONTOUR (FT)
- FORMER VACUUM OIL REFINERY (APPROXIMATE)
- BROWNFIELD CLEANUP PROGRAM SITE LIMITS (APPROXIMATELY 15.4 ACRES)

APPROXIMATE OVERBURDEN THICKNESS (FT) FOR EXCAVATION (APPROXIMATELY 475,000 CUBIC YARDS)

- 9 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50
- 51 - 60

0 100 200 Feet

BROWNFIELD CLEANUP PROGRAM
REMEDIAL ALTERNATIVES ANALYSIS REPORT

PORTION OF FORMER VACUUM OIL REFINERY

13, 31, 49, 69, AND 75 COTTAGE STREET; 100 RIVERVIEW PLACE; AND PORTIONS OF 1 COTTAGE STREET; 10 FLINT STREET; 102 VIOLETTA STREET; AND 1320 S. PLYMOUTH AVENUE
ROCHESTER, NEW YORK

FIGURE 6
ALTERNATIVE - 3

JUNE 2023

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
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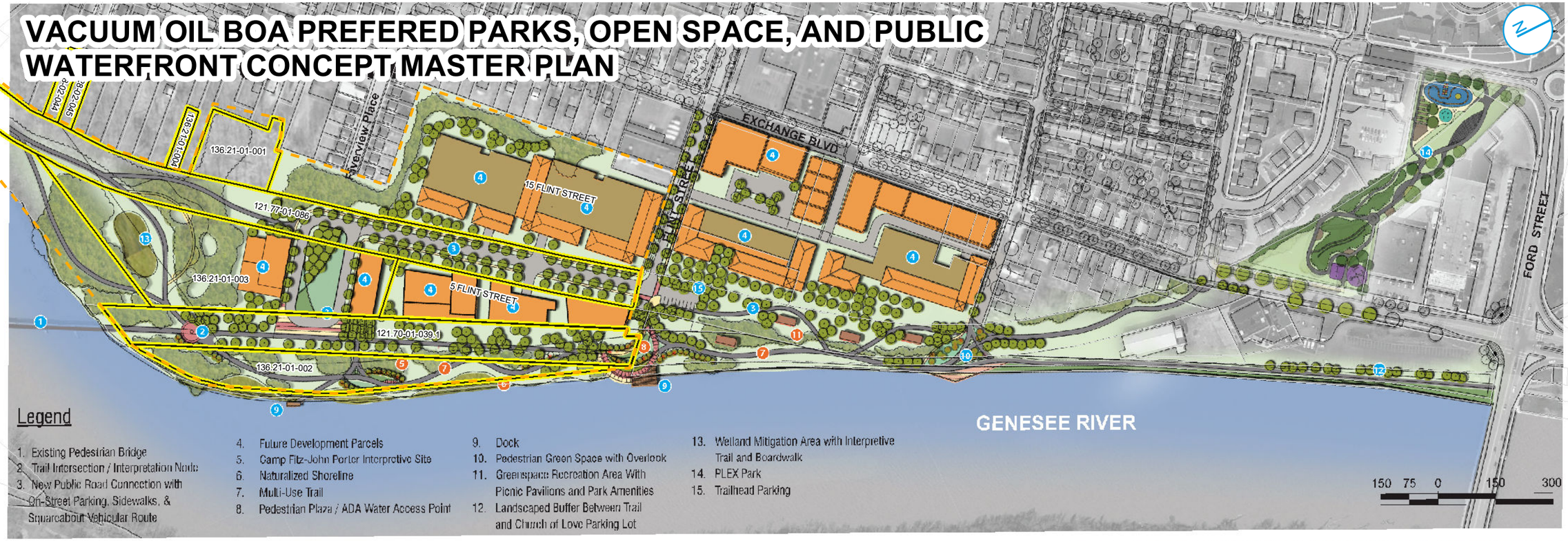
PROJECT: 11862.61157 | DATED: 6/8/2023 | DESIGNER: SSOULE

APPENDICES

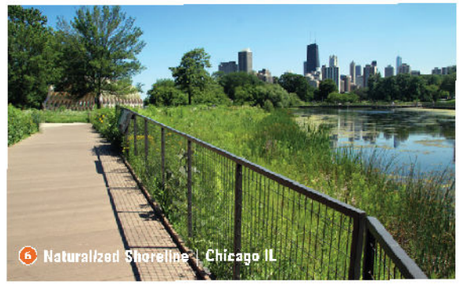
APPENDIX A
VACUUM OIL BOA PREFERRED PARKS, OPEN SPACE, AND PUBLIC WATERFRONT CONCEPT MASTER PLAN

VACUUM OIL BOA PREFERED PARKS, OPEN SPACE, AND PUBLIC WATERFRONT CONCEPT MASTER PLAN



Legend

1. Existing Pedestrian Bridge
2. Trail Intersection / Interpretation Node
3. New Public Road Connection with On-Street Parking, Sidewalks, & Squarcabout Vehicular Route
4. Future Development Parcels
5. Camp Fitz-John Porter Interpretive Site
6. Naturalized Shoreline
7. Multi-Use Trail
8. Pedestrian Plaza / ADA Water Access Point
9. Dock
10. Pedestrian Green Space with Overlook
11. Greenspace Recreation Area With Picnic Pavilions and Park Amenities
12. Landscaped Buffer Between Trail and Church of Love Parking Lot
13. Wetland Mitigation Area with Interpretive Trail and Boardwalk
14. PLEX Park
15. Trailhead Parking



LEGEND

- FORMER VACUUM OIL REFINERY (APPROXIMATE)
- BROWNFIELD CLEANUP PROGRAM SITE LIMITS (APPROXIMATELY 15.4 ACRES)
- PARCEL BOUNDARY

NOTE: Based on Bergmann Associates Vacuum Oil Preferred Parks, Open Space, Waterfront Concept Master Plan (2019)

CITY-OWNED PARCELS	
136.21-01-001	1 COTTAGE STREET
136.21-01-003	13 COTTAGE STREET
136.21-01-004	31 COTTAGE STREET
135.28-02-045	69 COTTAGE STREET
135.28-02-044	75 COTTAGE STREET
136.21-01-002	100 RIVERVIEW PLACE
121.70-01-039.1	102 VIOLETTA STREET
121.77-01-086	1320 S. PLYMOUTH AVENUE

MASTER PLAN OVERLAY
REMEDIAL ALTERNATIVES ANALYSIS REPORT
PORTION OF FORMER VACUUM OIL REFINERY
1, 13, 31, 69, AND 75 COTTAGE STREET;
100 RIIVERVIEW PLACE; 102 VIOLETTA STREET;
AND PORTION OF 1320 S. PLYMOUTH AVENUE
ROCHESTER, NEW YORK

APPENDIX A
PROPOSED SITE PLAN

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1940061157 | DATED: 10/23/2020 | DESIGNER: STANTOSA \\ramrofile01.ramboll.ramboll-group.global.network\projects\Rochester-C.1186261157.Vacuum-Oil-Bcp\Docs\DWG\MXD\RIR_2017JMN\MasterPlan_Update.mxd

APPENDIX B
WEST RIVER WALL REHABILITATION EVALUATION

Appendix B – West River Wall Rehabilitation Evaluation

The City of Rochester is currently designing modifications to the West River Wall (WRW) of the Genesee River as part of a rehabilitation program. The WRW modifications design in the area bordering the eastern boundary of the Vacuum Oil Site properties will result in lowering the top of the wall to an elevation of approximately 510 feet (ft) above mean sea level (amsl). This elevation is 2 ft lower than the current top of wall which is 512 ft amsl at this location. Given the WRW borders the eastern boundary of the former Vacuum Oil Refinery Site (Site) included in this Remedial Alternatives Analysis Report (RAAR), an evaluation was conducted to evaluate the potential effects of the lower WRW height on the groundwater system at the Site.

As presented in the *Remedial Investigation (RI) Report* for the Site (OBG 2019), groundwater elevations measured in 2016 along the eastern boundary of the Site near the WRW were between 506 ft and 508 ft asml, while the elevation of the Genesee River at the time the groundwater elevations were measured was slightly above 512 ft asml[1]. The elevation difference indicates that the overburden groundwater at the Site was not hydraulically connected to the river where the WRW is present. Review of construction information presented in Exhibit E of the *RI Report* (OBG 2019) showed that the river wall structure extends to the bedrock surface and therefore, is suspected to limit the hydraulic connection between Site groundwater and the river. Furthermore, the groundwater data indicated that the groundwater flow direction at the Site was to the west and then north along the former canal that borders the western side of the property under an estimated hydraulic gradient of 0.010 ft/ft. Review of historic information indicates that this canal continues north and then veers to the west near Ford Street.

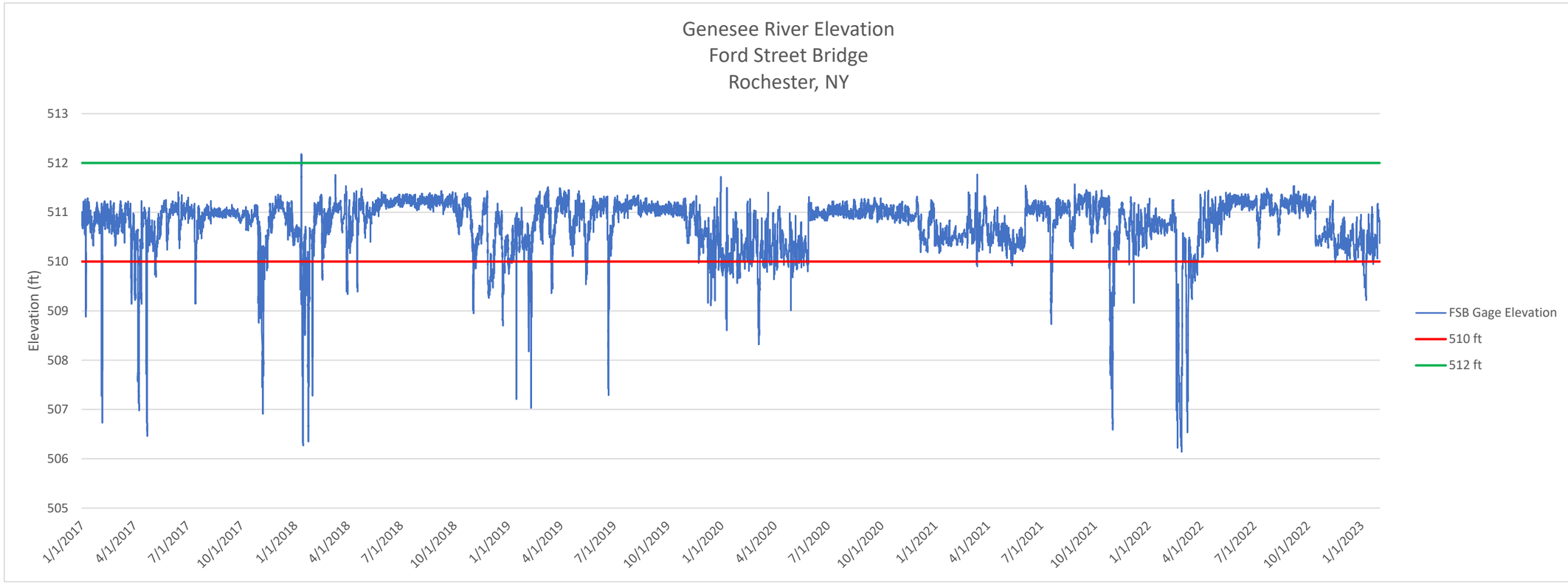
The Genesee River height in the vicinity of the Site is controlled by a dam operated by Rochester Gas and Electric (RG&E). The river elevation is generally maintained at an elevation of about 511 ft asml, as shown on the attached graph showing the river elevations between January 2017 and January 2023[1]. Based on this information, reducing the top of the wall to an elevation of 510 ft asml would allow for a portion of the river water column to enter the Site.

Under current conditions, there is an approximately 1,000 ft long area on the southern portion of the Site where the wall is absent. River water in this area recharges the Site groundwater system as evidenced by the groundwater elevations and flow contours presented in the *RI Report* (OBG 2019). Using the approximate bedrock elevation and the groundwater elevation measured in 2016, the saturated aquifer thickness at this end of the Site is between 10 and 13 ft. This results in a cross-sectional recharge area of between 10,000 and 13,000 square (sq) ft. An estimate of the additional cross-section area of recharge that will occur when the WRW is lowered was calculated using the length of the Site where the wall currently exists (1,400 ft) and the 1 ft of river water column that will be above the wall after it is lowered. The resulting estimated cross-sectional area where inflow would occur is 1,400 sq ft. Assuming hydraulic conductivity and the gradient are constant, this would result in an increase in 10% to 15% of the current groundwater recharge entering the Site. As a result of this inflow, it is expected that the groundwater levels within the Site will raise to the approximate level of the river and there will continue to be groundwater discharge to the north through the former canal.

The rise in the groundwater levels at the Site is not expected to result in a change in nature and extent of constituents at the Site. As discussed in the *RI Report* (OBG 2019), soil impacts identified were limited and predominantly associated with nuisance indicators such as odors or sheens, and there was no contiguous groundwater plume identified. The remedy, as identified in the RAAR, will include removal of localized impacted soil from four areas of the Site where evidence of sheens or odors were noted in the groundwater. The removal will take place prior to the lowering of the WRW to minimize the potential of generating a groundwater plume as a result of the rising groundwater contacting impacted soil. In addition, the surface elevation will be raised to 520 ft amsl as part of the planned redevelopment

[1] Water level data for the Genesee River at the Ford Street bridge river gage (No. 04231600) was obtained from United States Geological Survey (USGS). The gage is located approximately 1 mile north of the Site.

program envisioned for the Site, so that flooding is not expected to not occur under the current dam operations. Overall, it is concluded that the WRW modifications will not result in changes to the groundwater flow or the nature and extent of impacts at the Site.


Genesee River Elevation
Ford Street Bridge
Rochester, NY
Elevation (ft)
513
512
511
510
509
508
507
506
505
1/1/2017
4/1/2017
7/1/2017
10/1/2017
1/1/2018
4/1/2018
7/1/2018
10/1/2018
1/1/2019
4/1/2019
7/1/2019
10/1/2019
1/1/2020
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4/1/2021
7/1/2021
10/1/2021
1/1/2022
4/1/2022
7/1/2022
10/1/2022
1/1/2023
FSB Gage Elevation
510 ft
512 ft