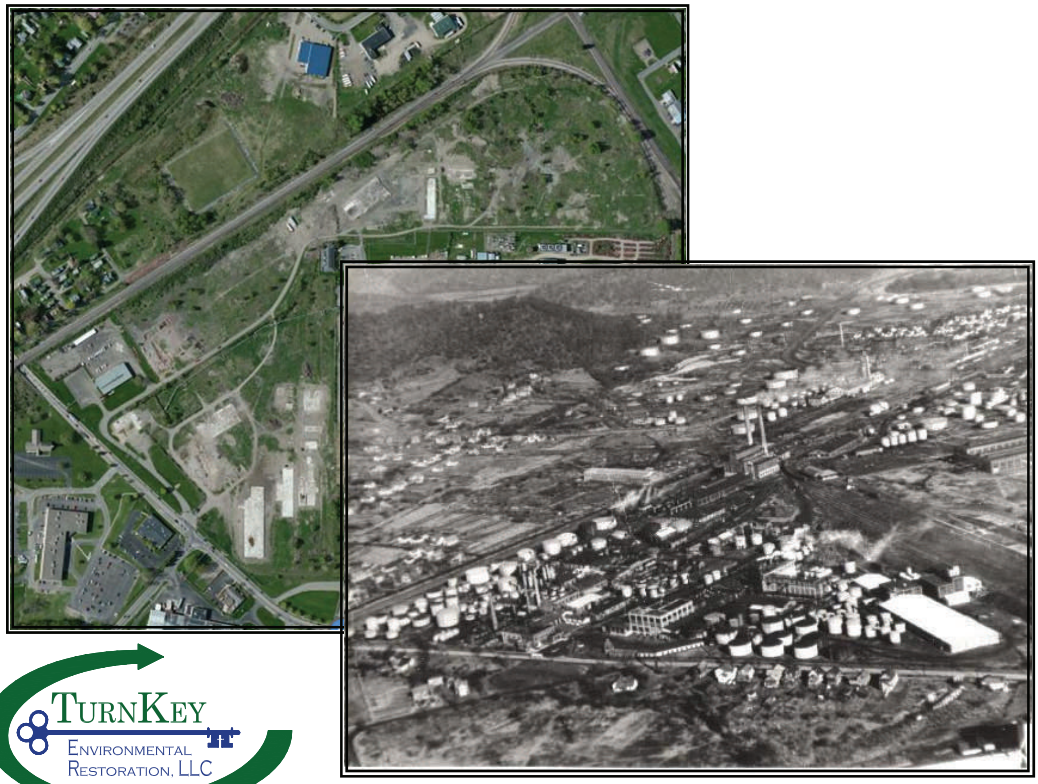
Comprehensive Remedial Investigation/Alternatives Analysis Report

Olean Redevelopment Property

July 2013
Revised September 2013

0250-012-001

Prepared For: Olean Gateway, LLC



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COMPREHENSIVE REMEDIAL INVESTIGATION/ALTERNATIVES ANALYSIS REPORT

OLEAN REDEVELOPMENT PROPERTY
BCP SITE NOs. C905031, C905032, & C905033
OLEAN, NEW YORK

July 2013 0250-012-001
Revised September 2013

Prepared for:

Olean-Gateway, LLC

Prepared by:

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COMPREHENSIVE RI/AA REPORT
OLEAN REDEVELOPMENT PROPERTY

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1.0 INTRODUCTION

Olean Gateway, LLC (Olean Gateway) has elected to pursue cleanup and redevelopment of the Olean Redevelopment Property, which is a 58.235-acre property currently owned by ExxonMobil Oil Corporation (ExxonMobil). The Property is comprised of three New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) sites designated as Olean Redevelopment Site 1 (BCP Site No. C905031), Olean Redevelopment Site 2 (BCP Site No. 905032), and Olean Redevelopment Site 3 (BCP Site No. 905033) on Buffalo Street in Olean, New York (see Figures 1-1 and 1-2).

In 2012, Olean Gateway LLC (Olean Gateway) was selected by ExxonMobil as the preferred purchaser of the Olean Redevelopment Property. In June 2012, Olean Gateway submitted new BCP applications for each of the three BCP Sites. In October 2012, Olean Gateway was accepted into the BCP as a "Volunteer" and entered into BCAs for all three Olean Redevelopment BCP Sites with the NYSDEC.

When individual BCP Sites are discussed in the foregoing sections, the Sites will be referred to as BCP Sites 1, 2, and 3.

1.1 Purpose and Scope

This Comprehensive Remedial Investigation/Alternatives Analysis (RI/AA) Report has been prepared on behalf of Olean Gateway LLC to: present historic data and 2012 Supplemental RI findings; describe environmental conditions across the Property; assess alternative remedial alternatives; and recommend a remedial approach to address the recognized environmental conditions. As discussed in Section 1.4.4, Woodard & Curran (W&C) received three rounds of comments from the NYSDEC on its draft RI/AA Report submitted to the NYSDEC in January 2009. Based on these comments, W&C conducted a Supplemental RI and presented the results of both investigations in an RI/AA Report dated September 2010. It is TurnKey Environmental Restoration's (TurnKey's) understanding that this report was not formally submitted to the NYSDEC for review. The results of the Supplemental RI, W&C's investigations, and historic findings are therefore presented herein. Throughout this Comprehensive RI/AA Report, TurnKey has relied on the summary data tables presented in W&C's reports since laboratory analytical data packages were not provided.

This Comprehensive RI/AA Report contains the following sections:

- Sections 1.2 and 1.3 present a description of the Property and summarize the Property's environmental and regulatory history.
- Section 2.0 presents the rationale for and a summary of the 2012 Supplemental RI sampling, as well as the bench- and pilot-scale treatability studies conducted.
- Section 3.0 describes the Property's physical characteristics and remaining infrastructure.
- Section 4.0 presents the historic (2008/2009) and 2012 Supplemental RI findings.
- Section 5.0 presents the results of the bench- and pilot-scale treatability studies.
- Section 6.0 describes potential chemical constituent migration pathways.
- Section 7.0 provides a qualitative human health exposure assessment, and fish and wildlife resources impact assessment.
- Section 8.0 develops remedial action objectives; evaluates the reasonably anticipated future use of the Property; summarizes remedial technologies considered; presents the estimated areas and volumes of impact by environmental media; develops and screens remedial alternatives; and presents the preferred remedial alternatives for each BCP Site.
- Section 9.0 provides conclusions from the investigations and alternatives analysis.
- Section 10.0 lists the cited references.

1.2 Background

1.2.1 Property and Site Description

The Olean Redevelopment Property is bounded on the west by Buffalo Street and on the northwest corner by an abutting commercial property. The Site is abutted on its northern and northeastern boundaries by the Southern Tier Rail Authority freight rail lines and on the east and south by the Dresser-Rand industrial facility. The Site lies approximately one half mile from the Southern Tier Expressway, which was upgraded in 1999 from New York State Route 17 to the newly designated Interstate 86 (I-86).The Site consists of the following three adjacent NYSDEC BCP Sites (see Figure 1-3):

- BCP Site 1 is a 25.099-acre area of vacant land, not currently improved with any buildings, bound by Dresser-Rand industrial facility to the east; Buffalo Street to the south and west; and BCP Sites 2 and 3 to the north. BCP Site 1 includes the following legal parcels:

  - 1404-1406 Buffalo Street, City of Olean, Cattaraugus County, New York – S.B.L. # 94.047-2-29 (24.154 acres)
  - 1420 Buffalo Street, City of Olean, Cattaraugus County, New York – S.B.L. # 94.047-2-30 (0.945 acres)

- BCP Site 2 is a 9.033-acre parcel of vacant land, not currently improved with any buildings, bound by Verizon Service Center to the west, BCP Site 3 to the east, BCP Site 1 to the south, and railroad tracks to the north. BCP Site 2 includes the following legal parcel:
  - 1470 Buffalo Street, City of Olean, Cattaraugus County, New York – S.B.L. # 94.047-2-28.1 (9.033 acres)

- BCP Site 3 is a 24.103-acre area of vacant land, not currently improved with any buildings, bound by railroad tracks to the north and east; BCP Site 2 to the west; and Dresser-Rand, an industrial facility, and BCP Site 1 to the south. BCP Site 3 includes the following legal parcels:
  - 1420 Buffalo Street, City of Olean, Cattaraugus County, New York – S.B.L. # 94.048-1-1.1 (12.925 acres)
  - 1404-1406R Buffalo Street, City of Olean, Cattaraugus County, New York – S.B.L. # 94.048-1-1.2 (11.178 acres)

1.2.2 Easements, Right-of-Ways, and Deed Notices

A number of easements and right-of-ways have been recorded in the Cattaraugus County land records throughout the long history of the parcels (Ref. 1). The easements are related to railway tracks, pipelines, access roads, and underground utilities on the parcels. As the parcels were once owned by separate entities, many of the filings grant access and use between the five parcels now owned in entirety by ExxonMobil. The following recorded easements are of note:

- Recorded easements for an elevated steam pipeline were filed in the Cattaraugus County land records. The easements allowed for the construction and installation of a steam delivery system from the Indeck-Olean property to Dresser-Rand Company. Under the agreements, Dresser-Rand was given the right to erect and install a steam delivery system, including underground piping and the grantors agreed not to erect any building or structure, park, or store vehicles, excavate, or otherwise use the easement in any other manner. The overhead steam pipeline in noted on property survey maps.

- Recorded rights and agreements for the construction of a joint driveway for ingress and egress from Buffalo Street. Access to the neighboring property located at 1480 Buffalo Street through the property is granted under this easement.
- Utility maps for the property show an 8-inch high-pressure (400 psi) gas pipeline leading from parcel 94.048-1-1.2 southwest to Buffalo Street. Cattaraugus County land records show an easement for an existing 8-inch gas pipeline approximately 2.74 miles in length. According to the deed (Liber 836 of Deeds at Page 545), filed November 10, 1983, the pipeline leads from parcel 94.048-1-1.2 off-site to the "Felmont's Gas Control Station" on the southerly bank of the Allegheny River.
- Utility maps for the property obtained from Agway, Inc. show two 6-inch Buckeye Oil Pipelines extending northeast from Buffalo Street through parcels 94.047-2-30, 94.047-2-29 and continuing into the Dresser-Rand facility. The pipeline also appears on a map filed with a Quit Claim Deed (Liber 836 of Deeds at Page 545) on November 10, 1983. No easements, right-of-ways, or specific information regarding the noted Buckeye Pipeline, its use or condition, was found during file searches.

A complete description of all easements can be found on recorded deeds for each parcel in Cattaraugus County Clerk office in Little Valley, New York.

1.3 Site Environmental and Regulatory History

The Olean Redevelopment Property was once part of a large refinery operation that operated in the Olean area from the mid-1800s through the 1950s. Refinery operations on the Site commenced in 1876 and included distilling and condensation of unrefined petroleum. Ancillary operations included trade shops, wooden container manufacture, filling and shipping stations, laboratories, a refrigeration plant, boiler houses, tank car repair, and an electric plant. Separate refineries operated on the Property and were merged in 1902 into the Vacuum Oil Company, and then in 1931 became the Socony-Vacuum Oil Company until 1954 when the refinery closed. The property was divided into multiple parcels in the 1960s. Felmont Oil Company constructed an anhydrous ammonia plant on the northern parcels where they manufactured ammonia from natural gas. Felmont sold the ammonia to Agway for use in manufacturing fertilizer at Agway's plant located on what is now referred to as BCP Site 1. On November 16, 1983, Agway purchased the portion of the Felmont site that included the ammonia production plant. Agway dismantled and sold both the ammonia and fertilizer plants in the summer of 1984. The Property has since remained vacant.

Documentation provided by NYSDEC indicates that groundwater contaminated with ammonia and nitrogen was identified within BCP Site 1 in the early 1970s. Of primary

concern to the NYSDEC was the potential for impacted groundwater to reach the City of Olean's public water supply wells, referred to as the St. Francis Well Field, located approximately 1.5 miles hydrologically downgradient from the Olean Nitrogen Complex. Agway entered into a Consent Order with the NYSDEC in 1977 requiring installation of one purge well and three groundwater pumping wells to contain the nitrogen plume on-site. These wells are referenced as part of the North Olean Well Field.

The sources of groundwater contamination found on BCP Site 1 potentially include downgradient groundwater pulled onto BCP Site 1 during Agway's operation of the wells from 1977 to 1984. According to a Water Resources Investigation Report prepared by the USGS in cooperation with the NYSDEC (Ref. 2), the purge well on BCP Site 1 had the potential to pump groundwater at a flow greater than 1,000 gallons per minute. In 1981, the purge well was pumped at a rate of 0.8 million gallons per day (Ref. 3).

In October 1984, Agway shut down the wells on the basis that the pumping had reduced the nitrate level to or below the acceptable concentrations (10 parts per million); it was also stated in the W&C RI Report that Agway shut down the on-site wells in 1984 after it was determined that the wells were pulling in chromium contamination from a neighboring property (Van Der Horst Plant #1 located approximately 0.4 miles east of the purge well on BCP Site 1).

A 1990 Stipulation Agreement required Agway to monitor the groundwater, under and downgradient of this parcel, and compare the data to the USGS model predictions. Quarterly monitoring was conducted between August 1991 and April 1994; the wells were sampled again in April 1997 and November 2001. The results indicated little change in the ammonia concentrations over the 10-year period from 1991 to 2001 and were consistently below values predicted in USGS groundwater modeling. On December 13, 2007, Agway received a No Further Action letter from the NYSDEC Division of Water to close out the groundwater issue.

1.4 Summary of Previous Site Investigations

The following assessments, investigations, and interim remedial measures (IRMs) have been completed on the Property:

1.4.1 Plumley Engineering Investigation (2005)

As reported by W&C in its Remedial Investigation Work Plan (RIWP; Ref. 4), Plumley Engineering conducted a subsurface soil investigation in September 2005. Fifty-four test pits were excavated on BCP Site 1, and 24 test pits were excavated on BCP Site 3. The surficial soils were identified as silty gravel with fill including black cinders, grey/brown slag, and yellow-colored firebrick. Deeper soils included native silt and gravel. Petroleum staining and/or odors were noted in many of the test pits, and appeared to roughly correlate to locations formerly containing petroleum aboveground storage tanks (ASTs). Perched water was noted on some of the finer (silty) soil layers at roughly eight feet below grade. Soil samples were not collected or analyzed during this investigation. Remnants of pipes, concrete and metal foundations and structures, and several potential USTs were identified during test pitting.

1.4.2 AMEC Investigation (2006)

AMEC Earth & Environmental, Inc. (AMEC) prepared a Historic and Current Site Conditions Report (Ref. 5) dated April 2006 for ExxonMobil Refining & Supply for the greater refinery site located in Olean, New York. This Report provides a review of historical operations of the broader Socony-Vacuum Oil refinery and an understanding of the existing environmental conditions at the Site and surrounding community.

1.4.3 TVGA Investigation (2004-2007)

The eastern portion of BCP Site 3 (i.e., former Felmont property) was investigated by TVGA Consultants between 2004 and 2007 under an Environmental Restoration Program (ERP) grant to the Olean Urban Renewal Agency (OURA).

Petroleum-impacted soil was noted from the surface down to the water table (15 to 27 feet below grade) and below. Analysis revealed volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) resulting from petroleum and the decomposition of petroleum products. Elevated arsenic concentrations were noted in several surficial soil samples. Groundwater under the eastern portion of BCP Site 3 contained several VOCs and SVOCs exceeding the NYS Class GA groundwater standards, with higher concentrations downgradient. Metals were detected in the groundwater at concentrations exceeding Class GA standards but were not attributed to former on-site activities. Hexavalent chromium was

not detected indicating that this groundwater contaminant from the nearby Van Der Horst site (discussed in Section 1.3) has not impacted groundwater on BCP Site 3.

The NYSDEC conducted off-site groundwater sampling on the Van Der Horst Sites #1 and #2 in September 2006 and compared the results to the on-site (BCP Site 3) groundwater data. Samples from Van Der Horst Site #2, located upgradient of the Felmont Site, generally contained the same VOCs at similar concentrations as those detected on-site, suggesting that groundwater quality is impaired before reaching the project site boundaries. Specifically, concentrations of benzene, chlorobenzene, ethylbenzene, isopropylbenzene, toluene, xylene, and vinyl chloride exceeded Class GA Groundwater Quality Standards and Guidance Values (GWQS/GVs) in off-site groundwater.

TVGA found a "catalyst material" spread on the surface of the central portion of the BCP Site 3. A sample of the suspected catalyst material was collected on November 3, 2005 and analyzed for Target Analyte List (TAL) and Toxicity Characteristic Leaching Procedure (TCLP) metals. Nine of the total TAL metals were detected in the sample at concentrations that exceeded TAGM 4046 soil cleanup objectives (the appropriate regulatory comparison at the time but no longer applicable). Five of these metals (i.e., aluminum, chromium, copper, potassium, and zinc) can be found in natural, uncontaminated soils at generally similar concentrations and/or were not detected above the TCLP Standard Criteria or Guidance (SCG) (hazardous waste determination). Calcium and magnesium are ubiquitous in natural material and did not present a concern to TVGA; however, the elevated concentrations of total cobalt and nickel did present a concern. The catalyst was located in drums inside a building and in piles on the ground. Agway contracted Clark Byrnes Associates, LLC (CBA) to recover and repackage the spent iron oxide and nickel oxide catalyst. In May 2006, CBA removed, repackaged, and sent off-site for reclamation a total of 44,740 pounds of nickel catalyst and 31,280 pounds of iron/chromium catalyst.

Information gathered from an Environmental Data Resources Inc. (EDR) database search report on Brownfield Cleanup Program (BCP) Site 3 revealed a NYSDEC Facility Information Report for the Site. One 1,300-gallon steel UST formerly containing #2 fuel oil was listed as removed from the Site on June 12, 2006. This UST was discovered by TVGA during their investigation, and was apparently registered at the time of removal.

The NYSDEC reviewed TVGA's draft December 2006 RI/AA Report (Ref. 6) and was preparing a Proposed Remedial Action Plan (PRAP) in early 2007 at the time that

ExxonMobil became involved with the Site. Further action on the ERP was put on hold while ExxonMobil applied for inclusion of the Site in the BCP.

1.4.4 Woodard & Curran Remedial Investigation (2008)

W&C prepared for ExxonMobil a Remedial Investigation Work Plan (RIWP) in December 2007 (Ref. 4); revised in January and May 2008, and amended during implementation (June through September 2008). All field work was conducted by Groundwater & Environmental Services, Inc. (GES) or their subcontractor, under the direction of W&C.

The scope of the RI included investigation of: (1) potential source areas (i.e., transformers, lagoons, spent catalyst area, Buckeye Oil Pipeline Right-of-Way, railroad spurs, underground storage tanks, former aboveground storage tanks, and drum storage areas); and (2) the entire Site, including areas of historical refinery operations (former Agway AST area, former Agway drum storage area, and other former Site structures), historically vacant areas that include rail spurs, and Site-wide groundwater.

Site investigation activities included a combination of surficial and subsurface soil and groundwater sampling. Soil samples were collected from 103 soil borings and test pits (34 shallow and 27 deep) installed on-site, and groundwater samples were collected from the 25 newly installed and 32 existing monitoring wells. Field screening for gross contamination and VOCs, as well as laboratory analysis of soil and groundwater, were used to assess on-site potential impacts from historic activities. Soil data were sorted and evaluated into two categories, shallow and deep, with the shallow soil set at up to 6 feet below existing grade and the deep soils from 6 feet and greater. The shallow depth of 6 feet below grade is representative of a typical depth in property development scenarios to accommodate subsurface utilities and building foundations, assuming a slab-on-grade building construction. W&C conducted a site-wide groundwater sampling event from August 25 through September 4, 2008. The analytical data is summarized in Section 4.0 and compared to GWQS/GVs per NYSDEC Technical & Operational Guidance Series (TOGS) 1.1.1.

The existing Site buildings were inspected by a W&C New York State Registered Professional Engineer (P.E.) to assess potential interior areas of concern. The P.E. inspection evaluated the potential of interior activities to have impacted subsurface soils. Subsequent sub-slab soil sample locations were biased to structural features (i.e., drains, trenches, joints, or cracks) and areas of discoloration (floor staining) in addition to random

locations. A ground penetrating radar (GPR) survey was conducted to mark out utility lines and to identify the potential presence of underground pipes, tanks, and structures. These subsurface features were inventoried and test pits were completed to verify and investigate the identified subsurface features.

Following data collection and analysis, a qualitative human health exposure assessment was completed to evaluate the potential soil, soil vapor, and groundwater exposure pathways to receptors under current and future use scenarios.

According to W&C, a draft Remedial Investigation/Alternative Analysis (RI/AA) Report (Ref. 7) was submitted to the NYSDEC on January 7, 2009. This report addressed the nature and extent of contamination in environmental media, but did not address alternative analysis beyond a brief discussion regarding interim remedial measures. The NYSDEC reviewed the draft RI/AA Report and issued comments on February 25, April 3, and May 7, 2009. A final RI/AA Report was not submitted to the NYSDEC; therefore, the results of the W&C RI are discussed in Section 4.0 with the 2012 investigation results.

1.4.5 Woodard & Curran Supplemental Remedial Investigations (2009-2010)

A Supplemental RI (SRI) Work Plan was prepared by W&C in September 2009 (Ref. 8) and implemented in October and November 2009. The SRI activities were conducted to further delineate soil and groundwater conditions as requested by the NYSDEC. The scope of the SRI was to address the following specific Site issues:

- Conduct additional soil borings to delineate select metals (total and leachable concentrations) and/or SVOC concentrations.
- Assess the need to install up to three additional monitoring wells to further delineate light non-aqueous phase liquid (LNAPL).
- Complete an exploratory excavation program to locate former site piping.
- Complete a site-wide groundwater sampling event.

A total of 55 additional soil borings and 124 additional soil samples were collected for laboratory analysis. The borings were located, based on the RI data, to facilitate further horizontal and/or vertical delineation of metals and/or SVOCs. According to W&C, TCLP analyses were conducted for metals at select locations to determine if soil/fill exhibited hazardous waste characteristics; however, only those samples analyzed in support of the IRM excavations were presented in W&C's summary tables.

SRI activities also included LNAPL delineation using soil borings, Membrane Interface Probe (MIP) testing, and exploratory trenching; as well as pipeline tapping to identify the quantity and type of buried on-site piping, and the contents within the piping.

W&C conducted a groundwater sampling event on a subset of the wells from November 4 through November 11, 2009. Section 4.0 summarizes and compares the analytical data to GWQS/GVs.

The results of this SRI are discussed in Section 4.0 with the recent investigation results since W&C's RI/AA Report dated September 2010 was not submitted to the NYSDEC. The alternatives analysis in W&C's RI/AA Report consisted of the statement that "This analysis will be discussed and formally presented in one or more Remedial Action Plans (RAPs) and/or Interim Remedial Measures Work Plans (IRMWPs), depending on development of the parcels and approval of this RI/AA Report."

1.4.6 Woodard & Curran Interim Remedial Measures (2010)

IRMs were performed by W&C in 2010 for ExxonMobil in accordance with the IRM Work Plan (Ref. 9). The IRM Report for the Buffalo Street Properties (BCP Site Nos. 1, 2 & 3) was prepared by W&C in March 2011 (Ref. 10). IRM activities are shown on Figure 1-4 and described below.

<u>BCP Site 1</u>

- Closure/removal of several suspected septic tanks:
  - Building 4: One 3,000-gallon tank closed in-place, and one 1,000-gallon aluminum lined concrete tank removed.
  - Building 6: One 700-gallon concrete tank and one 500-gallon steel tank removed.

<u>BCP Site 2</u>

- Closure/removal of several suspected septic tanks:
  - Basement Structure: Concrete structure 20' x 20' x 8' deep closed in-place.
  - Three steel tanks had been filled with sand by others prior to W&C and were left in-place.

<u>BCP Site 3</u>

- Building 2: Removal of one 2,000-gallon and two 500-gallon steel Underground Storage Tanks (USTs).

- Closure/removal of several suspected septic tanks:
  - Building 1: One vertical concrete tank of unknown size removed.
  - Pump House Tank: One 500-gallon steel tank closed in-place.
  - Trench 8: One steel tank of unknown size removed.
- Targeted removal of soil/fill in the vicinity of Soil Boring SB28 due to the presence of elevated arsenic and lead concentrations in shallow soil (0 to 2 feet below grade). An area 5 feet by 5 feet (within the accuracy of the field GPS unit) down to 2 feet (approx. 2 cubic yards) was excavated and stockpiled. Two confirmatory samples collected from the excavation, one bottom sample SB-28 (2'-2.5') and one north sidewall sample SB-28 SW-N (1'-1.5'), were analyzed for TCLP arsenic and lead and determined to be non-hazardous. The perimeter sidewall of the excavation was graded to approximately 45 degrees and compacted. Table 4-5 presents the pre- and post-excavation data.
- Targeted removal of soil/fill in the vicinity of Soil Boring SB48 due to concentrations of chromium, copper, selenium, and zinc above commercial Soil Cleanup Objectives (SCOs) and a lead concentration above the protection of groundwater SCO. To better define the impacted area, additional samples were collected and analyzed for these five metals. Soil/fill excavation limits were defined by former tank footprints and sample results. Confirmatory samples were collected at each end of the excavation (SB48N and SB48S at 1-1.5') and at two bottom locations SB-48 (2.5-3') and SB-48 (4-4.5'). Chromium, copper, selenium, and zinc concentrations in the four confirmatory samples were below commercial SCOs. The only confirmatory sample with a lead concentration below the commercial SCO was bottom sample SB-48 (4-4.5'). The north sidewall sample (1-1.5') detected lead at a concentration of 4,380 mg/kg. The sidewalls of the excavation were graded to approximately 45 degrees and compacted. W&C concluded that locations with lead concentrations in excess of an arbitrary cleanup goal of 10,000 mg/kg were excavated. Table 4-5 presents the pre- and post-excavation data.
- Recovery of measurable LNAPL from groundwater monitoring wells via sorbent socks.

1.4.7 ARCADIS Building Demolition (2010)

In a May 25, 2010, ARCADIS responded to the NYSDEC's request for additional information regarding the scheduled demolition program for the ExxonMobil Former Vacuum Oil Facility. The letter proposed abatement of asbestos-containing roofing material from six buildings; removal of suspect lead-based paint; and demolition to elevation of all above-grade structures (down to the floor slabs) on the Site with the exception of the Guard

Shack and the elevated foundations of Buildings 2 and 6. Since some of the smaller utility related structures/vaults extend below grade, ARCADIS proposed removing the appurtenances and filling the structures to grade with gravel. The apparent underground oil/water separator located outside and adjacent to Building 4 and the "ruin" structures (non-building structures) were to be demolished. Building demolition was completed in summer 2010. The demolition was conducted in accordance with the June 30, 2010 demolition permit issued by the City of Olean to Exxon Mobil Corporation (see Appendix F). On October 21, 2010, the Captain of the Fire Department, Code Enforcement Division, approved the final demolition of all above grade structures. The building slabs and underlying soil/fill (above general site grade) were not removed during building demolition. The following soil/fill samples were collected by W&C in 2008 beneath those elevated building slabs for analysis of the parameters indicated; All soil/fill concentrations were below the Site-Specific Action Levels (SSALs) listed in Section 8.3.1:

- Building 6 (BCP Site 1):
  - SB71, SB72, and SB73; VOCs, SVOCs and Inorganic Compounds
- Building 2 (BCP Site 3):
  - SB60, SB61, and SB62; VOCs, SVOCs and Inorganic Compounds

1.4.8 Woodard & Curran Interim Remedial Measures (2011)

According to W&C's March 2012 Progress Report (dated April 5, 2012), one tank west of former Building 7 on BCP Site 1 and Tanks 1-10 at the west end of BCP Site 2 were removed in December 2011 (see Figure 1-4). The tanks were cleaned and recycled as scrap steel; wash water was collected by vacuum truck for off-site disposal. Solids from the tank cleaning activities were staged on-site pending characterization and disposal.

1.4.9 Woodard & Curran Groundwater Monitoring Report (2012)

As a component of the Groundwater Monitoring Plan (GWMP), quarterly groundwater gauging and sampling of select wells as well as monthly LNAPL gauging and product removal are conducted by W&C personnel. These quarterly events began in November 2010 with the most recent event occurring in February 2012. On April 5, 2012, W&C submitted to NYSDEC a Groundwater Monitoring Report for the reporting period January through March 2012.

2.0 SUPPLEMENTAL REMEDIAL INVESTIGATION APPROACH

The 2012 SRI was designed to: supplement existing Site data to more fully refine the nature and extent of contamination in Site soil/fill and groundwater on each BCP Site; define chemical constituent migration pathways; and evaluate the potential feasibility and cost of reasonable remedial alternatives to support a NYSDEC-approvable remedial action plan for each BCP Site. The SRI included the following field activities, which are described in more detail herein:

- Visual, olfactory, and Photoionization Detector (PID) characterization of subsurface soil/fill through test trench excavation in areas with petroleum impact identified during W&C investigations.
- Collection of surface/near-surface and subsurface soil/fill samples to better delineate the lateral and vertical extent of impact where elevated concentrations of arsenic, lead, and/or mercury were identified during W&C investigations.
- Collection of surface soil/fill samples to better delineate three areas on BCP Site 1 where elevated concentrations of polychlorinated biphenyls (PCBs) were identified during W&C investigations.
- Advancement of two on-site soil borings that were completed as groundwater monitoring wells to assess groundwater quality at the downgradient property boundaries and refine groundwater flow direction.
- Collection and analysis of groundwater samples from three existing monitoring wells located at downgradient locations.
- Measurement of groundwater levels in all on-site monitoring wells to confirm groundwater flow direction.
- Performance of bench- and pilot-scale treatability studies to determine the efficacy and cost of remedial technologies for treating petroleum-impacted soil/fill.

SRI field activities were conducted by GES under the direction of and with oversight by TurnKey in accordance with the approved SRI Work Plan (Ref. 11). The majority of field activities were conducted under NYSDEC oversight. Each sampling location was surveyed via GPS and plotted on the base maps for each BCP Site. Table 2-1 summarizes the analytical testing program followed for the 2012 SRI.

2.1 Soil/Fill Investigation

Figures 2-1 through 2-3 show the test trench and soil boring locations for BCP Sites 1 through 3. Appendix A includes the test trench logs and field notes. Appendix B includes an electronic photo log for test trenches excavated at the Site.

2.1.1 Surface/Near-Surface Soil/Fill Sampling

2.1.1.1 Inorganic Compounds

Previous surface/near surface (0-6 fbgs) soil/fill sampling conducted by W&C identified concentrations of various metals (including arsenic, barium, copper, chromium, lead, mercury, nickel, and zinc) above Part 375 Restricted-Commercial Use SCOs (CSCOs). Of those metals, arsenic was detected site-wide, while the other metals were identified in localized areas. Eight areas of the Site were identified to contain elevated concentrations of arsenic, lead, and/or mercury in the surface/near surface soil/fill, and are referred to herein as "metals areas of interest" (MAOIs). Supplemental surface/near-surface samples were collected and analyzed for metals to better delineate the MAOIs listed below:

- BCP Site 1: 1-AS-1 (arsenic), 1-AS-2 (arsenic), and 1-AS-3 (arsenic)
- BCP Site 2: 2-AS-1 (arsenic) and 2-HG-1 (mercury)
- BCP Site 3: 3-AS-1 (arsenic), 3-AS-2 (arsenic), and 3-PB-1 (lead)

One of these areas (2-HG-1) was adequately delineated during W&C's RI; therefore, sampling in this area was limited to waste characterization parameters (refer to Section 2.3.1). However, the other seven areas were investigated to better delineate the lateral and vertical extent of impact. Arsenic Area 3-AS-2 was added at the request of NYSDEC in its June 7, 2012 letter commenting on TurnKey's Supplemental RI/AA Work Plan.

Surface/near-surface soil/fill samples collected from 0-2 feet below ground surface (fbgs) were analyzed for the metal of interest, and the samples collected from 2-4 fbgs were held at the laboratory pending results from the 0-2 fbgs samples. If the 0-2 fbgs sample detected elevated concentrations then the 2-4 fbgs sample was analyzed. Soil/fill samples in the areas of 3-PB-1 and 2-AS-4 were also collected from 4-6 fbgs and 6-8 fbgs to assess deeper impacts in those areas. The 4-6 fbgs samples were analyzed and the 6-8 fbgs samples

were held at the laboratory pending results from the 4-6 fbgs sample. If the 4-6 fbgs sample detected elevated concentrations then the 6-8 fbgs sample was analyzed.

Sample locations were excavated with a backhoe or excavator. Soil/fill samples were collected directly from the excavation wall of the targeted depth interval or from the excavator bucket using a dedicated stainless steel hand trowel or spoon. Each sample location was backfilled immediately after sample collection in the general order that it was excavated. Each sampling location was mapped using a hand-held GPS unit.

2.1.1.2 PCBs

PCB surface sampling (i.e., 0-0.5 fbgs) was completed on all three BCP Sites during W&C's SRI. PCBs were detected at concentrations above Part 375 CSCOs at three locations on BCP Site 1; therefore, supplemental surface soil/fill samples were collected to better delineate the lateral and vertical extent of the PCB-impacted areas surrounding TP-18, SB-22, and TP-25. Since PCBs were not detected above CSCOs on BCP Sites 2 and 3, no additional PCB sampling was conducted.

For each surface soil/fill grab sample, a dedicated stainless steel hand trowel or spoon was used to collect a representative sample. If an area was vegetated, then the surface soil/fill sample was collected following removal of the sod/vegetation.

2.1.2 Subsurface Soil/Fill Sampling

A total of 76 test trenches were excavated using a track excavator to further delineate the extent of petroleum-impacted soil/fill identified during W&C's investigations. The length and depth of the test trenches were guided by existing data, the reach of the excavator, depth to the water table, and professional judgment by qualified TurnKey personnel.

Excavated soil/fill was placed beside the test trench location (soil with visible impacts was placed on plastic sheeting). Soil/fill samples were collected at 2-foot intervals for screening with the PID, classification, and laboratory analysis (a total of 32 soil/fill samples were analyzed). TurnKey personal (i.e., a field engineer, scientist, or geologist) observed the excavations and created a field log (including photographs) for each test trench location. Real time air and particulate monitoring, if required due to visible dust, was conducted using PID and particulate monitoring equipment while the excavations were open. Excavated soil/fill was returned to the test trench in the general order that it was excavated.

2.2 Groundwater Investigation

In August 2012, two 4-inch diameter groundwater monitoring wells were installed at downgradient property boundaries as a component of the SRI. Monitoring well W29 (BCP Site 3) was installed downgradient from existing monitoring well W24 where the thickest amount of LNAPL has historically been observed. Monitoring well W30 (BCP Site 1) was installed in a data gap area. The monitoring wells were installed to provide groundwater flow and quality information, as well as the data needed to better understand groundwater geochemistry and the potential for anaerobic biodegradation as a possible groundwater remedy.

Monitoring well installation methodology followed TurnKey's SRI Work Plan requirements. The newly installed wells were developed to remove the fines from the filter pack and well casing prior to sampling. Groundwater samples were collected from newly installed wells W29 and W30, and existing wells W3 (BCP Site 1), W17 (BCP Site 2), and MW-4 (BCP Site 3). The existing wells were chosen based on their downgradient location as determined during W&C's investigations. Static depths to groundwater were measured in existing and newly installed wells on August 29, 2012 to confirm flow direction.

Figures 2-1 through 2-3 show the monitoring well locations discussed in this section. Appendix C includes the boring and monitoring well construction logs for all wells at the Site, and the well sampling logs for the August 2012 event. Table 2-2 presents monitoring well construction details and summarizes the August 29, 2012 groundwater elevations; Figure 2-4 is the isopotential map for this monitoring event.

2.3 Waste Characterization

2.3.1 Soil/Fill

Composite waste characterization samples were collected from the seven MAOIs described in Section 2.1.1.1 for analysis of TCLP Resource Conservation and Recovery Act (RCRA) Metals to characterize the soil/fill for eventual disposal. Two samples were collected from test pits TPSB-7, sample designation WC-TPSB-7-PT (6-10') and DTP-46, sample designation WC-DTP-46-PT (5-7'), and tested for ignitability and corrosivity to evaluate hazardous waste characteristics.

2.3.2 Subsurface Piping Contents

Previous analysis of subgrade piping contents on a nearby site, located within the boundaries of the former greater refinery site, identified three waste streams: separate phase petroleum; oily water (liquid phase); and oily pipe scale (solid phase). Therefore, each of these waste streams was targeted for waste characterization. TurnKey proposed in the SRI Work Plan to conduct an assessment of the subsurface pipe contents to assist in determining off-site disposition and disposal/treatment/recycling options by collecting samples from subsurface piping during test pit excavation. However, due to the large volume of piping and the potential for great variation in contents, it was determined that limited sample collection would not be representative of site-wide conditions. It was determined that waste characterization prior to disposal of pipe contents would be performed instead.

2.4 Data Usability Summary Report

In accordance with the SRI Work Plan, the laboratory analytical data from this SRI was independently assessed and, as required, submitted for independent review. Judy Harry of Data Validation Services located in North Creek, New York performed the data usability summary assessment for the soil/fill and groundwater samples.

The data usability evaluations were conducted using guidance from the USEPA Region 2 validation Standard Operating Procedures, the USEPA National Functional Guidelines for Data Review, as well as professional judgment. Appendix D includes the Data Usability Summary Reports (DUSRs) for the 2012 SRI data, prepared in accordance with Appendix 2B of NYSDEC's DER-10 guidance. Those items listed above that demonstrated deficiencies are discussed in detail in the DUSRs. Analytical results that were edited or qualified per the DUSR have been modified appropriately on the summary tables. Appendix E includes the analytical data packages for the 2012 SRI data.

2.5 Site Mapping

A Site base map was developed during the 2012 SRI. All sample points and relevant Site features are located on the map. TurnKey employed a Trimble GeoXT handheld GPS unit, with a similar level of precision to the GPS equipment used in the initial RI, to identify the locations of all soil borings and newly installed wells relative to State planar grid coordinates. Monitoring well elevations were measured by GES in August 2012.

2.6 Treatability Studies

Bench- and pilot-scale treatability studies were conducted to: demonstrate the efficacy of select technologies to treat petroleum-impacted soil/fill, including soil/fill with soil headspace readings greater than 1,000 ppm, odors, and staining, both in-situ and ex-situ. The petroleum products or intermediaries contained in the soil/fill vary across the three BCP Sites; however, there appears to be the following three general categories:

1) Light – predominately consists of VOCs (based on elevated PID readings)
2) Heavy – predominately consists of SVOCs
3) Light to Heavy – consists of a mixture of both VOCs and SVOCs

As a result, more than one remedial technology may be required to effectively remediate this petroleum-impacted soil/fill. The intent of the bench-scale study was to assess candidate technologies on representative samples of these general categories. Selected bench-scale technologies that appeared promising and in-situ soil vapor extraction (SVE) were demonstrated in the field as pilot-scale treatability studies with the intent of better defining design parameters and refining construction and operation cost estimates for full-scale application; and verifying the ability of tested remedial technologies to achieve the remedial objectives.

2.6.1 Bench-Scale Treatability Studies

Bench-scale treatability studies were performed on several representative samples of each category from various locations on each of the BCP Sites to evaluate potential soil amendments that would result in a significant reduction of nuisance characteristics and mitigation of contaminant migration potential. Sample collection was guided by previous test results and physical observations of the recovered soil/fill samples (e.g., odor and staining) made during the 2012 SRI. Figures 2-5 through 2-7 summarize the treatability tests conducted.

Two 5-gallon buckets of soil/fill were collected and transported under standard chain of custody to TurnKey's field laboratory, located in Lackawanna New York. Eleven homogenized samples from each sample location, weighing approximately 3 to 5 pounds each, were placed in aluminum pans. Each pan (test batch) was then labeled with the appropriate treatment type, amendment concentration, and Site location. Each test batch was mixed and a portion of the untreated sample aliquot was characterized for Spills

Technology and Remediation Series (STARS) List VOCs plus Tentatively Identified Compounds (TICs), STARS List SVOCs plus TICs, diesel range organics (DRO), and gasoline range organics (GRO). Soil amendments were weighed into aliquots, based on the weight of the soil sample, and mixed into the corresponding sample. The soil/fill was monitored throughout the testing period and PID readings, odor, and appearance were recorded. One aliquot of each test batch was used as a control sample (covered) and monitored as above.

When it appeared the soil had been adequately treated based on visual/olfactory observations and PID screening, a portion of the treated soil was placed in laboratory containers and analyzed for the above-listed pre-treatment parameters. In addition, synthetic precipitation leaching procedure (SPLP) was performed on select treated samples to evaluate the potential for contaminants to leach from the treated soil/fill to groundwater.

The location where the soil/fill samples used for bench-scale treatability tests were collected as well as the description from the W&C RI and SRI follow:

<u>BCP Site 1</u>

- TPSB23-C (6-8 fbgs): Former drum storage area. Noted in the field were a PID reading of 3.8 ppm, perched water at 7.5 fbgs, strong odor, and black staining.
- TPSB30 (10-12 fbgs): Former tank farm area. Noted in the field were a PID reading of 3,432 ppm, sheen, strong odor, and grey.
- T-2 (4-6 fbgs): Exploratory Test Trench. Noted in the field were PID reading of >1,000 ppm, strong odor, and dark brown.

<u>BCP Site 2</u>

- DTP7/TPSB7 (6-8 fbgs): Former tank farm area. Noted in the field were a PID reading of 879 ppm, strong odor, black staining, and blebs of product.
- SB2 (6-8 fbgs): Former tank farm area. Noted in the field were a PID reading of 226 ppm, strong odor, sheen, and dark black/brown staining.
- TPSB4A (12-14 fbgs): Former tank farm area. Noted in the field were a PID reading of 635, strong odor, sheen, and black staining.

<u>BCP Site 3</u>

- SB39 (4-6 fbgs): Former catalyst area. Noted in the field were a PID reading of 2,146 ppm, strong odor, sheen, and black staining.

- SB44 (10-12 fbgs): Former catalyst area. Noted in the field were a PID reading of 2,243 ppm, sheen, strong odor, and dark grey.
- DTP47/TPSB47 (6-10 fbgs): Former tank farm area. Noted in the field were PID readings of 756 to 879 ppm, strong odor, and dark brown/grey.
- Four additional samples were collected from the lead-impacted area near SB48 due to the soil/fill testing as characteristically hazardous for lead.

Section 5.0 presents the field observations for the soil/fill used in the treatability studies as well as the findings of the treatability studies. The technologies tested are described below.

2.6.1.1 Enhanced Ex-Situ Bioremediation/Landfarming Simulation

This bench-scale treatability test consisted of enhancing natural biodegradation of petroleum-impacted soil by mixing the soil twice a week, to simulate tilling with a tractor, and maintaining soil moisture and pH. A soil moisture content of 8 to 15% and a pH of 6 to 9 were maintained (e.g., with the addition of agricultural lime). Bench-scale treatment and monitoring was completed over a period of approximately 30 days; treatment periods varied based on observations (e.g., visual, odor, and PID screening) and/or progress testing results. This study was completed at ambient temperatures (i.e., 68-74F) within the laboratory building.

2.6.1.2 Solidification/Stabilization Simulations

Six bench-scale solidification/stabilization (S/S) simulations for each type of petroleum-impacted soil/fill at each BCP Site were completed by mixing various proportions (nominally 2% and 5% by weight) of lime kiln dust (LKD), Portland Cement (CP), and/or fly ash (FA) with the representative samples. Based on the nature of the S/S reactions, which typically reacted and "set" relatively quickly (i.e., within hours to a day), this simulation was considered complete within one week following treatment. Test data that was recorded pre-treatment, during treatment, and post-treatment included:

- Additive type and weight
- Weight of bench-scale test sample
- Physical description of soil – grain size, color, presence of staining
- Odor – none, mild, strong

- PID screening concentrations
- Photographs

After waste characterization data indicated the soil/fill in Area 3-PB-1 to be characteristically hazardous for lead, four additional samples were collected from this area for testing. Stabilization treatability tests were performed for each of the four samples using Portland cement (2%, 5%, and 10%) and phosphoric acid (2%, 5%, and 10%) as stabilizing amendments.

2.6.1.3 Chemical Oxidation Simulations

Hydrogen peroxide was mixed with each of the three types of petroleum-impacted soil/fill at different proportions (nominally 1% and 3% by weight). This test consisted of mixing the soil with the hydrogen peroxide in liquid form, and monitoring the reaction which was anticipated to occur within minutes. The samples were left uncovered and monitored daily; visual and olfactory observations, and PID readings were recorded.

2.6.2 Pilot-Scale Treatability Studies

Pilot-scale treatability studies were completed to complement the selected bench-scale treatability testing to provide full-scale design parameters; verify the treatment efficacy to achieve remedial objectives/criteria; and refine construction and operation cost estimates. Figure 2-8 shows where the impacted soil was obtained and the location of the pilot-scale in-situ SVE, ex-situ enhanced bioremediation (landfarming), ex-situ force vented biopiles, and in-situ solidification/ stabilization studies.

2.6.2.1 In-Situ Soil Vapor Extraction

Soil Vapor Extraction (SVE) is an in-situ remediation technology that removes VOCs and SVOCs from the soil matrix by applying a vacuum in the vadose zone. The purpose of the SVE pilot study was to assess the: radius-of-influence for extraction wells; composition of the vadose zone soil gas; and efficacy of using biofiltration to treat extracted vapors. The location of the in-situ SVE pilot-scale test was chosen to evaluate the effectiveness of collecting and treating both lightly and heavily impacted petroleum soil/fill. Two SVE extraction wells were constructed for the pilot test. Extraction well SVE-1 was screened from 9 to 13 fbgs and SVE-2 was screened from 10 to 14 fbgs. Four piezometers,

constructed similarly to the extraction wells, were installed to provide data on the strength of the vacuum field generated (i.e., radius-of-influence) within the vadose zone. Two-inch schedule 40 PVC piping was used to connect the two extraction wells (in parallel) to the SVE blower. The piping was laid on the ground surface to allow for easy operational modification and adjustment. Extraction piping was connected to a knock-out tank (moisture separator) to remove excess condensate/water vapor, followed by an inline air filter to remove particulates from the air stream prior to entering the blower. Exhaust from the blower was conveyed to a biofilter for treatment prior to discharge to the atmosphere.

The skid-mounted SVE system used during the pilot study consisted of the following components:

- A 5-hp regenerative blower
- 60-gallon moisture separator
- High float switch
- Dilution valve, air filter, and silencer
- Vacuum relief valve and gauge
- Control panel

To assess the quality of the extracted vadose zone soil gas, a sample port was installed on the intake line to allow for sampling of the untreated air for organic vapors (via PID and analytical testing) and measure velocity (which in turn was used to calculate flow rate of the extraction system). One analytical sample and a contemporaneous PID sample were collected from the intake sample port (pre-treatment) at system startup to provide a basis for comparison to subsequent data and to provide a basis for mass removal tracking (i.e., a correlation between the PID measurement and the mass of total petroleum hydrocarbons was created). The analytical air sample was collected using a summa canister and analyzed by: United States Environmental Protection Agency (USEPA) Method TO-15 plus TICs; and GRO and DRO by Massachusetts Department of Environmental Protection (MADEP) Air Phase Hydrocarbons (APH). Post-treatment air sampling (i.e., exhaust from the biofilter) was completed by measuring the organic vapor concentration in the headspace above the biofilter treatment media with a PID meter.

Vacuum was measured at each of the piezometers and selected existing monitoring wells at least twice per week using a temporary vacuum gauge in order to evaluate the radius of influence from the applied vacuum field. In addition, the following parameters were monitored over the 16-day operational period:

- PID reading at the influent to and effluent from the biofilter (daily)
- Qualitative observations of the odor at the effluent to the biofilter (daily)
- System vacuum and velocity measurements (bi-weekly)

To further evaluate the efficacy of in-situ SVE, soil samples were collected prior to system start-up from each of the SVE borings across the 5-foot screened interval. Samples were transferred to laboratory supplied, pre-cleaned sample containers, stored on ice in a cooler, and transported to TestAmerica Laboratory following chain of custody procedures. The samples were analyzed for VOCs, SVOCs, and TPH. Post-treatment characterization consisted of excavating test pits proximate to the SVE wells after completion of the pilot study and collecting samples from the same sampling depths as the initial samples. These samples were also analyzed for VOCs, SVOCs, and TPH.

2.6.2.2 Ex-Situ Enhanced Bioremediation/Landfarming Treatment

The objectives of this pilot-scale treatability study were to reduce contaminant concentrations (i.e., elevated PID readings) and remediate nuisance characteristics, thereby mitigating potential impacts to groundwater and soil gas, and allowing the soil to be reused on-site. Ex-situ enhanced bioremediation via landfarming consisted of mechanically mixing the soil/fill to stimulate aerobic biodegradation of the petroleum contaminants. The pilot study was completed with soil/fill from the following W&C RI locations on BCP Site 3:

- SB39 (4-6 fbgs)
- DTP47/TPSB47 (8-10 fbgs)

The biopads were positioned on the former Building 2 foundation. This study was completed in two nominal 400-foot square areas comprised of perimeter hay bales and a 1.5-foot thick layer of petroleum-impacted soil/fill (nominally 20 CY). The soil was tilled with a John Deere 160G Excavator at a minimum twice per week for a period of 30 days or until nuisance characteristics were remediated. A temporary cover (6-mil polyethylene) was placed over the soil/fill to control moisture during precipitation events and nights/holidays when there was no active treatment.

Pre- and post-treatment sampling and analysis were completed to assess the degree of treatment achieved over time. Characterization was accomplished by collecting one grab sample for analysis of VOCs and one composite sample for analysis of SVOCs. Each

composite sample consisted of four grab samples (one from each biopile) from a depth of approximately midway below the surface of the piles. A representative portion of the soil/fill was retained for field screening, including visual characterization of the soil (staining, presence of blebs, NAPL presence), olfactory evidence of impacts, and PID measurement.

One grab sample was submitted for NYSDEC STARS List VOCs and TICs by USEPA Method 8260B and GRO by USEPA Method 8015B. The four grab samples were mixed in a stainless steel bowl to homogenize the soil prior to placement of the composite in laboratory containers and submitted for NYSDEC STARS List SVOCs plus TICs by USEPA Method 8270C and DRO by USEPA Method 8015B. Post-treatment samples were also tested using SPLP STARS list VOCs and STARS list SVOCs. One air sample was collected from the vent piping prior to passing through the emissions controls at or near the system startup period to provide a basis for comparison to subsequent data and contaminant mass removal tracking. The air sample was collected using a summa canister, and analyzed by USEPA Method TO-15 plus TICs; and Gasoline Range Organics (GRO) and DRO by MADEP Air Phase Hydrocarbons (APH). The treatment process was gauged throughout the pilot-scale test by:

- Collecting weekly field visual/olfactory observations and screening the soil/fill with a PID.
- Characterizing the soil/fill initially, during the test, and at the completion of the test. The samples were analyzed for VOCs, SVOCs, and GRO/DRO as described above.

2.6.2.3 Ex-Situ Force Vented Biopiles

The objectives of this pilot-scale treatability study were to: reduce the volatile organic contaminant concentrations (i.e., PID readings); eliminate nuisance characteristics; and, mitigate potential impacts to groundwater thereby allowing the soil to be reused on-site. Ex-situ force vented biopiles (FVBP) are used to enhance aerobic biodegradation of petroleum compounds in soil. The impacted soil is placed in windrowed biopiles where petroleum contaminants are extracted, treated, and vented from the soil. The pilot study was completed with soil from the following impacted areas:

- BCP Site 2: DTP7/TPSB7 (6-8 fbgs)
- BCP Site 1: T-2 (4-6 fbgs)
- BCP Site 3: TT-50 (8-10 fbgs); replaced soil/fill from TT-2 on September 11.

This study consisted of a similar configuration as the biopad layout with a nominal 3-foot layer of petroleum-impacted soil/fill in four windrows representing about 20 CY each. Four-inch perforated piping was laid-out on top of the slab. The piping was attached to 2-inch solid wall piping and connected to a vacuum blower to remove volatile and semi-volatile petroleum constituents from the soil/fill. Sample ports were positioned on the effluent lines from each pad area to enable collection of representative vapor samples during treatment.

Treatment of the FVBP effluent air was accomplished with a biofilter consisting of a 10-foot square, closed-topped plywood box outfitted with perforated pipe in a 1-foot gravel envelope. A 2-foot wood and compost filter medium was used to allow the natural microbiota to remediate the contaminant-loaded air stream. Figure 2-8 provided details of the biofilter design.

Pre- and post-treatment soil sampling and analysis was completed to establish the degree of treatment achieved over time. Soil/fill characterization was accomplished by collecting one grab sample for analysis of VOCs and one composite sample for analysis of SVOCs. Each composite soil/fill sample consisted of four grab samples (one from each biopile) collected from a depth of approximately midway below the surface of the piles. The grab samples were mixed in a stainless steel bowl to homogenize the soil before collecting the sample for laboratory analysis. A representative portion of the soil/fill was retained for field screening, including visual characterization of the soil (staining, presence of blebs, NAPL presence), olfactory evidence of impacts, and PID measurement.

One air sample was collected from the vent piping, prior to passing through the biofilter, at start up and completion of the pilot study for contaminant mass removal tracking. The air sample was collected using a summa canister, and analyzed for VOCs plus TICs via USEPA Method TO-15; and air-phase petroleum hydrocarbons via MADEP Method APH to determine the volatile fraction of petroleum in air, including carbon number subgroups (GRO and DRO). The treatment process was gauged throughout the pilot-scale test by:

- Collecting weekly field visual/olfactory observations and screening the soil with a PID
- Characterizing the soil/fill initially, during the test, and at the completion of the test. The samples were analyzed for VOCs, SVOCs, and GRO/DRO as described above

- Assessing the VOC vapors extracted from the ex-situ FVBP with a PID
- Scanning air effluent from the biofilter with a PID and noting odors

2.6.2.4 In-Situ Solidification/Stabilization

The objectives of this pilot-scale treatability study were to: reduce the volatile organic contaminant concentrations (i.e., PID readings); eliminate nuisance characteristics; and mitigate potential impacts to groundwater and soil gas by in-situ treatment with lime. Two locations were selected for the pilot-study demonstration from the following W&C RI locations:

- BCP Site 2: TPSB-7 (7-9')
- BCP Site 3: DTP-46 (5-7')

On September 13, 2012, the areas were excavated to the top of the treatment zone and approximately 5% lime was added to the area of TPSB-7 and 10% lime was added to the area of DTP-46. The lime was thoroughly mixed into the contaminated interval. After mixing, the excavation was backfilled with trench spoils.

Progress samples were collected on September 20, 2012. The sample from DTP-46 was tested for STARS List VOCs plus TICs, SVOCS STARS List plus TICs, GRO, and DRO. The SPLP was performed on samples from both DTP-46 and TPSB-7 and the leachate was analyzed for SPLP VOCs and SVOCs. Samples were also collected from both DTP-46 and TPSB-7 and tested for hazardous waste characteristics including: SPLP VOCs and SVOCs; TCLP VOCs and SVOCs; ignitability; and corrosivity. A second set of progress samples were collected on October 24, 2012 from both treatment areas. The treatment interval was accessed for sampling by excavating to expose the top of the interval. These samples were analyzed for Target Compound List (TCL) VOCs plus STARS List and TICs, TCL SVOCs and TICs, DRO, and GRO.

3.0 PROPERTY PHYSICAL CHARACTERISTICS

3.1 Property Topography and Drainage

The topography of the Property is generally flat, and is situated at an elevation of approximately 1,430 feet above mean sea level. The Property is proximate to several waterways, including the Allegheny River (one mile south) and several perennial and intermittent streams: Olean Creek (2,000 feet east) and Two Mile Creek (1,000 feet west). Olean Creek flows to the south and enters the Allegheny River southeast of the Property, while Two Mile Creek flows to the southwest and enters the Allegheny River southwest of the Property.

3.2 Remaining Infrastructure

From the past operations on the Property, there are roadways, building footers, floor slabs, piping, overhead electrical and telecommunication lines and poles that still exist on the site. Most of the utilities are inactive and/or abandoned. All buildings were demolished with the exception of one guard shack along Buffalo Street at the southern portion of BCP Site 1.

3.2.1 Former Building Foundations/Floor Slabs and Paving

BCP Site 1

The existing foundations on BCP Site 1 consist of Building Nos. 4, 5, 6, 7, 8, and 10 along with some miscellaneous ruins having a total of approximately 115,000 square feet (SF). The paving that remains on BCP Site 1 is approximately 37,000 SF.

BCP Site 2

There are no known foundations on BCP Site 2, and the paving that remains is approximately 27,000 SF.

BCP Site 3

The foundations on BCP Site 3 consist of Building Nos. 1, 2, and 3 along with some miscellaneous ruins having a total of approximately 50,000 SF. There is no remaining pavement on BCP Site 3.

3.2.2 Utilities

The Property is served by municipal sanitary systems, water, and natural gas. An electrical substation is located in the northwestern portion of BCP Site 3. The water line enters BCP Site 3 along the northeastern property line. The Two Mile sanitary sewer, which serves the property, has recently been updated. Numerous utility corridors are located on the Sites for water, gas, sanitary sewer, and underground electric lines. Appendix F includes the utility summary provided in the May 2010 Site Demolition Work Plan prepared by ARCADIS (Ref. 12).

3.2.3 Subsurface Piping

W&C conducted exploratory trenching and piping delineation commencing October 2009. The exploratory trenching included completing nine main trenches, which uncovered various types of piping. The exploratory trenching data was managed using a Geographical Information System (GIS) database. The database contains information regarding the piping length, diameter, material (e.g., steel); contents removed; and associated field screening information such as PID readings, Lower Explosive Limit (LEL) readings, and observations.

The exploratory trenching included 153,000 square feet of trenching that uncovered approximately 95,000 feet of abandoned subgrade piping. In addition to the piping identified on the three BCP Sites, W&C located approximately 3,400 linear feet of abandoned process piping on the National Grid property that is located between BCP Sites 2 and 3. There are also several other underground utility lines (water, sewer, storm, "effluent line," electric, and fire protection) that once serviced the facility. These lines will remain in place. The effluent line appears to be related to the former Agway groundwater purge well discussed in Section 1.3. The effluent line is shown on Figure 8-5 based on its location on Figure 4A of W&C's RI Report.

3.3 Geology and Hydrogeology

Bedrock in the Olean area consists predominantly of Upper Devonian shale, siltstone, and sandstone of the Conewango and Conneaut Groups. The bedrock surface was shaped by former glacial action, and is characterized by deepened and widened river and stream valleys and rounded hilltops. Depth to bedrock is estimated at 220 to 260 feet beneath the Site (Ref. 2).

A stratified-drift aquifer composed of outwash and kame sand and gravel and Holocene alluvial gravel extends from 40 to 125 feet below the present river level and rests on as much as 200 feet of silt and clay. These deposits form the principal aquifer, which averages 80 feet in thickness and extends from the Salamanca area to the west, upvalley (eastward) through Olean and then south into Pennsylvania. The aquifer is thickest near the valley center and pinches out near the valley walls. In general, it also is thicker downstream (westward) than upstream (eastward).

Basal portions of the overburden consist of lacustrine silts and clays that were deposited (more than 200 feet) into an ancestral lake when the area was flooded due to an ice dam that blocked the westward flow of the Allegheny River and its tributaries. Subsequent glacial advances partly eroded the sediments and emplaced mixed sand, silt, and gravel deposits, as well as well-sorted gravel outwash fans and terraces. Minor till layers exist between the lacustrine sediments and the overlying outwash deposits documenting advancing and retreating ice sheets. Post-glacial stream deposition left alluvial deposits of silt, sand, and gravel from 3 to 10 feet thick over the valley flood plain, which includes the Property (Ref. 2).

The Property is underlain by an upper and lower outwash aquifer, separated by a lacustrine clay and silt unit. The upper aquifer ranges from 10 to 50 feet thick and is locally confined by a clayey gravel unit. The lower aquifer averages 30 feet thick and is confined by the overlying lacustrine silt and clay unit. The lower aquifer tends to be more permeable than the upper aquifer, which generally contains more silt. These two aquifers merge into one aquifer west of the Site, where the Olean Creek valley joins the Allegheny River valley, thickening towards the west.

Groundwater flow is to the southwest eventually discharging to the Allegheny River. The water table is located approximately 15 to 27 fbgs under the Property. The rate of natural groundwater flow is expected to be very slow in the less permeable upper aquifer due to the flat water table and non-homogeneous soil types. The rate of natural groundwater flow in the lower aquifer is expected to be higher than in the upper aquifer, but still slow due to the lack of hydraulic gradient.

Groundwater elevation contour maps completed for the August 2008 (Figure 3-1), May 2011 (Figure 3-2), and August 2012 (Figure 2-4) show shallow groundwater flowing south, southeast, and southwest across the Site.

3.4 Wetlands and Floodplains

The closest waterway, Olean Creek, is located approximately ¼-mile east of BCP Site 3. The Olean Redevelopment Property is outside the floodplain of Olean Creek.

4.0 HISTORIC AND SUPPLEMENTAL RI FINDINGS

This section describes field observations and analytical results in soil/fill and groundwater for Olean Redevelopment BCP Sites 1, 2, and 3 during W&C's RI (2008) and SRI (2009-2010), as well as the 2012 SRI. Chemical data for soil/fill and groundwater samples collected during these investigations are discussed sequentially by BCP Site and summarized by media.

For the purpose of comparison, the soil/fill analytical data summary tables include "Unrestricted Use" SCOs as published in 6NYCRR Part 375-6 "Remedial Program Soil Cleanup Objectives." Unrestricted Use SCOs are deemed protective of human health and groundwater irrespective of end use of the property. Accordingly, the Unrestricted Use SCOs represent conservative soil/fill cleanup objectives that are often difficult to achieve on former industrial sites in urban areas. The data is also compared to Restricted CSCOs per 6NYCRR Part 375-6. These values are deemed protective of human health, in the absence of other controls, for sites where end use will be limited to commercial or more restrictive (e.g., industrial) uses; these restricted uses are considered the reasonably anticipated future uses for the Olean Redevelopment Property as discussed in the land use evaluation (see Section 8.5.1).

Widespread exceedances of the Unrestricted Use SCOs were noted on BCP Sites 1, 2, and 3, particularly for BTEX, Polyaromatic hydrocarbons (PAHs), select metals, and, to a lesser extent, PCBs. As such, the discussions below are limited to soil/fill quality as indicated by the more meaningful comparison to CSCOs.

According to 6NYCRR Part 375-1.2(u), "Grossly Contaminated Media" means soil, sediment, surface water, or groundwater which contains sources or substantial quantities of mobile contamination in the form of NAPL, as defined in subdivision 375-1.2 (ac), that is identifiable either visually, through strong odor, by elevated contaminant vapor levels, or is otherwise readily detectable without laboratory analysis. Based on the RI results, evidence of "grossly contaminated soil" was identified on each of the BCP Sites as shown on Figures 4-1, 4-10 and 4-14. As grossly contaminated soil is impacted with petroleum constituents, such material is described throughout this report as "Grossly Contaminated Petroleum Soil (GCPS)," as defined above, using PID readings in excess of 1,000 ppm as an additional indicator of GCPS.

4.1 Olean Redevelopment BCP Site 1

4.1.1 Surface/Near-Surface Soil/Fill

4.1.1.1 Field Observations

The surface of BCP Site 1 is vegetated with grasses and weeds with some emergent trees (mostly poplars). Surface lithology generally consisted of a silty-sand with gravel and fill unit that on average extends from 0 to 4 fbgs and up to 10 fbgs in some areas. This unit is underlain by fill or a silty-sand with gravel unit.

Field evidence of GCPS impact to near-surface soil/fill was identified in two areas of BCP Site 1 (see 1-GCPS-1s and -2s on Figure 4-1) from 2 to 6 fbgs. Table 4-1 summarizes the soil/fill PID readings by depth measured during the 2012 SRI. Figure 4-1 presents the GCPS areas graphically for the 2012 SRI and W&C's 2008 and 2009 investigations.

4.1.1.2 VOCs

During W&C's 2008 RI, no VOCs were detected in the surface/near-surface soil/fill (referred to as shallow soil/fill by W&C) at concentrations above the CSCOs on BCP Site 1; therefore, W&C did not conduct additional VOC analyses during its SRI. VOC Tentatively Identified Compounds (TICs) were reported on approximately 10% of the sample data, with concentrations ranging from 0 to 92.5 mg/kg. Table 4-2 summarizes the VOC analytical data for W&C's surface/near-surface soil/fill investigation.

One surface/near-surface soil/fill sample (T-2; 4-6 fbgs) was collected from an exploratory test trench for use in the ex-situ force vented biopile treatability studies. The sample was analyzed for TCL VOCs (plus TICs) and gasoline range organics (GROs). As presented on Table 4-3, no VOCs were detected at concentrations above CSCOs; VOC TICs were detected at a concentration of 106.7 mg/kg; and GROs were detected at a concentration of 430 mg/kg.

4.1.1.3 SVOCs

SVOC analyses were conducted during W&C's RI. Four samples (0-2 fbgs) collected on BCP Site 1 contained concentrations of the following PAHs slightly above CSCOs: benzo(a)pyrene (all 4); benzo(a)anthracene (1 of 4); and dibenz(a,h)anthracene (1 of 4). No

additional SVOC analyses were performed on BCP Site 1 during W&C's SRI. Table 4-4 summarizes the SVOC analytical data for W&C's surface/near-surface soil/fill investigation.

As presented on Table 4-3 and discussed in Section 4.1.1.2, near-surface soil/fill sample T-2 (4-6 fbgs) was analyzed for TCL SVOCs (plus TICs) and diesel range organics (DROs) during the 2012 SRI. No SVOCs were detected in sample T-2; however, SVOC TICs were detected at a concentration of 14.5 mg/kg and DROs were detected at a concentration of 950 mg/kg (also detected in the method blank).

Figure 4-2 indicates the sample locations that exceeded the CSCOs for SVOCs.

4.1.1.4 Inorganic Compounds

Surface/near-surface soil/fill samples from BCP Site 1 were analyzed for inorganic compounds (plus cyanide) during W&C's RI. As summarized on Table 4-5, three metals were detected at concentrations above the CSCOs; arsenic in numerous samples; mercury in two locations; and lead in one location. W&C collected additional samples during the SRI to vertically and laterally delineate the following areas containing elevated metals concentrations per NYSDEC's February 25, 2009 comment letter:

- TPSB23 Area: RI sample TPSB23 (0-2 fbgs) contained arsenic at a concentration of 60.6 mg/kg. All of the four additional sample locations detected arsenic at concentrations (23.6-106 mg/kg) above the CSCO up to 6 fbgs.
- SB6 Area: RI sample SB6 (0-2 fbgs) contained arsenic at a concentration of 192 mg/kg. Two of the five additional sample locations detected arsenic slightly above the CSCO (16 mg/kg) from 0-2 fbgs but not from the 2-4 fbgs sample.
- TPSB26A Area: RI sample TPSB26A (0-2 fbgs) contained arsenic at a concentration of 148 mg/kg. All three additional sample locations detected arsenic above the CSCO (16 mg/kg) up to 6 fbgs.
- TP37A & SB7 Area: RI sample TP37A (0-2 fbgs) contained arsenic at a concentration of 124 mg/kg and lead at a concentration of 1,660 mg/kg. Nearby RI sample SB7 (0-2 fbgs) contained arsenic at a concentration of 47.7 mg/kg. Four of the eight additional sample locations contained arsenic at concentrations above the CSCO up to 6 fbgs; however, lead was not detected above the CSCO (1,000 mg/kg) in any of the additional samples.
- SB17 Area: RI sample SB17 (0-2 fbgs) contained arsenic at a concentration of 40.6 mg/kg and mercury at a concentration of 9.1 mg/kg. One of the three additional sample locations contained arsenic at concentrations above the CSCO

up to 4 fbgs; however, mercury was not detected above the CSCO (2.8 mg/kg) in any of the additional samples.

- TPSB31 Area: RI sample TPSB31B (2-4 fbgs) contained mercury at a concentration of 19.7 mg/kg. One of the four additional sample locations contained mercury at a concentration (31.1 mg/kg) above the CSCO from 2-4 fbgs; the concentration of mercury within the 4-6 fbgs sample at this same location was well below the CSCO.

Based on W&C's RI and SRI results, additional sampling was conducted in 2012 to further delineate the following four MAOIs (see Section 2.1.1.1) as summarized on Tables 4-6 and 4-7:

- Area 1-AS-1: One additional location (AS-9; 0-2 fbgs) in the vicinity of sample TP37A was sampled and analyzed for arsenic. Arsenic was detected at a concentration (24.1 mg/kg) slightly above the CSCO.
- Area 1-AS-2: One additional location (AS-8; 0-2 fbgs) in the vicinity of sample SB6 was sampled and analyzed for arsenic. Arsenic was detected at a concentration (12.2 mg/kg) below the CSCO.
- Area 1-AS-3: Ten additional locations (0-2 and 2-4 fbgs) in the vicinity of sample TPSB26A were sampled and analyzed for arsenic. Arsenic was detected at concentrations (17.7-83 mg/kg) above the CSCO in 8 of the 10 sample locations. Two of the 2-4 fbgs samples (As-30 and As-32) contained arsenic at concentrations above the CSCO.
- Area 1-HG-1: Eight additional locations (0-2, 2-4, and 4-6 fbgs) in the vicinity of samples SB-17 and TPSB31B&C were sampled for analysis of mercury. Only one sample HG-3 (4-6 fbgs) contained mercury at a concentration (3.4 mg/kg) slightly above the CSCO (2.8 mg/kg). This sample was collected adjacent to original sample TPSB31.

Figure 4-3 indicates the sample locations on BCP Site 1 that exceeded the CSCOs for inorganic compounds.

4.1.1.5 Pesticides/Herbicides

As summarized on Table 4-8, all samples collected from BCP Site 1 during W&C's RI and analyzed for pesticides/herbicides contained concentrations below the CSCOs; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.1.1.6 PCBs

Soil/fill samples were collected from BCP Site 1 and analyzed for PCBs during W&C's RI. As summarized on Table 4-9, PCBs were detected at concentrations above the CSCO (1 mg/kg) at three locations (SB22, TP18, and TP25) from 0-0.5 fbgs. No additional samples were analyzed for PCBs during W&C's SRI.

Based on W&C's RI results, 30 additional samples were collected during the 2012 SRI to delineate the areas surrounding SB22 (7.14 mg/kg), TP18 (1.21 mg/kg), and TP25 (7.46 mg/kg). As summarized on Table 4-10, 18 of the 30 samples contained PCB Aroclor 1254 at concentrations above the CSCO of 1 mg/kg; 17 of these 18 samples were collected from 0-0.5 fbgs and 1 sample was collected from 0.5-1 fbgs. Figure 4-4 indicates the sample locations on BCP Site 1 that exceeded the CSCOs for PCBs.

4.1.2 Subsurface Soil/Fill

4.1.2.1 Field Observations

Subsurface soil/fill (i.e., below 6 fbgs) on BCP Site 1 is a continuation of the fill or silty-sand with gravel, underlain by well-graded sand with silt and gravel. During the 2012 SRI, groundwater was only noted in two of the approximate 16-foot deep test trenches: perched at 8 fbgs (TT1) and at 15 fbgs (TT14). Groundwater was encountered at 17 fbgs during advancement of monitoring well W30.

Field evidence of GCPS was identified in certain areas. As illustrated by Figure 4-1, GCPS was identified in four subsurface (6 to 15 fbgs) areas (i.e., 1-GCPS-1d through -4d) of BCP Site 1. Table 4-1 summarizes the soil/fill PID readings by depth measured during the 2012 SRI.

4.1.2.2 VOCs

During W&C's 2008 RI, no VOCs were detected in the subsurface soil/fill (referred to as deep soil/fill by W&C) from BCP Site 1 at concentrations above CSCOs; therefore, W&C did not conduct additional VOC analyses on subsurface soil/fill during their SRI. VOC TIC concentrations ranged from 1.69 mg/kg (6-8 fbgs) to 95.3 mg/kg (6-10 fbgs). Table 4-11 summarizes the VOC analytical data for W&C's subsurface soil/fill investigation.

As presented on Table 4-3, an additional 11 subsurface soil/fill samples were collected across BCP Site 1 for analysis of TCL VOCs (plus TICs) and GROs during the 2012 SRI. None of the VOCs were detected at concentrations above the CSCOs. VOC TICs were detected at concentrations between 5.79 and 81 mg/kg (TPSB-23C; 6-8 fbgs). The concentration of GROs ranged from 64 to 550 mg/kg (TT-9; 14-16 fbgs).

4.1.2.3 SVOCs

Sample TPSB23 (6-8 fbgs) collected from BCP Site 1 during W&C's RI contained PAHs, specifically benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, at concentrations above CSCOs, with a total PAH concentration of approximately 1,557 mg/kg. During the SRI, W&C collected additional samples at five locations (TPSB23A through TPSB23E) at varying depths to vertically and laterally delineate the area surrounding TPSB23. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene were detected at much lower concentrations; however, concentrations were above CSCOs up to 10 fbgs. SVOC TIC concentrations ranged from 0.46 mg/kg (TPSB23B, 8-10 fbgs) to 4,238 mg/kg (TPSB23C, 6-8 fbgs). Table 4-12 summarizes the SVOC analytical data for W&C's subsurface soil/fill investigation.

As presented on Table 4-3, the 11 subsurface soil/fill samples were collected during the 2012 SRI were also analyzed for TCL SVOCs (plus TICs) and DROs. One sample (TPSB-23C; 6-8 fbgs) detected three SVOCs at concentrations slightly above CSCOs. SVOC TICs were detected at concentrations between 13.5 and 1,269 mg/kg (TPSB-23C; 6-8 fbgs). The concentration of DROs ranged from 160 to 21,000 mg/kg (TPSB-23C; 6-8 fbgs).

Figure 4-2 indicates the sample locations on BCP Site 1 that exceeded the CSCOs for SVOCs.

4.1.2.4 Inorganic Compounds

As summarized on Table 4-13 and shown on Figure 4-3, only arsenic was detected in BCP Site 1 subsurface soil/fill during W&C's RI at concentrations above the CSCO (16 mg/kg); 31 mg/kg in sample TPSB22 (10-16 fbgs) and 16.2 mg/kg in sample TPSB23 (6-8 fbgs). No additional analyses for inorganic compounds in subsurface soil/fill were conducted during the W&C or 2012 SRIs.

4.1.2.5 Pesticides/Herbicides

As summarized on Table 4-14, all subsurface soil/fill samples collected from BCP Site 1 during W&C's RI and analyzed for pesticides/herbicides contained concentrations below the CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.1.2.6 PCBs

As summarized on Table 4-15, all subsurface soil/fill samples collected from BCP Site 1 during W&C's RI and analyzed for PCBs contained concentrations below CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for PCBs during the W&C or 2012 SRIs.

4.1.3 Groundwater

4.1.3.1 Field Observations

During W&C's RI, SRI, and quarterly groundwater gauging events for BCP Site 1, LNAPL was detected in five wells at the following maximum thicknesses: W5 (3.38'), W7 (0.03'), W9 (1.77'), W10 (1.4'), and W27 (1.86') as presented on Table 4-16. In 2008, W&C collected samples of the LNAPL for laboratory fingerprinting analysis; the majority of the LNAPL appeared to contain moderately weathered middle to heavy distillate product. Sorbent socks were deployed in Wells W5, W9, and W10 in June 2010; Well W27 in May 2011; and Well W7 in June 2011. Sorbent socks are removed and inspected during W&C's quarterly monitoring events. Socks that are obviously oil-stained are replaced with new socks.

As indicated on Table 4-16, the following LNAPL thicknesses were observed during W&C's quarterly gauging events in February and August 2012: W5 (0.01' and 3.12'), W9 (1.77' and 0.15'), W10 (0.00' and 0.85'), and W27 (0.02' and 1.86'). No LNAPL was detected in the three wells (i.e., W3, W4, and W30) sampled during the August 2012 SRI.

4.1.3.2 VOCs

During W&C's RI, SRI, and quarterly monitoring events, VOCs were detected in groundwater at concentrations above GWQS/GVs in Wells MW-8S, MW-30S, W1, W2, W3, W4, W6, W7, W9, and W10. The VOCs detected above GWQS/GVs include benzene,

chlorobenzene, ethylbenzene, 1,4-dichlorobenzene, n-propylbenzene, toluene, 1,2,4 trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes. Total VOC concentrations were detected in groundwater at concentrations up to 247.79 ug/L (Well W9 in September 2008). With the addition of VOC TICs, this maximum concentration increased to 1,817.79 ug/L. TICs were reported on approximately 20% of the RI sample data and all of the SRI data. Figure 4-6 illustrates the September 2008 distribution of total VOCs in the groundwater on BCP Site 1 as well as the approximate extent of LNAPL observed. The September 2008 RI sampling event was represented on a figure because it encompassed more monitoring wells than the November 2009 SRI sampling event. Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012.

On August 30, 2012, newly installed groundwater monitoring well W30 and existing Wells W3 and W4 were sampled for analysis of TCL VOCs plus TICs; all three wells are located along the southwestern downgradient property boundary of BCP Site 1. Table 4-18 summarizes and compares the groundwater data to GWQS/GVs. Figures 4-6 and 4-7 present the total VOC concentrations and the total VOC plus TICs concentrations for the February 2012 monitoring event (the August 2012 data is shown for comparison); both figures show the approximate extent of LNAPL observed. Total VOCs were detected in groundwater at concentrations up to 620 ug/L (Well W5) in February 2012. With the addition of VOC TICs, this maximum concentration increased to 2,320 ug/L.

4.1.3.3 SVOCs

During W&C's RI and SRI, SVOCs were detected in groundwater at concentrations above GWQS/GVs in monitoring well W8. The SVOCs detected above GWQS/GVs include chrysene, cresols (m & p), and phenol; the total SVOC concentration in Well W8 was 15.4 ug/L. TICs were reported on approximately 20% of the RI sample data and all of the SRI data. SVOC TIC concentrations ranged from non-detect to 1,343 ug/L (MW-4S). Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012.

The 2012 SRI did not include analysis of groundwater samples for SVOCs because SVOCs were not considered constituents of potential concern (COPCs).

4.1.3.4 Inorganic Compounds

During W&C's RI, SRI, and quarterly monitoring events, inorganic compounds detected in groundwater at concentrations above GWQS/GVs in several monitoring wells on BCP Site 1 included arsenic, chromium, iron, lead, magnesium, manganese, sodium, and/or nickel. The following metals of interest were detected at concentrations above GWQS/GVs (see Table 4-17); the range of concentrations observed between August 2008 and February 2012 has been indicated:

- Arsenic: MW-6S (35.7 to 93.2 ug/L); MW-18 (25.4 to 64.2 ug/L); W4 (27.1 to 36.7 ug/L)
- Chromium: W8 (52.1 to 172 ug/L)
- Lead: W4 (27.1 to 47.9 ug/L); W8 (26.4 to 68.8 ug/L)
- Nickel: W8 (131 to 2,920 ug/L)

The 2012 SRI did not include analysis of groundwater samples for inorganic compounds because metals were not considered COPCs.

4.1.3.5 Pesticides/Herbicides

As indicated on Table 4-17, groundwater samples collected during W&C's RI and analyzed for pesticides/herbicides did not contain concentrations above GWQS/GVs; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.1.3.6 PCBs

PCBs were not detected in groundwater samples collected during W&C's RI; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.1.4 Subsurface Product Piping

Figure 4-9 shows the abandoned petroleum product conveyance piping on BCP Site 1 as reported by W&C; an estimated 22,500 linear feet. Subsurface piping was reportedly drained of liquids (by W&C in 2008 and 2009), and residual materials in the piping are expected to contain mostly scale and sludge. Petroleum-impacted soil/fill was observed during W&C's subsurface piping investigation in the areas shown on Figure 4-9.

As discussed in Section 2.3.2, no additional piping investigation or sampling was conducted during the 2012 SRI as it was determined that limited sample collection would not be representative of site-wide conditions due to the large volume of piping and the potential for great variation in contents.

4.1.5 Waste Characterization

Samples were collected from one mercury-impacted and two arsenic-impacted soil/fill areas for analysis of TCLP RCRA metals during the 2012 SRI. As summarized on Tables 4-6 and 4-7, none of the samples exhibited hazardous waste characteristics for metals.

4.1.6 Olean Redevelopment BCP Site 1 Summary of Findings

4.1.6.1 Surface/Near-Surface Soil/Fill

No GCPS was observed from 0-2 fbgs on BCP Site 1. The two areas with GCPS from 2-6 fbgs are isolated and cover a small percentage of BCP Site 1.

Three areas of arsenic impact and one area of mercury impact in near-surface (0-6 fbgs) soil/fill exist on BCP Site 1. The one lead exceedance falls within an arsenic-impacted area. None of the metal-impacted soil/fill tested characteristically hazardous and would therefore be handled as non-hazardous. Two surface soil/fill (0-0.5 fbgs) areas impacted by PCBs were identified on BCP Site 1.

4.1.6.2 Subsurface Soil/Fill

The four areas of GCPS subsurface soil/fill (6 to 15 fbgs) cover a small percentage of BCP Site 1. In some instances, the GCPS soil/fill appears to correlate with elevated VOCs in groundwater (W9 and W10) and, in other instances (W6), the GCPS soil/fill does not seem to impact groundwater quality. Area 1-GCPS-4d is located beneath the area (TPSB-23) with PAH concentrations detected significantly above CSCOs and elevated SVOC TICs in 2008/2009.

4.1.6.3 Groundwater

As illustrated by Figures 4-7 and 4-8, the 2012 distribution of total VOCs and VOCs plus TICs in groundwater show the highest concentrations located in upgradient Well W5 proximate to the northern property line (along the southern boundary of BCP Site 2), which

coincides with the presence of LNAPL in W5. These concentration contours show a decreasing trend in the direction of groundwater flow toward the southeast with a slightly elevated VOC concentration at Well W30, coincident with a groundwater elevation low surrounding Well W7 and Well W30. Groundwater impacts in Well W30 appear to be associated with an upgradient subsurface GCPS area.

The sources of groundwater contamination found on BCP Site 1 likely include upgradient off-site (BCP Site 2) groundwater, contributions from the former refinery operations on the Site (e.g., leaking pipelines and tanks, spillage, etc.), and potentially downgradient groundwater pulled onto BCP Site 1 during Agway's operation of the pumping and purge wells from 1977 to 1984 (referred to as the North Olean Well Field). There is a high concentration of subgrade piping potentially containing product and GCPS on the southern portion of BCP Site 2; no known subgrade piping or GCPS exist on the northern portion of BCP Site 1 in the vicinity of Well W5. Figures 4-5 and 4-6 show the historic LNAPL area on BCP Site 2 extending to Well W5 on BCP Site 1. The groundwater VOC impacts on BCP Site 1 are likely due to on-site migration of dissolved-phase VOCs from BCP Site 2 and LNAPL proximate to Well W5. As discussed in Section 1.3, the purge well on BCP Site 1 had the potential to pump groundwater at a flow greater than 1,000 gallons per minute (gpm). Since the purge well was located approximately 200 feet west of the northeastern BCP Site 1 property line, it is feasible that off-site contaminated groundwater from the Dresser-Rand site was drawn onto BCP Site 1.

The concentrations of inorganic compounds in groundwater do not coincide with the near-surface soil/fill MAOIs.

4.2 Olean Redevelopment BCP Site 2

4.2.1 Surface/Near-Surface Soil/Fill

4.2.1.1 Field Observations

The surface of BCP Site 2 is vegetated with grasses and weeds with some emergent trees (mostly poplars). Surface lithology generally consisted of either a silty-sand with gravel and fill unit or a fill unit that on average extends from 0 to 4 fbgs (upwards of 10 fbgs in some areas). This unit is underlain by fill or a silty-sand with gravel unit. Some areas of BCP Site 2 consist of either lean clay or well graded sand with silt and gravel beginning at 4 fbgs.

Field evidence of potential GCPS impact to surface/near-surface soil/fill was identified in one area of BCP Site 2 (a portion of 2-GCPS-1s) from 0-2 fbgs and in three areas (see 2-GCPS-1s through -3s on Figure 4-10) from 2-6 fbgs. Table 4-1 summarizes the soil/fill PID readings by depth measured during the 2012 SRI. Figure 4-10 presents the GCPS areas graphically for the 2012 SRI and W&C's 2008 and 2009 investigations.

4.2.1.2 VOCs

During W&C's 2008 RI, no VOCs were detected in the surface/near-surface soil/fill of BCP Site 2 at concentrations above the CSCOs; therefore, no additional VOC analyses were completed during W&C's SRI or the 2012 SRI. VOC TIC concentrations ranged from 0 to 4.39 mg/kg. Table 4-2 summarizes the VOC analytical data for W&C's surface/near-surface soil/fill investigation.

4.2.1.3 SVOCs

SVOC analyses were conducted during W&C's RI and SRI; the SRI included additional SVOC analyses on BCP Site 2 in the areas of RI samples TP3/SB57 and TPSB13. In the vicinity of TP3/SB57, benzo(a)pyrene and dibenz(a,h)anthracene were detected at concentrations above CSCOs from 0 to 4 fbgs. Benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene were detected at concentrations above CSCOs in the 4 to 6 fbgs interval. Test pit sample TPSB13 (0-2 fbgs) contained the following PAHs at concentrations above CSCOs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. However, none of the supplemental samples collected within the vicinity (laterally or at depth) contained concentrations of these SVOCs above CSCOs with the exception of one sample (TPSB13B; 4-6 fbgs) that contained a concentration of benzo(a)pyrene (1.2 mg/kg) slightly above its CSCO (1.0 mg/kg). A few of these PAHs were detected at four other locations at concentrations slightly above their respective CSCOs. Table 4-4 summarizes the SVOC analytical data for W&C's surface/near-surface soil/fill investigation. Figure 4-11 indicates the sample locations on BCP Site 2 that exceeded the CSCOs for SVOCs.

No additional surface/near-surface soil/fill samples were collected during the 2012 SRI for analysis of SVOCs as BCP Site 2 was sufficiently characterized during previous investigations.

4.2.1.4 Inorganic Compounds

Surface/near-surface soil/fill samples from BCP Site 2 were analyzed for inorganic compounds (plus cyanide) during W&C's RI. As summarized on Table 4-5, three metals were detected at concentrations above CSCOs: arsenic in numerous samples; mercury in four locations; and copper in one location. W&C collected additional samples during the SRI to vertically and laterally delineate the following areas containing elevated metals concentrations per NYSDEC's February 25, 2009 comment letter:

- TPSB13 Area: RI sample TPSB13 (0-2 fbgs) contained arsenic at a concentration of 191 mg/kg. All four additional sample locations contained arsenic at concentrations above the CSCO (16 mg/kg) up to 6 fbgs.

- SB57 Area: RI sample TP3 (0-0.5 fbgs) contained arsenic at a concentration of 312 mg/kg. All four sample locations contained arsenic at concentrations (17.2 – 1,460 mg/kg) above the CSCO (16 mg/kg) up to 6 fbgs. TCLP results (6.6 mg/L) at sample location SB57A (1,460 mg/kg total arsenic; 0-2 fbgs) indicate an exceedance of the TCLP Limit for arsenic (5 mg/L).

- TPSB2 Area: RI sample TPSB2 (0-2 fbgs) contained mercury at a concentration of 23.6 mg/kg. Two of the five additional sample locations contained mercury at concentrations above the CSCO from 0-2 fbgs.

Based on these RI and SRI results, additional sampling was conducted during the 2012 SRI to further delineate the following MAOIs (see Section 2.1.1.1) as summarized on Table 4-19:

- Area 2-AS-1: Nine additional locations (up to 8 fbgs) in the vicinity of samples TPSB13 and SB57 were sampled and analyzed for arsenic. Arsenic concentrations were detected above the CSCO at 6 of the 9 locations up to 6 fbgs. The highest concentration (233 mg/kg) was detected in sample As-13 from 4-6 fbgs. The TCLP arsenic result indicates non-hazardous soil/fill.
- Area 2-HG-1: This area had been adequately delineated during W&C's RI; therefore, sampling was limited to waste characterization parameters. The TCLP mercury result indicates non-hazardous soil/fill.

Figure 4-12 indicates the sample locations on BCP Site 2 that exceeded the CSCOs for inorganic compounds.

4.2.1.5 Pesticides/Herbicides

As summarized on Table 4-8, all samples collected from BCP Site 2 during W&C's RI and analyzed for pesticides/herbicides contained concentrations below the CSCOs; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.2.1.6 PCBs

As summarized on Table 4-9, all samples collected from BCP Site 2 during W&C's RI and analyzed for PCBs contained concentrations below CSCOs; therefore, no additional samples were analyzed for PCBs during the W&C or 2012 SRIs.

4.2.2 Subsurface Soil/Fill

4.2.2.1 Field Observations

Subsurface soil/fill (below 6 fbgs) on BCP Site 2 is a continuation of the fill or silty-sand with gravel, underlain by well-graded sand with silt and gravel; some areas have a 4- to 6-foot layer of lean clay as the second unit. During the 2012 SRI, groundwater was not noted within any of the approximately 16-foot deep test trenches.

Field evidence of potential subsurface GCPS soil/fill was identified in certain areas. As illustrated by Figure 4-10, GCPS soil/fill is present in two areas from 6 to 15 fbgs (2-GCPS-1d and -2d) of BCP Site 2. Table 4-1 summarizes the soil/fill PID readings by depth measured during the 2012 SRI.

4.2.2.2 VOCs

During the 2008 RI, no VOCs were detected in the subsurface soil/fill (referred to as deep soil/fill by W&C) at concentrations above CSCOs; therefore, W&C did not conduct additional VOC analyses on subsurface soil/fill during the SRI. VOC TIC concentrations ranged from 101.7 mg/kg (6-8 fbgs) to 851 mg/kg (12-16 fbgs). Table 4-11 summarizes the VOC analytical data for W&C's subsurface soil/fill investigation.

As presented on Table 4-20, six additional subsurface soil/fill samples were collected during the 2012 SRI across BCP Site 2 for analysis of TCL VOCs (plus TICs) and GROs. No VOCs were detected at concentrations above the CSCOs. VOC TICs were detected at

concentrations between 7.37 and 6,374.9 mg/kg (SVE-1; 8-14 fbgs). The concentration of GROs ranged from 47 to 3,600 mg/kg (SVE-1; 8-14 fbgs).

4.2.2.3 SVOCs

During W&C's 2008 RI, no SVOCs were detected in subsurface soil/fill at concentrations above CSCOs; therefore, W&C did not conduct additional SVOC analyses on subsurface soil/fill during the SRI. SVOC TIC concentrations ranged from 60.1 mg/kg to 517 mg/kg (SB-2; 12-16 fbgs). Table 4-12 summarizes the SVOC analytical data for W&C's subsurface soil/fill investigation.

As presented on Table 4-20, the six additional subsurface soil/fill samples collected during the 2012 SRI were also analyzed for TCL SVOCs (plus TICs) and DROs. One sample (TPSB-4A; 12-14 fbgs) detected benzo(a)pyrene at a concentration (1.9 mg/kg) slightly above its CSCO (1.0 mg/kg). SVOC TICs were detected at concentrations between 6.63 and 1,025 mg/kg (TPSB-4A; 12-14 fbgs). The concentration of DROs ranged from 1,400 to 19,000 mg/kg (DTP-7; 6-8 fbgs).

Figure 4-11 indicates the sample locations on BCP Site 2 that exceeded the CSCOs for SVOCs.

4.2.2.4 Inorganic Compounds

As summarized on Table 4-13, all subsurface soil/fill samples collected on BCP Site 2 during W&C's RI and analyzed for inorganic compounds contained concentrations below the CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for inorganic compounds during W&C's SRI.

As part of the surface/near-surface soil/fill investigation of the area surrounding SB57, sample AS-13 (6-8 fbgs) was analyzed for arsenic and found to contain a concentration below the CSCO.

4.2.2.5 Pesticides/Herbicides

As summarized on Table 4-14, all subsurface soil/fill samples collected on BCP Site 2 during W&C's RI and analyzed for pesticides/herbicides contained concentrations below the CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.2.2.6 PCBs

As summarized on Table 4-15, all subsurface soil/fill samples collected on BCP Site 2 during W&C's RI and analyzed for PCBs contained concentrations below CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for PCBs during the W&C or 2012 SRIs.

4.2.3 Groundwater

4.2.3.1 Field Observations

During W&C's RI, SRI, and quarterly groundwater gauging events on BCP Site 2, LNAPL was detected in two wells at the following maximum thicknesses: WCMW-1 (0.83') and W14 (6.55') as presented on Table 4-16. Sorbent socks were deployed in Wells W14 and WCMW1 in June 2010. Sorbent socks are removed and inspected during W&C's quarterly monitoring events. Socks that are obviously oil-stained are replaced with new socks.

As indicated on Table 4-16, the following LNAPL thicknesses were observed during W&C's quarterly gauging events in February and August 2012: W14 (0.68' and 5.85') and WCMW1 (0.00 and 0.61').

4.2.3.2 VOCs

During W&C's RI and SRI, VOCs were detected in BCP Site 2 groundwater at concentrations above GWQS/GVs in Wells W16 and W17. The VOCs detected above GWQS/GVs include benzene, n-propylbenzene, toluene, 1,2,4 trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes. Figure 4-6 presents the total VOC concentration distribution for the 2008 sampling event. Total VOCs were detected in groundwater at concentrations up to 540 ug/L (Well W17). With the addition of VOC TICs, this maximum concentration increased to 1,124.5 ug/L. Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012.

Figures 4-6 and 4-7 present the total VOC concentrations and the total VOC plus TICs concentrations for the February 2012 monitoring event; both figures show the approximate extent of LNAPL observed. Total VOCs were detected in groundwater at concentrations up to 390 ug/L (Well W17) in February 2012. With the addition of VOC TICs, this maximum concentration increased to 910 ug/L. None of the wells on BCP Site 2

were sampled during the August 2012 SRI as sufficient data existed to assess groundwater quality on this Site.

4.2.3.3 SVOCs

During W&C's RI and SRI, one SVOC (m & p cresols) was detected in BCP Site 2 groundwater at a concentration (5.6 ug/L) above GWQS/GVs in Well W15. The SVOC TIC concentration for W15 was 1,130 ug/L in November 2009 and 475.1 ug/L in May 2011; no other wells were analyzed for SVOC TICs. Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012. None of the wells on BCP Site 2 were sampled during the August 2012 SRI as sufficient data existed to assess groundwater quality on this Site.

4.2.3.4 Inorganic Compounds

During W&C's RI, SRI, and quarterly monitoring events, inorganic compounds detected in groundwater at concentrations above GWQS/GVs in several monitoring wells on BCP Site 2 included iron, manganese, and/or thallium; none of which are metals of interest in groundwater. Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012. None of the wells on BCP Site 2 were sampled during the 2012 SRI as sufficient data existed to assess groundwater quality on BCP Site 2.

4.2.3.5 Pesticides/Herbicides

Groundwater samples collected during W&C's RI and analyzed for pesticides/ herbicides did not contain concentrations above GWQS/GVs; therefore, no additional samples were analyzed for these parameters during W&C's SRI. Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012. None of the wells on BCP Site 2 were sampled during the August 2012 SRI.

4.2.3.6 PCBs

PCBs were not detected in groundwater samples collected during W&C's RI; therefore, no additional samples were analyzed for these parameters during W&C's SRI. None of the wells on BCP Site 2 were sampled during the August 2012 SRI.

4.2.4 Subsurface Product Piping

Figure 4-13 shows the abandoned subgrade petroleum product conveyance piping on BCP Site 2 as reported by W&C; an estimated 28,000 linear feet. Subsurface piping was reportedly drained of liquids (by W&C in 2008 and 2009), and residual materials in the piping are expected to contain mostly scale and sludge. GCPS soil/fill was observed during W&C's subsurface piping investigation in the areas shown on Figure 4-13.

As discussed in Section 2.3.2, no additional piping investigation or sampling was conducted during the 2012 SRI as it was determined that limited sample collection would not be representative of site-wide conditions due to the large volume of piping and the potential for great variation in contents.

4.2.5 Waste Characterization

Only one sample (SB57A) tested characteristically hazardous for arsenic during W&C's 2009 SRI. The TCLP arsenic result (6.6 mg/L) at sample location SB57A (1,460 mg/kg total arsenic; 0-2 fbgs) indicates an exceedance of the TCLP limit for arsenic (5 mg/L).

During the 2012 SRI, additional 0-2 fbgs grab samples were collected from four locations 5 to 10 feet from sample SB57A and composited to create waste characterization sample WC-SB57-As; the TCLP arsenic concentration was less than the method detection limit of 0.033 mg/L. The sample collected during the 2012 SRI from the mercury MAOI for analysis of TCLP RCRA metals indicated non-hazardous soil/fill.

4.2.6 Olean Redevelopment BCP Site 2 Summary of Findings

4.2.6.1 Surface/Near-Surface Soil/Fill

One area of GCPS soil/fill from 0-2 fbgs and the three areas of GCPS soil/fill from 2-6 fbgs cover a small percentage of BCP Site 2.

One area of arsenic impact and one area of mercury impact to near-surface (0-6 fbgs) soil/fill exist on BCP Site 2. Only one sample (SB57A) exhibited hazardous waste characteristics for arsenic; therefore, some soil/fill within the arsenic-impacted area may require handling as a hazardous waste; however, TCLP waste characterization sampling results from the same area in 2012 did not indicate exceedances of TCLP threshold of 5 mg/L for arsenic.

4.2.6.2 Subsurface Soil/Fill

The two areas of GCPS subsurface soil/fill (6 to 15 fbgs) cover approximately 25% of BCP Site 2. These areas do not correlate with the LNAPL observed in groundwater; however, elevated VOC (plus TICs) concentrations in groundwater exist within the GCPS soil/fill area along the western boundary of BCP Site 2. The north-central GCPS soil/fill area coincides with the elevated DRO concentration (19,000 mg/kg) detected in soil/fill sample DTP-7 (6-8 fbgs).

4.2.6.3 Groundwater

As illustrated by Figure 4-7, the distribution of total VOCs (VOC plus TICs on Figure 4-8) in groundwater shows the highest concentrations in Well W17 along the western end of BCP Site 2. As illustrated by Figure 4-8, groundwater generally flows southeast and southwest onto BCP Site 2, with a component of groundwater flowing northeast onto BCP Site 2 toward Well W17 from the adjacent off-site property (currently owned by Verizon). Since this property formerly contained numerous ASTs, dissolved-phase VOCs are possibly migrating onto BCP Site 2 toward Well W17. In addition, the high concentration of subgrade piping potentially containing product and shallow GCPS are potentially acting as source areas.

In June 2006, higher concentrations of total VOCs (611 ug/L) and VOC TICs (2,700 ug/L) were detected in upgradient, off-site Well MWPW-7S located on the former Van der Horst Plant No. 2 property near a former disposal area. In fact, the total VOC plus TICs concentration in off-site Well MWPW-7S (3,311 ug/L) is significantly higher than the concentrations detected in BCP Site 2 Well W16 (220 ug/L), which is an upgradient well on BCP Site 2. This suggests the possibility of another off-site source of groundwater contamination migrating onto BCP Site 2. The area of subsurface GCPS soil/fill located on the north-central portion of the BCP Site 2 is hydraulically upgradient of the area of groundwater impact by LNAPL.

The 2012 VOC concentration distribution shows a decreasing trend toward the center of BCP Site 2 from both the west and east (see Figure 4-7). A correlation between the presence of LNAPL along the southern boundary of BCP Site 2 in 2012 and total VOC concentrations in the groundwater cannot be made as Wells W14 and WCMW1 have not been sampled due to the presence of measureable LNAPL. Both wells are located near

former AST areas. However, as BCP Site 2 is hydraulically upgradient of BCP Site 1, VOC-impacted groundwater may be migrating off BCP Site 2 onto BCP Site 1. The concentrations of inorganic compounds in groundwater do not coincide with the soil/fill MAOIs (arsenic and mercury).

4.3 Olean Redevelopment BCP Site 3

4.3.1 Surface and Near-Surface Soil/Fill

4.3.1.1 Field Observations

The surface of BCP Site 3 is vegetated with grasses and weeds with some emergent trees (mostly poplars). Surface lithology generally consisted of either a silty-sand with gravel and fill unit or a fill unit that on average extends from 0 to 4 fbgs (upwards of 10 fbgs in some areas). This unit is underlain by fill or a silty-sand with gravel unit, with some areas of BCP Site 3 underlain by well graded sand with silt and gravel beginning at 4 fbgs.

Field evidence of potential GCPS impact to surface/near-surface soil/fill was identified in certain areas. As indicated on Figure 4-14, there are 11 surface/near-surface GCPS soil/fill areas. The majority of these areas are impacted from 2-6 fbgs; however, one area is impacted from 0-2 fbgs and three other discrete areas are impacted the full 0-6 fbgs. Table 4-1 summarizes the soil/fill PID readings by depth measured during the 2012 SRI. Figure 4-14 presents the GCPS areas graphically for the 2012 SRI and W&C's 2008 and 2009 investigations.

4.3.1.2 VOCs

During W&C's 2008 RI, no VOCs were detected in the surface/near-surface soil/fill (referred to as shallow soil/fill by W&C) at concentrations above the CSCOs on BCP Site 3; therefore, W&C did not conduct additional VOC analyses during the SRI. VOC TIC concentrations ranged from 0 to 0.044 mg/kg. Table 4-2 summarizes the VOC analytical data for W&C's surface/near-surface soil/fill investigation.

As presented on Table 4-21, two soil/fill samples (SB-39; 4-6 fbgs and TT-50; 4-6 fbgs) were collected from BCP Site 3 for use in the treatability studies and analyzed for TCL VOCs (plus TICs) and GROs. No VOCs were detected at concentrations above CSCOs.

VOC TICs were detected at concentrations of 19.11 and 154 mg/kg (SB-39), and GROs were detected at concentrations of 270 and 610 mg/kg (SB-39).

4.3.1.3 SVOCs

SVOC analyses were conducted during W&C's RI. Seven sample locations on BCP Site 3 detected concentrations of PAHs slightly above CSCOs: benzo(a)pyrene (all 7); dibenz(a,h)anthracene (4 of 7); benzo(b)fluoranthene (1 of 7), and benzo(a)anthracene (1 of 7). Table 4-4 summarizes the SVOC analytical data for W&C's surface/near-surface soil/fill investigation. No additional SVOC analyses were performed on BCP Site 3 during W&C's SRI.

As presented on Table 4-21 and discussed in Section 4.3.1.2, two soil/fill samples (SB-39; 4-6 fbgs and TT-50; 4-6 fbgs) were collected for analysis of TCL SVOCs (plus TICs) and DROs. No SVOCs were detected at concentrations above CSCOs. SVOC TICs were detected at concentrations of 17.2 and 27.3 mg/kg (SB-39), and DROs were detected at concentrations of 360 and 1,600 mg/kg (SB-39).

Figure 4-15 indicates the sample locations on BCP Site 3 that exceeded the CSCOs for SVOCs.

4.3.1.4 Inorganic Compounds

Surface/near-surface soil/fill samples from BCP Site 3 were analyzed for inorganic compounds (plus cyanide) during W&C's RI. As summarized on Table 4-5, seven metals were detected at concentrations above CSCOs: arsenic in numerous samples; copper in two locations; lead in three locations (SB28, SB44, and SB55); and barium, trivalent chromium, nickel, and zinc in one location each. W&C collected additional samples during the SRI to vertically and laterally delineate the following areas containing elevated metals concentrations per NYSDEC's February 25, 2009 comment letter:

- SB28 Area: RI sample SB28 (0-2 fbgs) contained lead at a concentration of 146,000 mg/kg. All four additional sample locations contained lead at concentrations well below the CSCO (1,000 mg/kg).

- SB48 Area: RI sample SB48 (0-0.5 fbgs) contained concentrations of trivalent chromium, copper, and zinc at a concentration above CSCOs. In delineating for these metals, lead was discovered at concentrations (1,240-19,100 mg/kg) above

the CSCO (1,000 mg/kg) in all five additional sample locations (SB48A-E) up to 4 fbgs.

- SB56 Area: RI sample SB56 (0-2 fbgs) contained arsenic at a concentration of 103 mg/kg. Two of the three additional sample locations contained arsenic at concentrations (30.6 and 67 mg/kg) above the CSCO up to 4 fbgs.

Based on NYSDEC's comments on W&C's draft RI/AA Report, an Interim Remedial Measures (IRM) Work Plan was developed to excavate the soil/fill in the vicinity of soil borings SB28 and SB48 due to the presence of elevated metals concentrations. This IRM is discussed in Section 1.4.6. The post-excavation confirmatory sample SB48D (2-4 fbgs) contained lead at a concentration of 2,320 mg/kg.

Based on W&C's RI, SRI, and IRM confirmatory sampling results, additional sampling was conducted during the 2012 SRI to further delineate the following MAOIs (see Section 2.1.1.1) as summarized on Table 4-22:

- Area 3-AS-1: One additional location (AS24; 0-2 fbgs) in the vicinity of sample SB56 was sampled and analyzed for arsenic. Arsenic was detected at a concentration (16.7 mg/kg) slightly above the CSCO.
- Area 3-AS-2: At the request of NYSDEC, the area surrounding sample TP34 (0-0.5 fbgs) with a detected arsenic concentration of 64.9 mg/kg was investigated. Seven additional locations were sampled from 0-2 fbgs; a 2-4 fbgs sample was collected at AS22. Arsenic was detected at concentrations above the CSCO at 5 of the 7 locations, including the 2-4 fbgs sample.
- Area 3-PB-1: Post-excavation confirmatory samples exceeded the lead CSCO; therefore, an additional 27 samples (0-2 and 2-4 fbgs) were analyzed in the vicinity of the excavation at SB48. Lead was detected at concentrations above the CSCO in 12 samples from 0-2 fbgs, four samples from 2-4 fbgs, and three samples from 4-6 fbgs. This area also contains the post-excavation confirmatory sample SB48D collected from 2-4 fbgs that exceeded the CSCO. All six samples analyzed for TCLP lead exceeded the TCLP limit of 5 mg/L indicating the soil/fill is characteristically hazardous.

Figure 4-16 indicates the sample locations on BCP Site 3 that exceeded the CSCOs for inorganic compounds.

4.3.1.5 Pesticides/Herbicides

As summarized on Table 4-8, all samples collected on BCP Site 3 during W&C's RI and analyzed for pesticides/herbicides contained concentrations below the CSCOs; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.3.1.6 PCBs

As summarized on Table 4-9, all samples collected on BCP Site 3 during W&C's RI and analyzed for PCBs contained concentrations below CSCOs; therefore, no additional samples were analyzed for PCBs during the W&C or 2012 SRIs.

4.3.2 Subsurface Soil/Fill

4.3.2.1 Field Observations

Subsurface soil/fill (below 6 fbgs) on BCP Site 3 is a continuation of the fill or silty-sand with gravel, underlain by well-graded sand with silt and gravel; only test trench TT-61 had lean clay as the second unit (4-8 fbgs). During the 2012 SRI, groundwater was not noted within any of the approximate 16-foot deep test trenches. Groundwater was encountered at 23 fbgs during advancement of Well W29.

Field evidence of potential GCPS impact to subsurface soil/fill was identified in certain areas. As illustrated by Figure 4-14, there are three GCPS soil/fill areas from 6 to 15 fbgs (3-GCPS-1d through -3d). Table 4-1 summarizes the soil/fill PID readings by depth measured during the 2012 SRI.

4.3.2.2 VOCs

During W&C's 2008 RI, no VOCs were detected in subsurface soil/fill (referred to as deep soil/fill by W&C) at concentrations above the CSCOs on BCP Site 3; therefore, W&C did not conduct additional VOC analyses on subsurface soil/fill during the SRI. VOC TIC concentrations ranged from 3.48 mg/kg (W22; 14-16 fbgs) to 836 mg/kg (SB48; 16-18 fbgs). Table 4-11 summarizes the VOC analytical data for W&C's subsurface soil/fill investigation.

As presented on Table 4-21, an additional 12 subsurface soil/fill samples were collected during the 2012 SRI across BCP Site 3 for analysis of TCL VOCs (plus TICs) and GROs. No VOCs were detected at concentrations above the CSCOs. VOC TICs were

detected at concentrations between 12.4 and 707 mg/kg (TT-46; 14-16 fbgs). The concentration of GROs ranged from 12 to 2,200 mg/kg (TT-46; 14-16 fbgs).

4.3.2.3 SVOCs

Sample DTP47 (6-8 fbgs) collected during W&C's RI contained PAHs, specifically benzo(a)pyrene and dibenz(a,h)anthracene, at concentrations slightly above CSCOs on BCP Site 3. Sample DTP50 (6-8 fbgs) contained benzo(a)pyrene at a concentration slightly above the CSCO; however, its duplicate sample did not. SVOC TIC concentrations ranged from 65.6 mg/kg to 1,396 mg/kg (SB48; 16-18 fbgs). Table 4-12 summarizes the SVOC analytical data for W&C's subsurface soil/fill investigation. W&C did not conduct additional SVOC analyses on subsurface soil/fill during the SRI.

As presented on Table 4-21, the additional 12 subsurface soil/fill samples collected during the 2012 SRI were also analyzed for TCL SVOCs (plus TICs) and DROs. No SVOCs were detected at concentrations above the CSCOs. SVOC TICs were detected at concentrations between 1.53 and 511 mg/kg (TT-46; 14-16 fbgs). The concentration of DROs ranged from 47 to 18,000 mg/kg (TT-46; 14-16 fbgs).

Figure 4-15 indicates the sample locations on BCP Site 3 that exceeded the CSCOs for SVOCs.

4.3.2.4 Inorganic Compounds

As indicated on Table 4-13, arsenic was the only inorganic compound detected in subsurface soil/fill on BCP Site 3 during W&C's RI at a concentration above its CSCO (16 mg/kg); 16.7 mg/kg of arsenic was detected in sample DTP47 (6-8 fbgs). As a result, additional analyses for inorganic compounds in subsurface soil/fill were not conducted during the W&C or 2012 SRIs. Figure 4-16 indicates the sample locations on BCP Site 3 that exceeded the CSCOs for inorganic compounds.

4.3.2.5 Pesticides/Herbicides

As indicated on Table 4-14, all subsurface soil/fill samples collected from BCP Site 3 during W&C's RI and analyzed for pesticides/herbicides contained concentrations below the CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.3.2.6 PCBs

As indicated on Table 4-15, all subsurface soil/fill samples collected from BCP Site 3 during W&C's RI and analyzed for PCBs contained concentrations below CSCOs; therefore, no additional subsurface soil/fill samples were analyzed for PCBs during the W&C or 2012 SRIs.

4.3.3 Groundwater

4.3.3.1 Field Observations

During W&C's RI, SRI, and quarterly groundwater gauging events on BCP Site 3, LNAPL was detected in two wells at the following maximum thicknesses: W22 (1.52') and W24 (9.16') as presented on Table 4-16. Sorbent socks were deployed in Wells W22 and W24 in June 2010. Sorbent socks are removed and inspected during W&C's quarterly monitoring events. Socks that are obviously oil-stained are replaced with new socks.

As indicated on Table 4-16, the following LNAPL thicknesses were observed during W&C's quarterly gauging events in February and August 2012: W22 (0.00' and 0.11') and W24 (0.18' and 0.00'). During the August 2012 SRI, no LNAPL was detected in the two wells sampled (i.e., W19 and W29).

4.3.3.2 VOCs

During W&C's RI and SRI, VOCs were detected in groundwater at concentrations above GWQS/GVs in monitoring wells MW-2, MW-4, MW-5, MW-9S, W19, W21, W22, W23, and W25. The VOCs detected above GWQS/GVs include benzene, sec-butylbenzene, n-propylbenzene, toluene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes. Figure 4-6 presents the total VOC concentration distribution for the 2008 sampling event. Total VOC concentrations were detected in groundwater at concentrations up to 1,058 ug/L (MW25 in September 2008). With the addition of VOC TICs, this maximum concentration increased to 2,783 ug/L (MW4 in November 2009. Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012.

On August 30, 2012, newly installed groundwater monitoring well W29, located along the southern downgradient property boundary of BCP Site 3, and existing monitoring well W19 located in the southeastern corner of the Site were sampled for analysis of TCL VOCs plus TICs. Table 4-18 summarizes and compares the groundwater data to GWQS/GVs.

Figures 4-6 and 4-7 present the total VOC concentrations and the total VOC plus TICs concentrations for the February 2012 monitoring event (the August 2012 data is shown for comparison); both figures show the approximate extent of LNAPL observed. Total VOCs were detected in groundwater at concentrations up to 726.5 ug/L (Well W29 in August 2012). With the addition of VOC TICs, this maximum concentration increased to 2,351.5 ug/L.

4.3.3.3 SVOCs

During W&C's RI and SRI, SVOCs were detected in groundwater at concentrations above GWQS/GVs in monitoring wells MW-3 and W18. The SVOCs detected above GWQS/GVs include benzo(a)anthracene, benzo(a)pyrene, and chrysene. SVOC TIC concentrations ranged from 155.9 ug/L (W18) to 434.1 ug/L (MW-2). Table 4-17 provides a summary of the groundwater analytical data from 2008 through February 2012.

The 2012 SRI did not include analysis of groundwater samples for SVOCs because SVOCs were not considered COPCs.

4.3.3.4 Inorganic Compounds

During W&C's RI, SRI, and quarterly monitoring events, inorganic compounds detected in BCP Site 3 groundwater at concentrations above GWQS/GVs in several monitoring wells included arsenic, chromium, iron, magnesium, manganese, and/or sodium. The following metals of interest were detected at concentrations above GWQS/GVs in the wells indicated (see Table 4-17); the range of concentrations observed between August 2008 and February 2012 has been indicated:

- Arsenic: W21 (26 to 40.9 ug/L)
- Chromium: MW10B (50.9 to 95 ug/L)

The 2012 SRI did not include analysis of groundwater samples for inorganic compounds because metals were not considered COPCs.

4.3.3.5 Pesticides/Herbicides

As indicated on Table 4-17, groundwater samples collected on BCP Site 3 during W&C's RI and analyzed for pesticides/herbicides did not contain concentrations above

GWQS/GVs; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.3.3.6 PCBs

PCBs were not detected in groundwater samples collected on BCP Site 3 during W&C's RI; therefore, no additional samples were analyzed for these parameters during the W&C or 2012 SRIs.

4.3.4 Subsurface Product Piping

Figure 4-17 shows the abandoned subgrade petroleum product conveyance piping on BCP Site 3 as reported by W&C; an estimated 44,000 linear feet. Subsurface piping was reportedly drained of liquids (by W&C in 2008 and 2009), and residual materials in the piping are expected to contain mostly scale and sludge. GCPS soil/fill was observed during W&C's subsurface piping investigation in the areas shown on Figure 4-17.

As discussed in Section 2.3.2, no additional piping investigation or sampling was conducted during the 2012 SRI as it was determined that limited sample collection would not be representative of site-wide conditions due to the large volume of piping and the potential for great variation in contents.

4.3.5 Waste Characterization

Samples were collected during the 2012 SRI from the lead and arsenic MAOIs for analysis of TCLP RCRA metals. All six samples collected from MAOI 3-PB-1 exceeded the TCLP lead threshold of 5 mg/L indicating the soil/fill is characteristically hazardous for lead.

4.3.6 Olean Redevelopment BCP Site 3 Summary of Findings

4.3.6.1 Surface/Near-Surface Soil/Fill

The 11 areas with GCPS soil/fill from 0-6 fbgs on BCP Site 3 generally fall within the areas of subsurface GCPS soil/fill.

Two areas of arsenic impact and one area of lead impact to near-surface (0-6 fbgs) soil/fill exist on BCP Site 3. The six samples analyzed for TCLP exhibited hazardous waste characteristics for lead.

4.3.6.2 Subsurface Soil/Fill

The three areas of GCPS subsurface soil/fill (6 to 15 fbgs) cover approximately 50% of BCP Site 3. Due to the widespread presence of GCPS impact to the subsurface, these areas correlate with the LNAPL and elevated VOC (plus TICs) concentrations observed in groundwater on the southern portion of BCP Site 3, as well as the SVOC (plus TICs) concentrations detected in subsurface soil/fill samples.

4.3.6.3 Groundwater

In June 2006, elevated concentrations of total VOCs and VOC TICs (542 ug/L) were detected in upgradient, off-site Well MW-10S located on the former Van Der Horst Plant No. 2 Site. The NYSDEC concluded in its December 2006 Groundwater Sampling Report (Ref. 20) that widespread dissolved groundwater contamination is present in the shallow aquifer on the Van der Horst Plant No. 2 property; therefore, it is possible that contaminated groundwater from the Van der Horst property is migrating toward Well MW-5, located at the northern boundary of BCP Site 3. As illustrated by Figure 4-8, the 2012 VOC concentration distribution shows a decreasing trend southeast and southwest (onto BCP Site 2) of Well MW-5 in the direction of groundwater flow. The elevated groundwater VOC concentrations detected in Well W29 (south of Well W5) during the August 2012 sampling event are similar to those in upgradient Well MW-5.

The majority of the on-site upgradient wells are no longer sampled since analytical results indicate no impacts. Therefore, groundwater impacted by VOCs is primarily located along the southern portion of BCP Site 3, with the highest VOC concentrations detected in Wells MW-9S, W25, and W29 (in addition to Well MW-5 in the western corner of the Site). Groundwater on BCP Site 3 flows off-site to the south, southwest, and southeast. No off-site groundwater quality data is available to conclude that VOC concentrations in off-site groundwater exceed GWQS/GVs. However, the VOC concentrations near the southern property line of BCP Site 3 suggest that groundwater with elevated VOC concentrations is likely migrating off-site.

5.0 BENCH- AND PILOT-SCALE TREATABILITY STUDY RESULTS

Bench-scale and pilot-scale studies were conducted to assess technologies for treating petroleum-impacted soil/fill, including GCPS, both in-situ and ex-situ. The petroleum products or intermediaries contained in the contaminated soil vary across the three BCP Sites; therefore, petroleum-impacted soil/fill was obtained from representative areas throughout the entire Site. The results of these treatability studies are presented below.

5.1 Bench-Scale Treatability Results

Section 2.8 describes the technologies behind the bench-scale treatability tests conducted as well as the procedures followed. The results of these treatability tests are presented below by BCP Site. Figures 2-5 through 2-7 illustrate the pre- and post-treatment bench-scale study data, PID readings, and visual and olfactory observations for BCP Sites 1-3. Tables 5-1 through 5-3 present the analytical data from pre- and post-treatment samples on soil/fill from BCP Sites 1-3. Appendix G includes the test sheets where all observations and measurements were recorded.

Section 2.6.1 provides the location where the soil/fill samples used for bench-scale treatability tests were collected and the descriptions from the W&C RI and SRI. TurnKey's field observations and PID readings are summarized on Figures 2-5 through 2-7. The soil/fill batches obtained from each BCP Site were: treated by mixing to simulate landfarming; stabilized with lime, Portland cement, and fly ash (all amendments added at 2% and 5% by weight); and chemically oxidized with hydrogen peroxide (1% and 3% by weight).

In general, the majority of all technologies successfully mitigated the nuisance characteristics for the contaminated soil with the exception of some minor staining, slight odors, and minor residual PID in several samples. Based on PID and visual/olfactory observations at the conclusion of the treatability studies, solidification/stabilization with 5% by weight of lime kiln dust was the most successful at mitigating nuisance characteristics in 7 of the 9 treatability tests; the addition of 2-5% by weight of fly ash was the most successful in 2 of the 9 treatability tests. The results from the synthetic precipitation leaching procedure (SPLP) indicate that the 5% lime admixture would be more protective of groundwater than the 2% admixture.

Table 5-4 presents the pre- and post-treatment data for the four samples collected from lead-impacted Area 3-PB-1. As indicated, 3 of the 4 samples collected exhibited

hazardous waste characteristics for lead. Stabilization with Portland cement (5% and 10%) and phosphoric acid (2%, 5%, and 10%) successfully reduced the TCLP lead concentration below 5 mg/L, rendering the samples non-hazardous.

5.2 Pilot-Scale Treatability Study Results

Based on the results of the bench-scale treatability studies, four pilot-scale treatability studies were performed. As presented in the following sections, in-situ SVE was conducted on BCP Site 2; ex-situ landfarming and force vented biopiles studies were completed on BCP Site 3; and solidification/stabilization was completed on BCP Sites 2 and 3. As part of these pilot-scale treatability studies, biofiltration was assessed as component of treatment of the extracted air from the in-situ SVE pilot study and for the FVBP pilot study. Figure 2-8 shows where the impacted soil was obtained and the location of the pilot-scale studies. Appendix H includes the test sheets used to record PID readings and visual/olfactory observations recorded during the pilot-scale tests.

5.2.1 In-Situ SVE

The in-situ SVE pilot-scale treatability study performed on BCP Site 2 began August 17, 2012 and ended September 12, 2012. The system was operated for a total of 13 days since it was shut down between August 21 and 28 for system adjustments and collection of an air sample, and between August 31 and September 3 for the Labor Day weekend.

Table 5-5 presents the analytical data for the air sample collected from the SVE pipe prior to entering the biofilter. As indicated, the SVE system extracted high concentrations of organics from the soil/fill. An air sample was not collected at the completion of the pilot study since the PID readings from the SVE system did not decrease, indicating the system continued to draw vapor with high concentrations of organics. Using the daily PID reading from the influent to the biofilter, a calculated mass of approximately 4,900 pounds was removed during the 13-day pilot study. The biofilter consistently reduced the influent PID reading by 77% to 95% (average of 84%). After six days of operation (12 days after start-up), the odor of the biofilter effluent was to trace levels indicating that the microbial population had become acclimated to the extracted contamination.

Vacuum readings in the piezometers PZ-1-1 and PZ-2-1 located 25 and 31 feet respectively from the SVE wells registered a vacuum ranging between 3.5 to 6.5 inches of water. Piezometers PZ-1-2 and PZ-2-2 located 35 to 50 feet respectively from the SVE

extraction wells registered a vacuum between 0.45 to 1.5 inches of water. The vacuum readings at the SVE wells indicate a radius-of-influence of at least 35 to more than 50 feet.

Table 5-6 summarizes the pre- and post-testing soil/fill analytical results at each of the SVE wells. The soil/fill from SVE-1 prior to SVE treatment was more heavily impacted by VOCs and VOC TICs than the soil/fill from SVE-2. A reduction in VOC TICs was observed for both post-treated samples; however, individual VOCs increased following treatment for sample location SVE-1. The GRO, DRO, and SVOC TIC concentrations following application of the short-term pilot test do not show a reduction due to the relative short time period of treatment, inherent variability in the pre- and post-treatability sampling locations, and the non-homogenous natural of the soil/fill. The results of the pre- and post-treatability study air sampling and mass removal indicates that continued application of SVE would be successful in removing the VOCs and SVOCs.

5.2.2 Ex-Situ Landfarming

The ex-situ landfarming pilot-scale treatability study consisted of two piles of soil/fill obtained from two areas of the Site as follows: the North Pile was obtained from the area of SB39 (4-6'), and the South Pile was obtained from the area of DTP-47 (8-10'). The pilot test began on August 16, 2012 and ended September 20, 2012 for a total operational period of 35 days. As indicated in Appendix H, the soil/fill odor decreased from moderate/strong to slight within approximately 14 days, and no odors were detected in either soil/fill pile at the end of the pilot test. Within three weeks, the staining initially present in both soil/fill samples was no longer observed. The PID readings were reduced from 753 to 13 ppm (98% reduction) in the North Pile soil/fill and from 696 to 91 ppm (87% reduction) in the South Pile soil/fill.

Table 5-6 summarizes the analytical results for the pre- and post-treatment sampling conducted for both the North and South Piles. The soil/fill from the North Pile was more impacted by GRO and DRO concentrations; however, it was less impacted than the soil/fill designated as the South Pile from a PID and visual/olfactory standpoint. GRO concentrations were reduced by 61% in the South Pile and >99% in the North Pile. DRO concentrations were reduced by 27% in the South Pile and 76% in the North Pile. The ex-situ landfarming pilot test was considered successful in remediating the petroleum-impacted soil/fill.

5.2.3 Ex-Situ Force Vented Biopiles

The ex-situ force vented biopile (FVBP) pilot-scale treatability study used soil/fill obtained from three areas of the Site as follows: the North Pile was obtained from the area of DTP7 (6-8'); South Pile #1 was obtained from the area of T-2 (4-6'); and South Pile #2 was obtained from the area of TT-50 (8-10'). The pilot test for the North Pile began on August 17 and ended September 20, 2012; South Pile #1 began on August 17 and ended on September 11, 2012 as the nuisance characteristics had been effectively mitigated; and South Pile #2 began on September 11 and ended on September 20, 2012. The pilot test was operated for a total of 25 days as it was shut down between August 23 and 28 for system adjustments and collection of an air sample, and August 31 to September 3 for the Labor Day weekend. The biopiles were covered with plastic for four days (9/14 through 9/18) due to excessive precipitation.

Table 5-6 summarizes the soil/fill sampling from the three soil piles. The pre-treatment sample from South Pile #1 contained an initial PID of 1,265 ppm with moderate odors, and GRO and DRO concentrations of 430 and 950 mg/kg, respectively. After 6 days of treatment, the sample from South Pile #1 exhibited a PID reading of 177 ppm equating to an 86% reduction which, based on the extraction rate, represents approximately 1,000 pore volumes. The post-treatment PID was 15 ppm, nearly a 99% reduction (after about 2,700 pore volumes were extracted), and odors were not detected. GRO and DRO concentrations in the post-treatment sample were 22 and 760 mg/kg, respectively.

The pre-treatment sample from South Pile #2 contained an initial PID of 2,618 ppm with moderate odors and GRO and DRO concentrations of 1,300 and 1,900 mg/kg, respectively. After 10 days of extraction, the PID had decreased to 349 ppm (87% reduction) and odors were slight. Approximately 1,500 pore volumes were removed during the 9-day pilot test for South Pile #2. The initial GRO (1,300 mg/kg) and DRO (1,900 mg/kg) concentrations were reduced to 190 and 610 mg/kg, respectively.

The pre-treatment sample from the North Pile contained an initial PID of 335 ppm with moderate odors. The GRO and DRO concentrations in the sample were 260 and 19,000 mg/kg, respectively. A progress sample was obtained on September 10, 2012: the PID was 34 ppm with slight odors, and it contained concentrations of GRO at 27 mg/kg and DRO at 6,900 mg/kg. The post-treatment sample obtained on September 20, 2012 had a PID reading of 33.2 ppm with slight to no odors, and concentrations of GRO at 35 mg/kg

and DRO at 2,800 mg/kg. Approximately 4,400 pore volumes were removed from the North Pile during the pilot study.

The biofilter consistently reduced the influent PID reading by 73% to 100% (average of 90%). After 1 to 3 days of operation, the odor of the biofilter effluent was slight to none, and after 6 days of operation no odor was noted.

Table 5-7 presents the analytical data for the air collected from the combined North and South #2 Piles prior to entering the biofilter. A significant reduction in both air-phase petroleum hydrocarbons (APH) and VOCs were achieved with the ex-situ FVBP pilot study; >99% reduction of aliphatic/aromatic compounds, total VOCs, and VOC TICs. Using the total APH detected in the pre-test air versus the post-test air for South Pile #2 soil/fill, a calculated mass of approximately 4,400 pounds of total petroleum hydrocarbons (GRO plus DRO) were removed during the 9-day pilot study.

The results of this pilot test were successful in removing the nuisance characteristics. Based on the reduction in the PID readings, total petroleum hydrocarbons (GRO and DRO), and odors, it appears that approximately 2,000 to 3,000 pore volumes of extracted air from the impacted soil/fill will remediate the nuisance criteria. The biofilter was able to achieve an average of 90% reduction of the contaminant mass extracted from the contaminated soil.

5.2.4 In-Situ Solidification/Stabilization

The lime solidification/stabilization pilot tests suggest this technology to be relatively ineffective in treating the organics in the soil/fill at concentrations up to approximately 10%. The PID readings from the samples collected from the areas of TPSB-7 and DTP-46 did not show a marked decrease. Samples from DTP-46 had PID results of 630 ppm (pre-treatment) to 859 and 874 ppm on September 20 and October 24, 2012, respectively. Samples from TPSB-7 had PID results of 457 ppm (pre-treatment) to 549 and 272 ppm on September 20 and October 24, 2012, respectively. The SPLP results for VOCs and SVOCs suggest that infiltrating water through the treatment zone would not significantly impact the groundwater quality. Possible reasons for the relative ineffectiveness of in-situ lime stabilization are the nature of the soil/contaminants treated, apparent high moisture content of the soil, the type of lime used, and/or the in-situ mixing mechanism.

5.2.5 Summary of Pilot-Scale Treatability Studies

In-Situ SVE

The SVE pilot study has demonstrated that the organic vapors in the unsaturated soil/fill can be extracted effectively. The short-term (i.e., 13 days) radius-of-influence for the extraction wells is at least 35 feet to greater than 50 feet. Given the predominant soil type on-site (sand and gravel), a long-term radius of influence greater than 50 feet is expected. The biofilter effectively treated extracted vapors from the in-situ SVE system. Extracted air treated in the biofilter reduced the organic vapors by an average of 84% from the in-situ SVE wells.

Ex-Situ Landfarming

Ex-situ landfarming was effective in remediating the contaminated soil. Staining was no longer observed in the samples collected from both piles; PID results from the samples showed 87% to 98% reduction; no odors were observed after three weeks; and the analytical testing for DRO/GRO, VOCs, and SVOCs all showed marked concentration decreases. However, fugitive odors during tilling would be released to the air presenting a nuisance condition and potential health hazard to workers. Both SVE and FVBP have odor control in the form of a biofilter.

Ex-Situ FVBP

FVBP was effective in mitigating the nuisance conditions in the soil/fill. Significant reductions in PID readings; odors; staining; and DRO/GRO, VOC, and SVOC concentrations in the soil/fill were achieved with ex-situ FVBP. Over 99% reduction of APH and VOC concentrations in extracted untreated air samples was observed following treatment through the biofilter. Extracted air treated in the biofilter reduced the organic vapors by an average of 90% from the FVBP, thereby significantly reducing fugitive odors.

In-Situ Solidification/Stabilization

In-situ solidification/stabilization with lime was determined have limited effectiveness for remediating organics in the soil/fill within the impacted areas treated with the admixtures type and concentrations used for this treatability study.

6.0 FATE AND TRANSPORT OF SITE CONTAMINANTS

Surface and subsurface soil/fill samples on portions of all three BCP Sites exceeded CSCOs for certain contaminants (i.e., metals, PCBs, and SVOCs) and contained volatile organic petroleum constituents. In addition, groundwater samples indicated exceedance of Class GA GWQS/GVs for certain parameters, and LNAPL was observed in several wells. Accordingly, the data were incorporated with the physical characterization of the Property to evaluate the fate and transport of contaminants in on-site media. The mechanisms by which the contaminants can migrate to other areas or media are briefly outlined below.

6.1 Fugitive Dust Generation

Contaminants present in soil/fill can be released to ambient air as a result of fugitive dust generation. Since the Property is presently unoccupied and is substantially covered with shrubs, grasses, trees, and concrete foundations, suspension due to wind erosion or physical disturbance of surface soil/fill particles is unlikely under the current use scenario. Under the planned future commercial land use scenario, the majority of the Property would be covered by asphalt and structures with only small areas covered by grass and/or ornamental landscaping. Fugitive dust may be generated during excavation related to remediation and/or redevelopment. Therefore, this migration pathway is potentially relevant under the reasonably anticipated future land use scenario.

6.2 Volatilization

Volatile chemicals, when present in soil/fill and/or groundwater at elevated levels, may be released to ambient air or future building indoor air through volatilization from or through the soil/fill pore space. Volatile chemicals typically have a low organic-carbon partition coefficient (K_{oc}), low molecular weight, and a high Henry's Law constant. VOCs were not detected in surface or subsurface soil/fill at concentrations above CSCOs; however, elevated PID readings from near surface and subsurface soil/fill indicate an impact by volatile organics. Groundwater samples contained concentrations of VOCs above Class GA GWQS/GVs on all three BCP Sites. Therefore, both the soil-to-air and groundwater-to-air pathways are potentially relevant.

6.3 Surface Water Runoff

Under the current use scenario, the potential for soil particle transport with surface water runoff is low, as the Property is mostly flat lying and contains a significant amount of vegetative growth. In addition, the well-drained soil/fill matrix limits surface water ponding. Uncontrolled off-site transport resulting from flooding is limited because the Property is outside the 100-year floodplain of Olean Creek (located 0.4 miles east of BCP Site 3). Under the reasonably anticipated future use scenario, the Property will be covered by asphalt, buildings, landscaping, and a soil cover system, mitigating transport of subsurface soil/fill (i.e., soil/fill under cover) via storm water runoff. Although stormwater runoff during future construction activities is possible, a general stormwater permit and Stormwater Pollution Prevention Plan (SWPPP) are required for construction activities, and would be implemented as a component of the Site Management Plan (specifically the Excavation Work Plan) required for BCP Sites that do not achieve Unrestricted-Use SCOs.

6.4 Leaching

VOCs were not detected at concentrations above CSCOs in surface or subsurface soil/fill across the Property; however, high PID readings were observed and VOC TICs were detected at elevated concentrations indicating weathered petroleum impact. VOC impacts were identified in groundwater samples collected from monitoring wells located on all three BCP Sites. Therefore, the presence of volatile organics in soil/fill and groundwater indicates that chemical migration via leaching of volatile organics is a potentially relevant pathway. SVOCs, metals, and PCBs present in Site soil/fill do not correlate with the constituents present in Site groundwater; therefore, leaching of these constituents is not a relevant pathway.

6.5 Groundwater Transport

As illustrated by Figures 2-4, 3-1, and 3-2, groundwater underlying the Property migrates to the south, southwest, and southeast. Contaminants present in on-site groundwater may be transported across the Property via this pathway.

According to DER-10 Section 4.1(d)4.ii., where the RI has identified groundwater contamination, the remedial program must consider measures to address on-site groundwater contamination that may be attributed to both an on-site and an off-site source,

where there is off-site migration of groundwater contamination. In doing so the remedy selection must:

"(1) Identify a remedy for the site that includes removal, containment, or treatment of the on-site sources contributing to the groundwater contamination, as set forth in DER-10 Section 4.1(d)2."

Since groundwater contamination is present on the three BCP Sites and there is the potential for off-site migration, the remedial alternatives assessed in Section 8.0 will include the requirements of DER-10 as outlined above.

The Property and surrounding area are serviced by a municipal (supplied) water service, with no evidence of potable wells in the area of the BCP Sites. Although transport off-site via groundwater migration is a relevant migration pathway, contaminants present would not reach receptors at significant exposure point concentrations.

6.5.1 Mobility and Migration of LNAPL

LNAPL has been periodically present in certain groundwater monitoring wells over time and absent from the others. The purpose of this section is to provide information on the mobility and migration of LNAPL historically observed on the BCP Sites. According to the American Petroleum Institute (Ref. 14), as long as an LNAPL release continues, LNAPL in the subsurface is moving. Once a release stops, the forces driving migration dissipate and the rate of LNAPL migration slows. With time, the driving force becomes insufficient to drive further LNAPL migration. As noted by G. D. Beckett of San Diego State University, the widely observed stability of BTEX plumes provides a strong basis for LNAPL being largely stable. Table 4-16 summarizes the LNAPL thicknesses in on-site wells from 2008 through 2012 and Figure 4-5 illustrates the wells where LNAPL has been present from 2008-2012 and the minimum and maximum thicknesses noted in that time period. Based on the fluctuation of LNAPL thicknesses on-site, it appears that LNAPL does not migrate beyond where it has been historically detected on-site for the reasons discussed below.

When combined, LNAPL and water do not mix. Subsurface LNAPL and water share pore space in soils, which limits the mobility of LNAPL by absorption and capillary forces, thereby complicating its recovery. LNAPLs are composed of mixtures of organic molecules that are slightly soluble in water (Ref. 13). Trace to low percent concentrations of the organic compounds in the LNAPL dissolve into the groundwater, often resulting in exceedances of

water quality standards close to the release. The benefits of the low solubility are that loading to the environment is typically small and natural processes often attenuate contaminants of concern over relatively short distances. A disadvantage of low solubility is that LNAPL can persist as a source of groundwater contamination for extended periods.

LNAPL thickness within a well should not solely be used to determine the following (Ref. 15):

- Whether LNAPL exists in an area
- If there has been a new or subsequent LNAPL release
- Whether the LNAPL is mobile
- Whether the LNAPL is recoverable and the extent to which it can be recovered
- How an LNAPL recovery program is progressing
- When the LNAPL remediation is completed

The presence of LNAPL in a well is highly dependent on the water table elevation. In an unconfined aquifer as is present on-site, an increase in water table elevation typically results in a decrease of in-well LNAPL thickness. Sometimes during high water table conditions the LNAPL can become entirely submerged and no LNAPL is detected in the well. Under these conditions, the LNAPL does not have the ability to displace water and flow into the well screen. LNAPL does not float above groundwater but instead LNAPL is largely submerged within the water-filled pore spaces. Movement of LNAPL is constrained by the pressures needed to displace water from the pores at the margins of the LNAPL (Ref. 13). LNAPL mobility and migration are functions of LNAPL saturation, relative permeability, and other soil and LNAPL properties. The mere presence of LNAPL in a well does not necessarily mean that the LNAPL has the potential to migrate.

The potential to recover LNAPL from a given well depends on the soil/LNAPL properties rather than the in-well LNAPL thickness. For example, a large in-well LNAPL thickness may be the result of the well intercepting a relatively small LNAPL-saturated sand seam/fracture within a fine-grained silt or clay; recovery in this situation may be very poor. Conversely, small in-well thicknesses in transmissive formations may yield much greater LNAPL recoveries. As LNAPL is depleted by dissolution or another removal mechanism, the fraction of pore space occupied by LNAPL decreases. With depletion, LNAPL flow paths become smaller and more tortuous, reducing the ease with which LNAPL can move (mobility). Ultimately, the LNAPL breaks into isolated blobs and ganglia that tend to be

discontinuous and immobile as a separate liquid phase. The saturation at which LNAPL becomes discontinuous (i.e., immobile) is referred to as residual saturation (Ref. 13).

Based on Site conditions and the historical areal extent of LNAPL limited to the wells identified in Table 4-16 and Figure 4-5 from 2008 to 2012, it appears that LNAPL does not migrate beyond historical boundaries or off-site.

6.6 Exposure Pathways

Based on the fate and transport analysis provided above, the pathways through which contaminants detected on-site could potentially migrate to other areas or media are fugitive dust emissions via physical disturbance of soil particles, vapor-to-air volatilization, soil/fill leaching, and groundwater transport.

However, given the absence of existing Property occupancy; the distance between the Property and occupied structures; the Environmental Easement that will restrict groundwater for potable use and require an active sub-slab depressurization system for all buildings; and NYSDEC/New York State Department of Health (NYSDOH) requirements for a Site Management Plan that addresses soil handling and dust controls during excavation at remedial program construction sites, it is unlikely that site-related contaminants would reach off-site receptors at significant exposure point concentrations.

7.0 QUALITATIVE HUMAN HEALTH EXPOSURE AND WILDLIFE IMPACT ASSESSMENT

7.1 Human Health Exposure Assessment

A qualitative exposure assessment consists of characterizing the exposure setting (including the physical environment and potentially exposed human populations), identifying exposure pathways, and evaluating chemical fate and transport.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements:

- A receptor population
- A contaminant source
- A contaminant release and transport mechanism
- A point of exposure
- A route of exposure

The receptor population is the people who are or may be exposed to contaminants at a point of exposure. The source of contamination is defined as either the source of contaminant release to the environment (such as a waste disposal area or point of discharge), or the impacted environmental medium (soil, air, biota, water) at the point of exposure. Contaminant release and transport mechanisms carry contaminants from the source to points where people may be exposed. The point of exposure is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (i.e., ingestion, inhalation, dermal absorption).

An exposure pathway is complete only when all five elements listed above are documented; a potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway is not documented but could reasonably occur. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway does not exist in the present and will not reasonably occur in the future.

7.1.1 Potential Receptors

The identification of potential human receptors is based on the characteristics of a site, the surrounding land uses, and current and reasonably anticipated future land uses. The Property is presently unoccupied. Under current use conditions, receptors would be limited to trespassers who may traverse the Property (although presently mitigated by security fencing and signage); and construction workers that may access the Property during remediation or to service utilities or similar duties. Trespassers might be comprised of adolescents and adults, whereas construction workers would be limited to adults.

Section 8.4 indicates that the reasonably anticipated future use of the Property is for commercial purposes, which is consistent with surrounding property use and site zoning. Exposed receptors under the future use scenario may be comprised of indoor workers, outdoor workers (e.g., groundskeepers or maintenance staff), and construction workers (e.g., remediation and redevelopment utilities) who may from time to time perform work on the property. Property visitors/customers may also be considered receptors; however, their exposure would be similar to that of the indoor worker but at a lesser frequency and duration. Therefore, consideration of the indoor worker is conservatively protective of the Property visitor.

7.1.2 Contaminant Sources

Section 4.0 discusses the contaminants present in unremediated media at elevated concentrations. In general, these are limited to: select inorganic compounds, PCBs, SVOCs (plus TICs), and volatile organic petroleum constituents in surface/near-surface soil/fill; SVOC TICs, DROs, and elevated PID readings in subsurface soil/fill; and petroleum-related VOCs and SVOCs in groundwater.

7.1.3 Contaminant Release and Transport Mechanisms

Contaminant release and transport mechanisms are specific to the type of contaminant and site use. For the non-volatile contaminants present in site-wide soil/fill, contaminant release and transport mechanisms will generally be limited to fugitive dust migration and direct contact during intrusive work (i.e., excavation or soil/fill handling) since the Property is currently covered by vegetation and concrete foundations and will be substantially covered by buildings, parking lots, driveways, and landscaping after redevelopment.

For volatile contaminants present in the petroleum-impacted groundwater, the potential exists for exposure through pathways associated with soil gas migration. This would include both the outdoor pathway (primarily to construction workers involved in subsurface activities where volatiles are present at elevated concentration) as well as the indoor vapor intrusion pathway, also referred to as "soil vapor intrusion."

Concerning the indoor air pathway, the NYSDOH has issued a guidance document for assessing potential impacts to indoor air via soil vapor intrusion (Ref. 16). This document presently provides guidance criteria for seven chlorinated aliphatic VOCs, none of which were detected at elevated concentrations in soil/fill or groundwater on-site. Rather, the VOCs detected above GWQS/GVs in groundwater are petroleum-based compounds and were limited to benzene, chlorobenzene, ethylbenzene, 1,4-dichlorobenzene, n-propylbenzene, toluene, 1,2,4 trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes. Weathered petroleum impacts are present in Site soil/fill as evidenced by elevated TICs and elevated PID readings.

As such, under the future (un-remediated) use scenario, the potential exists for soil vapor migration. For the current use scenario, soil vapor intrusion is not a concern since there are no existing buildings. Concerning the outdoor air pathway, the potential exists for exposure to VOCs under the current and future use scenarios for construction workers.

In accordance with Section 3.6 of DER-10, the conditions under which a building is subject to soil vapor investigation include scenarios where: i) a source of volatile chemical contamination in subsurface soil or groundwater is identified in the vicinity of the buildings or future building site; or ii) based on known prior industrial, commercial, or other land uses, a source of volatile chemical contamination in subsurface soil or groundwater may be suspected.

7.1.4 Point of Exposure

Based on the widespread exceedance of CSCOs for certain ubiquitous parameters (i.e., arsenic and PAHs), the point of exposure is defined as the surface or subsurface on the BCP Sites. For both the current and future use scenarios, groundwater is not considered to pose a relevant mechanism due to the availability of a local municipal potable water supply, the depth to groundwater (well below the typical depth of utilities and foundation footers), and the existence of a deed restriction that does not allow the use of groundwater on the Property.

7.1.5 Route of Exposure

Based on the types of receptors and points of exposure identified above, potential routes of exposure are listed below:

Current Use Scenario

- Construction Worker – skin contact, inhalation, and incidental ingestion.

Future Use Scenario

- Indoor Worker – inhalation.
- Construction and Outdoor Worker – skin contact, inhalation and incidental ingestion.

7.1.6 Exposure Assessment Summary

Based on the above assessment, the potential exposure pathways for the un-remediated site condition are listed below.

Current Use Scenario

- Construction Worker – direct contact, incidental ingestion, and inhalation of non-volatile contaminants present in site-wide soil/fill, and inhalation of volatile TICs present in GCPS soil/fill during intrusive activities.

Future Use Scenario

- Indoor Worker – inhalation of volatile contaminants present in GCPS soil/fill and groundwater via indoor air migration.
- Construction and Outdoor Worker – direct contact, incidental ingestion and inhalation of non-volatile contaminants present in site-wide soil/fill, and inhalation of volatile contaminants present in GCPS soil/fill during intrusive activities.

In most instances, these exposures can be readily mitigated during and following redevelopment through proper soil/fill management and engineering controls including placement of asphalt, building, and landscape cover and construction of vapor barriers or sub-slab depressurization systems in newly constructed buildings.

7.1.7 Qualitative Off-Site Exposure Assessment

Per DER-10, the qualitative exposure assessment must consider the nature of populations currently exposed or have the potential to be exposed to site related contaminants both on-site and off-site, and must describe the reasonably anticipated future land use of the site and affected off-site areas. The qualitative exposure assessment must include a full delineation of the nature and extent of off-site impacts; unless the remedial party is a volunteer in the BCP, in which event off-site field information is only needed sufficient to identify the presence of contamination and support the qualitative off-site exposure assessment for these sites.

Although Olean Gateway did not perform off-site sampling, Olean Gateway reviewed historic sampling results and reports for off-site properties adjacent to the three BCP Sites as discussed below.

7.1.7.1 BCP Site 1

As discussed in Section 1.3, Agway operated pumping and purge wells from 1977 to 1984 (referred to as the North Olean Well Field) as a component of groundwater remediation. The purge well was located on BCP Site 1 and had the potential to pump groundwater at a flow greater than 1,000 gallons per minute (gpm), which lowered the water table by 10 to 15 feet (Ref. 6). Since the purge well was located approximately 200 feet west of the northeastern BCP Site 1 property line, it is feasible that contaminated groundwater from the adjacent Dresser-Rand site was drawn onto BCP Site 1.

7.1.7.2 BCP Site 2

Olean Gateway reviewed the December 2006 Draft RI/AA Report prepared by TVGA Consultants for the former Felmont Oil Site (Ref. 6), formerly located on the eastern portion of BCP Site 3. TVGA conducted off-site groundwater sampling on the former Van der Horst Plant No. 2 Site, which is adjacent to and upgradient from BCP Site 2. The results of the June 2006 sampling revealed elevated concentrations of total VOCs (611 ug/L) and VOC TICs (2,700 ug/L) in off-site, upgradient Well MWPW-7S located near a former disposal area on the Van der Horst Plant No. 2 Site. The presence of VOCs at elevated concentrations upgradient of BCP Site 2 suggests that groundwater quality is impaired before reaching the BCP Site boundary. In fact, the total VOC plus TICs concentration in off-site Well MWPW-72 (3,311 ug/L) is significantly higher than the concentrations detected

in BCP Site 2 Well W16 (220 ug/L), which is an upgradient well on BCP Site 2. In addition, the elevated concentration of TICs indicates that the petroleum compounds have been degraded over time.

A component of off-site groundwater flows generally easterly onto BCP Site 2 toward Well W17 from the adjacent off-site property (currently owned by Verizon) to the western boundary of BCP Site 2. The highest VOCs in groundwater concentrations were detected in the vicinity of Well W17 on BCP Site 2. The adjacent off-site property formerly contained numerous ASTs.

The groundwater impacts on BCP Site 2 appear to be a combination of dissolved-phase VOCs migrating on-Site from up-gradient and on-Site sources. As BCP Site 2 is hydraulically upgradient of BCP Site 1, VOC-impacted groundwater may be migrating off BCP Site 2 onto BCP Site 1.

7.1.7.3 BCP Site 3

In June 2006, elevated concentrations of total VOCs and VOC TICs (542 ug/L) were detected in upgradient, off-site Well MW-10S located on the former Van Der Horst Plant No. 2 Site. The NYSDEC concluded in its December 2006 Groundwater Sampling Report (Ref. 20) that widespread dissolved groundwater contamination is present in the shallow aquifer on the Van der Horst Plant No. 2 property; therefore, it is possible that contaminated groundwater from the Van der Horst property is migrating toward Well MW-5, located at the northern boundary of BCP Site 3. The NYSDEC Report also indicated petroleum odor and sheen in off-site wells upgradient from BCP Site 3.

Olean Gateway reviewed analytical data for soil and groundwater sampling from 2004 that occurred on the Dresser Rand property (Ref. 21) located south of BCP Site 3. Although the groundwater sampling indicates elevated total petroleum hydrocarbon (TPH) concentrations in temporary monitoring wells (i.e., TPW10 and TPW12) along the common boundary of Dresser Rand and BCP Site 3, even higher TPH concentrations were detected in wells located in the central portion of the Dresser Rand site indicating a separate source on the Dresser Rand property. Furthermore, NYSDEC Spill Number 0408322 for the Dresser Rand site was opened October 28, 2004 for a petroleum release affecting groundwater. As of May 2013, the spill file had not yet been closed. Based on this off-site information, any future Qualitative Exposure Assessment in this area would need to

consider impacts to both soil/fill and groundwater and exposure associated with the Dresser Rand site.

The groundwater impacts on BCP Site 3 appear to be a combination of dissolved-phase VOCs migrating on-Site from up-gradient sources, and on-Site sources. No off-site groundwater quality data is available to conclude that VOC concentrations in off-site groundwater exceed GWQS/GVs. However, the VOC concentrations near the southern property line of BCP Site 3 suggest that groundwater with elevated VOC concentrations is likely migrating off-site.

7.1.7.4 Summary

Regardless, under the future use (remediated) scenario, GCPS and other potential soil/fill source areas on all three BCP Sites will be removed (i.e., soil excavated and product removed from subgrade piping) or treated (i.e., via SVE or FVBP), and LNAPL will be removed from groundwater in which it has historically been detected. GCPS and soil/fill AOCs will be removed and/or treated to achieve on-site groundwater plume stabilization and prevent off-site migration of contaminated groundwater, to the extent feasible. Therefore, following remediation of the BCP Sites, groundwater and potential associated soil vapor quality downgradient of the BCP Sites will improve over time. Soil and LNAPL are not mobile and are therefore not an off-site migration or exposure concern. Further evaluation of off-site groundwater quality on the properties discussed above would be required to determine the current impact, if any, to groundwater quality.

7.2 Fish and Wildlife Impact Assessment (FWIA)

The Property has been vacant since 1983. The historical use of the Property has eliminated the majority of native species. The Property is mainly populated by low-lying vegetation and small stature early successional trees (e.g., eastern cottonwood and poplar). The majority of fauna found on the Property are avian and small mammal species. No federally listed or proposed threatened or endangered species are known to exist in the project area (Ref. 17).

The Property is slated for commercial redevelopment, consistent with surrounding land use. Roadways, buildings, parking lots, and maintained ornamental landscaping will substantially limit availability of suitable cover type for reestablishment of biota. As such, the

Fish and Wildlife Resource Impact Analysis Decision Key, included as Appendix I (Source: NYSDEC DER-10 Guidelines; Appendix 3C), indicates no fish and wildlife resources impact analysis is warranted.

8.0 REMEDIAL ALTERNATIVES ASSESSMENT

This section provides an analysis of the selected remedial approach by media using the Remedy Selection Evaluation Criteria identified in Section 4.2 of Guidance Document DER-10: Technical Guidance for Site Investigation and Remediation (Ref. 18). In accordance with DER-10 Section 4.4(d)2, the following two alternatives for soil/fill are developed and assessed for each BCP Site based on NYSDEC-defined cleanup tracks as follows:

- Track 1, 6 New York Codes, Rules and Regulations (NYCRR) Part 375-3.8(e)(1) requires site media to meet 6 NYCRR Part 375 SCOs that will allow the site to be used for any purpose without restrictions on the use of the site (i.e., unrestricted use). The soil cleanup must achieve the unrestricted use criteria at any depth above bedrock. Exceedances of the unrestricted SCOs were observed between 20 and 32 fbgs and on average to 30 fbgs over the entire 58.235 acres (total of all three BCP Sites). Therefore, this alterative assumes soil/fill will be removed from the Property to an average depth of 30 fbgs, for a corresponding in-place volume of approximately 2.8 million cubic yards (est. 4.5 million tons).
- Track 4, 6NYCRR Part 375-3.8(e)(4) soil cleanups uses site-specific information to identify site-specific SCOs (or site-specific action levels; SSALs) that are protective of public health and the environment under a restricted use scenario. For Track 4 remedies, restrictions can be placed on the use of the property in the form of institutional and engineering controls if they can be realistically implemented and maintained in a reliable and enforceable manner. As set forth in 6 NYCRR 375-3.8(e)(4)(iii)(b)(1), the top one foot of all exposed surface soils, not otherwise covered by the components of the development of the site (e.g., buildings, pavement), shall not exceed the restricted-use SCOs. Areas that exceed these SCOs must be covered by material meeting the requirements of the generic soil cleanup table contained in 6NYCRR Part 375-6.7(d) for the applicable future site uses (i.e., commercial).

A Track 2 cleanup approach (i.e., soil remediation to achieve restricted-commercial Part 375 SCOs) was considered; however, it was determined that a Track 2 cleanup would require a similar effort to a Track 1 cleanup.

Since groundwater contamination is present on the three BCP Sites and there is the potential for off-site migration, DER-10 requires remedy selection to:

(1) Identify a remedy for the site that includes removal, containment, or treatment of the on-site sources contributing to the groundwater contamination, as set forth in DER-10 Section 4.1(d)2.

Remedial alternatives to address groundwater and abandoned subsurface petroleum product conveyance piping are included under both evaluated alternatives for each BCP Site.

8.1 Remedial Action Objectives

The development of an appropriate remedial approach begins with definition of site-specific Remedial Action Objectives (RAOs) to address substantial public health and ecological risk or other significant environmental issues identified during remedial investigations. In developing the RAOs, consideration is given to the reasonably anticipated future use of the Property (i.e., commercial reuse as initially submitted to the NYSDEC via the BCP application) and the applicable SCGs. Accordingly, appropriate RAOs for the BCP Sites have been defined as:

8.1.1 Soil/Fill RAOs

- Treat GCPS soil/fill to eliminate the characteristics making the soil/fill grossly contaminated by treating/removing soil/fill with elevated headspace levels (PID >1,000 ppm) with strong odors and/or substantial quantities of NAPL, and prevent degradation of on-site and off-site groundwater quality.
- Remove or treat metals-impacted soil/fill areas of concern (AOCs) to the degree necessary to prevent further degradation of groundwater quality and remove soil/fill that exhibits hazardous waste characteristics or render it non-hazardous.
- Prevent ingestion/direct contact with soil/fill where contaminant levels exceed SCGs.
- Prevent off-site migration of soil/fill contaminants in surface water in excess of SCGs.
- Prevent inhalation of or exposure to contaminants volatilizing from contaminated soil/fill.
- Implement and maintain engineering and institutional controls to assure that the Property is not used in a manner inconsistent with the reasonably anticipated future use.

8.1.2 Groundwater RAOs

- Prevent ingestion of groundwater containing contaminant levels exceeding SCGs or with evidence of LNAPL.
- Prevent contact with or inhalation of VOCs emanating from contaminated groundwater.

- Remove, capture, or otherwise mitigate LNAPL as potential source of groundwater contamination.
- Remove and/or treat GCPS and soil/fill AOCs to achieve on-site groundwater plume stabilization and prevent off-site migration of contaminated groundwater, to the extent feasible.
- Implement and maintain engineering and institutional controls to assure that the Site is not used in a manner inconsistent with the reasonably anticipated future use scenario.

8.1.3 Subsurface Piping RAOs

- Remove or mitigate subsurface piping to the degree necessary to protect public health and the environment and to prevent further degradation of on-site and off-site soil/fill and groundwater quality.

8.2 General Response Actions

General Response Actions (GRAs) are broad classes of actions that are developed to achieve the RAOs and form the foundation for the identification and screening of remedial technologies and alternatives. Estimates of the areas and volumes of contaminated media to be addressed are presented by BCP Site in Section 8.7.1, 8.8.1, and 8.9.1.

8.2.1 Soil/Fill

The GRAs available to address the RAOs for soil/fill include:

- Institutional controls (e.g., Site Management Plan, Environmental Easement)
- Engineering controls (e.g., cover system)
- Treatment (e.g., in-situ or ex-situ)
- Excavation and off-site disposal

8.2.2 Groundwater

The GRAs available to address the RAOs for groundwater include:

- Monitored natural attenuation
- Institutional controls
- Engineering controls (e.g., pump-and-treat)
- Treatment (e.g., in-situ or ex-situ)

8.2.3 Subsurface Product Piping

The GRAs available to address the RAOs for subsurface product piping include:

- Removal and off-site disposal/recycling
- Cleaning and capping in-place
- Treatment of impacted soil/fill (see Section 8.2.1)

8.3 Standards, Criteria, and Guidance

According to DER-10 Section 1.3(b)71, SCGs mean "*standards and criteria that are generally applicable, consistently applied, and officially promulgated, that are either directly applicable or not directly applicable but are relevant and appropriate, unless good cause exists why conformity should be dispensed with, and with consideration being given to guidance determined, after the exercise of scientific and engineering judgment, to be applicable. This term incorporates both the CERCLA concept of 'applicable or relevant and appropriate requirements' (ARARs) and the USEPA's 'to be considered' (TBCs) category of non-enforceable criteria or guidance. For purposes of this Guidance, 'soil SCGs' means the soil cleanup objectives and supplemental soil cleanup objectives identified in 6NYCRR 375-6.8 and the Commissioner Policy on Soil Cleanup Guidance (CP-Soil).*"

Additional discussions concerning the specific chemical-, action-, and location-specific SCGs that may be applicable, relevant, or appropriate to remedy selection for the Property are presented below. In each case, the identified SCGs are generally limited to regulations or technical guidance in lieu of the environmental laws from which they are authorized, as the laws are typically less prescriptive in nature and are inherently considered in the regulatory and guidance evaluations. Table 8-1 summarizes the SCGs by media that may be applicable or relevant and appropriate to the BCP Sites.

8.3.1 Chemical-Specific SCGs

Chemical-specific SCGs are usually health- or risk-based concentrations in environmental media (e.g., air, soil, water), or methodologies that when applied to site-specific conditions, result in the establishment of concentrations of a chemical that may be found in, or discharged to, the ambient environment. The determination of potential chemical-specific SCGs for a site is based on the: nature and extent of contamination; potential migration pathways and release mechanisms for site contaminants; reasonably anticipated future site use; and likelihood that exposure to site contaminants will occur. RI

and SRI sampling events included the collection and analysis of surface/near-surface soil/fill, subsurface soil/fill, and groundwater samples.

One of the remedial alternatives to be assessed for the BCP Sites is a Track 4 cleanup for soil/fill. This approach requires institutional controls (e.g., groundwater and land use restrictions, Site Management Plan, and Environmental Easement) and engineering controls (e.g., a soil cover system, ASD systems) as components of the final remedy to reduce future potential exposure to impacted surface/near-surface soil/fill.

Site-specific action levels (SSALs) were developed for the three BCP Sites. These SSALs will be applicable to soil/fill that greatly exceed CSCOs, have the potential to impact groundwater, or otherwise represent an unacceptable risk to public health or the environment in the context of reasonably anticipated future use and a Track 4 cleanup and therefore require removal, treatment, or stabilization. These SSALs were developed based on the planned removal of potential source areas, including areas that have a greater potential for contaminant migration, and the feasibility of achieving the SSALs based on the nine factors outlined in 6NYCRR Part 375-1.8(f) and described in Section 8.6. The following SSALs were developed for the three BCP Sites and used to designate soil/fill AOCs requiring remediation:

- Arsenic > 90 mg/kg
- Total Lead > 2,000 mg/kg
- TCLP Lead >5 mg/L
- Mercury > 9 mg/kg
- PCB > 10 mg/kg
- Total PAHs > 500 mg/kg
- GCPS soil/fill areas

Seven areas of the Property contain concentrations of arsenic, lead, and/or mercury in the surface/near surface soil/fill that greatly exceed CSCOs, indicating a potential source area, and are therefore considered metals-impacted soil/fill AOCs. Arsenic is a ubiquitous metal with urban background soils in New York State frequently containing concentrations in excess of the CSCO (16 mg/kg), particularly at former industrial properties with a history of fossil fuel burning, oil refining, and fertilizer production such as that which occurred on the Olean Redevelopment Property. Accordingly, comparison of the arsenic data to site-specific background or average concentrations is considered appropriate. To determine the

arsenic background concentration, TurnKey performed a statistical analysis using all of the arsenic concentrations for surface/near-surface soil/fill (i.e., 0-6 fbgs) across the Property (a total of 318 samples). The analysis revealed a 95% upper confidence limit (UCL) on the mean of approximately 45 mg/kg (see Appendix J). Of the 318 samples used in the analysis, only 47 samples (approx. 15%) had concentrations above the UCL. On other BCP sites, the NYSDEC recommended using twice the 95% UCL on the mean for arsenic as the SSAL for removal (a soil cover system and SMP were components of the final remedy).

The SSALs used to designate the lead and mercury soil/fill AOCs were based on site-specific concentration anomalies (i.e., concentrations well above CSCOs that indicate a potential source area), taking into consideration that this is a Track 4 cleanup with a cover system to be installed over all areas with remaining soil/fill concentrations above CSCOs, a Site Management Plan (SMP) and environmental easement. Based on the TCLP data presented in Table 4-5, soil/fill with lead concentrations below the SSAL of 1,310 mg/kg did not exhibit the characteristics of a hazardous waste. Specifically, five samples collected in 2009 and 2010 with total lead concentrations between 11.2 and 1,310 mg/kg had corresponding TCLP lead concentrations of <0.5 to 1.6 mg/L, well below the hazardous waste characteristic concentration of 5 mg/L for lead. Conversely, Table 4-22 indicates that samples collected in 2012 with total lead concentrations between 2,440 and 40,900 mg/kg had corresponding TCLP lead concentrations of 10.5 to 385B mg/L.

According to DEC Policy CP-51 (Ref. 19), an acceptable presumptive remedy for soil may include a soil cleanup level for PCBs of 1 ppm (the applicable SCO) in surface soils and 10 ppm in subsurface soils (defined as soil beneath permanent structures, pavement, or similar cover systems; and soil beneath one foot of soil cover for commercial and industrial uses) in limited circumstances as follows:

- Cleanup track is Track 4
- Property use will be restricted residential, commercial, or industrial
- SCOs developed to protect ecological resources (ESCOs) do not apply

For PAHs, the alternative Soil Cleanup Level of 500 mg/kg total PAHs was employed in lieu of individual CSCOs, per NYSDEC CP-51 Soil Cleanup Guidance, on the premise that the Track 4 cleanup will include institutional controls (Environmental Easement and Site Management Plan).

8.3.2 Location-Specific SCGs

Location-specific SCGs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in a specific location. Some examples of these unique locations include: floodplains, wetlands, historic places, and sensitive ecosystems or habitats. The location of the site is a fundamental determinant of its impact on human health and the environment.

8.3.3 Action-Specific SCGs

Action-specific SCGs are restrictions placed on particular treatment or disposal technologies. Examples of action-specific SCGs are effluent discharge limits and hazardous waste manifest requirements.

8.4 Future Use Evaluation

In developing and screening remedial alternatives, NYSDEC's Part 375 regulations require that the reasonableness of the anticipated future land use be factored into the evaluation. The regulations identify 16 criteria that must be considered. These criteria and the resultant outcome for the Olean Redevelopment Property are presented in Appendix K. The reasonably anticipated future land use for the Property, initially submitted to the NYSDEC via the BCP applications, is in a commercial capacity. As indicated, the evaluation supports commercial redevelopment as the reasonably anticipated future use of the Property, consistent with past and current development and zoning on-site as well as within the vicinity of the Property. As discussed in Section 8.6, the remedial alternatives are evaluated against their consistency with the reasonably anticipated land use as well as other screening criteria.

In addition to the evaluation of alternatives to remediate to the reasonably anticipate future use of the Property, NYSDEC regulation and policy calls for evaluation of an unrestricted use scenario (considered under 6NYCRR Part 375-2.8 to be representative of cleanup to pre-disposal conditions.

8.5 Potentially Applicable Remedial Technologies

The following sections describe the remedial technologies that were considered for impacted soil/fill AOCs and groundwater at the Olean Redevelopment Property. Those

soil/fill remedial technologies deemed technically feasible were tested through bench-scale and pilot-scale treatability studies as described in Sections 2.8 and 5.0.

8.5.1 Soil/Fill Remedial Technologies

Enhanced Biotreatment

Landfarming is an aboveground remediation technology for soils that reduces concentrations of petroleum constituents through biodegradation. This technology typically involves spreading excavated contaminated soils in a 12- to 36-inch layer on the ground surface and stimulating aerobic indigenous microbial activity within the soils through aeration and/or the addition of minerals, nutrients, moisture, and sometimes pH adjustment. The enhanced microbial activity results in degradation of adsorbed petroleum constituents through microbial respiration. If contaminated soils are shallow (i.e., less than 3 feet below ground surface), it may be possible to effectively stimulate microbial activity without excavating the soils but to a lesser degree and with longer treatment times. If soil is impacted deeper than 3 feet, the soils should be excavated and reapplied on the ground surface. Ex-situ enhanced bioremediation/landfarming simulations were performed in the field through mechanically mixing the petroleum-impacted soil/fill and controlling soil moisture, pH, and nutrients.

Biopiles are used to reduce concentrations of petroleum constituents in excavated soils through the use of biodegradation. This technology involves heaping contaminated soils into piles (or "cells") and stimulating aerobic microbial activity within the soils through the aeration and/or addition of minerals, nutrients, and moisture. The enhanced microbial activity results in degradation of adsorbed petroleum-product constituents through microbial respiration. Biopiles are aboveground, engineered systems that use oxygen (generally from air) to stimulate the growth and reproduction of aerobic bacteria which, in turn, degrade the petroleum constituents adsorbed to soil. Biopiles are aerated most often by forcing air to move by injection or extraction through slotted or perforated piping placed throughout the pile. Ex-situ force vented biopiles simulations were performed in the field by placing impacted soil in windrowed biopiles. Perforated piping placed within the windrows extracted petroleum contaminants in the form of vapor. The off-gasses from the extracted vapor phase were treated using biofiltration. The biofilter was constructed using a 10-ft by 10-ft closed-topped plywood box containing wood and compost filter medium to allow the natural bacteria to bioremediate the air stream.

Solidification/Stabilization

Solidification/Stabilization (S/S) is a widely used treatment technology to reduce or mitigate migration and exposure of contaminants from a contaminated media (i.e., soil, sludge, and sediment). Solidification refers to a process that binds a contaminated media with a reagent changing its permeability or other physical properties. Stabilization refers to the process that involves a chemical reaction that reduces the leachability of a waste. Solidification/stabilization bench-scale simulations were completed by mixing various proportions of agricultural lime, Portland cement, and fly ash (2% and 5% by weight) with the petroleum-impacted soil/fill. Additional bench-scale treatability tests were performed on soil/fill determined to be characteristically hazardous for lead. The lead treatment bench-scale simulations included stabilization with Portland cement (5% and 10% by weight) and phosphoric acid (2%, 5%, and 10% by weight).

Chemical Oxidation

In-situ chemical oxidation (ISCO) is an advanced oxidation process used to reduce the concentrations of targeted organic environmental contaminants in soil to acceptable levels. ISCO is accomplished by injecting or otherwise introducing strong chemical oxidants directly into the contaminated soil. The effectiveness of ISCO depends on the degree to which the oxidant and contaminant are in direct contact with each other, particularly in the vadose zone. ISCO is typically more effective in permeable, granular, and homogeneous soils. Other soil constituents (i.e., iron, pH, Eh) can compete or inhibit the ISCO process. Hydrogen peroxide is one of the most successfully used oxidants for soil remediation because: oxidation is relatively fast (i.e., days or weeks) and the contaminants are treated in situ and converted to innocuous and/or natural occurring compounds (e.g., water and carbon dioxide). Chemical oxidation bench-scale simulations were completed by mixing hydrogen peroxide with each type of petroleum-impacted soil/fill at different proportions (1% and 3% by weight).

Soil Vapor Extraction

Soil vapor extraction (SVE) is an in-situ remedial technology that reduces concentrations of volatile constituents in petroleum products adsorbed to soils in the unsaturated (vadose) zone. In this technology, a vacuum is applied through wells near the source of soil contamination to reduce the vapor pressure to less than atmospheric. Volatile

constituents of the contaminant mass volatilize and the vapors or "soil gas' are drawn toward the extraction wells. Extracted vapor is then treated (commonly with carbon adsorption or biofiltration) before being released to the atmosphere. Treatment of the extracted soil is performed to reduce nuisance odors and/or emissions consistent with SCGs. The increased air flow through the subsurface can also stimulate biodegradation of some of the contaminants, especially those that are less volatile. During the field-scale pilot studies, the off-gasses from the extracted vapor phase were treated with biofiltration. The biofilter was constructed using a 10-foot by 10-foot closed-top plywood box containing wood and compost filter medium to allow the natural bacteria to bioremediate the air stream.

Excavation and Disposal

This technology would entail excavating impacted soil/fill from selected areas of the Property using mechanical equipment. The volume and depth of impacted soil/fill to be removed depends on the SCOs to be applied to achieve various land-use based goals as defined in Part 375, to the degree necessary for protection of groundwater and public health. Excavated soil/fill would be disposed at a permitted off-site treatment and/or disposal facility. Post-excavation bottom and sidewall sampling and waste characterization sampling for disposal would be conducted. Excavation shoring and dewatering would be required to excavate contaminated soil to any depth below the water table. The excavated area would be backfilled with approved material. Backfilled areas would be graded and seeded for drainage and erosion control as applicable.

8.5.2 Groundwater/LNAPL Remedial Technologies

Monitored Natural Attenuation

Monitored natural attenuation (MNA) refers to the reliance on natural biological and physiochemical processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods (EPA, 1999). Natural attenuation processes include a variety of physical, chemical, and biological processes that, under favorable conditions, reduce the mass, toxicity, mobility, volume, and/or concentration of contaminants in groundwater. Long-term performance monitoring is a

fundamental component of a MNA remedy; hence, the emphasis on "monitoring" in the term "monitored natural attenuation."

In-Situ Bioremediation

In-situ groundwater bioremediation is a technology that encourages metabolism and reproduction of indigenous microorganisms to increase the rate of biodegradation of organic constituents in the saturated zone. In-situ groundwater bioremediation can effectively degrade organic constituents which are dissolved in groundwater and adsorbed onto the aquifer matrix. In-situ groundwater bioremediation can be effective for a wide range of petroleum hydrocarbons. While there are some notable exceptions (e.g., methyl tert-butyl ether or MTBE), the short-chain, low-molecular-weight, more water soluble constituents are degraded more rapidly and to lower residual levels than are long-chain, high-molecular-weight, less soluble constituents. Recoverable free product should be removed from the subsurface prior to or in conjunction with operation of an in-situ groundwater bioremediation system to mitigate the major continuing source of contaminants as well as reduce the potential for smearing or spreading high concentrations of contaminants.

Bioremediation generally requires a mechanism for stimulating and maintaining the activity of indigenous microorganisms. This mechanism is usually a delivery system for providing one or more of the following: An electron acceptor (oxygen, nitrate); nutrients (nitrogen, phosphorus); and an energy source (carbon). Generally, electron acceptors and nutrients are the two most critical components of any delivery system.

In-Situ Chemical Oxidation

Chemical oxidation technology is based on the oxidative power of specific chemicals. Through the process of oxidation, groundwater contaminants are ultimately broken down into carbon dioxide and water. In-situ chemical oxidation (ISCO) involves injecting oxidants and potentially co-amendments directly into the source zone and downgradient plume. The four major oxidants used for soil and groundwater remediation are permanganate, persulfate, peroxide, and ozone.

Contaminants amenable to treatment by ISCO include, but are not limited to, the following: benzene, toluene, ethylbenzene, and xylenes (BTEX); MTBE; total petroleum hydrocarbons (TPH); chlorinated solvents (ethenes and ethanes); and polyaromatic hydrocarbons (PAHs).

Certain physical properties are very important to successful applications using ISCO with hydrogen peroxide. For example, peroxide's exothermic characteristic, when controlled, can be very beneficial to enhance desorption and dissolution of sorbed and NAPL mass, making it available for effective treatment by oxidation or mass transfer systems. When not controlled, these same characteristics can cause migration of the contaminants.

Permeable Reactive Barrier

A permeable reactive barrier (PRB) is a continuous, in situ permeable treatment zone designed to intercept and remediate a contaminant plume. The treatment zone may be created directly using reactive materials such as iron or indirectly using materials designed to stimulate secondary processes, such as by adding carbon substrate and nutrients to enhance microbial activity. In this way, contaminant treatment may occur through physical, chemical, or biological processes. With most PRBs, the reactive material is in direct contact with the surrounding aquifer material. The term "barrier" is intended to convey the idea of a barrier to contaminants, but not to groundwater flow. PRBs are designed to be more permeable than the surrounding aquifer materials so that contaminants are treated as groundwater readily flows through without significantly altering groundwater hydrogeology. PRB technology has limitations and should not be considered as the only remedy for a site but may be used in conjunction with one or more other remedies such as source removal. Zero-valent iron (ZVI) is the most widely used reactive material in PRB for treating common organic and inorganic contaminants in groundwater, such as chlorinated volatile organic compounds (cVOCs), petroleum hydrocarbons, chromium, and arsenic.

Passive LNAPL Recovery

Passive LNAPL recovery involves non-mechanical removal of measurable LNAPL from groundwater by installing various devices within the groundwater well. Absorbent socks are designed specifically for absorbing hydrocarbons. The socks are periodically removed and, when spent, properly disposed. Another option is a passive skimming system (e.g., PetroTrap™) that provides a floating hydrophobic filter for the recovery of free-floating LNAPL that is stored in a collection canister. Once the canister is full, the product would be transferred to another container for disposal or recycling.

Biosparging

Biosparging is an in-situ remediation technology that uses indigenous microorganisms as well as physical "stripping" to biodegrade organic constituents in the saturated zone. In biosparging, air (or oxygen) and nutrients (if needed) are injected into the saturated zone to increase the biological activity of the indigenous microorganisms and/or volatilization of VOCs from the saturated soil. Biosparging can be used to reduce concentrations of petroleum constituents that are dissolved in groundwater, adsorbed to soil below the water table, and within the capillary fringe. When volatile constituents are present, biosparging is often combined with SVE or bioventing and can also be used with other remedial technologies. When biosparging is combined with SVE, the SVE system creates a negative pressure in the vadose zone through a series of extraction wells that control the vapor plume migration.

Biosparging should not be used if free product is present because biosparging can create groundwater mounding, potentially causing free product to migrate and contamination to spread.

Dual-Phase/Multiphase Extraction

Dual-phase extraction (DPE) is an in situ technology that uses pumps to remove various combinations of contaminated groundwater, separate-phase petroleum product, and hydrocarbon vapor from the subsurface. Extracted liquids and vapor are treated and collected for disposal, or re-injected to the subsurface. DPE systems are typically designed to maximize extraction rates; however, the technology also stimulates biodegradation of petroleum constituents in the unsaturated zone by increasing the supply of oxygen. DPE is often selected because it enhances groundwater and/or product recovery rates, especially in layered, fine-grained soils. The application of DPE also maximizes the effectiveness of SVE by lowering the water table (addressing smear zone impact) and therefore increasing air-phase permeability in the vadose zone. Multiphase extraction (MPE) is the same as DPE with vacuum enhancement at the wellhead. This is also referred to as bioslurping/enhanced fluid recovery (EFR).

DPE/MPE systems can be effective in removing separate-phase product (free product) from the subsurface, thereby reducing concentrations of petroleum hydrocarbons in both the saturated and unsaturated zones of the subsurface. The groundwater pump creates a cone of depression that induces LNAPL flow into the well through an increased

hydraulic gradient. The LNAPL pump then recovers the LNAPL as it accumulates in the well. The groundwater pump is typically a submersible positive displacement pump. Each phase is typically treated separately. A single pump can also be used to extracts groundwater and LNAPL together, requiring LNAPL/water separation due to emulsification.

Pump-and-Treat

Traditional pump-and-treat systems extract contaminated groundwater for aboveground treatment. Such systems have primarily been designed to recover aqueous-phase contaminants. Flushing of hundreds or thousands of pore volumes of groundwater may be required to significantly diminish contaminant levels at some sites. Complete mobilization of LNAPL trapped below the water table using increased hydraulic gradients alone is not practical under conditions encountered in the field. Many of the more soluble LNAPL components may continue to dissolve in groundwater resulting in groundwater contamination at unacceptable concentrations, potentially necessitating containment operations. Depending on site conditions, time frames of many decades or centuries may be required to remove LNAPLs trapped in the saturated zone using dissolution alone.

8.6 Evaluation of Alternatives

NYSDEC's Brownfield Cleanup Program calls for remedy evaluation in accordance with DER-10 Technical Guidance for Site Investigation and Remediation (Ref. 17). In addition to achieving RAOs, the remedial alternatives are evaluated against the following criteria consistent with 6NYCRR Part 375-1.8(f):

- **Overall Protectiveness of Public Health and the Environment**. This criterion is an evaluation of the remedy's ability to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced, or controlled through removal, treatment, engineering controls, or institutional controls.
- **Compliance with Standards, Criteria, and Guidance (SCGs)**. Compliance with SCGs addresses whether a remedy will meet applicable environmental laws, regulations, standards, and guidance as described in Section 8.1.
- **Long-Term Effectiveness and Permanence**. This criterion evaluates the long-term effectiveness of the remedy after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: (i) the magnitude of the remaining risks (i.e., will there be any significant threats, exposure pathways, or risks to the community and

environment from the remaining wastes or treated residuals), (ii) the adequacy of the engineering and institutional controls intended to limit the risk, (iii) the reliability of these controls, and (iv) the ability of the remedy to continue to meet RAOs in the future.

- **Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment**. This criterion evaluates the remedy's ability to reduce the toxicity, mobility, or volume of Site contamination. Preference is given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.
- **Short-Term Impacts and Effectiveness**. Short-term effectiveness is an evaluation of the potential short-term adverse impacts and risks of the remedy upon the community, the workers, and the environment during construction and/or implementation. This includes a discussion of how the identified adverse impacts and health risks to the community or workers at the Site will be controlled, and the effectiveness of the controls. This criterion also includes a discussion of engineering controls that will be used to mitigate short term impacts (i.e., dust control measures), and an estimate of the length of time needed to achieve the remedial objectives.
- **Implementability**. The implementability criterion evaluates the technical and administrative feasibility of implementing the remedy. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.
- **Cost-Effectiveness**. Capital and annual operation, maintenance, and monitoring (OM&M) costs are estimated for each remedial alternative. The annual OM&M costs have not been presented as a net present worth, which discounts future costs to the current calendar year, but have been presented as a total for the 30-year post-remedial period to provide a more conservative evaluation of costs. The estimated soil/fill areas and volumes presented in Sections 8.6.1, 8.7.1, and 8.8.1 are estimates of the maximum in-place extent of impacted soil/fill. The cost estimates developed for the remedial alternatives include contingencies for excavation inefficiencies as well as volume to weight assumptions; therefore, the impacted soil/fill weights on the summary tables may differ from those presented in Sections 8.6.1, 8.7.1, and 8.8.1.
- **Community Acceptance**. This criterion evaluates the public's comments, concerns, and overall perception of the remedy. The Community Acceptance criterion incorporates public concerns into the evaluation of the remedial alternatives. Therefore, Community Acceptance of the remedy will be evaluated

after the public review of the remedy selection process as part of the final NYSDEC selection/approval.

- **Land Use**. In addition to the above criteria, 6NYCRR Part 375-1 specifies that the criterion of Land Use (i.e., the current, intended, and reasonably anticipated future land uses of the Site and its surroundings) be considered in the selection of the remedy. The reasonably anticipated future land use for the Site, initially submitted to the NYSDEC via the BCP application, is in a commercial capacity. Appendix K presents the land use evaluation for the BCP Sites.

8.7 Olean Redevelopment BCP Site 1

8.7.1 Estimated Areas and Volumes by Media

The IRMs completed during 2009-2011 are discussed in Sections 1.3.6 through 1.3.8, and shown on Figure 1-4.

8.7.1.1 Surface/Near-Surface Soil/Fill

GCPS Soil/Fill Areas

No GCPS soil/fill was observed from 0-2 fbgs on BCP Site 1. The two areas with GCPS soil/fill from 2-6 fbgs are isolated and cover a small percentage of BCP Site 1. The approximate extent of impact is shown on Figure 8-1 and described below:

- 1-GCPS-1s is an approximate 6,200-square foot area with an average 4-foot depth for an estimated in-place volume of 900 cubic yards.
- 1-GCPS-2s is an approximate 1,600-square foot area with an average 4-foot depth for an estimated in-place volume of 250 cubic yards.

Therefore, the total volume of GCPS soil/fill between 2 and 6 fbgs on BCP Site 1 is approximately 1,150 cubic yards. This GCPS soil/fill will be excavated during removal of the subsurface product conveyance piping discussed in Section 8.6.1.4.

Metals-Impacted Soil/Fill AOCs

The estimated areal and vertical extent of near-surface (0-6 fbgs) metals-impacted soil/fill AOCs on BCP Site 1 is illustrated on Figure 8-2 and described below:

- Area 1-AS-1: Arsenic was detected above the SSAL of 90 mg/kg in the vicinity of TP37A; this sample also exceeded the CSCO for lead. The maximum extent of the impact is estimated to span an approximate 3,370 square-foot area with an

average depth of 2 fbgs, for a corresponding in-place volume of approximately 250 cubic yards.

- Area 1-AS-2: Arsenic was detected above the SSAL of 90 mg/kg in the vicinity of SB6. The maximum extent of the impact is estimated to span an approximate 765 square-foot area with an average depth of 2 fbgs, for a corresponding in-place volume of approximately 60 cubic yards.
- Area 1-AS-3: Arsenic was detected above the SSAL of 90 mg/kg in the vicinity of TPSB26D and TPSB26A. The maximum extent of the impact is estimated to span an approximate 3,690 square-foot area (0-2 fbgs) and an approximate 13,200 square-foot area (2-4 fbgs), for a corresponding in-place volume of approximately 1,250 cubic yards.
- Area 1-HG-1: Mercury was detected above the SSAL of 9 mg/kg in two distinct yet adjacent areas in the vicinity of TPSB31C and SB17. The maximum extent of the impact for these two areas is estimated to span an approximate 4,160-square foot area with an average depth of 2 fbgs, for a corresponding in-place volume of approximately 300 cubic yards.

Therefore, the approximate in-place volume of near-surface soil/fill AOCs on BCP Site 1 impacted by arsenic is 1,560 cubic yards and mercury is 300 cubic yards. None of the metals-impacted soil/fill AOCs exhibited hazardous waste characteristics and therefore would be disposed as non-hazardous.

PCB-Impacted Soil/Fill AOCs

As discussed in Section 8.3.1, since the PCB-impacted soil/fill AOCs on BCP Site 1 will receive one foot of soil cover, buildings, or pavement, the AOCs have been defined as PCB concentrations in soil/fill above 10 mg/kg. Therefore, the estimated areal and vertical extent of surface soil/fill (0-1 fbgs) impact by PCBs on BCP Site 1 is illustrated on Figure 8-3 and described below:

- Area 1-PCB-1: PCBs were detected above 10 mg/kg in the vicinity of PCB5 and PCB5A. The maximum extent of the impact is estimated to span an approximate 4,070 square-foot area with an average depth of 1 fbgs, for a corresponding in-place volume of approximately 150 cubic yards.
- Area 1-PCB-2: PCBs were detected above 10 mg/kg in the vicinity of PCB16, PCB16A, and PCB18. The maximum extent of the impact is estimated to span an approximate 8,400 square-foot area with an average depth of 1 fbgs, for a corresponding in-place volume of approximately 310 cubic yards.

Therefore, the in-place volume of PCB-impacted surface soil/fill AOCs on BCP Site 1 is estimated at 460 cubic yards.

8.7.1.2 Subsurface Soil/Fill

GCPS Soil/Fill Areas

Figure 8-1 shows the four areas of GCPS subsurface soil/fill (6 to 15 fbgs). These areas combined cover an approximate 38,730-square foot area for a total in-place volume of approximately 13,000 cubic yards. Since the majority of area 1-GCPS-2d falls within BCP Site 1, the portion extending onto BCP Site 2 has been included in this total.

SVOC-Impacted Soil/Fill AOC

As discussed in Section 8.3.1, area 1-SVOC-1 is defined as an AOC since the total PAH concentration in TPSB-23 is above 500 mg/kg. As shown on Figure 8-4, area 1-SVOC-1 covers an approximate 6,725-square foot area with impact from 0-10 fbgs, for an in-place volume of approximately 2,500 cubic yards. This area encompasses the majority of area 1-GCPS-4d where elevated SVOCs, TICs, and DRO concentrations were detected in subsurface soil/fill.

8.7.1.3 Groundwater

As illustrated by Figure 4-7, the distribution of total VOCs (VOCs plus TICs on Figure 4-8) in groundwater shows the highest concentration as well as LNAPL located in upgradient Well W5 proximate to the northern property line (along the southern boundary of BCP Site 2). No known subgrade piping or GCPS exist on the northern portion of BCP Site 1 in the vicinity of Well W5; however, here is a high concentration of subgrade piping potentially containing product and GCPS on the southern portion of BCP Site 2 suggesting dissolved-phase VOCs are migrating onto BCP Site 1. Figures 4-5 and 4-6 show the historic LNAPL area on BCP Site 2 extending to Well W5 on BCP Site 1. The groundwater VOC impacts on BCP Site 1 are likely due to on-site migration of dissolved-phase VOCs from BCP Site 2 and LNAPL proximate to Well W5..

Groundwater impacts in Well W30 appear to be associated with an upgradient subsurface GCPS area.

The following LNAPL thicknesses were observed during W&C's February and August 2012 gauging events (see Table 4-16 and Figure 4-7): Wells W5 (0.01' and 3.12'), W9

(1.77' and 0.15'), W10 (0.00' and 0.85'), and W27 (0.02' and 1.86'). As discussed in Section 6.5.1, LNAPL thickness varies with the elevation of the groundwater table. During the August 2012 SRI, no LNAPL was detected in the three wells sampled (i.e., Wells W3, W4, and W30). Elevated petroleum-related volatile organics have also been detected in the vicinity of monitoring wells W5 and W9.

8.7.1.4 Subsurface Product Piping

Based on W&C's piping assessment, all known abandoned subgrade product conveyance piping present on BCP Site 1 (estimated at 22,500 linear feet) will either be removed and transported off-site for disposal/ recycling (estimated 250 tons) or cleaned and capped. As illustrated by Figure 4-9, the entire 1,150 cubic yards of surface/near-surface GCPS soil/fill on BCP Site 1 is present within these subgrade product piping areas. The GCPS soil/fill will be excavated and treated on-site using force-vented biopiles.

For cost estimating purposes, it has been assumed that approximately 6,000 gallons of non-hazardous and approximately 2,000 gallons of hazardous material (i.e., product/pipe scale) contained in the piping will require off-site disposal. The quantity of product/pipe scale per linear foot of piping was estimated based on TurnKey's experience with piping at other former refinery sites.

8.7.2 Identification of Remedial Alternatives for BCP Site 1

The following two remedial alternatives have been developed in accordance with the General Response Actions and NYSDEC regulation and policy:

- Alternative 1-A: Unrestricted Use (Track 1) Cleanup
- Alternative 1-B: Commercial Use (Track 4) Cleanup

8.7.2.1 Alternative 1-A: Unrestricted Use (Track 1) Cleanup

Alternative 1-A for BCP Site 1 consists of excavation and off-site disposal of all soil/fill that contains chemical constituents at concentrations greater than 6 NYCRR Part 375 SCOs for unrestricted use and/or has evidence of grossly contaminated media. Achieving these Track 1 remediation goals (Section 4 and Part 4.4 (d)(2) of DER-10) obviates the need for engineering and institutional controls. For unrestricted use scenarios, excavation and off-site disposal of impacted soil/fill is generally regarded as the most

applicable remedial measure, because engineering controls cannot be used to supplement the remedy.

Due to the widespread exceedance of these SCOs, it is assumed that the entire 25.099 acres of BCP Site 1 soil/fill to an average depth of 30 fbgs would require excavation with transport of the excavated soil/fill to and disposal at a permitted, off-site disposal facility. Therefore, the estimated total in-place volume of soil/fill removed from BCP Site 1 and disposed off-site is approximately 1.2 million cubic yards (1.9 million tons). Based on TCLP testing during the investigations, the excavated soil/fill is considered non-hazardous and would be transported to a commercial solid waste disposal facility. If encountered during excavation, hazardous soil/fill would be transported to a permitted hazardous landfill or stabilized to render non-hazardous followed by disposal at an off-site commercial solid waste disposal facility. Excavated soil/fill would require handling and preparation for off-site transportation and disposal. If necessary, a dewatering system would be installed to facilitate excavation activities. Water generated during the dewatering activities would be treated on-site via temporary water treatment system and then discharged to the sanitary sewer under a temporary discharge permit. On-site dewatering of saturated soil/fill may be required prior to off-site disposal; however, these potential costs have not been included in the estimate presented below. Asphalt/concrete and existing subsurface piping would be located and removed prior to initiating excavation activities. Excavated areas would be backfilled with an estimated 1.2 million cubic yards of material meeting the BCP criteria presented in DER-10 and further in 6 NYCRR Part 375 to the pre-excavation elevations and grades, and all disturbed areas would be restored with topsoil and grass seeding, or hardscape if redevelopment activities have been approved.

Based on the removal of source area material (i.e., product from subgrade piping and impacted soil/fill), groundwater concentration would be expected to decrease over time. Therefore, LNAPL removal and groundwater monitoring have not been included in this alternative. However, a restriction on groundwater use may be included as a component of the remedial program per 6NYCRR Part 375-3.8(e)(1)(iii).

Overall Protectiveness of Public Health and the Environment – Excavation and off-site disposal to unrestricted use SCOs would be protective of public health under any reuse scenario. However, this alternative would permanently use and displace approximately 1.2 million cubic yards of valuable landfill airspace, causing ancillary environmental issues

due to reduced landfill capacity, and would require excavating, transporting, and placing 1.2 million cubic yards of clean soil from an off-site borrow source to backfill the excavation, also contributing to significant detrimental off-site environmental issues.

Compliance with SCGs – Excavation and off-site disposal would need to be performed in accordance with applicable, relevant, and appropriate SCGs. Soil excavation activities would necessitate preparation of and adherence to a community air monitoring plan in accordance with Appendices 1A and 1B of DER-10.

Long-Term Effectiveness and Permanence – This alternative would remove all impacted soil/fill and subsurface piping and therefore provide long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Through removal of all impacted soil/fill, this alternative would permanently and significantly reduce the toxicity, mobility, and volume of contamination on BCP Site 1. However, since this alternative transfers impacted soil/fill from one environment to another, an overall reduction of toxicity and volume would not occur, although mobility would be significantly reduced in a commercial landfill with a liner, leachate collection, and a cover system.

Short-Term Impacts and Effectiveness – The principal advantage of a large-scale excavation to achieve unrestricted SCOs is reliability of effectiveness in the long-term. The short-term adverse impacts and risks to the community, workers, and environment during implementation of this alternative are significant. Site workers would be required to wear personal protective equipment (PPE) during excavation to prevent direct contact with soil/fill. Dust control methods would be required to limit the release of particulates during placement of the backfill soils. Fugitive odors during excavation and hauling of impacted soil/fill would be released to the air presenting a nuisance condition and potential health hazard to workers. Physical hazards, primarily related to potential accidents from heavy truck traffic, would be expected as the excavation work would require removal of approximately 85,000 truckloads of soil and import of a similar number of clean loads from the borrow source. Substantial disruption of the neighboring community would occur due to material transport and deliveries and noise from heavy equipment used to construct the remedy. This

action would result in stormwater impacts at the borrow source(s) and on-site; diesel fuel consumption on the order of 1.3 million gallons (assuming 120 miles round trip to a local landfill; 8 miles per gallons), with several thousands of gallons also consumed by excavation and grading equipment. The USEPA's estimated CO_2 generation rate for diesel engines is approximately 22.2 pounds per gallon of diesel consumed. Accordingly, this alternative would produce over 28 million pounds of greenhouse gas.

This alternative represents a significant adverse effect in the short-term; however, the RAOs would be achieved once the soil/fill is removed from the BCP Site 1 and backfill soils are in place (est. 2-3 years).

Implementability – Significant technical and administrative implementability issues would be encountered in construction of this unrestricted use alternative. Technical implementability issues include, but are not limited to: shoring/stabilizing excavation sidewalls to prevent sloughing during the deep excavation; the need for construction, maintenance, and operation of dewatering facilities; groundwater and/or stormwater handling, treatment and/or discharge/disposal; and traffic coordination for trucks entering and exiting Interstate 86. Administrative implementability issues may include: the need to coordinate and secure disposal contracts with numerous permitted off-site landfills, as no single location would be able to accept the volume of soil/fill generated under this alternative; difficulty locating local borrow sources for such a large volume of backfill; and the need for rezoning of the area to allow for unrestricted uses, which are not consistent with current surrounding land-use or the reasonably anticipated future use of BCP Site 1.

Cost-Effectiveness – The remedial costs for implementation of Alternative 1A are estimated at $115.6 million, not including potential costs for dewatering saturated soil/fill prior to off-site transport and disposal. Since the majority of the impacted soil/fill will be removed under this alternative, LNAPL removal and groundwater monitoring are not deemed necessary and are therefore not included in the cost estimate provided in Table 8-2.

Land Use – This alternative, although inconsistent with the reasonably anticipated future use of BPC Site 1, would not preclude commercial redevelopment.

Community Acceptance – Community acceptance will be evaluated based on comments to be received from the public in response to Fact Sheets and other planned Citizen Participation activities.

8.7.2.2 Alternative 1-B: Commercial Use (Track 4) Cleanup

Alternative 1-B would remediate BCP Site 1 to Part 375 restricted-commercial use in accordance with SSALs and include the following components:

- Limited excavation and off-site disposal of metals-, PAH-, and PCB-impacted surface/near-surface soil/fill AOCs described in Section 8.7.1.
- Removal, cleaning, and off-site recycling or cleaning/capping in-place of abandoned subsurface product piping. Pipe contents would be disposed or recycled off-site.
- Ex-situ treatment of GCPS soil/fill via force-vented biopiles and on-site subsurface reuse of the treated soil/fill.
- Installation of an in-situ SVE system to treat unsaturated GCPS soil/fill to 15 fbgs. The water table is typically greater than 15 fbgs. No areas of perched water (i.e., above 15 fbgs) were observed on BCP Site 1.
- Groundwater treatment through LNAPL recovery from monitoring wells via high vacuum extraction (and/or DPE), passive skimmers, and/or absorbent socks in select wells with historically measurable LNAPL (i.e., Wells W5, W7, S9, W10, and W27).
- Placement of a soil cover over those portions of BCP Site 1 not redeveloped and covered by pavement or buildings. The system would include a demarcation layer (e.g., plastic netting) beneath the soil cover.
- Excavation of a clean utility corridor.
- Installation of active sub-slab depressurization (ASD) systems in future buildings.
- Implementation of a SMP. For any BCP Site not cleaned up to NYSDEC Part 375 unrestricted SCOs, preparation of an SMP that describes site-specific Institutional Controls and/or Engineering Controls (IC/EC) is a required component of the final remedy. The SMP will include the following components: IC/EC Plan; Operations and Maintenance (O&M) Plan; Excavation Work Plan; Site Monitoring Plan; and Environmental Easement.

Overall Protectiveness of Public Health and the Environment – This alternative meets NYSDEC requirements for a Track 4 cleanup under the BCP regulations and is

protective of public health and the environment. The RAOs for the Site would be satisfied through the planned extent of remedial activities, including: removal and off-site disposal of GCPS and soil/fill AOCs; removal of subsurface piping and off-site disposal/recycling of pipe contents; on-site ex-situ treatment of certain shallow GCPS soil/fill; in-situ treatment of deeper GCPS soil/fill; installation of ASD systems in future buildings to mitigate potential VOC vapor intrusion concerns; and the use of IC/ECs to prevent potential future exposure, and limit the future use to commercial purposes. Impacted groundwater will be addressed through source removal (i.e., GCPS and soil/fill AOCs excavation and/or treatment, and removal of product from subgrade piping), active/passive LNAPL removal from groundwater monitoring wells, and monitored natural attenuation (MNA).

Compliance with SCGs – The planned remedial activities would need to be performed in accordance with applicable, relevant, and appropriate SCGs (see Table 8-1). Imported cover material would need to meet backfill quality criteria per 6NYCRR Part 375. Borrow source mining would require a permit and storm water pollution prevention plan (SWPPP) for all disturbed areas greater than 1 acre. Vegetative cover stripping and cover placement would be performed under the BCP and require an equivalent SWPPP to address on-site impacts. Subgrade preparation activities would necessitate preparation of and adherence to a community air monitoring plan in accordance with Appendices 1A and 1B of DER-10. The planned remedial actions are fully protective of public health and the environment, and achieve all RAOs for BCP Site 1.

Long-Term Effectiveness and Permanence – Removal/treatment of GCPS and soil/fill AOCs as well as construction of a soil cover system would prevent direct contact with soil/fill exceeding SSALs or CSCOs. Periodic inspection and maintenance of the cover and possible repair of the soil and vegetative layers would be required to assure long-term cover integrity. SVE and FVBP will effectively and permanently reduce VOCs from subsurface soil/fill. Removal of subgrade piping containing product will remove potential source areas. All treatment and removal activities will prevent degradation of groundwater. ASD systems in future buildings will mitigate potential VOC vapor intrusion concerns. The SMP will include: an O&M Plan to confirm that engineering controls, including the SVE and ASD system(s) and soil cover, are operating and being maintained in accordance with the SMP; an Excavation Work Plan to address any impacted soil/fill encountered during post-

development maintenance activities; and a Site-wide inspection program to assure that the IC/ECs placed on BCP Site 1 have not been altered and remain effective. Furthermore, an Environmental Easement for BCP Site 1 will be filed with Cattaraugus County, which will limit the future use of BCP Site 1 to commercial or industrial activity, restrict groundwater use, and reference the Department-approved SMP. As such, this alternative will provide long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Removal of GCPS and soil/fill AOCs would permanently and significantly reduce the toxicity, mobility, and volume of the soil/fill that could potentially be contacted or produce localized areas of environmental impact at BCP Site 1. Ex-situ treatment of soil/fill via FVBP, in-situ treatment of soil/fill via SVE, removal of product from subgrade piping, and removal of LNAPL from groundwater would reduce the toxicity, mobility, and volume of contamination on BCP Site 1. Accordingly, this alternative satisfies this criterion.

Short-Term Effectiveness and Impacts – Installation/operation of the in-situ SVE and ex-situ FVBP systems; cover soil placement; and LNAPL removal will not cause significant adverse short-term effects. During intrusive remedial activities (e.g., soil/fill excavation, subsurface piping removal), air monitoring will be performed to assure conformance with community air monitoring action levels. The potential for chemical exposures and physical injuries are reduced through safe work practices; proper personal protection equipment; environmental monitoring; establishment of work zones and Site control; and appropriate decontamination procedures. The GCPS and soil/fill AOC excavation and subsurface piping removal will be completed within approximately six months, limiting short-term adverse effects. Planned remedial activities will be performed in accordance with an approved Remedial Action Work Plan, including health and safety plan (HASP), community air monitoring plan (CAMP), and soil erosion measures during subgrade preparation and soil cover placement. This alternative achieves the RAOs for BCP Site 1.

Implementability – No significant technical or administrative implementability issues are associated with this alternative.

Cost-Effectiveness – The estimated capital cost for Alternative 1-B is $2.8 million, including: one-third of the site-wide costs presented in Table 8-3; GCPS and soil/fill AOC removal and off-site disposal; removal and off-site disposal of abandoned subsurface piping and pipe contents or capping/cleaning of piping; construction of a 12-inch soil cover system over the entire 25.099 acres; excavation of a clean utility corridor; installation and operation of the in-situ SVE and ex-situ FVBP systems; installation of LNAPL removal devices in monitoring wells; and development of an SMP. OM&M costs are estimated to be $876,000 and include FVBP and SVE system O&M (2-3 years) as well as 30 years of LNAPL recovery/disposal, groundwater monitoring, soil cover maintenance, and annual certifications. Therefore, the total estimated remedial cost to implement Alternative 1-B is $3.7 million. Table 8-3 provides a breakdown of these costs.

Land Use – Based on the land use evaluation in Section 8.5.1, reuse of BCP Site 1 in a commercial capacity is consistent with past and current development and zoning on-site and within the vicinity of BCP Site 1, and does not pose additional environmental or public health risk.

Community Acceptance – Community acceptance will be evaluated based on comments to be received from the public in response to Fact Sheets and other planned Citizen Participation activities.

8.7.3 Comparison of Remedial Alternatives

The previous sections describe and evaluate the remedial alternatives for BCP Site 1 against the screening criteria. Table 8-4 provides a comparison of the alternatives by media to identify appropriate remedial measures that will achieve the RAOs for the Site.

8.7.4 Preferred Remedial Alternative

The proposed remedial approach for BCP Site 1 is *Alternative 1-B: Commercial Use (Track 4) Cleanup* because it is fully protective of public health and the environment; is significantly less disruptive to the community; is consistent with current and future land use; and represents a more cost-effective approach than Alternative 1-A while fully satisfying the RAOs.

The components and details of the remedial approach will be more fully described in a Remedial Action Work Plan to be submitted to the NYSDEC for approval. In summary, this alternative would involve:

- Excavation of an estimated 2,745 cubic yards of non-hazardous metals-, PAH-, and PCB-impacted soil/fill AOCs followed by off-site disposal at a permitted commercial solid waste landfill.
- Removal and/or cleaning/capping of an estimated 22,500 linear feet of abandoned subsurface product piping. The piping will be cleaned and capped or recycled off-site; all pipe contents will be containerized, characterized, and disposed/recycled off-site.
- Installation of an ex-situ FVBP system to remediate GCPS soil/fill generated during abandoned piping excavations (estimated to be the majority of the approximate 1,150 cubic yards) and clean corridor excavation. FVBP effluent air will be treated with a biofilter.
- Installation of an in-situ SVE system to remediate the approximately 38,730 square feet of GCPS soil/fill from 6-15 fbgs. The SVE system will consist of an estimated five SVE wells screened between 2 and 15 fbgs and installed on 50-foot centers (more or less as determined by field operational experience). These wells will be manifolded together and connected to one centrally located blower on BCP Site 1. SVE effluent air will be treated with a biofilter.
- GCPS encountered during remedial activities will be treated via FVBP or SVE.
- The biofilter will be operated in general accordance with 6NYCRR Part 212 and has been determined to meet the guidelines established in DAR Air-Guide 1 (see Appendix L).
- Placement of a soil cover system over the entire 25.099-acre BCP Site, including a demarcation layer and at least one foot of approved cover material, or impervious materials such as asphalt roads and concrete building foundations, slabs or walkways. Approved cover material will meet NYSDEC DER-10 standards for commercial sites (i.e., lower of Part 375 public health or groundwater protection values for restricted-commercial sites).
- Excavation of a clean corridor to lay future utilities for redevelopment. Figure 8-5 shows the location of the planned utility corridor.
- LNAPL recovery in monitoring wells W5, W7, W9, W10, W27, and MW-4s (and others if necessary) via HVE, DPE, passive skimmer, and/or adsorbent socks until LNAPL is no longer measureable. Wells proximate to planned SVE wells may be converted to DPE wells.

- An ASD system within future buildings on BCP Site 1 to mitigate potential VOC vapor intrusion concerns.
- Implementation of a SMP that will include:
  - Institutional Controls and Engineering Controls (IC/EC) Plan. Engineering controls include any physical barrier or method employed to actively or passively contain, stabilize, or monitor contaminants; restrict the movement of contaminants; or eliminate potential exposure pathways to contaminants. Institutional controls at the site will include groundwater use restrictions, provision of soil vapor intrusion protection for any buildings, and restrictions on the use of the site (i.e., for commercial/industrial purposes). Adherence to these Institutional Controls is required by the Environmental Easement and will be implemented under this Site Management Plan.
  - Operation and Maintenance Plan that describes the measures necessary to operate, monitor, and maintain the mechanical components of the in-situ SVE, ex-situ FVBP, LNAPL recovery, and ASD systems including criteria for system shutdown.
  - Excavation Work Plan to assure that future intrusive activities and soil/fill handling at the Site are completed in a safe and environmentally responsible manner.
  - Site Monitoring Plan that includes provisions for a groundwater monitoring plan and a Site-wide inspection program to assure that the IC/ECs have not been altered and remain effective.
  - Environmental Easement filed with Cattaraugus County.

8.8 Olean Redevelopment BCP Site 2

8.8.1 Estimated Areas and Volumes by Media

The IRMs completed during 2009-2011 are discussed in Sections 1.3.6 through 1.3.8, and shown on Figure 1-4.

8.8.1.1 Surface/Near-Surface Soil/Fill

<u>GCPS Soil/Fill Areas</u>

Figure 8-1 shows the areas on BCP Site 2 with GCPS soil/fill from 0-2 fbgs and 2-6 fbgs. The approximate extent of impact is described below:

- 2-GCPS-1s covers an approximate 12,200-square foot area with impact from 2-6 fbgs with a smaller 2,900-square foot area with impact from 0-2 fbgs. The total in-place volume is approximately 2,000 cubic yards.
- 2-GCPS-2s covers an approximate 1,900-square foot area with an average 4-foot depth for an in-place volume of approximately 280 cubic yards.
- 2-GCPS-3s covers an approximate 2,100-square foot area with an average 4-foot depth for an in-place volume of approximately 310 cubic yards.

Therefore, the total volume of GCPS soil/fill from 0-6 fbgs on BCP Site 2 is approximately 2,590 cubic yards. The majority of this GCPS soil/fill will be excavated during removal of the abandoned subsurface product piping discussed in Section 8.6.1.4.

Metals-Impacted Soil/Fill AOCs

The estimated areal and vertical extent of near-surface (0-6 fbgs) metals-impacted soil/fill AOCs is illustrated on Figure 8-6 and described below:

- Area 2-AS-1: Arsenic was detected above the SSAL of 90 mg/kg in the vicinity of SB57A. The maximum extent of the impact is estimated to span a 10,300-square foot area with an average depth of 2 fbgs as well as a 2,700-square foot area from 2-6 fbgs. The total in-place volume of arsenic impact is approximately 1,200 cubic yards.
- Area 2-HG-1: Mercury was detected above the SSAL of 9 mg/kg in the vicinity of TPSB2. The maximum extent of the impact covers an approximate 1,500-square foot area from 0-2 fbgs, for a corresponding in-place volume of approximately 110 cubic yards.

Therefore, the approximate in-place volume of near-surface soil/fill on BCP Site 2 impacted by arsenic is 1,200 cubic yards and mercury is 110 cubic yards. One sample (SB57A) exhibited hazardous waste characteristics for arsenic during W&C's 2009 SRI. However, additional 0-2 fbgs grab samples were collected from four locations 5 to 10 feet from sample SB57A and composited to create waste characterization sample WC-SB57-As; the TCLP arsenic concentration was less than the method detection limit of 0.033 mg/L. Therefore, an estimated 20-foot by 20-foot area with an average depth of 2 feet (30 cubic yards) is considered characteristically hazardous for arsenic and will be handled as a hazardous waste. The 2012 TCLP mercury result indicates non-hazardous soil/fill.

8.8.1.2 Subsurface Soil/Fill

Figure 8-1 shows the two areas of GCPS impact to subsurface soil/fill (6 to 15 fbgs) on BCP Site 2 as described below:

- 2-GCPS-1d covers an approximate 37,000-square foot area with impact from 6-15 fbgs, for an in-place volume of approximately 12,300 cubic yards.
- 2-GCPS-2d covers an approximate 32,600-square foot area with impact from 6-15 fbgs, for an in-place volume of approximately 11,900 cubic yards.

Therefore, the total in-place volume of GCPS soil/fill from 6-15 fbgs on BCP Site 2 is approximately 24,200 cubic yards.

8.8.1.3 Groundwater

As illustrated by Figure 4-7, the distribution of total VOCs (VOC plus TICs on Figure 4-8) in groundwater shows the highest concentrations in Well W17 along the western end of BCP Site 2 suggesting dissolved-phase VOCs are possibly migrating onto BCP Site 2 and/or the high concentration of subgrade piping potentially containing product and shallow GCPS are potentially acting as source areas.

As discussed in Section 7.1.7.2, higher concentrations of total VOCs and VOC TICs were detected in upgradient, off-site Well MWPW-7S located on the former Van Der Horst Plant No. 2 than in Well W16 located on the northwestern boundary of BCP Site 2, suggesting the possibility that contaminated groundwater is migrating onto BCP Site 2 toward Well W16.

The following LNAPL thicknesses were observed during W&C's February and August 2012 gauging events (see Table 4-16 and Figure 4-7): Wells W14 (0.68' and 5.85') and WCMW1 (0.00' and 0.61'). As discussed in Section 6.5.1, LNAPL thickness varies with the elevation of the groundwater table. During the August 2012 SRI, no LNAPL was detected in the three wells sampled (i.e., Wells W3, W4, and W30).

8.8.1.4 Subsurface Product Piping

Based on W&C's piping assessment, all known abandoned subgrade product conveyance piping on BCP Site 2 (estimated 28,000 linear feet) will either be removed and transported off-site for disposal/recycling (estimated 300 tons) or cleaned and capped. As illustrated by Figure 4-13, the majority of the 2,590 cubic yards of surface/near-surface

GCPS soil/fill on BCP Site 2 is present in subsurface piping areas. The GCPS soil/fill will be excavated and treated on-site using force-vented biopiles.

For cost estimating purposes, it has been assumed that approximately 7,500 gallons of non-hazardous and approximately 2,500 gallons of hazardous material (i.e., product/pipe scale) contained in the piping will require off-site disposal. The quantity of product/pipe scale per linear foot of piping was estimated based on TurnKey's experience with piping at other former refinery sites.

8.8.2 Identification of Remedial Alternatives for BCP Site 2

The following two remedial alternatives have been developed in accordance with the General Response Actions and NYSDEC regulation and policy:

- Alternative 2-A: Unrestricted Use (Track 1) Cleanup
- Alternative 2-B: Commercial Use (Track 4) Cleanup

8.8.2.1 Alternative 2-A: Unrestricted Use (Track 1) Cleanup

Alternative 2-A for BCP Site 2 consists of excavation and off-site disposal of all soil/fill that contains chemical constituents at concentrations greater than 6 NYCRR Part 375 SCOs for unrestricted use and/or has evidence of grossly contaminated media. Achieving these Track 1 remediation goals (Section 4 and Part 4.4 (d)(2) of DER-10) obviates the need for engineering and institutional controls. For unrestricted use scenarios, excavation and off-site disposal of impacted soil/fill is generally regarded as the most applicable remedial measure, because engineering controls cannot be used to supplement the remedy.

Due to the widespread exceedance of these SCOs, it is assumed that the entire 9.033 acres of BCP Site 2 to an average depth of 20 fbgs would require excavation with transport of the excavated soil/fill to and disposal at a permitted, off-site commercial disposal facility. Therefore, the estimated total in-place volume of soil/fill removed from BCP Site 2 and disposed off-site is approximately 300,000 cubic yards (480,000 tons). Based on TCLP testing during the investigations, the excavated soil/fill is considered non-hazardous and would be transported to a commercial solid waste disposal facility. A small area of soil/fill exhibited hazardous waste characteristics for arsenic in the 0-2 fbgs interval (est. 30 cubic yards) and would therefore be transported to a permitted hazardous landfill or treated to

render it non-hazardous followed by disposal at an off-site commercial solid waste disposal facility.

Excavated soil/fill would require handling and preparation for off-site transportation and disposal. If necessary, a dewatering system would be installed to facilitate excavation activities. Water generated during the dewatering activities would be treated on-site via temporary water treatment system and then discharged to the sanitary sewer under a temporary discharge permit. On-site dewatering of saturated soil/fill may be required prior to off-site disposal; however, these potential costs have not been included in the estimate presented below. Asphalt/concrete and existing subsurface piping would be located and removed prior to initiating excavation activities. Excavated areas would be backfilled with an estimated 300,000 cubic yards of material meeting the BCP criteria presented in DER-10 and further in 6NYCRR Part 375 to the pre-excavation elevations and grades, and all disturbed areas would be restored with topsoil and grass seeding, or hardscape if redevelopment activities have been approved.

Based on the removal of source area material (i.e., subgrade product piping and impacted soil/fill), groundwater concentration would be expected to decrease over time. Therefore, LNAPL removal and groundwater monitoring have not been included in this alternative. However, a restriction on groundwater use may be included as a component of the remedial program per 6NYCRR Part 375-3.8(e)(1)(iii).

Overall Protectiveness of Public Health and the Environment – Excavation and off-site disposal to unrestricted use SCOs would be protective of public health under any reuse scenario. However, this alternative would permanently use and displace approximately 300,000 cubic yards of valuable landfill airspace, causing ancillary environmental issues due to reduced landfill capacity, and would require excavating, transporting, and placing 300,000 cubic yards of clean soil from an off-site borrow source to backfill the excavation, also contributing to significant detrimental off-site environmental issues.

Compliance with SCGs – Excavation and off-site disposal would need to be performed in accordance with applicable, relevant, and appropriate SCGs. Soil excavation activities would necessitate preparation of and adherence to a community air monitoring plan in accordance with Appendices 1A and 1B of DER-10.

Long-Term Effectiveness and Permanence – This alternative would remove all impacted soil/fill and subsurface piping and therefore provide long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Through removal of all impacted soil/fill, this alternative would permanently and significantly reduce the toxicity, mobility, and volume of contamination on BCP Site 2. However, since this alternative transfers impacted soil/fill from one environment to another, an overall reduction of toxicity and volume would not occur, although mobility would be significantly reduced in a commercial landfill with a liner, leachate collection, and a cover system.

Short-Term Impacts and Effectiveness – The principal advantage of a large-scale excavation to achieve unrestricted SCOs is reliability of effectiveness in the long-term. The short-term adverse impacts and risks to the community, workers, and environment during implementation of this alternative are significant. Site workers would be required to wear PPE during excavation to prevent direct contact with soil/fill. Dust control methods would be required to limit the release of particulates during placement of the backfill soils. Fugitive odors during excavation and hauling of impacted soil/fill would be released to the air presenting a nuisance condition and potential health hazard to workers. Physical hazards, primarily related to potential accidents from heavy truck traffic, would be expected as the excavation work would require removal of approximately 22,000 truckloads of soil and import of a similar number of clean loads from the borrow source. Substantial disruption of the neighboring community would occur due to material transport and deliveries and noise from heavy equipment used to construct the remedy. This action would result in stormwater impacts at the borrow source(s) and on-site; diesel fuel consumption on the order of 330,000 gallons (assuming 120 miles round trip to a local landfill; 8 miles per gallons), with several thousands of gallons also consumed by excavation and grading equipment. The USEPA's estimated CO_2 generation rate for diesel engines is approximately 22.2 pounds per gallon of diesel consumed. Accordingly, this alternative would produce over 7 million pounds of greenhouse gas.

This alternative represents a significant adverse effect in the short-term; however, the RAOs would be achieved once the soil/fill is removed from BCP Site 2 and backfill soils are in place (est. 1-2 years).

Implementability – Significant technical and administrative implementability issues would be encountered in construction of this unrestricted use alternative. Technical implementability issues include, but are not limited to: shoring/stabilizing excavation sidewalls to prevent sloughing during the deep excavation; the need for construction, maintenance, and operation of dewatering facilities; groundwater and/or stormwater handling, treatment and/or discharge/disposal; and traffic coordination for trucks entering and exiting Interstate 86. Administrative implementability issues may include: the need to coordinate and secure disposal contracts with numerous permitted off-site landfills, as no single location would be able to accept the volume of soil/fill generated under this alternative; difficulty locating local borrow sources for such a large volume of backfill; and the need for rezoning of the area to allow for unrestricted uses, which are not consistent with current surrounding land-use or the reasonably anticipated future use of BCP Site 2.

Cost-Effectiveness – The remedial costs for implementation of Alternative 2A are estimated at $28.8 million, not including potential costs for dewatering saturated soil/fill prior to off-site transport and disposal. Since the majority of the impacted soil/fill will be removed under this alternative, LNAPL removal and groundwater monitoring are not deemed necessary and are therefore not included in the cost estimate provided in Table 8-5.

Land Use – This alternative, although inconsistent with the reasonably anticipated future use of BCP Site 2, would not preclude commercial redevelopment.

Community Acceptance – Community acceptance will be evaluated based on comments to be received from the public in response to Fact Sheets and other planned Citizen Participation activities.

8.8.2.2 Alternative 2-B: Commercial Use (Track 4) Cleanup

Alternative 2-B would remediate BCP Site 2 to Part 375 restricted-commercial use in accordance with SSALs and include the following components:

- Limited excavation and off-site disposal of metals-impacted surface/near-surface soil/fill AOCs described in Section 8.8.1.
- Removal, cleaning, and off-site recycling or cleaning/capping in-place of abandoned subsurface product piping. Pipe contents would be disposed or recycled off-site.
- Ex-situ treatment of GCPS soil/fill via force-vented biopiles and on-site subsurface reuse of the treated soil/fill.
- Installation of an in-situ SVE system to treat unsaturated GCPS soil/fill to 15 fbgs. The water table is typically greater than 15 fbgs. During the 2012 SRI, perched water was encountered in one area on BCP Site 2 during installation of a pilot-scale SVE well. However, only one measurement in Well W17 (14.72 fbgs) was recorded below 15 fbgs during the February 2012 sampling event. Therefore, it is unlikely that significant saturated soil/fill is present within the area for in-situ SVE. If water is encountered during installation of a full-scale SVE well, the well will be completed to top of water at that isolated location. If significant saturated soils are encountered, then the SVE well(s) in that area may be converted to DPE wells.
- Groundwater treatment through LNAPL recovery from monitoring wells via high vacuum extraction (and/or DPE), passive skimmers, and/or absorbent socks in select wells with historically measurable LNAPL (i.e., Wells WCMW-1 and W14).
- Placement of a soil cover over those portions of BCP Site 2 not redeveloped and covered by pavement or buildings. The system would include a demarcation layer (e.g., plastic netting) beneath the soil cover.
- Excavation of a clean utility corridor.
- Installation of ASD systems in future buildings.
- Implementation of a Site Management Plan (SMP). For any BCP Site not cleaned up to NYSDEC Part 375 unrestricted SCOs, preparation of an SMP that describes site-specific IC/EC is a required component of the final remedy. The SMP will include the following components: IC/EC Plan; O&M Plan; Excavation Work Plan; Site Monitoring Plan; and Environmental Easement.

Overall Protectiveness of Public Health and the Environment – This alternative meets NYSDEC requirements for a Track 4 cleanup under the BCP regulations and is protective of public health and the environment. The RAOs for BCP Site 2 would be satisfied through the planned extent of remedial activities, including: removal and off-site disposal/recycling of GCPS and soil/fill AOCs; removal of subsurface piping and off-site disposal of pipe contents; on-site ex situ treatment of certain shallow GCPS soil/fill; in situ

treatment of deeper GCPS soil/fill; installation of ASD systems in future buildings to mitigate potential VOC vapor intrusion concerns; and, the use of IC/ECs to prevent potential future exposure, and limit the future use to commercial purposes. Impacted groundwater will be addressed through source removal (i.e., GCPS and soil/fill AOCs excavation and/or treatment, and removal of product from subgrade piping), active/passive LNAPL removal from groundwater monitoring wells, and monitored natural attenuation (MNA).

Compliance with SCGs – The planned remedial activities would need to be performed in accordance with applicable, relevant, and appropriate SCGs (see Table 8-1). Imported cover material would need to meet backfill quality criteria per 6NYCRR Part 375. Borrow source mining would require a permit and storm water pollution prevention plan (SWPPP) for all disturbed areas greater than 1 acre. Vegetative cover stripping and cover placement would be performed under the BCP and require an equivalent SWPPP to address on-site impacts. Subgrade preparation activities would necessitate preparation of and adherence to a community air monitoring plan in accordance with Appendices 1A and 1B of DER-10. The planned remedial actions are fully protective of public health and the environment, and achieve all RAOs for BCP Site 2.

Long-Term Effectiveness and Permanence – Removal/treatment of GCPS and soil/fill AOCs as well as construction of a soil cover system would prevent direct contact with soil/fill exceeding SSALs or CSCOs.. Periodic inspection and maintenance of the cover and possible repair of the soil and vegetative layers would be required to assure long-term cover integrity. SVE and FVBP will effectively and permanently reduce VOCs from subsurface soil/fill. Removal of subgrade piping containing product will remove potential source areas. All treatment and removal activities will prevent degradation of groundwater. ASD systems in future buildings will mitigate potential VOC vapor intrusion concerns. The SMP will include: an O&M Plan to confirm that engineering controls, including the SVE and ASD system(s) and soil cover, are operating and being maintained in accordance with the SMP; an Excavation Work Plan to address any impacted soil/fill encountered during post-development maintenance activities; and a Site-wide inspection program to assure that the IC/ECs placed on the Site have not been altered and remain effective. Furthermore, an Environmental Easement for BCP Site 2 will be filed with Cattaraugus County, which will

limit the future use of the Site to commercial or industrial activity, restrict groundwater use, and reference the Department-approved SMP. As such, this alternative will provide long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Removal of GCPS and soil/fill AOCs would permanently and significantly reduce the toxicity, mobility, and volume of the soil/fill that could potentially be contacted or produce localized areas of environmental impact at BCP Site 2. Ex-situ treatment of soil/fill via FVBP, in-situ treatment of soil/fill via SVE, removal of product from subgrade piping, and removal of LNAPL from groundwater would reduce the toxicity, mobility, and volume of contamination on BCP Site 2. Accordingly, this alternative satisfies this criterion.

Short-Term Effectiveness and Impacts – Installation/operation of the in-situ SVE and ex-situ FVBP systems; cover soil placement; and LNAPL removal will not cause significant adverse short-term effects. During intrusive remedial activities (e.g., soil/fill excavation, subsurface piping removal), air monitoring will be performed to assure conformance with community air monitoring action levels. The potential for chemical exposures and physical injuries are reduced through safe work practices; proper personal protection equipment; environmental monitoring; establishment of work zones and site control; and appropriate decontamination procedures. The GCPS and soil/fill AOC excavation and subsurface piping removal will be completed within approximately four months, limiting short-term adverse effects. Planned remedial activities will be performed in accordance with an approved Remedial Action Work Plan, including HASP, CAMP, and soil erosion measures during subgrade preparation and soil cover placement. This alternative achieves the RAOs for BCP Site 2.

Implementability – No significant technical or administrative implementability issues are associated with this alternative.

Cost-Effectiveness – The estimated capital cost for Alternative 2-B is $2.3 million, including: one-third of the site-wide costs presented in Table 8-3; GCPS and soil/fill AOC removal and off-site disposal; removal and off-site disposal of abandoned subsurface piping and pipe contents or capping/cleaning of piping; construction of a 12-inch soil cover system over the entire 9.033 acres; excavation of a clean utility corridor; installation and operation of

the in-situ SVE and ex-situ FVBP systems; installation of LNAPL removal devices in monitoring wells; and development of an SMP. OM&M costs are estimated to be $657,000 and include FVBP and SVE system O&M (2-3 years) as well as 30 years of LNAPL recovery/disposal, groundwater monitoring, soil cover maintenance, and annual certifications. Therefore, the total estimated remedial cost to implement Alternative 2-B is $2.9 million. Table 8-3 provides a breakdown of these costs.

Land Use – Based on the land use evaluation in Section 8.5.1, reuse of BCP Site 2 in a commercial capacity is consistent with past and current development and zoning on-site and within the vicinity of BCP Site 2, and does not pose additional environmental or public health risk.

Community Acceptance – Community acceptance will be evaluated based on comments to be received from the public in response to Fact Sheets and other planned Citizen Participation activities.

8.8.3 Comparison of Remedial Alternatives

The previous sections describe and evaluate the remedial alternatives for BCP Site 2 against the screening criteria. Table 8-4 provides a comparison of the alternatives by media to identify appropriate remedial measures that will achieve the RAOs for BCP Site 2.

8.8.4 Preferred Remedial Alternative

The proposed remedial approach for BCP Site 2 is *Alternative 2-B; Commercial Use (Track 4) Cleanup* because it is fully protective of public health and the environment; is significantly less disruptive to the community; is consistent with current and future land use; and represents a more cost-effective approach than Alternative 2-A while fully satisfying the RAOs.

The components and details of the remedial approach will be more fully described in a Remedial Action Work Plan to be submitted to the NYSDEC for approval. In summary, this alternative would involve:

- Excavation of an estimated 1,280 cubic yards of non-hazardous metals-impacted soil/fill AOCs followed by off-site disposal at a permitted commercial solid waste landfill. An estimated 30 cubic yards of arsenic-impacted soil/fill would be

disposed off-site as characteristically hazardous or treated to render it non-hazardous prior to off-site disposal.

- Removal and/or capping/cleaning of an estimated 28,000 linear feet of abandoned subsurface product piping. The piping will be cleaned and disposed/recycled off-site; all pipe contents will be containerized, characterized, and disposed off-site.
- Installation of an ex-situ FVBP system to remediate GCPS soil/fill generated during abandoned pipeline excavations (estimated to be the majority of the approximate 2,590 cubic yards), clean corridor excavation, and certain areas that exhibit surficial contamination (0-2 fbgs). FVBP effluent air will be treated with a biofilter.
- Installation of an in-situ SVE system to remediate the approximately 69,600 square feet of GCPS soil/fill from 6-15 fbgs. The SVE system will consist of SVE wells screened between 2 and 15 fbgs and placed on 50-foot centers (more or less as determined by field operational experience); seven within area 2-GCPS-1 and six within area 2-GCPS-2. These wells will be manifolded together and connected to one centrally located blower on BCP Site 2. SVE effluent air will be treated with a biofilter.
- GCPS encountered during remedial activities will be treated via FVBP or SVE.
- The biofilter will be operated in general accordance with 6NYCRR Part 212 and has been determined to meet the guidelines established in DAR Air-Guide 1 (see Appendix L).
- Placement of a soil cover system over the entire 9.033-acre BCP Site, including a demarcation layer and at least one foot of approved cover material, or impervious materials such as asphalt roads and concrete building foundations, slabs or walkways. Approved cover material will meet NYSDEC DER-10 standards for commercial sites (i.e., lower of Part 375 public health or groundwater protection values for restricted-commercial sites).
- Excavation of a clean corridor to lay future utilities for redevelopment. Figure 8-5 shows the location of the planned utility corridor.
- LNAPL recovery in monitoring wells WCMW1, WCMW4, and W14 (and others if necessary) via HVE, DPE, passive skimmers, and/or adsorbent socks until LNAPL is no longer measureable. Wells proximate to planned SVE wells may be converted to DPE wells.
- An ASD system within future buildings on BCP Site 2 to mitigate potential VOC vapor intrusion concerns.
- Implementation of a SMP that will include:

- Institutional Controls and Engineering Controls (IC/EC) Plan. Engineering controls include any physical barrier or method employed to actively or passively contain, stabilize, or monitor contaminants; restrict the movement of contaminants; or eliminate potential exposure pathways to contaminants. Institutional controls at the site will include groundwater use restrictions, a requirement for evaluation of soil vapor intrusion potential for any buildings, and restrictions on the use of the site (i.e., commercial purposes). Adherence to these Institutional Controls is required by the Environmental Easement and will be implemented under this Site Management Plan.
- Operation and Maintenance Plan that describes the measures necessary to operate, monitor, and maintain the mechanical components of the in-situ SVE, ex-situ FVBP, LNAPL recovery, and ASD systems including criteria for system shutdown.
- Excavation Work Plan to assure that future intrusive activities and soil/fill handling at the Site are completed in a safe and environmentally responsible manner.
- Site Monitoring Plan that includes provisions for a groundwater monitoring plan and a Site-wide inspection program to assure that the IC/ECs have not been altered and remain effective.
- Environmental Easement filed with Cattaraugus County.

8.9 Olean Redevelopment BCP Site 3

8.9.1 Estimated Areas and Volumes by Media

The IRMs completed during 2009-2011 are discussed in Sections 1.3.6 through 1.3.8, and shown on Figure 1-4.

8.9.1.1 Surface/Near-Surface Soil/Fill

<u>GCPS Soil/Fill Areas</u>

Figure 8-1 shows the areas on BCP Site 3 with GCPS soil/fill from 0-2 fbgs and 2-6 fbgs. The approximate extent of impact is described below:

- The four distinct areas with GCPS from 0-2 fbgs cover a total area of approximately 36,100 square feet, for a total in-place volume of approximately 2,670 cubic yards.

- The 10 separate areas with GCPS from 2-6 fbgs cover a total area of approximately 132,000 square feet, for a total in-place volume of approximately 19,560 cubic yards.

Therefore, the total volume of GCPS soil/fill from 0-6 fbgs on BCP Site 3 is approximately 22,230 cubic yards. Approximately half of this GCPS soil/fill will be excavated during removal of the abandoned subsurface piping discussed in Section 8.6.1.4.

Metals-Impacted Soil/Fill AOCs

The estimated areal and vertical extent of near-surface (0-6 fbgs) metals-impacted soil/fill AOCs is illustrated on Figures 8-7 and 8-8 and described below:

- Area 3-AS-1: Arsenic was detected above the SSAL of 90 mg/kg in the vicinity of SB56. The maximum extent of the impact is estimated to span an 11,800-square foot area with an average depth of 2 fbgs, for a total in-place volume of approximately 880 cubic yards.
- Area 3-AS-2: Arsenic was detected slightly above the SSAL of 90 mg/kg in the vicinity of AS22. The maximum extent of the impact is estimated to span a 6,160-square foot area with an average depth of 2 fbgs, for a total in-place volume of approximately 460 cubic yards.
- Area 3-PB-1: Lead was detected above the SSAL of 2,000 mg/kg in the vicinity of SB48, the former IRM excavation area. The maximum extent of the impact covers an approximate: 36,000-square foot area from 0-2 fbgs; 13,300-square foot area from 2-4 fbgs; 5,000-square foot area from 4-6 fbgs; and 2,100-square foot area from 6-8 fbgs; for a total in-place volume of approximately 4,200 cubic yards. This area extends to include the lead exceedance at SB44.

Therefore, the approximate in-place volume of near-surface soil/fill on BCP Site 3 impacted by arsenic is 1,340 cubic yards and lead is 4,200 cubic yards. None of the arsenic samples tested exhibited hazardous waste characteristics for arsenic and will be disposed as non-hazardous. All six samples collected from Area 3-PB-1 in 2012 and analyzed for TCLP lead exceeded the TCLP lead limit of 5 mg/L indicating the soil/fill is characteristically hazardous. Therefore, it has been assumed that the 4,200 cubic yards of lead-impacted soil/fill will require on-site stabilization to render it non-hazardous.

8.9.1.2 Subsurface Soil/Fill

GCPS Soil/Fill Areas

The three areas of GCPS subsurface soil/fill (6 to 15 fbgs) on BCP Site 3 are shown on Figure 8-1 and described below:

- 3-GCPS-1d covers an approximate 6,540-square foot area with impact from 6-15 fbgs, for an in-place volume of approximately 2,180 cubic yards.
- 3-GCPS-2d covers an approximate 471,740-square foot area with impact from 6-15 fbgs, for an in-place volume of approximately 157,250 cubic yards.
- 3-GCPS-3d covers an approximate 4,330-square foot area with impact from 6-15 fbgs, for an in-place volume of approximately 1,450 cubic yards.

Therefore, the total in-place volume of GCPS soil/fill from 6-15 fbgs on BCP Site 3 is approximately 160,880 cubic yards. The aerial extent of GCPS subsurface soil/fill is approximately 45% (11 acres) of the BCP Site 3.

8.9.1.3 Groundwater

As illustrated by Figure 4-7, the distribution of total VOCs (VOCs plus TICs on Figure 4-8) in groundwater shows the highest concentrations in monitoring well MW-5 on the upgradient, northwestern portion of BCP Site 3, and in downgradient Well W29. As discussed in Section 7.1.7.2, the NYSDEC concluded that widespread dissolved groundwater contamination is present in the shallow aquifer on the adjacent, upgradient Van der Horst Plant No. 2 property; therefore, it is possible that contaminated groundwater from the Van der Horst property is migrating toward Well MW-5, located at the northern boundary of BCP Site 3.

The majority of the on-site upgradient wells are no longer sampled since analytical results indicate no impacts. Therefore, groundwater impacted by VOCs is primarily located along the southern portion of BCP Site 3, with the highest VOC concentrations detected in Wells MW-9S, W25, and W29 (in addition to Well MW-5 in the western corner of the Site). Groundwater on BCP Site 3 flows off-site to the south, southwest, and southeast.

LNAPL has been historically observed downgradient of MW-5 in monitoring wells W22 and W24; however, LNAPL was not observed in newly installed (2012) monitoring well W29 along the southwestern (downgradient) boundary of BCP Site 3. The following LNAPL thicknesses were observed during W&C's February and August 2012 gauging events (see

Table 4-16 and Figure 4-7): Wells W22 (0.00' and 0.11') and W24 (0.18' and 0.00'). As discussed in Section 6.5.1, LNAPL thickness varies with the elevation of the groundwater table.

8.9.1.4 Subsurface Product Piping

Based on W&C's piping assessment, all known abandoned subgrade product conveyance piping on BCP Site 3 (estimated 44,000 linear feet) will either be removed and transported off-site for disposal/recycling (estimated 480 tons)or cleaned and capped. As illustrated by Figure 4-17, approximately 50% of the 22,230 cubic yards of surface/near-surface GCPS soil/fill on BCP Site 3 is present within these subgrade piping areas. The GCPS soil/fill will be excavated and treated on-site using force-vented biopiles.

For cost estimating purposes, it has been assumed that approximately 11,800 gallons of non-hazardous and approximately 3,900 gallons of hazardous material (i.e., product/pipe scale) contained in the piping will require off-site disposal. The quantity of product/pipe scale per linear foot of piping was estimated based on TurnKey's experience with piping at other former refinery sites.

8.9.2 Identification of Remedial Alternatives for BCP Site 3

The following two remedial alternatives have been developed in accordance with the General Response Actions and NYSDEC regulation and policy:

- Alternative 3-A: Unrestricted Use (Track 1) Cleanup
- Alternative 3-B: Commercial Use (Track 4) Cleanup

8.9.2.1 Alternative 3-A: Unrestricted Use (Track 1) Cleanup

Alternative 3-A for BCP Site 3 consists of excavation and off-site disposal of all soil/fill that contains chemical constituents at concentrations greater than 6 NYCRR Part 375 SCOs for unrestricted use and/or has evidence of grossly contaminated media. Achieving these Track 1 remediation goals (Section 4 and Part 4.4 (d)(2) of DER-10) obviates the need for engineering and institutional controls. For unrestricted use scenarios, excavation and off-site disposal of impacted soil/fill is generally regarded as the most applicable remedial measure, because engineering controls cannot be used to supplement the remedy.

Due to the widespread exceedance of these SCOs, it is assumed that the entire 24.103 acres of BCP Site 3 to an average depth of 32 fbgs would require excavation with transport of the excavated materials to and disposal at a permitted, off-site disposal facility. Therefore, the estimated total volume of impacted soil/fill that would be removed from BCP Site 3 and disposed off-site is approximately 1.25 million cubic yards (2.0 million tons). Based on TCLP testing during the investigations, the excavated soil/fill is considered non-hazardous and would be transported to a commercial solid waste disposal facility. One area of soil/fill (3-PB-1) tested characteristically hazardous for lead (est. 4,200 cubic yards) and would therefore be treated on-site to render it non-hazardous followed by disposal at an off-site commercial solid waste disposal facility.

Excavated materials would require handling and preparation for off-site transportation and disposal. If necessary, a dewatering system would be installed to facilitate excavation activities. Water generated during the dewatering activities would be treated on-site via temporary water treatment system and then discharged to the sanitary sewer under a temporary discharge permit. On-site dewatering of saturated soil/fill may be required prior to off-site disposal; however, these potential costs have not been included in the estimate presented below. Asphalt/concrete and existing subsurface piping would be located and removed prior to initiating excavation activities. Excavated areas would be backfilled with an estimated 1.25 million cubic yards of material meeting the BCP criteria presented in DER-10 and further in 6 NYCRR Part 375 to the pre-excavation elevations and grades, and all disturbed areas would be restored with topsoil and grass seeding, or hardscape if redevelopment activities have been approved.

Based on the removal of source area material (i.e., subgrade product piping and impacted soil/fill), groundwater concentrations would be expected to decrease over time. Therefore, LNAPL removal and groundwater monitoring have not been included in this alternative. However, a restriction on groundwater use may be included as a component of the remedial program per 6NYCRR Part 375-3.8(e)(1)(iii).

Overall Protectiveness of Public Health and the Environment – Excavation and off-site disposal to unrestricted use SCOs would be protective of public health under any reuse scenario. However, this alternative would permanently use and displace approximately 1.25 million cubic yards of valuable landfill airspace, causing ancillary environmental issues due to reduced landfill capacity, and would require excavating, transporting, and placing 1.25

million cubic yards of clean soil from an off-site borrow source to backfill the excavation, also contributing to significant detrimental off-site environmental issues.

Compliance with SCGs – Excavation and off-site disposal would need to be performed in accordance with applicable, relevant, and appropriate SCGs. Soil excavation activities would necessitate preparation of and adherence to a community air monitoring plan in accordance with Appendices 1A and 1B of DER-10.

Long-Term Effectiveness and Permanence – This alternative would remove all impacted soil/fill and subsurface piping and therefore provide long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Through removal of all impacted soil/fill, this alternative would permanently and significantly reduce the toxicity, mobility, and volume of contamination on BCP Site 3. However, since this alternative transfers impacted soil/fill from one environment to another, an overall reduction of toxicity and volume would not occur, although mobility would be significantly reduced in a commercial landfill with a liner, leachate collection, and a cover system.

Short-Term Impacts and Effectiveness – The principal advantage of a large-scale excavation to achieve unrestricted SCOs is reliability of effectiveness in the long-term. The short-term adverse impacts and risks to the community, workers, and environment during implementation of this alternative are significant. Site workers would be required to wear PPE during excavation to prevent direct contact with soil/fill. Dust control methods would be required to limit the release of particulates during placement of the backfill soils. Fugitive odors during excavation and hauling of impacted soil/fill would be released to the air presenting a nuisance condition and potential health hazard to workers. Physical hazards, primarily related to potential accidents from heavy truck traffic, would be expected as the excavation work would require removal of approximately 90,000 truckloads of soil and import of a similar number of clean loads from the borrow source. Substantial disruption of the neighboring community would occur due to material transport and deliveries and noise from heavy equipment used to construct the remedy. This action would result in stormwater impacts at the borrow source(s) and on-site; diesel fuel consumption on the order of 1.4

million gallons (assuming 120 miles round trip to a local landfill; 8 miles per gallons), with several thousands of gallons also consumed by excavation and grading equipment. The USEPA's estimated CO_2 generation rate for diesel engines is approximately 22.2 pounds per gallon of diesel consumed. Accordingly, this alternative would produce over 31 million pounds of greenhouse gas.

This alternative represents a significant adverse effect in the short-term; however, the RAOs would be achieved once the soil/fill is removed from BCP Site 3 and backfill soils are in place (est. 2-3 years).

Implementability – Significant technical and administrative implementability issues would be encountered in construction of this unrestricted use alternative. Technical implementability issues include, but are not limited to: shoring/stabilizing excavation sidewalls to prevent sloughing during the deep excavation; the need for construction, maintenance, and operation of dewatering facilities; groundwater and/or stormwater handling, treatment and/or discharge/disposal; and traffic coordination for trucks entering and exiting Interstate 86. Administrative implementability issues may include: the need to coordinate and secure disposal contracts with numerous permitted off-site landfills, as no single location would be able to accept the volume of soil/fill generated under this alternative; difficulty locating local borrow sources for such a large volume of backfill; and the need for rezoning of the area to allow for unrestricted uses, which are not consistent with current surrounding land-use or the reasonably anticipated future use of BCP Site 3.

Cost-Effectiveness – The remedial costs for implementation of Alternative 2A are estimated at $121.8 million, not including potential costs for dewatering saturated soil/fill prior to off-site transport and disposal. Since the majority of the impacted soil/fill will be removed under this alternative, LNAPL removal and groundwater monitoring are not deemed necessary and are therefore not included in the cost estimate provided in Table 8-6.

Land Use – This alternative, although inconsistent with the reasonably anticipated future use of BCP Site 3, would not preclude commercial redevelopment.

Community Acceptance – Community acceptance will be evaluated based on comments to be received from the public in response to Fact Sheets and other planned Citizen Participation activities.

8.9.2.2 Alternative 3-B: Commercial Use (Track 4) Cleanup

Alternative 3-B would remediate BCP Site 3 to Part 375 restricted-commercial use in accordance with SSALs and include the following components:

- Limited excavation and off-site disposal of metals-impacted surface/near-surface soil/fill AOCs described in Section 8.9.1.
- In-situ stabilization of hazardous lead-impacted soil/fill AOCs followed by placement of one foot of clean soil cover.
- Removal, cleaning, and off-site recycling or cleaning/capping in-place of abandoned subsurface product piping. Pipe contents would be disposed or recycled off-site.
- Ex-situ treatment of GCPS soil/fill via force-vented biopiles and on-site subsurface reuse of the treated soil/fill.
- Installation of an in-situ SVE system to treat unsaturated GCPS soil/fill to 15 fbgs. The water table is typically greater than 15 fbgs. No areas of perched water (i.e., above 15 fbgs) were observed on BCP Site 3.
- Groundwater treatment through LNAPL recovery from monitoring wells via high vacuum extraction (and/or DPE), passive skimmers, and/or absorbent socks in select wells with historically measurable LNAPL (i.e., Wells W22 and W24).
- Placement of a soil cover over those portions of BCP Site 3 not redeveloped and covered by pavement or buildings. The system would include a demarcation layer (e.g., plastic netting) beneath the soil cover.
- Excavation of a clean utility corridor.
- Installation of ASD systems in future buildings.
- Implementation of a SMP. For any BCP Site not cleaned up to NYSDEC Part 375 unrestricted SCOs, preparation of an SMP that describes site-specific IC/EC is a required component of the final remedy. The SMP will include the following components: IC/EC Plan; O&M Plan; Excavation Work Plan; Site Monitoring Plan; and Environmental Easement.

Overall Protectiveness of Public Health and the Environment – This alternative meets NYSDEC requirements for a Track 4 cleanup under the BCP regulations and is protective of public health and the environment. The RAOs for BCP Site 3 would be satisfied through the planned extent of remedial activities, including: removal and off-site disposal of GCPS and soil/fill AOCs; in-situ treatment of hazardous lead-impacted soil/fill; removal of subsurface piping and off-site disposal/recycling of pipe contents or

cleaning/capping of piping; on-site ex-situ treatment of certain shallow GCPS soil/fill; in-situ treatment of deeper GCPS soil/fill; planned ASD systems in future buildings to mitigate potential VOC vapor intrusion concerns; and, the use of IC/ECs to prevent potential future exposure, and limit the future use to commercial purposes. By removing, containing, and treating the on-site sources contributing to the groundwater contamination, this alternative satisfies the RAO by mitigating the potential off-site migration of groundwater contamination. Impacted groundwater will be addressed through source removal (i.e., GCPS and soil/fill AOCs excavation and/or treatment, and removal of product from subgrade piping), active/passive LNAPL removal from groundwater monitoring wells, and monitored natural attenuation (MNA).

Compliance with SCGs – The planned remedial activities would need to be performed in accordance with applicable, relevant, and appropriate SCGs (see Table 8-1). TCLP testing would be performed on stabilized lead-impacted soil/fill to confirm TCLP lead concentrations are below 5 mg/L. Imported cover material would need to meet backfill quality criteria per 6NYCRR Part 375. Borrow source mining would require a permit and SWPPP for all disturbed areas greater than 1 acre. Vegetative cover stripping and cover placement would be performed under the BCP and require an equivalent SWPPP to address on-site impacts. Subgrade preparation activities would necessitate preparation of and adherence to a community air monitoring plan in accordance with Appendices 1A and 1B of DER-10. The planned remedial actions are fully protective of public health and the environment, and achieve all RAOs for BCP Site 3.

Long-Term Effectiveness and Permanence – Removal/treatment of GCPS and soil/fill AOCs as well as construction of a soil cover system would prevent direct contact with soil/fill exceeding SSALs or CSCOs.. Periodic inspection and maintenance of the cover and possible repair of the soil and vegetative layers would be required to assure long-term cover integrity. SVE and FVBP will effectively and permanently reduce VOCs from subsurface soil/fill. Removal of subgrade piping containing product will remove potential source areas. All treatment and removal activities will prevent degradation of groundwater. ASD systems in future buildings will mitigate potential VOC vapor intrusion concerns. The SMP will include: an O&M Plan to confirm that engineering controls, including the SVE and ASD system(s) and soil cover, are operating and being maintained in accordance with the

SMP; an Excavation Work Plan to address any impacted soil/fill encountered during post-development maintenance activities; and a Site-wide inspection program to assure that the IC/ECs placed on the Site have not been altered and remain effective. Based on the removal of source area material (i.e., subgrade product piping and impacted soil/fill) and LNAPL, groundwater concentrations would be expected to decrease over time; monitoring of groundwater quality will confirm concentration decreases. Furthermore, an Environmental Easement for BCP Site 3 will be filed with Cattaraugus County, which will limit the future use of BCP Site 3 to commercial or industrial activity, restrict groundwater use, and reference the Department-approved SMP. As such, this alternative will provide long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment – Removal of GCPS and soil/fill AOCs would permanently and significantly reduce the toxicity, mobility, and volume of the soil/fill that could potentially be contacted or produce localized areas of environmental impact at the Site. Ex-situ treatment of soil/fill via FVBP, in-situ treatment of soil/fill via SVE, stabilization of lead-impacted soil/fill, removal of product from subgrade piping, and removal of LNAPL from groundwater would reduce the toxicity, mobility, and volume of contamination potentially contributing to groundwater contamination on BCP Site 3.Accordingly, this alternative satisfies this criterion.

Short-Term Effectiveness and Impacts – Installation/operation of the in-situ SVE and ex-situ FVBP systems; cover soil placement; and LNAPL removal will not cause significant adverse short-term effects. During intrusive remedial activities (e.g., soil/fill excavation, subsurface piping removal), air monitoring will be performed to assure conformance with community air monitoring action levels. The potential for chemical exposures and physical injuries are reduced through safe work practices; proper personal protection equipment; environmental monitoring; establishment of work zones and site control; and appropriate decontamination procedures. The GCPS and soil/fill AOC excavation and subsurface piping removal will be completed within approximately six months, limiting short-term adverse effects. Planned remedial activities will be performed in accordance with an approved Remedial Action Work Plan, including HASP, CAMP, and soil

erosion measures during subgrade preparation and soil cover placement. This alternative achieves the RAOs for BCP Site 3.

Implementability – No significant technical or administrative implementability issues are associated with this alternative.

Cost-Effectiveness – The estimated capital cost for Alternative 3-B is $4.4 million, including: one-third the site-wide costs presented in Table 8-3; GCPS and soil/fill AOC removal and off-site disposal; in-situ stabilization of hazardous lead-impacted soil/fill; removal and off-site disposal of abandoned subsurface piping and pipe contents or capping/cleaning of piping; construction of a 12-inch soil cover system over the entire 24.103 acres; excavation of a clean utility corridor; installation and operation of the in-situ SVE and ex-situ FVBP systems; installation of LNAPL removal devices in monitoring wells; and development of an SMP. OM&M costs are estimated to be $1.2 million and include FVBP and SVE system O&M (5 years) as well as 30 years of LNAPL recovery/disposal, groundwater monitoring, soil cover maintenance, and annual certifications. Therefore, the total estimated remedial cost to implement Alternative 3-B is $5.6 million. Table 8-3 provides a breakdown of these costs.

Land Use – Based on the land use evaluation in Section 8.5.1, reuse of BCP Site 3 in a commercial capacity is consistent with past and current development and zoning on-site and within the vicinity of BPC Site 3, and does not pose additional environmental or public health risk.

Community Acceptance – Community acceptance will be evaluated based on comments to be received from the public in response to Fact Sheets and other planned Citizen Participation activities.

8.9.3 Comparison of Remedial Alternatives

The previous sections describe and evaluate the remedial alternatives for BCP Site 3 against the screening criteria. Table 8-4 provides a comparison of the alternatives by media to identify appropriate remedial measures that will achieve the RAOs for BCP Site 3.

8.9.4 Preferred Remedial Alternative

The proposed remedial approach for BCP Site 3 is *Alternative 3-B; Commercial Use Track 4 Cleanup* because it: is fully protective of public health and the environment; addressing potential off-site migration of groundwater contaminants by removing and/or treating on-site sources; is significantly less disruptive to the community; is consistent with current and future land use; and represents a more cost-effective approach than Alternative 3-A while fully satisfying the RAOs for BCP Site 3.

The components and details of the remedial approach will be more fully described in a Remedial Action Work Plan to be submitted to the NYSDEC for approval. In summary, this alternative would involve:

- Excavation of an estimated 1,340 cubic yards of non-hazardous arsenic-impacted soil/fill AOCs followed by off-site disposal at a permitted commercial solid waste landfill.
- In-situ stabilization of an estimated 4,200 cubic yards of hazardous lead-impacted soil/fill AOCs with approximately 5% Portland cement by weight (in dry form) followed by placement of soil cover system.
- Removal and/or cleaning/capping of an estimated 44,000 linear feet of abandoned subsurface product piping. The piping will be cleaned and disposed/recycled off-site; all pipe contents will be containerized, characterized, and disposed off-site.
- Installation of an ex-situ FVBP system to remediate GCPS soil/fill generated during abandoned piping excavations (estimated to be approximately half of the 22,230 cubic yards), clean corridor excavation, and certain areas that exhibit surficial contamination (0-2 fbgs). FVBP effluent air will be treated with a biofilter.
- Installation of an in-situ SVE system to remediate the approximately 482,610 square feet (11 acres) of GCPS soil/fill from 6-15 fbgs. The SVE system will consist of SVE wells screened between 2 and 15 fbgs and placed on 50-foot centers (more or less as determined by field operational experience). Area 3-GCPS-1d and -3d will be served by one well in each area; 3-GCPS-2d will be served by 54 wells. Between 17 and 19 SVE wells will be manifolded together and connected to one of the three blowers centrally located on BCP Site 3. SVE effluent air will be treated with a biofilter.
- GCPS encountered during remedial activities will be treated via FVBP or SVE.

- The biofilter will be operated in general accordance with 6NYCRR Part 212 and has been determined to meet the guidelines established in DAR Air-Guide 1 (see Appendix L).
- Placement of a soil cover system over the entire 24.103-acre BCP Site, including a demarcation layer and at least one foot of approved cover material, or impervious materials such as asphalt roads and concrete building foundations, slabs or walkways. The approved cover material will meet NYSDEC DER-10 standards for commercial sites (i.e., lower of Part 375 public health or groundwater protection values for restricted-commercial sites.
- Excavation of a clean corridor to lay future utilities for redevelopment. Figure 8-5 shows the layout of the planned utility corridor.
- LNAPL recovery in monitoring wells W22 and W24 (and others if necessary) via HVE, DPE, passive skimmers, or adsorbent socks until LNAPL is no longer measureable. Wells proximate to planned SVE wells may be converted to DPE wells.
- An ASD system within future buildings on BCP Site 3 to mitigate potential VOC vapor intrusion concerns.
- Implementation of a SMP that will include:
    - IC/EC Plan. Engineering controls include any physical barrier or method employed to actively or passively contain, stabilize, or monitor contaminants; restrict the movement of contaminants; or eliminate potential exposure pathways to contaminants. Institutional controls at the site will include groundwater use restrictions, a requirement for evaluation of soil vapor intrusion potential for any buildings, and restrictions on the use of the site (i.e., commercial purposes). Adherence to these Institutional Controls is required by the Environmental Easement and will be implemented under this Site Management Plan.
    - Operation and Maintenance Plan that describes the measures necessary to operate, monitor, and maintain the mechanical components of the in-situ SVE, ex-situ FVBP, LNAPL recovery, and ASD systems including criteria for system shutdown.
    - Excavation Work Plan to assure that future intrusive activities and soil/fill handling at the Site are completed in a safe and environmentally responsible manner.
    - Site Monitoring Plan that includes provisions for a groundwater monitoring plan and a Site-wide inspection program to assure that the IC/ECs have not been altered and remain effective.
    - Environmental Easement filed with Cattaraugus County.

9.0 RI/AAR CONCLUSIONS

Based on the work completed during historic investigations, W&C's 2008 RI and 2009 SRI, and the 2012 SRI, remediation is required at each of the three Olean Redevelopment BCP Sites discussed herein. IRMs have been completed to address certain environmental concerns, including demolitions of buildings, removal/closure of USTs, and targeted soil removal; however, additional remedial measures are required for the Property to be protective of public health and the environment and suitable for future redevelopment.

Given the nature and extent of contamination present in soil/fill and groundwater, and the long history of heavy industrial use, it is not practicable to remediate the Property to pre-release (Unrestricted Use) conditions. The evaluation of remedial alternatives selected a Commercial Use (Track 4) Cleanup that is fully protective of public health and the environment.

A draft Remedial Action Work Plan (RAWP) has been prepared to provide details of the selected remedy for each of the three BCP Sites.

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