NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

FINAL STATEMENT OF BASIS CORRECTIVE MEASURES SELECTION

Bethlehem Steel

Coke Oven Area Groundwater

Operable Unit 04

Site No. 915009

EPA ID No. NYD002134880

Lackawanna, Erie County

March 2017

PREPARED BY

DIVISION OF ENVIRONMENTAL REMEDIATION

www.dec.ny.gov

DECLARATION STATEMENT – STATEMENT OF BASIS
FINAL CORRECTIVE MEASURES SELECTION

Bethlehem Steel
Operable Unit 04: Coke Oven Area Groundwater
Lackawanna, Erie County
Site No. 915009
March 2017

Statement of Purpose and Basis

This document presents the selected final corrective measures for Operable Unit 04: Coke Oven Area Groundwater at the Bethlehem Steel Site. The remedial program was chosen in accordance with the requirements of New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Parts 373 (RCRA) and Part 375 (State Superfund).

The proposed remedy selection was made available for public comment between February 15, 2017 and March 31, 2017. A public meeting was also held during the comment period. Comments received from the public are addressed in the Responsiveness Summary included in Appendix A of this final Statement of Basis. Appendix A includes additional information about public participation activities for this project.

This decision is based on the Administrative Record for the New York State Department of Environmental Conservation (the Department) for Operable Unit 04: Coke Oven Area Groundwater at the Bethlehem Steel Site, included in Appendix B of the Statement of Basis.

Description of Selected Remedy

The selected remedy addresses groundwater contaminated by historic releases associated with coke-making and coke by-product processing that was conducted at the site by Bethlehem Steel.

The elements of the selected remedy are as follows:

Remedial Design – Program to provide the engineering details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial

program. This includes design of the groundwater and source material control measures. This includes extraction and treatment of contaminated groundwater. The extraction system will utilize a series of existing and newly installed wells. A new treatment plant will be constructed at the site.

Institutional Control - An Environmental Easement will be placed on the site to ensure that the remedy remains protective in the future.

Site Management Plan – This includes an institutional and engineering control plan, a monitoring plan, and an operation and maintenance plan to ensure that the remedy functions as designed and is effective.

Financial Assurance - Long-term operation of the remedial system will be necessary so a dedicated funding mechanism for implementing and completing the remedy is required.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

March 31, 2017

Date

Robert W. Schick, P.E., Director

Division of Environmental Remediation

FINAL STATEMENT OF BASIS

CORRECTIVE MEASURES SELECTION

Bethlehem Steel
Operable Unit 04: Coke Oven Area Groundwater
Lackawanna, Erie County
Site No. 915009

SECTION 1: INTRODUCTION

The New York State Department of Environmental Conservation (Department), in consultation with the New York State Department of Health (NYSDOH), has selected a remedy for the above referenced site. The disposal or release of hazardous wastes at this site, as more fully described in this document, has contaminated various environmental media. The remedy is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This Statement of Basis (SB) identifies the selected remedy and discusses the reasons for selection of the remedy. This document is a summary of the information that can be found in the site-related reports and documents.

The New York State Inactive Hazardous Waste Disposal Site Remedial Program (also known as the State Superfund Program) is an enforcement program, the mission of which is to identify and characterize suspected inactive hazardous waste disposal sites and to investigate and remediate those sites found to pose a significant threat to public health and environment. The New York State Hazardous Waste Management Program (also known as the RCRA Program) requires corrective action for releases of hazardous waste and hazardous constituents to the environment. This facility is subject to both programs, and this remedy is consistent with the remedial requirements of both programs.

SECTION 2: CITIZEN PARTICIPATION

The Department seeks input from the community on all final remedies. A public meeting and comment period was held, during which the public was encouraged to submit comment on the proposed remedy. All comments on the remedy received during the comment period were considered by the Department in selecting a remedy for the site.

Site-related reports and documents were made available for review by the public at the following document repositories:

NYSDEC Region 9 Office
270 Michigan Avenue
Buffalo, NY 14203

Lackawanna Public Library
560 Ridge Road
Lackawanna, NY 14218

Information about the comment period and citizen participation actions for this site is summarized in the responsiveness summary section of the Statement of Basis (see **Appendix A**).

Receive Site Citizen Participation Information By Email

Please note that the Department's Division of Environmental Remediation (DER) is "going paperless" relative to citizen participation information. The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county email listservs. Information will be distributed for all sites that are being investigated and cleaned up in a particular county under the State Superfund Program, Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and Resource Conservation and Recovery Act Program. We encourage the public to sign up for one or more county listservs at:

http://www.dec.ny.gov/chemical/61092.html

SECTION 3: SITE DESCRIPTION AND HISTORY

Location - The Bethlehem Steel site (also known as Tecumseh Redevelopment Inc. [Tecumseh]) is located at the east end of Lake Erie, just south of the City of Buffalo. The site is located between NYS Route 5 and the lake, in Lackawanna. The Coke Oven Area addressed by this document is located in the northern part of the site, just west of the Ship Canal.

Site Features - The site is an irregular parcel which extends from south of Smokes Creek to the Buffalo Outer Harbor on the north, and from the east end of Lake Erie to the Gateway Metroport Ship Canal (Ship Canal). The site consists of approximately 468 acres, and has approximately 2 miles of shoreline along Lake Erie. Smokes Creek passes westward across the site where it discharges to Lake Erie. The Ship Canal, located towards the northern end of the site, extends approximately 3,000 feet southward into the site from the Buffalo Harbor. The western portion of the site was created by the placement of slag-fill materials from iron and steel-making within an area that was formerly within the boundaries of Lake Erie. The site is mostly undeveloped, especially the western slag fill portion.

Current Zoning and Land Use - This area of the site is currently zoned for industrial use and is currently used for slag reclamation, coal handling facilities, wood recycling facilities, and the site groundwater treatment plant. Renewable energy (i.e., wind) turbines, are located along the shoreline. The majority of the land is vacant/undeveloped.

Past Use of the Site - The former Bethlehem Steel Corporation (BSC) property was used for iron and steel production since the beginning of the 20th century. Iron and steel-making operations were discontinued by the end of 1983, and by the mid-1990s, most of the steel-making facilities on the west side of Hamburg Turnpike (NYS Route 5) had been demolished. In September 2001, BSC's coke oven operation was terminated. While some buildings remain, most structures have been razed. The western portion, that includes approximately two miles of Lake Erie waterfront, consists of a considerable area of manmade land (~440 acres) where iron and steel making slag and plant wastes were disposed.

Site Geology and Hydrogeology – The predominant site feature is the wedge-shaped slag fill area that extends into Lake Erie. This area extends from the former lake shore an average of 1,300 feet westward, and now forms the eastern shoreline of Lake Erie. The site geology beneath the slag-fill layer consists lake and glacial sediments overlying shale or limestone bedrock. In order beneath the slag-fill, there is a sand layer with occasional peat deposits, lake clay/silt deposits, and glacial till overlying shale or limestone bedrock.

The depth to groundwater is variable and depends upon the topography, and can vary in depths ranging from about 10 to over 60 feet below ground surface. Groundwater generally flows toward Lake Erie, Smokes Creek, or the Ship Canal. Groundwater occurs within the fill and sand layers in the overburden and in the bedrock beneath the site.

Operable Units/SWMU Groups - A number of Solid Waste Management Units (SWMUs) in the Corrective Measures Study (CMS) Area of the site have been designated as operable units and/or SWMU groups that typically contain similar wastes, are located proximate to each other, and/or have common remedies. The Operable Unit 04 (OU-04) area of the site is regulated under both the RCRA and NYS Superfund program and consists of 468 acres. For technical or administrative reasons SWMUs within these operable units or SWMU groups can be addressed collectively to investigate, eliminate, or mitigate a release, threat of release or exposure pathway.

To date, the following operable units have been designated for the Tecumseh Redevelopment Inc. property:

- **OU-01** (Site-wide) – This operable unit is being used to track site-wide issues. It is also being used to track the interim corrective measures (ICMs) noted below. A final remedy decision by NYSDEC for this operable unit has not been made yet.

- **OU-01A** (Smokes Creek ICM) – This interim measure (sediment removal action) was performed to address contamination attributable to historic

discharges from the Acid Tar Pit SWMU Group. The lower 2,600 feet of Smokes Creek sediment was dredged by Tecumseh in 2009, removing approximately 40,000 cubic yards of material. This action improved the hydraulic capacity of the stream, reducing flooding potential and need for flood insurance in a nearby, upstream residential neighborhood. Dredging of the remaining portion of Smokes Creek on the Tecumseh property was performed by NYSDEC in 2015 to maintain the flood capacity of the Creek in accordance with agreements with the US Army Corps of Engineers.

- **OU-02** (SWMUs S-18, P-9, and P-18) –SWMU S-18 is located in the Slag Fill Area Zones 4 & 5 of the CMS Area, while SWMUs P-9 and P-18 are located within the Coke Plant & By-Products Facility Sub-Area. These SWMUs contain materials from historic coke-making and blast furnace operations. In 2015 a final remedy was selected and implemented for these SWMUs.

- **OU-03** (Acid Tar Pit SWMUs S-11, S-22 and S-24) - This is an area on the south side of Smokes Creek, near the mouth on Lake Erie, where coking tar wastes were disposed. Releases from these SWMUs had historically impacted groundwater and the adjacent Smokes Creek. In 2010 Tecumseh proposed and NYSDEC selected a final remedy for the Acid Tar Pit SWMU Group, which is being implemented by Tecumseh under Consent Order. As a consequence of the remedy implemented for OU-02 2015, the remedy for OU-03 was also modified.

- **OU-04** (Coke Oven By-Products Sub-Area Groundwater) – The OU-04 Site is the groundwater associated with the former Coke Oven Area and includes approximately 27 acres located along the western side of the Ship Canal. OU-04 is not intended to address soil, soil vapor, or other environmental issues associated with the former Coke Oven Area. These other media will be addressed through a separate remedy decision(s) at a later date. OU-04 groundwater is the subject of this decision document.

- **OU-04A** (Benzol Yard Interim Measure) – This is an interim measure for groundwater in an area located near the south end of the Ship Canal, where historic coke oven by-product operations (SWMU P-11) caused impacts to the groundwater, including releases of non-aqueous phase liquid (benzol oil). This measure has been operating since 2005. It is located within the Coke Plant By-Products Facility Sub-Area. This collection system and treatment facility may be integrated into the OU-04 final remedy.

Additional SWMU groupings are also present at the site and operable units will be formally designated by the Department when processing remedy decisions for these areas is completed. These groupings include, but may not be limited to: Zone 2 Slag/Fill Sub-Area, Zone 4 Slag/Fill Sub-Area, and the Tank Farm Sub-Area.

A site location map is attached as Figure 1 and a facility map is attached as Figure 2.

SECTION 4: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, an alternative which allows for industrial use of the site was selected.

SECTION 5: ENFORCEMENT STATUS

The Tecumseh site is subject to hazardous waste treatment, storage, and disposal facility (TSDF) permitting requirements under New York State (NYS) hazardous waste regulations (6 NYCRR Part 373) and has RCRA EPA ID No. NYD002134880. Under this regulatory program, Tecumseh is responsible for implementing Corrective Action to address releases to the environment from solid waste management units (SWMUs) and areas of concern (e.g., watercourses). On June 30, 2009 the Department and Tecumseh signed an Order on Consent (the "Order") to complete a Corrective Measures Study (CMS) for the facility. The Order also required that Tecumseh provide financial assurance for completing RCRA closure, post-closure and corrective action requirements for the site.

The property that includes OU-04 is also part of a site listed on the Department's Registry of Inactive Hazardous Waste Disposal Sites (Site No. 915009-Former Bethlehem Steel) and is currently classified as a Class 2 site as defined in the associated 6NYCRR Part 375 regulations. Portions of the Tecumseh site, including property abutting the southern boundary of OU-04, are also participating in the Brownfield Cleanup Program administered by the Department.

SECTION 6: SITE CONTAMINATION

6.1 Summary of the Site Investigation

A site investigation serves as the mechanism for collecting data to:

- characterize site conditions;
- determine the nature of the contamination; and
- assess risk to public health and the environment.

A RCRA Facility Investigation (RFI) was initiated by Bethlehem Steel in 1990 and subsequently completed by Tecumseh in January 2005. The investigation was intended to identify the nature (or type) of contamination which may be present at a site and the extent of that contamination in the environment on the site, or leaving the site. The investigation reports on data gathered to determine if waste containing hazardous substances were disposed at the site, and if the soil, groundwater, soil vapor, indoor air, surface water or sediments may have been contaminated. The RFI investigated conditions on approximately 1,600 acres of former Bethlehem Steel property, not just the

area in the vicinity of OU-04. Based on the RFI results, areas of the former Bethlehem Steel property were identified as needing remediation or further assessment. Further investigation and assessment of remedial alternatives performed by Tecumseh in a Corrective Measures Study (CMS) Report (2014). A supplemental Comprehensive Groundwater Quality Report (May 2014) was also prepared that summarized and assessed the groundwater data collected during both the RFI and CMS.

Based on the presence of contaminants in wastes, soil and groundwater at OU-04, soil vapor will also be sampled for the presence of contamination if routinely occupied buildings or structures are to be constructed in the OU-04 area. Data collected in the investigation influence the development of remedial alternatives. Numerous phases of investigation were conducted in the OU-04 area. Investigation reports are available for review in the site document repository and pertinent results are summarized in section 6.3.

The analytical data collected for OU-04 includes data for:

- waste material contained in SWMUs
- groundwater

6.1.1 Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the site investigations were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in Exhibits A and B list the applicable SCGs. For a full listing of all SCGs see:

http://www.dec.ny.gov/regulations/61794.html

6.1.2 OU-04 Investigation Results

The data have identified contaminants of concern. A "contaminant of concern" is a contaminant that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized below and in **Exhibit A**. Additionally, the site investigation reports contains a full discussion of the data. The contaminant(s) of concern identified at this site is/are:

Benzene
Toluene

Xylene
Naphthalene
Total Recoverable Phenolics

The contaminant(s) of concern exceed the applicable SCGs for:

- groundwater

Note that OU-04 is limited to the groundwater in the Coke Oven Area. Remedial decisions regarding contaminants remaining in other media, such as in soils or within SWMUs will be handled at a later date as a separate operable unit.

6.1.3 Interim Measures

An interim measure is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Decision Document. The following measures have been completed within the OU-04 area based on conditions observed during the investigation phase:

Benzol Yard Interim Measure (SWMU P-11 Pump and Treat) - This interim measure is a groundwater and non-aqueous phase liquid (NAPL – or free product) pump and treat system installed in the Benzol Yard (SWMU P-11), located in the Coke Oven Area, near the south end of the Ship Canal. The system includes multiple extraction wells, NAPL separation, air stripping of groundwater, and reinjection of treated water. This system began operating in 2005. A thermal oxidizer was initially used to treat vapor discharge from air stripper, but oxidizer use was discontinued due the reduced loading into the system. As of 2015, this interim measure had recovered approximately 30,000 pounds of contaminants.

6.2: Summary of Environmental Assessment

The corrective action process began with evaluations and investigations to identify potential areas of the site that may have been impacted by hazardous wastes and/or hazardous constituents. Based on the results of numerous phases of investigations, the Department has determined that hazardous substances are present in the material disposed in the OU-04 SWMUs contained in the Coke Oven area. The nature of these materials was characterized and evaluated to identify contaminants of concern, migration potential, engineering properties and stabilization options.

Environmental assessments and investigations for the former coke oven area have focused on the SWMU material and groundwater associated with the Coke Oven area. As noted earlier, evaluation of other environmental media and surrounding areas will be addressed through a separate remedy selection action that will be made at a later date. A brief summary of these assessments and investigations of the former coke over area SWMUs is included in **Exhibit A**.

6.3: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

The site is completely fenced, which restricts public access. However, persons who enter the site could contact contaminants in the soil by walking on the site, digging or otherwise disturbing the soil. People are not coming into contact with the contaminated groundwater because the area is served by a public water supply that is not affected by this contamination. Volatile organic compounds in the groundwater may move into the soil vapor (air spaces within the soil), which in turn may move into overlying buildings and affect the indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil vapor intrusion. Because the site is vacant, the inhalation of site-related contaminants due to soil vapor intrusion does not represent a current concern.

6.4: Summary of the Remedial Action Objectives

The objectives for the remedial program for Operable Unit 04 have been established through the remedy selection process in the 6 NYCRR Part 373 Post-Closure Permit and 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial action objectives for Operable Unit 04 are:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with contaminated groundwater.

RAOs for Environmental Protection

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

SECTION 7: SUMMARY OF THE SELECTED REMEDY

To be selected, the remedy must be protective of public health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the

site, which are presented in Section 6.4. The criteria that will be used to determine if the remedial action objectives are being achieved are presented in **Exhibit B**. The alternatives that were considered for this site are presented in **Exhibit C**. A summary of the Remedial Alternatives Costs is included as **Exhibit D**. The basis for the Department's selection of the proposed remedy is set forth in **Exhibit E**.

The elements of the selected remedy are as follows:

Remedial Design

A remedial design program will be implemented to provide the engineering details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. This shall include design of the groundwater and source material control measures.

Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

Groundwater Extraction and Treatment

Groundwater extraction and treatment will be implemented to treat volatile organic compounds, phenolics, and naphthalene in groundwater and to ensure contaminated groundwater does not migrate to the Ship Canal. The groundwater extraction system will be designed and installed so that the capture zone is sufficient to intercept and treat contaminated groundwater prior to migration to the Ship Canal. The extraction system will incorporate some of the existing infrastructure (pumping wells, conveyance lines) that were installed as part of the Benzol Yard Interim Measure. The extraction system will create a depression of the water table so that contaminated groundwater is directed toward the extraction wells within the plume area. Groundwater will be extracted from the subsurface over an approximately 25 acre area located in the eastern portion of the OU-04 where organic compounds are elevated in groundwater. Further details of the extraction system will be determined during the remedial design.

The extracted groundwater will be treated by two separate groundwater treatment systems. The southern extraction OU-04 system groundwater will pass through a separator to remove light non-aqueous phase liquids; followed by a filtration system to remove suspended solids; and then an air stripper to remove volatile organic compounds. The groundwater collected by the northern extraction OU-04system will pass through a chemical feed system to mitigate scale build-up; followed by a filtration system to remove suspended solids; then an air stripper to remove volatile organic compounds; finally the water will be passed through granular activated carbon to remove any remaining naphthalene and phenolics. Following treatment of the groundwater from both the southern and northern OU-04 groundwater extraction systems, the treated water will be discharged to an infiltration gallery located along the western edge of OU-04.

Financial Assurance

Financial assurance for implementing and completing the remedy is being required. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the Department determines that continued operation is technically impracticable or not feasible.

Institutional Control

Imposition of an institutional control in the form of an environmental easement for the controlled property which will:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- allow the use and development of the controlled property for industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or County DOH; and
- require compliance with the Department approved Site Management Plan.

The environmental easement will supplement or supersede an existing restrictive covenant that Bethlehem Steel placed on the property limiting site use.

Site Management Plan

A Site Management Plan is required, which includes the following:

1. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

   Institutional Controls: The Environmental Easement discussed above.

Engineering Controls: The groundwater monitoring well network, the groundwater extraction and treatment system, and related utility and conveyance lines discussed above.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
- descriptions of the provisions of the environmental easement including any land use, and groundwater water use restrictions;
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

2. a Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:
    - monitoring of groundwater to assess the performance and effectiveness of the remedy; and
    - a schedule of monitoring and frequency of submittals to the Department.

3. an Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:
    - procedures for operating and maintaining the remedy;
    - compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
    - maintaining site access controls and Department notification; and
    - providing the Department access to the site and O&M records.

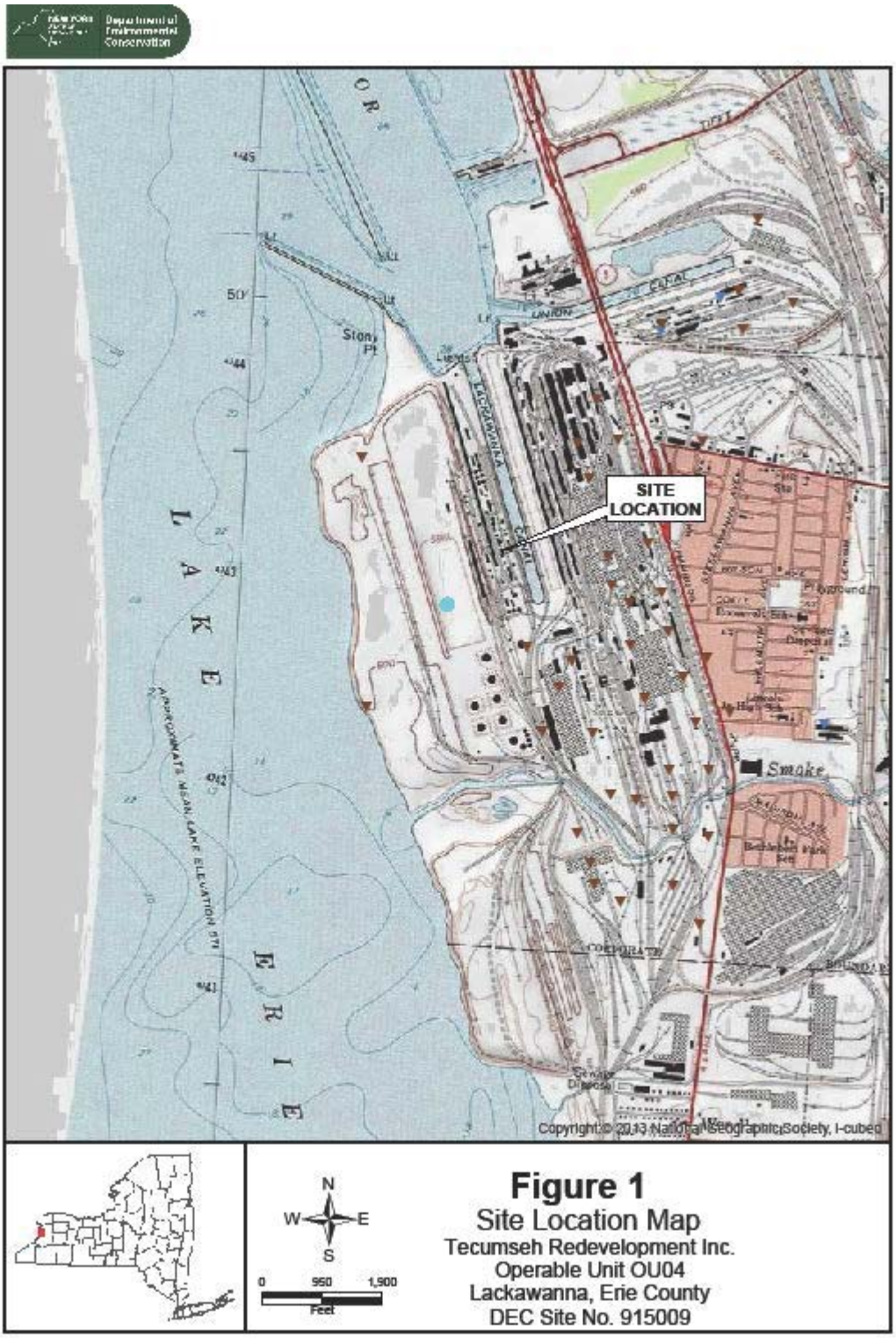


Figure 1
Site Location Map
Tecumseh Redevelopment Inc.
Operable Unit OU04
Lackawanna, Erie County
DEC Site No. 915009

Figure 2

Site Map
Tecumseh Redevelopment Inc.
Operable Unit 04 - Coke Oven Area Groundwater
City of Lackawanna, Erie County
DEC Site No. 915009

Exhibit A

Nature and Extent of Contamination

This exhibit describes the findings of the RCRA Facility Investigation (RFI), the Corrective Measures Study (CMS), supplemental sampling and data generated from the Benzol Yard Interim Measures pump and treat system. As described in Section 6.1, samples were collected to characterize the nature and extent of contamination (groundwater well locations are shown in Figures 1 and 2).

The section below includes a table that summarizes recent groundwater data for the Coke Oven Area. The table presents results and compares the data with the applicable standards, criteria and guidance values (SCGs) for the site. The contaminants are arranged into three categories: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and inorganics. The primary VOCs of concern for the site are benzene, toluene, ethylbenzene, and xylenes. These are collectively referred to as BTEX in this document. SVOCs detected include polycyclic aromatic hydrocarbons (PAHs) and naphthalene. Total PAH concentrations referred to in this document are the sum of individual PAH compounds. The inorganic contaminants detected in the area include arsenic, barium, cyanide, and phenolics. BTEX, naphthalene and phenolics are the primary contaminants of concern, and are expected to be key indicators of remedy effectiveness.

The following sections identify the wastes/contaminant source material found at the site and then identify the individual contaminants that are associated with the manufactured gas disposal/operations at the site. Since operable unit OU-04 is specific to groundwater, the information below is limited to a description of the source areas contributing to groundwater contamination and the nature and extent of the groundwater impacts. Soil and other media that may be impacted within or due to the Coke Oven Area operations will be subject to a future remedy decision, and are not addressed in this document.

Waste/Source Areas

As described in the RFI and CMS Report, waste/source materials were identified at the site which are impacting soil and groundwater. Wastes are defined in 6 NYCRR Part 375-1.2 and include solid, industrial and/or hazardous wastes. Source is also defined in 6 NYCRR Part 375-1.2 as a portion of a site or area of concern at a site where the investigation has identified a discrete area of soil, sediment, surface water or groundwater containing contaminants in sufficient concentrations to migrate in that medium, or to release significant levels of contaminants to another environmental medium, which could result in a threat to public health or the environment. A source area typically includes, but is not limited to, a portion of a site where a substantial quantity of any of the following are present:

(1) concentrated solid or semi-solid hazardous substances;

(2) non-aqueous phase liquids; or
(3) grossly contaminated media.

Benzol Plant Area

There are two apparent primary sources for the groundwater contamination identified in the former Benzol Plant area. The first is the former Benzol Yard (SWMU P-11) which contained many above-ground storage tanks (ASTs), underground storage tanks (USTs), two above-ground process tanks and one above-ground Coke Oven gas seal condensate holding tank, and associated piping within the area of the SWMU P-11 footprint. The ASTs and USTs were used to store recovered light oils (benzol) or virgin wash oil; the process tanks were used in the recovery of the light oils. The second apparent source area is near recovery well RW-2 where coke by-products were transferred into rail cars that loaded along the west side of the former Benzol Yard.

All ASTs and USTs in SWMU P-11 were decommissioned by Bethlehem Steel Corporation prior to 2001. The Benzol building remains along with some of the former process equipment and structures. SWMU P-11 also contains two below-grade water-filled structures consisting of the # 17 Pit and the South Sump. The #17 Pit housed the Coke Oven gas seal condensate holding tank of approximately 20,000 gallons capacity that was decommissioned in 2000. The South Sump was reported to be cleaned by BSC in 2001.

Benzene and other volatile aromatics identified in the Benzol Yard groundwater are likely to have leaked from the underground light oil recovery process pipelines, tanks, and valves once present in the SWMU P-11 area and from accidental spillage during product transfer (proximate to recovery well RW-2). In the late 1980s, the underground lines were reported to be replaced with above-ground piping by BSC and provisions for release prevention mechanisms and/or containment for aboveground process equipment and storage tanks. As such, the remaining source materials in SWMU P-11 and near well RW-2 are the unsaturated soil/fill in the area of the surface spillage, Light Non-aqueous phase liquids (LNAPL) on the groundwater table and in the “smear” zone (i.e., the zone of groundwater fluctuation) located at 6 to 12 feet below ground surface. The depth to and thickness of the smear zone is affected by the operation of the 11 ICM recovery wells which cause the groundwater elevations to fluctuate down in the vicinity of the well screens when the recovery well pumps cycle on at their high water set points and back up when the pumps cycle off at their low water set points. Such cycling of the ICM recovery wells also locally affects the flow and accumulation of LNAPL in the groundwater recovery wells.

The apparent groundwater contaminant source areas have been assessed using the results of a soil vapor survey performed during the RFI, results of LNAPL gauging in wells and piezometers in the Benzol Yard associated with the ICM, and based upon historic information (e.g., locations of accidental spillage). In addition, LNAPL is persistently detected along the east side of SWMU P-11 and at a maximum thickness of greater than 1 foot in wells/piezometers RW-1, RW-C, RW-D, RW-F, MWN-31A and

BPP-6. Elevated PID readings based on the soil vapor survey and LNAPL was detected in well RW-2 and piezometer BPP-17 persistently at a thickness greater than 1 foot. The apparent source impacted slag/fill covers an area of nominally 29,000 SF and the estimated depth of impact (i.e., bottom of the smear zone) is estimated at 10 feet. The volume of impacted slag fill is approximated at 11,000 CY. The approximate position/extent is shown on Figure 1. Note that Figure 1 also shows "hotspots" where groundwater is highly contaminated in the vicinity of SWMU P-11.

"Old" Benzol Plant Area

The sources of groundwater contamination from the Old Benzol Plant are likely similar to those identified for SWMU P-11, mainly accidental spillage during product loading or handling, or leaking above-ground or below-ground pipe lines and valves. The facilities associated with SWMU P-11A have been demolished and/or abandoned since approximately 1930. As the concentration of groundwater contaminants in the vicinity of SWMU P-11A are much lower than SWMU P-11, there do not appear to be widespread contaminant source areas associated with SWMU P-11A. LNAPL has only been observed in well MWN-26C. This location is highlighted on Figure 1, as are "hotspots" where groundwater is highly contaminated in the vicinity of SWMU P-11A.

Source Areas Requiring Control

The following contaminant source areas have been identified in the former Coke Plant By-Products Sub-Area:

- Benzol product in the form of LNAPL that exists in unsaturated and smear zone slag/fill in certain identified locations in the vicinity of the former Benzol Yard(SWMU P-11) will continue to impact the groundwater quality in that portion of the broader Coke Plant By-Products Sub-Area. Without more aggressive source area controls in these specific locations, the existing ICM groundwater pump-and-treat system will likely operate for many years, probably decades.
- Within the Old Benzol Yard source area controls should focus on NAPL recovery in the vicinity of MWN-26C.

Groundwater

Benzol Yard Area (SWMU P-11)

The RFI identified significant groundwater quality impacts in the vicinity of the former Benzol Plant, where storage and handling of liquid coke gas by-products resulted in significant groundwater quality impacts from the presence of light non-aqueous phase liquids (LNAPLs), dissolved-phase volatile organic compounds (VOCs; primarily benzene), as well as phenolics and naphthalene.

In response Tecumseh entered into an Order on Consent (File No. 03-73, dated November 4, 2004) with the NYSDEC to implement an Interim Corrective Measure (ICM)

to address groundwater for SWMU P-11. The ICM consisted of: 11 groundwater and eight LNAPL collection wells; a 30-gpm aqueous-phase treatment system with shallow-tray air stripper; and two infiltration galleries to recharge treated groundwater and flush residual Benzol from the shallow slag/fill. Since 2005, the ICM has removed over 15 tons of aqueous and non-aqueous VOCs (primarily benzene, toluene, and xylenes).

The concentration of VOCs in the ICM treatment system influent has decreased over time but remains relatively high. Similarly, LNAPL recovery has decreased over time and currently occurring at a rate of approximately 70 to 80 gallons/year, predominantly and consistently from recovery wells RW-2 and RW-1, and occasionally in lesser volumes from RW-F, RW-C and RW-D in descending order. As such, a significant mass of VOCs remains in portions of the Benzol Plant slag/fill concentrated in the vicinity of the above-referenced recovery wells. As shown on Figure 2, groundwater in the area remains contaminated. Table 1 provides a summary of recent groundwater data for the area.

There are groundwater impacts related to SWMU P-11 that are located laterally beyond the reach of the existing ICM collection system. A portion of the dissolved phase groundwater plume extends to the south, beyond the CMS Area. During the recent remedial investigation of the Business Park performed under the Brownfield Cleanup Program (BCP), VOCs were noted in shallow fill unit monitoring well MWN-30A and, to a lesser degree, well MWN-19A.

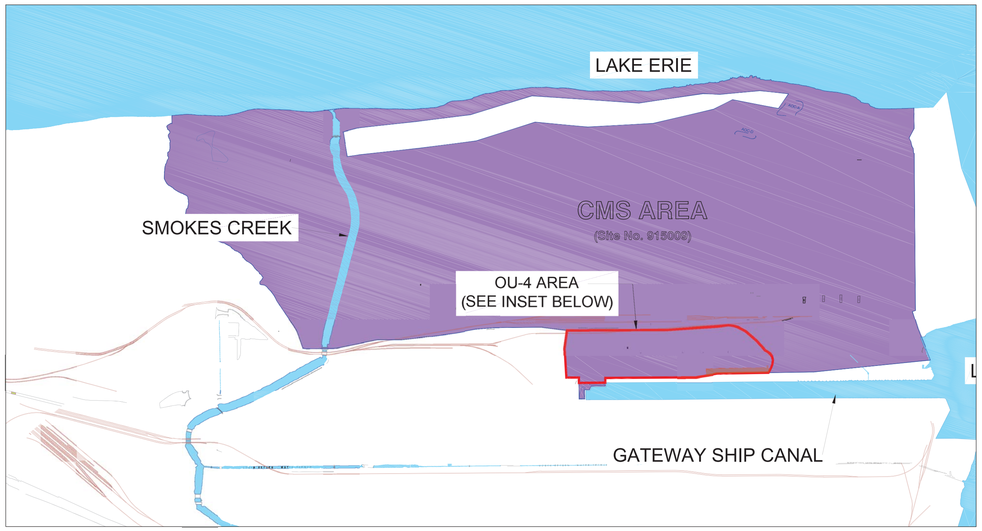
In addition, there are several wells east, west and north of and outside the ICM groundwater collection system influence of the current Benzol Yard ICM within OU-4 where levels of VOCs have not decreased significantly.

Old Benzol Plant (SWMU P-11A)

Groundwater quality impacts associated with the Old Benzol Plant (also referred to as the old Benzol Yard or SWMU P-11A, see Figure 2) were identified during supplemental (post-RFI) investigations that were performed by Tecumseh. SWMU P-11A is the initial location within the former Coke Plant By-Products Sub-Area where benzol was historically produced by BSC from about 1915 to the late 1920s/early 1930s, prior to construction and operation of the newer Benzol Yard Plant (SWMU P-11).

The groundwater quality in the vicinity of SWMU P-11A is impacted with VOCs characteristic of benzol including benzene, toluene, and xylene. In addition, in contrast to the Benzol Yard (P-11), the Old Benzol Plant (P-11A) also has elevated concentrations of naphthalene and phenolics. Groundwater results for the area are shown on Figure 2. Table 1 provides a summary of recent groundwater data for the wells located in this area. The concentrations of VOCs in the vicinity of SWMU P-11A are only 10 to 20% of that measured in the influent to the groundwater treatment system at SWMU P-11, but are still at concentrations warranting collection and treatment. LNAPL was detected in only one well (MWN-26C) within the vicinity of SWMU P-11A and appears to be localized to that location.

EXHIBIT A - FIGURE 1 - OU-04 SWMUs P-11 and P-11A Source Areas/Hotspots



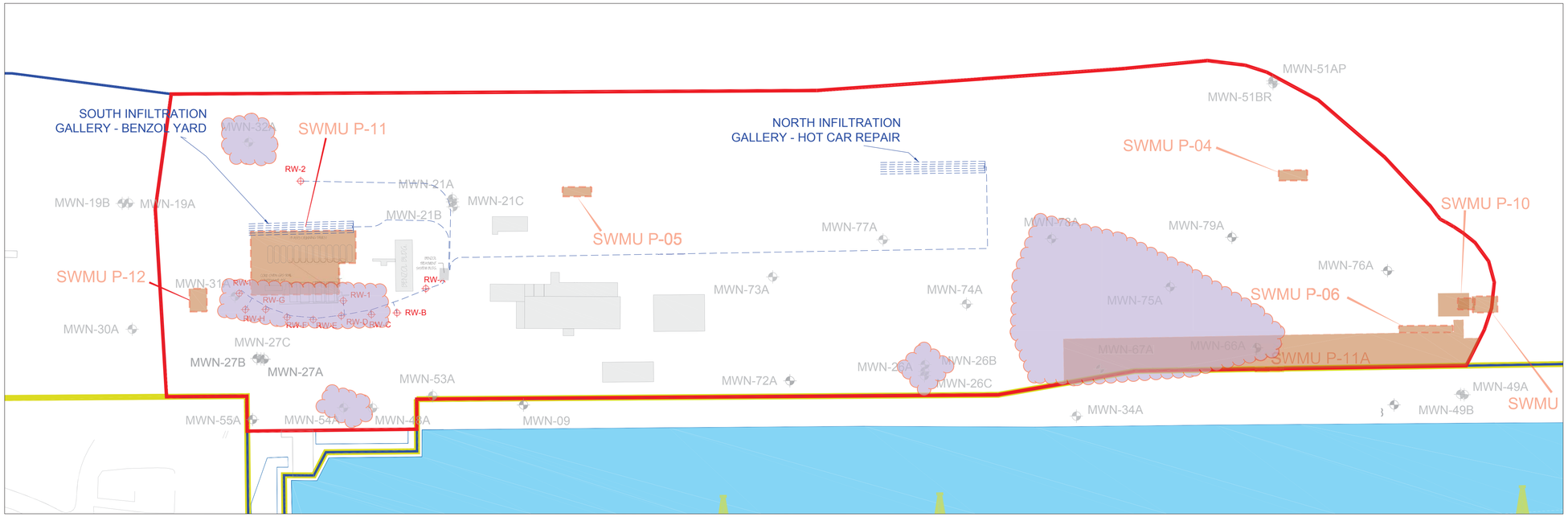
CMS AREA FEATURES
APPROXIMATE SCALE 1" = 800'

LEGEND:

- TECUMSEH PROPERTY BOUNDARY
- OPERABLE UNIT 4 BOUNDARY
- EXISTING GROUNDWATER COLLECTION FORCE MAIN
- SOLID WASTE MANAGEMENT UNIT (SWMU) BOUNDARY
- REMEDIATED AND CLOSED SWMU BOUNDARY
- CMS AREA BOUNDARY (EXCLUDING WATER COURSES)
- APPROXIMATE SWMU BOUNDARY FROM RFI OPERABLE UNIT 4 BOUNDARY
- MWN-54A — EXISTING MONITORING WELL
- RW-H — EXISTING RECOVERY WELLS
- SOURCE AREAS/GROUNDWATER HOTSPOTS

NOTES:

1. Existing monitoring well suffix definitions are as follows: A = fill unit, B = sand unit, C = misc. unit, D = bedrock unit. Monitoring wells without a suffix are fill unit wells.



OPERABLE UNIT 4 PLAN VIEW

100' 0' 100' 200'

SCALE: 1 INCH = 100 FEET
SCALE IN FEET
(approximate)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
TURNKEY ENVIRONMENTAL RESTORATION, LLC
2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599
JOB NO.: 0071-013-921

REVISIONS

NO.	BY	DATE	REMARKS

DRAWN BY: RFL/KRR
DATE: APRIL 2016
CHECKED BY: NTM
APPROVED BY: PHW

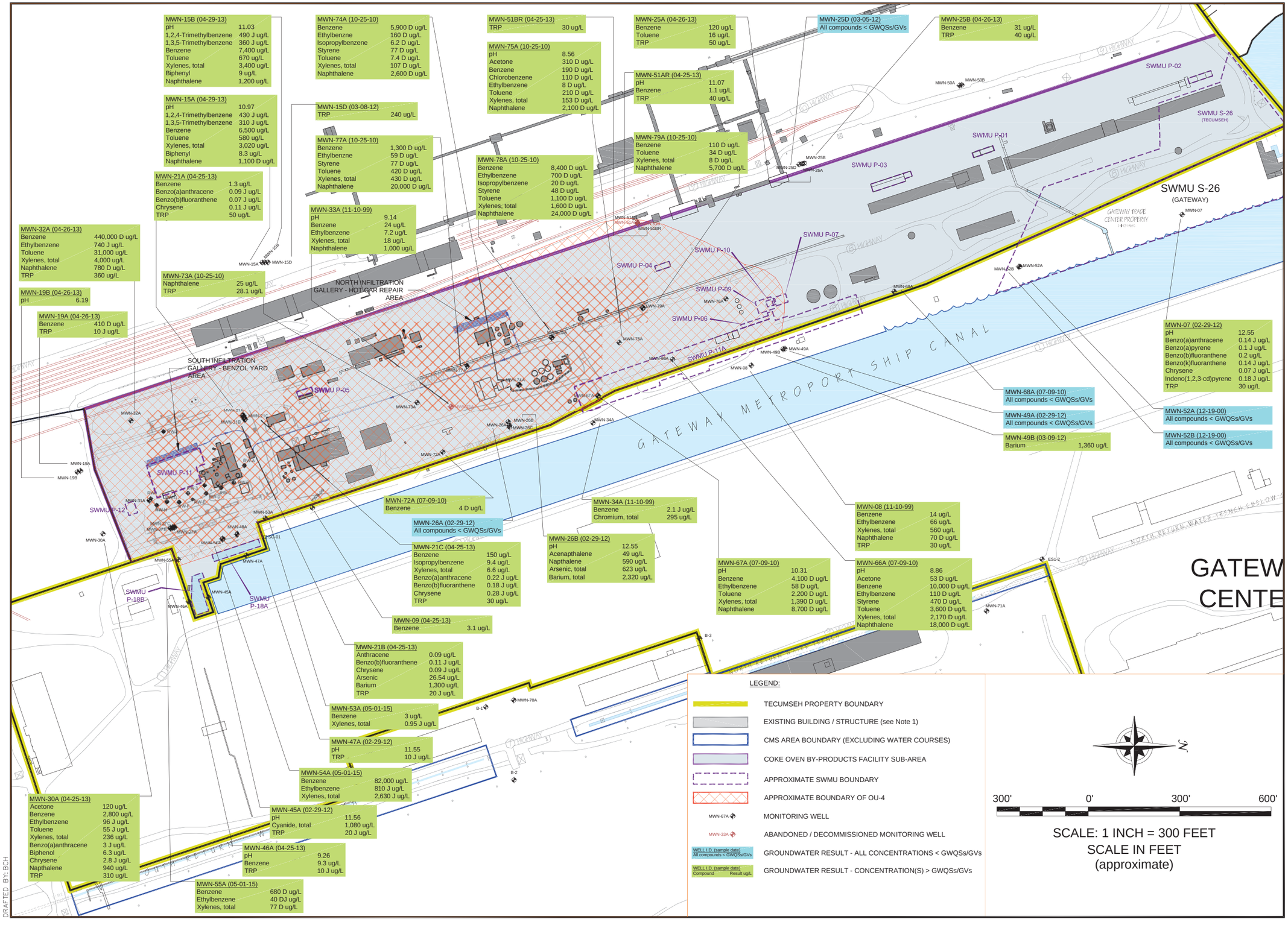
SEAL

PLAN VIEW OF CMS AND OU4 AREA

OU-4 ENGINEERING REPORT
TECUMSEH SITE - CMS AREA
LACKAWANNA, NEW YORK

PREPARED FOR
TECUMSEH REDEVELOPMENT INC.

Exhibit A - Figure 2 Groundwater Results



OPERABLE UNIT OU-04 WORK LIMITS & GROUNDWATER CONCENTRATIONS

DRAFT SB FOR PROPOSED CORRECTIVE MEASURE OU-4

CMS AREA - FORMER BETHLEHEM STEEL SITE
LACKAWANNA, NEW YORK

PREPARED FOR
TECUMSEH REDEVELOPMENT INC.

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
TURNKEY ENVIRONMENTAL RESTORATION, LLC
2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

JOB NO.: 0071-013-921

DATE: JULY 2015
DRAFTED BY: BCH

F:\CAD\TurnKey\Tecumseh Redevelopment\Corrective Measures\OU-4 DRAFT Statement of Basis\Figure 5; OU-4 Work Limits & GW Concentrations.dwg

EXHIBIT A - TABLE 1

GROUNDWATER ANALYTICAL SUMMARY [1]

COKE OVEN AREA

Parameter	CAS No.	GWQS/GV [2]	Units	Monitoring Well Location, Sample Date(s), & Monitoring Program																					
				MWN-07		MWN-08	MWN-09			MWN-26A			MWN-26B			MWN-30A		MWN-34A	MWN-45A		MWN-46A		MWN-47A		MWN-49A	
				11/10/1999	2/29/2012	11/10/1999	11/10/99	04/25/13	11/11/1999	7/9/2010	2/29/2012	11/11/1999	7/9/2010	2/29/2012	11/10/99	04/25/13	11/10/1999	12/20/2000	2/29/2012	12/20/00	04/25/13	12/20/200	2/29/2012	12/20/200	2/29/2012
				RFI	CMS	RFI	RFI	CMS	RFI	CMS	CMS	RFI	CMS	CMS	RFI	CMS	RFI	RFI	CMS	RFI	CMS	RFI	CMS	RFI	CMS
Field Measurements																									
Dissolved Oxygen	NA	-	MG/L	0.9	9.23	0.80	0.4	1.52	0.8	2.35	2.39	0.5	1.72	2.33	0.5	2.66	1.40	na	3.1	3.65	3	na	5.27	na	0.93
Field pH	NA	6.5 - 8.5	S.U	11.77	12.55	7.29	7.10	7.21	7.96	7.15	7.19	6.66	6.51	7.33	7.40	7.80	7.28	11.28	11.56	9.55	9.26	11.41	11.55	7.35	7.75
Redox Potential	NA	-	mV	-173	-83	-205	-204	-15	-158	-118	-114	-107	-74	-55	-296	-285	-86	-127	-154	7	-7	-299	-144	-292	-250
Specific Conductance	NA	-	UMHOS/CM	2,960	2494	3,470	1400	1015	1,150	754.2	970.6	1,630	1408	1689	600	1499	3,060	6,450	11.54	1260	3740	1,350	800.6	3,600	1531
Temperature	NA	-	DEG C	18.2	9.3	16.7	16.9	11.0	13.0	17.5	7.2	11.8	14.1	6.6	16.3	11.4	18.1	13.6	6.5	10.3	8.9	12.6	7.0	14.8	9.9
Turbidity	NA	-	NTU	180	7.44	200	190	33.2	8	11.2	2.58	44	8.21	269	150	20	300	na	20.9	13	13	4	37.5	7.23	150
Volatile Organics (Method 8260B) (STARS List parameters in blue)																									
1,1,1,2-Tetrachloroethane	630-20-6	5	ug/l	ND	-	ND	ND	-	ND	-	-	ND	-	-	ND	-	ND	ND	-	ND	-	ND	-	ND	-
1,2,4-Trimethylbenzene	95-63-6	5	ug/l	-	ND	-	-	ND	-	-	-	-	-	-	-	120	-	-	ND	-	ND	-	ND	-	ND
Acetone	67-64-1	50	ug/l	-	-	-	-	-	-	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	71-43-2	1	ug/l	4.6 J	ND	14	6300	3.1	1800	ND	-	240	290 D	-	14000	2800	2.1 J	7.2	0.97	17	9.3	37	ND	2.8 J	ND
Carbon disulfide	75-15-0	60	ug/l	-	-	-	-	-	-	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	100-41-4	5	ug/l	ND	ND	66	ND	ND	28 J	ND	-	27	24 D	-	180 J	96 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	98-82-8	5	ug/l	-	ND	-	-	ND	-	ND	-	-	ND	-	-	ND	-	-	ND	-	ND	-	ND	-	ND
Methyl cyclohexane	108-87-2	-	ug/l	-	-	-	-	ND	-	ND	-	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-
Styrene	100-42-5	5	ug/l	-	-	-	-	-	-	ND	-	-	ND	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	108-88-3	5	ug/l	1 J	ND	ND	ND	ND	11 J	ND	-	ND	4 D	-	360 J	55 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, m/p	179601-23-1	5	ug/l	-	ND	-	-	ND	-	ND	-	-	ND	-	-	86 J	-	-	ND	-	ND	-	ND	-	ND
Xylenes, o	95-47-6	5	ug/l	-	ND	-	-	ND	-	ND	-	-	5.1 D	-	-	150	-	-	ND	-	ND	-	ND	-	ND
Xylenes, Total	1330-20-7	5	ug/l	ND	ND	560	ND	ND	74	ND	-	64	7.8 D	-	980	236	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL BTEX	**NA**	**NA**	**ug/l**	**5.6**	**ND**	**640**	**6300**	**3.1**	**1913**	**ND**	**-**	**331**	**325.8**	**-**	**15520**	**3187**	**2.1**	**7.2**	**0.97**	**17**	**9.3**	**37**	**ND**	**2.8**	**ND**
Semivolatile Organics (Method 8270C) (Base-Neutrals in black, Acid Extractables in blue and PAHs in red)																									
2,4-Dimethylphenol	105-67-9	50	ug/l	R	-	2.4 J	ND	-	5.4 J	-	-	ND	-	-	ND	-	ND	ND	-	ND	-	ND	-	ND	-
2-Methylnaphthalene	91-57-6	-	ug/l	-	ND	-	-	ND	-	-	ND	-	-	61	-	18	-	-	0.26	-	ND	-	ND	-	ND
2-Methylphenol (o-Cresol)	95-48-7	-	ug/l	R	-	ND	ND	-	22	-	-	ND	-	-	ND	-	ND	ND	-	ND	-	ND	-	ND	-
Acenaphthene	83-32-9	20	ug/l	-	0.18 J	-	-	ND	-	-	2.9	-	-	49	-	ND	-	-	0.63	-	0.08 J	-	ND	-	ND
Acenaphthylene	208-96-8	-	ug/l	ND	0.08 J	ND	2.7 J	0.63	9.2 J	-	0.47	ND	-	ND	35 J	10	ND	ND	ND	ND	ND	ND	ND	ND	0.08 J
Anthracene	120-12-7	50	ug/l	ND	ND	ND	ND	0.1 J	ND	-	0.15 J	ND	-	5.4 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	56-55-3	0.002	ug/l	ND	0.14 J	ND	ND	ND	ND	-	ND	ND	-	ND	ND	3 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	50-32-8	0 (ND)	ug/l	ND	0.1 J	ND	ND	ND	ND	-	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	205-99-2	0.002	ug/l	-	0.2	-	-	ND	-	-	ND	-	-	ND	-	ND	-	-	ND	-	ND	-	ND	-	ND
Benzo(ghi)perylene	191-24-2	-	ug/l	-	0.07 J	-	-	ND	-	-	ND	-	-	ND	-	ND	-	-	ND	-	ND	-	ND	-	ND
Benzo(k)fluoranthene	207-08-9	0.002	ug/l	-	0.14 J	-	-	ND	-	-	ND	-	-	ND	-	ND	-	-	ND	-	ND	-	ND	-	ND
Biphenyl	92-52-4	5	ug/l	-	ND	-	-	ND	-	-	ND	-	-	ND	-	6.3	-	-	ND	-	ND	-	ND	-	ND
Bis(2-ethylhexyl)phthalate	117-81-7	5	ug/l	3.8 J	ND	4.1 J	ND	ND	ND	-	ND	ND	-	ND	ND	ND	3.5 J	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	86-74-8	-	ug/l	-	ND	-	-	ND	-	-	ND	-	-	21	-	ND	-	-	ND	-	ND	-	ND	-	ND
Chrysene	218-01-9	0.002	ug/l	ND	0.07 J	ND	ND	ND	ND	-	ND	ND	-	ND	ND	2.8 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	132-64-9	-	ug/l	-	ND	-	-	ND	-	-	ND	-	-	18	-	ND	-	-	ND	-	ND	-	ND	-	ND
Fluoranthene	206-44-0	50	ug/l	1.6 J	0.43	ND	ND	0.1 J	ND	-	0.45	ND	-	5.5 J	ND	7.6 J	ND	ND	ND	ND	0.13 J	ND	ND	ND	ND
Fluorene	86-73-7	50	ug/l	2.9 J	0.16 J	ND	10	ND	3.3 J	-	0.13 J	40 J	-	29	1700 D	ND	ND	ND	0.14 J	ND	ND	ND	ND	ND	ND
Hexachloroethane	67-72-1	5	ug/l	ND	ND	ND	ND	ND	ND	-	ND	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.07 J
Indeno(1,2,3-cd)Pyrene	193-39-5	0.002	ug/l	-	0.18 J	-	-	ND	-	-	ND	-	-	ND	-	ND	-	-	ND	-	ND	-	ND	-	ND
Naphthalene	91-20-3	10	ug/l	230 D	1.1	70 D	18	0.09 J	150 D	ND **	ND	2000 D	1100 **	590	2400 D	940	ND	ND	3.5	ND	0.2	ND	ND	ND	ND
Phenanthrene	85-01-8	50	ug/l	3.2 J	0.2	2 J	ND	ND	1.1 J	-	ND	43 J	-	34	48 J	19	ND	ND	ND	ND	0.12 J	ND	ND	ND	0.08 J
Phenol	108-95-2	-	ug/l	R	-	2.3 J	150 D	-	16	-	-	ND	-	-	ND	-	ND	ND	-	ND	-	ND	-	ND	-
Pyrene	129-00-0	50	ug/l	1.3 J	0.55	ND	ND	0.08 J	ND	-	0.33	ND	-	3.2 J	ND	2.9 J	ND	ND	ND	ND	0.1 J	ND	ND	ND	ND
Pyridine	110-86-1	50	ug/l	6.5 J	-	ND	4 J	-	ND	-	-	ND	-	-	ND	-	ND	ND	-	ND	-	ND	-	ND	-
TOTAL PAHs	**NA**	**NA**	**ug/l**	**239**	**3.6**	**72**	**30.7**	**1**	**163.6**	**ND**	**-**	**2083**	**1100**	**-**	**4183**	**1003.3**	**ND**	**ND**	**4.53**	**ND**	**0.63**	**ND**	**ND**	**ND**	**0.16**
TOTAL Phenolic Compounds	**NA**	**NA**	**ug/l**	**ND**	**-**	**4.7**	**150**	**-**	**43.4**	**-**	**-**	**ND**	**-**	**-**	**ND**	**-**	**ND**	**ND**	**-**	**ND**	**-**	**ND**	**-**	**ND**	**-**
Total Metals																									
Arsenic, Total	7440-38-2	25	ug/l	ND	ND	4.6 B	3.2 B	-	10.1	-	4 J	485 J	-	623	8.2 B	1.96	ND	ND	ND	6.3 B	-	ND	ND	ND	ND
Barium, Total	7440-39-3	1000	ug/l	398 J	41	148 JB	150 JB	-	31.1 B	-	42	1790	-	2320	250 J	69.94	62.3 JB	120 B	109	42.9 B	-	35.7 B	71	146 B	90
Cadmium, Total	7440-43-9	5	ug/l	ND	-	ND	ND	-	ND	-	-	ND	-	-	0.25 B	-	ND	ND	-	0.64 B	-	ND	-	ND	-
Chromium, Total	7440-47-3	50	ug/l	19.1	40	2.7 B	2.4 B	-	0.8 B	-	ND	2.7 B	-	3 J	12.1	1.64	295	12.3	3 J	6.2	-	4.2 B	10	4.3 B	20
Lead, Total	7439-92-1	25	ug/l	ND	-	ND	ND	-	2.3 B	-	-	ND	-	-	1.9 B	0.64 J	2.9 B	ND	-	6.8	-	ND	-	ND	-
Selenium, Total	7782-49-2	10	ug/l	4.8 B	-	ND	ND	-	1.9 B	-	-	ND	-	-	ND	0.56 J	6.3	2.3 B	-	2.1 B	-	3.3 B	-	ND	-
Dissolved Metals																									
Arsenic, Dissolved	7440-38-2	25	ug/l	ND	-	-	-	-	-	-	-	541 J	-	152	4.5 JB	-	-	-	-	6.6 B	-	-	-	-	ND
Barium, Dissolved	7440-39-3	1000	ug/l	418 J	-	-	-	-	-	-	-	1740	-	1890	204 J	-	-	-	-	36.2 B	-	-	-	-	78
Cadmium, Dissolved	7440-43-9	5	ug/l	ND	-	-	-	-	-	-	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-	-
Chromium, Dissolved	7440-47-3	50	ug/l	19.2	-	-	-	-	-	-	-	0.62 B	-	ND	ND	-	-	-	-	1.3 B	-	-	-	-	ND
Lead, Dissolved	7439-92-1	25	ug/l	ND	-	-	-	-	-	-	-	ND	-	-	ND	-	-	-	-	ND	-	-	-	-	-
Selenium, Dissolved	7782-49-2	10	ug/l	4.2 JB	-	-	-	-	-	-	-	1.6 B	-	-	ND	-	-	-	-	ND	-	-	-	-	-
General Chemistry																									
Cyanide, Total	57-12-5	200	ug/l	510	49	0	0.14	-	220	-	186	89	-	-	0.61	-	0.11	290 J	1080	0.02 J	-	ND	-	16 J	-
Total Recoverable Phenolics (TRP)	NONE	1 *	ug/l	10	30	ND	ND	ND	15	ND	-	ND	41.2	-	0.032	310	ND	ND	20 J	ND	10 J	ND	10 J	ND	ND

EXHIBIT A - TABLE 1

GROUNDWATER ANALYTICAL SUMMARY [1]

Parameter	CAS No.	GWQS/GV [2]	Units	Monitoring Well Location, Sample Date(s), & Monitoring Program															
				MWN-49B		MWN-52A	MWN-52B	MWN-53A			MWN-54A			MWN-55A			MWN-66A	MWN-67A	MWN-68A	MWN-72A
				12/28/2000	3/9/2012	12/19/2000	12/19/2000	3/18/2005	4/4/2013	4/25/2013	3/18/2005	4/4/2013	4/25/2013	3/18/2005	4/4/2013	4/25/2013	7/9/2010	7/9/2010	7/9/2010	7/9/2010
				RFI	CMS	RFI	RFI	ICM 2005	ICM 2013	CMS	ICM 2005	ICM 2013	CMS	ICM 2005	ICM 2013	CMS	CMS	CMS	CMS	CMS
Field Measurements																				
Dissolved Oxygen	NA	-	MG/L	na	4.71	-	-	-	1.95	1.97	-	1.3	1.29	-	0.98	2.25	1.57	0.27	2.35	2.22
Field pH	NA	6.5 - 8.5	S.U	8.21	7.20	8.42	7.26	6.22	7.03	7.05	7.01	7.14	7.25	8.78	8.79	8.67	8.86	10.31	7.00	7.12
Redox Potential	NA	-	mV	-97	-48	-98	-124	63	-58	-73	-24	-88	-176	-29	-213	-216	-104	-516	-76	-100
Specific Conductance	NA	-	UMHOS/CM	1,700	1540	3250	3130	1001	1051	1060	947	2164	1996	2145	4542	4682	5885	3164	830.1	1094
Temperature	NA	-	DEG C	11.3	7.2	13.2	13.5	7.4	11.0	11.9	6.5	11.3	11.1	6.2	9.0	9.8	15.8	16.8	16.9	14.8
Turbidity	NA	-	NTU	950	>1000	7.1	-	100	15.4	6.59	12.9	17	8.11	10.6	1.66	1.6	189	>1000	7.41	29.3
Volatile Organics (Method 8260B) ***(STARS List parameters in blue)***																				
1,1,1,2-Tetrachloroethane	630-20-6	5	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	95-63-6	5	ug/l	-	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-	-	-
Acetone	67-64-1	50	ug/l	-	-	-	-	ND	ND	-	ND	ND	-	ND	ND	-	53 D	40 DJ	ND	ND
Benzene	71-43-2	1	ug/l	ND	ND	ND	ND	74	ND	-	180000 B	50000	-	2400 DB	700	-	10000 D	4100 D	ND	4 D
Carbon disulfide	75-15-0	60	ug/l	-	-	-	-	ND	ND	-	ND	ND	-	ND	ND	-	ND	4.3 DJ	ND	ND
Ethylbenzene	100-41-4	5	ug/l	ND	ND	ND	ND	ND	ND	-	1300 J	450 J	-	140	62	-	110 D	58 D	ND	ND
Isopropylbenzene	98-82-8	5	ug/l	-	ND	ND	ND	ND	ND	-	ND	ND	-	8.2	ND	-	ND	ND	ND	ND
Methyl cyclohexane	108-87-2	-	ug/l	-	-	-	-	ND	ND	-	ND	ND	-	4.8 J	ND	-	ND	ND	ND	ND
Styrene	100-42-5	5	ug/l	-	-	-	-	ND	ND	-	ND	ND	-	7.6	ND	-	470 D	ND	ND	ND
Toluene	108-88-3	5	ug/l	ND	ND	ND	ND	ND	ND	-	9400	200 J	-	23	ND	-	3600 D	2200 D	ND	ND
Xylenes, m\p	179601-23-1	5	ug/l	-	ND	-	-	-	ND	-	-	ND	-	-	ND	-	1600 D	1000 D	ND	ND
Xylenes, o	95-47-6	5	ug/l	-	ND	-	-	-	ND	-	-	ND	-	-	ND	-	570 D	390 D	ND	ND
Xylenes, Total	1330-20-7	5	ug/l	ND	ND	ND	ND	ND	ND	-	ND	1060 J	-	340	1250 J	-	2170 D	1390 D	ND	ND
TOTAL BTEX	**NA**	**NA**	**ug/l**	**ND**	**ND**	**ND**	**ND**	**74**	**ND**	**-**	**190700**	**51710**	**-**	**2903**	**2012**	**-**	**15880**	**7748**	**ND**	**4**
Semivolatile Organics (Method 8270C) (Base-Neutrals in black, ***Acid Extractables in blue*** ***and*** ***PAHs in red)***																				
2,4-Dimethylphenol	105-67-9	50	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	91-57-6	-	ug/l	-	ND	-	-	-	-	ND	-	-	39	-	-	22	-	-	-	-
2-Methylphenol (o-Cresol)	95-48-7	-	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthene	83-32-9	20	ug/l	-	ND	-	-	-	-	0.8	-	-	3.8 J	-	-	5.4 J	-	-	-	-
Acenaphthylene	208-96-8	-	ug/l	ND	ND	ND	ND	-	-	ND	-	-	21	-	-	8.3 J	-	-	-	-
Anthracene	120-12-7	50	ug/l	ND	ND	ND	ND	-	-	0.09 J	-	-	ND	-	-	ND	-	-	-	-
Benzo(a)anthracene	56-55-3	0.002	ug/l	ND	ND	ND	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Benzo(a)pyrene	50-32-8	0 (ND)	ug/l	ND	ND	ND	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Benzo(b)fluoranthene	205-99-2	0.002	ug/l	-	ND	-	-	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Benzo(ghi)perylene	191-24-2	-	ug/l	-	ND	-	-	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Benzo(k)fluoranthene	207-08-9	0.002	ug/l	-	ND	-	-	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Biphenyl	92-52-4	5	ug/l	-	ND	-	-	-	-	ND	-	-	4.2	-	-	4.8	-	-	-	-
Bis(2-ethylhexyl)phthalate	117-81-7	5	ug/l	6.6 J	ND	ND	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Carbazole	86-74-8	-	ug/l	-	ND	-	-	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Chrysene	218-01-9	0.002	ug/l	ND	ND	ND	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Dibenzofuran	132-64-9	-	ug/l	-	ND	-	-	-	-	ND	-	-	5.1	-	-	5.4	-	-	-	-
Fluoranthene	206-44-0	50	ug/l	ND	ND	ND	ND	-	-	ND	-	-	3.5 J	-	-	ND	-	-	-	-
Fluorene	86-73-7	50	ug/l	ND	ND	ND	ND	-	-	ND	-	-	ND	-	-	5.8 J	-	-	-	-
Hexachloroethane	67-72-1	5	ug/l	ND	ND	ND	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Indeno(1,2,3-cd)Pyrene	193-39-5	0.002	ug/l	-	ND	-	-	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Naphthalene	91-20-3	10	ug/l	ND	ND	ND	ND	-	-	ND	-	-	2700 D	-	-	730	18000 D **	8700 D **	0.7 J **	7.8 D **
Phenanthrene	85-01-8	50	ug/l	ND	ND	ND	ND	-	-	ND	-	-	9.3 J	-	-	3.4 J	-	-	-	-
Phenol	108-95-2	-	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	129-00-0	50	ug/l	ND	ND	ND	ND	-	-	ND	-	-	ND	-	-	ND	-	-	-	-
Pyridine	110-86-1	50	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL PAHs	**NA**	**NA**	**ug/l**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**-**	**ND**	**ND**	**-**	**ND**	**ND**	**-**	**18000**	**8700**	**0.7**	**7.8**
TOTAL Phenolic Compounds	**NA**	**NA**	**ug/l**	**ND**	**-**	**ND**	**ND**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total Metals																				
Arsenic, Total	7440-38-2	25	ug/l	6.6 B	17	4.5 B	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium, Total	7440-39-3	1000	ug/l	1160	1360	136 B	356	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium, Total	7440-43-9	5	ug/l	0.97 B	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Total	7440-47-3	50	ug/l	3.5 B	40	6.6	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Total	7439-92-1	25	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium, Total	7782-49-2	10	ug/l	ND	-	ND	ND	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Metals																				
Arsenic, Dissolved	7440-38-2	25	ug/l	4.2 B	4 J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium, Dissolved	7440-39-3	1000	ug/l	1040	1110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium, Dissolved	7440-43-9	5	ug/l	0.65 B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium, Dissolved	7440-47-3	50	ug/l	1.4 B	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead, Dissolved	7439-92-1	25	ug/l	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium, Dissolved	7782-49-2	10	ug/l	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
General Chemistry																				
Cyanide, Total	57-12-5	200	ug/l	17 J	-	40 J	53 J	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Recoverable Phenolics (TRP)	NONE	1 *	ug/l	25 J	ND	ND	ND	-	-	50	-	-	420	-	-	50	7720 B	ND	ND	ND

Notes:

1. Only those compounds detected above the method detection limit at a minimum of one sample location are reported in this table.
2. NYSDEC Class "GA" Groundwater Quality Standards/Guidance Values (GWQS/GV) as per 6 NYCRR Part 703.

Qualifier Key:

B	The analyte was detected above the reporting limit in the associated method blank.
J	Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).
ND	Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.
R	Sample result was rejected by a third party validator.
D	Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
-	Not analyzed for this parameter
*	The general standard of 1.0 ug/L for phenolic compounds was used.
**	Indicates that naphthalene was analyzed as a VOC via Method 8260 rather than as an SVOC via Method 8270.

Color Code:

= concentration exceeds the GWQS/GV, but is less than 10 times the GWQS/GV
= concentration exceeds 10 times the GWQS/GV, but is less than 100 times the GWQS/GV
= concentration exceeds 100 times the GWQS/GV

Exhibit B

SUMMARY OF THE CLEANUP OBJECTIVES

The goal for the corrective measure program is to achieve unrestricted use of the site to the extent feasible. At a minimum, the corrective measure(s) shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the facility through the proper application of scientific and engineering principles. Note that OU-04 is limited to the groundwater in the Coke Oven Area, so the table below only lists objectives specific to that medium.

The established cleanup objectives for OU-04 are identified in the table below.

Compound	Groundwater Cleanup Objective[1] (ppb or ug/l)
VOCs	
1,1,2,2-Tetrachloroethane	5
1,2,4-Trimethylbenzene	5
1,3,5-Trimethylbenzene	5
2-Butanone	50
Acetone	50
Benzene	1
Carbon disulfide	60
Chlorobenzene	5
Ethylbenzene	5
Isopropylbenzene	5
Methyl cyclohexane	NV[2]
Styrene	5
Toluene	5
Trichloroethene	5
Xylenes, Total	5
SVOCs	
2,4-Dimethylphenol	50
2-Methylnaphthalene	NV
2-Methylphenol (o-Cresol)	NV
3-Methylphenol (m-Cresol)	NV
Acenaphthene	20
Acenaphthylene	NV
Anthracene	50
Benzo(a)anthracene	0.002
Benzo(b)fluoranthene	0.002
Biphenyl	5

Compound	Groundwater Cleanup Objective[1] (ppb or ug/l)
Bis(2-ethylhexyl)phthalate	5
Carbazole	NV
Chrysene	0.002
Dibenzofuran	NV
Fluoranthene	50
Fluorene	50
Naphthalene	10
Phenanthrene	50
Phenol	NV
Pyrene	50
Pyridine	50
General Chemistry	
Phenolics (chlorinated)	1
Phenolics (unchlorinated)	5

Table Notes:

[1] Standard Criteria or Guidance - Ambient Water Quality Standards and Guidance Values (NYSDEC TOGS 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).

[2] NV indicates that no comparison value is listed in TOGS 1.1.1.

Exhibit C

Description of Remedial Alternatives

The following potential remedies were considered based on the remedial action objectives (see Section 6.5) to address the contamination identified at the site as described in Exhibit A. For costing purposes, operation, monitoring and maintenance for a 30 year period is included for each alternative.

Alternative 1: No Further Action

Under this alternative, the existing Benzol Yard ICM groundwater treatment system would continue to operate with no significant modifications or enhancements. Key elements of this system are shown on Figure C-1. Monitoring of the groundwater in the Coke Oven Area (OU 04) would continue. This alternative would not prevent contaminated groundwater from reaching the Gateway Metroport Ship Canal. This alternative serves as the baseline for comparison of the overall effectiveness of the other remedial alternatives and does not provide any additional protection of the environment and public health. This alternative could be implemented immediately. The costs associated with this alternative are estimated to be $1.4 million.

Alternative 2: Enhanced Groundwater Collection and Treatment

Under the alternative, expanded groundwater collection, conveyance and treatment systems would be constructed. The southern groundwater collection system would include the 11 existing Benzol Yard collection wells (that were initially installed as an Interim Corrective Measure in 2005), supplemented with 12 new groundwater collection wells. Extracted groundwater would be treated by phase separation (oil-water separator), followed by air stripping for removal of volatile organic compounds (VOCs).

Under this alternative, groundwater in the northern portion of OU-04 (including SWMU P-11A) would be captured by the installation of 29 new groundwater pumping wells. Water would be treated by air stripping for VOC removal, with secondary polishing by granular activated carbon to remove phenolics and naphthalene (these compounds are not elevated in the groundwater in the southern area). In total, 52 groundwater collection wells, associated force mains and two independent groundwater treatment systems would be constructed to capture, convey and treat the extracted groundwater in OU-04.

The treatment systems for both the southern and northern collection systems, with a combined capacity of approximately 80 gallons per minute would be housed in single new building centrally located in OU-04. Treated water would be re-injected into groundwater through an expanded infiltration gallery located along the western perimeter of OU-04.

Key elements of this system are shown on Figure C-2. The costs associated with this alternative are estimated to be $3.8 million.

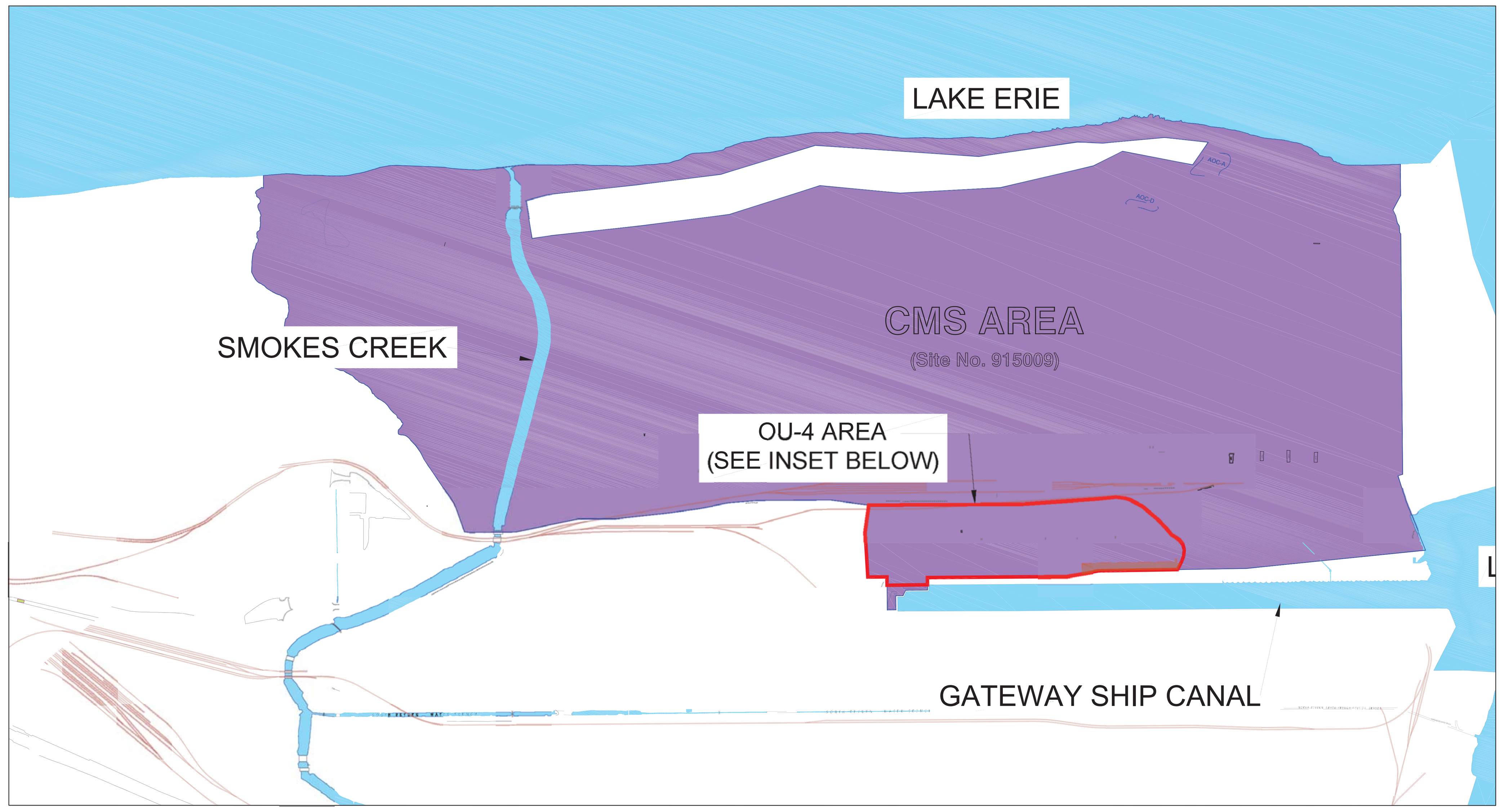
Alternative 3: Partial Slurry Wall Containment System with Enhanced Groundwater Collection and Treatment

Under this alternative, approximately 2,500 linear feet of low permeability bentonite slurry wall would be constructed along the eastern side of OU-04 to isolate groundwater flow to and from the Ship Canal. A new groundwater extraction and treatment system would be constructed to collect and treat the extracted groundwater. The treatment system would consist of the same process units described for Alternative 2, but would be sized for slightly lower flow rates (i.e., 60 gpm) since the slurry wall would reduce recharge of groundwater along the eastern perimeter of OU-04. As described in Alternative 2, treated groundwater would be reinjected via an infiltration gallery. Key elements of this system are shown on Figure C-3. The costs associated with this alternative are estimated to be $6.15 million.

Alternative 4: Slurry Wall Containment System with Low-Permeability Cover System and Enhanced Groundwater Collection and Treatment

Under this alternative, approximately 5,500 linear feet of low permeability bentonite slurry wall would be constructed around OU-04 to isolate groundwater flow to and from the Ship Canal, a low permeability geo-composite cover system would be constructed over the OU-04 area to reduce infiltration from precipitation, and a new groundwater extraction and treatment system would be constructed to treat extracted groundwater. The treatment system would consist of the same process units described for Alternatives 2 and 3, but would be sized for an even lower flow rates (i.e., 40 gpm) since the slurry wall would reduce lateral recharge of groundwater along the perimeter of OU-04, and the cover system would reduce vertical recharge. Treated groundwater would be discharged to groundwater outside of the slurry wall, or discharged to the municipal treatment plant (POTW) through the existing site sewer system. Key elements of this system are shown on Figure C-4. The costs associated with this alternative are estimated to be $16.2 million.

ALTERNATIVE 1 - NO FURTHER ACTION - EXISTING INTERIM CORRECTIVE MEASURE SYSTEM



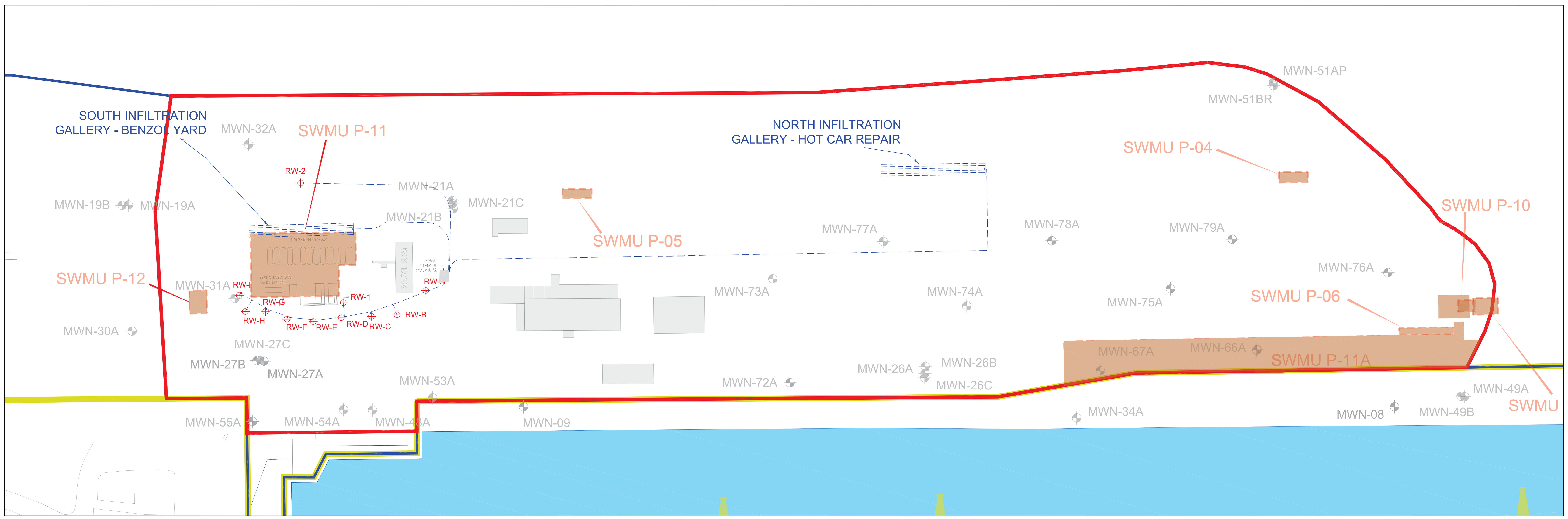
CMS AREA FEATURES
APPROXIMATE SCALE 1" = 800'

LEGEND:

- TECUMSEH PROPERTY BOUNDARY
- OPERABLE UNIT 4 BOUNDARY
- EXISTING GROUNDWATER COLLECTION FORCE MAIN
- SOLID WASTE MANAGEMENT UNIT (SWMU) BOUNDARY
- REMEDIATED AND CLOSED SWMU BOUNDARY
- CMS AREA BOUNDARY (EXCLUDING WATER COURSES)
- APPROXIMATE SWMU BOUNDARY FROM RFI OPERABLE UNIT 4 BOUNDARY
- MWN-54A — EXISTING MONITORING WELL
- RW-H — EXISTING RECOVERY WELLS

NOTES:

1. Existing monitoring well suffix definitions are as follows: A = fill unit, B = sand unit, C = misc. unit, D = bedrock unit. Monitoring wells without a suffix are fill unit wells.



OPERABLE UNIT 4 PLAN VIEW

SCALE: 1 INCH = 100 FEET
SCALE IN FEET
(approximate)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
TURNKEY ENVIRONMENTAL RESTORATION, LLC

JOB NO.: 0071-013-921

REVISIONS

NO.	BY	DATE	REMARKS

SEAL

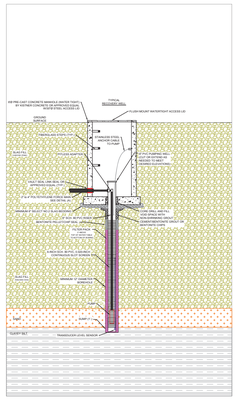
DRAWN BY: RFL/KRR
DATE: APRIL 2016
CHECKED BY: NTM
APPROVED BY: PHW

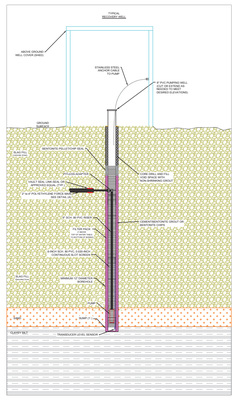
PLAN VIEW OF CMS AND OU4 AREA

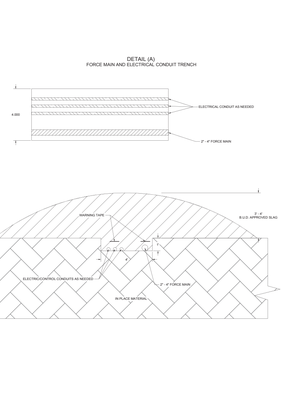
OU-4 ENGINEERING REPORT
TECUMSEH SITE - CMS AREA
LACKAWANNA, NEW YORK
PREPARED FOR
TECUMSEH REDEVELOPMENT INC.

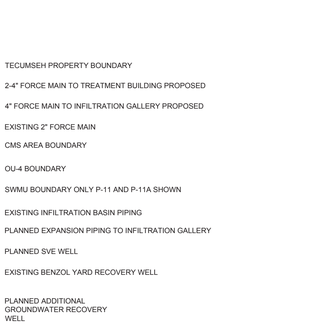
FIGURE 1-2

ALTERNATIVE 2 - ENHANCED GROUNDWATER EXTRACTION and TREATMENT

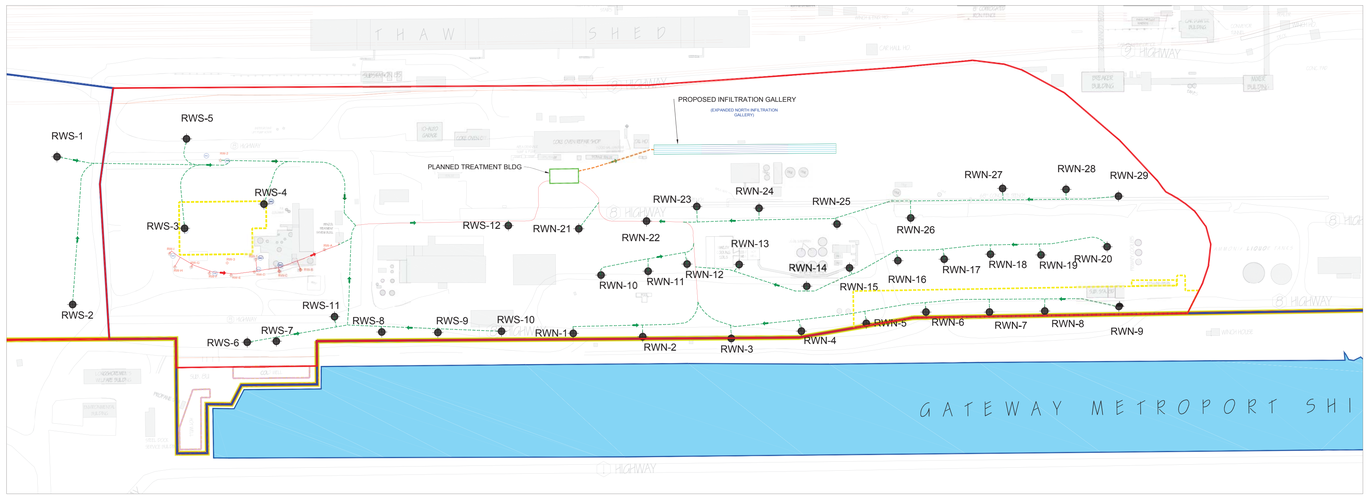








NOTE:
1. NEW OR EXISTING WELLS EXHIBITING THE PRESENCE OF LNAPL WILL BE SUBJECT TO FREE-PRODUCT RECOVERY.



PLAN VIEW OF OU-4 AREA

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC
TURNKEY Environmental Restoration, LLC
2558 HAMBURG TURNPIKE SUITE 300, BUFFALO, NY 14218, 716.856.0599

JOB NO.: 0071-013-921

REVISIONS

NO.	BY	DATE	REMARKS

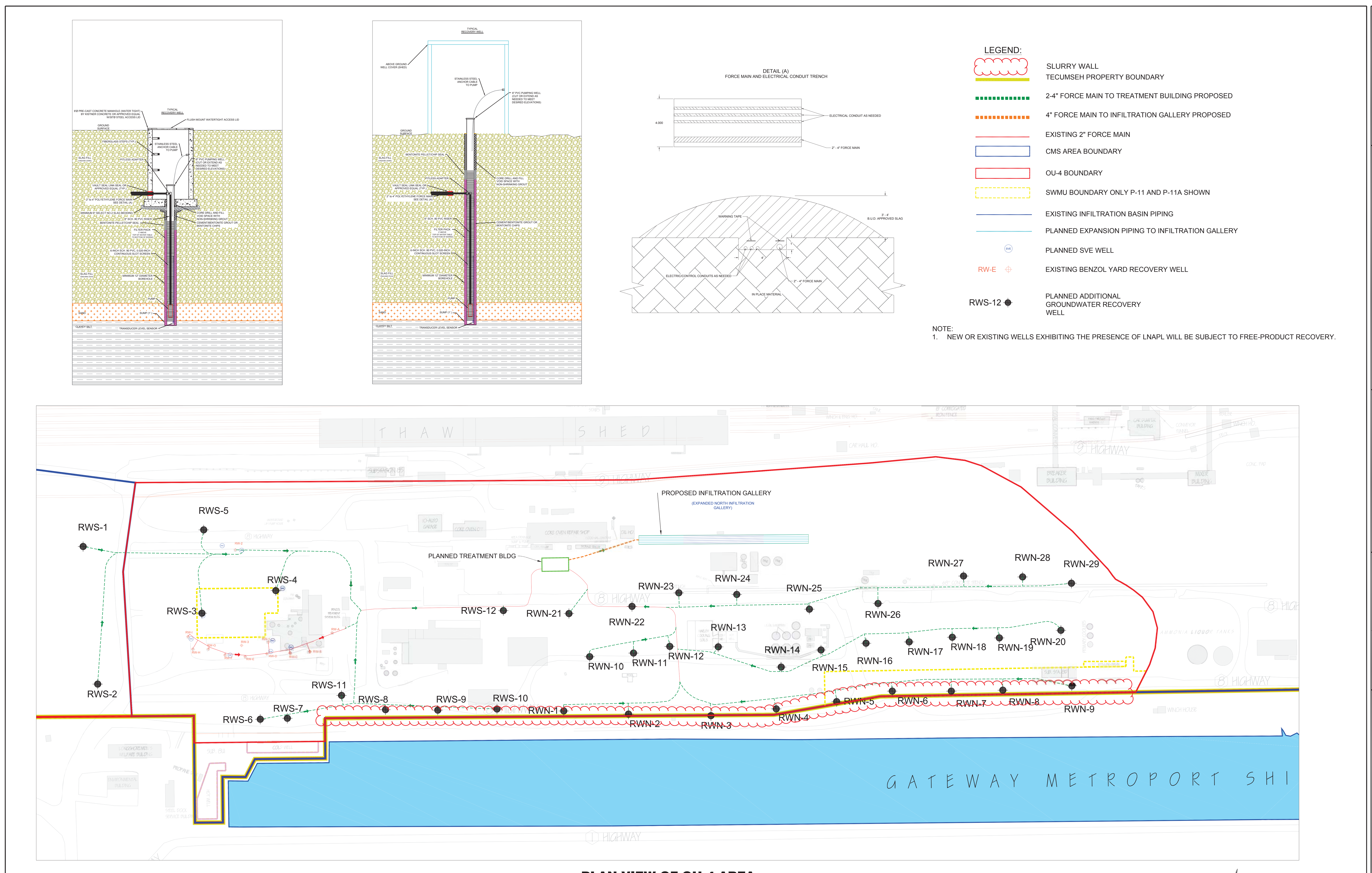
SEAL

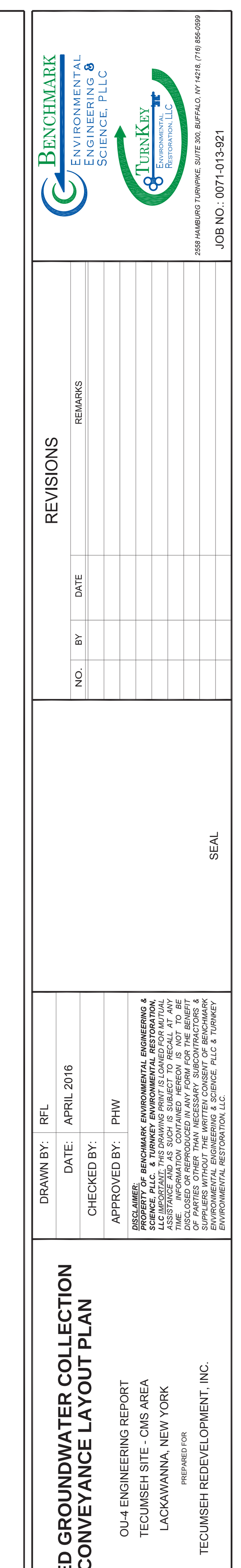
DRAWN BY: RFL
DATE: APRIL 2016
CHECKED BY:
APPROVED BY: PHW

PROPOSED GROUNDWATER COLLECTION AND CONVEYANCE LAYOUT PLAN

OU-4 ENGINEERING REPORT
TECUMSEH SITE - CMS AREA
LACKAWANNA, NEW YORK
PROJECT NO. 0071-013-921
TECUMSEH REDEVELOPMENT, INC.

ALTERNATIVE 3 - ENHANCED GROUNDWATER EXTRACTION with PARTIAL SLURRY WALL





ALTERNATIVE 4 - PERIMETER SLURRY WALL/COVER SYSTEM with ENHANCED GROUNDWATER EXTRACTION

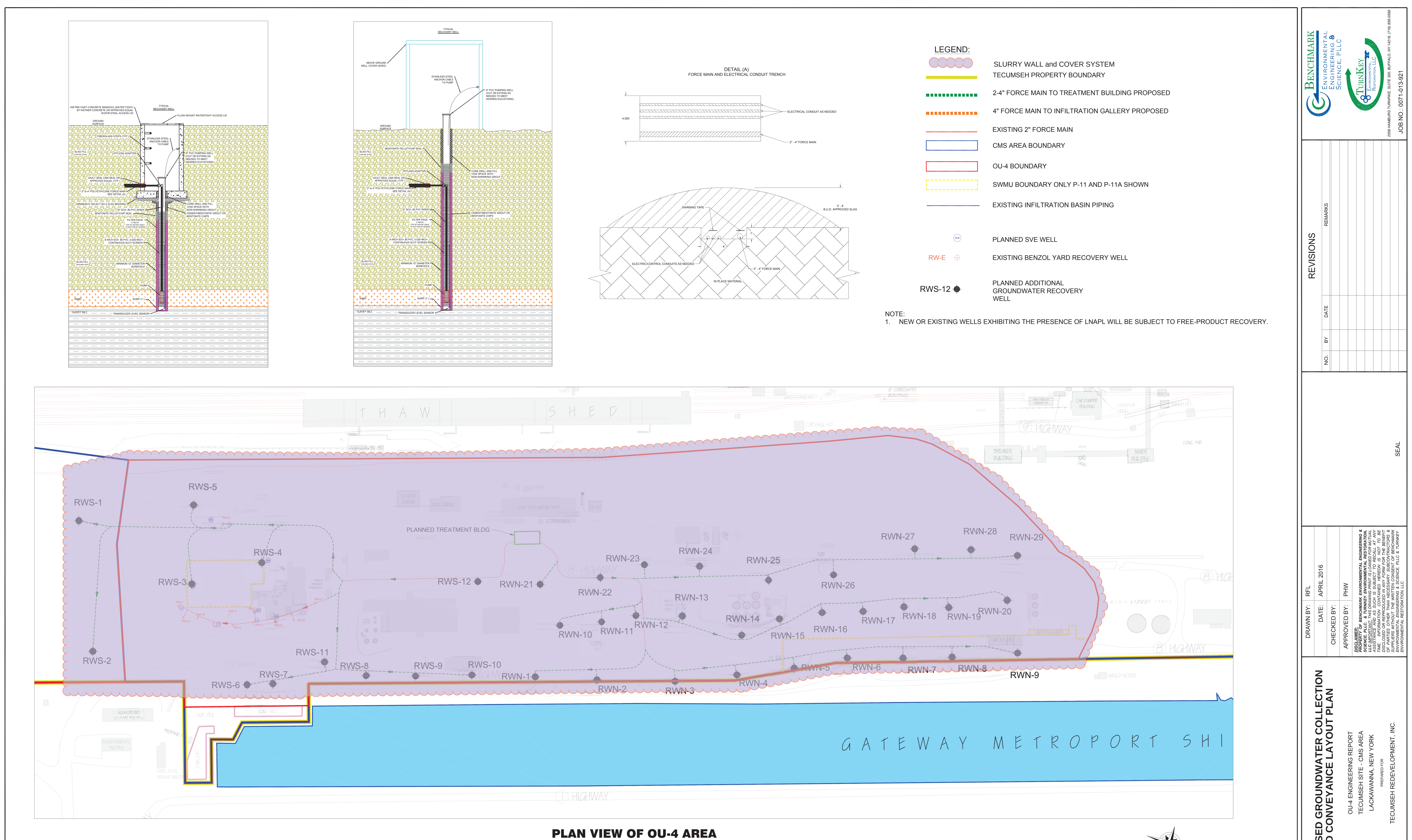


Exhibit D

Corrective Measure Alternative Cost Summary

Corrective Measure Alternative	Total Estimated Cost
Alternative No. 1 No Further Action	$1.4 million
Alternative No. 2 Enhanced Groundwater Collection and Treatment	$3.8 million
Alternative No. 3 Partial Slurry Wall Containment System with Enhanced Groundwater Collection and Treatment	$6.15 million
Alternative No. 4 Slurry Wall Containment System with Low-Permeability Cover System and Enhanced Groundwater Collection and Treatment	$16.2 million

Exhibit E

BASIS FOR FINAL CORRECTIVE MEASURES SELECTION

The Department has identified Alternative No. 2 – Enhanced Groundwater Collection and Treatment as the preferred remedy for this site. The Department's basis for selection of Alternative 2 is summarized below.

Alternative 2 – Enhanced Groundwater Collection and Treatment

Under this alternative, expanded groundwater collection, conveyance and treatment systems would be constructed. The southern groundwater collection system would include the 11 existing Benzol Yard collection wells (that were initially installed as an Interim Corrective Measure in 2005), supplemented with 12 new groundwater collection wells. Extracted groundwater would be treated by phase separation (oil-water separator), followed by air stripping for removal of volatile organic compounds (VOCs).

Groundwater in the northern portion of OU-04 (including SWMU P-11A) would be captured by the installation of 29 new groundwater pumping wells. Water would be treated by air stripping for VOC removal, with secondary polishing by granular activated carbon to remove phenolics and naphthalene (these compounds are not elevated in the groundwater in the southern area). In total, 52 groundwater collection wells, associated force mains and two independent groundwater treatment systems would be constructed to capture, convey and treat the extracted groundwater in OU-04.

The treatment systems for both the southern and northern collection systems, with a combined capacity of approximately 80 gallons per minute would be housed in single new building centrally located in OU-04. Treated water would be re-injected into groundwater through an expanded infiltration gallery located along the western perimeter of OU-04.

This alternative is implementable from a technical standpoint and utilizes readily available equipment, construction techniques, and relies on commonly used sampling, analytical, data assessment, and reporting methodologies for monitoring performance.

Remedy Selection Criteria

Threshold Criteria

Overall Protection of Public Health and the Environment

Alternatives 2, 3 and 4 are protective of public health, because they each provide effective controls to minimize future exposures related to groundwater contamination. Groundwater use within the impacted area is also not a contributing factor as the impacted area has access to municipal water service.

Alternatives 2, 3, and 4 are protective of the environment as the pathway for direct contact and potential metabolic uptake from ground water exposure to ecologic receptors is blocked. Alternatives 2, 3 and 4 also include collection and removal of LNAPL that is a source for the groundwater contamination. These alternatives include collection and treatment of highly contaminated groundwater that could be acting as a source impacting surrounding areas. Under Alternatives 2, 3, and 4 the potential for adverse future exposures will continue to diminish as contaminant concentrations continue to decline due to contaminant mass removal, as well as contaminant degradation and related natural attenuation processes.

Alternative 1 is not considered protective of human health or the environment because it does not effectively control the migration of contaminants from the site and it does not treat the source of the contamination. This migration and subsequent discharge to adjacent surface water has the potential to adversely affect human as well as ecological receptors. Since Alternative 1 fails to satisfy this threshold selection criterion, it is eliminated from further consideration.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) – Alternatives 2, 3, and 4 will generate wastes associated with the treatment of groundwater as well as through the collection of LNAPL. These wastes will be similar to those generated by operation of the existing ICM and are not expected to pose any significant waste management concerns. LNAPL will be shipped offsite for recycling or disposal as hazardous waste. Treated groundwater will either be re-injected or discharged to a POTW under an appropriate sewer use agreement. Spent carbon from the GAC treatment of water from the SWMU P-11A area will be shipped off-site for regeneration or disposal. Any wastes generated by these alternatives can readily be conducted in a protective manner.

Based on the results obtained from operation of the Benzol Yard interim measure, the technologies employed in Alternatives 2, 3, and 4 have the potential to reduce contaminant concentrations in groundwater to the SCGs, however it will take a considerable amount of time to do so.

Balancing Criteria

Long-term Effectiveness and Permanence. Alternatives 2, 3 and 4 are expected to provide similar levels of long-term effectiveness after implementation. Groundwater concentrations are expected to continue to exceed the SCGs for some time after remedy implementation for all of these alternatives because of difficulties in mobilizing contaminants out of the smear zone. Due to these site conditions, the time to achieve the SCGs for groundwater is expected to be generally comparable for all three alternatives.

These alternatives rely on common, active groundwater and LNAPL recovery technologies, so they are viewed as equivalent in this regard. Alternatives 3 and 4 also incorporate passive features (slurry wall and/or low permeability cover) to reduce the volume of recharge occurring either laterally, from the sides, or from above. This in turn

reduces the expected flow rate for the treatment system over the long term, and decreases the load and energy required by the system infrastructure, relative to Alternative 2. However, in order to sustain these potential benefits, these passive features need to be maintained and protected to retain their effectiveness.

The reliability of Alternatives 2, 3 and 4 is dependent on proper operation, monitoring and maintenance. Alternatives 3 and 4 include additional engineering controls that require additional protection relative to Alternative 2.

Alternatives 2, 3, and 4 are expected to provide comparable levels of long term effective and permanence.

Reduction of Toxicity, Mobility, Volume. Alternatives 2, 3 and 4 are expected to provide similar levels of performance relative to this criterion. The alternatives all include removal of similar contaminant mass, control of migration over a similar area and involve similar volumes of contaminated media.

Short-term Impacts and Effectiveness. Alternatives 2, 3 and 4 include similar levels of impact associated with extraction well installation and construction of related conveyance and treatment systems. Alternatives 3 and 4 involve considerable impacts associated with construction of slurry walls, such as management of spoils generated from the trench alignments and use of heavy equipment. Since Alternative 4 includes installation of substantially more slurry wall than Alternative 3, the magnitude of such impacts will be proportionally greater than those of Alternative 3. Alternative 4 also includes construction of an engineered low permeability cover system over a large area. This involves substantial impacts associated with removal of existing infrastructure to provide access, transport of cover materials to the site, and heavy equipment used during construction. The short-term impacts associated with Alternative 2 are less than those associated with Alternatives 3 and 4. While potential short-term adverse impacts upon the community, the workers, and the environment associated with construction/implementation of Alternatives 3 and 4 can be mitigated, these are negatives relative to Alternative 2. Alternatives 3 and 4 also involve greater direct and indirect greenhouse gas and other emissions relative to Alternative 2, so they are viewed negatively on these green remediation metrics. Alternative 2 is preferred based on this balancing criterion.

Alternatives 3 and 4 require more time to construct than Alternative 2, before they become effective, so Alternative 2 has a slight preference based on this balancing criterion.

Implementability. While implementation of all three alternatives is feasible, Alternative 2 is most readily implementable, since it does not involve construction of slurry walls. Past experience at this site encountered difficult subsurface conditions that made slurry wall construction difficult but not impossible. Alternative 4, especially the cover system element, is complicated by the presence of existing infrastructure (buildings, piping, and tankage) that will interfere with construction.

Alternatives 2, 3 and 4 involve reinjection of treated groundwater into the ground. Reinjection is subject to regulatory controls pursuant to DEC policy. Conditions related to reinjection are not expected to be a significant impediment since the existing ICM system re-injects treated water. One option under Alternative 4 involves directing effluent to a POTW. This requires a sewer use permit from the local municipality for discharge of the treated water, and typically imposes pretreatment requirements, but can generally be obtained readily.

Alternatives 2, 3 and 4 are expected to involve air stripping as part of the water treatment process. These alternatives are all subject to an air discharge evaluation (possible permit requirement) so all are considered equal on this issue.

Alternative 2 is preferred alternative based on the implementability balancing criterion.

Cost-Effectiveness. Alternative 2 has lower estimated costs than Alternatives 3 and 4, but offers a comparable level of effectiveness, so Alternative 2 is preferred based on this balancing criterion.

Summary

All three alternatives satisfy the threshold section criteria, and have the potential to meet the remedial objectives for this site. However, when the balancing criteria are taken into consideration, Alternative 2 is preferred. Alternative 2 provides an effective approach for reducing groundwater concentrations, protecting the environment and minimizing exposure potential, in a readily implementable, cost effective manner.

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Bethlehem Steel
Coke Oven Area Groundwater
Operable Unit 04
Site No. 915009
EPA ID No. NYD002134880
Lackawanna, Erie County

The Draft Statement of Basis (DSB) for the referenced site was prepared by the New York State Department of Environmental Conservation (the Department) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on February 15, 2017. The DSB outlined the remedial measures proposed for the referenced operable unit associated with the Bethlehem Steel site.

The release of the DSB was announced by sending a notice to the public contact list, informing the public of the opportunity to comment on the proposed remedy. The notice also appeared in the Lackawanna Front Page.

A public meeting was held on March 8, 2017, which included a presentation of the site investigations as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the DSB was from February 15, 2017 through March 31, 2017.

This responsiveness summary responds to all questions and comments raised during the public comment period. This includes comments received at the public meeting, as well as those submitted by email, and by letter. The following are the comments received, with the Department's responses:

Public Meeting Comments:

COMMENT 1: Where does the oil go after it goes through the treatment center?

RESPONSE 1: After the oil is collected, it is shipped to a facility in Pennsylvania for recycling.

COMMENT 2: How long will these wells be in place?

RESPONSE 2: It is difficult to determine the exact time frame, but it is anticipated for at least 10 years. Once groundwater is contaminated, it is difficult to restore the groundwater quality. Source removal will also help in reducing the duration of the groundwater extraction system.

COMMENT 3: What is the goal of this cleanup plan/partial temporary system?

RESPONSE 3: The near-term goal is to prevent contaminated groundwater from entering into the ship canal and Lake Erie. The longer-term goal is to restore groundwater quality within the operable unit.

COMMENT 4: What steps remain before DEC has a plan to remove the source (that is making the groundwater contaminated)?

RESPONSE 4: The remedy that has been proposed will remove oil/free product that is contaminating the groundwater. However, contamination is also likely to be present within soil in the area. In conjunction with the proposed groundwater remedy, the Department is also evaluating an interim remedial measure for the soils. This measure involves a soil vapor extraction system that the Department expects will be implemented during the next year. A recent pilot test of this technology conducted in the coke oven area indicated favorable results.

COMMENT 5: Is there no current overall study of the whole RCRA site?

RESPONSE 5: Yes, a site-wide RCRA Facility Investigation (RFI) was completed in 2006. This investigation assessed the environmental conditions across the entire site and identified potential sources of contamination.

COMMENT 6: Is there a timeline for Tecumseh to clean the whole site?

RESPONSE 6: There is no set timeline and the large site is being handled by breaking it into smaller more manageable units (operable units). The Department is currently reviewing additional projects such as the former tank farm area. The Department is addressing the highest-priority operable units first.

COMMENT 7: I thought Benzene breaks down over time and over distance? You said Benzene is going towards the lake, but that doesn't seem bad (as it would be almost non-existent by the time it gets there). Or how bad is it actually?

RESPONSE 7: Benzene does break down and by the time the westward component gets near the lake, the levels of benzene are very low.

COMMENT 8: How many sites/OUs are there total in the whole Former Bethlehem Steel area?

RESPONSE 8: 43 solid waste management units (SWMUs) and 5 watercourses were identified in the RFI. A number of them have been addressed in previous remedial programs. Currently there nine operable units associated with the site.

COMMENT 9: Are the hot spots (SWMUs?) right by Lake Erie part of this proposal?

RESPONSE 9: No, the proposal is for an action that is located next to the Ship Canal

and not out along the western edge of the site where the shore of Lake Erie is.

COMMENT 10: Do we have any idea of impact to wildlife on remediation of this site since 2001?

RESPONSE 10: An ecological risk assessment was performed as part of the RFI in 2006. Since that time, much work has been completed to reduce exposure of contaminants to fish and wildlife.

COMMENT 11: What are the current monitoring programs for the whole site? This specific area? Is there anywhere that is less than annual (monitoring fewer than once a year)?

RESPONSE 11: Monitoring occurs at different frequencies depending on the nature of the project. For example, quarterly monitoring occurs at the Acid Tar Pits (OU03), biannual monitoring occurs at the benzol yard (OU04A), and annual monitoring is performed at HWMUs 1A, 1B and HWMU 2A.

COMMENT 12: Is that ship canal still in use?

RESPONSE 12: Yes.

COMMENT 13: Where is the county trying to buy the parcel?

RESPONSE 13: A map was shown to the audience that showed the area that the county intends to buy. That area is not near the OU04 area.

COMMENT 14: Is the State paying for this project?

RESPONSE 14: Tecumseh Redevelopment is paying for all costs for this project and costs associated with investigation and cleanup of the site.

APPENDIX B

Administrative Record

Administrative Record

Bethlehem Steel
Coke Oven Area Groundwater
Operable Unit 04
Site No. 915009
EPA ID No. NYD002134880
Lackawanna, Erie County

URS Consultants, Inc. RCRA Facility Investigation (RFI) Report for the Former Bethlehem Steel Corporation Facility, Lackawanna, New York, Parts I through VII. October 2004.

TurnKey Environmental Restoration, LLC in association with Benchmark Environmental Engineering & Science, PLLC. Corrective Measures Study Work Plan, Tecumseh Redevelopment Site, Lackawanna, New York. May 2009.

TurnKey Environmental Restoration, LLC in association with Benchmark Environmental Engineering & Science, PLLC. Corrective Measures Study Report (Final Draft), Tecumseh Redevelopment Site, Lackawanna, New York. December 2011, revised October 2014.

TurnKey Environmental Restoration, LLC in association with Benchmark Environmental Engineering & Science, PLLC. Comprehensive Groundwater Quality Assessment Report (2014). Tecumseh Redevelopment CMS Area, Lackawanna, New York. May 2014.

TurnKey Environmental Restoration, LLC in association with Benchmark Environmental Engineering & Science, PLLC. Expedited Corrective Measures Work Plan, Operable Unit 4, Tecumseh Redevelopment Site, Lackawanna, New York. January 2014, revised June 2015.

Benchmark Environmental Engineering & Science, PLLC, in association with TurnKey Environmental Restoration, LLC. Benzol Yard Groundwater Contaminant Source Area Pilot-Scale Treatability Test Report, Operable Unit OU-4, Tecumseh Redevelopment Site, Lackawanna, New York. February 2016.

TurnKey Environmental Restoration, LLC in association with Benchmark Environmental Engineering & Science, PLLC. Evaluation of Groundwater Corrective Measures Operable Unit 4 Coke Plant By-Products Solid Waste Management Group Tecumseh Redevelopment Site Lackawanna, New York. Rev August 2016

TurnKey Environmental Restoration, LLC in association with Benchmark Environmental Engineering & Science, PLLC. Year 11 – Annual & Second Semi-Annual ICM Operation and Performance Summary Report Tecumseh Redevelopment Inc. -

Lackawanna, NY Site Former Benzol Plant Tank Storage Area (SWMU P-11) Interim Corrective Measure (ICM) October 2016.

New York State Department of Environmental Conservation, Interim Order on Consent – File No. 03-73: Interim Corrective Measures for the Benzol Plant Tank Storage Area (SWMU P-11), November 2004.

New York State Department of Environmental Conservation, Draft Statement of Basis Corrective Measures Selection: Bethlehem Steel Coke Oven Groundwater Operable Unit 04, Site No. 915009, EPA ID No. NYD002134880, Lackawanna, Erie County February 2017.