BARKER CHEMICAL

NIAGARA COUNTY

SOMERSET, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: 932119

USEPA ID #: Not Applicable

Prepared for:

Not Applicable

Prepared by:

New York State Department of Environmental Conservation

700 Delaware Avenue, Buffalo, New York 14209

716-851-7220

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

---

AUGUST 2023

CERTIFICATION STATEMENT

I, GLENN M. MAY, certify that I am currently a NYS registered professional geologist and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Glenn M. May P.G.

AUGUST 7, 2023 DATE

BARKER CHEMICAL

NIAGARA COUNTY

SOMERSET, NEW YORK

SITE MANAGEMENT PLAN

Table of Contents

List of Tables

List of Tables (continued)

List of Figures

List of Figures (continued)

List of Appendices

List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Soil Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List

List of Acronyms (continued)

TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring and reporting activities required by this Site Management Plan:

Site Identification: Barker Chemical, Site No. 932119
8473 West Somerset Road, Somerset, New York

Institutional Controls:	1. The property may be used for commercial or industrial use
	2. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Niagara County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
	3. Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP.
	4. All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP.
	5. Access to the site must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Notice.
	6. Vegetable gardens and farming on the site are prohibited.

Inspections:	Frequency
Site-Wide Inspection	Periodically
Monitoring:	
1. Groundwater sampling and analysis. 2. Surface water sampling and analysis. 3. Surface water pH monitoring	Biennially (every 2 years) Biennially (every 2 years) Periodically
Evaluations	
Climate Change Vulnerability Assessment	There are currently no vulnerability concerns at the site. If conditions change, the SMP will be updated per Section 1.2.
Reporting:	
Inspection Reports	Periodically
Certification/PRR	Periodically

Final Construction Report	Upon completion of soil management or excavation activities.

Further descriptions of the above requirements are provided in detail in the subsequent sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Barker Chemical Site located in Somerset, Niagara County, New York, hereinafter referred to as the "Site" (Figure 1-1). The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program as Site No. 932119, which is administered by New York State Department of Environmental Conservation (NYSDEC).

There is no Remedial Party for this site. Figure 1-2 shows the boundaries of the site, which are more fully described in the metes and bounds site description that is part of the Environmental Notice provided in Appendix A.

After completion of the remedial work, some contamination remains at this site, which is hereafter referred to as "remaining contamination". Institutional (ICs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Notice granted to the NYSDEC, and recorded with the Niagara County Clerk, requires compliance with this SMP and all ICs placed on the site.

This SMP was prepared to manage remaining contamination at the site until the Environmental Notice is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Notice and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Notice. Failure to properly implement the SMP is a violation of the Environmental Notice;
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375, and thereby subject to applicable penalties.

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix B of this SMP.

This SMP was prepared by the New York State Department of Environmental Conservation in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs that are required by the Environmental Notice for the site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Environmental Notice for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- Written 60-day advance notice of any proposed changes in site use that are required under the terms of 6NYCRR Part 375 and/or Environmental Conservation Law;
- 7-day advance notice of any field activity associated with the remedial program and
- Written 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan (EWP).

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of all approved work plans and reports, including this SMP; and

- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table 1-1: Notifications*

Name	**Contact Information**
NYSDEC Project Manager	Glenn M. May; 716-851-7220; glenn.may@dec.ny.gov
NYSDEC Regional HW Engineer	Andrea Caprio; 716-851-7220; Andrea.Caprio@dec.ny.gov
NYSDOH Project Manager	Not Applicable

* Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Barker Chemical Site is located at 8473 West Somerset Road in the Town of Somerset, Niagara County, New York (Figure 1-1), and is identified as Section 18, Block 1, Lot 65 on the Town of Somerset Tax Map. The site is approximately 10 acres in size, and is bordered to the north and east by woodlands, to the south by West Somerset Road and to the west by a vacant field (Figure 1-2). The boundaries of the site are more fully described in Appendix A - Environmental Notice.

The property was formerly operated as a fungicide/herbicide manufacturing, warehousing, and distribution facility by the Barker Chemical Corporation from 1930 to the early 1970s. The property has remained largely vacant since that time.

Historically, the site contained five abandoned buildings, an above ground storage tank, two lagoons (the North and South Lagoons), one filled lagoon (the Filled Lagoon), a ditch containing low pH water (Low pH Trough), and two large areas void of vegetation (the Barren Strip and Lime Waste Area; Figure 2-1). The Barren Strip contained a brownish-gray, fine-grained waste material, while the Lime Waste Area contained a whitish-gray, lime-like waste material with large quantities of sulfur. An open drainage ditch (the Eastern Boundary Ditch) parallels the eastern boundary of the site from West Somerset Road to the north end of the South Lagoon, where it makes a sharp eastward turn (Figure 2-1). This ditch ultimately feeds Golden Hill Creek (Figure 1-1), a tributary to Lake Ontario.

2.2 Physical Setting

2.2.1 Land Use

The site is vacant and contains a single building along the western edge of the property near West Somerset Road (Figure 2-1). The site also contains two former lagoons that are filled with waste material, and a third lagoon (the North Lagoon; Figure 2-1) that was remediated by EPA. The northern portion of the property is heavily wooded. The site is zoned commercial and the on-site building is being used.

The site is located in a mixed agricultural and residential setting with residences located near the site to the west, south and east (Figure 1-2). Eleven residences are located within ¼ mile of the property.

2.2.2 Geology

The geology of the Barker Chemical Site was evaluated largely by examining data obtained during a Removal Site Evaluation completed by the United States Environmental Protection Agency (USEPA) in 2000 and a Site Investigation completed by the NYSDEC in 2003. Additional geologic information was obtained from a Phase II Environmental Site Assessment completed for Niagara County in 2012. The geology for the southern portion of the site was supplemented by information obtained during an Extent of Contamination Investigation completed by the NYSDEC in 2013. The locations of these borings are shown on Figures 2-2 and 2-3, while the available stratigraphic logs are given in Appendix C. A summary of the available stratigraphic data is given in Table D-1 (Appendix D). The soil borings from 2013 were not included in this evaluation as a large quantity of fill and soil were subsequently excavated from this portion of the site (see Section 2.3).

Investigations completed at the Barker Chemical Site reveal the presence of three non-native deposits that underlie the site. These units consist of clean fill (crushed stone and imported or reworked native soils), lime-like waste material and former lagoon sludge. Clean fill was encountered in 19 of 47 borings completed at the site by the USEPA and NYSDEC in 2000 and 2003, respectively (Table D-1). Where present, clean fill ranged in thickness from 0.5 to 4.0 feet (Table D-1). Clean fill is generally thickest in the former Lime Waste area, and consists predominantly of clay and topsoil imported by EPA during remediation of this area. Crushed stone and/or gravel are present in the roadway and parking lot areas, and was used as backfill during the 2014 remedial activities completed by the NYSDEC (see Section 2.3). The remediation area that was backfilled with crushed stone is shown on Figure 2-13.

Waste material at the site is associated with the Filled Lagoon, and was encountered in 29 of the 47 borings completed by the USEPA and NYSDEC. This material consists predominantly of very loose, coarse grained, lime-like material that contains alternating layers of blue-gray, yellow, orange-brown, and whitish-gray waste. Prior to the EPA removal action, this material was thickest in the Lime Waste area (Table D-1), and appeared to have been vertically piled at this location. The layering of this waste within the Filled Lagoon, however, suggests that this material was deposited in standing water. Where currently present, the waste material ranges in thickness from 0.5 to greater than 7.0 feet (Table D-1).

The third non-native deposit identified at the site is sludge in the former lagoons. In the Filled Lagoon, this material was encountered at many locations immediately below the lime-like material, and consists predominantly of saturated, black sludge with blue-green mottling. This material appears to have been deposited in standing water, and ranges in thickness from 0.2 to 2.5 feet (Table D-1). In the South Lagoon, the sludge contains crystallized sulfur and lime, and layers of gray-white powder believed to be Portland cement from incomplete stabilization efforts by the USEPA (see Section 2.3). In the one boring (SB-14) completed in this lagoon, the sludge was 5.0 feet thick (Table D-1).

The Filled Lagoon covers an area of approximately 1 acre. A north-south cross-section through this lagoon is shown as Figure 2-4, and includes waste material, lagoon sludge and stained native soil. These units were lumped together because the boring logs and stratigraphic summary tables generated during the 2003 NYSDEC Site Investigation do not distinguish between these units. An isopach map of these units (Figure 2-5) indicates that the greatest thicknesses are in the center of the lagoon. The volume of waste in the Filled Lagoon was estimated as 2,500 yd^3. While the areal extent and volume of stabilized sludge in the South Lagoon was not determined during the Site Investigation, the lagoon prior to the EPA removal action covered an area of approximately 0.5 acres. If a uniform sludge thickness of 5.0 feet is used (the sludge thickness in boring SB-14), the volume of stabilized sludge is estimated as 3,250 yd^3.

The available stratigraphic data indicate that two native deposits underlie the Barker Chemical Site. The first of these deposits consists of the post-glacial topsoil and root zone, including the silty humus material in low lying areas, and the underlying silty-loam soil horizon that formed in the glacial till. In undisturbed areas, this layer extends from grade to approximately two feet below ground surface (Figure 2-4; Table D-1), transitioning into the underlying glacial till.

The second native deposit underlying the site is a relatively compact glacial till. This deposit is dark red, and consists predominantly of an unsorted mixture of silt, sand and gravel. The till is well consolidated, relatively stiff, and contains abundant sub-angular to well rounded, pebble sized gravel. This deposit was encountered at relatively shallow depths (<2 feet) in undisturbed areas, but was greater than eight feet in depth in the former lagoons (Table

D-1; Figure 2-6). The till layer extends downward to a thin veneer of sapprolitic (weathered) bedrock overlying the Queenston Shale bedrock.

In the Filled Lagoon, the uppermost portion of the glacial till is stained black. At several locations a black fluid was observed above the till, and is likely responsible for the black staining that was observed. This stained zone ranges in thickness from 0.1 to 4.0 feet (Table D-1).

The uppermost bedrock formation underlying the Barker Chemical Site is the Queenston Shale Formation of the Richmond Group. Bedrock was encountered with certainty in five borings completed at the Site, with macro core refusal (presumed to be bedrock) occurring at six additional boring locations. None of these borings, however, penetrated the formation to any significant depth. As a result, the best description of the Queenston Shale for this area of Niagara County comes from a stratigraphic log for a boring completed 6½ miles northeast of the Site on Somerset Drive. At this location, the Queenston Shale was described as a red, hard, siltstone interbedded with red and gray, fine grained sandstone. Depth to bedrock at the Barker Chemical Site ranged from 6.2 to 13.2 feet (Table D-1), with the greatest depths associated with the thickest fill areas (e.g., the Filled Lagoon; Figure 2-7). The Queenston Shale was encountered at a depth of 12 feet at the Somerset Drive location.

2.2.3 Hydrogeology

The hydrogeology of the Barker Chemical Site was evaluated by examining data obtained during the 2003 and 2008 NYSDEC investigations. The hydrogeologic data obtained for the site confirms the presence of a shallow water bearing zone within the glacial till deposit. In order to determine the shallow groundwater flow pattern across the site, eight shallow micro-wells were installed during the 2003 NYSDEC Site Investigation (Figure 2-8). These wells screen thin sand seams within the glacial till, with the micro-well in the Filled Lagoon also screening waste and sludge.

Water level measurements from the eight micro-wells were collected eight times between May 22, 2003 and November 21, 2003, and four times between April 16, 2008 and June 25, 2008 (Table 2-1). This table reveals that groundwater elevations during this period ranged from 483.42 to 496.29 feet amsl, and also reveals that four wells (MW-2, MW-6, MW-

11 and MW-12) went dry during this period. The hydrographs constructed from these data are shown as Figures 2-9 and 2-10, and show a cyclical pattern of high and low water levels: high during periods of increased precipitation and snow melt; low during the drier summer and early fall months.

The water level data obtained from the micro-wells were also utilized to construct groundwater contour maps. A representative map is shown as Figure 2-11, and reveals that shallow groundwater under the Barker Chemical Site flows to the east toward the Eastern Boundary Ditch. The North Lagoon does not appear to influence groundwater flow across the site.

Slug, bail down or pump tests were not conducted on any micro-well installed at the site. Based upon the fine-grained nature of the glacial till, however, the hydraulic conductivity is expected to be relatively low.

Groundwater monitoring well construction diagrams are provided in Appendix C.

2.3 Investigation and Remedial History

A number of investigations and remedial actions have been completed at the Barker Chemical Site including: (1) waste, lagoon sludge and surface water sampling by the NYSDEC in 1999; (2) pH measurements of site surface water by the NYSDEC in 1999 and 2000; (3) the completion of a Removal Site Evaluation by the United States Environmental Protection Agency (USEPA) in 2000; (4) an emergency removal action by the USEPA between October 2000 and November 2001; (5) a Site Investigation completed by the NYSDEC in 2003; (6) a Supplemental Site Investigation completed by the NYSDEC in 2008; (6) a Phase II Environmental Site Assessment completed by LaBella Associates in November 2012; (7) an Extent of Contamination Investigation completed by the NYSDEC in 2013; and (8) the excavation of arsenic contaminated soil by the NYSDEC during February and March 2014.

During December 1999 and January 2000, the NYSDEC inspected the site, collected sludge, waste, and surface water samples, and measured the pH of surface water at various locations throughout the site. While the analytical results of the waste, sludge, and surface water samples indicated that concentrations of metals exceeded NYSDEC standards and guidance values, it was the low pH of surface water (1.71 to 3.62) that caused the most concern

because local children were using the site for recreational activities, thereby increasing their exposure potential to low pH water.

In late January 2000, based upon the presence of low pH surface water, the Niagara County Health Department (NCHD) issued a public health advisory to nearby residents cautioning against entry onto the site. In response to this advisory the NYSDEC implemented an emergency site security action by placing warning signs across the front of the property and installing high visibility fencing around the direct contact areas of concern.

In May 2000, the NYSDEC made a request to the USEPA to evaluate the site and perform removal actions, as appropriate, to address the public health threats from low pH surface waters, and to identify, contain, control and/or remediate any other hazardous wastes or hazardous substances found at the site. Due to the public health threat that existed, the USEPA agreed to this request.

In June 2000, the USEPA completed a Removal Site Evaluation to determine the nature and extent of contamination at the site. Samples were collected from waste piles, two lagoons, ditches, process, and production areas, suspected dumping areas, spill areas, and the filled lagoon. The analytical results from these samples identified areas of contamination requiring remediation. As a result, the USEPA initiated a removal action in October 2000 that was completed in November 2001. During this removal action, the EPA remediated the Barren Strip, the Low pH Trough, the Ponded Water Area, the South Lagoon, the North Lagoon, the Lime Waste Area, the above ground storage tank, and the Chip Area (Figure 2-12). Four buildings were demolished as part of the removal action to gain access to contaminated soils. More detail concerning the USEPA removal action can be found in the March 2007 NYSDEC Site Investigation Report.

Between May and November 2003, the NYSDEC completed a Site Investigation to evaluate areas of the site not remediated by the USEPA to determine the degree to which waste and sludge had contaminated site soil, groundwater, surface water and sediment. The Site Investigation Report was completed in March 2007 and concluded that hazardous substances (lime waste and lagoon sludge) were present at the site. Surface water was contaminated with metals, and contained high concentrations of sulfide and sulfate. Sediment was contaminated

with pesticides and metals. Groundwater samples were not collected during the Site Investigation because four of the eight micro-wells went dry before they could be sampled.

Between April and June 2008, the NYSDEC completed a Supplemental Site Investigation at the Barker Chemical Site. During this investigation, three surface water samples were collected for chemical analysis to compare with the analytical results obtained in 2003. Groundwater samples from seven of the eight wells were also collected for analysis. In addition, pH of surface water was measured monthly to evaluate the current pH conditions at the site. Surface water was contaminated with pesticides and metals, and continued to exhibit high concentrations of sulfide and sulfate, and low pH (3.04 to 3.75). Groundwater was contaminated with metals, and also contained high concentrations of sulfide and sulfate.

Prior to the USEPA removal action, corrosive hazardous waste (D002) was likely present at this site as suggested by the presence of low pH (less than 2.0) surface water. Although corrosive fill and sediment remain on site, no hazardous waste was identified during the 2003 NYSDEC Site Investigation nor the 2008 NYSDEC Supplemental Site Investigation. Due to the absence of hazardous waste, this site did not qualify for inclusion in the NYSDEC Registry of Inactive Hazardous Waste Disposal Sites in New York State. As a result, the site was made a Class C in 2009.

In November 2012 Niagara County commissioned a Phase II Environmental Site Assessment (ESA) of the Barker Chemical property in preparation for proceeding with a foreclosure action. The Phase II ESA identified elevated concentrations of arsenic in a previously uninvestigated area of the southern portion of the site. In addition, groundwater was found to be contaminated with petroleum compounds, metals, and sulfate. In February 2013, the Town of Somerset made a request to the NYSDEC to assist with the arsenic remediation recommended in the Phase II ESA report. The NYSDEC agreed to this request.

During the Spring and Summer of 2013, the NYSDEC completed an Extent of Contamination Investigation to determine the extent of arsenic contamination requiring remediation.

Excavation of arsenic contaminated soil began on February 25, 2014, and was completed on March 21, 2014. The extent of the excavation is shown on Figure 2-13.

Confirmatory samples were collected as the excavation progressed. Once the confirmatory sample results were deemed acceptable, the excavation was backfilled with 2-inch crusher run stone. In total, 3,769 tons of contaminated soil and fill were excavated from the site and transported to the Town of Tonawanda Landfill for disposal.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the site are summarized as follows.

2.4.1 Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Restore the groundwater 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.

2.4.2 Soil

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

2.4.3 Surface Water

RAOs for Public Health Protection

- Prevent ingestion of surface water impacted by contaminants.

- Prevent contact or inhalation of contaminants from impacted surface water.
- Prevent contact with low pH surface water.

RAOs for Environmental Protection

- Restore surface water to ambient water quality criteria for the contaminants of concern.
- Prevent impacts to biota from ingestion/direct contact with surface water causing toxicity and impacts from bioaccumulation through the aquatic food chain.
- Remove the source of surface water contamination.

2.4.4 Sediment

RAOs for Public Health Protection

- Prevent direct contact with contaminated sediments.

RAOs for Environmental Protection

- Prevent releases of contaminants from sediments that would result in surface water levels in excess of the ambient water quality criteria.
- Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the aquatic food chain.
- Restore sediments to pre-release/background conditions to the extent feasible.

2.5 Remaining Contamination

2.5.1 Lime Waste

Following the removal actions by the USEPA and NYSDEC, lime waste is still present at the Barker Chemical Site. Analytical results for seven lime waste samples collected from the Filled Lagoon were compiled and evaluated during the 2003 NYSDEC Site Investigation. The locations of these samples are shown on Figure 2-14, and include one sample collected by the NYSDEC in December 1999, one sample collected by the USEPA in June 2000, and five samples collected by the NYSDEC in May 2003. Analyses varied among the samples (Table 2-2A), and included Target Compound List (TCL) semivolatile organic compounds, TCL pesticides, herbicides, metals, cyanide, sulfur, boron and leachable pH. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the organic analyses revealed that six semivolatile organic compounds were detected in the lime waste samples collected from the Filled Lagoon (Table 2-3). None of the concentrations, however, exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives. Pesticides and herbicides, including BHC, DDD, DDE, DDT, endrin ketone, methoxychlor, 2,4-D, silvex and 2,4,5-T, were also detected in the lime waste samples (Table 2-3). Only the concentrations of alpha-BHC (280 J µg/kg), delta-BHC (250 J µg/kg), DDD (5.6 J and 5,400 J µg/kg), DDE (17 J and 670 J µg/kg), and DDT (5.8 J and 21,000 µg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Table 2-3). These concentrations, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Table 2-3).

Thirteen metals were detected in the lime waste samples collected from the Filled Lagoon (Table 2-3). Of these compounds, only arsenic (16.1 mg/kg) and copper (52.3 and 143.0 mg/kg) were detected at concentrations that exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Table 2-3). Both metals are USEPA priority pollutant metals. USEPA priority pollutant metals are toxic metals for which technology based effluent limitations and guidelines are required by Federal law. The concentration of arsenic in sample W-2 also exceeded the Part 375 commercial use soil cleanup objective for this contaminant (Table 2-3). Concentrations of iron (3,270 and 3,450 mg/kg) exceeded the NYSDEC CP-51 residential soil cleanup objective for this contaminant (Table 2-3).

The lime waste samples collected from the Filled Lagoon contained significant concentrations of sulfur, ranging from 10,000 to 352,000 mg/kg (Table 2-3). Boron was also detected in these samples at concentrations ranging from 0.44 to 10.4 mg/kg (Table 2-3). There are no soil cleanup objectives for these contaminants. Leachable pH was measured at levels ranging from 3.34 to 7.54 standard pH units (Table 2-3).

2.5.2 Lagoon Sludge

Following the removal actions by the USEPA and NYSDEC, lagoon sludge is still present at the Barker Chemical Site. Analytical results for eleven lagoon sludge samples collected from the Filled Lagoon and southern portion of the site were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figure 2-15, and include one sample collected by the USEPA in June 2000, one sample collected by the

NYSDEC in May 2003, and five samples collected by the NYSDEC in August 2013. Analyses varied among the samples (Table 2-2A), and included TCL semivolatile organic compounds, TCL pesticides, herbicides, metals, sulfur, boron, and leachable pH. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the organic analyses revealed that naphthalene was the only semivolatile organic compound detected in the sludge samples collected from the Barker Chemical Site (Table 2-4A). The concentration of naphthalene (10 J µg/kg), however, did not exceed the NYSDEC Part 375 unrestricted soil cleanup objective for this contaminant. Pesticides and herbicides, including DDD, DDE, 2,4-D, silvex and 2,4,5-T, were also detected in the sludge samples (Table 2-4A). Only the concentrations of DDD (3.8 J µg/kg) and DDE (35.0 µg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Table 2-4A). These concentrations, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Table 2-4A).

Seventeen metals were detected in the sludge samples collected from the Barker Chemical Site (Tables 2-4A and 2-4B). Of these compounds, only chromium (32.8 mg/kg) and lead (90.0 mg/kg) were detected at concentrations that exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Tables 2-4A and 2-4B). Both metals are USEPA priority pollutant metals. These concentrations, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-4A and 2-4B). The concentration of iron in one sample (12,000 mg/kg) exceeded the NYSDEC CP-51 residential soil cleanup objective for this contaminant (Table 2-4A).

The lagoon sludge samples collected from the Barker Chemical Site contained significant concentrations of sulfur, ranging from 7,700 to 551,000 mg/kg (Table 2-4A). Boron was also detected in these samples at concentrations ranging from 2.5 to 14.6 mg/kg (Table 2-4A). There are no soil cleanup objectives for these contaminants. Leachable pH was measured at 9.65 standard pH units in the only sample analyzed for leachable pH (Table 2-4A).

2.5.3 Miscellaneous Fill

Following the removal actions by the USEPA and NYSDEC, miscellaneous fill is still present at the Barker Chemical Site. Miscellaneous fill is either reworked soil, granular fill, cinder fill, or ash with coal. Analytical results for eleven miscellaneous fill samples collected

from the southern portion of the site were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figure 2-16, and were collected by the NYSDEC in August 2013. Analyses included either arsenic or RCRA metals. Detailed information concerning sample collection and analysis is given in Table 2-2A.

Seven metals were detected in the miscellaneous fill samples collected from the Barker Chemical Site (Tables 2-5A and 2-5B). None of the concentrations, however, exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives.

2.5.4 Surface Soil

Forty surface soil samples that represent remaining contamination have been collected from the Barker Chemical Site. Analytical results for these samples were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figures 2-17 and 2-18, and include thirteen samples collected by the USEPA from the Chip Area in August 2001, three samples collected by LaBella from the southern portion of the site in June 2012, three samples collected by LaBella from the wooded northern portion of the site in June 2012, and twenty-one samples collected by the NYSDEC in May 2013. Six samples were analyzed for TCL semivolatile organic compounds, TCL pesticides, Target Analyte List (TAL) metals, sulfur and leachable pH. The remaining surface soil samples were analyzed for arsenic only. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the organic analyses revealed that five semivolatile organic compounds were detected in the surface soil samples collected from the Barker Chemical Site (Table 2-6B). None of the concentrations, however, exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives. Pesticides, including DDD, DDE and DDT were also detected in the surface soil samples (Table 2-6B). Concentrations of DDD (280.0 µg/kg), DDE (4 J and 120.0 µg/kg), and DDT (100.0 µg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Table 2-6B). These concentrations, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Table 2-6B).

Eighteen metals were detected in the surface soil samples collected from the Barker Chemical Site (Tables 2-6A and 2-6B). Of these compounds, only arsenic in five samples (14.8 to 17.0 mg/kg) and lead in one sample (572.0 mg/kg) were detected at concentrations that exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Tables 2-6A and 2-6B).

Both metals are USEPA priority pollutant metals. Only the concentration of arsenic in one sample (17.0 mg/kg) exceeded the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-6A and 2-6B). The concentration of iron in six samples (5,470 to 143,000 mg/kg) exceeded the NYSDEC CP-51 residential soil cleanup objective for this contaminant (Table 2-6B). The concentration of aluminum in three samples (10,300 to 11,000 mg/kg) exceeded the NYSDEC CP-51 protection of ecological resources soil cleanup objective for this contaminant (Table 2-6B).

The surface soil samples collected from the Barker Chemical Site contained sulfur but at lower concentrations than the waste samples, ranging from 158.0 to 3,200 mg/kg (Table 2-6B). There is no soil cleanup objective for this contaminant. Leachable pH was measured at levels ranging from 6.7 to 8.3 standard pH units (Table 2-6B).

2.5.5 Subsurface Soil

Two hundred forty-three (243) subsurface soil samples that represent remaining contamination have been collected from the Barker Chemical Site. Analytical results for these samples were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figures 2-19 thru 2-21, and include two samples collected by the USEPA from the Filled Lagoon in June 2000, three samples collected by the USEPA from under the Production Building in December 2000, two samples collected by the USEPA from under the Eastern Storage Building in August 2001, forty-five samples collected by the USEPA from the Chip Area in August 2001, eight samples collected by the NYSDEC in May 2003, five samples collected by LaBella in June 2012, and one hundred seventy-eight (178) samples collected by the NYSDEC from the arsenic remediation area in May 2013. The majority of the subsurface soil samples were analyzed for arsenic only (221 samples), while twenty-two samples were analyzed for a larger suite of analytes that included TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides, TCL polychlorinated biphenyls (PCB), herbicides, metals, sulfur, boron and/or leachable pH. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the organic analyses revealed that seventeen semivolatile organic compounds were detected in the eleven subsurface soil samples analyzed for these contaminants (Tables 2-7A, 2-7C and 2-7D). Only the concentration of chrysene in one sample (1,100 µg/kg), however, exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives

(Tables 2-7A, 2-7C and 2-7D). This concentration, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Table 2-7A). Volatile organic compounds were not detected in the three samples analyzed for these contaminants.

Pesticides, including aldrin, BHC, DDD, DDT, dieldrin and endrin were detected in the eighteen subsurface soil samples analyzed for these contaminants (Tables 2-7A, 2-7C and 2-7D). Concentrations of aldrin (270.0 µg/kg), alpha-BHC (1,200 µg/kg), beta-BHC (170.0 µg/kg), DDD (85.0 µg/kg), DDT (16.0 to 400.0 µg/kg), and dieldrin (13.0 µg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Tables 2-7A, 2-7C and 2-7D). These concentrations, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-7A, 2-7C and 2-7D).

Herbicides, including 2,4-D, silvex and 2,4,5-T, were detected in the fifteen subsurface soil samples analyzed for these contaminants (Tables 2-7A, 2-7C and 2-7D). None of the concentrations, however, exceeded the NYSDEC Part 375 unrestricted use or the NYSDEC CP-51 residential soil cleanup objectives (Tables 2-7A, 2-7C and 2-7D).

Polychlorinated biphenyls were not detected in the three samples analyzed for these contaminants.

Eighteen metals were detected in the twenty-two subsurface soil samples analyzed for TAL or RCRA metals (Tables 2-7A, 2-7C, 2-7D and 2-7F). Of these compounds, only arsenic in three samples (13.8 to 78.0 mg/kg), copper in one sample (51.0 mg/kg), mercury in four samples (0.25 to 2.3 mg/kg) and zinc in two samples (110.0 and 230.0 mg/kg) were detected at concentrations that exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Tables 2-7A, 2-7C, 2-7D and 2-7F). All four metals are USEPA priority pollutant metals. Only the concentration of arsenic in one sample (78.0 mg/kg) exceeded the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-7A, 2-7C, 2-7D and 2-7F). The concentration of iron in eleven samples (5,900 to 17,000 mg/kg) exceeded the NYSDEC CP-51 residential soil cleanup objective for this contaminant (Tables 2-7A, 2-7C, 2-7D and 2-7F).

Arsenic was detected in all two hundred twenty-one (221) subsurface soil samples analyzed only for arsenic (Tables 2-7B and 2-7E). The arsenic concentration in only four samples (13.8 to 18.0 mg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup

objective for this contaminant (Tables 2-7B and 2-7E). Arsenic concentrations in two samples (16.8 and 18.0 mg/kg) also exceeded the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-7B and 2-7E).

Sulfur was detected in all nine subsurface soil samples analyzed for this contaminant at concentrations ranging from 130.0 to 198,000 mg/kg (Tables 2-7A, 2-7C and 2-7D). Boron was detected in all ten subsurface soil samples analyzed for this contaminant at concentrations ranging from 1.5 to 25.7 mg/kg (Tables 2-7A, 2-7C and 2-7D). There are no soil cleanup objectives for these contaminants. TPH was detected at a concentration of 131.0 mg/kg in the only sample tested (Table 2-7A). There is no soil cleanup objective for total petroleum hydrocarbons. Leachable pH was measured in fifteen subsurface soil samples at levels ranging from 4.6 to 12.0 standard pH units (Tables 2-7A, 2-7C and 2-7D).

2.5.6 Confirmatory Samples

During the removal actions completed by the USEPA (2000 and 2001) and the NYSDEC (2014), one hundred thirty (130) confirmatory samples that represent remaining contamination were collected from the Barker Chemical Site. Analytical results for these samples were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figures 2-13, and include six samples collected by the USEPA in November and December 2000, five samples collected by the USEPA in May and June 2001, and one hundred nineteen (119) samples collected by the NYSDEC from the arsenic remediation area in February and March 2014. The six samples collected in 2000 were analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides, TCL polychlorinated biphenyls and TAL metals. The three samples collected in May 2001 were analyzed for TAL metals, while the two samples collected in June 2001 were analyzed for TCL pesticides, herbicides, and TAL metals. Detailed information concerning sample collection and analysis is given in Table 2-2B.

Volatile organic compounds, semivolatile organic compounds and polychlorinated biphenyls were not detected in the six confirmatory samples analyzed for these contaminants. Herbicides were not detected in the two confirmatory samples analyzed for these contaminants (Table 2-8B).

Pesticides, including BHC, DDD, DDE, DDT and endrin were detected in the eight confirmatory samples analyzed for these contaminants (Tables 2-8A and 2-8B). Concentrations of alpha-BHC (56.0 µg/kg), DDD (10.0 to 2,400 µg/kg), DDE (120.0 and 5,600 µg/kg), DDT (890.0 to 3,000 µg/kg), and endrin (440.0 µg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Tables 2-8A and 2-8B). These concentrations, however, did not exceed the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-8A and 2-8B).

Fourteen metals were detected in the eleven confirmatory samples analyzed for these contaminants (Tables 2-8A and 2-8B). Of these compounds, arsenic in two samples (17.0 and 31.0 mg/kg), copper in three samples (160.0 to 290.0 mg/kg), manganese in one sample (1,800 mg/kg), mercury in three samples (0.19 to 0.64 mg/kg) and zinc in one sample (820.0 mg/kg) were detected at concentrations that exceeded the NYSDEC Part 375 unrestricted soil cleanup objectives (Tables 2-8A and 2-8B). Arsenic, copper, mercury, and zinc are USEPA priority pollutant metals. The concentrations of arsenic in two samples (17.0 and 31.0 mg/kg) and copper in two samples (280.0 and 290.0 mg/kg) exceeded the NYSDEC Part 375 commercial use soil cleanup objectives (Tables 2-8A and 2-8B). The concentration of iron in ten samples (2,400 to 17,000 mg/kg) exceeded the NYSDEC CP-51 residential soil cleanup objective for this contaminant (Tables 2-8A and 2-8B).

Arsenic was detected in all one hundred nineteen (119) confirmatory samples analyzed only for arsenic (Table 2-8C). The arsenic concentration in only two samples (both 21.0 mg/kg) exceeded the NYSDEC Part 375 unrestricted soil cleanup objective for this contaminant (Table 2-8C). These concentrations also exceeded the NYSDEC Part 375 commercial use soil cleanup objectives (Table 2-8C).

2.5.7 Sediment

Seven sediment samples that represent remaining contamination have been collected from the Barker Chemical Site. Analytical results for these samples were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figure 2-23, and include three samples collected by the USEPA in June and December 2000, and four samples collected by the NYSDEC in September 2003. Analyses varied among the samples (Table 2-2A), and included TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides, TCL PCBs, herbicides, TAL metals, sulfur, boron, and leachable pH. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the organic analyses reveal that volatile organic compounds were not detected in the one sample analyzed for these contaminants. Twelve semivolatile organic compounds, however, were detected in the sediment samples collected from the Barker Chemical Site (Table 2-9A and 2-9B). None of these compounds were detected at concentrations that exceeded the NYSDEC sediment criteria.

Pesticides and herbicides, including BHC, chlordane, DDD, DDE, DDT, endosulfan, endosulfan sulfate, 2,4-D, silvex and 2,4,5-T, were also detected in the sediment samples (Table 2-9A and 2-9B). Only the concentrations of chlordane (34 J µg/kg), DDT (7.5 J to 250 J µg/kg) and endosulfan (17 J µg/kg) exceeded the NYSDEC sediment criteria (Table 2-9A and 2-9B).

Polychlorinated biphenyls were not detected in the one sample analyzed for these contaminants (Table 2-9A and 2-9B).

Fourteen metals were detected in the sediment samples collected from the Barker Chemical Site (Table 2-9A and 2-9B). Of these compounds, six were detected at concentrations that exceeded the NYSDEC sediment criteria, with all six being USEPA priority pollutant metals. The metals exceeding the NYSDEC sediment criteria include arsenic (5 samples; 22.1 to 53.0 mg/kg), cadmium (1 sample; 1.1 mg/kg), chromium (1 sample; 69.6 mg/kg), copper (3 samples; 53.4 to 114.0 mg/kg), lead (3 samples; 48.9 to 314.0 mg/kg), and mercury (2 samples; 0.27 and 0.51 mg/kg).

The sediment samples collected from the Barker Chemical Site contained relatively high concentrations of sulfur, ranging from 670.0 to 2,530 mg/kg (Table 2-9A and 2-9B). Boron was also detected in these samples at concentrations ranging from 1.9 to 30.6 mg/kg (Table 2-9A and 2-9B). There are no sediment criteria for these contaminants. Leachable pH was measured at levels ranging from 3.80 to 6.86 standard pH units (Table 2-9A and 2-9B).

2.5.8 Surface Water

Five surface water samples that represent remaining contamination have been collected from the Barker Chemical Site. Analytical results for these samples were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figure

2-23, and include three samples collected by the NYSDEC in 2008 to evaluate conditions in the North Lagoon, Ponded Water Area, and Central Drainage Ditch (former Low pH Trough), and two samples collected by LaBella in June 2012, one from the Eastern Boundary Ditch (SW-1) and one from the North Lagoon (SW-2). All samples were analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides, TAL metals, sulfate and sulfide. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the surface water samples collected from the Barker Chemical Site revealed the presence of both volatile and semivolatile organic compounds (Table 2-10). Four volatile organic compounds were detected in these samples including acetone (2 samples), 2-butanone (1 sample), carbon disulfide (2 samples) and toluene (1 sample). None of these compounds, however, were detected at concentrations that exceeded the NYSDEC surface water standards or guidance values (Table 2-10). Volatile organic compounds were not detected in the 2012 surface water samples.

Two semivolatile organic compounds were detected in the surface water samples including pentachlorophenol (1 sample) and phenol (1 sample). Both contaminants were detected in the sample collected from the Central Drainage Ditch (former Low pH Trough), and both compounds were detected at concentrations that exceeded the NYSDEC surface water standards (Table 2-10). Semivolatile organic compounds were not detected in the 2012 surface water samples.

Pesticides, including BHC, chlordane, DDD, DDE, DDT, dieldrin, endosulfan, endrin ketone and heptachlor, were also detected in the surface water samples collected from the Barker Chemical Site (Table 2-10). The concentrations of alpha-BHC (1.1 µg/L), beta-BHC (0.19 J µg/L), delta-BHC (0.27 µg/L), gamma-BHC (1.2 µg/L), dieldrin (0.017 J and 0.11 J µg/L), endosulfan II (0.19 J µg/L) and heptachlor (0.086 J µg/L) exceeded the NYSDEC surface water standards or guidance values (Table 2-10). Except for dieldrin in sample SW-7 (Ponded Water Area), all exceedances were associated with sample SW-9, which was collected from the Central Drainage Ditch (former Low pH Trough). Pesticides were not detected in the 2012 surface water samples.

Eighteen metals were detected in the surface water samples collected from the Barker Chemical Site (Table 2-10). Of these compounds, eight were detected at concentrations that exceeded the NYSDEC surface water standards or guidance values, with three of these metals being USEPA priority pollutant metals. The priority pollutant metals exceeding the NYSDEC surface water standards or guidance values include arsenic (1 sample; 106.0 µg/L), beryllium (1 sample; 5.8 µg/L) and nickel (1 sample; 144.0 µg/L). Other metals that exceeded the NYSDEC surface water standards or guidance include aluminum (5 samples; 340.0 to 57,400 µg/L), cobalt (2 samples; 6.9 and 92.3 µg/L), iron (5 samples; 1,090 to 104,000 µg/L), magnesium (2 samples; 68,2000 and 102,000 µg/L) and manganese (5 samples; 430.0 to 14,100 µg/L). The surface water samples collected in 2012 only exceeded the NYSDEC surface water standards or guidance values for aluminum (both samples), iron (both samples) and manganese (both samples) (Table 2-10).

The surface water samples collected from the Barker Chemical Site also contained significant concentrations of sulfate, ranging from 92,000 to 2,600,000 µg/L (Table 2-10). The sulfate concentration in two samples exceeded the NYSDEC surface water standard for this contaminant (Table 2-10). Sulfide was detected in three surface water samples collected from the Barker Chemical Site at concentrations ranging from 400.0 to 3,200 µg/L (Table 2-10). The sulfide concentration in all three samples exceeded the NYSDEC surface water standard for this contaminant (Table 2-10).

The pH of surface water in 2008 ranged from 3.04 (Central Drainage Ditch) to 7.37 (North Lagoon) standard pH units, with the values from the Central Drainage Ditch and Ponded Water Area outside acceptable limits (Table 2-11). The locations of these pH measurements are shown on Figure 2-24. The pH of surface water in 2012 was 7.17 standard pH units in the Eastern Drainage Ditch and 7.07 standard pH units in the North Lagoon.

2.5.9 Groundwater

Ten groundwater samples that represent remaining contamination have been collected from the Barker Chemical Site. Analytical results for these samples were compiled and evaluated for this Site Management Plan. The locations of these samples are shown on Figure 2-25, and include seven groundwater samples collected by the NYSDEC in 2008. Micro-well MW-11 was not sampled due to the closer proximity of micro-wells MW-6 and MW-12 to the North Lagoon. Three additional groundwater samples were collected by LaBella in 2012, two

from temporary micro-wells installed during the Phase II ESA and one from well MW-5, which was installed during the 2003 NYSDEC Site Investigation. Analyses varied by well due to insufficient groundwater qualities (Table 2-2A), but included TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides, TAL metals, sulfate and sulfide. Detailed information concerning sample collection and analysis is given in Table 2-2A.

The results of the organic analyses revealed that sixteen volatile organic compounds were detected in the groundwater samples collected from the Barker Chemical Site (Tables 2-12A and 2-12B). Of these compounds, the concentrations of acetone (1 sample; 92.0 µg/L), benzene (1 sample; 1.2 J µg/L), 2-butanone (1 sample; 59.0 µg/L), chlorobenzene (1 sample; 6.5 µg/L), 1,2-dichloroethane (1 sample; 2.7 J µg/L), 1,2-dichloropropane (1 sample; 13.0 µg/L), ethylbenzene (1 sample; 34.0 µg/L), 1,2,4-trimethylbenzene (1 sample; 19.0 µg/L), 1,3,5-trimethylbenzene (1 sample; 5.4 µg/L), and xylenes (1 sample; 31.0 µg/L) were detected at concentrations that exceeded the NYSDEC groundwater standards or guidance values (Tables 2-12A and 2-12B).

During the 2012 Phase II ESA, thirteen volatile organic compounds were detected in micro-well TPMW3, which was installed near the former storage tank removed by the USEPA. Concentrations of benzene, 1,2-dichloroethane, 1,2-dichloropropane, ethylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene and xylenes exceeded the NYSDEC groundwater standards or guidance values (Table 2-12B).

Eight semivolatile organic compounds were detected in the groundwater samples collected from the Barker Chemical Site, all in micro-well TPMW3 (Tables 2-12A and 2-12B). Only the concentration of naphthalene (610 µg/L); however, exceeded the NYSDEC groundwater standards or guidance values (Table 2-12B).

Pesticides, including BHC, chlordane, DDD, DDE, dieldrin, endosulfan, endrin ketone, heptachlor and heptachlor epoxide, were detected in the groundwater samples collected from the Barker Chemical Site (Tables 2-12A and 2-12B). Of these compounds, only the concentrations of alpha-BHC (2 samples; 0.029 J and 0.10 µg/L), dieldrin (2 samples; 0.028 J and 0.032 J µg/L), and heptachlor epoxide (1 sample; 0.11 µg/L) exceeded the NYSDEC groundwater standards (Tables 2-12A and 2-12B).

Twenty-two metals were detected in the groundwater samples collected from the Barker Chemical Site (Tables 2-12A and 2-12B). Of these compounds, fifteen were detected at concentrations that exceeded the NYSDEC groundwater standards or guidance values, with nine of these metals being USEPA priority pollutant metals. The priority pollutant metals exceeding the groundwater standards or guidance include arsenic (6 samples; 31.1 to 365 µg/L), beryllium (6 samples; 3.5 to 12.7 µg/L), cadmium (1 sample; 21.4 µg/L), chromium (7 samples; 89.9 to 460 µg/L), copper (4 samples; 218 to 953 µg/L), lead (7 samples; 25.8 to 127 µg/L), mercury (4 samples; 0.81 to 2.5 µg/L), nickel (4 samples; 141 to 466 µg/L), and selenium (1 sample; 45.8 µg/L). Other metals that exceeded the NYSDEC groundwater standards or guidance values include barium (3 samples; 1,090 to 2,700 µg/L), iron (9 samples; 9,140 to 892,000 µg/L), magnesium (9 samples; 65,600 to 666,000 µg/L), manganese (9 samples; 540 to 29,200 µg/L), sodium (6 samples; 31,900 to 159,000 µg/L), and thallium (2 samples; 26.0 to 27.9 µg/L). Aluminum, cobalt, and vanadium were also detected at significant concentrations, ranging to 275,000 µg/L, 216 µg/L, and 508 µg/L, respectively. There are no NYSDEC groundwater standards or guidance values for these contaminants.

The groundwater samples collected from the Barker Chemical Site also contained significant concentrations of sulfate, ranging from 32,100 to 3,400,000 µg/L (Tables 2-12A and 2-12B). Sulfate was detected in every well sampled, and exceeded the NYSDEC groundwater standard in six of the seven samples (Tables 2-12A and 2-12B). Sulfide was detected in six groundwater samples collected from the Barker Chemical Site at concentrations ranging from 43.0 to 2,470,000 µg/L (Tables 2-12A and 2-12B). The sulfide concentration in five samples exceeded the NYSDEC surface water standard for this contaminant (Tables 2-12A and 2-12B).

The pH of groundwater in 2008 ranged from 6.53 (MW-5) to 7.85 (MW-4) standard pH units, while the pH of groundwater in 2012 ranged from 5.69 (TPMW3) to 6.63 (MW-5) standard pH units. The pH in two wells was outside acceptable limits (Tables 2-12A and 2-12B).

3.0 INSTITUTIONAL CONTROL PLAN

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) are required to protect human health and the environment. This IC Plan describes the procedures for the implementation and management of all ICs at the site. The IC Plan is one component of the SMP and is subject to revision by the NYSDEC. This plan provides:

- A description of all ICs on the site;
- The basic implementation and intended role of each IC;
- A description of the key components of the ICs set forth in the Environmental Notice;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of ICs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix E for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the ICs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required to: (1) prevent future exposure to remaining contamination; and, (2) limit the use and development of the site to commercial or industrial uses only. Adherence to these ICs on the site is required by the Environmental Notice and will be implemented under this SMP. ICs identified in the Environmental Notice may not be discontinued without an amendment to or extinguishment of the Environmental Notice. The IC boundaries are shown on a figure in Appendix A. These ICs are:

- The property may be used for commercial or industrial use;
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Niagara County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;

- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;

- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Notice; and

- Vegetable gardens and farming on the site are prohibited.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC project manager. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix G.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of surface water and groundwater;
- Measuring pH of surface water at the site;
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater and surface water standards and guidance values; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and
- Periodic inspections and certifications.

Reporting requirements are provided in Section 6.0 of this SMP.

4.2 Site-Wide Inspection

Site-wide inspections will be performed at a minimum of once per year. These periodic inspections must be conducted when the ground surface is visible (i.e., no snow cover). Site-wide inspections will be performed by a qualified environmental professional as defined in 6

NYCRR Part 375, a PE who is licensed and registered in New York State, or a qualified person who directly reports to a PE who is licensed and registered in New York State. Modification to the frequency or duration of the inspections will require approval from the NYSDEC project manager. Site-wide inspections will also be performed after all severe weather conditions that may affect the remaining contamination at the site. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report.

During an inspection, an inspection form will be completed as provided in Appendix I - Site Management Forms. The inspections will determine and document the following:

- Compliance with all ICs, including site usage;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Notice; and
- If site records are complete and up to date.

Reporting requirements are outlined in Section 6.0 of this SMP.

Inspections will also be performed in the event of an emergency. If an emergency occurs, such as a natural disaster, verbal notice to the NYSDEC project manager must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the ICs implemented at the site by a qualified environmental professional, as defined in 6 NYCCR Part 375. Written confirmation must be provided to the NYSDEC project manager within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Post-Remediation Media Monitoring and Sampling

Groundwater and surface water samples shall be collected on a routine basis. Sample locations, required analytical parameters, and sampling schedule are provided in Table 4-1 –

Post-Remediation Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 4-1 – Post-Remediation Sampling Requirements and Schedule

Sample Location	Analytical Parameters	Sampling Schedule
Wells MW-1 thru MW-12	VOCs, SVOCs, Pesticides, Metals, Sulfate, Sulfide	Biennially (every 2 years)
Surface Water	VOCs, SVOCs, Pesticides, Metals, Sulfate, Sulfide	Biennially (every 2 years)

Detailed sample collection and analytical procedures and protocols are provided in Appendix F – Field Sampling Plan and Appendix G – Quality Assurance Project Plan.

4.3.1 Groundwater Sampling

Groundwater monitoring will be performed biennially (every 2 years) to assess the performance of the remedial actions completed at the site. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

A network of monitoring wells has been installed to monitor groundwater conditions at the site. The locations of these wells are shown on Figure 4-1. Monitoring well construction logs are included in Appendix C of this SMP.

Table 4-2 summarizes the monitoring well construction details including the well identification numbers, locations, coordinates, depths, and screened intervals. As part of long-term groundwater monitoring, eight on-site wells are to be sampled to evaluate the effectiveness of the remedial actions. Depth to water in each monitoring well will be measured before sampling takes place.

If biofouling or silt accumulation occurs in the monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC project manager will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be completed only with the prior approval of the NYSDEC project manager. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC project manager.

Deliverables for the groundwater monitoring program are specified in Section 6.0 of this SMP.

4.3.2 Surface Water Sampling

Surface water sampling will be performed biennially (every 2 years) to assess the performance of the remedial actions completed at the site. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Surface water sample locations will include the Spill Area, Central Drainage Ditch, Eastern Boundary Ditch, Ponded Water Area, and the North Lagoon. The locations of these samples are shown on Figure 4-2.

Deliverables for the surface water sampling program are specified in Section 6.0 of this SMP.

4.3.3 Surface Water pH Monitoring

Surface water pH monitoring will be performed monthly as pH was found to fluctuate throughout the year. This monitoring will be completed to assess the performance of the remedial actions completed at the site. Modification to the frequency of pH measurements will require approval from the NYSDEC project manager.

Surface water bodies that will be measured for pH include the Spill Area, Central Drainage Ditch, Eastern Boundary Ditch, Ponded Water Area, and the North Lagoon. The locations of these samples are shown on Figure 4-3.

Deliverables for the surface water pH monitoring program are specified in Section 6.0 of this SMP.

4.3.4 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix I - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling logs. The sampling logs will serve as the inspection forms for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Field Sampling Plan provided as Appendix F of this SMP.

5.0 PERIODIC ASSESSMENTS/EVALUATIONS

5.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site is prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

There are currently no vulnerability concerns at the site. If conditions change, the SMP will be updated per Section 1.2 of this SMP.

5.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the Periodic Review Report (PRR).

5.2.1 Sampling and Other Periodic Activities

Transportation to and from the site, use of consumables in relation to visiting the site in order to collect samples, and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

5.3 Remedial System Optimization

There are no active remedial systems at the Barker Chemical Site so a Remedial Site Optimization study will not be required.

6.0 REPORTING REQUIREMENTS

6.1 Site Management Reports

All site management inspection events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 5-1 and summarized in the Periodic Review Report.

Table 5-1: Schedule of Inspection Reports

Task/Report	Reporting Frequency*
Inspection Report	Periodically, or as otherwise determined by the Department
Periodic Review Report	Periodically, or as otherwise determined by the Department

* The frequency of events will be conducted as specified until otherwise modified by the NYSDEC.

All inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Non-routine event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;

- Description of non-routine activities performed; and

- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet).

6.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning 30 days after the initial 15 month certifying period. This initial certifying period commences upon the reclassification of the site. After submittal of the initial Periodic Review Report, follow-up PRRs shall be submitted periodically to the Department or at another frequency as may be subsequently required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A - Environmental Notice. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment, and certification of all ICs required by the remedy for the site;

- Results of the required periodic site inspections and severe condition inspections, if applicable;

- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted;

- A summary of any data and/or information generated during the reporting period, with comments and conclusions, if any;

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends;

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html; and

- A site evaluation, which includes the following:
  - The compliance of the remedy;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated;
  - Recommendations regarding any necessary changes to the remedy; and
  - The overall performance and effectiveness of the remedy.

6.2.1 Certification of Institutional Controls

Within 30 days after the end of each certifying period, as determined by the NYSDEC, the following certification will be provided to the Department:

"For each institutional control identified for the site, I certify that all of the following statements are true:

- *The institutional control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental Notice;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practice; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as Owner's Designated Site Representative for the site."

The signed certification will be included in the Periodic Review Report, if such report is required for the period. Otherwise, the Certification will be submitted as a stand-alone document.

The Periodic Review Report/Certification will be submitted, in electronic format, to the NYSDEC Central Office, the NYSDEC Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report/Certification may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

6.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC. Upon completion of the Corrective Measure, a signed certification form must be submitted to the Department.

7.0 REFERENCES

LaBella, 2012, Phase II Environmental Site Assessment of the Barker Chemical Site: LaBella Associates, P.C., Buffalo, New York.

Lockheed Martin, 2000, Removal Site Evaluation Report: Lockheed Martin Technology Services Group, Edison, New Jersey.

NYSDEC, 1995, Determination of Soil Cleanup Objectives and Cleanup Levels: New York State Department of Environmental Conservation, Division of Environmental Remediation Technical and Administrative Guidance Memorandum # HWR-95-4046, Albany, New York.

NYSDEC, 1995, Identification and Listing of Hazardous Wastes, New York State Codes, Rules and Regulations Title 6, Part 371: New York State Department of Environmental Conservation, Division of Hazardous Substances Regulation, Albany, New York.

NYSDEC, 1998, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations: New York State Department of Environmental Conservation, Division of Water Technical and Operational Guidance Series (1.1.1) June 1998 (April 2000 addendum), Albany, New York.

NYSDEC, 1999, Technical Guidance for Screening Contaminated Sediments: New York State Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Albany, New York.

NYSDEC, 2006, 6 NYCRR Part 375: Environmental Remediation Programs, Soil Cleanup Objectives: New York State Department of Environmental Conservation, Division of Environmental Remediation, Albany, New York.

NYSDEC, 2007, Site Investigation Report of the Former Barker Chemical Site, Village of Barker, Niagara County, New York: New York State Department of Environmental Conservation, Division of Environmental Remediation, Buffalo, New York.

NYSDEC, 2009, Supplemental Site Investigation Report of the Former Barker Chemical Site, Village of Barker, Niagara County, New York: New York State Department of Environmental Conservation, Division of Environmental Remediation, Buffalo, New York.

NYSDEC, 2010, Program Policy DER-10: Technical Guidance for Site Investigation and Remediation: New York State Department of Environmental Conservation, Division of Environmental Remediation, Albany, New York.

NYSDEC, 2015, Remediation Report of the Barker Chemical Site, Barker, Niagara County, New York: New York State Department of Environmental Conservation, Division of Environmental Remediation, Buffalo, New York.