

**SECOND FIVE-YEAR REVIEW REPORT
LCP BRIDGE STREET SUBSITE
OF THE
ONONDAGA LAKE SITE
ONONDAGA COUNTY, NEW YORK**

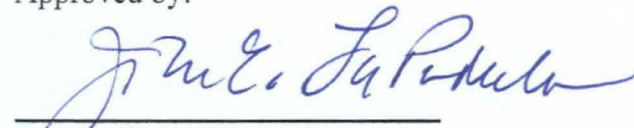


Prepared by

**U.S. Environmental Protection Agency
Region 2
New York, New York**

October 2014

Approved by:

for 
**Walter E. Mugdan, Director
Emergency and Remedial Response Division**

October 2, 2014
Date

277289



Table of Contents

EXECUTIVE SUMMARY	iii
FIVE-YEAR REVIEW SUMMARY FORM	iv
INTRODUCTION	1
SITE CHRONOLOGY	1
BACKGROUND.....	1
Physical Characteristics	1
Site Geology/Hydrogeology	2
Land and Resource Use	2
History of Contamination	2
Initial Response.....	3
Basis for Taking Action.....	4
REMEDIAL ACTIONS.....	6
Remedy Selection	6
Remedy Implementation.....	7
System Operations/Operation, Maintenance and Monitoring	Error! Bookmark not defined. 10
PROGRESS SINCE LAST FIVE-YEAR REVIEW	11
FIVE-YEAR REVIEW PROCESS	12
Administrative Components	12
Community Involvement	12
Document Review.....	13
Data Review.....	13
Site Inspection.....	16
Interviews.....	16
Institutional Controls Verification	16
TECHNICAL ASSESSMENT	17
Question A: Is the remedy functioning as intended by the decision documents?	17
Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?	18

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?.....	18
Technical Assessment Summary	19
ISSUES, RECOMMENDATIONS AND FOLLOW-UP ACTIONS	20
PROTECTIVENESS STATEMENT	20
NEXT REVIEW.....	20

TABLES

Table 1: Chronology of Site Events

Table 2: Documents, Data and Information Reviewed in Completing the Five-Year Review

Table 3: Recommendations and Follow-Up Actions

FIGURES

Figure 1: Site Plan

Figure 2: Additional Soil/Sediment Removals

Figure 3: Groundwater Sampling Results - Dissolved Mercury

Figure 4: Piezometer/Monitoring Well Locations

Figure 5: Surface Water Sampling Results - Dissolved Mercury

Figure 6: 2008-2013 Surface Water/Sediment Locations

Figure 7: Sediment Sampling Results - Total Mercury

EXECUTIVE SUMMARY

This is the second five-year review (FYR) for the LCP Bridge Street subsite of the Onondaga Lake Superfund site, located in the Village of Solvay, Town of Geddes, Onondaga County, New York. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR is the completion date of the previous FYR (October 8, 2009).

The remedy is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that would result in unacceptable risks in these areas.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Onondaga Lake Site (LCP Bridge Street Subsite)		
EPA ID: NYD986913580		
Region: 2	State: NY	City/County: Village of Solvay/Onondaga County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	Has the Site achieved construction completion? No	
REVIEW STATUS		
Lead agency: State If "Other Federal Agency" was selected above, enter Agency name: N/A		
Author name (Federal or State Project Manager): Mark Granger		
Author affiliation: EPA		
Review period: 10/09/2009 – 10/08/2014		
Date of subsite inspection: 07/16/2014		
Type of review: Statutory		
Review number: 2		
Triggering action date: 10/08/2009		
Due date (five years after triggering action date): 10/08/2014		

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
N/A

Five-Year Review Summary Form (continued)

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 05	Issue Category: Remedy Performance			
	Issue: The LCP Bridge Street subsite extraction wells may not be providing a complete inward gradient of the contaminated groundwater within the slurry wall.			
	Recommendation: Three years after the completion of the construction of an impermeable cap over the containment area/slurry wall, measure the effectiveness of the groundwater extraction system in sustaining an inward gradient.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	State	6/30/2018

OU(s): 05	Issue Category: Institutional Controls			
	Issue: The placement of institutional controls, required as part of the ROD, is awaiting remedy completion.			
	Recommendation: Finalized placement of institutional controls within one year of remedy completion.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	State	6/30/2016

Protectiveness Statement(s)		
<i>Operable Unit:</i> 05	<i>Protectiveness Determination:</i> Will be Protective	<i>Addendum Due Date (if applicable):</i>
<i>Protectiveness Statement:</i>		
The implemented remedy is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled.		

INTRODUCTION

The Onondaga Lake site includes 11 subsites, which are defined as any site that is situated on Onondaga Lake's shores or tributaries that has contributed contamination to, or threatens to contribute contamination to, Onondaga Lake. Each subsite is an operable unit (OU).

This five-year review (FYR) focuses only on the Linden Chemicals and Plastics (LCP) Bridge Street subsite (LCP subsite) (OU 5) of the Onondaga Lake site. The LCP subsite is located in Village of Solvay, Town of Geddes, Onondaga County, New York. This is the second FYR for the LCP subsite. This FYR was prepared by United States Environmental Protection Agency (EPA) Remedial Project Manager (RPM) Mark Granger. It was conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation and Liability Act, as amended, 42 U.S.C. § 9601 *et seq.* and 40 CFR 300.430(F)(4)(ii), and in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The purpose of a FYR is to ensure that the implemented actions protect human health and the environment and that they function as intended by the decision documents. This document will become part of the subsite file.

The triggering action for this statutory review is the completion date of the previous FYR, which was October 8, 2009. A FYR is required at this subsite due to the fact that hazardous substances, pollutants or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure.

SITE CHRONOLOGY

See **Table 1** for the chronology of subsite events.

BACKGROUND

Physical Characteristics

The LCP subsite is located in an industrial area south of the New York State Fairgrounds complex and a Conrail right-of-way and north of Belle Isle Road. A scrap yard owned by the Matlow Company and the former NAKOH Chemical Company are located northeast of the subsite. The WPS Syracuse Cogeneration facility (formerly known as Kamine) is located immediately west of the subsite.

The LCP subsite encompasses approximately 30 acres, 20 acres of which was host to various former industrial, storage and office buildings, as well as storage tanks and railroad tracks. These structures were remediated (*e.g.*, tank cleaning, lead and asbestos abatement) and demolished during an Interim Remedial Measure (IRM) completed in 2001. This 20-acre area subsequently became a soil/sediment containment area surrounded by a slurry wall, receiving contaminated soil, sediment and debris from other on-site remedial efforts. Areas downgradient of the subsite that were required to have soil, sediment and debris removed because subsite-related mercury came to contaminate these materials (*i.e.*, Geddes Brook and Ninemile Creek) have also used the on-site

soil/sediment containment area to dispose of these materials. The remaining 10 acres are associated with flumes, wetlands, ditches and other non-facility features.

The West Flume, a man-made drainage channel, runs east-west through the northern portion of the LCP subsite. The West Flume typically ranges in width from 5 to 10 feet. In addition to runoff from the main subsite, the West Flume conveys storm water from a portion of the Village of Solvay. The West Flume is a New York State Class C water body. The West Flume converges with Geddes Brook under Interstate 695, approximately 4,500 feet west of the subsite. Geddes Brook flows into Ninemile Creek, which eventually discharges into Onondaga Lake.

Immediately north of the West Flume is an area that received material from historical West-Flume dredging efforts. This area is known as the Dredge Spoils area.

Two wetlands, Wetlands A and B, are located to the west of the LCP facility. These wetlands are part of the New York State regulated wetland complex SYW-14. Wetland A is located immediately west of the LCP facility and is approximately 1.3 acres in size. It includes a portion of the West Ditch, a shallow man-made ditch that conveys surface water from the western portion of the LCP facility and other upstream areas to the main body of Wetland A. Surface water discharges from Wetland A to Wetland B via a spillway that was constructed during the Remedial Action (RA).

Wetland B is approximately 7.6 acres in size. The main body of Wetland B is located several hundred feet west of Wetland A. Wetland B discharges to the West Flume downstream of the LCP facility.

The East Ditch is a shallow, man-made ditch located along the east side of the facility. The East Ditch transports surface water runoff from the eastern portion of the subsite and from upstream areas to the West Flume. See **Figure 1** for the site plan.

Site Geology/Hydrogeology

Groundwater generally occurs from three to eight feet below ground surface. There are three distinctive saturated units separated by two aquitards (a layer of low permeability) at the LCP subsite. The uppermost saturated unit is comprised of fill and clay (fill/clay), while the underlying saturated unit is made up of silt, clay and fine sand (silt/clay/fine sand). A shallow clay layer separates the fill/clay from the silt/clay/fine sand. The bedrock (Vernon shale) is the lowest saturated unit beneath the subsite. Bedrock is separated from the silt/clay/fine sand by a dense, low-permeability till aquitard.

Land and Resource Use

The on-site aquifers are not used for drinking water. Residents located in the vicinity of the LCP subsite use the public water supply provided by Onondaga County. Groundwater near the subsite will not be used as a source of potable water under future-use scenarios.

The property and surrounding areas are presently zoned industrial, and the reasonably-anticipated future land use is not expected to change. The soil/sediment containment area is surrounded by a fence that prevents public access.

History of Contamination

From the mid-1800s to 1908, the land on which the LCP subsite is located was occupied by several companies that produced salt from naturally-occurring brine springs in the area. The subsite was

first developed and used for commercial/industrial purposes by the Atmospheric Nitrogen Company (ANC) between 1919 and 1940. ANC constructed and operated a plant that manufactured ammonia. Ammonia production eventually ceased and in the early 1950s, the facility was demolished. The resulting debris was used to fill the subsite.

In 1953, the Allied Chemical Corporation, a predecessor to AlliedSignal and then Honeywell, constructed a chlor-alkali facility at the LCP subsite to manufacture caustic soda (sodium hydroxide) and chlorine gas. From 1953 to 1968, the facility used only the mercury-cell process for this purpose. After 1968, both the mercury cell and diaphragm cell processes were used. Hydrogen gas, generated as a by-product of the mercury cell process, was used to manufacture hydrogen peroxide between 1955 and 1969. Between 1972 and 1975, two lined surface impoundments were constructed southwest of the Mercury Cell and Diaphragm Cell Buildings. These surface impoundments were used to settle suspended matter from process wastewaters and equalize the volume surges to the chlor-alkali facility wastewater treatment system.

In 1979, the facility was purchased by LCP. LCP installed a hydrochloric acid production process in 1980 and a sodium-hypochlorite bleach production process in 1981. In 1981, LCP filed a Resource Conservation and Recovery Act (RCRA) Part A Permit Application with the New York State Department of Environmental Conservation (NYSDEC) and obtained interim status as a hazardous waste storage facility under RCRA. In 1984, two surface impoundments used to separate mercury from chlor-alkali wastewater were taken out of service. Manufacturing operations ceased in 1988. Hanlin Group, parent corporation to LCP, filed for bankruptcy in 1992. The eastern portion of the facility was leased by the HoltraChem Manufacturing Company from the mid-1990s through 1998 and was used as a product transfer station for the distribution of caustic soda and acids. Currently, no operations are conducted at the LCP subsite.

Initial Response

In July 1986, LCP submitted a closure plan for the surface impoundments and subsequently obtained NYSDEC approval. The closure entailed the removal of sludge, liners and impacted soil associated with the impoundments. The surface impoundment closures were completed in July 1989.

In 1990, polychlorinated biphenyl (PCB)-contaminated soils were excavated and removed from the Eastern Rectifier Area by LCP in accordance with the Toxic Substance Control Act (TSCA). In March 1995, approximately 21,000 gallons of PCB-impacted oil were drained from transformers and rectifiers in the Western Rectifier Area. As part of an IRM conducted by Honeywell (as AlliedSignal), approximately 200,000 pounds of PCB-impacted electrical equipment and the 21,000 gallons of PCB-impacted oil were disposed of off-site under TSCA and NYSDEC Part 375 requirements.

In March 1999, an IRM involving the drumming and off-site disposal of hazardous laboratory chemicals was conducted by Honeywell. In July 1999, a hazardous wastewater and sludge IRM was completed. Under this action, Honeywell removed hazardous wastewaters and sludges from the on-site tanks and disposed of the waste off-site.

In October 1999, NYSDEC obtained groundwater samples from north of the West Flume on an adjacent property in the vicinity of the Peroxide Building. Laboratory analysis characterized the

groundwater as having high xylene concentrations (xylene was used by Allied Chemical in the hydrogen peroxide process).

In March 2000, a sewer pipe removal IRM was performed that removed portions of the on-site sewers which may have been releasing mercury-impacted water into the West Flume and East Ditch, and plugged the downgradient ends of the sewers.

An IRM entailing the demolition of most of the on-site structures commenced in May 2000. A Diaphragm and Mercury Cell Building demolition IRM commenced in July 2000. This IRM consisted of the removal and recycling of elemental mercury from cells inside the Mercury Cell Building, followed by the decontamination and demolition of the buildings. This work was completed in August 2001.

Basis for Taking Action

In October 1995, the State of New York and Honeywell entered into a Stipulation and Order, under the 1992 Onondaga Lake Remedial Investigation/Feasibility Study (RI/FS) Interim Consent Decree, to conduct an RI/FS at the LCP subsite. Field work began in October 1995 and was completed in November 1996. In October 1997, Honeywell (as AlliedSignal) completed an RI report for the subsite. The report was subsequently modified by NYSDEC and reissued in March 1999. Honeywell completed the FS in May 1999.

The results of the RI are summarized below.

Groundwater

Mercury was found in the upper two saturated units at concentrations exceeding NYSDEC's drinking water standard of 0.7 micrograms per liter ($\mu\text{g/L}$) in a number of wells at the LCP subsite. The only other metals detected in the groundwater above NYSDEC's drinking water standards were antimony and lead.

Volatile organic compounds (VOCs), including vinyl chloride, chloroethane, 1,1-dichloroethane and 1,2-dichloroethene, were detected in the groundwater in the western portion of the facility. The VOCs are within a contaminant plume emanating from upgradient of the subsite. Concentrations of these VOCs in groundwater dissipated to non-detectable levels on-site. Other VOCs including chloroform and benzene, were sporadically detected on-site. Semi-volatile organic compounds (SVOCs), including hexachlorobenzene (HCB), benzo(a)anthracene, chrysene, 4-methylphenol and naphthalene, were detected sporadically above NYSDEC drinking water standards. PCBs were detected in one monitoring well (Aroclors 1242 and 1248) above the NYSDEC groundwater standard of 0.09 $\mu\text{g/L}$.

Surface Water

Mercury was detected above NYSDEC surface water standards in the Wetlands A and B and in the West Flume. Lead, chromium and seven organic compounds (including PCBs) were also present above NYSDEC surface water standards.

Sediments

Mercury was detected in the sediments in Wetlands A and B and in the West Flume. Nine VOCs, SVOCs (including HCB), additional metals other than mercury (including lead), and PCB Aroclor

1254 were also detected at concentrations above screening levels or above those which were detected at the upgradient sediment-sampling location.

Surface and Subsurface Soil

Mercury was detected in soils throughout the LCP subsite. PCBs were detected in soils in the Western Rectiformer Area (Aroclors 1254 and 1260) and lead was detected in solids from the Diaphragm Cell Building. Visible elemental-mercury dense non-aqueous phase liquid (DNAPL) was observed in a shallow soil boring obtained from within the Mercury Cell Building. Elemental-mercury DNAPL was also observed in deep soil collected from approximately 18 to 50 feet below the ground surface in the area just north of the Mercury Cell Building.

Air Quality

Air monitoring conducted at three locations along the perimeter of the LCP subsite did not show the presence of contamination. Air monitoring yielded concentrations of mercury above the Occupational Safety and Health Administration limit of 0.05 milligrams per cubic meter inside the Mercury Cell Building; mercury was not detected above background in the air outside of the Mercury Cell Building.

Site Sewers

Various LCP subsite sewers discharged mercury-contaminated groundwater and/or surface-water runoff to the West Flume. Several sewers traversed or ended at the West Flume and East Ditch. While these other sewers did not appear to be discharging to the West Flume or East Ditch during the RI, the potential for discharge existed.

Brine Mud Disposal Area

The Brine Mud Disposal Area contained approximately 3,200 cubic yards (CY) of uncapped brine muds in an area north of the West Flume. The brine muds are non-hazardous precipitated calcium carbonate and magnesium carbonate that were generated during brine purification as part of the caustic soda production process which took place at the facility. Relatively low levels of mercury were detected in the Brine Mud Disposal Area during the RI. Mercury concentrations ranged from 0.46 to 6.8 milligrams per kilogram (mg/kg), with an average of 4 mg/kg, in the shallow muds, and 0.24 to 0.92 mg/kg, with an average of 0.57 mg/kg, in the deeper muds.

Biological Tissues

Biota samples were collected at various locations from the West Flume and Poned Area. Mercury, PCBs and HCB were detected in all fish samples that were examined. The maximum concentrations of PCBs (0.24 mg/kg) and HCB (0.35 mg/kg) in fish were higher than the ecological screening thresholds of 0.11 mg/kg and 0.2 mg/kg, respectively, for these compounds. The maximum concentration of mercury in fish (2.23 mg/kg) was higher than the Food and Drug Administration threshold of 1 mg/kg. (The fish collected from these water bodies were too small to be desirable for human consumption.) The highest concentration of mercury in biota (3.70 mg/kg) was detected in a hellgrammite, a predatory insect. The highest concentration of total PCBs in biota (0.80 mg/kg) was detected in a crayfish.

Summary of Subsite Risks

All of the contaminants that were detected (VOCs, SVOCs, PCBs and metals) in subsite-related media were considered in the risk assessment. The human health risk assessment conducted for this subsite concluded that noncancer health effects to humans could occur due to trespassing and future work at the subsite, and that the primary contributors to these potential adverse non-cancer health effects are mercury and PCBs. The ecological risk assessment concluded that the primary concern for fish and wildlife resources is mainly due to mercury (as methyl mercury) and PCBs.

REMEDIAL ACTIONS

Remedy Selection

Based on the results of the RI/FS, a ROD was issued on September 29, 2000, which selected a remedy for the LCP subsite. The major components of the selected remedy include:

- Excavation of approximately 54,300 CY of sediment exceeding upstream mercury concentrations. Backfilling of the excavated areas with clean fill and re-vegetating such areas, as appropriate. All excavated material will be dewatered, characterized and placed on-site under a New York State 6 NYCRR Part 360 equivalent low-permeability cap. Restoration of any wetlands impacted by remedial activities. The restored wetlands will require routine inspection for several years to ensure adequate survival of the planted vegetation;
- Cleaning sewer catch basins and manhole structures and filling LCP subsite sewer systems with grout;
- Excavation of approximately 3,200 cy of brine muds and placement of the brine muds on-site under a New York State 6 NYCRR Part 360 equivalent low-permeability cap;
- Excavation and on-site treatment of approximately 4,500 cy of mercury-contaminated principal threat waste shallow soils at the facility with on-site placement of the treated soils under a New York State 6 NYCRR Part 360 equivalent low-permeability cap;
- Excavation and off-site disposal of soils which contain PCB contamination above NYSDEC Division of Environmental Remediation Technical and Administrative Guidance Memorandum levels. All excavated material will be characterized and transported for treatment/disposal at an off-site Resource Conservation and Recovery Act-and/or Toxic Substances Control Act-compliant facility, as appropriate;
- Installation of a New York State 6 NYCRR Part 360 equivalent low-permeability cap over the facility to contain LCP subsite soils, excavated sediments and brine muds and demolition debris;
- Hydraulic containment of both the shallow and deep aquifers with a subsurface barrier wall and a groundwater collection-and-treatment system to maintain proper hydraulic gradients;
- Implementation of institutional controls (*i.e.*, deed restrictions) to prohibit the use of groundwater at the LCP subsite and the disturbance of the subsite cap and slurry wall; and

- Long-term monitoring of groundwater, surface water, sediment and biota to ensure the effectiveness of the selected remedy.

Remedial action objectives (RAOs) are specific goals to protect human health and the environment. These objectives are based on available information and standards such as applicable or relevant and appropriate requirements and risk-based levels established in the risk assessment. Based upon the results of the RI, the following RAOs were established:

- Eliminate, to the extent practicable, contaminant migration from the LCP subsite to the Onondaga Lake environs and environmental media (*e.g.*, groundwater, surface waters, soil, air and sediment);
- Restore, to the extent practicable, groundwater quality to levels which meet state and federal drinking water standards;
- Mitigate, to the extent practicable, the migration and potential migration of contaminated waters through LCP subsite sewers;
- Eliminate, to the extent practicable, the direct-contact threat associated with contaminated soil, surface water and groundwater; and
- Reduce, to the extent practicable, the level of contaminants in surface water and sediments to attain surface water Applicable or Relevant and Appropriate Requirements (ARARs) and sediment remedial goals to be protective of fish, wildlife and the resources upon which they depend.

Remedy Implementation

The remedial design was completed with the approval of the Final 100% Remedial Design Report in September 2004. The RA commenced in October 2004. The various components of the RA are described below.

Sewer Closure

The sewer system was closed in two phases. Sections of sewer lines within 10 feet of the West Flume and East Ditch were removed during an IRM performed in March 2000. The remaining portions of the sewer lines were closed from June through August 2005. The majority of the sewer system was closed by excavation and crushing; several sewer lines were closed by cleaning and grouting in place.

Cut-Off Wall Construction

Construction of a cut-off wall around the soil/sediment containment area to contain the contaminated groundwater was performed from July to September 2005. The cut-off wall consisted of a mixture of suitable soil and bentonite slurry with a hydraulic conductivity of less than 10^{-7} centimeters per second (cm/sec). The cut-off wall was keyed three feet into the underlying low-permeability till and was tied into an interim low-permeability cover.

Excavation and Treatment of Principal-Threat Waste

Principal-threat-waste excavation areas were identified as:

- Shallow soils beneath the Mercury Cell Building within the confines of the foundation down to a clay layer, or to approximately eight feet below ground surface;
- Shallow soils from the Mercury Retort and Still Areas with soils that when subject to the Toxic Characteristic Leaching Procedure (TCLP) testing exceeded the cleanup objective of 0.2 milligrams per liter (mg/L) for mercury in leachate; and
- Soils from the vicinity of the former Hydrogen Compressor Building with visible elemental mercury.

Excavation was conducted from October to December 2004. The concrete slab and soils from the Mercury Cell Building, the Mercury Retort and Still Areas and the Hydrogen Compressor Building Area were excavated. Approximately 7,000 CY of material were stockpiled for treatment.

The excavated material was treated (by soil washing) to below 0.2 mg/L mercury in TCLP leachate and placed at the soil/sediment containment area. A portion (87 CY) of the washed material required stabilization. A portion of that stabilized material did not pass Toxic Characteristic Leaching Procedure testing and was disposed of offsite at an approved facility. A total of 15,715 pounds of elemental mercury was recovered by the soil-washing process and shipped off-site for recycling.

Excavation of Sediments and Soils

West Flume Sediment Excavation:

The West Flume sediment excavation was conducted from August through September 2006. Post-excavation samples were collected from the excavation bottom prior to backfilling and additional excavations conducted, as necessary and appropriate. A volume of 22,500 CY was excavated from the West Flume and consolidated on the soil/sediment containment area. Additionally, 40 CY of VOC-contaminated soil were excavated and disposed of offsite. The West Flume excavation was backfilled with clean imported soil, covered with 6 inches of clean imported topsoil and restored. Restoration consisted of seeding, placement of erosion control fabric and planting of trees.

Wetlands Sediment Excavation:

The Wetlands A and B sediment excavation was conducted from June 2005 to July 2007. Post-excavation samples were collected from the excavation bottom prior to backfilling and additional excavations conducted, as necessary and appropriate. A total volume of 69,200 CY was excavated from the wetlands and consolidated on the soil/sediment containment area. The wetlands were backfilled with clean imported soil, covered with one foot of clean imported topsoil and restored. Restoration consisted of seeding and planting of wetland plants and trees.

Brine Mud Disposal Area Excavation:

From October 2003 to June 2006, a total of 23,100 CY of material was excavated from the Brine Mud Disposal Area and consolidated on the soil/sediment containment area. Post-excavation samples were collected from the excavation bottom prior to backfilling and additional excavations conducted, as necessary and appropriate. The Brine Mud excavation was backfilled with clean imported soil, covered with six inches of clean imported topsoil and seeded.

North Ditch Area Excavation:

The North Ditch Area is located between the Matlow Scrap Yard and the Brine Mud Disposal Area. Excavation of the North Ditch Area was conducted from June through November 2005. Post-excavation samples were collected from the excavation bottom prior to backfilling and additional excavations conducted, as necessary and appropriate. A total of 14,900 CY of soil was excavated from the North Ditch Area and consolidated on the soil/sediment containment area. The North Ditch Area excavation was backfilled with clean imported soil, covered with six inches of clean imported topsoil and seeded.

MW-26 Area Excavation:

The MW-26 Area is located on the northwestern portion of the subsite adjacent to Wetland A. This was a depth-based excavation; a total of 2,900 CY of soil was excavated from this area and consolidated on the soil/sediment containment area. The MW-26 Area excavation was backfilled with clean imported soil and seeded.

PCB Soil Excavation:

Approximately 300 CY of PCB-contaminated soil were excavated from the PCB excavation areas and disposed of off-site at an approved facility. After excavation, sample concentrations in the PCB excavation area outside the soil/sediment containment area were below 1 mg/kg in surface soil samples and below 10 mg/kg in subsurface soil samples; sample concentrations in the PCB excavation area inside the soil/sediment containment area were below 10 mg/kg. The excavation areas were subsequently backfilled and regraded.

Soil/Sediment Containment Area

The soil/sediment containment area was constructed over most of the 20-acre, facility-related area of the property. Excavated materials from the West Flume, Wetlands A and B, the Brine Mud Area and other areas were consolidated at the on-site soil/sediment containment area. Treated principal threat waste was also consolidated there. A total of approximately 132,000 CY of soil, sediment, waste and debris was consolidated at the soil/sediment containment area. A fence with gates was constructed around the soil/sediment containment area to prevent public access.

In addition, after completion of the aforementioned efforts, the soil/sediment containment area has been used to dispose of soil, sediment and debris from the downgradient Geddes Brook/Ninemile Creek cleanups as well as 33,400 CY of materials from the supplemental on-site excavations of the East Ditch, West Ditch, Wetland A and Dredge Spoils areas.

Interim Low-Permeability Cover

The soil/sediment containment area is covered with an interim cover. An interim cover was utilized to be able to accommodate contaminated material being removed from the Geddes Brook/Ninemile Creek subsite (the LCP subsite is the source of the contamination in Geddes Brook/Ninemile Creek) over the course of several construction seasons. Due to the construction schedules for that subsite, an interim low-permeability soil cover was placed over impacted sediments to limit infiltration and achieve effective closure of the LCP subsite. Ultimately, a NYCRR Part 360 equivalent cap, physically tied to the subsurface cut-off wall, will be installed.

The interim low-permeability soil cover consists of a one-foot thick layer of a predominately silt material. Geotechnical testing indicated that, when compacted, the material meets the permeability

requirement of 10^{-6} cm/sec. Four inches of topsoil were placed over the low-permeability soil cover and seeded.

Groundwater Collection and Pre-Treatment System

The groundwater collection system was designed to recover groundwater from the soil/sediment containment area. In 2006, a building was constructed to house two 10,000-gallon fiberglass groundwater storage tanks. Groundwater was extracted from above the till unit to create an inward and upward hydraulic gradient via 15 pumping wells and sent to a common sump through a gravity header. A 50-gallon per minute (gpm) submersible pump carried the water to the extraction building through a 3-inch high density polyethylene force main. This work was completed in 2007. The collected water (approximately 130,000 gallons per month) was originally transported by truck to the nearby Willis Avenue/Semet IRM treatment facility. In 2009, a pre-treatment system consisting of a filter feed pump, two 5-micron bag filters, two fiberglass-reinforced plastic granular activated carbon vessels and a flow meter was constructed. This system treats the collected water and then pumps it to the Onondaga County West Side Trunk Sewer (sanitary sewer), from which it flows to the Onondaga County Metropolitan Wastewater Treatment Facility (Metro) for additional treatment. The design pumping rate is approximately 5 to 25 gpm.

Three monitoring wells were installed within the soil/sediment containment area with elemental mercury to monitor for the potential movement of elemental mercury.

Engineering Controls

A fence was constructed around the soil/sediment containment area. The fence is locked and prevents public access.

Restoration

The excavation areas were restored to provide habitats for wading birds, ducks, amphibians, fish and mammals.

System Operation/Operation and Maintenance

Requirements for operation, maintenance and monitoring (OM&M) are identified in the OM&M Plan and include the operation of the groundwater-collection system and the implementation of monitoring and inspections. OM&M activities are documented and submitted to NYSDEC in monthly reports. The first monthly report was submitted in November 2008.

Subsite inspections focus on four major items: 1) general site conditions (*i.e.*, access roads, security fence/gates, signs, erosion control measures); 2) groundwater collection/storage system condition (*i.e.*, building structure, extraction wells, piezometers, pumps, instrumentation, storage tanks); 3) interim cap condition (*i.e.*, vegetated topsoil, vent pipes, drainage system, settlement and subsidence) and 4) static water-level measurements within the groundwater piezometers upgradient and downgradient of the cut-off wall.

The monitoring components of the OM&M Plan include:

- Periodic sampling of groundwater, surface water/sediment and biota; and
- Wetlands assessments.

The first annual sampling event for sediment, surface water and biota was conducted in November and December 2008.

Three monitoring wells located within the area with deep elemental mercury within the soil/sediment containment area are sampled quarterly and analyzed for total mercury and inspected for the presence of elemental mercury. The OM&M Plan specifies that if mercury is detected in a monitoring well, the three monitoring wells should be sampled each month for three months. In addition, groundwater from piezometers located outside the cut-off wall are sampled quarterly and analyzed for total mercury.

A total of nine surface water/sediment annual monitoring locations have been established within the West Flume, Wetland A and Wetland B. Surface water is analyzed for total and dissolved mercury and methyl mercury. Sediments are analyzed for total mercury and methyl mercury. The first round of samples was collected in December 2008.

The December 2008 sediment samples were collected from four locations in the West Flume, two locations in Wetland A and three locations in Wetland B. Due to sediment concentrations significantly above 0.2 mg/kg, additional sediment sampling was conducted in May 2009. The additional sampling event consisted of re-sampling the locations sampled during the December 2008 sampling event and eight additional locations in the West Flume, three additional locations in Wetland A and fourteen additional locations in Wetland B. Eight sediment locations were also sampled from the surface water drainage ditches, six from the West Ditch and two from the East Ditch. The sample results showed elevated concentrations of mercury in sediments in the West Ditch and Wetland A, thus confirming the December 2008 results and identifying additional areas of potential concern.

Biota in and around the West Flume, Wetland A and Wetland B have been collected and analyzed annually for total mercury and methyl mercury (benthic macroinvertebrates only). Biota being monitored include forage fish, benthic macroinvertebrates, small mammals and earthworms.

The restored wetlands were monitored twice annually for five years to evaluate the success of the restoration. The parameters monitored included vegetation (type, percent cover and frequency), hydrology, invasive species (species, location and approximate size of patch) and wildlife usage.

The supplemental excavation effort in the Dredge Spoils area (see the "Progress Since Last Five-Year Review" section, below) resulted in the creation of an additional wetland area, which has been named "Wetland C." Wetland C is now included in the ongoing surface-water, sediment and wetland-assessment aspects of the OM&M program.

Since January 2008, approximately eight-million gallons of groundwater have been removed from inside the soil/sediment containment area, at an average rate of approximately 100,000 gallons per month.

Potential impacts on the subsite from climate change was assessed. The performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the subsite.

PROGRESS SINCE LAST FIVE-YEAR REVIEW

The first FYR was completed in October 2009. The FYR concluded that the remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The previous FYR made four recommendations: areas of elevated concentrations of mercury in sediments in the East Ditch, West Ditch, Wetland A and Dredge Spoils areas should be sampled to define the extent of the contamination and then excavated; the design and construction of the final low-permeability cap should be completed upon completion of the Geddes Brook/Ninemile Creek remedial action (contaminated sediments from this action are being disposed of under the cap); the groundwater pumping rate should be adjusted to achieve an inward gradient once the discharge to the sanitary sewer commences and again after the final cap is constructed and deed restrictions need to be put into place.

Sediment samples were collected in the East Ditch, West Ditch, Wetland A and Dredge Spoils areas in 2009 and 2010. Based upon the sample results, from 2010 to 2012, 33,400 CY of mercury-contaminated soil, sediment and debris was excavated and placed under the cap. As noted above, the supplemental excavation effort in the Dredge Spoils area resulted in the creation of Wetland C, which is now included in the ongoing surface-water, sediment and wetland assessment aspects of the OM&M program.

See **Figure 2** for a map of areas included in the supplemental-excavation efforts.

The final low-permeability cap design was approved in June 2014. Construction of the cap is currently underway. It is anticipated that the work will be completed in 2015. The groundwater pumping rate will be adjusted to achieve an inward gradient once the discharge to the sanitary sewer commences and again after the final cap is constructed.

The deed restrictions will be put into place after the installation of the cap.

FIVE-YEAR REVIEW PROCESS

Administrative Components

The FYR team consisted of Mark Granger (Remedial Project Manager), Ed Modica (hydrogeologist), Michael Sivak (human-health risk assessor), Mindy Pensak (ecological risk assessor) and Larisa Romanowski (EPA Community Involvement Coordinator [CIC]).

Community Involvement

The CIC, Larisa Romanowski, posted a FYR public notice on the EPA's Onondaga Lake Superfund site webpage on July 30, 2014. The notice was provided to the Village of Solvay and Town of Geddes Clerks by email on July 31, 2014 and was subsequently posted in the respective municipal offices. In addition, the notice was distributed via the NYSDEC's Onondaga Lake News listserv, which includes approximately 4,000 subscribers. The purpose of the public notice was to inform the community that the EPA would be conducting a second FYR to ensure that the remedies implemented at the subsite remain protective of public health and are functioning as designed. In addition, the notice included the RPM's and the CIC's addresses and telephone numbers for questions related to the FYR process or the LCP Bridge Street subsite. No questions were received.

Once the FYR is completed, the results will be made available at the subsite information repositories, which are at the NYSDEC Albany and Syracuse offices; the Onondaga County Public Library, Syracuse Branch at the Galleries, 447 South Salina Street, Syracuse New York; the Atlantic States Legal Foundation, 658 West Onondaga Street, Syracuse, New York and on EPA's webpage. In addition, efforts will be made to reach out to local public officials to inform them of the results.

Document Review

The documents, data and information which were reviewed in completing this FYR are summarized in **Table 2**.

Data Review

Groundwater - Water-Quality Data

Groundwater samples are collected from four piezometer clusters (PZ-1B, PZ-2B, PZ-3B and PZ-4B, each with the depth designators -S, -I and -D for shallow, intermediate and deep, respectively) located on the outside of the cut-off wall along its northwestern length and from three monitoring wells located within the soil/sediment containment area. Samples are collected quarterly and analyzed for total mercury. For the period 2010 to 2013, concentrations of mercury ranged from 0.04 µg/L (PZ-3B-D and PZ-2B-I) to 4.3 µg/L (PZ-2B-S). Mercury was reported as not detected (ND) for most piezometers for a majority of the sampling quarters. Of the detections reported, most tended to be sporadic and at concentrations on the order of less than 0.1 µg/L, below the NYSDEC Groundwater Standard of 0.7 µg/L. A higher number of detections were observed for the first and third or fourth quarter sampling events, which is likely related to seasonal changes in water levels. Due to the large number of ND results, no trends are observable for most piezometers in comparing first quarter 2010 to fourth quarter 2013 data; however, it is clear that no increase in mercury concentrations is occurring.

Although there appears to be no correlation of mercury concentration to sampling depth, the results from piezometer PZ-2B-S (a shallow piezometer on northwest corner of soil/sediment containment area) were an exception in that total mercury concentrations were consistently higher for each quarter than in other piezometers. Over the period, mercury concentrations fluctuated about the average value of 2.8 µg/L (above the 0.7 µg/L NYSDEC Groundwater Standard) but showed a decreasing trend over the period. The highest concentration in PZ-2B-S was reported for the third quarter of 2010 at 4.3 µg/L whereas the lowest concentration was reported for the second and third quarters of 2013 at 1.8 µg/L. The piezometers will continue to be monitored on a quarterly basis.

Three monitoring wells (MW-34D, MW-35D and MW-36D) located within the soil/sediment containment area within the area of deep elemental mercury were sampled and analyzed for total mercury in 2010, 2011 and the early part of 2012. The wells were not sampled during the latter part of 2012 and in 2013 due to ongoing construction activities at the subsite. Generally, concentrations fluctuated about an average value but did not show a discernible trend. Total mercury concentrations ranged from 0.97 µg/L (MW-34-D) to 17.6 µg/L (MW-35-D). Well 35-D showed the highest average concentration of mercury of 9.3 µg/L of the three wells for the 2010-2011 period, compared to the average concentrations of 6.04 µg/L and 2.02 µg/L for wells MW-

36-D and MW-34-D, respectively. Although no decreasing trends were noted, mercury concentrations are somewhat lower compared to those reported in 2009 (maximum of 20 µg/L reported). See **Figure 3** for a summary of groundwater sampling results. See **Figure 4** for a map of piezometer/monitoring well locations.

During each sampling event, the monitoring wells were also inspected for elemental mercury by the use of a copper probe. Elemental mercury will coat copper via amalgamation. A copper probe was inserted down to the bottom of the wells and then retrieved and inspected for a mercury coating. Elemental mercury was not detected during any of the sampling events. The total mercury concentrations in the wells have been stable.

Groundwater - Hydraulics Data

Seven piezometer clusters installed on either side of the cut-off wall circumscribing the soil/sediment containment area are used to measure water levels across the wall. The data is needed to confirm that inward groundwater flow gradients are achieved relative to the soil/sediment containment area. Inward gradients are achieved when the interior shallow, intermediate and deep piezometer readings are less than the corresponding exterior shallow, intermediate and deep piezometer readings. During the monitoring period 2009 to 2013, the quarterly water levels measured by the piezometers have remained fairly steady and below the elevation of the top of the cut-off wall. The piezometer clusters PZ-6A and PZ-6B, located on the southern edge of the area and, to a lesser extent, piezometers clusters PZ-5A and PZ-5B, located on the southeastern edge of the area, show that inward gradients are achieved in these areas. However, other piezometer clusters have not shown that inward gradients are achieved across other sections of the wall.

The lack of inward gradients is largely attributed to excessive water accretion in the soil/sediment containment area that is a result of the absence of a final low-permeability cap. The groundwater flow condition in and around the soil/sediment containment area is expected to be corrected after the low-permeability cap is installed, as the cap will substantially reduce infiltration within the soil/sediment containment area and help induce inward flow gradients. Work on installing a low-permeability cap is scheduled for completion in 2015. Inward gradients are expected to be fully achieved several years after the final low-permeability cap is constructed. Pumping rates may need to be adjusted to achieve inward gradient after construction of the final low-permeability cap is completed.

Surface Water

As required by the OM&M Plan, over the last five-year period, surface water was sampled annually at four locations in the West Flume, two locations in Wetland A and three locations in Wetland B. Samples were analyzed for total mercury, total dissolved mercury and methyl mercury, although dissolved mercury is the primary component used to ascertain the surface-water remedial goals. In general, concentrations of dissolved mercury in surface water reported for 2009-2013 were well below concentrations reported in the RI for the wetland areas and in the West Flume and remain well below the acute and chronic aquatic standards (1,400 ng/L and 770 ng/L respectively) and the surface water standard of 2.6 ng/l (based on wildlife protection to total mercury) has also been met in each monitored area.

For the four sampling locations in the West Flume, concentrations of dissolved mercury ranged from 0.6 nanograms per liter (ng/L) to 3.4 ng/L, with an average concentration of 1.64 ng/L over the five-year period. On average, concentrations were lowest for the West Flume (compared to Wetland A and B), where concentrations were below the NYSDEC Ambient Water Quality Standard for mercury (in Class C water bodies) of 2.6 ng/L, except for sampling location LCP1-SW-60, where 3.4 ng/L was reported in 2011. No discernible trends were noted for any of the locations over the period.

For the three sampling locations in Wetland B, concentrations of dissolved mercury ranged from ND to 18 ng/L, and averaged 3.53 ng/L. Concentrations were, on average, higher in Wetland B than in the West Flume, where exceedances of the Ambient Water Quality Standard were reported for LCP1-SW-64 (18 ng/L) and LCP1-SW-66 (4.8 ng/L) in 2011, and LCP1-SW-64 (4.6 ng/L), LCP1-SW-65 (4.4 ng/L) and LCP1-SW-66 (2.9 ng/L) in 2013.

For the two sampling locations in Wetland A, concentrations ranged from 0.91 ng/L to 20.9 ng/L, and averaged 9.11 ng/L. Concentrations in Wetland A were, on average, the highest of the three areas. At LCP1-SW-67, mercury concentrations were reported to fluctuate about the average of 10.28 ng/L, with a maximum of 20.9 ng/L in 2010 but decreasing to a minimum of 0.91 ng/L in 2013. Similarly, at sampling location LCP1-SW-68, mercury concentrations fluctuated about the average of 7.95 ng/L, with a maximum of 17.4 ng/L in 2010 but decreasing to a minimum of 0.93 ng/L in 2013.

It is likely that much of the mercury-contamination of surface water reported for the West Flume and wetland areas is attributable to mercury-contaminated sediments/soils that were found in the East Ditch, West Ditch, Wetland A and Dredge Spoils areas. The removal of the affected sediments/soils from these areas was completed in 2012; consequently, it is expected that surface water quality in the West Flume and wetland areas will continue to improve. See **Figure 5** for a summary of surface-water sampling results. See **Figure 6** for a map of surface-water sampling locations.

Sediment

The OM&M Plan established the annual collection of samples from nine sediment-monitoring locations for total and methyl mercury at the same locations as those established for surface-water sampling. Over the last five-year period, sediments were sampled at four locations in the West Flume, two locations in Wetland A and three locations in Wetland B. The total mercury data ranges were 0.12 to 3.1 mg/kg with an average of 0.6 mg/kg for the West Flume, 0.24 to 4.2 mg/kg with an average of 1.19 mg/kg for Wetland A, and 0.06 to 0.84 mg/kg with an average of 0.2 mg/kg for Wetland B. Mercury concentrations were lowest for Wetland B and highest for Wetland A. See **Figure 7** for a summary of sediment sampling results. See **Figure 6** for a map of sediment sampling locations.

Biota

Baseline sampling was conducted in 2005 to establish body burden at the subsite prior to remediation. The OM&M Plan established a long-term monitoring program that analyzes mercury concentrations in forage fish, benthic macro invertebrates, small mammals and earthworms. The

OM&M Plan specifies that monitoring should continue regularly (every two to three years) until results indicate that the remedy has been effective and the contaminant concentrations have stabilized. Five annual sampling events (post remediation) have been conducted following completion of initial remedial activities in 2007. No trend was discernible after completion of these five annual sampling events. All biota values were below 1 mg/kg. While biota sampling was not conducted in 2013, it is anticipated that biota sampling will continue per the schedule outlined in the OM&M Plan.

Wetlands Assessments

Wetland A, Wetland B and the West Flume were restored after the removal of contaminated sediments in 2008. Generally, these areas were covered with one foot of clean imported topsoil and restored to a variety of habitat types, including a wet meadow/scrub-shrub fringe, emergent wetland, aquatic bed, open water and drainage channel. These habitat types were created by the development of various water depth zones according to the wetland-restoration plan. In order to limit invasive species, the restoration plan places an emphasis on the development of aquatic-bed and deep-emergent-marsh habitat types. Assessments of the wetland restorations are made regularly in accordance with the OM&M Plan. The wetland assessments indicate that overall, the efforts to restore these areas have been very successful since the initiation of restoration activities; areas that were previously dominated by a monoculture with little habitat value are now diverse wetlands that support a mix of plant and animal species. While common reed grass (an invasive species) occurs in several locations in uplands around the restored areas, ongoing efforts to control the common reed grass have been successfully performed in accordance with the OM&M Plan. Wildlife usage of the restored wetlands and West Flume is extensive. In sum, it is evident that the restored wetlands are thriving. Monitoring of the restored areas will be continued as part of OM&M, including newly-restored Wetland C.

Site Inspection

A subsite inspection related to this FYR was conducted on July 16, 2014. Those in attendance included Mark Granger from EPA; Rick Mustico and Aimee Clinkhammer from NYSDEC; Alma Lowry representing the Onondaga Nation; Curtis Waterman of the Haudenosaunee Environmental Task Force/Onondaga Nation; Michael Savage and Craig Milburn of Honeywell; John Formoza of CH2M Hill and Mark Arrigo of Parsons.

Interviews

No interviews were conducted for this review.

Institutional Controls Verification

The ROD called for institutional controls (*i.e.*, deed restrictions) to prohibit the use of groundwater at the LCP subsite and to prohibit the disturbance of the final low-permeability cap and slurry wall. It is anticipated that deed restrictions or restrictive covenants to prohibit the use of groundwater and to prohibit the disturbance of the final low-permeability cap and slurry wall will be placed on the property once the cap is constructed.

TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

The September 2000 ROD called for the excavation of sediment exceeding upstream mercury concentrations, backfilling of the excavated areas with clean fill and re-vegetating, sewer system closure, mercury removal from soil on the former plant property, construction of an underground cut-off wall and low-permeability engineered soil cover over the soil/sediment containment area, installation of an on-site groundwater collection system and a long-term monitoring of groundwater, surface water, sediment and biota to ensure the effectiveness of the selected remedy. The ROD also calls for the implementation of institutional controls to prohibit the use of groundwater at the LCP subsite and to prohibit the disturbance of the subsite cap and slurry wall.

These measures were necessary to achieve the RAOs, to the extent practicable, of eliminating contaminant migration from the LCP subsite to the Onondaga Lake environs and environmental media; restoring groundwater quality to state and federal drinking water standards; mitigating the migration of contaminated waters through LCP subsite sewers; eliminating the direct contact threat associated with contaminated soil, surface water and groundwater and reducing the level of contaminants in surface water and sediments to attain surface water ARARs and sediment remedial goals to be protective of fish, wildlife and the resources upon which they depend.

Most of the components of the remedy that have been implemented are functioning as intended by the decision documents. Over the past five years, groundwater sampled from outside the soil/sediment containment area show low levels of mercury substantially below the NYSDEC groundwater standard (0.7 µg/L) in 11 of the 12 piezometers. For the twelfth piezometer (PZ-2B-S), where mercury concentrations in groundwater are highest and averaged 2.8 µg/L, concentrations decreased over the last five years. Concentrations of dissolved mercury in surface water reported for the same period were well below concentrations reported in the RI for the wetland areas and in the West Flume and remain well below the acute and chronic aquatic standards (of 1,400 ng/L and 770 ng/L respectively). On average, mercury concentrations for the West Flume were below the NYSDEC Ambient Water Quality Standard for mercury of 2.6 ng/L. Although mercury concentrations were higher for Wetlands A and B (on average 9.11 ng/L and 3.53 ng/L, respectively), the concentrations are likely attributed to mercury-contaminated sediments in the East Ditch, West Ditch, Wetland A and Dredge Spoils areas. For this reason, contaminated sediment was removed in these areas in 2012. Mercury concentrations in surface water in wetland areas are expected to decrease in upcoming sampling events; 2013 concentrations of total dissolved mercury in the West Flume and Wetland A meet the wildlife protection value of 2.6 ng/l. All surface water values are below the acute and chronic surface water values. The five year trends for total mercury in sediment indicate that with the exception of one sample collected from the West Flume and one sample collected from Wetland A total mercury concentrations are below the severe effect level of 2.0 mg/kg and generally in the range of the lowest effect level (LEL) of 0.20 mg/kg. Wetland A has the highest concentration of total mercury in sediment.

While there are no remedial goals for tissue, concentrations are expected to decrease with the removal of contaminated soil and sediment completed in 2012. Mercury concentrations in prey

fish and crayfish have remained generally consistent since 2009 and are considerably lower than concentrations measured in the 1995 RI. Mercury concentrations in earthworms have stabilized and mercury concentrations in mice have been and continue to be low or below the level of detection. All biota values were below 1 mg/kg for the 2009 to 2013 time frame. The wetlands restoration is successful and provides a diverse habitat for a thriving community of plant and animal species.

Hydraulic monitoring over the past five years indicates that an inward hydraulic gradient for the barrier wall is not being consistently maintained. This is likely due to an increase in water infiltration caused by the interim soil cap. Once the final impermeable cap is constructed, pump rates will be evaluated and adjusted, as necessary, to achieve hydraulic control in the containment area.

The construction of the final low-permeability cover needs to be completed, and deed restrictions need to be placed on the property. It is expected that once construction of the final low-permeability cap is completed over the soil/sediment containment area and slurry wall, the remaining portions of the remedy will function as intended by the decision documents as well.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?

There are no changes in the physical conditions of the LCP subsite or land uses that would affect the protectiveness of the selected remedy. Contaminated soils and sediments identified during the RI, as well as those identified as part of OM&M monitoring in 2008, 2009 and 2010, have either been excavated and treated or have been consolidated in the on-site landfill that will be capped in 2015 and is surrounded by a fence which restricts access. Groundwater, which is designated by New York State as potable, is being controlled by a pump-and-treat system in the soil/sediment containment area and no potable wells are impacted by LCP subsite-related contamination.

The exposure assumptions and toxicity values that were used to estimate the potential risk and hazards to human health and ecological receptors from exposure to LCP subsite contaminants followed the general practice at the time that the risk assessment was performed. Although specific parameters and toxicity values may have changed, the risk assessment process that was used is still consistent with current practices and the need for a remedial action remains valid.

For groundwater, the remedy identified in the ROD includes containment of groundwater at the subsite in both the shallow and the deep aquifers and institutional controls in the form of deed restrictions to prohibit the use of groundwater. Shallow soils associated with unacceptable risks were excavated, treated and relocated to the on-site landfill that will be capped in 2015. The most significant risk driver in the shallow soils was mercury and the cleanup goal established in the ROD was 0.15 mg/kg, which is based on ecological effects. Surface soils contaminated with PCBs above 1 mg/kg were excavated and disposed of off-site. Subsurface soils contaminated with PCBs above 10 mg/kg were excavated and disposed of off-site. These levels remain protective of human health, based on the commercial/industrial exposures that are expected to occur at this subsite.

The RAOs and goals established at the time of the ROD are still valid for ecological receptors. The excavation of contaminated soils and sediments has removed contaminant pathways to ecological receptors, which is supported by on-going sediment, surface- water and tissue monitoring. Surface-water data indicate that mercury concentrations in surface water have declined over time and are expected to decline further following the 2012 removal of additionally-identified contaminated sediments (see **Figure 5**). The acute and chronic surface-water values identified (1400 ng/l and 770 ng/l, respectively) are still valid. The sediment clean-up value of 0.2 mg/kg reflects the LEL and the July 2014 NYSDEC sediment guidance which identifies 0.2 mg/kg as a concentration where sediments are considered to be of low risk to aquatic life. Sediment data show (**Figure 7**) that sediments in Wetland B meet the ROD goal of 0.2 mg/kg. However, sediment mercury concentrations in the West Flume and Wetland A remain above 0.2 mg/kg, with five year average concentrations of 0.6 mg/kg for the West Flume and 1.19 mg/kg in Wetland A. In the West Flume there has been a decrease in mercury concentrations in three out of the four sample locations following the 2012 sediment excavation. Conversely, there appears to be an increase in sediment mercury concentrations following the 2012 removal in Wetland A. Monitoring will continue to measure sediment mercury concentrations to ensure that there is a downward trend over time. Current monitoring indicates that tissue mercury concentrations in the aquatic community are considerably lower than measurements conducted during the RI and have remained consistent since 2009. It is expected that concentrations will decrease over time to reflect the additional removal of sediments in 2012. In the terrestrial community, benthic tissue have stabilized and mammalian tissue continues to be at or below detection levels.

The potential for vapor intrusion was evaluated during the 2009 FYR. During that evaluation, groundwater concentrations were compared to health-based screening criteria provided in the *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*. This guidance provides concentrations of chemicals in groundwater associated with indoor air concentrations at acceptable levels of cancer risk and non-cancer hazard using residential exposure assumptions. At the time, no occupied buildings were above the contaminated groundwater and the FYR recommended that future FYRs should continue to evaluate this pathway if the buildings become occupied or if new buildings are constructed over the contaminated groundwater. As of this second FYR, no buildings have become occupied over the contaminated groundwater, no new buildings have been constructed over the contaminated groundwater and there are no plans in either case prior to the next FYR.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no new information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

Based upon the results of the FYR, it has been concluded that:

- Elemental mercury was not observed in the monitoring wells inside the cut-off wall during the sampling events and the total mercury concentrations present in the wells have not indicated an upward trend;
- Piezometer readings show that an inward gradient is not being maintained across the barrier wall. It is anticipated that this gradient will be achieved after construction of the final, impermeable cap that is currently being implemented.
- There have been a large number of non-detect results for total mercury in the piezometers outside the cut-off wall. While a trend is not observable in the data, it does not appear that mercury concentrations are increasing;
- Surface water and sediment mercury concentrations for the West Flume, Wetland A and Wetland B remain substantially lower than concentrations from the RI; and
- Wetlands monitoring continues to show that the restoration efforts have been successful. The planted vegetation is thriving and wildlife usage of the wetlands is extensive.

ISSUES, RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 3 summarizes several recommendations and follow-up action stemming from this five-year review.

PROTECTIVENESS STATEMENT

The implemented remedy is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled.

NEXT REVIEW

The next FYR report for the LCP Bridge Street subsite is required five years from the completion date of this review.

Table 1: Chronology of Subsite Events

DATE	ACTIVITY
1800s-1908	LCP property developed for production of salt from naturally occurring brine springs in the area.
1919-1940	LCP subsite developed by the Atmospheric Nitrogen Company to produce ammonia.
1950s	Ammonia production ceases and the facility demolished.
1953	Allied Chemical Corporation constructs a chlor-alkali facility to manufacture sodium hydroxide and chlorine gas using a mercury-cell process. Hydrogen peroxide is manufactured from byproducts.
1968	Diaphragm cell process added.
1972, 1975	Two lined surface impoundments constructed southwest of the Mercury Cell and Diaphragm Cell Buildings.
1979	Facility purchased by Linden Chemicals and Plastics (LCP).
1980	LCP installs a hydrochloric acid production process.
1981	LCP installs a sodium hypochlorite (bleach) production process.
1981	LCP files a Resource Conservation and Recovery Act Part A Permit Application with NYSDEC and obtains interim status as a hazardous waste storage facility.
1984	The two lined surface impoundments are taken out of service.
1988	Manufacturing operations cease.
1990s	The facility is leased as a product transfer station for the distribution of caustic soda and acids.
1995	NYSDEC and Honeywell enter into a Stipulation and Order to conduct an RI/FS.
1997	Honeywell (as Allied Signal) completes the RI.
1999	Honeywell (as Allied Signal) completes the FS.
2000	<i>Record of Decision</i> issued by NYSDEC.
2002	Order on Consent for design and construction of selected remedy executed.
2003	<i>Preliminary (50%) Design Report</i> submitted to NYSDEC.
2004	NYSDEC approval of <i>Final (100%) Design Report</i> .
2005	<i>Remedial Action Work Plan</i> approved by NYSDEC; biota monitoring, sewer closure, cut-off wall, Wetland A excavation and North Ditch excavation and backfill completed.
2006	Brine-mud excavation and backfill, pumping-wells installation, piezometer installation, West Flume excavation and backfill and extraction building completed.
2007	Low-permeability cap, Wetland B excavation and backfill and subsite restoration completed.
2008	Demobilization.
2008	Begin OM&M (including groundwater, wetland, surface water, sediment and biota monitoring).
2009	<i>Final Operation, Maintenance and Monitoring Plan</i> and <i>Remedial Action Report</i> .
2009	First EPA Five-Year Review.
2010-2012	Supplemental soil and sediment excavation.
2012	<i>Final Remedial Action Report Addendum</i> .
2014	<i>Final 100% Design Report, Final Cover Construction</i> .

Table 2: Documents, Data and Information Reviewed in Completing the Five-Year Review

Document Title, Author	Submittal or Signed Date
<i>Record of Decision, Site Number 7-34-049 LCP Bridge Street Subsite, Subsite to the Onondaga Lake NPL Site, New York State Department of Environmental Conservation</i>	September 2000
<i>Final (100%) Design Report for the LCP Bridge Street Site (OU-1), Parsons</i>	September 2004
<i>Operation, Maintenance and Monitoring Plan for the LCP Bridge Street Site, Parsons</i>	January 2009
Monthly OM&M Reports	September 2009 thru August 2014
<i>First Five-year Review Report, EPA</i>	October 2009
<i>Remedial Action Report, Parsons</i>	November 2009
<i>2009 Annual Operation, Maintenance and Monitoring Report, Parsons</i>	March 2010
<i>Remedial Action Report Addendum for the Supplemental Excavation of Soil and Sediment, EPA</i>	November 2012
<i>2010 Annual Operation, Maintenance and Monitoring Report, Parsons</i>	January 2013
<i>2011 Annual Operation, Maintenance and Monitoring Report, Parsons</i>	February 2013
<i>2012 Annual Operation, Maintenance and Monitoring Report, Parsons</i>	November 2013
<i>2013 Draft Annual Operation, Maintenance and Monitoring Report, Parsons</i>	March 2014
<i>100% Design Report, Final Cover Construction, Parsons</i>	March 2014
<i>2008-2013 Draft Operation, Maintenance and Monitoring Report, Parsons</i>	July 2014
EPA guidance for conducting five-year reviews and other guidance and regulations to determine if any new Applicable or Relevant and Appropriate Requirements relating to the protectiveness of the remedy have been developed since EPA issued the ROD.	

Table 3: Recommendations and Follow-Up Actions				
OU(s): 05	Issue Category: Remedy Performance			
	Issue: The LCP Bridge Street subsite extraction wells may not be providing a complete inward gradient of the contaminated groundwater within the slurry wall.			
	Recommendation: Three years after the completion of the construction of an impermeable cap over the containment area/slurry wall, the effectiveness of the groundwater extraction system in sustaining an inward gradient should be determined.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	State	6/30/2018
OU(s): 05	Issue Category: Institutional Controls			
	Issue: The placement of institutional controls, required as part of the ROD, is awaiting remedy completion to be finalized.			
	Recommendation: Finalized placement of institutional controls within one year of remedy completion.			
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	PRP	State	6/30/2016



P:\H-WELL-SYR\448308\10.0\CAD\FIGURES\SLM\LCP SITE PLAN.PPTX

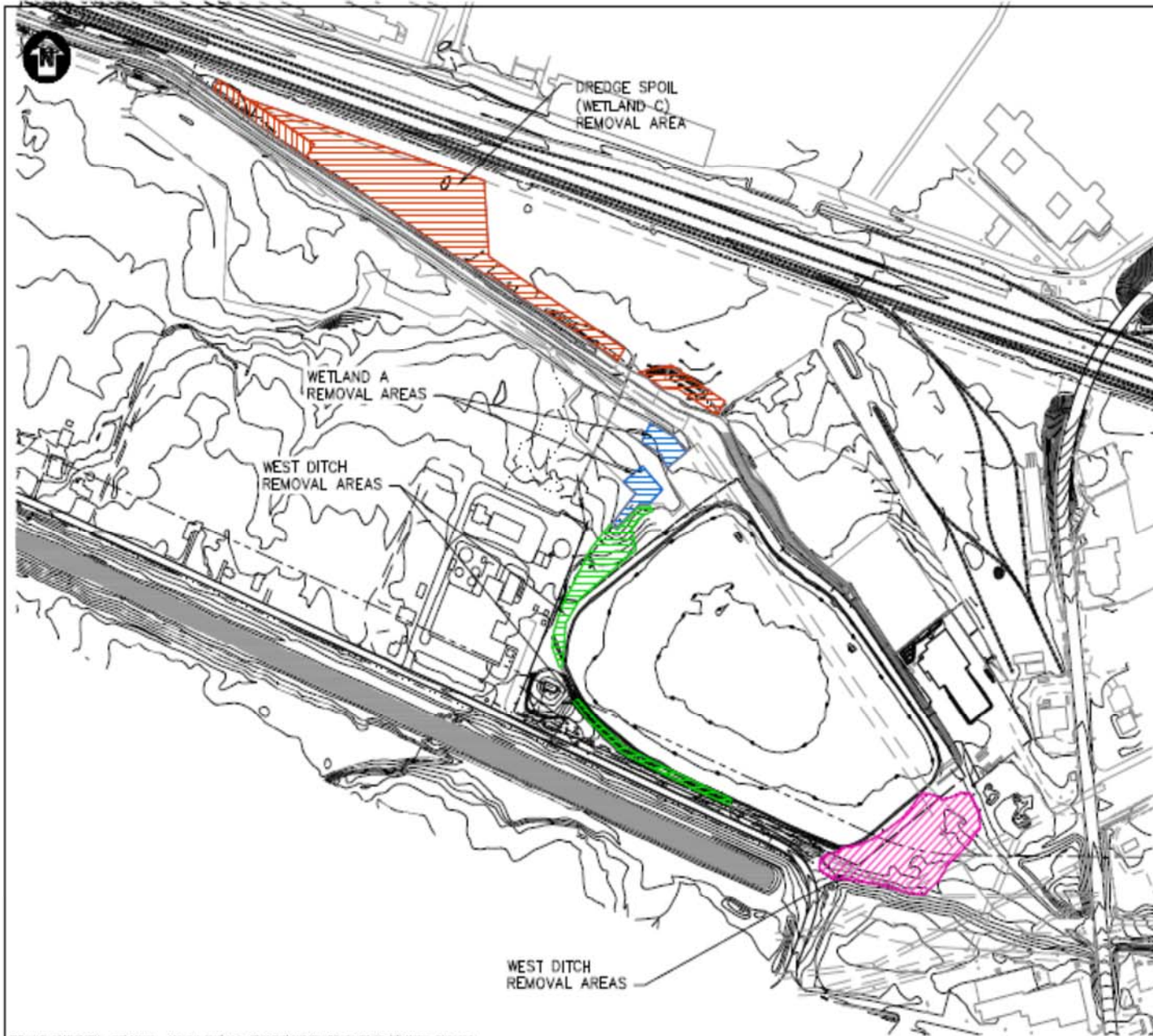
FIGURE 1

Honeywell LCP BRIDGE STREET SITE
SYRACUSE, NY

LCP SITE PLAN

PARSONS

30 PLUMBLINE ROAD 10TH FLOOR SYRACUSE, NY 13210 PHONE (315) 451-8900

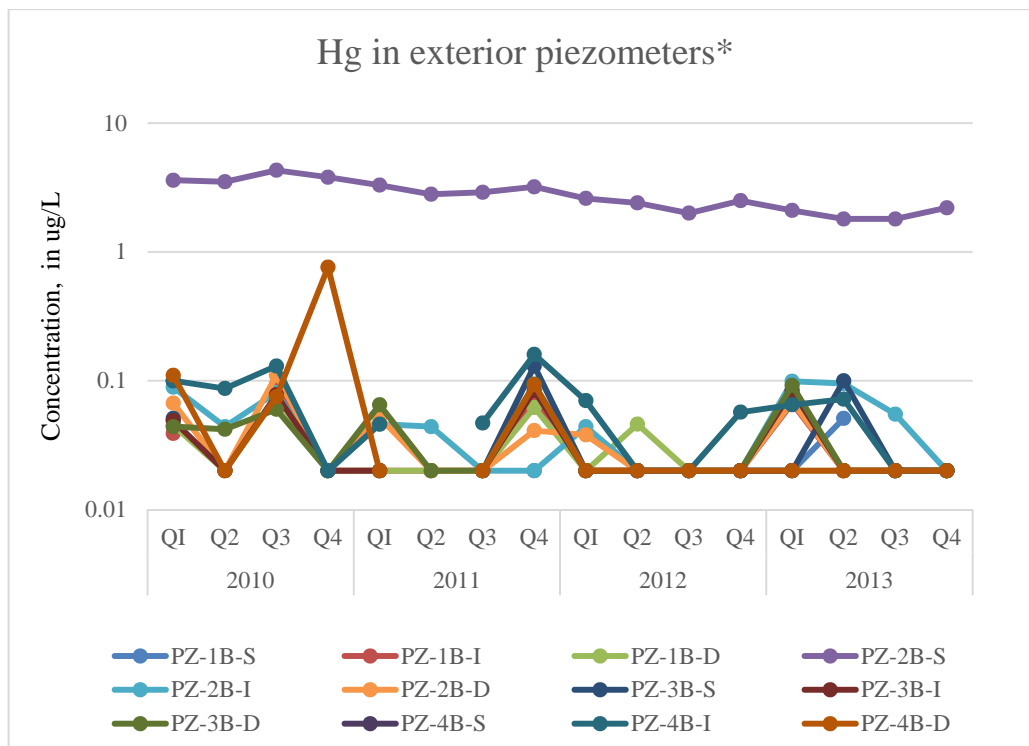
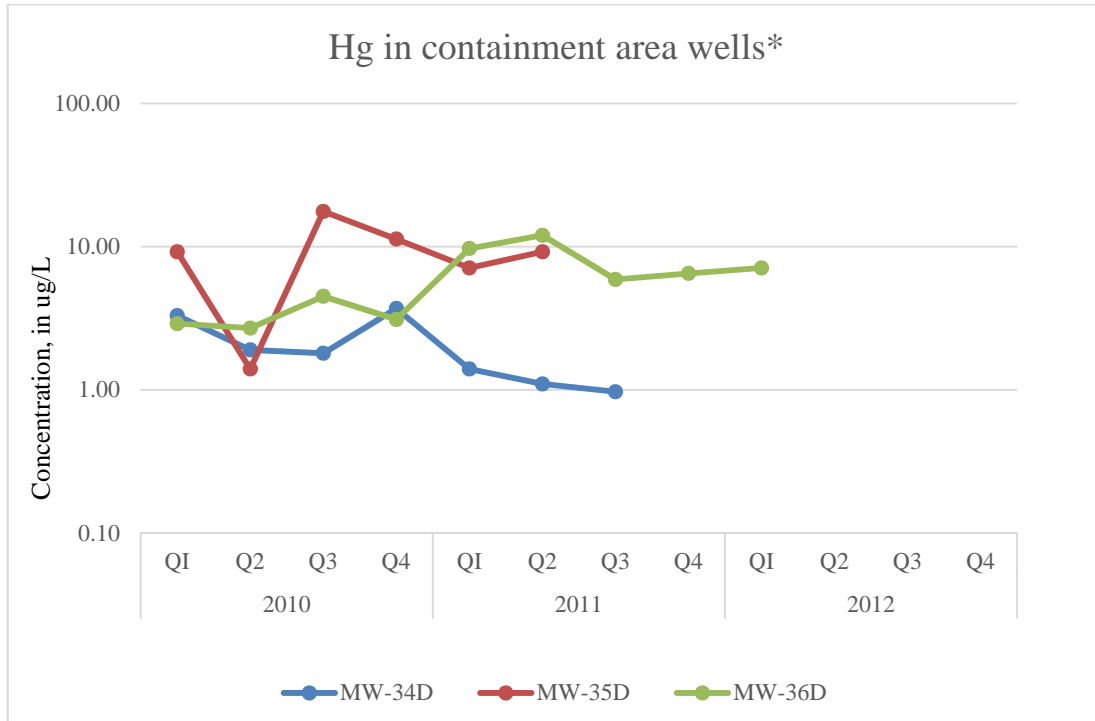


SCALE: 1"=300'

PRELIMINARY DRAFT
SETTLEMENT CONFIDENTIAL
NOT INTENDED FOR PUBLIC REVIEW

FIGURE 2
Honeywell FORMER LINDEN CHEMICAL PLANT
 SOLWAY, NEW YORK
 ADDITIONAL SOIL/SEDIMENT
 REMOVALS

Figure 3: Groundwater Sampling Results -- Dissolved Mercury



* Note: The NYSDEC MCL for Hg is 0.7 µg/L.

Change to Fig 4

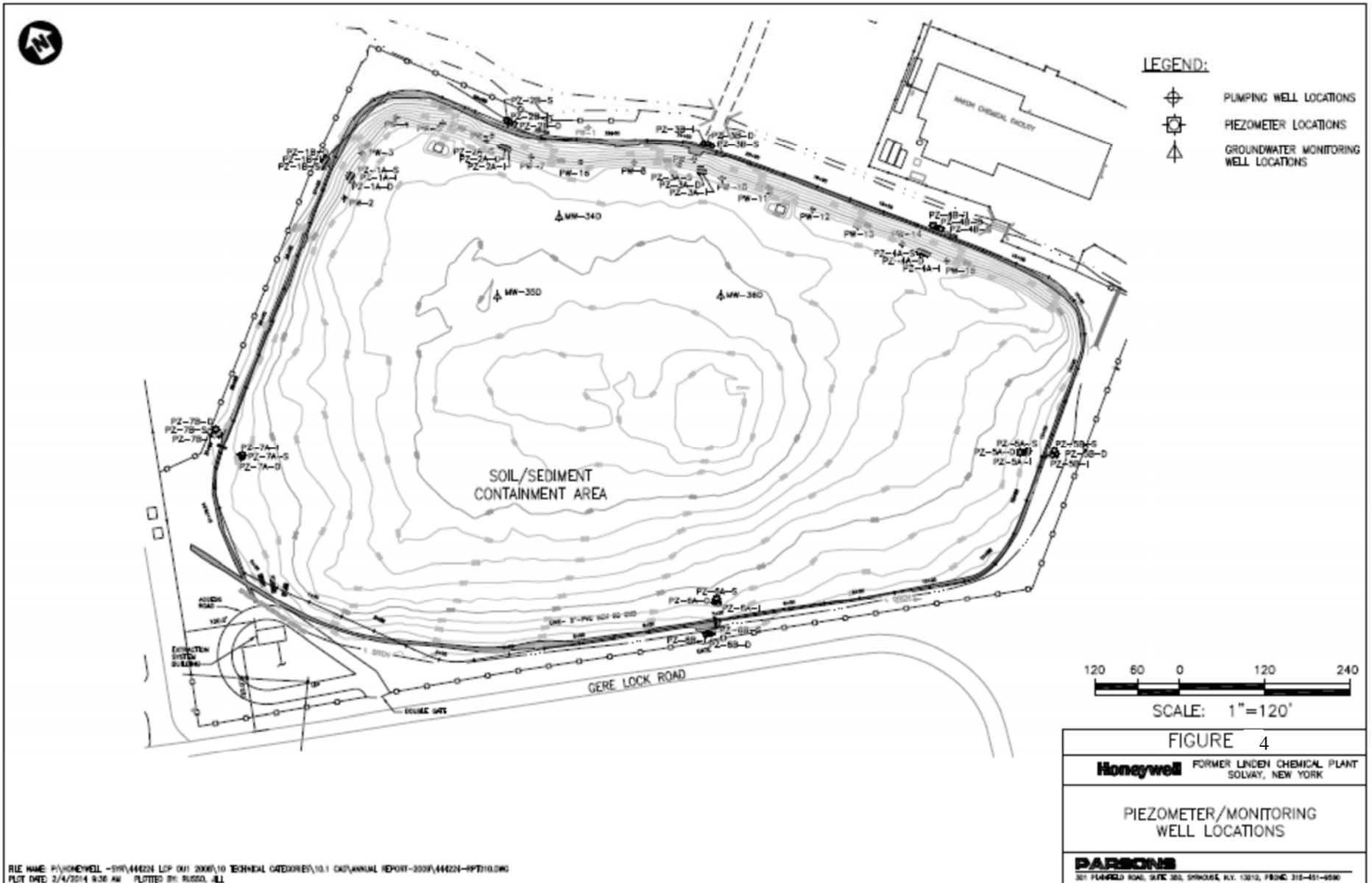
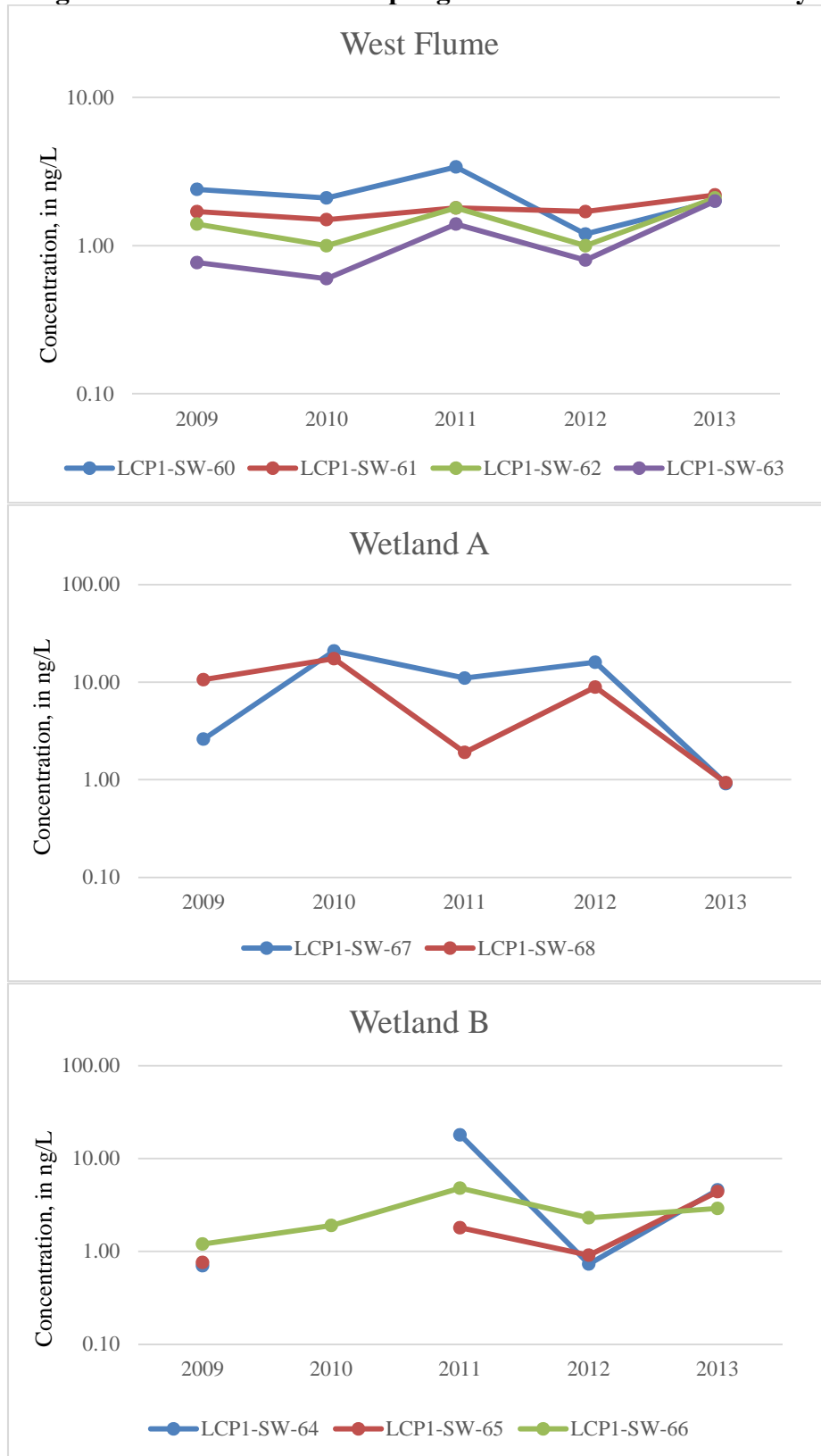


Figure 5: Surface Water Sampling Results -- Dissolved Mercury



* Note: The NYSDEC Surface Water Cleanup Goal for Hg is 2.60 ng/L.

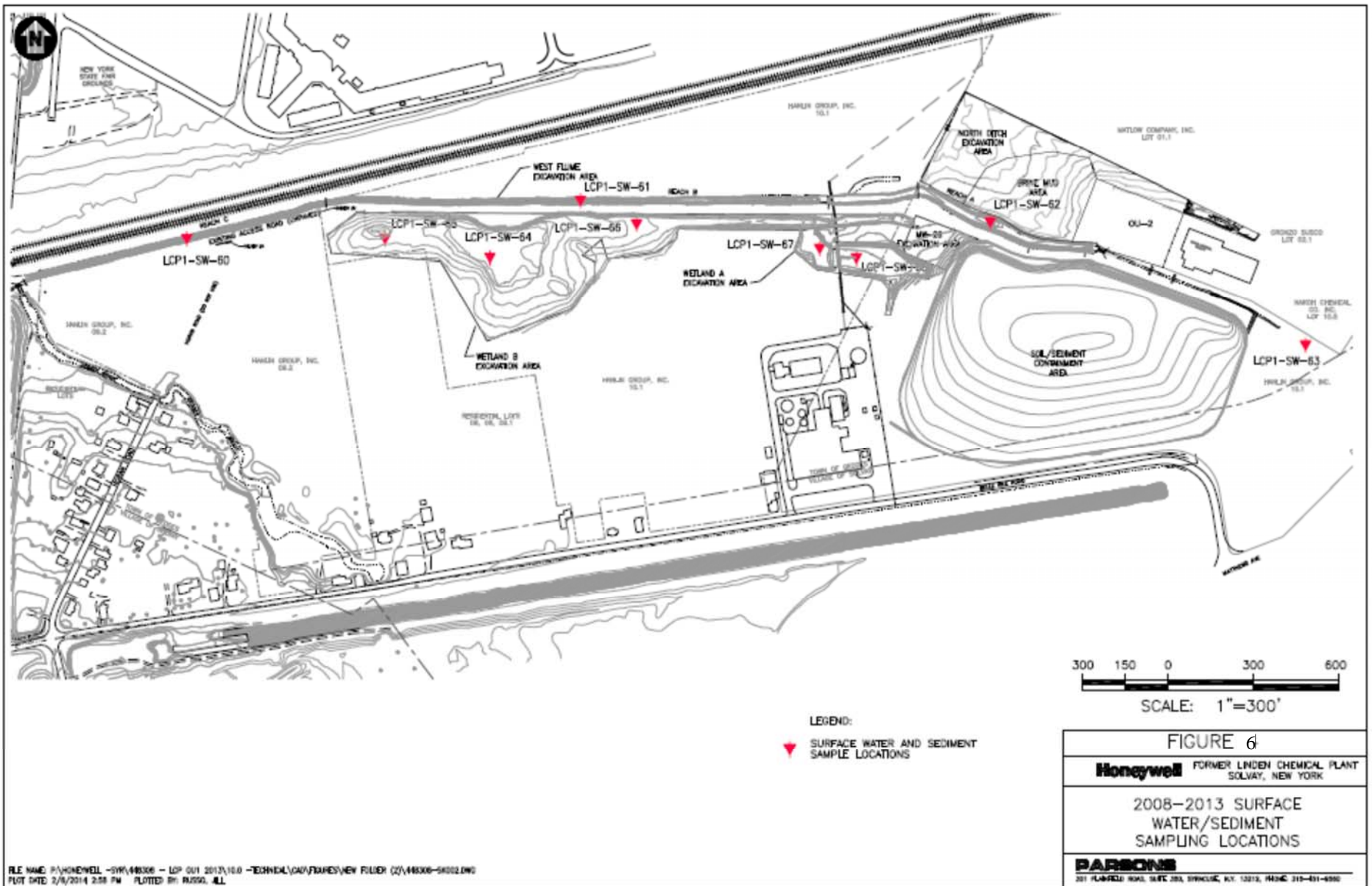
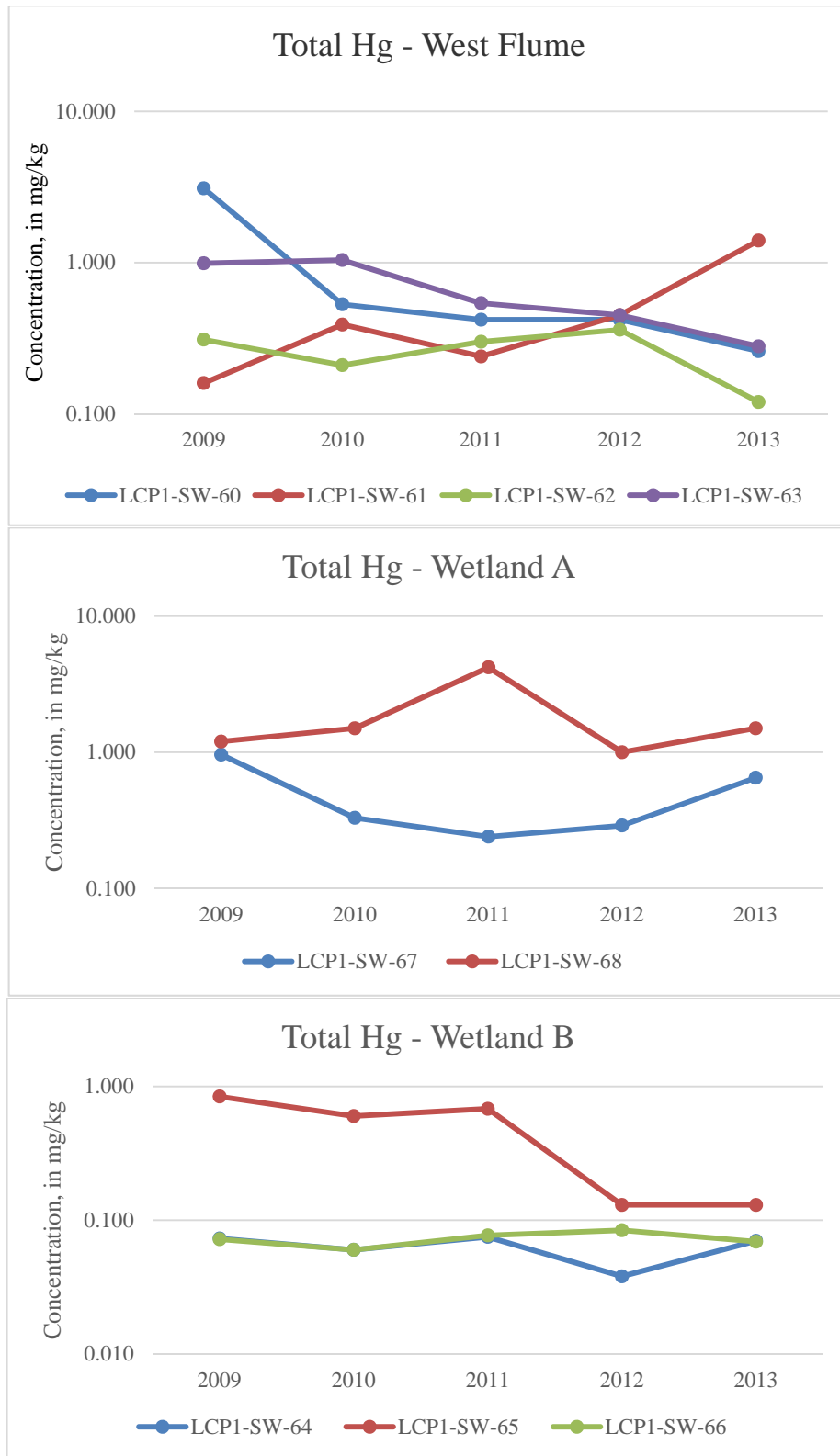


Figure 7: Sediment Sampling Results -- Total Mercury



* Note: The NYSDEC Lower Effect Level (LEL) Sediment Cleanup Goal for Hg is 0.200 mg/kg.