Honeywell

Wastebed B / Harbor Brook Outboard Area

Engineering Evaluation/Cost Analysis (EE/CA)

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Acronyms

AOS	area of study
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPOI	chemical parameter of interest
CSO	combined sewer overflow
CY	cubic yard
DNAPL	dense non-aqueous phase liquid
DSA	dredge spoils area
EE/CA	engineering evaluation/cost analysis
FS	feasibility study
GHG	greenhouse gases
GRA	general response actions
ILWD	in-lake waste deposit
IRM	interim remedial measure
LEF	Lower East Flume
NAPL	non-aqueous phase liquid
NCP	National Contingency Plan
NRC	National Research Council
NYSCC	New York State Conservation Council
NYSDEC	New York State Department of Environmental Conservation
OM&M	operations, maintenance & monitoring
PCB	polychlorinated biphenyls
PEC	probable effect concentrations
PECQ	probable effect concentrations quotient
PRAD	Proposed response action document
PSA	preliminary site assessment
RAD	Remedial Action Document

Acronyms (continued)

RAO	Response Action or Remedial Action Objective
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	record of decision
SCA	Sediment Consolidation Area
SMU	sediment management unit
SPDES	State Pollutant Discharge Elimination System
SRE	streamlined risk evaluation
SVOC	semivolatile organic compound
TBC	to-be-considered
UEF	Upper East Flume
USEPA	United States Environmental Protection Agency
USSCS	United States Soil Conservation Service
VOC	volatile organic compound
WBB/HB	Wastebed B/Harbor Brook
WL	wetland

Executive Summary

The Outboard Area is a 16-acre strip of land that lies between the Wastebed B/Harbor Brook Interim Remedial Measure (IRM) barrier wall and Onondaga Lake including the mouth of Harbor Brook and areas of wetlands along the lake shoreline. The Outboard Area is part of the Wastebed B/Harbor Brook (WBB/HB) site, which is considered a subsite of the Onondaga Lake Superfund site.

This engineering evaluation/cost analysis (EE/CA) was developed as part of the Superfund process. A streamlined risk evaluation was performed and it was determined that a response action is warranted, but that decisions regarding the actual remedy of the site are not time critical. This EE/CA is an agency requirement for “non-time-critical” removal actions.

This EE/CA presents the evaluation of response action alternatives for addressing contamination within the Outboard Area. The remediation of the Outboard Area would occur at or about the same time as the remediation of the adjacent Onondaga Lake area because of the similarities in the source and nature of contaminants and potential remedies, the connectivity between the Outboard Area and the adjacent lake sediments, and the critical relationship between the two areas under the Onondaga Lake Habitat Plan. In order to maintain the overall schedule for remediation of Onondaga Lake, Honeywell has proposed to address remediation of the Outboard Area as an IRM.

A team of engineers and scientists evaluated four response actions for evaluation in this EE/CA.

- Response Action 1 - No Action (used only as a baseline for comparison of alternatives)
- Response Action 2 - Removal for Cap Placement and Habitat Restoration
- Response Action 3 - Removal for Cap Placement, Hot Spot Excavation, and Habitat Restoration
- Response Action 4 - Removal to Maximum Excavation Limits, Cap Placement, and Habitat Restoration

The response actions were independently evaluated for effectiveness, implementability, and cost. Then a comparative analysis of the response actions was presented to evaluate the relative performance of each alternative in relation to the criteria.

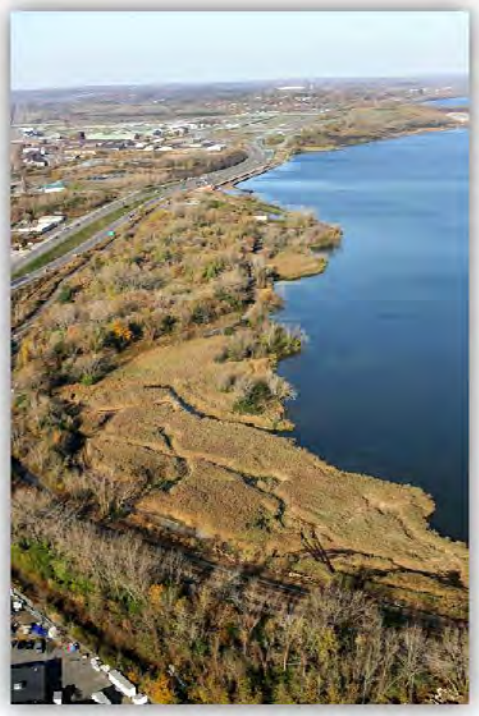
Based on the engineering evaluation and cost analysis, Response Action 3 (Removal for Cap Placement, Hot Spot Excavation, and Habitat Restoration) was recommended to address contaminated material within the Outboard Area. This alternative includes the following components:

- Removal of sediment and soil
- Placement of an isolation cap
- Habitat restoration
- Implementation of institutional controls
- Implementation of a long-term operation, maintenance, and monitoring (OM&M) program

The recommended response action provides protection for human health and the environment and promotes the restoration of high-quality wetland and aquatic habitats. Compared to the other alternatives evaluated, the recommended response action would also remove additional material from the Outboard Area with concentrations exceeding hot spot criteria with minimal increase in the duration and potential short-term impacts associated with construction activities such as vehicle emissions and truck traffic.

New York State Department of Environmental Conservation (NYSDEC) and United States Environmental Protection Agency (USEPA) will identify which action they will propose as a recommended response action in the proposed response action document (PRAD) and following the receipt of public comment on the PRAD, NYSDEC, and EPA will select a response action in a decision document. The response action recommended and selected by NYSDEC and EPA may be different than recommended in this EE/CA.

Options for the management of removed soils and sediments from the Outboard Area were also evaluated in this EE/CA. The soil and sediment approach used in the response action alternatives evaluation included on-site placement of a portion of the dry soil/sediment inboard of the IRM barrier wall and transport and long-term management of the remaining soil/sediment at the Sediment Consolidation Area (SCA) in conjunction with lake dredging operations. Placement of the Outboard dredge materials at the SCA involves contained transport of materials by way of a pipeline and thus no off-site truck transport of soil and sediment.



1.0 Introduction

This report presents the EE/CA for the Outboard Area at the WBB/HB site in Geddes and Syracuse, New York. The Outboard Area consists of a 16-acre strip of land lying between the barrier wall being installed as part of the WBB/HB IRM and the Onondaga Lake shoreline (Figure 1).

Section 300.415(b)(4)(i) of the National Contingency Plan (NCP) requires that an EE/CA or its equivalent be performed for all non-time-critical removal actions. Non-time-critical removal actions are conducted at Superfund sites when the lead agency determines, based on the site evaluation, that a removal action is appropriate, and a planning period of at least six months is available before on-site activities must begin.

The EE/CA is intended to (1) satisfy environmental review requirements for removal actions (2) satisfy administrative record requirements for documentation of removal action selection, and (3) provide a framework for evaluating and selecting alternative technologies. In doing so, the EE/CA identifies the objectives of the removal action and analyzes the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives.

1.1 Purpose of the Outboard Area EE/CA

This EE/CA evaluates alternatives for remediating the Outboard Area including the permanent relocation and restoration of Lower Harbor Brook.

The remediation of the Outboard Area would occur at or about the same time as the remediation of the adjacent Onondaga Lake area because of the similarities in the source and nature of contaminants, potential remedies, and the connectivity between the Outboard Area and the adjacent lake sediments. In order to maintain the overall schedule for remediation of Onondaga Lake, Honeywell has proposed to address remediation of the Outboard Area as an IRM.

1.2 Integration with Other Remedies and Schedule

In 2003, Honeywell International, Inc. and the New York State Department of Environmental Conservation (NYSDEC) entered into an Order on Consent (Index #D7-0008-01-09) to conduct an IRM for WBB/HB. As shown on Figure 2, the current WBB/HB IRM scope

included a vertical barrier along the Onondaga Lake shoreline perimeter of Wastebed B and upstream along the west bank of Harbor Brook (located just downgradient and downstream of the non-aqueous phase liquid [NAPL] found in the wetland area west of lower Harbor Brook and within the sediments of lower Harbor Brook) with a groundwater collection system. After the consent order was signed, investigations performed as part of the WBB/HB Remedial Investigation (RI) detected subsurface NAPL to the east of Harbor Brook as well. As a result, the routing of the barrier wall to the east of Harbor Brook was evaluated to encompass the horizontal limits of NAPL encountered during the RI. To achieve the WBB/HB IRM objective of limiting the discharge of contaminated groundwater to Onondaga Lake, hydraulic control of groundwater and NAPL discharge into Upper Harbor Brook was evaluated and incorporated into the WBB/HB IRM.

A separate EE/CA (the “Harbor Brook EE/CA”) evaluates the eastern portion of the proposed barrier wall (O’Brien & Gere, 2010). That EE/CA also evaluates the temporary relocation of Lower Harbor Brook to facilitate a barrier wall alignment which encompasses the NAPL detected east of the existing Lower Harbor Brook. A remedial action document (RAD) for the East Wall IRM was issued in May 2011 by the NYSDEC and EPA.

The WBB/HB IRM design for the portion of the barrier wall and groundwater collection system located to the west of Harbor Brook (“West Wall”) has been completed (Parsons, 2009a) (Figure 2). Construction work associated with the West Wall portion of the IRM began in December 2009 and is projected to be completed in 2011. The remainder of the barrier wall, extending from the eastern terminus of the West Wall, is referred to as the “East Wall” and is scheduled for construction in 2011.

As part of the designs for the East and West barrier walls, comprehensive geotechnical analyses were conducted to determine if and what kind of impacts future excavation activities within the Outboard Area might have on the stability of the walls and nearby structures. Based on the results of the geotechnical analyses, limitations on the size and depth of Outboard Area excavations have been established to maintain the stability of the walls and the nearby structures. Outboard Area excavation limitations are summarized in Appendix A and have been considered during the development of the potential response actions evaluated in this EE/CA.

1.3 Site Description and Background

1.3.1 Site Description

The Outboard Area lies between the barrier wall and the Onondaga Lake shoreline and includes portions of the areas described below (Figure 2).

East Flume

The former Upper East Flume was a water conveyance system located along the southern shoreline of Onondaga Lake. The Upper East Flume was backfilled during West Wall construction activities.

The East Flume was located at the northeast end of the Outboard Area and consisted of a manmade stormwater drainage channel and pond (Figure 3). It was approximately 1,100-ft. long including the pond, which has a top width of approximately 200 ft. and a maximum depth of approximately 9 ft. The East Flume was originally an excavated drainage ditch that primarily carried a combined waste stream from the Main and Willis Avenue Plants to Onondaga Lake. Under prior conditions, stormwater from upstream areas was directed to the pond, called the Upper East Flume (UEF), and overflowed a spillway to a narrow stream channel, called the Lower East Flume (LEF), which then discharged to Onondaga Lake.

Until recently, there were two pipes conveying discharge to the UEF (60-inch and 72-inch in diameter). The 60-inch discharge pipe has been abandoned and all flow is now conveyed through the 72-inch pipe which discharges through the existing Willis Barrier Wall directly to Onondaga Lake under a State Pollutant Discharge Elimination System (SPDES) discharge permit. O'Brien & Gere completed this work as part of the East Flume IRM.

A portion of the West Wall has been installed within the UEF as shown on Figure 3. The UEF has been filled and portions of the spillway have been demolished to install the work platform, barrier wall, and collection trench. A section of an abandoned 60-inch diameter steel pipe that runs from the pump station through the spillway at the southern end was also removed before the wall was installed. Flow to the LEF now consists of only surface runoff that discharges to the channel along its length. The area of the East Flume that is on the lake side of the West Wall is considered part of the Outboard Area.

Harbor Brook begins at a spring south of Onondaga Hill and meanders until it discharges into Onondaga Lake on the southwest shoreline. Near the shoreline the tributary is surrounded by Phragmites.

Lower Harbor Brook

Harbor Brook originates southeast of Syracuse, New York, in the Town of Onondaga and flows through western Syracuse, discharging to the southwest corner of Onondaga Lake. The main stem length is 7.5 miles, and 18 combined sewer overflows (CSO) discharge to its lower reaches (Blasland & Bouck, 1989). The lower portion of Harbor Brook, considered part of the WBB/HB site, is classified as a Class C[1] stream

[1] Classification C is for waters supporting fisheries and suitable for non-contact activities. The best use of Class C waters is fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and

by NYSDEC, and is routed through the City of Syracuse with most of the brook flowing through underground culverts. Harbor Brook contributes approximately 2 percent of the annual flow to Onondaga Lake (Blasland & Bouck, 2001).

DSA #2

Dredge Spoils Area (DSA) #2 is located to the east of the Upper East Flume and south of the Lower East Flume (Figure 3). The area is approximately 350 ft. by 350 ft, and bermed to the north and east. This area received sediments from the lake which were removed during the installation of a thermal diffuser pipe in 1977. The spoils in this area are approximately 3 to 5 ft. thick and are underlain by Solvay waste. The portion of DSA #2 that will be on the lake side of the West Wall is considered part of the Outboard Area.

AOS-1

Area of Study (AOS) #1 is a wetland area situated east of Harbor Brook and adjacent to the Lakeshore Area (Figure 3). Based on a review of historical aerial photographs, this area is a floodplain created by deposition of Onondaga Lake and Harbor Brook sediments during the 1950s and 1960s. There is also evidence that non-Solvay waste fill was likely placed during this time.

Delineated Wetland Areas

Harbor Brook and Surrounding Wetland

The Outboard Area also includes wetland SYW-19, which is located along Wastebed B on the southwest lakeshore at the mouth of Harbor Brook, and is a Class I (NYSDEC Freshwater Wetlands Classification System) freshwater palustrine wetland. A jurisdictional wetland delineation of the SYW-19 area was conducted in the summers of 2000 and 2003 as part of the Harbor Brook Site Remedial Investigation/Feasibility Study. Wetland delineation findings are reported in Jurisdictional Wetland Delineation Report, Harbor Brook Site (O'Brien & Gere, 2003) and summarized below.

The SYW-19 area consists of four wetland areas (WL1, WL2, WL3, and WL4) located along the Onondaga Lake shoreline (Figure 3). WL1 and WL2 are located near the mouth of Harbor Brook, and WL3 and WL4 are located near the mouth of the Lower East Flume. These wetlands are degraded by the presence of both waste material and the invasive *Phragmites* and offer limited habitat opportunities.

Soils mapped for these wetlands consist predominantly of bed areas of Solvay waste that may be covered with vegetation (USSCS, 1977). The drainage characteristics of these soils range from somewhat poorly drained to poorly drained on the wastebed areas located near lake level (USSCS, 1977). The soils observed in WL2 through WL4 during the

survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

wetland delineation effort were predominantly a mixture of weathered Solvay waste material with varying proportions of brown silty loam and organic (decomposed plant matter) material.

1.3.2 Site Background

A preliminary site assessment (PSA) was performed in the summer of 2000 and winter of 2001 in accordance with the requirements of the Consent Order D-7-0001-00-02 between the NYSDEC and Honeywell dated April 10, 2000 (NYSDEC, 2000). The PSA field work was performed according to the NYSDEC-approved PSA Work Plan (O'Brien & Gere, 2000), and a summary of the analytical data collected was submitted to the NYSDEC in September 2001 (O'Brien & Gere, 2001). Based on review of the data, and in consideration of other previous study data, the NYSDEC determined that a remedial investigation/feasibility study (RI/FS) should be implemented at the site.

The RI was performed according to the NYSDEC-approved RI/FS Work Plan (O'Brien & Gere, 2002). The initial RI field program was performed November 2002 through May 2004. A supplemental RI was conducted at the request of NYSDEC. This supplemental RI consisted of further investigation on the WBB/HB site as well as wetland SYW-12 situated on the southeast corner of Onondaga Lake. The field work for that investigation was completed in June 2007, but the revised RI report (O'Brien & Gere, 2007) has not yet been approved by the NYSDEC. The feasibility study (FS) is currently underway.

1.4 Site Characterization

1.4.1 Source, Nature, and Extent of Contamination

Review of data collected during the PSA, RI, Supplemental RI, Harbor Brook Sediment IRM (BBL, 2001), Wastebed B/Harbor Brook IRM, I-690 Limited Investigation, and Wastebed B Geotechnical Investigation and previous studies indicate that the following potential Site-related source areas are present within the Wastebed B/Harbor Brook Site. The areas are:

- The former Barrett Paving Facility
- Historic East Flume discharges
- Historic placement of fill materials (AOS#1, Wetland Area #2, and DSAs)
- Solvay waste associated with Wastebed B
- Co-disposal of other wastes with the historic placement of Solvay waste
- Undigested sewage sludge placed on Wastebed B

Other possible sources of Site-related CPOIs at the Wastebed B/Harbor Brook Site include the Willis Avenue Chlorobenzene Site, the Ballfield Site, and anthropogenic sources (i.e., I-690 drainage, past and present railroad operations, general urban run-off, etc.). Wastebed B/Harbor Brook Site-related CPOIs within the East Flume are likely from past operations at the Willis Avenue Facility and groundwater infiltrating into the flume. It is believed that anthropogenic sources are also impacting the East Flume and Harbor Brook, as well as the adjacent areas.

An apparent source of coal tar residues, including dense non-aqueous phase liquid (DNAPL), was identified in the eastern central portion of the Penn-Can Property. The coal tar residues are associated with the historic operations of the former paving facilities that were located on the central and eastern portions of the Penn-Can Property. These residues are likely present due to releases from the former Barrett Paving facility. Residues from this source area migrated into the subsurface and then down slope through coarse lenses of marl and along the top of low-permeability (confining) geologic units (i.e., silt/clay and till) to the Lakeshore Area, downgradient portions of the Railroad Area, Harbor Brook, portions of AOS # 2, and portions of AOS #1. Groundwater has also been impacted in areas associated with the residues. Soils and surface water have been impacted in areas where shallow and intermediate groundwater discharge to surface water bodies (Harbor Brook, I-690 drainage ditch, and other site-related ditches).

Dredge spoils from the UEF were placed in DSA#1 around 1980. These spoils were impacted by combined sewer overflows (CPOI) prior to placement from process and storm water from the former Syracuse Works Main Plant and the former Willis Avenue Plant and potentially from groundwater migrating from the Willis Avenue Chlorobenzene Site. Subsequently, constituents from DSA#1 have migrated via groundwater and have impacted soils and groundwater in the western portion of the Lakeshore Area and surface water and sediment within the UEF.

Dredge spoils from Onondaga Lake were placed in DSA#2 in 1977 during reconstruction of the East Flume, in particular during installation of the thermal diffuser discharge pipe. Spoils placed in DSA#2 were previously impacted by CPOIs from a variety of sources including historic East Flume discharges associated with the formation of the in-lake waste deposit (ILWD). CPOIs associated with the black stained material in DSA #2 have likely leached from the soil matrix and migrated via groundwater and have impacted soils and groundwater in the northern central portion of the Lakeshore Area, and surface water and sediment within the LEF.

AOS #1 and other wetland areas along the lakeshore of the Harbor Brook site have likely been impacted by historical discharges from the East Flume associated with the formation of the ILWD. AOS #1 and Wetland Area #2 near the mouth of Harbor Brook both appear to have received some fill material in the past; however, the source of this fill is unknown. These two areas have also likely been impacted by Harbor

Brook discharges. CPOIs from these areas have migrated via groundwater and have impacted soils and groundwater in the western and central portion of the Lakeshore Area, and surface water and sediment within Harbor Brook.

1.4.2 Analytical Data

Available analytical data for soil and porewater samples collected within the Outboard Area are summarized in the *Outboard Area Investigation Data Summary Report* (Parsons, 2009b). A supplemental investigation was conducted in November 2010 and in accordance with the NYSDEC approved *Wastebed B/Harbor Brook IRM Work Plan Addendum - Proposed Outboard Area Additional Investigation* (Parsons, 2010). A data summary report for this supplemental effort has been issued under separate cover, and the data have been incorporated into the assessment below.

Data indicate CPOIs present within the Outboard Area are similar to those detected in the adjacent lake area. In general, however, concentrations of CPOIs within the Outboard Area are significantly less than those in the area of the lake adjacent to the site. Table 1 provides a comparison of CPOI sediment and porewater data detected within the Outboard Area and the adjacent sediment management unit (SMU) 1 area of the lake.

Soil and porewater concentrations are higher in samples collected outboard of the West Wall compared to samples collected outboard of the East Wall. The highest concentrations of CPOIs in the Outboard Area appear to be associated with the East Flume and DSA #2.

1.4.3 Streamlined Risk Evaluation

O'Brien & Gere performed a streamlined risk evaluation (SRE) to support this EE/CA, provided in Appendix B. The SRE provides a thorough and concise evaluation of potential risks to human and ecological receptors assuming no removal or cleanup actions are taken at the site. The SRE concluded there is a potential threat to human health from exposure to some constituents found in surface soil, subsurface soil, and sediment. Likewise, there is a potential threat posed to ecological receptors from exposure to surface soil and sediment.

1.5 Future Use of Outboard Area

Current and potential future land uses for the Outboard Area include recreational and ecological activities. More than 75 percent of the shoreline of Onondaga Lake is currently classified as parkland. The recreational-use path along Onondaga Lake Park is being expanded along the southern shoreline across Ninemile Creek. The remainder of

the lakeshore (including portions of the Outboard Area) is being evaluated to potentially create a continuous trail around the entire lake.

Preliminary habitat restoration plans for this area were developed in the draft Habitat Plan (Parsons, 2009c) which presents the conceptual habitat restoration and enhancement designs for Onondaga Lake in those portions of the lake and adjacent areas where remediation activities would be conducted. The Habitat Plan was developed with input from multiple stakeholders and incorporates input from the 2010 public comment period. Habitat restoration plans for this area were further developed in the draft Onondaga Lake Capping, Dredging, and Habitat Intermediate Design (Parsons, 2011). Onshore areas between the barrier wall and existing shoreline would be restored to wetlands that would enhance the habitat function and value in this area. Most of the area would be persistent emergent wetland, with a small portion of forested wetland. Good quality emergent wetlands are a noticeably missing habitat around the lake and these areas would enhance and diversify the lake system for aquatic and terrestrial organisms.

1.6 Organization of the EE/CA

This EE/CA consists of six sections and four appendices.

- **Section 1**: Introduction – discusses general site conditions and background, site characterization results including the streamlined risk evaluation, future plans for the area, and the purpose of this EE/CA.
- **Section 2**: Identification of Response Action Objectives – provides the objectives or goals to be achieved by the response actions evaluated in this EE/CA.
- **Section 3**: Identification and Analysis of Response Actions – for each response action, the scope is defined and an analysis is provided to assess its effectiveness, implementability, and cost.
- **Section 4**: Comparative Analysis of Response Actions – provides a comparative analysis of the response actions to evaluate the relative performance in relation to the response action objectives.
- **Section 5**: Recommended Response Action – provides the recommended response action and rationale for the recommendation made.
- **Section 6**: References
- **Appendix A:** *Excavation Limitations*
- **Appendix B:** *Streamlined Risk Evaluation*
- **Appendix C:** *Response Action 2 Cross Sections*
- **Appendix D:** *Preliminary Delineation of Hot Spots*

2.0 Identification of Response Action Objectives

Response action objectives (also referred to as “remedial action objectives” or “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 (ARARs), to-be-considered (TBC) guidance, and site-specific risk-based levels.

The following Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be- Considered criteria (TBCs) will be complied with during implementation of the WBB/HB Outboard Area Response Action.

The ARARs/TBCs include, but are not limited to:

- 6 NYCRR 701 - Classifications - Surface Waters and Ground Waters
- 6 NYCRR Part 703 - Class GA Groundwater Quality Standards
- NYS TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations
- 6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives
- NYSDEC Technical Guidance for Screening Contaminated Sediment (1999)
- 6 NYCRR 663 - Freshwater Wetland Permit Requirements
- Clean Water Act Section 404, 33 Code of Federal Regulations (CFR) Parts 320 - 330
- Clean Water Act Section 404, 40 CFR Parts 230 – 231
- Executive Order 11990 - Protection of Wetlands
- Executive Order 11988 – Floodplain Management
- Policy on Flood Plains and Wetland Assessments for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Actions (OSWER Directive 9280.0-02)
- National Historic Preservation Act, 36 CFR 800- Preservation of Historic Properties Owned by a Federal Agency
- National Historic Preservation Act, 36 CFR Part 65 - National Historic Landmarks Program
- New York State Historic Preservation Act of 1980, 9 NYCRR Parts 426 – 428
- 33 U.S.C. 1341 - Clean Water Act Section 401, State Water Quality Certification Program
- 6 NYCRR 608 - Use and Protection Of Waters
- 16 USC 661 - Fish and Wildlife Coordination Act

- 33 CFR Parts 330 - Nationwide Permit Program
- 40 CFR Part 257 - Criteria for Classification of Solid Waste Disposal Facilities and Practices
- 6 NYCRR 360 - Solid Waste Management Facilities
- 29 CFR Part 1910.120 - Occupational Safety and Health Standards - Hazardous Waste Operations and Emergency Response
- 29 CFR Part 1926 - Safety and Health Regulations for Construction
- DEC/TAMS, Onondaga Lake Baseline Risk Assessment (2002) (site specific Sediment Effect Concentrations (SECs) and Probable Effect Concentrations (PECs))
- Lake Bottom Subsite ROD (NYSDEC, 2005) (Probable Effect Concentrations Quotient (PECQ) and the Hot Spot threshold concentrations)

The Onondaga Lake Bottom Subsite Record of Decision (ROD) established five RAOs to address CPOIs within the lake. RAOs consistent with those established for the lake are appropriate to use for developing the Outboard Area remedy because the Outboard Area is similar to the adjacent lake sediments in that there are similar CPOIs and distribution and stratification of subsurface materials. In addition, the Outboard Area is hydraulically connected to lake and isolated from the upland site by the barrier wall. The lake RI and FS addressed a wide range of contaminants of concern, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals.

Although there are some variations for individual compounds, the proposed remedy would be designed to ensure that it is protective of human health and the environment.

After the east and west barrier walls and groundwater collection systems have been fully constructed and operating, the Outboard Area would be hydraulically isolated from the remainder of the upland WBB/HB site. It would remain, however, hydraulically connected to and share similar habitat designs with the adjacent lake areas. For these reasons, the following RAOs have been established for the outboard area:

- To eliminate or reduce, to the extent practicable, releases of contaminants from the Outboard Area.
- To be protective of fish and wildlife by eliminating or reducing, to the extent practicable, existing and potential future adverse ecological effects on fish and wildlife resources and to be protective of human health by eliminating or reducing, to the extent practicable, potential risks to humans.

- To achieve surface water quality standards, to the extent practicable, associated with CPOIs.

3.0 Identification and Evaluation of Response Actions

3.1 Introduction

This section identifies and evaluates alternative response actions to achieve the RAOs established for the Outboard Area. The evaluation in this section includes the following:

- An initial screening to identify potential response actions which are not feasible, are impracticable, or do not substantially meet the IRM objectives, and therefore, are not suitable for further analysis.
- An evaluation to determine the most appropriate management option for materials generated during the response actions. Each response action carried further for evaluation would include the selected soil/sediment management option.
- A description of the remedial components common to each of the response actions.
- An analysis of the effectiveness, implementability, and cost of each of the response action.

3.2 Identification and Initial Screening of Response Actions

The General Response Actions (GRAs) development and screening presented in the Onondaga Lake FS was the basis for the identification of applicable response actions addressed in this EE/CA. Potential applicable GRAs and the basis for further consideration in or elimination from this EE/CA are presented below. Combinations of removal and containment are the most practical approaches for the outboard site areas. *In situ* treatment technologies were not considered for the outboard area due to the difficulty with implementation in a shoreline setting where groundwater is in close proximity to the surface and there is a high potential for flooding, as well as because of limitations for addressing the full range of CPOIs. *Ex situ* treatment technologies were not considered for the outboard area due to material handling space requirements and technology limitations.

GRA	Remedial Technologies Considered	Basis for Further Consideration or Elimination
No Action		Retained for baseline
Institutional Control	Property and government controls, enforcement tools, and informational devices.	Retained for use in conjunction with remedial alternatives.
Natural Recovery	Monitored natural recovery	Eliminated since action would not be supportive of habitat objectives and potential impact to lake remedial action.
Sediment Containment	Capping	Retained for use in conjunction with remedial alternatives.
Sediment Removal	Dredging/excavation	Retained for use in conjunction with remedial alternatives.
Sediment Consolidation or Disposal	On-site disposal and offsite disposal	Retained for use in conjunction with remedial alternatives.
In situ Treatment	Chemical, biological, phytoremediaiton, solidification, stabilization, electrokinetic	Eliminated since action would not be supportive of habitat objectives and because of technology limitations and site conditions
Ex situ treatment	Thermal desorption, incineration, vitrification, dechlorination, chemical extraction, sediment washing, solidification, biological	Eliminated because of technology and space limitations

The following alternatives were identified for potential evaluation in this EE/CA.

No Action

The “No Action” alternative involves implementing no remedial activities to address contamination within the Outboard Area. The “No Action” alternative is required and would serve as a baseline against which the other response actions are evaluated.

Complete Removal

This alternative involves the removal of all contaminated materials within the Outboard Area. CPOIs have been detected in Outboard Area sediment samples in exceedance of the PEC for each of the contaminants that have been shown to exhibit acute toxicity on a lake-wide basis (see Table 2), as well as the NYSDEC sediment screening criteria for benzene, toluene, and phenol at depths of up to 6 meters below ground surface (bgs). However, the excavation limitations established in Appendix A for site stability prohibit the removal of all contaminated materials. Therefore, complete removal is not feasible and not retained for further evaluation.

Cap Placement (No Removal)

This alternative involves the placement of an isolation cap throughout the Outboard Area. An isolation cap would isolate contaminants and mitigate further discharge of contaminants from the Outboard Area to the lake. However, because this alternative would not involve the removal of any Outboard Area materials prior to cap placement, the existing elevations within the outboard area would be increased approximately 4 to 4.5 ft. following cap placement based on the draft *Onondaga Lake Capping, Dredging, and Habitat Intermediate Design* (Parson, 2011). Increasing the elevation of the Outboard Area would significantly limit any potential wetland creation at the WBB/HB site and would eliminate or substantially decrease existing wetland areas within the Outboard Area. Habitat designs proposed in the Draft Habitat Plan for the Outboard Area would not be achieved under this alternative. Therefore, this alternative is not retained for further evaluation.

Removal for Cap Placement

This alternative involves the removal of surface materials and the placement of an isolation cap throughout the Outboard Area. Removal depths would coincide with the cap thickness so that the final grade of the Outboard Area (following cap placement) is consistent with the existing grade. An isolation cap would isolate contaminants and mitigate further discharge of contaminants from the Outboard Area to the lake. Because this alternative would maintain the existing elevations within the outboard area, existing habitats could be restored. However, additional wetland area would not be created and the habitat designs proposed in the Draft Habitat Plan would not be achieved. Therefore, this alternative is not retained for further evaluation.

Removal for Cap Placement and Habitat Restoration

This alternative also involves the removal of surface materials and the placement of an isolation cap throughout the Outboard Area. However, additional removal would be conducted to achieve final grades (following cap placement) to facilitate wetland mitigation and habitat restoration in accordance with the Draft Habitat Plan. Because an isolation cap would effectively isolate contaminants and mitigate further discharge of contaminants from the Outboard Area to the lake and habitat goals would be achieved, this response action is retained for further evaluation.

Removal for Cap Placement, Hot Spot Excavation, and Habitat Restoration

Similar to the previous alternatives, materials from the Outboard Area would be removed to facilitate placement of an isolation cap and achieve final grades required for habitat restoration. Additionally, this response action would include removal of materials with higher concentrations of CPOIs identified as “hot spots.” Hot spot removal would be conducted one additional meter below the excavation limits required for cap placement and habitat restoration. The additional 1

meter hot spot would also not exceed the maximum excavation limits established for maintaining site stability. Because an isolation cap would effectively isolate contaminants and mitigate further discharge of contaminants from the Outboard Area to the lake and habitat goals would be achieved, this alternative is retained for further evaluation.

Removal to Maximum Excavation Limits, Cap Placement, and Habitat Restoration

Under this alternative, materials from the Outboard Area would be removed to the maximum excavation limits provided in Appendix A. Following removal, the excavation would be filled (where necessary) and an isolation cap would be installed to achieve final grades required for habitat restoration. Because an isolation cap would effectively isolate contaminants and mitigate further discharge of contaminants from the Outboard Area to the lake and habitat goals would be achieved, this response action is retained for further evaluation.

Response Action Retained for Evaluation

Based on the initial screening, the following response actions will be retained for further analysis in this EE/CA:

- Response Action 1 - No Action
- Response Action 2 - Removal for Cap Placement and Habitat Restoration
- Response Action 3 - Removal for Cap Placement, Hot Spot Excavation, and Habitat Restoration
- Response Action 4 - Removal to Maximum Excavation Limits, Cap Placement, and Habitat Restoration

3.3 Evaluation of Soil/Sediment Management Options

The remediation of the Outboard Area will occur at the same time as the remediation of the adjacent Onondaga Lake area because of the similarities in the source and nature of contaminants and potential remedies, the connectivity between the Outboard Area and the adjacent lake sediments, and the critical relationship between the two areas under the Onondaga Lake Habitat Plan. As shown on Table 1, concentrations of CPOIs within the Outboard Area are significantly lower than those in the adjacent lake area. Since the Outboard Area is hydraulically connected to the adjacent lake area, the potential for recontamination exists if the remediation of Outboard Area and the lake is not done concurrently.

The draft Habitat Plan (Parsons, 2009c) was developed to incorporate the Outboard Area to take advantage of the hydraulic connectivity between the lake and the Outboard Area. Habitat restoration plans includes restoration of wetlands and enhancement of the habitat function and value in this area. The Habitat Plan was developed with input from multiple stakeholders and incorporates input from the 2010

public comment period. The restoration plans for this area were further developed in the draft Onondaga Lake Capping, Dredging, and Habitat Intermediate Design (Parsons, 2011).

Four options for the management of removed soils/sediments from the Outboard Area were evaluated for the purposes of this EE/CA:

- Option A – On-site placement of a portion of the dry soil/sediment at the WBB/HB site and transport and disposal of the remaining soil/sediment at the Sediment Consolidation Area (SCA)
- Option B – Consolidation of all soil/sediment at the WBB/HB site
- Option C – Off-site transportation and disposal of all soil/sediment at a commercial landfill facility
- Option D – Transport and disposal of all soil/sediment at the SCA

The soil/sediment cost estimates for Options A through D are based on Onondaga Lake FS (Parsons, 2004) values where applicable (increased by factor of 19 percent for inflation) and engineer's estimates for remedial measures for Onondaga Lake and upland sites**.**

Option A

Under this option, a portion of the dry soil/sediment removed from the Outboard Area would be placed on-site inboard of the IRM barrier wall and groundwater collection system. The remaining soil/sediment removed from the Outboard Area would be hydraulically dredged and transported via pipeline and consolidated at the SCA at Wastebed 13 as part of the Onondaga Lake Bottom subsite remedy. This would take advantage of the infrastructure that would be constructed to support the lake remediation. As discussed in the Onondaga Lake Remedial Design Work Plan (Parsons, 2008), the SCA would be designed, constructed, operated, and maintained in accordance with the substantive requirements of NYSDEC Part 360, Section 2.14(a) (industrial monofills) and would include an impermeable liner, leachate collection system, and cover. This option would not require the use of trucks for transporting Outboard Area soils/sediment off-site.

For purposes of cost estimating, the total estimated volume of dry materials to be removed (materials located above the average lake level) for each of the response actions is approximately 35,000 cubic yards (CY). The exact volume of dry material to be placed on Wastebed B would be determined as part of future designs for the Outboard Area. The dry material would be mechanically excavated, relocated to an area inboard of the barrier wall and groundwater collection trench at the WBB/HB site, and covered. The remaining materials to be removed from the Outboard Area (between approximately 155,000 CY and 245,000 CY, depending on the response action) would be hydraulically dredged and transported via pipeline to the SCA in conjunction with the adjacent lake dredging using the same equipment and transport system that would be constructed to support the lake dredging activities.

Hydraulic dredging operation

The final disposition of the Outboard Area materials relocated on-site would be determined as part of the WBB/HB FS and addressed as part of the site remedy. Approximately 35,000 CY of material was recently relocated at the WBB/HB site as part of the site regrading work required for the WBB/HB West Wall installation.

The estimated cost for the management of soil/sediment under Option A is $121 per CY.

Option B

This option consists of consolidating all soils/sediments removed from the Outboard Area to a location inboard and upgradient of the barrier wall and groundwater collection system. The final disposition of the Outboard Area materials would be determined as part of the WBB/HB FS and addressed as part of the site remedy. The total volume of materials that would be placed on-site ranges from 190,000 to 280,000 CY, depending on the response action.

This option would require the construction of on-site dewatering and wastewater treatment facilities. Although the transport of materials onto public roadways would not be required, additional measures may be needed to control odors and emissions generated during the on-site activities. Due to stability concerns, limitations have been established for the staging of materials behind the barrier wall. Following removal and relocation of the Outboard Area materials, there would be limited space available to support the concurrent lake remediation work (e.g., staging of cap materials). Lastly, the placement of between 190,000 to 280,000 CY of waste materials at Wastebed B may significantly impact any future restoration plans for this area following remediation.

The estimated unit cost for the management of soil/sediment under Option B is $116 per CY.

Option C

This option consists of disposing impacted site soils/sediments at an appropriate commercial landfill. It is anticipated that Outboard Area materials would be disposed off-site at a permitted facility as a non-hazardous waste. This option would require the construction of on-site dewatering and wastewater treatment facilities. Additional measures would be required to control odors and emissions generated during the on-site activities. The total volume of materials that would be taken off-site ranges from 190,000 to 280,000 CY, depending on the response action. Approximately 11,000 to 16,000 truck trips (approximately 135 to 145 truck trips per day) would be required for off-site transportation of the Outboard Area materials.

The estimated cost for the management of soil/sediment under Option C is $203 per CY.

Option D

This option consists of consolidating all soils/sediments removed from the Outboard Area within the containment system under design at the SCA.

For the purposes of this evaluation, it was assumed approximately 77,000 CY of dry material would be mechanically excavated and trucked to the SCA (an estimated 5,500 truck trips) and the remaining materials to be removed from the Outboard Area (between approximately 113,000 CY and 203,000 CY, depending on the response action) would be hydraulically dredged and transported via pipeline to the SCA using the same equipment and transport system that would be constructed to support the adjacent lake dredging activities. The Outboard Area materials would represent between approximately 6 and 9 percent of the design capacity of the SCA.

The estimated cost for the management of soil/sediment under Option D is $118 per CY.

Evaluation of Soil/Sediment Management Options

Effectiveness

Options A, B, C, and D would be protective of human health and the environment by effectively containing excavated materials.

Implementability

For options A and D, the Outboard Area materials to be managed at the SCA represent a small percentage (less than 10 percent) of the total SCA volume. There is also adequate space available at the SCA to manage this material. Odor and emission issues are not anticipated at the SCA as a result of the Outboard Area materials because of the similarities in the source and nature between the outboard area material and adjacent lake area.

Option B significantly limits the space available at the site to support the lake remediation activities and significantly impacts any future development of the WBB/HB site.

Options B and C require additional infrastructure be constructed on-site to support the Outboard Area remediation, including dewatering operations and construction of a temporary water treatment plant.

Options C and D both involve the use of trucks to transport materials from the site across public roads. Increased truck traffic poses a public nuisance and increases the carbon footprint of the remedial activities.

Costs

Options A and D take advantage of the infrastructure that would already have been constructed to support the lake remediation and the additional volume generated during the Outboard Area removal would have minimal impacts on the design/construction of those systems.

Options B and C require additional infrastructure be constructed on-site to support the Outboard Area remediation.

Option A involves contained transport of materials to the SCA via pipeline, no off-site truck transport of soil and sediment, and facilitates the restoration and future development plans for the WBB/HBB site.

Recommended Soil/Sediment Management Option

Based on the above evaluation, Option A is the recommended soils/sediment management option. Option A is protective of human health and the environment, can be implemented with minimal impacts to the surrounding communities (e.g., no truck traffic on public roads, noise, etc.), is consistent with previous material management activities at WBB, facilitates the restoration and future development plans for the WBB/HB site and manage dredged material in a fashion that is consistent with the Onondaga Lake remedy.

Sediment would be hydraulically dredged and pumped to an onshore support area. The dredged material would be routed into a double-walled pipeline and then conveyed to the SCA. The closed loop system prevents exposure of the dredged material to the air during conveyance and would prevent emission of volatized sediments and odors into the surrounding areas. A leak detection system has also been incorporated into the pipeline design. Option A has been included in the response actions evaluated further in this EE/CA.

3.4 Common Response Action Components

With the exception of Response Action 1 (No Action), the response actions evaluated in this EE/CA involve different scenarios for the removal of Outboard Area materials over the entire footprint of the Outboard Area prior to cap placement. While the removal depths may vary for each response action, the remaining components would be the same. These methods are proven environmental cleanup methods that would address contamination in the Outboard Area. The cap would provide a suitable habitat layer for plants, animals, and fish to use without impacting the chemical isolation layer. The cap would also provide long-term chemical and physical isolation of underlying material from the lake and would resist erosive forces such as wind/wave-generated currents, tributary and other inflows, and ice.

To achieve the RAOs established for the Outboard Area, each of the response actions evaluated in this EE/CA include the following common components:

- Removal of surface materials
- Placement of an isolation cap
- Habitat restoration

- Implementation of institutional controls
- Implementation of a long-term OM&M program.

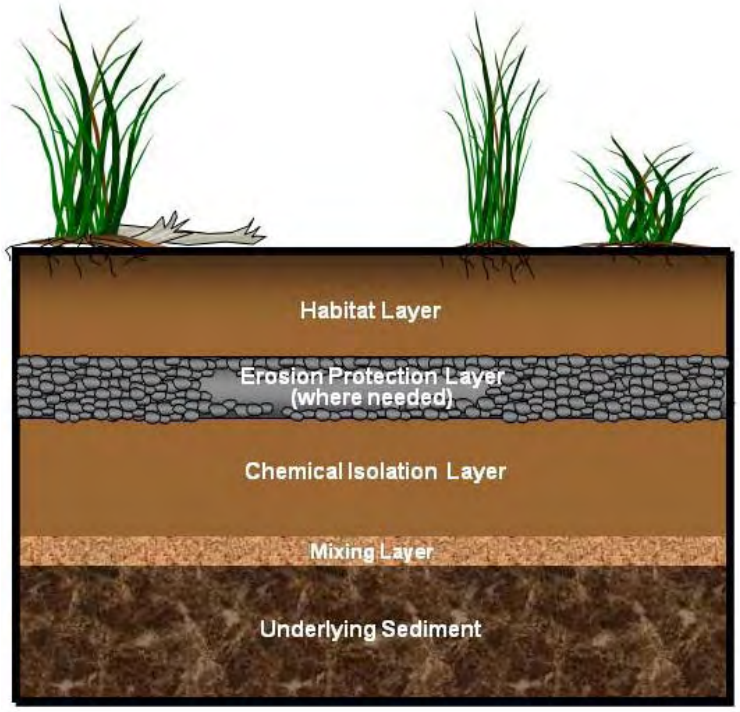
A description of the cap, habitat restoration, institutional controls, and OM&M program for Response Actions 2, 3, and 4 is provided below.

3.4.1 Isolation Cap

Based on the RAOs established for the Outboard Area, the functions of the cap include the following:

- Restoration and enhancement of habitat in the onshore areas of Onondaga Lake
- Physical isolation of the contaminated sediment/soil from the environment
- Reduction or elimination of the flux of dissolved contamination into the upper layers of the cap
- Stabilization of contaminated sediment/soil, preventing resuspension and transport of contaminants to the lake

To ensure that habitat restoration and chemical isolation goals are met and that the cap provides long-term protection of human health and the environment, the cap would include specific layers dedicated to various purposes. These layers would include a habitat layer, an erosion protection layer (if necessary), a chemical isolation layer, and an allowance for mixing of the bottom of the chemical isolation layer with the underlying sediment, as shown in the schematic below.



General Schematic of Sediment Cap

Removal depths and cap thicknesses will consider the base removal and hot-spot removal depths/elevations and cap thicknesses in the near-shore areas of the ILWD to ensure slope stability during dredging and placement of a multi-layered cap. The final lake dredge design will address the transition between the Outboard Area and Onondaga Lake.

Cap Performance Criteria: The performance criteria for the cap would be the PEC for each of the contaminants that have been shown to exhibit acute toxicity on a lake-wide basis (see Table 2), as well as the NYSDEC sediment screening criteria for benzene, toluene, and phenol.

Using data obtained from the lake cap design, the anticipated cap thickness in the western Outboard Area would be approximately 4.5 ft. Due to lower pH levels, the anticipated cap thickness in the eastern Outboard Area would be approximately 4 ft. It is anticipated that the western outboard area would require a pH amendment to the isolation cap similar to the adjacent ILWD due to the elevated pH levels. A pH amendment is not anticipated for the eastern portion accounting for the difference in cap thickness between the two areas. These thicknesses are based on a minimum 12-inch chemical isolation layer, a 24-inch habitat layer, and include average over placement that may result to ensure a minimum thickness of each layer is achievable. The actual cap thickness would likely vary based on further detailed analysis and testing conducted during the design.

3.4.2 Restoration

Preliminary habitat restoration plans for this area were developed in the Draft Habitat Plan (Parsons, 2009c) which presents the conceptual habitat restoration and enhancement designs for Onondaga Lake in those portions of the lake and adjacent areas where remediation activities would be conducted. Habitat restoration plans for this area were further developed in the draft Onondaga Lake Capping, Dredging, and Habitat Intermediate Design (Parsons, 2011). An overview of the restoration for the Outboard Area is shown on Figure 4. The goals that would be used to determine clean soil acceptable for use as suitable habitat layer material would be based on NYSDEC's sediment screening criteria (for wetland and open water areas) and unrestricted use Soil Cleanup Objectives (SCO) (6 NYCRR 375-6.8[a]) (for non-wetland areas).

3.4.3 Monitoring, Maintenance, and Institutional Controls

Post-construction monitoring and maintenance of the capped areas would be performed to verify that the overall integrity of the cap is maintained so that it remains physically stable (i.e., would not erode) and chemically protective over time. Long-term monitoring of the cap would include physical monitoring to verify stability and sampling of the cap to verify its chemical integrity. In the unlikely event that the monitoring identifies areas where the cap is not performing consistent

with expectations, contingency response actions would be taken to maintain and repair the cap as necessary.

Because the majority of the Outboard Area would be restored as an emergent wetland, the only institutional control envisioned to promote the long-term integrity of cap is to prevent disturbance of the cap by dredging or other shoreline or in-water construction activities. It is anticipated that “No Dredge Areas” would be established over capped areas in the lake and along the lake shoreline by the NYSDEC and New York State Canal Corporation (NYSCC) to prevent removal of the capping materials. These restrictions would also include anchoring of commercial vessels and certain in-water development activities, such as setting utility or cable corridors.

3.5 Detailed Evaluation of Response Actions

3.5.1 Response Action 1 - No Action

Response Action 1 is the “No Action” scenario and would not involve the implementation of any remedial activities to address contaminated materials within the Outboard Area. The “No Action” scenario is required to be evaluated in an EE/CA and is used as a baseline against which the other response actions are evaluated.

3.5.1.1 Effectiveness

Overall Protection of Public Health and the Environment

Response Action 1 would not address contamination present within the Outboard Area, nor would it mitigate further migration or discharge of contamination from the Outboard Area into Onondaga Lake. Therefore, this response action would not be protective of public health and the environment.

Compliance with ARARs

Response Action 1 would not be compliant with ARARs since contaminated materials are present within the Outboard Area and further migration into Onondaga Lake would not be addressed.

Long-Term Effectiveness and Permanence

Response Action 1 is not effective in reducing risk to the public or the environment.

Reduction of Toxicity, Mobility or Volume through Treatment

Response Action 1 would not reduce the toxicity, mobility, or volume of contaminated material present within the Outboard Area.

Short-Term Effectiveness

Response Action 1 would not involve implementation of any remedial activities or site work; therefore, evaluation of short-term effectiveness is not applicable.

3.5.1.2 Implementability

Technical Feasibility

Response Action 1 is technically feasible and easily implemented.

Administrative Feasibility

Response action 1 is administratively feasible. No permits are required.

Availability of Services and Materials

No services, equipment, or materials are required for Response Action 1.

State Acceptance

Response Action 1 would not meet the ARARs for the Outboard Area and is therefore not an acceptable response action.

3.5.1.3 Cost

There are no costs associated with implementing Response Action 1.

3.6 Response Action 2 – Removal for Cap Placement and Habitat Restoration

Under Response Action 2, surface materials within the Outboard Area would be removed for placement of an isolation cap and achieving final grades lower than the existing grade elevations to facilitate habitat restoration. Habitat restoration in the Outboard Area was designed to take better advantage of the seasonal inundation of emergent wetland areas along the shoreline and create habitat that is more suitable for northern pike reproduction.

To provide suitable conditions over a wide range of lake levels, the wetlands have been designed with a gradual slope from the areas adjacent to the barrier wall out to the Onondaga Lake shoreline. This type of self-designing system would respond to natural changes in water level and patterns of sediment movement. Water levels during potential spawning season were evaluated using Onondaga Lake level data from the USGS Gauging Station at Liverpool, New York. The median, 10th percentile and 90th percentile values for Onondaga Lake water levels during this time period are shown in Figure 5. Because dam and lock procedures from plant operations on the Seneca River were modified in 1997, only data from the last 12 years were used for this analysis.

Based on the anticipated cap thicknesses and target final grades for the western and eastern Outboard Areas, excavation would be conducted to depths ranging from 1.5 to 3 meters (an average depth of 2 meters), in order to facilitate placement of the cap and achieve final target grades. A schematic illustrating the removal scenario under Response Action 2 is shown on Figure 6.

Figure 7 shows the anticipated removal depths throughout the Outboard Area under Response Action 2. Approximately 190,000 CY of material would be removed under Response Action 2. Approximately 35,000 CY of dry material would be excavated and relocated to an area inboard of the barrier wall and groundwater collection system at the WBB/HB site and the remaining 155,000 CY would be dredged and pumped to the SCA. Additional detailed design drawings from the draft Onondaga Lake Capping, Dredging, and Habitat Intermediate Design (Parsons, 2011) are provided in Appendix C. The anticipated duration of the excavation/dredging, material transport capping is approximately 137 work days.

3.6.1 Effectiveness

Overall Protection of Public Health and the Environment

This response action would provide overall protection of human health and the environment. Detailed technical evaluations presented in the draft Onondaga Lake Capping, Dredging, and Habitat Intermediate Design (Parsons, 2011) demonstrate that capping would be effective in Onondaga Lake, where CPOIs are similar to the Outboard Area but, in general, present at higher concentrations. Capping of subaqueous contaminated sediments is an accepted and proven long-term engineering option for managing dredged materials, and for *in situ* remediation of contaminated sediments (USEPA, 1994; 2002; National Research Council (NRC), 1997, 2001; Palermo, Clausner, et al., 1998; Palermo, Miller, et al., 1998), and is a significant component of the Onondaga Lake remedy. Sediment caps are a proven technology and have been implemented at numerous sediment remediation sites, including the Fox River in Wisconsin, the St. Lawrence River in New York, the St. Louis River Interlake Duluth Tar site in Minnesota, and Port Hueneme in California.

Compliance with ARARs

The chemical isolation layer would physically and chemically isolate plants, benthic organisms, animals, and humans from the underlying sediment. Chemical isolation is achieved because contaminants migrate so slowly through the chemical isolation layer that it would take a very long time before they migrate through the chemical isolation layer, or because the contaminants biologically decay within the chemical isolation layer, and as a result, never migrate through the chemical isolation layer. Additionally, operation and maintenance of a hydraulic containment/collection system reduces groundwater upwelling through the cap materials.

This Response Action would achieve compliance with Federal and State ARARs.

Long-Term Effectiveness and Permanence

The cap would provide long-term chemical isolation of underlying impacted soils/sediments. It would be resistant to erosive forces such as wind/wave-generated currents, tributary and other inflows, and ice. It would also provide a suitable habitat substrate that plants, animals, and fish can use without impacting the chemical isolation layer. A long-term cap monitoring and maintenance plan would be developed and implemented to ensure that the cap performs as intended. Similar to the design process for the lake, detailed evaluations for each of the Outboard Area cap layers would be performed during design to ensure that each individual layer is sufficient to withstand the various conditions expected in the Outboard Area, and would function as necessary to ensure compliance with the remedial action objectives. Long-term reduction of groundwater upwelling would contribute to long-term cap effectiveness through operation and maintenance of a hydraulic containment/collection system.

Reduction of Toxicity, Mobility or Volume through Treatment

Leachate generated from the dewatering of dredged/excavated sediment managed at the SCA would be collected and treated prior to discharge. No other active treatment is associated with Response Action 2.

Short-Term Effectiveness

Potential short-term risks associated with Response Action 2 would be mitigated through the use of proven control measures. Impacts are not anticipated due to the nature and contaminant concentration of the materials. However, emission control measures and an air monitoring program would be implemented during intrusive work.

Work completed to date has not identified any issues with potential risk to workers during construction with regards to the inhalation of dust and/or vapors and potential direct contact with materials. These risks however would be mitigated through the implementation of a comprehensive site-specific Health and Safety Plan which includes requirements and procedures for use of personal protective equipment and worker breathing zone air monitoring.

3.6.2 Implementability

Technical Feasibility

Response Action 2 is technically feasible and primarily involves mechanical and hydraulic excavation of soil and sediment, and the mechanical placement of cap materials. The wet conditions and soft materials present within the Outboard Area may impact work methods and schedules at certain times of the year which would be considered during the design.

Administrative Feasibility

Response Action 2 is administratively feasible. Permitting and access requirements are anticipated to be similar to those required for the adjacent lake remediation.

Availability of Services and Materials

The personnel, equipment and materials necessary to implement Response Action 2 are available. Materials required for the capping operations would be similar to those required for the lake cap and may include aggregate materials and potentially, pH and carbon amendments, as well as biological seed materials. Material would be brought in bulk directly from the mines, quarry pits, and other material supply facilities. Multiple sources of each material may be required to facilitate the overall cap design quantities for the lake and Outboard Area.

State Acceptance

There are no anticipated concerns with the State's acceptance of Response Action 2.

3.6.3 Cost

The estimated total present value cost for implementing Response Action 2 is $23 million as summarized on Table 3.

3.7 Response Action 3 – Removal for Cap Placement, Hot Spot Excavation, and Habitat Restoration

Response Action 3 involves the same components as Response Action 2 including an isolation cap and removal of surface materials to achieve a final post-cap grade for habitat restoration. Response Action 3 would also involve additional removal of Outboard Area materials in areas where higher concentrations of CPOIs were detected. These areas are referred to as "hot spots" and are defined as those sediments and or wastes that contain contaminants above the threshold criteria specified in the Onondaga Lake ROD, as listed below.

CPOI	Sediment Hot Spot Criteria (mg/kg)
Benzene	208
Chlorobenzene	114
Dichlorobenzenes	90
Naphthalene	20,573
Xylenes	142
Ethylbenzene	1,655
Toluene	2,625
Mercury	2,924

Only two CPOIs were detected within the Outboard Area at concentrations which exceeded the lake hot spot criteria. These include dichlorobenzene and xylene.

For the purposes of estimating removal depths and volumes for Response Action 3, a delineation of hot spots is provided in Appendix D. Two hot spot areas (East Flume Hot Spots and DSA Hot Spots) were identified where sediment concentrations have been detected which exceed the lake sediment screening criteria within the 1-meter interval below the base excavation required for cap placement and habitat restoration, but above the maximum excavation limits established for stability.

Hot spot delineations were determined based on data indicating that adjacent samples within the same depth interval did not exceed the lake sediment screening criteria. The delineation methods used for the Outboard Area were consistent with those used to delineate hot spot removal areas within Remediation Area D of the lake, as described in Appendix G of the Lake Sediment Capping, Dredging, and Habitat Intermediate Design Report (Parsons, 2011).

Under Response Action 3, hot spot excavation/dredging would include removal of an additional 3.3 ft. (1 meter) if the hot spot exceedance falls within this additional meter depth range, consistent with the hot spot approach for the lake. Excavation/dredging for hot spot removal would not extend beyond the maximum excavation limits that are established for stability of existing or proposed site features, including the railroad, and barrier wall as defined in Appendix A of this EE/CA. The cap would be designed to isolate remaining sediments and soils that exceed the hot-spot criteria. The restoration design would consider deeper pools for nursery habitat that coincide with the hot spot removal areas as a means of creating variable topography. If appropriate, additional fill materials would be placed within the Outboard Area to achieve the final post-cap target grades. A schematic illustrating the removal scenario under Response Action 3 is provided on Figure 8.

Figure 9 shows the anticipated removal depths throughout the Outboard Area under Response Action 3. Approximately 199,000 CY of material would be removed under Response Action 3. Approximately 35,000 CY of dry material would be excavated and relocated to an area inboard of the barrier wall and groundwater collection system at the WBB/HB site and the remaining 164,000 CY would be managed at the SCA. The anticipated duration of the excavation/dredging, transport of materials, and capping is 140 work days.

3.7.1 Effectiveness

Overall Protection of Public Health and the Environment

This response action would provide overall protection of human health and the environment. Response Action 3 involves the placement of an isolation cap to isolate contaminated materials within the Outboard Area and prevent future releases to Onondaga Lake. Detailed evaluations

would be performed during design to ensure that the cap is sufficient to withstand the various conditions expected in the Outboard Area, and would function as necessary to ensure compliance with the remedial goals. Operation and maintenance of a hydraulic containment/collection system reduces groundwater upwelling through the cap materials.

In addition to the removal of materials for placement of the cap and habitat restoration, Response Action 3 involves the removal of an additional 9,000 CY of materials exhibiting concentrations which exceed the lake sediment hot spot criteria.

Compliance with ARARs

The cap installed under Response Action 3 would physically and chemically isolate plants, benthic organisms, animals, and humans from the underlying sediment.

This Response Action would achieve compliance with Federal and State ARARs.

Long-Term Effectiveness and Permanence

The cap installed under Response Action 3 would provide long-term chemical isolation of underlying impacted soils/sediments. Long term reduction of groundwater upwelling would contribute to long term cap effectiveness through operation and maintenance of a hydraulic containment/collection system. Response Action 3 would also permanently remove approximately 9,000 CY of additional material from the Outboard Area which exhibits concentrations exceeding the lake sediment hot spot criteria.

Reduction of Toxicity, Mobility or Volume through Treatment

Leachate generated from the dewatering of dredged/excavated sediment managed at the SCA would be collected and treated prior to discharge. No other active treatment is associated with Response Action 3.

Short-Term Effectiveness

The same risks posed by Response Action 2 are associated with Response Action 3. Risks to the public and workers as a result of the construction activities would be mitigated through the implementation of odor and emission control measures, air monitoring, and a site-specific Health and Safety Plan.

3.7.2 Implementability

Technical Feasibility

Response Action 3 is technically feasible and primarily involves mechanical and hydraulic excavation of soil and sediment, and the mechanical placement of cap materials. Similar to Response Action 2, the wet conditions and soft materials present within the Outboard Area may impact work methods and schedules at certain times of the year which would need to be considered during the design.

Administrative Feasibility

Response Action 3 is administratively feasible. Permitting and access requirements are anticipated to be similar to those required for the adjacent lake remediation.

Availability of Services and Materials

The personnel, equipment, and materials necessary to implement Response Action 3 are similar to Response Action 2. Due to the additional hot spot excavation, additional fill materials may be required to achieve the final target grades for habitat restoration. Fill materials for this purpose are readily available in the Syracuse area.

State Acceptance

There are no anticipated concerns with the State's acceptance of Response Action 3.

3.7.3 Cost

The estimated total present value cost for implementing Response Action 3 is $24 million as summarized on Table 4.

3.8 Response Action 4 – Removal to Maximum Excavation Limits, Cap Placement, and Habitat Restoration

Response Action 4 involves the removal of Outboard Area materials to the maximum excavation limits established to maintain site stability. The excavation limitations established in Appendix A for wall and railroad stability during Outboard Area excavation prohibit the removal of all contaminated materials. Therefore, Response Action 4 represents the maximum removal response action for evaluation in this EE/CA.

Under Response Action 4, excavation/dredging would be extended to the maximum excavation depths based on stability considerations, which range from approximately 1 to 4 meters. Additional fill materials would be placed within the Outboard Area, as necessary, to achieve the final post-cap target grades. A schematic illustrating the removal scenario under Response Action 4 is shown on Figure 10.

Figure 11 shows the anticipated removal depths throughout the Outboard Area under Response Action 4. Approximately 280,000 CY of material would be removed under Response Action 4. Approximately 35,000 CY of dry material would be excavated and relocated to an area inboard of the barrier wall and groundwater collection system at the WBB/HB site and the remaining 245,000 CY would be managed at the SCA. The anticipated duration of the excavation/dredging, material transport and capping is 204 days.

3.8.1 Effectiveness

Overall Protection of Public Health and the Environment

This response action would provide overall protection of human health and the environment. Response Action 4 involves the placement of an isolation cap to isolate contaminated materials within the Outboard Area and prevent future releases to Onondaga Lake. Detailed evaluations would be performed during design to ensure that the cap is sufficient to withstand the various conditions expected in the Outboard Area, and would function as necessary to ensure compliance with the remedial goals.

Compliance with ARARs

The cap installed under Response Action 4 would physically and chemically isolate plants, benthic organisms, animals, and humans from the underlying sediment. Additionally, operation and maintenance of a hydraulic containment/collection system reduce groundwater upwelling through the cap materials.

This Response Action would achieve compliance with Federal and State ARARs.

Long-Term Effectiveness and Permanence

The cap installed under Response Action 4 would provide long-term chemical isolation of underlying impacted soils/sediments. Long-term reduction of groundwater upwelling would contribute to long-term cap effectiveness through operation and maintenance of a hydraulic containment/collection system. Response Action 4 would also permanently remove approximately 82,000 CY of additional material from the Outboard Area than in Response Action 3.

Reduction of Toxicity, Mobility or Volume through Treatment

Leachate generated from the dewatering of dredged/excavated sediment managed at the SCA would be collected and treated prior to discharge. No other active treatment is associated with Response Action 4.

Short-Term Effectiveness

The same risks posed by Response Actions 2 and 3 are associated with Response Action 4 and would be mitigated through the implementation of control measures, monitoring, and a site-specific Health and Safety Plan.

3.8.2 Implementability

Technical Feasibility

Response Action 4 is technically feasible and primarily involves mechanical and hydraulic excavation of soil and sediment and the mechanical placement of cap materials. The additional volume of materials to be removed at greater depths may make

excavation/dredging more difficult and lengthens the construction duration. The wet conditions and soft materials present within the Outboard Area may impact work methods and schedules at certain times of the year which would need to be considered during the design.

Administrative Feasibility

Response Action 4 is administratively feasible. Permitting and access requirements are anticipated to be similar to those required for the adjacent lake remediation.

Availability of Services and Materials

The personnel, equipment, and materials necessary to implement Response Action 4 are available. Due to the additional volume of materials being removed, additional fill materials would be required to achieve the final target grades for habitat restoration. Fill materials for this purpose are readily available in the Syracuse area.

State Acceptance

There are no anticipated concerns with the State's acceptance of Response Action 4.

3.8.3 Cost

The estimated total present value cost for implementing Response Action 4 is $34 million as summarized on Table 5.

4.0 Comparative Analysis of Response Actions

With the exception of Response Action 1 (No Action), each of the response actions evaluated in this EE/CA include the following common components:

- Removal of surface materials
- Placement of an isolation cap
- Habitat restoration
- Implementation of institutional controls
- Implementation of a long-term OM&M program

The primary differentiators between Response Actions 2, 3 and 4 are:

1) the volume of materials removed prior to cap placement;
2) the estimated duration of the removal and transport activities; and
3) backfill quantities (Response Action 4 only).

The table below presents a summary of response action removal volumes, duration, and costs.

Response Action	Total Removal (CY)	Duration (days)	Cost
Response Action 1 - No Action	0	0	$0
Response Action 2 - Removal for Cap Placement and Habitat Restoration	190,000	137	$23M
Response Action 3 - Removal for Cap Placement, Hot Spot Excavation, and Habitat Restoration	199,000	140	$24M
Response Action 4 - Removal to Maximum Excavation Limits, Cap Placement, and Habitat Restoration	280,000	204	$34M

Response actions were independently evaluated in the preceding sections for effectiveness, implementability, and cost. The subsections below provide a comparative analysis of Response Actions 2, 3, and 4 to evaluate the relative performance of each alternative in relation to the criteria. Section 3.3 presents an assessment of soil/sediment management options. Option A is recommended for management of

soil/sediment removed from the Outboard Area since this option involves contained transport of materials to the SCA via pipeline, no off-site truck transport of soil and sediment, and facilitates the restoration and future development plans for the WBB/HB site. This option was used as part of the response action alternatives evaluation.

4.1 Effectiveness

The effectiveness of each of the response actions, other than no action, would rely on the ability of the cap, in conjunction with institutional controls and a long-term OM&M program, to provide long-term chemical isolation of underlying impacted soil/sediments. As discussed in more detail in Section 3.4, with the exception of the No Action Response Action, all of the evaluated Response Actions include restoration consistent with the Habitat Plan and/or subsequent design changes regarding pike spawning habitat for the Outboard Area. Cap design would be based on meeting long-term effectiveness objectives for protection of human health and the environment; cap design effectiveness would be such that Response Actions 2, 3, and 4 would provide the same degree of protectiveness. Because the cap, institutional controls, and OM&M components are the same, the long-term effectiveness associated with Response Actions 2, 3 and 4 is anticipated to be the same.

Data suggests that Response Action 2 removes the majority of materials present within the Outboard Area that exceed the lake sediment hot spot criteria. Response Action 3 removes approximately 9,000 additional cubic yards of material exceeding the lake hot spot criteria reducing the toxicity and mobility of the contaminated sediments/soils; and reliance on the cap to provide protection. Although Response Action 4 removes the largest volume of material, the additional 79,000 CY under Response Action 4 results in the removal of minimal additional amounts that exceeds hot spot criteria and would not increase the protectiveness of the response action.

The potential short-term impacts associated with each response action are similar. Although none of the response actions represents unacceptable short-term risk, the potential for incidents to occur would be dependent on the volume of materials handled which would impact the duration of the construction activities. Based on the estimated volumes presented in this EE/CA, Response Action 2 represents the least potential short-term risk and Response Action 4 represents the greatest risk of potential short-term impacts. Each of these risks would be mitigated during construction through the implementation of control measures, monitoring, the planning and use of proper procedures, and implementation of a comprehensive site-specific Health and Safety Plan.

4.2 Implementability

Each of the response actions involves the mechanical and hydraulic excavation of soil and sediment and the mechanical placement of cap

materials. Each of the response actions is technically and administratively feasible and the personnel, equipment, and materials necessary to implement each of the response actions are available.

The degree of difficulty for each response action is dependent on the volume and depth of Outboard Area material to be removed. Based on the removal scenarios presented in this EE/CA, Response Action 2 represents the least difficult response action to implement and Response Action 4 represents the most difficult response action to implement due to the need to remove more material at greater depths, as well as to backfill to meet targeted finish grades. However, all of the response actions are implementable.

4.3 Cost

Response Action 2 represents the least expensive response action at $23 million. Response Action 4 is the most costly option at $34 million. Response Action 3 costs more than Response Action 2 at $24 million.

4.4 Sustainability Considerations

Sustanability and green remediation considerations were evaluated for each disposal option and each remedial response action consistent with inititatives developed by the NYSDEC and United States Environmental Protection Agency (USEPA). The main focus was reduction of energy use, direct and indirect emissions of greenhouse gases (GHG), efficient management of resources and materials, and maximizing habitat values.

The recommended disposal option minimizes energy use, direct and indirect greenhouse gas emisions, and the associated carbon footprint by utilizing infrastructure being constructed to support the lake remediation. It also minimizes additional on-site material handling and off-site trucking of materials. The overall remedy for the Outboard Area outlined in this EE/CA would replace approximately 12 acres of high quality wetland and aquatic habitat.

Future sustainability and green remediation evaluations would be conducted as part of the overall lake design, habitat plans, and remedial construction phases of work.

5.0 Recommended Response Action

Three options for the management of removed soils/sediments from the Outboard Area were evaluated for the purposes of this EE/CA:

- Option A – On-site placement of a portion of the dry soil/sediment at the WBB/HB site and transport and disposal of the remaining soil/sediment at the SCA
- Option B – Consolidation of all soil/sediment at the WBB/HB site
- Option C – Off-site transportation and disposal of all soil/sediment at a commercial landfill facility
- Option D – Transport and disposal of all soil/sediment at the SCA

Option A is recommended for management of soil/sediment removed from the Outboard Area since this option involves contained transport of materials to the SCA via pipeline, no off-site truck transport of soil and sediment, and facilitates the restoration and future development plans for the WBB/HB site. This option was used as part of the response action alternatives evaluation.

Response Action 3 (Removal for Cap Placement, Hot Spot Removal, and Habitat Restoration) is the recommended response action to address contaminated material within the Outboard Area for the following reasons: [2]

- Response Action 3 provides the same level of protectiveness as Response Actions 2 and 4.
- In comparison to Response Action 2, Response Action 3 involves removing 9,000 additional cubic yards of material from the Outboard Area which exceeds the lake sediment hot spot criteria.
- Response Action 4 would not provide additional protection of human health or the environment. Response Action 4 presents a greater risk of potential short-term impacts due to a greater duration of construction activities and it costs $10 million (42 percent) more than Response Action 3.

[2] NYSDEC and USEPA will identify which action they will propose as a recommended response action in the proposed response action document (PRAD) and following the receipt of public comment on the PRAD, NYSDEC, and USEPA will select a response action in a decision document. The response action recommended and selected by NYSDEC and USEPA may be different than Honeywell's recommendation

6.0 References

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Tables

Table 1
Comparison of Outboard Area and Onondaga Lake SMU 1
Sediment and Porewater Concentrations

	Outboard Area	SMU1 Lake	Outboard Area	SMU1 Lake
Chlorobenzene	**Sediment (mg/kg)**	**Sediment (mg/kg)**	**Porewater (ug/L)**	**Porewater (ug/L)**
90th Percentile	4.8	50	147	2,391
95th Percentile	11.7	110	290	7,524
Mean	6.7	30	60	1,205
Maximum	1,300	6,000	990	22,200
Total Dichlorobenzene				
90th Percentile	30.6	123	826	1,822
95th Percentile	76.2	257	1,082	2,682
Mean	22.2	96	197	638
Maximum	1,272	31,000	3,611	10,379
Benzene				
90th Percentile	4	11	180	2,725
95th Percentile	5.8	18	607	3,740
Mean	1.7	13	72	1,200
Maximum	190	7,200	770	23,980
Ethylbenzene				
90th Percentile	3.3	11	33	171
95th Percentile	5.6	16	40	235
Mean	4.1	10	11	80
Maximum	1,300	2,400	63	1,712
Naphthalene				
90th Percentile	71	370	1,980	6,514
95th Percentile	182	510	2,925	9,648
Mean	64.1	378	664	3,304
Maximum	14,600	230,000	8,000	93,940
Toluene				
90th Percentile	3.4	21	217	1,673
95th Percentile	5.2	45	463	2,623
Mean	2.4	36	72	700
Maximum	450	26,000	930	10,800
Total Xylenes				
90th Percentile	13.0	120	637	3,330
95th Percentile	28.0	180	843	4,869
Mean	8.5	97	152	1,380
Maximum	860	52,000	1,600	15,540
Mercury				
90th Percentile	11.1	25	0.59	37
95th Percentile	20.8	40	0.99	84
Mean	4	8	0.19	23
Maximum	60	109	1.6	1,463

porewater data based on data collected through Phase VI PDI.

TABLE 2

Contaminants Used in Mean PEC Quotient Calculation

	PEC
Metals (mg/kg)	
Mercury	2.2
Organic Compounds	
BTEX Compounds (μg/kg)	
Ethylbenzene	176
Xylenes	560.8
Chlorinated Benzenes (μg/kg)	
Chlorobenzene	428
Dichlorobenzenes	239
Trichlorobenzenes	347
PAH Compounds (μg/kg)	
Acenaphthene	861
Acenaphthylene	1301
Anthracene	207
Benz[a]anthracene	192
Benzo[a]pyrene	146
Benzo[b]fluoranthene	908
Benzo[ghi]perylene	780
Benzo[k]fluoranthene	203
Chrysene	253
Dibenz[a,h]anthracene	157
Fluoranthene	1436
Fluorene	264
Indeno[1,2,3-cd]pyrene	183
Naphthalene	917
Phenanthrene	543
Pyrene	344
Polychlorinated Biphenyls (μg/kg)	
Total PCBs	295

The PECQ for a given contaminant is calculated as the concentration of that contaminant in a given location within the lake divided by the PEC value associated with that contaminant. The PECQ is first calculated for the first five chemical parameter of interest (CPOI) groups (mercury, ethylbenzene and xylenes, chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) using detections. These values are then averaged to get the final mean PECQ for the station. For example, in a simplified hypothetical case where all contaminants for the five CPOI groups are detected at a station and PECQs of 1.0, 2.0, 3.0, 4.0 and 5.0 were calculated for the five groups, the mean PECQ for the station would be the average of the five PECQ values (i.e., (1.0+2.0+3.0+4.0+5.0)/5 = 3), resulting in a mean PECQ of 3.0 (i.e., 15/5) for the overall station.

Table 3 - Summary of Cost Estimate for Response Action 2
Removal for Cap Placement and Habitat Restoration

Item Number	Item Description	Item U/M	Bid Qty	Unit Cost	Total Cost
1	Site Preparation-Outboard Area Clearing	AC	17	$ 6,071.76	$ 103,220
2	Excavation of Upland Soil Material	CY	35,000	$ 11.17	$ 390,872
3	Grading and Onsite Management	CY	35,000	$ 21.80	$ 762,833
4	Hydraulic Dredging/Transportation to the SCA	CY	155,000	$ 16.66	$ 2,581,745
5	SCA Management	CY	155,000	$ 46.46	$ 7,201,732
6	SCA-Water Treatment After Geotube Dewatering	CY	155,000	$ 9.20	$ 1,426,000
7	Topsoil and Seeding - Stockpile Area	AC	6	$ 27,030	$ 162,179
8	Placement of Isolation Cap	AC	17	$ 303,054	$ 5,151,912
9	Habitat Layer Planting and Seeding	AC	17	$ 26,045	$ 442,765
10	Long Term Monitoring	AC	17	$ 9,450	$ 160,649

Subtotal Construction Costs	$ 18,383,907
Engineering, Design, and Construction Oversight (10%)	$ 1,838,391
Contingency Costs (15% of CC)	$ 2,757,586
Total (Rounded)	**$ 23,000,000**

Notes:

1. Response Action 2 includes excavation to EL 359.0 along the west wall down to elevation 357.0 along the west wall outboard shoreline, and elevation 359.25 along the east wall down to elevation 357.25 along the eastern outboard area shoreline. Includes subsequent installation of a cap consistent with the Onondaga Lake Cap. The finished grade of the cap varies from elevation 363.25 near the barrier wall to elevation 361.25 along the shoreline.

2. Onsite management of dry material will require a stockpile approximately 7' high above the existing surface, not including final cover and given an available area of approximately 6 acres.

3. Sediment dredging, transport and management at the SCA and water treatment operation costs consistent with the Onondaga Lake Feasibility Study (FS) Costs, value adjusted from 2004 to 2011 (7 years) at an annual rate of 2.5%.

4. Monitoring costs assume collection of 1 sample per acre every 5-years for 30 years at $1,000 ea. Value adjusted for present worth.

5. Isolation Cap based on the Onondaga Lake FS Costs adjusted from 2004 to 2011 (7 years) at an annual rate of 2.5%, with the addtion of carbon amendment at 0.5 lb/sf over the outboard area cap as well as an addition of siderite to the 10.3-acre area adjacent to the West Wall only at 1.5lb/sf.

Table 4 - Summary of Cost Estimate for Response Action 3
Removal for Cap Placement, Hot Spot Removal, and Habitat Restoration

Item Number	Item Description	Item U/M	Bid Qty	Unit Cost	Total Cost
1	Site Preparation-Outboard Area Clearing	AC	17	$ 6,071.76	$ 103,220
2	Excavation of Upland Soil Material	CY	35,000	$ 11.17	$ 390,872
3	Grading and Onsite Management	CY	35,000	$ 21.80	$ 762,833
4	Hydraulic Dredging/Transportation to the SCA	CY	164,000	$ 16.66	$ 2,731,653
5	SCA Management	CY	164,000	$ 46.46	$ 7,619,897
6	SCA-Water Treatment After Geotube Dewatering	CY	164,000	$ 9.20	$ 1,508,800
7	Topsoil and Seeding - Stockpile Area	AC	6	$ 27,030	$ 162,179
8	Placement of Isolation Cap	AC	17	$ 303,054	$ 5,151,912
9	Habitat Layer Planting and Seeding	AC	17	$ 26,045	$ 442,765
10	Long Term Monitoring	AC	17	$ 9,450	$ 160,649
	Subtotal Construction Costs				$ 19,034,780
	Engineering, Design, and Construction Oversight (10%)				$ 1,903,478
	Contingency Costs (15% of CC)				$ 2,855,217
	Total (Rounded)				**$ 24,000,000**

Notes:

1. Response Action 3, as with Response Action 2, includes similar excavation of Response Action 2, and also includes additional material removed for Hot Spots consistant with Onondaga Lake Hot Spot Criteria.

2. The volume of dry material is calculated amount above EL 364. Material below EL 364 is assumed to be removable by dredging.

3. Onsite management of dry material will require a stockpile approximately 7' high above the existing surface, not including final cover and given an available area of approximately 6 acres.

4. Sediment dredging, transport and management at the SCA and water treatment operation costs consistent with the Onondaga Lake Feasibility Study (FS) Costs, value adjusted from 2004 to 2011 (7 years) at an annual rate of 2.5%.

5. Monitoring costs assume collection of 1 sample per acre every 5-years for 30 years at $1,000 ea. Value adjusted for present worth.

6. Isolation Cap based on the Onondaga Lake FS Costs adjusted from 2004 to 2011 (7 years) at an annual rate of 2.5%, with the addtion of carbon amendment at 0.5 lb/sf over the outboard area cap as well as an addition of siderite to the 10.3-acre area adjacent to the West Wall only at 1.5lb/sf.

Table 5 - Summary of Cost Estimate for Response Action 4

Removal to Maximum Excavation Limits, Cap Placement, and Habitat Restoration

Item Number	Item Description	Item U/M	Bid Qty	Unit Cost	Total Cost
1	Site Preparation-Outboard Area Clearing	AC	17	$ 6,071.76	$ 103,220
2	Excavation of Upland Soil Material	CY	35,000	$ 11.17	$ 390,872
3	Grading and Onsite Management	CY	35,000	$ 21.80	$ 762,833
4	Hydraulic Dredging/Transportation to the SCA	CY	245,000	$ 16.66	$ 4,080,823
5	SCA Management	CY	245,000	$ 46.46	$ 11,383,382
6	SCA-Water Treatment After Geotube Dewatering	CY	245,000	$ 9.20	$ 2,254,000
7	Additional Backfill	CY	84,000	$ 30.77	$ 2,584,680
8	Topsoil and Seeding - Stockpile Area	AC	6	$ 27,030	$ 162,179
9	Placement of Isolation Cap	AC	17	$ 303,054	$ 5,151,912
10	Habitat Layer Planting and Seeding	AC	17	$ 26,045	$ 442,765
11	Long Term Monitoring	AC	17	$ 9,450	$ 160,649
	Subtotal Construction Costs				$ 27,477,315
	Engineering, Design, and Construction Oversight (10%)				$ 2,747,732
	Contingency Costs (15% of CC)				$ 4,121,597
	Total (Rounded)				**$ 34,000,000**

Notes:

1. Response Action 4 includes excavation to the maximum depth allowed for wall stability. The excavation depth removes hot spot dredging which is located within the maximum dredge limits.

2. The volume of dry material is calculated amount above EL 364. Material below EL 364 is assumed to be removable by dredging.

3. Onsite management of dry material will require a stockpile approximately 7' high above the existing surface, not including final cover and given an available area of approximately 6 acres.

4. Sediment dredging, transport and management at the SCA and water treatment operation costs consistent with the Onondaga Lake Feasibility Study (FS) Costs, value adjusted from 2004 to 2011 (7 years) at an annual rate of 2.5%.

5. Monitoring costs assume collection of 1 sample per acre every 5-years for 30 years at $1,000 ea. Value adjusted for present worth.

6. Isolation Cap based on the Onondaga Lake FS Costs adjusted from 2004 to 2011 (7 years) at an annual rate of 2.5%, with the addtion of carbon amendment at 0.5 lb/sf over the outboard area cap as well as an addition of siderite to the 10.3-acre area adjacent to the West Wall only at 1.5lb/sf.

Figures

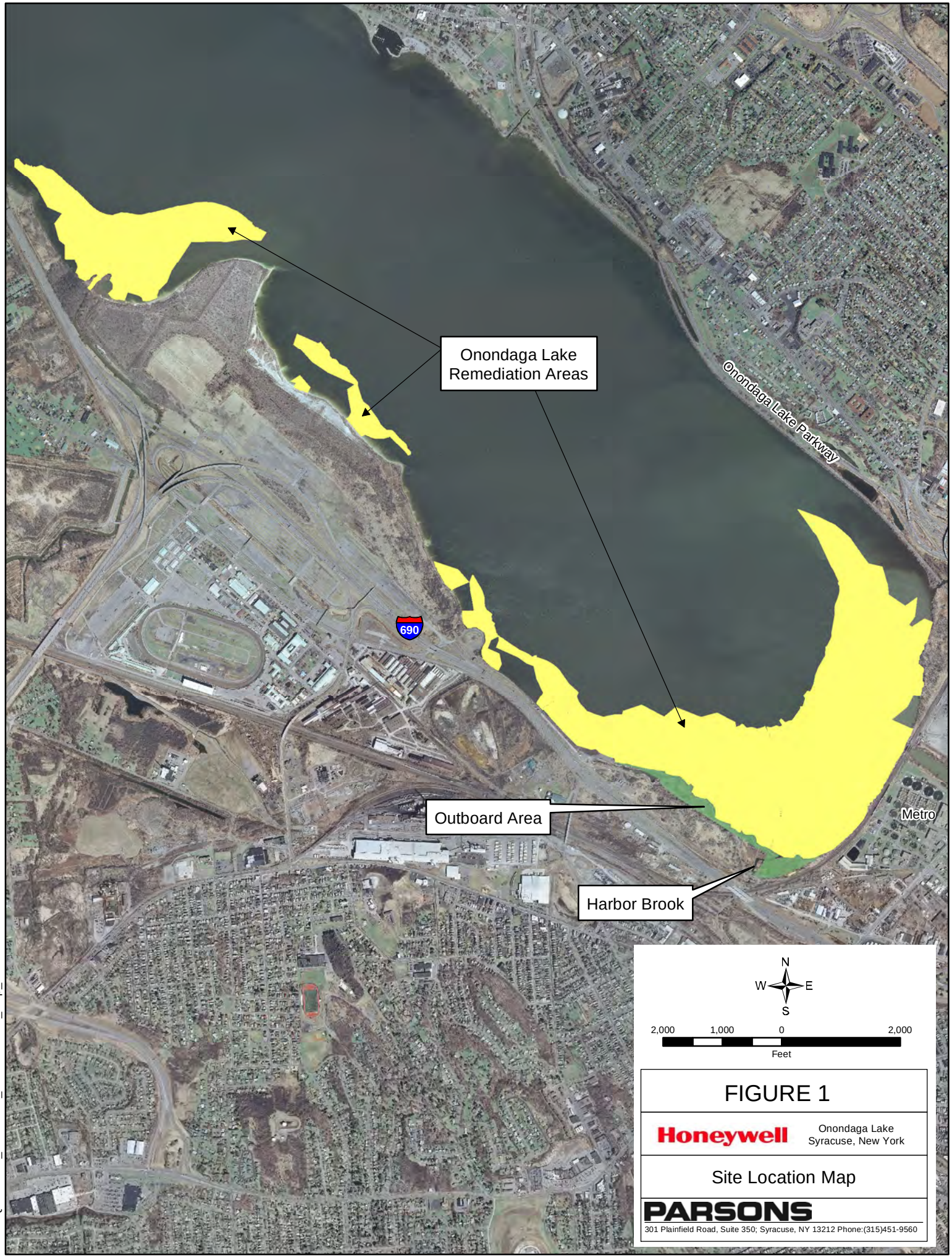

FIGURE 1

Honeywell

Onondaga Lake
Syracuse, New York

Site Location Map

PARSONS

301 Plainfield Road, Suite 350; Syracuse, NY 13212 Phone:(315)451-9560

Date Revised: 5/19/2011 4:22:38 PM

Path: Q:\GIS\GIS_Lake\WBB_HB\MXDs\Site_Map_aerials.mxd

FIGURE 2

Honeywell

Onondaga Lake
Syracuse, New York

Wastebed B/Harbor Brook Site and Outboard Area

PARSONS

301 Plainfield Road, Suite 350; Syracuse, NY 13212 Phone:(315)451-9560

Date Revised: 5/19/2011 4:34:50 PM

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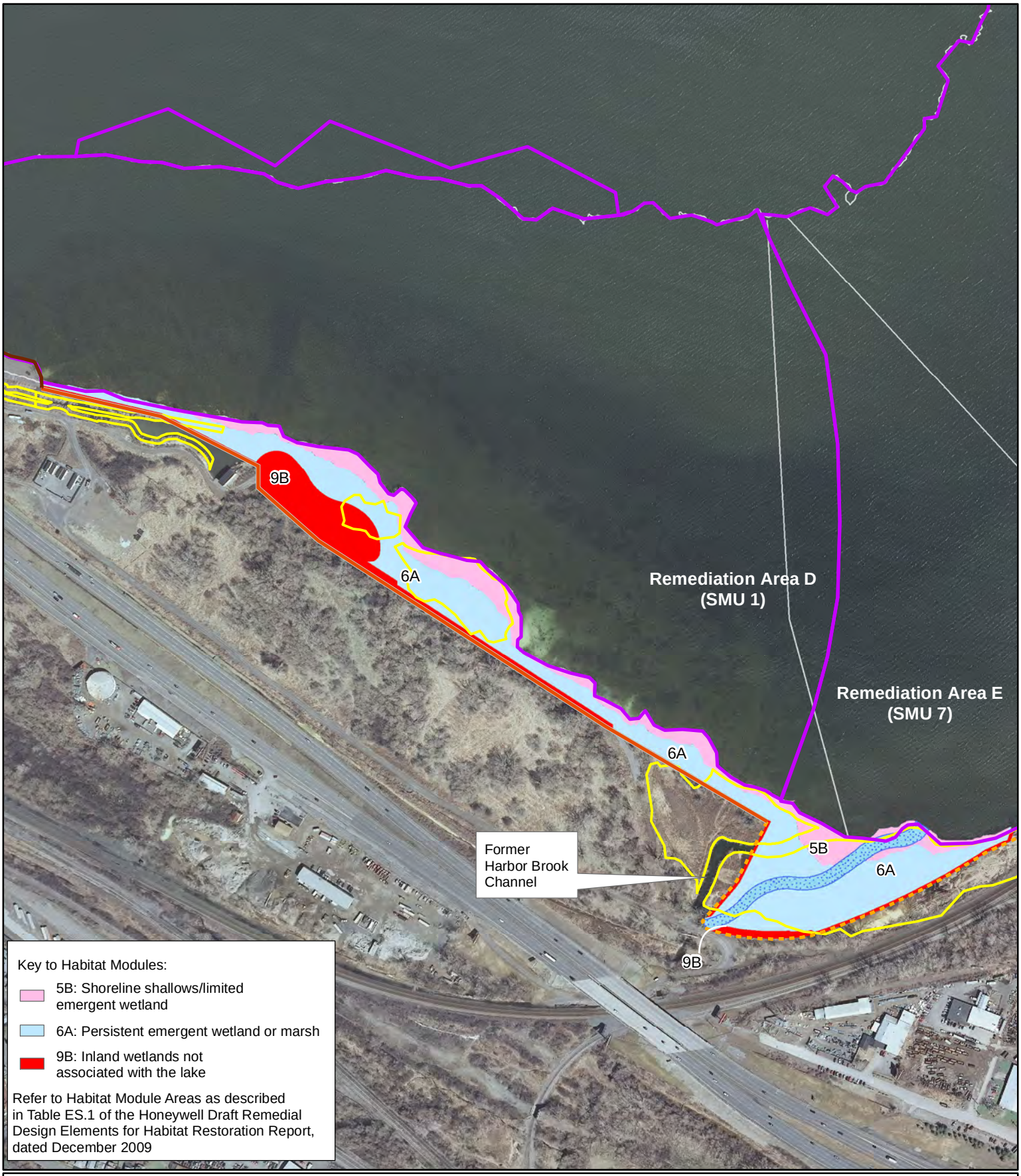

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NYSDEC Approved Wetland Boundaries

Sediment Management Unit (SMU) Boundary

Remediation Area Boundary (Parsons, 2010)

Approximate Final Harbor Brook Channel Alignment

Willis/Semet IRM Barrier Wall

West Wall Portion of the WB-B/HB IRM Barrier Wall

East Wall Portion of the WB-B/HB IRM Barrier Wall

Note: The East Flume has subsequently been filled in to elevation 365 (NAVD 88).

N W E S

New York State Digital Orthoimagery from 2009

0 150 300 600

Feet

FIGURE 4

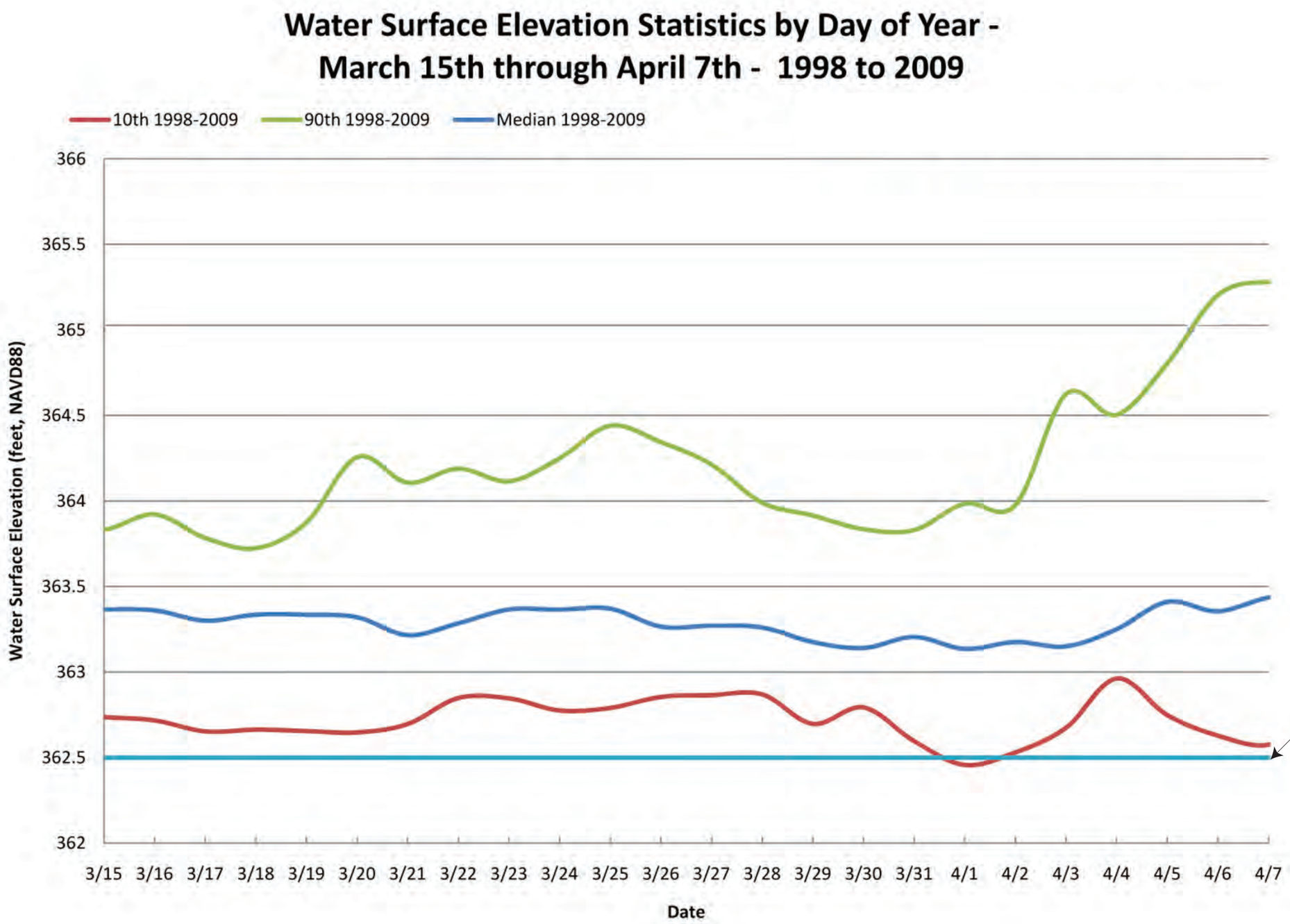
Honeywell

Onondaga Lake
Syracuse, New York

Conceptual Plan for Outboard Area Habitat Restoration

PARSONS

301 PLAINFIELD RD, SUITE 350; SYRACUSE, NY 13212



*NOTE:
May-October median water level during growing season 362.5 NAVD 88

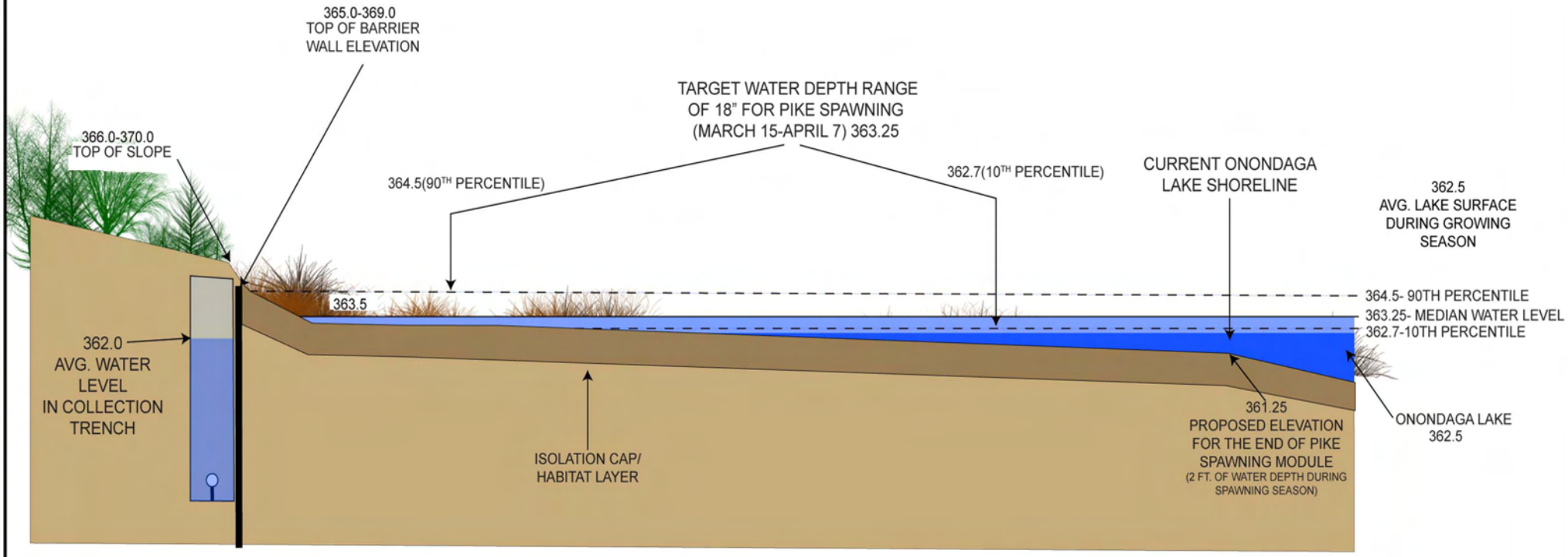
FIGURE 5

Honeywell

ONONDAGA LAKE
SYRACUSE, NEW YORK

Onondaga Lake Water Levels-
Harbor Brook Outboard Area Pike
Spawning Design Data

PARSONS
301 PLAINFIELD RD, SUITE 350; SYRACUSE, NY 13212



MEDIAN LAKE LEVEL DURING PIKE SPAWNING SEASON

MEDIAN LAKE LEVEL DURING GROWING SEASON

NOT TO SCALE

FIGURE 6

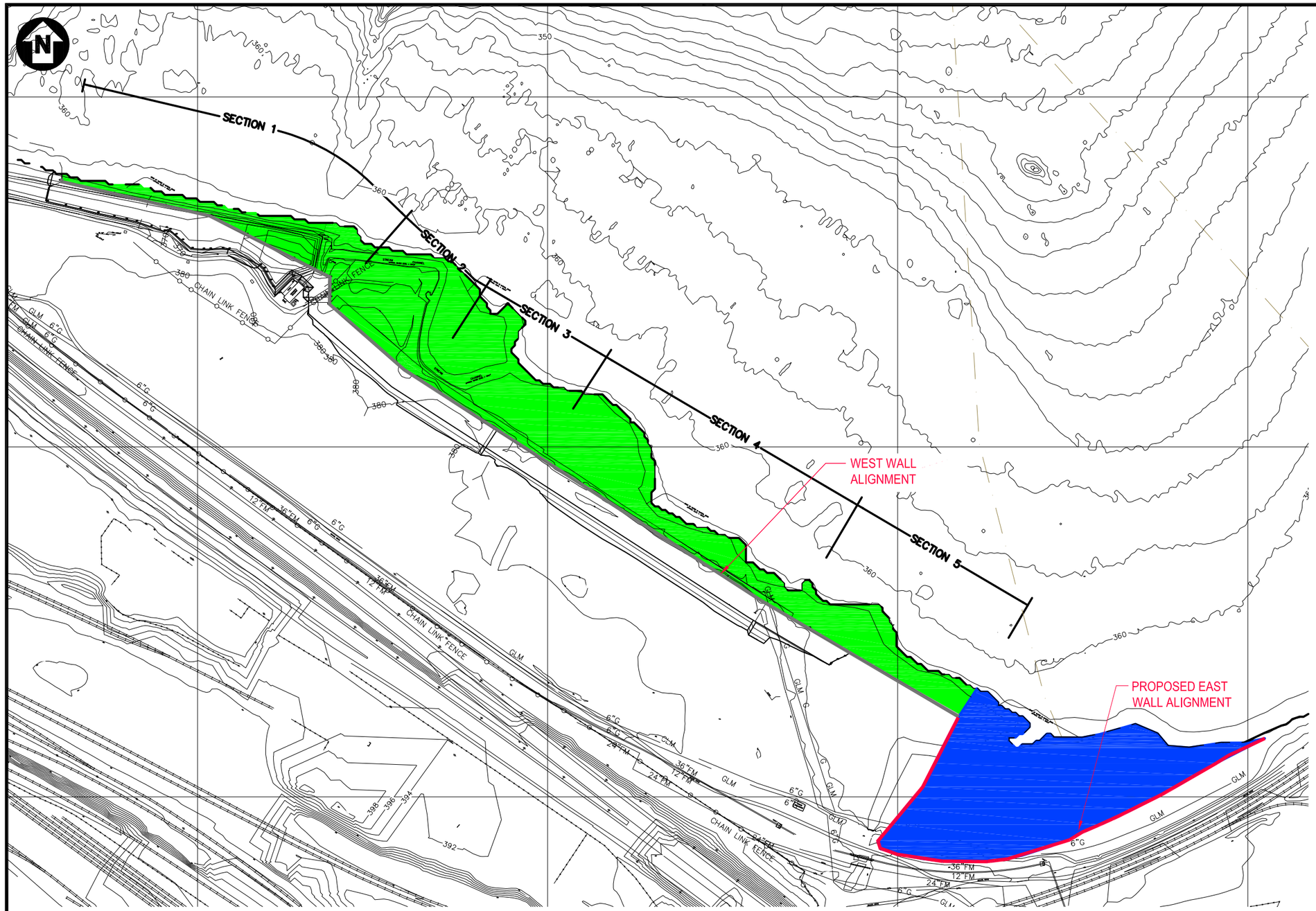
Honeywell

Onondaga Lake
Syracuse, New York

RESPONSE ACTION 2
REMOVAL AND RESTORATION
CONCEPTUAL CROSS SECTION

PARSONS

301 PLAINFIELD RD, SUITE 350; SYRACUSE, NY 13212



LEGEND:

360 — EXISTING GROUND ELEVATION (FEET) (NOTE 1)

EXISTING SHORELINE

PROPOSED WEST WALL ALIGNMENT

370 — PROPOSED CONTOURS (5 FT)

PROPOSED EAST WALL ALIGNMENT

PROPOSED EXCAVATION DEPTH
SEE NOTE 3

2–3 METERS

1–2 METERS

NOTES:

1. THE WB–B/HB TOPOGRAPHIC MAP DATED APRIL 18, 2008 WAS PREPARED BY CNY LAND SURVEYING. THE LAKE BATHYMETRIC CONTOUR MAP IS DATED 2006.
2. EXCAVATION DEPTHS PROVIDED SHOW ANTICIPATED MINIMUM REMOVAL FOR SUBSEQUENT PLACEMENT OF THE CAP AND HABITAT LAYER.
3. FIGURE SHOWS AVERAGE REMOVAL DEPTHS. THE ACTUAL REMOVAL DEPTHS AND ELEVATIONS WILL VARY THROUGHOUT THE AREA TO ACCOMMODATE THE EXISTING GRADE, TOP OF WALL ELEVATION, AND PROPOSED HABITAT FEATURES.
4. EAST FLUME HAS BEEN BACKFILLED TO ELEVATION 365 (NAVD 88)

300 150 0 300 600

SCALE: 1"=300'

FIGURE 7

Honeywell

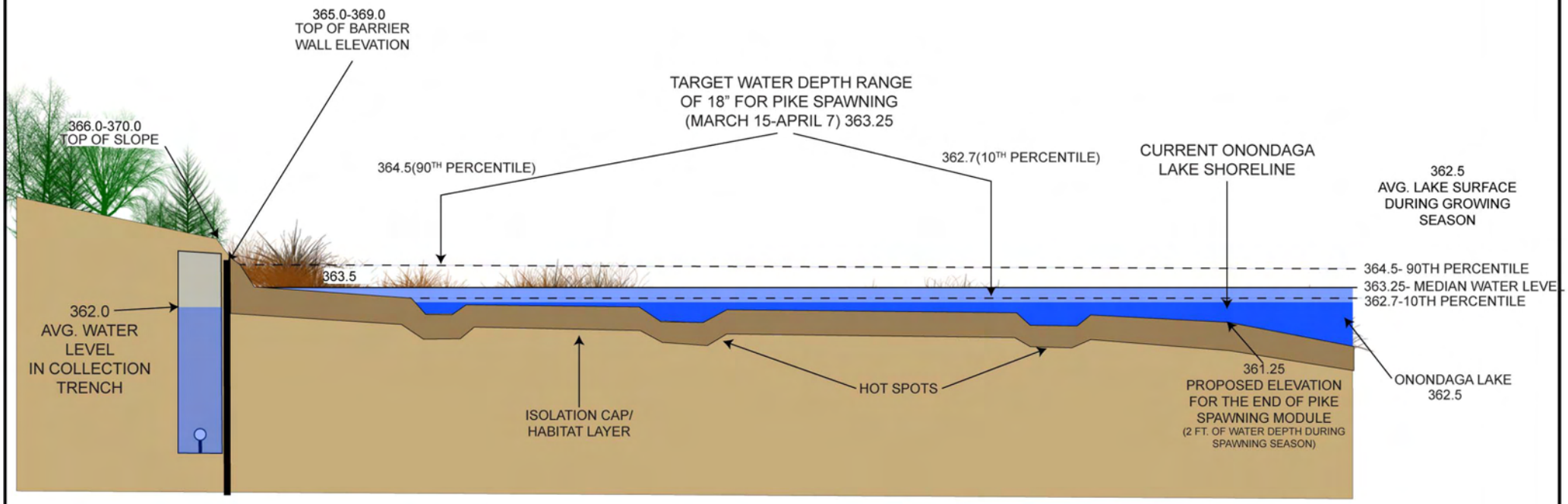
ONONDAGA LAKE WBB/HB IRM OUTBOARD AREA

REMOVAL DEPTHS & AREAS
RESPONSE ACTION 2

PARSONS

310 PLAINFIELD ROAD * SUITE 350 * SYRACUSE, NY 13212 * 315/451–9560
OFFICES IN PRINCIPAL CITIES

FILE NAME: P:\HONEYWELL –SYR\445308 WASTEBED B–HB OUTBOARD\10 TECHNICAL CATEGORIES\10.1 CAD\FIGURES\EE–CA\445308–EECA–003 (2).DWG
PLOT DATE: 1/25/2008 12:29 PM PLOTTED BY: RUSSO, JILL



MEDIAN LAKE LEVEL DURING PIKE SPAWNING SEASON

MEDIAN LAKE LEVEL DURING GROWING SEASON

NOT TO SCALE

FIGURE 8

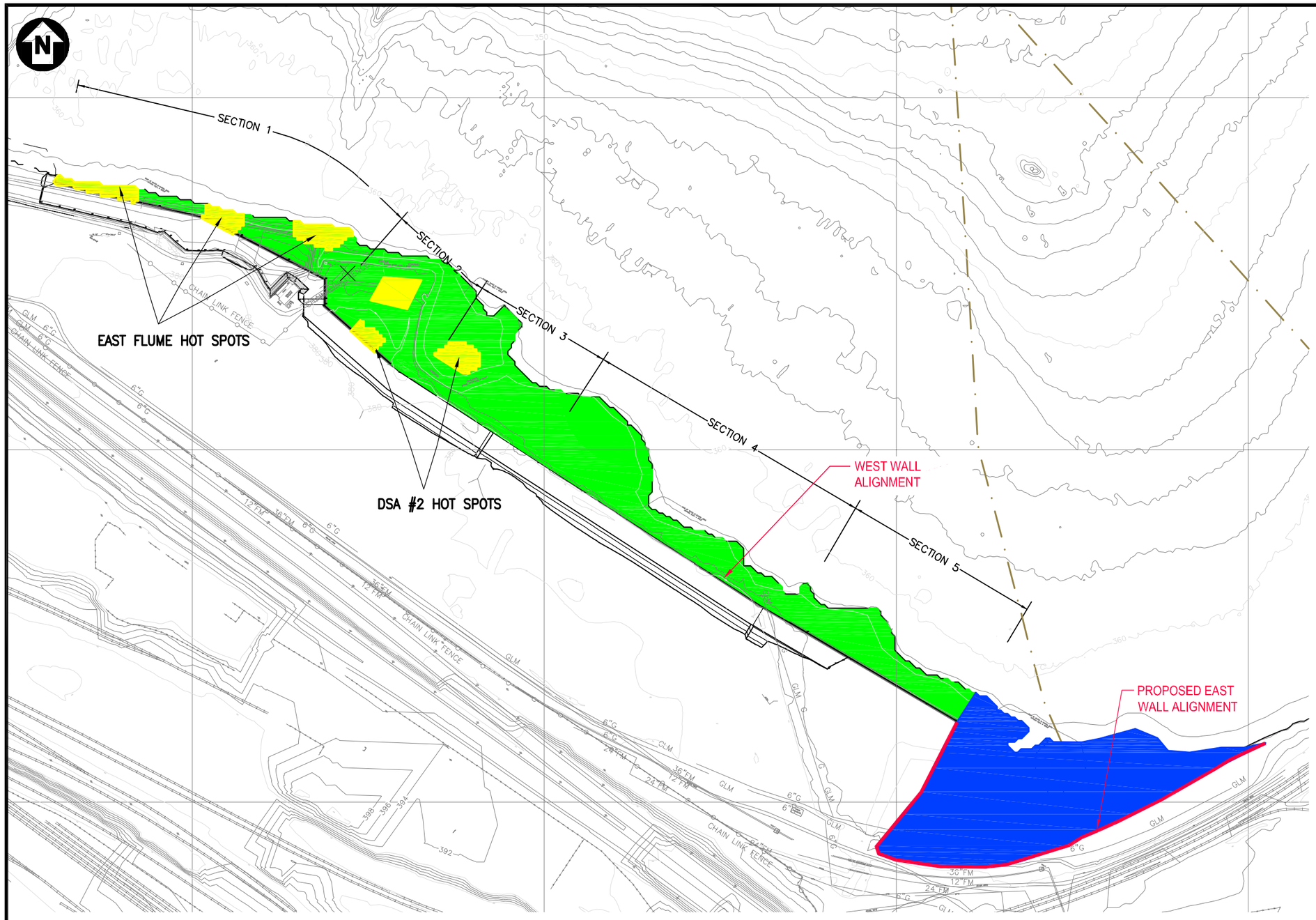
Honeywell

Onondaga Lake
Syracuse, New York

RESPONSE ACTION 3
REMOVAL AND RESTORATION
CONCEPTUAL CROSS SECTION

PARSONS

301 PLAINFIELD RD, SUITE 350; SYRACUSE, NY 13212



LEGEND:

- 360 — EXISTING GROUND ELEVATION (FEET) (NOTE 1)
- EXISTING SHORELINE
- PROPOSED WEST WALL ALIGNMENT
- 370 — PROPOSED CONTOURS (5 FT)
- PROPOSED EAST WALL ALIGNMENT

PROPOSED EXCAVATION DEPTH
SEE NOTE 3

- 2–3 METERS
- 1–2 METERS
- ADDITIONAL 1 METER HOT SPOT REMOVAL

NOTES:

1. THE WB–B/HB TOPOGRAPHIC MAP DATED APRIL 18, 2008 WAS PREPARED BY CNY LAND SURVEYING. THE LAKE BATHYMETRIC CONTOUR MAP IS DATED 2006.
2. EXCAVATION DEPTHS SHOWN FACILITATE REMOVAL OF MATERIAL FOR SUBSEQUENT PLACEMENT OF THE OUTBOARD CAP AND HABITAT LAYER AND FOR REMOVAL OF HOT SPOTS AND POTENTIAL HOT SPOTS.
3. FIGURE SHOWS AVERAGE REMOVAL DEPTHS. THE ACTUAL REMOVAL DEPTHS AND ELEVATIONS WILL VARY THROUGHOUT THE AREA TO ACCOMMODATE THE EXISTING GRADE, TOP OF WALL ELEVATION, AND PROPOSED HABITAT FEATURES.
4. EAST FLUME HAS BEEN BACKFILLED TO ELEVATION 365 (NAVD 88)

300 150 0 300 600

SCALE: 1"=300'

FIGURE 9

Honeywell

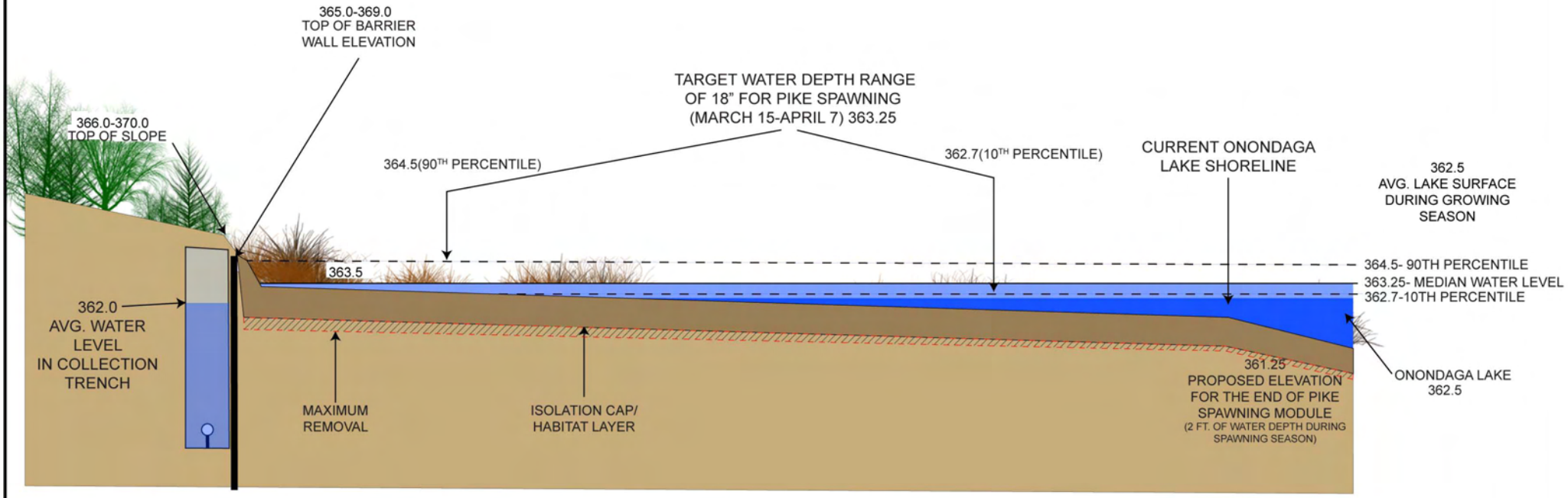
ONONDAGA LAKE WBB/HB IRM OUTBOARD AREA

REMEDIAL DEPTHS & AREAS
RESPONSE ACTION 3

PARSONS

310 PLAINFIELD ROAD • SUITE 350 • SYRACUSE, NY 13212 • 315/451–9560
OFFICES IN PRINCIPAL CITIES

FILE NAME: P:\HONEYWELL –SYR\446377 (WBB OUTBOARD)\10 TECHNICAL\10.1 CAD\FIGURES\EE-CA\446377-SK001-8-28-11.DWG
PLOT DATE: 1/25/2008 12:29 PM PLOTTED BY: RUSSO, JILL



MEDIAN LAKE LEVEL DURING PIKE SPAWNING SEASON

MEDIAN LAKE LEVEL DURING GROWING SEASON

NOT TO SCALE

FIGURE 10

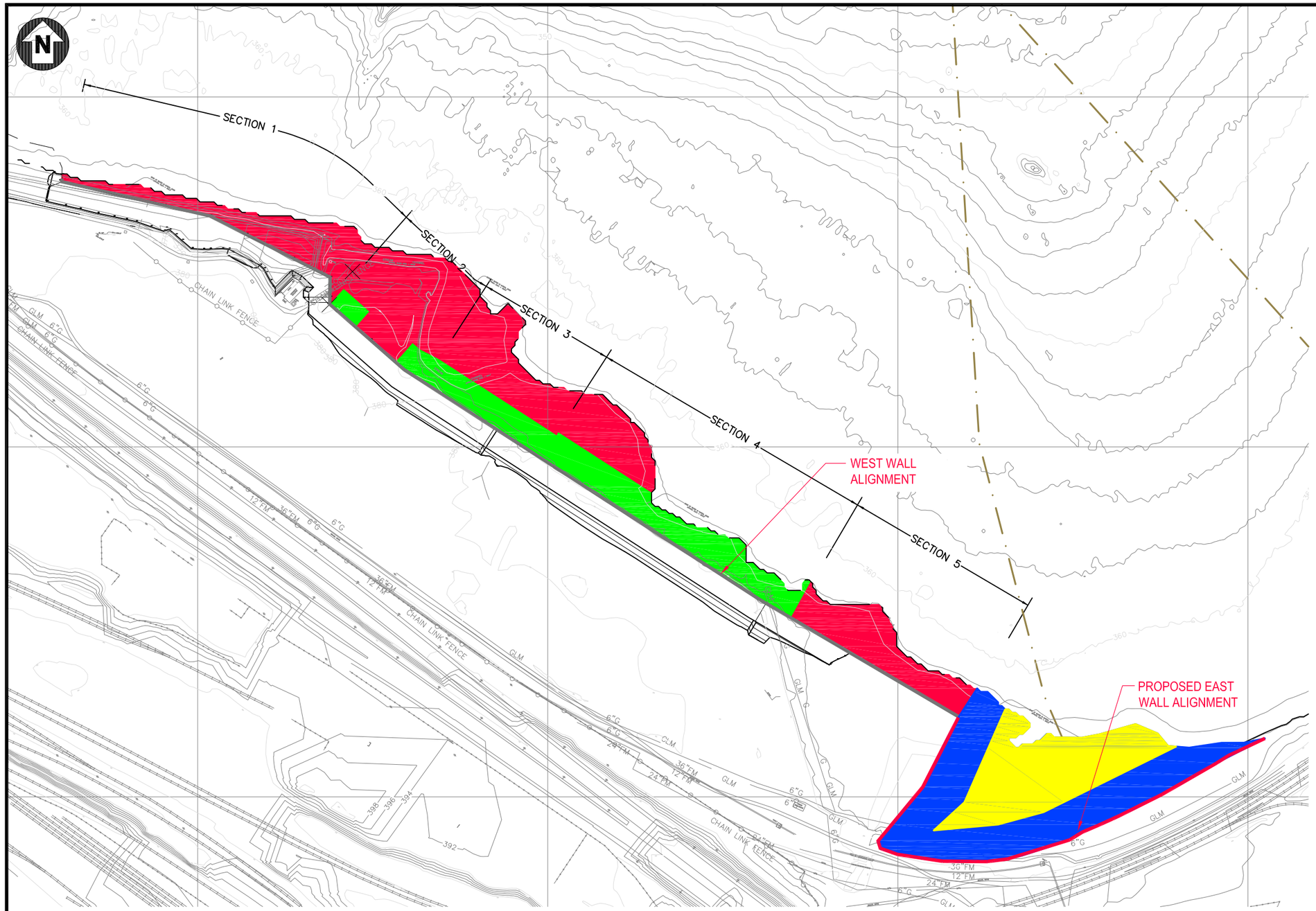
Honeywell

Onondaga Lake
Syracuse, New York

RESPONSE ACTION 4
REMOVAL AND RESTORATION
CONCEPTUAL CROSS SECTION

PARSONS

301 PLAINFIELD RD, SUITE 350; SYRACUSE, NY 13212



LEGEND:

360 — EXISTING GROUND ELEVATION (FEET) (NOTE 1)

EXISTING SHORELINE

PROPOSED WEST WALL ALIGNMENT

370 — PROPOSED CONTOURS (5 FT)

PROPOSED EAST WALL ALIGNMENT

PROPOSED EXCAVATION DEPTH
SEE NOTE 3

- 2–3 METERS
- 4 METERS
- 1–2 METERS
- 2–3 METERS (NOTE: REMOVAL CONSTRAINED BY STABILITY AND SEQUENTIAL EXCAVATION CONSIDERATIONS)

NOTES:

1. THE WB–B/HB TOPOGRAPHIC MAP DATED APRIL 18, 2008 WAS PREPARED BY CNY LAND SURVEYING. THE LAKE BATHYMETRIC CONTOUR MAP IS DATED 2006.
2. EXCAVATION DEPTHS PROVIDED SHOW MAXIMUM MATERIAL REMOVAL TO MAINTAIN SITE STABILITY.
3. FIGURE SHOWS AVERAGE REMOVAL DEPTHS. THE ACTUAL REMOVAL DEPTHS AND ELEVATIONS WILL VARY THROUGHOUT THE AREA TO ACCOMMODATE THE EXISTING GRADE, TOP OF WALL ELEVATION, AND PROPOSED HABITAT FEATURES.
4. EAST FLUME HAS BEEN BACKFILLED TO ELEVATION 365 (NAVD 88)

300 150 0 300 600

SCALE: 1"=300'

FIGURE 11

Honeywell

ONONDAGA LAKE WBB/HB IRM OUTBOARD AREA

REMOVAL DEPTHS & AREAS
RESPONSE ACTION 4

PARSONS
310 PLAINFIELD ROAD * SUITE 350 * SYRACUSE, NY 13212 * 315/451–9560
OFFICES IN PRINCIPAL CITIES

FILE NAME: P:\HONEYWELL –SYR\446377 (WBB OUTBOARD)\10 TECHNICAL\10.1 CAD\FIGURES\EE–CA\446377–SK002.DWG
PLOT DATE: 1/25/2008 12:29 PM PLOTTED BY: RUSSO, JILL