REMEDIAL DESIGN WORK PLAN
FOR THE ONONDAGA LAKE BOTTOM SUBSITE

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ACRONYMS AND ABBREVIATIONS

AMP	Ambient Monitoring Program
ARAR	Applicable or Relevant and Appropriate Requirements
BSQV	Bioaccumulation-Based Sediment Quality Value
CPOI	Chemical Parameters of Interest
FS	Feasibility Study
IDS	Initial Design Submittal
ILWD	In-Lake Waste Deposit
IRM	Interim Remedial Measure
MNR	Monitored Natural Recovery
NPL	National Priorities List
NAPL	Non-Aqueous Phase Liquids
NYSDEC	New York State Department of Environmental Conservation
OLP	Onondaga Lake Partnership
OM&M	Operation, Maintenance, and Monitoring
PDI	Pre-Design Investigation
PRG	Preliminary Remediation Goal
PSA	Preliminary Site Assessment
RA	Remedial Action
RAO	Remedial Action Objective
RI/FS	Remedial Investigation/Feasibility Study
RD	Remedial Design
ROD	Record of Decision
SCA	Sediment Consolidation Area
SMU	Sediment Management Unit
SUNY ESF	State University of New York College of Environmental Science and Forestry
TBC	To Be Considered
USEPA	Environmental Protection Agency

EXECUTIVE SUMMARY

This Remedial Design Work Plan has been prepared on behalf of Honeywell International Inc. (Honeywell) and presents the activities and sequencing necessary to complete remedial design of the remedy selected in the Record of Decision (ROD) issued by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) Region 2 in 2005 for the Onondaga Lake Bottom subsite. The NYSDEC and Honeywell have agreed to conditions under which Honeywell will design and implement the selected remedy, as set forth in the Consent Decree (United States District Court, Northern District of New York, 2007) (89-CV-815). The selected remedy provides for:

- dredging and proper management of as much as approximately 2,653,000 cubic yards of contaminated sediments and wastes;
- construction of an isolation cap over an estimated 425 acres in shallower areas (the littoral zone);
- construction of a thin-layer cap over an estimated 154 acres in the deeper areas (the profundal zone);
- performance of a pilot study that evaluates methods to prevent the formation of methylmercury in the deeper areas;
- re-establishment of habitat impacted by implementation of the remedy and enhancement of habitat in certain near-shore areas;
- monitored natural recovery (MNR) in portions of the deeper areas (the profundal zone);
- implementation of institutional controls; and
- long-term operation, maintenance and monitoring.

Given the central role played by the lake in the surrounding community, Honeywell is strongly committed to the implementation of the selected remedy that will help restore this important resource and enhance the overall quality of life within the community. The overall goal for remedial design and construction is to achieve the remedial action objectives (RAOs) and preliminary remediation goals (PRGs) developed as part of the Onondaga Lake Feasibility Study (Parsons, 2004) and set forth in the ROD. RAOs are identifiable goals to protect human health and the environment. PRGs are specific goals to achieve the RAOs and address the three primary affected media within the lake: sediment, biological tissues, and surface water.

The selected remedy relies upon the control of upland areas that contribute or have contributed contamination to Onondaga Lake. Remediation of contaminant sources is underway at multiple upland sites. Honeywell, under supervision from the NYSDEC, is nearing completion of remediation at the former Linden Chemical and Plastics (LCP) Bridge Street site

which was once one of the primary sources of mercury to Onondaga Lake. In 2005, Honeywell also began the Willis/Semet interim remedial measure (IRM) which includes the construction and operation of a groundwater treatment plant and underground barrier wall along the southwest shoreline of Onondaga Lake to control ongoing releases of contaminated groundwater from upland sites/sources.

Honeywell has conducted extensive pre-design activities to support design of the selected remedy and to supplement data collected by Honeywell and by others for the Remedial Investigation (TAMS Consultants, 2002) from 1992 to 2002. Pre-design activities have included Feasibility Study (Parsons, 2004) analyses, design-related investigation activities, bench-scale tests, siting of the Sediment Consolidation Area (SCA), nitrate addition/oxygenation evaluations, cultural resource assessment, wetlands and floodplain assessment, IRM design and construction, and coordination with other lake programs/projects. Design-related investigation activities have been conducted since 2005 to accelerate the design process and include: geotechnical testing and a settlement pilot study at the SCA; geophysical surveys; sediment sampling for chemical and geotechnical analyses; in-situ geotechnical testing of sediments; surface water and porewater sampling and analysis; seepage meter and Geoprobe™ measurements; sediment cores and borehole drilling to evaluate groundwater discharge and delineate contaminant extent; and installation and monitoring of two meteorological stations. These activities have provided more than 400 sediment cores, 60 borings, 7,300 environmental samples, and 120,000 chemical and geotechnical analyses through 2007 to support design of the selected remedy. Additional pre-design activities will be conducted as necessary to support the remedial design.

Honeywell will design and construct the lake bottom remedy on an accelerated basis, to the extent possible, using expedited pre-design, design, and construction of critical path components. The remedial design will include the preparation of four initial design submittals (IDSs):

- SCA Civil and Geotechnical;
- Dredging, SCA, and Water Treatment Operations;
- Sediment Cap and Dredge Area and Depth; and
- Thin-layer Capping, Nitrate Addition/Oxygenation, and MNR in Sediment Management Unit (SMU)-8.

Following completion of each IDS, Honeywell will prepare subsequent design submittals (e.g., intermediate and final designs) and specifications to construct the remedial design for the lake bottom. Subsequent design submittals will include supporting plans to the remedial design, such as a Health and Safety Plan. The remedial design process and sequencing of submittals allows for the acceleration of critical path activities including construction of the water (supernatant) treatment facility and the SCA and initiation of dredging within five years from entry of the Consent Decree.

Several organizations will be directly involved in the performance and review of the remedial design. Honeywell has retained professional consultants and subject matter experts to

perform the technical, engineering, and analytical aspects of the remedial design, including preparation of the design submittals. The NYSDEC and USEPA will review and approve plans, drawings, reports, and schedules submitted for the pre-design, remedial design, and remedial action. The NYSDEC will be assisted by retained professional consultants to assist in the oversight of pre-design investigation activities and remedial design review. Honeywell will distribute documents approved or accepted by NYSDEC within 14 days to the six public document repositories located in Syracuse, New York and vicinity.

Honeywell is committed to informing and involving the public during the Onondaga Lake remediation program. Honeywell has prepared a Citizen Participation Plan that provides a formal yet flexible plan for communication with the public during the Onondaga Lake remediation program.

SECTION 1

INTRODUCTION

This Remedial Design Work Plan has been prepared on behalf of Honeywell International Inc. (Honeywell) and presents the process to design the remedy for the Onondaga Lake Bottom subsite. The lake bottom is on the New York State Registry of Inactive Hazardous Waste Sites and is part of the Onondaga Lake National Priorities List (NPL) Site. Honeywell entered into a Consent Decree (United States District Court, Northern District of New York, 2007) (89-CV-815) with the New York State Department of Environmental Conservation (NYSDEC) to implement the selected remedy for Onondaga Lake as outlined in the Record of Decision (ROD) issued on July 1, 2005. The Consent Decree is the result of 12 years and 90,000 hours of intensive effort by world-class scientists, engineers and technicians working in cooperation with NYSDEC and the United States Environmental Protection Agency (USEPA). The following documents are appended to the Consent Decree: ROD, Explanation of Significant Differences, Statement of Work, and Environmental Easement.

The primary objective of this work plan is to provide the framework for implementing remedial design activities for the Lake Bottom subsite that is consistent with the Consent Decree. The Consent Decree requires this Remedial Design Work Plan to include the elements listed below.

- Description of remedial design activities with a schedule for performing these activities.
- Summary of pre-design investigation (PDI) field activities.
- Discussion of the need for further design-related investigation activities and need for a PDI work plan (including a quality assurance project plan and field sampling plan) and schedule for such activities.
- Plan for physical security and posting of the site.
- Health and Safety Plan to protect persons at and in the vicinity of the site during the remedial design program and during and after completion of remedial construction.
- Description of the remedial design, including remedial goals, and the means for implementing each element of the remedy to achieve those goals.
- Schedule for submitting remedial design documents.

Additionally, this Remedial Design Work Plan was developed consistent with applicable federal and state guidance documents for remedial design for a hazardous waste site (NYSDEC, 2002; USEPA, 1995a and b; and USEPA, 2005).

1.1 ONONDAGA LAKE SUBSITE DESCRIPTION

Onondaga Lake is a 4.6 square mile (3,000 acre) lake located in Central New York State immediately northwest of the City of Syracuse. The lake is approximately 4.5 miles long and 1 mile wide, with an average water depth of 36 ft. The lake has two deep basins, a northern basin and a southern basin, that have maximum water depths of approximately 61 and 65 ft, respectively. The basins are separated by a saddle region at a water depth of approximately 56 ft. Most of the lake has a broad nearshore shelf with water depths less than 12 ft. This nearshore shelf is bordered by a steep offshore slope in water depths of 12 to 24 ft (TAMS Consultants, 2002).

Ninemile Creek and Onondaga Creek are the two largest tributaries to Onondaga Lake. Other tributaries in a clockwise direction from the southeast section of the lake include Ley Creek, Harbor Brook, the East Flume, Tributary 5A, Sawmill Creek, and Bloody Brook (see Figure 1.1). In addition to the tributary streams, the treated effluent from the Onondaga County Metropolitan Wastewater Treatment Plant (Metro), located between Onondaga Creek and Harbor Brook, provides a significant portion of the water entering the lake.

Central New York State has experienced significant growth in the twentieth century. As a result, the area around Onondaga Lake is mostly urban. The City of Syracuse is located at the southern end of Onondaga Lake, and numerous towns, villages, and major roadways surround the lake (see Figure 1.1). The eastern shore of Onondaga Lake is urban and residential, while the northern shore is dominated by parkland, wooded acres, and wetlands. The northwest upland areas in Liverpool and Lakeland are mainly residential, with interspersed urban structures and several undeveloped areas. Much of the western and southern lakeshore is covered by wastebeds that received wastes generated from Honeywell's former Allied Signal, Solvay operations. Urban centers and industrial zones in Syracuse and Solvay dominate the landscape surrounding the southern and eastern shores of Onondaga Lake from approximately the New York State Fairgrounds south to Ley Creek.

For investigation and remediation purposes, the sediments in the lake are divided into two regions: the littoral zone (shallower area) and profundal zone (deeper area). The littoral zone includes sediments along the shoreline in less than 30 ft (9 m) of water that are in contact with the epilimnion – the uppermost warm-water layer. The profundal zone includes sediments in the deep basins in more than 30 ft (9 m) of water that are in contact with the hypolimnion – the deeper, colder, and denser water layer. Additionally, the site has been divided into eight Sediment Management Units (SMUs) based on water depth, source of water entering the lake, and physical, ecological, and chemical characteristics (NYSDEC and USEPA, 2005). SMUs 1 through 7 are located in the littoral zone of the lake where most aquatic vegetation and aquatic life reside, while SMU 8 consists of sediment in the profundal zone (see Figure 1.2).

1.2 REMEDIATION OBJECTIVES AND GOALS

Remedial action objectives (RAOs) are identifiable goals to protect human health and the environment. RAOs for Onondaga Lake, as per the ROD, are listed below.

- "RAO 1: To eliminate or reduce, to the extent practicable, methylation of mercury in the hypolimnion."
- "RAO 2: To eliminate or reduce, to the extent practicable, releases of contaminants from the in-lake waste deposit (ILWD) and other littoral areas around the lake."
- "RAO 3: To eliminate or reduce, to the extent practicable, releases of mercury from profundal (SMU 8) sediments."
- "RAO 4: 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."
- "RAO 5: To achieve surface water quality standards, to the extent practicable, associated with chemical parameters of interest (CPOIs)" (NYSDEC and USEPA, 2005, p. 35).

To achieve the RAOs, preliminary remediation goals (PRGs) were developed to provide specific goals to address the three primary affected media within the lake: sediment, biological tissue, and surface water. PRGs for Onondaga Lake, as per the ROD, are listed below.

- "PRG 1: Achieve applicable and appropriate sediment effects concentrations (SECs) for CPOIs and the bioaccumulation-based sediment quality value (BSQV) of 0.8 mg/kg for mercury, to the extent practicable, by reducing, containing, or controlling CPOIs in profundal and littoral sediments."
- "PRG 2: Achieve CPOI concentrations in fish tissue that are protective of humans and wildlife that consume fish. This includes a mercury concentration of 0.2 mg/kg in fish tissue (fillets) for protection of human health based on the reasonable maximum exposure scenario and USEPA's methylmercury National Recommended Water Quality criterion for the protection of human health for the consumption of organisms of 0.3 mg/kg in fish tissue. This also includes a mercury concentration of 0.14 mg/kg in fish (whole body) for protection of ecological receptors. These values represent the range of fish tissue PRGs."
- "PRG 3: Achieve surface water quality standards, to the extent practicable, associated with CPOIs" (NYSDEC and USEPA, 2005, p. 35).

PRG 1 addresses RAOs 1 through 4. PRG 2 primarily addresses RAO 4. PRG 3 addresses RAO 5.

1.3 REMEDY OF RECORD

The ROD for the lake bottom presents the remedy selected by NYSDEC and USEPA for addressing the RAOs and PRGs presented in Section 1.2 above. The Statement of Work, presented as Appendix C of the Consent Decree, further describes design-related elements for the implementation of the remedy, such as the development of dredging areas and volume; isolation cap areas, models and components; profundal zone (SMU 8); management of dredged sediments; water treatment system; and design and construction schedule.

Major components of the selected remedy, set forth in the ROD and Statement of Work, are summarized as follows (United States District Court, 2007 – appendices to the Consent Decree):

- "Dredging of as much as an estimated 2,653,000 cubic yards (cy) of contaminated sediment/waste from the littoral zone in Sediment Management Units (SMUs) 1 through 7 to a depth that will prevent the loss of lake surface area, ensure cap effectiveness, remove non-aqueous-phase liquids (NAPLs), reduce contaminant mass, allow for erosion protection, and re-establish the littoral zone habitat. Most of the dredging will be performed in the ILWD (which largely exists in SMU 1) and in SMU 2."
- Dredging, as needed, of an additional 3.3 ft in the ILWD to remove materials within areas of hot spots (to improve cap effectiveness) and additional dredging, as needed, to ensure stability of the cap.
- "Placement of an isolation cap over an estimated 425 acres of SMUs 1 through 7."
- "Construction/operation of a hydraulic control system along the SMU 7 shoreline to maintain cap effectiveness. In addition, the remedy for SMUs 1 and 2 will rely upon the proper operation of the hydraulic control system, which is being designed under interim remedial measures (IRMs) presently underway at the Semet Residue Ponds, Willis Avenue, and Wastebed B/Harbor Brook subsites to control migration of contamination to the lake via groundwater from the adjacent upland areas."
- "Placement of a thin-layer cap over an estimated 154 acres of the profundal zone."
- The majority of the "dredged sediment will be placed in one or more Sediment Consolidation Areas (SCAs), which will be constructed on one or more of Honeywell's Solvay wastebeds that historically received process wastes from Honeywell's former operations. The containment area will include, at a minimum, the installation of a liner, a cap, and a leachate collection and treatment system."
- "Treatment of water generated by dredging and sediment handling processes to meet NYSDEC discharge limits."
- "Completion of a comprehensive lake-wide habitat restoration plan."
- "Habitat reestablishment will be performed consistent with the lakewide habitat restoration plan in areas of dredging/capping."

- "A pilot study will be performed to evaluate the potential effectiveness of oxygenation at reducing the formation of methylmercury in the water column, while preserving the normal cycle of stratification within the lake. An additional factor which will be considered during the design of the pilot study will be the effectiveness of oxygenation at reducing fish tissue methylmercury concentrations. If supported by the pilot study results, the pilot study will be followed by full-scale implementation of oxygenation in SMU 8. Furthermore, potential impacts of oxygenation on the lake system will be evaluated during the pilot study and/or the remedial design of the full-scale oxygenation system." In addition, as discussed in the Statement of Work, a study will be performed to determine if nitrification can effectively reduce formation of methyl mercury in the water column while preserving the normal cycle of lake stratification. If NYSDEC determines from this study that nitrification is effective and appropriate, a nitrification program will be implemented in lieu of oxygenation."
- Monitored natural recovery (MNR) in SMU 8 to achieve the mercury PEC (probable effect concentration) of 2.2 milligrams per kilogram (mg/kg or part per million) in the lake's profundal zone (where water depths exceed 9 meters or 30 feet) and to achieve the bioaccumulation-based sediment quality value (BSQV) for mercury of 0.8 mg/kg on an area-wide basis, within 10 years following the remediation of upland sources, dredging and/or isolation capping of littoral sediment, and initial thin-layer capping in the profundal zone. "An investigation will be conducted during the remedial design to refine the application of an MNR model and determine any additional remedial measures (e.g., additional thin-layer capping) needed in the profundal zone."
- "Investigation during the remedial design to determine the appropriate area-wide basis for the application of the BSQV of 0.8 mg/kg. During remedy implementation, additional remedial measures may be needed (e.g., thin-layer capping) to meet the BSQV on an area-wide basis."
- "Implementation of institutional controls including the notification of appropriate governmental agencies with authority for permitting potential future activities which could impact the implementation and effectiveness of the remedy."
- "Implementation of a long-term operation, maintenance, and monitoring (OM&M) program to monitor and maintain the effectiveness of the remedy".

Annually, it will be certified that the institutional controls are in place and that Honeywell is performing remedy-related OM&M.

A draft Phase 1A Cultural Resource Assessment for various areas including Onondaga Lake was prepared for the selected remedy. "If, based upon the results of this Cultural Resource Assessment, a Phase 1B Cultural Resource Assessment (to locate culturally sensitive areas) is determined necessary, it would be performed during the remedial design phase" (NYSDEC and USEPA, 2005, p. iii).

"The selected remedy also includes habitat enhancement, which is an improvement of habitat conditions in areas where CERCLA contaminants do not occur at levels that warrant active remediation, but where habitat impairment due to stressors has been identified as a concern. Habitat enhancement will be performed along an estimated 1.5 mi (2.4 km) of shoreline (SMU 3) and over approximately 23 acres (SMU 5). Habitat enhancement will be performed consistent with the lakewide habitat restoration plan" (NYSDEC and USEPA, 2005, p. iii-iv). The lakewide habitat restoration plan is hereafter referred to as Remedial Design Elements for Habitat Restoration, which is described in Sections 2 and 3 of this Work Plan.

The selected remedy addresses all areas of the lake where the surface sediments exceed a mean probable effect concentration quotient of 1 or the mercury probable effect concentration of 2.2 milligrams per kilogram (mg/kg). "The selected remedy will also attain a 0.8 mg/kg BSQV for mercury on an area-wide basis for the lake and other applicable areas of the lake to be determined during the remedial design. The selected remedy is also intended to achieve lakewide fish tissue mercury concentrations ranging from 0.14 mg/kg, which is for protection of ecological receptors, to 0.3 mg/kg, which is based on EPA's methylmercury National Recommended Water Quality criterion for the protection of human health for the consumption of organisms." (NYSDEC and USEPA, 2005, p. 73). The depth of surface sediments will be defined as part of upcoming design efforts. If the selected remedy does not at least achieve the range of fish tissue PRGs specified in the ROD, the remedy will be reevaluated at a minimum as part of the five-year review under CERCLA, and could be addressed through a modification of the ROD.

An evaluation was performed to assess potential locations for building and operating an SCA to contain sediment removed from Onondaga Lake during the remedial action, as documented in *Onondaga Lake SCA Siting Evaluation* (Parsons, 2006a). Each of Honeywell's Solvay wastebeds was evaluated as a potential location for an SCA based on accessibility, estimated capacity, current and future site use, geotechnical considerations, and potential community impacts. Based on evaluation results, Wastebed 13 was selected for building and operating an SCA (Figure 1.2). The SCA will be designed, constructed, operated and maintained in accordance with the substantive requirements of NYSDEC Regulations Part 360, Section 2.14(a) (industrial monofills).

The NYSDEC and USEPA issued an Explanation of Significant Differences as Appendix B of the Consent Decree to specify a modification to the selected remedy documented in the ROD. Based on PDI data and a stability evaluation, there was significantly less NAPL-impacted material beneath the lake in SMU 2 than was assumed during the FS and ROD, and removing this material could result in instability of the adjacent shoreline. Therefore, the alignment of the Willis/Semet IRM barrier wall (Willis portion) was moved off-shore immediately beyond the farthest extent of pooled NAPLs within the lake. In addition, recovery wells will be installed landward of the new barrier wall, between the barrier wall and the causeway. Existing upland areas adjacent to Onondaga Lake will be converted to new aquatic habitat to mitigate the loss of habitat resulting from placement of the barrier wall off-shore.

1.4 DESCRIPTION OF UPLAND SITES/SOURCES

Onondaga Lake and several areas upland that contribute or have contributed contamination to the lake system are part of USEPA's National Priorities List (NPL) Onondaga Lake site. The NYSDEC and USEPA have, to date, organized the work for the Onondaga Lake NPL site into eight NPL subsites, five of which are Honeywell's responsibility (see Figure 1.1). In accordance with various agreements, Honeywell has assumed responsibility for the following four NPL subsites in addition to the lake bottom NPL subsite. Whether a site is subject to a Remedial Investigation/Feasibility Study (RI/FS), Preliminary Site Assessment (PSA), Remedial Design/Remedial Action (RD/RA), or closure is also indicated below:

- Linden Chemical and Plastics (LCP) Bridge Street Operable Unit No. 1 (remediated and now subject to closure),
- Semet Residue Ponds (subject to a RI/FS and RD/RA),
- Willis Avenue (subject to a RI/FS), and
- Wastebed B/Harbor Brook (subject to a RI/FS).

The Geddes Brook/Ninemile Creek site, which is an operable unit of the lake bottom subsite, is subject to a RI/FS.

In addition to the Onondaga Lake NPL subsites, there are state-lead sites for which Honeywell has assumed responsibility in accordance with agreements:

- Ballfield (subject to a RI/FS),
- LCP Bridge Street OU-2 (subject to a RI/FS),
- Mathews Avenue (subject to a PSA),
- Wastebeds 1 through 8 (subject to a RI/FS),
- Wastebeds 9 through 15 (subject to closure), and the
- Dredge Spoils Area (subject to a PSA).

Interim remedial measures (IRMs) are at present or are anticipated to be elements of remedies for the following sites: Willis/Semet (shoreline barrier wall and groundwater treatment plant), Wastebed B/Harbor Brook (shoreline barrier wall extension and remediation of the East Flume), and Geddes Brook/Ninemile Creek (removal of sediment and floodplain soils from the lowermost section of Geddes Brook).

The ROD describes the importance of controlling upland sources of contamination to the lake system. The ROD states "The remediation of the Onondaga Lake subsite will need to be coordinated with upland remedial activities. The control of contamination migrating to the lake from various upland sites (e.g., Willis Avenue, Semet Residue Ponds, Wastebed B/Harbor Brook, LCP Bridge Street, and Geddes Brook/Ninemile Creek) is an integral part of the overall cleanup of Onondaga Lake. To prevent the recontamination of lake sediments, active sources of

contamination to a given portion of the lake will need to be shut off prior to performing cleanup activities in that area of the lake. For example, the hydraulic control systems which are being installed/operated as part of the Wastebed B/Harbor Brook and Willis/Semet Barrier IRMs will address the ongoing releases of contaminants from these upland areas to SMUs 1 and 2, respectively. These systems will need to be constructed and in operation prior to cleanup activities commencing in this part of the lake" (NYSDEC and USEPA, 2005, p. 80).

Given that these active upland sources of contamination will need to be shut off prior to dredging in a respective area of the lake, Honeywell is drafting a schedule for remedial activities for various upland sites, as well as the lake. As the remedial design proceeds, NYSDEC and Honeywell will provide the public with projected milestone dates for performing remedial activities in the lake, as well as at the various upland sites.

Honeywell has made significant progress with the remediation of upland sites. Honeywell has completed construction of the remedy at the LCP site (Operable Unit No. 1) in the Town of Geddes, a former Allied Chemical property that was one of the primary sources of mercury contamination to Onondaga Lake. Under direction of the NYSDEC, the cleanup program at the LCP site involved a combination of mercury removal from soil on the former plant property; excavation of contaminated sediments in surrounding areas; installation of an on-site groundwater collection system; and the construction of a five-story deep, underground cut off wall to prevent any future contaminant migration from the site. As part of the remediation, Honeywell has removed 15,300 pounds (nearly eight tons) of mercury from plant property through "soil washing." The mercury was recycled and the remaining soil was consolidated and capped at the LCP site. Remediation and restoration activities at the LCP site, with the exception of the permanent cover/cap, were completed in 2007. Groundwater collection at the LCP site is ongoing. The permanent cover/cap will be placed in the future as part of the site closure effort.

Honeywell has also made significant progress with installing a hydraulic barrier wall and groundwater treatment plant, as part of the Willis/Semet Barrier IRM, to prevent contaminated groundwater from entering the lake. Approximately 1,200 feet of an underground barrier wall (the Semet portion), constructed of interlocking steel panels, and was installed along the southwest shoreline of Onondaga Lake in 2006 as part of an IRM. Additionally, Honeywell completed construction of a groundwater treatment plant in 2006, one year ahead of schedule, to collect, process, and treat contaminated groundwater that will accumulate behind the underground barrier wall. Installation of an additional 1,600 feet of nearshore underground barrier wall (the Willis portion of the IRM) began during the summer of 2008.

1.5 OVERVIEW OF REMEDIAL DESIGN REQUIREMENTS

The primary objective of the remedial design is to develop plans and specifications for implementing the selected remedy consistent with the Consent Decree. Remedial design requirements presented in Consent Decree are quoted below.

- "A detailed description of remedial goals for the site, as set forth in the ROD";

- "A detailed description of each element of the remedy and the means by which each element will be implemented to achieve the remedial goals for the site…";
- " 'Biddable Quality' documents for the remedial design including, but not limited to, documents and specifications prepared, signed, and sealed by a professional engineer. These plans shall be consistent with all applicable local, state, and federal laws, rules, and regulations";
- "A detailed time schedule to implement the remedial design";
- "The parameters, conditions, procedures, and protocols to determine the effectiveness of the remedial design, including a schedule for periodic sampling of all relevant environmental media, on-site and off-site";
- "A description of operation, maintenance, and monitoring ('OM&M') activities to be undertaken at and in the vicinity of the Site, which details the operation and maintenance procedures to be employed during system startup as well as on a long-term basis, and which describes the long-term OM&M strategy and schedule";
- "A contingency plan to be implemented if any element of the remedial design, when implemented, fails to achieve any of its objectives or otherwise fails to protect human health or the environment, to ensure that such objectives and protections are achieved ('Remedial Program Contingency Plans')"; and
- "A citizen participation plan which incorporates appropriate activities outlined in the NYSDEC's publication, *Citizen Participation in New York's Hazardous Waste Site Remediation Program- A Guidebook*, dated June 1998, and any subsequent revisions thereto, and 6 NYCRR Part 375" (United States District Court, Northern District of New York, 2007, paragraph 29).

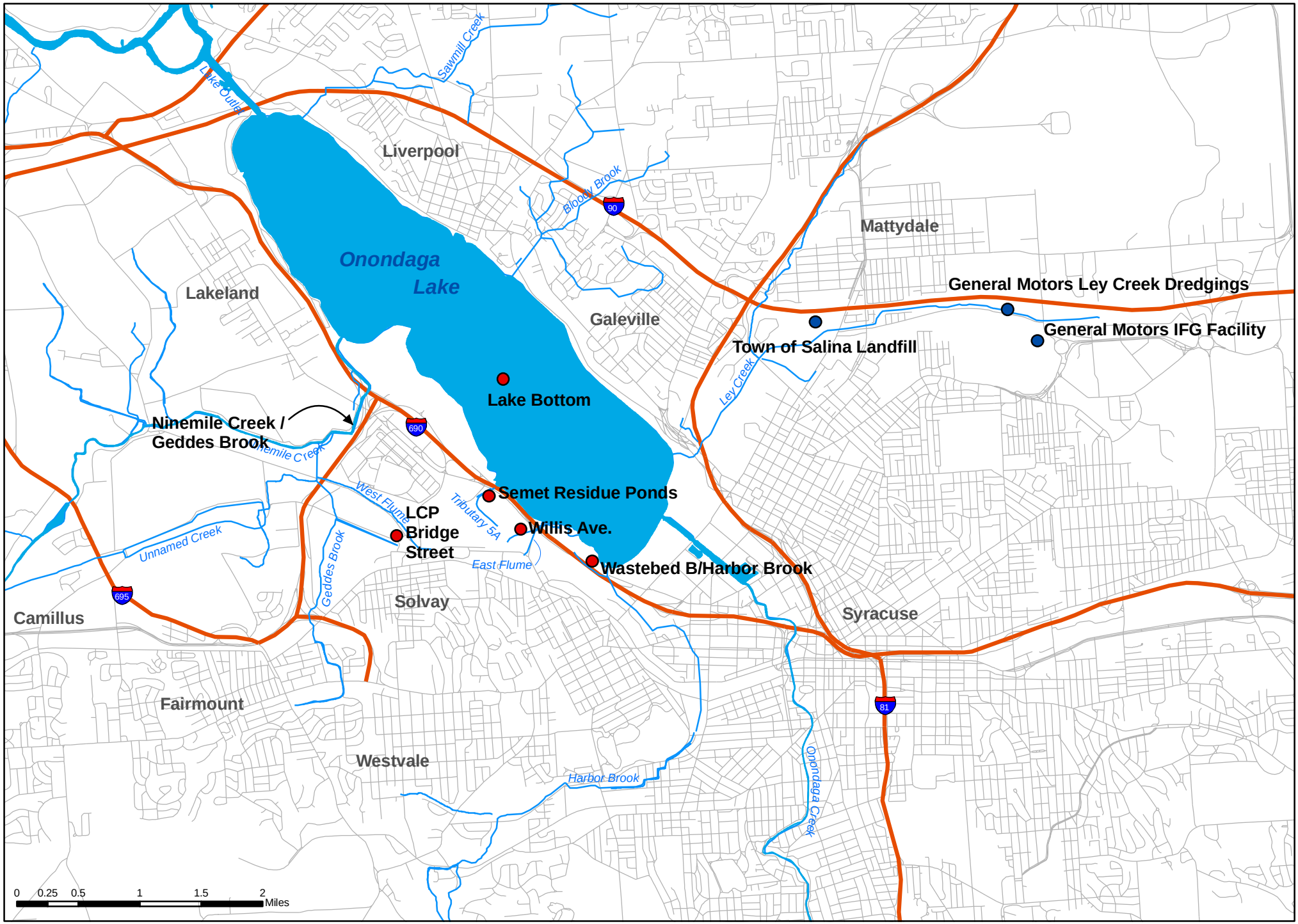
Specific activities to accomplish the remedial design requirements, thus achieving the primary remedial design objective, are described within this Work Plan.

1.6 WORK PLAN ORGANIZATION

This Remedial Design Work Plan is organized into six sections and two appendices.

- Section 1: Introduction – presents background information, project objectives, and remedial goals for the site.
- Section 2: Pre-Design Activities to Date – describes pre-design activities conducted to date by Honeywell as well as other monitoring efforts that may be of value during the remedial design.
- Section 3: Future Design Related Activities - presents available information about objectives and plans for further PDI work.
- Section 4: Remedial Design Process – describes the engineering design processes and deliverables to be produced to address each element of the selected remedy as well as major milestones and dates of the remedial program.

- Section 5: Remedial Design Management – describes the project management approach, including remedial design organization, project communication, document management, quality assurance, health and safety, physical security, regulatory requirements, and citizen participation as part of the remedial design process.
- Section 6: References – lists the references used to prepare this work plan and provides a glossary of terms.
- Appendix A: Regulatory Requirements – provides a preliminary guide for involvement of each local, state, federal, and regulatory agency with jurisdiction over implementing at least a portion of the selected remedy.
- Appendix B: Outline for Remedial Design Elements for Habitat Restoration Plan – based on work initiated between Honeywell and NYSDEC to describe habitat restoration and enhancement measures to be included as part of the lake remediation effort.



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Onondaga Lake Area and NPL Subsites

Figure 1.1

Notes:
1. Wetland boundary delineations were performed during various upland site investigation programs. Some of the delineations are currently under NYSDEC review.

0 650 1,300 2,600 3,900 5,200
Feet

FIGURE 1.2

Honeywell

Onondaga Lake
Syracuse, New York

SMU Boundaries, Vicinity Wetlands, and Wastebeds

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SECTION 2

PRE-DESIGN ACTIVITIES TO DATE

This section provides a summary of pre-design and design-related activities conducted to date to support design of the selected remedy. Specifically, it provides an overview of the Onondaga Lake Remedial Investigation (RI) and Feasibility Study (FS) analyses, design-related investigation activities, bench-scale tests, nitrate addition/oxygenation evaluations, cultural resource assessment, wetland and floodplain assessment, relevant IRMs at upland sites, and useful data gathered by others. Section 3 of this work plan outlines further activities performed in 2008 to support the remedial design. Referenced documents are available at the public document repositories listed in Section 5.3 of this Remedial Design Work Plan.

2.1 REMEDIAL INVESTIGATION / FEASIBILITY STUDY

Field efforts that were part of the Remedial Investigation for Onondaga Lake were conducted from 1992 to 2002. Five initial major RI investigation efforts were conducted by Honeywell in 1992: a geophysical survey, substance distribution sampling and analysis, mercury and calcite mass balances, an ecological effects investigation, and bioaccumulation analyses. Additional RI work was conducted by Honeywell in 1996 to assess mercury methylation and remineralization. Supplemental lake water sampling and analyses were performed by Honeywell in 1999. Additional investigation work by Honeywell in 2000 involved extensive lake sediment sampling along with sampling of four wetlands and the dredge spoils area shown on Figure 1.2. In addition to work by Honeywell, limited sampling of lake water and wetland sediment was performed by NYSDEC in 2001 and 2002 as part of the RI effort. In total, more than 6,000 samples of water, sediments, and organisms were collected during the RI, and more than 130,000 data point were generated from RI samples (TAMS Consultants, 2002). Output from these efforts will be applied as appropriate during the remedial design effort.

Preliminary analyses conducted as part of the Onondaga Lake FS (Parsons, 2004) are summarized below. These analyses may be used as a basis for further remedial design evaluations.

- Applicable or Relevant and Appropriate Requirements (ARARs)– Appendix C of the FS identifies potential federal and state ARARs and to-be-considered (TBC) associated with the remedial action for Onondaga Lake. Final ARARs and TBCs for Onondaga Lake are contained in the ROD (NYSDEC and USEPA Region 2, 2005).
- Groundwater– Appendix D of the FS describes the analysis completed to identify the amount of groundwater flow to Onondaga Lake. One of the tools used in this analysis was a numerical three-dimensional model developed to simulate groundwater flow beneath and in the vicinity of the lake.

- Capping– Appendix H of the FS provides preliminary analysis for lake sediment capping, including a basis for cap layer types (e.g., chemical isolation, erosion protection, habitat suitability) and thicknesses.
- Sediment Consolidation Area (SCA)- Appendix K of the FS provides a preliminary evaluation of sediment management options.
- Dredging– Appendix L of the FS provides a preliminary evaluation of sediment removal options.
- Habitat Restoration and Enhancement– Appendix M of the FS describes the preliminary basis for integrating habitat restoration and enhancement with sediment remediation.
- Monitored Natural Recovery– Appendix N of the FS provides a preliminary basis for addressing profundal sediments, including a model developed specifically for evaluating natural recovery in SMU 8.

2.2 LAKE BOTTOM DESIGN-RELATED INVESTIGATIONS THROUGH 2007

More than 6,000 water, sediment, and related samples were collected and analyzed as part of the Remedial Investigation for Onondaga Lake (TAMS Consultants, 2002). This data was used to determine the appropriate remedy for the lake during completion of the FS and ROD. This data will also be used as appropriate during completion of the remedial design. However, significant additional data is required to facilitate the design of the selected remedy. In order to expedite collection of this data and allow design and construction of the remedy to commence earlier, Honeywell voluntarily entered into an Order on Consent dated August 22, 2005 (State of New York: Department of Environmental Conservation) for collection of PDI data. This was over a year prior to finalization of the Lake Consent Decree requiring Honeywell to implement the remedy, which allowed for data collection and design activities to begin prior to finalization of this Remedial Design Work Plan.

Because of the large volume and complexity of the data required, design-related investigation activities for the lake bottom are being conducted in a phased approach. This allows the data from one phase to be interpreted and used to develop the appropriate scope for the next phase of investigation. This ensures the overall quality and usefulness of the data and ensures that all data gaps are identified and fulfilled. Phase I, Phase II, and Phase III PDI field efforts were conducted during 2005, 2006, and 2007, respectively, and were performed in accordance with the following NYSDEC-approved work plans that are available in the public document repositories:

- *Onondaga Lake PDI: Phase I Work Plan* (Parsons, 2005), which included the following appended documents: Appendix A- Sampling and Analysis Plan, Appendix B- Quality Assurance Project Plan, Appendix C- Project Safety Plan, and Appendix D- Emission and Odor Work Plan.

- *Onondaga Lake PDI: Phase II Work Plan* (Parsons, 2006b), which included the following appended documents: Addendum 1- Porewater Sampling Plan; Addendum 2- Wastebed 13 Work Plan, Addendum 3- Wastebed 13 Work Plan, Addendum 4- Groundwater Discharge Evaluation, Addendum 5- Water Treatability, Effluent Elutriate, Odors and Column Settling Testing, and Addendum 6 - Cap Design Bench Scale Studies.
- *Onondaga Lake PDI Phase III Work Plan (Parsons, 2007b)* which included the following appended documents: Addendum 1- Geotube™ evaluation (bench-scale testing) ; Addendum 2- In-Lake Waste Deposit stability, porewater, and additional vibracores and shallow borings; Addendum 3- Cap design bench-scale column studies, Addendum 4- Wastebed 13 survey, piezocone penetrometer tests with porewater pressure measurements and borings; Addendum 5- Geoprobes™ and vibracores, Addendum 6 – MNR sediment sampling; and Addendum 7- Air emissions and odors bench-scale testing.

Design-related investigation activities during Phases I, II, and III included more than 400 sediment cores, 60 borings, 7,300 environmental samples, and 120,000 chemical and geotechnical analyses. In general, the activities completed under the Phases I, II and/or III PDI efforts included the tasks listed below.

- Geophysical surveys;
- Sediment sampling for chemical and geotechnical analyses;
- *In situ* geotechnical testing of sediments;
- Surface water sampling and analysis;
- Porewater sampling and analysis;
- Seepage meter and Geoprobe™ measurements, sediment cores, and drilling to evaluate groundwater discharge and in-lake waste deposit stability;
- Various types of sediment cores and drilling to delineate DNAPL extent;
- Various types of bench-scale testing; and
- Installation and monitoring of two meteorological stations.

Additional details for each of these activities are provided below in Sections 2.2.1 through 2.2.6 and in Section 2.3.3.

Phase I PDI results, with the exception of the Geophysical Survey Report, are provided in *Onondaga Lake Pre-Design Investigation: Phase I Data Summary Report* (Parsons, 2007a), which is available at the public document repositories. The Geophysical Survey Report has been provided to the public document repositories separately. Results from the Phase II and Phase III investigations are currently being compiled as a Phase II PDI Data Summary Report and a Phase III PDI Data Summary Report, which will be available at the public document repositories after

they are finalized by Honeywell and approved by NYSDEC. The Phase I, Phase II, and Phase III chemical analytical data were validated in accordance with the Quality Assurance Project Plan appended to the Work Plan (Parsons, 2005) to ensure that the data are scientifically sound, comparable, defensible, and of known quality.

Data generated from the Phase II and Phase III PDI are being documented in data summary reports that will be available in the public document repositories following approval by NYSDEC.

Results from the Phase I, Phase II, and Phase III PDI were used to develop the scope for the Phase IV PDI, which is discussed in Section 3. Interpretation of PDI and other relevant data will be included in the design documents discussed in Section 4.

2.2.1 Geophysical Surveys

Geophysical surveys were conducted lake-wide as part of the Phase I PDI using remote sensing technology including side-scan sonar, sub-bottom profiling, and magnetometer surveying. The objective of these surveys was to obtain current lake bathymetry, identify surficial features on the lake bottom, profile sub-bottom geology, and identify metallic objects in lake sediments.

2.2.2 Sediment Geotechnical Characterization

Lake sediments were collected from multiple SMUs during design-related investigation activities to date to characterize the physical properties and strength of the sediment. This data will be used in developing the sediment cap design. Sediment samples were collected using several sampling techniques, including: grab sampler, vibracore, borehole drilling, and standard penetration testing. Index testing (e.g., moisture content, grain size, Atterberg limits, specific gravity) and performance testing (consolidation and strength) were performed on the collected sediment at an independent laboratory in accordance with American Standard of Testing Materials (ASTM) methods or other industry standards.

Piezocone penetrometer testing and vane shear testing were conducted *in situ* to evaluate the geotechnical properties of the sediment. Piezocone penetrometer testing was conducted by pushing a cone (similar to a probe) into the lakebed sediments to measure sidewall friction, tip resistance, and porewater pressure. Vane shear testing was conducted to measure undrained shear strength and residual shear strength of the shallow sediments.

2.2.3 Sediment Chemical Characterization

Lake sediments were collected from each SMU during the Phase I, Phase II, and Phase III design-related investigation activities to characterize the chemical properties of the sediment. Sediment samples were collected using multiple techniques: surface grab sampler, vibracore, and borehole drilling. Sediment samples were analyzed for various chemical parameters, which included CPOIs documented in the ROD. Chemical analyses were performed at an independent laboratory in accordance with the Quality Assurance Project Plan appended to the Phase I PDI

Work Plan (Parsons, 2005). Additionally, visual characterization of borehole drilling samples and a membrane interface probe were used to collect data to evaluate separate-phase liquids in SMU 1 and SMU 2 sediments.

2.2.4 Porewater Evaluation

Porewater sampling was conducted during the Phase I, Phase II, and Phase III design-related investigation activities to support the sediment cap evaluation and groundwater discharge evaluations. Three different porewater sampling methods were evaluated during the Phase I PDI to determine the appropriate technology for porewater sampling. Porewater was collected from centrifuged sediment, existing upwelling pumps, and diffusive samplers (peepers) and analyzed for CPOIs. Since diffusive samplers (peepers) were determined to be one appropriate porewater sampling technique in softer sediments, as part of the Phase II and Phase III PDI, additional porewater samples were collected using diffusion samplers and analyzed for CPOIs to provide additional data for the sediment cap evaluation.

2.2.5 Surface Water Evaluation

Discrete surface water samples were collected in SMU 3 as part of the Phase I PDI and analyzed for CPOIs. The objective of this effort was to evaluate the influences of Wastebeds 1 through 8 on the lake.

As part of the Phase II PDI, surface water samples were also collected and analyzed for anions and cations at the locations where sediment cores were collected for the groundwater discharge evaluation.

2.2.6 Groundwater Discharge Evaluation

Groundwater discharge to Onondaga Lake was evaluated as part of design-related investigation activities to date to support the design of the selected remedy. During the Phase I PDI, preliminary screening surveys for temperature and conductivity were conducted to identify potential areas of groundwater upwelling. Additionally, shallow water seepage meters were installed and monitored in an attempt to measure the amount of groundwater discharging to the lake. Porewater samples were also collected from discrete depth intervals to establish chloride profiles, which can be used to estimate groundwater upwelling velocities. During the Phase II and Phase III PDIs, temperature/conductivity surveys, conductivity/temperature profiles using a Geoprobe®, and/or chloride-specific conductance tests were conducted to further assess groundwater discharge into the lake. In addition, as part of the Phase III PDI, seepage meters were installed and monitored as a follow up to the Phase I PDI seepage meter work.

2.3 BENCH-SCALE TESTS

Bench-scale tests were conducted as part of the Onondaga Lake design-related investigation activities to date to further assess sediment characteristics, water treatability, emissions and odors management, and sediment capping. Consistent with the discussion provided above for the lake bottom investigation, bench scale testing is being conducted in phases and was initiated prior to

finalization of the Consent Decree in order to expedite the design process. Work was performed in accordance with the three agency-approved PDI work plans completed to data and listed in Section 2.2 of this work plan. Phase I PDI bench test results are provided in *Onondaga Lake Pre-Design Investigation: Phase I Data Summary Report* (Parsons, 2007a), which is available at the public document repositories. Results from the Phase II and Phase III PDI bench tests are currently being compiled and will be documented in the Phase II and Phase III PDI Data Summary Reports, which will be available at the public document repositories upon approval by NYSDEC. Results from the Phase I, Phase II, and Phase III PDI bench testing were used to develop the scope for the Phase IV PDI bench testing, which is discussed in Section 3. Interpretation of bench test results will be included in the design documents discussed in Section 4.

Bench-scale tests initiated or completed to date as part of the Phase I, Phase II, and Phase III PDI efforts are described below.

2.3.1 Column Settling

Column settling and self-weight consolidation tests were conducted in 2005 using sediment and surface water samples collected from the lake. The objective of these tests was to evaluate the physical properties of sediment from various SMUs, specifically to simulate settling and consolidation characteristics within the SCA.

2.3.2 Water Treatability

Water treatability tests were conducted as part of the Phase I PDI to characterize SCA supernatant composition, to the extent practical based on sediment from SMU 1, and screen potential water treatment technologies. Additional water treatability tests were performed as part of the Phase II PDI to confirm the initial test results; assess variability in supernatant characteristics from sediments in SMUs 1, 4, 6 and 7; and further evaluate treatment technologies and anticipated contaminant removal efficiencies. Effluent elutriate tests were also performed to assess the variability of supernatant water characteristics resulting from future dredging of sediments from SMUs 1, 4, 6, and 7, with particular emphasis on mercury and ammonia.

2.3.3 Emissions and Odors Management

A bench-scale wind tunnel test was completed as part of the Phase I PDI to assess potential emissions and odors from remediation activities (e.g., dredging and SCA). The test was performed using lake sediment and surface water to provide estimates of potential emission rates of compounds and odors under various conditions which may occur in the SCA. The Phase I Wind Tunnel Summary Report (Service Engineering Group, 2008) was finalized and approved and copies have been provided to the public document repositories.

Additional sediment sampling and analyses from select SMUs was conducted as part of the Phase II and Phase III PDIs to identify the odor-causing compounds. Completed Phase III PDI efforts associated with emissions and odors included analysis of sediment samples from SMUs 1

and 7; analysis of sediment samples exposed in the wind tunnel as potentially applicable for SCA operations; and analysis of sediment samples with and without application of control techniques, such as counteractant sprays, activated carbon, and an exposed sediment sand cap. In addition, other tests were conducted to correlate emission rates and wind speed and to evaluate wind tunnel emissions rates with emission rates from a flux chamber.

A meteorological monitoring station was installed at Wastebed 13 as part of the Phase I PDI to provide site-specific meteorological data. As part of the Phase II PDI, an additional meteorological station was installed near SMUs 1 and 2 to collect site-specific data near the lakeshore. Meteorological data (e.g., wind speed and direction, temperature, precipitation) are currently being collected from both stations (i.e., SCA and lakeshore). Data from these tests will be used to develop a plan to mitigate potential emissions and odors from remediation activities.

2.3.4 Sediment Capping

Bench-scale sediment capping tests initiated as part of the Phase II and Phase III PDI are ongoing. These tests are intended to further evaluate inputs to the isolation cap model and to ensure the impact of consolidation, gas generation, and biodegradation are considered appropriately during design of the isolation cap.

2.4 SEDIMENT CONSOLIDATION AREA PRE-DESIGN INVESTIGATION

Consistent with the discussion provided above for the lake bottom investigation, the SCA PDI is being conducted in phases and was initiated prior to finalization of the Consent Decree in order to expedite the design process. Results from the Phase I and Phase II SCA PDI were used to develop the scope for the Phase III SCA.

Investigation activities began in 2004 as part of the *Settling Basins 9-15 Leachate Minimization / End Use Program* (O'Brien & Gere, 2004). This investigation included piezocone penetrometer testing, borehole drilling, standard penetration testing, sample collection, geotechnical laboratory testing, and piezometer installations across Wastebed 13.

A Phase I PDI was initiated in 2005 to evaluate Solvay waste behavior under the loadings anticipated for the SCA in accordance with the NYSDEC-approved work plan (Parsons and Geosyntec, 2005) to ensure that the SCA liner design takes into consideration settlement of this material. Phase I consisted of a settlement pilot study that focused on a one-acre area within the SCA and included the following three stages:

- Stage 1 – piezocone penetrometer testing, borehole drilling, standard penetration testing, sample collection, geotechnical laboratory testing, instrument installation (piezometers, inclinometers, extensometers, settlement plates, and settlement profilers), and baseline instrument monitoring within or in close proximity to the pilot study area.
- Stage 2 – Test pit excavation, haul road construction, placement of 10 ft of fill material over the 1-acre pilot study area, and instrument monitoring.

- Stage 3 – Post-pilot study monitoring (ongoing).

Phase II design-related investigation activities were completed in 2006 in accordance with the NYSDEC-approved work plan (Parsons, 2006b) to collect additional information required for the remedial design. Since the Phase I activities occurred over a one-acre area, the primary objective of Phase II included obtaining data across the remainder of the wastebed and confirming the Phase I results. The specific objectives were as follows:

- Establish existing basin geometry and Solvay waste thickness;
- Obtain additional data for evaluating potential settlement across the SCA; and
- Collect water level data both in the wastebed and in the dikes surrounding the SCA.

Piezocone penetrometer testing, borehole drilling, standard penetration testing, sample collection, laboratory testing, and piezometer installation were performed similar to previous investigations. The testing/monitoring locations were selected to obtain adequate coverage across the entire wastebed, and the piezometers were installed to evaluate water levels within the dikes, Solvay waste, and native materials below the wastebed. Groundwater elevations are being monitored quarterly at piezometers installed during 2004, Phase I, and Phase II.

Phase III design-related investigation activities at the SCA site (Wastebed 13) included the following tasks:

- Subsurface borings and/or other field exploration techniques;
- Visual observation and laboratory testing to further characterize Solvay waste, dike materials, and native materials;
- A topographical survey;
- Continuation of settlement and groundwater elevation monitoring initiated as part of the 2005 pilot test; and
- Bench-scale testing to help evaluate applicability of geotextile tubes for dewatering.

Results from the Phase I PDI work are available in the public document repositories (Parsons, 2007a). Results from the Phase II and Phase III SCA PDI work are currently being compiled and will be documented in PDI reports which will be available at the public document repositories upon approval by NYSDEC. A settlement pilot study report (Parsons and Geosyntec, 2008) was also finalized and approved by NYSDEC and made available at the public document repositories. Interpretation of these results will be included in the design documents discussed in Section 4.

In addition, leachate generated from Wastebed 13 is currently being monitored by Honeywell as part of the Wastebed Leachate Minimization Program. Results from evaluating leachate generation will be integrated into the Wastebed Leachate Minimization Program, and, if required, the Program will be modified accordingly.

2.5 NITRATE ADDITION/OXYGENATION EVALUATION

The selected remedy includes performance of a pilot study to evaluate the potential effectiveness of oxygenation at reducing methylmercury formation in the deeper water of the lake, while preserving the normal cycle of stratification within the lake. Subsequent to ROD issuance, research conducted by Upstate Freshwater Institute and Syracuse University indicated that nitrate addition may present an alternative method for reducing methylmercury production. Consequently, nitrate addition is also being evaluated as an alternative method of reducing methylmercury formation and possibly as a supplement to oxygenation. As summarized in the Statement of Work, if NYSDEC determines that nitrate addition is shown to be effective and appropriate, NYSDEC will document this in an Explanation of Significant Difference, and Honeywell will implement nitrate addition in lieu of oxygenation. If NYSDEC determines that nitrate addition is not effective or appropriate, Honeywell will conduct an oxygenation pilot study and, if appropriate, implement oxygenation as required by the ROD.

To further evaluate the effectiveness of nitrate addition, Honeywell funded Upstate Freshwater Institute and Syracuse University beginning in 2006 to monitor concentrations of reduction and oxygenation (collectively referred to as redox) species (including oxygen, nitrate, and sulfide), total mercury, and methylmercury in lake water; to report on their findings; and to conduct a preliminary feasibility and impact analysis of nitrate addition to control methylmercury production in the hypolimnion. A report documenting data collected prior to 2006 (Upstate Freshwater Institute and Syracuse University, 2007) and a data usability and data summary report for the 2006 data (Exponent, 2007) have been accepted or approved by NYSDEC and placed in public document repositories. An interpretive report of the 2006 data related to nitrate addition, which includes a preliminary feasibility and impact analysis, has also been prepared and is available at the public document repositories (Upstate Freshwater Institute and Syracuse University, 2008a). Sampling continued in 2007 and is continuing in 2008 that includes both surface water and zooplankton. A data usability and data summary report for the 2007 data is available at the public document repositories (Exponent, 2008).

2.6 CULTURAL RESOURCE ASSESSMENT

Onondaga Lake and the surrounding area has a rich historic tradition that requires Honeywell to take due care in cultural resources management during the remediation efforts. Within the Lake itself, the potential sites are most likely historic relics from the earlier days of Solvay and Syracuse. Shoreline and adjacent sites (e.g., Ninemile Creek) may include cultural resources from camp sites of the Onondaga Nation or other ancestral peoples.

In order to insure that historic preservation is carefully considered in publicly-funded or permitted undertakings, there are laws at each level of government that require projects to be reviewed for their potential impact/effect on historic properties. At the federal level, Section 106 of the National Historic Preservation Act of 1966 directs the review of federally funded, licensed or permitted projects. At the state level, Section 14.09 of the New York State Parks, Recreation and Historic Preservation Law of 1980 performs a comparable function. Local environmental

review for municipalities is carried out under the State Environmental Quality Review Act of 1978.

The New York Archeology Council has developed a step-wise process for assessing cultural resources within a project area. The process is based on the standard practices of archeology and is designed to identify potential cultural resources prior to construction that could impact historic sites. Honeywell has completed the first step of a cultural resource assessment (Hohman, 2004), which includes a literature review and field reconnaissance for the lake itself, Wastebed B, and Wastebed 13 (see Figure 1.2). In addition, various design-related investigation activities (e.g., geophysical survey and underwater diving) performed subsequent to the Phase 1A assessment have contributed additional cultural resource information. As part of the remedial design, Honeywell will assess and conduct subsequent cultural resource assessments (i.e., Phase 1B), as described in Section 3.7 of this Work Plan. Final reports will be available at the public document repositories following NYSDEC's review and approval.

2.7 WETLAND AND FLOODPLAIN ASSESSMENT

Four New York State regulated wetlands occur along or near the lake's shoreline near the mouths of Harbor Brook (SYW-19), Ley Creek (SYW-12), Ninemile Creek (SYW-10), and along the northwest portion of the lake (SYW-6). These wetland areas are being addressed as part of investigations at other Onondaga Lake sites. State-regulated wetland SYW-6 is being addressed as part of Ninemile Creek Dredge Spoils Area, wetland SYW-10 as part of the Geddes Brook / Ninemile Creek site, and wetlands SYW-12 and SYW-19 as part of Wastebed B/ Harbor Brook subsite. Wetland boundary delineations have been performed for each of these wetlands during various site investigations, as illustrated on Figure 1.2.

A wetlands and floodplain assessment was performed in 2004 to characterize wetlands and floodplain adjoining Onondaga Lake that could potentially be impacted by lake remedial activities. The wetlands and floodplain assessment was conducted in accordance with a NYSDEC-approved work plan (O'Brien and Gere and Parsons, 2004) and consistent with USEPA's policy on *Floodplains and Wetlands Assessment for CERCLA Actions* (1985). The draft wetlands and floodplain assessment will be revised as needed based on comments from NYSDEC and USEPA and updated as appropriate during the remedial design as various project elements are designed to ensure vicinity wetlands and floodplain are not adversely impacted.

2.8 HYDRAULIC CONTROL SYSTEM

The lake bottom remedy relies upon the installation and operation of a hydraulic control system along the southwest portion of the lake shoreline (adjacent to SMUs 1, 2, and 7). The hydraulic control system includes an underground barrier wall and groundwater collection system on the landward side of the barrier wall. The purpose of the hydraulic control system is to prevent the migration of contaminated groundwater and free-phase liquids to the lake from adjacent upland areas. The hydraulic control system is being completed in multiple stages as IRMs for the Willis Avenue/Semet Residue Ponds (Willis/Semet) and the Wastebed B/Harbor Brook projects and serves as a critical step for the overall lake cleanup. A portion of the

Willis/Semet hydraulic control system was installed downgradient of the Semet Residue Ponds during the fall of 2006 (Parsons, 2006c).

2.9 REMEDIAL DESIGN ELEMENTS FOR HABITAT RESTORATION PLAN

Honeywell and NYSDEC prepared an outline for the Remedial Design Elements for Habitat Restoration Plan, which is presented as Appendix B to this Work Plan. The overall objective of this effort is to develop and implement a habitat restoration plan for remedial actions associated with the Onondaga Lake Bottom remedy and with remedies/IRMs for adjacent Honeywell sites that provide ecological, recreational, and/or aesthetic benefits as well as complies with applicable state and federal laws and regulations, executive orders and policies for floodplains, wetlands and surface waters. Preparation of the Plan is further described in Section 3.9 of this Work Plan.

2.10 LAKE MONITORING BY OTHERS

There are a variety of projects and programs which have been or are currently being performed by local authorities and interested parties that assess or monitor the physical, chemical, and biological conditions of Onondaga Lake and its tributaries. These programs focus primarily on sample collection and analysis to assess water quality and biological communities. Data from these efforts may be of value during the remedial design. The descriptions presented below are not intended to be a comprehensive list nor detailed description of ongoing projects/programs, but rather an overview of several main programs.

2.10.1 Water Quality

Onondaga County Department of Water Environment and Protection has developed an Ambient Monitoring Program (AMP) to monitor Onondaga Lake, its tributaries, and the Seneca River to track their responses to pollution abatement actions. As part of the AMP, the County collects and analyzes water samples for a comprehensive list of water quality and biological parameters. Analytical results are used to identify pollution sources, track water quality trends, and to determine whether water quality meets state and federal standards.

Upstate Freshwater Institute is a not-for-profit research organization located in Syracuse, New York that has studied Onondaga Lake extensively for more than 25 years. Annual monitoring programs include water sample collection for laboratory analysis, as well as *in situ* measurements. UFI maintains a robotic monitoring system in the south basin that monitors ambient water quality parameters automatically, with the data posted to a website accessible to the public.

2.10.2 Biological Community

The following parties or programs have assessed biological communities within the lake.

Fishes and Other Aquatic Organisms

NYSDEC annually collects fish samples and performs chemical analyses of sampled fish tissue for mercury and periodically select bioaccumulative organic compounds. This work is called the Onondaga Lake Long-Term Mercury in Fish Trends Project.

The State University of New York (SUNY) College of Environmental Science and Forestry (ESF) has been studying fishes in Onondaga Lake since 1986 under the direction of Dr. Neil Ringler. SUNY ESF's research efforts have included various adult fish surveys, a littoral habitat modification study, and wetland connection assessment.

Onondaga County's AMP also investigates biological indicators to evaluate the overall vitality of the lake ecosystem. The County's biological monitoring began in 2000 and focuses primarily on fish studies to monitor success in fish reproduction. The program involves counts of fish nests, samples of larval and adult fish, and tagging of adult fish to track individual histories. The monitoring program also includes studies of phytoplankton, zooplankton, macroinvertebrates, and aquatic plants. Data concerning their number, variety, and condition in Onondaga Lake are good indicators of quality of life in the lake. Additional details can be found in the Onondaga Lake Ambient Monitoring Program 2005 and 2006 Annual Reports (Ecologic, 2006 and Ecologic, 2007 respectively).

Aquatic Plants

Onondaga County also monitors macrophyte communities (rooted aquatic plants and algae) within the lake as part of their AMP. The County's program uses remote sensing techniques (e.g., aerial photography) every year and field sampling every five years to monitor aquatic vegetation. In general, the objectives of the program include:

- Determine the species composition, abundance, and distribution of aquatic vegetation in Onondaga Lake;
- Determine whether significant changes to the community have occurred; and
- Determine if any significant change in the aquatic vegetation can be correlated to changes in the water quality or ecological factors.

Onondaga County initiated the first aquatic vegetation survey in 2000 to establish baseline conditions. A second field sampling effort was performed in 2005 and included four additional sampling locations at the request of Honeywell. The supplementary data complimented the AMP program as well as provided information to support Honeywell's remedial design effort. The County plans to conduct a third aquatic vegetation field sampling effort during 2010.

Independent from Onondaga County's AMP, Dr. John Madsen (formerly affiliated with the US Army Corps of Engineers and currently with Mississippi State University) and colleagues have examined submerged aquatic vegetation in Onondaga Lake periodically between 1991 and 2006. The results of these efforts are documented in various papers and were presented at the

Eighth Annual Onondaga Lake Scientific Forum in November 2006 held in Liverpool, New York.

2.10.3 Other Lake Programs

The Onondaga Lake Partnership (OLP) was established in 2000 to promote cooperation among government agencies and other parties involved in managing the environmental issues of Onondaga Lake and its watershed. The OLP coordinates development and implementation of improvement projects in accordance with the Onondaga Lake Management Plan (Onondaga Lake Management Conference, 1993) and the Amended Consent Judgment to restore, conserve, and manage the lake. The Partnership also identifies projects and programs in accordance with the goals and objectives of the Onondaga Lake Management Plan, which is beyond the scope of the Amended Consent Judgment. As an example, the OLP is underway with the Onondaga Lake 2020 Vision Project – Engaging the Community in the Future of Onondaga Lake. The 2020 Vision Project is designed to develop a community-based vision of the future of Onondaga Lake as a sustainable resource.

2.11 CITIZEN PARTICIPATION PLANNING

A Citizen Participation Plan has been prepared for the Onondaga Lake Bottom Subsite Remedial Design Program (NYSDEC, 2009). The purpose of the plan is to inform and involve the public during the upcoming remedial design and construction phases of the Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site. This Citizen Participation Plan provides a formal, yet flexible plan for communication with the public during the remediation of Onondaga Lake. The plan briefly describes the site and remediation program, identifies specific community outreach and participation activities, and includes a list of community members that have an interest in Onondaga Lake.

The goals of the Citizen Participation Plan are to provide communications and dialogue with the public in a proactive manner. In addition to providing multiple opportunities for dissemination of information to the public, the plan outlines ways for interested stakeholders to participate in discussions related to the remediation activities.

The citizen participation activities for Onondaga Lake are designed to:

- Ensure open communication among the public, NYSDEC project staff and Honeywell throughout the remedial process;
- Involve key stakeholder groups in critical projects;
- Create opportunities for the public to contribute information, opinions, and perspectives; and
- Continually analyze the effectiveness of the plan.

SECTION 3

FUTURE DESIGN-RELATED ACTIVITIES

As discussed in Section 2, design-related investigation activities for the lake bottom are being conducted in a phased approach due to the large volume and complexity of the data required. This allows the data from one phase to be interpreted and used to develop the appropriate plan for the next phase of investigation, and ensures the overall quality and usefulness of the data and that all data gaps are identified and fulfilled. Phase I, Phase II, and Phase III design-related investigation activities from 2005 through 2007 alone included more than 400 sediment cores, 60 borings, 7,300 environmental samples, and 120,000 chemical and geotechnical analyses as discussed in Section 2.

Additional design-related investigation activities beyond those completed to date will be conducted to support the remedial design. A summary of planned additional PDI tasks is provided below. Some of these investigation tasks were initiated in 2008 as part of the Phase IV PDI (Parsons, 2008b), while some activities will continue into subsequent years.

Collectively, results from each phase of the PDI will be evaluated and interpreted during the remedial design. Interpretation of this data will be included in the design documents described in Section 4. Evaluation of PDI data collected to date and identification of data gaps are ongoing. Therefore, design-related investigation activities beyond those listed below may be appropriate.

3.1 BASELINE MONITORING

Baseline monitoring in the lake began in 2008 to enable future evaluation of remedy effectiveness. Baseline monitoring will provide a comprehensive description of current chemical and biological conditions and will include, at a minimum, analysis of sediment, water, zooplankton, invertebrates, and fish. To date, baseline monitoring is being addressed by two Work Plan Books: (a) Book 1 which includes zooplankton and water quality monitoring in SMU 8; and (b) Book 2 which includes fish and invertebrate monitoring. The Book 1 work plan (Upstate Freshwater Institute and Syracuse University, 2008b) and the Book 2 work plan (Parsons, Exponent and QEA, 2008) are available in the public document repositories. The scope and schedule for baseline monitoring will continue to be developed over time taking into consideration the remedial scope and objectives as specified in the ROD and the remedial program schedule discussed in Section 4.

3.2 LITTORAL SEDIMENT AND POREWATER INVESTIGATION

Sampling and analyses are being conducted to further characterize lake bottom sediments and refine the overall remedy design. Phase IV PDI work includes a continuation of the following Phase III PDI work efforts.

- Collection of additional porewater samples to support cap design;
- Additional measurements and sampling to evaluate groundwater discharge to support cap design; and
- Additional sediment sampling to refine cap areas and dredge volumes and to support dredging and cap design.

3.3 PROFUNDAL SEDIMENT AND RELATED MNR SAMPLING

High resolution sediment cores and surface sediment samples from the profundal zone will be collected and analyzed to evaluate current sediment conditions and support refinement of the application of an MNR model. In addition, sediment samples from sediment traps may be collected and analyzed to support the MNR model.

In addition, one or two microbead markers will be placed at various locations in the profundal zone (SMU 8) to improve understanding of sedimentation rates, mechanisms, and dynamics. Data from microbead placement in the lake will be used to refine the MNR model inputs and update model predictions as appropriate.

3.4 SEDIMENT CONSOLIDATION AREA INVESTIGATION

Future design-related investigation activities at and in the vicinity of the SCA may include collection of baseline groundwater quality and air quality data. Additional bench-scale testing may also be performed to evaluate methods for managing at the SCA sediment to be dredged from the lake.

3.5 NITRATE ADDITION/OXYGENATION EVALUATION

The remedy for Onondaga Lake specified in the ROD includes performance of a pilot study to "evaluate the potential effectiveness of oxygenation at reducing the formation of methylmercury in the water column, while preserving the normal cycle of stratification within the lake" (NYSDEC and USEPA, 2005, p. 51). Prior to this pilot study, a second method of reducing methylmercury formation, nitrate addition, will also be evaluated. In accordance with the Statement of Work, "Honeywell shall conduct a study (which may include the performance of nitrification pilot study as determined by NYSDEC) to determine if nitrification would effectively reduce the formation of methylmercury in the water column while preserving the normal cycle of stratification within the lake" (United States District Court, 2007, Appendix C, p. 3). "If DEC determines that nitrification is effective and appropriate based upon the results of this study, this will be documented in an Explanation of Significant Difference, and Honeywell shall be required to implement a nitrification program in lieu of oxygenation. If DEC determines

that nitrification is not effective and/or appropriate, Honeywell shall conduct an oxygenation pilot study and implement oxygenation as provided in the ROD" (United States District Court, 2007, Appendix C, p. 3).

Pre-design activities related to nitrate addition or oxygenation of the hypolimnion will be completed prior to the oxygenation/nitrate addition pilot study, and will include the following tasks:

- Continue water column monitoring of mercury, reduction/oxygenation (redox) constituents, and zooplankton in support of the evaluation of nitrate addition or oxygenation to control methylmercury production in the hypolimnion. This effort is being conducted under Book 1 of the baseline monitoring program for 2008.
- Measure water current velocities at the sediment surface to support design of nitrate addition and oxygenation systems.
- Conduct sediment incubation tests to determine threshold concentrations of nitrate and oxygen to control methylmercury production, and to estimate sediment nitrate and oxygen demand in support of design of nitrate addition and oxygenation systems (Parsons, 2008a).
- Conduct a dye tracer study in bottom profundal waters to measure horizontal mass transport and mixing needed to design a nitrate addition or oxygenation system.
- Conduct a nitrate application field trial to assess application of a nitrate compound to SMU 8 to control methylmercury formation.

3.6 BENCH TESTS

Significant bench testing has already been completed or is ongoing, as discussed in Section 2. As part of the Phase IV PDI, additional bench-scale testing has been proposed by Honeywell to assess mechanical dewatering technologies for managing dredged sediment, and to assess performance of potential cap amendments. Phase IV PDI work plan addenda have been prepared by Honeywell and approved by NYSDEC for these efforts (see Parsons, 2008b). Depending on the results of various design-related investigation activities and related analysis, additional bench testing may be proposed by Honeywell, such as to facilitate evaluation of dredged sediment management at the SCA, sediment capping, water treatment, and odor and emissions controls.

3.7 CULTURAL RESOURCE ASSESSMENT

As discussed in Section 2, Honeywell has prepared a draft cultural resource assessment (Phase IA) for the probable remediation areas in Onondaga Lake. Additionally, Honeywell conducted geophysical surveys coupled with underwater diving to identify probable artifacts within the lake, such as a sunken barge. As the specific remediation areas are further defined during the remedial design, Honeywell will review the Phase IA assessment findings and the survey data to develop recommendations for areas that may warrant additional field investigation

(i.e., Phase IB cultural resource assessment) to locate cultural sensitive artifacts. Honeywell will develop a Phase IB Work Plan for these areas for agency review and comment. Honeywell will subsequently conduct the Phase 1B investigation in accordance with the approved work plan and present the findings report to NYSDEC. Further recommended actions, if required, will be identified in the summary report and performed during the remedial design phase, prior to construction.

3.8 HYDRAULIC CONTROL SYSTEM

As discussed under Section 2, the lake bottom remedy relies upon the installation and operation of a hydraulic control system along the southwest portion of the lake shoreline (adjacent to SMUs 1, 2, and 7). Additional activities pertaining to the PDI, design, and installation of these IRMs will be implemented as part of a separate, but interrelated, remedial program.

3.9 REMEDIAL DESIGN ELEMENTS FOR HABITAT RESTORATION PLAN

As discussed in Section 2, Honeywell will prepare a Remedial Design Elements for Habitat Restoration Plan to address such issues as thickness and composition of the habitat layer, mitigation of lake surface area, and wetland mitigation. Honeywell has initiated work on the outline for the Plan, which is included as Appendix B to this Work Plan, to expedite the remedial design process and ensure that sufficient information is available to meet the design schedule for the Onondaga Lake and adjacent IRM sites. Honeywell will prepare the Plan in two parts as described below.

Part One of the Plan will consist of three sections. Section 1 of the Plan will present background, regulatory requirements, and goals and objectives for the plan. Section 2 (Conditions in Onondaga Lake) will summarize information that has been collected to date and previously reported to describe historical and current conditions in the lake. Section 3 (Effects of Remediation on Onondaga Lake Habitat) will describe the expected effects of remediation on existing habitats to the extent feasible. The schedules for several sites listed in Section 3c (specifically, the Dredge Spoil Area, Wastebeds 1-8, Wastebed B/Harbor Brook, and Geddes Brook/Ninemile Creek) may extend well into or past the schedule for completing the remedial designs for the lake bottom which will limit the amount of design information that can be included in the Plan. Conversely, other sites have schedules that require designs to be completed relatively soon. For these sites, if the schedule requires the design of any site to be accelerated, then that site can be designed and this plan will simply describe the design from the site. In these cases, the Plan may not be sufficiently complete to materially affect the detailed design of the site. However, the habitat restoration details for these sites (to be provided in the site-specific final remedial designs) will be completed in accordance with the initial designs and objectives specified in the Plan and incorporate any new relevant information and approaches developed through ongoing discussions with NYSDEC. Any new information and approaches will be reflected in the Plan, if such revisions are agreed to by Honeywell and NYSDEC.

Part Two of the Plan will identify the target habitats and associated species (Section 4) that will be used to develop the initial designs to be included in the document (Section 5). During preparation of the Plan, Honeywell will work with NYSDEC to determine the appropriate level of detail for the drawings and specifications for the initial designs. This will ensure that the level of detail will be consistent with the Consent Decree requirements.

SECTION 4

REMEDIAL DESIGN PROCESS

This section describes major design elements, initial design submittals, subsequent design submittals, and schedule for the remedial design. The design and construction of remedy components will be performed concurrently, where appropriate, to expedite the remedial program schedule. Additionally, the remedial design submittals may vary depending on the preferred contracting method (e.g., design/build) for different components of the remedial action, as well as key decisions made during the remedial design. These decisions will consider critical path components and key factors that influence the design and implementation of the lake bottom remedy.

4.1 REMEDIAL DESIGN ELEMENTS

The primary elements of the selected remedy as documented in the ROD and summarized in Section 1.3 include:

- Sediment removal (dredging) and transport to the SCA;
- SCA;
- Sediment capping (isolation and thin-layer) including remedial area determination;
- Water treatment system and discharge points;
- Nitrate addition or oxygenation of the hypolimnion;
- MNR;
- Habitat restoration and enhancement;
- Institutional controls; and
- Long-term operation, maintenance, and monitoring.

The design of these elements is interdependent; thus each will influence the design of other elements. For example, the thickness of a cap and target habitat conditions (e.g., water depth) will influence the required dredge depth and thus the overall dredge volume. The remedial design will be conducted in an iterative manner to account for these interrelationships and optimize the overall design.

Honeywell and representatives from the agencies have formed various Technical Work Groups in an effort to expedite the design process and achieve an acceptable and implementable design. Work Groups have been formed to focus on the ten technical topics listed below.

- capping;

- groundwater upwelling;
- habitat;
- water treatment;
- SCA civil and geotechnical;
- SMU 8 (thin-layer capping, nitrate addition/oxygenation, and MNR);
- dredging/SCA operations;
- baseline and long-term monitoring;
- emissions and odors; and
- citizen participation.

Work Group communications will allow NYSDEC, USEPA, and Honeywell to proactively evaluate key design aspects. Figure 4.1 illustrates the Technical Work Groups and remedial design elements the groups will evaluate during development of the initial design submittals described in Section 4.2 below.

4.2 PREPARATION OF INITIAL DESIGN SUBMITTALS

The remedial design will include the preparation of four initial design submittals (IDSs), which will be submitted separately. The four IDSs will address all of the remedial elements. Separating the design into four submittals allows for accelerated design submittal for critical path activities (e.g., SCA and water treatment) to facilitate the schedule for starting and completing the remedial action consistent with the Consent Decree. Specifically, the design for the SCA and water treatment system can be completed on an expedited schedule to allow construction to start in advance of the dredging. The four IDSs will be:

- SCA civil and geotechnical;
- dredging, SCA, and water treatment operations;
- sediment cap and dredge area and depth (including habitat restoration and enhancement); and
- thin-layer capping, nitrate addition/oxygenation, and MNR (SMU 8).

Institutional controls and long-term operation, maintenance, and monitoring will be included within one or more of the four design efforts as applicable.

Figure 4.1 shows the integration of the remedial design elements into the four IDSs. Each of the four IDSs will contain the following common components:

- design and performance criteria;
- summary of relevant pre-design investigation, bench-scale, and pilot study results and other data to date;

- initial designs;
- identification of any data gaps that need to be addressed prior to completing an intermediate or final design and a schedule for addressing any data gaps;
- narrative of contracting approach and technical issues; and
- description of subsequent design submittals (e.g., intermediate and final designs) and schedule.

These common components are discussed in more detail below. Details regarding anticipated contents for each of the four IDSs are provided in Sections 4.2.2.1 through 4.2.2.4.

4.2.1 Design and Performance Criteria

Design and performance criteria will be developed working with the Technical Work Groups as collaborative efforts with the agencies (NYSDEC, NYSDOH, and USEPA) and Honeywell. To the extent possible, the design and performance criteria will be developed prior to submitting each IDS. The design and performance criteria will provide overall guidance for relevant design, construction, and operational criteria. The design criteria will be derived from the Consent Decree and appended documents, regulatory standards, engineering standards and guidelines, and performance criteria. Performance criteria will be developed using a performance-based approach, which describes the criteria (parameters) by which to measure performance, and will consider both environmental and community aspects. Examples of remedial elements that may require performance criteria include, but are not necessarily limited to, sediment resuspended from dredging and capping; dredging and capping productivity; dredge area and depth established prior to dredging; cap component layers (including habitat layer) placement verification; chemical and geotechnical requirements for cap materials; regulatory water and air discharge requirements; and odor and noise management at dredge sites, pump stations, the SCA and at the water treatment plant. Performance criteria will be established to guide remedial program activities toward successful completion of the remedial action while minimizing impacts to the community and the environment.

4.2.2 Initial Designs

Initial designs as part of each IDS will include evaluation and interpretation of PDI findings, engineering analyses and calculations, and means and methods for implementing the selected remedy. Initial designs, which will represent approximately a 30 percent design effort level, are further described below for each IDS.

4.2.2.1 SCA Civil and Geotechnical

PDI results will be used in conjunction with engineering analyses and calculations to develop an initial design for SCA civil and geotechnical work. Additionally, the initial design for SCA civil and geotechnical will incorporate inputs from dredging, SCA, and water treatment operations design criteria. The initial design will:

- Summarize the SCA siting evaluation.

- Summarize the ability of the site to accommodate dredge volumes quantified in the ROD and Statement of Work or whether other wastebed areas will need to be utilized.
- Discuss factors influencing the SCA design, as well as anticipated limitations to operations and closure.
- Evaluate engineering properties of dredged material to be placed in the SCA.
- Develop a cell geometry/shape (i.e., number and size of basins) layout for the SCA, based on operational considerations (e.g., use of Geotubes™ and/or mechanical systems for dewatering sediment, water treatment, odor controls, access, etc.) and site constraints (e.g., geotechnical limitations of foundation materials).
- Recommend an approach for constructing the liner/liquids removal system(s). Liner and liquids removal system(s) design will account for properties of the in-place Solvay waste while providing containment of the dredged sediment.
- Determine preload requirements to accomplish some of the anticipated consolidation of the underlying in-place Solvay waste prior to cell construction. Preload requirements will consider the anticipated cell layout and liner/liquids removal system(s) requirements.
- Determine external and internal dike design parameters, including appropriate operating heights for the dikes and potential staging for dike extension construction to assure stability of the cell construction.
- Evaluate potential construction material sources, material staging areas, and construction support areas, including site access limitations and temporary road requirements to promote safe construction and minimize impacts to the public.
- Evaluate potential stability/constructability issues during construction.
- Evaluate geosynthetics compatibility with dredged materials.
- Outline contingency procedures.
- Recommend sequencing to construct the SCA.
- Discuss stormwater management procedures during construction.
- Evaluate visual barriers.
- Describe preliminary SCA cap design concepts/details.
- Develop post-closure care monitoring approach that considers liner integrity, long-term performance of the liquids management system(s), long-term monitoring, contingency planning, and potential site end-uses.

Relevant design-related investigation data will be summarized and interpreted to develop the initial design and identify any data gaps. The interpretation will include:

- Estimate of the Solvay waste thickness across the wastebed;

- Engineering properties (or a range in properties) of the Solvay waste, native materials, and dike materials; and
- A plan to obtain data needs identified as data gaps.

Calculations or analyses that will be conducted to support the initial design will include:

- Settlement analyses for the range of anticipated vertical loading scenarios developed for the potential SCA configuration(s) and operations assumptions.
- Sensitivity analyses to assess the range in potential settlement that could be anticipated for a given range in loadings.
- Foundation and dike (internal and external) slope stability to insure long-term integrity of the cell.
- Evaluation of dredged sediment volume for a given SCA configuration and filling sequence.
- Assessment of liner and dredged material short- and long-term settlement magnitudes and rates resulting from cap loading to ensure the containment system performs as designed throughout final closure.

4.2.2.2 Dredging, SCA, and Water Treatment Operations

PDI results will be used in conjunction with engineering evaluations/calculations to develop a preliminary design for dredging, SCA, and water treatment operations. The preliminary design will include the items listed below for each of these operations.

Dredging and Sediment Transport Operations

The dredging and sediment transport operations portion of the preliminary design will include the following tasks:

- Develop preliminary dredge volume and production rates (based on *in situ* cubic yards per work day or per season) and estimated solids concentrations in the dredge slurry based on the preliminary dredge areas and depths, the dredging method, and the design and performance criteria. Production rate estimates will be used to calculate the projected volume and weight of sediment solids and slurry water that will be discharged into the SCA each work day. Revised dredge volume estimates will be developed as part of the Sediment Cap and Dredge Areas and Depths IDS. Therefore, revised dredging production rates will be developed based on an actual anticipated dredge volume as part of the detailed design.
- Basis for selecting the chosen dredge method(s), sediment transport system, and pipeline route(s).
- Pipeline preliminary design information (e.g., size and type) and locations and sizes of pump stations (including community impacts and property access) will be included.

Following NYSDEC acceptance of one or more potential pipeline routes, Honeywell will initiate efforts to obtain access to properties along the route(s) and identify any permit requirements.

- Evaluate need and methods, as appropriate, for shoreline based excavation of sediment that may be necessary in near-shore lake remediation areas. Dredge depths are not anticipated to be available from the sediment capping design effort until after this IDS for dredging and sediment transport operations is submitted.
- Evaluate methods for dredging along the in-lake barrier wall that maintain wall stability (both global stability and structural integrity) and also maintain stability of hydraulic containment trenches and NAPL recovery wells on the shore side of the wall.
- Evaluate sediment debris removal and management. This analysis will assess locations and types of debris that will have be to removed prior to dredging, potential methods for removing and/or relocating debris, the location and space needed for debris off-loading and upland processing, the type of disposal or recycling for each type of debris, and additional steps that may be needed to further assess how to manage debris.
- Evaluate the location of utilities in the dredge and cap area of Onondaga Lake. For each utility, preliminary recommendations will be made for which utilities (a) can be abandoned in place, (b) need to be removed, (c) can be relocated, or (d) must remain in service and relocation is not feasible. Potentially applicable methods for removing and/or relocating utilities will also be described.
- Evaluate sediment resuspension due to dredging and evaluate potential dredging best management practices to control water quality impacts at the point of dredging. This evaluation will include an analysis of silt curtains, as well as other standard practices.
- Evaluate the approach, as necessary, to minimize residual contamination in areas that require dredging of sediment to achieve numeric cleanup criteria.
- Develop a lake water quality monitoring approach to assess attainment of water quality goals in Onondaga Lake during in-lake remedial activities such as dredging and capping.
- Evaluate potential cultural resources in dredging or capping areas.
- Develop preliminary site requirements for upland support facilities including debris barge off-loading; debris separation and stockpiling; docks for the dredge fleet (dredge, debris barges, tugs, supply boats, and crew boats); field offices and material storage; and slurry pre-treatment, if required. In addition, the upland support facilities will include space for importing, stockpiling, and transporting of cap materials.
- Evaluate a NAPL recovery and management approach as needed.

- Develop dredging and monitoring approaches to ensure compliance with applicable goals and performance criteria. Regulatory requirements to be met are presented in Appendix A.

SCA Operations

The SCA operations portion of the initial design will include the following tasks:

- Estimate the required minimum size of basins to dewater and contain dewatered sediment.
- Determine the operational approach for Geotubes™ and/or mechanical dewatering as part of the SCA operation plan.
- Evaluate and recommend slurry discharge methods and locations in the SCA.
- Use precipitation data to develop an estimate of stormwater volume that will require water treatment, verify minimum freeboard requirements, and provide requirements for winter shut-down operations.
- Develop a NAPL recovery and management approach for the SCA.
- Prepare an odor and VOCs evaluation control approach, if required, that will include potential controls for the dredge and SCA system including controls at the dredge site as warranted, in the slurry prior to discharge into the SCA, and within the SCA to ensure performance criteria are met.
- Develop an approach for baseline monitoring based on the results of the emissions evaluation and control approach. The purpose of this monitoring would be to establish the baseline air quality for volatile organics from other sources in the vicinity of the SCA.
- Address potential odors, noise, traffic, and lighting impacts to the community as necessary.

Water Treatment Operations

The water treatment system portion of the initial design will include the following items:

- Describe the water treatment unit processes needed to meet discharge requirements.
- A Site Plan that identifies the proposed location(s) of the water treatment infrastructure and routing of major conveyance pipes (i.e. from the SCA to the water treatment system and then to the discharge location).
- A drawing depicting the general configuration of the water treatment unit operations and related infrastructure with respect to physical location and footprint.
- A process flow diagram and mass balance that summarizes (as a one-line schematic diagram) the general configuration of the selected treatment train (i.e., how each of the

unit processes will be configured to produce a complete water treatment system), and presents anticipated influent/effluent characteristics to each of the major unit operations and the entire water treatment system.

- Outlines for operation-maintenance-monitoring and contingency plans.
- A process flow diagram and discussion of piping and instrumentation for the proposed water treatment system unit operations.
- Summarize water treatment system infrastructure requirements such as buildings, site improvements, support utilities, and similar items.

Relevant PDI data will be summarized and interpreted to develop the initial design and identify data gaps. In addition, results generated from the water treatability bench tests will be evaluated and used to:

- Develop a plan to obtain data needs identified as data gaps;
- Identify candidate water treatment technologies for additional testing as needed;
- Develop methodologies for additional testing; and
- Provide baseline criteria for the initial design of the water treatment system.

Supporting Calculations and Analyses

Calculations or analyses that will be performed to support the initial design for dredging, SCA, and water treatment operations will include:

- Volume and weight of dredged material pumped to the SCA each working day and each season;
- Volume of supernatant water from the SCA that will be treated or recycled each working day;
- Total suspended solids and dissolved contaminant concentrations in SCA supernatant;
- Analysis of where and how treated SCA supernatant will be discharged, impacts of potential discharge locations, and how discharge monitoring will be implemented;
- Preliminary pipeline size and booster pump size for dredge material slurry;
- Initial bulking and self-weight consolidation of dredged material in the SCA;
- Analysis of the potential for generation of volatile emissions;
- Analysis of concentration of volatile organics in the air in the vicinity of the SCA during SCA operations and subsequent to SCA operations prior to closure;
- Average quantity of precipitation that will accumulate in the SCA on a monthly average basis and at various recurrence intervals;

- Mass balance calculations to estimate influent/effluent loading for each major water treatment unit operation based on performance criteria to be established; and
- Other calculations needed to select the preferred water treatment system including estimates of operational performance, utility demands, and consumables.

4.2.2.3 Sediment Cap and Dredge Area and Depth

PDI results will be used in conjunction with on-going engineering evaluations and calculations and habitat assessments to develop the initial design for the Sediment Cap and Dredge Volume IDS, which will include the following tasks.

- Demarcate an isolation cap area and develop a cap design. This design will include chemical isolation layer thicknesses and materials based on the PDI evaluations and the results of cap isolation modeling for each distinct capping area (*i.e.*, each area having a unique basis for cap thickness or composition). It will also include preliminary erosion layer requirements for each distinct capping area considering the various potential erosive forces including ice scour, wind-induced waves, currents from tributaries and propeller wash.
- Evaluate the effectiveness of thin-layer capping versus isolation capping in areas where the water depth is between 20 and 30 ft. to justify thin-layer capping at that range of water depths.
- Evaluate the effectiveness of thin-layer capping and isolation capping for the portion of the ILWD that extends into SMU 8.
- Summarize habitat-related design elements relative to dredging and cap design, including habitat layer thickness, and material (composition) requirements (including consideration of bioturbation), post capping water depth, mitigation for the loss of lake surface area in SMUs 1 and 2, and the design for shoreline transition areas. These design elements will be developed consistent with the Lake-Wide Habitat Restoration Plan (see annotated outline in Appendix B).
- Develop an initial design for habitat enhancement to address impairments/ stressors along an estimated 1.5 miles of shoreline in SMU 3 and 23 acres in SMU 5 as documented in the ROD. These habitat enhancements will be developed consistent with the Lake-Wide Habitat Restoration Plan and included as appropriate with the initial design for capping, because habitat enhancement considerations are similar to many of the habitat layer considerations for an isolation cap.
- Evaluate the degree and rate of consolidation of existing sediments as well as sediment resuspension resulting from placement of the cap. A range of consolidation/settlement predictions will be presented based on the sensitivity of modeling estimates. Evaluate the depth of dredging necessary to achieve target (post-consolidation) cap elevations. Estimate post-consolidation lake-bottom and cap surface elevations. An estimate of porewater flux related to the consolidation of underlying sediments will be generated and considered during the design of the chemical isolation layer.

- Analyze the static and seismic stability of the ILWD. Results available from the 2005 geophysical survey will be included in the stability analysis and in other aspects of cap design as appropriate. If the analysis concludes that the stability goals specified in the Statement of Work are not met, then methods for achieving the stability goals will be specified. For dredged and/or capped areas outside the ILWD, static slope stability evaluations will be performed as necessary to support the design of appropriate dredge cut slopes and to ensure that slope stability is not adversely impacted by cap placement.
- Evaluate appropriate cap materials, potential sources, transportation, and handling methods.
- Evaluate cap placement methods and equipment, including methods for verifying and monitoring appropriate placement.
- Evaluate potential cap material staging and construction support areas, including site access limitations and preliminary temporary road requirements.
- Recalculate ILWD hot spot criteria, if appropriate, based on cap modeling and identify any resulting hot spot dredging areas.
- Identify dredge areas and depths and calculate the projected dredge volumes.
- Summarize the analysis of debris and in-lake structures (including utilities) to the extent the analysis pertains to areas to be capped but not dredged.
- Evaluate sequence to perform the dredging and construct the sediment cap based on the initial design.
- Develop the transition between areas with an isolation cap and areas with a thin-layer cap as well as the transition between cap areas and areas not slated for capping.
- Identify appropriate institutional controls.
- Provide post construction maintenance and monitoring approach.

PDI data will be summarized and interpreted to develop the initial design and identify data gaps. The interpretation will include cap model input parameters based on PDI data and bench-scale studies, and a plan to address any data gaps. Calculations or preliminary analyses that will be conducted to support the initial design will include:

- Preliminary settlement analyses for the range of anticipated loading scenarios assuming different dredge cuts and cap thicknesses.
- Static and seismic ILWD slope stability analysis.
- Modeling to determine chemical isolation layer thicknesses.
- Modeling to determine erosion layer gradation and thickness.
- Calculation of dredge volumes.

- Estimates of groundwater upwelling velocities.

4.2.2.4 Profundal Zone (SMU 8) Thin-Layer Capping, Nitrate Addition/Oxygenation and MNR

The initial design elements for thin-layer capping, nitrate addition/oxygenation, and MNR for SMU 8 are described below.

Thin-Layer Capping

The thin-layer capping portion of the initial design will include the tasks listed below.

- Develop sub-areas of the lake over which the bioaccumulation-based sediment quality value (BSQV) will be applied on a surface area-weighted average concentration basis.
- Determine the extent of thin-layer capping based on: areas which currently exceed the mean probable effects concentration (PEC) quotient of 1, areas which are predicted to exceed the mercury PEC value at the end of the 10 year MNR period, and as required to meet the BSQV on a surface-weighted average concentration (SWAC) basis at the end of the 10 year MNR period.
- Develop the required thickness of the thin-layer cap.
- Evaluate appropriate cap materials and potential sources and transportation methods.
- Evaluate cap placement methods and equipment, including methods to verify appropriate placement.
- Evaluate potential material staging areas, including site access limitations and preliminary temporary road requirements.
- Recommend sequencing to conduct thin-layer capping relative to other lake remedial activities, including source remediation and implementation of nitrate addition or oxygenation.

Nitrate Addition/Oxygenation

The nitrate addition/oxygenation portion of the initial design will include the following items:

- Evaluate full-scale nitrate addition versus oxygenation based on the results of the field trial and/or pilot work and related PDI data, and a recommendation whether either of these technologies should be implemented at full-scale (note: the bulleted items below assume that nitrate addition or oxygenation will be recommended for full-scale implementation).
- Prepare an initial design of a nitrate addition or oxygenation system.
- Evaluate potential material (i.e., nitrate or oxygen) staging areas, including site access limitations and preliminary temporary road requirements.

- Develop a preliminary monitoring approach that considers available baseline data, data to be collected to monitor system performance, anticipated long-term performance of the application system(s), long-term monitoring of methylmercury concentrations in biota, and contingency planning.

Monitored Natural Recovery (MNR)

The MNR portion of the initial design will include the following items.

- Results from MNR modeling based on PDI data and information from microbead marker placement.
- Recommendations for monitoring activities throughout the 10-year MNR period.
- Contingency actions to be implemented during and/or at the end of the 10-year MNR period if required sediment goals are not met.

Supporting Calculations and Analyses

PDI data will be summarized and interpreted to develop the initial design and identify potential data gaps. If data gaps are identified, a plan will be developed to address these during the remedial design. The interpretation will include establishing the nitrate and/or oxygen concentration to be maintained in the water column to sufficiently reduce or eliminate to the extent practicable methylmercury production and quantifying the expected range of current velocities at the sediment/water interface. Results from sediment incubation tests and other associated laboratory tests, the dye tracer study, and oxidation-reduction process modeling described in the work plan for sediment incubations (Parsons, 2008a) will be used to characterize the effectiveness of adding oxygen and/or nitrate in terms methylmercury elimination. In addition, preliminary sensitivity analyses will be conducted to assess the range in potential nitrate or oxygen concentrations by depth that could be anticipated for a given range in nitrate and/or oxygen input loadings. Inputs to the MNR model developed in the Feasibility Study for predicting future natural recovery are being updated and revised, and results will be included in a future design submittal.

Narrative of Contracting Approach and Technical Issues

Each IDS will provide a description of the anticipated contracting approach for each remedial component. The two primary contracting approaches under consideration are design-bid-build and design-build.

- Design-Bid-Build: The design under this approach is typically prescriptive to allow bidding from multiple contractors on well-defined work that can be implemented using standard construction methods. The design would include agency review at initial, intermediate, and final design phases. This method tends to be more favorable when schedule is less of a factor, when significant modifications for the design are unlikely, and when constructability issues are expected to involve only typical field challenges. Modifications to the design require amendments or change orders. This

design-bid-build method could result in either a prescriptive specification or performance based specification approach. The overall design, review, procurement, and construction schedule must be able to accommodate this method which could be the longest in duration.

- Design-Build: Under this approach, contractor procurement and construction elements are initiated during the design process. Prior to embarking upon this contracting method, an agreed-upon design review process would be developed to assure appropriate agency review and approval of the remedial design and construction submittals. This process would likely involve the submittal, review, and approval of design packages as each is developed to move into contractor procurement and remedial construction. The request(s) for proposal for construction services will include the approved intermediate design documents, for which subsequent changes and final design will also need agency review and approval. The design documents used for evaluation and selection of the design-build team would likely be more performance-based allowing latitude in the means and methods to meet the selected remedy requirements. This contracting approach tends to be more favorable when the schedule does not allow time to accommodate the design-bid-build approach. It also allows for significant flexibility and creativity during the contracting phase to consider optimal or innovative approaches.

The selection of the appropriate contracting approach for various remedial components will consider the accelerated schedule and numerous technical issues to be resolved as part of the initial design. Decisions regarding the contracting approach and key technical issues will significantly influence the most appropriate approach for subsequent design submittals. For example, it may be appropriate to divide subsequent design submittals for the SCA into preloading and site preparation, liner and dike design, and closure. Depending on the degree of preloading determined appropriate as part of the initial design, it may be necessary to conduct preloading and site preparation at an accelerated pace, perhaps using a design-build approach, to expedite the overall construction. Similarly, it may be beneficial to finalize the liner and dike design prior to finalizing the closure design since the closure design depends on the final land use, which may take time to develop and plan. This process may result in using multiple contract methods to complete the overall project. Figure 4.2 illustrates the association between the initial and subsequent design submittals based on selection of the contracting method for remedial construction.

4.2.3 Description of Subsequent Design Submittals and Schedule

The format and schedule for subsequent design submittals will be defined within the IDSs and be based on the decisions regarding the technical issues and selected contracting approach, as discussed above.

4.3 PREPARATION OF SUBSEQUENT DESIGN SUBMITTALS

Following completion of each IDS, Honeywell will prepare subsequent design submittals (e.g., intermediate and final designs) and specifications as necessary to implement the remedial

action for the lake bottom consistent with the Consent Decree. Subject to approval by NYSDEC, Honeywell may submit more than one set of design submittals reflecting different components of the remedial action. The final remedial design documents will have the signature and seal of a professional engineer who will certify that the remedial design was prepared in accordance with the Consent Decree.

Subsequent design phases will also require the preparation of engineering plans to describe construction and operational considerations and constraints. It is anticipated that the following supporting plans will be incorporated into subsequent design submittals.

- Health and Safety Plan;
- Operations Plan;
- Construction Quality Assurance (CQA) Plan;
- Performance Monitoring Plan;
- Contingency Plan;
- Water Treatment Optimization Plan;
- Water Treatment Operations and Maintenance Manual; and
- Post-Construction Monitoring Plan.

Preliminary outlines for these plans will be included as part of the IDSs.

4.4 SCHEDULE

Numerous design-related documents have been completed to date and submitted to the public document repositories. A listing of these documents is provided in Table 4.1.

Honeywell will make good faith efforts to design and construct the lake bottom remedy on an accelerated basis utilizing, where appropriate, a design/build approach, expedited sampling and analysis, and pre-design and construction of critical path components. Honeywell has developed a remedial program schedule to promote acceleration of critical activities, to the extent practical, in order to complete the design of the remedial program (including construction of the SCA and effluent water treatment system) within five years from entry of the Consent Decree, and to complete dredging within four years following construction of the SCA and effluent water treatment system. To achieve this schedule, it is anticipated that the NYSDEC will make good faith efforts to review and approve submittals and provide required critical input, such as final water treatment discharge criteria, on a priority basis.

Major milestones and associated dates for the remedial program are listed below.

Task/Milestone	Date
Lodging of the Consent Decree between State of New York and Honeywell	1/4/07
Initial Design Submittals	
• Draft SCA Civil and Geotechnical IDS	8/14/09
• Draft Dredging, SCA, and Water Treatment Operations IDS	2/4/09
• Draft Sediment Capping and Dredge Areas and Depths IDS	TBD
• Draft SMU 8 IDS	11/25/10
Supporting Documents/Activities	
• SCA Settlement Pilot Study Monitoring Data Year 2 (2007) Report	7/28/08
• Draft SCA Phase III PDI Report	4/15/08
• Draft SCA Engineering Evaluation Technical Memorandum	6/13/08
• Draft SCA Dewatering Method Evaluation Report	11/10/08
• Sections 1 through 3 of the Draft Habitat Plan	7/12/07
• Draft Section 4 (Habitat Restoration Goals) of Remedial Design Elements for Habitat Restoration	12/10/08
• Draft Section 5 (Habitat Design) of Remedial Design Elements for Habitat Restoration	7/20/09
• Draft 2008 Baseline Monitoring Report	6/24/09
• Draft Phase III PDI Emissions and Odors Data Summary Report	7/31/08
• Draft Phase II PDI Cap Bench Test Report	10/31/08
• Draft Phase III PDI Cap Bench Test Report	12/24/08
• Draft Phase IV PDI Data Summary Report	4/2/09
• Draft SMU 8 Dye Tracer Study Report	7/22/09
• Draft SMU 8 Sediment Incubations Data Report	6/24/09
• Draft Work Plan for Field Trial of Nitrate Application	3/9/09
• Draft Report for Field Trial of Nitrate Application	9/25/09

• Draft Nitrate Pilot Test Design	1/14/10
• Draft Nitrate Pilot Test Report	7/27/11
• Draft Baseline Monitoring Scoping Document	1/25/08
Facilities Construction	
• SCA Construction Sufficiently Complete for Managing Lake Sediment to be Dredged	1/4/12
• Sediment Transport System and other Required On-shore Support Facilities Construction Complete	1/4/12
• Water Treatment System Construction Complete	1/4/12
SCA, Water Treatment System, Sediment Transport System and Required On-shore Support Facilities Operational and Begin Dredging	May 2012
Dredging Complete	1/4/16

TBD – The required submittal date will be identified and approved by NYSDEC within 30 days from NYSDEC's approval of the Remedial Design Work Plan. The date will be no later than December 20, 2009.

As described previously, the format and schedule for subsequent design submittals will be defined in each of the four initial design submittals based on technical and contracting determinations made during the initial design.

As discussed in Section 2.11, an Onondaga Lake Citizen Participation Plan has been prepared. Details regarding citizen participation activities and schedules are addressed in the Citizen Participation Plan.

TABLE 4.1
ONONDAGA LAKE BOTTOM SUBSITE DOCUMENTS SUBMITTED TO PUBLIC DOCUMENT REPOSITORIES
SINCE THE RECORD OF DECISION (JULY 2005)

Date	Name of Document	Prepared for	Prepared by
2008, December	Onondaga Lake PDI: Wastebed 13 Settlement Pilot Study Monitoring Data - Year 2	Honeywell	Parsons
2008, November	Onondaga Lake PDI Phase IV, Addendum 8, SMU 8 High-Resolution Core	Honeywell	Parsons, Anchor, Exponent
2008, November	Onondaga Lake PDI Phase IV, Addendum 7, Cap pH Amendment Evaluatior	Honeywell	Parsons
2008, October	Draft Remedial Design Work Plan for the Onondaga Lake Bottom Subsite	Honeywell	Parsons
2008, October	Draft Citizen Participation Plan for the Onondaga Lake Bottom Subsite Remedial Design Program	Honeywell	NYSDEC, Region 7
2008, September	Data Usability and Summary Report Evaluation of Nitrate Addition to Control Methylmercury Production in Onondaga Lake: 2007 Study	Honeywell	Exponent, in conjunction with UFI and SU
2008, September	Onondaga Lake Microbead Marker Work Plan for Monitoring Natural Recovery in SMU 8	Honeywell	Parsons, Anchor, Environmental Tracing Systems
2008, September	Onondaga Lake Baseline Monitoring Book 2 Work Plan, Fish, Invertebrate, and Littoral Water Monitoring for 2008	Honeywell	Parsons, Exponent, and QEA
2008, July	Onondaga Lake PDI: Phase IV Work Plan: Addendum 4: Mechanical Dewatering Evaluatior	Honeywell	Parsons
2008, July	Onondaga Lake PDI: Phase IV Work Plan: Addendum 2: Cap Amendment Study Isotherm Development	Honeywell	Parsons, Danny Reible, Gregory Lowry
2008, July	Onondaga Lake PDI: Phase IV Work Plan: Addendum 1: Habitat	Honeywell	Parsons, QEA
2008, June	Onondaga Lake: Wind Tunnel Testing Report	Parsons	Service Engineering Group
2008, June	Onondaga Lake PDI: Phase III Data Summary Report, Addendum 6	Honeywell	Parsons, Exponent, and Anchor
2008, June	Onondaga Lake PDI: Phase IV Work Plan	Honeywell	Parsons
2008, June	Work Plan to Perform a Dye Tracer Study to Evaluate Transport and Mixing in the Hypolimnion of Onondaga Lake	Honeywell	UFI
2008, June	Onondaga Lake PDI: Wastebed 13 Settlement Pilot Study Data Summary Repor	Honeywell	Parsons, in association with Geosyntec
2008, May	Onondaga Lake Baseline Monitoring Book 1, Deep Basin Water and Zooplankton Monitoring Work Plan for 2008	Honeywell	UFI & SU
2008, May	Air Dispersion Modeling Protocol for Onondaga Lake	Honeywell	Parsons
2008, May	Onondaga Lake Interpretive Report: Eval of Nitrate Addition to Control Methylmercury Production in Onondaga Lake: 2006 Study, dated April 2008	Honeywell	UFI & SU
2008, April	Onondaga Lake Phase II and III PDI: Odorant Characterization and Analysis Summary Rpt	Honeywell	Parsons
2008, March	Onondaga Lake Phase III PDI, Work Plan Addendum 7	Honeywell	Parsons
2008, January	Onondaga Lake Pre-Design Investigation: Meteorological Monitoring Program Manua	Honeywell	Parsons
2008, January	Work Plan for Evaluation of Nitrate Addition to Control Methylmercury Production in Onondaga Lake, 2007 Study (Appendix B - Quality Assurance Project Plan)	Honeywell	SU and UFI
2008, January	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 6, SMU 8 Sampling to Monitor Natural Recovery	Honeywell	Parsons
2007, December	Work Plan for Onondaga Lake SMU 8 Sediment Incubations and Supporting Studies	Honeywell	Parsons, in association with Exponent and SU/UFI
2007, November	Onondaga Lake Phase 1 Pre-Design Investigation Geophysical Survey Repor	Honeywell/Parsons	CR Environmental, Inc.
2007, October	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 3	Honeywell	Parsons
2007, October	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 4	Honeywell	Parsons
2007, October	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 5	Honeywell	Parsons
2007, September	Cultural Resource Management Report Phase 1A CRA Onondaga Lake Project Oct. 29, 2004	Honeywell/Parsons	Christopher D. Hohman, RPA, Public Archaeology Facility, Binghamton University.
2007, September	Final Data Usability and Summary Report Evaluation of Nitrate Addition to Control Methylmercury Production in Onondaga Lake 2006 Study	Honeywell	Exponent, in conjunction with UFI and SU
2007, August	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 2	Honeywell	Parsons
2007, July	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 1	Honeywell	Parsons
2007, June	Preliminary Feasibility Analysis for Control of Methylmercury Production in the Lower Waters of Onondaga Lake through Nitrate Addition	Honeywell	UFI & SU

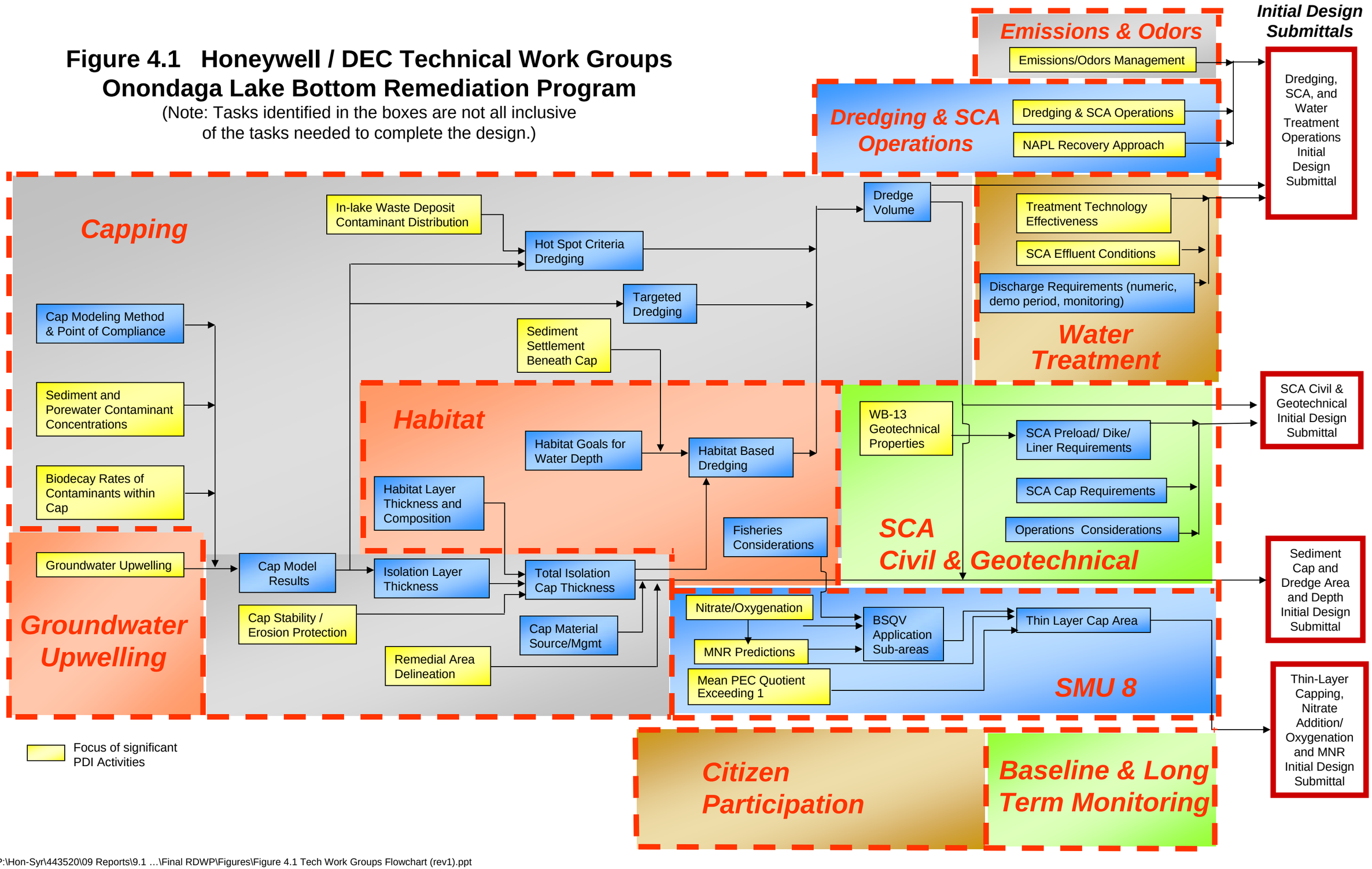
TABLE 4.1
ONONDAGA LAKE BOTTOM SUBSITE DOCUMENTS SUBMITTED TO PUBLIC DOCUMENT REPOSITORIES
SINCE THE RECORD OF DECISION (JULY 2005)

Date	Name of Document	Prepared for	Prepared by
2007, June	Work Plan for the Evaluation of Nitrate Addition to Control Methylmercury Production in Onondaga Lake, 2007 Study (May 2007)	Honeywell	UFI & SU
2007, May	Onondaga Lake Pre-Design Investigation: Phase I Data Summary Report	Honeywell	Parsons
2007, May	Onondaga Lake Phase III Pre-Design Investigation Work Plan	Honeywell	Parsons
2007, January	State of New York and Denise M. Sheehan as Trustee of the Natural Resources, Plaintiffs Against Honeywell International Inc., Defendant : Consent Decree between the State of New York and Honeywell International Inc. / United States District Court, Northern District of New York.		United States District Court Northern District of New York
2006, September	Onondaga Lake Pre-Design Investigation. Phase II Work Plan	Honeywell	Parsons
2006, August	Onondaga Lake Pre-Design Investigation: Equilibrium Study Work Plan	Honeywell	Parsons
2006, August	Onondaga Lake : Technical Support Document for Explanation of Significant Differences	Honeywell	Parsons
2005, Aug, Sep & Nov	Onondaga Lake Pre-Design Investigation Work Plan (Phase I), Vol. 1-6	Honeywell	Parsons

Note:
- See Appendix III of the Onondaga Lake ROD (NYSDEC/USEPA, July 2005) for the Administrative Record Index which contains a list of documents issued prior to the ROD.

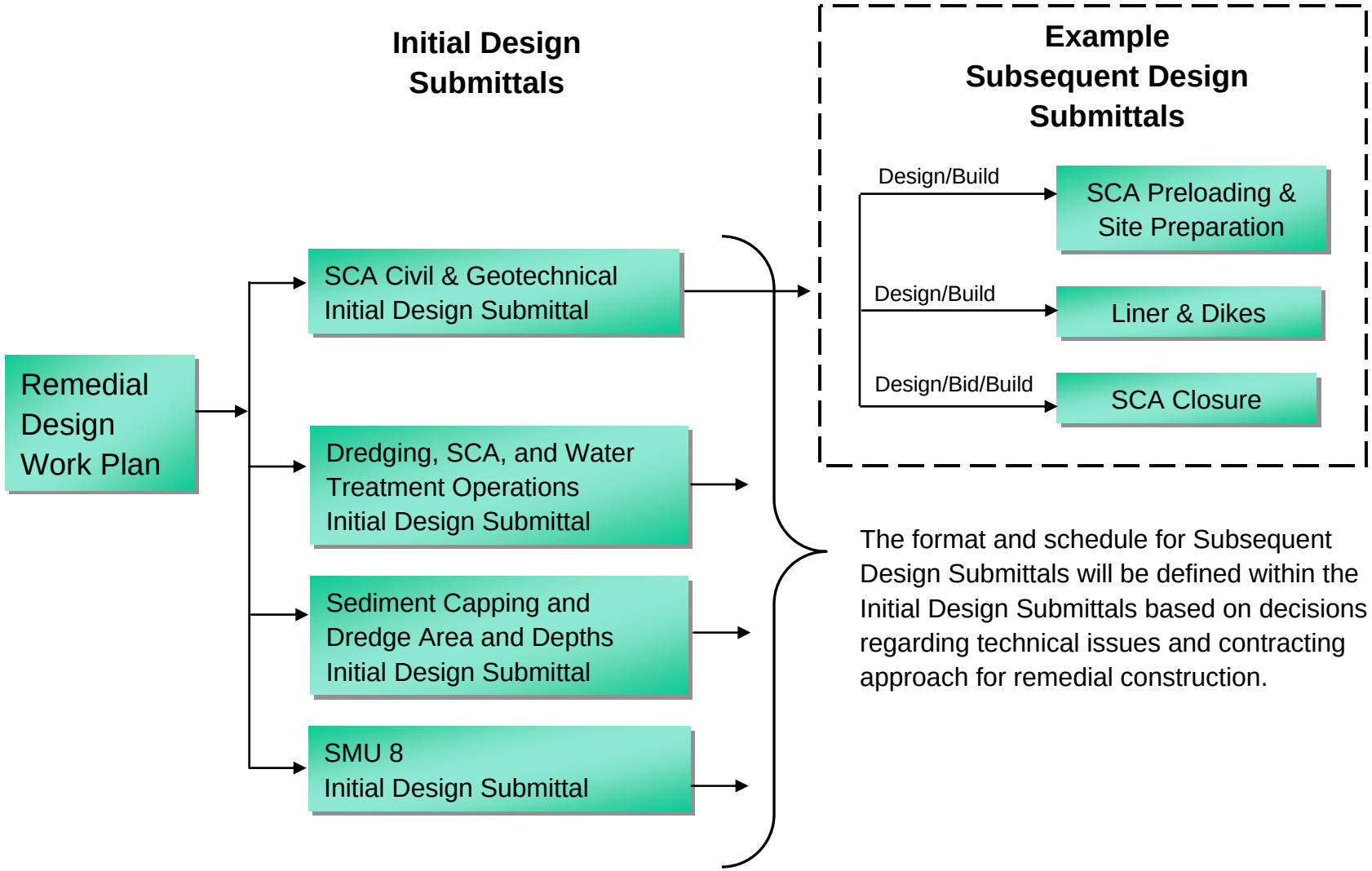
Figure 4.1 Honeywell / DEC Technical Work Groups
Onondaga Lake Bottom Remediation Program

(Note: Tasks identified in the boxes are not all inclusive
of the tasks needed to complete the design.)



P:\Hon-Syr\443520\09 Reports\9.1 …\Final RDWP\Figures\Figure 4.1 Tech Work Groups Flowchart (rev1).ppt

Figure 4.2
Onondaga Lake Remedial Design & Construction Flow Chart



P:\Hon-Syr\443520\Reports\Final RDWP\Figures\Figure 4.2 Flow Chart (rev4).ppt

SECTION 5

REMEDIAL DESIGN MANAGEMENT

This section describes the management approach, including project organization, project communication, document management, quality assurance, health and safety, physical security, and citizen participation for the Onondaga Lake remedial design.

5.1 REMEDIAL DESIGN ORGANIZATION

Several organizations will be directly involved in the performance and review of the remedial design (see Figure 5.1). These organizations have specific project functions that relate to each other in various ways according to their project responsibilities. The objective of this section is to describe the overall project organization and responsibility of various parties to aid in the exchange of information and to ensure efficient project operation.

5.1.1 New York State Department of Environmental Conservation

The NYSDEC is the lead agency for the Onondaga Lake Superfund Site. This state agency will review and approve plans, drawings, reports, and schedules submitted for the pre-design, remedial design, and remedial action as documented in the Consent Decree. Mr. Timothy Larson, P.E. is NYSDEC's Project Manager for the Onondaga Lake Bottom subsite. In addition, NYSDEC has contracted with Earth Tech to assist in the oversight of design-related investigation activities and remedial design review. Mr. Michael Spera, P.E., is Earth Tech's Project Manager for the Onondaga Lake Bottom Subsite.

5.1.2 United States Environmental Protection Agency

The USEPA is the federal regulatory agency involved with the remedial action for the site. As appropriate, USEPA will review submittals of plans, drawings, and reports to ensure compliance with USEPA regulatory criteria. Mr. Robert Nunes is USEPA's Project Manager for the Onondaga Lake Bottom Subsite.

5.1.3 Honeywell

Honeywell is responsible for the design and implementation of the lake bottom remedy. Mr. John McAuliffe, P.E., is the Honeywell Syracuse Program Director and primary contact for this project. Mr. William Hague is Honeywell's Director for Remediation and Construction for this project. Mr. Jeff Parsons with O'Brien & Gere Engineers, Inc. will serve as Honeywell's liaison for the development and implementation of a health and safety program for this project. Honeywell has retained Parsons Corporation (Parsons) of Liverpool, New York to manage and prepare the remedial design for the lake bottom remedy.

5.1.4 Parsons

Parsons is Honeywell's primary consultant for the remedial design. The design organization for the project team is further described below.

5.1.4.1 Program Manager

Mr. Steve Warren is Parsons Program Manager for the Honeywell Syracuse Program. Mr. Warren is directly responsible to Honeywell and Parsons' management to ensure that the project objectives and project schedules are met.

5.1.4.2 Project Manager

Mr. Edward Glaza, P.E., and Mr. Paul Blue will serve as the Project Managers for the initial design and subsequent design submittals, respectively. Project Managers will perform the functions listed below:

- Provide overall direction and management for remedial design activities;
- Perform administrative and decision-making activities, as well as provide necessary authorizations related to the project;
- Facilitate remedial design coordination between Parsons and external organizations;
- Review all reports in the draft version prior to their final edition; and
- Communicate with NYSDEC and other agencies on an ongoing basis regarding technical issues and project status.

5.1.4.3 Remedial Design and Construction Manager

Mr. Steve Miller, P.E., will act as Honeywell's liaison serving as the Remedial Design and Construction Manager. Mr. Miller is responsible for the consistency and quality of remedial design and construction documents.

5.1.4.4 Analytical Quality Assurance Manager

Ms. Maryanne Kosciewicz is the Analytical Quality Assurance Manager. Ms. Kosciewicz will perform the functions listed below:

- Provide quality assurance technical assistance to the project staff,
- Direct the preparation and review of quality assurance plans for analytical work, as necessary;
- Review and validate analytical data in accordance with approved quality assurance plans; and
- Ensure compliance with regulatory guidelines.

5.1.4.5 Project Control Specialist

Mr. Douglas Mayer is the Project Control Specialist for the remedial design. Mr. Mayer will develop and maintain a working project schedule, including assessing project status against target milestones. He will maintain a liaison with the Project Manager so that all relevant project control issues are managed effectively.

5.1.4.6 Document Coordinator

Ms. Michelle McDonald is the Document Coordinator for this project. Ms. McDonald will support communications and document control activities for Honeywell's Syracuse Program projects, including the Onondaga Lake remedial design.

5.1.5 Teaming Partners and Technical Experts

Parsons has partnered with several professional consultants and independent subject experts to provide technical direction and support for the remedial design. These firms or affiliations as well as their area of expertise are listed in Table 5.1. The use of such specialized expertise, including numerous nationally-recognized experts, will enhance the overall efficiency and effectiveness of the remedial design. For instance, Dr. Michael Palermo, Dr. Danny Reible, and Dr. Donald Hayes bring more than 75 years of combined experience with contaminated sediment dredging, capping, and management.

Dr. Michael Palermo has over 35 years of experience with the US Army Corps of Engineers dealing with contaminated sediment remediation. He served as the Director of the Center for Contaminated Sediments at the Waterways Experiment Station, where he managed and conducted both research and applied studies for the US Army Corps of Engineers, USEPA, US Navy, and the National Oceanic and Atmospheric Administration. Dr. Palermo has served on numerous national and international workgroups and peer-review panels related to contaminated sediment remediation projects and authored numerous publications, such as *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities - Testing Manual* (U.S. Army Corps of Engineers, 2003)..

Dr. Danny Reible has over 20 years of experience with cap modeling as it pertains to capping contaminated sediments. He has been the director of the USEPA Hazardous Substance Research Center for the past 11 years and also co-authored USEPA's *Guidance for In-Situ Subaqueous Capping of Contaminated Sediments* (1998). He served on the National Research Council Committee on PCB-contaminated sediments and currently serves on the National Research Council Committee for Remediation of Navy Sites. Dr. Reible has published more than 150 journal papers and reports and has been a professor at Louisiana State University, the University of Sydney and is currently an Endowed Professor at the University of Texas. Dr. Reible and Dr. Michael Palermo have been involved with the development and outreach associated with the recently published *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA, 2005).

Dr. Donald Hayes has over 20 years of experience with sediment dredging and contaminated sediment management. He is a professor at the University of Louisiana at Lafayette and is

currently supporting USEPA on the Hudson River remediation project. Dr. Hayes has participated in several expert panels for other Superfund sites across the United States, extensively published in the field of dredging and sediment management, and co-authored *Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies* (National Research Council, 1997).

5.2 PROJECT COMMUNICATION

Honeywell will communicate with the NYSDEC and other agencies in order to complete the remedial design effectively and efficiently. Honeywell will submit monthly progress reports that describe actions from the prior month, provide raw and/or validated data not previously submitted, identify completed deliverables, describe actions anticipated for the next month, provide overall status of ongoing obligations, identify modifications to any work plans, and describe citizen participation activities during the previous month. Each monthly progress report, data submittal, or other design deliverable will be submitted to the agencies and persons on the distribution list identified in the Consent Decree (paragraphs 82 and 83) for review and comment.

5.3 DOCUMENT MANAGEMENT

Honeywell will prepare and submit remedial design documents for review and approval in accordance with the Consent Decree. Honeywell will distribute documents approved by NYSDEC within 14 days to the six public document repositories identified in the Consent Decree: (1) NYSDEC's regional office in Syracuse, (2) the Onondaga County Public Library, (3) Atlantic States Legal Foundation, (4) Liverpool Public Library, (5) Camillus Town Hall, and (6) Moon Library at SUNY ESF in Syracuse, New York. In addition, the Onondaga Nation will receive a copy of all NYSDEC-approved documents. The Document Coordinator, Ms. Michelle McDonald, will manage document control activities for the remedial design.

5.4 ANALYTICAL QUALITY ASSURANCE

Standard quality assurance and quality control procedures will be applied during the remedial design process. Field sampling conducted as part of the PDI will follow procedures outlined in the Quality Assurance Project Plan, which is appended to the *Onondaga Lake Phase I PDI Work Plan* (Parsons, 2005). The Plan provides a standard for quality control to ensure that data are scientifically sound, comparable, defensible, and of known quality. The Quality Assurance Project Plan defines procedures required to meet the data quality objectives including, although not limited to, procedures for field sampling, laboratory analysis, data validation, and data management.

5.5 HEALTH AND SAFETY PLAN(S)

The health and safety of site personnel, visitors and members of the public are considered paramount. Written health and safety plan(s) will be developed for each phase of the remediation project. The *Onondaga Lake PDI Project Safety Plan* (Parsons, August 2005),

included by reference in this Remedial Design Work Plan, describes the anticipated hazards and control measures to be applied to ongoing investigation activities related to the remedial design. Project health and safety plans will be developed and updated as needed to address changing activities and site conditions.

5.6 PHYSICAL SECURITY AND POSTING OF THE SITE

Physical security for the site and physical security for off-site areas to be used to support the remedial action (e.g., slurry pipelines) will be evaluated and controlled to minimize risks to persons, property, and the environment. Physical security planning will include remedial design and remedial action activities on the lake, at the lakeshore (e.g., support facilities), in the area between the lakeshore and the SCA (e.g., slurry pipelines), and at the SCA. A vulnerability assessment will be performed to identify potential security challenges, prioritize those challenges, and describe appropriate control measures. Security measures that may be used include fences, gates, signs, and lighting. In areas where work is ongoing, workers will post appropriate warning signs, barricades, and caution tape to protect members of the public from accidentally accessing the site. Periodic assessments will be made to assess the effectiveness of security measures and determine if changes are needed.

5.7 CITIZEN PARTICIPATION

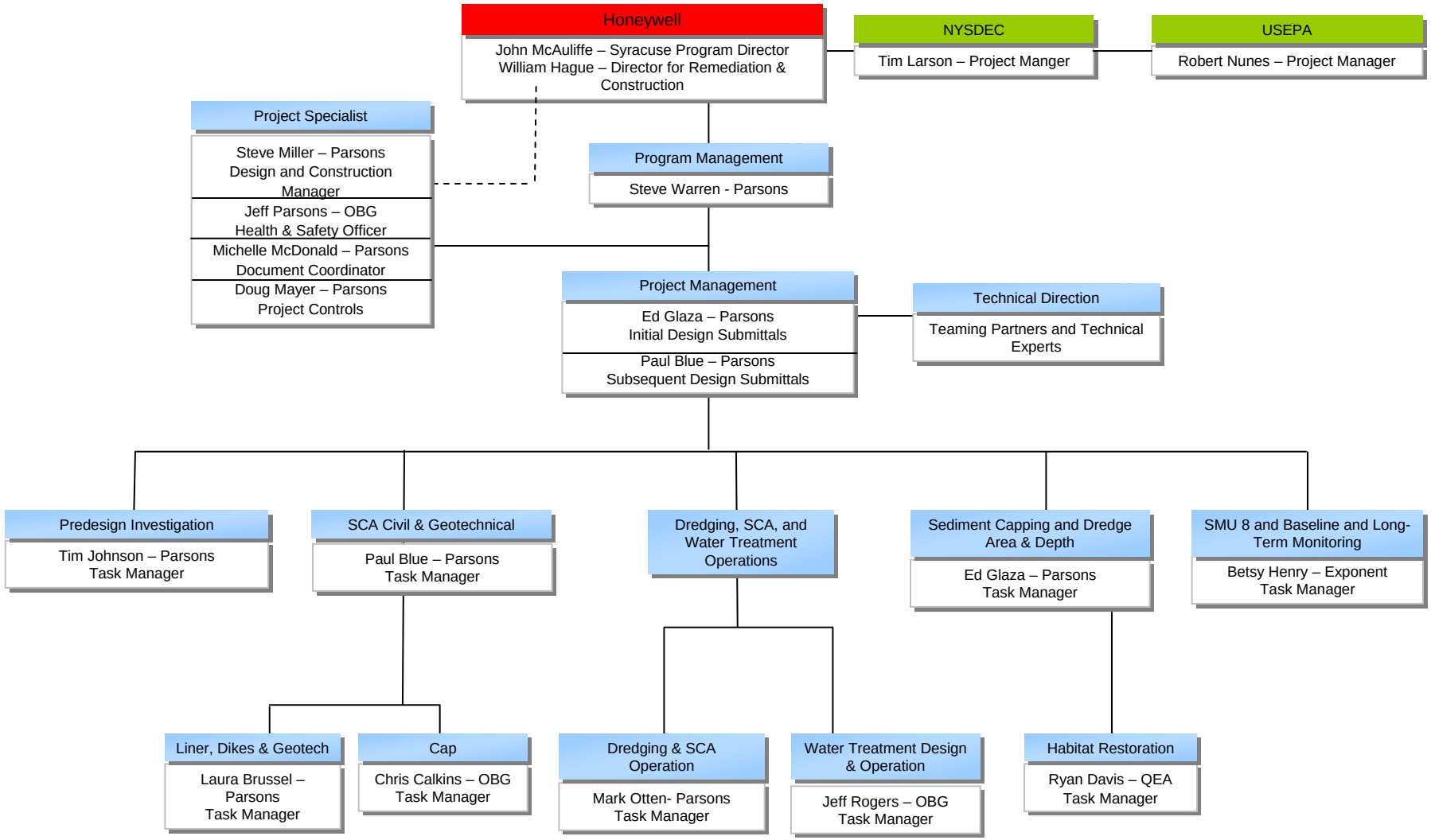
Honeywell has assisted the NYSDEC in its implementation of a citizen participation program and will continue to provide information regarding the Remedial Program to the public. A Citizen Participation Plan has been prepared (NYSDEC, 2009) per NYSDEC's publication, *Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook* (June 1998) consistent with the Consent Decree. The Citizen Participation Plan provides a formal yet flexible plan for communication with the public during the Onondaga Lake remediation program.

TABLE 5.1

PARSONS TEAMING PARTNERS AND KEY TECHNICAL EXPERTS FOR THE ONONDAGA LAKE REMEDIAL DESIGN

Firm/Affiliation	Primary Contact	Area of Technical Expertise
Environmental Consulting		
Anchor Environmental	John Verduin and Carl Stivers	Dredging, Capping, and MNR
Exponent	Betsy Henry, Ph.D.	Nitrate addition/oxygenation, MNR, and baseline/long-term monitoring
Geosyntec Consultants	Jay Beech, Ph.D.	Geotechnical design of the SCA
Michael Palermo Consulting	Michael Palermo, Ph.D.	Capping, dredging, and SCA operations
O'Brien & Gere Engineers	Chris Calkins and Jeff Rogers, P.E.	Water treatment design, air quality, groundwater hydraulics, and integration with upland sites
Quantitative Environmental Analysis	Ryan Davis, Ph.D. and Margaret Murphy, Ph.D.	Habitat restoration, baseline/long-term monitoring, water quality
S.S. Papadopulous & Associates	Charles Andrews, Ph.D.	Groundwater modeling
St. Croix Sensory	Chuck McGinely	Emissions and odors
Terrestrial Environmental Specialists	Joseph McMullen	Habitat restoration
Academic / Research		
Binghamton University	Christopher Hohman, Ph.D.	Cultural resources
Georgia Institute of Technology	Joseph Hughes	Sediment cap modeling
Louisiana State University	Louis Thibodeaux, Ph.D.	Emissions and odors
SUNY ESF	Neil Ringler, Ph.D.	Habitat restoration and fisheries
Mississippi State University	John Madsen, Ph.D.	Submerged aquatic plants
Syracuse University	Charles T. Driscoll, Ph.D.	Nitrate addition/oxygenation and monitoring
Texas Tech University	Andrew Jackson, Ph.D.	Sediment porewater sampling
University of Louisiana at Lafayette	Donald Hayes, Ph.D.	Water quality monitoring, dredging, and SCA operations
University of Texas	Danny Reible, Ph.D.	Sediment capping and cap bench tests / modeling
Upstate Freshwater Institute	Steven Effler, Ph.D. and David Matthews, Ph.D.	Nitrate addition/oxygenation and Onondaga Lake limnology
Michigan Tech University	Martin Auer, Ph.D.	Nitrate addition/oxygenation

Figure 5.1
Onondaga Lake Remedial Design Organization Chart



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SECTION 6

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Appendix A *Phase I Sampling And Analysis Plan* September 2005.

Appendix B *Quality Assurance Project Plan* September 2005.

Appendix C *Project Safety Plan* August 2005.

Appendix D *Emissions and Odor Work Plan* November 2005.

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GLOSSARY

Applicable or Relevant and Appropriate Requirements (ARARs) - The federal and state environmental laws that a selected remedy will meet. These requirements may vary among sites and alternatives.

Baseline (or remediation baseline)- Current conditions without remediation implemented (i.e., no action).

Bathymetry - The measurement of the depth of the floor of a water body from the water surface.

Bioaccumulation - The general term describing a process by which chemicals are taken up by an organism either directly from exposure to a contaminated medium or by consumption of food containing the chemical.

Biota - Animal and plant life.

Centrifuge - A piece of equipment, generally driven by a motor that puts an object in rotation around a fixed axis, applying force perpendicular to the axis.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - Commonly known as Superfund, CERCLA was enacted by Congress on December 11, 1980 and subsequently amended. This law provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.

Cone Penetrometer - An instrument in the form of a cylindrical rod with a cone-shaped tip designed for penetrating soil and for measuring the end-bearing component of penetration resistance.

Consent Decree - A legal document, approved by a judge, that, in the case of a CERCLA investigation, formalized an agreement between USEPA (or, in the case of Onondaga Lake, New York State) and one or more potentially responsible parties outlining the terms by which the investigation will take place. A Consent Decree is subject to a public comment period prior to its approval by a judge and is enforceable as a final judgment by a court.

Consolidation Test - A test used to establish the settlement characteristics of a given material (typically soil/sediment).

Contaminant - Any physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, sediment, soil, or biota. In the case of Onondaga Lake, contaminants are typically chemical substances.

Diffusion - The movement of dissolved constituents from areas of high concentration to areas of low concentration.

Discharge - Flow of surface water in a stream or the outflow of groundwater from a flowing well, ditch, or spring. Can also apply to release of liquid effluent from a facility or to chemical emissions into the air.

Dissolved Oxygen (DO) - The oxygen freely available in water, vital to fish and other aquatic life and for the prevention of odors. DO levels are considered an important indicator of a water body's ability to support desirable aquatic life.

Ecosystem - The biotic community and abiotic (non-living) environment within a specified location and time, including the chemical, physical, and biological relationships among the biotic and abiotic components.

Elutriate - To purify, separate, or remove by washing, decanting, and/or settling.

Emissions - The release of volatile substances into the air from a source.

Epilimnion - During summer stratification, the upper portion of the water column located between the 0 and 30-foot (0 and 9-meter) water depth in Onondaga Lake. The epilimnion is warm and well-mixed by wind and waves.

Exposure - Contact by humans or wildlife with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term (acute exposure), of intermediate duration, or long-term (chronic exposure).

Extensometer - An instrument used to measure soil and rock movements along the axis of a borehole.

Feasibility Study (FS) - A study to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well. The FS typically evaluates a series of remedial alternatives and recommends the selection of a cost-effective alternative.

Flume - A natural and manmade channel that diverts water.

Geophysical - Related to the study of the earth by quantitative physical methods, especially by seismic reflection and refraction, gravity, magnetic, electrical, electromagnetic, and radioactivity methods.

Grab Sampler - A sampling device used to collect an accurate representative sample of the sediment bottom.

Groundwater - Underground water that fills pores in soils or openings in rocks to the point of saturation.

Hazardous Substance - Defined in CERCLA and New York State law generally, any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive.

Hypolimnion - During summer stratification, the lower portion of the water column located between 30 and 60-foot (9 to 18-meter) water depth in Onondaga Lake. The hypolimnion is cool and not well-mixed by wind and waves.

In situ - A Latin term meaning "in place" or not removed.

Inclinometer - An instrument used to measure angles of slope and inclination within a borehole.

Isolation Cap - An engineered cap that covers sediments to eliminate or reduce potential exposure by humans and other living organisms that may be impacted by pollutants.

Littoral Sediment - Sediments located beneath epilimnetic water in water depths less than 30 feet (9 meters).

Littoral Zone - The part of a water body where light penetration is sufficient for the growth of plants; contrast with "profundal zone".

Macroinvertebrates - Animals without backbones that are big enough to see with the naked eye. Examples include most aquatic insects, snails and crayfish.

Macrophyte - Plants, usually aquatic, large enough to be seen without magnification. They may be rooted or free floating.

Magnetometer - An instrument that measures the strength of the earth's magnetic field.

Media (Singular: medium) - Specific environments (e.g., water, sediment, fish) that are the subject of regulatory concern and activities.

Meteorological - Related to the weather.

Methylation of Mercury – The process of bonding an organic molecule (a methyl group) to a mercury atom (mercuric ion) to form a new chemical: methylmercury.

Methylmercury - An organic form of mercury, which can be created from metallic or elemental mercury by bacteria in sediments and water.

Mitigation – Measures taken to reduce adverse impacts on the environment.

Monitoring – Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action.

National Priorities List (NPL) – The NPL is USEPA's list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. THE NPL is intended primarily to guide the USEPA in determining which sites warrant further investigation and remediation.

Non-Aqueous-Phase Liquid (NAPL) – Contaminants that remain undiluted as the original bulk liquid in the subsurface; e.g., spilled oil. Dense NAPL, or DNAPL, includes chlorinated hydrocarbon solvents or petroleum fractions with a specific gravity greater than 1.0 that can sink through the water column until they reach a confining layer.

Operation and Maintenance (O&M) – Activities conducted after a Superfund site action is completed to ensure that the action is effective. O&M actions can include those taken after construction to ensure that facilities constructed to treat wastewater will be properly operated and maintained to meet discharge limits.

Oxygenation - The process of providing or combining or treating with oxygen.

Phytoplankton - Microscopic plant life (i.e., algae) that lives in the water column of a lake and serves as food for zooplankton and some fish species.

Piezometer - A non-pumping well, generally of small diameter, for measuring the elevation of groundwater.

Porewater - Porewater is the water filling the spaces between grains of sediment.

Preliminary Remediation Goals (PRGs) – Established for the Onondaga Lake RI/FS to provide additional information and goals with which remedial alternatives can be developed and selected. PRGs are used to achieve remedial action objectives.

Probable Effect Concentration (PEC) – Sediment quality values established as the concentrations of individual chemicals above which adverse effects in sediments are expected to frequently occur.

Profundal Sediment – Sediment located beneath hypolimnetic water in water depths greater than 30 feet (9 meters).

Profundal Zone – The part of a water body below the depth to which sunlight penetration can support aquatic plants; contrast with "littoral zone".

Receptor – Entity exposed to a stressor.

Remedial Action Objectives (RAO) – RAOs were developed for the Onondaga Lake subsite to provide the overall goals of the remedial process and provide the basis for comparing the degree to which various alternatives protect human health and the environment.

Remedial Design – A phase of remedial action that follows the remedial investigation/feasibility study and Record of Decision and includes development of engineering drawings and specifications for a site cleanup.

Remedial Investigation (RI) – An in-depth study designed to gather data needed to determine the nature and extent of contamination and risks to humans and the environment at a Superfund site. The RI is usually done prior to the feasibility study (FS). Together they are usually referred to as the "RI/FS".

Remediation – Cleanup or other methods used to remove or contain a toxic spill or hazardous materials from a Superfund site.

Sediment – Materials that sink to the bottom of a body of water or materials that are deposited by wind, water, or glaciers. Sediment is the primary contaminated medium at the Onondaga Lake subsite.

Sediment Effects Concentration (SECs) – Sediment quality guidelines used to predict sediment toxicity. Site-specific SECs were derived for Onondaga Lake based on the results of the acute toxicity tests.

Sediment Management Units (SMUs) – The eight areas of Onondaga Lake that were established to assist in the evaluation to better manage remediation of contaminated sediments. SMUs 1 through 7 are located in the littoral zone of the lake and SMU 8 is the entire profundal zone of the lake.

Stratification - Containing distinct layers. During summer stratification, from approximately mid-May to mid-October, Onondaga Lake consists of two layers of water (i.e., the hypolimnion and the epilimnion).

Stressor – A physical, chemical, or biological entity that can induce adverse effects on an ecosystem or human health.

Superfund – The common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The Superfund Amendments and Reauthorization Act (SARA) amended CERCLA on October 17, 1986.

Supernatant - The liquid above settled solids.

Surface Water – Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs.

Thin-layer Cap - A thin-layer cap is similar to an isolation cap, but with a thinner layer of capping material. A thin-layer cap provides many of the benefits of an isolation cap, and is appropriate for sediment that is less impacted by pollutants as well as prone to recovery from natural processes, such as sediment deposition.

Threshold – The dose or exposure level below which a significant adverse effect is not expected.

Treatment – Any method, technique, or process designed to remove solids and/or pollutants from solid water, waste streams, effluent, and air emissions.

Undrained Shear Test - A test used to measure the strength of soil.

Upwelling – The upward movement of groundwater through sediments.

Vane Shear Test - A field shear test done by rotating a set of fins in the soil. The shear strength is determined from the soil's resistance to rotation.

Vibracore - A sampling device that uses a vibration source to sink a sample barrel into water-saturated sediments for purposes of collecting a sediment sample.

Zooplankton – Small (often microscopic) planktonic animals that live in the water column of a lake and serve as food for some fish species.

APPENDIX A

REGULATORY REQUIREMENTS

APPENDIX A

REGULATORY REQUIREMENTS

This Appendix provides a preliminary guide for involvement of local, state and federal regulatory agencies with potential jurisdiction over implementing at least a portion of the selected remedy.

Table A-1 provides a listing of potentially applicable federal, state, and local requirements for the Onondaga Lake Remediation. In addition to these requirements, it will likely also be necessary to obtain access agreements from government and private entities where remedial activities will impact properties not under the control of Honeywell.

As set forth in the Consent Decree, the NYSDEC may exempt Honeywell from the requirement to obtain any Department issued permit if all substantive technical requirements applicable to like activity conducted pursuant to a permit are complied with. In addition, the NYSDEC may exempt Honeywell from the requirement to obtain any other State or local permit if, *inter alia*, there is a demonstration that obtaining such State or local permit will substantially delay the project or present a hardship. Finally, pursuant to CERCLA, Section 121(e), Honeywell is not required to obtain federally-issued permits, but will need to comply with the substantive requirements of applicable regulations.

TABLE A-1
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments
Nationwide 38 Permit (Sect. 404 Clean Water Act) Joint Application For Permit	**U.S. Army Corps of Engineers and NYSDEC with input from U.S. Fish and Wildlife Service (USFWS) and USEPA, as appropriate, through federal Executive Order 11990.**	• Preconstruction notification (PCN) • Remediation Project Scope of Work narrative. Indicate its an NPL/ CERCLA site. • Location Map (USGS Quad) • Site/Remediation/Grading Plan • Details (e.g., Erosion & Sediment Controls, cross-sections, treatment options) • Photographs of the Project Area • Statement of the status of Endangered/ Threatened Species Resources Archaeological Resources • Vegetative Community Species List • Wetlands Delineation Report • Wetlands Restoration Program/Plan	• Activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by authority of CERCLA as approved or required by USEPA (such as Onondaga Lake), are not required to obtain permits under Section 404 of the CWA or Section 10 of the Rivers and Harbors Act. (Sections 10 and 404). • Per discussions with local USACE staff, notification of USACE is not required on CERCLA Sites as USACE assumes USEPA will ensure compliance with appropriate regulations. • NYSDEC to determine compliance with substantive requirements of CWA as well as 6 NYCRR Parts 663 – 665.
401 Water Quality Certification	**USEPA** **NYSDEC**	• Notice of Intent • Complete copy of package to be submitted to the New York District Army Corps of Engineers and to the NYSDEC • Pursuant to Section 401 of the Clean Water Act and 6NYCRR Part 608.9, the New York State Department of Environmental Conservation has certified that activities authorized by NWP 38 will comply with the applicable provisions of the Clean Water Act and applicable New York State water quality standards.	• Activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by authority of CERCLA as approved or required by USEPA, are not required to obtain permits under Section 404 of the CWA or Section 10 of the Rivers and Harbors Act. (Sections 10 and 404) • NYSDEC to determine compliance with substantive requirements.
6 NYCRR Part 175 Special Licenses and Permits - Definitions and Uniform Procedures	**NYSDEC**	• Properly completed department application form. • Submitted to the appropriate department office as identified on the application or application instructions. • If the applicant is a corporation, firm, partnership, association, institution, or public or private agency, the application must be signed on behalf of such entity by the president or an appropriate principal officer.	• New York State Fish and Wildlife License may be required to collect and possess fish and wildlife for investigative purposes.

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments
6 NYCRR Part 360 – Solid Waste Management Facilities	**NYSDEC**	• Engineering drawings that set forth the proposed consolidation area's location, property boundaries, adjacent land uses and detailed construction plans. • Operation drawings that prescribe how the consolidation area will fulfill the regulatory requirements. • Landscape plan. • Engineering report that comprehensively describes the existing site conditions and a full engineering analysis of the consolidation area and its containment components, including closure and post-closure plans and criteria. • Construction quality assurance/construction quality control plan. • Operation and maintenance manual. • Contingency plan. • Hydrogeologic report (Completed for SCA). • Siting report (Completed for SCA). • Leachate management plan • Mined land use plan. If the applicant plans to use on-site excavation of cover material. • The most recent closure cost estimate and a copy of the documentation required to demonstrate financial assurance. • Where applicable, the most recent post-closure care cost estimate for the landfill and a copy of the documentation required to demonstrate financial assurance. • Where applicable, the most recent corrective action cost estimate and a copy of the documentation required to demonstrate the financial assurance. • Where applicable, an engineering report demonstrating how the landfill will meet the landfill gas collection system requirements.	• Regulation contains requirements for siting, design and operation. The SOW attached to the Consent Order for the Onondaga Lake Bottom Subsite requires Honeywell to design, operate, and maintain the SCA in accordance with the substantive requirements of NYSDEC Regulations Part 360, Section 2.14(a) for industrial monofills. • Part 360–2.14 regulations are performance based and complementary to the USACE pathway analysis requirements for dredged sediment management facilities.

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments
6 NYCRR Part 420 – Part 425 Mining Regulations	**NYSDEC**	• Completed application forms. • A mined land-use plan which shall set forth in detail an outline of the mining property and the affected land, the mining plan (description of the mining operation, including maps, plans, written materials and other documents as required by NYSDEC, such as Erosion Control, etc.) and the reclamation plan (description of operations to be performed to reclaim the land to be mined over the life of the mine including maps, plans, the schedule for reclamation, written material and other documents as required by NYSDEC). • A reclamation bond or appropriate substitute which is conditioned upon conformance with the mined land-use plan. • A renewal application shall contain the following: (i) completed application forms; (ii) an updated mining plan map consistent with the provisions of title 27 and including an identification of the area to be mined during the proposed permit term; (iii) a description of any changes to the mined land-use plan; and (iv) an identification of reclamation accomplished during the existing permit term.	• Mining means the extraction of overburden and minerals from the earth; the preparation and processing of minerals, including any activities or processes or parts thereof for the extraction or removal of minerals from their original location and the preparation, washing, cleaning, crushing, stockpiling or other processing of minerals at the mine location so as to make them suitable for commercial, industrial, or construction use; exclusive of manufacturing processes, at the mine location; the removal of such materials through sale or exchange, or for commercial, industrial or municipal use; and the disposition of overburden, tailings and waste at the mine location. Mining does not include the excavation, removal and disposition of minerals from construction projects, exclusive of the creation of water bodies, or excavations in aid of agricultural activities. • Mineral means any naturally formed, usually inorganic, solid material located on or below the surface of the earth • Performance of the Lake bottom dredging and backfilling operations is outside the definition of mining, so a mining permit is not required. However restoration materials, such as imported SCA dike and cap materials are considered minerals, so any operation supplying these materials to the project would be subject to the requirements of this part.

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments
6 NYCRR Part 500 Floodplain Management Regulations Development Permits **Executive Order 11988** **Camillus Municipal Code, Chapter 31: Flood Damage Prevention** **Geddes Flood Protection Ordinance**	**NYSDEC** **USEPA** **Town of Camillus** **Town of Geddes**	• Application to the Region 7 Permit Administrator on application forms provided by the department. • Description of the location, type and extent of the proposed project • Other information or plans required or specified in 6 NYCRR Part 500, section 500.8 and 6 NYCRR Part 621.	• May be applicable for shoreline support facilities and for construction of the pipeline from the Lakeshore to Wastebed 13, if routed within a floodplain. • Executive Order 11988 may apply. • Camillus Municipal Code Chapter 31 covers Flood Damage Prevention within the Town of Camillus, and Town of Geddes also has a Flood Protection Ordinance. Per discussions with NYSDEC, both Town ordinances would take the place of 6 NYCRR Part 500. As a result, any work in areas of special flood hazard would require a permit from the town where the area is located. • In the Town of Camillus, the Code Enforcement Officer reviews any permit applications. Application for a flood plain development permit from the Town of Geddes in the near future as part of the Willis/Semet Lakeshore IRM could trigger the Site Plan approval process.
6NYCRR Part 608 Use and Protection of Waters.	**NYSDEC**	• Application to Region 7 Permit Administrator • Plan of Proposed Project • Location Map (USGS Quad) • Other as determined by NYSDEC	• 6 NYCRR Part 608 and Section 404 of the Federal Clean Water Act together regulate alterations to protected waters such as dredging and filling. Approval would be governed by whether: (a) the proposal is reasonable and necessary; (b) the proposal would not endanger the health, safety or welfare of the people of the State of New York; and (c) the proposal would not cause unreasonable, uncontrolled or unnecessary damage to the natural resources of the state.

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments

6NYCRR Parts 200, 201, 211, 212, 255, 256, 257, and 291 Prevention and Control of Air Contamination and Air Pollution	**NYSDEC**	• Preconstruction deliverables to NYSDEC Division of Air include:
		  • Emission estimates
		  • Control technology description
		  • Air dispersion modeling protocol and analysis.
			• Although no permit was required for the Vapor Phase Treatment System (VPTS) at the Willis Ave. GWTP because the project was conducted under an Order on Consent, pre-approval by the NYSDEC was required prior to construction. VPTS at the GWTP is subject to 6 NYCRR Part 212 and DAR-1. Honeywell was also required to perform compliance testing to obtain the equivalent of "Certificate to Operate".
			• Will also apply to SCA leachate treatment plant if discharge to the atmosphere is included. Will need to coordinate with NYSDEC when leachate treatment design is ready.
			• The Site Remediation MACT (Subpart GGGGG) does not apply since the project will not emit pollutants above the "major source" thresholds.

Request for Authorization Letter **National Historic Preservation Act 36 CFR Part 800**	**NYS Office of Parks, Recreation, & Historic Preservation (OPRHP) – State Historic Preservation Office (SHPO)**	• Letter of Findings requesting SHPO to concur that no additional archeological work is necessary in the project area if Phase 1A determined no need for additional work. If a Phase 1B required, submit Phase 1B scope of work for comment. • Scope of Work - Brief remedy narrative • Location Map (USGS Quad w/site location) & results of Cultural Resource Survey work..	• A Phase 1A Cultural Resource Assessment was conducted for the lake. A Phase1B Cultural Resources assessment will be performed during the RD. .
Request for Authorization Letter **Federal Endangered Species Act and 50 CFR Parts 17 and 23** **Fish and Wildlife Coordination Act (16 USC Section 662)**	**US Fish & Wildlife Service (USWFS)**	• Letter of Intent requesting USWFS to identify any potential endangered or threatened species or critical habitats in the project area. • Scope of Work - Brief narrative of remedy • Location Map (USGS Quad with site location)	• A letter from USFWS (6/25/02) in the Baseline Ecological Risk Assessment indicates one threatened species within two miles of Onondaga Lake. Will send copy of letter to USF&WS when we request an updated evaluation.

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Request for Authorization Letter **NYS Endangered Species Act and 6 NYCRR Part 182**	**NYS Natural Heritage Program (NYSNHP),** **NYSDEC Wildlife Resources Center**	• Letter of Intent requesting NYSNHP to identify any potential endangered or threatened species or critical habitats in the project area • Scope of Work - Brief narrative of remedy • Location Map (topographic map with site location)	• A letter from NY Natural Heritage Program (10/24/02) in the Baseline Ecological Risk Assessment indicates three threatened species within two miles of Onondaga Lake. Will send copy of letter to NYSNHP when we request an updated evaluation.
Stormwater Management & Erosion Control Plan - General Permit (Stormwater Pollution Prevention - SWPPP)	**USEPA,** **NYSDEC Division of Water**	• Notice of Intent to Discharge • Stormwater management scope of work narrative. Indicate its an NPL/CERCLA site • Stormwater Pollution Prevention Plan	• Disturbance of more than 1 acre requires preparation of an erosion control plan meeting the substantive requirements of the regulations.
SPDES (6NYCRR Parts 750-757) **Clean Water Act, Sections 318, 402, and 405(a) and 40 CFR Parts 122 and 123**	**NYSDEC Division of Water ,** **USEPA**	• Notice of Intent to Discharge <u>for discharge directly to NYS Surface Waters.</u> • Wastewater management scope of work narrative. Indicate it's an NPL/CERCLA site. • Technical information including : 1) Site status & site number 2) DHWR Engineer contact 3) Treatment system description 4) Discharge rate and duration 5) Description of receiving stream 6) Wastewater monitoring data (e.g., if system is new, then provide soil/sediment, groundwater, and surface water sampling data as representative of projected influent constituents) • Request effluent discharge criteria (suggest that Best Available Technology/Best Available Practice (BAT/BAP) criteria be used, along with the applicable analytical methods) • Sampling & Analysis Plan - Implemented for the duration of the treatment system operation	• Would receive a "Permit Equivalent" letter from the Division of Environmental Remediation in lieu of an actual SPDES permit from the Division of Water.
CSX Access Agreement		• Description of Work • Site Narrative • Plan of Proposed Project • Location Map (USGS Quad) • CSX Application Form • Insurance Certificate	• Determine if access agreement would be required if area under railroad bridge over Ninemile Creek is utilized for dredge slurry piping (i.e. property under bridge owned by CSX).

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments
Local Building Permit (Bldg. Permit Application/Form)	**Town of Geddes (Town of Geddes zoning ordinance) Town of Camillus (Municipal Code, Chapter 30 – Zoning Regulations of the Town of Camillus).** **(possibly City of Syracuse)**	• Potential for Building Permit, Site Development Permit, Site Plan Approval. • Location Map of the site (USGS Quad & Local); Drawings of the structure (plan & profile) • Plan and profile for sediment transfer pipeline from the Lake shore to the SCA. • Truck access to SCA at Wastebed 13 – Frequency and Route (Town of Camillus). • Placement of shoreline support facilities at Wastebeds 1-8 (Town of Geddes) and perhaps also at Wastebed B (Town of Geddes and City of Syracuse) • Building and stormwater designs for shoreline support facilities. • Certificate of Occupancy for areas where workers will stay.	• Any work in the Town of Camillus may be subject to additional level of regulation and review if constructed in a "Stream Corridor Overlay District", dependent on the horizontal distance from the high water mark
Onondaga County Agreements	**Onondaga County**	• Access and building construction at northern portion of Wastebeds 1-8 as needed for dredging and capping support facilities.	• Truck access to Wastebeds 1-8 will also need to be coordinated with New York State Department of Agriculture & Markets (NYS Fair).
Highway work permit and occupancy permit. (Honeywell submit application and proof of adequate insurance)	**NYSDOT, Onondaga County, and possibly local municipalities.**	• Perm 32 – Highway Work Permit Application for Utility Work. • Perm 33 – Highway Work Permit Application for Non-Utility Work. • Perm 44e – Surety Bond (Performance). • Perm 17 – Certificate of Insurance for Special Hauling, Divisible Load Overweight, and Highway Work Permit Insurance Requirements. • 17 NYCRR Part 131 – Accommodation of Utilities within State Highway Right-of-Way.	• Applicable if access to/from the SCA and/or Shoreline Processing area from I-690/SR-695 needs to be improved. • Applicable if pipeline routing requires crossing I-690. • 17 NYCRR Part 131 may also apply to pipeline route and/or access improvements. • May also need "Temporary Access/Curb Cut" permits to construct a new site entrance.

TABLE A-1 (Continued)
POTENTIALLY-APPLICABLE REGULATORY REQUIREMENTS

Potential Requirement	Responsible Agency	Example Supporting Documentation	Comments
Private Landowner Agreements	**TBD**	• Access from Lakeshore to Wastebed 13 (if a private landowner exists along selected ROW) • Quarry locations for SCA and lake cap materials (Candidate locations not yet identified. May also be subject to 6 NYCRR Part 420 - Part 425)	• Will need to review tax maps when routing of the pipeline from the lakeshore to the SCA is determined. Parsons has tax data in GIS and can generate required information. Also, data from Pictometry® Visual Intelligence may be useful.
Canal System Work Permit **Canal Law, Article 2 § 10.**	**NYS Canal Corporation**	• Canal Permit Application • Certificate of Insurance • Maps, Plans and Specifications of the proposed work • Copies of USACE and/or NYSDEC Approval • Application Fee	• May require permits and/or access agreements for: (a) Use of Barge Canal for material and equipment transfers; (b) Short-term navigation constraints during dredging and capping; and (c) Long-term cap protection institutional controls. • Per discussions with Canal Corp. personnel, Work Permit would allow the Canal Corp. to issue notices to navigation of work in progress in the lake and coordination with Canal Corp. maintenance activities. It would also help facilitate use of the Canal System for transport of equipment and supplies. • Estimated time requirements for obtaining permit for lake work would be approximately one month. Area of maximum interference would be with work in SMU 6 at the outlet of the Syracuse Terminal Channel. • Creation of an obstruction in Onondaga Lake such as a submerged outfall pipe or water intake.

APPENDIX B

OUTLINE FOR REMEDIAL DESIGN ELEMENTS FOR HABITAT RESTORATION PLAN

Onondaga Lake
Remedial Design Elements for Habitat Restoration
(For Compliance with Applicable State and Federal Laws, Regulations, Executive Orders and Policies for Floodplains, Wetlands and Surface Waters)

A. PART ONE

1. INTRODUCTION

a. General Description of Habitat Restoration at the Onondaga Lake NPL site (Summary of restoration following remediation at all Onondaga Lake subsites).

b. Habitat Design Background

i. Onondaga Lake site requirements

1. Lakewide habitat restoration plan (from OL ROD)
2. Compliance with substantive requirements for permitting –
   a. ECL Article 15, 6 NYCRR Part 608
   b. ECL Article 24, 6 NYCRR Part 663
   c. 40 CFR Part 6, Appendix A
   d. Executive Order No. 11988 - "Floodplain Mgmt"
   e. Executive Order No. 11990 - "Wetlands Protection"
   f. Policy on Floodplains and Wetland Assessments for CERCLA Actions, August 1985
   g. Section 10, Rivers and Harbors Act, 33 USC § 403
   h. National Historic Preservation Act
   i. Endangered Species Act (for any off-site mitigation)
   j. Any additional state or federal regulations, criteria, advisories and guidance that would apply to habitat (upland, wetland and aquatic) or species (T&E, migratory, or resident) protection (e.g. Migratory Bird Treaty Act)
3. Habitat restoration, reestablishment, enhancement

ii. IRM scope requirements - Compliance with substantive requirements of state and federal laws and regulations (as above)

iii. Other Honeywell sites (see 3c below) that may incorporate habitat design elements

c. Goal of the Lakewide Habitat Design - To implement a habitat restoration plan for remedial actions associated with the Onondaga Lake Bottom Remedy and with remedies/IRMs for adjacent Honeywell sites that complies with applicable state and federal laws and regulations, executive orders and policies for floodplains, wetlands and surface waters. In addition, provide ecological, recreational and aesthetic benefits to the

extent practicable.

i. Objective 1 - Provide a comprehensive analysis of the habitats that will be affected by the various remedial activities in the lakeshore, floodplains, littoral, profundal and wetland areas of Onondaga Lake.

ii. Objective 2 - Provide preliminary design concepts and final design plans for:

1. Habitat restoration for the Onondaga Lake Bottom remedy in areas of the lakeshore, floodplains, littoral, profundal and wetland areas that will be affected by the remedial activities for Onondaga Lake.

2. Habitat enhancement in Onondaga Lake as defined in the Onondaga Lake Bottom ROD.

3. Habitat restoration for the remedies and IRMs of other Honeywell sites where remedial activities will affect Onondaga Lake lakeshore, floodplains, littoral, profundal and wetland areas.

2. CONDITIONS IN ONONDAGA LAKE

(including but not limited to Onondaga Lake BERA Section 3, Onondaga Lake FS Section 1.3.9 and Appendix M, and Effler 1996, and O'Brien & Gere Engineers and Parsons 2004, Onondaga County Ambient Monitoring Program Reports)

a. Summary of pre-contamination conditions
   i. Habitats
   ii. Biological Communities

b. Summary of current conditions
   i. Changes from historical conditions around Onondaga Lake
      1. Lake level and surface area changes
      2. Development
      3. METRO/CSO loading /improvements
      4. Remedial Actions/ IRMs impacts
   ii. Existing Habitats
      1. Littoral Zone
      2. Profundal Zone
      3. Wetlands
      4. Riparian Zone
      5. Tributaries (Lower Reaches)

iii. Existing Biological Communities
1. Submerged/Emergent Macrophytes
2. Phyto- and Zoo-plankton
3. Benthic Macroinvertebrates
4. Fishes
5. Amphibian/Reptiles
6. Avian
7. Mammals
8. Other

3. EFFECTS OF REMEDIATION ON ONONDAGA LAKE HABITAT

a. Onondaga Lake Bottom Remedy expected effects
i. Shoreline/ wetlands
ii. Floodplain
iii. Littoral
iv. Profundal

b. IRMs
i. East Flume IRM
1. Habitats
2. Biological Communities
3. Expected effects of remedial activities
ii. Wastebed B/Harbor Brook IRM
1. Habitats
2. Biological Communities
3. Expected effects of remedial activities
iii. Willis/ Semet IRM
1. Habitats
2. Biological Communities
3. Expected effects of remedial activities

c. Other remediation sites
i. Dredge Spoils Area
1. Habitats (including SYW-6)
2. Biological Communities
3. Expected effects of remedial activities
ii. Wastebeds 1-8
1. Habitats (including shoreline)
2. Biological Communities
3. Expected effects of remedial activities
iii. Wastebed B/Harbor Brook
1. Habitats (including SYW-19, SYW-12, stream outlets)

2. Biological Communities
3. Expected effects of remedial activities

iv. Geddes Brook/ Ninemile Creek – OU-2
1. Habitats (including SYW-10, stream outlet)
2. Biological Communities
3. Expected effects of remedial activities

d. Summary of the habitat areas to be affected by remedial activities

B. PART TWO (Section 4 to be generated in conjunction with and with agreement from DEC after substantive completion of Part One)

4. IDENTIFICATION OF TARGET HABITATS FOR RESTORATION

a. Establishment of general habitat restoration goals

b. Identification of target habitats and associated species needs
i. Target Habitat Identification
ii. Target habitat requirements
iii. Species associated with target habitats
iv. Species requirements

5. PRELIMINARY DESIGNS FOR LAKEWIDE HABITAT

a. Integration of remedial design and construction with target habitats
i. Determination of appropriate restoration subareas (based on habitat characteristics, location, and/or remediation scheduling)
1. SMU-1/SMU-2 subarea
a. Sites comprising subarea *(Lake Bottom, Wastebed B/Harbor Brook, Harbor*)
2. SMU-4 subarea
a. Sites comprising subarea (*Lake Bottom, Ninemile Creek, Wastebeds 1-8*)
b. Boundaries
c. Expected remedial impact
3. Other subareas
ii. Designs for habitat restoration
1. Subareas
2. Lake Bottom Site (all remaining SMUs nto in subareas)
a. Required water depth
b. Habitat Layer thickness for littoral cap
c. Habitat Layer substrate for littoral cap
d. Substrate and thickness of thin layer cap
e. Habitat enhancement

3. East Flume IRM
4. Wastebed B/ Harbor Brook IRM
5. Willis/Semet IRM
6. Other remediation sites

iii. General Specifications
1. Species lists for planting
2. Acceptable substrate types
3. Monitoring Requirements
4. Maintenance Requirements

Effler. S. 1996. Limnological and Engineering Analysis of a Polluted Urban Lake: Prelude to Environmental Management of Onondaga Lake, New York. Springer-Verlag, New York.

O'Brien & Gere Engineers, Inc. and Parsons. 2004. Draft Report: Wetlands/Floodplain Assessment Onondaga Lake Geddes and Syracuse, New York. October.