ONONDAGA LAKE
SEDIMENT CONSOLIDATION AREA (SCA)
CIVIL AND GEOTECHNICAL
FINAL DESIGN

Prepared For:

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APRIL 2011

CERTIFICATION

Pursuant to item 28 of the Consent Decree, the following certification is provided, signed by a licensed professional engineer in New York:

> I, John F. Beech, am currently a registered professional engineer licensed by the State of New York, and I certify that this Sediment Consolidation Area (SCA) Civil and Geotechnical Design was, in my professional opinion, prepared in substantial conformance with the Consent Decree between the State of New York and Honeywell International, Inc. dated January 4, 2007.

By: ______________________

NYS PE # 066337

STATE OF NEW YORK JOHN F. BEECH LICENSED PROFESSIONAL ENGINEER No. 066337

20 APR 2011

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LIST OF ACRONYMS

ACAP	Alternative Cover Assessment Program
ARAR	Applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
BOD	Basis of Design
cm/sec	centimeter per second
CPP	Citizen Participation Plan
CQAP	Construction Quality Assurance Plan
CSM	Cross-section settlement model
CY	Cubic yards
EPDM	Ethylene propylene diene monomer
ft	feet
GCL	geosynthetic clay liner
gpm	gallon per minute
HDPE	High density polyethylene
HELP	Hydraulic Evaluation of Landfill Performance
IDS	Initial Design Submittal
LLDPE	Linear low density polyethylene
MNR	Monitored Natural Recovery
NAPL	Non-aqueous phase liquid
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OM&M	Operation, maintenance, and monitoring
OU	Operable unit
PP	Polypropylene
PRG	Preliminary remedial goals
RAO	Remedial action objectives
RDWP	Remedial Design Work Plan

LIST OF ACRONYMS (CONTINUED)

ROD	Record of Decision
SCA	Sediment consolidation area
SMU	Sediment management unit
SOW	Statement of work
SPDES	State Pollution Discharge Elimination System
SSM	Surface settlement model
SUNY ESF	State University of New York College of Environmental Science and Forestry
SWPPP	Stormwater Pollution Prevention Plan
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WTP	Water treatment plant

EXECUTIVE SUMMARY

The development of this Sediment Consolidation Area (SCA) Civil and Geotechnical Final Design is Honeywell's next step toward achieving the goals of the Record of Decision (ROD) and the community's vision for a restored Onondaga Lake. The lake remediation plan, which was selected by the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (USEPA), calls for a combination of dredging and capping. This Final Design presents the civil and geotechnical design components of the SCA and incorporates comments received from the NYSDEC on the Draft SCA Final Design Submittal.

Onondaga Lake Remedy

Sediment containment is only one portion of the entire lake remedy. The selected remedy outlined in the ROD issued by USEPA and NYSDEC calls for the following activities:

- Dredging and SCA containment of up to an estimated 2,653,000 cubic yards (CY) of contaminated sediments
- Construction of an isolation cap over an estimated 425 acres in shallow areas of the lake
- Construction of a thin-layer cap over an estimated 154 acres in the lake's deeper areas
- Construction and operation of a hydraulic control system (i.e., barrier wall) along part of the shoreline
- Completion of a pilot study to evaluate methods to prevent formation of methylmercury
- Wetland and habitat restoration
- Monitored natural recovery
- Long-term maintenance and monitoring

Honeywell's remedial design effectively restores Onondaga Lake while ensuring long-term protection of human health and the environment. Protective measures meet the design and performance criteria consistent with the requirements set forth in the ROD and associated Consent Decree Statement of Work (SOW). Aspects of the SCA design described in this document include the following: location and layout, composite liner system, slope stability, settlement, liquids management, surface water management, monitoring, and construction phasing.

Community Input

Community input remains a vital component to Honeywell's design for the restoration of Onondaga Lake. Honeywell is committed to working with community leaders, interested stakeholders, and citizens to include their input, recommendations, comments, and perspectives. Community members have the opportunity to provide input in the design, construction, and post-construction periods, as outlined in the NYSDEC's Citizen Participation Plan (CPP) (NYSDEC, 2009). Two examples of design elements of the SCA that were based on public comments are the use of dewatering methods to proactively control potential odors, and the inclusion of buffer zones to reduce visual impacts.

SCA Location and Layout

The NYSDEC identified Wastebed 13 as the SCA location following completion of the Onondaga Lake SCA Siting Evaluation (Parsons, 2006). The location is based on accessibility, estimated capacity, current and future site use, geotechnical considerations, and distance from the community.

This selection is described and documented in NYSDEC's October 2006 Fact Sheet and the Consent Decree SOW. The layout, as shown on the right, provides more than the community-requested 500-feet (ft.) buffer zone along the western boundary of Wastebed 13 and an additional 200-ft. buffer zone from the northern boundary of Wastebed 13.

SCA Location on Wastebed 13

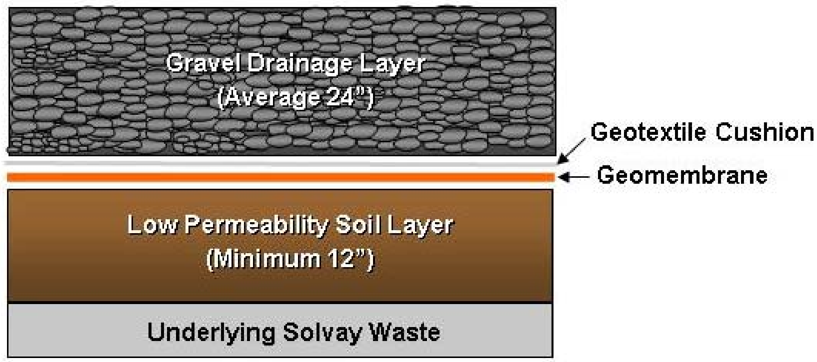
Design Process

Evaluations confirm that overall stability of the SCA will be maintained during construction, operations, and post-closure. The data required to perform these evaluations were obtained through a variety of field and laboratory tests including the following:

- Approximately 180 cone penetration test locations to establish thickness of the underlying Solvay waste for the SCA settlement calculations
- Approximately 60 borings (not including piezometer installations) to obtain samples for hundreds of index tests (e.g., moisture content, grain-size, Atterberg limits) and dozens of performance laboratory tests (i.e., strength and consolidation tests) to generate data for the stability and settlement calculations
- Approximately 50 piezometer installations to obtain water level data for use in the stability and settlement evaluations
- A 1-acre field settlement pilot study, which included installation of instruments (i.e., settlement plates, piezometers, and inclinometers), placement of 10 ft. of fill material over the 1-acre area, and monitoring of the instrumentation, to obtain data for the settlement evaluations

The results from these tests were used to evaluate how Wastebed 13 will perform under full-scale SCA loading. These results included thickness and engineering properties of the Solvay waste contained within the wastebed, and the geometry and properties of the existing perimeter dikes.

Honeywell performed numerous detailed evaluations to develop a design for the SCA that will provide safe and protective containment of the material dredged as part of the Onondaga Lake remediation. The composite liner system shown below will provide long-term isolation of the dredged sediment. Honeywell will monitor the performance of the SCA during construction, operations, and post-closure.



Composite Liner System

SCA Design Components

The major components and considerations of the SCA civil and geotechnical design described in this report are as follows:

- SCA capacity
- Slope stability
- Settlement
- Composite liner and liquid collection system design
- Surface water control system design
- Construction phasing
- Monitoring

Long-Term Effectiveness and Protection

A separate design document detailing the plans to cover and permanently close the SCA will be developed and submitted to the NYSDEC. Information gathered during the initial stages of SCA operations will be evaluated to provide the design team further details to effectively develop a long-term, permanent cover system. As part of ongoing Citizen Participation activities, the public will have an opportunity to review and provide input into the cover system including a potential vegetative cover.

Sustainable Practices

Honeywell is committed to minimizing the carbon footprint of remedial construction activities. Evaluations are being conducted to identify opportunities to incorporate sustainability concepts, including those presented in the Clean and Green Policy (USEPA, 2009) into all aspects of the remediation. To the extent practicable, use of renewable energy sources, utilization of locally produced/sourced materials and supplies, reduction/elimination of waste, efficient use of resources and energy, and other practices will be specified in the remedial design, and implemented during remedial construction.

SECTION 1

BACKGROUND AND DESIGN PROCESS OVERVIEW

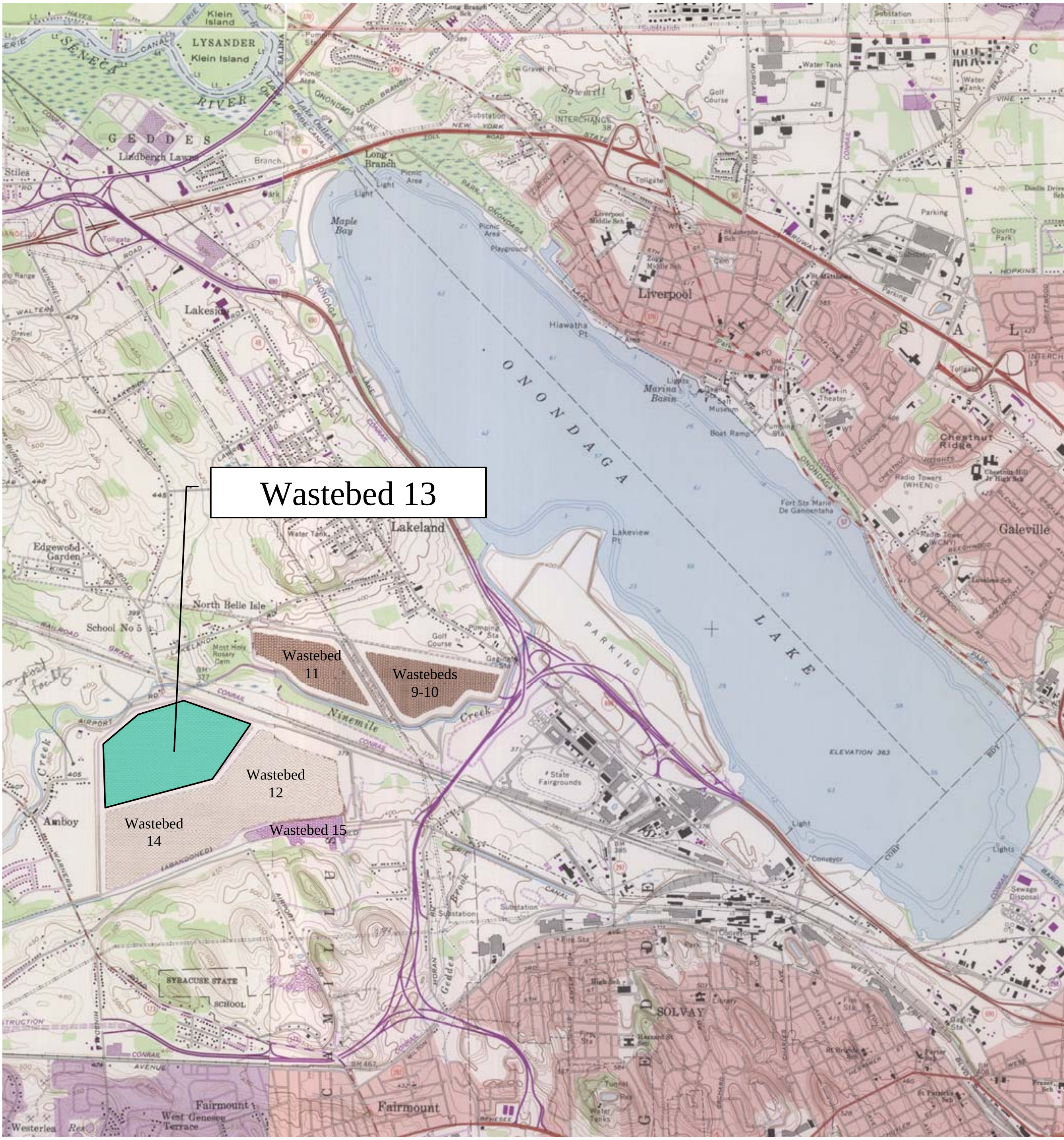
This Onondaga Lake Sediment Consolidation Area (SCA) Civil and Geotechnical Final Design (Final Design) Report has been prepared on behalf of Honeywell International Inc. (Honeywell). The lake bottom is on the New York State Registry of Inactive Hazardous Waste Sites and is part of the Onondaga Lake 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 NYSDEC to implement the selected remedy for Onondaga Lake as outlined in the ROD issued on July 1, 2005. The following documents are appended to the Consent Decree: ROD, Explanation of Significant Differences, SOW, and Environmental Easement.

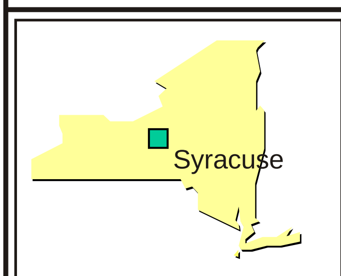
This report is based on extensive information and data gathered during design-related investigations. It provides a final design for the civil and geotechnical components of the SCA and further develops the SCA Initial Design Submittal (IDS) (Parsons and Geosyntec, 2009) and the Draft SCA Final Design (Parsons and Geosyntec, 2010) that were prepared in accordance with the Remedial Design Work Plan (RDWP) for the Onondaga Lake Bottom Subsite (Parsons, 2009c). This report also addresses comments received from the NYSDEC on October 18, 2009; May 13, 2010; September 9, 2010; and January 14, 2011.

1.1 BACKGROUND

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 (Figure 1.1). As specified in the ROD, a component of the selected lake remedy includes the dredging and on-site consolidation of sediments removed from the lake. Honeywell evaluated potential locations for building and operating an SCA to contain sediment removed from Onondaga Lake during the remedial action, as documented in the Onondaga Lake SCA Siting Evaluation (Parsons, 2006). 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 distance from residences. Based on the evaluation results, and as documented in the SOW of the Consent Decree, Wastebed 13 was selected for building and operating the SCA (Figure 1.1).

Wastebed 13 is located in the Town of Camillus and encompasses approximately 163 acres. It is bordered to the north by Ninemile Creek and the CSX Railroad tracks; to the west by an Onondaga County Garage property and a former gravel excavation owned by Honeywell; and to the east and south by Wastebeds 12 and 14, respectively. Wastebed 13 was originally designed as a settling basin for the disposal of Solvay waste and has recently been used by the State University of New York College of Environmental Science and Forestry (SUNY ESF) and Honeywell for willow/evapotranspiration cover pilot test plots. These test plots now occupy several acres along the southern border of the wastebed (Figure 1.2).





New York Quadrangle

LATITUDE: N 43° 5' 57"
LONGITUDE: W 76° 10' 41"

N

SOURCE: U.S.G.S. SYRACUSE WEST QUADRANGLE

FIGURE 1.1

Honeywell

Sediment Consolidation Area
Onondaga Lake Bottom Subsite
Remedial Design

SITE LOCATION MAP

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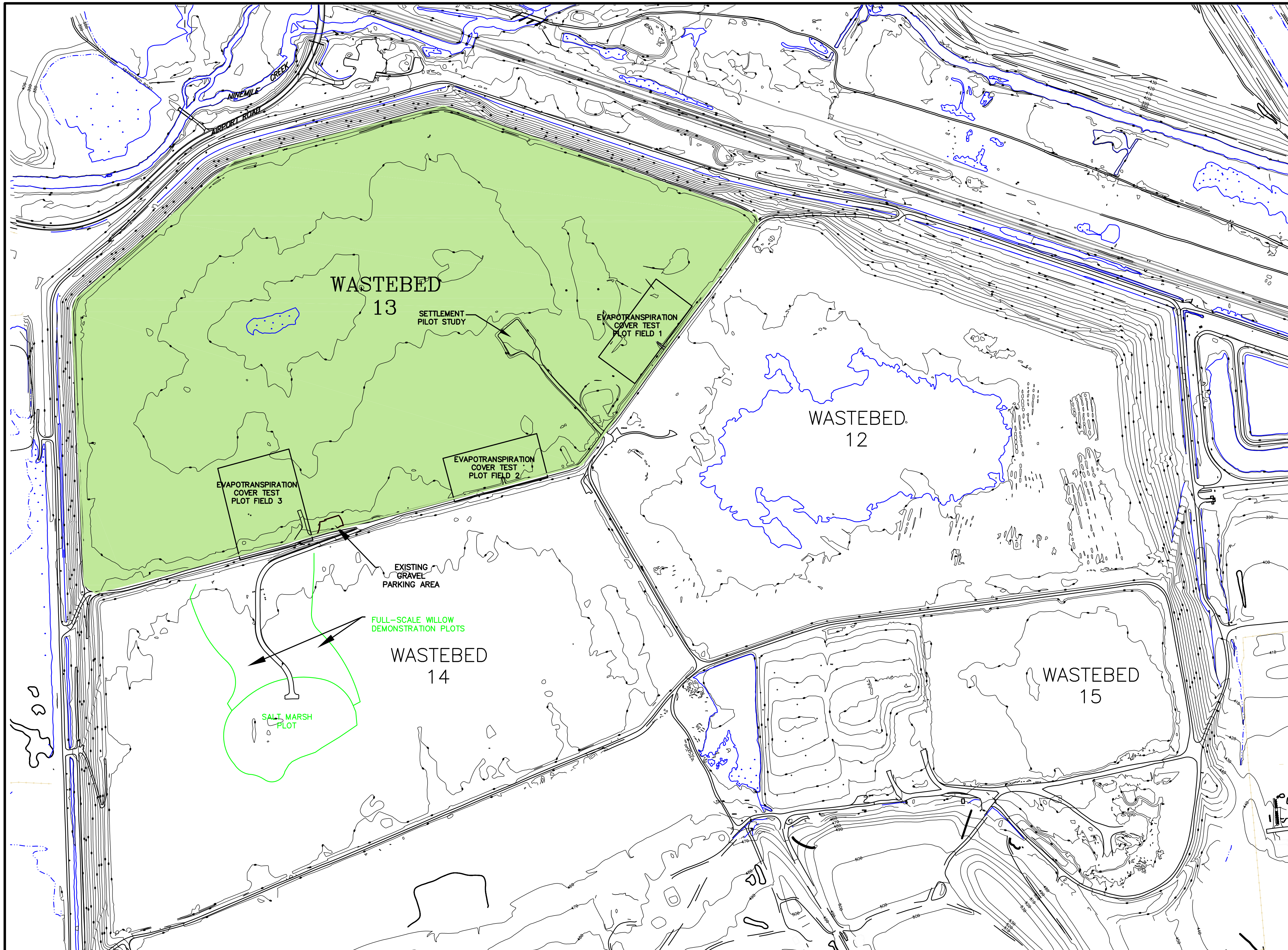

NOTE:

1. BASE MAP PROVIDED BY D.W.HANNIG L.S., P.C.; SURVEYED 6/10/08

600 300 0 600 1200

SCALE: 1"=600'

FIGURE 1.2

Honeywell

SEDIMENT CONSOLIDATION AREA
ONONDAGA LAKE BOTTOM SUBSITE REMEDIAL DESIGN
CAMILLUS, NEW YORK

WASTEBEDS 12–15
EXISTING SITE PLAN

PARSONS

301 PLAINFIELD ROAD * SUITE 350 * SYRACUSE, NEW YORK 13212 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\444853 – LAKE DETAIL DESIGN\10 TECHNICAL CATEGORIES\10.1 CAD\SCA RDI\441598SK001.DWG
PLOT DATE: 1/11/2010 11:40 AM PLOTTED BY: RUSSO, JILL

1.2 REMEDIATION OBJECTIVES AND GOALS

Activities associated with the Onondaga Lake remediation, including construction of the SCA, are designed to ensure the health and safety of the surrounding community, the environment, and on-site workers from potential hazards associated with the execution of the remedy. The ROD also provides more specific objectives—referred to as remedial action objectives (RAOs)—and goals (referred to as preliminary remedial goals [PRGs]) for the lake remedy. Honeywell's specific objectives related to the SCA design include the following:

- Design the SCA for the efficient and secure containment of sediments dredged as part of the Onondaga Lake remedy in a manner that ensures the health and safety of the community and the environment
- Incorporate dredging, SCA operations, and water treatment into the SCA civil and geotechnical design
- Incorporate stakeholder (i.e., regulatory agencies and the community) input in the process to identify design criteria (i.e., odor mitigation, redundancy of operations, leachate containment, dewatering, traffic, beneficial use, groundwater monitoring, etc.)

These objectives are also presented in the Basis of Design (BOD), which is included as Attachment A of the SCA Civil and Geotechnical Technical Memorandum (Parsons, 2009d) in Appendix A of this document and has been approved by the NYSDEC.

1.3 REMEDY OF RECORD

The ROD for the lake bottom describes the remedy selected by NYSDEC and the United States Environmental Protection Agency (USEPA). The SOW, 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 volumes, and isolation cap areas, models and components; design of the profundal zone (sediment management unit [SMU] 8) remedy; management of dredged sediments; design of the water treatment system; and development of the design and construction schedule. According to the ROD and SOW (United States District Court, 2007 – appendices to the Consent Decree), the components of the selected remedy relevant to the civil and geotechnical aspects of the SCA design, which is the focus of this report, are summarized as follows:

- "Dredging of as much as an estimated 2,653,000 CY of contaminated sediment/ waste …."
- Placing the majority of "dredged sediment … in one or more 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."
- "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."

The Consent Decree also states that "Honeywell shall design, operate, and maintain the SCA in accordance with the substantive requirements of NYSDEC Regulations Part 360, Section 2.14(a) (industrial monofills). The SCA shall have the following elements:"

- "*Impermeable Liner* – Honeywell shall design and install an impermeable liner system. The grading design for the SCA shall utilize the existing surface topography of Wastebed 13 as much as possible so as to limit wastebed cut and fill requirements and the associated need for a large volume of imported soil fill. Preloading and stabilization of the wastebed shall only be required to the extent necessary to ensure the integrity of the SCA components and underlying Solvay waste foundation, based upon the remedial design."
- "*Leachate Collection* – The impermeable liner shall be overlain by a leachate collection system. The type of system will be determined during Remedial Design. A laterally-transmissive sand or geosynthetic liquid collection layer may be considered by NYSDEC for inclusion in the system. The system shall convey leachate by gravity drainage to collection sumps where the leachate will be pumped via force main to a water treatment plant."
- "*SCA Cover* - The SCA cover shall be designed pursuant to applicable regulations and guidance including the USEPA Alternative Cover Assessment Program ("ACAP"). If appropriate based upon the Remedial Design, the SCA cover may utilize a soil layer and ecological plant community to produce evapotranspiration rate sufficient to reduce precipitation infiltration rates to acceptably low levels."
- "*NAPL Collection and Off-site Treatment and/or Disposal* – Dredged material that may contain non-aqueous phase liquids (NAPLs) shall pass through an oil/water separator. NAPLs that collect on the water surface within the oil/water separator, or that are otherwise collected, will be separated and collected for off-site treatment and/or disposal. In addition, the SCA liner and leachate collection system shall be designed and operated to collect for off-site treatment and/or disposal any NAPL present in the SCA leachate."

The first two design elements listed above are addressed in Section 4 of this document. An assumed SCA cover is discussed in Section 4. A Conceptual Closure Plan (including a closure schedule), content consistent with Part 360 2.15(b), will be submitted prior to the start of the third year of dredging and will be reviewed and approved by NYSDEC. As defined in the Conceptual Closure Plan, the final SCA cover design will be submitted as part of the Onondaga Lake Remedy Restoration and SCA Closure Design for review and approval by the NYSDEC prior to implementation. The fourth bullet (i.e., NAPL Collection and Off-site Treatment and/or Disposal) will be addressed by monitoring the SCA permanent sumps for the presence of NAPL and removing it, if detected. NAPL encountered or collected as part of the water treatment process will be removed or treated. Details will be included as part of the Water Treatment Plant (WTP) Design.

1.4 DESIGN PROCESS OVERVIEW

This document focuses on the civil and geotechnical aspects of the SCA design, which is just one element of the Onondaga Lake remedy. The design overview that follows is provided to put the SCA design in context with the rest of the remedy.

The primary elements of the selected Onondaga Lake remedy, as documented in the ROD, include the following:

- Sediment removal (dredging) and transport to the SCA
- SCA construction, operation, and closure
- Sediment capping (isolation and thin-layer) including remedial area determination and definition of dredge areas, depths, and volumes
- Water treatment system
- Oxygenation of the hypolimnion
- Monitored natural recovery (MNR)
- Habitat restoration and enhancement
- Institutional controls
- Long-term operation, maintenance, and monitoring

For most of the remedial elements listed above, design-related investigations, engineering assessments, and evaluation reports have already been completed to assess specific elements of the remedy, advance design decisions, and to obtain NYSDEC and USEPA approval on critical path components (through a series of work group meetings, conference calls, and previous design submittals). A summary of the documents pertinent to this report that are available in the document repositories is included as Table 1.1.

Due to interaction between the various remedial elements and varying design durations associated with specific components, it was necessary to separate the design into four initial design reports that, collectively, address all of the remedial elements listed above, as follows:

- The *SCA Civil & Geotechnical IDS* (Parsons and Geosyntec, 2009) includes the civil and geotechnical design elements (e.g., composite liner system) required for construction of the SCA. This IDS was submitted to the NYSDEC in August 2009 and is in the public document repositories.
- The *Dredging, Sediment Management, and Water Treatment IDS* (Parsons et al., 2009) provides initial design-level information pertaining to operational components of the remedy including the dredging, transportation, and dewatering of impacted lake sediments, and treatment of construction water generated during the process. This IDS was submitted to the NYSDEC in February 2009 and is in the public document repositories.
- The *Capping and Dredge Area and Depth IDS* (Parsons and Anchor QEA, 2009) includes the proposed, conceptual-level design detail for the sediment cap component of the remedy. This submittal also includes the design details pertaining to habitat restoration, and provides dredging volumes and removal areas/depths. This IDS was submitted to the NYSDEC in December 2009 and is in the public document repositories.

TABLE 1.1

ONONDAGA LAKE HISTORICAL DOCUMENTS

Date	Name of Document
2011, January	Draft Onondaga Lake Capping, Dredging and Habitat Intermediate Design
2011, January	Draft Onondaga Lake Sediment Management Final Design
2010, February	Draft Onondaga Lake Sediment Management Intermediate Design
2010, January	Draft Onondaga Lake Capping and Dredge Area and Depth Initial Design Submittal
2009, December	Draft Onondaga Lake Capping and Dredge Area and Depth Initial Design Submittal
2009, October	Onondaga Lake Remedial Design SCA Water Treatment Plant Intermediate Design Submittal
2009, September	Onondaga Lake Pre-Design Investigation: Phase III Data Summary Report
2009, August	Draft Onondaga Lake SCA Civil & Geotechnical Initial Design Submittal
2009, August	Onondaga Lake Pre-Design Investigation: Phase II Data Summary Report
2009, July	Wastebed 13 Settlement Pilot Study Monitoring Data - Year 3
2009, March	Remedial Design Work Plan for the Onondaga Lake Bottom Subsite
2009, March	Onondaga Lake PDI: Phase IV Work Plan, Addendum 6
2009, March	Citizen Participation Plan for the Onondaga Lake Bottom Subsite Remedial Design Program
2009, February	SCA Dewatering Evaluation Report
2009, February	Draft Onondaga Lake Dredging, Sediment Management, and Water Treatment Initial Design Submittal
2008, December	Wastebed 13 Settlement Pilot Study Monitoring Data - Year 2
2008, June	Onondaga Lake PDI: Wastebed 13 Settlement Pilot Study Data Summary Report
2007, October	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 4
2007, July	Onondaga Lake Phase III Pre-Design Investigation Work Plan, Addendum 1
2007, May	Onondaga Lake Pre-Design Investigation: Phase I Data Summary Report
2007, May	Onondaga Lake Phase III Pre-Design Investigation Work Plan
2007, January	Consent Decree between the State of New York and Honeywell International Inc.
2006, September	Onondaga Lake Pre-Design Investigation: Phase II Work Plan
2006, September	Onondaga Lake SCA Siting Evaluation
2005, August	Onondaga Lake Pre-Design Investigation: Wastebed 13 Settlement Pilot Study Work Plan
2005, July	Record of Decision: Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site
2004, November	Onondaga Lake Feasibility Study Report. Draft Final

- The *Thin-Layer Capping, Nitrate Addition/Oxygenation, and MNR (SMU 8) IDS* focuses on the deep water areas of the lake, and will provide initial design-level details pertaining to thin-layer capping (including locations, extent, materials, and sequencing), nitrate addition and/or oxygenation for the purposes of inhibiting the formation of methylmercury within the lake, and the approach to monitoring natural recovery in specific areas of the lake. This IDS was submitted to the NYSDEC in November 2010.

Separating the design into the four components shown above has allowed for accelerated design submittals, as well as agency review and approval for critical path activities (e.g., SCA and water treatment design) to facilitate the schedule for starting and completing the remedial action consistent with the Consent Decree. Figure 1.3 illustrates the relationships between the various submittals and the Remedial Design Components for the Onondaga Lake project and the importance of citizen participation throughout the entire design process.

1.5 FINAL DESIGN SUBMITTAL ORGANIZATION

This report is organized into eight sections and 15 appendices.

- Section 1: Background and Design Process Overview – Presents background information, site description, remedial goals, and a summary of the overall design process.
- Section 2: Community Participation, Community Health and Safety, and General Project Requirements – Highlights Honeywell's incorporation of community considerations into the design and presents general requirements applicable to many aspects of the project, including various federal, state, and local requirements, ordinances, and regulations applicable to the design.
- Section 3: Summary of Previous Investigations – Presents and summarizes data collected as part of design-related investigations, and describes the existing conditions at Wastebed 13, including subgrade properties.
- Section 4: Engineering Analysis and Design – Presents the technical evaluations and design for the civil and geotechnical aspects of the SCA design.
- Section 5: Plans – Presents the plans that will be required during SCA construction and operation.
- Section 6: Subcontracting Strategy – Summarizes the anticipated work scope packaging and anticipated subcontracting strategy for each work package.
- Section 7: Construction Milestones – Presents the anticipated design submittal and construction schedule.
- Section 8: References – Lists the references used to prepare this report.

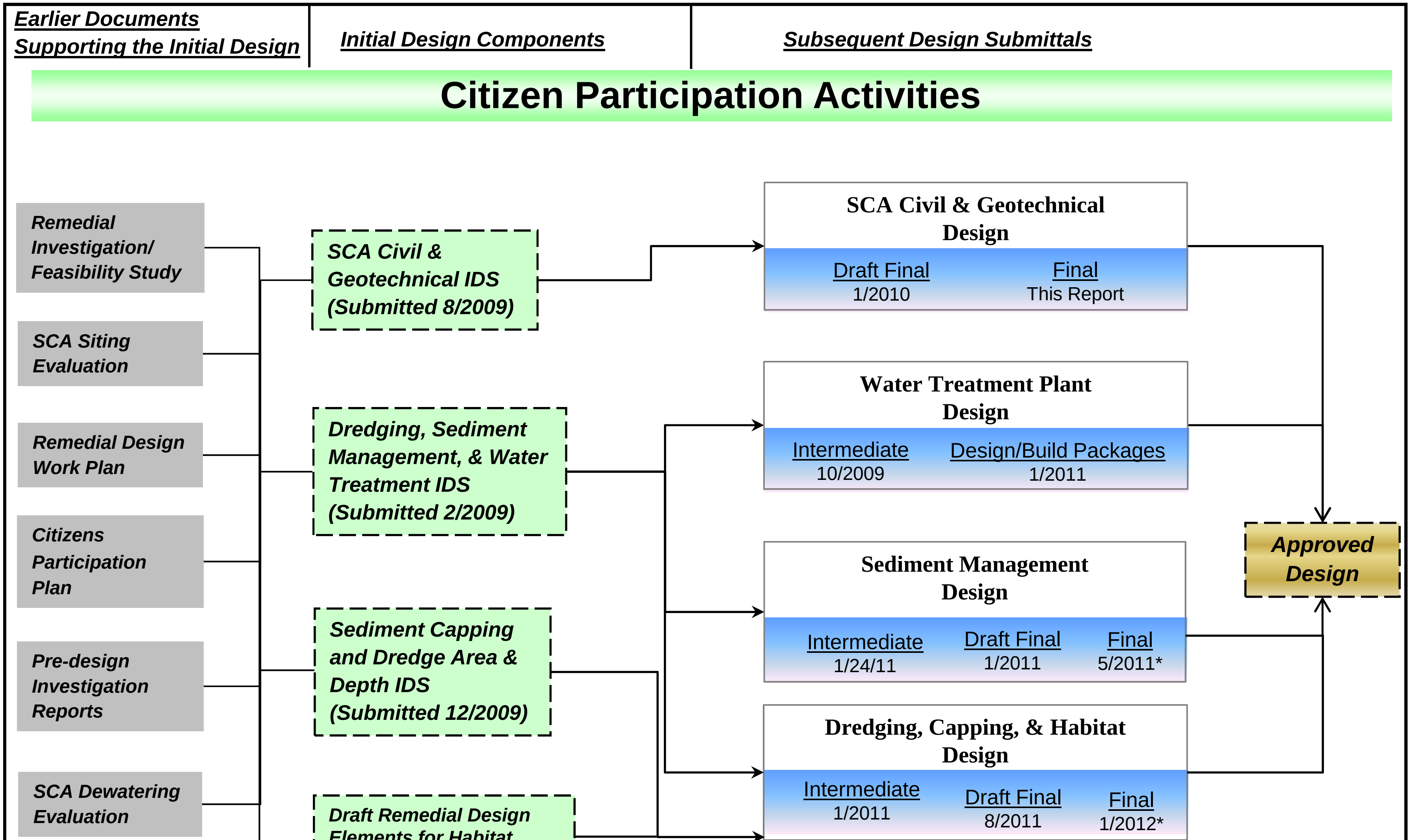

Figure 1.3

Honeywell ONONDAGA LAKE SYRACUSE, NEW YORK

Onondaga Lake Remedial Design Components

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* - Final Design dates are preliminary, and based on 60 day NYSDEC review period

SECTION 2

COMMUNITY PARTICIPATION, COMMUNITY HEALTH AND SAFETY, AND GENERAL PROJECT REQUIREMENTS

The health and safety of members of the community and consideration of community input are of paramount importance in designing the lake remedy. Honeywell is continuing a Community Outreach Program designed to ensure transparency of the design process, to incorporate community ideas and feedback, and to maintain awareness of remedial progress and milestones. This outreach was designed in recognition of the importance of the lake as a natural resource to the surrounding area, and the level of community interest in the progress of the Onondaga Lake remediation.

Section 2.1 of the Dredging, Sediment Management, and Water Treatment IDS (Parsons et al., 2009) and the Capping and Dredge Area and Depth IDS (Parsons and Anchor QEA, 2009) provide detailed discussions of community considerations and project requirements relevant to those aspects of the Onondaga Lake remedy. The Onondaga Lake CPP (NYSDEC, 2009) provides details regarding community involvement for the entire Onondaga Lake Bottom Subsite remedial program.

2.1 COMMUNITY PARTICIPATION AND HEALTH AND SAFETY

Community feedback continues to be an important component of the remedy design. Public feedback received through the community participation process has influenced design-level decisions associated with the SCA. Specific examples, which are discussed in more detail in Section 2.1.1, include:

- SCA location
- Buffer zones to reduce visual impacts to the community
- Dewatering method (i.e., control of potential odors)

Honeywell is working with community leaders to develop work plans specifically designed to ensure the health and safety of the surrounding community and environment is maintained throughout the execution of the remedy. These work plans will be reviewed by, and ultimately approved by, NYSDEC and USEPA. The work plans directly applicable to the SCA construction are discussed in Section 2.1.2. Work plans applicable to other aspects of the design will be discussed in the other design submittals outlined in Section 1.

2.1.1 Community Participation

The NYSDEC and Honeywell are required and committed to informing and involving the public during the remedial design and construction phases of the Onondaga Lake project. The CPP provides a formal, yet flexible plan for communication with the public during the remediation of the Onondaga Lake bottom.

Community input was a major consideration in the selection of geotextile tubes for the sediment dewatering method to be used within the SCA. The dewatering method presumed during the issuance of the ROD was a large open settling basin; however, the local community raised valid concerns pertaining to potential odor generation of this dewatering method. Based on these community concerns and a recommendation by NYSDEC, Honeywell performed an extensive evaluation comparing the geotextile tube and settling basin dewatering methods based on ten site-specific dewatering objectives.

Based on this evaluation, Honeywell determined that there are some site-specific benefits of using geotextile tubes as compared to settling basins. These benefits include the following:

- Potential for odor is significantly reduced
- Primary containment of the dredged sediments within the geotextile tubes
- Reduction in required berm height and preloading requirements as compared to an open settling basin, thereby reducing scale of construction activities and associated truck traffic and noise levels
- Reduction in required footprint as compared to an open settling basin because of lower SCA perimeter dike height; thereby reducing the visibility of the SCA and related construction activities
- Reduction in time to closure

Details of the comparison between dewatering methods and the decision to use geotextile tubes are documented in the SCA Dewatering Evaluation (Parsons, 2009a), which has been approved by the NYSDEC and is available at the public document repositories. The document is also provided herein as Appendix B.

Another component of the remedy that was based heavily on community input was the selection of the SCA location on Wastebed 13. The location was selected with careful consideration for minimizing impacts on the local community and providing the maximum buffer distance from nearby residential areas and public facilities. In addition, Wastebed 13 was selected based on the size of the area and storage capacity required for dredged sediment management, and the geographical layout of the wastebeds.

Another example of how input from the community influenced the final SCA design is the request from the community for a 500-ft. wide buffer zone between sediment dewatering activities and the Wastebed 13 western boundary. The design, as presented in Section 4, in response to those concerns, includes a 500-ft. buffer zone from the western boundary to provide further protection to the community from nuisance impacts (i.e., light, noise, or odors) associated with the operation of the SCA. In addition, Honeywell has incorporated in the design a 200-ft. buffer zone from the northern boundary of Wastebed 13 to the SCA.

2.1.2 Community Health and Safety

As part of the remedial design process, the design team will prepare a Community Health and Safety Plan to ensure that the health and safety of the surrounding community and environment are maintained. The issues relevant to the SCA civil construction will include, but are not necessarily limited to:

- Site Security & Community Health and Safety
- Traffic Management

- Noise Abatement
- In addition, other issues such as navigation protection, spill contingency, and volatile and odor emissions monitoring and mitigation will also be addressed in the community health and safety plan

2.2 GENERAL PROJECT REQUIREMENTS

Details of specific requirements pertaining to the SCA design are provided in the BOD (Attachment A of Appendix A, "SCA Civil and Geotechnical Technical Memorandum"). General requirements pertaining to the civil and geotechnical aspects of SCA design and construction are discussed in the subsections that follow.

2.2.1 Sustainability

Honeywell is committed to minimizing the carbon footprint of construction activities. During the lake remedy design phases, evaluations are being conducted to identify opportunities to incorporate sustainability concepts, including those presented in the *Clean and Green Policy* (USEPA, 2009), into all aspects of the Onondaga Lake remediation. To the extent practicable, use of renewable energy sources, utilization of locally produced/sourced materials and supplies, reduction/elimination of waste, efficient use of resources and energy, and other practices are specified in the design and will be implemented during remedial construction.

2.2.2 Applicable Regulations

Compliance with federal, state, and local Applicable or Relevant and Appropriate Requirements (ARARs) will ensure that existing resources are protected during operations and provide for overall protection of human health and the environment. A comprehensive list of chemical-specific, action-specific, and location-specific ARARs are included in the ROD. Compliance with federal, state, and local ARARs frequently involve formal permit application and approval processes. Details pertaining to these processes applicable to Onondaga Lake are outlined in the Consent Decree (United States District Court, 2007).

2.2.3 Construction Health and Safety Requirements

The health and safety of site personnel, visitors, and members of the public are considered paramount. Written safety plans will be developed for SCA construction, and they will be developed and updated as needed to address changing activities and site conditions. The health and safety record of all bidding contractors will be evaluated as part of the bidding process. At a minimum, selected Remedial Contractors will be required to prepare Project Safety Plans which will address potential safety issues associated with the specific tasks the contractor will be performing. Specific requirements, including audit procedures, employee drug and alcohol screening programs, and near-miss reporting protocols will also be specified within these safety plans.

2.2.4 Property and Site Access and Right-of-Way Entry

SCA construction and operation are not expected to require the use of non-Honeywell owned property.

SECTION 3

SUMMARY OF PREVIOUS INVESTIGATIONS

Honeywell used a phased approach to completing design-related investigation activities. This approach allowed the data from one phase to be interpreted and used to develop the appropriate scope for the next phase of investigation. This process also improves the overall quality and usefulness of the data and ensures that data gaps are identified and filled. Phase I, Phase II, Phase III, and Phase IV design-related investigation field efforts were conducted from 2005 to 2009, and were performed in accordance with NYSDEC-approved work plans.

This section provides a summary of the field investigations and laboratory testing performed for the design and construction of the SCA. Referenced documents are available at the public document repositories outlined in the Consent Decree.

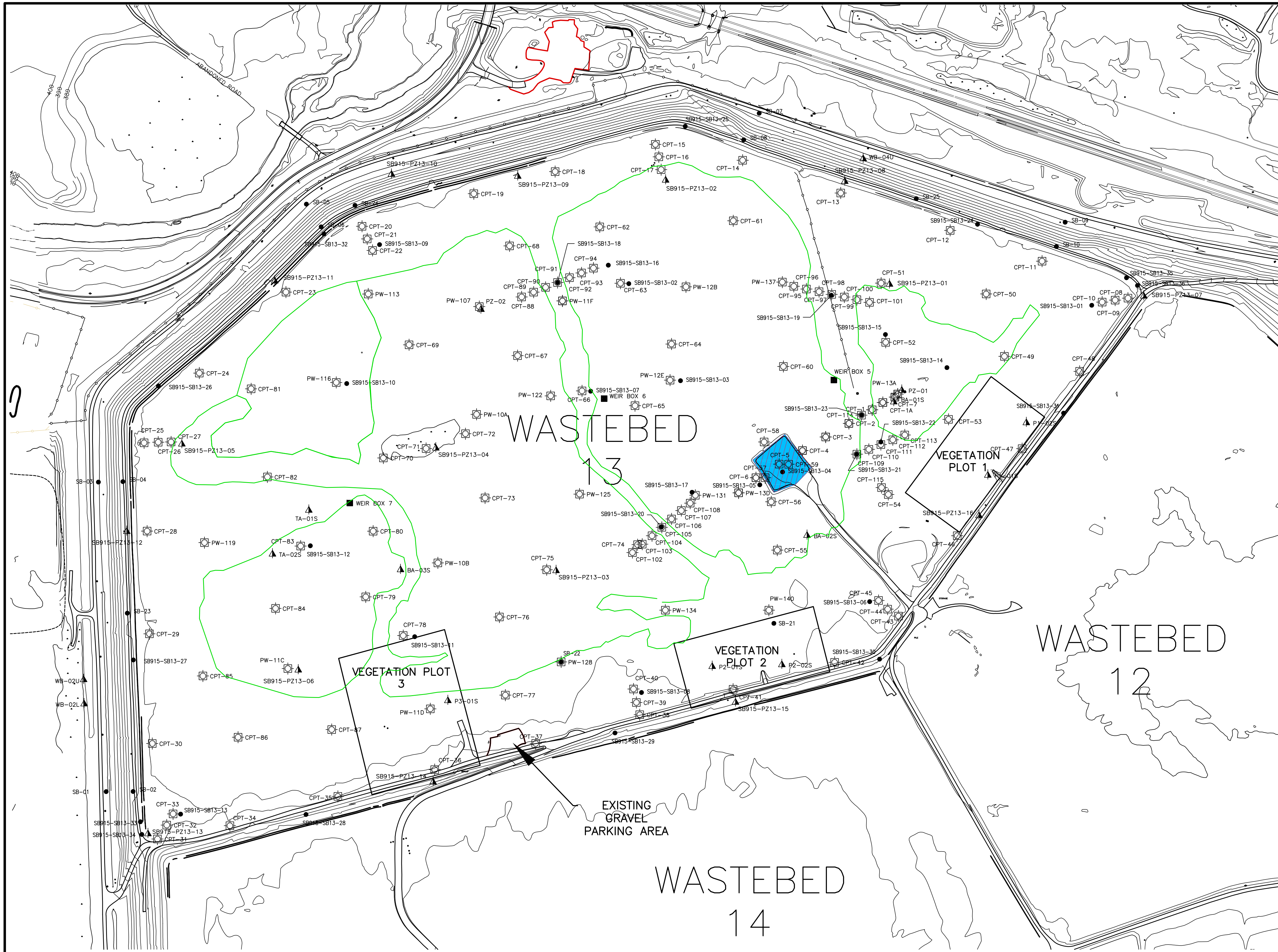
3.1 PRE-DESIGN INVESTIGATIONS AND SUBSURFACE CONDITIONS

Data related to subsurface conditions were collected during the Phase I, II, and III design-related investigation activities at Wastebed 13 and included the following (Figure 3.1):

- Approximately 180 cone penetration test locations to establish Solvay waste thickness in Wastebed 13 for the SCA settlement calculations
- Approximately 60 borings (not including piezometer installations) to obtain samples for hundreds of index tests (e.g., moisture content, grain-size, Atterberg limits) and dozens of performance laboratory tests (i.e., strength and consolidation tests) to generate data for the SCA stability and settlement calculations
- Approximately 50 piezometer installations to obtain water level data for use in the SCA stability and settlement evaluations
- A 1-acre field settlement pilot study, which included installation of instruments (i.e., settlement plates, piezometers, and inclinometers), placement of 10 ft. of fill material over the 1-acre area, and monitoring of the instrumentation, to obtain data for the SCA settlement evaluations

The data obtained from the investigation activities listed above were used to develop a Data Package titled “Subsurface Stratigraphy Model of Wastebed 13 for the Design of SCA,” which has been approved by the NYSDEC and is included herein as Attachment B to Appendix A, “SCA Civil and Geotechnical Technical Memorandum.” This Data Package includes the following:

- A summary of the site investigation activities conducted in Wastebed 13 to date
- Interpretation of material characteristics and subsurface stratigraphy in Wastebed 13 based on the results of the site investigations



NOTE:

1. BASE MAP PROVIDED BY D.W.HANNIG L.S., P.C.; SURVEYED 6/10/08

LEGEND:

- SETTLEMENT PILOT STUDY (2005)
- CPT LOCATIONS
- BORING LOCATIONS
- PIEZOMETER LOCATIONS
- EXISTING WEIR BOX LOCATIONS
- APPROXIMATE DELINEATION OF PITS (1972/ 1973)

400 200 0 400 800

SCALE: 1"=400'

FIGURE 3.1

Honeywell

SEDIMENT CONSOLIDATION AREA
ONONDAGA LAKE BOTTOM SUBSITE REMEDIAL DESIGN
CAMILLUS, NEW YORK

WASTEBED 13
INVESTIGATION ACTIVITIES

PARSONS

301 PLAINFIELD ROAD • SUITE 350 • SYRACUSE, NEW YORK 13212 315-451-9560

FILE NAME: P:\HONEYWELL -SYR\444853 - LAKE DETAIL DESIGN\10 TECHNICAL CATEGORIES\10.1 CAD\SCA RDI\441598SK002.DWG
PLOT DATE: 1/11/2010 11:48 AM PLOTTED BY: RUSSO, JILL

- Interpretation of material properties (i.e., index properties, shear strength, and compressibility) based on the results of laboratory tests, the field settlement pilot test, and empirical correlations
- Recommendations on material properties to be used for the SCA design
- Verification of the interpreted subsurface model and compressibility of Solvay waste using the field settlement test results

In addition to providing this information in the Data Package, Honeywell has prepared summary reports for each of these investigations that have been submitted to NYSDEC. These reports have been approved by the NYSDEC and are in the public document repositories (Parsons and Geosyntec, 2008; Parsons, 2009e; Parsons, 2009f).

3.2 COMPATIBILITY AND INTERFACE TESTING

Compatibility tests were performed to monitor the physical properties of potential geotextile tube and geomembrane materials immersed in sediment from the lake, as described in the Phase IV Work Plan – Addendum 6 Bulk Sediment Collection And Dewatering Treatability Study (Parsons, 2009b). Based on these tests, Honeywell selected a high strength geotextile and thread for the geotextile tubes, and a high density polyethylene (HDPE) geomembrane for the composite liner system.

Interface direct shear testing was also performed on the geotextile tube material and potential composite liner system options, and the results were used to establish reasonable strength values to be used in slope stability analyses, which are discussed in Section 4. During the compatibility testing, the condition of the materials was monitored as a function of cumulative exposure time by means of dimensional measurements and physical property tests. Compatibility tests were performed on the polypropylene (PP) geotextile tube material in accordance with American Society for Testing and Materials (ASTM) D6389. Geomembrane compatibility tests were performed in accordance with ASTM D5747 on materials that were considered for construction of the SCA composite base liner, including HDPE, linear low density polyethylene (LLDPE), ethylene propylene diene monomer (EPDM), and PP liner materials.

Results of the compatibility testing are presented in Appendix C, “Compatibility Test Results.” All four geomembrane types performed well; however, the LLDPE and HDPE performed the best. The PP and EPDM absorbed the most extractables and volatiles which resulted in variation in strength properties. Based on the results of the testing and engineering judgment, a HDPE geomembrane was selected for the composite liner system. Both the high strength geotextile and the thread for the geotextile tubes performed well and are considered suitable for the project.

Strength parameters from the interface direct shear tests were used in the slope stability analyses, which are presented in Section 4. The direct shear testing, in accordance with ASTM D5321, was performed on the geotextile tube material to evaluate the strength (both peak and residual) of the interface between two tubes. This testing was also performed on the composite liner system to establish a reasonable interface strength value (both peak and residual) for the composite liner system.

For the direct shear test on the composite liner system, the following components layered from top to bottom were used for modeling purposes:

- Concrete sand
- Non-woven geotextile
- Geomembrane
- Compacted clay (from source anticipated for construction)

Testing was performed for each type of geomembrane (i.e., smooth HDPE, textured HDPE, EPDM, and PP). Based on this testing, the results for the non-woven geotextile to geomembrane interface will be used in the calculations. The complete test results are provided in Appendix D, “Direct Shear Interface Test Results”. Site-specific interface direct shear testing will be performed during construction, as part of the construction quality control and assurance requirements, to confirm that the actual construction materials meet the interface strength requirements specified in this design.

3.3 DATA GAPS

Based on the data evaluations performed during preparation of the data package and review of the compatibility and interface test results, no additional data needs for the SCA design have been identified. Therefore, no additional field work associated with the SCA design will be performed.

SECTION 4

ENGINEERING ANALYSIS AND DESIGN

The analyses presented in this section indicate that the SCA is designed to provide sufficient capacity and to perform as necessary for containment of the dredged sediment. In addition, the drainage layer of the liquids management system will maintain an adequate slope towards the sump areas during construction, operations, and post-closure. Finally, the composite liner system will effectively protect groundwater quality. Monitoring will be performed during construction, operations, and post-closure to confirm the SCA is performing as designed.

The SCA design drawings and specifications that were developed using the engineering evaluations presented in this section are provided in Appendix E, "Drawings and Specifications". The key assumptions (e.g., dredge volume) required to proceed with the SCA layout design and engineering analyses are presented first in this section. After the key assumptions, the SCA layout and the basis for that layout are presented, followed by a discussion of the engineering analyses performed on that layout and the impact of those results on the design. Since the overall objectives for the SCA design are discussed in Section 1.2, and the detailed requirements and criteria of the civil and geotechnical aspects of the design are provided in the BOD (Attachment A of Appendix A, "SCA Civil and Geotechnical Technical Memorandum"), they are not repeated here; however, as applicable, they are incorporated into the discussions of the engineering analyses. The engineering analyses in this section focus on slope stability, settlement, the composite liner and liquid management system, and the surface water control system. An assumed final cover design is also discussed for purposes of the analyses presented herein. The actual final cover design will be provided in the Onondaga Lake Remedy Restoration and SCA Closure Design. Finally, the anticipated base composite liner system construction phasing, preloading, and construction material transportation and placement are discussed.

4.1 KEY ASSUMPTIONS

The two key assumptions that were required for the development of the SCA design are associated with the dredge volume and the dewatering process. The assumptions associated with these issues are discussed in the following subsections.

4.1.1 Dredge Volume

The design volume stated in the BOD (Attachment A of Appendix A, "SCA Civil and Geotechnical Technical Memorandum") and the design presented herein are based on a dredge volume of up to 2,653,000 CY, which is consistent with the Onondaga Lake ROD (NYSDEC and USEPA, 2005). The flexibility included in the design to accommodate a change in final volume is described in Section 4.2.2.

4.1.2 Slurry Dewatering

The volume to be contained in the SCA is expected to be approximately equal to or less than the *in situ* volume prior to dredging, which is consistent with a 1.0 bulking factor that is assumed in the BOD (Attachment A of Appendix A, "SCA Civil and Geotechnical Technical Memorandum"). The Onondaga Lake Dredging, Sediment Management, and Water Treatment

IDS (Parsons et al., 2009) presented a baseline operational scenario for dredging and sediment dewatering that includes hydraulic dredging followed by a potential dredged slurry conditioning system prior to geotextile tube dewatering in the SCA. Whether or not slurry conditioning is performed, it is anticipated that the slurry will return to near *in situ* (pre-dredging) solids content by weight once it has undergone at least initial dewatering in the geotextile tubes. If gravel and sand-size particles are removed from the slurry during a slurry conditioning step, they will be stockpiled and periodically transferred to the SCA. These particles would also be at or above their *in situ* solids content by weight.

The geotextile tubes will be arranged in a series of rows and columns to most efficiently use the SCA and meet loading restrictions. Based on the required dredge rate, total sediment volume, and experience with similar applications, it is anticipated that geotextile tubes approximately 80 to 90 ft. in circumference with a maximum length of 300 ft. will be used. For modeling purposes, each geotextile tube is assumed to be 300 ft. by 40 ft. by 6 ft. after initial dewatering (i.e., dredge material is at or near pre-dredging solids content by weight).

4.2 SCA LAYOUT

In addition to the dredge volume and slurry dewatering assumptions discussed previously, there are several other factors that were considered in the development of the SCA layout (i.e., footprint), which is shown on Drawing C-002. These factors included the following:

- Proximity to the community
- Capacity for the required dredge volume
- Wastebed 13 surface and subsurface characteristics
- Minimizing excavation and import of fill into Wastebed 13
- Operational requirements

A discussion of each of these factors and how it was incorporated into the SCA layout design is provided in the subsections that follow.

4.2.1 Proximity to Community

A minimum buffer zone of 500 ft. to the western dike and 200 ft. to the northern dike of Wastebed 13 was maintained in the SCA layout (see Figure 4.1 and Section 2.1.1 for details). The footprint of the SCA was designed to be large enough so that the geotextile tube height and the resulting final elevation of the SCA will be consistent with the surrounding terrain (i.e., Wastebeds 12, 14, and 15). Specifically, the highest anticipated elevation of the SCA (including the final cover) will be at least 20 ft. lower than the Camillus Construction and Demolition Landfill on Wastebed 15 after settlement. The anticipated final grades after settlement are discussed in more detail in Section 4.3.2.

Pole Locations
for Visual Assessment

Note: Locations and dimensions are approximate and will be finalized at later stage of the remedial design.

N
W E
S

New York State Digital
Orthoimagery from 2009

490 245 0 490
Feet

FIGURE 4.1

Honeywell
Onondaga Lake
Camillus, New York

Wastebed 13 Support
Areas and Accessibility

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

To the extent practical, existing trees and other vegetation around the perimeter of Wastebed 13 will be left in place during SCA construction and operation to provide a visual barrier. Upon completion of dredging and dewatering activities, a vegetated cover will be constructed on the SCA.

To further reduce SCA visibility during construction and operations, a visual barrier consisting of a mix of native and naturalized evergreen conifers and native grasses was planted along the northern and western Wastebed 13 dikes in 2010 (see Figure 4.1). The extent of this barrier was established based on an assessment that was performed during the spring of 2009. This assessment included installing poles at the four corners (top and toe of sideslope) of the proposed SCA footprint (i.e., footprint presented in the IDS), as shown on Figure 4.1. Flags were attached to the top of the poles (top of sideslope only) at elevations of between 452 and 458 ft., which is the approximate post-settlement elevation of the SCA after final closure. After the poles were in place, members of the design team assessed whether the flags could be seen from off-site areas. The results of this visual assessment indicate that the buffer zones discussed previously and the existing vegetation around Wastebed 13 effectively minimize the visibility of the SCA from most offsite areas, and additional plantings along the northern and western dikes will further reduce visibility.

4.2.2 SCA Capacity

The SCA is designed to contain up to the ROD volume of 2,653,000 CY of dredged sediment. As indicated in Section 4.1.2 and the BOD (Attachment A of Appendix A, “SCA Civil and Geotechnical Technical Memorandum”), a bulking factor of approximately 1.0 is anticipated following self-weight consolidation; therefore, the dredge volume is approximately equal to the required capacity. However, it should be recognized that there are several other considerations that could affect the final SCA required capacity. As discussed in the Onondaga Lake Dredging, Sediment Management, and Water Treatment IDS (Parsons et al., 2009) and the Onondaga Lake Sediment Capping and Dredge Area & Depth IDS (Parsons and Anchor QEA, 2009), further characterization of dredging areas has indicated that the extent and depth of impacted material are less than were previously assumed. As a result, the actual volume of sediment dredging needed to accomplish the remedial goals will be less than 2,653,000 CY. In addition, the contaminated soils and sediment from Ninemile Creek may be placed in either the containment system at the LCP Bridge Street site or the SCA according to the ROD for Geddes Brook/Ninemile Creek Site Operable Unit (OU) 1 (NYSDEC and USEPA, 2009a) and the ROD for Geddes Brook/Ninemile Creek Site OU2 (NYSDEC and USEPA, 2009b). The estimated volumes to be excavated from Ninemile Creek are 59,000 CY for OU1 and 58,000 CY for OU2, for a total of 117,000 CY.

As discussed in Section 4.4 and shown on Drawing C-003, flexibility in the SCA capacity is included in the design through a phased construction approach. The calculations provided in Appendix F, “Volume Calculations for SCA Design” indicate the Phase I footprint, which is approximately 25 acres, would be sufficient to contain more than one year’s dredge volume (i.e., 660,000 CY), if the geotextile tubes are stacked three high (i.e., approximately 18 ft.). As shown in the drawings, the sump areas, which are located near the center of the wastebed, are within the Phase I footprint. If it is operationally advantageous and settlement and porewater monitoring of the underlying materials indicate it is acceptable, tubes may be stacked up to five high (i.e., approximately 30 ft.) during the first year of operation.

Phase II construction, approximately 24 acres, would be constructed to the south of the Phase I area. The combined footprint of Phases I and II (i.e., 49 acres) would provide sufficient area for the second year of dredged material to be placed in tubes stacked three high (i.e., approximately 18 ft.) across the entire area and approximately 1,900,000 CY in tubes stacked five high (i.e., approximately 30 ft.) across the entire area.

If it is determined that a larger footprint is required, Phase III of the SCA would be constructed. This Phase III area, up to 16 acres, would be located to the north of the Phase I area (Drawing C-003). The combined footprint of Phases I, II, and III could contain up to 2,653,000 CY with geotextile tubes stacked five high (i.e., approximately 30 ft.).

4.2.3 Wastebed 13 Surface and Subsurface Conditions

The SCA location within Wastebed 13 was selected because the existing grades already slope to low areas where liquids (i.e., filtrate and consolidation water from dewatering sediment and surface water) can be collected, and these slopes can be maintained even after settlement is taken into consideration. In addition, the location and footprint of the SCA were selected to preserve existing surface water flows outside of the SCA, as discussed in Section 4.3.4. This location selection is based on the information in the Data Package (Attachment B of Appendix A, "SCA Civil and Geotechnical Technical Memorandum") that indicates the potential for settlement varies across Wastebed 13 due to subsurface characteristics, including thickness and properties of underlying Solvay waste, and buried dikes.

4.2.4 Excavation and Import of Fill into Wastebed 13

The SCA layout minimizes the amount of excavation and fill placement that will be required during construction because it is located in an area of Wastebed 13 that already slopes to two low points. Minimizing the need for excavation and importing of fill were both considerations in the development of the SCA layout to reduce impacts to the community (e.g., truck traffic). Additionally, the minimization of excavation and import of fill is a requirement that is stated in Section 5 of the SOW, as follows, "The grading design for the SCA shall utilize the existing surface topography of Wastebed 13 as much as possible so as to limit wastebed cut and fill requirements and the associated need for a large volume of imported soil fill. Preloading and stabilization of the wastebed shall only be required to the extent necessary to ensure the integrity of the SCA components and underlying Solvay waste foundation, based upon the remedial design."

4.2.5 Operational Requirements

Geotextile tubes will be used to dewater the dredged slurry within the SCA. The slope of the area to be used for geotextile tube placement, the anticipated geotextile tube stacking height, and the control of liquids within the SCA are aspects of operations that were taken into consideration in developing the SCA layout. An area at Wastebed 13 with fairly uniform, gentle slopes towards two low points was selected for the SCA. This area achieves a balance between the requirements for operating the geotextile tubes and the drainage layer underlying the tubes. Specifically, geotextile tubes are typically operated on drainage areas that are relatively flat; however, the drainage system underlying the tubes is required to slope to two low points.

Tube stacking height is mostly a consideration under capacity; however, it is also important in terms of operations. As presented in Section 4.3.1, slope stability analyses were conducted using strength properties of the subsurface materials in Wastebed 13, potential geomembrane and geotextile tube materials, and dredge material that were established through analysis of laboratory and field test results. Results from the slope stability analyses indicate that geotextile tubes can be safely stacked five high in a given year; however, depending on the monitoring results (e.g., settlement and porewater pressures) and general observations during construction, it may be operationally advantageous to adjust the number of tubes stacked in a year and/or the active dewatering area. This operational flexibility was taken into consideration when developing the layout and the phased construction that is discussed in Section 4.4.

Other operational considerations when designing the SCA layout include the SCA dike height and the size and location of the SCA basins. The SCA dikes are required to contain the filtrate water from the geotextile tubes. In addition, the SCA dikes combined with the basins are required to prevent surface water from running onto or off of the SCA (see Figure 4.1 for basin locations). Specifically, the ability to contain a 25-year, 24-hour storm without overtopping the SCA dikes or basins was evaluated. The selection of dike height and basin size are discussed in more detail in Section 4.3.4.

The potential need for a debris areas and a temporary staging area were additional considerations in terms of operations and the layout design (see Figure 4.1 for anticipated location). Some debris will be removed from the lake prior to dredging. Portions of that debris will be recycled (as practical), and other portions of the debris will be placed in the SCA, as shown on Figure 4.1. In addition, slurry conditioning (which may be conducted prior to slurry transfer to the SCA) may include gravel and sand-sized particle separation with the resulting materials also being placed in the temporary staging area. During operations, these materials would be transferred to the SCA for permanent containment. The placement of this staging area to handle these temporary stockpiles was considered in developing the layout. The overall operational requirements for the SCA will be submitted as part of other documents. For example, the Draft Sediment Management Final Design document contains details regarding the hydraulic dredge delivery system and the pumping system to be used to transfer geotextile tube filtrate, consolidation water, and precipitation from the SCA to the WTP, and Construction submittals, that will be submitted following the final design, will contain the description of the filling and sequencing of geotextile tubes. Since settlement may impact tube placement and filling, flexibility with regards to tube placement will be required during operations.

4.3 ENGINEERING ANALYSES

The following subsections present the engineering analyses required to develop the drawings and specifications included in Appendix E. These design elements include slope stability, settlement, composite liner, liquids management, surface water control, and an assumed final cover system that was developed for purposes of the analyses presented herein. The final cover system design will be provided in the Onondaga Lake Remedy Restoration and SCA Closure Design.

4.3.1 Slope Stability Analyses

The SCA, as designed, is stable. Detailed slope stability analyses of the SCA under both interim (i.e., during SCA construction and operation) and long-term (i.e., post-closure) conditions are provided in Appendix G, "Slope Stability Analyses for SCA Design." The following subsections provide a summary of this evaluation.

4.3.1.1 Design and Performance Criteria

The stability of a slope is reported in geotechnical engineering terms as the "factor of safety." A factor of safety of 1.0 or greater is required for a slope to be stable. Due to the inherent variability in the engineering properties of soils, slopes are typically designed with a factor of safety greater than 1.0. Appropriate factors of safety for a given set of conditions were developed for the SCA considering the importance of the facility, and guidance provided by:

- U.S. Army Engineer Waterways Experiment Station Technical Report D-77-9 (Hammer and Blackburn, 1977)
- U.S. Army Corps of Engineers (USACE) Engineering Manual EM 1110-2-1902 (USACE, 2003)

As discussed in the BOD (Attachment A of Appendix A, "SCA Civil and Geotechnical Technical Memorandum"), based on these guidance documents, a factor of safety of 1.3 was selected as an appropriate value to be used for interim static conditions (i.e., during construction and operation). In addition, a factor of safety of 1.5 was selected as an appropriate value to be used for long-term static conditions (i.e., post-closure). This factor of safety for long-term static conditions is consistent with NYSDEC Regulations Section 360-2.7(b)(6), which indicates a factor of safety of 1.50 for the final cover system under long-term static conditions. The site is not located in a seismic impact zone; therefore, a seismic slope stability analysis is not required.

4.3.1.2 Methodology

Slope stability analyses were performed using Janbu's and Spencer's method in the computer program SLIDE version 5.039 (Rocscience, 2006). Four potential slip modes were evaluated in the analyses: (i) block slip mode along geotextile tube interfaces, (ii) block slip mode along the composite liner system; (iii) circular slip surfaces through dredge material contained in geotextile tubes and Wastebed 13 foundation materials; and (iv) circular slip surfaces through existing Wastebed 13 perimeter dikes.

Information required for the static slope stability analyses included the slope geometry, the subsurface soil stratigraphy, the groundwater table elevation, the material properties of the subsurface soils, dredge material, liner and assumed cover system materials, and the external surface loading, if any, at the selected cross section locations. Material properties obtained from previous investigations (as discussed in Section 3.1) and the results from interface testing on potential liner materials (as described in Section 3.2) were used in the analyses. In terms of geometry, it was assumed typical geotextile tube practices would be employed, which include stacking tubes such that each successive layer of tubes is approximately 20 ft. shorter in total length than the tubes in the layer below, and the tubes in upper layers straddle the underlying tubes.

4.3.1.3 Results

Four potential slope stability slip modes were evaluated, and two cross sections were analyzed for each slip mode (i.e., one running perpendicular and one running parallel to the long direction of the geotextile tubes - see Figure 2 of Appendix G, “Slope Stability Analyses for SCA Design”). These cross sections were selected to represent the critical (i.e., worst) case cross sections. Interim conditions were analyzed for each slip mode, with up to five layers of geotextile tubes and an assumed final cover. Final conditions were also analyzed for each slip mode for five layers of geotextile tubes with a final cover.

The calculated factors of safety for all four slip modes met or exceeded the appropriate values under both interim and long-term conditions (see Tables 2, 3, and 4 of Appendix G). Consolidation of the underlying Solvay waste will be monitored during construction, operation, and post-closure (if needed) to confirm that the SCA is performing as anticipated. Section 5.3 provides a summary of the geotechnical instrumentation monitoring plan.

The overall Wastebed 13 perimeter dike has an appropriate factor of safety for potential slip surfaces that pass through the proposed SCA. The calculated factors of safety for the Wastebed 13 perimeter dike during and following SCA construction range from 2.84 to 11.96, as shown on Tables 2 and 3 of Appendix G. These calculated factors of safety are based on an assumed water level of 15 ft. below ground surface both beneath the SCA and in the perimeter dikes. Since the stability of the Wastebed 13 perimeter dike is directly linked to the water level in the dike (i.e., porewater pressure), the water level in the perimeter dike will be monitored during SCA operations, and remedial measures (e.g., well points) will be implemented if required. Details regarding this monitoring are provided in Section 5.3.

Slope stability analyses were performed using strength properties for the geotextile tubes and the geosynthetics in the composite liner system that were established based on laboratory testing of representative materials. Prior to installation, samples will be tested to confirm that the actual materials to be installed meet the range of acceptable liner system and geotextile tube to geotextile tube interface strength parameters (both peak and residual) that are provided in Appendix G.

4.3.2 Settlement Analysis

The composite liner system will perform properly during operations, closure, and post-closure, as designed. Detailed settlement analyses of the SCA under both interim (i.e., during SCA construction and operation) and long-term (i.e., post-closure) conditions are provided in Appendix H, “Settlement Analyses for SCA.” The following subsections provide a summary of this evaluation.

4.3.2.1 Design and Performance Criteria

As detailed in the BOD (Attachment A of Appendix A, “SCA Civil and Geotechnical Technical Memorandum”), settlement calculations were required to evaluate the magnitude of settlement in the Solvay waste underlying the SCA and in the dredged material inside the geotextile tubes. Based on these settlement calculations, tensile strain was evaluated and compared to the maximum recommended tensile strain of 5 percent for the geomembrane liner (Berg and Bonaparte, 1993). In addition, the effect of settlement on grading was evaluated. In particular, the focus was on maintaining the composite liner grading towards the sumps and positive grading under operations. Post-closure conditions were also evaluated using the assumed final cover system discussed in Section 4.3.5.

4.3.2.2 Methodology

Conventional one-dimension (1-D) primary consolidation settlement and secondary compression settlement calculation methods were used to estimate the settlement due to SCA perimeter dike, composite liner, geotextile tube, and assumed final cover placement. The foundation and dredged material settlement was calculated at the time of closure (i.e., at the end of year 4 or the fourth year of dredging) and 30 years after closure.

For purposes of the foundation settlement calculations, it was assumed that geotextile tubes containing all four years of dredged material were placed at the beginning of operations (i.e., year 1). For the dredged material settlement analyses, it was assumed that the loading was increased incrementally (i.e., geotextile tubes containing the first year of dredged material were placed at the beginning of year 1, etc. for subsequent years). Thus, the loading from subsequent years of tubes was included in the settlement calculations for the dredged material in the bottom tubes.

For the post-cover settlement calculations, the deformed geometry of the composite liner system, SCA perimeter dike, and the geotextile tubes estimated from the settlement analyses at closure (i.e., before cover placement) became the initial geometry. An assumed final cover system loading was placed at the beginning of year 5.

Foundation and cover settlements were calculated using two different models, the surface settlement model (SSM) and the cross-section settlement model (CSM). The SSM produced post-settlement elevation and settlement contour maps for a deformed surface using approximately 2,300 settlement calculation points. The CSM produced similar results along a cross section. The main difference between SSM and CSM is that the CSM considered the load-induced stress distribution within the foundation Solvay waste and the dredge material in the geotextile tubes, while the SSM did not. The post-settlement contour maps produced using the SSM were used to evaluate whether positive drainage was maintained in the composite liner system and the assumed final cover system. The post-settlement section figures produced using the CSM were used to evaluate the maximum strain in the geosynthetic components.

4.3.2.3 Results

Based on the settlement analysis, the liquids management system (i.e., the gravel layer) is anticipated to maintain an adequate slope to the sump areas (i.e., no slope reversals or local ponding) during the closure and post-closure periods. Using the SSM, the foundation settlement during the operations period was calculated to be 9 to 11 ft., and the settlement of dredge material in the geotextile tubes during the operations period was calculated to be 2 ft. on average with a maximum of 4 ft. As compared to during operations, relatively small settlements were calculated for the post-closure period. The additional foundation settlement during the post-closure period was calculated to be 1 to 2 ft. The additional settlement of dredge material in the geotextile tubes during the post-closure period was calculated to be 1.5 ft. on average with a maximum of 3 ft. Contour maps of the calculated post-settlement grades for these cases are provided in Appendix H and Addendum to Appendix H, “Settlement Analyses for SCA.” Any long-term development of local low points will be addressed during maintenance.

Using the CSM, the maximum tensile strain on the liner system was calculated to be 2.2 percent during the closure and post-closure periods, which is less than the maximum allowable tensile strain of 5 percent for geomembrane (see the Results Section of Appendix H for a more detailed explanation of this calculation). According to the analyses, liner tensile strains were typically in the sideslope and the SCA perimeter dike areas, not in the areas where the loading is more uniform. The maximum liner tensile strains typically occurred on the inner side of the dike sideslope area.

4.3.3 Composite Liner and Liquids Management System Design

The base composite liner system, which is designed to effectively protect site groundwater and is shown in Drawing C-009, consists of the following components from top to bottom:

- 24-inch (average) drainage layer (24-inch minimum in truck traffic areas)
- Geotextile cushion
- 60-mil HDPE geomembrane liner
- 12-inch minimum (18-inch minimum at the sumps) low-permeability soil component with top 6 inches compacted to achieve a permeability less than or equal to $1x10^{-6}$ centimeters per second (cm/sec)

In addition, a geosynthetic clay liner (GCL) will be placed directly under the geomembrane in a portion of the sump area, as shown on Drawing C-004. The liquids management system includes the drainage layer (which is also part of the base composite liner system), pumps, sumps, and risers, which are designed to handle the appropriate design flows. The design and performance criteria for these systems and the assumptions made and calculations performed to develop the liquid management system design are discussed in the subsections that follow.

4.3.3.1 Design and Performance Criteria

As indicated in the BOD (Attachment A of Appendix A, “SCA Civil and Geotechnical Technical Memorandum”), the composite liner and liquids management system is designed in accordance with the requirements of NYSDEC Regulations Part 360, Section 2.14(a). Since the efficiency (i.e., leakage relative to precipitation) of the SCA with the composite liner system defined above and the efficiency of the SCA with a Part 360 liner are both greater than 99.99 percent, it can be demonstrated that the proposed system will effectively protect groundwater quality at the site. These efficiency calculations are provided in Appendix I, “Evaluation of Hydraulic Performance for SCA Design.”

Because of the existing site conditions, a “landform”-type grading design was used. Specifically, the existing site topography was used, to the extent possible, in designing the grading of the composite liner and liquids management system. Therefore, the system is designed so that the drainage layer maintains a positive slope toward the sumps during operations and post-closure.

The intent of the composite liner and liquid collection system is to achieve a head no greater than 1 ft. on the liner during operations and post-closure; however, consistent with Part 360, Section 2.14(a), heads greater than 1 ft. in the sump areas and for some interim periods during operations may occur. Initial filling of the first layer of geotextile tube, storm events, and geotextile tube failures are examples of when there is a potential for temporarily exceeding 1 ft.

of head on the liner. As discussed in Section 4.3.4, temporary pumping (with the use of the SCA basins, as necessary) will be used to supplement the permanent sump pumps to control these short-term conditions. The details associated with the liquids management strategy under operational conditions are included in the Draft Sediment Management Final Design submittal.

The volume of liquids to be handled by the liquids management system will change significantly as the SCA transitions from operation to closure. Therefore, the liquids management system will have operational and post-closure phases. During operation, the liquids management system will collect filtrate and consolidation water from the geotextile tubes and precipitation that comes into contact with the tubes. For purposes of this discussion, "filtrate" refers to the water released from the tubes during the first 24 hours after filling, and "consolidation water" refers to the water released from the tubes after 24 hours. After SCA closure, the liquids management system will handle remaining consolidation water that is generated by the continuing dewatering of the dredge material within the tubes and precipitation that infiltrates through the SCA cover.

4.3.3.2 Liquids Management System Design

The liquids management system is designed for post-closure conditions, and it is designed to handle operational flows and precipitation when augmented with temporary pumps. Operational volumes will vary depending on precipitation events, dredge rate, dredge work schedule, and operation of the geotextile tubes. The location, in addition to the intensity, of the operational flows will vary throughout the four year operational period. Therefore, to control the head in the drainage layer, a temporary pumping system with flexible hoses, in combination with the liquids management system, will be used to handle large flows on a temporary basis. Since stormwater is a major component of the flows that need to be managed during the operations phase, additional discussion regarding handling operational flows is provided in Section 4.3.4.

As presented in Appendix I, the Hydraulic Evaluation of Landfill Performance (HELP) software (Version 3.07 developed by the USEPA) was used to calculate a design inflow rate of 0.4 gallons per minute (gpm) for the entire SCA under post-closure conditions. To calculate the design inflow under these conditions, a final cover design was assumed, as discussed in Section 4.3.5, along with the hydraulic conductivity of the dredge material and composite liner system components, assumed SCA cover geometry, and local weather data (adjusted to include a 25-year, 24-hour rainfall). The calculated average and peak liquid head on the composite liner system under these conditions meets the 1 ft. or less requirement.

As discussed in Appendix I, since placement of the assumed final cover system (geomembrane in particular) will likely not occur immediately following the completion of tube filling, a target inflow rate of 15 gpm has been selected for the sump and riser design. The HELP analysis under these conditions also results in a calculated average and peak liquid head on the composite liner system that meets the 1 ft. or less requirement.

Using the inflow assumption from above, Appendix J, "Sump and Riser Calculations for SCA Design" presents the detailed analyses required for the design of the pumps, risers, and sumps. Based on an inflow of 15 gpm and the composite liner grading, inflow values of 10 gpm towards the western sump area and 5 gpm towards the eastern sump area were assumed. The following calculations were performed as part of this design: (i) evaluation of the hydraulic requirements for the riser pipe perforations; (ii) evaluation of the structural stability of the riser pipe; and (iii) calculation of liquid storage volume and filling time for the sump area.

Based on these calculations, the recommended riser pipe is 5 ft. in diameter, and the required sump excavation depth is 5 ft. into the Solvay waste. The sump area design includes two separate permanent riser pipes with pumps (a main and a backup) and a 10-ft. offset between each riser pipe. The design also includes four temporary riser pipes for use during operations only. Drawings C-005 and C-010 in Appendix E provide the detailed design of the sump grading, pumps, and risers of the liquids management system.

4.3.4 Surface Water Control System Design

The surface water control system design presented herein assumes that the surface water generated from the SCA will be handled separately from the surface water generated by the rest of the wastebed. The following sections describe the management of, and design for, the surface water to be generated by the SCA during construction and operations. The post-closure surface water management will be addressed in the Onondaga Lake Remedy Restoration and SCA Closure Design.

The surface water from the areas outside the SCA will be handled by the existing weir boxes, topographic features, and existing leachate collection system. The long-term effectiveness of the current leachate collection system is being evaluated as part of the closure of Wastebeds 9 through 15.

4.3.4.1 Design and Performance Criteria

The design and performance criteria for surface water management are provided in the BOD (Attachment A of Appendix A, "SCA Civil and Geotechnical Technical Memorandum"). In summary, the surface water management system will be designed to meet the project requirements for both temporary (i.e., during construction, operations, and closure of the SCA) and long-term conditions (i.e., after closure of the SCA). As indicated previously, the post-closure surface water management system will be provided in the Onondaga Lake Remedy Restoration and SCA Closure Design. Furthermore, calculations for temporary and permanent surface water control structures will be performed using the 25-year, 24-hour storm event, as indicated in NYSDEC Regulations Section 360-2.7(b)(8)(ii). Finally, the "New York State Standards and Specifications for Erosion and Sediment Control" (NYSDEC, 2005) will be the guidance document used for this design.

4.3.4.2 Surface Water Management During Construction

Erosion and sediment control during SCA construction, operation, and winter shutdown has been addressed in a Stormwater Pollution Prevention Plan (SWPPP) that has been provided as a pre-construction submittal. This plan is consistent with the NYSDEC guidance document mentioned previously.

As part of the initial construction activities, Weir Box 6, which is located approximately in the center of Wastebed 13, will be abandoned by removing the wooden weir box structure down to a depth of 15 ft. below the surface of the wastebed and then filling the entire weir box with slurry fill. A detail is provided on Drawing C-012 of Appendix E. The integrity of Weir Boxes 5 and 7, which are located on the east and west sides of the SCA, respectively, should not be impacted by SCA loading based on a stress distribution analysis. This analysis indicated that the stress increase should not be significant. During construction of the SCA, surface water will be managed as described in the SWPPP. After liner construction is complete and prior to geotextile tube placement, surface water generated from lined areas within the SCA will be non-contact water and managed in accordance with the SWPPP.

4.3.4.3 Surface Water Management During Operations

Surface water within the active dewatering area (i.e., area where tubes have been placed) during operations and winter shutdown will be collected in the liquids management system and directed to the SCA WTP for treatment. Non-contact water from lined areas will be directed off the wastebed and out through the existing State Pollution Discharge Elimination System (SPDES) discharge points, as described in the previous subsection. Temporary stationary pumps, mobile pumps, and the SCA basins will be used to augment the liquids management system to provide adequate capacity to remove the precipitation, filtrate, and consolidation water from the SCA. At a minimum, the liquids management system during operations will have a pumping capacity equal to the expected generation rate (i.e., the design dredge rate) of filtrate and consolidation water which, when combined with the surge capacity provided in the SCA basins, will meet the design objectives for managing liquids in the SCA. More details regarding this temporary system will be provided in the Sediment Management Final Design. Since the overall anticipated approach for this temporary system is the basis for the SCA berm height design, a general description is provided below.

During normal operations, a combination of temporary operational pumps located near the low-points of the north/south SCA perimeter berms and in the sump areas, along with the permanent and temporary sump pumps, will be used to remove water from the SCA and pump it to the East SCA basin sump where it will be pumped directly to the SCA WTP. Additional mobile pumps and aboveground piping will likely be deployed around the SCA to move ponded water to the East SCA Basin sump for conveyance to the WTP. As necessary during and following precipitation events, the SCA basins shown on Figure 4.1 will be used to manage the additional liquids that will be generated. The use of these basins will depend on the storm severity, the lined area, and the area covered with geotextile tubes.

Given the approach described above, the SCA perimeter berm height and the SCA basin size and berm height were optimized so that a 25-year, 24-hour storm could be contained within the SCA and SCA basins without overflowing onto the rest of Wastebed 13. This optimization was performed for the condition where the entire lined area (i.e., 65 acres) has been constructed and covered with at least one layer of geotextile tubes, which is expected to be the case that requires the most storage. More details regarding this design are provided in Appendix K, "Operations and Final Cover Surface Water Management System Design." Although Appendix K of the Draft Final Design included calculations for the post-closure condition (i.e., Appendix K.2), those calculations are not included in this SCA Final Design. Instead, those calculations will be provided in the Onondaga Lake Remedy Restoration and SCA Closure Design. The SCA basin designs will be provided in the Sediment Management Final Design.

4.3.5 Final Cover Design

As indicated previously, the SCA final cover design will be presented in the Onondaga Lake Remedy Restoration and SCA Closure Design. However, assumptions regarding the final cover system were required to perform the calculations presented herein. Specifically, the final cover was assumed to include a geomembrane, 24-inches of barrier protection soil, and 6-inches of topsoil. In the Draft SCA Final Design, veneer stability analyses were provided in Appendix L. These analyses are not included in this Final SCA Design because they will be presented in the Onondaga Lake Remedy Restoration and SCA Closure Design.

4.3.6 SCA Design Features for Protection of Groundwater

There are several SCA features that are designed to protect groundwater during both the operations and post-closure periods. As discussed in Section 4.3.3.1, the composite liner and liquids management system is designed in accordance with the requirements of NYSDEC Regulations Part 360, Section 2.14(a). The efficiency (i.e., leakage relative to precipitation) of the SCA with a composite liner system is greater than 99.99 percent demonstrating that the proposed system will effectively protect groundwater quality at the site. After installation of the composite liner and drainage material, an electronic quality assurance survey will be performed on the installed geomembrane to provide additional assurance as to the integrity of the completed liner system. This quality assurance procedure goes beyond the quality assurance requirements of NYSDEC Regulations for a Part 360 liner system and adds an extra level of protection.

Consistent with Part 360 requirements and as described in Section 4.3.3.1 and 4.3.3.2, the SCA liquids management system is designed to control the liquid head on the liner. SCA operations will include flexibility to expand pumping capacity based on operational needs and surface water management practices, as described in Section 4.3.4. Liquid heads within the SCA will be reduced to insignificant levels after operations by the installation of an assumed final cover system that includes a geomembrane, as described in Section 4.3.5. The final cover system will include features to route surface water off the final cover to minimize infiltration. The final cover design will be provided in the Onondaga Lake Remedy Restoration and SCA Closure Design.

An existing Solvay waste deposit separates the SCA composite liner system and the groundwater by about 50 ft. As presented in Appendix A, “SCA Civil and Geotechnical Technical Memorandum”, Solvay waste Zones 2 and 3, which are below the SCA footprint, have representative hydraulic conductivities of 4.3×10^{-6} cm/s and 2.2×10^{-6} cm/s, respectively. Therefore, the 50-ft. distance to groundwater and the presence of a thick, low permeability Solvay waste deposit between the SCA liner system and the groundwater table add additional protection for the groundwater. Finally, in addition to the above Wastebed 13 and SCA features for protecting the groundwater, a comprehensive network of monitoring wells are proposed to monitor the groundwater quality in the vicinity of the SCA.

4.4 SCA CONSTRUCTION

The SCA design that was developed based on the calculation packages presented in the previous sections is provided in Appendix E, “Drawings and Specifications.” The following sections describe certain aspects of the design in detail, specifically, the proposed SCA base composite liner construction phasing, the appropriateness of preloading, the material sources for

SCA liner construction, material staging and support areas, and traffic routes. Operational considerations associated with the geotextile tubes (e.g., stability during filling, tube placement sequence) will be addressed in the Sediment Management Final Design.

4.4.1 Composite Liner Construction Phasing

The SCA composite liner system will be constructed in phases, which will minimize impacts to the community each year and best allow for the work to be performed within the capabilities of the local construction and material markets. The phased construction will also allow flexibility in total and yearly volume needs, as described in Section 4.2.2. The phasing plan for the SCA construction is presented in Drawings C-003, C-004, and C-006.

4.4.2 Operation Support Areas

In addition to the SCA, the Wastebed 13 area will also be used for siting of a slurry conditioning operation, temporary staging area (i.e., staging of debris and/or gravel- and sand-sized particles), WTP facility, water storage facilities, and necessary support facilities for these operations. Figure 4.1 presents the locations of these facilities.

4.4.3 Preloading

Preloading and stabilization under the SCA or its berms are not required. The SCA is designed to accommodate settlement of the underlying materials of Wastebed 13 and will provide secure containment and a functioning liquids management system during operations and post-closure. If specific preloading is required for WTP, basin sumps, or processing equipment, it will be included in the Sediment Management Final Design. Stockpiling SCA low-permeability soil, engineered fill, and/or gravel will be considered for support area preloading, if needed.

4.4.4 Material Sources

Materials to be used in SCA construction include low-permeability soil, geomembrane, geotextile, gravel, and engineered fill for the SCA perimeter berms. The engineered fill, low-permeability soil, and gravel are expected to be available locally and will be delivered to the site by truck. Approximately 87,000 CY of berm material (i.e., engineered fill), 271,000 CY of low-permeability soil, and 204,000 CY of gravel will be required (see Appendix F, "Volume Calculations for SCA Design"). Geomembrane and geotextile will be obtained from yet-to-be determined sources and will also be delivered to the site via truck. Approximately 2,800,000 SF of geomembrane and geotextile will be required. The quantities provided are for the 65-acre footprint that corresponds to a SCA capacity of 2,653,000 CY and would be phased over three separate construction periods.

SECTION 5

PLANS

5.1 SCA PLANS

Plans have been prepared to ensure proper construction of the SCA, to monitor stability, settlement, and water levels during SCA construction and operation, and to monitor groundwater quality. Post-closure monitoring of the SCA will be addressed in the Onondaga Lake Remedy Restoration and SCA Closure Design.

5.2 CONSTRUCTION QUALITY ASSURANCE PLAN

The Construction Quality Assurance Plan (CQAP) presents the procedures and protocols that will ensure the construction of the SCA will be executed in accordance with the approved design documents. The CQAP, which was developed in accordance with NYSDEC Regulations Part 360, Sections 2.8 and 2.13, is provided in Appendix M.

5.3 GEOTECHNICAL INSTRUMENTATION AND MONITORING PLAN

The Geotechnical Instrumentation and Monitoring Plan is provided in Appendix N and includes the procedures for installing, monitoring, and maintaining vibrating wire piezometers, settlement cells, inclinometers, and settlement profilers, which are shown on Drawing C-007. These instruments will be used to monitor water levels, settlement, and stability during construction, operations, and post-closure, as needed.

5.4 GROUNDWATER MONITORING PLAN

The detailed groundwater monitoring plan for the SCA will be included as part of the SCA Groundwater Monitoring Plan that will be submitted to the NYSDEC under separate cover. The plan will include monitoring wells installed on approximately 500-ft spacing downgradient of the SCA (i.e., along the northern perimeter of Wastebed 13) and 1,500-ft spacing upgradient of the SCA (i.e., in between Wastebeds 12 and 13 and Wastebeds 13 and 14) for a total of approximately 16 monitoring wells, some of which are existing wells. All the wells will be screened in native material. In addition, the plan will have details regarding sampling frequency, analytes, response actions, and contingency measures. One year of baseline monitoring will be performed prior to dredge material placement in the SCA.

5.5 POST-CLOSURE CARE PLAN

Although the Post-Closure Care Plan was provided in Appendix O of the Draft SCA Final Design, it is not included in this SCA Final Design. Instead, it will be provided in the Onondaga Lake Remedy Restoration and SCA Closure Design and will include the site monitoring requirements associated with the final cover, liquid management system, surface water control, and geotechnical instrumentation. In addition, the required documentation for the inspection, operation, and maintenance activities that will occur during the post-closure period will be provided, along with details regarding citizen participation and site access.

SECTION 6

SUBCONTRACTING STRATEGY

An integrated team of in-house resources, teaming partners, and key subcontractors will execute the final design and implementation of the entire remedial action. The design team will interact with the personnel that will execute the construction and operations to ensure that the final design components are complete, implementable, and meet the project objectives. In addition, key members of the design team will have functional quality assurance/quality control responsibilities during the construction efforts.

The design and subcontracting strategy for the SCA construction component of the remedy will be a design-bid-build approach. The design under this approach has incorporated agency review with public input into this final design. The construction of the SCA will be accomplished in conjunction with surface water controls for the site. Operations of the SCA during sediment dewatering will be subcontracted separately from the SCA construction.

SECTION 7

CONSTRUCTION MILESTONES

Critical to the success of the lake remedial action is the sequencing of events and interrelations of design and construction activities to ensure the process is efficient and completed within the appropriate timeframe. A logical progression of the decisions, analysis, and planning needed to execute the work was established during the initial design phase.

SCA CIVIL & GEOTECHNICAL CONSTRUCTION MILESTONES	
Complete Phase I SCA Construction	On or before 12/31/2011
Complete Phase II SCA Construction	On or before 12/31/2012
Start Phase III SCA Construction (if needed)	TBD (based on need)
Start SCA Cover Construction (phased approach)	TBD (based on sediment consolidation rates)

SECTION 8

REFERENCES

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APPENDIX A

SEDIMENT CONSOLIDATION AREA (SCA) CIVIL AND GEOTECHNICAL TECHNICAL MEMORANDUM

APPENDIX B

SEDIMENT CONSOLIDATION AREA (SCA) DEWATERING EVALUATION

APPENDIX C

COMPATIBILITY TEST RESULTS

APPENDIX D

DIRECT SHEAR INTERFACE TEST RESULTS

APPENDIX E

DRAWINGS AND SPECIFICATIONS

APPENDIX F

VOLUME CALCULATIONS FOR SCA DESIGN

APPENDIX G

SLOPE STABILITY ANALYSES FOR SCA DESIGN

APPENDIX H

SETTLEMENT ANALYSES FOR SCA

APPENDIX I

EVALUATION OF HYDRAULIC PERFORMANCE FOR SCA DESIGN

APPENDIX J

SUMP AND RISER CALCULATIONS FOR SCA DESIGN

APPENDIX K

OPERATIONS AND FINAL COVER SURFACE WATER MANAGEMENT SYSTEM DESIGN

APPENDIX L

FINAL COVER VENEER STABILITY ANALYSES FOR SCA DESIGN

(This appendix will be included in the Closure Design)

APPENDIX M

CONSTRUCTION QUALITY ASSURANCE PLAN

APPENDIX N

GEOTECHNICAL INSTRUMENTATION AND MONITORING PLAN

APPENDIX O

POST-CLOSURE CARE PLAN

(This appendix will be included in the Closure Design)