DRAFT ONONDAGA LAKE SEDIMENT MANAGEMENT INTERMEDIATE DESIGN

Prepared For:

Honeywell

301 Plainfield Road Suite 330
Syracuse, NY 13212

Prepared By:

PARSONS

301 Plainfield Road Suite 350
Syracuse, New York 13212
Phone: (315) 451-9560
Fax: (315) 451-9570

O'BRIEN & GERE

5000 Brittonfield Parkway
East Syracuse, NY 13057
Phone: (315) 437-6100

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LIST OF ACRONYMS

AOS	apparent opening size
AQMP	Air Quality Monitoring Plan
cm/sec	centimeters per second
CPP	Citizens Participation Plan
CPWG	Community Participation Working Groups
CQAPP	Construction Quality Assurance Procedures Plan
CSX	CSX Corporation
CY	cubic yard(s)
fps	feet per second
gpm	Gallons per minute
HDPE	high-density polyethylene
Honeywell	Honeywell International Inc.
IDS	initial design submittal
ILWD	in-lake waste deposit
LLDPE	linear low-density polyethylene
Metro	Metropolitan Wastewater Treatment Plant
MGD	million gallons per day
mg/L	milligrams per liter
MNR	Monitored natural recovery
NPL	National Priorities List
NYSDAM	New York State Department of Agriculture and Markets
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
OBG	O’Brien & Gere
OCWA	Onondaga County Water Authority
OSHA	Occupational Safety and Health Administration
PDI	Pre-Design Investigation
P-GDT	pressure-gravity dewatering test
QA	Quality Assurance
RA	Remediation Areas

LIST OF ACRONYMS
(CONTINUED)

RDT	rapid dewatering test
RDWP	Remedial Design Work Plan
ROD	Record of Decision
ROW	right-of-way
SCA	sediment consolidation area
SMOCP	Sediment Management Operational Contingency Plan
SOW	Scope of Work
SMU	Sediment Management Unit
SVOC	semi-volatile organic compound
TDH	total dynamic head
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WST	Waste Stream Technology, Inc.
WTP	water treatment plant

EXECUTIVE SUMMARY

Honeywell continues the progress toward achieving the goals of the Record of Decision (ROD) and the community's vision for a restored Onondaga Lake with the development of this Sediment Management Intermediate Design. This Intermediate Design presents the intermediate-level design details associated with the conveyance and dewatering of the sediments to be dredged as part of the remedy, and the supporting infrastructure and processes that will support those operations. 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 – standard environmental cleanup methods that will address the contamination in lake sediments and water. This Intermediate Design is an advancement of the design for the transportation and dewatering phases for the sediments that will be dredged.

Honeywell's remedial design effectively restores Onondaga Lake while ensuring long lasting protection of health and the environment by meeting the design and performance criteria consistent with the requirements set forth in the ROD and associated Consent Decree Statement of Work (SOW). This design is the culmination of work from more than 100 local engineers and scientists working with nationally recognized experts from various universities, research institutions, and specialty engineering firms, with input from community stakeholders.

Community input remains a vital component of Honeywell's design for the restoration of Onondaga Lake. Honeywell is committed to working with community leaders, interested stakeholders, and citizens to include input, recommendations, comments, and perspectives into the design process. Community members have the opportunity to participate in the design, construction, and post-construction periods as detailed in the NYSDEC's Citizen Participation Plan (CPP) (NYSDEC, 2009). Feedback received through the community participation process has already had a considerable influence on design-level decisions in several areas of the remedial design, including:

- Geotextile tubes for sediment dewatering (i.e., control of potential odors)
- Hydraulic dredging and transportation
- Secondary containment of the slurry pipeline

The selected remedy outlined in the ROD calls for the dredging and disposal of up to an estimated 2.65 million cubic yards (CY) of contaminated sediments, construction of an isolation cap over an estimated 425 acres in the shallower 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 along part of the shoreline, completion of a pilot study to evaluate methods to prevent formation of methyl mercury, wetland and habitat restoration, monitored natural recovery, and long-term maintenance and monitoring.

Onondaga Lake Design Process

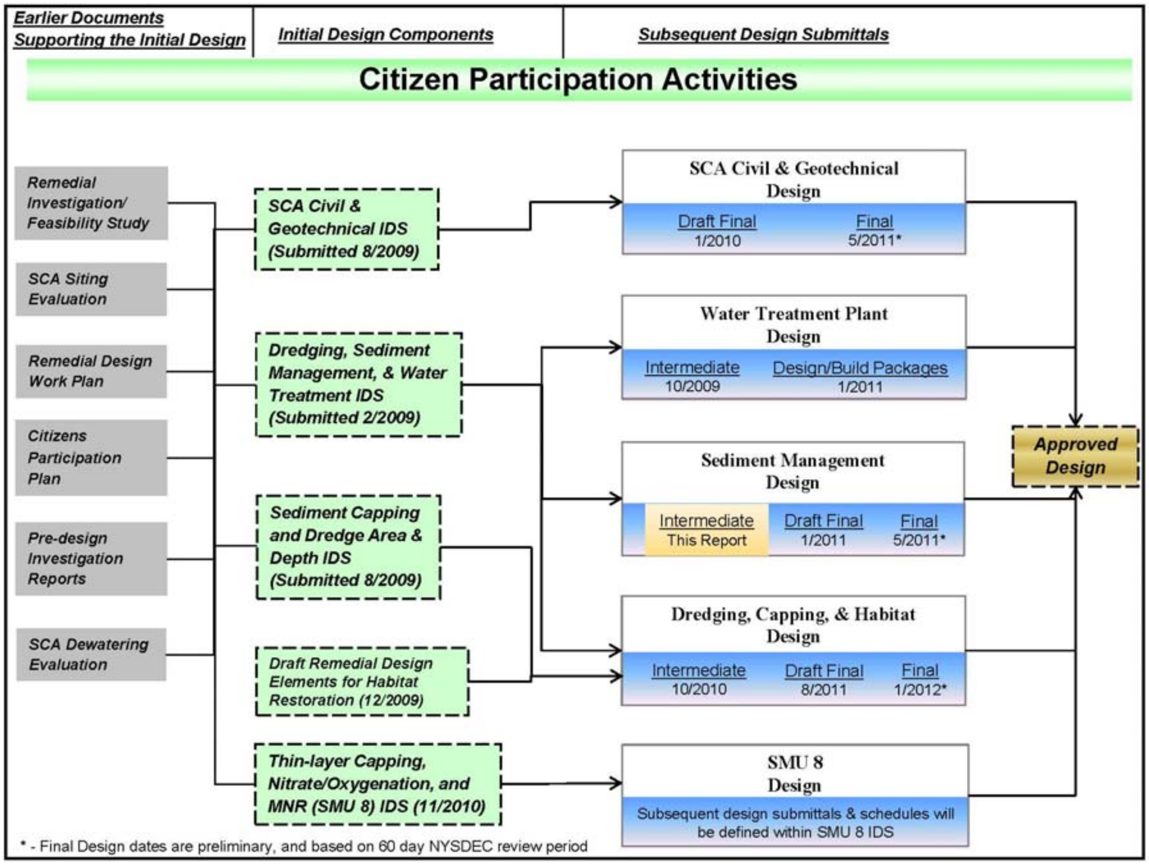
The Remedial Design Work Plan (RDWP) describes how the designs for all the various components of the remedy will be developed and distributed. As detailed in the RDWP, the remedial design will include the preparation of four IDSs, each of which will be submitted separately, and will address various elements of the remedy. Separating the design into four initial submittals has allowed for a streamlined schedule associated with critical path activities. The four initial design submittals (IDSs) include the following:

- Dredging, Sediment Management, and Water Treatment (Submitted February 2009)
- Sediment Consolidation Area (SCA) Civil and Geotechnical IDS (Submitted December 2009)
- Capping and Dredge Area and Depth IDS (Submitted December 2009)
- Thin-Layer Capping, Nitrate Addition/Oxygenation, and Monitored Natural Recovery (MNR) IDS (scheduled for submittal 11/25/2010)

Following the initial phase of the design, separate design tracks were established, with each track ultimately constituting a portion of the overall Onondaga Lake Design. These design tracks include:

- SCA Civil & Geotechnical Design
- Water Treatment Plant (WTP)
- Sediment Management
- Dredging, Capping, & Habitat
- SMU 8 (deep water)

The graphic below depicts the overall Onondaga Lake Design process, how project documents submitted to date serve as the basis for the various design tracks, and presents the schedule for the submittal of the remaining design components.



General Schematic of Onondaga Lake Design Process

This Intermediate Design is an advancement of the design for the conveyance of the dredge slurry to the SCA, the dewatering of the sediments, and the infrastructure needed to support these operations. This Intermediate Design incorporates comments received from the NYSDEC on the Dredging, Sediment Management, and Water Treatment IDS and further develops the design for these remedial components.

Slurry Conveyance

The slurry conveyance system will incorporate several components that ensure the integrity of the pipe and conveyance operation, while protecting human health and the environment.

Sediment will be hydraulically dredged from the lake remediation areas and will be pumped through a flexible pipe to an onshore support area. Upon reaching shore, this wet sediment mix ("dredged slurry") will be routed into a double-contained slurry pipeline, where it will be conveyed to the SCA, located on Wastebed 13. From the lake to the SCA, the dredged material is never exposed to the air. In fact, secondary containment will be provided for the entire length of the pipe through the use of a double-walled pipe, lined channel, or other containment means. A leak detection system in the pipeline will also be incorporated into the design.

Sediment Dewatering

Sediment dewatering is a necessary step in the sediment management process, and includes several material screening steps. These steps, including oversize material/debris screening and gravel/sand removal, are designed to enhance the primary method of dewatering, which is through the use of geotextile tubes. After the dredge slurry passes through the screening steps, it will be injected into the geotextile tubes for final dewatering and management.

Geotextile tubes were selected for dewatering based on an enhanced ability, over alternative dewatering methods, to achieve the various project objectives, including:

- Objective 1 - protect the public and wildlife during SCA operations
- Objective 2 - facilitate efficient emissions and odor management
- Objective 3 - protect workers during SCA operations
- Objective 4 - maintain geotechnical stability and SCA liner system integrity
- Objective 5 - meet operations requirements
- Objective 6 - select a method acceptable to the public
- Objective 7 - meet cell closure requirements
- Objective 8 - minimize dewatering area
- Objective 9 - enhance the water treatment process
- Objective 10 - minimize imported material quantities


Typical geotextile tube dewatering operation

Water seeping from the geotextile tubes, as well as precipitation falling into the SCA, will be collected in a controlled drainage system and sent to the SCA WTP, for treatment.

The design team will continue to work with the community to develop various performance criteria and work plans specifically designed to ensure that the health and safety of the surrounding community and environment are maintained throughout the execution of the remedy. The community health and safety plans that will be developed as part of the final Onondaga Lake design will include:

- Site Security & Community Safety Plan
- Air Quality Monitoring Plan (AQMP)
- Spill Contingency Plan
- Traffic Management Plan
- Noise Abatement Plan

- Navigational Protection Plan

Honeywell is also 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

INTRODUCTION AND DESIGN PROCESS OVERVIEW

This Onondaga Lake Sediment Management Intermediate Design 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 Design Report provides an intermediate-level design evaluation of components of the Onondaga Lake Remediation pertaining to the conveyance and management of dredged sediments from the lake. This Report has been prepared in advancement of several of the components of the conceptual level design previously submitted in the Onondaga Lake Dredging, Sediment Management, and Water Treatment Initial Design Submittal (Parsons, 2009). For other key aspects of this design, advancement of design details will completed as part of the final phase of design, in collaboration with the dredging contractor that will selected for this project. A dredging contractor will be selected in the first quarter of 2010.

1.1 DESIGN PROCESS OVERVIEW

As described in the Dredging, Sediment Management, and Water Treatment IDS (Parsons, 2009), the conceptual design of the Onondaga Lake Remediation was split into four IDSs. These IDS reports included:

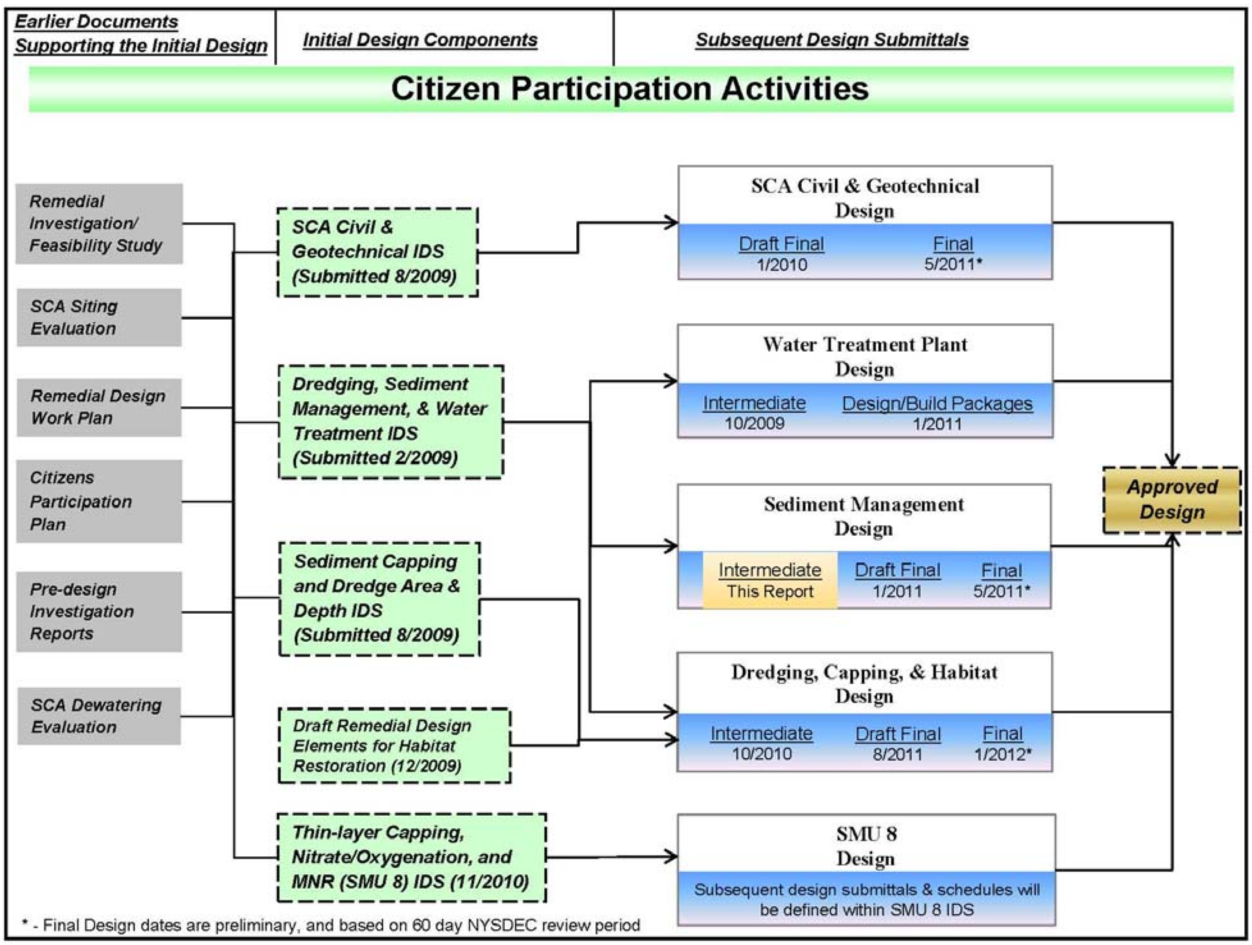
- The *Dredging, Sediment Management, and Water Treatment IDS* (hereafter referred to as the Operations IDS) provided initial design-level information pertaining to operational components of the remedy including the dredging, conveyance, and dewatering of impacted lake sediments, and treatment of construction water generated during the process. This IDS was submitted in February 2009.
- *The SCA Civil & Geotechnical IDS* (hereafter referred to as the SCA IDS) included the civil and geotechnical design elements (e.g., liner system) required for construction of the SCA. This IDS was submitted in August 2009.
- *The Sediment Cap and Dredge Area Depth and Volume IDS* (hereafter referred to as the Dredging & Capping IDS) included the proposed, conceptual level, design detail for the sediment cap component of the remedy, as well as the design details pertaining to habitat restoration, and dredging volumes and removal areas/depths. This IDS was submitted in December 2009.
- *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 will be submitted in November 2010.

Following the initial phase of the design, separate design tracks were established, with each track ultimately constituting a portion of the overall Onondaga Lake Design. These design tracks include:

- SCA Civil & Geotechnical Design
- Water Treatment Plant (WTP)
- Sediment Management
- Dredging, Capping, & Habitat
- SMU 8 (deep water)

The graphic below depicts the overall Onondaga Lake Design process, how project documents submitted to date serve as the basis for the various design tracks, and presents the schedule for the submittal of the remaining design components.



1.2 INTERMEDIATE DESIGN SUBMITTAL ORGANIZATION

This design report documents design and analysis that were completed to advance the slurry conveyance and sediment dewatering operations initially included in the Dredging, Sediment Management, and Water Treatment IDS (Parsons, 2009). This Intermediate Design is organized into four sections and nine appendices. A summary of each section is provided below.

- Section 1: Introduction and Design Process Overview – Presents a summary of the overall Onondaga Lake Remedial Design process, and the contents of this Intermediate Design.
- Section 2: Engineering Analysis and Design – Provides intermediate-level design details and technical evaluation for specific aspects of the remedy included in the sediment management aspects of the project.
- Section 3: Draft Final Sediment Management Design Submittal – Summarizes the content of the Final Design submittal, including a preliminary list of specifications and Drawings to be included.
- Section 4: References – Lists the references used to prepare this Intermediate Design Report.

SECTION 2

ENGINEERING ANALYSIS AND DESIGN

As described in Section 1, this Intermediate Design focuses on the conveyance and dewatering of dredged sediment at the SCA, and supporting operations. This design report summarizes the advancement of details for several remedial components, initially provided in the Operations IDS (Parsons, 2009). For other key aspects of this design, advancement of design details will completed as part of the final phase of design, in collaboration with the dredging contractor that will selected for this project. A dredging contractor will be selected in the first quarter of 2010.

2.1 SEDIMENT CONVEYANCE AND DEWATERING SCOPE OVERVIEW

Sediments from Onondaga Lake will be dredged hydraulically from the remediation areas (RAs) within the lake. Details pertaining to the definition of material that will be dredged (e.g., areas, depths, etc) and operational details associated with the dredging process will be addressed as part of the Dredging and Capping Design. The dredged sediment will be conveyed hydraulically, as slurry, from the lake to the SCA (located on Wastebed 13) utilizing a series of booster pumps.

Once at the SCA, the dredge slurry will be passed through several sediment screening steps. These steps, including oversized-material screening and gravel/sand removal, are designed to enhance the geotextile tube dewatering process, the primary method of sediment dewatering.

Following these material separation steps, the slurry will undergo polymer injection, which will precondition the slurry for dewatering within the tubes.

Next, the dredged sediment will be discharged into geotextile tubes for final dewatering. The geotextile tubes will be managed within the lined SCA, which will collect and manage water discharged from the geotextile tubes. Details pertaining to the design of the SCA are presented in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010).

The geotextile tube filtrate and water coming into contact with filling tubes or dredged sediment (herein referred to as contact water) will be collected and routed to the WTP for treatment (metals, volatile organic compound [VOC]/semi-volatile organic compound [SVOC]/total suspended solids [TSS] removal) prior to discharge to Onondaga County Metropolitan Wastewater Treatment Plant (Metro), for ammonia removal.

There are several areas associated with design and construction of the slurry conveyance and sediment dewatering operations where adaptive management concepts may be appropriate. Adaptive management refers to enhancements to project implementation based on lessons learned and from actual experience gained during the course of the project. These lessons learned can lead to revisions to the assumptions that were made during the course of the design, allowing the project construction schedule and final effectiveness to be optimized. Specific areas of the sediment management design and construction where adaptive management may be appropriate include the application of material (oversized, gravel, sand) screening steps, optimum production rates, polymer injection operations, and geotextile tube operations. Each of these areas of the sediment management design are discussed in detail below.

2.1.1 Dredge Volume

The current estimate of sediment volume to be dredged from the Lake is approximately 2,172,000 CY, which includes the current best estimate volume and contingency volumes. This volume estimate reflects data collected through the Phase V PDI, detailed design evaluations, and detailed dredge volume estimation that were completed as part of the Dredging & Capping IDS (Parsons, 2009). The breakout of this volume by remediation area, base volume, and contingency volume, is presented in the table below. Details pertaining to the development of these dredge volume estimates, including the basis for the contingency volumes, are provided in the Dredging & Capping IDS (Parsons, 2009). This volume provides the basis for operational design of the conveyance and dewatering systems presented herein.

Remediation Areas	Surface Area (AC)	Base Dredge Volume (cy)	Contingency Volume (cy)	Design Volume (cy)
A	23.6	133,000	38,000	171,000
B	2.9	20,000	5,000	25,000
C	7.0	38,000	11,000	49,000
D	89.2	1,147,000	57,000	1,204,000
E	83.8	588,000	135,000	723,000
Total	206	1,926,000	246,000	2,172,000

2.1.2 Design Flowrate and Dredge Productivity

The dredging, slurry conveyance, pre-processing, and geotextile tube dewatering processes will be an integrated system, with each process designed to operate within constraints imparted by each of the other components. The primary design factor common to each of the system components is the maximum design slurry flowrate. This flowrate, generated by the dredge, will largely dictate the sizing and capacity of each of the remaining components.

Successful completion of the sediment dredging in the four year schedule required by the Consent Decree will depend on, among several factors, the capacity of the dredging and conveyance systems to move the sediments at a sufficient rate. Two main variables dictating the ability of the system to meet the required schedule include the flowrate produced by the dredge, and the average percent solids (percent by weight, contained within the dredge slurry) that the dredging operation is able to maintain.

Maintaining percent solids will depend on both the performance of the dredging contractor, and on the geotechnical characteristics of the material that is being dredged. Geotechnical characteristics that were initially presented in the Operations IDS (Parsons, 2009) have been updated to reflect additional data collected and modifications to the Remediation Area delineation that was completed as part of the Dredging and Capping IDS (Parsons, 2009). These statistics are based on the five phases of design investigation which has been completed prior to the preparation of this report. As part of this design investigation, nearly 10,000 samples were collected, and more than 200,000 chemical and geotechnical analyses were completed. These updated sediment characteristics are summarized in Table 2.1, and presented in greater detail in Appendix A.

To assess the impact of these two variables on the overall dredge schedule, and to assess capacity requirements of the conveyance system, a dredging productivity sensitivity analysis was completed. The methodology of this analysis is included in Appendix B, and the results are summarized in the table below. As detailed in Appendix B, the durations shown in the table below assume an average dredging “up-time” (effective time in which the dredge is actually dredging sediment in a given period of time) of 70%. This factor accounts for routine maintenance, shift changes, dredge relocation, and other operational factors. Similarly-executed dredge projects have maintained up-time factors of greater than 80%. In addition, this calculation is based on an assumed dredging schedule of 24 hours per day, 7 days a week, 30 weeks a year (approximately mid-April to mid-November), and an estimated 32 Metro shutdown days. Further details pertaining to this Metro shutdown analysis are presented in Appendix C.

Based on experience at other similar dredging projects that have been completed, it is not uncommon for dredging operations to decreased levels of “up-time” during startup periods (e.g., beginning of the dredging project, start of a new dredging season, etc.). Often times, during these startup periods, various components of the dredging/conveyance/dewatering system will require adjustments to be made as field conditions may be different from what was anticipated during the system design. The duration of this period, and the degree to which it impacts production vary from site to site. Due to the scale of the project, the dredging/conveyance/dewatering systems that will be constructed for the Onondaga Lake project may be subject to similar “ramp-up” periods, where system “up-time” fall short of the estimated 70% average. However, it is anticipated that maintaining the average 70% “up-time” over the duration of the project, including start-up periods”, will be achievable.

Estimated Dredge Volume - 2,172,000 cy						
	Dredge Design Flowrate					
Average % Solids	4500 gpm	4800 gpm	5000 gpm	5200 gpm	5500 gpm	5700 gpm
	Dredging Duration (Seasons)					
12%	3.06	2.87	2.75	2.65	2.50	2.42
11%	3.36	3.15	3.02	2.91	2.75	2.65
10%	3.72	3.49	3.35	3.22	3.04	2.94
9%	4.16	3.90	3.75	3.60	3.40	3.29
8%	4.71	4.42	4.24	4.08	3.86	3.72
7%	5.42	5.08	4.88	4.69	4.43	4.28

As described in the Operations IDS (Parsons, 2009), based on an evaluation of the thickness and nature of the dredge cuts required in the various remediation areas, it is estimated that the solids by weight of the slurry produced by the dredge will vary between 7-12%. For the purposes of this design report, an average percent solids of 10% by weight is assumed. Under this scenario, compliance with the four-year dredge schedule would be feasible over a broad range of design flowrates within the pipeline. The design flowrate will be optimized to provide sufficient capacity to ensure the dredging can be completed in the schedule outlined in the ROD, without exceeding the design throughput capacity of the WTP, which has been sized to maximize discharge to Metro to the anticipated permit-limit of 6.5 million gallons per day

(MGD). For the purposes of this Intermediate Design, a maximum flowrate of 5,000 gallons per minute (gpm) is assumed as the operational output from the dredge. This design flowrate will be subject to modification during the final design, based on the actual equipment selected/proposed by the dredging contractor. This final flowrate, and the corresponding design details of the conveyance system, will be presented in the final design.

2.2 SLURRY CONVEYANCE

Sediments dredged from the RA's will be pumped hydraulically from the dredge head through an in-water (floating or submerged) pipeline to the lakeshore. When necessary, in-water booster stations may be utilized by the dredging contractor to convey the slurry to shore over distance greater than the capacity of the dredge pump. Details pertaining to these in-water booster pumps will be provided by a contractor submittal during remedial operations. Upon reaching shore, the pipeline will be routed on land, and use a series of booster pumps to convey the slurry to the sediment processing area located adjacent to the SCA. A general layout drawing of the slurry pipeline is presented in Drawing C-004 (see Appendix D).

2.2.1 Design and Performance Criteria

Based on dredge schedule requirements, water balance determinations, and water treatment flowrates, a maximum flowrate of 5,000 gpm is assumed as the operational output from the dredge. The slurry conveyance system is being designed to operate 24 hours a day, and will operate as a complete system with the dredging equipment selected for the project. As such, final sizing of the operational capacity of the system, including booster pump size and pipeline diameter, will be coordinated with the dredging equipment specified by the selected dredging contractor. Capacity of this system will be sized to handle anticipated dredging production levels, and will be sufficient to allow for the completion of the dredging operation within the four-year time frame required by the ROD. Selection of the dredging contractor will be completed in early 2010. Finalization of this system, including the targeted slurry flowrate will be completed as part of the final design.

To ensure the protection of human health and the environment, the design of the slurry conveyance system incorporates several measures and procedures to ensure the integrity of the pipe and conveyance operation. Secondary containment will be provided for the entire length of the pipe, through the use of a double-walled pipe, lined channel, or other containment means. The specification of the secondary containment measures will be completed as part of the final design. In addition to secondary containment, means for leak detection in the pipeline will be incorporated into the design. The detailed pipeline design will clarify leak detection measures and procedures.

Several design and operational procedures will also be specified to minimize the potential for slurry back flow if a booster pump or dredge pump fails. These will be presented in the Sediment Management Final Design. In addition, prior to regularly planned shutdown periods of the slurry conveyance system, the pipe will be rinsed with lake water to remove solids contained within the pipe. Furthermore, a supply of key replacement parts will be kept onsite, to allow for quick repair/replacement and to minimize system downtime.

The slurry pipeline alignment and associated supporting utilities requires coordination and approval by other third parties, property owners, and entities. Several of these groups have specific requirements (e.g., occupancy permits, operational limitations, etc.) for the design and operation of the slurry pipeline, which will be addressed as part of the remedial design.

2.2.2 Slurry Pipeline Alignment

The slurry pipeline alignment was selected based on several factors, including minimization of both visibility and accessibility of the pipeline to the public. In general, the pipeline and booster pumps will be located as far away from areas of heavy public use as possible.

When dredging in Remediation Areas C, D, or E, the pipeline will transition from water to land near Wastebed B, which is close to the dredging that will occur in the southern end of the lake. From Wastebed B, the pipeline will run along the western shore of the lake, along the western side of the Wastebeds 1-8 site adjacent to the I-690 corridor, to an intersection point with Ninemile Creek. From the creek intersection point, the pipeline will then follow the Ninemile Creek corridor to Wastebed 13. The total length of the pipeline from Wastebed B to the SCA is approximately 19,830 feet (3.75 miles).

During dredging in Remediation Areas A and B, the pipeline may be routed directly to an intersection point with Ninemile Creek, at its discharge to Onondaga Lake. For this stretch, the pipeline will be located on land adjacent to the creek.

Drawings C-101 through C-117 (see Appendix D) present the pipeline route. The alignment depicted in these drawings will be finalized as part of the final design, and may be subject to modifications based on detailed engineering analysis, and access agreement/permitting discussions with various property owners. In addition, drawings included in the final design will depict final booster pump locations, necessary utility connections, infrastructure requirements, and other design features. Additionally, grading plans in the areas of these booster pumps will be prepared, in areas where existing conditions are not conducive to the siting of a booster location.

2.2.2.1 New York State Department of Transportation (NYSDOT) Requirements

As depicted in Drawings C-105 through C-109, a portion of the slurry pipeline will be located proximate to the I-690 west bound lane, and will cross beneath the I-690 Westbound Exit 6 Ramp connecting to NY-695S (Drawing C-107). To cross this exit ramp, underground installation of the pipeline using trenchless technology will be required. To ensure compliance and acceptance by NYSDOT for these portions of the slurry pipeline, a Highway Permit and a Use and Occupancy Permit will be obtained. As part of the permit application process, the following design details, at a minimum will be provided to NYSDOT, per their requirements:

- Set of highway drawings, depicting property boundaries, existing structures and utilities, proposed pipeline route and supporting structures, and proposed power line routes
- Proposed plans for pipeline, booster pumps, and power line installation/operation/ decommission
- Contingency plans for pipeline breakage/leakage
- Highway permit application (covers installation/operation/decommission)
- Use and occupancy permit application (covers installation/operation/decommission)

The permits described above will be obtained prior to initiating any of the construction activities associated with the slurry pipeline. To facilitate the initiation of dredging activities in 2012, the slurry pipeline is expected to be constructed in 2011. To ensure all necessary NYSDOT requirements are met, the permitting process has been initiated concurrent with the preparation of this Intermediate Design.

In addition to these permits, the pipeline installation will also adhere to the requirements outlined in the "Guidelines in New York State Highway Design Manual". Requirements will include the installation of additional NYSDOT specified highway guardrails.

2.2.2.2 New York State Department of Agriculture and Markets (NYSDAM) Requirements

As depicted in Drawings C-105 through C-109, a portion of the slurry pipeline will be located on property owned by the NYSDAM and used by the New York State Fair as parking lots during events. To ensure all necessary NYSDAM requirements are met, discussions with NYSDAM have been initiated concurrent with the preparation of this Intermediate Design.

2.2.2.3 Ninemile Creek / Wetland Considerations

To the extent practicable, the pipeline alignment has been selected so as to minimize the impact of the slurry pipeline and any supporting infrastructure (e.g., service road) on the identified wetland areas and Ninemile Creek. Placement of the pipeline within or alongside the creek will be minimized to the extent practicable, to protect the natural habitats contained within these areas. Honeywell will continue to coordinate with NYSDEC and USEPA to finalize this alignment to optimize these factors, and provide maximum protection to these habitat areas.

In support of the design of the slurry pipeline, wetland delineation was performed along the pipeline route, upstream of the confluence of Geddes Brook. This work was completed by O'Brien & Gere (OBG), under a NYSDEC approved work plan (Honeywell, 2009). A summary report has been prepared for this delineation effort, and is included as Appendix E. A total of 20 individual wetland areas were identified and delineated as part of this effort. These areas have been incorporated into the pipeline alignment drawings included as Appendix D. Following completion, any impacted wetlands will be restored. Details pertaining to the restoration of these areas will be presented in the final design.

The pipeline alignment presented in Drawings C-101 through C-117 (see Appendix D) will cross the creek twice (crossing from one bank to the other) to reach the SCA. The first crossing location is in the vicinity of State Fair Boulevard, and the second crossing is near the southwest corner of the Wastebeds 9-11 site. The location of these crossings will be finalized during the Final Design, in coordination with the Ninemile Creek remediation project team, and NYSDEC/USEPA. To maintain the navigability of the Creek, and to minimize the potential for the pipeline to act as a barrier to floating debris (trees, branches, leaves, etc.) flowing downstream, the slurry pipeline will be submerged in locations where it crosses from one side of Ninemile Creek to the other.

2.2.2.4 Ninemile Creek Remediation

As depicted in Drawings C-110 through C-113, a portion of the slurry pipeline will be located in or along portions of Ninemile Creek where construction activities associated with the remediation of the Creek will take place. Due to spatial constraints on the shoreline between the Creek and I-695 exit ramp crossing over the creek, the slurry pipeline may be situated in the creek or along the bank for limited portions of this stretch. Coordination with the Ninemile Creek project will minimize the impacts of the slurry pipeline on the remedial activities associated with the Creek, and identify efficiencies where constructed infrastructure can be designed to support both projects.

2.2.2.5 CSX Corporation (CSX) Requirements

The slurry pipeline will cross through CSX's right-of-way (ROW) in two locations. The first crossing, shown on Drawing C-110 (see Appendix D), is under the former Erie Lackawanna line adjacent to State Fair Blvd and the 690-695 interchange. CSX regulations do not allow utility pipeline occupancy under or within 45 ft of any railroad bridge, unless by special design and approval by the CSX Chief Engineer. Since CSX approval is not certain at this time, the option of installing the pipeline using trenchless technology under the railroad and State Fair Blvd along the bank of Ninemile Creek is being advanced concurrently with the request for CSX approval. The second CSX crossing is under three adjacent tracks north of the SCA area shown in Drawing C-116. The pipeline will cross under the tracks to the east of the Ninemile Creek railroad bridge.

CSX's regulations and preferred procedures for operating in their ROW are outlined in the "Design and Construction Standard Specifications: Pipeline Occupancy". Standard design procedures for utility encroachment will be followed in applying for these two permits (permits are granted on per location basis) so they can be considered standard proposals by CSX. The slurry pipeline high-density polyethylene (HDPE) "carrier" pipe is required to be encased in steel within the CSX ROW. CSX's standard method of underground pipeline installation for casings up to 36 inch pipe is bore and jack which uses a rotating auger bore.

To obtain permits for the two CSX crossings, two application packages will be submitted for CSX review and approval. The Facility Encroachment Application Packet for new installations includes:

- Utility Encroachment Form
- Drawings in CSX's required format showing: the pipeline plan view, pipeline profile view and the cross sectional view
- Review fees based on the size of casing

2.2.3 Pipeline and Booster Pump Hydraulic Design

This section discusses the approach that will be taken for the hydraulic design the slurry conveyance pipeline and associated booster pump stations. For the purposes of demonstrating the approach that will be taken for hydraulic modeling, an example calculation is included in Appendix F. The design approach includes definition of the following items:

1. Critical (minimum) flow velocity
2. System total dynamic head (TDH)
3. System horsepower requirements
4. Booster pump size (Hp), number, and location

A critical (minimum) flow velocity must be maintained in the pipe to prevent excessive settling of particles in the pipe. As flow velocities increase within the pipeline, the system TDH also increases, which increases the pump energy input to convey the material at that velocity. One focus of the slurry conveyance hydraulic design will be to weight these two factors and select the optimum pipe size that meets critical velocity criteria but also minimizes TDH and pumps energy requirements.

Based on the geotechnical properties of the dredge material and a review of standard HDPE pipeline sizes, the critical velocity is estimated to be 12.5 feet per second (fps) for pipeline sections with an 8% incline. An example calculation is included in Appendix F for demonstrating the approach to critical velocity calculation. This critical velocity assessment will be finalized in conjunction with the selection of the dredging equipment.

Based on the above critical velocity estimates and the corresponding requirement to limit system TDH and pump energy requirements, 16 inch DR9 HDPE pipe (average inner diameter 12.3 inches) may be utilized for the conveyance line. Preliminary TDH calculations have been completed using this pipe size to range-find the size, number, and location of the booster pumps that may be employed in the conveyance system. Pipeline TDH and corresponding horsepower requirements were estimated using four different hydraulic models commonly employed in slurry conveyance modeling, as follows:

1. Hazen-Williams model
2. Darcy-Weisbach model
3. Durand model
4. Newitt model

Based on the preliminary hydraulic modeling, it is estimated that the system TDH will range from 800 feet to 1000 feet at a 5,000 gpm flowrate. Horsepower requirements associated with this TDH will range from 1,800 to 2,400 horsepower. Based on these requirements, it is estimated that up to five booster stations may be required. Preliminary locations of these stations are discussed below. The selection of hydraulic model and design of the slurry pipeline will be advanced further after selection of the dredging contractor and identification of specific dredging equipment. The final design of the slurry pipeline, including details pertaining to the number, size, and location of selected booster pumps, will be presented in the final design.

2.2.4 Booster Pump Stations

The locations for these five preliminary booster stations that have been identified are as follows:

- Booster pump station #1 – This station will likely be located on the on-shore support area located on the northwest corner of the Wastebed B site. This station will be located on Honeywell property, and is depicted on Drawing C-102 in Appendix D.
- Booster pump station #2 – This station will likely be located on the south east corner of the Wastebeds 1-8 site, adjacent to the entrance ramp to the fairgrounds parking area. This station will be located on property owned by NYSDOT, adjacent to the NYSDOT turnaround area and the Onondaga County West Side Pump Station. This station is depicted on C-105 in Appendix D.

- Booster pump station #3 – This station will likely be located adjacent to I-690W and the exit from the fairgrounds parking area, near an existing I-690 billboard. This station will be located on land owned by NYSDAM, and is depicted on Drawing C-109 in Appendix D.
- Booster pump station #4 – This station will likely be located on the Wastebeds 9-11 site, on the north side of the southern access road along Ninemile Creek, and upstream of the confluence between Ninemile Creek and Geddes Brook. This station will be located on Honeywell property, and is depicted on Drawing C-113 in Appendix D.
- Booster pump station #5 – This station will likely be located on the Wastebeds 9-11 site, on the north side of the southern access road along Ninemile Creek, just east of the southwest corner of the site. This station will be located on Honeywell property, and is depicted on Drawing C-115 in Appendix D.

The actual number of booster pump stations planned for construction, and their respective locations will be presented in the final design, and will incorporate design modifications associated with the finalization of the pipeline design, and the results of on-going access agreement negotiations. Additional engineering details pertaining to the design of these booster pump stations (e.g., foundation requirements, utility connections, etc.) will be provided in the final design.

Power alternatives (e.g., electric, diesel, etc.) for the booster stations will be evaluated during the final design. Electric booster stations could provide specific advantages, such as limiting the infrastructure needed to refuel diesel booster stations and allow Honeywell to evaluate the purchase of "green" electricity to reduce the carbon footprint of the project. Diesel booster stations could provide additional flexibility by eliminating the need to rely on supplied electrical power. Due to the lead time needed for installing electrical services to the booster locations, discussions and negotiations have been initiated with the two utility companies located in the project area (Solvay Electric and National Grid). The power supply for the various booster stations (electric, diesel, or a combination of both) will be specified in the final design.

2.3 SLURRY PRE-PROCESSING

As described in Section 2.1, the dredge slurry will undergo several pre-processing steps designed to optimize the geotextile tube dewatering process. Several of these pre-processing steps that were initially presented in the Operations IDS (Parsons, 2009) have been evaluated through various bench-scale studies. Some of these pre-processing steps have been retained as part of this design, including oversized-material screening and gravel/sand removal, while other processes under consideration (e.g., gravity thickening) were determined to present only marginal, if any, enhancing effects on the overall dewatering process, and have not been retained.

For processes retained, some will be utilized for the entire dredge operation, while some have been retained as an option for only a portion of the dredging operation. For the purposes of the dewatering design, the dredging has been divided into two phases: Phase 1 consists of dredging of the in-lake waste deposit (ILWD) material (Remediation Area B, C & D); and Phase 2 consists of dredging of non-ILWD material (Remediation Area A and E).

Based on bench-scale testing and geotechnical information obtained from field investigations, the material produced by the desanding of the non-ILWD material (Phase 2) is anticipated to be reusable in the construction of the subbase for the SCA cover. However, the material generated by this operation while dredging ILWD material (Phase 1) is not expected to be reusable. Based on this assessment, sand removal has been retained for potential implementation for Phase 2 dredging only, if this reuse is determined to be beneficial prior to, or during remedial construction.

Process flow diagrams for both Phases 1 and 2 of dredging are presented on Drawings D-001 and D-003 respectively (see Appendix D).

2.3.1 Design and Performance Criteria

The overall design objective of the pre-processing system is to enhance the geotextile tube dewatering process by removing material that can be more efficiently dewatered by other means, by enhancing the polymer addition step by removing a portion of the material which does not require polymer for dewatering, and by amending the dredge slurry to provide optimum dewaterability. The level of pre-processing will not impact the volume of material placed in the SCA, nor the dredge rate.

The slurry pre-processing system is designed to operate 24 hours a day, and have the capacity to process the maximum flow produced by the dredging and slurry conveyance operations. To account for the various sinks and sources of sediment/water/slurry throughout the process, the mass balance presented in Section 2.3.7 provides a maximum flow for each of the pre-processing components.

2.3.2 Primary Screening

The dredging contractor will take measures to limit the size and quantity of large debris entering the slurry pipeline. Details pertaining to these measures are being advanced as part of the dredging design, under a separate design package.

Following conveyance of the dredge slurry to the SCA, primary screening will be conducted during dredging of both ILWD material and non-ILWD material. For the purposes of this intermediate design, it is assumed that material greater than 2 inches in size will be removed during the primary screening operation. The final screen size will be presented in the final design.

2.3.2.1 Screening Process

Material rejected during the primary screening process will be conveyed to a temporary staging area. The underflow of the screen will be routed into a holding tank. During Phase 1 dredging, slurry in this tank will then be routed to the polymer addition system. During Phase 2 dredging, slurry in this tank will then be routed to the secondary screening process.

A source of water will be required to rinse the primary screens to maintain their operability. Rinsing frequency and duration will vary based on the nature of the material being dredged at a given time. Based on an assessment of commercially-available equipment capable of meeting the design requirements for the screening operation, the required rinse flow is assumed to be approximately 100 gpm. This water will be drawn from the SCA operational sumps. To accommodate periods when water from the SCA may not be available for this purpose, an alternate water source (e.g., SCA WTP effluent, collected storm water, etc) will be used. In all cases, the screened material will be contained within the SCA.

2.3.2.2 Screened Material Management

Material produced from the primary screening operation will be transported from the temporary staging area to the lined separated material management area. Details pertaining to the design of this lined area will be provided in the final design. This material is expected to consist primarily of coarse gravel, cobbles, gravel or cobble size particles of ILWD material, or debris with very few fine particles. All material generated by the primary screening process will be incorporated into the SCA prior to closure, for final containment. For non-ILWD material, beneficial reuse of this material within the SCA (e.g., access roads and ramps) will be evaluated during the course of the remediation.

2.3.3 Secondary Screening

For Phase 2 dredging, the dredge slurry may undergo an additional screening step to remove gravel-sized material, referred to herein as secondary screening. Screening to remove gravel is an economical method for removal of gravel-sized material from natural sediment, and has the benefit of reducing the volume of sediment in the geotextile tubes and reducing the quantity of polymer required for pre-treatment. In addition, gravel-size particle removal will be required prior to sand separation, discussed in Section 2.3.4 below.

2.3.3.1 Screening Process

For Phase 2 dredging, slurry in the primary screen holding tank will be passed through a second screen. The rejected material from the second screen will be conveyed to a temporary staging area. The underflow of the screen will either be routed to the sand separation system, or directly to the chemical conditioning process.

Screen sizing for the removal of gravel-sized particles typically range from $^{3}/_{16}$ inch to $^{3}/_{8}$ inch. For the purposes of this intermediate design, a ¼ inch screen has been assumed. The final screen size for the secondary screening operation will be determined as part of the final design.

A source of water will be required to rinse the secondary screens to maintain their operability. Based on an assessment of commercially-available equipment capable of meeting the design requirements for the screening operation, the total required flow is assumed to be approximately 510 gpm. This flow will be sufficient for rinsing of both the secondary screens, and of the hydrocyclone screens, as described below. This water will be drawn from the SCA operational sumps. The screen rinse water will be visually monitored for residual polymer, which can accumulate on the screens, reducing their operability. To accommodate periods when water from the SCA operational sumps may not be available for this purpose, an alternate water source (e.g., SCA WTP effluent, collected storm water, etc.) will be available.

2.3.3.2 Screened Material Management

Gravel-sized material produced from the secondary screening operation will be transported to the lined separated material management area. Details pertaining to the design of this lined area will be provided in the final design. It is anticipated that this material will have a beneficial reuse, within the containment area of the SCA such as for access roads and ramps within the

SCA, and subbase for the SCA final cover. During the final design, the demand for this material will be evaluated. The secondary screening operation may be eliminated from the system, or terminated prior to the completion of dredging, if the screening process is ineffective, if it is determined that the material does not have beneficial reuse, or a preferable material is identified for the reuse opportunities.

2.3.4 Sand Separation

For Phase 2 dredging, the dredge slurry may also undergo a sand separation step. Based on previous project experience, the removal of sand-sized particles from the slurry flow prior to dewatering in the geotextile tubes can provide several benefits. Sandy material can dewater sufficiently without the use of polymers and geotextile tubes, potentially reducing the quantities of these materials to be used. Additionally, the removal of the sand-sized particles may enhance the filling and dewatering process within the geotextile tubes, by removing particles that would settle in the immediate vicinity of the discharge ports. This can lead to “camel-backing” of the bags, or creation of “humps,” which can lead to tube stacking limitations. Finally, the removal of sand can produce a reusable material within the SCA, which reduces the need to truck material from off-site.

To assess the incorporation of a sand removal step to the dewatering process for the Onondaga Lake project, bench testing was completed by Wastestream Technologies (WST) as part of the Phase IV Pre-Design Investigation (PDI). This testing investigated the efficiency of hydrocyclones to remove sand-sized particles from samples collected from Remediation Areas D and E. The hydrocyclone tests indicated that removal of sand material from the dredge slurry was achievable using a hydrocyclone. The summary report describing the results of this testing is included in Appendix G.

As described above, natural lake sediments (i.e., non-ILWD material) are anticipated to be suitable for sand separation. Therefore, sand separation would only be conducted during Phase 2 dredging.

2.3.4.1 Sand Separation System

Hydrocyclones with linear motion screens will be utilized for sand removal. Hydrocyclones are static, conical devices sized by recycle pump feed rate, pressure, and the specific gravity and size of the particles to be removed from the stream. The underflow (sand sized particles separated by the hydrocyclones) drops to linear motion shaker screens placed under the hydrocyclones to further separate sand and liquid. The screened underflow will be conveyed to a temporary staging area. The screen size utilized for the linear motion screens (e.g., 100 mesh) will be determined as part of the final design. The underflow of the linear shaker screens and the overflow of the hydrocylone (non-captured fine sized-particles and liquid) are routed into the re-circulation tanks. Slurry from the bottom of the recirculation tanks is pumped into the hydrocyclones. Slurry from the top of the recirculation tanks, which only contains silt and clay size sediment particles, will then be pumped through to the polymer addition process.

As describe in Section 2.3.3.1 above, a source of water will be required to rinse the hydrocyclone screens to maintain their operability. Based on an assessment of commercially-available equipment capable of meeting the design requirements for the sand removal step, the

510 gpm discussed in Section 2.3.3.1 will be sufficient for both the secondary screens and hydrocylone.

2.3.4.2 Sand-Sized Material Management

Sand-sized material produced from the sand separation system will be transported to the lined separated material management area. Details pertaining to the design of this lined area will be provided in the final design. It is anticipated that this material will have a beneficial reuse, within the containment area of the SCA, as subbase material for the SCA final cover. This layer will facilitate the final grading of the SCA, while keeping this material within the containment system of the SCA. The sand removal operation may be eliminated from the design, or terminated prior to the completion of the dredging, if the sand separation process is ineffective, if it is determined that the material does not have beneficial reuse, or a preferable material is identified for the reuse opportunities.

2.3.5 Gravity Thickening

As described in Section 4.5 of the Operations IDS (Parsons, 2009), gravity thickening of the dredge slurry prior to discharge into the geotextile tubes could provide several enhancements to the dewatering operation, including providing a more consistent flow to the chemical conditioning and geotextile tube dewatering operations, and potentially decreasing the time required for dewatering of the sediments within the tubes by increasing the solids concentration of the incoming slurry.

To assess the incorporation of a gravity thickener to the dewatering process for the Onondaga Lake project, bench testing was completed by WST as part of the Phase IV PDI. Jar testing was completed as part of this investigation, to determine the optimal polymer and dosage that will be required for the thickening step. Following jar testing, modified column testing was completed to assess the potential efficiency of a thickening step with the polymer selected from the jar tests. Results from this testing were mixed, as the addition of the polymer did not significantly enhance the settling rate of the slurry, but were generally effective at reducing the total suspended solids in the supernatant.

In addition to this testing, the benefits of the thickening operation were evaluated on geotextile tube dewatering as a separate part of the Phase IV PDI. This testing indicated that the thickening step did not enhance the tube dewatering performance significantly. The summary report describing the results of this testing is included in Appendix G. Further details pertaining to this testing are provided in Section 2.3.6 below. Based on these results, the gravity thickening step has not been retained as part of the dewatering process.

2.3.6 Chemical Conditioning

Proper chemical conditioning is a critical element of the operation of the geotextile tube dewatering system. Chemical conditioning impacts the performance and capacity realized within each tube, as well as the quality of filtrate produced by the tubes. Minimization of filtrate TSS is critical for maintaining the functionality of the gravel collection system and the downstream WTP.

Bench-scale testing was conducted as part of the Phase IV PDI to identify polymers which will be most effective in enhancing the geotextile tube dewatering process. This investigation included rapid dewatering tests (RDT) of more than 160 unique polymers from several of the major manufacturers with experience in similar sediment dewatering applications. In addition to these polymers, four geotextile fabric types were evaluated as part of the RDT. The three polymers identified as the best performers during the RDTs were carried to the next phase of the testing, the pressure-gravity dewatering test (P-GDT). Additionally, three of the four fabrics tested performed sufficiently during the RDT to warrant further evaluation in the P-GDT. The summary report describing the results of this testing is included in Appendix H.

The P-GDT is designed to assess the performance of the chemical conditioning step in a bench-scale pressurized geotube, by monitoring the dewatering rate of the sediments within the tube, and the quality of filtrate (e.g., TSS) passing through the tube fabric. The test is designed to expose the treated slurry to conditions considered representative of a full-scale operation, to ensure the polymer selected is capable of producing a sufficient dewatering performance to meet the project requirements.

The three RDT-best-performing polymers were tested in the P-GDT. Based on this testing, two dry polymers: Ashland 2520; and Kemira A-100, provided the best dewatering performance for the sediments tested (Remediation Areas D and E). During P-GDT testing, dry polymers were found to result in a better dewatering performance than emulsions. As such, the design of the polymer addition process will include infrastructure and equipment to process the dry polymer. Polymer utilized for this project will be the Ashland 2520, Kemira A-100, or an approved equivalent. Based on P-GDT testing, 1.59 pounds of dry polymer per dry ton of sediment will be used as the base design dosage rate.

Based on P-GDT testing results, the addition of a coagulant will be necessary to effectively dewater Remediation Area E sediments. Based on P-GDT testing, coagulant used for this project will be the Ashland 492 emulsion, or an approved equivalent. As such, the design of the polymer addition process will include infrastructure and equipment to process the emulsion coagulant. Based on P-GDT testing, 5.71 pounds of emulsion coagulant per dry ton of sediment will be used as the base design dosage rate. This coagulant will be added during Phase 2 dredging.

Based on experience at other projects, it may be necessary to modify the polymer/coagulant dosage rate on a regular basis to maintain optimum dewaterability, as the characteristics of the sediment processed by the dredging operation change from area to area. The dewatering operation will have the flexibility to modify the dosage as necessary. Additionally, should the polymers and coagulant selected based on the P-GDT testing not perform adequately during remedial operations, the contractor will have the flexibility to test and utilize an alternate polymer/coagulant as needed.

2.3.6.1 Polymer Storage and Mixing

Dry polymer is typically delivered in large (e.g., 2,000 pound) "supersacks," which must be stored in a dry area prior to use. Polymer deliveries will be maintained on a regular basis (e.g., weekly), and sufficient polymer storage area will be provided to ensure adequate polymer is on hand to continue polymer addition. The storage building is shown on Drawing C-003 (see Appendix D), located in close proximity to the mixing and addition operations. The polymer mixing system will be equipped to accommodate the supersacks.

Prior to injection into the slurry line, dry polymer will be mixed with "make-down" water and allowed to age for a period of time. Based on the design dosing rate obtained from the bench-scale testing, approximately 300 gpm of polymer make-down water will be required. The bench-scale testing also evaluated SCA WTP effluent as make-down water. Based on the testing completed, the quality of the WTP effluent was sufficient to serve as make-down water, and will serve as the primary source during remedial construction. In the event that WTP effluent is not available, or water quality is not conducive to creating an effective polymer, accommodations for an alternative water source (e.g., surface water drawn from Onondaga Lake or Ninemile Creek) will be in place, sufficient to meet the 300 gpm demand.

Based on the bench testing described above, a minimum aging period of 30 minutes is required. Mixed polymer is typically considered usable for up to 72 hours after initial mixing. To ensure that all the polymer solution has achieved the minimum aging time, several polymer mixing/aging tanks will be provided.

The coagulant recommended during the P-GDT testing was an emulsion coagulant, and will be injected directly into the slurry line. Based on previous project experience, it may be necessary to supplement this injection with a small flow of flush water (5-10 gpm) when the solids content of the dredge slurry exceeds certain percent solids. To accommodate this potential demand, the return line from the WTP effluent, which will provide the polymer make-down water, will be sized with sufficient capacity to provide this flow.

2.3.6.2 Polymer/Coagulant Injection

Following the mixing and aging steps, the polymer will be injected in-line into the slurry. The number and location of the injection points will be based upon several factors including pipeline mixing, contact time and floc stability/shear. An in-line mixer will ensure complete mixing of the polymer and slurry. The mixture will then be pumped to the geotextile tube dewatering system for final dewatering.

Operational factors, such as a change of physical properties of the sediments being dredged or the implementation/suspension of sand removal, will lead to variation in the properties and corresponding polymer/coagulant demand of the slurry entering the polymer injection system. The density and flow rate of the dredge slurry will be continually monitored by in-line flow and density meters that automatically control the dose applied to the dredge slurry.

The flocculation of the dredge slurry will be observed in the field frequently to ensure proper conditioning of the dredge slurry is occurring prior to entry into the geotextile tubes. This will be accomplished by manually drawing grab samples from the header system via sample ports located downstream for the polymer injection spool pieces. The samples will be observed for proper floc formation and water clarity. Additionally, when necessary, the dewatering contractor will perform "jar tests" in the field, to assess the need for changes in the required polymer dose.

2.3.7 Dredging / Conveyance / Pre-Process System Mass Balance

To provide a basis for the sizing and design of the slurry pre-processing equipment, ancillary pipes and pumps, the geotextile tube header and distribution system, and the SCA WTP, a system mass balance was developed which identified the various flows (solids and liquid) associated with the dredging, dewatering, and water treatment systems. This mass balance was developed in conjunction with the Onondaga Lake Remedial Design SCA WTP - Intermediate Design Submittal (OBG, 2009), which contains the mass balance for the water treatment plant under maximum flow conditions. Mass balance diagrams have been developed for the two dredging phases described in Section 2.3. This mass balance is presented in Appendix I.

2.3.8 Equipment List

Equipment that will be required for the processes described in this Section includes:

Drawing #	Tag #	Description	Comment
D-102	P-01	Supplemental Lake Water Pump	As needed to maintain pipe velocity
D-103, 104	P-02 to P-06	Booster Pump	500 hp
D-105	SC-01	Primary Screen	6,000 gpm capacity
D-105	SC-02	Primary Screen Tank with Auger	11,700 gal capacity
D-105	CV-01	Conveyor	~30 ft x 50 ft
D-105	P-07, -08	Geotextile Tube Feed Pump	3,000 gpm capacity
D-106	P-09, -10	Sand Separation Feed Pumps (2)	3,000 gpm, 75 Hp
D-107, 108	SC-03, -05	Secondary Screens	3,000 gpm
D-107, 108	SC-04, -06	Recirculation Tanks w/ Auger (2)	13,700 gal
D-107, 108	HC-1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D	Hydrocyclones (8)	750 gpm
D-107, 108	P-1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D	Recirculation Pumps (8)	750 gpm
D-107, 108	CV-02, -03, -04, -05	Solids Conveyor	~30 ft x 50 ft
D-109	T-02, -03	Slurry Tanks	
D-110	P-0x	Polymer Make-up Water Booster Pump	600 gpm, 15 Hp
D-110, 113	T-0x	Polymer Mixing Tank (2)	17,500 gal capacity
D-110	MX-01A,B,C	Polymer Mixer Unit (2)	
D-110, 113	T-0x	Polymer Make-Up Water Storage Tank	17,500 gal capacity
D-110, 113	P-0xA,B	Polymer Make-Up Water Pumps	300 gpm, 15 Hp
D-110	P-0xA,B	Polymer Pump	300 gpm, 15 Hp
D-110	POL-03	Dry Polymer Makeup Unit	
D-111, -112		Geotextile Tubes	
D-111, -112	P-11, -12	SCA/Stormwater Basin Pumps	3,000 gpm
D-111, -112	P-xx	SCA Sump Pumps	

2.4 GEOTEXTILE TUBE DEWATERING

Following applicable pre-processing and polymer addition steps, the remaining sediments contained within the dredge slurry will be dewatered for final management using geotextile tubes. As described in SCA Dewatering Evaluation (Parsons, 2009), geotextile tubes were selected based on an enhanced ability to achieve the various project objectives. The dewatering objectives that were developed as a basis for the comparative analysis of the various dewatering methods include:

- Objective 1 - protect the public and wildlife during SCA operations
- Objective 2 - facilitate efficient emissions and odor management
- Objective 3 - protect workers during SCA operations

- Objective 4 - maintain geotechnical stability and SCA liner system integrity
- Objective 5 - meet operations requirements
- Objective 6 - select a method acceptable to the public
- Objective 7 - meet cell closure requirements
- Objective 8 - minimize dewatering area
- Objective 9 - enhance the water treatment process
- Objective 10 - minimize imported material quantities

As discussed in Section 2.3.6, bench testing was conducted during the Phase IV PDI to further assess the effectiveness of the geotextile tube dewatering process, and to provide critical input to the geotextile tube dewatering design. Key results from this testing that will be incorporated into the design of the geotextile tubes are discussed in greater detail in Section 2.4.2.

Geotextile tubes will be placed in the SCA and receive pre-conditioned slurry from the slurry processing area. The geotextile tubes will retain the solids and allow filtered water (filtrate) to drain to the SCA liquids management system. The basic steps in geotextile tube dewatering are:

- Slurry is routed through a header system into the tubes via fill ports located on the top of each tube.
- Slurry will be pumped into the tubes over several filling cycles, until the tube capacity is reached. Maximum fill height is the primary method of process control for each individual tube.
- The filtrate seeps out of the tubes while the solids remain in the tube and consolidate.
- Filtrate flows to SCA liquids management system and is pumped to the water treatment system.

This section describes these process steps that will comprise the geotextile tube dewatering operation, outline supporting infrastructure, present design constraints associated with geotechnical and operational limitations, and provide the basis for advancing the final design of the geotextile tube dewatering operation.

2.4.1 Geotextile Tube Header System

Pumps located prior to the polymer addition equipment in the slurry processing area will be used to transfer the pre-conditioned slurry to the geotextile tube header system, located in the SCA. The pumps will have a capacity to handle the maximum flow produced by the dredging operation, as calculated in the mass balance presented in Appendix I.

As stated in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA will be constructed in phases. An area of the SCA will be designated for active tube dewatering. The active area will be sized so that enough tubes, given the tube performance characteristics describe above, can be deployed to match the filtering rate with the dredge rate. The active area may consist of an entire phase of SCA construction, or combinations of several phases, and will be adjusted throughout the operation.

The geotextile tube header will consist of a piping network routed around the active area of the SCA with several branch manifolds deployed in a configuration that facilitates distribution of the slurry into geotextile tubes within the active dewatering area. Based on the maximum flows estimated for the project, five to 10 geotextile tubes will be on-line at any given time. The header system will have a capacity to handle the maximum flow, as calculated in the mass balance presented in Appendix I. The header piping will transition from solid pipe to flexible pipe near the geotextile tubes to allow for manual reconfiguration of the filling network, as full tubes are taken off-line, and new tubes are being prepared for filling. Valves will be installed in selected areas of the header piping to allow for control of slurry flow to the desired tube. Tube operation, including piping reconfiguration and flow control, will primarily be a manual operation. Tube operators will constantly monitor filling tubes, and perform necessary adjustments to maintain the performance of the tubes and line velocities in the header system to minimize plugging and excessive pressure buildups. The number of tubes being filled at any time will depend on the flow rate at that time, the characteristics of the slurry, and the rate of drainage through the tubes.

Details pertaining to the design of the geotextile tube header system will be provided in the Sediment Management Final Design Submittal.

2.4.2 Geotextile Tube Design

Geotextile tubes are fabricated in a variety of circumferences and lengths using high strength, permeable geotextile. For dewatering the Onondaga Lake sediments, geotextile tubes 80 to 90 ft in circumference, and up to 300 ft in length, will be used in the dewatering operation.

Based on the results of the P-GDT testing conducted in the Phase IV PDI, TenCate Geotube® Fabric GT500 was found to provide the best dewatering performance from other TenCate® fabrics tested. The fabric utilized for geotextile tubes for this project will be GT500, which has an apparent opening size (AOS) of 0.425 mm, or an approved equivalent from another manufacturer.

Several fabric materials were tested for compatibility with the Solvay waste material to be dredged from Remediation Area D (the ILWD). As part of this testing, high strength geotextile tubes and the thread for the geotextile tubes were evaluated. Both performed well and are considered suitable for the project. Further details are provided in the Draft Final SCA Civil and Geotechnical Design Submittal (Parsons, 2010).

2.4.3 Geotextile Tube Dewatering Operations

All dewatering operations will be conducted with an emphasis on personnel safety. All personnel working within the SCA will be property trained in all aspects of geotextile tube operations, and will be required to follow the safe work practices that will be established for the project.

The operational objectives for the geotextile tube dewatering are:

- To achieve a dewatered condition, in a reasonable time frame, that allows for tube stacking
- To achieve a filtrate quality that allows for effective operation of the water treatment system

- To operate within the geotechnical parameters of the SCA
- To minimize the impact on dredge production rates and project schedule

The geotextile tubes will undergo several fill cycles, until their capacity is reached. The capacity of each geotextile tube is a function of the tube's material properties and size. The primary control parameter is the maximum fill height of each tube, determined by the tubes circumference and seam loading. The height of actively-filling tubes will be continuously monitored by the geotextile tube operators. Once a geotextile tube has been filled to capacity, sediments within the tube will need to sufficiently consolidate before another tube can be safely stacked on top of it. The required level of sediment consolidation and the methods for verification will be developed by the contractor as a construction submittal.

The primary measure of the quality of the filtrate passing through the tubes is the TSS. Control of TSS levels is critical to maintaining the gravel collection layer beneath the tubes, controlling deposition in the sump areas, and ensuring the performance of the WTP. Based on the Phase IV bench-scale testing, it is estimated that the geotextile tube filtrate will contain TSS less than 200 milligrams per liter (mg/L). This 200 mg/L has been utilized as a conservative maximum TSS value for the design of the WTP.

Similar to the need for flexibility in the polymer addition process, as discussed in Section 2.3.6, it may be necessary to adjust geotextile tube operational parameters, such as number of fill cycles for each tube, to maintain the desired tube performance and filtrate quality. As such, the contractor will have the flexibility to modify the tube dewatering operations to maintain tube performance. In addition, the contractor will have responsibility of preparing draft tube arrangement plans and filling/tube management procedures.

As stated in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA design is based on a concept of stacking the geotextile tubes to a height of approximately 30 ft (approximately five tubes stacked) over the SCA footprint. The sequence of tube placement (location, alignment, rate of stacking, etc.) up to this final configuration will be guided by the geotechnical behavior of the SCA as the project progresses. To monitor this behavior, extensive instrumentation including piezometers, settlement cells, settlement profilers, and inclinometers will be installed during the construction of the SCA. These instruments will be monitored during the dewatering operation to ensure the SCA continues to operate within its design parameters. The details of this monitoring program are outlined in the Geotechnical Instrumentation and Monitoring Plan, contained in Appendix N of the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010).

2.4.4 Supporting Infrastructure

A road is incorporated in the design of the top of the SCA perimeter berm that allows access to the SCA because installation of the header piping system, deployment of the geotextile tubes, and the filling operation of the tubes will require access around and within the SCA. Small, low-ground-pressure vehicles will be operated in the SCA to aid in tube deployment and other tasks. Some gravel may be placed at strategic locations in the SCA for this small vehicle access. Ladders, steps, and platforms will also be installed in the SCA for worker access. As layers of tubes are added, the gravel ramps/roads and ladders/steps/platforms will be extended to allow access to the active working areas. Infrastructure (e.g., lighting) will be installed to ensure the health and safety of workers during night time operating hours, in accordance with applicable requirements (e.g., Occupational Safety and Health Administration [OSHA]). Details pertaining to this infrastructure will be prepared as a contractor submittal.

2.5 WATER MANAGEMENT

As the dredge slurry is pumped into SCA and into the geotextile tubes, filtrate water will weep out, while the sediment will remain in the tubes. The filtrate water will flow into the SCA liquids management system, which will have temporary pump upgrades for the flow conditions expected during operations. The SCA liquids management system will collect the filtrate and transfer it to the WTP.

As discussed in the Operations IDS (Parsons, 2009), the WTP will be subject to periods of shutdown, as dictated by the permit terms for the discharge of the water to the Metro treatment plant. These shutdown events are typically tied to periods of high precipitation. To minimize the impact of these shutdown events on the dredging operation, provisions for water storage before and after the WTP are included in the design.

2.5.1 Design and Performance Criteria

The design of water management strategies and infrastructure will be such that filtrate, process water, and precipitation/contact water falling within the shoreline debris management area, SCA, preprocessing area, separated material management area, and WTP

The management strategies and associated conveyance infrastructure will be designed to handle the maximum flow from the dredge, in addition to the daily average precipitation and recirculation flows identified in the mass balance. Based on the mass balance presented in Appendix I, and based on the dredge flowrate of 5,000 gpm, the SCA operational liquids management system will be sized to handle 5,750 gpm.

In addition to the operational capacity of the filtrate collection and management system, the SCA will also be designed with contingency water storage capacity. This storage capacity will help minimize the impact on the Metro shutdown days on the dredging operation, and provide storage for high precipitation events. Total water storage capacity upstream of the WTP will be sized to contain the volume of water generated by a 25-year, 24-hour storm falling within the SCA.

2.5.2 Non-SCA-Area Water Management Systems

Water potentially requiring treatment will be collected from the following locations: the shoreline debris management area, SCA, preprocessing area, separated material management area, and the WTP. Surface water control features will be incorporated into the grading of these areas to direct surface water to collection points. In addition, water from decontamination facilities in these various support areas will be designed such that decon water can be routed to separate collection points. Pumps in these collection points will be installed to route the collected water to an appropriate point in the dredge slurry pipeline prior to water treatment. Engineering controls (e.g., grading and covers) will be utilized to minimize the amount of water requiring management. The surface water control system and collection points will be included in the Sediment Management Final Design.

2.5.3 Water Management Within the SCA

Water within the SCA will be managed by a liquids management system that will collect and remove water that is contained by the SCA composite liner system, as described below.

2.5.3.1 SCA Operation Liquids Management System Design

Details pertaining to the SCA composite liner and liquids management system design are described in Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010). The SCA composite liner system 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 linear low-density polyethylene (LLDPE) 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)

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 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 from the geotextile tubes and precipitation that comes into contact with the tubes. After SCA closure, the liquids management system will handle remaining water that is generated by the continuing dewatering of the dredge material within the tubes and precipitation that infiltrates through the SCA cover. The details associated with the liquids management strategy under post-closure conditions are included in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010). The details associated with the liquids management strategy during operational conditions are discussed in the subsections below.

2.5.3.2 SCA Operational Liquids Management System Operation

The location and intensity of this flow is expected to vary within the SCA depending on precipitation events, dredge rate, dredge work schedule, and operation of the geotextile tubes. The operational liquids management system is designed to handle this variability by having mobile components and the ability to use temporary storage for precipitation events (described in Section 2.5.4).

Part of the potential spatial variability in SCA flows is due to variability in liquid flow routes. As filtrate flows out of the geotextile tubes, it will follow one, or a combination, of the following flow paths:

- Directly into the gravel drainage layer beneath the tubes
- Across the top of adjacent tubes and into the gravel drainage layer
- Across the top of adjacent tubes and to the channel between the geotubes and the perimeter berm of the SCA

Filtrate that enters the gravel drainage layer will follow the SCA liner slope towards two permanent collection sumps, from which it will be removed via submersible pumps in the risers. Filtrate that flows to the perimeter channel will either flow into the gravel drainage layer (via the exposed gravel on the inside edge of the channel) or follow the slope of this channel towards low points on the east and west sides of the SCA. Operational pumps will be situated on the SCA berms at the low points of the channels (operational collection points) to remove water from the channels and transfer it to the WTP. The amount of flow that enters the gravel drainage layer and the amount that flows down the channel will depend on the head and resistance to flow at any given time. Flow may also flow out of the gravel drainage layer and into the perimeter channel, also depending on head differentials and flow resistance. This potential redirection of flow contributes to the potential spatial variability of flow, but does not affect the total flow volume in the SCA.

It is possible that, due to variations in geotextile tube configurations, filtrate may locally pond before it follows the identified flow paths. Additional mobile pumps and aboveground piping will be deployed if necessary around the SCA to move ponded water to the perimeter channel for collection in the operational pumps and conveyance to the WTP, to ensure the maximum allowable head is not exceeded.

Design details associated with the permanent collection sumps are presented in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010). Water collected in these sumps will be pumped to the operational collection points via temporary, above-ground piping that will be repositioned as geotextile tubes are deployed in the area. Also as described in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA perimeter berms and channels have been designed with adequate dimensions to convey the design flow to the operational collection points. In order to account for the potential spatial variability of flow, each side of the SCA channel has sufficient capacity to carry the full design flow. Likewise, the pump capacity at each operational collection point will have sufficient capacity for the full design flow.

2.5.4 Stormwater Diversion Basins

As described in Section 2.5 above, the discharge of water from the WTP to Metro will be subject to shutdown periods, based on total flow to the Metro facility during precipitation events. To minimize the impact of these shutdown events on the dredging operation, two water storage points have been designed into the overall process. Water storage will be available between the SCA and the WTP; and between the WTP and the Metro discharge point, herein referred to as upstream and downstream storage, respectively. Each storage point will have sufficient capacity to hold the volume of water produced by approximately one day of dredging.

2.5.4.1 Basin Design

To provide for upstream storage, two basins have been designed on the eastern and western berms of the SCA. As presented in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA perimeter berm height and the stormwater basin volume were optimized so that a 25-year, 24-hour storm could be contained within the SCA and stormwater basins without discharging to the WTP. These basins are sized for the condition where all three phases of the SCA (i.e., 72 acres) have been constructed and covered with at least one layer of geotextile tubes, which is expected to be the case that requires the most storage. Based on this design storm event, each of these basins will provide approximately four million gallons of storage, or eight million gallons total. Drawings C-005 and C-006 (see Appendix D) present preliminary site plans for these two basins. The Sediment Management Final Design will include detailed plans and design details associated with the civil and mechanical engineering design for these basins.

To provide for downstream storage, the existing wastebed leachate collection pond will be utilized. Operational capacity of this pond to hold the required water volume will be validated during final design. Details pertaining to the mechanical engineering design associated with the use of this basin will be included as part of the WTP Final Design.

2.5.4.2 Basin Operations

In general, the upstream basins will be utilized as needed to minimize water levels within the SCA. Water generation in excess of the WTP throughput capacity may occur under a variety of conditions, including during periods of extremely low percent solids in the dredge slurry, during storm events, and during Metro shutdown periods. As necessary during and following these conditions, the SCA and the stormwater basins will be used to manage the additional liquids that will be generated. The operational pumps pulling water from the operational collection points will also be designed to discharge both to, and from, the stormwater basins. In addition, the SCA will have overflow culverts leading to these basins. The use of these basins will depend on the storm severity, the lined area of SCA constructed, and the area covered with geotextile tubes. The culverts will be designed at an elevation that allows for normal operational flows and average precipitation to be managed within the SCA and management of flows in the stormwater basins only during periods of above-average rainfall. Further details pertaining to the operation of these upstream basins will be provided in the Sediment Management Final Design.

Under normal operations, effluent from the WTP will discharge directly to Metro. The leachate collection pond will be utilized only in instances when the WTP is unable to directly discharge to Metro, and collected water within the SCA requires treatment. To empty this pond following a Metro shutdown period, the WTP conveyance system will have the ability to pump from the collection pond to the Metro discharge point. Further details pertaining to the operation of this collection pond will be provided in the WTP Final Design.

2.6 DEBRIS MANAGEMENT

As part of the preparation for dredging and capping operation, an evaluation will be completed to assess in-lake debris, to determine which debris targets will not impact the function of the sediment cap, and can remain in place, and which targets will require removal. For debris that could impact the sediment cap or the efficiency of the dredging operation, debris removal may be conducted by the dredging contractor prior to dredging. Details pertaining to this debris removal operation will be addressed as part of the dredging and capping design. Any debris removed from the lake bottom will be transported to the shoreline support area for further processing. Debris management options may include:

- Porous debris and utility remnants, such as concrete, bricks, timber, railroad ties, rubber, and other porous materials. This material could be crushed, or otherwise reduced in size as appropriate and transported to the SCA.

- Non-porous debris and utility remnants, such as metal, large rocks, and possibly fiberglass, ceramic, glass, plastics or other non-porous materials. This material could be cleaned and recycled. For example, large rocks could be washed and possibly reused for armoring as appropriate. Large metal or other non-porous objects could possibly be sold for reuse or recycling. Small pieces of non-porous debris will likely need to be managed with the porous debris.
- Debris requiring special handling (e.g., compressed gas cylinders, chemical containers with unknown contents, etc.), if encountered, may require handling by specialty subcontractors and/or transported offsite for disposal.

Further details pertaining to the on-shore management of debris will be finalized in conjunction with the dredging contractor selected for the project, and will be provided in the sediment management final design. The final design will provide details pertaining to facilities required to manage the debris, both at the shoreline support area, as well as at the SCA. Figure 2.1 presents potential traffic routes that would be utilized for the transportation of debris from the lakeshore to the SCA.

2.7 UTILITIES

Various utilities will be needed to support dredging, slurry conveyance, sediment dewatering and water treatment. This section includes a summary of the utility needs, locations they will be needed, and plans for procuring the necessary utilities in sufficient time to allow for equipment testing prior to the start of dredging in 2012.

2.7.1 Lakeshore Support Area and Booster Stations #1 & #2

Several operations and activities will be based at the Lakeshore Support Area, that will be located on or near the Wastebed B site, including:

- Office facilities
- Operational support facilities for work crews (break trailers, decontamination trailers, etc.)
- Equipment storage
- Heavy craft (dredge, debris barge, etc.) service dock;
- Small craft (oversight boats, tender boats, etc.) dock
- Debris decontamination and staging
- Booster pump station(s)

Utility requirements for these activities are described below.

2.7.1.1 Electrical Service

Based on the activities and operations that will be staged in this area, two types of electrical service will be required. Office facilities, operational support facilities, equipment storage, docking facilities, and debris decontamination/staging areas will require 480 volt three phase power service. Existing service lines owned by Solvay Electric in the vicinity of the Wastebed B site will be sufficient for this demand.

Three phase electrical service will be required for the booster pump stations, if electrical boosters are selected. To supply power to booster pump station #1, located on Wastebed B, existing three phase infrastructure is currently in place, which supplied the Semet/Willis Groundwater Pump Station with three phase power. This service line, owned by Solvay Electric, will require line upgrades to ensure the supply is sufficient for the demands from the booster pump. Furthermore, additional infrastructure will be necessary to bring the power to the actual booster pump location. To supply power to booster pump station #2, preliminarily located at the southeast corner of the Wastebeds 1-8 site, existing infrastructure which supplies power to the Onondaga County West Side pump station may be utilized. However additional infrastructure will be necessary to extend the service a short distance, to the actual booster pump location.

The location of the Lakeshore Support Area lies within the jurisdiction of Solvay Electric Department. To ensure necessary connections are installed prior to the initiation of dredging activities, Honeywell has begun coordination with Solvay Electric Department to extend the necessary electrical service to the lakeshore site.

2.7.1.2 Water

For sanitary purposes, potable water will be needed for the office and support facilities. Potable water service is available near the Westside Pump Station. A buried tap from this source to the office and support trailer area will be installed during the construction of this support area.

Other activities and processes in the shoreline support area will require a source of non-potable water. Activities such as fire protection, equipment and debris decontamination, truck wash stations, and booster pumps will have a considerable demand for non-potable water. To provide water for these activities, surface water will be drawn from Onondaga Lake. The intake for the lake water will be designed with a screening system to prevent the intake of objects which may damage conveyance pipes and pumps (aquatic vegetation, debris, etc.). If necessary, lake surface water will be passed through a simple filtration system to remove suspended solids. Any surface water used onsite and considered construction/contact water will be collected and routed into the slurry pipeline for treatment at the WTP.

2.7.2 Slurry Pipeline Alignment (Booster Stations #3, #4, & #5)

Utility requirements along the slurry pipeline will be limited to booster pump locations. Electrical power and water services will not be required along the length of the pipeline in between these locations.

2.7.2.1 Electrical Service

Three phase electrical service will be required to power the booster stations, if electrical boosters are selected. Sufficient service is not currently available at the preliminary locations depicted in Drawing C-004 (see Appendix D). As such, installation and upgrading of existing infrastructure at booster locations 3, 4, and 5 will be required.

Booster pump station #3 and any associated appurtenances shall be served by a new three phase drop from Solvay Electric. The wooden pole infrastructure presently exists within the New York State Fairgrounds parking lot located on the Wastebeds 1-8 site. This infrastructure will require permission to build out the new three phase aerial conductor needed to support the Solvay Electric service drop.

Booster pump station #4, and any associated appurtenances, shall be served by a new three phase drop from Solvay Electric. The existing wooden pole infrastructure along the Wastebeds 9-11 maintenance road, alongside Ninemile Creek, may be utilized, but will require upgrading service conductors to support the new three phase Solvay Electric service drop.

Booster pump station #5, and any associated appurtenances, shall be served by a new three phase drop from National Grid. New infrastructure will need to be installed, as there are no current poles which extend to this vicinity to support a new three phase National Grid service drop.

The preliminary locations of the booster pump stations lie within the jurisdiction of both Solvay Electric Department and National Grid. To ensure necessary connections are installed prior to the initiation of dredging activities, Honeywell has begun coordination with Solvay Electric Department and National Grid to extend the necessary electrical service to these locations.

2.7.2.2 Water

As described above, the booster pump stations will require a constant non-potable water supply to feed the pump seal. Based on the caliber of pumps that will be required for this project, this flow is estimated to be 50 gpm per pump. As most of the pipeline route and corresponding booster stations are located in close proximity to either Onondaga Lake or Ninemile Creek, surface water will be drawn from the nearest source to fulfill this demand. Surface water intakes will be designed with a screening system to prevent the intake of objects which may damage conveyance pipes and pumps (aquatic vegetation, debris, etc.). If necessary, surface water will be passed through a simple filtration system to remove suspended solids. Most of the estimated 50 gpm flow will directly enter the pipeline, and be treated at the WTP. Most pump seals are design to “drip” a small portion of the pump seal water out of the pump casing. This water will be collected and routed into the pipeline for treatment.

2.7.3 SCA

Several operations and activities will be based at the SCA, including:

- Office facilities
- Operational support facilities for work crews (break trailers, decontamination trailers, etc.)
- Equipment storage
- Debris & sand removal
- Polymer addition
- Geotextile tube dewatering
- Water treatment

Utility requirements for these activities are described below.

2.7.3.1 Electrical Service

The SCA and supporting areas will be served by a new 13,200 volt primary metered service distributed to the site by the installation of a new National Grid service drop. After the

13,200 volt has been distributed to the site, transformation to a reduced voltage will be required. A new 3-switch compartment (line, load-1, load-2) pad mounted 13.2 KV switch at the SCA/WTP area will be used to distributed an individual 13,200 volt service to both the SCA and WTP. At the SCA and WTP, new pad mounted transformers will transform the power to 480 volt 3-phase. At present, the SCA is estimated to require a service of 2,500 amps at 480 volt three phase, and the WTP is estimated to require a service of 4,000 amps at 480 volt 3-phase. After transformation to 480 volt 3-phase, a new service-entrance-rated switchboard will be used to either distribute power to single pieces of equipment or motor control centers capable of providing the required starting characteristics of the equipment. SCA area equipment lighting will be 480 volt single phase. Convenience outlets and administrative support offices will be from the SCA service at 120 volt single phase.

Electrical services lines currently extend to the perimeter of the Wastebeds 12-15 site, near the Gerelock Road entrance, but do not extend to Wastebed 13. New poles and service lines are required to extend services to the Wastebed 13 area. The location of the SCA lies within the jurisdiction of National Grid. To ensure necessary connections are installed prior to the initiation of dredging activities, Honeywell has begun coordination with National Grid to extend the necessary electrical service up to the SCA site.

2.7.3.2 Water Demands

For sanitary purposes, potable water will be provided for the Office and Support Facilities. In addition, a potable water supply will be required for potential use as polymer “make-down” water, should the treated effluent water from the WTP not be suitable for that purpose. Additionally, potable water will be needed at the WTP for the purposes of eye wash stations, emergency showers, and sanitary purposes. The total estimated potable water demand at Wastebed 13 will be evaluated as part of the final design. Potable water is not available on the Wastebeds 12-15 site. As such, a buried service line will be constructed during the construction of the SCA and support areas. Based on discussions with the Onondaga County Water Authority (OCWA) and the Camillus Water Company, the level of potable water demand will determine the source of the potable water supplied to the site, and the supplier. To ensure potable water service is installed prior to the initiation of dredging activities, Honeywell has begun coordination with OCWA and the Camillus Water Company to extend water service to the SCA.

Water needed for fire protection could be potable or non-potable. The flow rate and source of fire protection water and the location of fire hydrants, if any, will be determined during final design.

TABLE 2.1
ONONDAGA LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

			Gravel	Sand	Fines								
Remediation Area	**Parameters**	**Water Content %**	**Percent Gravel %**	**Percent Sand %**	**Percent Fines (Silt and Clay) %**	**Percent Silt %**	**Percent Clay %**	**Liquid Limit %**	**Plastic Limit %**	**Plasticity Index %**	**Solids Specific Gravity**	**Organic Content %**	**Carbonate Alkalinity %**
A (Top 1 meter)	Average	80.7	3.4	35.9	60.8	51.5	9.3	49	36	13	2.68	3.5	
	Max	122.0	51.6	62.0	97.0	87.0	21.0	53	40	18	2.78	4.1	
	Min	50.3	0.0	3.0	19.8	18.0	1.8	42	33	9	2.60	2.9	
	Standard Dev (s)	20.3	12.9	17.3	20.3	19.4	5.0	6	4	5	0.05	0.8	
	Number of Samples	15	16	16	16	16	16	3	3	3	18	2	
	Average+1.96s	120.4	28.6	69.8	100.5	89.5	19.2	60	43	22	2.78	5.2	
	Average-1.96s	40.9	-21.9	1.9	21.0	13.4	-0.6	37	29	3	2.59	1.8	
C (Top 1 meter)	Average	68.4	10.8	37.3	51.9	42.3	9.6	39	31	8	2.80		
	Max	104.5	58.2	87.0	92.0	84.0	23.1	39	31	8	3.40		
	Min	43.1	0.0	8.0	5.5	4.4	0.7	39	31	8	2.52		
	Standard Dev (s)	19.6	19.3	20.5	27.5	25.9	6.3	NA	NA	NA	0.23		
	Number of Samples	11	25	25	25	25	25	1	1	1	38		
	Average+1.96s	106.9	48.7	77.6	105.8	93.0	21.9	NA	NA	NA	3.25		
	Average-1.96s	30.0	-27.1	-2.9	-2.0	-8.4	-2.8	NA	NA	NA	2.34		
D (Top 2 meter)	Average	148.5	1.4	14.4	84.2	64.0	20.1	60	40	20	2.54	7.4	58.5
	Max	242.2	36.0	78.0	99.7	98.9	44.0	161	88	112	2.75	15.7	83.0
	Min	19.0	0.0	0.3	17.2	12.6	0.0	26	25	0	2.02	2.9	23.0
	Standard Dev (s)	47.5	5.3	16.4	18.3	16.2	10.1	32	12	23	0.10	3.9	9.7
	Number of Samples	114	126	126	126	125	125	105	105	105	96	16	83
	Average+1.96s	241.6	11.7	46.4	120.0	95.7	39.9	122	64	65	2.73	14.9	77.5
	Average-1.96s	55.4	-9.0	-17.7	48.4	32.2	0.4	-2	16	-25	2.35	-0.2	39.5
E (Top 1 meter)	Average	61.3	18.8	42.0	39.2	30.8	8.4	46	33	13	2.63	3.2	60.7
	Max	146.0	62.0	93.0	98.6	91.0	49.7	69	43	26	2.71	12.2	67.9
	Min	28.9	0.0	1.4	0.9	0.3	0.0	26	24	2	2.35	0.7	56.2
	Standard Dev (s)	24.6	24.2	31.0	29.0	22.8	9.2	13	5	9	0.08	3.7	5.5
	Number of Samples	51	67	67	67	67	67	13	13	13	48	8	7
	Average+1.96s	109.6	66.3	102.8	96.1	75.5	26.5	71	43	30	2.79	10.5	71.5
	Average-1.96s	13.1	-28.7	-18.9	-17.6	-13.9	-9.6	20	22	-5	2.46	-4.1	49.9

Notes:
1. Negative values from Average-1.96s calculations do not have practical meaning.
2. Remediation Areas B and F only have four and two sampling locations within the dredging prism, respectively; therefore, Remediation Areas B and F are not included in this summary.
3. NA indicates not applicable.

SECTION 3

SEDIMENT MANAGEMENT FINAL DESIGN

3.1 DRAFT FINAL DREDGING AND SEDIMENT MANAGEMENT DESIGN REPORT

The Draft Final Sediment Management Design will be submitted on January 24, 2011. This report will contain the final design-level details, and engineering evaluations associated with the conveyance and dewatering of sediments dredged from the lake bottom, and will include drawings and specifications adequate to define the temporary system for conveyance, processing, and dewatering the dredged sediment. These elements of the design will be finalized with significant input from the dredging contractor selected for the project. Contractor input during the final design process will allow the design to be adjusted for any specific operational practices that the dredging contractor may utilize during implementation.

Drawings that will be included in the draft final design will include the following:

- General layout plans for each of the project work areas; including pipeline alignment plans
- Civil design plans for project work areas, booster pump stations, and stormwater basins
- Design details for erosion and sedimentation controls, grading, access roads, utilities, and drainage
- Final process flow diagrams and mass balance tables
- Equipment layout drawings
- Major equipment/pumps sections and details
- P&IDs
- Electrical plans for each of the project work areas
- Lighting Plans
- Power distribution single line diagrams

Supporting calculation packages will be finalized, and will include:

- Final mass balance calculations
- Conveyance system head curves/booster pump design calculations
- Stormwater generation calculations

Dredging productivity calculations, which have been included in this design report as a basis for sizing of the dredge slurry conveyance system, will be finalized as part of the dredging and capping design.

Honeywell is working with NYSDEC and the community to develop various performance criteria and work plans specifically designed to ensure that the protection of the surrounding community and environment is maintained throughout the execution of the remedy. As described in the Operations IDS (Parsons, 2009), the performance criteria and work plans will be presented in the Final Design, and will include, but not necessarily be limited to:

- Site Security & Community Health and Safety Plan
- Air Quality Monitoring & Mitigation Plan
- Spill Contingency Plan
- Traffic Management Plan
- Noise Abatement Plan
- Navigational Protection Plan

3.2 PROJECT SCHEDULE

Critical to the success of the lake remedial action is the sequencing of events and interrelations of design and construction activities to assure the process is efficient and completed within the appropriate timeframe. A logical progression of the decisions, analysis, and planning needed to execute the work has been established during the initial design phase. This section outlines the schedule milestones established to accomplish the operational aspects of the remedial action consistent with the CD schedule requirements. The schedule is based on receipt of NYSDEC review and comments within 60 calendar days of submittal.

DESIGN & CONSTRUCTION MOBILIZATION MILESTONES

SEDIMENT MANAGEMENT	
Submit Sediment Management Draft Final Design to NYSDEC	1/24/2011
Start Construction Conveyance Pipeline & Support Facilities	5/28/2011
Conveyance Pipeline & Support Facilities Construction Complete	1/4/2012
Begin Dredging	5/31/2012
Complete Dredging	1/4/2016
WATER TREATMENT	
Submit Water Treatment Design\Build Procurement Packages to NYSDEC (Three Design Packages)	3/10/10, 5/12/10, 9/3/10
Start Construction Water Treatment System	9/14/2010
Water Treatment System Construction Complete	1/3/2012
Water Treatment System Operational	5/30/2012

DREDGING AND CAPPING	
Submit Capping, Habitat, and Dredging Intermediate Design to NYSDEC	10/27/2010
Submit Capping, Habitat, and Dredging Final Design to NYSDEC	1/4/2012
Begin Dredging	May 2012
Begin Capping	May 2013
Dredging Complete	1/4/2016
Capping Complete	1/4/2017

3.3 CONSTRUCTION QUALITY ASSURANCE PROCEDURES PLAN

A Construction Quality Assurance Procedures Plan (CQAPP) will be prepared as part of the Draft Final Sediment Management Design Submittal. This Plan will summarize the quality assurance (QA) requirements and procedures for the project, including:

- Identification of the roles and responsibilities of the project team members.
- Outline the chain of command and communication procedures for QA related issues.
- Summarize requirements for project meetings including schedule/frequency, purpose, required attendees.
- Outline QA oversight tasks, including routine inspections, QA testing, review of technical submittals, and documentation.

3.4 SEDIMENT MANAGEMENT OPERATIONS CONTINGENCY PLAN

A Sediment Management Operations Contingency Plan (SMOCP) will be prepared as part of the Draft Final Sediment Management Design Submittal. This plan will outline procedures associated with the normal operations of the integrated dredging, conveyance, and dewatering system, as well as outline procedures for management of the remedial activities and implementation of contingency measures under specific scenarios. Procedures will be developed for a variety of scenarios, including:

1. Mechanical problems
    a. Plan for dredge shutdown
    b. Plan for booster pump shutdown
    c. Plan for sediment processing shutdown
    d. Plan for geotextile tube dewatering operation shutdown
    e. Plan for WTP shutdown
2. Wet weather / Metro shutdown protocols
3. Air quality phased response actions

4. Spill control
    a. Monitoring
    b. Response
5. Noise abatement response actions
6. Seasonal Startups/Shutdowns
    a. Plan for winter shutdown
    b. Plan for spring startup

SECTION 4

REFERENCES

Honeywell. 2009. Letter Work Plan from John McAuliffe to Tim Larson. Dated September 24, 2009.

OBG. 2009. *Onondaga Lake Remedial Design SCA Water Treatment Plant Intermediate Design Submittal*. October 2009.

NYSDEC. 2009. *Citizens Participation Plan, Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site*. March 2009.

Parsons. 2004. *Onondaga Lake Feasibility Study Report*. Onondaga County, NY. Three volumes. Prepared for Honeywell. Draft Final (final version). November 2004.

Parsons. 2006. *Onondaga Lake Sediment Consolidation Area (SCA): Siting Evaluation*. Prepared for Honeywell, Syracuse, New York. September 2006.

Parsons. 2009. *Remedial Design Work Plan for the Onondaga Lake Bottom Subsite*. Prepared for Honeywell, Morristown, NJ. Draft March 2009.

Parsons. 2008. *Onondaga Lake Pre-Design Investigation Phase IV Work Plan, Phase IV Work Plan, Addendum 6.* Prepared for Honeywell, Morristown, NJ. December, 2008.

Parsons. 2009. *Onondaga Lake Sediment Consolidation Area (SCA) Dewatering Evaluation Report*. Prepared for Honeywell, Morristown, NJ. Draft January 2009.

Parsons. 2009 *Remedial Design Work Plan for the Onondaga Lake Bottom Subsite*. Prepared for Honeywell, Morristown, NJ. March 2009.

Parsons. 2009. *Draft Onondaga Lake Dredging, Sediment Management & Water Treatment Design Submittal*. Prepared for Honeywell, Morristown, New Jersey and Syracuse, New York in association with O'Brien & Gere and Anchor. February, 2009.

Parsons. 2010 *Draft Onondaga Lake Sediment Consolidation Area Civil and Geotechnical Final Design*. Prepared for Honeywell, Morristown, NJ. January 2010.

TAMS Consultants, Inc. 2002. *Onondaga Lake Remedial Investigation Report*. Prepared with YEC, Inc. for NYSDEC, Division of Environmental Remediation, Albany, New York. December 2002.

United States District Court, Northern District of New York. 2007. State of New York and Denise M. Sheehan against Honeywell International, Inc. Consent Decree Between the State of New York and Honeywell International, Inc. Senior Judge Scullin. Dated October 11, 2006. File January 4, 2007.

USEPA. 2009. *Clean and Green Policy. U*.S. Environmental Protection Agency, Region 2. http://epa.gov/region2/superfund/green_remediation/policy.html

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

APPENDIX B

DREDGE PRODUCTIVITY CALCULATIONS

APPENDIX C

WET WEATHER SHUTDOWN STATISTICAL ANALYSIS

APPENDIX D

INTERMEDIATE DESIGN DRAWINGS

APPENDIX E

SLURRY PIPELINE WETLAND DELINEATION MEMO

APPENDIX F

CONVEYANCE SYSTEM HEADLOSS CALCULATIONS

APPENDIX G

WASTESTREAM TECHNOLOGIES PHASE IV ADDENDUM 6 SUMMARY REPORT

APPENDIX H

MINERAL PROCESSING SERVICES PHASE IV ADDENDUM 6 SUMMARY REPORT

APPENDIX I

MASS BALANCE CALCULATIONS

APPENDIX I

MASS BALANCE CALCULATIONS

I.1 CALCULATION ASSUMPTIONS

The mass balance presented in this Appendix has been prepared to provide a basis for the sizing and design of the equipment, pumps, and pipelines that will be utilized in the various sediment management activities that are described in this Intermediate Design Report. Mass balance diagrams have been developed for dredging Phases 1 and 2. As presented in this Appendix, two scenarios have been evaluated for each dredging Phase, the maximum flow produced by the dredge, and the average flow. The maximum flow represents the mass balance of flows while dredging operations are ongoing. The average flow incorporates the dredging "up-time" (assumed to be 70%) to produce calculated average flows over the course of a one-day period.

As described in this design report, selection of a dredging contractor has not been finalized at the time of the preparation of this report. As such, assumptions must be made regarding the flowrate and slurry percent solids that are produced by the equipment utilized to execute the dredging portion of the remedy. As described in Section 2.1.2, a dredge flowrate of 5,000 gpm, and a 10% solids by weight slurry, are assumed to be maintained by the dredging operation. Following selection of the dredging contractor, these assumptions will be reevaluated. If necessary, the mass balance will be updated as part of the Final Design to reflect any changes in these assumptions.

Due to the nature of dredging operations, the achieved percent solids produced will vary significantly over short periods of time, which will result in significant short-term variation in the proportion of water versus solids entering the system at a given time. The impact of these changes on pre-processing equipment is expected to be minimal. Due to the time required for geotextile tube filtrate to flow through the gravel and/or drainage channels, water within the SCA will effectively have some residence time before reaching the sumps. This residence time will attenuate fluctuating solids content, limiting any potential impacts to the SCA WTP.