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Joe Martens
Commissioner

September 16, 2014

Mr. John P. McAuliffe, P.E.
Honeywell International, Inc.
301 Plainfield Road
Suite 330
Syracuse, NY 13212

Re: Wastebeds 1 through 8 Site Revised Final Feasibility Study

Dear Mr. McAuliffe:

The New York State Department of Environmental Conservation (NYSDEC) has completed its review of the "Wastebeds 1 through 8 Site Revised Final Feasibility Study" (FS) dated September 2014 and submitted with your letter dated September 15, 2014. Based on our review, we have determined that the FS is sufficiently complete to: allow us to generate a proposed plan for Operable Unit 1 of the Wastebeds 1-8 Site; and be released to the public for review and comment. If you have any questions, please contact me at 518-402-9796.

Sincerely,

Tracy A. Smith

Tracy A. Smith
Project Manager

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September 15, 2014

Mr. Tracy Smith
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D
625 Broadway 12th Floor
Albany, NY 12233-7013

Re: Wastebeds 1 – 8, Town of Geddes, Onondaga County, New York
Index # D-7-0002-02-08

Dear Mr. Smith:

Attached please find three copies of the *Revised Final Feasibility Study Report – Wastebeds 1 through 8, Operable Unit 1.* The feasibility study report was prepared by O'Brien & Gere.

Please contact Douglas Crawford of O'Brien & Gere at (315) 956-6442 or me if you have any questions.

Sincerely,

John P. McAuliffe
by CCC

John P. McAuliffe, P.E.
Program Director, Syracuse

Enc. (3 copies, 1 CD)

cc:	Robert Nunes	USEPA (1 copy, 2 CDs)
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Revised Final

Feasibility Study Report
Wastebeds 1 through 8
Operable Unit 1
Geddes, New York

Honeywell

September 2014

O'BRIEN & GERE

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Revised Final Feasibility Study Report Wastebeds 1 through 8 Operable Unit 1 Geddes, New York

Prepared for:

Honeywell

DOUGLAS M. CRAWFORD, PE, VP
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ACRONYMS

ACO	Administrative Consent Order
ARAR	Applicable or Relevant and Appropriate Requirement
BBL	Blasland, Bouck & Lee
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
C&D	Construction and Demolition
C&S	Calocerinos & Spina
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Constituent of Concern
CP	Commissioner Policy
CPOI	Chemical Parameter of Interest
Crucible	Crucible Specialty Metals
cy	cubic yards
FFS	Focused Feasibility Study
FRI	Focused Remedial Investigation
FS	Feasibility Study
Ft	feet or foot
GRA	General Response Action
GWTP	Groundwater Treatment Plant
HHRA	Human Health Risk Assessment
I-690	Interstate 690
IRM	Interim Remedial Measure
LDR	Land Disposal Restriction
MSL	Mean Sea Level
$MTCO_2e$	metric tons of carbon dioxide
NCP	National Oil and Hazardous Substances Contingency Plan
NMC	Ninemile Creek
NMCSG	Ninemile Creek Sand and Gravel
NYS	New York State
NY-695	New York State Route 695

NYSDAM	New York State Department of Agriculture and Markets
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
OU	Operable Unit
OU-1	Operable Unit 1
OU-2	Operable Unit 2
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PSA	Preliminary Site Assessment
PTI	PTI Environmental Services, Inc.
RAD	Response Action Document
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
SCA	Sediment Consolidation Area
SCO	Soil Cleanup Objective
SMU	Sediment Management Unit
SRI	Supplemental Remedial Investigation
SVOC	Semi-volatile Organic Compound
USLD	Ultra Low Sulfur Diesel
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This Feasibility Study (FS) Report presents the development, screening and evaluation of remedial alternatives to address Operable Unit (OU)-1 (soil/fill material) at the Wastebeds 1 through 8 Site (Site). Development of this OU-1 FS follows the completion of the Remedial Investigation (RI) for the Site, in which the nature and extent of the contamination at and emanating from the Site, and the potential risk that this contamination poses to public health and the environment were evaluated. The focus of the OU-1 FS is to address potential risks to human and ecological receptors associated with certain constituents in soil/fill material at the Site, and to protect nearby remedies implemented in Ninemile Creek (NMC) and Onondaga Lake. This FS was conducted pursuant to the Administrative Consent Order (ACO) (D-7-0002-02-08) between the New York State Department of Environmental Conservation (NYSDEC) and Honeywell dated January 22, 2004, as described in the Revised RI/FS Work Plan (O'Brien & Gere 2006), and in accordance with NYSDEC's Division of Environmental Remediation *Technical Guidance for Site Investigation and Remediation (DER-10)* (NYSDEC 2010a), the National Oil and Hazardous Substances Contingency Plan (NCP) (40 CFR Part 300.430), and United States Environmental Protection Agency's (USEPA's) *Guidance for Conducting Remedial Investigations and Feasibility Studies* under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (USEPA 1988).

According to the NYSDEC and USEPA in the Onondaga Lake Record of Decision (ROD), "the control of contamination migrating from…upland sub-sites to Onondaga Lake is an integral part of the overall remediation of Onondaga Lake." This statement reinforces remediation of adjacent sites as a necessary element for the lake cleanup. The ROD also acknowledges the importance of coordinating the work at these upland sites with the lake bottom activities.

Introduction

The Wastebeds 1 through 8 Site is a 404-acre property situated along the southwestern shore of Onondaga Lake (**Figure 1-1**) that is owned by New York State and Onondaga County. Environmental conditions observed at the Site are related to historical industrial activities, as well as former and current land uses, including:

- Solvay waste - The historic use of the site was primarily as a settling basin for Solvay waste, an inert material consisting largely of calcium carbonate, calcium silicate, and magnesium hydroxide. The settling basins were in active operation from approximately 1916 to 1943. In addition over the operating time frame there was periodic co-disposal of former Allied Chemical Main Plant byproducts including benzene, toluene, ethyl benzene, and xylenes (BTEX). These activities resulted in impacts to lakeshore surface soil/fill, subsurface soil/fill, groundwater, and surface water. The impacts to Onondaga Lake and Ninemile Creek are being addressed by the Integrated Interim Remedial Measure (IRM) that has been implemented at the Site.

- Crucible Landfill - The disposal of waste materials containing chromium, nickel and other metals from Crucible Specialty Metals (Crucible) in an on-site Landfill from 1973 until its regulated closure in 1988. This activity resulted in impacts to surface soil/fill, subsurface soil/fill, and groundwater.

- Municipal Sewage Sludge - The placement of municipal sewage sludge from the City of Syracuse and Onondaga County generally containing metals, PAHs, Pesticides, and polychlorinated biphenyls (PCBs) in the Biosolids Area from 1925 to 1978. This activity resulted in impacts to surface soil/fill, subsurface soil/fill, and groundwater.

- Other - Portions of the Site are used as parking lots for the New York State (NYS) Fairgrounds and the Site is transected by Interstate 690 (I-690) and New York State Route 695 (NY-695) interchange. Storm water run-off from the parking areas, I-690 and NY-695, and upstream areas (*i.e.*, Bridge Street and Crucible Parking lots) have resulted in impacts to site surface water and sediment in Ditch A. These impacts include constituents ubiquitous to the environment and general urban run-off such as BTEX, PAHs, pesticides, and metals, which are also constituents of concern at the Site.

As part of this FS, an assessment of reasonably anticipated future land use was completed. Notable land uses include:

- Parking lots that support the nearby NYS Fairgrounds are present over approximately 77 acres of the property.
- The Onondaga County West Shore Trail Extension, an approximately 9-acre public recreation trail, has been constructed at the Site by Onondaga County.
- Onondaga County plans to construct an amphitheater complex at the Site in 2015.

This assessment concluded that the reasonably anticipated future land uses for the Site are commercial, recreational, and ecological. The alternatives considered in this FS will be protective for these Site uses. Further, the implementation of the components of the OU-1 remedy will be performed using a phased approach to adapt the remedy to varying Site uses as they are identified.

Interim Remedial Measure

Remediation at the Site began in 2011, in accordance with a 2011 Response Action Document (RAD) (NYSDEC and USEPA 2011) that called for an IRM to address shallow and intermediate groundwater and seeps, removal of sediments in a portion of a ditch, and shoreline stabilization that were evaluated in a Focused Feasibility Study (FFS) (O'Brien & Gere 2010a). Also relevant to remediation at the Site is the establishment and construction of mitigation wetlands along the eastern shore of the Site. The mitigation wetlands will consist of an integrated diverse wetland complex on 9.5 acres of the Site's eastern shore, which is part of a larger 30-acre integrated habitat restoration component of the Integrated IRM that includes both the wetlands and the associated terrestrial habitat. The IRM, hydraulic containment of groundwater along the Site's northern shoreline, and wetlands (collectively referred to as the Integrated IRM) have been under construction since 2011, and will be substantially completed in 2014. The benefits of the IRM have been incorporated in the development of this FS. Specifically, the cover system, consisting of vegetated cover and wetlands, addresses potential exposures to and migration of soil/fill material along the shoreline of Onondaga Lake.

Feasibility Study Remedial Action Objectives

As part of the FS process, Remedial Action Objectives (RAOs) for soil/fill material at the Site were developed to be protective of human health and the environment, while providing for continued effectiveness of the Onondaga Lake Sediment Management Unit (SMU)-3 and SMU-4, and NMC Operable Unit 2 (OU-2) remedies. The RAOs for the FS are the following:

RAOs for Public Health Protection

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated soil/fill material.
- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated soil/fill material. In the event that buildings are constructed at the Site, mitigate impacts to public health resulting from existing, or potential for, soil vapor intrusion into buildings at the Site.

RAOs for Environmental Protection

- Prevent, or reduce to the extent practicable, adverse ecological impacts to biota from ingestion/direct contact with contaminated soil/fill material causing toxicity or impacts from bioaccumulation through the terrestrial food chain.
- Prevent, or reduce to the extent practicable, the migration of contaminants to surface water that would result in groundwater, sediment or surface water contamination.

Consistent with 6 NYCRR Part 375, promulgated soil cleanup objectives (SCOs) for the protection of human health and ecological resources were used to ascertain acceptable soil/fill material concentrations for a given anticipated site use. Attainment of these SCOs constitutes acceptable protectiveness and, therefore, was used as a measure for achievement of the corresponding RAOs.

Development of Remedial Alternatives

As part of the development of remedial alternatives, the following steps were followed:

- Development of general response actions (GRAs), which are media-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs and SCOs
- Identification of areas and volumes of media, which define the material(s) to be addressed
- Identification and screening of remedial technologies and process options, which result in a series of potential remediation technologies for addressing Site media of concern.
- Evaluation of technologies and process options for effectiveness, implementability, and cost

During the screening and evaluation of technologies containment, *in situ* treatments, removal, *ex situ* treatments, disposal and reuse technologies and process options to address soil/fill material were screened and evaluated. Once these steps were completed, remediation alternatives were assembled based on the findings of the screening processes. Assembled alternatives included a no action alternative, as required by the NCP, and a complete removal alternative, as required by DER-10. The alternatives evaluated in the FS were:

- Alternative 1 - No Action
- Alternative 2 – Vegetated Cover System
- Alternative 3 – Enhanced Vegetated Cover System
- Alternatives 4A and 4B – Excavation (Full and Partial) and Off-Site Disposal/Treatment/Reuse.

Detailed Analysis of Remedial Alternatives

Following the development of remedial alternatives, Alternatives 1, 2, 3, 4A, and 4B were analyzed in detail using the evaluation criteria as required by state and federal regulations and guidance. The detailed analysis of alternatives shows the following:

- Alternative 1 does not fully comply with applicable regulatory requirements.
- Alternative 2 is a containment alternative that includes implementation of a vegetated cover system that would meet regulatory requirements as it would be protective of human health and the environment, comply with applicable or relevant and appropriate requirements (ARARs), be effective in both the short- and long-term, reduce the mobility of constituents, and would be implementable.
- Alternative 3 is an enhanced containment alternative and, similar to Alternative 2, would meet the regulatory requirements. The difference between Alternatives 2 and 3 is that Alternative 3 would provide more robust covers in areas of anticipated future active and passive recreational use than those included in Alternative 2. The additional cover thickness provided in Alternative 3 would provide added protectiveness over covers proposed in Alternative 2.
- Alternatives 4A and 4B, the removal alternatives, attain the RAOs; however, they are likely not implementable given these alternatives would be extremely difficult to construct, there would likely be no viable disposal/management options, and there would be significant impacts to the surrounding community. Specifically, Alternatives 4A and 4B would require excavation of approximately 23 to 26 million cy of soil/fill

material over approximately 27 to 30 years. These volumes would require 50,000 truck loads per year (180 truck loads per day during the construction season) resulting in significant negative impacts to the surrounding community (*e.g.*, heavy truck traffic, potential accidents, rerouting of traffic, noise and odors) and substantial greenhouse gas emissions from fuel consumption. Further, there is a lack of current landfill capacity, new landfills are difficult to site, and viable reuse options for the material may not exist.

In addition, Alternatives 4A and 4B would not support current, intended, or anticipated land use. These currently include NYS Fairgrounds overflow parking, the existing Onondaga County West Shore Trail Extension, and the proposed Onondaga County amphitheater. Alternative 4A would also involve significant construction on Interstate 690 and interchanges to NYS Route 695 for a significant period of time.

Together with the vegetated covers and wetlands included in the Integrated IRM, the vegetated cover systems and institutional controls in both Alternative 2 and Alternative 3 would protect human health and the environment. While Alternative 2 has the lower cost of the two alternatives, Alternative 3 would provide added protectiveness as compared to Alternative 2 through added thickness of vegetated covers for areas of the Site reasonably anticipated to be used for active and passive use.

Following review of the evaluations documented in this FS Report, NYSDEC and USEPA will document the preferred remedial action in a Proposed Plan. Following receipt of public comments on the Proposed Plan, the selected remedial alternative will be documented in a ROD. Groundwater at the Site will be addressed in a separate FS Report as OU-2. The groundwater medium was separated from site-wide soil/fill material to allow for an accelerated schedule for the soil/fill material remedy selection in advance of planned site redevelopment.

1. INTRODUCTION

As part of the continuing progress toward achieving the goals of the Wastebeds 1 through 8 Administrative Consent Order (ACO) and the community's vision for a restored Onondaga Lake, this report documents the Operable Unit 1 (OU-1) Feasibility Study (FS) that was conducted to develop and evaluate remedial alternatives to address soil/fill material[1] at the Site. The Wastebeds 1 through 8 Site (Site) is located in Geddes, New York; a Site location plan is included as **Figure 1-1**. This FS was conducted pursuant to the ACO (D-7-0002-02-08) between the New York State Department of Environmental Conservation (NYSDEC) and Honeywell International, Inc. (Honeywell) dated January 22, 2004 and as described in the *Revised RI/FS Work Plan* (O'Brien & Gere 2006). This FS was performed on behalf of Honeywell, by a project team consisting of local and nationally recognized experts from various universities, research institutions, and specialty engineering firms to meet Honeywell's overall goal to provide long-lasting protection to the local community and environment, and restore the Onondaga Lake shoreline.

This report documents the development and evaluation of remedial alternatives to address Wastebeds 1 through 8 OU-1 (soil/fill material at the Site). Portions of Site groundwater are being addressed by elements of an ongoing Interim Remedial Measure (IRM); the long-term remedy for Site groundwater and Ditch A will be addressed in a separate FS as Wastebeds 1 through 8 Operable Unit 2 (OU-2). The OU-2 FS is anticipated to include discussion of a site water balance which would consider factors such as the permeability of surface materials, evapotranspiration rates associated with vegetated cover systems, and the collection rates of groundwater and seep collection systems included in the IRM.

This FS Report contains five sections. The remainder of this section presents a brief description of the Site and its history. In addition, background information relevant to this FS as it relates to the Onondaga Lake Site, Ninemile Creek (NMC) Site remedies, IRMs, and pilot studies completed at the Site is also provided in this section. **Section 2** presents a summary of previous environmental investigations and studies, including a summary of the Remedial Investigation (RI), human health and ecological risk evaluations, Focused Feasibility Study (FFS) and resulting IRM. The development and screening of remedial alternatives and the detailed analysis of alternatives are documented in **Sections 3** and **4**, respectively. The alternative that represents the best balance with respect to the evaluation criteria is presented in **Section 5**.

1.1 SITE DESCRIPTION

The Site is located on the southwestern shore of Onondaga Lake in Geddes, New York. A Site Plan is included as **Figure 1-2**. The Wastebeds consist primarily of inorganic materials resultant from the production of soda ash using the Solvay process. The irregularly shaped beds include eight delineated cells that are approximately 315 acres in size, and extend roughly 1.5 miles along the shore, with a maximum width of 0.5 miles. The Site, in its entirety, and inclusive of the Solvay wastebeds, covers approximately 404 acres.

The Site is situated between the New York State (NYS) Fairgrounds and the shoreline of Onondaga Lake. The outlet of NMC defines the westernmost boundary of the Site, while the eastern end of the Site is generally bounded by roadways. A surface water drainage feature, Ditch A, runs along the southern and eastern Site boundaries and discharges stormwater from roads, parking areas and overland surface flow from the Site to NMC and Onondaga Lake.

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[1] The Site was used historically as a settling basin for Solvay waste, an inert material consisting largely of calcium carbonate, calcium silicate, and magnesium hydroxide. Additional wastes that were periodically co-disposed (from approximately 1916 to 1943) during settling basin operations include former Allied Chemical Main Plant byproducts including benzene, toluene, ethyl benzene, and xylenes (BTEX); naphthalene and other polycyclic aromatic hydrocarbons (PAHs); and phenol. The term "soil/fill material" throughout this document refers to Solvay waste, other Allied wastes as described above, fill materials (*e.g.*, gravel) that have been placed at the Site, and soil that has formed above the Solvay waste.

Transportation features bisect the Site and include Interstate 690 (I-690) (which is situated between the lakeshore and State Fair Boulevard) and interchanges associated with New York State Route 695 (NY-695), NYS Fairgrounds parking lots, access roads for the parking lots, and foot bridges. The existing NYS Fairgrounds parking lots (approximately 77 acres) consist of over two feet of gravel and fill material over Site soil/fill material. Other infrastructure and development present at the Site include the approximately 9-acre Onondaga County West Shore Trail Extension (public recreation trail) and a 20-acre closed, permitted landfill operated by Crucible Specialty Metals (Crucible). An approximately 17-acre area that was a formal disposal site for County biosolids material (Biosolids Area) is located near the southeastern end of the Site over portions of Wastebeds 1 and 2. Lakeview Point, which generally comprises Wastebed 6, forms one of the Site's more prominent features - a peninsula that extends into Onondaga Lake near the northern end of the Site. Adjacent to the northwest of Lakeview Point is a region of the Site that contains historic NMC channel deposits that are referred to in Site documentation as the NMC Deltaic Deposits.

The portion of the property that is developed as parking lots and roadways is, in general, owned by the People of the State of New York. The remaining portion of the Site is currently owned by Onondaga County. The County-owned portion of the Site is largely undeveloped, characterized by varying degrees of vegetation ranging from sparsely vegetated areas to stands of mature trees. Both property deeds restrict property use to park purposes. **Figure 1-2** depicts the approximate property boundaries.

In general, the Site consists of variable terrain with numerous topographic highs and lows that range from approximately 362.9 feet (ft) above mean sea level (MSL) at the shore of Onondaga Lake, to 430 ft above MSL, at the highest point. Steeply-sloped berms define the outer-most boundaries of the delineated Wastebed cells, as well as interior boundaries (*e.g.*, between Wastebeds 5 and 6). As presented on **Figure 1-2**, two wetland areas have been identified and delineated along the eastern shore. These wetlands encompass a total of approximately 0.7 acres and are further described in the *Wetland Delineation and Floodplain Assessment for Wastebeds 1-8* (O'Brien & Gere 2009a).

1.2 SITE HISTORY

The wastebeds were constructed by predecessor companies of Honeywell over the Geddes Marsh, which resulted from the lowering of the lake level in 1822 to the same level as the Seneca River (Blasland, Bouck & Lee [BBL] 1989). The wastebeds are composed primarily of Solvay waste consisting of particles of insoluble residues, hydroxides, calcium carbonate, sodium chloride (salt), and calcium chloride. These wastes were generated at the former Solvay Process Main Plant as part of soda ash production using the Solvay process. Soda ash production began in 1884 and continued until 1986. The Solvay waste was hydraulically placed in the wastebeds in slurry form (90 to 95% water and 5 to 10% solid material) (BBL 1989).

The nature of the material used to construct the perimeter berms is expected to be variable depending on location. Containment of the wastebeds consisted of perimeter berms constructed of wooden piles, sheeting, and/or earth. Earthen berms likely consisted of a mixture of urban fill including slag, bricks, gravel, sand, and silt. Remnants of bulkheads that were installed prior to filling the wastebeds are evident along the lakeshore. Wooden weir box structures were constructed to allow water to decant into the structures and be conveyed using metal pipes through the perimeter berms. Remnants of collapsed weir boxes and associated pipes have been encountered at various locations at the Site.

Chlorinated benzene production at the Willis Avenue plant occurred between 1918 and 1977. Additional operations reportedly took place at the Willis Avenue plant from 1918 to 1977 including production of hydrochloric acid, caustic soda, caustic potash, and chlorine gas (O'Brien & Gere 1990). The Benzol plant operated from 1915 to 1970. This plant produced benzene, toluene, xylenes, and naphthalene by the fractional distillation of coke "light oil". The Solvay Process Company operated a coke plant from 1892 through 1923. A phenol production plant operated from 1942 to 1946 [PTI Environmental Services, Inc. (PTI) 1992]. Materials associated with these operations may have been disposed of in Wastebeds 1 through 8 with the Solvay waste slurry or by alternative means, although there are no records or reports to indicate this occurred.

Wastebeds 1 through 6 were in use before 1926 and may have become operational as early as 1916, although no definitive construction date is available. NMC was rerouted to the north to permit the construction of Wastebeds

5 and 6. Wastebeds 7 and 8 were not utilized until after 1939 and remained in use with Wastebeds 1 through 6 until 1943 (BBL 1989).

A dike along Wastebed 7 failed, and an area along State Fair Boulevard was flooded with Solvay waste on November 25, 1943. This led to the cessation of operations of Wastebeds 1 through 8. The location of each wastebed is presented on **Figure 1-2**.

Subsequent uses of the Site included construction of I-690 prior to 1958, construction of the I-690 and NY-695 interchange between 1973 and 1978, and the operation of a landfill on a portion of Wastebed 5 by Crucible from 1973 to 1988 [Calcerinos & Spina (C&S) 1986]. The Crucible Landfill covers an area of approximately 20 acres and contains an estimated volume of 225,100 cubic yards (cy) of non-hazardous and hazardous wastes (C&S 1986). The NYSDEC approved the revised Crucible Landfill closure plan in 1986, and the landfill was closed with a cap in 1988. Long-term monitoring of the Crucible Landfill is performed annually consistent with the landfill closure requirements. The City of Syracuse and Onondaga County utilized a portion of the wastebeds (Biosolids Area) from 1925 to 1978 for sewage sludge disposal. The approximate boundary of the Biosolids Area, as depicted on **Figure 1-2**, is based on soil borings and test pits completed to date.

The New York State Fair uses a portion of the Site for parking. While (except for access roads and lanes) the parking lots are not paved, they have received gravel and fill over the years, and currently over 2 ft of gravel and fill overlay the Site soil/fill material in these areas. The remainder of the Site is currently vegetated, except for the wastebed slopes along the shore of Onondaga Lake and east of the mouth of NMC where soil/fill material is exposed due to wind/wave erosion. These areas are being vegetated as part of the Integrated IRM.

1.3 FS BACKGROUND

The FS activities have been conducted in alignment with the schedules for remediation of Onondaga Lake and a portion of NMC, and future redevelopment plans for the Site. As a result, portions of the Site were addressed in an FFS and subsequent Integrated IRM. In addition, further investigations and pilot studies have been conducted since the RI. It is necessary to consider these various activities during identification of media to be considered in the FS and during the technology evaluation phase of the FS. Relevant background information regarding these efforts is provided below.

Remedial Actions Adjacent to the Site

Components of the Onondaga Lake remedy that are adjacent to the Site are those in-lake remedial elements to be completed in Onondaga Lake Site sediment management unit (SMU)-3 and SMU-4. Figures showing the locations of SMU-3 and SMU-4 are presented in **Exhibit A**. As described in the July 2005 Record of Decision (ROD) [NYSDEC and United States Environmental Protection Agency (USEPA) 2005], these consist of:

- Targeted dredging and capping in SMU-3 and SMU-4
- Shoreline stabilization along SMU-3 and portions of SMU-4

Also of interest are Onondaga Lake Remediation Areas A, B and C located within SMU-3 and SMU-4. An illustrative summary of the proposed remedial approach for SMU-3 and SMU-4 is provided as **Exhibit A** to this report (NYSDEC and USEPA 2005).

Components of the NMC OU-2 remedy that are adjacent to the Site are those in-creek remedial elements to be completed in the lower reach of NMC (reach AB) and in the floodplain along NMC reach AB. The location of NMC reach AB is presented in **Exhibit B**. The remedy for the NMC reach AB as described in the ROD for OU-2 of the Geddes Brook/NMC Site (NYSDEC 2009a) consists of:

- Sediment removal within the NMC AB Channel
- Restoration of NMC AB Channel by installation of a sand base layer and habitat layer
- Removal of floodplain soil/sediment between the NMC waterline and the 370 ft contour on the shore of the Wastebed 1 through 8 Site
- Restoration of floodplain between the NMC waterline and the 370 ft contour on the shore of the Wastebed 1 through 8 Site by placement of a vegetated habitat layer
- Removal of soil/sediment within Wetland SYW-10 at the eastern spit of NMC
- Restoration of excavated area within Wetland SYW-10.

An illustrative summary of the remedial approach for OU-2 is provided as **Exhibit B** to this report (NYSDEC 2009a).

Focused Feasibility Study

A FFS was conducted to develop and evaluate IRM alternatives to mitigate groundwater flow, seep discharge, and shoreline soil/fill material erosion from the Site to Onondaga Lake, and groundwater and seep discharge from the Site to NMC. The FFS was conducted pursuant to the ACO (D-7-0002-02-08) between the NYSDEC and Honeywell dated January 22, 2004 and as described in the *Shallow and Intermediate Groundwater FFS Work Plan* (O'Brien & Gere 2008a). It was conducted to accelerate the development and evaluation of IRM alternatives so that implementation of the preferred IRM could be conducted in alignment with the schedules for remediation of NMC OU-2 and Onondaga Lake, and thus provide for continued effectiveness of the NMC OU-2 and Onondaga Lake remedies.

The FFS generally focused on the portions of the shallow and intermediate groundwater discharging to Onondaga Lake and NMC. In addition, erosion of soil/fill material at the eastern shore to Onondaga Lake, wind and wave erosion of soil/fill material along the surf zone of Onondaga Lake, erosion of soil/fill material substrate and sediment in the lower reaches of Ditch A, and seep discharges from the upper reach of Ditch A to NMC were also addressed in the FFS.

Remedial action objectives (RAOs) were developed in the FFS for the protection of human and environmental health and in consideration of the final Site-wide and nearby Site remedies. Based on these considerations, FFS RAOs were to mitigate, to the extent necessary and practicable, and within the context of the IRM, the following:

- Direct contact with and ingestion of exposed Solvay waste along the eastern shore and other contaminated soil along the eastern shore
- Discharge of NMC Sand and Gravel (NMCSG)(Deltaic Deposits) unit and eastern shore groundwater to Onondaga Lake and NMC
- Discharge of shallow and intermediate groundwater to Ditch A
- Direct contact with and discharge of NMC bank seep water, and eastern and northern shore seep water to Onondaga Lake and NMC
- Erosion of Solvay waste from the eastern shore to Onondaga Lake
- Erosion of Solvay waste along the surf zone of Onondaga Lake SMU-4 and portions of SMU-3 due to wind and wave action
- Erosion of Solvay waste substrate and sediment from the lower reach of Ditch A to Onondaga Lake
- Discharge of seep water from the upper reach of Ditch A to NMC.

Technologies and process options to address the FFS RAOs were identified and evaluated. Four IRM alternatives were developed and evaluated in detail. These evaluations were documented in the *FFS Report* (O'Brien & Gere 2010a). Following completion of the FFS, NYSDEC issued a Proposed Response Action Document in 2010. Following public comment, NYSDEC issued the Response Action Document (RAD) in 2011, which presented the selected IRM alternative, Vegetative Cover with Lakeshore Groundwater Collection.

Integrated Interim Remedial Measures

Following the FFS, the selected IRM alternative was documented in the NYSDEC's RAD (NYSDEC and USEPA 2011). In addition to groundwater, the Integrated IRM addressed soil/fill material in the following areas:

- Surface water erosion of soil/fill material at the Site's eastern shore to Onondaga Lake
- Wind and wave erosion of soil/fill material along the surf zone of Onondaga Lake
- Soil/fill material substrate and sediment in the lower reaches of Ditch A

Site soil/fill material addressed by the Integrated IRM and FS are summarized and depicted on **Table 1-1** and **Figure 1-3**, respectively. As described in the August 2011 RAD, Integrated IRM remedy components addressing soil/fill material include:

- Vegetative cover on eastern shore to Onondaga Lake
- Shoreline stabilization of soil/fill material along the surf zone
- Ditch A sediment removal

As part of construction activities, soil/fill material has been staged on-site in three staging areas, Staging Areas A, B and C. Shoreline stabilization elements of the Integrated IRM are under construction. The Integrated IRM cover systems and Ditch A sediment removal and associated restoration will be constructed in 2014. Integrated IRM remedial components, design and implementation are further described below in **Section 1.4**.

Existing Infrastructure

Approximately 77 acres of existing parking lots currently used for NYS Fairground parking are located over portions of Wastebeds 1, 2, 3, 4, 7 and 8. In addition, approximately 55 acres associated with I-690 and interchanges to NY-695 are located over portions of these Wastebeds as depicted on **Figure 1-2**. Together, these transportation-related facilities make up approximately 28% of the Site. Gravel and fill have been placed in the parking areas over Wastebed materials. Based on boring logs, the thickness of this layer is approximately 2 to 7 ft thick. Similarly, areas adjacent to I-690 and NY-695 have well-established vegetation.

Pilot Studies

To aid in remedial technology evaluation for the soil/fill material at the Site, a series of cover system pilot studies has been conducted. A brief summary of preliminary findings is provided below. Reporting on the pilot studies will be provided in a separate report following completion of the studies.

As described above, much of the surface of the Site is composed of soil/fill material. Cover system pilot studies were initiated in 2011, as part of the FS process to aid in the evaluation of OU-1 cover system remedial technologies.

Pilot study activities have focused on evaluating vegetation management strategies (*i.e.,* fertilizer addition and species introduction) for undeveloped and NYS Fairground parking areas on the Site in accordance with the *Cover System Pilot Study Work Plan* (O'Brien & Gere 2011a) and *Cover System Pilot Study Work Plan Addendum* (O'Brien & Gere 2013a). These were approved by NYSDEC in its letters dated August 30, 2011 and March 7, 2013 (NYSDEC 2011 and 2013) The objective of these pilot studies was to develop information on cover systems, based on vegetation enhancement of substrate cover and stabilization. This information was used to evaluate the efficacy of nutrient addition and re-vegetation to establish a suitable and sustainable vegetative treatment/cover system for evaluation in the OU-1 FS.

Pilot testing conducted to date in the undeveloped areas has identified materials and seed mixes that provide successful vegetation enhancement and erosion control for the various terrains at the Site. Pilot testing also showed positive evapotranspiration results for this technology. Specifically, preliminary results show that use of an organic matter treatment was superior to hydromulch in enhancing substrate stabilization and ET. While the organic matter had a longer structural lifespan (0% exposed soil/fill material after three winters and two growing seasons), organic matter also appeared to facilitate greater vegetation productivity in terms of cover and ET. In general, this study demonstrates that simple vegetation management measures, such as the addition

of nutrients and seed, can be implemented to increase Site cover and ecological services such as soil stabilization and ET.

In addition to the pilot testing described above for undeveloped areas, a series of vegetated structural fill plots (for parking areas) were constructed in the fall of 2013. Results of these studies will be utilized for the remedial design where vegetated structural fill covers are proposed as part of a remedial alternative for the Site.

1.4 INTERIM REMEDIAL MEASURES

As described in **Section 1.3**, following completion of the FFS, NYSDEC issued a RAD that identified a selected IRM. The IRM was implemented together with hydraulic containment of Site groundwater discharging to Onondaga Lake Remediation Area A, and construction of mitigation wetlands. These actions were collectively referred to as the Integrated IRM. The design for the Integrated IRM for the Wastebeds 1 through 8 Site was performed pursuant to the Order on Consent (Index # D7-0002-02-08) between Honeywell and the NYSDEC. The Integrated IRM was developed to mitigate groundwater and seep discharges from the Site that had the potential to adversely affect the NMC and Onondaga Lake remedies, mitigate erosion of soil/fill material along the Onondaga Lake Shoreline, and also reduce groundwater upwelling velocities for cap effectiveness in adjacent Onondaga Lake Remediation Area B and a portion of Onondaga Lake Remediation Areas A and C. The Integrated IRM is documented in the NYSDEC's RAD (NYSDEC and USEPA 2011). The Integrated IRM design is presented in detail within the *Integrated IRM, Mitigation Wetlands, and Remediation Area A Hydraulic Control System 100% Design Report* submitted to the NYSDEC in January 2013 (O'Brien & Gere 2013b).

The Integrated IRM included the following elements, as depicted on **Figure 1-4**:

- Shoreline stabilization
- Vegetative cover
- Groundwater and seep collection systems
- Lower Ditch A restoration
- Upper, Middle, and Lower Ditch A sediment removal and maintenance
- Mitigation wetlands along the Wastebeds 1 through 8 shoreline

During the selection and design of these remedial elements, careful consideration was given to potential Site-wide remedies in areas addressed by the Integrated IRM. Specifically, surface restoration features over soil/fill material were selected to enhance habitat features at the site and address potential risks associated with exposures and erosion of this material.

Elements of the Integrated IRM that address soil/fill material include the shoreline stabilization, vegetated cover, mitigation wetlands, Lower Ditch A restoration, Upper Ditch A remediation, and Ditch A sediment removal and maintenance. These elements are described below:

Shoreline Stabilization

Two areas of the site required stabilization to mitigate erosion: a steep embankment area and a shallow sloped shoreline area located along the northern and eastern shorelines of the Site as depicted on **Figure 1-4**. A vegetated on-shore revetment was used to stabilize approximately 1,700 ft of steep embankment area adjacent to Onondaga Lake SMUs 3 and 4.

A portion of the on-shore revetment consists of 2 ft of stone (*i.e.*, approximately 18 inch rip rap) to provide protection from erosion caused by wind-wave action. A 1 ft layer of filter soil underlies the stone and provides a rooting zone for revetment vegetation. Between the elevation of 365 ft and the upper limit of slope disturbance, site materials are covered with 4 inches of topsoil and seeded with the Successional Old Field seed mix.

Vegetated Cover

The vegetative cover system was selected for areas of the eastern shoreline not occupied by other elements of the Integrated IRM (*i.e.*, inland wetlands, the connected wetland, stormwater features, berms, and access

pathways). The vegetative cover system is being installed to minimize direct contact with, and ingestion and erosion of exposed soil/fill material along the eastern shoreline of the Site. The vegetative cover system also provides ecological value to the Site by providing habitat diversity complementary to the mitigation wetlands and by introducing locally native species. The Integrated IRM vegetated cover system areas are depicted on **Figure 1-4**.

The vegetated cover system comprises the following, from the bottom up: geotextile placed on existing materials, 12 inches of silty bank run, and 12 inches of topsoil. Typically, the vegetative cover is vegetated with the Successional Forest treatment (O'Brien & Gere, 2013b). On the lake-side of the Eastern Shoreline Access Pathway, the vegetative cover, which is typically 24 inches thick, transitions to the Onondaga Lake shoreline stabilization treatment, which is 18 inches thick. This shoreline area is vegetated with a Shoreline Meadow plant community.

Mitigation Wetlands

The Mitigation Wetlands consist of the construction of 9.5 acres of wetlands, of which 2.3 acres are connected wetlands and 7.2 acres are inland wetlands. The inland wetland substrate consists of 12 inches of topsoil, and 12 inches of habitat subgrade (*i.e.*, a silty bank run), and a geomembrane liner system. The topsoil and habitat subgrade will provide sufficient rooting area for wetland plants as well as soil habitat for wetland animals. Below the geomembrane, a liner pad/gas venting layer was placed, consisting of 6 inches of sand and a layer of geotextile placed on site material.

Integrated IRM Staging Areas

Soils that were excavated during the construction of the Integrated IRM were consolidated and staged in one of three staging areas on the Site (Staging Areas A, B, and C). Analytical results for staged material are summarized in **Appendix A**. In accordance with the IRM design, restoration for each of the staging areas consists of placement of 6 inches of vegetated, clean fill placed over staged materials. These covers are further evaluated in this FS.

In addition to Staging Areas A, B, and C, a clean fill staging area was constructed using 6 inches of crushed stone. In accordance with the IRM design, restoration for this clean fill staging area will consist of placement of 6 inches of vegetated, clean fill. Final thickness of material over soil/fill material will be evaluated during design. Similarly, an additional clean fill staging area associated with NMC and Onondaga Lake remedies is situated on the western portion of Wastebed 5. Restoration for this clean fill staging area is anticipated to consist of 6 inches of vegetated, clean fill. Final thickness of material over soil/fill material will be evaluated during design.

Lower Ditch A

The existing soil/fill material substrate of the lower reach of Ditch A, approximately 380 ft spanning from the I-690 culvert to the confluence with Onondaga Lake, was addressed by removal of the existing substrate and subsequent placement of a low permeability habitat cover. The lower Ditch A cover consists of a geomembrane liner system installed beneath a 24 inch layer of erosion protection and habitat restoration stone. The most downstream portion of Ditch A (approximately 100 ft) is vegetated with a successional shrubland comprising live stakes, potted shrubs and seed mix.

In addition to the elements that address soil/fill material, the following elements were constructed as part of the Integrated IRM:

Groundwater and Surface Water Collection Systems

The hydraulic control systems designed to control the movement of shallow and intermediate groundwater were installed as part of the Integrated IRM. Specifically, four collection systems were constructed. These include the eastern shoreline seep collection system, eastern shoreline shallow and intermediate groundwater collection system, Onondaga Lake Remediation Area A (located within Onondaga Lake SMU-4, see **Exhibit A**) hydraulic control system, and the NMC collection system. The groundwater collection systems consist of a combination of collection trenches and passive wells. Collected groundwater is conveyed to pump stations that

direct collected groundwater to the Willis Ave Groundwater Treatment Plant (GWTP). Groundwater elevations will be monitored to assess the effectiveness of the collection systems.

Seep aprons were constructed at the toe of the eastern shoreline Site slope to divert groundwater discharge to a collection trench. These seep aprons consist of the following, starting at existing materials: a geogrid, six inches of rounded river rock, geotextile, a geomembrane, a geotextile, and 12 inches of silty bank run. Where the apron is installed on steeper slopes, an additional geogrid is installed with the seep apron system. The seep aprons were seeded with the Successional Old Field seed mix. Collected seep water is conveyed to pump stations that direct collected water to the Willis Ave GWTP.

NMC seep aprons comprise a 6 inch geocell filled with topsoil and 8 inches of silty bank run above a geotextile. Where the seep apron is to be installed on steep slopes an additional geogrid is installed with the seep apron system. Below the geotextile, a 6 inch deep Gabion or Reno mattress is placed; these structures are filled with rounded river rock, typically 4 inches in size. The seep apron is seeded with the Successional Old Field Mix. Collected seep water is conveyed to pump stations that direct collected water to the Willis Ave GWTP.

Upper and Middle Ditch A

Approximately 320 linear ft of the culvert, originating in the upper portion of Ditch A and terminating at NMC (referred to as the Upper Reach of Ditch A), was rehabilitated as part of the Integrated IRM. This culvert was lined with cured-in-place pipe (CIPP) and the existing manhole associated with this system was rehabilitated with Epoxytech liner.

Sediment removal and maintenance of the Middle Reach of Ditch A to mitigate transport of soil/fill material substrate and sediment to Onondaga Lake and to NMC was included as part of the Integrated IRM. This was accomplished by promoting the controlled settlement of sediment and calcium carbonate precipitate, accompanied by on-going maintenance activities, as necessary, to remove accumulated sediment from the Middle Reach of Ditch A.

1.5 ASSESSMENT OF LAND USE

The reasonably anticipated future land use for the Site was evaluated consistent with the USEPA's Office of Solid Waste and Emergency Response Directives 9355.7-06 and 9355.7-04 (USEPA 1995). Consistent with these directives, a "reuse assessment assists in developing assumptions regarding the *types* or *broad categories* of reuse that might reasonably occur at a Superfund site. Examples of land use assumptions that appear likely based on the conclusions of a reuse assessment include, but are not limited to, residential, commercial/industrial, recreational and ecological." Based on the assessment, the reasonably anticipated future land uses for the Site are commercial, ecological and recreational. The implementation of the components of the OU-1 remedy will be performed using a phased approach that will provide the flexibility to adapt the remedy to varying Site uses as they are identified.

The property consists of a total of 404 acres, and contains gravel-covered overflow parking lots for the NYS Fairgrounds, the recently constructed public recreation trail, and vegetated/wooded areas. The public recreation trail serves as an extension to the progressing Onondaga County Loop the Lake Trail as well as the Erie Canalway Trail. The Site is located in an area zoned for industrial use in the Town of Geddes and is immediately bounded by commercial and industrial properties to the south and west, that include the NYS Fairgrounds, Crucible, and State Fair Boulevard.

A portion of the property is owned by Onondaga County, and was deeded to Onondaga County for use as parkland. The remainder of the property is owned by the People of the State of New York. The deed includes property easements for highway and stormwater drainage features.

Intended future use for the portion of the Site owned by Onondaga County will include the existing public recreation trail. In addition to the trail, in early 2014, Onondaga County announced plans to construct an amphitheater on the northwestern portion of the Site, near Lakeview Point, as part of a community revitalization effort that is supported by New York State. The proposed construction for the Onondaga County Lakeview Amphitheater and Community Revitalization Project is estimated to start in late 2014, with a

proposed completion date of the Fall of 2015. The remainder of the property currently owned by Onondaga County may be subject to potential future development as opportunities become available; in the meantime this portion of the land will remain undeveloped, wooded/vegetated land. Intended future use of the portion of the property currently owned by the State of New York will include continued use as overflow parking for the NYS Fairgrounds, as well as a venue for outdoor events such as recreational vehicle vendor shows.

2. SITE CHARACTERIZATION

This section presents the Site conditions as they relate to this FS. As described in **Section 1**, this FS addresses OU-1 soil/fill material.

As summarized below, Site conditions have been evaluated during a series of investigations that are described in detail in the *Revised RI Report* (O'Brien & Gere 2014).

2.1 PREVIOUS INVESTIGATIONS

Several investigations have been previously undertaken at or adjacent to the Site and include:

- Crucible applications for NYSDEC Part 360 and 364 permits and landfill closure, including supporting documents *Phase II Geotechnical Investigations, Crucible Inc., Solid Waste Management Facilities and Phase I Hydrogeological Investigations, Crucible Inc., Solid Waste Management Facilities* (Thomsen 1982a; Thomsen 1982b), and the *Revised Landfill Closure Plan Volumes 1 & 2* (C&S 1986)
- *Hydrogeologic Assessment of the Allied Waste Beds in the Syracuse Area* (BBL 1989)
- *Onondaga Lake Project Waste Beds Investigation Report* performed by TAMS Consultants, Inc. (TAMS) on behalf of the NYSDEC (TAMS 1995)
- *Geddes Brook/Ninemile Creek Remedial Investigation* (NYSDEC 2003a) and *Ninemile Creek Supplemental Sampling Program* (O'Brien & Gere 2002)
- *Onondaga Lake Remedial Investigation Report* (NYSDEC 2002)
- *Supplemental Wastebeds 1 through 8 Seeps, Sediment, and Water Sampling* performed by NYSDEC in May 2003 (NYSDEC 2003b)
- *Wastebeds 1 through 8 Preliminary Site Assessment (PSA) Data Summary* (O'Brien & Gere 2005a)
- *Environmental Sampling Along the Proposed Onondaga Canalways Trail Section 1* (Parsons 2004)
- *Wastebeds 1 through 8 Focused Remedial Investigation (FRI)* (O'Brien & Gere 2005b)
- *Chromium Speciation Investigation* (O'Brien & Gere 2008b)
- *Supplemental Remedial Investigation (SRI)* (O'Brien & Gere 2009b and 2010b)

In addition to the reports referenced above, the data and results of these studies are discussed in the *Revised RI Report* (O'Brien & Gere 2014) for the Site.

2.2 REMEDIAL INVESTIGATION AND RISK ASSESSMENT

The RI was performed pursuant to the ACO (D-7-002-02-08) between NYSDEC and Honeywell dated January 22, 2004, and is documented in the *Revised RI Report* (O'Brien & Gere 2014). The data generated during the RI were used to evaluate the nature and extent of chemical parameters of interest (CPOIs) and identify potential source areas. This information was used to develop interim remedial alternatives for the FFS and subsequent designs for the Integrated IRM. The RI information was also used in the development of the alternatives in this FS.

As described in the Revised RI Report, four geologic cross-sections have been developed to present the Site geology (**Figures 2-2** through **2-5**). The cross-section locations are shown on **Figure 2-1**. Based on the Site geologic and hydrogeologic data collected during the PSA, FRI, RI, Chromium Speciation Investigation, SRI, and other investigations conducted, the following conclusions have been developed:

- The Site geology consists of seven distinct layers including soil/fill material, marl/peat, silt and clay, silt and fine-grained sand, basal sand and gravel, basal till, and bedrock
- The marl layer pinches out to the south away from the lake and transitions to alternating layers of marl and peat

- The Site hydrogeology consists of two groundwater zones, an Upper Groundwater System (also referred to as shallow and intermediate groundwater) and a Lower Groundwater System separated by a confining silt and clay layer. Site groundwater will be addressed under a subsequent OU-2 FS.
- CPOIs at the Site include benzene, toluene, ethylbenzene, xylenes (BTEX), naphthalene and assorted polycyclic aromatic hydrocarbons (PAHs), phenolic compounds, pesticides, and inorganics.
- Two areas of stained soil/fill material are present along the lakeshore, which are located on the eastern side of Lakeview Point and southeastern lakeshore of the Site and extend roughly 5 ft below ground surface (bgs) and these areas are currently being mitigated through cover systems and the collection of shallow and intermediate groundwater by the on-going Integrated IRM.
- A layer of stained soil/fill material is present at the base of Wastebeds 1 through 4 approximately 60 ft below the surface. This layer may be a source of BTEX, naphthalene and other PAHs, and phenol concentrations in groundwater along the lakeshore and southeastern portion of the Site including deep and bedrock groundwater beneath both the Site and the adjacent Onondaga Lake. It should be noted that a separate Deep Groundwater Investigation is being conducted to evaluate other potential sources of benzene in deep and bedrock groundwater encountered along the lakeshore and beneath Onondaga Lake.

Analytical results for Site media were also evaluated in the *Revised Human Health Risk Assessment Report* (O'Brien & Gere 2011b) and the *Revised Baseline Ecological Risk Assessment Report* (O'Brien & Gere 2011c). These risk assessments identified potential risks to human and ecological receptors. Specifically, potential risks related to human exposures to soil/fill material were limited to non-cancer risks driven by inhalation of metals in dust or the accidental ingestion of PCBs in surface soil. The estimated risks to human health are similar to those risk levels estimated for typical background concentrations or were associated with concentrations only detected in a relatively small area proximal to the Crucible Landfill.

Although risks and hazards from vapor intrusion were not quantitatively evaluated in the Human Health Risk Assessment (HHRA), based on the vapor intrusion screening presented in the HHRA and the vapor pressure of many of the compounds detected, a vapor intrusion evaluation should be conducted prior to the construction of occupied buildings at the Site. Based on the vapor intrusion evaluation, preventative measures may be included in the design and construction of buildings at the Site to mitigate the potential for exposure to constituents that may be present in soil vapor. Such measures may include the use of a vapor barrier or the installation of a venting system.

With respect to ecological receptors, potential risks related to terrestrial ecological receptor exposures to soil/fill material were primarily driven by metals for which detected concentrations do not exceed background concentrations in New York State, are associated with a single outlier, or are associated with the Biosolids Area at the Site. To a lesser extent than metals, organic constituents including BTEX compounds, naphthalene, phenols, and several other compounds detected at low frequencies but retained for their bioaccumulative properties, presented potential risk to terrestrial ecological receptors exposed to soil/fill material. In addition, potential risks to ecological receptors were identified related to exposure of aquatic ecological receptors to soil/fill material substrate in one location at the Site (lower Ditch A).

2.3 NATURE AND EXTENT OF CONTAMINATION

This section presents a summary of the nature and extent of contamination of soil/fill material at the Site to be used in the FS.

As described in Section 1, the wastebeds are composed primarily of Solvay waste, an inert material consisting largely of calcium carbonate, calcium silicate, and magnesium hydroxide. Additional wastes including BTEX; naphthalene and other PAHs; and phenol were periodically co-disposed. In addition to the Solvay waste, waste materials containing chromium, nickel and other metals associated with Crucible operations and PAHs, pesticides and PCBs associated with placement of municipal sewage sludge from the City of Syracuse and Onondaga County have impacted surface and subsurface material at the Site.

Based on anticipated future development of the Site, assumptions of the reasonably anticipated land use, as described in **Section 1.5,** have been considered in the FS to facilitate the development and evaluation of

remedial alternatives. In addition, for the purpose of identifying areas to be addressed in this FS and to support the development and evaluation of remedial alternatives, analytical results presented in the *Revised RI Report* (O'Brien & Gere 2014) were compared to the respective New York State's 6 NYCRR 375 soil cleanup objectives (SCOs) applicable to each land use type.

Consistent with the reasonably anticipated future uses described in **Section 1.5**, the analytical results were compared to the restricted residential use SCOs (which includes active recreational uses), the commercial use SCOs (which includes passive recreational uses), and the SCOs for the protection of ecological resources. Constituents that exceed these SCOs are considered constituents of concern (COCs) for the FS. Based on these considerations, the nature and extent of contamination discussion below is presented in the context of these SCOs and reasonably anticipated future land uses.

Surface Soil/Fill Material (0 to 2 ft bgs)

Surface soil/fill samples were collected as part of the PSA [including the public recreation trail (West Shore Trail Extension) surface soil sampling], RI, Chromium Speciation Investigation, and SRI. Surface soil/fill samples are considered any sample collected between 0 and 2 ft bgs. Based on Site data, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), PCBs and inorganics were detected in surface soil/fill material on the Site. **Figure 2-6** illustrates sample locations where SCOs were exceeded.

In existing NYS Fairground parking lot areas, where the anticipated land use will remain as parking, data were compared to the 6 NYCRR 375 SCOs for commercial use (which includes passive recreational use). COC exceedances in surface soil/fill material of commercial use SCOs in parking lot areas consisted of metals and SVOCs. Given the location and extent of commercial SCO exceedances and the areas of anticipated passive recreational, commercial land use, a total of approximately 24 acres of the Site would be subject to evaluation for remedial action based on commercial SCOs.

In areas of the Site that include proposed development (*e.g.*, lawn seating areas within the amphitheater footprint), data were compared to the 6 NYCRR 375 SCOs for restricted residential use (which includes active recreational use). Based on information provided as of the date of this report, it is understood that the proposed amphitheater may be constructed within/proximal to the Lakeview Point portion of the Site. Because the exact location of the amphitheater is unknown, samples within the footprint of wastebed 6 and areas extending to the shorelines of Onondaga Lake around wastebed 6 were evaluated using these SCOs. There were no COC exceedances in surface soils over restricted residential use SCOs in this area.

In areas of the Site that are heavily wooded or steeply sloped, data was compared to the 6 NYCRR 375 SCOs for protection of ecological resources. With the exception of parking areas or proposed access corridors (which would not be subject to these SCOs), the majority of the SCO exceedances, which consisted of metals, pesticides, PCBs and SVOCs, are located within the footprint of the former County Biosolids Area (including Integrated IRM Staging Area C, described below) and within the footprint of the Integrated IRM (eastern shoreline, staging areas, and clean fill staging area near the upper parking lot). Given the location and extent of ecological SCO exceedances and the areas of anticipated undeveloped land use, a total of approximately 30 acres of the Site would be subject to evaluation for remedial action based on SCOs for the protection of ecological resources.

Subsurface Soil/Fill Material (at depths greater than 2 ft bgs)

During the PSA, FRI, RI, Chromium Speciation Investigation, and SRI, subsurface soil samples (> 2 ft) were collected from soil borings and test pits. Based on Site data, VOCs, SVOCs, pesticides, PCBs and inorganics were detected in subsurface soil/fill materials at the Site. The highest VOC concentrations were found at depths of over 70 ft bgs. Location and depth of SVOCs vary by individual compound; however, in general the higher concentrations of SVOCs found at the Site were located in excess of 40 ft bgs. The samples that exhibit the highest concentrations of organic COCs are found within a layer of stained soil/fill material that is located within the footprints of Wastebeds 1-4. Further description of the stained soil/fill material is discussed in **Section 3.3**.

Integrated IRM Staging Areas

As discussed in **Section 1.4**, excavation spoils were staged in three designated staging areas on the Site during construction of the Integrated IRM. Staging Areas A, B and C are situated near the northern shoreline, NMC shoreline, and within the former County biosolids area, respectively (see **Figure 1-4**). Further description of the

characteristics of the Integrated IRM staging areas is included in **Section 3.3**. Characterization sampling and analysis were performed throughout the duration of the placement of materials within the staging areas to document that materials being placed within these footprints did not exceed hazardous characteristics, as per the Integrated IRM Design. Data that has been collected to date from staging area soils is summarized in **Appendix A**. Soil/fill material that was placed within Staging Areas A, B and C contained COC concentrations that exceeded the 6 NYCRR 375 SCOs for protection of ecological resources, as well as restricted use SCOs. These areas are therefore included in the surface soil exceedances described above. As described in **Section 3.3**, these areas have been or will be covered with 6-inches of vegetated clean fill as part of the IRM. The thickness of these covers will be further evaluated in this FS.

3. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section documents the development of remedial alternatives for soil/fill at the Site. Consistent with the *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA* (Comprehensive Environmental Response, Compensation, and Liability Act; USEPA 1988), NYSDEC's Division of Environmental Remediation *Technical Guidance for Site Investigation and Remediation (DER-10)* (NYSDEC 2010a), and the *Revised RI/FS Work Plan* (O'Brien & Gere 2006), this section describes RAOs and general response actions (GRAs) that were identified for the FS. This section also describes the areas and volumes of media to be addressed by the remedial alternatives and identifies specific remedial technologies that, following screening, were used to develop the range of remedial alternatives evaluated in this FS. In addition, consistent with NYSDEC's *DER-31 – Green Remediation* (NYSDEC 2011) and USEPA's *Superfund Green Remediation Strategy* (September 2010), green remediation concepts were considered during the development of alternatives in this FS.

3.1 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

RAOs are media-specific goals for protecting human health and the environment. RAOs form the basis for the FS by providing overall goals for site remediation. The RAOs are considered during the identification of appropriate remedial technologies and development of remedial alternatives for the Site, and later during the evaluation of remedial alternatives.

RAOs are based on engineering judgment, risks identified in the HHRA and Baseline Ecological Risk Assessment (BERA) Reports (O'Brien & Gere 2011b and 2011c, respectively), potentially applicable or relevant and appropriate requirements (ARARs), and migration potential. Additionally, the current, intended and reasonably anticipated future land use of the Site and its surroundings; the nature and extent of COCs exceeding chemical-specific ARARs and potential impact(s) to nearby Sites were considered during the development of the RAOs. Documentation of the rationale employed in the development of RAOs for Site media is presented below.

3.1.1 Identification of ARARs

There are three types of ARARs: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs are health- or risk-based numerical values, or methodologies which when applied to site-specific conditions result in numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment. Location-specific ARARs set restrictions on activities based on the characteristics of the land on which the activity is to be performed. Action-specific ARARs set controls or restrictions on particular types of remedial actions once the remedial actions have been identified as part of a remedial alternative. The identification of potential ARARs is documented in **Table 3-1**. The rationale for the selection of chemical-specific ARARs related to New York State's 6 NYCRR 375 SCOs and land use is further described below.

3.1.2 Land Use and Selection of Soil Cleanup Objectives

Consistent with 6 NYCRR 375-1.8 (f) and DER-10 4.2 (i) the current, intended and reasonably anticipated future uses of the Site are considered when selecting SCOs. As described in **Section 1.1**, the Site is owned by Onondaga County and the People of the State of New York. The following property use information is relevant to these areas:

- The property deeds for the Site restrict Site use to park purposes
- Onondaga County has constructed a public recreation trail across the Site
- Onondaga County has proposed to construct an amphitheater on its property
- The portion of the Site owned by the People of the State of New York is currently used for parking lots to support the nearby NYS Fairgrounds and is also occupied by I-690 and highway interchanges associated with NY-695
- It is reasonably anticipated that similar commercial and recreational property uses will continue in the foreseeable future.

Based on habitat, portions of the Site represent areas of value to ecological resources; however, certain portions of the Site would not be preferred habitat for ecological resources. These include:

- Parking areas used for NYS Fairgrounds overflow parking
- Interstate and other roadways
- Future Buildings and support structures.

Given that the reasonably anticipated future use for the Site includes current and planned commercial and recreational uses, and that certain areas are viable habitat for ecological resources, the following 6 NYCRR Part 375 Restricted Use SCOs are identified as appropriate SCOs for the Site:

- 6 NYCRR Part 375 SCOs for Commercial Use
  - Commercial use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iii) includes passive recreational uses, which are public uses with limited potential for soil contact.
  - SCOs for Commercial Use are proposed for areas identified for parking lot use and other areas where passive recreation might be anticipated. Existing parking lots and the public recreation trail are considered in this FS to be passive recreational use areas.
- 6 NYCRR Part 375 SCOs for Restricted Residential Use
  - Restricted-residential use, as defined in 6 NYCRR Part 375-1.8(g)(2)(ii) includes active recreational uses, which are public uses with a reasonable potential for soil contact.
  - SCOs for Restricted Residential Use are proposed for areas where active recreation might be anticipated. Lawn areas within the footprint of proposed amphitheater are considered in this FS to be an active recreational use area.
- 6 NYCRR Part 375 SCOs for the Protection of Ecological Resources
  - Consistent with 6 NYCRR Part 375-6.6, SCOs for protection of ecological resources must be considered and applied for the upland soils at sites where terrestrial flora and fauna and the habitats that support them are identified.
  - Also consistent with 6 NYCRR Part 375-6.6, the SCOs for protection of ecological resources do not apply to sites or portions of sites where the condition of the land (*e.g.*, paved, covered by impervious surfaces, buildings and other structures) precludes the existence of an ecological resource, or to landscaping in developed areas.
  - SCOs for the Protection of Ecological Resources are proposed for portions of the Site exclusive of parking areas, building and other structures, the public recreation trail, or landscaped areas.

3.1.3 RAOs for Soil/Fill Material

Potential chemical-specific ARARs and human health and ecological risks identified for soil/fill material at the Site were considered during the development of RAOs and remedial alternatives. As described in **Section 2.3**, soil/fill material samples exhibit concentrations above SCOs in certain areas at the Site. In addition, potential risks related to human exposures to soil/fill material were limited to non-cancer risks driven by inhalation of metals in dust. The estimated risks to human health are similar to those risk levels estimated for typical background concentrations, or were associated with concentrations only detected in a relatively small area proximal to the Crucible Landfill.

Potential risks related to terrestrial ecological receptor exposures to soil/fill material were primarily driven by metals for which detected concentrations do not exceed background concentrations in New York State, are associated with a single outlier, or are associated with the Biosolids Area at the Site. Potential risks to aquatic ecological receptors were related to exposure to soil/fill material substrate in one location at the Site (lower Ditch A). Accordingly, the following RAOs were developed.

RAOs for Public Health Protection

Based on consideration of potential chemical-specific ARARs, nature and extent of contamination, potentially unacceptable risks, and the current, intended and reasonably anticipated future use of the Site and its surroundings, the following RAOs for soil/fill material were developed for the protection of human health:

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated soil/fill material.
- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated soil/fill material. In the event that buildings are constructed at the Site, mitigate impacts to public health resulting from existing, or potential for, soil vapor intrusion into buildings at the Site.

RAOs for Environmental Protection

Based on consideration of potential chemical-specific ARARs, nature and extent of contamination, potentially unacceptable risks, and the current, intended and reasonably anticipated future use of the Site and its surroundings, the following RAOs for soil/fill material were developed for protection of the environment:

- Prevent, or reduce to the extent practicable, adverse impacts to biota from ingestion/direct contact with contaminated soil/fill material causing toxicity or impacts from bioaccumulation through the terrestrial food chain.
- Prevent, or reduce to the extent practicable, the migration of contaminants to surface water that would result in groundwater, sediment or surface water contamination.

As presented in NYSDEC and New York State Department of Health's (NYSDOH) *New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document* (NYSDEC and NYSDOH 2006), the document that presents the assumptions, rationale, algorithms and calculations utilized to develop the SCOs, the SCOs were developed by NYSDEC and NYSDOH based on health effects to human and ecological receptors, rural soil background concentrations, and maximum acceptable soil concentrations. Thus, the promulgated SCOs for the protection of human health and ecological resources were used to ascertain acceptable concentrations for a given anticipated site use. Attainment of these SCOs was assumed to constitute acceptable protectiveness and, therefore, the SCOs were used as a measure for achievement of the corresponding RAOs.

3.2 DEVELOPMENT OF GENERAL RESPONSE ACTIONS (GRAS)

GRAs are media-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs and SCOs. GRAs identified for soil/fill material, based on the RAOs, are summarized as follows:

- ***No action.*** No action must be considered in the FS, as specified in the National Oil and Hazardous Substances Contingency Plan (NCP) (40 CFR Part 300.430).
- ***Institutional controls/limited actions.*** Actions that provide site access and use restrictions and provisions for continued operation of the remedy.
- ***Containment actions.*** Actions that minimize the potential for direct contact with and erosion of surface soil/fill material.
- ***In situ treatment actions.*** Actions that treat soil/fill material in place to reduce mobility or toxicity.
- ***Removal actions.*** Actions to excavate soil/fill material.
- ***Ex situ treatment actions.*** Actions that treat soil/fill material following removal, to reduce mobility or toxicity.
- ***Disposal actions.*** Actions that dispose of soil/fill material on-site or off-site.
- ***Reuse actions.*** Actions that provide for the beneficial reuse of soil/fill material.

The GRAs for each medium of concern for this FS are identified in **Table 3-2**.

3.3 IDENTIFICATION OF VOLUMES OR AREAS OF MEDIA

Volumes and areas of soil/fill material to be addressed in this FS were estimated based on Site conditions, the nature and extent of contamination, RAOs, and potential chemical-specific ARARs. For purposes of discussion in this FS, media is discussed as soil/fill material, stained soil and Integrated IRM staging areas. The areal extents of these media are described below.

Soil/Fill Material

The Wastebeds 1 through 8 Site includes an area of approximately 404 acres. Approximately 315 acres of the Site are within the delineated Wastebeds 1 through 8 cells (see **Figures 3-1 and 3-2**); however, soil/fill material is present on areas of the Site beyond the limits of the wastebed cells. The thickness of soil/fill material across the Site ranges from approximately 5 to 70 ft in thickness; site elevation across this area ranges from 363 to 430 ft above MSL. The total estimated volume of soil/fill material at the Site is approximately 26 million cy. The basis for the total estimated volume of soil/fill material is presented in **Appendix B**.

As described in **Section 2.3**, certain surface areas at the site exhibit concentrations of COCs that are greater than potential chemical-specific ARARs. In addition, erosion of surface soil/fill has the potential to affect surrounding surface water bodies. The areas that are not currently addressed by cover systems associated with the Integrated IRM or existing infrastructure constitute a total of approximately 171 acres of the Site (See **Figures 3-1 and 3-2**). The remaining approximately 233 acres include: approximately 71 acres of surfaces addressed by the Integrated IRM (including clean fill staging areas), approximately 58 acres addressed by existing NYS Fairgrounds parking lot surfaces, approximately 20 acres currently occupied by the Crucible Landfill, 9 acres of the Onondaga County West Shore Trail Extension (public recreation trail), and approximately 75 acres addressed by the vegetated covers and roadways associated with the I-690 and NY-695 corridor and other Site roads/infrastructure.

As described in **Section 2.3**, the approximately 171 acres of areas to be addressed by cover systems can be categorized as follows:

- Given the location and extent of commercial SCO exceedances and the areas of anticipated passive recreational, commercial land use, a total of approximately 24 acres of the Site would be subject to evaluation for remedial action based on commercial SCOs.
- Given the location and extent of ecological SCO exceedances and the areas of anticipated undeveloped land use, a total of approximately 30 acres of the Site would be subject to evaluation for remedial action based on SCOs for the protection of ecological resources.
- Approximately 118 acres exhibit concentrations below corresponding SCOs.

Some areas within the above-identified 118 acres of the Site may receive vegetated soil covers based on areas of anticipated active or passive recreational use.

An area of subsurface stained soil/fill exists within the wastebeds. As described in **Section 2**, this material consists of soil/fill material containing elevated VOC and SVOC concentrations. The area of subsurface stained soil/fill includes approximately 140 acres within the 315 acres of soil/fill material located within Wastebeds 1 through 8. The approximate areal extent of stained soil/fill is generally within the footprint of Wastebeds 1 through 4, which are shown on **Figure 1-2**. The thickness of the stained soil/fill ranges from 3 to 17 ft, and it is located at a depth range of approximately 40 to 70 ft bgs. An estimate of the total volume of stained soil/fill, based on an average thickness of 10 ft, is 2.3 million cy.

Integrated IRM Staging Areas

Soil/fill that was excavated during the construction of the Integrated IRM was consolidated and staged in one of three staging areas on the Site (Staging Areas A, B, and C). Staging Area A is located near the Northern Shoreline/SMU-4 collection system and is approximately 2 acres in size; Staging Area B is located near the NMC collection system and is approximately 2 acres in size; and Staging Area C is located within the southeastern portion of the Biosolids Area and is approximately 6 acres in size. Analytical results associated with material consolidated in these areas are presented in **Appendix A**. In addition, two clean fill staging areas were

established for temporary storage of backfill materials. **Figure 1-4** depicts the locations of the Integrated IRM staging areas. One of the staging areas, the Integrated IRM clean fill staging area, is located along the northern boundary of the New York State Fairgrounds Orange parking lot, within the footprint of Wastebeds 3 and 4, and is approximately 5 acres in size. The second clean fill staging area is associated with Onondaga Lake remediation efforts, is approximately 6 acres in size and is located immediately adjacent to Staging Area B near NMC on Wastebed 5. The Integrated IRM staging areas cover approximately 21 acres of the Site in total.

In accordance with the IRM design, restoration for each of the staging areas consists of placement of 6 inches of vegetated, clean fill. Restoration cover for clean fill staging areas will be placed directly over the gravel subbase that was established for the staging area, whereas restoration cover in Staging Areas A, B and C will be placed directly over staged soil/fill material.

3.4 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Potentially applicable remedial technologies and process options for each general response action (GRA) were identified and then screened on the basis of technical implementability. Technical implementability for each identified process option was evaluated with respect to contaminant information, physical characteristics, and areas and volumes of affected media summarized in **Section 3.3**.

Descriptions for technologies and process options identified for the FS are presented in **Table 3-2**. Technologies and process options that were viewed as not implementable were not considered further in the FS. The technologies and process options retained for further consideration for Site soil/fill material are presented below.

Soil/Fill Material

- No action
- Access/use restrictions/administrative control(s) (institutional controls)
- Site controls (Site management plan)
- Periodic reviews (periodic site reviews)
- Vegetated cover systems (vegetation enhancement, vegetated cover, vegetated structural fill)
- Removal (mechanical excavation)
- *Ex situ* treatment (thermal treatment)
- Disposal (off-site commercial facility)
- Reuse (beneficial reuse off-site).

3.5 EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

The remedial technologies and process options remaining after the initial screening were evaluated further according to the criteria of effectiveness, implementability, and cost. The effectiveness criterion included the evaluation of:

- Potential effectiveness of the process option in meeting the RAOs and handling the estimated lengths, areas and/or volumes of media summarized in **Section 3.3**
- Potential effects on human health and the environment during implementation (including, as appropriate, construction and operation)
- Reliability of the process options for Site COCs and conditions.

Technical and institutional aspects of implementing the process options were assessed for the implementability criterion. The capital and operation and maintenance (O&M) costs of each process option were evaluated as to whether they were high, medium, or low relative to the other process options of the same technology type. Based on the evaluation, the more favorable process options of each technology type were chosen as representative process options. The selection of representative process options simplifies the assembly and

evaluation of alternatives, but does not eliminate other process options for consideration. The representative process option provides a basis for conceptual design during the FS, without limiting flexibility during the remedial design phase. An alternative process option may be selected during the remedial design phase as a result of design evaluations or testing. The screening and evaluation of technologies is summarized in **Table 3-2**.

As a result of the screening and evaluation of technologies, the following technologies/process options were not retained: soil amendment; 6 NYCRR Part 360 solid waste landfill cover; *in situ* chemical, physical, and thermal treatments; and *ex situ* chemical and biological treatments. Soil amendment was not retained because of the large amount of clearing of existing established vegetation that would be required. The part 360 solid waste landfill cover was not retained because it was not considered implementable for the Site and would require significant regrading of the Site which would be incompatible with current and reasonably anticipated land use. *In situ* chemical treatment technologies were generally not retained because of limited implementability and/or effectiveness due to low permeability conditions of subsurface materials and the depths at which materials requiring treatment are located. *Ex situ* technologies were not retained because of limitations in implementability due to the excessive volumes of material requiring treatment and associated restoration.

A description of the representative process options for retained technologies, by GRA and technology for soil/fill material, is presented in the following sections.

No Action

The no action alternative must be considered in the FS, as required by the NCP (40 CFR Part 300.430) and DER-10 Section 4.4(b)3 (NYSDEC 2010a). Under this alternative, no remedial actions addressing Site soil/fill material would be conducted, and O&M of the Integrated IRM would be discontinued.

Institutional Controls/Limited Actions

Institutional controls, site management plan, and periodic reviews were identified as representative process options associated with the institutional controls/limited actions GRA for soil/fill material.

- ***Institutional controls.*** Access/use limitations (*e.g.,* institutional controls) would be recorded for the Site documenting land use restrictions, and requiring that activities that would potentially expose contaminated materials (and require health and safety precautions) be performed in accordance with the site management plan. The institutional controls would also provide provisions to evaluate and address, if necessary, potential soil vapor intrusion if buildings are constructed at the Site.
- ***Site management plan.*** A site management plan would document Site institutional and engineering controls and any physical components of the selected remedy requiring operation, maintenance and monitoring to provide for continued effectiveness of the remedy. The site management plan would also present provisions for periodic site reviews.
- ***Periodic site reviews***. Periodic reviews are required by 6 NYCRR Part 375 where institutional and engineering controls, monitoring and/or O&M activities are required at the Site. The purpose of the periodic reviews is to evaluate the Site with regard to the continuing protection of human health and the environment and to document remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC. Periodic site review would also include the performance of Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.

Containment

Vegetation enhancement, vegetated cover, and vegetated structural fill were identified as representative process options associated with the containment GRA for soil/fill material. Containment systems provide a sustainable means of minimizing erosion of soil/fill material on the Site resultant from surface water flow, minimize the potential for contact with the soil/fill material on the Site, and would also serve to enhance the habitat.

- ***Vegetation enhancement***. Vegetation enhancement would reduce erosion of surface soil/fill material. Vegetative plantings can be applied using pneumatic processes and/or hydroseeding techniques and can be mixed with wood or paper mulch during application. Pilot testing conducted to date has identified mulch materials and seed mixes (including native species) that provide successful vegetation enhancement and

erosion control for the various terrains at the Site. Pilot testing also showed positive ET enhancement results for this technology.

- ***Vegetated cover***. A vegetated cover would consist of a soil layer of an appropriate thickness over existing soil/fill material, followed by a top restoration layer of vegetation, to enhance ET properties of the cover. The vegetation would consist of native vegetation (*e.g.*, native successional old field species mix). As in prior restoration design work for Onondaga Lake and adjacent areas, vegetation experts and ecologists from ESF and other local universities will provide technical input and review of restoration plans, including seed mixes. Grading and cover installation would be performed such that drainage is promoted, erosion is minimized, and cover integrity is protected. Routine cover maintenance, consisting of mowing of vegetation and inspections for integrity, would be necessary. A vector control program, to minimize disturbance of the cover that could jeopardize its integrity by burrowing animals, may also be of benefit. A vegetated cover functions by maintaining a balance between the water stored in the topsoil layer and the water used by the vegetation supported on the cover. A vegetated cover would be used on the Site to prevent erosion of and exposure to surface soil/fill material through direct contact and inhalation of dust. It is anticipated that an added benefit of a vegetated cover would be reduction in infiltration. The effectiveness of this will be evaluated during the OU-2 FS.
- ***Vegetated structural fill***. A vegetated structural fill cover would serve as a structural base for parking and traffic areas. The structural fill cover could consist of a structural fill layer of an appropriate thickness over existing soil/fill material, followed by a top restoration layer of native vegetation, where possible, to enhance ET properties of the cover. The structural fill material provides water holding capacity, rooting volume and growing conditions to support vegetation. Routine cover maintenance, consisting of mowing of vegetation and inspections for integrity, would be necessary. A vegetated structural fill cover would be used on the Site to prevent erosion of and exposure to surface soil/fill material through direct contact and inhalation of dust. It is anticipated that an added benefit of a vegetated structural fill would be reduction in infiltration. The effectiveness of this will be evaluated during the OU-2 FS. A pilot test is currently under way to evaluate optimum thickness of structural fill, seed mixtures for parking activities, and enhancement of ET.

Removal

Mechanical excavation was identified as the representative process option associated with the removal GRA for soil/fill material.

- ***Mechanical excavation***. Mechanical excavation of soil is generally implemented using construction equipment such as backhoes and front-end loaders. Excavated areas are backfilled, graded, and restored based on restoration requirements. Sloping techniques, benching, and/or engineering controls (*i.e.*, sheet piling) would be necessary during excavation to maintain stability of excavation walls. Geotechnical stability evaluations would need to be conducted to evaluate implementability and safe methods for excavation. Dewatering of excavations and management of water would also be necessary.

***Ex situ* Treatment**

Thermal treatment of excavated soil was identified as the representative process option associated with the treatment GRA for soil/fill material.

- ***Thermal treatment.*** Coupled with mechanical removal, excavated soil/fill material exhibiting elevated concentrations of organic compounds would be treated using thermal treatment. Thermal treatment would consist of combustion of organic contaminants present in soil/fill material in a commercial incinerator at temperatures generally between 1,600° F and 2,200° F. Such an incinerator might be located at the Site, pending permitting.

Disposal

Disposal at off-site commercial facilities was identified as the representative process option associated with the disposal GRA for soil/fill material.

- ***Off-site commercial facility.*** Coupled with mechanical removal, excavated soil/fill material would be transported to regulated, commercial off-site facilities for subsequent treatment/disposal. Excavated soil/fill material identified as non-hazardous would be disposed at an off-site facility, while excavated soil/fill

material identified as hazardous may require treatment to meet land disposal restrictions (LDRs) prior to disposal. Waste characterization sampling and analysis would be completed, and a Waste Manifest would be submitted to, and approved by the landfills prior to disposal. Due to the exceedingly large volume of soil/fill material, multiple transportation mechanisms and off-site disposal facilities would need to be identified.

Reuse

Beneficial reuse was identified as the representative process option associated with the reuse GRA for soil/fill material.

- ***Reuse off-site***. Coupled with mechanical excavation, excavated soil/fill material would be transported to off-site facilities to be repurposed as fill material, landfill cover, landfill construction grading material, aggregate, or other beneficial use.

3.6 ASSEMBLY OF REMEDIAL ALTERNATIVES

Four remedial alternatives were developed by assembling GRAs and representative process options into combinations that address RAOs for soil/fill material. A summary of the alternatives and their components is presented in **Table 3-3**. The four remedial alternatives discussed in this section of the FS report are as follows:

- Alternative 1 is the no action alternative. This alternative is required to be considered by the NCP (40 CFR Part 300.430) and NYSDEC DER-10 Section 4.4(b)3 (NYSDEC 2010a) and serves as a benchmark for the evaluation of action alternatives.
- Alternative 2 is vegetated cover system alternative and includes vegetation enhancement, vegetated cover, and vegetated structural fill; institutional controls; a site management plan; and periodic reviews. The thickness of the vegetated cover system in Alternative 2 for areas exceeding SCOs would be consistent with cover thickness requirements for the corresponding anticipated land use.
- Alternative 3 is an enhanced vegetated cover system alternative and includes vegetation enhancement, vegetated cover, and vegetated structural fill; institutional controls; a site management plan; and periodic reviews. In addition to areas addressed under Alternative 2, the enhanced vegetated cover system in Alternative 3 would include additional thickness for covers to prevent direct contact exposures in areas not exceeding SCOs that are anticipated to have active or passive uses.
- Alternative 4 includes soil/fill material excavation and off-site transportation and management, with subsequent Site restoration. Two options for removal were evaluated under excavation Alternatives 4A and 4B. Alternative 4A reflects excavation to pre-disposal conditions. Alternative 4B reflects an excavation option that retains the existing I-690 and NY-695 infrastructure, which are built on soil/fill material, and includes restoration, institutional controls, a site management plan, and periodic reviews. Both Alternatives 4A and 4B also includes off-site management via *ex situ* treatment and/or beneficial reuse.

A description of each alternative is included in the following subsections.

3.6.1 Alternative 1 – No Action

Alternative 1 is the no action alternative. The no further action alternative is required to be considered by the NCP and NYSDEC DER-10 Section 4.4(b)3 (NYSDEC 2010a) and serves as a benchmark for the evaluation of action alternatives. This alternative provides for an assessment of the environmental conditions if no remedial actions are implemented and existing/ongoing actions are ceased. Under Alternative 1, operation and maintenance of the Integrated IRM elements would be discontinued. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

3.6.2 Alternative 2 – Vegetated Cover System

Alternative 2 is a containment alternative that includes implementation of a vegetated cover system based on potential chemical-specific ARARs and reasonably anticipated future land uses at the Site. The vegetated cover system would consist of vegetation enhancement and vegetated soil covers based on land use and land form. It would be applied over approximately 171 acres of the Site for the purpose of minimizing erosion and potential

exposure of human and ecological receptors to contaminants in soil/fill material. As depicted on **Figure 3-1**, implementation of the vegetated cover system is proposed for a portion of the Site, extending from the shore of Onondaga Lake and Integrated IRM boundaries, to the south and southwest, including portions of Wastebeds 1 through 5. The anticipated percentages and corresponding acreages of the Site assumed for the different cover types listed on **Figure 3-1** are based on exceedances of SCOs that correspond to the anticipated recreational use and suitability of areas for ecological resources. Alternative 2 also includes long-term maintenance, institutional controls, site management plan, and periodic site reviews. The vegetated cover system and institutional controls in Alternative 2 would support reasonably anticipated future land uses for the Site. In addition to maintenance of the vegetated cover system, continued maintenance and inspection activities associated with the wetland and vegetated cover system being implemented as part of the Integrated IRM are expected to continue under Alternative 2. Existing parking lot surfaces and areas of established vegetation (*e.g.*, I-690/NY-695 corridor) will also be maintained under this alternative. The remedial components of Alternative 2 are described in this Section.

Institutional Controls

Under Alternative 2, soil/fill material would be covered with vegetated soil covers and vegetation enhancement. Administrative control(s) such as an institutional control (*e.g.*, environmental easements, deed restrictions, and environmental notices) would be recorded for the Site to require the continued management of engineering controls to maintain protectiveness of human health and the environment. The institutional controls would limit site use and require maintenance of remedial elements such as covers. Evaluation and possible mitigation of potential vapor intrusion would be required under provisions specified in the institutional controls, depending on building(s) constructed and type of occupation on the Site. Where necessary, preventative measures may be included in the design and construction of buildings at the Site to mitigate the potential for exposure to constituents that may be present in soil vapor. Such measures may include the use of a vapor barrier or the installation of a venting system. Restrictions would preclude activities that would potentially expose soil/fill materials and soil vapor that might cause vapor intrusion, or impair the integrity of the engineered cover systems without prior review and approval by NYSDEC. Based on the assessment of land use described above in **Section 1.5**, the reasonably anticipated future land uses for the Site are commercial, recreational and ecological. The institutional controls would reflect these Site uses.

Site Management Plan

A site management plan would guide future activities at the Site by documenting institutional and engineering controls and by developing requirements for periodic site reviews, the implementation of required O&M activities for the selected remedy, and future development on the Site. In addition, consistent with 6 NYCRR Part 375-1.8(h)(3), annual certification of institutional and engineering controls would be required in the site management plan.

Periodic Site Reviews

Periodic site reviews would be conducted in accordance with the site management plan to evaluate the Site with regard to continuing protection of human health and the environment as evidenced by information such as documentation of field inspections. 6 NYCRR Part 375-1.8(h)(3) specifies that the frequency of periodic site reviews should be annual, unless a different frequency is approved by NYSDEC; it is assumed that annual reviews would be conducted at the Site. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

Vegetated Cover System

Consistent with the current and reasonably anticipated future land uses for the Site, a series of vegetated covers would be implemented in areas at the Site, as illustrated on **Figure 3-1**. As described in **Section 1.5**, the current and reasonably anticipated future land uses for the Site are commercial (passive recreational use), restricted residential (active recreational use), and ecological. Given current and anticipated development plans, Site recreational usage can be expected to be either active or passive recreational use. Accordingly, vegetated cover systems would include vegetated soil covers, vegetated structural fill covers, and vegetation enhancements for

the purposes of mitigating potentially unacceptable exposure risks and surface erosion in support of the reasonably anticipated future use of the Site and its surroundings. The following vegetated covers are anticipated to be utilized for areas with corresponding usages:

Areas below SCOs

Vegetated covers in areas where surface soil concentrations are below SCOs for commercial use (passive recreational use), restricted residential use (active recreational use), or for the protection of ecological receptors, will consist of the following for the purpose of erosion control:

- ***Vegetation enhancement***. Vegetation enhancement would consist of supplementing existing vegetation to reduce erosion of surface soil/fill material. Seeds would be mixed with wood fiber mulch/compost and fertilizer as appropriate. Native species would be applied. In an effort to minimize disturbance to established vegetation at the Site, the application of vegetation enhancements would be conducted with minor clearing and grubbing of existing mature vegetation. For the purpose of the FS, vegetation enhancements are anticipated to be applied to areas of the Site with steep terrain or areas that are heavily wooded. Pilot testing conducted to date has identified mulch materials and seed mixes that provide successful vegetation enhancement and erosion control for the various terrains at the Site. For the purposes of cost estimation, the thickness of the mulch and seed application is anticipated to be approximately 4 inches. The thickness of this application would be evaluated during design.

Areas of Passive Recreational Use

Consistent with 6 NYCRR Part 375-1.8(g)(2)(iii), passive recreational uses are public uses with limited potential for soil contact. As described in **Section 1.5**, passive recreational use is included in the commercial land use category as defined in 6 NYCRR Part 375-1.8(g)(2)(iii). Consistent with NYSDEC's DER-10, soil covers in such areas are required to be 1 ft in thickness where SCOs for commercial use are exceeded. As such, for passive recreational use areas, a site cover will be required to allow for commercial use of the Site. The cover will consist either of structures such as buildings, pavements, sidewalks comprising the site development or a soil cover in areas where the upper 1 ft of exposed surface soil exceeds the commercial SCO. Where the cover is required it will be a minimum of 1 ft of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375 6.7(d) for commercial use. Accordingly, vegetated soil covers in areas of passive recreational use (such as parking lots and an area directly west of the upper parking lot), where surface soil/fill material concentrations are above SCOs would consist of the following:

- ***Vegetated soil cover***. A vegetated soil cover would consist of a vegetated soil layer having a thickness of 1 ft over existing soil/fill material. Native species would be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to attain relatively high growth rates and ecological function. Note that, for passive recreational use areas also identified as areas of ecological resources (*e.g.*, Biosolids Area), the thickness of vegetated soil cover would be 2 ft, as described below.
- ***Vegetated structural fill***. In areas where NYS Fairgrounds overflow parking is anticipated, a vegetated structural fill cover would be installed. The structural fill cover would consist of a 1 ft vegetated structural fill layer over existing soil/fill to support vehicle traffic and provide water holding capacity, rooting volume and growing conditions to support vegetation. Structural fill consists of a compacted mixture of aggregate and soil. For cost purposes, the structural fill mixture is assumed to consist of 1-ft of crushed stone and 20% clay loam topsoil. The thickness of the structural fill would be evaluated during design. The structural fill will be mixed and placed according to design specifications. Native species will be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to attain relatively high growth rates and ecological function.

Areas of Active Recreational Use

Consistent with 6 NYCRR Part 375-1.8(g)(2)(ii), active recreational uses are public uses with the potential for soil contact. As described in **Section 1.5**, active recreational use is included in the restricted residential use land category as defined in 6 NYCRR Part 275-1.8(g)(2)(ii). Consistent with NYSDEC's DER-10, soil covers in such areas are required to be 2 ft in thickness where SCOs for restricted residential use are exceeded. As such, for active recreational use areas, a site cover will be required to allow for restricted residential use of the Site. The

cover will consist either of structures such as buildings, pavements, sidewalks comprising the site development or a soil cover in areas where the upper 2 ft of exposed surface soil exceeds the restricted residential SCO. Where the cover is required it will be a minimum of 2 ft of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375 6.7(d) for restricted use. Accordingly, vegetated soil covers in active recreational use areas where soil/fill material concentrations are above SCOs would consist of the following:

- ***Vegetated soil cover***. A vegetated soil cover would consist of a 2 ft vegetated soil layer over existing soil/fill material. Native species will be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to attain relatively high growth rates and ecological function.

Areas of Ecological Resources Value

As described above in **Sections 1.5 and 3.1.2**, the ecological resources cover type applies to areas that are upland portions of the Site where flora and fauna and the habitats that support them have been identified and for which there are no currently anticipated changes in use. Consistent with NYSDEC's DER-10, soil covers in such areas are required to be 2 ft in thickness where SCOs for the protection of ecological resources are exceeded. Accordingly, vegetated soil covers in such areas would consist of the following:

- ***Vegetated soil cover***. A vegetated soil cover would consist of a soil layer over existing soil/fill material followed by a top restoration layer of vegetation having a minimum total thickness of 2 ft. The need for a demarcation layer would be evaluated during design. Grading and cover installation would be performed to promote drainage and minimize erosion. Native species will be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to retain relatively high growth rates and ecological function.

Based on the current anticipated future use and exceedances to SCOs, the vegetated cover system included in Alternative 2 is anticipated to include vegetation enhancement, 1 ft thick vegetated structural fill over portions of parking lots, 1 ft thick vegetated soil cover immediately west of the upper parking lot, and a 2 ft thick vegetated cover over the Biosolids Area. Staging Areas A, B, and C would receive an additional 18 inches of vegetated cover over Integrated IRM restoration covers (6-inches). Routine cover maintenance, including erosion repairs and inspections for integrity, would be implemented for each of the vegetated covers. A vector control program, to minimize disturbance of the cover that could jeopardize its integrity by burrowing animals, would also be implemented, if necessary.

Because development plans are yet unknown for the whole Site, the exact boundaries of the vegetated covers and seed application mixes within the anticipated footprint illustrated on **Figure 3-1** are unknown; however, for the purposes of cost estimation in this FS, assumptions for the extent of vegetation enhancements and vegetated covers have been made and are summarized on **Figure 3-1**. The assumptions used are presented in **Appendix B**. The extent of covers will be revisited during the design phase, at which time site use and corresponding surface concentrations will be revisited for consistency. Similarly, the thicknesses of covers that have been assumed will be revisited during design (*e.g.*, depending on site use). Implementation of the vegetated cover system would be conducted over several construction seasons consistent with the availability of materials and optimum growing seasons and to allow for adjustment in cover type as development plans dictate. The Alternative 2 cost estimate, presented in **Section 4.2**, reflects this phased construction approach.

Future IRM Staging Areas

As addressed above in the discussion of IRMs, Honeywell is constructing a 2.3 -acre lake-connected wetland at the Wastebeds 1-8 site. The construction includes the hydraulic dredging of materials from the lakeshore area (see **Figure 3**). Materials that are hydraulically dredged will be managed at the Sediment Consolidation Area as part of the Onondaga Lake remedy. As needed, materials that cannot be hydraulically dredged (estimated to be approximately 17,500 CY) will be excavated and consolidated in an upland area of the Site and a 2-foot vegetated soil cover will be installed. Consistent with what was done under the IRM, prior to covering, characterization sampling and analysis will be performed to ensure that materials that exhibit hazardous waste characteristics are not left on-site. If materials are determined to be hazardous, they will be disposed of at an off-site permitted facility.

Existing Infrastructure and Cover Elements of the Integrated IRM

As described in **Section 1.3**, there are several surface covers associated with existing infrastructure. Specifically, vegetated covers associated with the I-690/NY-695 corridor exist at the Site. These covers would be retained in Alternative 2, and consistent with the vegetated cover system described above for vegetated areas, these areas would not require further action. However, the extent of existing vegetation would be confirmed during design.

Also as described in **Section 1.3**, imported fill ranging in thickness from 2 to 7 ft has been placed in parking lots associated with the NYS Fairground. These covers would be retained in Alternative 2. These areas are anticipated to remain in commercial use (passive recreational use). While surface soil samples do not indicate widespread constituents over commercial SCOs in these areas, over 1 ft of gravel/fill material covers wastebed materials in these areas. The extent and thickness of gravel and imported fill material would be confirmed during design.

As described in **Section 1.4**, the Integrated IRM along the shorelines includes vegetated covers, seep aprons, shoreline stabilization and constructed wetlands. Vegetated covers and constructed wetlands incorporate cover or liner thicknesses that are 2 ft thick and are located in areas considered viable ecological habitat. Seep aprons consist of a total thickness of 18 inches of material (rock and soil), geotextile and geomembrane. Soil/fill material in these areas exhibits concentrations above SCOs for the protection of ecological resources. Consistent with the vegetated covers described above, the vegetated covers and wetland liners result in 2 ft of vegetated soil in these areas. While the seep aprons located in areas consist of thicknesses of less than 2 ft, the presence of stone, geotextile and geomembrane are considered adequate barriers to ecological receptors. Thus, elevated concentrations in these areas do not pose an unacceptable risk to ecological receptors as concentrations are below vegetated cover and wetland liners.

In addition to the shoreline areas, three staging areas associated with the Integrated IRM are located in upland areas. Restoration of these areas consisted of 6-inches of topsoil. These areas are considered potentially viable ecological habitat. Consistent with the vegetated cover types described above, an additional 18 inches would be placed over these areas to meet the vegetated cover requirements for such areas.

Clean fill staging areas were constructed using a minimum of 6 inches of crushed stone. Restoration for these areas will consist of placement of 6 inches of vegetated, clean fill. Additional cover thickness, if any, in these areas will be evaluated during design.

Continued Maintenance and Inspection of Integrated IRM Cover Elements

Cover system O&M for Integrated IRM elements would include monitoring to document that success criteria are met and to identify the need for corrective action(s), as warranted. Corrective actions for cover types/zones may consist of repair of cover cross-sections in areas of disturbance or re-application of vegetation in areas of non-survivorship. Maintenance of access roadways would be included in the cover system maintenance.

3.6.3 Alternative 3 – Enhanced Vegetated Cover System

Alternative 3 is a containment alternative that includes implementation of a vegetated cover system in addition to the other elements described for Alternative 2. Under this alternative, an enhanced cover system would be utilized, even though SCOs are achieved (as in Alternative 2). The enhanced vegetated cover system is based on reasonably anticipated future land uses at the Site. The enhanced vegetated cover system, which would consist of a collection of vegetation enhancement and vegetated soil covers based on land use and land form, would be applied over approximately 171 acres of the Site for the purpose of minimizing erosion and potential exposure of human and ecological receptors to contaminants in soil/fill material. As depicted on **Figure 3-2**, implementation of the enhanced vegetated cover system is proposed for a portion of the Site, extending from the shore of Onondaga Lake and Integrated IRM boundaries, to the south and southwest, including portions of Wastebeds 1 through 5. The anticipated percentages and corresponding acreages of the Site for the assumed different cover types listed on **Figure 3-2** are based on exceedances to SCOs and on land use. Similar to Alternative 2, Alternative 3 also includes long-term maintenance, institutional controls (*e.g.*, environmental easements, deed restrictions, and environmental notices), site management plan, periodic site reviews, and continued maintenance and inspection activities associated with the wetland and vegetated cover system being

implemented as part of the Integrated IRM. Existing parking lot surfaces and areas of established vegetation (*e.g.*, I-690/NY-695 corridor) will also be maintained under this alternative. The remedial components of Alternative 3 are the same as those described above for Alternative 2, however, in addition to areas addressed under Alternative 2, the enhanced vegetated cover system in Alternative 3 would include additional thickness for vegetation covers in areas not exceeding SCOs. Specifically, in certain areas identified for passive recreational use, a 1-ft vegetated cover would be used, even if corresponding SCOs are not exceeded. Similarly, in certain areas identified for active recreational use, a 2-ft vegetated cover would be used, even if corresponding SCOs are not exceeded. The specific differences are described below.

Vegetated Cover System

Consistent with the current and reasonably anticipated future land uses for the Site, a series of vegetated covers would be implemented in areas at the Site, as illustrated on **Figure 3-2**. As described in **Section 1.5**, the current and reasonably anticipated future land uses for the Site are commercial (passive recreational use), restricted residential (active recreational use), and ecological. Given current and anticipated development plans, Site recreational usage can be expected to be either active or passive recreational use. In addition, there are areas at the Site that given the steep terrain and heavy wooded nature, little, if any recreational use can be expected. Accordingly, vegetated cover systems would include vegetated soil covers, vegetated structural fill covers, and vegetation enhancements for the purposes of mitigating potentially unacceptable exposure risks and surface erosion in support of the reasonably anticipated future use of the Site and its surroundings. The following vegetated covers are anticipated to be utilized for areas with corresponding usages:

Vegetation Cover System in Areas of Passive Recreational Use

Vegetated soil covers in areas of passive recreational use (parking lots, areas surrounding the amphitheater and a buffer around the public recreation trail and parking lots), regardless of surface soil/fill material concentrations, would consist of the following:

- ***Vegetated soil cover***. A vegetated soil cover would consist of a vegetated soil layer having a thickness of 1 ft over existing soil/fill material. Native species would be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to attain relatively high growth rates and ecological function.
- ***Vegetated structural fill***. In areas where NYS Fairgrounds overflow parking is anticipated, a vegetated structural fill cover would be installed. The structural fill cover would consist of a 1 ft vegetated structural fill layer over existing soil/fill to support vehicle traffic and provide water holding capacity, rooting volume and growing conditions to support vegetation. Structural fill consists of a compacted mixture of aggregate and soil. For cost purposes, the structural fill mixture is assumed to consist of 1 ft of crushed stone and 20% clay loam topsoil. The thickness of structural fill would be evaluated during the design. The structural fill will be mixed and placed according to design specifications. Native species will be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to attain relatively high growth rates and ecological function.

Vegetated Covers in Areas of Active Recreational Use

Vegetated soil covers in areas of active recreational use (*e.g.*, lawn areas within the amphitheater), regardless of surface soil/fill material concentrations, would consist of the following:

- ***Vegetated soil cover***. A vegetated soil cover would consist of a 2 ft vegetated soil layer over existing soil/fill material. Native species will be applied. For the purpose of developing cost estimates, the seed application is anticipated to consist of a grassland seed mix native to New York State and selected for its ability to attain relatively high growth rates and ecological function.

Areas with Steep Slopes and/or Well-Established Vegetation

Vegetated covers in areas with steep slopes and/or well established vegetation where surface soil concentrations are below SCOs for commercial use or SCOs for the protection of ecological receptors, such as undeveloped upland areas and steep slopes, will consist of the following for the purpose of erosion control:

Vegetation enhancement. Vegetation enhancement would consist of supplementing existing vegetation and reduce erosion of surface soil/fill material. Seeds would be mixed with wood fiber mulch/compost and fertilizer as appropriate. Native species would be applied. In an effort to minimize disturbance to established vegetation at the Site, the application of vegetation enhancements would be conducted with minor clearing and grubbing of existing mature vegetation. For the purpose of the FS, vegetation enhancements are anticipated to be applied to areas of the Site with steep terrain or areas that are heavily wooded. Pilot testing conducted to date has identified mulch materials and seed mixes that provide successful vegetation enhancement and erosion control for the various terrains at the Site. For the purposes of cost estimation, the thickness of the mulch and seed application is anticipated to be approximately 4 inches. The thickness of application would be evaluated during the design.

Future IRM Staging Areas

As addressed above in the discussion of IRMs, Honeywell is constructing a 2.3-acre lake-connected wetland at the Wastebeds 1-8 site. The construction includes the hydraulic dredging of materials from the lakeshore area (see **Figure 3**). Materials that are hydraulically dredged will be managed at the Sediment Consolidation Area as part of the Onondaga Lake remedy. As needed, materials that cannot be hydraulically dredged (estimated to be approximately 17,500 CY) will be excavated and consolidated in an upland area of the Site and a 2-foot vegetated soil cover will be installed. Consistent with what was done under the IRM, prior to covering, characterization sampling and analysis will be performed to ensure that materials that exhibit hazardous waste characteristics are not left on-site. If materials are determined to be hazardous, they will be disposed of at an off-site permitted facility.

Based on the current anticipated future use, the enhanced vegetated cover system included in Alternative 3 is anticipated to include vegetation enhancement, 1 ft thick vegetated structural fill over portions of parking lots, a 2 ft thick vegetated cover over the Biosolids Area, 2 ft thick vegetated cover over active recreational areas within the proposed amphitheater, and a 1 ft vegetated cover for passive recreational areas such as areas in the vicinity of the proposed amphitheater and buffer areas around the public recreation areas and parking lots. Routine cover maintenance, including erosion repairs and inspections for integrity, would be implemented for each of the vegetated covers. A vector control program, to minimize disturbance of the cover that could jeopardize its integrity by burrowing animals, would also be implemented, if necessary. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

Because development plans are yet unknown for the whole Site, the exact boundaries of covers and seed application mixes within the anticipated footprint illustrated on **Figures 3-1 and 3-2** are unknown; however, for the purposes of cost estimation in this FS, assumptions for the extent of vegetation enhancements and vegetated covers have been made. These assumptions are presented in **Appendix B**. The extent of covers will be revisited during the design phase, at which time site use and corresponding surface concentrations will be revisited for consistency. Similarly, the thicknesses of covers that have been assumed will be revisited during design (*e.g.*, depending on site use). Implementation of vegetated cover systems would be conducted over several construction seasons in keeping with the availability of materials and optimum growing seasons, and to allow for adjustment in cover type as development plans dictate. The Alternative 3 cost estimate, presented in **Appendix B**, reflects this phased construction approach.

As described for Alternative 2, there are areas of the site where exceedances to SCOs do not pose unacceptable risks to receptors due to the presence of existing infrastructure or covers associated with the Integrated IRM cover or wetlands. Also, as described for Alternative 2, the extent of existing vegetation and the extent and thickness of gravel and imported fill material associated with existing infrastructure would be confirmed during design. In the event that sufficient thickness is not present in these areas, appropriate covers will be added, as appropriate. In addition, consistent with the vegetated cover types described above, an additional 18 inches would be placed over Integrated IRM staging areas to meet the vegetated cover requirements for such areas.

3.6.4 Alternative 4 – Excavation and Off-Site Disposal/Treatment/Reuse

Alternative 4 is an excavation and off-site management alternative that includes mechanical excavation of soil/fill material. The presence of I-690 and NY-695 over portions of the Site merit evaluation of full removal and partial removal. Additionally, the exceedingly large volume of material warrants evaluation of several options for management of the excavated material, including off-site disposal, treatment and/or reuse. These options are explored in variations of Alternative 4, as Alternatives 4A and 4B, as follows:

- Alternative 4A is intended to evaluate restoration to pre-disposal conditions through the excavation of soil/fill material. This alternative also includes the removal of the portions of I-690 and interchanges associated with NY-695 that traverse the Site. Management of excavated materials for this alternative could include off-site disposal and treatment and/or beneficial reuse of portions of the excavated volume of material. Restoration of the excavated area would constitute replacement of the pre-existing marshes (that existed prior to the creation of Wastebeds 1-8) along this shoreline of Onondaga Lake and replacement of removed portions of I-690 and interchanges associated with NY-695. Long-term maintenance of vegetated areas would be included in this option. A site management plan and periodic reviews would also be included in this option. No institutional controls related to soil/fill material would be envisioned with this option.
- Alternative 4B represents partial removal of soil/fill material, as the highways traversing the site would remain in place allowing continued, undisturbed use of these transportation features. Management of excavated materials for this option could include off-site disposal, treatment and/or beneficial reuse of portions of the excavated volume of material. Restoration of the excavated area would constitute replacement of the pre-existing salt marshes along this shoreline of Onondaga Lake and vegetated soil covers over soil/fill material remaining in the vicinity of the highway features. Long-term maintenance of vegetated areas would be included in this option. In the event that materials exhibiting concentrations greater than SCOs were to remain, this option would include institutional controls (*e.g.*, environmental easements, deed restrictions, and environmental notices) in addition to site management plan and periodic reviews.

  Institutional controls, a site management plan and periodic reviews would be the same as those described under Alternatives 2 and 3.

Excavation, management, restoration and O&M components for Alternative 4 are described below.

Mechanical Excavation of Soil/Fill Material for Alternative 4A

Mechanical excavation would be conducted to remove soil/fill material. Additionally, to support OU-1 excavation, approximately 6 miles of four lane interstate highway and several exit/entrance ramps would be removed and re-routed.

For cost estimating purposes, it was assumed that soil/fill material ranging in thickness from 8 to 75 ft would be removed from existing grade to the top of marl (a native material), which ranges from 356 to 362.5 ft above MSL, but generally lies at approximately 361 to 362 ft above MSL over the majority of the excavation area. Based on these approximate elevations, the total volume of soil/fill material in Alternative 4A is estimated at approximately 26 million cy *in situ*. Sloping techniques, benching, and/or engineering controls (*i.e.,* sheet piling) would be necessary during excavation to maintain stability of excavation walls. It has been assumed that dewatering of some of the soil/fill material would be required prior to off-site transportation. In addition, for remedial alternative cost estimate purposes, it was assumed that a portion of the excavated soil/fill material would require stabilization, due to anticipated liquid content, prior to transportation. It is anticipated that a total of 26.6 million cy (estimated to be approximately 32.0 million tons) of stabilized excavated soil/fill material would require off-site management.

In addition to Site soil/fill material to be excavated, approximately 70,000 cy of construction and demolition (C&D) material associated with the highways is also assumed to require removal and off-site management.

As part of Alternative 4A, it is also assumed that Integrated IRM components would be removed; however, Integrated IRM pump stations and conveyance piping could be utilized for the purpose of excavation dewatering during construction. Treatment of construction water is anticipated to be necessary. For purposes of this FS, the Sediment Consolidation Area (SCA) treatment plant would be repurposed to treat this construction water. Viability of this option would need to be further evaluated. In addition, it was assumed that for a portion of the

duration of excavations, the Integrated IRM components would remain in place. For purposes of this FS, operation and maintenance of the Integrated IRM is assumed for the first 15 years of the duration of excavation activities.

Off-Site Transportation and Disposal for Alternative 4A

Excavated material would be disposal off-site, or if a reuse opportunity were available, all or a portion of excavated material could be beneficially reused. For remedial alternative cost estimation purposes, it was assumed a total of 26.6 million cy (estimated to be approximately 32.0 million tons) of excavated and stabilized soil/fill material would be transported off-site. Based on a daily production rate of 3,200 cy per day for 10 months of the year, it is estimated that approximately 896,000 cy of material would be shipped off-site each year in 50,000 truck loads (180 truck loads per day) over a period of approximately 30 years. For remedial alternative cost estimation purposes excavated material was assumed to be disposed off-site as described below.

Due to concentrations of VOCs, it was assumed that a portion of the stained soil, would be treated prior to disposal or reuse. For remedial alternative cost estimate purposes, *ex situ* treatment using thermal treatment was assumed for a volume of approximately 1.7 million cy. Treated material was assumed to require disposal in an off-site non-hazardous waste landfill. This volume was assumed to be transported by truck to facilities within 200 miles of the Site.

For purposes of cost estimation, it was assumed that approximately 24.9 million cy of excavated soil/fill material would be suitable for disposal at a non-hazardous waste landfill. This volume was assumed to be transported by truck within 200 miles of the Site. It should be noted, that based on certain subsurface concentrations detected at the Site, some of the stained soil/fill may be hazardous. In addition, due to the exceedingly large volume of soil/fill, landfill capacity may not be available within the timeframe of anticipated construction. These factors would add to the implementability and cost of this alternative. In addition to the soil/fill being removed under this alternative, it was assumed that 70,000 cy of C&D material associated with the removal of portions of I-690 and NY-695 would be transported to an in-state C&D landfill for disposal. Based on the total estimated volumes of material to be transported off-site, it is estimated that a total of 1.5 million truckloads would be required.

Site Restoration for Alternative 4A

The portions of I-690 and NY-695 that were removed to support Site-wide excavation would be replaced. In addition, clean backfill would be transported via trucks from off-site borrow sources to the Site, requiring an estimated 1.9 million cy (approximately 85,000 truck trips), to restore excavated areas to an approximately 362.5 ft above MSL. Excavated areas would be restored with salt marsh vegetation or freshwater wetland vegetation, depending on optimum post-excavation conditions. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use institutional controls may be necessary.

Cost estimate assumptions are presented in **Appendix B**. Implementation of Alternative 4A is estimated to require 31 construction seasons. Removal of soil/fill material from the Site would be limited by the number of trucks available to transport soil/fill material and their capacity. Additionally, it is anticipated that multiple landfills would be required due to the volume of material landfills would be able to accept annually. The Alternative 4A cost estimate, presented below in **Appendix B**, reflects this phased construction approach.

Mechanical Excavation of Soil/Fill Material Alternative 4B

Mechanical excavation would be conducted to remove Site-wide soil/fill material, while retaining existing I-690 and NY-695.

For cost estimating purposes, it was assumed that soil/fill material ranging in thickness from 8 to 75 ft would be removed from existing grade to the top of marl, which ranges from Elevation 356 to 362.5 ft above MSL, but generally lies at approximately 361 to 362 ft above MSL over the majority of the excavation area except where material must remain either directly below or adjacent to highways necessary for support of those facilities. No removal is assumed within 30-ft of highway structures, and excavation would be conducted to achieve a temporary slope of 1:2 until an elevation of 362.5 ft above MSL is achieved, beyond which full depth of removal would occur. Based on these approximate elevations, the total volume of soil/fill material in Alternative 4B is estimated at approximately 23 million cy *in situ*. It is assumed that sloping techniques and/or engineering controls (*i.e.,* sheet piling) would be necessary during excavation to maintain stability of excavation walls. It has

been assumed that dewatering of some of the soil/fill material would be required prior to off-site transportation. In addition, for remedial alternative cost estimate purposes, it was assumed that a portion of the excavated soil/fill material would require stabilization prior to transportation resulting in a total of 23.4 million cy (equivalent to approximately 28.1 million tons) requiring off-site management.

As part of Alternative 4B, it is also assumed that Integrated IRM components would be removed; however, Integrated IRM pump stations and conveyance piping could be utilized for the purpose of excavation dewatering during construction. Treatment of construction water is anticipated to be necessary. For purposes of this FS, the SCA treatment plant would be repurposed to treat this construction water. Viability of this option would need to be further evaluated. In addition, it was assumed that for a portion of the duration of excavations, the Integrated IRM components would remain in place. For purposes of this FS, operation and maintenance of the Integrated IRM is assumed for the first 15 years of the duration of excavation activities.

Off-Site Transportation for Alternative 4B

For remedial alternative cost estimation purposes, it was assumed a total of 23.4 million cy (estimated to be approximately 28.1 million tons) of excavated and stabilized soil/fill material would be transported off-site. Based on a daily production rate of 3,200 cy per day for 10 months of the year, it is estimated that approximately 896,000 cy of material would be shipped off-site each year in 50,000 truck loads (180 truck loads per day) over a period of approximately 27 years.

Due to concentrations of VOCs, it was assumed that a portion of the stained soil would be treated prior to disposal or reuse. For remedial alternative cost estimate purposes, *ex situ* treatment using thermal treatment was assumed for a volume of approximately 1.7 million cy. Treated material was assumed to be beneficially reused off-site. This volume was assumed to be transported by truck to facilities within 400 miles of the Site.

For purposes of cost estimation, it was assumed that approximately 21.7 million cy of excavated soil/fill material would be suitable for reuse at an off-site facility. Potential beneficial reuses might include fill material, landfill cover, aggregate, or other beneficial use. However, beneficial reuse demand is highly project specific and, given the volumes of material to be re-used, it is assumed numerous beneficial reuse projects would need to be identified each year. For remedial cost estimating purposes, it has been assumed that suitable capacity would be identified within 400 miles of the New York State border, with transportation and disposal provided by trucking and evaluated on a ton-mile basis. Based on this assumption, 1.1 million truck trips would be generated from the assumed volume.

Site Restoration for Alternative 4B

Clean backfill would be transported via trucks from an off-site borrow source to the Site, requiring an estimated 1.4 million cy (approximately 63,000 truck trips), to restore excavated areas of Wastebeds 1-6 and associated shoreline areas to salt marsh or freshwater wetland vegetation, depending on optimum post-excavation conditions, at an approximate Elevation of 362.5 ft above MSL and excavated areas over Wastebeds 7 and 8 to an elevation of 380 ft above MSL and provide a stable sloping cover (1:3) outboard of existing Wastebeds 2, 3 and 4. Restoration of the slopes would be a 1 ft thick vegetated cover. The remainder of the outboard areas would be restored with salt marsh vegetation or freshwater wetland vegetation, depending on optimum post-excavation conditions. Because this alternative would result in contaminants remaining above levels that allow for unrestricted use and unlimited exposure, CERCLA requires that the Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

Cost estimate assumptions are presented in **Appendix B**. Implementation of Alternative 4B is estimated to require 27 construction seasons. Removal of soil/fill material from the Site would be limited by the number of trucks available to transport soil/fill material and their capacity. Additionally, it is anticipated that multiple reuse opportunities would be required due to the volume of material generated annually.

4. DETAILED ANALYSIS OF ALTERNATIVES

This section documents the detailed analysis of the four remedial alternatives that were developed during the FS for soil/fill material. The detailed analysis of the remedial alternatives was conducted consistent with *NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010a), the *Guidance for Developing Remedial Investigation and Feasibility Studies under CERCLA* (USEPA 1988) and consistent with the *Revised RI/FS Work Plan* (O'Brien & Gere 2006). This section describes the individual and comparative analysis of the remedial alternatives with respect to nine evaluation criteria that embody the specific statutory requirements that must be evaluated to satisfy the CERCLA remedy selection process.

4.1 INDIVIDUAL ANALYSIS OF ALTERNATIVES

The preamble to the NCP (Federal Register 1990) indicates that, during remedy selection, nine criteria should be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The two threshold criteria, overall protection of human health and the environment, and compliance with ARARs, must be satisfied in order for an alternative to be eligible for selection. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost are primary balancing criteria that are used to balance the differences between alternatives. The modifying criteria are state and community acceptance; they are formally considered by NYSDEC after public comment is received on the Proposed Plan.

The objective of the detailed analysis of alternatives was to analyze and present sufficient information to allow the alternatives to be compared and a remedy selected. The analysis consisted of an individual assessment of each alternative with respect to the evaluation criteria that encompass statutory requirements and overall feasibility and acceptability. The following evaluation criteria used in the detailed analysis of alternatives for this FS are:

- Overall protectiveness of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Consistent with NYSDEC DER-10, land use was also evaluated for each alternative. The evaluation of land use was included in the first criterion, overall protectiveness of human health and the environment. In the individual analysis of alternatives, each of the remedial alternatives was evaluated with respect to the above-listed evaluation criteria. The criteria are described below and the summary of this analysis is presented in **Table 4-1**.

4.1.1 Overall Protection of Human Health and the Environment

The analysis of each alternative with respect to this criterion provides an evaluation of whether the alternative would achieve and maintain adequate protection and a description of how Site risks would be eliminated, reduced, or controlled through treatment, engineering, or institutional controls.

In addition, pursuant to NYSDEC DER-10 Section 4.2(i), each alternative was assessed relative to the current, intended and reasonably anticipated future use of the Site and its surroundings by considering the following factors, as appropriate:

- Current land use and historical and/or recent development patterns
- Consistency of proposed land use with applicable zoning laws and maps
- Brownfield opportunity areas

- Consistency of proposed land use with applicable comprehensive master plans or any other applicable land-use plan formally adopted by a municipality
- Proximity to property currently used for residential use and to urban, commercial, industrial, agricultural and recreational areas
- Written and oral comments submitted by the public as part of citizen participation activities on the proposed land use
- Environmental justice concerns
- Proximity of the Site to cultural and natural resources
- Vulnerability of groundwater to contamination that might migrate from the Site
- Final use determination of the Site.

The evaluation of each alternative with respect to overall protection of human health and the environment and land use is presented in **Table 4-1**.

4.1.2 Compliance with Site-Specific Applicable or Relevant and Appropriate Requirements

Each alternative was evaluated to assess whether it would attain ARARs or provide grounds for invoking a waiver. Potential ARARs for the Site are presented in **Table 3-1**.

4.1.3 Long-Term Effectiveness and Permanence

Each alternative was evaluated to assess the long-term effectiveness and permanence it would afford. Factors considered, as appropriate, include:

- The magnitude of potential residual risk from materials remaining at the conclusion of the remedial activities. The characteristics of the remaining materials are considered to the degree that they remain hazardous, taking into account their mobility, toxicity and volume, as well as their propensity to bioaccumulate.
- The adequacy and reliability of controls, such as containment systems and institutional controls, necessary to manage materials left on Site. This factor addresses the uncertainties of remedial components, the assessment of the potential need to replace components of the alternative, and the potential exposure pathways and risks posed should the remedial action need replacement.

4.1.4 Reduction of Toxicity, Mobility or Volume through Treatment

For each alternative, the degree to which the alternative results in the reduction of mobility, toxicity or volume was assessed. Factors considered, as appropriate, include:

- The treatment or recycling processes the alternative would employ and the materials it would treat
- The amount of hazardous substances, pollutants, or contaminants that would be treated or recycled
- The degree of expected reduction of mobility, toxicity or volume of the waste due to treatment or recycling and the specification of which reduction(s) would occur
- The degree to which treatment would be irreversible
- The type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility and propensity to bioaccumulate such hazardous substances and their constituents
- The degree to which treatment would reduce the inherent hazards posed by the Site.

4.1.5 Short-Term Effectiveness

The short-term impacts of each alternative were assessed, considering the following:

- Short-term potential risks that might be posed to the community during implementation of the alternative

- Potential impacts to workers during implementation of the remedy and the effectiveness and reliability of protective measures
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation
- Time until protection would be achieved.

4.1.6 Implementability

Each alternative was assessed relative to the ease or difficulty of implementation by considering the following types of factors, as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy
- Administrative feasibility, including activities needed to coordinate with other offices and agencies
- Ability and time required to obtain any necessary approvals and permits from agencies
- Availability of services and materials, including the availability of adequate off-Site treatment, storage and disposal capacity and services; the availability of necessary equipment and specialists, provisions to obtain necessary additional resources; and the availability of prospective technologies.

4.1.7 Cost

Detailed cost estimates for Alternatives 1 through 4 are included as **Tables 4-2 through 4-6**. Assumptions used for the cost estimates are presented in **Appendix B**.

4.2 COMPARATIVE ANALYSIS OF ALTERNATIVES

The detailed analysis of alternatives also included a comparative evaluation designed to consider the relative performance of the alternatives and identify major trade-offs among them. The comparative evaluation of alternatives is presented in the following subsections. In the comparative analysis of alternatives, the performance of each alternative relative to the others was evaluated for each criterion.

As discussed in the following subsections, with the exception of Alternative 1, each alternative would satisfy the threshold criteria by providing protection to human health and the environment, and by addressing the identified ARARs. Therefore, Alternatives 2, 3, 4A, and 4B would be eligible for selection as the final remedy, however, Alternatives 4A and 4B would not be consistent with the current or anticipated future use of the Site. The relative comparison based on the primary balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) concludes that Alternatives 2 and 3 would satisfy the primary balancing criteria, as both alternatives would provide for adequate and reliable means of mitigating potentially unacceptable risks to human health and the environment through the implementation of vegetated cover systems. Additionally, vegetated cover systems and institutional controls in Alternatives 2 and 3 are readily implementable and cost effective. Alternatives 4A and 4B would provide for adequate and reliable means of mitigating potentially unacceptable risks to human health and the environment through excavation and off-site management of soil/fill material. However, the relative comparison based on the primary balancing criteria also concluded that Alternatives 4A and 4B would not satisfy the primary balancing criteria of implementability and cost. Due to the volume of soil associated with Alternatives 4A and 4B, there are significant implementability limitations associated with excavation, transportation, disposal and reuse capacity of this volume of material. Additionally, Alternatives 4A and 4B are not cost effective, with estimated capital present worth costs in the billions of dollars. In addition to not being implementable or cost-effective, Alternatives 4A and 4B also have limited effectiveness, primarily due to significant impacts to the surrounding community (*e.g.*, heavy truck traffic and associated safety hazards, significant rerouting of traffic, noise and odors), the substantial environmental footprint (*i.e.*, carbon footprint due to greenhouse gas emissions and fuel consumption) associated with the 27 to 30-year duration of remedy construction, and use of greenspace for off-site disposal.

As described in **Section 4.1**, the detailed evaluation with respect to the FS criteria for each of the alternatives is presented in **Table 4-1**.

4.2.1 Overall Protection of Human Health and the Environment

Alternative 1, the no action alternative, would not provide protection of human health and the environment, whereas Alternatives 2, 3, 4A, and 4B would each be protective of human health and the environment. Though Alternatives 4A and 4B provide protectiveness through removal of the soil/fill material, as opposed to Alternatives 2 and 3 that provide protectiveness through covering the soil/fill material, Alternatives 4A and 4B would be significantly disruptive to the surrounding community for over 25 years of remedy implementation. As described below, Alternative 3 would provide added protectiveness as compared to Alternative 2 through added thickness of vegetated covers for areas of the Site reasonably anticipated to be used for active and passive use.

Consistent with 6 NYCRR-1.8(f) and DER-10 4.2(i), the current, intended and reasonably anticipated future use of the Site was considered when selecting SCOs. Specifically, recreational uses are planned for portions of the Site, and the consideration of both active and passive recreational use was included in the evaluation of appropriate SCOs. The vegetated cover system features in Alternatives 2 and 3 were selected to address soil/fill material exceeding SCOs consistent with current, intended and reasonably anticipated future use of the Site. The cover system proposed in Alternative 3 includes cover thicknesses of 1 ft in passive recreational use areas and 2 ft in active recreational use areas, even where surface soil/fill material concentrations are below SCOs. The vegetated cover systems included in Alternatives 2 and 3 would be consistent with current, intended, and reasonably anticipated future land uses

Alternatives 1, 4A and 4B would not be consistent with current, intended and reasonably anticipated future use of the Site. Specifically, Alternative 1 would not be protective of human health and the environment and would therefore not be consistent. Alternatives 4A and 4B would not support current, intended, or anticipated future land use, since removal of the soil/fill material would eliminate NYS Fairgrounds overflow parking, the existing Onondaga County West Shore Trail Extension, the proposed Onondaga County amphitheater, and under Alternative 4A, the removal of Interstate 690 and interchanges to NYS Route 695 for a significant period of time.

Alternatives 2 and 3, in conjunction with existing parking lot surfaces and the actions taken on shoreline and near-shoreline areas including cover systems, mitigation wetlands and shoreline stabilization actions included in the Integrated IRM would be protective of human health and the environment through the use of vegetative cover systems which would control erosion of, and direct contact with soil/fill material. Institutional controls, site management plan, and continued inspection and maintenance of the cover systems would further preclude direct contact with soil/fill material and provide a means to evaluate continued protectiveness. Alternatives 2 and 3 would meet the RAOs by controlling erosion of soil/fill, and exposures to constituents in soil/fill materials that are above SCOs.

Alternatives 4A and 4B (full/partial restoration to pre-disposal conditions) would be protective of human health and the environment through removal and off-site management of soil/fill material and institutional controls. Both Alternatives 4A and 4B would meet RAOs through the removal of soil/fill materials and/or implementation of institutional controls. However, as described further in Section 4.2.5, implementation of Alternatives 4A and 4B would result in significant human hazards related to 27 to 30 years of heavy truck traffic and transportation miles and resultant roadway accidents and truck emissions. In addition, implementation of Alternatives 4A and 4B would result in significant impacts to the environment with greenhouse gas emissions and fuel consumption by construction equipment and transportation vehicles.

In summary, Alternatives 2, 3, 4A, and 4B would each be protective of human health and the environment and would address RAOs. Alternatives 4A and 4B would present significant long-term impacts to the surrounding community (*e.g.*, heavy truck traffic and associated hazards, significant rerouting of traffic, noise and odors), result in substantial environmental impacts (*i.e.*, large carbon footprint due to greenhouse gas emissions and fuel consumption), and would not be consistent with current, intended, and reasonably anticipated future land uses. While Alternatives 2 and 3 would both achieve protectiveness of human health and the environment and achieve RAOs, and are consistent with current, intended and reasonably anticipated future use of the Site, the

added cover thicknesses in Alternative 3 would provide some added protectiveness. Alternative 1 would not provide a similar level of protectiveness or achievement of RAOs.

4.2.2 Compliance with ARARs

Chemical-, location-, and action-specific ARARs identified for consideration in the FS are summarized in **Table 3-1**. Alternative 1 does not achieve chemical-specific ARARs. Exposures to soil/fill material exceeding chemical-specific ARARs would be managed through the vegetated cover systems, site management plan and institutional controls in Alternatives 2 and 3. In conjunction with existing parking lot surfaces and the actions taken on shoreline and near-shoreline areas including cover systems, mitigation wetlands and shoreline stabilization actions included in the Integrated IRM, exposures to OU-1 soil/fill material exceeding chemical-specific ARARs are fully addressed in these alternatives. Under Alternatives 4A and 4B, exposures to soil/fill material exceeding chemical-specific ARARs would be managed through excavation of soil/fill material to pre-disposal conditions or partial excavation in conjunction with site management and institutional controls. If SCOs for the protection of groundwater are applicable, vegetated covers in Alternatives 2 and 3, in addition to the cover systems included under the Integrated IRM, would address these through increased evapotranspiration rates and associated reduction in infiltration and the potential for Site soil to impact groundwater (this will be evaluated under OU-2). Alternatives 4A and 4B would address these SCOs through removal of the soil/fill material at the Site.

Construction methods and safety procedures would be implemented to adhere to the location- and action-specific ARARS identified for Alternatives 2, 3, 4A, and 4B. No action- or location-specific ARARs were identified for Alternative 1, the no action alternative. Alternatives 2, 3, 4A, and 4B would comply with the action-specific ARARs. Specifically, institutional controls would be implemented in Alternatives 2, 3, and 4B in general conformance with NYSDEC's guidance DER-33. Additionally, vegetated cover systems in Alternatives 2, 3 and 4B would prevent erosion and exposure to soil/fill material. Vegetated cover systems would be implemented in general conformance with NYSDEC's guidance DER-10. The additional cover thicknesses provided in Alternative 3 would provide added protectiveness over covers proposed in Alternative 2. Construction and O&M activities in Alternatives 2, 3, 4A, and 4B would be conducted in compliance with Occupational Safety and Health Administration requirements.

4.2.3 Long-term Effectiveness and Permanence

Alternative 1 would not provide long-term effectiveness and permanence, whereas Alternatives 2, 3, 4A, and 4B would. With respect to the magnitude of residual risk, potentially unacceptable human health risk associated with soil/fill material exceeding SCOs would remain in Alternative 1. In conjunction with existing parking lot surfaces and the actions taken on shoreline and near-shoreline areas including cover systems, mitigation wetlands and shoreline stabilization actions included in the Integrated IRM, potentially unacceptable human health risk associated with soil/fill material exceeding SCOs would be addressed in Alternatives 2 and 3 through vegetation cover systems, institutional controls, site management plan, and periodic reviews. Under Alternatives 4A and 4B, residual risks would be eliminated or addressed through the removal of soil/fill material (full and partial removal of soil/fill material, respectively) in conjunction with institutional controls, site management plan, periodic reviews and O&M.

No controls are included in Alternative 1. Maintained vegetated cover systems, institutional controls, site management, and periodic reviews included in Alternatives 2 and 3 would be adequate and reliable controls of potential risks associated with erosion of and exposure to constituents in soil/fill material at the Site. Additionally, the vegetated cover systems in Alternatives 2 and 3 and the removal of soil/fill material in Alternatives 4A and 4B would provide an adequate and reliable means to support the long-term effectiveness and permanence of the Onondaga Lake and NMC OU-2 remedies. Institutional controls, site management, and periodic reviews included in Alternative 4B would provide an adequate and reliable means of addressing potential risks associated with erosion of and exposure to constituents in soil/fill material remaining at the site below and in the immediate vicinity of I-690 and NYS Route 695. Institutional controls included in Alternatives 4A and 4B would provide an adequate and reliable means of addressing potential risks associated with residual groundwater contamination.

Alternatives 1, 2, and 3 offer long-term sustainability. Long-term O&M requirements in Alternatives 2 and 3 would result in minimal impact to the environment. The significant volume of soil/fill material requiring

excavation and off-site management in Alternatives 4A and 4B and the associated duration of 27 to 30 years to complete the removals would result in far greater long-term fuel consumption and greenhouse gas emissions as compared to the importing of construction materials and construction of vegetated covers in Alternatives 2 and 3. Alternatives 4A and 4B are significantly less sustainable over the long-term compared to Alternatives 2 and 3.

Alternatives 2, 3, 4A, and 4B would provide long-term effectiveness and permanence, while Alternative 1 would not. Residual risks in Alternatives 2, 3, and 4B are adequately and reliably addressed through institutional controls. Alternatives 1, 2, and 3 offer long-term sustainability, while Alternatives 4A and 4B is are less sustainable due to the long-term consumption of fuel (and associated emissions) and long-term negative impacts to the community.

4.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction in toxicity, mobility or volume provided in Alternative 1. Alternatives 2 and 3 would reduce mobility (*e.g.*, associated with erosion and infiltration) of COCs in soil/fill material through vegetated cover systems. Alternative 3 provides for greater reduction in mobility of soil/fill material constituents as compared to Alternative 2 due to placement of a vegetated cover in portions of the Site where only vegetation enhancement is included in Alternative 2. It should be noted that groundwater and seep collection systems implemented as part of the Integrated IRM also provide for reduction of mobility of COCs in groundwater. Alternatives 4A and 4B would reduce toxicity, mobility, and volume of COCs in soil/fill material through the excavation and off-site management of materials.

4.2.5 Short-term Effectiveness

Alternative 1, the no action alternative, does not provide short-term effectiveness. Alternatives 2, 3, and 4 would be constructed using proper protective equipment to manage potential risks to on-site workers, and proper precautions and monitoring to be protective of the general public and the environment. Alternatives 2 and 3 will meet RAOs for areas of the Site where vegetation is applied within 3 years of application, which is the estimated timeframe for vegetation to reach maturity. Alternatives 2 and 3 are anticipated to meet RAOs on a Site-wide basis within 6 to 8 years, the estimated timeframe for construction of vegetated cover systems. Alternatives 4A and 4B would require a significantly longer timeframe to implement as complete excavation is estimated to take place over approximately 30 years and 27 years, respectively. Due to the volume of soil/fill material requiring excavation and off-site management and the estimated construction duration, Alternatives 4A and 4B would result in substantial impacts to the community and the environment.

As it relates to short-term sustainability, there is an environmental footprint inherent to implementation of each alternative as it relates to construction and operation as well as impacts to the community. The implementation of the excavation and off-site disposal/reuse included in Alternatives 4A and 4B would result in far greater direct emissions and fuel consumption, as compared to importing construction materials and construction of covers included in Alternatives 2 and 3. Additionally, the vegetation associated with Alternatives 2 and 3, would sequester carbon which would off-set the environmental footprint associated with implementation. It is estimated that greenhouse gas emissions associated with transportation needs for Alternatives 4A and 4B would be approximately 1,495,000 and 850,000 metric tons of carbon dioxide equivalent ($MTCO_2e$), respectively, as compared to an estimated 1,000 $MTCO_2e$ for Alternatives 2 and 3. Alternative 2 and 3 represent the equivalent of the annual emissions of approximately 210 cars, however, excavation of materials in Alternatives 4A and 4B would represent adding an additional 180,000 to 315,000 cars.

Dust, emissions and surface water runoff controls would be implemented during construction phase activities associated with each of the active remedial alternatives. Only limited clearing and grubbing would be required under Alternative 2, while Alternative 3 would require additional clearing and grubbing of existing vegetation to support the implementation of vegetated soil cover systems. However, much of this work would need to be performed as part of the construction of the amphitheater. Comparatively, Alternatives 4A and 4B would require nearly site-wide clearing and grubbing of existing vegetation to support excavation activities. Installation of vegetated cover systems in Alternatives 2 and 3 and replacement of the pre-existing marshes (that existed prior to the creation of Wastebeds 1-8) in Alternatives 4A and 4B, would result in enhancements to existing ecological habitats.

Short-term environmental impacts resulting from construction of Alternatives 2 and 3 would be minimal, however, due to the increased quantity of materials and increased acreage of surfaces requiring clearing under Alternative 3, there is a slightly increased environmental footprint associated with Alternative 3 as compared to Alternative 2. However, much of this work would need to be performed as part of the construction of the amphitheater. Substantial negative short-term environmental impacts would result from soil/fill material excavation, transportation and off-site management activities associated with Alternatives 4A and 4B, compared to vegetated cover system construction activities associated with Alternatives 2 and 3. Alternative 4A would results in a greater environmental impact as compared to Alternative 4B due to the removal and reconstruction of portions of I-690 and NYS Route 695 which transect the Site.

Impacts to the community resulting from the construction of Alternatives 2, 3, 4A, and 4B would primarily be due to increased truck traffic and noise for the duration of construction. Because of the increased quantity of materials and enhanced vegetation cover associated with Alternative 3, there could be slightly increased impacts to the community relative to truck traffic and noise during the construction of Alternative 3 as compared to Alternative 2. Construction of Alternatives 4A and 4B would result in substantial long-term community impacts due to construction-related noise, odors, dust, and most notably traffic. As it relates to traffic, transportation of excavated materials in Alternatives 4A and 4B is anticipated to result in 1.3 to 1.5 million trucks trips to and from the Site as compared to 9,000 to 12,000 large trucks necessary for construction of Alternatives 2 and 3. Notably, according to the Insurance Institute for Highway Safety (IIHS) (IIHS 2014a), approximately one in ten highway deaths occur in an accident involving a large truck. Large truck drivers and drivers of passenger vehicles were involved in 1.3 fatal crashes per 100 million miles traveled in 2012 (IIHS 2014b). It is assumed that an estimated 500 to 590 million miles would be associated with transportation for Alternatives 4A and 4B. The increased traffic associated with Alternatives 4A and 4B presents a significant risk to worker and community safety.

Green remediation techniques, as detailed in NYSDEC's *Green Remediation Program Policy - DER-31* (NYSDEC 2011), would be considered for each alternative to reduce short-term environmental impacts. Green remediation best practices such as the following may be considered:

- Use of renewable energy and/or purchase of renewable energy credits to power energy needs during construction and/or operation and maintenance of the remedy
- Reduction in vehicle idling, including both on and off road vehicles and construction equipment during construction and/or operation and maintenance of the remedy
- Design of cover systems, to the extent possible, to be usable for alternate uses, require minimal maintenance (*e.g.* less mowing), allow for infiltration of storm water and/or be integrated with the planned use of the property. For example, the use of vegetated structural fill to create parkable surfaces as identified in both Alternatives 2 and 3, will address stormwater management in these areas, while resulting in a surface usable for current and intended land use in these area.
- Beneficial reuse of material that would otherwise be considered a waste
- Use of Ultra Low Sulfur Diesel (ULSD).

The vegetated cover system included in Alternatives 2 and 3 would be consistent with current and reasonably anticipated future use. Alternatives 1, 4A, and 4B would not be consistent with current and reasonably anticipated future use. Specifically, Alternative 1 would not be protective and would therefore not be consistent. Alternatives 4A and 4B would require removal of land mass that is currently occupied by NYS Fairgrounds parking lots, public recreation trail and the proposed amphitheater.

While excavation and removal of soil/fill material included in Alternatives 4A and 4B would attain RAOs, the impacts to the community and environment, anticipated future land use, and the duration of these alternatives as compared to Alternatives 2 and 3 make them highly undesirable means to attain the RAOs.

4.2.6 Implementability

Alternatives 2 and 3 can be readily constructed and operated; the materials necessary for the construction of Alternatives 2 and 3 are reasonably available. Vegetated cover systems in Alternatives 2 and 3 would incorporate constructible and reliable technologies. Monitoring the effectiveness of Alternatives 2 and 3 would be accomplished through vegetated cover systems inspections and maintenance to verify continued cover integrity, visual signs of erosion, and condition of the vegetative cover. Alternatives 4A and 4B are likely not implementable. Specifically, the following factors demonstrate that Alternatives 4A and 4B would be extremely difficult to implement:

Excavation and off-site management of 23 to 26 million cy of soil/fill material associated with Alternatives 4A and 4B would be much more difficult to implement than the cover placement contemplated in Alternatives 2 and 3. Specifically, there are significant implementability limitations associated with excavation, transportation, disposal and reuse capacity of this volume of material. These are discussed as follows:

- *Excavation of anticipated volumes would be very difficult.* Excavation considerations that limit the implementability of Alternatives 4A and 4B include construction water management, air quality and odors. Construction water management is anticipated to be significant during excavation of the approximately 5 to 70-ft thick area of 280 to 340 acres (including excavation below the groundwater table) anticipated in Alternatives 4A and 4B. Treatment capacity is assumed to be available through repurposing of the SCA Treatment Plant, however, viability of this option would require further evaluation. Air quality and odors are anticipated to be controlled during construction, however, given the elevated concentrations of VOCs in the stained material, volatilization of VOCs and generation of odors may hinder productivity and, thus, may result in significant delays to the implementation timeframe of this alternative.
- *Transportation of anticipated volumes presents significant hazards and disruption to community.* Transportation considerations that severely limit the implementability of Alternatives 4A and 4B include significantly increased traffic, fuel usage and adverse effects on air quality and community safety. It is estimated that approximately 896,000 cy of material would be shipped off-site each year in 50,000 truck loads (180 truck loads per day). During an 8-hour work day, this would equate to approximately 1 truck entering or leaving the Site every 3 minutes. In addition to the potentially significant effects on local air quality and community traffic patterns, traffic of this magnitude is anticipated to result in significant effects on conditions of roadways.
- *Sufficient capacity for disposal of anticipated volumes may not exist.* Due to the volume anticipated to be excavated, off-site disposal capacity for excavated materials would be a critical factor for Alternatives 4A and 4B and significantly limit the implementability of these alternatives. An estimated 23.4 to 26.6 million cy (estimated to be approximately 28.1 to 32.0 million tons) would require off-site disposal under Alternatives 4A and 4B. Given the magnitude of this volume, multiple commercial landfill facilities would be necessary. While disposal within 200 miles of the Site has been assumed for cost estimation purposes, given the timeframe of approximately 27 to 30 years to implement Alternatives 4A and 4B, it is not possible to reliably predict that disposal capacity for this volume of material would exist within the assumed distance from the Site. Lack of landfill capacity would result in significant delays to the implementation timeframe of this alternative.
- *Limited reuse options for anticipated volumes of material.* Due to the volume anticipated to be excavated, reuse opportunities for excavated materials are anticipated to be a critical factor for Alternatives 4A and 4B and significantly limits the implementability of these alternatives. It should be noted that the physical and geotechnical characteristics of this material would restrict potential options for its reuse. Notwithstanding these limitations based on physical characteristics and given the magnitude of this volume, it is anticipated that multiple end-use facilities would be necessary. While reuse within 400 miles of the Site has been assumed for cost estimation purposes, it is unlikely that reuse capacity for this volume of material would exist given the timeframe of approximately 27 to 30 years to implement Alternatives 4A and 4B. Lack of reuse capacity would result in an even longer timeframe for implementation of this alternative.

Each alternative would require coordination with other agencies, including NYSDEC, NYSDOH, USEPA, New York State Department of Agriculture and Markets (NYS Fairgrounds), Onondaga County, and the Town of Geddes.

The necessary equipment and specialists would be available for each alternative. Cover system construction materials are anticipated to be available; however, material sources and availability of cover system materials would be further evaluated during the design.

4.2.7 Cost

Detailed cost estimates for Alternatives 2, 3, 4A, and 4B are included as **Tables 4-2** through **4-6.** Associated cost assumptions are presented in **Appendix B**. The costs associated with Alternatives 1, 2, 3, 4A, and 4B are summarized as follows:

Alternative	Total estimated capital present worth cost	Total estimated present worth of O&M (30 yrs)	Total estimated net present worth cost
1 – No Action	$0	$0	$0
2 – Vegetated Cover System	$14.3 Million	$2.3 Million	$16.6 Million
3 – Enhanced Vegetated Cover System	$17.8 Million	$2.2 Million	$20.0 Million
4 – Excavation and Off-site Disposal/Treatment/Reuse			
4A – Full Removal	$6,135 Million (6.1 Billion)	$7.0 Million	$6,142 Million (6.1 Billion)
4B – Partial Removal	$5,124 Million (5.1 Billion)	$6.0 Million	$ 5,130 Million (5.1 Billion)

5. CONCLUSIONS

To provide long-lasting protection to human health and environment, and restore the Onondaga Lake shore to the community, four remedial alternatives were developed and evaluated for OU-1 in this FS Report. Specifically, this FS Report documents the development of RAOs for the protection of human health and the environment to address contaminants identified for WB 1-8 OU-1. Consistent with DER-10 and the NCP, the four remedial alternatives developed to address these RAOs were evaluated based on required evaluation criteria and in sufficient detail such that risk management decision makers may select a remedy for the site.

As part of the process established for remedial alternatives under the ACO, following review of the evaluations documented in this FS Report, NYSDEC and USEPA will identify an alternative to propose as the preferred remedy to be documented in a Proposed Plan for OU-1. Following receipt of public comments on the Proposed Plan, the selected remedial alternative will be documented in a ROD of OU-1.

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Tables

TABLE 1-1. INTERIM REMEDIAL MEASURE AND FEASIBILITY STUDY MEDIA SUMMARY

Site Media	Site Area	Integrated IRM	NMC OU-2 Remedy	OL Remedy	OU-2 FS	OU-1 FS
Refer to Figure 1-3, IRM and FS Site Media, for graphical depiction of remedy areas (e.g., "Area FS-A") where noted below.						
Soil/Fill Material	Shoreline Areas	***Area IRM-A, IRM-B, IRM-C*** • Mitigation wetlands, cover systems, and shoreline stabilization address erosion and potential exposure to COCs	***Area NMC-A*** • Shoreline stabilization addressees erosion along NMC shoreline	***Area OL-A*** • Shoreline stabilization addresses erosion along Eastern and Northern shorelines	None	None. Erosion potential and direct contact addressed by Integrated IRM
	Upland Areas	***Area IRM-A*** • Shoreline stabilization revetment (Lakeview Point), and lower Ditch A/lower middle reach Ditch A restoration address erosion and potential exposure to COCs ***Area IRM-D*** • Restoration of clean fill staging areas addresses erosion and potential exposure to COCs. Restoration of Integrated IRM staging areas for excavation spoils will be included in the OU-1 FS	None	None		***Area FS-A*** • Erosion and potential risk over upland portions of the Site not addressed by Integrated IRM ***Area FS-B*** • Erosion and potential risk along middle reach of Ditch A sloped areas not addressed by Integrated IRM ***Area FS-C*** • Restoration of Integrated IRM staging areas with Part 375 Ecological exceedances addresses erosion and potential exposure to COCs
Groundwater	Shallow and Intermediate Groundwater	***Areas IRM-A, IRM-B, IRM-C*** • Groundwater collection along Eastern shoreline, Northern shoreline, and along NMC address potential migration	None	None	***Site-wide*** • Potential risk to be addressed in OU-2 FS ***Area FS-D*** • Potential migration for areas, if any, not addressed in Integrated IRM around Lakeview point and at the mouth of NMC ***Area FS-E*** • Groundwater collection along section of Ditch A (lower middle reach Ditch A) behind Crucible parking area address potential migration	None
	Intermediate Groundwater (Deltaic Deposits)	***Area IRM-B*** • Groundwater collection along Northern shoreline partially addresses potential migration				
	Deep Groundwater	None			***Site-wide*** • Potential risk and potential migration, if any, to be addressed in OU-2 FS	

Notes:
COC - Constituent of Concern
IRM - Interim Remedial Measures
FS - Feasibility Study
NMC - Ninemile Creek
OL - Onondaga Lake
OU - Operable Unit

TABLE 3-1. POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Medium/Location/ Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Potential chemical-specific ARARs and TBCs					
Soil/fill material	6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives	Promulgated state regulation that provides guidance for soil cleanup objectives for various restricted property uses (industrial, commercial, restricted residential, and residential), for the protection of groundwater and ecological resources, and for unrestricted property use. Commercial use includes passive recreational use that refers to recreational uses with limited potential for soil contact, such as: (1) artificial surface fields; (2) outdoor tennis or basketball courts; (3) other paved recreational facilities used for roller hockey, roller skating, shuffle board, etc.; (4) outdoor pools; (5) indoor sports or recreational facilities; (6) golf courses; and (7) paved (raised) bike or walking paths (DER-10 (NYSDEC 2010)). Restricted residential includes active recreational use that refers to recreational activities with a reasonable potential for soil contact, such as: (1) designated picnic areas; (2) playgrounds; or (3) natural grass sports playing fields, including surrounding unpaved spectator areas (DER-10 (NYSDEC 2010)).	Soil cleanup objectives for restricted use (Restricted residential and commercial) are potentially relevant and appropriate to site soil/fill material for areas where reasonably anticipated future property use includes active recreational use and passive recreational use, respectively. Soil cleanup objectives for the protection of ecological resources are potentially relevant and appropriate to site soil/fill material for areas other than where conditions of the land (*e.g.* , paved, covered by impervious surfaces, buildings or other structures) preclude the existence of ecological resources. Soil cleanup objectives for the protection of groundwater may not be applicable, relevant or appropriate because migration of shallow/intermediate groundwater is currently being controlled, however, they are being considered for this FS.	Yes	No
Potential location-specific ARARs and TBCs					
Construction of Buildings	NYSDOH's October 2006 Guidance for Evaluating Soil Vapor Intrusion in the State of New York	Guidance document that provides thresholds for indoor air and subslab soil vapor above which vapor mitigation is required.	Not currently applicable, because no buildings are present on the Site. Potentially applicable if future buildings are constructed at the Site.	No	Yes
Water Bodies	33 CFR 320 - 330	Regulatory policies and permit requirements for work affecting waters of the United States and navigable waterways.	Substantive, non-administrative requirements potentially applicable to work affecting Ninemile Creek or Onondaga Lake.	Yes	No
Wetlands	6 NYCRR 663 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 ft) must be approved by NYSDEC or its designee. Activities occurring adjacent to freshwater wetlands must: be compatible with preservation, protection, and conservation of wetlands and benefits; result in no more than insubstantial degradation to or loss of any part of the wetland; and be compatible with public health and welfare.	Delineated wetlands at the site are on the eastern shore, and are not within the footprint of upland portions of the site to be addressed in the FS. However, substantive requirements are potentially applicable for activities being implemented in proximity of delineated wetlands at the site.	Yes	No
	Clean Water Act Section 404 33 CFR Parts 320 - 330	Regulatory policies and permit requirements for work affecting waters of the United States, including wetlands.	Delineated wetlands at the site are on the eastern shore, and are not within the footprint of upland portions of the site to be addressed in the FS. However, substantive requirements are potentially applicable for activities being implemented in proximity of delineated wetlands at the site.	Yes	No
	Clean Water Act Section 404 40 CFR Parts 230-231	Provides for restoration and maintenance of integrity of waters of the United States, including wetlands, through the control of dredged or fill material discharge.	Delineated wetlands at the site are on the eastern shore, and are not within the footprint of upland portions of the site to be addressed in the FS. However, substantive requirements are potentially applicable for activities being implemented in proximity of delineated wetlands at the site.	Yes	No
	Executive Order 11990 - Protection of Wetlands	Executive order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or loss of wetlands if a practical alternative exists.	Delineated wetlands at the site are on the eastern shore, and are not within the footprint of upland portions of the site to be addressed in the FS. However, potentially applicable for activities being implemented in proximity of delineated wetlands at the site.	Yes	No
Wetlands & Floodplains	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-2; 1985)	Policy and guidance requiring Superfund actions to meet substantive requirements of Executive Orders 11988 and 11990. Describes requirements for floodplain assessment during remedial action planning.	Not applicable or relevant and appropriate if during OU-1 remedy design it is confirmed that all OU-1 remedial activities will occur outside the 100-year and 500-year floodplains as defined by FEMA. A floodplain and wetland assessment was completed for the shorelines of the site. If an additional floodplain assessment is required for the OU-1 remedy area based on remedial design findings, a floodplain assessment would be completed. The assessment would document a description of the proposed OU-1 remedial actions and other remedial alternatives considered, the effects of the proposed action and other remedial alternatives on the floodplain, and measures to mitigate potential impacts to the floodplain. Upland portions of the site addressed in the FS are not within the 100-year floodplain or delineated wetlands at the site.	No	Yes
	Policy on Flood Plains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-02)	Federal guidance that provides requirements for wetlands and floodplain assessments.	Not applicable or relevant and appropriate if during OU-1 remedy design it is confirmed that all OU-1 remedial activities will occur outside the 100-year and 500-year floodplains as defined by FEMA. A floodplain and wetland assessment was completed for the shorelines of the site. If an additional floodplain assessment is required for the OU-1 remedy area based on remedial design findings, a floodplain assessment would be completed consistent with OSWER Directive 9280.0-02). Upland portions of the site addressed in the FS are not within the 100-year floodplain or delineated wetlands at the site.	No	No

TABLE 3-1. POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Medium/Location/ Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Potential location-specific ARARs and TBCs (continued)					
Floodplains	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities -100-yr floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-yr flood.	Not applicable or relevant and appropriate. Wetland and 100-yr floodplain are not present within upland portions of the site to be addressed in the FS. Further, no hazardous waste treatment, storage, or disposal facilities are planned to be located on site.	No	No
	40 CFR Part 264.18(b) - Location Standards - Floodplains	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-yr flood.	Not applicable or relevant and appropriate. Wetland and floodplain are not present within upland portions of the site to be addressed in the FS. Further, no hazardous waste treatment, storage, or disposal facilities are planned to be located on site.	No	No
	Executive Order 11988 - Floodplain Management	USEPA is required to conduct activities to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupation or modification of floodplains. The procedures also require USEPA to avoid direct or indirect support of floodplain development wherever there are practicable alternatives and minimize potential harm to floodplains when there are no practicable alternatives.	Not applicable or relevant and appropriate if during OU-1 remedy design it is confirmed that all OU-1 remedial activities will occur outside the 100-year and 500-year floodplains as defined by FEMA and wetlands. Wetland and floodplain are not believed to be present within upland portions of the site to be addressed in the FS. If, during design, portions of the OU-1 remedy are found to be within the floodplain or a wetland, remedial activities will be conducted in a manner so as to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupation or modification of floodplains.	No	No
	6 NYCRR 500 - Floodplain Management Regulations Development Permits	Promulgated state regulations providing permit requirements for development in areas of special flood hazard (floodplain within a community subject to a one percent or greater chance of flooding in any given year).	Not applicable or relevant and appropriate if during OU-1 remedy design it is confirmed that all OU-1 remedial activities will occur outside the 100-year and 500-year floodplains as defined by FEMA and wetlands. Wetland and floodplain are not believed to be present within upland portions of the site to be addressed in the FS. If, during design, portions of the OU-1 remedy are found to be within the floodplain or a wetland, remedial activities would be conducted in accordance with the statutory requirements of flood-associated permits.	No	No
	Town of Geddes Flood Protection Ordinance	Permit requirements for work in areas of special flood hazard.	Not applicable or relevant and appropriate if during OU-1 remedy design it is confirmed that all OU-1 remedial activities will occur outside the 100-year and 500-year floodplains as defined by FEMA and wetlands. Floodplain is not believed to be present within upland portions of the site to be addressed in the FS. If, during design, portions of the OU-1 remedy are found to be within the floodplain or a wetland, remedial activities would be conducted in accordance with the statutory requirements of Town of Geddes Flood Protection Ordinances.	No	No
Within 61 meters (200 ft) of a fault displaced in Holocene time	40 CFR Part 264.18(a) - Location Standards - Seismic considerations	New treatment, storage, or disposal of hazardous waste is not allowed.	Not applicable or relevant and appropriate. Site is not located within 200 ft of a fault displaced in Holocene time, as listed in 40 CFR 264 Appendix VI. None listed in New York State.	No	No
Within salt dome or bed formation, underground mine, or cave	40 CFR Part 264.18 (c) - Location standards; salt dome formations, salt bed formations, underground mines and caves.	Placement of non-containerized or bulk liquid hazardous waste is not allowed.	Not applicable or relevant and appropriate. No salt dome formations, salt bed formations, underground mines or caves present at site.	No	No
Habitat of an endangered or threatened species	6 NYCRR 182	Promulgated state regulation that provides requirements to minimize damage to habitat of an endangered species.	Not applicable or relevant and appropriate. No endangered or threatened wildlife species, rare plants or significant habitats were identified at the site. One threatened plant within 2 miles of site on north shore of Onondaga Lake not anticipated to be impacted by site activities.	No	No
	Endangered Species Act	Provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction.	Not applicable or relevant and appropriate. No endangered or threatened wildlife species, rare plants or significant habitats were identified at the site. One threatened plant within 2 miles of site on north shore of Onondaga Lake not anticipated to be impacted by site activities.	No	No
	50 CFR Part 17 - Endangered and Threatened Wildlife and Plants and 50 CFR Part 402 - Interagency Cooperation	Promulgated federal regulation that requires that federal agencies ensure authorized, funded, or executed actions will not destroy or have adverse modification of critical habitat.	Not applicable or relevant and appropriate. No endangered or threatened wildlife species, rare plants or significant habitats were identified at the site. One threatened plant within 2 miles of site on north shore of Onondaga Lake not anticipated to be impacted by site activities.	No	No

TABLE 3-1. POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Medium/Location/ Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Potential location-specific ARARs and TBCs (continued)					
Historical property or district	National Historic Preservation Act 36 CFR 800- Preservation of Historic Properties Owned by a Federal Agency	Remedial actions are required to account for the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places.	Potentially applicable. A draft Phase 1 assessment identified the potential for prehistoric and historic resources in and in the vicinity of the Site.	Yes	No
	National Historic Preservation Act 36 CFR Part 65 - National Historic Landmarks Program	Promulgated federal regulation requiring that actions must be taken to preserve and recover historical/archeological artifacts found.	Potentially applicable. A draft Phase 1 assessment identified the potential for prehistoric and historic resources in and in the vicinity of the Site.	Yes	No
	New York State Historic Preservation Act of 1980 9 NYCRR Parts 426 - 428	State law and regulations requiring the protection of historic, architectural, archeological and cultural property.	Potentially applicable. A draft Phase 1 assessment identified the potential for prehistoric and historic resources in and in the vicinity of the Site.	Yes	No
Wilderness area	Wilderness Act 50 CFR Part 35 - Wilderness Preservation and Management	Provides for protection of federally-owned designated wilderness areas.	Not applicable or relevant and appropriate. Site not located in wilderness area.	No	No
Wild, scenic, or recreational river	Wild and Scenic Rivers Act	Provides for protection of areas specified as wild, scenic, or recreational.	Not applicable or relevant and appropriate. Site not located near wild, scenic or recreational river.	No	No
Coastal zone	Coastal Zone Management Act	Requires activities be conducted consistent with approved State management programs.	Not applicable or relevant and appropriate. Site not located in coastal zone.	No	No
Coastal barrier	Coastal Barrier Resources Act	Prohibits any new Federal expenditure within the Coastal Barrier Resource System.	Not applicable or relevant and appropriate. Site not located in coastal barrier.	No	No
Protection of waters	33 U.S.C. 1341 - Clean Water Act Section 401, State Water Quality Certification Program	States have the authority to veto or place conditions on federally permitted activities that may result in water pollution.	Potentially applicable to site.	Yes	Yes
Potential action-specific ARARs and TBCs					
Institutional controls	NYSDEC DER-33 Institutional Controls: A Guide to Drafting and Recording Institutional Controls, December 2010	Technical guidance document that provides guidelines for proper development and recording of institutional controls as part of a site remedial program.	Potentially applicable TBC when institutional controls are implemented as a component of the selected remedy.	No	Yes
Cover systems	NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010	Technical guidance document that provides guidelines for cover thicknesses as they relate to property use in areas where exposed surface soil exceeds NYCRR Part 375 soil cleanup objectives. Specifically, where the exposed surface soil at the site exceeds the applicable SCO for protection of human health and/or ecological resources, the soil cover for restricted residential use, is to be two feet; for commercial or industrial use, is to be one foot; or when an ecological resource has been identified is to be a minimum of two feet; and when such a concern is identified by DEC, consideration should be given to supplementing the demarcation layer to serve as an impediment to burrowing.	Potentially applicable TBC for cover alternatives.	No	Yes
Landfilling of solid wastes	40 CFR Part 257 - Criteria for Classification of Solid Waste Disposal Facilities and Practices	Promulgated federal regulation that provides criteria for solid waste disposal facilities to protect health and the environment.	Landfilling of wastes may be applicable for the site.	Yes	No
Generation and management of solid waste	6 NYCRR 360 - Solid Waste Management Facilities	Promulgated state regulation that provides requirements for management of solid wastes, including disposal and closure of disposal facilities.	Potentially applicable to alternatives including disposal of residuals generated by treatment processes as well as capping alternatives.	Yes	No

TABLE 3-1. POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Medium/Location/ Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Potential action-specific ARARs and TBCs (continued)					
Land disposal	6 NYCRR 376 - Land Disposal Restrictions	Promulgated federal and state regulations that provide treatment standards to be met prior to land disposal of hazardous wastes.	Potentially applicable.	Yes	No
	40 CFR Part 268 - Land Disposal Restrictions				
	62 CFR 25997 - Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes				
Beneficial use	6 NYCRR 360 - General Provisions, Beneficial Use	Promulgated federal and state regulations that provide criteria for beneficial use and recycling of solids wastes and soils. Provisions for case-specific beneficial use and recycling are also identified.	Potentially applicable to alternatives including beneficial use of excavated soil/fill material.	Yes	No
	60 CFR 261 - Solid Waste Recycling/Reuse				
Green remediation	NYSDEC DER-31 Green Remediation Program Policy, January 2011	State and federal technical guidance documents that provide guidelines for the development of site remediation strategies in a manner that minimizes environmental impacts and applies green remediation concepts (e.*g.,* reduction in green house gas emissions, energy consumption and resource use, promotion of recycling of materials and conservations of water, land and habitat).	Potentially applicable TBC	No	Yes
	Superfund Green Remediation Strategy, September 2010				
General excavation	6 NYCRR 257 - Air Quality Standards	Promulgated state regulation that provides specific limits on generation of SO_2, particulates, CO_2, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides, beryllium and H2S from point sources.	No air emissions sources anticipated as part of alternatives.	No	No
	40 CFR Part 50.1 - 50.12 - National Ambient Air Quality Standards	Promulgated federal regulation that provides air quality standards for pollutants considered harmful to public health and the environment. The six principle pollutants are carbon monoxide, lead, nitrogen dioxide, particulates, ozone, and sulfur oxides.	Potentially applicable to alternatives during which dust generation may result, such as during earth moving, grading, and excavation.	Yes	No
	NYS TAGM 4031 - Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites	State guidance document that provides limitations on dust emissions.	To be considered material where more stringent than air-related ARARs.	No	Yes
Construction	29 CFR Part 1910.120 - Occupational Safety and Health Standards - Hazardous Waste Operations and Emergency Response	Promulgated federal regulation requiring that remedial activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes	No
	29 CFR Part 1926 - Safety and Health Regulations for Construction	Promulgated federal regulation requiring that remedial construction activities must be in accordance with applicable OSHA requirements.	Potentially applicable for construction activities.	Yes	No
Transportation	6 NYCRR 364 - Waste Transporter Permits	Promulgated state regulation requiring that hazardous waste transport must be conducted by a hauler permitted under 6 NYCRR 364.	Potentially applicable.	Yes	No
	49 CFR 107, 171-174 and 177-179 - Department of Transportation Regulations	Promulgated federal regulation requiring that hazardous waste transport to offsite disposal facilities must be conducted in accordance with applicable DOT requirements.	Potentially applicable.	Yes	No

Notes:

ARARs - Applicable or Relevant and Appropriate Requirements
CERLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations
DOT - Department of Transportation
FEMA - Federal Emergency Management Agency
FS - Feasibility Study
FT - Feet or Foot
IRM - Interim Remedial Measure
NYCRR - New York Code of Rules and Regulations
NYSDEC - New York State Department of Environmental Conservation
NYSDOH - New York State Department of Environmental Conservation
OSHA - Occupational Safety and Health Administration
OSWER - Office of Solid Waste and Emergency Response
OU - Operable Unit
RI - Remedial Investigation
SCO - Soil Cleanup Objectives
SPDES - State Pollutant Discharge Elimination System
SVOCs - Semi Volatile Organic Compounds
TAGM - Technical and Administrative Guidance Memorandum
TBC - To be Considered
TOGS - Technical and Operational Guidance Series
USC - United States Code
USEPA or EPA - United States Environmental Protection Agency
USFWS - United States Fish and Wildlife Service
Shaded cells - not identified as Potential ARARs or TBCs

TABLE 3-2. SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	RELATIVE COST	SCREENING COMMENTS	RETAINED FOR FURTHER CONSIDERATION
No Action	No action	No action*	No action. Discontinuation of O&M for existing Integrated IRM elements.	Implementable	Not effective in mitigating potential for erosion of, or contact with exposed soil/fill material in areas not addressed by the IRM.	No capital No O&M	Required for consideration by the NCP (40 CFR Part 300.430) and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.	Yes
Institutional controls/Limited actions	Access/use restrictions/administrative control(s)	Institutional controls	Implementation and documentation of access and land use restrictions that would require activities that would potentially disturb or expose contaminated soil/fill material (and require health and safety precautions) be conducted in accordance with the site management plan. Institutional controls would also provide provisions to evaluate and address potential soil vapor intrusion if a new building(s) is constructed at the Site.	Implementable. Requires property owner agreement/implementation.	Effective means of controlling site use.	Low capital cost No O&M cost	Potentially applicable	Yes
	Site controls	Site management plan*	Documentation of site restrictions and provisions for continued operation and maintenance of the remedy. Presents site engineering and institutional controls and physical components of the selected remedy requiring operation, maintenance and monitoring to provide continued effectiveness. The site management plan would also present provisions for periodic site reviews.	Implementable	Effective means of controlling site use.	Low capital cost No O&M cost	Potentially applicable	Yes
	Periodic reviews	Periodic site reviews*	Periodic reviews are required by DER-10 where institutional and engineering controls, monitoring plans, and/or operations and maintenance activities are implemented on a site. The purpose of the reviews is to evaluate the areas in regard to the continuing protection of human health and the environment and to provide documentation of remedy effectiveness. Periodic site reviews would include the performance of Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.	Readily implementable.	Effective means of evaluating continued protection to human health and the environment.	No capital Low O&M	Potentially applicable	Yes
Containment	Vegetated cover system	Vegetation enhancement*	Use of enhanced vegetative growth to reduce erosion of surface soil/fill material. Can be applied using hydroseeding techniques (i.e., blown or sprayed on), and can be mixed with wood or paper mulch during application.	Implementable. Site pilot testing has demonstrated successful vegetation enhancement using mulch and seed application.	Effective for reducing surface soil/fill material erosion due to surface water/storm water flow or wind. Thick vegetation is effective at inhibiting contact with soil/fill material. Pilot testing indicates vegetation enhancement also improves evapotranspiration.	Medium capital Low O&M	Potentially applicable.	Yes
		Soil amendment	Soil amendments are materials that are added to surface soil/fill material to improve its physical, chemical or biological properties to provide conditions necessary to enhance vegetative growth. Soil amendments would support vegetation and reduce erosion.	Implementable with substantial clearing and Site work.	Effective for sustaining vegetation which, in turn, provides effective erosion control. Thick vegetation is effective at inhibiting contact with soil/fill material. Pilot testing indicates vegetation enhancement also improves evapotranspiration.	Medium to high capital Low O&M	Potentially applicable for portions of Site.	No
		Vegetated cover*	Use of vegetated soil cover to minimize erosion of surface soil/fill material and prevent direct contact with soil/fill material.	Implementable	Effective means of minimizing erosion of, and contact with exposed surface soil and soil/fill material. Vegetation also improves evapotranspiration. It is anticipated that an added benefit of a vegetated cover would be reduction in infiltration.	Medium capital Low O&M	Potentially applicable.	Yes
		Vegetated structural fill*	Use of engineered structural fill material as a structural base for parking and traffic areas. The structural fill is vegetated to enhance evapotranspiration properties of the cover. The structural fill material provides water holding capacity, rooting volume and growing conditions to support vegetation.	Implementable	Effective means of minimizing erosion of, and contact with exposed soil/fill material. Water holding capacity and vegetation effective for surface water management through promotion of evapotranspiration. It is anticipated that an added benefit of a vegetated cover would be reduction in infiltration.	Medium capital Low O&M	Potentially applicable	Yes
		Low permeability cover	Use of a low permeability vegetated cover (NYCRR Part 360 landfill cover) designed to isolate solid waste and limit infiltration that generates leachate.	Not implementable due to substantial regrading required to meet NYCRR Part 360 grade requirements and incompatibility with current and reasonably anticipated land use. Extensive clearing required would not be consistent with ecological use of the Site. Specifically, clearing would require removal of vegetation and trees that currently provide important habitat for birds and other wildlife. Not compatible with future use.	Effective means of minimizing erosion of, and contact with exposed soil/fill material.	Very high capital High O&M	Not applicable for this Site. GW control measures are in place and will control discharges of site GW.	No

TABLE 3-2. SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	RELATIVE COST	SCREENING COMMENTS	RETAINED FOR FURTHER CONSIDERATION
In situ treatment	Chemical	Chemical oxidation	*In situ* treatment of contaminated soil/fill material (*e.g .*, stained soil/fill material) using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Limited implementability, due to low permeability conditions and the depths of stained soil/fill material at the Site. A treatability study would be necessary to evaluate implementability.	Limited effectiveness for oxidizing VOCs in the saturated zone due to low permeability and the nature of the soil/fill material (*e.g .*, cemented layers and chemical properties of fill material). A treatability study would be necessary to evaluate effectiveness.	Medium capital Low O&M	Limited implementability and effectiveness over large-scale area with low permeability conditions.	No
	Physical	Soil-vapor extraction (SVE)	Vacuum is applied through extraction wells within the vadose zone to create a pressure/concentration gradient that induces organics sorbed on the soil/fill material, dissolved in pore water and/or present as vapor to volatilize. Extracted vapors are removed through extraction wells and treated *ex situ* as needed.	Limited implementability, due to low permeability conditions and the depths of stained soil/fill material at the Site (large portions of stained soil in saturated zone). A treatability study would be necessary to evaluate implementability.	Limited effectiveness for VOCs in the unsaturated zone due to low permeability and the overall heterogeneous nature of soil/fill material. A treatability study would be necessary to evaluate effectiveness. Not effective for soil/fill material below the groundwater table.	High capital High O&M	Limited implementability and effectiveness over large-scale area with low permeability conditions.	No
	Thermal	Soil heating	Heating of soil using various techniques, including heating wells, thermal blankets, injection points, electrodes, or electromagnetic energy to heat and volatilize organic contaminants. Volatilized contaminants are removed by vapor extraction and treated ex situ as needed	Potentially applicable for smaller areas of higher concentration of contaminants; however, implementability is limited due to low permeability of site soil and site-specific groundwater characteristics. Geotechnical study necessary to evaluate effects on soil/fill material. Pilot study necessary to evaluate implementability.	Effective for treating VOC and SVOC. Collection of volatilized contaminants would be difficult due to low permeability of Site soils. Pilot study necessary to evaluate effectiveness.	High capital High O&M	Limited implementability and effectiveness over large scale area with low soil permeability conditions.	No
		Hot air or steam injection	Injection of hot air or steam through injection wells to enhance the recovery of organic contaminants. The injected steam heats the surrounding subsurface, volatilizing organic contaminants, with subsequent collection and treatment through a series of extraction wells.	Limited implementability, due to low permeability conditions, and the depths of stained soil/fill material at the Site. Geotechnical study would be necessary to evaluate effects on soil/fill material. A treatability study would be necessary to evaluate implementability.	Limited effectiveness for treating VOCs and SVOCs due to low permeability and the overall heterogeneous nature of soil/fill material. A treatability study would be necessary to evaluate effectiveness.	High capital Medium O&M	Limited implementability and effectiveness over large-scale area with low permeability conditions.	No
	Biological	Enhanced Bioremediation	Injection of microbial populations, nutrient sources, or electron donors into groundwater to enhance biological degradation of organic constituents.	Limited implementability, due to low permeability conditions, and the depths of stained soil/fill material at the Site. A treatability study would be necessary to evaluate implementability.	Results of the Site-specific microcosm study performed showed a lack of biological degradation of COCs in microcosms constructed using Site groundwater and solids.	High capital Low O&M	Not effective.	No
		Bioventing	Induction of low air flow rates in the subsurface to provide enough oxygen to sustain microbial activity, thereby stimulating the natural *in situ* biodegradation of aerobically degradable compounds in shallow soil	Limited implementability, due to low permeability conditions, and the depths of stained soil/fill material at the Site. A treatability study would be necessary to evaluate implementability.	Results of the Site-specific microcosm study performed showed a lack of biological degradation of COCs in microcosms constructed using Site groundwater and solids. Not effective for soil/fill material below the groundwater table.	High capital Low O&M	Not effective.	No
		Phytoremediation	Use of plants to remove, transfer, stabilize, or destroy contaminants in shallow soil.	Implementable	Effective for reducing contamination at shallow depths.	High capital Low O&M	Not effective at depth.	No
Removal	Excavation	Mechanical excavation*	Use of construction equipment to remove soil/fill material. Due to physical characteristics of soil/fill material and presence below groundwater table, dewatering would likely be required. It is anticipated that in addition to dewatering, stabilization may also be required to render the excavated material sufficiently dry for management and transportation. Excavated areas would be backfilled, graded and restored based on restoration requirements.	Implementability limited by presence of interstate highways, proximity to lake, need for sloping and shoring, quantities of soil/fill material, and depths of excavation.	Effective technology for removal of soil/fill material. It is anticipated that in addition to dewatering, stabilization may also be required to render the excavated material sufficiently dry for management and transportation. Treatability studies necessary to evaluate stabilization of material.	Very high capital No O&M	Potentially applicable.	Yes

TABLE 3-2. SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	RELATIVE COST	SCREENING COMMENTS	RETAINED FOR FURTHER CONSIDERATION
Ex situ treatment	Chemical	Oxidation	*Ex situ* treatment of contaminated soil/fill material using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Implementability limited for large quantities of soil/fill material.	Effective technology for treating *ex situ* soil/fill material containing volatiles. Volume of OU-1 soil/fill material to be treated would require an excessively large treatment area and/or duration to treat OU-1 soil/fill material in smaller batches.	High capital Low O&M	Limited implementability given the quantity of OU-1 soil/fill material.	No
		Extraction/washing	Soil/fill material and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use.	Implementability limited for large quantities of soil/fill material.	Effective technology for treating *ex situ* soil/fill material containing volatiles. Volume of OU-1 soil/fill material to be treated would require an excessively large treatment area and/or duration to treat OU-1 soil/fill material in smaller batches.	High capital Low O&M	Limited implementability given the quantity of OU-1 soil/fill material.	No
	Thermal	Incineration*	Combustion of organic contaminants present in soil/fill material in commercial incinerator at temperatures generally between 1600° F and 2200° F.	Implementability limited for large quantities of soil/fill material.	Effective technology for treating ex situ soil/fill material containing volatiles. Volume of OU-1 soil/fill material to be treated would require use of multiple commercial incinerators and extended duration to treat OU-1 soil/fill material in smaller batches.	High capital Low O&M	Potentially applicable for limited quantities of OU-1 soil/fill material.	Yes
		Low temperature thermal desorption	Use of direct or indirect heat to volatilize organic contaminants at temperatures generally between 90 and 300 °C, creating a physical separation (volume reduction) process. The volatilized contaminants from the thermal desorption process are typically directed to a secondary system for destruction via incineration, catalytic oxidation, adsorption on activated carbon, or recovery by condensation. If volatilized contaminants are incinerated, further treatment of acid gases and particulates would be required.	Implementability limited for large quantities of soil/fill material.	Effective technology for treating ex situ soil/fill material containing volatiles. Volume of OU-1 soil/fill material to be treated would require use of multiple commercial incinerators and extended duration to treat OU-1 soil/fill material in smaller batches.	High capital Low O&M	Potentially applicable for limited quantities of OU-1 soil/fill material.	Yes
	Biological	Biopiles	Excavated soil/fill material is mixed with soil amendments and placed in aboveground enclosures. Compost is formed into piles and aerated with blowers or vacuum pumps using an aerated static pile composting process.	Implementability limited for large quantities of soil/fill material.	Effective technology for treating *ex situ* soil/fill material containing volatiles. Volume of OU-1 soil/fill material to be treated would require an excessively large treatment area and/or duration to treat OU-1 soil/fill material in smaller batches.	High capital Medium O&M	Limited implementability given the quantity of OU-1 soil/fill material.	No
		Landfarming	Contaminated soil/fill material is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Implementability limited for large quantities of soil/fill material.	Effective technology for treating *ex situ* soil/fill material containing volatiles. Volume of OU-1 soil/fill material to be treated would require an excessively large treatment area and/or duration to treat OU-1 soil/fill material in smaller batches.	High capital Medium O&M	Limited implementability given the quantity of OU-1 soil/fill material.	No
Disposal	Off-site disposal	Disposal at a commercial facility*	Excavated soil/fill material would be transported to a permitted commercial landfill, if it meets land disposal restriction requirements.	Implementability limited for large quantities of soil/fill material.	Effective technology for management of materials for disposal.	Very high capital No O&M	Potentially applicable.	Yes
Reuse	Beneficial reuse	Reuse off-site*	Excavated soil/fill material would be screened for repurposing and, provided it met off-site reuse screening criteria, used as fill material, landfill cover, landfill grading material, aggregate, or other beneficial reuse.	Implementability limited for large quantities of soil/fill material. Implementability limited for some of the material due to COCs and physical characteristics of soil/fill material.	Effective technology for management of soil/fill materials off-site.	High capital No O&M	Potentially applicable.	Yes

Notes:
* Representative Process Option
CFR - Code of Federal Regulations
COCs - Constituents of Concern
DER - Division of Environmental Remediation
IRM - Interim remedial measure
O&M - Operation and Maintenance
NCP - National Oil and Hazardous Substances Contingency Plan
NYCRR - New York Code of Rules and Regulations
NYSDEC - New York State Department of Environmental Conservation
SVOC - Semi-volatile organic compound
VOC - Volatile organic compound

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TABLE 3-3. COMPONENTS OF REMEDIAL ALTERNATIVES FOR SOIL/FILL MATERIAL

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTION	Alternative 1 No Action	Alternative 2 Vegetated Cover System	Alternative 3 Enhanced Vegetated Cover System	Alternative 4A Removal with Disposal/Treatment/Reuse	Alternative 4B Partial Removal with Disposal/Treatment/Reuse
No Action	No action	No action	X				
Institutional controls/Limited actions	Access/use restrictions/administrative control(s)	Institutional controls		X	X	X	X
	Government controls	Site management plan		X	X		X
	Periodic reviews	Periodic site reviews		X	X		X
Containment	Vegetated Cover System	Vegetation enhancement		X	X		
		Vegetated cover		X[1]	X[1]		
		Vegetated structural fill		X	X		
Removal	Excavation	Mechanical excavation				X	X
Ex situ treatment	Thermal	Thermal				X[2]	X[2]
Disposal	Off-site disposal	Disposal at a commercial facility					
Reuse	Beneficial reuse	Reuse off-site					

Notes:

[1] Extent of vegetated cover for Alternative 2 is limited to areas where surface soil/fill material exhibits concentrations above corresponding soil cleanup objectives (SCOs). Extent of vegetated cover for Alternative 3 is greater than Alternative 2 and includes anticipated passive and active recreational use areas where surface soil/fill material exhibits concentrations below corresponding SCOs.

[2] Alternatives 4A and 4B assume excavated soil/fill material would be managed off-site through a combination of *ex situ* treatment, disposal, and/or reuse.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL/FILL MATERIAL

Criterion	Alternative 1 - No Action	Alternative 2 - Vegetated Cover System	Alternative 3 - Enhanced Vegetated Cover System	Alternative 4A - Removal and Off-Site Disposal/*Ex situ* Treatment	Alternative 4B - Partial Removal with Off-Site Disposal/*Ex situ* Treatment/Beneficial Reuse
	• **No action** • **Discontinued O&M of Integrated IRM**	• **Institutional Controls/Limited Actions** • **Vegetated Cover System based on SCOs Including:** ▪ **Vegetated Soil Cover** ▪ **Vegetated Structural Fill** ▪ **Vegetation Enhancement** • **Vegetated cover system O&M** • **Continued O&M of Integrated IRM Components**	• **Institutional Controls/Limited Actions** • **Vegetated Cover System based on current, intended, and reasonably anticipated future land uses Including:** ▪ **Vegetated Soil Cover** ▪ **Vegetated Structural Fill** ▪ **Vegetation Enhancement** • **Vegetated cover system O&M** • **Continued O&M of Integrated IRM Components**	• **Institutional Controls/Limited Actions** • **Temporary Re-Routing/Replacement of I-690/NY-695** • **Sequential Excavation of Site Soil/Fill Material to Pre-Disposal Conditions (Including Removal of I-690/NY-695)** • **Off-Site Management of Excavated Soil/Fill Material via Disposal at Permitted Landfills, Ex situ Treatment, and/or Beneficial Reuse at Permitted/Approved Locations** • **Site Restoration and Replacement of I-690/NY-695**	• **Institutional Controls/Limited Actions** • **Sequential Partial Excavation of Site Soil/Fill Material (Retains I-690/NY-695)** • **Off-Site Management of excavated Soil/Fill Material via Disposal at Permitted Landfills, Ex situ Treatment, and/or Beneficial Reuse at Permitted/Approved Locations** • **Site Restoration**
Overall protection of human health and the environment					
Overall protection of human health	Not protective of human health. Alternative would not provide for mitigation of potentially unacceptable risks to human health associated with inhalation of dust and soil exceeding commercial SCOs in passive recreational use areas and restricted residential SCOs in active recreational use areas.	Protection of human health would be provided. Vegetated cover system would address potentially unacceptable risks to human health associated with inhalation of dust and direct exposure to soil exceeding commercial SCOs in passive recreational use areas and restricted residential SCOs in active recreational use areas. Maintenance of vegetated cover system, access restrictions, site management plan, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with soil exceeding SCOs.	Protection of human health would be provided. Vegetated cover system would address potentially unacceptable risks to human health associated with inhalation of dust and direct exposure to soil in passive recreational use areas and in active recreational use areas. Maintenance of vegetated cover system, access restrictions, site management plan, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with soil exceeding SCOs.	Protection of human health would be provided. Removal of Site soil/fill material would address potentially unacceptable risks to human health associated with soil exceeding unrestricted use SCOs. Groundwater use restrictions, wetland maintenance, and periodic reviews would limit groundwater use until such a time that potentially unacceptable risks to human health associated with groundwater do not remain at the Site.	Protection of human health would be provided. Removal of Site soil/fill material would address potentially unacceptable risks to human health associated with soil exceeding unrestricted use SCOs. Access restrictions, maintenance, site management plan, and periodic reviews would limit site use and minimize potentially unacceptable risks to human health associated with soil/fill material remaining at the Site.
Overall protection of the environment	Not protective of the environment. Alternative would not provide for mitigation of potentially unacceptable risks to ecological resources associated with soil exceeding SCOs for the protection of ecological resources in habitat areas at the Site.	Protection of ecological receptors and the environment would be provided. Vegetated cover system would address potentially unacceptable risks to ecological receptors associated with direct exposure to soil exceeding SCOs for the protection of ecological receptors in habitat areas. Vegetated cover system would also address potential erosion of soil/fill material to NMC and Onondaga Lake. Maintenance of cover systems, site management plan, and periodic reviews would minimize potential for erosion and potentially unacceptable risks to ecological resources associated with soil/fill material exceeding SCOs.	Protection of ecological receptors and the environment would be provided. Vegetated cover system would address potentially unacceptable risks to ecological receptors associated with direct exposure to soil in habitat areas. Vegetated cover system would also address potential erosion of soil/fill material to NMC and Onondaga Lake. Maintenance of cover systems, site management plan, and periodic reviews would minimize potential for erosion and potentially unacceptable risks to ecological resources associated with soil/fill material exceeding SCOs.	Protection of ecological receptors and the environment would be provided. Removal of Site soil/fill material would address potentially unacceptable risks to ecological receptors. Groundwater use restrictions and periodic reviews would minimize potentially unacceptable risk to human receptors associated with residual groundwater contamination at the Site.	Protection of the environment would be provided through removal of Site soil/fill material. Site maintenance, site management plan, and periodic reviews would minimize potentially unacceptable risk to ecological receptors associated with soil/fill material remaining at the Site.
Attainment of Remedial Action Objectives (RAOs)	Alternative would not attain RAOs.	Alternative would attain RAOs by controlling erosion of soil/fill material and exposures to constituents in soil/fill materials that are above SCOs via vegetated cover systems and institutional controls.	Alternative would attain RAOs by controlling erosion of soil/fill material and exposures to constituents in soil/fill materials that are above SCOs via vegetated cover systems and institutional controls.	Alternative would attain RAOs by removing soil/fill materials that are above SCOs.	Alternative would attain RAOs by removing soil/fill materials that are above SCOs. Alternative would also attain RAOs for soil/fill material remaining at the Site (below and under vegetated covers in the immediate vicinity of I-690/NY-695) by controlling erosion of and exposure to constituents via vegetated cover systems and institutional controls.
Compliance with applicable, relevant and appropriate requirements (ARARs) and to be considered material (TBCs)					
Compliance with chemical-specific ARARs and TBCs	Alternative does not comply with ARARs for all areas.	Institutional controls would be implemented in general conformance with NYSDEC DER-33. Installation of the vegetative cover system over areas of surface soil/fill material that exhibit exceedances of SCOs, institutional controls, site management plan and periodic reviews would address soil ARARs by minimizing the potential for erosion of soil/fill material and the potential for direct contact with Site soil/fill material.	Institutional controls would be implemented in general conformance with NYSDEC DER-33. Installation of the vegetative cover system over areas of surface soil/fill material that exhibit exceedances of SCOs, institutional controls, site management plan and periodic reviews would address soil ARARs by minimizing the potential for erosion of soil/fill material and the potential for direct contact with Site soil/fill material.	Removal of Site soil/fill material would address soil ARARs by removing the potential for direct contact with Site soil/fill material. Unrestricted use SCOs would be attained through removal and off-Site management of excavated soil/fill material.	Removal of Site soil/fill material would address soil ARARs by removing the potential for direct contact with Site soil/fill material. Unrestricted use SCOs would be attained for much of the Site through removal and off-Site management of excavated soil/fill material. Institutional controls, site management plan and periodic reviews would address soil ARARs for soil/fill material remaining at the Site (below and in the immediate vicinity of I-690/NY-695).
Compliance with location-specific ARARs and TBCs	No location-specific ARARs triggered.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archeological, and historical resources.
Compliance with action-specific ARARs and TBCs	No actions.	Proposed vegetated cover system activities would be conducted consistent with applicable standards. Solid wastes, if any, would be managed in accordance with applicable State regulations. Proposed actions would be conducted in a manner consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and NMC. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Site construction activities would be conducted in accordance with OSHA safety requirements.	Proposed vegetated cover system activities would be conducted consistent with applicable standards. Solid wastes, if any, would be managed in accordance with applicable State regulations. Proposed actions would be conducted in a manner consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and NMC. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Site construction activities would be conducted in accordance with OSHA safety requirements.	Generated solid waste would be managed and disposed of in accordance with applicable State and Federal requirements. Proposed actions would be conducted in a manner consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake, NMC and Ditch A. Beneficial reuse would be coordinated and executed under promulgated State and Federal regulations. Excavation activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed permitted haulers. Federal guidance for sediment management/remediation would be considered. Site construction activities would be conducted in accordance with OSHA safety requirements.	Generated solid waste would be managed and disposed of in accordance with applicable State and Federal requirements. Proposed actions would be conducted in a manner consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake, NMC and Ditch A. Beneficial reuse would be coordinated and executed under promulgated State and Federal regulations. Excavation activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed permitted haulers. Federal guidance for sediment management/remediation would be considered. Site construction activities would be conducted in accordance with OSHA safety requirements.
Long-term effectiveness and permanence					
Magnitude of residual risk	Residual risks associated with soil exceeding SCOs would remain. The effectiveness of the Onondaga Lake and NMC OU-2 remedies would not be supported by a no action alternative.	Minimal residual risk. Residual risks associated with soil exceeding SCOs would be mitigated through the vegetated cover system, institutional controls, site management plan, periodic reviews and O&M. The effectiveness of the Onondaga Lake and NMC OU-2 remedies are supported through placement and maintenance of a vegetated cover system and Integrated IRM.	Minimal residual risk. Residual risks associated with soil exceeding SCOs would be mitigated through the vegetated cover system, institutional controls, site management plan, periodic reviews and O&M. The effectiveness of the Onondaga Lake and NMC OU-2 remedies are supported through placement and maintenance of a vegetated cover system and Integrated IRM.	No residual risk associated with soil/fill material. The effectiveness of the Onondaga Lake and NMC OU-2 remedies are supported through removal of Site soil/fill material.	Minimal residual risk associated with soil/fill material remaining at the Site as a result of retaining I-690/NY-695. Residual risks associated with soil exceeding SCOs would be mitigated through institutional controls, site management plan, periodic reviews and O&M. The effectiveness of the Onondaga Lake and NMC OU-2 remedies are supported through removal of Site soil/fill material.
Adequacy and reliability of controls	No controls are included in this alternative.	Placement and maintenance of vegetated cover system would provide adequate and reliable means of controlling erosion of and exposures to soil/fill material. Institutional controls are an adequate and reliable means of controlling site use and direct contact with Site soil/fill material. The vegetated cover system would be an adequate and reliable control to support the effectiveness of the Onondaga Lake and NMC OU-2 remedies.	Placement and maintenance of vegetated cover system would provide adequate and reliable means of controlling erosion of and exposures to soil/fill material. Institutional controls are an adequate and reliable means of controlling site use and direct contact with Site soil/fill material. The vegetated cover system would be an adequate and reliable control to support the effectiveness of the Onondaga Lake and NMC OU-2 remedies.	Removal of Site soil/fill material would be adequate and reliable means of controlling exposures soil/fill material and adequate and reliable means for supporting the effectiveness of the Onondaga Lake and NMC OU-2 remedies.	Removal of Site soil/fill material would be adequate and reliable means of controlling exposures soil/fill material and adequate and reliable means for supporting the effectiveness of the Onondaga Lake and NMC OU-2 remedies. Institutional controls are an adequate and reliable means of controlling site use and direct contact with residual Site soil/fill material associated with soil/fill material remaining at the Site as a result of retaining I-690/NY-695.
Long-term sustainability	No fuel/energy consumption, greenhouse gas or pollutant emissions, no water or resource use, no impacts to water, ecology, workers or community.	No long-term fuel/energy consumption or pollutant emissions, no water or resource use, no impacts to water, ecology, workers or community. Minimal fuel/energy use/greenhouse gas emissions for long-term maintenance .	No long-term fuel/energy consumption or pollutant emissions, no water or resource use, no impacts to water, ecology, workers or community. Minimal fuel/energy use/greenhouse gas emissions for long-term maintenance .	Substantial long-term fuel/energy consumption and pollutant emissions anticipated due to the volume of soil/fill material requiring excavation and transport and associated construction duration of 30 years.	Substantial long-term fuel/energy consumption and pollutant emissions anticipated due to the volume of soil/fill material requiring excavation and transport and associated construction duration of 27 years.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL/FILL MATERIAL

Criterion	Alternative 1 - No Action	Alternative 2 - Vegetated Cover System	Alternative 3 - Enhanced Vegetated Cover System	Alternative 4A - Removal and Off-Site Disposal/*Ex situ* Treatment	Alternative 4B - Partial Removal with Off-Site Disposal/*Ex situ* Treatment/Beneficial Reuse
	• **No action** • **Discontinued O&M of Integrated IRM**	• **Institutional Controls/Limited Actions** • **Vegetated Cover System based on SCOs Including:** ▪ **Vegetated Soil Cover** ▪ **Vegetated Structural Fill** ▪ **Vegetation Enhancement** • **Vegetated cover system O&M** • **Continued O&M of Integrated IRM Components**	• **Institutional Controls/Limited Actions** • **Vegetated Cover System based on current, intended, and reasonably anticipated future land uses Including:** ▪ **Vegetated Soil Cover** ▪ **Vegetated Structural Fill** ▪ **Vegetation Enhancement** • **Vegetated cover system O&M** • **Continued O&M of Integrated IRM Components**	• **Institutional Controls/Limited Actions** • **Temporary Re-Routing/Replacement of I-690/NY-695** • **Sequential Excavation of Site Soil/Fill Material to Pre-Disposal Conditions (Including Removal of I-690/NY-695)** • **Off-Site Management of Excavated Soil/Fill Material via Disposal at Permitted Landfills, Ex situ Treatment, and/or Beneficial Reuse at Permitted/Approved Locations** • **Site Restoration and Replacement of I-690/NY-695**	• **Institutional Controls/Limited Actions** • **Sequential Partial Excavation of Site Soil/Fill Material (Retains I-690/NY-695)** • **Off-Site Management of excavated Soil/Fill Material via Disposal at Permitted Landfills, Ex situ Treatment, and/or Beneficial Reuse at Permitted/Approved Locations** • **Site Restoration**
Reduction of toxicity, mobility, or volume through treatment					
Treatment process used and materials treated	No treatment processes are used in this alternative.	No treatment processes are used in this alternative.	No treatment processes are used in this alternative.	Groundwater (excavation water) collected as part of this remedy would be treated off site at the SCA treatment plant. *Ex situ* treatment using thermal treatment was assumed for a portion of the stained soil exhibiting elevated VOC concentrations.	Groundwater (excavation water) collected as part of this remedy would be treated off site at the SCA treatment plant. *Ex situ* treatment using thermal treatment was assumed for a portion of the stained soil exhibiting elevated VOC concentrations.
Amount of hazardous material destroyed or treated	No treatment processes or removal are used in this alternative.	No treatment processes or removal are used in this alternative.	No treatment processes or removal are used in this alternative.	Groundwater (excavation water) collected as part of this remedy would be treated off site at the SCA treatment plant. *Ex situ* treatment using thermal treatment was assumed for a portion of the stained soil exhibiting elevated VOC concentrations.	Approximately 23.4 million cy of soil/fill material would be excavated, stabilized, and transported off-site. It was assumed, due to VOC concentrations in stained soil, that approximately 1.7 million cy of excavated soil/fill material would require *ex situ* thermal treatment prior to disposal at a non-hazardous waste landfill. It was assumed that approximately 21.7 million cy of excavated soil/fill material would be suitable for reuse at an off-site facility.
Degree of expected reduction in toxicity, mobility, or volume	No treatment processes or removal are used in this alternative.	The mobility of COCs (*e.g.* , associated with erosion and enhanced evapotranspiration effects on infiltration) in surface soil/fill material would be reduced by installation of the vegetated cover systems. It should be noted that groundwater and seep collection systems implemented as part of the Integrated IRM also provide for reduction of mobility of COCs in groundwater.	The mobility of COCs (*e.g.* , associated with erosion and enhanced evapotranspiration effects on infiltration) in surface soil/fill material would be reduced by installation of the vegetated cover systems. Additional protectiveness and reduction in mobility of COCs may be provided through added vegetated cover thickness for areas of the Site reasonably anticipated to be used for active and passive use. Additional reduction in mobility of COCs in soil/fill material would be provided by placement of a vegetative cover in portions of the Site where vegetation enhancement is included in Alternative 2. It should be noted that groundwater and seep collection systems implemented as part of the Integrated IRM also provide for reduction of mobility of COCs in groundwater.	Approximately 26.6 million cy of soil/fill material would be removed under this alternative, thereby reducing the toxicity, volume and mobility of COCs in soil/fill material at the Site.	Approximately 23.4 million cy of soil/fill material would be removed under this alternative, thereby reducing the toxicity, volume and mobility of COCs in soil/fill material at the Site.
Degree to which treatment is irreversible	No treatment processes are used in this alternative.	No treatment processes are used in this alternative.	No treatment processes are used in this alternative.	Treatment of groundwater would be irreversible. Treatment and removal of soil/fill material is considered irreversible.	Treatment of groundwater would be irreversible. Treatment and removal of soil/fill material is considered irreversible.
Type and quantity of residuals remaining after treatment	No treatment processes or removal are used in this alternative.	No treatment processes are used in this alternative.	No treatment processes are used in this alternative.	Treatment residuals including precipitates and spent carbon would be anticipated related to groundwater treatment. Solid treatment residuals would also be anticipated related to *ex situ* thermal treatment.	Treatment residuals including precipitates and spent carbon would be anticipated related to groundwater treatment. Solid treatment residuals would also be anticipated related to *ex situ* thermal treatment.
Short-term effectiveness					
Protection of community during remedial actions	No active components are related to this alternative.	Dust and volatile emissions, if any, would be controlled during construction activities. Effects to community such as traffic and noise related to construction of Alternative 2.	Dust and volatile emissions, if any, would be controlled during construction activities. Additional cover construction in Alternative 3 could result in slightly increased impacts to the community relative to truck traffic and noise during the construction on Alternative 3 as compared to Alternative 2.	Construction-related noise, odors, dust, and traffic would be generated as a result of excavation and off-site soil/fill material transport and management activities. Dust and volatile emissions would be controlled during construction/excavation activities. Transportation of excavated materials is anticipated to result in 50,000 truck loads per year (180 truck loads per day) during 10 months of the year for 30 years, resulting in a significant risk of vehicle accidents and risk to community safety. Substantial traffic control measures for construction traffic would be required to provide protection of the community.	Construction-related noise, odors, dust, and traffic would be generated as a result of excavation and off-site soil/fill material transport and management activities. Dust and volatile emissions would be controlled during construction/excavation activities. Transportation of excavated materials is anticipated to result in 50,000 truck loads per year (180 truck loads per day) during 10 months of the year for 27 years, resulting in a significant risk of vehicle accidents and risk to community safety. Substantial traffic control measures for construction traffic would be required to provide protection of the community.
Protection of workers during remedial actions	No active components are related to this alternative.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, and would be effective in protecting workers from exposure to contaminants.
Environmental impacts	No active components are related to this alternative.	Dust, volatile emissions and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Limited clearing and grubbing would be required prior to cover installation due to extensive application of vegetation enhancements. Vegetated cover system placement would result in enhancements to existing habitats.	Dust, volatile emissions and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Clearing and grubbing would be required prior to vegetated soil cover and vegetated structural fill installation. Vegetated cover system placement would result in enhancements to existing habitats.	Dust, volatile emissions, surface runoff controls, and sediment control measures would be instituted to minimize impacts to the environment during implementation of this alternative. The restoration component of this remedy would result in enhancements to existing habitats. Transportation of excavated materials is anticipated to result in 1.3 million truck trips to and from the Site, resulting in significant emissions and fuel consumption over the course of an estimated 30 construction seasons.	Dust, volatile emissions, surface runoff controls, and sediment control measures would be instituted to minimize impacts to the environment during implementation of this alternative. The restoration component of this remedy would result in enhancements to existing habitats. Transportation of excavated materials is anticipated to result in 1.5 million truck trips to and from the Site, resulting in significant emissions and fuel consumption over the course of an estimated 27 construction seasons.
Time until remedial action objectives are achieved	Remedial action objectives would not be met with this alternative.	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately 6 construction seasons.	Remedial action objectives would be achieved upon completion of the remedy. The remedy would be completed in approximately 8 construction seasons.	Remedial action objectives would be achieved upon completion of the remedy. The remedy is anticipated to be completed over an estimated 30 construction seasons.	Remedial action objectives would be achieved upon completion of the remedy. The remedy is anticipated to be completed over an estimated 27 construction seasons.
Short-term sustainability	No fuel/energy consumption, greenhouse gas or pollutant emissions, no water or resource use, no impacts to water or ecology.	Greenhouse gas emissions associated with construction equipment fuel/energy use during cover installation. Minimal fuel/energy consumption, pollutant emissions, water and resource use, and impacts to water or ecology.	Greater greenhouse gas emissions associated with construction equipment fuel/energy use during cover installation as compared to Alternative 2 due to additional cover thicknesses. Minimal fuel/energy consumption, pollutant emissions, water and resource use, and impacts to water or ecology.	Substantial greenhouse gas emissions associated with construction equipment fuel/energy use during excavation and transportation of excavated material to off-site facilities. Given the anticipated volume of removal, substantial fuel/energy consumption and pollutant emissions are associated with this alternative. Greenhouse gas emissions associate with transportation needs for this alternative would result in an estimated 1,495,000 metric tons of carbon dioxide equivalent, equal to the annual emissions of approximately 315,000 cars. Moderate consumption of water and resource use, and impacts to water or ecology. Substantial impacts to community and safety as a result of anticipated truck traffic. According to the Insurance Institute for Highway Safety, large truck drivers and drivers of passenger vehicles were involved in 1.3 fatal crashes per 100 million miles traveled in 2012 (IIHS 2014). It is assumed than an estimated 500 to 590 million miles of truck travel would be required for this alternative. Additional traffic impacts would result from rerouting of traffic to local streets during removal and replacement of a portion of I-690/NY-695.	Substantial greenhouse gas emissions associated with construction equipment fuel/energy use during excavation and transportation of excavated material to off-site facilities. Given the anticipated volume of removal, substantial fuel/energy consumption and pollutant emissions are associated with this alternative. Greenhouse gas emissions associate with transportation needs for this alternative would result in an estimated 850,000 metric tons of carbon dioxide equivalent, equal to the annual emissions of approximately 180,000 cars. Moderate consumption of water and resource use, and impacts to water or ecology. According to the Insurance Institute for Highway Safety, large truck drivers and drivers of passenger vehicles were involved in 1.3 fatal crashes per 100 million miles traveled in 2012 (IIHS 2014). It is assumed than an estimated 500 to 590 million miles of truck travel would be required for this alternative. Substantial impacts to community and safety as a result of anticipated truck traffic.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SOIL/FILL MATERIAL

Criterion	Alternative 1 - No Action	Alternative 2 - Vegetated Cover System	Alternative 3 - Enhanced Vegetated Cover System	Alternative 4A - Removal and Off-Site Disposal/*Ex situ* Treatment	Alternative 4B - Partial Removal with Off-Site Disposal/*Ex situ* Treatment/Beneficial Reuse
	• No action • Discontinued O&M of Integrated IRM	• Institutional Controls/Limited Actions • Vegetated Cover System based on SCOs Including: ▪ Vegetated Soil Cover ▪ Vegetated Structural Fill ▪ Vegetation Enhancement • Vegetated cover system O&M • Continued O&M of Integrated IRM Components	• Institutional Controls/Limited Actions • Vegetated Cover System based on current, intended, and reasonably anticipated future land uses Including: ▪ Vegetated Soil Cover ▪ Vegetated Structural Fill ▪ Vegetation Enhancement • Vegetated cover system O&M • Continued O&M of Integrated IRM Components	• Institutional Controls/Limited Actions • Temporary Re-Routing/Replacement of I-690/NY-695 • Sequential Excavation of Site Soil/Fill Material to Pre-Disposal Conditions (Including Removal of I-690/NY-695) • Off-Site Management of Excavated Soil/Fill Material via Disposal at Permitted Landfills, Ex situ Treatment, and/or Beneficial Reuse at Permitted/Approved Locations • Site Restoration and Replacement of I-690/NY-695	• Institutional Controls/Limited Actions • Sequential Partial Excavation of Site Soil/Fill Material (Retains I-690/NY-695) • Off-Site Management of excavated Soil/Fill Material via Disposal at Permitted Landfills, Ex situ Treatment, and/or Beneficial Reuse at Permitted/Approved Locations • Site Restoration
Implementability					
Ability to construct and operate the technology	There are no technologies to be constructed in this alternative.	Vegetated cover systems are readily constructible; however, it is anticipated that the availability of materials and weather-related construction constraints for these systems will impose limitations on construction timeframes/durations.	Vegetated cover systems are readily constructible; however, it is anticipated that the availability of materials and weather-related construction constraints for these systems will impose limitations on construction timeframes/durations. Additional topsoil volume required under this alternative due to added cover thickness.	Likely not implementable, based on volume of soil/fill material (26.6 million cy) requiring excavation, management and disposal off-site. Availability of off-site disposal and/or reuse facilities is uncertain for the anticipated volume of soil/fill material requiring management.	Likely not implementable, based on volume of soil/fill material (23.4 million cy) requiring excavation, management and disposal off-site. Availability of off-site disposal and/or reuse facilities is uncertain for the anticipated volume of soil/fill material requiring management.
Reliability of technology	There are no technologies to be constructed in this alternative.	A vegetated cover system is a reliable technology. These technologies provide a reliable means of supporting the effectiveness of the Onondaga Lake and NMC OU-2 remedies.	A vegetated cover system is a reliable technology. These technologies provide a reliable means of supporting the effectiveness of the Onondaga Lake and NMC OU-2 remedies.	Excavation and off-site disposal are reliable technologies. These technologies provide a reliable means of supporting the effectiveness of the Onondaga Lake and NMC OU-2 remedies.	Excavation and beneficial reuse are reliable technologies. These technologies provide a reliable means of supporting the effectiveness of the Onondaga Lake and NMC OU-2 remedies.
Ease of undertaking additional remedial actions, if necessary	Additional remedial actions, if necessary, would be readily implementable.	Additional remedial actions, if necessary, may be implementable.	Additional remedial actions, if necessary, may be implementable.	Additional remedial actions, if necessary, may be implementable.	Additional remedial actions, if necessary, may be implementable.
Ability to monitor effectiveness of remedy	Remedy effectiveness could be monitored with periodic site inspection.	Effectiveness of remedy could be monitored through inspection and maintenance of the vegetated cover system to verify continued cover integrity, visual signs of erosion, and condition of the vegetated cover.	Effectiveness of remedy could be monitored through inspection and maintenance of the vegetated cover system to verify continued cover integrity, visual signs of erosion, and condition of the vegetated cover.	Effectiveness of remedy could be monitored through inspection.	Effectiveness of remedy could be monitored through inspection.
Coordination with other agencies and property owners	None required.	Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDAM (NYS Fairgrounds), Onondaga County, and the Town of Geddes would be necessary.	Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDAM (NYS Fairgrounds), Onondaga County, and the Town of Geddes would be necessary.	Extensive permitting, site preparation, and agency coordination efforts would be required. Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDAM (NYS Fairgrounds), Onondaga County, and the Town of Geddes would be necessary.	Extensive permitting, site preparation, and agency coordination efforts would be required. Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDAM (NYS Fairgrounds), Onondaga County, and the Town of Geddes would be necessary.
Availability of off-site treatment storage and disposal services and capacities	None required.	None required.	None required.	Off-site treatment of construction water is available. Availability of off-site disposal and/or treatment facilities for the anticipated volume of soil/fill material is uncertain. Coordination with off-site disposal facilities would be required to accommodate the quantities of materials that would be generated under this alternative.	Off-site treatment of construction water is available. Availability of off-site disposal, treatment and/or beneficial reuse facilities for the anticipated volume of soil/fill material is uncertain. COCs in soil/fill material and physical characteristics would limit beneficial reuse options. Coordination with off-site disposal/reuse facilities would be required to accommodate the quantities of materials that would be generated under this alternative.
Availability of necessary equipment, specialists, and materials	None required.	Equipment, specialists and materials are available, however, it is anticipated that the availability of materials and weather-related construction constraints for these systems will impose limitations on construction timeframes/durations.	Equipment, specialists and materials are available, however, it is anticipated that the availability of materials and weather-related construction constraints for these systems will impose limitations on construction timeframes/durations.	Equipment, specialists and materials are readily available.	Equipment, specialists and materials are readily available.
Costs					
Present worth of capital cost	$0	$14.3 Million[1]	$17.8 Million[2]	$6,135 Million ($6.1 Billion)	$5,124 Million ($5.1 Billion)
Present worth of operation and maintenance cost (30 years, 7% discount factor)	$0	$2.3 Million	$2.2 Million	$7.0 Million	$6.0 Million
Approximate total net present worth cost	$0	$16.6 Million	$20.0 Million	$6,142 Million ($6.1 Billion)	$5,130 Million ($5.1 Billion)
Land Use					
Consistency with proposed future use	Not consistent with current, intended and reasonably anticipated future use uses on all areas of the Site.	Vegetated cover system would be consistent with current, intended and reasonably anticipated future uses of the Site.	Vegetated cover system would be consistent with current, intended and reasonably anticipated future uses of the Site.	Removal of soil/fill material is not compatible with current, intended and reasonably anticipated future use. Specifically, current NYS Fairgrounds parking lots, public recreation trail and proposed amphitheater would need be relocated from the Site.	Removal of soil/fill material is not compatible with current, intended and reasonably anticipated future use. Specifically, current NYS Fairgrounds parking lots, public-recreation trail and proposed amphitheater would need be relocated from the Site.

Notes:
1. Capital cost for Alternative 2 reflects phased implementation over 6 construction seasons (present worth calculated using 7% discount factor)
2. Capital cost for Alternative 3 reflects phased implementation over 8 construction seasons (present worth calculated using 7% discount factor)

ARAR - Applicable or Relevant and Appropriate Requirement
COC - Constituent of Concern
cy - cubic yards
I-690 - Interstate 690
IRM - Interim Remedial Measure
NMC - Ninemile Creek
NYS - New York State
NYSDAM - New York State Department of Agriculture and Markets
NYSDEC - New York State Department of Environmental Conservation
NYSDOH - New York State Department of Health
NY-695 - New York State Route 695
O&M - Operation and Maintenance
OSHA - Occupational Safety and Health Administration
OU - Operable Unit
SCA - Sediment Consolidation Area
SCO - Soil Cleanup Objective
TBC - To Be Considered
USEPA - United States Environmental Protection Agency

Reference:
Insurance Institute for Highway Safety (IIHS). 2014. Topics - Large Trucks, Fatality Facts. http://www.iihs.org/iihs/topics/t/large-trucks/fatalityfacts/large-trucks#Trends. April 2014.

TABLE 4-2. ALTERNATIVE 1 NO ACTION COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	0	Acres
Location:	Geddes, NY	0	Construction Seasons
Phase:	Feasibility Study		
Base Year:	2014		

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
Direct Capital Costs					
			SUBTOTAL (rounded):	**$0**	
			TOTAL DIRECT CAPITAL COST (rounded):	**$0**	
			ENGINEERING/MANAGMENT, CONSTRUCTION OVERSIGHT, OBG OH&P	**$0**	6%, 8%, and 5% respectively
			CONTINGENCY (15%)	**$0**	Scope Contingency
			TOTAL CAPITAL COST (rounded):	**$0**	
Annual Operation and Maintenance Costs					

Present Worth Analysis Years (1-30)		Discount Factor	**Present Worth ($)**	
Cost Type	Cost	Df=7	**(rounded)**	
Capital Cost - Year 0	0	$0.877	**$0**	Over 5 construction seasons; average discount years 0-4
Annual O&M - Years 1-30	0	$0.433	**$0**	Average discount factor for years 1-30
		TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST (rounded):	**$0**	

TABLE 4-3. ALTERNATIVE 2 VEGETATED COVER COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	171	Acres	
Location:	Geddes, NY	6	Construction Seasons	
Phase:	Feasibility Study			
Base Year:	2014			

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST		NOTES
Direct Capital Costs						
General Conditions	WK	172	$9,500	$1,634,000		Trailer, fuel, small tools, consumables and safety
Mobilization	LS	6	$54,000	$324,000		One per construction season
Air Monitoring	WK	114	$7,500	$855,000		Active construction periods only
Surveys	WK	114	$3,000	$342,000		Active construction periods only
Irrigation	WK	24	$5,000	$120,000		Germination periods only/ 4 wks per year
Environmental Easement	LS	1	$30,000	$30,000		
Site Management Plan	LS	1	$50,000	$50,000		
Site Preparation						
Access Roadways	LF	3,000	$20	$60,000		For currently inaccessible areas only
Clearing and Grubbing	AC	25	$3,200	$80,000		2-ft and 1-ft Vegetative cover areas
Rough Grading	AC	54	$800	$43,200		
Mixing Area	EA	3	$32,000	$96,000		50-ft by 50-ft
QA/QC						
Materials QA/QC Testing - Topsoil	EA	65	$230	$14,996		1/500 cy of imported materials
Materials QA/QC Testing - Fill and Stone	EA	198	$70	$13,832		1/500 cy of imported materials
Erosion and Sediment Control	LF	145,000	$2.75	$398,750		Reinforced silt fence
Structural Soil Cover - 1-ft						*Assume 19 acres total parking and travel lanes*
Seeding	AC	14.0	$13,000	$182,000		Modified old field successional with fertilizer and hydromulch
Structural Stone - 1-ft thickness	CY	22,700	$30	$681,000		NYSDOT Type 3A Stone
Topsoil	CY	4,550	$28	$127,400		20% by volume of 1-ft thickness
Structural Soil Mixing	CY	27,250	$6	$163,500		Mechanically mix stone and topsoil by loader/excavator
Structural Soil Placement	CY	22,700	$8	$181,600		Includes placement and compaction
Geogrid	SY	24,000	$3.25	$78,000		Placed beneath travel areas only
Travel Lanes	CY	8,000	$28	$224,000		12-inches Crusher Run gravel, Geogrid; 15-ft width; approx 5.0 acres
Vegetative Soil Cover, 2-ft						*Assume 20 acres total*
Place Topsoil to 6-inch depth	CY	16,000	$45	$720,000		Placement by conventional equipment in 6-inch lifts
Place Imported Fill to 18-inch depth	CY	48,000	$32	$1,536,000		Placement by conventional equipment in 6-inch lifts
Seeding	AC	20	$13,000	$260,000		Modified old field successional with fertilizer and hydromulch
Vegetative Soil Cover, 1.5-foot						*Assume 10 acres total*
Place Topsoil to 6-inch depth	CY	8,050	$45	$362,250		Placement by conventional equipment in 6-inch lifts
Place Imported Fill to 12-inch depth	CY	16,100	$32	$515,200		Placement by conventional equipment in 6-inch lifts
Seeding	AC	10	$13,000	$130,000		Modified old field successional with fertilizer and hydromulch
Vegetative Soil Cover, 1-foot						*Assume 8 acres total*
Place Topsoil to 6-inch depth	CY	4,000	$45	$180,000		Placement by conventional equipment in 6-inch lifts
Place Imported Fill to 6-inch depth	CY	4,000	$32	$128,000		Placement by conventional equipment in 6-inch lifts
Seeding	AC	5	$13,000	$65,000		Modified old field successional with fertilizer and hydromulch (5 ac > SCOs, 3 ac < SCOs)
Vegetative Enhancement, 4-inches						*Assume 114 acres total*
Hydromulch installation	CY	62,900	$42	$2,641,800		Mulch/Seed placement by blown-in methods
Seeding	AC	117	$3,000	$351,000		Raw seed cost only; installed with solid media.
				SUBTOTAL (rounded):	**$12,590,000**	

TABLE 4-3. ALTERNATIVE 2 VEGETATED COVER COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	171	Acres
Location:	Geddes, NY	6	Construction Seasons
Phase:	Feasibility Study		
Base Year:	2014		

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
TOTAL DIRECT CAPITAL COST (rounded):				**$12,590,000**	
ENGINEERING/MANAGMENT, CONSTRUCTION OVERSIGHT, OBG OH&P				**$2,392,100**	6%, 8%, and 5% respectively
CONTINGENCY (15%)				**$1,888,500**	Scope Contingency
Annual Operation and Maintenance Costs					
Annual					
Cover inspection - vegetated covers	MH	128	$120	$15,360	Assumes 2 scientists/engineers, 4 days, 8 hours/day; Twice annually
Reporting	EA	1	$10,000	$10,000	
Years 1-5					
Vegetation maintenance	AC	16.6	$3,000	$49,800	Spot seeding; 10% of all areas annually
Soil Cover maintenance and incidental repairs	AC	35	$225	$7,875	Topsoil repair, 5 cy per acre annually
Vegetative enhancement maintenance/repair	AC	1.2	$25,600	$29,952	Reinstallation over eroded areas; 4-inches of hydromulch over 1% enhanced areas annually
Structural cover maintenance/repair	AC	14.0	$1,100	$15,400	Spot stone fill 10 cy per acre annually; regrade/reseed 10% annually
Structural cover travel lane repair	AC	0.10	$4,600	$460	Resurface (1-inch crushed stone) and regrade travel lanes; 10% annually
Years 6-30					
Cover inspection - veg. covers and Int. IRM	MH	224	$120	$26,880	Assumes 2 scientists/engineers, 7 days, 8 hours/day; Twice annually
Vegetation Maintenance	AC	1.7	$3,000	$4,980	Spot seeding; 1% of all areas annually
Soil Cover maintenance and incidental repairs	AC	35	$225	$7,875	Topsoil repair, 5 cy per acre annually
Vegetative enhancement maintenance/repair	AC	1.2	$25,600	$29,952	Reinstallation over eroded areas; 4-inches of hydromulch over 1% enhanced areas annually
Structural Cover maintenance/repair	AC	14.0	$1,100	$15,400	Spot stone fill 10 cy per acre annually; regrade/reseed 10% annually
Structural Cover travel lane repair	AC	0.10	$4,600	$460	Resurface (1-inch crushed stone) and regrade travel lanes; 10% annually
Spot Repair of Integrated IRM covers	SF	31,365	$0.12	$3,764	5% of cover annually; years 1-5 carried in 2010 FFS
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	
Maintenance of Integrated IRM paths	SY	57,525	$10	$575,250	Place and grade 6-inch resurface; 20% of Total Area; commencing Yr 10

Present Worth Analysis Years (1-30)		Discount Factor	**Present Worth ($)**	
Cost Type	Cost	Df=7	**(rounded)**	
Capital Cost - Year 0	16,870,000	$0.850	**$14,340,000**	Phased construction. Assumed over 6 construction seasons; average discount years 0-5
Annual O&M - Years 1-5	128,847	$0.820	**$530,000**	Average discount factor for years 1-5
Annual O&M - Years 6-30	99,311	$0.332	**$830,000**	Average discount factor for years 6-30
Periodic O&M - Years 5, 10, 15, 20, 25, 30	15,000	$0.360	**$32,000**	Average discount factor for years 5, 10, 15, 20, 25 and 30
Periodic O&M - Years 10, 15, 20, 25, 30	575,250	$0.289	**$850,000**	Average discount factor for years 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST (rounded):			**$16,600,000**	

TABLE 4-4. ALTERNATIVE 3 ENHANCED VEGETATED COVER SYSTEM COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	171	Acres
Location:	Geddes, NY	8	Construction Seasons
Phase:	Feasibility Study		
Base Year:	2014		

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST		NOTES
Direct Capital Costs						
General Conditions	WK	250	$9,500	$2,375,000		Trailer, fuel, small tools, consumables and safety
Mobilization	LS	8	$54,000	$432,000		One per construction season
Air Monitoring	WK	168	$7,500	$1,260,000		Active construction periods only
Surveys	WK	168	$3,000	$504,000		Active construction periods only
Irrigation	WK	32	$5,000	$160,000		Germination periods only/ 4 wks per year
Environmental Easement	LS	1	$30,000	$30,000		
Site Management Plan	LS	1	$50,000	$50,000		
Site Preparation						
Access Roadways	LF	3,000	$20	$60,000		For currently inaccessible areas only
Clearing and Grubbing	AC	66	$3,200	$211,200		2-ft and 1-ft Vegetative cover areas
Rough Grading	AC	95	$800	$76,000		
Mixing Area	EA	3	$32,000	$96,000		50-ft by 50-ft
QA/QC						
Materials QA/QC Testing - Topsoil	EA	132	$230	$30,314		1/500 cy of imported materials
Materials QA/QC Testing - Fill and Stone	EA	287	$70	$20,104		1/500 cy of imported materials
Erosion and Sediment Control	LF	145,000	$2.75	$398,750		Reinforced silt fence
Structural Soil Cover - 1-ft						*Assume 19 acres total parking and travel lanes*
Seeding	AC	14.0	$13,000	$182,000		Modified old field successional with fertilizer and hydromulch
Structural Stone - 1-ft thickness	CY	22,700	$30	$681,000		NYSDOT Type 3A Stone
Topsoil	CY	4,550	$28	$127,400		20% by volume of 1-ft thickness
Structural Soil Mixing	CY	27,250	$6	$163,500		Mechanically mix stone and topsoil by loader/excavator
Structural Soil Placement	CY	22,700	$8	$181,600		Includes placement and compaction
Geogrid	SY	24,000	$3.25	$78,000		Placed beneath travel areas only
Travel Lanes	CY	8,000	$28	$224,000		12-inches Crusher Run gravel, Geogrid; 15-ft width; approx 4.6 acres
Vegetative Soil Cover, 2-ft						*Assume 27 acres total*
Place Topsoil to 6-inch depth	CY	21,800	$45	$981,000		Placement by conventional equipment in 6-inch lifts
Place Imported Fill to 18-inch depth	CY	65,300	$32	$2,089,600		Placement by conventional equipment in 6-inch lifts
Seeding	AC	27	$13,000	$351,000		Modified old field successional with fertilizer and hydromulch
Vegetative Soil Cover, 1.5-foot						*Assume 10 acres total*
Place Topsoil to 6-inch depth	CY	8,050	$45	$362,250		Placement by conventional equipment in 6-inch lifts
Place Imported Fill to 12-inch depth	CY	16,100	$32	$515,200		Placement by conventional equipment in 6-inch lifts
Seeding	AC	10	$13,000	$130,000		Modified old field successional with fertilizer and hydromulch
Vegetative Soil Cover, 1-foot						*Assume 39 acres total*
Place Topsoil to 6-inch depth	CY	31,500	$45	$1,417,500		Placement by conventional equipment in 6-inch lifts
Place Imported Fill to 6-inch depth	CY	31,500	$32	$1,008,000		Placement by conventional equipment in 6-inch lifts
Seeding	AC	39	$13,000	$507,000		Modified old field successional with fertilizer and hydromulch
Vegetative Enhancement, 4-inches						*Assume 76 acres total*
Hydromulch installation	CY	40,900	$42	$1,717,800		Mulch/Seed placement by blown-in methods
Seeding	AC	76	$3,000	$228,000		Raw seed cost only; installed with solid media.
				SUBTOTAL (rounded):	**$16,650,000**	

TABLE 4-4. ALTERNATIVE 3 ENHANCED VEGETATED COVER SYSTEM COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	171	Acres
Location:	Geddes, NY	8	Construction Seasons
Phase:	Feasibility Study		
Base Year:	2014		

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST		NOTES
				TOTAL DIRECT CAPITAL COST (rounded):	**$16,650,000**	
				ENGINEERING/MANAGMENT, CONSTRUCTION OVERSIGHT, OBG OH&P	**$3,163,500**	6%, 8%, and 5% respectively
				CONTINGENCY (15%)	**$2,497,500**	Scope Contingency
Annual Operation and Maintenance Costs						
Annual						
Cover inspection - vegetated covers	MH	128	$120	$15,360		Assumes 2 scientists/engineers, 4 days, 8 hours/day; Twice annually
Reporting	EA	1	$10,000	$10,000		
Years 1-5						
Vegetation maintenance	AC	16.6	$3,000	$49,800		Spot seeding; 10% of all areas annually
Soil Cover maintenance and incidental repairs	AC	76	$225	$17,100		Topsoil repair, 5 cy per acre annually
Vegetative enhancement maintenance/repair	AC	0.8	$25,600	$19,456		Reinstallation over eroded areas; 4-inches of hydromulch over 1% enhanced areas annually
Structural cover maintenance/repair	AC	14.0	$1,100	$15,400		Spot stone fill 10 cy per acre annually; regrade/reseed 10% annually
Structural cover travel lane repair	AC	0.10	$4,600	$460		Resurface (1-inch crushed stone) and regrade travel lanes; 10% annually
Years 6-30						
Cover inspection - veg. covers and Int. IRM	MH	224	$120	$26,880		Assumes 2 scientists/engineers, 7 days, 8 hours/day; Twice annually
Vegetation Maintenance	AC	1.7	$3,000	$4,980		Spot seeding; 1% of all areas annually
Soil Cover maintenance and incidental repairs	AC	76	$225	$17,100		Topsoil repair, 5 cy per acre annually
Vegetative enhancement maintenance/repair	AC	0.8	$25,600	$19,456		Reinstallation over eroded areas; 4-inches of hydromulch over 1% enhanced areas annually
Structural Cover maintenance/repair	AC	14.0	$1,100	$15,400		Spot stone fill 10 cy per acre annually; regrade/reseed 10% annually
Structural Cover travel lane repair	AC	0.10	$4,600	$460		Resurface (1-inch crushed stone) and regrade travel lanes; 10% annually
Spot Repair of Integrated IRM covers	SF	31,365	$0.12	$3,764		5% of cover annually; years 1-5 carried in 2010 FFS
Years 5, 10, 15, 20, 25, 30						
Five Year Review	EA	1	$15,000	$15,000		
Maintenance of Integrated IRM paths	SY	57,525	$10	$575,250		Place and grade 6-inch resurface; 20% of Total Area; commencing Yr 10

Present Worth Analysis Years (1-30)		Discount Factor	**Present Worth ($)**	
Cost Type	Cost	Df=7	**(rounded)**	
Capital Cost - Year 0	22,310,000	$0.799	**$17,820,000**	Phased construction. Assumed over 8 construction seasons; average discount years 0-7
Annual O&M - Years 1-5	127,576	$0.820	**$520,000**	Average discount factor for years 1-5
Annual O&M - Years 6-30	98,040	$0.332	**$810,000**	Average discount factor for years 6-30
Periodic O&M - Years 5, 10, 15, 20, 25, 30	15,000	$0.360	**$32,000**	Average discount factor for years 5, 10, 15, 20, 25 and 30
Periodic O&M - Years 10, 15, 20, 25, 30	575,250	$0.289	**$850,000**	Average discount factor for years 10, 15, 20, 25 and 30
		TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST (rounded):	**$20,000,000**	

TABLE 4-5. ALTERNATIVE 4A FULL EXCAVATION, TREATMENT AND OFF-SITE DISPOSAL COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	338	Acres
Location:	Geddes, NY	31	Construction Seasons
Phase:	Feasibility Study		
Base Year:	2014		

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST		NOTES
Direct Capital Costs						
General Conditions	WK	1,239	$192,000	$237,977,028		Trailer, fuel, small tools, consumables and safety
Mobilization	EA	31	$425,000	$13,169,302		
Air Monitoring	WK	1,239	$7,500	$9,295,978		
Surveys	WK	1,239	$3,000	$3,718,391		
Irrigation	WK	1,239	$5,000	$6,197,318		
Site Preparation						
690/695 Detour	LS	1	$12,500,000	$12,500,000		Construct Detour Ramp to/from highways and signage
Clear and Grub	AC	100	$3,200	$320,000		clearing, grubbing; inc. chipping of trees
Dewatering	DA	6,197	$250	$1,549,330		dewatering pumps and frac tank equalization
Haul Road	CY	149,074	$27	$4,025,000		24-inch thick gravel
Staging Area	CY	11,100	$27	$299,700		50-ft by 50-ft
Sheeting	SF	399,000	$40	$15,960,000		20 to 50-ft depths, including grout
QA/QC						
Materials QA/QC Testing - Topsoil	EA	90	$230	$20,700		1/500 cy of imported materials
Materials QA/QC Testing - Fill and Stone	EA	3,626	$70	$253,820		1/500 cy of imported materials
Turbidity Curtain	LF	10,500	$4	$42,000		outboard of sheeting
Erosion and Sediment Control	LF	21,700	$3	$59,675		Reinforced silt fence
Excavation						
690/695 Interchange Demolition	CY	70,000	$10	$700,000		
Excavation of Soil/Fill Material	CY	25,805,000	$6.25	$161,281,250		removal by conventional excavation; 10-ft layers
Ex situ treatment	TON	2,040,000	$170	$346,800,000		thermal treatment at site of disposal; prior to disposal; 1.2 ton per cy
Stabilization	CY	4,185,000	$3.50	$14,647,500		grout addition; addition of grout increases stabilized material volume by 20% for disposal
Transportation						
On-site Hauling to Treatment	CY	1,700,000	$7	$11,900,000		18 cy per truck; average 3-mile round trip from excavation area
Transport by Truck	CY	26,642,000	$40	$1,065,680,000		400 mile round trip
C&D Hauling by Truck	CY	70,000	$10	$700,000		400 mile round trip
Disposal						
Non-Hazardous Waste Disposal	TN	31,970,400	$75	$2,397,780,000		1.2 tons per cy; landfill
C&D Waste Disposal	TN	105,000	$35	$3,675,000		1.5 tons per cy; landfill
Restoration						
Aquatic Substrate - Clay Loam	CY	1,073,000	$32	$34,336,000		restore to El. 362.5, Wastebeds 1-8 and shoreline areas
Upland Site Fill	CY	740,000	$32	$23,680,000		restore to El. 379.5, Wastebeds 7/8
Upland Topsoil	CY	45,000	$45	$2,025,000		restore to El. 380, Wastebeds 7/8
Inland Salt Marsh Vegetation Restoration	AC	282	$40,000	$11,280,000		installation of live plugs/stakes
Supplemental Marsh Seeding	AC	282	$6,000	$1,692,000		seeding
Hydroseeding	AC	55	$6,000	$330,900		
Replace I-690/695; at grade portions	LM	18	$8,840,000	$154,700,000		along existing alignment
Replace Overpass/Interchange	LS	1	$41,600,000	$41,600,000		along existing alignment
				SUBTOTAL (rounded):	**$4,578,000,000**	

TABLE 4-5. ALTERNATIVE 4A FULL EXCAVATION, TREATMENT AND OFF-SITE DISPOSAL COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	338	Acres
Location:	Geddes, NY	31	Construction Seasons
Phase:	Feasibility Study		
Base Year:	2014		

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
TOTAL DIRECT CAPITAL COST (rounded):				**$4,578,000,000**	
ENGINEERING/MANAGMENT, CONSTRUCTION OVERSIGHT, OBG OH&P				**$869,820,000**	6%, 8%, and 5% respectively
CONTINGENCY (15%)				**$686,700,000**	Scope Contingency
TOTAL CAPITAL COST (rounded):				**$6,135,000,000**	
Integrated IRM Operation and Maintenance Costs (During Remedy Construction)					
Years 6-15					
Cover inspection - Int. IRM	MH	96	$120	$26,880	24 hrs x 2 Persons per 6 Months
Spot Repair of Integrated IRM covers	SF	31,365	$0.12	$3,764	5% of cover annually; years 1-5 carried in 2010 FFS
Years 10 and 15					
Maintenance of Integrated IRM paths	SY	57,525	$10	$575,250	Place and grade 6-inch resurface; 20% of Total Area; commencing Yr 10
Post-Remedy Operation and Maintenance Costs					
Annual					
Cover inspection	MH	256	$120	$30,720	Assumes 2 scientists/engineers, 8 days, 8 hours/day, semi-annual inspections
Years 1-5					
Salt Marsh Vegetation Maintenance	AC	28.2	$40,000	$1,128,000	Targeting plant replacement 10% annually
Salt Marsh Seeding Maintenance	AC	28.2	$6,000	$169,200	Repair of 10% of areas annually
Soil maintenance and incidental repairs	AC	6	$225	$1,241	Topsoil repair, 5 cy per acre annually
Upland Seeding Maintenance	AC	6	$6,000	$33,090	Repair of 10% of areas annually
Years 6-30					
Salt Marsh Vegetation Maintenance	AC	2.8	$40,000	$112,800	Targeting plant replacement 1% annually
Salt Marsh Seeding Maintenance	AC	2.8	$3,000	$8,460	Spot seeding; 1% of all areas annually
Soil maintenance and incidental repairs	AC	6	$225	$1,241	Topsoil repair, 5 cy per acre annually
Upland Seeding Maintenance	AC	6	$3,000	$16,545	Spot seeding; 1% of all areas annually
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	

Present Worth Analysis Years (1-30)		Discount Factor	**Present Worth ($)**	
Cost Type	Cost	Df=7	**(rounded)**	
Capital Cost - Year 0	6,135,000,000	1	**$6,135,000,000**	
Int. IRM Annual O&M - Years 6-15	30,644	0.501	**$15,000**	average discount factor for years 6-15
Int. IRM Periodic O&M - Years 10, 15	575,250	0.435	**$250,000**	average discount factor for years 10 and 15
Remedy Annual O&M - Years 1-5	1,362,251	$0.820	**$5,590,000**	average discount factor for years 1-5
Remedy Annual O&M - Years 6-30	169,766	$0.332	**$1,410,000**	average discount factor for years 6-30
Remedy Periodic Costs - Years 5, 10, 15, 20, 15, 30	15,000	$0.360	**$5,000**	average discount factor for years 5, 10, 15, 20, 15, 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST (rounded):			**$6,142,000,000**	

TABLE 4-6. ALTERNATIVE 4B PARTIAL EXCAVATION, TREATMENT AND OFF-SITE DISPOSAL COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	288	Acres	
Location:	Geddes, NY	27	Construction Seasons	
Phase:	Feasibility Study			
Base Year:	2014			

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
Direct Capital Costs					
General Conditions	WK	1,080	$192,000	$207,325,676	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	27	$425,000	$11,473,101	
Air Monitoring	WK	1,080	$7,500	$8,098,659	
Surveys	WK	1,080	$3,000	$3,239,464	
Irrigation	WK	1,080	$5,000	$5,399,106	
Site Preparation					
Clear and Grub	AC	100	$3,200	$320,000	clearing, grubbing; inc. chipping of trees
Dewatering	DA	5,399	$250	$1,349,777	dewatering pumps and frac tank equalization
Haul Road	CY	149,074	$27	$4,025,000	24-inch thick gravel
Staging Area	CY	11,100	$27	$299,700	50-ft by 50-ft
Sheeting	SF	399,000	$40	$15,960,000	20 to 50-ft depths, including grout
QA/QC					
Materials QA/QC Testing - Topsoil	EA	56	$230	$12,880	1/500 cy of imported materials
Materials QA/QC Testing	EA	2,816	$70	$197,120	1/500 cy of imported materials
Turbidity Curtain	LF	10,500	$4	$42,000	outboard of sheeting
Erosion and Sediment Control	LF	21,700	$3	$59,675	Reinforced silt fence
Excavation					
Excavation of Soil/Fill Material	CY	22,725,000	$6.25	$142,031,250	removal by conventional excavation; 10-ft layers
Ex situ treatment	TON	2,040,000	$170	$346,800,000	thermal treatment at site of disposal; prior to disposal; 1.2 ton per cy
Stabilization	CY	3,439,000	$3.50	$12,036,500	grout addition; assume addition of grout increases stabilized material volume by 20%
Transportation					
On-site Hauling to Treatment	CY	1,700,000	$7	$11,900,000	18 cy per truck; average 3-mile round trip from excavation area
Transport by Truck	CY	23,400,000	$80	$1,872,000,000	800 mile round trip
C&D Hauling by Truck	CY	70,000	$10	$700,000	
Disposal					
Beneficial Reuse	TN	28,080,000	$40	$1,123,200,000	allotment as fee for beneficial reuse
Restoration					
Aquatic Substrate - Clay Loam	CY	1,048,000	$32	$33,536,000	restore to El. 362.5, Wastebeds 1-8 and shoreline areas
Upland Site Fill	CY	360,000	$32	$11,520,000	restore to El. 379.5, Wastebeds 7/8
Upland Topsoil	CY	28,000	$45	$1,260,000	restore to El. 380, Wastebeds 7/8
Inland Salt Marsh Vegetation Restoration	AC	245	$40,000	$9,800,000	installation of live plugs/stakes
Supplemental Marsh Seeding	AC	245	$6,000	$1,470,000	seeding
Hydroseeding	AC	43	$6,000	$258,000	basic cover grasses
			SUBTOTAL (rounded):	**$3,824,000,000**	

TABLE 4-6. ALTERNATIVE 4B PARTIAL EXCAVATION, TREATMENT AND OFF-SITE DISPOSAL COST ESTIMATE

COST ESTIMATE SUMMARY

Site:	Honeywell Wastebeds 1 - 8	288	Acres	
Location:	Geddes, NY	27	Construction Seasons	
Phase:	Feasibility Study			
Base Year:	2014			

ITEM	UNIT	ESTIMATED QUANTITY	ESTIMATED UNIT COST	ESTIMATED COST	NOTES
			TOTAL DIRECT CAPITAL COST (rounded):	$3,824,000,000	
			ENGINEERING/MANAGMENT, CONSTRUCTION OVERSIGHT, OBG OH&P	$726,560,000	6%, 8%, and 5% respectively
			CONTINGENCY (15%)	$573,600,000	Scope Contingency
			TOTAL CAPITAL COST (rounded):	$5,124,000,000	
Integrated IRM Operation and Maintenance Costs (During Remedy Construction)					
Years 6-15					
Cover inspection - Int. IRM	MH	96	$120	$26,880	24 hrs x 2 Persons per 6 Months
Spot Repair of Integrated IRM covers	SF	31,365	$0.12	$3,764	5% of cover annually; years 1-5 carried in 2010 FFS
Years 10 and 15					
Maintenance of Integrated IRM paths	SY	57,525	$10	$575,250	Place and grade 6-inch resurface; 20% of Total Area; commencing Yr 10
Post-Remedy Operation and Maintenance Costs					
Annual					
Cover inspection	MH	256	$120	$30,720	Assumes 2 scientists/engineers, 8 days, 8 hours/day, semi-annual inspections
Years 1-5					
Salt Marsh Vegetation Maintenance	AC	24.5	$40,000	$980,000	Targeting plant replacement 10% annually
Salt Marsh Seeding Maintenance	AC	24.5	$6,000	$147,000	Repair of 10% of areas annually
Soil maintenance and incidental repairs	AC	4	$225	$968	Topsoil repair, 5 cy per acre annually
Upland Seeding Maintenance	AC	4	$3,000	$12,900	Repair of 10% of areas annually
Years 6-30					
Salt Marsh Vegetation Maintenance	AC	2.5	$40,000	$98,000	Targeting plant replacement 1% annually
Salt Marsh Seeding Maintenance	AC	2.5	$6,000	$14,700	Spot seeding; 1% of all areas annually
Soil maintenance and incidental repairs	AC	4	$225	$968	Topsoil repair, 5 cy per acre annually
Upland Seeding Maintenance	AC	4	$3,000	$12,900	Spot seeding; 1% of all areas annually
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	

Present Worth Analysis Years (1-30)		Discount Factor	**Present Worth ($)**	
Cost Type	Cost	Df=7	**(rounded)**	
Capital Cost - Year 0	5,124,000,000	1	**$5,124,000,000**	
Int. IRM Annual O&M - Years 6-15	30,644	0.468	**$14,000**	average discount factor for years 6-15
Int. IRM Periodic O&M - Years 10, 15	575,250	0.407	**$234,000**	average discount factor for years 10 and 15
Remedy Annual O&M - Years 1-5	1,171,588	$0.820	**$4,800,000**	average discount factor for years 1-5
Remedy Annual O&M - Years 6-30	157,288	$0.332	**$1,310,000**	average discount factor for years 6-30
Remedy Periodic Costs - Years 5, 10, 15, 20, 15, 30	15,000	$0.360	**$5,000**	average discount factor for years 5, 10, 15, 20, 15, 30
		TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST (rounded):	**$5,130,000,000**	

Figures

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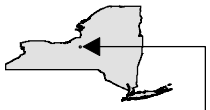
ADAPTED FROM: SYRACUSE WEST, NY USGS QUADRANGLE.

HONEYWELL
WASTEBEDS 1 - 8
OU-1 FEASIBILITY STUDY
WASTEBEDS 1-8
GEDDES, NEW YORK



QUADRANGLE LOCATION

N

SITE LOCATION

0 1,000 2,000 4,000 6,000 8,000

Feet

1:24,000

SEPTEMBER 2014
1163.45176

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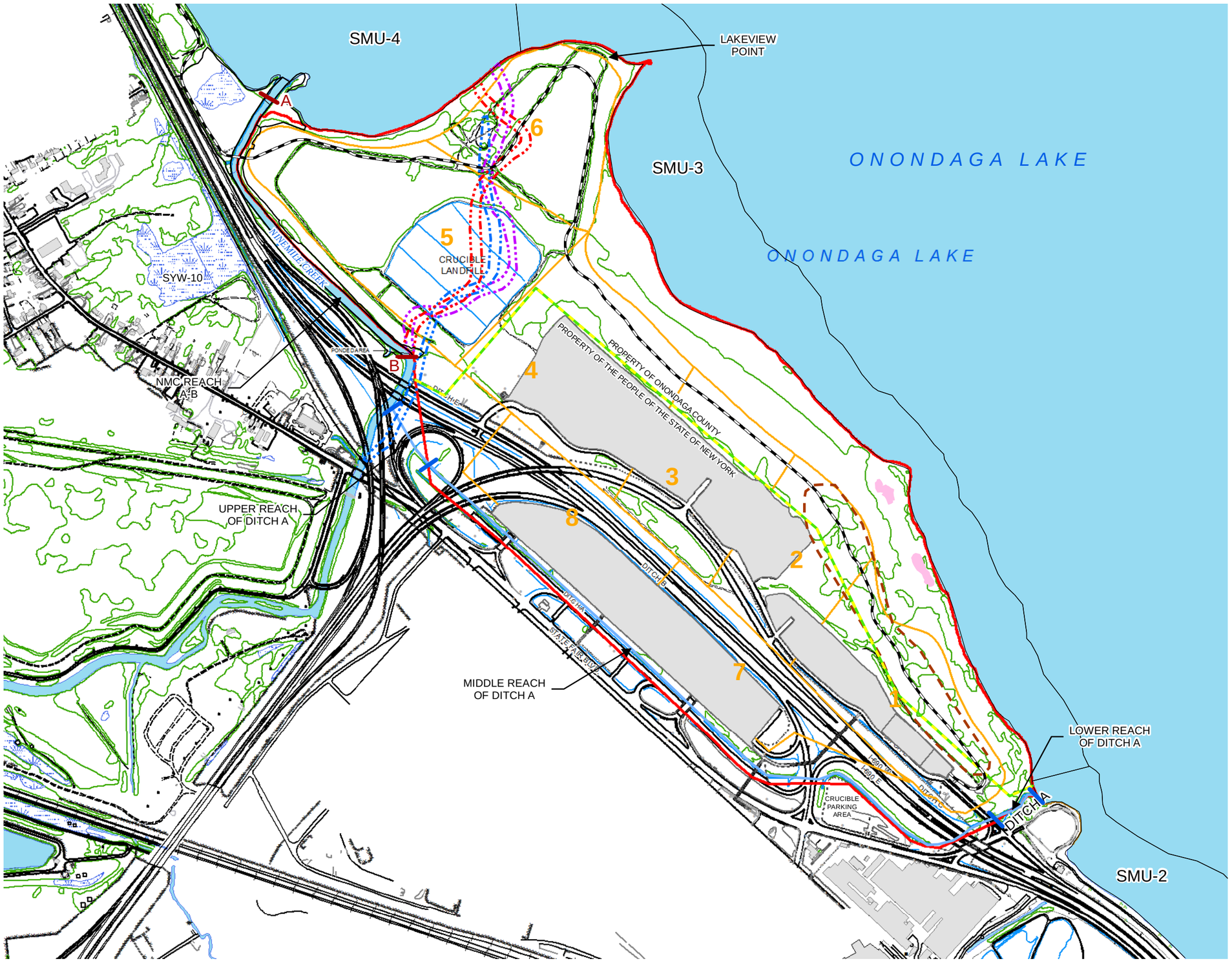
FIGURE 1-2



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N

LEGEND

- ONONDAGA COUNTY WEST SHORE TRAIL
- SMU-2 ONONDAGA LAKE SEDIMENT MANAGEMENT UNIT BOUNDARY
- DELINEATED WETLANDS
- PARKING LOT
- WASTEBEDS 1-8 PROPERTY BOUNDARY (PEOPLE OF THE STATE OF NY AND ONONDAGA COUNTY)
- APPROXIMATE WASTEBED BOUNDARY
- WASTEBEDS 1-8 SITE
- BIOSOLIDS AREA

FORMER NINEMILE CREEK CHANNEL

- USGS TOPO MAP 1898
- THOMSEN ASSOCIATES
- ALLIED DRAWING 1937

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

SITE PLAN

0 400 800 1,600
Feet

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FIGURE 1-3

N

LEGEND

- OL REMEDY
- NMC OU-2 REMEDY
- OU-2 FS AREA
- INTEGRATED IRM FOOTPRINT
- PROPOSED OU-1 FS FOOTPRINT AREA
- PROPOSED NO FURTHER ACTION AREAS (EXISTING FILL) TO BE CONFIRMED AS PART OF OU-1 FS DESIGN
- INTEGRATED IRM FOOTPRINT / PROPOSED OU-1 FS FOOTPRINT
- WASTEBEDS 1-8 SITE

HONEYWELL INTERNATIONAL INC.
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WASTEBEDS 1- 8
GEDDES, NEW YORK

IRM AND FS SITE MEDIA

0 350 700 1,400
Feet

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FIGURE 1-4

N

LEGEND

- SEEP COLLECTION TRENCH
- GROUNDWATER COLLECTION TRENCH
- DITCH A IRM
- ACCESS PATHWAYS
- REVETMENT
- SEEP APRON
- VEGETATIVE COVER / RESTORED AREA / SHORELINE STABILIZATION / WET SWALE
- MITIGATION WETLAND
- BIOSOLIDS AREA
- WASTEBEDS 1-8 SITE

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

INTEGRATED IRM COMPONENTS

0 350 700 1,400
Feet

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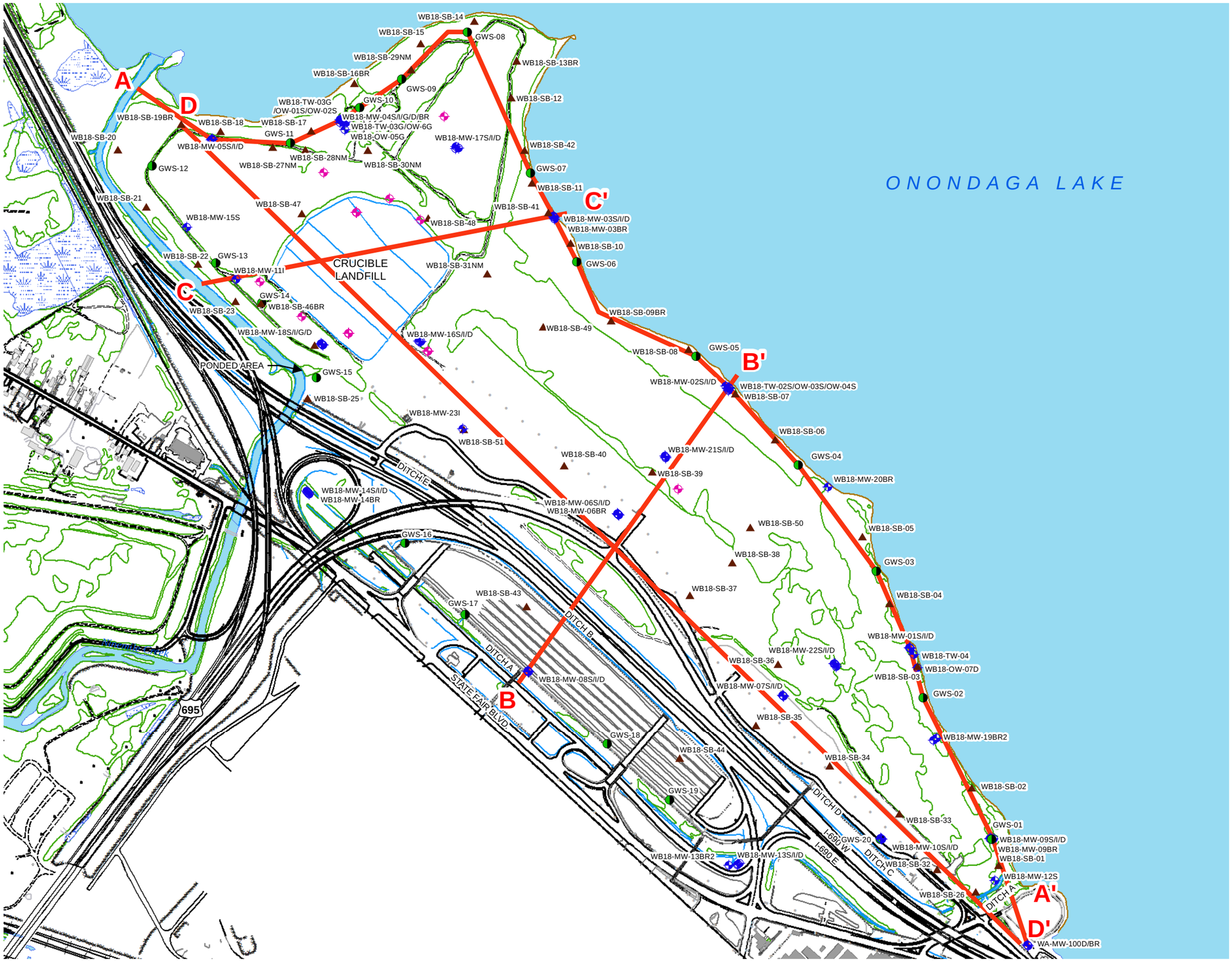
FIGURE 2-1



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N

LEGEND

- CROSS SECTION LOCATION

SAMPLE LOCATIONS

- MONITORING WELL
- SOIL BORING
- GROUNDWATER SCREENING
- CRUCIBLE WELLS

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1 - 8
GEDDES, NEW YORK

CROSS SECTION LOCATIONS

0 350 700 1,400
Feet

SEPTEMBER 2014
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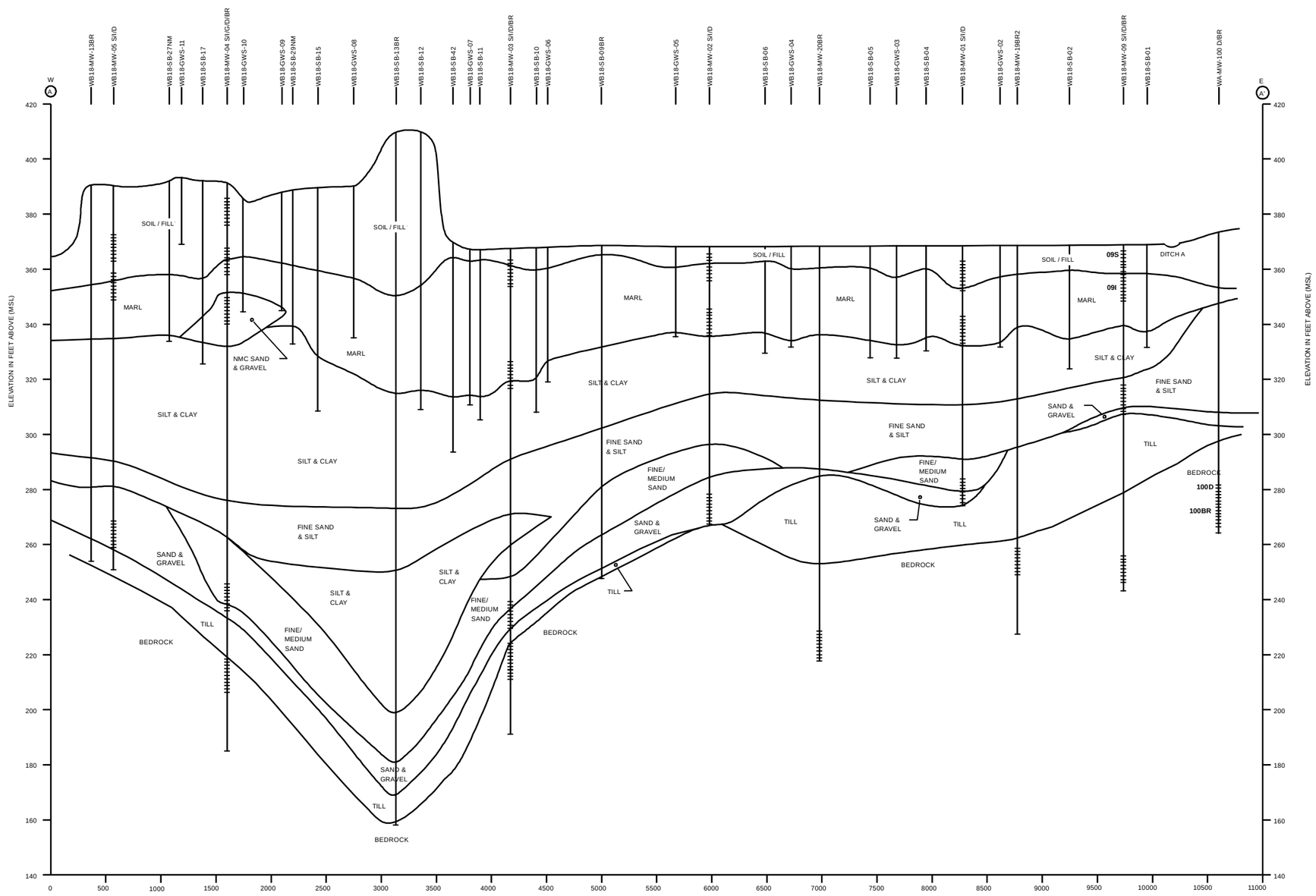

FIGURE 2-2

LEGEND

MW	MONITORING WELL
SB	SOIL BORING
GWS	GROUNDWATER SCREENING
NM	NINEMILE CREEK
S/I/D/BR	SHALLOW/INTERMEDIATE/DEEP/ BEDROCK
	SCREENED INTERVAL

NOTE: WELL CLUSTERS SHOWN AS ONE LOCATION WITH MULTIPLE SCREENS.

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

GEOLOGIC CROSS SECTION A-A'

HORIZONTAL SCALE

0 500 1,000 2,000
Feet

VERTICAL EXAGGERATION = 10x

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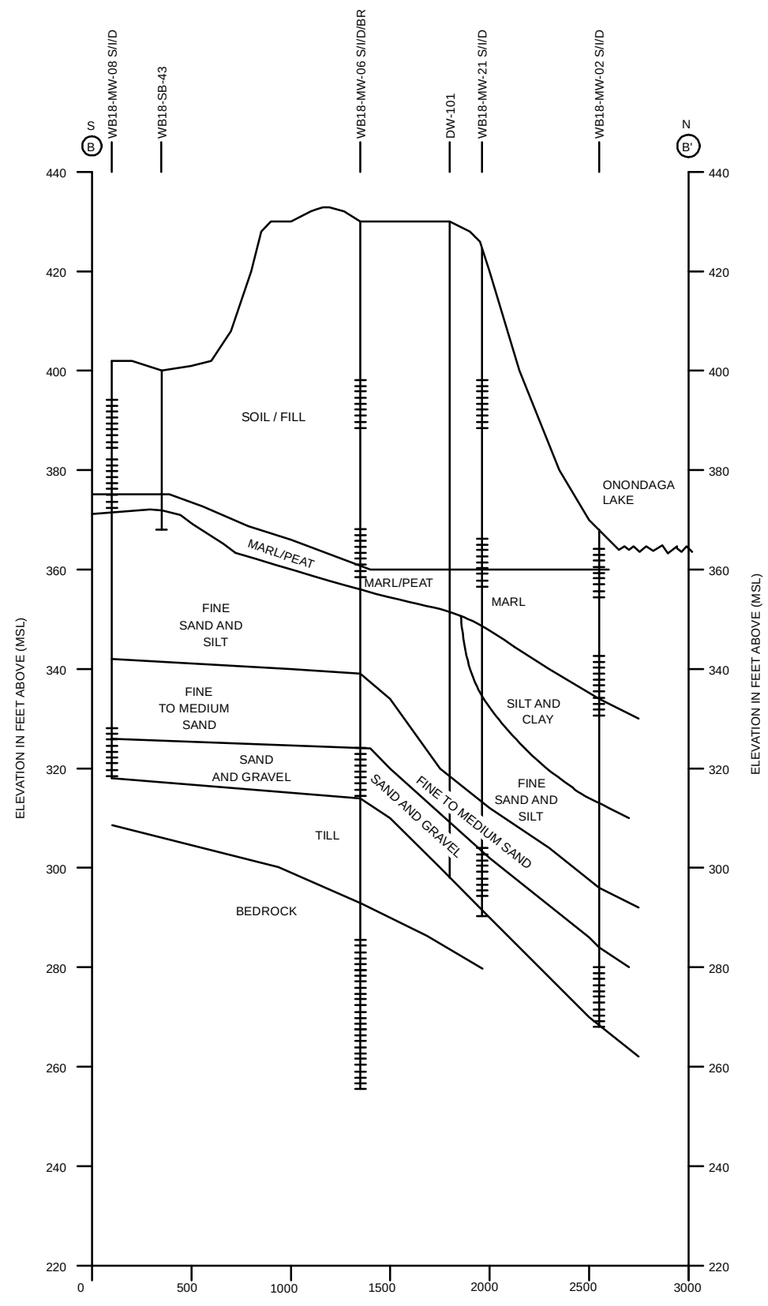
FIGURE 2-3



LEGEND

MW	MONITORING WELL
SB	SOIL BORING
GWS	GROUNDWATER SCREENING
NM	NINEMILE CREEK
S/I/D/BR	SHALLOW/INTERMEDIATE/DEEP/ BEDROCK
	SCREENED INTERVAL

NOTE: WELL CLUSTERS SHOWN AS ONE LOCATION WITH MULTIPLE SCREENS.

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

GEOLOGIC CROSS SECTION B-B'

HORIZONTAL SCALE

0 500 1,000 2,000
Feet

VERTICAL EXAGGERATION = 10x

SEPTEMBER 2014
1163.45176

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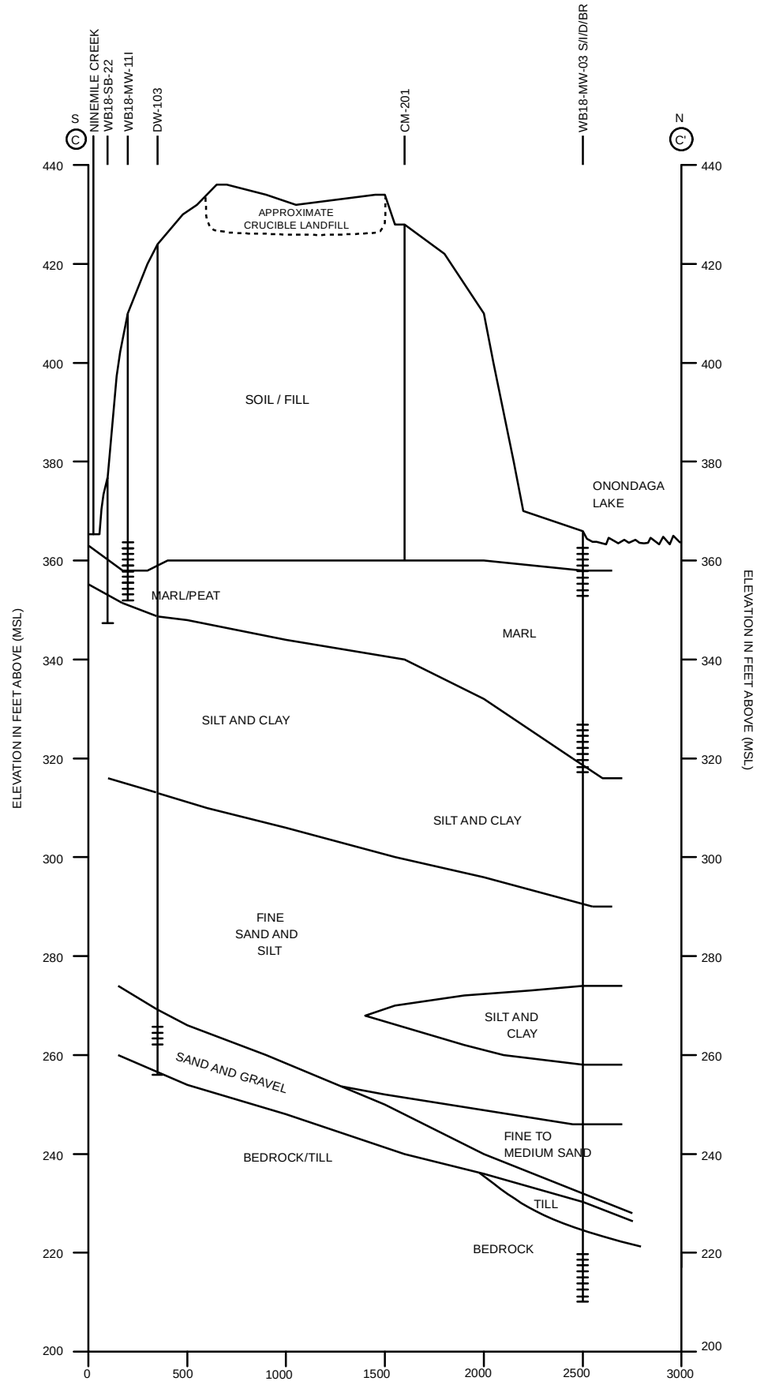
FIGURE 2-4



LEGEND

MW	MONITORING WELL
SB	SOIL BORING
GWS	GROUNDWATER SCREENING
NM	NINEMILE CREEK
S/I/D/BR	SHALLOW/INTERMEDIATE/DEEP/ BEDROCK
|||||	SCREENED INTERVAL

NOTE: WELL CLUSTERS SHOWN AS ONE LOCATION WITH MULTIPLE SCREENS.

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

GEOLOGIC CROSS SECTION C-C'

HORIZONTAL SCALE

0 500 1,000 2,000
Feet

VERTICAL EXAGGERATION = 10x

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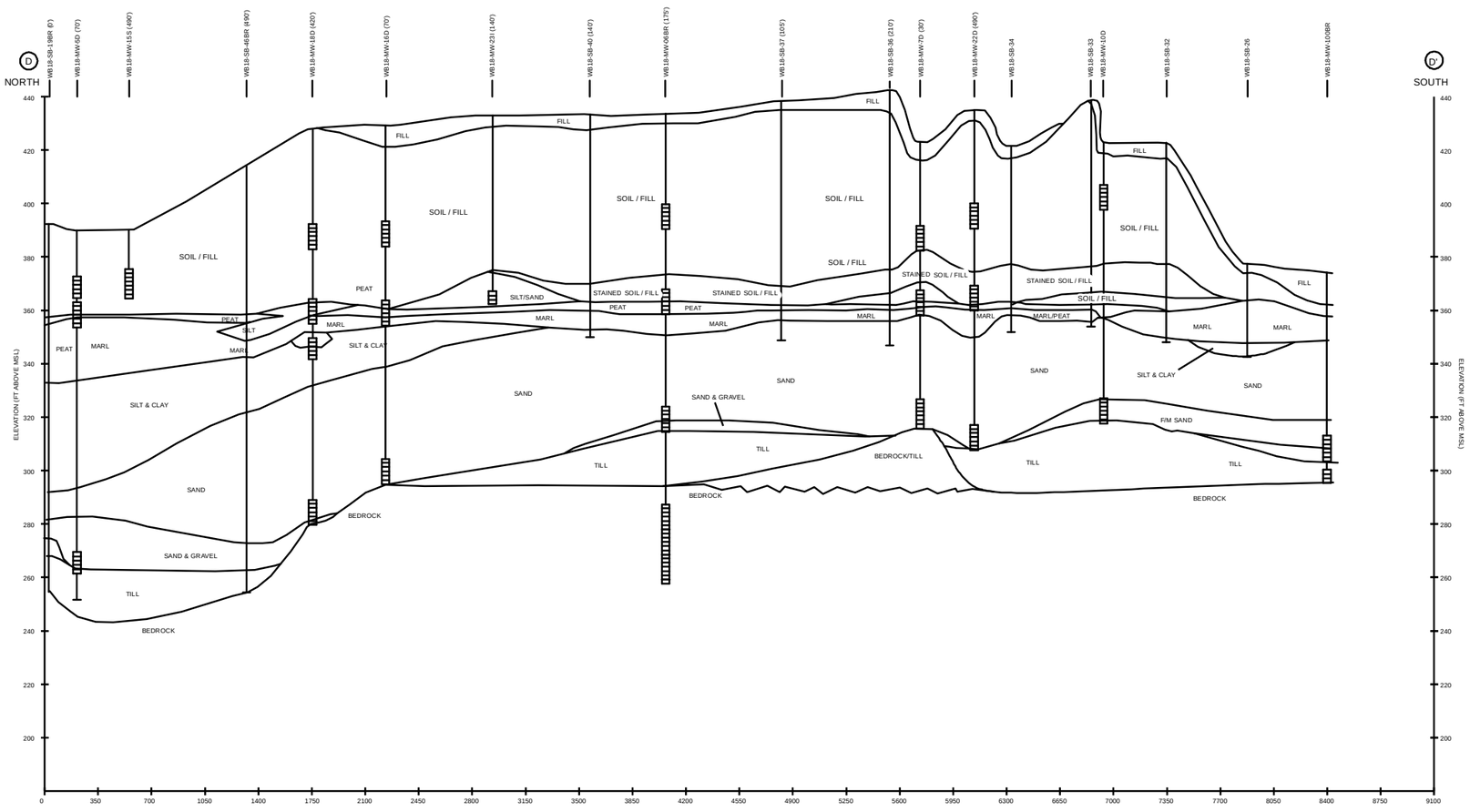
FIGURE 2-5



LEGEND

MW	MONITORING WELL
SB	SOIL BORING
GWS	GROUNDWATER SCREENING
	SCREENED INTERVAL

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INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1 - 8
GEDDES, NEW YORK

GEOLOGIC CROSS SECTION D-D'

HORIZONTAL SCALE

0 500 1,000 2,000
Feet

VERTICAL EXAGGERATION = 10x

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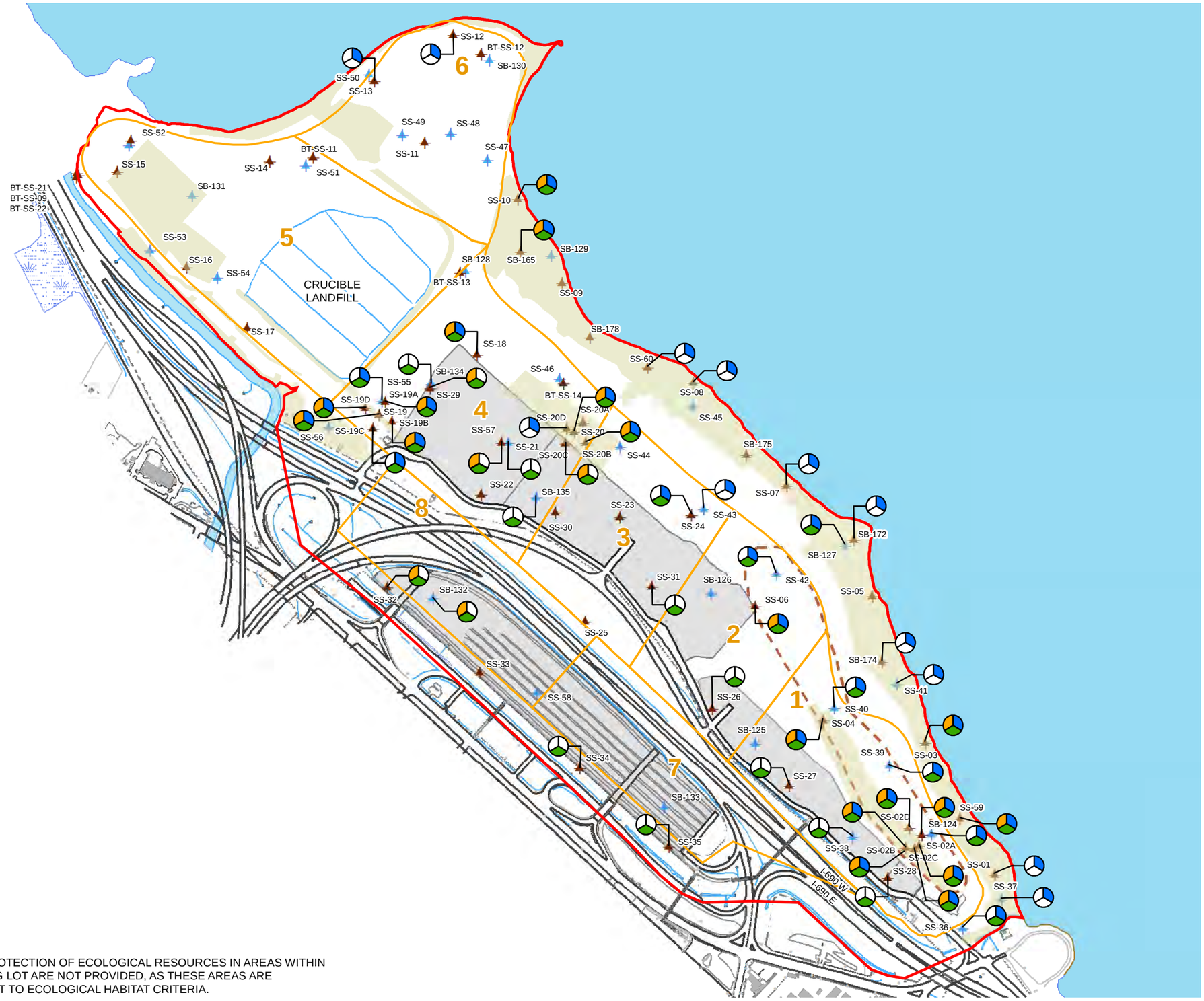
FIGURE 2-6



LEGEND

SCO TYPE

- RESULT EXCEEDING COMMERCIAL SCOs
- RESULT EXCEEDING ECOLOGICAL SCOs
- RESULT EXCEEDING RESTRICTED RESIDENTIAL SCOs
- SURFACE SOIL DATA BELOW SCREENING CRITERIA
- RI CHROMIUM SURFACE SOIL
- AREAS ADDRESSED AS PART OF INTEGRATED IRM
- PARKING LOT AREA
- BIOSOLIDS AREA FOOTPRINT
- APPROXIMATE WASTEBED BOUNDARY
- WASTEBEDS 1-8 SITE

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WASTEBEDS 1- 8
GEDDES, NEW YORK

SURFACE SOIL DATA COMPARED TO COMMERCIAL, ECOLOGICAL, AND RESTRICTED RESIDENTIAL SCOs

0 350 700 1,400
Feet

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NOTE:
PART 375 PROTECTION OF ECOLOGICAL RESOURCES IN AREAS WITHIN THE PARKING LOT ARE NOT PROVIDED, AS THESE AREAS ARE NOT SUBJECT TO ECOLOGICAL HABITAT CRITERIA.

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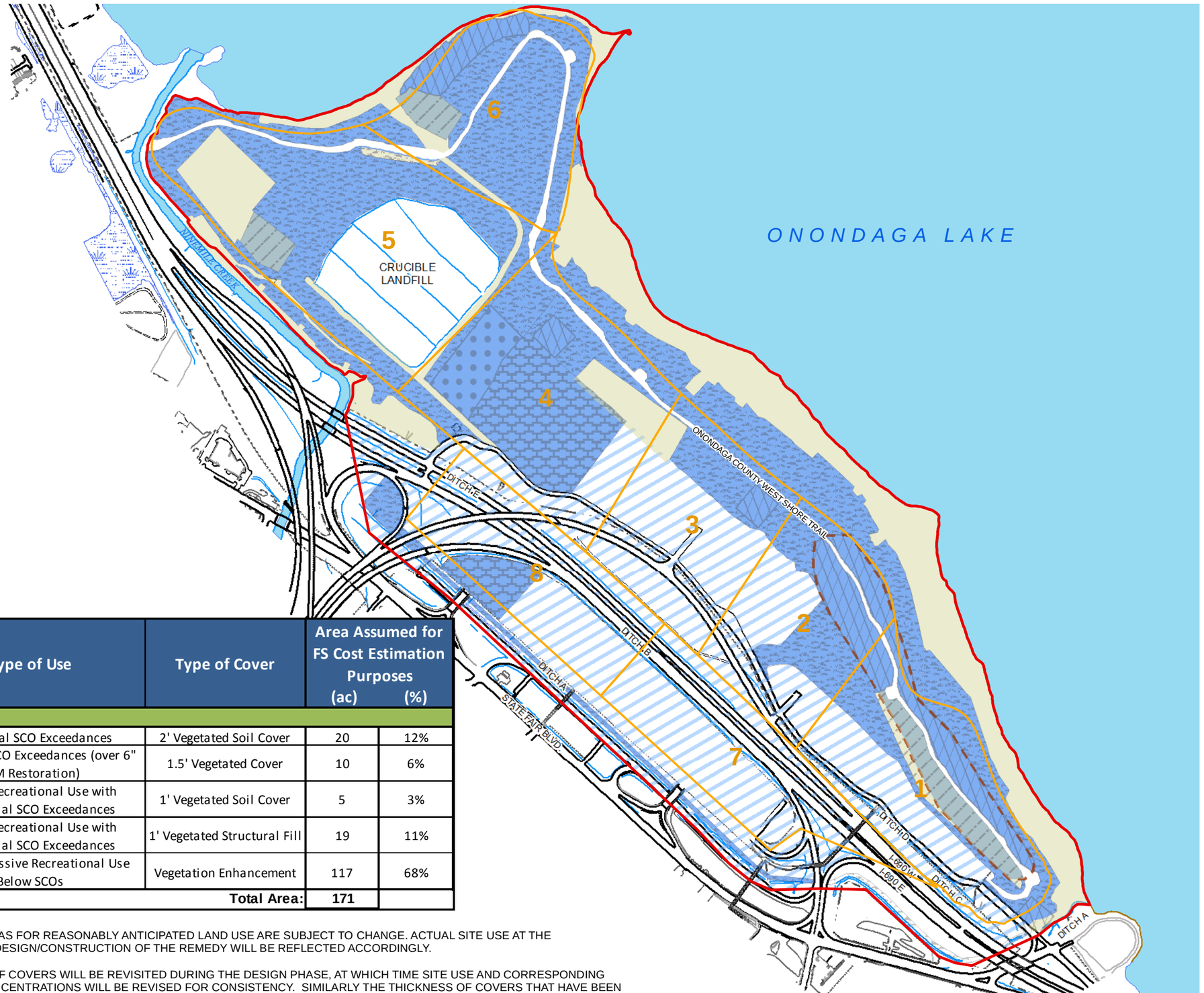
FIGURE 3-1



Type of Use	Type of Cover	Area Assumed for FS Cost Estimation Purposes (ac)	(%)
Ecological SCO Exceedances	2' Vegetated Soil Cover	20	12%
Ecological SCO Exceedances (over 6" IRM Restoration)	1.5' Vegetated Cover	10	6%
Passive Recreational Use with Commercial SCO Exceedances	1' Vegetated Soil Cover	5	3%
Passive Recreational Use with Commercial SCO Exceedances	1' Vegetated Structural Fill	19	11%
Active or Passive Recreational Use Below SCOs	Vegetation Enhancement	117	68%
	Total Area:	**171**	

[1] ASSUMED AREAS FOR REASONABLY ANTICIPATED LAND USE ARE SUBJECT TO CHANGE. ACTUAL SITE USE AT THE TIME OF THE DESIGN/CONSTRUCTION OF THE REMEDY WILL BE REFLECTED ACCORDINGLY.

[2] THE EXTENT OF COVERS WILL BE REVISITED DURING THE DESIGN PHASE, AT WHICH TIME SITE USE AND CORRESPONDING SURFACE CONCENTRATIONS WILL BE REVISED FOR CONSISTENCY. SIMILARLY THE THICKNESS OF COVERS THAT HAVE BEEN ASSUMED WILL BE REVISITED DURING DESIGN SUCH THAT FACTORS INCLUDING LAND USE CAN BE CONSIDERED WHERE APPROPRIATE.

N

LEGEND

- NO FURTHER ACTION AREAS (EXISTING FILL) TO BE CONFIRMED AS PART OF OU-1 FS DESIGN[2] (118 ac)
- ALTERNATIVE 2 FOOTPRINT (171 ac)
- AREAS ADDRESSED AS PART OF INTEGRATED IRM (71 ac)
- STAGING AREAS ADDRESSED AS PART OF INTEGRATED IRM AND OU-1 FS
- EXISTING VEGETATION ENHANCEMENT
- BIOSOLIDS AREA FOOTPRINT
- APPROXIMATE WASTEBED BOUNDARY
- WASTEBEDS 1-8 SITE

TYPE OF COVER[1,2]

- 1' VEGETATED SOIL COVER[1,2]
- 1' VEGETATED STRUCTURAL FILL[1,2]
- 1.5' VEGETATED SOIL COVER[1,2]
- 2' VEGETATED SOIL COVER[1,2]
- VEGETATION ENHANCEMENT[1,2]

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

ALTERNATIVE 2 - VEGETATED COVER SYSTEM

0 350 700 1,400
Feet

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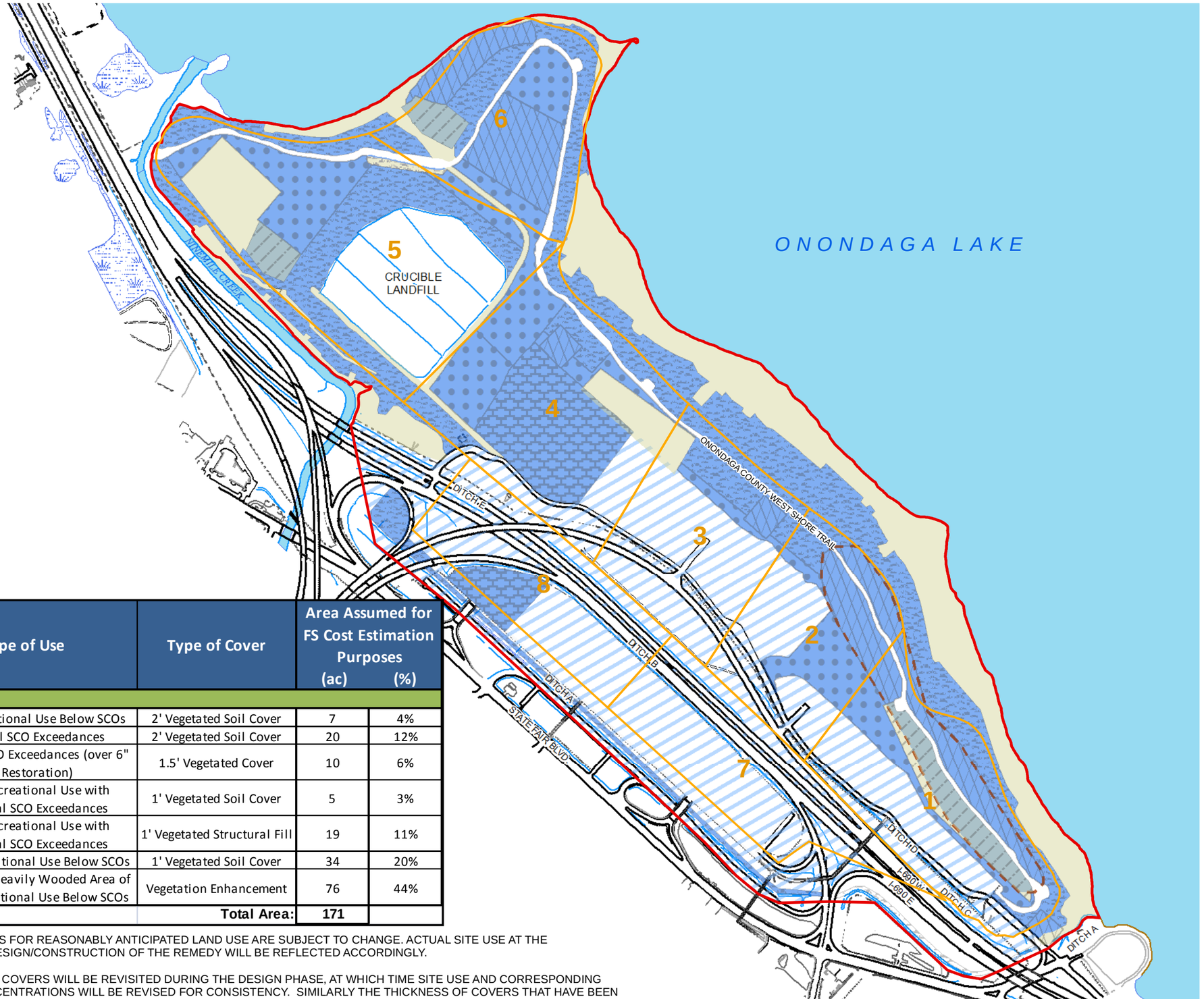
FIGURE 3-2



Type of Use	Type of Cover	Area Assumed for FS Cost Estimation Purposes (ac)	(%)
Active Recreational Use Below SCOs	2' Vegetated Soil Cover	7	4%
Ecological SCO Exceedances	2' Vegetated Soil Cover	20	12%
Ecological SCO Exceedances (over 6" IRM Restoration)	1.5' Vegetated Cover	10	6%
Passive Recreational Use with Commercial SCO Exceedances	1' Vegetated Soil Cover	5	3%
Passive Recreational Use with Commercial SCO Exceedances	1' Vegetated Structural Fill	19	11%
Passive Recreational Use Below SCOs	1' Vegetated Soil Cover	34	20%
Steep Slopes/Heavily Wooded Area of Limited Recreational Use Below SCOs	Vegetation Enhancement	76	44%
	Total Area:	**171**	

[1] ASSUMED AREAS FOR REASONABLY ANTICIPATED LAND USE ARE SUBJECT TO CHANGE. ACTUAL SITE USE AT THE TIME OF THE DESIGN/CONSTRUCTION OF THE REMEDY WILL BE REFLECTED ACCORDINGLY.

[2] THE EXTENT OF COVERS WILL BE REVISITED DURING THE DESIGN PHASE, AT WHICH TIME SITE USE AND CORRESPONDING SURFACE CONCENTRATIONS WILL BE REVISED FOR CONSISTENCY. SIMILARLY THE THICKNESS OF COVERS THAT HAVE BEEN ASSUMED WILL BE REVISITED DURING DESIGN SUCH THAT FACTORS INCLUDING LAND USE CAN BE CONSIDERED WHERE APPROPRIATE.

N

LEGEND

- NO FURTHER ACTION AREAS (EXISTING FILL) TO BE CONFIRMED AS PART OF OU-1 FS DESIGN[2] (118 ac)
- ALTERNATIVE 2 FOOTPRINT (171 ac)
- AREAS RESTORED AS PART OF INTEGRATED IRM (71 ac)
- STAGING AREAS ADDRESSED AS PART OF INTEGRATED IRM AND OU-1 FS
- EXISTING VEGETATION ENHANCEMENT
- BIOSOLIDS AREA FOOTPRINT
- APPROXIMATE WASTEBED BOUNDARY
- WASTEBEDS 1-8 SITE

TYPE OF COVER[1,2]

- 1' VEGETATED SOIL COVER[1,2]
- 1' VEGETATED STRUCTURAL FILL[1,2]
- 1.5' VEGETATED SOIL COVER[1,2]
- 2' VEGETATED SOIL COVER[1,2]
- VEGETATION ENHANCEMENT[1,2]

HONEYWELL INTERNATIONAL INC.
OU-1 FEASIBILITY STUDY
WASTEBEDS 1- 8
GEDDES, NEW YORK

ALTERNATIVE 3 - ENHANCED VEGETATED COVER SYSTEM

0 350 700 1,400
Feet

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