EXPLANATION OF SIGNIFICANT DIFFERENCES

ONONDAGA LAKE BOTTOM SUBSITE OF THE ONONDAGA LAKE SUPERFUND SITE

Towns of Geddes and Salina, Villages of Solvay and Liverpool, and City of Syracuse, Onondaga County, New York

Onondaga County Site No. 734030 August 2014

1.0 INTRODUCTION

If the need for a significant change to a component of an action is identified after the selection of a remedy in a Record of Decision (ROD), Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan require the publishing of an Explanation of Significant Differences (ESD) which sets forth the reasons such changes are necessary.

In July 2005, the New York State Department of Environmental Conservation (NYSDEC) and U.S. Environmental Protection Agency (EPA) issued a ROD that documented the selection of a remedy for the Onondaga Lake Bottom Subsite (Lake Bottom Subsite) of the Onondaga Lake Superfund Site (Site) (NYSDEC and EPA, 2005). A key component of that remedy is the dredging and capping of contaminated sediments/waste from the littoral zone (close to the shore) in Sediment Management Units (SMUs) 1 through 7 (see Figures 1 and 3 depicting the location of the Subsite and SMUs, respectively). The ROD also called for the performance of a study to evaluate the effectiveness of oxygenation (adding oxygen) in reducing the formation of methylmercury in the water column.

The selected remedy was based largely on data collected as part of the remedial investigation for the Lake Bottom Subsite. Subsequent to the issuance of the 2005 ROD, and as part of the remedial design, a detailed geotechnical analysis was conducted in portions of SMUs 6 and 7 located immediately adjacent to the three active railroad lines at the south end of the Lake (see Figure 2). The geotechnical analysis found that dredging in the vicinity of this shoreline area could result in shoreline and railroad line instability as a result of the potential shifting of the ground under the railroad lines during sediment removal. Based on this new information, a study to identify and evaluate alternative approaches was undertaken. The study identified the establishment of a buffer zone where no dredging or capping will occur as the best means to prevent shoreline and railroad line instability. This buffer area is shown on Figure 4. Additional measures to improve habitat and promote natural recovery in this area, such as a wave damper along a portion of the buffer zone to reduce wave energy along the shoreline, and active planting of primarily emergent wetland species in the buffer area will also be included.

The 2005 ROD also called for a post-ROD evaluation of the effectiveness of oxygenation of the deep lake water in reducing the formation of methylmercury in the water column. This post-ROD study initially identified nitrification of the hypolimnion (adding nitrate to the deep lake water) as a possible alternative to oxygenation. Subsequently, a three-year nitrate addition pilot study was conducted from 2011 through 2013. Based on the study's results, it was concluded that nitrate addition effectively inhibits the release of methylmercury from sediment in the deep water portions of the lake, resulting in lower concentrations of methylmercury in lake water and in zooplankton. The lower methylmercury concentrations in zooplankton are expected to result in lower exposure of fish to methylmercury. Likewise, reductions in methylmercury exposures from the water column and through the food chain are anticipated over time to result in lower concentrations of methylmercury in fish in Onondaga Lake, which would reduce potential risks to humans and wildlife that consume fish. Based on information gathered during the nitrate addition study as discussed in more detail below, nitrate addition will be utilized instead of oxygenation. Monitoring will be conducted to ensure the effectiveness of the remedy in meeting the related goals specified in the 2005 ROD.

This ESD presents and provides the basis for the noted modifications to the remedy and will become part of the Administrative Record related to the above-noted ROD for this Site. The information here is a summary of what can be found in greater detail in the technical support documents and other documents that have been placed in the following repositories:

Onondaga County Public Library
Syracuse Branch at the Galleries
447 South Salina Street
Syracuse, NY 13202
Telephone: 315-435-1900

NYSDEC, Syracuse Office
615 Erie Boulevard West
Syracuse, NY 13204
Telephone: 315-426-7400
Please call for an appointment

Atlantic States Legal Foundation
658 West Onondaga Street
Syracuse, NY 13204
Telephone: 315-475-1170
Please call for an appointment.

Solvay Public Library
615 Woods Road
Solvay, NY 13209
Telephone: 315-468-2441

NYSDEC, Central Office
625 Broadway
Albany, NY 12233
Telephone: 518-402-9676
Please call for an appointment

Information related to the Site can also be viewed electronically on the NYSDEC web site at http://www.dec.ny.gov/chemical/37558.html.

NYSDEC and EPA have determined that these revisions do not constitute a fundamental alteration of the remedy selected in the 2005 ROD. The remedy, with these revisions, will be protective of human health and the environment and will comply with the federal and state requirements identified in the ROD.

2.0 SITE DESCRIPTION AND ORIGINAL REMEDY

On June 23, 1989, Onondaga Lake was added to the New York State Registry of Inactive Hazardous Waste Disposal Sites. On December 16, 1994, Onondaga Lake and tributaries and areas upland that contribute or have contributed contamination to the lake system were added to the EPA's National Priorities List (NPL). The NPL listing means that the lake system is among the nation's highest priorities for investigation and response under CERCLA (more commonly known as Superfund) for sites where there has been a release of hazardous substances, pollutants, or contaminants. On July 1, 2005, NYSDEC and EPA issued a ROD documenting the selection of a remedy for the Lake Bottom Subsite. A key component of that selected remedy is the dredging of as much as an estimated 2,653,000 cubic yards (cy) of contaminated sediments/waste from the littoral zone in SMUs 1 through 7 to a depth that will prevent the loss of lake surface area, ensure cap effectiveness, remove non-aqueous-phase liquids, reduce contaminant mass, allow for erosion protection, and reestablish the littoral zone habitat. The selected remedy also includes the placement of an isolation cap over an estimated 425 acres of SMUs 1 through 7.

The 2005 ROD also called for the performance of a study to evaluate the potential effectiveness of oxygenation at reducing the formation of methylmercury in the water column. Post-ROD, nitrification was identified as a possible alternative to oxygenation. The January 4, 2007 Onondaga Lake Consent Decree Statement of Work (SOW), executed between New York State and Honeywell International Inc. (Honeywell), required Honeywell to conduct a study to determine if nitrification would effectively reduce the formation of methylmercury in the water column. The Consent Decree SOW indicated that if NYSDEC determined that nitrification is effective and appropriate, this would be documented in an ESD and Honeywell would be required to implement a nitrification program in lieu of oxygenation.

3.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES AND THE BASIS FOR THOSE DIFFERENCES

3.1 Remedial Area Along Southeastern Shoreline - New Information

Three active railroad lines are located along the shoreline immediately adjacent to SMUs 6 and 7 (see Figure 2). Detailed geotechnical analysis indicates that dredging along this shoreline could result in shoreline and rail line instability, as a result of potential shifting of the ground under the rail lines (Parsons and Geosyntec, 2014).

3.2 Remedial Area Along Southeastern Shoreline – Remedy Modification and Comparison of Changes with the Original Remedy

The ROD called for dredging to a depth of approximately three to four feet in this area followed by placement of a cap of similar thickness with (from bottom to top) a mixing layer, chemical isolation layer, erosion protection (armor) layer, and habitat restoration layer. Although dredging has been determined to be precluded because of the railroad line stability issue described above, other options, including sequential dredging/capping, driving sheetpile along the shoreline and in the lake approximately 30 feet from the shoreline, placement of a cap or a modified cap without prior dredging, temporary surcharging, and in-situ treatment were also considered.

Sequential dredging and capping would involve dredging a portion of the shoreline area and then capping this dredged area before proceeding with dredging and capping the adjacent area. The entire shoreline area would ultimately be dredged and capped through a series of such incremental steps. This would reduce the potential impacts to the shoreline and rail stability, but it would not eliminate them. The detailed geotechnical analysis indicates that any activity that reduces the shoreline stability from its current state would not be acceptable.

Driving sheetpile along the shoreline to improve stability was determined to not be viable because of unacceptable shoreline and railroad instability resulting from the need to excavate a significant amount of debris and rip-rap along the shoreline prior to installing the sheetpile. While driving sheetpile approximately 30 feet from the shoreline may result in less debris needing to be removed, it would require construction of a 30-foot-wide soil buttress on the lake side of the sheetpile wall to prevent unacceptable deflection of the sheetpile wall during dredging. This 30-foot-wide buttress as well as the 30-foot-wide area between the shoreline and sheetpile wall would result in permanent loss of lake surface area and would not be acceptable.

Placement of an isolation cap without prior dredging would not be an appropriate approach because it would result in loss of lake surface area because of the shallow water depths in this area (ranging from 0 to 3 feet). The ROD-specified cap includes a chemical isolation layer with a minimum thickness of 1 foot overlain by a habitat/erosion protection layer with a minimum thickness of 1 foot. Allowances must also be made for mixing with underlying sediment and the overplacement that results during construction, as shown in Figure 5. This results in an average cap thickness of approximately 3 feet. Thinner caps were also considered for this area. The minimum constructible cap that would provide chemical isolation and erosion protection would be approximately 17 inches thick, as shown in Figure 5. However, the water depth in this area remains shallow for a significant distance from the shore, and placement of a 17-inch thick cap would result in a loss of lake surface area of approximately 5 acres.

A temporary surcharge approach would involve placing the cap without prior dredging along the shoreline area adjacent to the rail lines, and then covering the cap with a large temporary soil pile (berm), as shown in Figure 6. Over time, the weight of the soil would result in compression of the sediments underlying the cap by an amount equal to the cap thickness, thereby lowering the cap surface. The goal would be to create enough settlement so that when the temporary soil pile was removed, the cap surface would be below the lake surface so that there was no loss of lake surface area. The average cap thickness based on ROD-specified minimums plus average overplacements is approximately 3 feet. Geotechnical analysis indicates that placement of a 10-foot-tall temporary soil pile over the impacted area along the entire shoreline would result in settlement of approximately 3 feet within approximately 5 years. However, this would result in a loss of lake surface area during the 5-year settlement period. It would also present a significant negative visual impact because of the length and height of the soil pile. Most significantly, detailed geotechnical modeling indicates it could also result in unacceptable settlement of the adjacent rail lines.

In-situ treatment would consist of applying a treatment media such as granular activated carbon (GAC) to the surface of the sediment. The media would either be actively mixed or allowed to mix naturally with the upper layer of contaminated sediment, thereby reducing potential risks. Since activated carbon does not reduce the contaminant concentration within the sediment, it would not achieve the sediment criteria established in the 2005 ROD. However, the high sorptive capacity of activated carbon may reduce the contaminant concentration within the sediment porewater and thus may reduce contaminant bioavailability. Direct application of GAC without prior mixing with sands is most commonly applied in relatively low energy environments, such as wetlands or in deep water as GAC is susceptible to disturbance and movement by currents or wave action because of its lower density relative to typical sediment particles. The southeastern shoreline area is the highest energy shoreline area within the lake. Even with implementing the wave damper and enhanced vegetation noted above, this area will still be subject to waves and ice scour that would periodically displace and move surface sediments and any activated carbon. In-situ treatment would therefore not provide long-term effectiveness in this area and would not be appropriate.

Further information on the screening of sequential dredging/capping, driving sheetpile along the shoreline and in the lake, placement of a cap or modified cap without prior dredging, temporary surcharging, and in-situ treatment is presented in more detail in *Onondaga Lake Technical Support Document for Remediation Area E Shoreline* (Parsons and Geosyntec, 2014).

While dredging and capping in the buffer area are precluded based on geotechnical stability concerns and a desire to avoid loss of lake surface area, it is also important to consider the contaminant concentrations in the area. The lower contaminant concentrations in this area (relative to the concentrations in sediments of the in-lake waste deposit area in SMU 1 and portions of SMUs 2 and 7) further support a decision for not capping the buffer area at the expense of lake surface area. The human health risk assessment related to exposure to sediments in the southern basin nearshore area, including exposure to sediments along the southeastern shoreline through activities such as wading and swimming, found that cancer risks were within the EPA target risk range and that non-cancer risks were below the EPA target threshold, as discussed in the 2005 ROD. Regarding potential ecological risks, although contaminant concentrations in some sample locations in the buffer zone exceed the Site-specific mercury probable effect concentration (PEC), which is one of two thresholds used to delineate potential direct toxicity to sediment dwelling organisms, the relatively small size of this area would not substantively affect ecological populations. Among the 17 surface sediment samples within the area, eight exceeded the mercury PEC of 2.2 mg/kg and only two of the eight locations exhibited mercury concentrations that exceeded the mercury PEC by more than a factor of two. It should be noted that the bioaccumulation-based sediment quality value (BSQV) of 0.8 mg/kg total mercury will still be achieved lake-wide and in the southern portion of the lake, which includes the area being affected by this ESD. Contaminant concentrations in some sample locations in the buffer zone exceeded the mean probable effects concentration quotient (mean PECQ) of 1, which is an index which incorporates sediment toxicity effects of multiple Site-specific contaminants, and which is the other threshold used to delineate potential direct toxicity to sediment-dwelling organisms. The mean PECQ in surface sediments in this buffer area ranges from 0.4 to 27. Although the high end of the range is significantly greater than the threshold, the relatively small size of this area would not substantively affect sediment dwelling populations. In addition, the elevated mean PECQ in this area is primarily driven by heavy polyaromatic hydrocarbons (PAHs), which are not very mobile in sediment porewater (compared to volatile organic contaminants, chlorinated benzenes, and naphthalene) and would therefore have less potential to migrate to any clean material which may accumulate above the existing sediment surface. Polychlorinated biphenyls (PCBs) were generally not detected at elevated concentrations in the samples collected from this area, and therefore this area does not present a lake-wide bioaccumulation concern for PCBs.

A summary of the mean PEC quotient values as well as the concentrations of mercury and PCBs in surface sediments in this buffer area is provided below.

Chemical	Units	Remedial Goals	Surface Sediment (Top Interval of Cores)	
			Average	Maximum
Mean PEC Quotient	--	1	8.9	27.0
Mercury	mg/kg	2.2	2.7	11.9
PCBs	ug/kg	295	228	2207

Notes

1. Only data from the top interval from each core (0 to 1 ft or 0 to 3.3 ft) were used.

2. For undetected PCBs, one-half of the detection limit was used to calculate the average.

The 2005 remedy is being modified by the establishment of a buffer zone in a portion of SMUs 6 and 7 where no dredging or capping will occur in order to prevent shoreline and railroad line instability. The buffer zone varies from 130 to 200 feet from the shoreline and encompasses an area of approximately 10 acres (approximately 2% of the total area which was to be dredged and/or capped as part of the overall remedy). The areas of SMUs 6 and 7 that lie outside of the buffer zone will be remediated consistent with the selected remedy in the 2005 ROD and with the final design (see Onondaga Lake Capping, Dredging, Habitat, and Profundal Zone (Sediment Management Unit 8) Final Design. Parsons and Anchor QEA. March 2012).

The revised approach incorporates measures to improve habitat and promote natural recovery of sediments in the buffer area. The approach includes the construction of a wave damper using natural materials (cobble) along approximately 1,000 feet of the buffer zone to reduce wave energy along the shoreline and allow for better growing conditions for aquatic vegetation. (See Figure 4.) In addition, active planting of primarily emergent wetland species will be implemented in the areas behind the wave damper and behind areas with a shallow cap which would serve as a wave damper. The wave damper and increased vegetation will improve the area's habitat value for fish and other organisms. It will also help stabilize sediments and promote natural recovery through deposition and retention of new clean sediments such as those entering the lake from Onondaga Creek and/or resulting from decay of vegetation. The remedial approach in the buffer area will include baseline surface sediment sampling, characterization of existing substrate, structure, and vegetation to gain a better understanding of the need for additional plantings/types of plantings as well as the presence of invasive species, and post-remedy surface sediment sampling and vegetation monitoring to confirm natural recovery and restoration success.

Given the small area involved in the modification relative to the remaining areas of the lake that are being dredged and capped, or capped only, the modification will not significantly affect remedial timeframes, degree of protectiveness, remedial costs, or the extent of institutional controls needed.

3.3 Nitrate Addition to the Deep Waters of the Lake – New Information

Subsequent to the 2005 ROD issuance, new insights for controlling methylmercury concentrations in lake waters emerged, and the potential effectiveness of nitrate addition was identified as an alternative to oxygenation by the Upstate Freshwater Institute (UFI) and Syracuse University (SU). Specifically, UFI and SU noted that, like oxygen-reduction, nitrate reduction is (1) a common bacterially mediated oxidation-reduction (redox) reaction in the terminal decomposition of organic matter in lake ecosystems, and (2) relative to sulfate reduction, it is an alternate and energetically favorable decomposition pathway. As sulfate-reducing bacteria are the dominant methylators of inorganic mercury in freshwater sediments, UFI and SU noted that internal production of methylmercury may be inhibited by maintenance of adequate concentrations of nitrate in the lake.

Wastewater treatment upgrades in 2004 at the Metropolitan Syracuse Wastewater Treatment Plant (Metro), which is owned and operated by Onondaga County, resulted in higher levels of nitrate discharge and a 2-fold increase in nitrate concentrations in the lake at the onset of stratification each year in May subsequent to the upgrades. Additional wastewater treatment upgrades at Metro in 2005 to remove phosphorus resulted in marked reductions in phosphorus loading to Onondaga Lake and commensurate reductions in primary production and demand for oxygen and nitrate in the lake's hypolimnion. Less demand for oxygen and nitrate leads to less release of methylmercury from lake sediments (Parsons and UFI, 2014).

In 2005, UFI and SU identified the potential benefits to mercury cycling resulting from nitrification treatment (conversion of ammonia to nitrate via bacteria) and improved phosphorus removal implemented by Onondaga County at Metro. The potential benefits of augmenting the hypolimnetic nitrate pool were presented to NYSDEC, EPA, and Honeywell in the fall of 2005. In 2006, a feasibility analysis was prepared by UFI and SU that documented that addition of nitrate to the hypolimnion of Onondaga Lake during summer stratification could meet the objectives specified in the ROD associated with oxygenation (UFI and SU, 2007 and 2008).

As a result, the 2007 SOW attached to the Consent Decree for the design and implementation of the 2005 remedy between the State of New York and Honeywell required that Honeywell conduct a study to determine if nitrification would effectively reduce the formation of methylmercury in the deeper layer of the water column. The SOW also states, "if [NYS]DEC determines that nitrification is effective and appropriate based upon the results of this study, this will be documented in an ESD, and Honeywell shall be required to implement a nitrification program in lieu of oxygenation. If [NYS]DEC determines that nitrification is not effective and/or appropriate, Honeywell shall conduct an oxygenation pilot study and implement oxygenation as provided in the ROD."

Consistent with that SOW, Honeywell completed a lake-wide three-year pilot study of nitrate addition. The pilot study achieved significant reductions in methylmercury release from sediment in the deeper stratified waters of Onondaga Lake, resulting in lower lake water methylmercury concentrations while preserving the lake's normal cycle of stratification. Lower methylmercury concentrations in lake water have resulted in lower methylmercury concentrations in zooplankton, which in turn may result in lower exposure of fish to methylmercury. These reductions in methylmercury exposures from the water column and through the food chain are anticipated over time to result in lower concentrations of methylmercury in fish in Onondaga Lake and reduce potential risk to humans and wildlife that consume fish.

3.4 Nitrate Addition to the Deep Waters of the Lake – Remedy Modification and Comparison of Changes with the Original Remedy

Based on Honeywell's nitrate addition pilot study, NYSDEC and EPA are modifying the remedy to require full-scale implementation of nitrate addition in Onondaga Lake in lieu of oxygenation. Adding nitrate to deep waters in Onondaga Lake during summer months provides a significant environmental benefit to the lake by effectively inhibiting releases of methylmercury from lake sediments without adverse effects, such as the extensive infrastructure in the lake that would be needed to deliver oxygen to the deep lake waters. Furthermore, adding nitrate to deep waters effectively builds on the benefit provided since 2004 by the conversion of ammonia to nitrate in treated wastewater discharged to Onondaga Lake from Metro.

In light of the nitrate addition study results and in accordance with the SOW attached to the Consent Decree, NYSDEC and EPA have determined that an oxygenation pilot study will not be performed. Available information suggests that oxygen addition would most likely not be as effective in Onondaga Lake as nitrate addition and any full scale application of oxygenation would require energy intensive and extensive infrastructure in the lake in order to deliver oxygen to the deep lake waters. Infrastructure for oxygenation may include onshore evaporators or oxygen-generation units, high-voltage electrical service, oxygen delivery and power lines from the shoreline into the lake, and Speece Cones, which are inverted funnels approximately 20 feet tall and 12 ft in diameter which act as contact chambers in which oxygen gas is mixed with oxygen-depleted water to produce water enriched with dissolved oxygen. Access to the lake bottom (*e.g.*, anchoring of boats) would need to be restricted in the vicinity of underwater infrastructure.

In contrast, a significant operational advantage exists for nitrate addition over oxygenation in that the nitrate solution is heavier than water, allowing the diluted nitrate solution to be applied at depth and remain close to the lake bottom and spread laterally, thus making it feasible to maintain sufficient concentrations of nitrate at the critical sediment-water interface to suppress release of methylmercury to the water column. It would likely not be feasible to apply oxygenation in a way that would result in concentrations of oxygen at the critical sediment-water interface sufficient to suppress release of methylmercury without significantly disturbing the sediment.

Full-scale nitrate addition can be conducted using a barge-based application consistent with the applications successfully completed during the pilot test. Nitrate addition is sufficiently flexible that even unlikely, extreme future scenarios of very low nitrate levels in lake waters during the spring season would be manageable. For example, in the unlikely event that Metro treatment of ammonia to nitrate would go offline or in the unlikely event that the lake would not mix vertically in early spring prior to summer stratification, then less nitrate would be available in the hypolimnion. However, sufficient quantities of nitrate could be added to the lake at a more rapid pace if needed to sufficiently address these conditions.

Applying nitrate to Onondaga Lake does not result in any potentially significant adverse effects on water quality, growth of algae, or biota in the lake. Furthermore, adverse impacts on water quality from adding nitrate were not observed during the pilot test. Concentrations of nitrite and ammonia in the hypolimnion were in general the same or lower during the nitrate addition pilot test compared to the years 2007 through 2010, prior to adding nitrate. The statewide water quality standard for nitrite (0.10 milligrams per liter as nitrogen) was not exceeded in the lake's epilimnion between 2007 and 2010 or during the pilot test. Adding nitrate also does not affect algal productivity in Onondaga Lake, because algal productivity is controlled by phosphorus inputs to the lake rather than by nitrogen inputs. The nitrate solution used in the pilot study and which will likely be used in this aspect of the lake remedy is most often used as an agricultural fertilizer and has been used as such for many years with no known effects on human health or biota. Monitoring data confirm that algal biomass did not increase during the years of the nitrate addition pilot test and that summertime algal blooms have not occurred since 2007.

Monitoring during the three-year nitrate-addition pilot test also addressed other potential impacts discussed in the 2007 feasibility analysis (UFI and SU, 2007). The ultimate fate of nitrate added to the lake is transformation to nitrogen gas, based on supporting studies conducted prior to the pilot test as well as the dissolved gas measurement data collected during the pilot test. Adding nitrate to the hypolimnion did not result in significant increases in dissolved gases during the pilot test. No adverse impacts to fish are evident in Onondaga Lake from dissolved gases given that supersaturation conditions did not exist during the pilot test (Parsons and UFI, 2014). Average nitrate-nitrogen concentrations in the hypolimnion remained, on average, less than 2 milligrams per liter which is well below the 10 milligrams per liter concentration at which long-term exposure may adversely affect sensitive freshwater species (Camargo et. al., 2005). Ammonia toxicity is generally not a noteworthy concern in deeper waters in stratified lakes because concentrations of the toxic fraction are low at typical values of pH and temperature in lake waters (Matthews et. al., 2000).

Adding nitrate also did not lead to significant changes in pH of the hypolimnion or deposition of solids to the Onondaga Lake hypolimnion. Water temperatures in the hypolimnion were 2 to 4 degrees Fahrenheit lower during the pilot test compared to the years 2007 through 2010 prior to the pilot test, which indicates that mixing and transport between hypolimnion and epilimnion waters does not increase because of nitrate addition. During the nitrate addition pilot test, concentrations of nitrate-nitrogen in the hypolimnion at fall turnover ranged from 0 to 1 milligram per liter higher than in the years without nitrate addition, which is less than 10 percent of the prevailing summertime (June through September) mass of nitrate carried by the Seneca River which receives the outflow from Onondaga Lake. Nitrate loading is not a concern with respect to primary production in downstream ecosystems (Seneca River, Oswego River, Lake Ontario) because algal growth in these systems is limited by phosphorus.

The need to add nitrate in the future is expected to decline gradually on an average annual basis. The need for continued nitrate addition will be evaluated annually based on prior year results, the lake's fluctuating seasonal hydrologic and nitrate inputs, and other factors. Improved phosphorus removal from Metro discharges since 2005 is expected to reduce the demand for oxygen and nitrate over time. In addition, ongoing natural recovery because of gradual burial of sediment with cleaner solids being deposited in SMU 8 will reduce total mercury concentrations in SMU 8 surface sediments (Parsons and UFI, 2014).

With respect to costs, installation costs and annual costs for labor, materials, and energy would be expected to be higher for oxygenation relative to nitrate addition; however, the cost differentials between the two are not significant with respect to the estimated costs for implementation of the overall Site remedy ($451 million). The incorporation of nitrate addition into the remedy will not affect the 10-year remedial timeframe prescribed in the 2005 ROD for monitored natural recovery of mercury-contaminated sediment in the deep water portion of the lake.

Long-term monitoring will continue to be performed in Onondaga Lake to assess progress toward meeting the goals specified in the 2005 ROD, as well as to continue to confirm that nitrate addition does not result in adverse impacts on the environment.

4.0 SUPPORT AGENCY COMMENTS

The New York State Department of Health concurs with this modification**.**

5.0 FIVE-YEAR REVIEWS

Since hazardous substances, pollutants or contaminants remain at the Site which do not allow for unlimited use or unrestricted exposure, in accordance with 40 CFR 300.430(f)(4)(ii), the remedy for this Subsite must be reviewed no less often than every five years.

6.0 AFFIRMATION OF STATUTORY DETERMINATIONS

Considering the new information that has been developed and the changes that have been made to the selected remedy, NYSDEC and EPA believe that the 2005 remedy, as revised, remains protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to this remedial action, and is cost effective. The modified remedy satisfies Section 121 of CERCLA.

7.0 PUBLIC PARTICIPATION ACTIVITIES

NYSDEC and EPA are making this ESD and supporting information available to the public in the Administrative Record for the Lake Bottom Subsite. Should there be any questions regarding this ESD, please contact:

Timothy Larson, P.E., Project Manager
New York State Department of Environmental Conservation
625 Broadway, Albany, NY 12233-7013
Phone: (518) 402-9676
E-Mail: tim.larson@dec.ny.gov

Or

Robert Nunes, Remedial Project Manager
United States Environmental Protection Agency, Region 2
290 Broadway, New York, NY 10007-1866
Phone: (212) 637-4254
E-Mail: nunes.robert@epa.gov

Project health-related questions should be directed to:

Mark S. Sergott, Project Manager
New York State Department of Health
Empire State Plaza Corning Tower
Room 1787
Albany, NY 12237
Phone: (518) 402-7860
E-Mail: mark.sergott@health.ny.gov

With the publication of this ESD, the public participation requirements set out in §300.435(c)(2)(i) of the NCP have been met.

August 4, 2014
Date

Robert W. Schick, P.E., Director
Division of Environmental Remediation

8.0 REFERENCES

Camargo, J., A. Alonso and A. Salamanca. 2005. *Nitrate Toxicity to Aquatic Animals: A Review with New data for Freshwater Invertebrates*. Chemosphere 58:1255-1267.

Matthews, D. A., S. W. Effler and C. M. Matthews (Brooks). 2000. *Ammonia and toxicity criteria in polluted Onondaga Lake, New York.* Water Environment Research 72:731-741.

New York State Department of Environmental Conservation and United States Environmental Protection Agency Region 2. 2005. *Record of Decision. Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site*. July.

Parsons and Anchor QEA. 2012. *Onondaga Lake Capping, Dredging, Habitat, and Profundal Zone (Sediment Management Unit 8) Final Design.* Prepared for Honeywell. March.

Parsons and Geosyntec. 2014. *Onondaga Lake Technical Support Document for Remediation*

Area E Shoreline. Prepared for Honeywell. July.

Parsons and UFI. 2014. *Onondaga Lake Technical Support Document for Nitrate Addition.* Prepared for Honeywell. June.

UFI and SU. 2007. *Preliminary Feasibility Analysis for Control of Methylmercury Production in the Lower Waters of Onondaga Lake Through Nitrate Addition*. A report prepared for Honeywell by Upstate Freshwater Institute, Syracuse, NY and Syracuse University, Center for Environmental Systems Engineering, Syracuse, NY.

UFI and SU. 2008. *Interpretive Report Evaluation of Nitrate Addition to Control Methylmercury Production in Onondaga Lake: 2006 Study*. Prepared for Honeywell. April.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

DATE: JUL 22 2014

SUBJECT: Explanation of Significant Differences for Lake Bottom Subsite of the Onondaga Lake Superfund Site

FROM: Doug Garbarini, Chief
New York Remediation Branch

TO: Walter E. Mugdan, Director
Emergency and Remedial Response Division

In July 2005, the New York State Department of Environmental Conservation (NYSDEC) and U.S. Environmental Protection Agency (EPA) issued a Record of Decision (ROD) that documented the selection of a remedy for the Onondaga Lake Bottom subsite of the Onondaga Lake Superfund site. A key component of the remedy is the dredging and capping of contaminated sediments/waste from the littoral zone (close to the shore) in Sediment Management Units (SMUs) 1 through 7 (see attached Explanation of Significant Differences [ESD] Figures 1 and 3 depicting the location of the subsite and SMUs, respectively). The ROD also called for the performance of a study to evaluate the effectiveness of oxygenation (adding oxygen) in reducing the formation of methylmercury in the water column.

The selected remedy was based largely on data collected as part of the remedial investigation for the Lake Bottom subsite. Subsequent to the issuance of the ROD, and as part of the remedial design, a detailed geotechnical analysis was conducted in portions of SMUs 6 and 7 located immediately adjacent to the three active railroad lines at the south end of the Lake (see ESD Figure 2). The geotechnical analysis found that dredging in the vicinity of this shoreline area could result in shoreline and railroad line instability as a result of the potential shifting of the ground under the railroad lines during sediment removal. Based on this new information, a study to identify and evaluate alternative approaches was undertaken. The study identified the establishment of a buffer zone where no dredging or capping will occur as the best means to prevent shoreline and railroad line instability. This buffer area is shown on ESD Figure 4. Additional measures to improve habitat and promote natural recovery in this area, such as a wave damper along a portion of the buffer zone to reduce wave energy along the shoreline, and active planting of primarily emergent wetland species in the buffer area, will also be included.

The ROD also called for a post-ROD evaluation of the effectiveness of oxygenation of the deep lake water in reducing the formation of methylmercury in the water column. This post-ROD study initially identified nitrification of the hypolimnion (adding nitrate to the deep lake water) as a possible alternative to oxygenation. Subsequently, a three-year nitrate addition pilot study was conducted from 2011 through 2013. Based on the study's results, it was concluded that nitrate addition effectively inhibits the release of methylmercury from sediment in the deep water portions of the lake, resulting in lower concentrations of methylmercury in lake water and in zooplankton. The lower methylmercury concentrations in zooplankton are expected to result in lower exposure of fish to methylmercury. Likewise, reductions in methylmercury exposures from the water column and through the food chain are anticipated over time to result in lower concentrations of methylmercury in fish in Onondaga Lake which would reduce potential risks to humans and wildlife that consume fish. Based on information gathered during the nitrate addition study discussed below, nitrate addition will be utilized instead of oxygenation. Monitoring will be conducted to ensure the effectiveness of the remedy in meeting the related goals specified in the ROD.

The attached ESD serves to document the above-noted change to the remedy. The ESD was originally drafted by NYSDEC and subsequently modified to incorporate comments from the EPA Region 2's New York Remediation Branch, EPA Headquarters, and the Onondaga Nation. The ESD would be co-issued by NYSDEC and the EPA consistent with previously issued Onondaga Lake site decision documents such as the ROD noted above.

Please indicate your approval of the ESD by signing below.

If you have any questions related to the ESD, please call me at extension 4288.

Attachment

Approved: for John E. LaPadula July 22 2014

Walter E. Mugdan, Director
Emergency and Remedial Response Division

Date

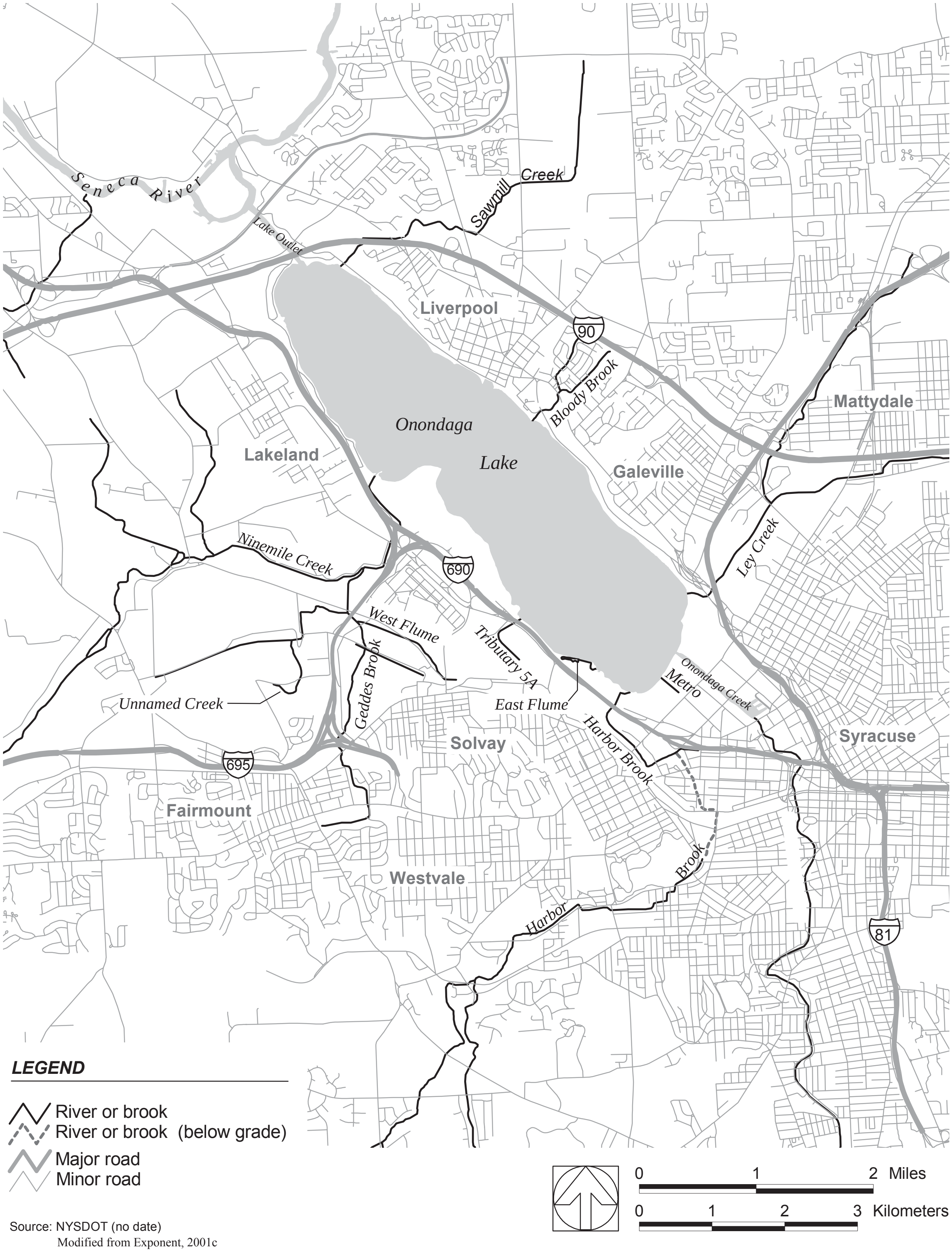

Figure 1 Onondaga Lake Area Tributaries and Roads

FIGURE 2

Honeywell

Onondaga Lake
Syracuse, New York

Shoreline Railroad Lines

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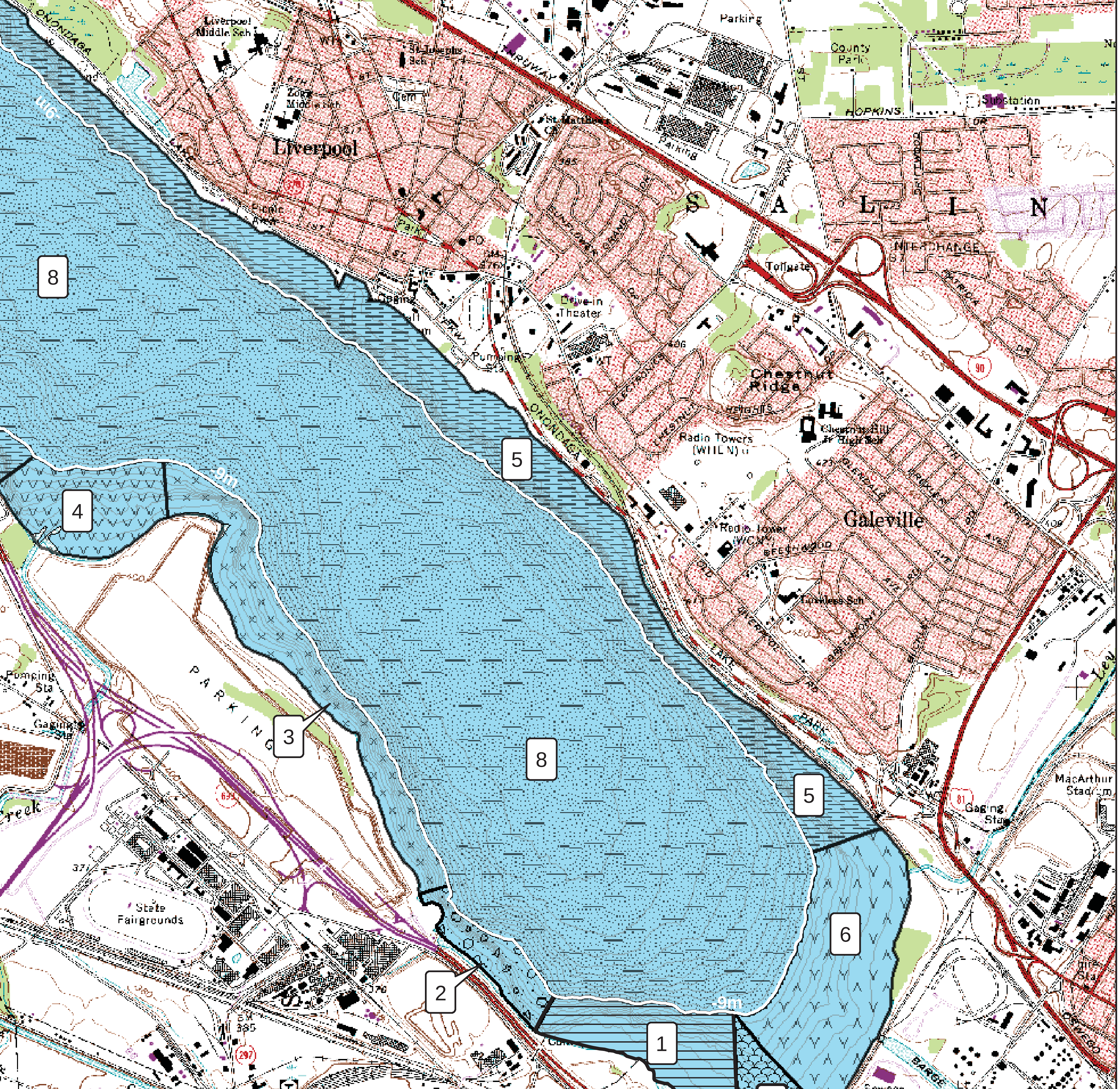

SMU 2 - Cause

SMU 3 - Waste

SMU 4 - Mouth

SMU 5 - Northe

SMU 6 - Ley Cr

SMU 7 - 700 ft

SMU 8 - Profun

NOTES

1. Bathymetric contour (9 meter) highl

2. Boundary between littoral and profu

0 1,500 3,000

Feet

1:25,000

Remediation Area C
SMU 8
SMU5
SMU6
Remediation Area E
Remediation Area D
SYW-12
Ley Cre
SMU2
SMU1
SMU1
SMU7
SMU6
SMU7
Offset/Buffer Area
Wave Damper Unnecessary Due to Shallow Post-Capping Water Depths
Wave Dam
Wave Damper
Metro Shoreline Outfall
Metro Storm Water Drain
Carou Mall
Onondaga Creek
Metro
East Flume
Wastebed B
Harbor Brook

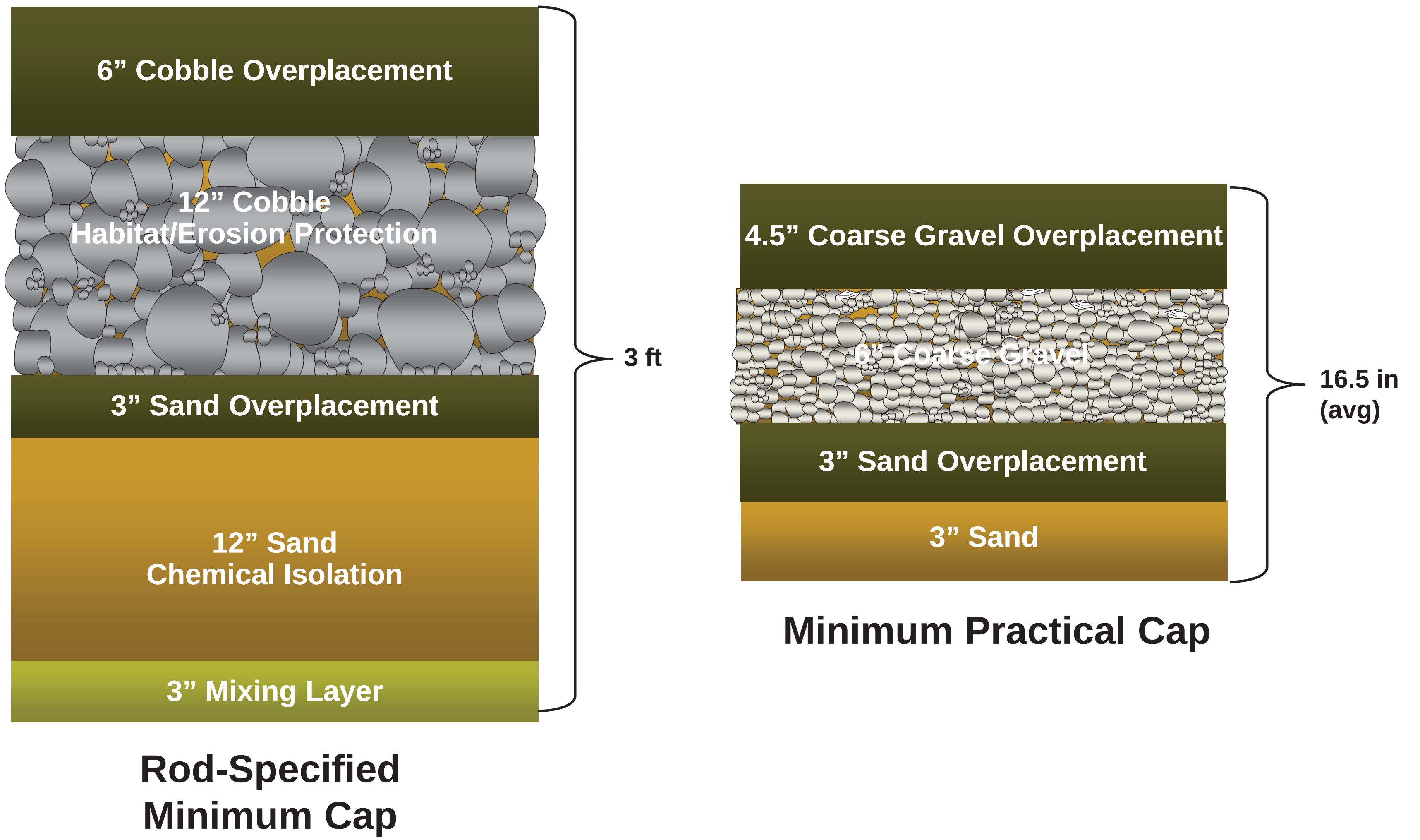

FIGURE 5

Honeywell

Onondaga Lake
Syracuse, New York

ROD-Specified Minimum Cap and Minimum Practical Cap

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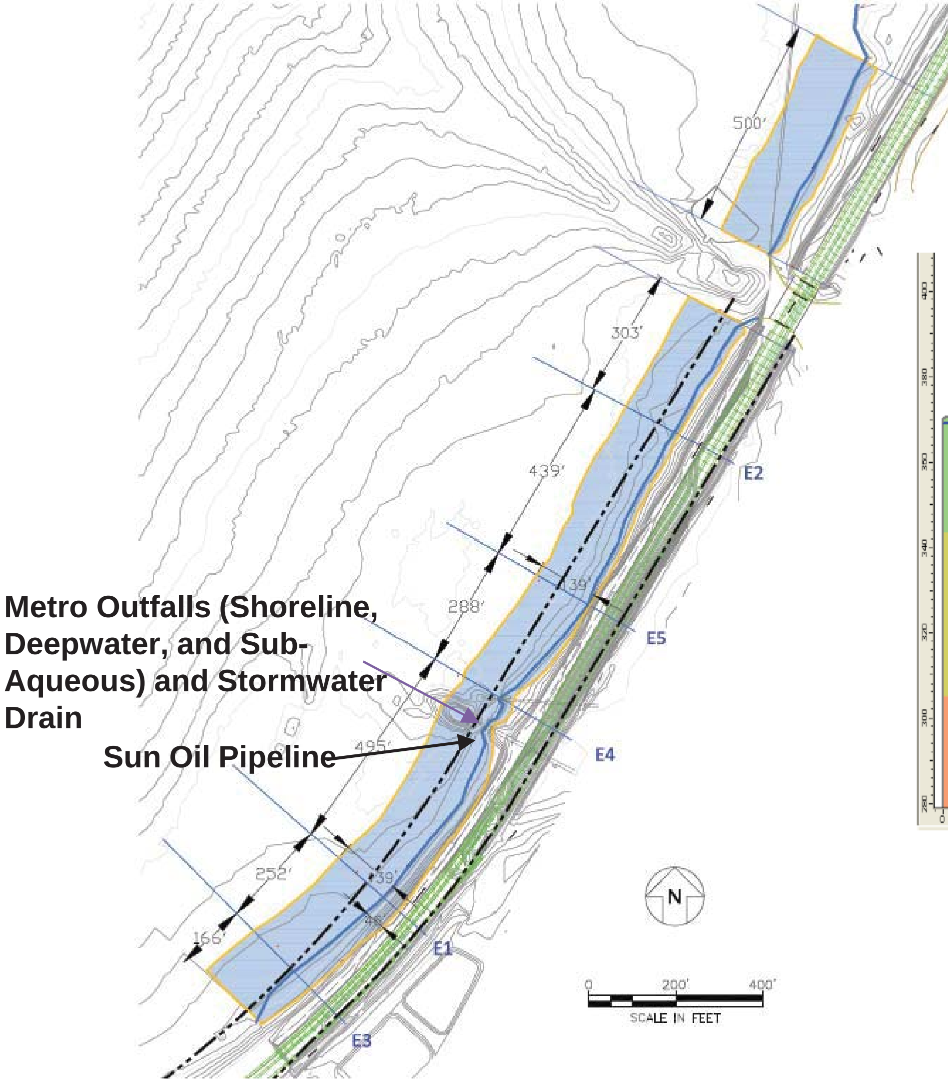

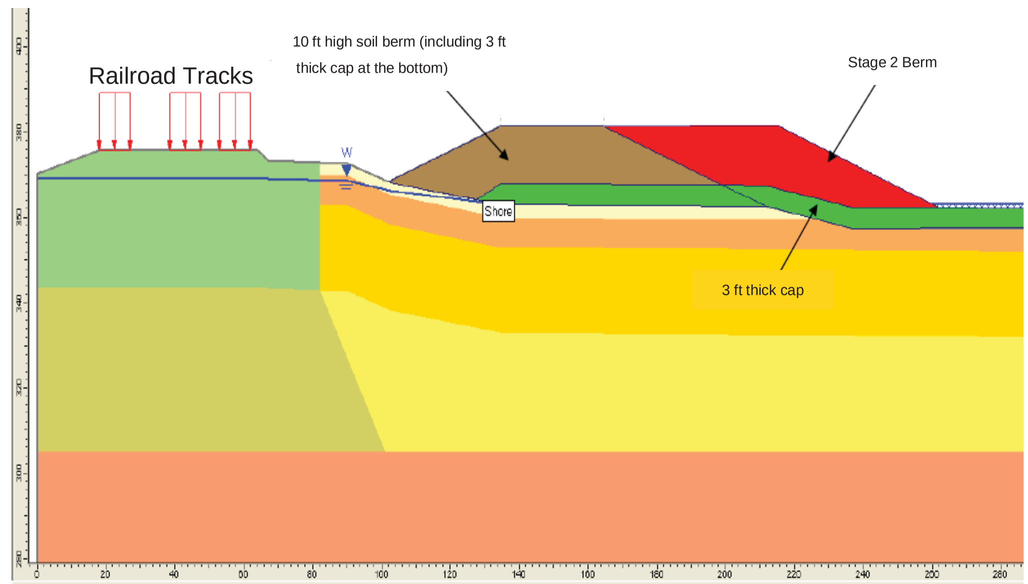

Uncertainty associated with potential settlement under the railroad tracks

Legend

- Surcharge Area
- Shoreline

FIGURE 6

Honeywell

Onondaga Lake
Syracuse, New York

Surcharge Conceptual Design

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