2013 ANNUAL MONITORING AND MAINTENANCE REPORT

GEDDES BROOK/NINEMILE CREEK
Solvay, New York

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DECEMBER 2014

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ACRONYMS

BSQV	based sediment quality value
IRM	Interim Remedial Measure
LEL	lowest effect level
LOAEL	lowest-observed-adverse-effect level
OM&M	operation, monitoring and maintenance
NYSDEC	New York State Department of Environmental Conservation
ROD	Record of Decision
USEPA	United States Environmental Protection Agency

Units

mg	milligram(s)
µg	microgram(s)
ng	nanogram(s)
kg	kilogram(s)
L	liter(s)

2013 ANNUAL OPERATION, MAINTENANCE AND MONITORING REPORT

1.0 INTRODUCTION

This report summarizes the first year (2013) of monitoring and maintenance activities and results for the Geddes Brook and Ninemile Creek sites (Figure 1). Remediation of Geddes Brook and Ninemile Creek is part of Honeywell's continuing efforts to remediate and restore Onondaga Lake and its subsites. Under direction of the New York State Department of Environmental Conservation (NYSDEC), the remediation at the Geddes Brook and Ninemile Creek sites included the removal of soils and sediment from the Geddes Brook and Ninemile Creek channels and adjoining floodplains as well as the restoration of habitat affected by construction activities. Geddes Brook was remediated under an Interim Remedial Measure (IRM) (Parsons, 2011); the remedial construction for the Geddes Brook IRM began in 2011 and was substantially completed in 2012. Likewise, the Ninemile Creek remedial construction in Reach CD began in 2012 pursuant to the Ninemile Creek 100% Design Report – Reach CD (Parsons, 2012) and was also substantially completed in 2012. Remedial construction for Reaches BC and AB began in 2013 with Reach BC being substantially completed that year and Reach AB anticipated to be completed in 2014.

Geddes Brook activities were completed consistent with the Final Geddes Brook Operation, Monitoring & Maintenance (OM&M) Plan (Parsons 2011). Activities conducted at the Geddes Brook site in 2013 consisted of routine site maintenance, as well as monitoring of sediment, surface water, biota, and habitat.

Ninemile Creek activities were limited to habitat monitoring within the completed section of that site (Reach CD). Monitoring and reporting for the Ninemile Creek Reaches AB and BC, as well as other monitoring components in Reach CD, will begin once remediation and restoration within Ninemile Creek is completed and the OM&M Plan for that site (Parsons 2012) is approved.

2.0 MAINTENANCE

Routine maintenance is minimal at both sites. It consists of mowing the vegetated trafficable lane on the Geddes Brook utility berm every two to three years (not conducted in 2013) and snow removal as needed for site access (not conducted in 2013). Specialized maintence activities related to habitat establishment consisted of invasive plant species controls and herbivore control.

Invasive plant control in the form of pulling or digging small areas of invasive species was carried out throughout the growing season as patches were encountered. During September and October, a herbicide (Glyphosate) was applied by a certified applicator to all known invasive plants within and adjacent to the sites that were not in standing water.

Trained border collies were used to discourage geese from feeding on newly installed plants and from nesting within the sites during the first year of plant establishment. Because northern white cedar are often browsed heavily by deer during the winter, a 5–ft. high chicken wire fence was installed in December around each northern white cedar to deter browsing. In addition, 3-ft. high chicken wire fencing was installed around the trunks of all newly installed large trees to protect them from being damaged or removed by beaver.

3.0 MONITORING

Monitoring related to attainment of remedial goals began in 2013 at the Geddes Brook site in accordance with the approved Geddes Brook OM&M Plan. Ninemile Creek remedial goal monitoring is expected to commence in 2015, following completion of construction activities in 2014. Monitoring at the Ninemile Creek site will be conducted in accordance with the Ninemile Creek OM&M Plan, once approved.

3.1 Surface Water

The Geddes Brook OM&M Plan established a total of six surface water monitoring locations (Figure 2) in Geddes Brook and Outfall O19 that are sampled annually for total mercury, methylmercury, and dissolved mercury (Parsons 2011). Field parameters (oxygen reduction potential, pH, temperature, and conductivity) were also recorded during the sampling event. Field parameter measurements and surface water sample results are provided in Tables 1 and 2, respectively.

Dissolved mercury concentrations at the six Geddes Brook and Outfall 19 sampling stations averaged 0.25 nanograms per liter (ng/L) (range 0.15 to 0.38 ng/L), which is well below the Record of Decision (ROD) goal of 2.6 ng/L for protection of wildlife (NYSDEC/USEPA[1] 2009). These results are also an order of magnitude lower than the concentrations documented prior to remediation (1.33 to 1.41 ng/L) (NYSDEC/USEPA 2009). Although goals are not specified in the ROD for total mercury or methylmercury in surface water, concentrations documented in 2013 were notably lower than baseline concentrations. Total mercury averaged 0.98 ng/L (range 0.15 to 1.79) and is at least an order of magnitude lower than the 2.1 and 22.3 ng/L found prior to remediation (NYSDEC/USEPA 2009). Methylmercury averaged 0.08 ng/L (range 0.026 to 0.17 ng/L), which is more than an order of magnitude lower than the average pre-remediation concentration of 0.46 ng/L (NYSDEC 2003).

3.2 Sediment

The Geddes Brook OM&M Plan established six sediment monitoring locations that were co-located with the surface water sample locations (Figure 2) and are analyzed annually for total mercury and methylmercury. The results are summarized in Table 3 and below.

[1] USEPA – United States Environmental Protection Agency

Sediment concentrations for total mercury in Geddes Brook and Outfall 19 averaged 0.04 milligrams per kilogram (mg/kg) (range 0.03 to 0.07 mg/kg), which is an order of magnitude lower than the lowest effect level (LEL). These results are also lower than the site-specific bioaccumulation-based sediment quality value (BSQV) for sediment and floodplain soil of 0.8 and 0.6 mg/kg, respectively (NYSDEC/USEPA 2009). Goals are not specified in the ROD for methylmercury in sediment; however concentrations documented in 2013 were, like surface water, notably lower than during baseline. Methylmercury averaged 0.39 micrograms per kilogram (µg/kg) (range 0.03 to 1.15 µg/kg), which is an order of magnitude lower than the average pre-remediation levels of 1.6 and 2.9 µg/kg (NYSDEC/USEPA 2009).

3.3 Biota

Baseline sampling was conducted in 2010 at the Geddes Brook site to establish mercury concentrations in biota prior to remediation. The OM&M Plan for Geddes Brook established a monitoring program that analyzes mercury concentrations in forage (prey) fish, benthic macroinvertebrates, small mammals, and earthworms (Parsons 2011). Figure 3 shows the biota sampling locations for 2013, and Table 4 includes the analytical results for each sample.

In 2013, total mercury concentrations averaged 0.083 mg/kg (wet weight) in prey fish (range 0.042 to 0.17), 0.030 mg/kg in macroinvertebrates (range 0.015 to 0.056 mg/kg), 0.025 mg/kg in earthworms (range 0.010 to 0.050 mg/kg), and 0.017 mg/kg in small mammals (range non-detect to 0.25 mg/kg). There are no remedial goals for macroinvertebrates, earthworms, or small mammals, however, compared to baseline results, earthworms and small mammals show a notable decrease in both total mercury and methylmercury (Table 4, Figure 4). Total mercury concentrations in macroinvertebrates were nearly the same as during baseline while methylmercury increased (Table 4). The average prey fish concentration (0.083 mg/kg) was below the remedial goal of 0.1 mg/kg for protection of ecological receptors based on the LOAELs (NYSDEC/USEPA 2009).

No biota sampling was conducted at Ninemile Creek in 2013. Biota sampling, if necessary, will be conducted following completion of remedial construction activities and in accordance with the Ninemile Creek OM&M Plan once it is finalized.

3.4 Wetlands/Uplands

This section provides a summary of the habitat restoration monitoring activities. The comprehensive 2013 wetlands report is provided in Appendix A of this report.

The habitat at the Geddes Brook and Ninemile Creek Reach CD sites was originally dominated by a monoculture of the invasive grass common reed (*Phragmites australis*) and had very limited habitat value. Following the removal of impacted sediments and reconfiguration of the stream channels, habitats were restored in 2012 using a diverse assemblage of plant species. The restoration design placed an emphasis on the development of diverse wetland and riparian habitats. These newly restored habitats will be monitored for five consecutive years. At the end of five years, data will be evaluated to determine if restoration goals have been met. The first

year of monitoring for these newly restored areas in Outfall 19, Geddes Brook, and Ninemile Creek Reach CD was completed in 2013.

The parameters monitored include:

- Vegetation (type, percent cover, and frequency)
- Hydrology
- Invasive species (species, location, and approximate size of patch)
- Wildlife usage

The first year of monitoring indicates that the restoration of habitats, including creation of a diverse wetland community, has been successful. Habitat types in the newly restored areas were primarily emergent wetland, aquatic/open water, wet meadow, and riparian habitats. Hydrologic conditions were maintained throughout the 2013 growing season. High water levels in Ninemile Creek and Geddes Brook throughout most of the summer allowed carp continual access to channel grade wetlands where their spawning and foraging activities uprooted plants and increased turbidity. Measures to reduce impacts from carp will be implemented in spring 2014. Despite the challenges carp created in connected wetland areas, overall establishment of vegetation has been successful. A diverse assemblage of plants was documented during the first year of monitoring, including 147 plant species at the Geddes Brook and Outfall 19 sites and 79 plant species in Ninemile Creek Reach CD, most of which were wetland species.

Invasive species, primarily common reed, were sporadically present but mostly isolated to either sparse patches within the interior of the sites or larger patches along the periphery of the sites. A small area of Japanese knotweed was also documented on the Geddes Brook utility berm. All known areas of common reed and Japanese knotweed within the sites were either dug out by hand or treated by a certified herbicide applicator in the Fall 2013. In addition, invasive species observed adjacent to the sites were also treated with herbicide to reduce the potential for them to act as colonization sources in the future.

The newly restored wetlands and uplands are providing exceptional habitat for a diversity of fish and wildlife species. Fifty species were documented using the restored habitats in the first year. Of particular note, substantial reproduction of amphibians was observed in both the Geddes Brook and Ninemile Creek Reach CD wetlands. A large number of tadpoles were observed within the wetlands during the spring, and a snapping turtle nest was discovered on a slope in the Geddes Brook wetlands. In addition, numerous wading birds such as Great Blue Heron, Green Heron, Greater Yellow Legs, and Least Sandpiper were observed in both areas. A large number of waterfowl were observed using the Geddes Brook wetlands during their fall migration, and a family group of Wood Duck and Green Heron were observed on numerous occasions throughout the summer in the west basin of Geddes Brook.

Overall, the newly restored areas were found to be successful during the first year of monitoring and minimal maintence was required. In the Fall 2013, fencing was installed around the perimeter of large cedar trees in Geddes Brook to protect them from winter browsing by deer.

Fencing was also installed around the trunks of all large trees in both Geddes Brook and Ninemile Creek Reach CD to protect them from beaver.

3.5 Geddes Brook Channel Elevations and Wetland Connections

The OM&M Plan indicates that the elevations of the east floodplain channel grade wetlands should be surveyed annually for five years or until the realigned channel and connected wetlands have reached a dynamic equilibrium based on the hydrology of the restored site, whichever is earlier. This is to ensure that the wetland connections perform as intended by allowing the free flow of water between the channel grade wetlands and Geddes Brook when creek levels are high and by allowing the wetlands to retain water during lower water periods. In 2013, water levels within the Geddes Brook site remained high throughout the summer and fall, resulting in a continual connection between the wetlands and Geddes Brook. The elevation of the wetland connections will be surveyed during a low water period in 2014 to verify that the connection will be maintained.

Some changes to channel elevations and wetland configurations (due to sedimentation or erosion) are expected to occur over time. The OM&M Plan states that substantial erosion or slumping of the Geddes Brook bank will be photographed and reported with a recommendation for corrective actions, if necessary. However, no substantial erosion or slumping of the Geddes Brook bank was observed during 2013.

4.0 MONITORING AND MAINTENANCE PROGRAM RECOMMENDATIONS

The first year of the OM&M program implemented at the Geddes Brook and Ninemile Creek sites has been effective. Based on the data presented in this report it is recommended that:

1. The encroachment of invasive vegetation such as common reed and Japanese knotweed should continue to be mitigated in 2014 by physical removal and/or treatment with appropriate herbicide at both sites.
2. Mitigation measures to reduce damage caused by carp in Geddes Brook and Ninemile Creek Reach CD wetlands should be implemented in 2014.
3. Habitat monitoring and maintence activities should continue in 2014 with no changes at both sites and should begin in Ninemile Creek Reach AB/BC and SYW-10 upon their completion.
4. Fencing installed to protect large northern white cedar from deer browsing and protect other trees from beaver should be periodically checked and maintained at both sites (where applicable).
5. Vegetation has established and efforts to discourage geese are no longer needed and should be discontinued.
6. The site remedy included complete removals in most areas of Geddes Brook and then verification of clean soil placement during construction. Post construction monitoring of mercury in surface water, sediment, and biota was designed to verify remedy effectiveness by determining when ROD goals were met. The results of the 2013

monitoring are encouraging and indicate that overall average concentrations in surface water, sediment, and biota are below ROD goals. The monitoring program will continue in 2015 in accordance with the approved Geddes Brook OM&M Plan.

5.0 REFERENCES

Parsons. 2011. *Operation, Maintenance, and Monitoring Plan for the Geddes Brook Site*. Prepared for Honeywell, Syracuse, New York. February 2011.

Parsons. 2012. *Operation, Maintenance, and Monitoring Plan for the Ninemile Creek Site*. Prepared for Honeywell. Syracuse, New York, April 2012.

NYSDEC, 2003. *Geddes Brook / Ninemile Creek Remedial Investigation Report. Appendix I, Table I-34. Prepared for NYSDEC by TAMS and YEC, INC. July 2003.*

NYSDEC/USEPA, 2009. *Record of Decision, Operable Unit 2 of the Geddes Brook/Ninemile Creek Site Operable Unit of the Onondaga Lake Bottom Subsite Onondaga Lake Superfund Site.* October, 2009.

TABLES

TABLE 1: GEDDES BROOK SURFACE WATER FIELD PARAMETERS RESULTS						
Location	Date	ORP	pH	Temp C	Conductivity (uS)	Salinity (ppt)
GB-SW-01WP	10/29/2013	-45	8.3	7.5	1190	0.6
GB-SW-02WWL		-11	7.6	5.6	1040	0.5
GB-SW-03CGW		-36	8.1	7.5	1810	0.9
GB-SW-04GB		-10	7.6	7.7	1970	1.0
GB-SW-05PW		+54	6.4	5.2	1590	0.8
GB-SW-06OF		-42	8.2	8.3	4140	2.1

TABLE 2: GEDDES BROOK SURFACE WATER ANALYTICAL RESULTS						
Location ID	October 2013					
	Total Mercury		Methyl Mercury		Dissolved Mercury	
	Result ng/L	Qualifier	Result ng/L	Qualifier	Result ng/L	Qualifier
ROD Remedial Goals [1]	*None*		*None*		*2.6*	
Baseline Results [2]	*2.1 to 22.3*		*0.33 to 0.67*		*1.3 to 1.4*	
GB-SW-01WP	1.0		0.096	J	0.21	J
GB-SW-01WP - Field Dup	1.1		0.087	J	0.28	J
GB-SW-02WWL	1.8		0.17	J	0.38	J
GB-SW-03CGW	0.74		0.070	J	0.17	J
GB-SW-04GB	0.81		0.032	J	0.17	J
GB-SW-05PW	0.15		0.026	J	0.15	J
GB-SW-06OF	1.2		0.070	J	0.38	J

Table Notes:

J: Result is considered an estimate.

U: Not dectected.

[1] NYSDEC/United States Environmental Protection Agency, 2009

[2] Total and dissolved mercury results from NYSDEC/USEPA, 2010. Methylmercury results from NYSDEC, 2003.

TABLE 3: GEDDES BROOK SEDIMENT ANALYTICAL RESULTS				
Location ID	October 2013			
	Mercury		Methyl Mercury	
	Result mg/kg	Qualifier	Result ug/kg	Qualifier
GB-SED-01WP	0.041	J	1.2	
GB-SED-02WWL	0.065	J	0.95	
GB-SED-03CGW	0.028	J	0.097	
GB-SED-04GB	0.028	J	0.027	J
GB-SED-05PW	0.034	J	0.031	J
GB-SED-06OF	0.067	J	0.062	J

Table Notes:
J: Result is considered an estimate.

TABLE 4: GEDDES BROOK BIOTA RESULTS					
September 2013					
Location	Mercury		Methyl Mercury		Organism
	Result[1] mg/kg	Qualifier[2]	Result[1] ug/kg	Qualifier[2]	
01CH	0.052	J	-		Round Goby
01CH	0.11		-		Round Goby
01CH	0.057	J	-		Green Sunfish
01CH	0.10		-		Pumpkinseed
01CH	0.049	J	-		Sunfish spp.
02WP	0.055	J	-		Sunfish spp.
02WP	0.042	J	-		Shorthead Redhorse
02WP	0.075	J	-		Sunfish spp.
02WP	0.049	J	-		Sunfish spp.
02WP	0.052	J	-		Sunfish spp.
03OF	0.17		-		Longnose Dace
03OF	0.11		-		Longnose Dace
03OF	0.11		-		Longnose Dace
03OF	0.099		-		Longnose Dace
03OF	0.12		-		Longnose Dace
2013 Average	**0.083**		**-**		**Prey Fish**
Baseline Average	**0.14**		**-**		
01CH	0.015	J	25	J	Crayfish
01CH	0.041	J	70	J	Dragonfly nymph
01CH	0.040	J	47	J	Dragonfly nymph
02WP	0.042	J	61	J	Dragonfly nymph
02WP	0.015	J	46	J	Dragonfly nymph
02WP	0.056	J	79	J	Dragonfly nymph
03OF	0.019	J	26	J	Amphipod
03OF	0.030	J	45	J	Dragonfly nymph
03OF	0.017	J	21	J	Dragonfly nymph
2013 Average	**0.030**		**47**		**Macroinvertebrates**
Baseline Average	**0.038**		**16**		
GB-EW-01	0.010	J	20		Earthworm
GB-EW-02	0.050	J	24		Earthworm
GB-EW-03	0.015	J	16		Earthworm
2013 Average	**0.025**		**34**		**Earthworm**
Baseline Average	**0.20**		**59**		
GB-MAM-01	0.012	J	14		White Footed Mouse
GB-MAM-02	0.013	J	3.4		White Footed Mouse
GB-MAM-03	0.025	J	12		White Footed Mouse
GB-MAM-04	0.025	J	13		White Footed Mouse
GB-MAM-05	0.010	U	5		White Footed Mouse
2013 Average	**0.017**		**20**		**Small Mammal**
Baseline Average	**0.11**		**72**		

[1] wet weight

[2] J = estimated value; the result is less than or equal to the Method Detection Limit (MDL) and less than the Limit of Quantitation (LOQ). U = Compound was not detected

FIGURES

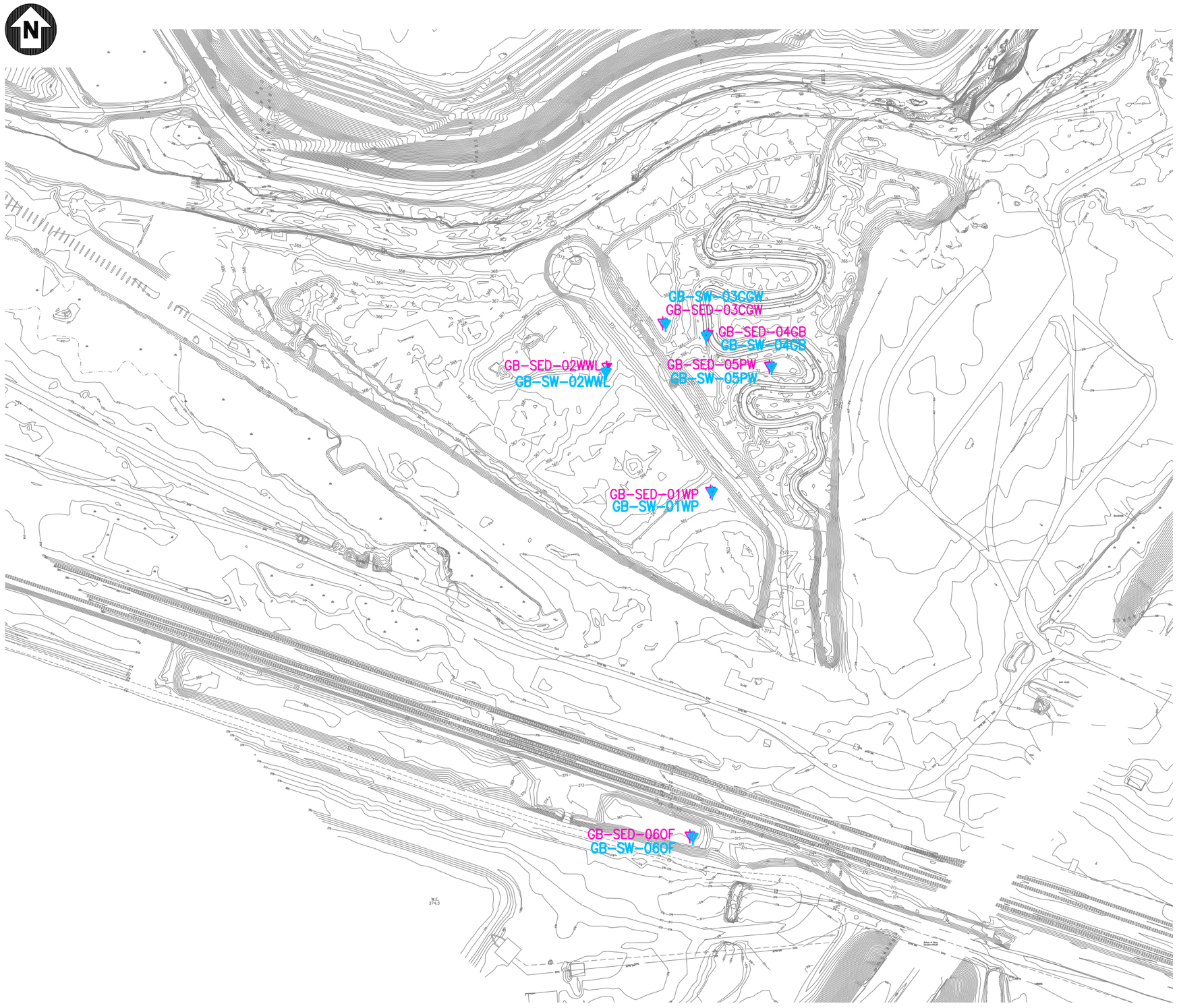
FIGURE 1

Honeywell

Ninemile Creek
Syracuse, New York

**Geddes Brook &
Ninemile Creek Site Map**

301 Plainfield Rd, Suite 350, Syracuse NY, (315) 451-9560



LEGEND:

SEDIMENT SAMPLING LOCATIONS

SURFACE WATER SAMPLE LOCATIONS

200 100 0 200 400

SCALE: 1"=200'

FIGURE 2

Honeywell

NINEMILE CREEK/GEDDES BROOK
2013 OM&M

GEDDES BROOK
SURFACE WATER AND SEDIMENT
MONITORING LOCATIONS – 2013

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FILE NAME: P:\HONEYWELL -SYR\448443 GB-NMC OMM\10.0 TECHNICAL CATEGORIES\10.2 CAD\FIGURES\WETLAND MONIT\FIGURES\448443-GB-SED AND SW.DWG
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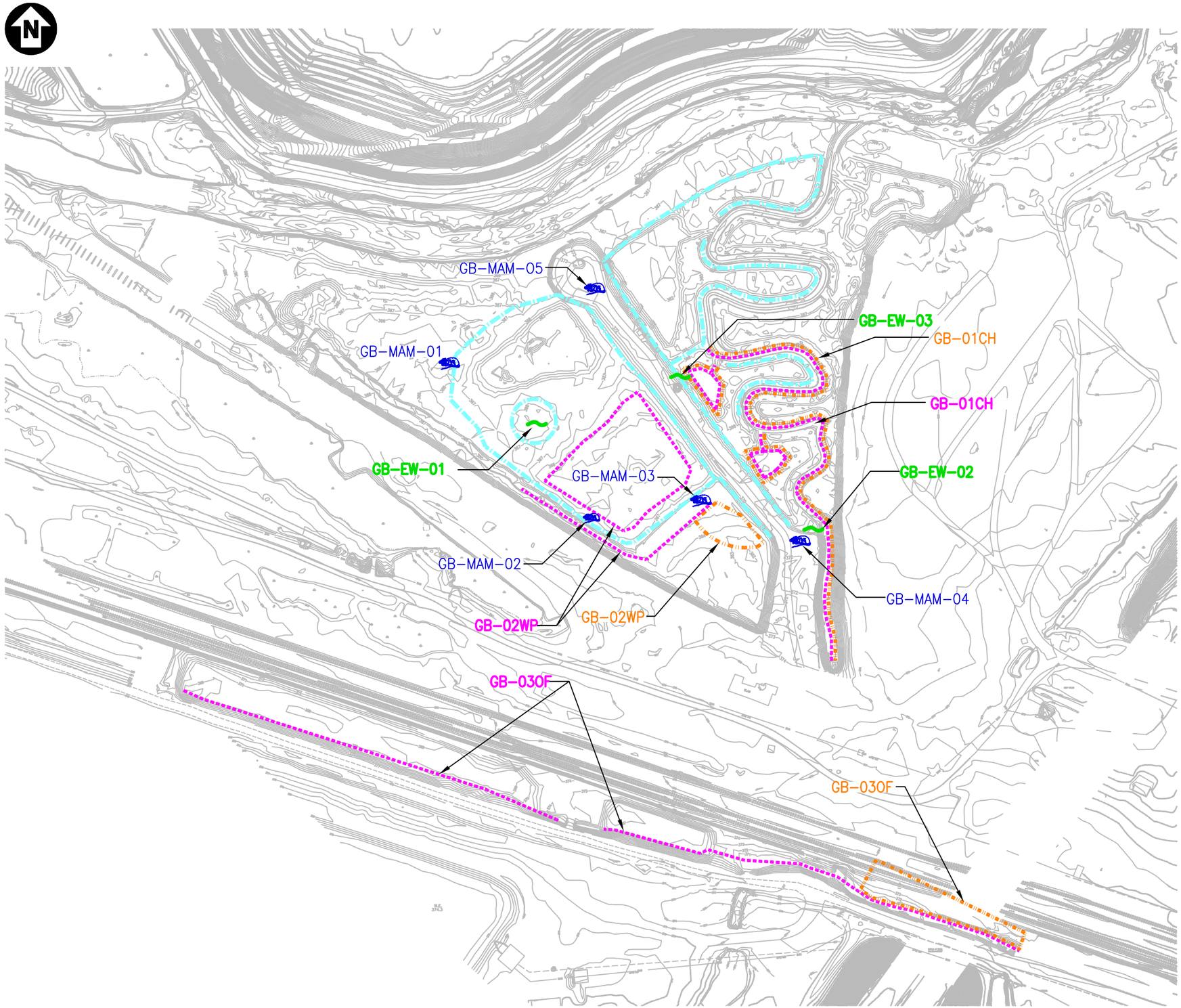

NOTES:

1. A MINIMUM OF 15 TRAPS WERE DEPLOYED OVERNIGHT FOR UP TO FIVE NIGHTS TO COLLECT SUFFICIENT SMALL MAMMAL SAMPLE MASS.
2. UP TO THREE SAMPLE ATTEMPTS (IE. FIELD DAYS) WERE MADE TO COLLECT FISH AND MACROINVERTEBRATE SAMPLE MASS.
3. SAMPLE AREAS FOR FISH, MACROINVERTEBRATES AND SMALL MAMMALS DEPICT THE RANGE WHERE SAMPLING OCCURED.
4. FISH SAMPLING AREAS IN THE EAST FLOODPLAIN WERE INTENDED TO MINIMIZE THE CHANCE THAT FISH FROM NINEMILE CREEK WERE INADVERTENTLY COLLECTED.
5. SMALL MAMMAL SAMPLING AREAS FOCUSED ON INTERIOR PORTIONS OF THE SITE TO MINIMIZE THE CHANCE THAT MIGRANTS FROM OFF SITE WERE COLLECTED.

LEGEND:

- BENTHIC MACROINVERT SAMPLING AREAS
- FISH SAMPLING AREAS
- SMALL MAMMAL SAMPLING AREAS
- EARTHWORM SAMPLING AREAS
- MAMMAL SAMPLING AREAS

FIGURE 3

Honeywell

NINEMILE CREEK/GEDDES BROOK
2013 OM&M

GEDDES BROOK
BIOTA MONITORING SAMPLE
LOCATIONS – 2013

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FILE NAME: P:\HONEYWELL -SYR\448443 GB-NMC OMM\10.0 TECHNICAL CATEGORIES\10.2 CAD\FIGURES\WETLAND MONIT\FIGURES\448443-GB-BIOTA-MONIT.DWG
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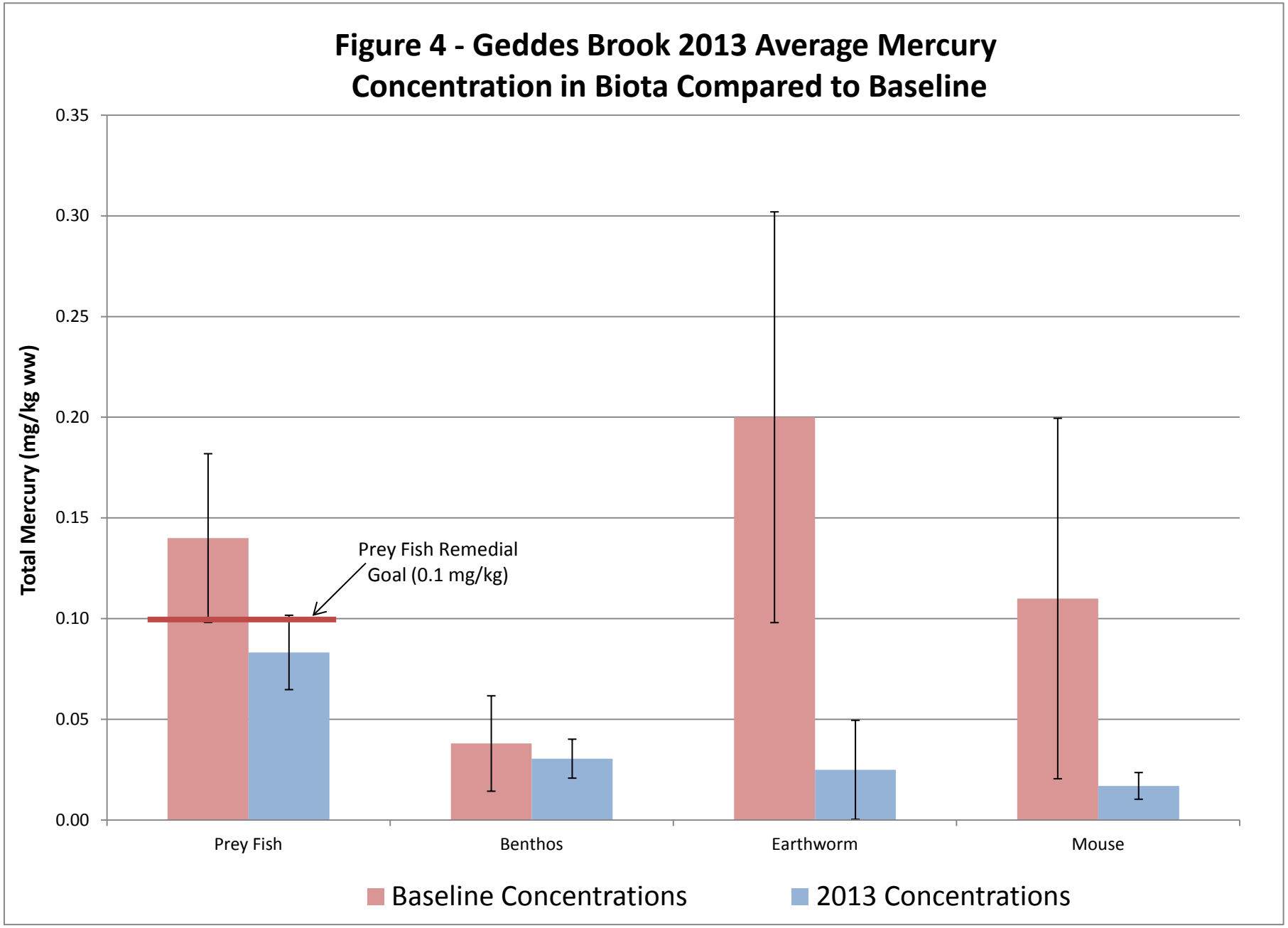
Figure 4 - Geddes Brook 2013 Average Mercury Concentration in Biota Compared to Baseline
Total Mercury (mg/kg ww)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Prey Fish Remedial Goal (0.1 mg/kg)
Prey Fish
Benthos
Earthworm
Mouse
Baseline Concentrations
2013 Concentrations

APPENDIX A

2013 WETLANDS MONITORING REPORT GEDDES BROOK/NINEMILE CREEK

APPENDIX A

2013 WETLAND MONITORING REPORT
GEDDES BROOK/NINEMILE CREEK

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Figure 9 Geddes Brook Future Focus Areas for 2014

Figure 10 Ninemile Creek Reach CD Future Focus Areas for 2014

WETLAND MONITORING REPORT
GEDDES BROOK AND NINEMILE CREEK SITES

1.0 INTRODUCTION

The wetland restoration sites are located in the Town of Geddes, Onondaga County, New York. Remediation at the Geddes Brook and Ninemile Creek sites included the removal of soils and sediment from the Geddes Brook and Ninemile Creek channels and adjoining floodplains and the restoration of habitat affected by construction activities. Geddes Brook was remediated under an Interim Remedial Measure (IRM) (Parsons 2011a); the remedial construction for the Geddes Brook IRM began in 2011 and was substantially completed in 2012. Likewise, the Ninemile Creek remedial construction in Reach CD began in 2012 pursuant to the Ninemile Creek 100% Design Report – Reach CD (Parsons 2012b) and was also substantially completed in 2012. Remedial construction for Reaches BC and AB began in 2013, with Reach BC being substantially completed that year and Reach AB anticipated to be completed in 2014. The Operations, Monitoring and Maintenance (OM&M) Plans call for monitoring of restored wetlands for five years after restoration. At the five-year point, data are to be evaluated to determine if conditions for restoration have been met and if hydrologic conditions can be maintained in the future (Parsons 2011b and Parsons 2012a). This report presents the findings of the 2013 wetland monitoring effort, the first of five years of monitoring at Geddes Brook, Outfall 19 and Ninemile Creek Reach CD. Future reports will include Ninemile Creek Reaches BC and AB.

2.0 MONITORING METHODS

Methods used to monitor the restored wetland areas are provided in the OM&M Plans (Parsons 2011b and Parsons 2012a). The parameters to be monitored include vegetation, hydrology, wildlife usage, invasive species, and channel, bank, and wetland connections.

2.1 Vegetation

Vegetation monitoring included field reconnaissance surveys, qualitative assessments, and quantitative sampling. At the Geddes Brook, Outfall 19, and Ninemile Creek sites, several field reconnaissance surveys were conducted from May through November 2013, tracking plant and wildlife species encountered. More detailed qualitative vegetation and wildlife use assessments were performed in July and August 2013. Plant species were systematically identified and locations for invasive species control were finalized during these detailed assessments.

Quantitative vegetation sampling was conducted in early September 2013 at predetermined plot locations across both sites. There are 25 plot locations at the Geddes Brook site and two plot locations in the Outfall 19 area. There are 10 locations at the Ninemile Creek site. A 100 square foot (ft^2) sample plot was established at each station to evaluate herbaceous vegetation, and a 400 ft^2 sample plot was established to evaluate woody vegetation. Plot

locations are shown on Figure 1 for Geddes Brook and Outfall 19 and Figure 2 for Ninemile Creek.

Vegetation data collected in each sample plot consisted of the following:

1. Vegetation cover type present
2. Total percent areal cover of vegetation
3. Plant species observed
4. Percent areal cover of each species
5. Approximate water depth

Sample plot data sheets are presented in Attachment A. Photographs were taken at each plot and at permanent photograph points (see Attachment B). The photograph locations and the directions in which they were taken are shown on Figures 1 and 2.

2.2 Hydrology

Staff gauge readings were collected at nine sites in Geddes Brook and two sites in Outfall 19 in 2013. Staff gauge locations are presented in Figure 1. Data are presented in Table 1 for the Geddes Brook & Outfall 19 Restoration Area. Staff gauges will be installed and monitored in the Ninemile Creek emergent wetlands in 2014.

2.3 Wildlife

Wildlife usage was assessed during all site visits using standard field observation methods. Wildlife usage data are presented in Table 2.

3.0 MONITORING RESULTS

3.1 Vegetation

Vegetation growth in newly restored areas of Geddes Brook and Ninemile Creek is generally dense and diverse. A total of 147 plant species were recorded at Geddes Brook, and 79 plant species were recorded at Ninemile Creek in 2013, the first year following restoration (Tables 3 and 4). However, high water levels in 2013 allowed carp (*Cyprinus carpio*) to maintain a continual presence in the channel grade wetlands in Geddes Brook and the emergent and forested wetlands connected to Ninemile Creek. Their presence appears to have negatively affected emergent plant establishment in these areas by increasing turbidity and physically uprooting plants. Carp are also likely present in the south pond of Geddes Brook, judging from the high turbidity there and apparent similar impacts to establishment of emergent vegetation. Measures to mitigate impacts from carp will be implemented in 2014 (see Section 4.3).

Geddes Brook

Plant species observed in the recently restored sections of Geddes Brook are presented in Table 3. Vegetation plot data for Geddes Brook are provided in Attachment A, and the data are summarized in Table 5.

A total of 147 species were identified during all monitoring activities (Table 3). A total of 112 species were identified during quantitative plot sampling, of which 66 percent were obligate or facultative wetland species (Table 5). Creeping spikerush (*Eleocharis obtusa*), ragweed

(*Ambrosia artemisiifolia*), bladderwort (*Utricularia vulgaris*), narrowleaf cattail (*Typha angustifolia*), broadleaf cattail (*Typha latifolia*), and sago pondweed (*Stuckenia pectinata*) were the dominant species in the quantitative sampling, accounting for a combined total of 50 percent of the overall relative cover (Table 5). Tables 9 and 10 summarize the observed conditions of trees in the Geddes Brook and Outfall 19 areas. The locations of large trees are depicted in Figure 3.

In general, the wet summer experienced in 2013 combined with whole-site irrigation resulted in wetland covers types establishing at higher elevations, and in a greater area than originally expected. The interior of both the west and east floodplains contain primarily well vegetated emergent and aquatic bed wetland cover types with interspersed scrub shrub wetland habitat (Figure 4). The channel grade wetlands in the east floodplain are mostly categorized currently as aquatic bed habitat containing varying amounts of aquatic vegetation. Upland habitats were generally limited to higher elevations on the side slopes and the tops of the central utility berm and tower pads.

Ninemile Creek Reach CD

Plant species observed in Ninemile Creek in 2013 are presented in Table 4. Vegetation plot data for Ninemile Creek are provided in Attachment A, and the data are summarized in Table 7. Table 11 summarizes the observed conditions of trees in the Ninemile Creek area. The locations of large trees are depicted in Figure 5.

A total of 79 species were identified during all monitoring activities in 2013 (Table 4). A total of 53 species were identified during quantitative sampling, of which 40.7 percent were obligate or facultative wetland species (Table 8). White clover (*Trifolium repens*), American water plantain (*Alisma subcordatum*), yellow foxtail (*Settaria glauca*), switchgrass (*Panicum virgatum*), were the dominant species in the quantitative sampling, combining to account for approximately 50 percent of the overall relative cover (Table 7).

The slopes and peninsulas of Reach CD provide predominantly well vegetated upland habitat while the backwater areas connected to Ninemile Creek are sparsely vegetated aquatic bed habitat and the non-connected wetland on the north bank contains a dense emergent wetland cover type with interspersed higher elevation upland “islands” (Figure 6).

3.2 Hydrology

High water levels throughout most of the summer in 2013 prevented staff gauges from being installed in Ninemile Creek Reach CD wetlands. However, observations made during reconnaissance surveys indicate that all wetlands, including the red maple swamp area were, at a minimum, saturated throughout the summer.

3.3 Wildlife

Wildlife observations from the restoration areas are presented in Table 2. These observations were made during various site visits in the 2013 season, mostly during the vegetation reconnaissance and quantitative plot sampling.

Fish

A total of 14 fish species were documented in 2013, including brown bullhead (*Ameiurus nebulosus*), gizzard shad (*Dorosoma cepedianum*), banded killifish (*Dulus diaphanus*), tessellated darter (*Etheostoma olmstedi*), pumpkinseed (*Lepomis gibbosus*), largemouth bass (*Micropterus salmoides*), and brown trout (*Salmo trutta*). Many of these were captured during fish sampling for tissue analysis, including over 600 fish from the south pond in Geddes Brook and an estimated 300 to 400 juvenile brown trout at the confluence of Geddes Brook and Outfall 19.

Amphibians and Reptiles

Adult green frog (*Lithobates clamitans*) and American toad (*Bufo americanus)* were observed in Geddes Brook. Of particular note, substantial reproduction of amphibians was observed in both the Geddes Brook and Ninemile Creek Reach CD wetlands. A large number of tadpoles were observed within the wetlands during the spring, and a snapping turtle nest was discovered on a slope in the Geddes Brook wetlands.

Birds

Numerous wading birds such as great blue heron (*Ardea herodias*), greater yellowlegs (*Tringa melanoleuca*), and least sandpiper (*Calidris minutilla*) were observed in both restoration areas. A large number of waterfowl were observed using the Geddes Brook wetlands during their fall migration, and a family group of wood duck (*Aix sponsa*) and green heron (*Butorides virescens*) were observed on numerous occasions throughout the summer in the west basin of Geddes Brook. Other species observed included canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), eastern kingbird (*Tyrannus tyrannus*), cedar waxwing (*Bombycilla cedrorum*), red tail hawk (*Butei jamaicensis*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus)* and red-winged blackbird (*Agelaius quiscula*).

Mammals

White-tailed deer (*Odocoileus virginianus*) and their signs were commonly observed in and around the wetlands of Geddes Brook and Ninemile Creek. Tracks of eastern coyote (*Canis latrans var.)* were also observed early in 2013, and muskrat (*Ondatra zibeticus*) were observed in the Geddes Brook west floodplain wetlands. A muskrat den had been constructed in Outfall 19 (Table 2). Animal borrows were observed at several locations in Geddes Brook, Outfall 19, and Ninemile Creek Restoration Areas, but the species using them could not be determined.

4.0 WETLAND RESTORATION MAINTENANCE

While the restoration of the newly restored areas has been successful, maintenance of the areas is considered necessary to maintain the habitat value. Two concerns were addressed in 2013: 1) the encroachment and infiltration of invasive plant species into the restored areas and 2) damage to plants and trees from herbivores.

4.1 Invasive Species Control

Measures were implemented during the 2013 growing season to control invasive species to the extent practical including; pulling by hand, digging out rhizomes, and treatment with

herbicide (Figures 7 and 8). Mechanical methods of removal such as pulling by hand and digging out rhizomes was done mostly during the summer months. Applications of the herbicide Rodeo® (glyphosate) to known patches of invasive species was conducted in early October. Areas both inside and adjacent to the wetland restoration footprint were treated. Invasive species in adjacent areas outside the restoration area were treated to reduce the likelihood that they would serve as colonization sources. Use of herbicides over water is restricted; therefore, when individual plants and/or stolons (above ground rhizomes) were present in standing water, they were pulled by hand to the extent practical. Japanese knotweed rhizomes and soil immediately surrounding the rhizomes were removed by hand shovel upon discovery. Some areas required multiple removals throughout the summer and any Japanese knotweed documented in the fall was treated with herbicide.

4.2 Herbivore Control

During the early spring, predation of newly installed herbaceous plants by geese and browsing of woody material, particularly northern white cedar, by deer was evident in all areas. Trained border collies were used to discourage geese from inhabiting the site and causing further damage. A 5-ft. high fence was installed around all large northern white cedar to protect them from deer browsing. In addition, 3-ft. high fencing was installed around the trunks of all newly installed large trees to protect them from being damaged or removed by beaver that were observed near the site.

4.3 Focus Areas for 2014

Areas that will be further evaluated for possible maintenance activities in 2014 are presented in Figures 9 and 10. This includes areas where measures will be taken, to the extent practicable, to reduce impacts associated with carp. Other areas will be monitored closely and maintenance activities undertaken as needed after consultation with NYDEC.

5.0 SUMMARY

The first year of monitoring of the newly restored areas of Geddes Brook and Ninemile Creek indicates that the restoration has been largely successful. These areas were previously dominated by a monoculture of the invasive common reed, with little aquatic habitat component. They are now diverse wetlands and riparian zones that support a mix of plant and animal species and contain an interspersion of deeper aquatic and flowing aquatic habitat.

Wildlife use of the restored wetlands appears extensive. Numerous wetland birds and waterfowl were observed, including the state-listed threatened osprey and bald eagle. Japanese knotweed and common reed control measures were implemented to keep these invasive species from further encroachment into restored habitats.

6.0 REFERENCES

Parsons. 2011a. *Final (100%) Design Report for the Geddes Brook Interim Remedial Measure*. Prepared for Honeywell, Inc. Parsons, Liverpool, NY.

Parsons. 2011b. *Operation, Maintenance, and Monitoring Plan for Geddes Brook*. Prepared for Honeywell. Parsons, Liverpool, NY.

Parsons. 2012b. *Ninemile Creek (100%) Design Report Reach CD*. Prepared for Honeywell, Inc. Parsons, Liverpool, NY.

Parsons. 2012a. *Operation, Maintenance, and Monitoring Plan for Ninemile Creek*. Prepared for Honeywell. Parsons, Liverpool, NY.