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FISH AND WILDLIFE SERVICE
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Dear Colleagues:

The U.S. Fish and Wildlife Service, New York Field Office is pleased to deliver the enclosed final status report entitled, "Wetland Restoration Recommendations at the Rochester Embayment Area of Concern in Support of the Loss of Fish and Wildlife Habitat BUI Removal."

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Sincerely,

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WETLAND RESTORATION RECOMMENDATIONS AT THE ROCHESTER EMBAYMENT AREA OF CONCERN IN SUPPORT OF THE LOSS OF FISH AND WILDLIFE HABITAT BUI REMOVAL

FINAL STATUS REPORT

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EXECUTIVE SUMMARY

The 2011 Rochester Embayment Area of Concern (REAOC) Remedial Action Plan (RAP) Stage II Addendum describes the current status of the Loss of Fish and Wildlife Beneficial Use Impairment (BUI) as "impaired." The U.S. Fish and Wildlife Service (USFWS) New York Field Office (NYFO) conducted an analysis of recently acquired wetland assessment data to produce restoration recommendations for priority wetlands in the vicinity of the REAOC and constructed pilot restorations in support of habitat loss BUI removal and eventual delisting of the AOC. Restoration recommendations were based on wetland assessment information collected in 2012-2013 by NYFO at the REAOC[1] and numerous consultations with Great Lakes wetland experts, REAOC RAC members and advisors, and environmental agencies at all levels of government. Included in this report are:

- recommendations for specific actions that would enhance habitat quality and resilience in the vicinity of the REAOC,
- identification of specific waterbodies that would benefit most from wetland quality enhancements, and
- portfolio of candidate habitat restoration projects that would improve wetland habitat in and adjacent to the REAOC.

Pilot restorations are nearly complete, and pre- and post-construction monitoring at those sites will provide efficacy data that will be used to inform additional habitat enhancements at the REAOC.

The NYFO identified the most significant factors contributing to impairment of REAOC wetlands as habitat for plants and animals, including:

- poor habitat complexity (i.e., lack of habitat patchiness, multiple plant heights and types, varying topography, interspersion of water with emergent wetland, etc.) that limits plant and animal species diversity,
- invasive species that can crowd out native species and reduce habitat diversity,
- wetland buffer degradation that reduces the resilience of wetland habitat,
- phosphorus that can, under certain conditions, contribute to trophic degradation including algae blooms and depleted oxygen, and
- ammonia that can be toxic to some aquatic and wetland species.

The NYFO's recommendations to counter these impairments and restore quality wetland habitat are straight forward and have been vetted with the REAOC Remedial Action Committee (RAC) and environmental agencies. Structural habitat improvements are planned in ponds, bays and creeks associated with the REAOC that ranked among the lowest for wetland quality, namely, Braddock Bay tributaries, Braddock Bay, Long Pond, Buck Pond, and the Genesee River. The areal extent of structural habitat enhancements is anticipated to total over 100 acres with full implementation of these projects.

[1] "Wetland Assessment in the Rochester Embayment Area of Concern in Support of the Loss of Fish and Wildlife Habitat BUI Removal Evaluation. Final Report." Available at: http://www.fws.gov/northeast/nyfo/ec/glri.htm.

The NYFO recommends excavation of channels and potholes within monotypic cattail marshes, along with habitat mounds or islands constructed from on-site materials that would restore natural habitat patchiness and topographic and vegetative complexity. Channels and potholes within emergent marshes would be sited to restore areas that were open water historically; small islands would be constructed in shallow water areas that were formerly emergent wetland. Construction in emergent marshes would occur in areas currently dominated by cattail, an effectively invasive (albeit, native) species in the REAOC wetlands, thereby reducing coverage of invasive species. Habitat mounds would be planted with native herbaceous and mast-bearing shrubs to directly reduce coverage by invasive plants and encourage usage of wetlands by large animals. These structural habitat recommendations have been implemented in pilot projects in the Lower Salmon Creek and Braddock Bay; final monitoring will be conducted within a few years.

NYFO further recommends enhancing wetland habitat resiliency by assuring New York State water quality standards are met within the most degraded watersheds. In particular, NYFO recommends track down studies of major phosphorus and ammonia sources, implementation of source loading reduction measures, where feasible, and application of best management practices.

The REAOC Wetland Habitat Restoration Recommendations project is complete; this document is the final status report.

Table of Contents

ACKNOWLEDGEMENTS ii
INTRODUCTION 1
PROJECT SCOPE 2
Objectives 2
Project Area 2
METHODS 3
Ranking Habitat Quality Metrics 3
Deconstructing Habitat Structure Metrics 4
Preliminary Wetland Habitat Restoration Recommendations 5
Pilot Restoration Projects 5
Efficacy Monitoring 5
RESULTS 6
Ranking Habitat Quality Metrics 6
Deconstructing Complex Habitat Structure Metrics 7
Improving Wetland Habitat Condition: Recommendations for Wetland Structural Restoration 8
Protecting Wetland Habitat Resilience: Recommendations for Wetland Buffers and Watersheds 8
Habitat Restoration Project Prioritization for Habitat Loss BUI Removal 9
Pilot Structural Habitat Restoration Project 9
LITERATURE CITED 11
Attachment 1 – USEPA's USA RAM 2012 Field Data Sheets 26
Attachment 2 – Portfolio of Conceptual Plans for NYFO's Ten Candidate Pilot Projects 40
Attachment 3 – Ranking of Field Indicators in the Stress to Buffer Zone Metric 56
Attachment 4 – Ranking of Field Indicators in the Topographic Complexity Metric 60
Attachment 5 – Initial Construction Sketches for the Lower Salmon Creek and Braddock Bay Emergent Wetland Sites 62

INTRODUCTION

The Great Lakes Water Quality Agreement (GLWQA) between the United States and Canada addresses the degradation of the physical, chemical, and biological integrity of the Great Lakes. In the agreement, first signed in 1972, each country committed to work toward restoration of the Great Lakes Basin. The GLWQA of 1987 (Annex 2) identified locations that have serious contamination and degradation issues to a greater degree than in the rest of the Great Lakes, and designated these locations as Areas of Concern (AOCs). In total, 43 AOCs have been identified to date – 26 located entirely within U.S. borders, 12 located entirely in Canada, and five with shared jurisdiction. Of these, three Canadian AOCs and two U.S. AOCs have been delisted (International Joint Commission [IJC] 2013, USEPA 2013a; 2013b).

The GLWQA defines 14 "beneficial uses" related to human and intrinsic values of the ecological system. AOCs are being assessed to determine which of these beneficial uses remain impaired, and to identify actions that will restore beneficial uses. Remedial Action Plans (RAPs) were developed by AOC-specific Remedial Action Committees (RACs) to guide rehabilitation efforts.

The RAP for the Rochester Embayment Area of Concern (REAOC) identifies, and provides the rationale and remediation plans, for 12 BUIs including the "Loss of Fish and Wildlife Habitat" BUI (Beal and Stevenson 1997, MCDPD 1993, USEPA 2014). An update of BUI-specific status, delisting criteria, and recommended actions for BUI removal was prepared in December 2011, associated with the REAOC RAP Stage 2 Addendum (MCDPH 2011). According to that report, the current status of the Loss of Fish and Wildlife Habitat BUI at the REAOC is "impaired." Among delisting criteria and recommended actions for the habitat loss BUI are requirements to assess trends in wetland size and condition, and rank wetland habitats for protection and restoration. In February 2012 the U.S. Environmental Protection Agency (USEPA) Great Lakes National Program Office (GLNPO) requested that the U.S. Fish and Wildlife Service (USFWS) New York Field Office (NYFO) conduct those assessments.

In 2014, NYFO completed the requested wetland assessments (Gefell et al. 2014a, 2014b). As part of the assessment project, the NYFO ranked relative wetland quality among 15 waterbodies (seven lotic and eight lentic) using a total of 26 metrics representing features of structural and vegetative habitat (Attachment 1), water quality, and animal communities (Table 1; Figure 1). Data were collected during 2012-2013 at 112 wetland sampling stations distributed across the project area in waterbodies that are contiguous with the REAOC (Figure 2). In the process, NYFO identified the environmental features contributing most to wetland habitat impairment across the project area.

This REAOC habitat restoration recommendation project is a direct extension of the REAOC wetland habitat assessment project. This project utilizes the output from the wetland assessment project and conducts further analyses of the assessment data to recommend defensible solutions and begin implementing them in areas most in need of restoration.

The restoration recommendation project is complete, and this document is the final status report. It provides a description of the habitat restoration recommendation project scope (objectives,

study area, general approach, etc.), methods, interim results and interpretation, and next steps. Details are provided in Attachments 1 to 5.

PROJECT SCOPE

Objectives

Objectives of the habitat restoration recommendations project are to:

1) Develop preliminary restoration recommendations relevant to the AOC as a whole, (based on evaluation of wetland assessment results) and propose candidate restoration projects.
2) Solicit input from the REAOC RAC and collaborating federal, state, and local agencies concerning preliminary restoration recommendations and pilot project prioritization.
3) Design and construct two pilot wetland restoration projects consistent with preliminary restoration recommendations and tailored to site-specific conditions.
4) Conduct pre- and post-construction monitoring to evaluate efficacy of the restoration measures with respect to habitat quality and biological community improvement.
5) Develop final wetland restoration recommendations. Re-interpret and refine the preliminary AOC-wide restoration recommendations, if necessary, based on results of the efficacy monitoring at pilot restoration sites.

Project Area

The NYFO defined the initial project area for the REAOC wetland assessment based on a synthesis of information provided in RAP documents (MCDPD 1993, Beal and Stevenson 1997, Beal 2002), suggestions provided in E&E (2011), discussions with the RAC and its technical advisors, and professional judgment (Gefell et al. 2014b).

Wetlands that were ranked for restoration and protection in the habitat assessment project are associated with 17 waterbodies within the project area (Figure 2). Lentic waterbodies included in developing the restoration recommendations were: Bogus Point Pond, Rose Marsh Pond, Braddock Bay, Cranberry Pond, Long Pond, Buck Pond, Round Pond, and Irondequoit Bay. Lotic waterbodies include: Salmon Creek, West Creek, Buttonwood Creek, Northrup Creek, Larkin Creek, Round Pond Inlet, Slater Creek, Genesee River, and Irondequoit Creek.

Candidate structural habitat restoration projects presented in this report (Attachment 2) were focused on the most consistently low-scoring waterbodies identified in the habitat assessment project (Table 2): Braddock Bay, Braddock Bay tributaries, Long Pond, Buck Pond, Genesee River, Irondequoit Bay, and Irondequoit Creek.

METHODS

Full details on determination of the project area, sampling station selection, identifying assessment parameters, and data collection and analysis methods are provided in Gefell et al. (2014b). The following sections describe NYFO's methods for producing restoration recommendations from results of the wetland assessment project.

Ranking Habitat Quality Metrics

Structural Habitat. The NYFO assessed current physical and vegetative structural aspects of wetland habitat quality using the USEPA Rapid Assessment Method (RAM) (USEPA 2011) in the Fall of 2012 and in the Spring of 2013 (a total of 79 RAM sampling stations; 26 stations repeated). The RAM is a visual assessment method wherein an observer scores each of 12 metrics (Table 3) based on the occurrence and/or magnitude of field indicators, and compiles a multi-metric score to represent the overall habitat condition at each sampling station (Figure 3). Each metric received one of four scores based on the field indicators: 3, 6, 9, or 12, where 3 is poorest and 12 is highest value for habitat quality. Detailed descriptions of sampling station selection and methods are provided in Gefell et al. (2014b).

The RAM metrics are associated either with a desirable condition or stressors and scored either within a 40m radius assessment area or within the surrounding 100m buffer area (Figure 4). The six RAM metrics related to wetland condition characterize the extent to which favorable wetland functions and services are supported by the visible physical and vegetative structure. Greater variety of wetland form and structure is related to broader functionality as wetland habitat, which, in turn, presumably is related to richness and diversity of wetland plant and animal species. The six stressor-related metrics characterize the degree to which anthropogenic processes and events have degraded form and structure, thereby deteriorating the capacity of the wetland to support a diversity of plants and animals.

The NYFO ranked metric scores to identify those most responsible for driving down overall structural habitat quality across the project area. No *a priori* information was located concerning the potential for systematic differences in metric scores due to waterbody type (lentic vs. lotic) or seasonality (fall versus spring). Therefore, separate metric ranking analyses were conducted for four separate observation sets of RAM data. Within each observation set, metric scores were summed, and sums-of-scores were ranked by metric. Metrics that ranked low consistently across the four observation sets were identified in a weight of evidence synthesis. Observation sets were:

- Lentic waterbodies, Fall 2012 (N=42);
- Lotic waterbodies, Fall 2012 (N=11);
- Lentic waterbodies, Spring 2013 (N=40); and
- Lotic waterbodies, Spring 2013 (N=12).

Water Quality. The NYFO collected surface water grab samples and obtained YSI meter readings at locations distributed throughout the project area in the Fall of 2012. Surface water grab samples were taken at a total of 68 sites and YSI measurements were taken using the YSI

Professional Plus multi-parameter water quality meter at 66 sites throughout the project area in the Fall of 2012. An additional 47 YSI measurements were taken in 2013, of which 17 were taken at locations previously sampled in 2012 and 30 were at new sampling locations. The number of water samples per waterbody was approximately proportional to water body size. Mean values for each parameter were computed, by waterbody.

The NYFO selected screening values that were related to aquatic life uses. At least one screening value was identified for each of the following water quality parameters: ammonia, nitrite, total phosphorus (TP), total suspended solids (TSS), total dissolved solids (TDS), dissolved oxygen (DO), and pH (Table 4). Water quality parameters were ranked by tallying the total number of excursions for each parameter, across waterbodies; a high number of excursions indicated low rank.

Deconstructing Habitat Structure Metrics

Structural habitat metric scores, and the overall RAM score, were calculated at each sampling station from the occurrence and/or magnitude of field indicators. Each field indicator was assessed by simple visual observations (Figure 3). The RAM habitat metrics are broadly defined. They do not themselves identify specific practical remedies that, if implemented, would improve overall habitat condition. However, RAM field indicators do pertain to specific physical features of a wetland, many of which could be readily rehabilitated or offset using widely available, conventional methods and technologies. Attachment 1 contains field data forms used in the wetland assessment project which show relationships between field indicators and the 12 RAM metrics.

Field indicators were interpreted as negative for metrics related to stress to the wetland system (i.e., the greater number and/or magnitude of indicators, the lower the score) including: Stress to the Buffer Zone, Stress to Water Quality, Alterations of the Hydroperiod, Alterations of the Substrate, Cover of Invasive Plant Species, and Vegetation Disturbance. Additional metrics were computed using specific field indicators interpreted as positive attributes of habitat structure (i.e., the greater the number and/or magnitude of field indicators, the higher the score). These metrics include: Percent of Assessment Area Adjoining a Buffer, Mean Buffer Width, Patch Mosaic Complexity, Topographic Complexity, Vertical Complexity, and Plant Community Complexity.

Some of the metrics are evaluated principally in terms of presence/absence of numerous field indicators (Table 3; Attachment 1). The NYFO deconstructed the most poorly ranked of these complex RAM metrics to identify specific field indicators most responsible for driving down metric scores. For these metrics, the relative importance of field indicators to the final metric score was assessed using RAM data generated in the Fall of 2012 and Spring of 2013, across all sampling stations. As with the ranking of habitat quality metrics, no *a priori* information was located concerning systematic biases in field indicator observability or magnitude due to waterbody type or sampling season. Hence, separate evaluations of field indicator importance were conducted using the same four observation sets as were used for ranking metrics, followed by a weight-of-evidence determination.

Preliminary Wetland Habitat Restoration Recommendations

Preliminary restoration recommendations were prepared for wetlands in the lowest ranked waterbodies (Gefell et al. 2014b) based on the most important field indicators in the lowest scoring metrics. Certain preliminary recommendations are being implemented in pilot projects to evaluate whether prescribed habitat alterations will result in increased use of existing monotypic cattail marshes by wildlife and increased plant and animal diversity.

Pilot Restoration Projects

In a September 16, 2013, meeting with the REAOC RAC, regulatory agencies, and collaborating organizations, NYFO presented wetland assessment findings, provided preliminary habitat restoration recommendations, and described conceptual plans for 10 candidate restoration projects located within five of the lowest ranked waterbodies (Attachment 2). Based on these 10 candidate restoration projects, the REAOC RAC provided an initial prioritization of the projects to NYFO in December 2013. The final project list and prioritization for BUI removal were developed during subsequent discussions between REAOC RAC, regulatory agencies, NYFO, and other project collaborators.

During the Summer of 2014, NYFO coordinated the design, planning, and construction of pilot projects, including obtaining necessary permits and permissions, communicating with jurisdictional state and local agencies and private landowners, consulting with technical collaborators, coordinating logistics, and overseeing subcontractors.

Efficacy Monitoring

NYFO arranged preconstruction monitoring with Dr. Douglas Wilcox (SUNY Brockport), who is affiliated with the Great Lakes Coastal Wetland Monitoring Program and is already conducting monitoring in the immediate vicinity of NYFO's proposed pilot projects. Monitoring includes vegetation surveys, fish and aquatic macroinvertebrate sampling, bird and amphibian call count surveys, measurements of water table elevation, soil moisture, and fine scale topography.

Post-construction monitoring at the pilot project locations, and monitoring at additional proposed restoration sites, will be completed under separate funding in future projects.

The NYFO will work with NYSDEC, REAOC RAC, USEPA, U.S. Army Corps of Engineers (USACE), and possibly other stakeholders to develop and implement an adaptive monitoring and management strategy to be applied to future habitat projects at the REAOC.

RESULTS

Ranking Habitat Quality Metrics

Five RAM metrics were among the lowest ranked in at least three of the four observation sets (Table 5):

- Stress to the Buffer Zone,
- Topographic Complexity,
- Patch Mosaic Complexity,
- Vertical Complexity, and
- Plant Community Complexity.

All four of the metrics that explicitly measure habitat complexity were among the lowest ranked metrics. Habitat complexity is related to local diversity of wetland functions and services (as habitat), which in turn is related to the diversity of plant and animal wetland species that may inhabit the area. The implication is that deteriorated habitat complexity results in reduced biotic diversity and richness, and that improvement in these complexity factors would improve richness and diversity of inhabiting species.

Among the seven water quality parameters used in the metric ranking process, any excursions from screening values related to aquatic life (Table 4) were most frequently observed for TP, ammonia, and DO (Table 6). All waterbodies included in the REAOC wetland assessment (Gefell et al. 2014b) are polluted with TP at levels exceeding screening values. Both historical mean TP levels and mean 2012 grab samples exceeded the NYSDEC water quality standard for TP (20 ug/L; NYSDEC 1998) and threshold values demarcating the transition from mesotrophic to eutrophic (30 ug/L; Wetzel 2001) in all waterbodies sampled. The ecological threshold between eutrophic and hypereutrophic condition (100 ug/L; Wetzel 2001) was exceeded by mean TP in Braddock Bay, Bogus Pond, and Long Pond in NYFO's 2012 water grab sampling (Table 6).

Trend analysis of TP and soluble reactive phosphorus (SRP) was conducted in the REAOC wetland assessment (Gefell et al. 2014b) based on data collected by Dr. Joseph Makarewicz (SUNY Brockport) and other investigators during the period 1991 to 2009. Despite generally improving trends in mean phosphorus, TP levels remain very high in Long Pond and Northrup Creek, both of which had received effluent until a few years ago from an upstream wastewater treatment plant. Irondequoit Creek, which also historically received wastewater treatment plant effluent, was the only waterbody included in the wetland quality trend analysis to show an increasing trend in SRP (Gefell et al. 2014b).

Mean ammonia was elevated in NYFO's 2012 water grab sampling in Long Pond, Round Pond, Bogus Pond, Genesee River, West Creek, Northrup Creek, and Irondequoit Creek (Table 6). Dissolved oxygen also showed excursions from acceptable levels in several waterbodies. Sub-standard DO was observed in nearly all of the lotic systems in the Fall of 2012, and most of the lentic systems in the Spring of 2013 (Table 6).

Nitrite and pH appeared to be most consistently within normal ranges among the parameters evaluated.

Deconstructing Complex Habitat Structure Metrics

Two of the five lowest ranked RAM metrics utilize a tally of occurrence of their field indicators to compute the final score. For Stress to the Buffer Zone, field indicators were ranked low when percent occurrence was high; they were ranked from greatest percent occurrence to least in each of the four observation sets (Attachment 3). Field indicators occurring at greater than ~20% of stations in three or more observation sets were identified as potential drivers (Table 7), and are considered features of the buffer zone that should be considered for mitigation during restoration. These included:

- Cover of non-native or invasive species
- Mowing/shrub cutting (brush hogging)
- Dikes/dams/levees/ railroad or road beds
- 1- or 2-lane paved roads
- Suburban residential land use
- Trails

Restoration recommendations based on these indicators focused on those that are most readily adjusted on the ground and that do not require altering hardened infrastructural features of the landscape or restricting land uses on private property.

For the Topographic Complexity metric, field indicators were ranked low when percent occurrence was low; they were ranked from lowest percent occurrence to greatest in each of the four observation sets (Attachment 4). Field indicators occurring at fewer than ~20% of stations in three or more of the four observation sets were identified as potential drivers (Table 8). These are wetland features that should be augmented through restoration. They included:

- Natural/artificial swales
- Bank slumps or undercut banks
- Cobbles or boulders
- Multiple high water marks etched in substrate
- Inorganic sediment mounds not from animals
- Soil cracks or fissures
- Animal activity affecting microtopography (3 indicators)
- Potholes, sinkholes, or other natural depressions not caused by animals
- Natural or artificial levee or berm

Interpretation of the remaining low-ranked RAM metrics (Patch Mosaic Complexity, Vertical Complexity, and Plant Community Complexity) was not based on percent occurrence of field indicators. Instead, restoration recommendations were interpreted from the simple scoring methods involving visual estimates of percent cover or spatial patterns (see Attachment 1).

Improving Wetland Habitat Condition: Recommendations for Wetland Structural Restoration

Based on results presented above, the following structural habitat restoration recommendations were developed for the entire wetland assessment project area (not necessarily in order of importance):

1. Increase habitat patchiness (i.e., patch mosaic complexity – the diversity and interspersion of substrate and vegetative cover types).
2. Substantially decrease coverage of invasive and non-native plant species.
3. Conduct wetland restorations in areas with substantial buffers that are unaltered by intensive human use (e.g., roads, trails, suburban land use, mowing, etc.).
4. Increase naturally variable water fluctuations.
5. Increase occurrence of potholes, sinkholes, and other natural depressions.
6. Increase number of natural and artificial swales, levees, and berms.
7. Increase wetland use by large animals.
8. Substantially increase presence of cobbles and boulders in substrate.
9. Increase number of undercut banks.
10. Increase number of plant strata, and the number of native, non-invasive, co-dominant (>10% coverage) plant species in each stratum.

Protecting Wetland Habitat Resilience: Recommendations for Wetland Buffers and Watersheds

Findings of the REAOC wetland assessment (Gefell et al. 2014b), as well as the analysis presented above, suggest that the resilience of any improvements in fish and wildlife presence resulting from structural habitat restoration would be enhanced by alleviating outstanding issues related to wetland buffers and water quality. The NYFO recommends the following measures to protect wetland habitat resilience:

1. Pollutant loadings in surface water entering wetlands from upstream (particularly phosphorus and ammonia) should be limited as much as possible:
    a. Principal pollutant sources should be identified and prioritized for remediation based on relative loadings;
    b. If sediment bedloads of pollutants, either within subject waterbodies and/or upgradient in the watersheds, are identified as principal sources, feasibility of sediment removal should be investigated and implemented where found feasible;
    c. Pollution prevention best management practices, including establishment of buffers along streams, should be implemented as appropriate to minimize principal pollutant loadings.
2. Intact, undeveloped wetland buffers should be permanently protected from future disturbance.
3. Disturbances to buffers around existing wetlands, and along tributary streams, should be reduced to the degree that is feasible.

Habitat Restoration Project Prioritization for Habitat Loss BUI Removal

The final wetland restoration project list and prioritization for BUI removal were developed during discussions between REAOC RAC, NYSDEC, USEPA Regional and GLNPO offices, the NYFO, and other project collaborators. The discussions and final project list were based directly on NYFO's restoration recommendations for improved habitat condition and resilience, NYFO's conceptual plans for candidate structural habitat enhancement projects (Attachment 2), and waterbody rankings and other the findings in NYFO's wetland assessment report (Gefell et al. 2014b). As a result of these discussions, the NYFO has agreed to design, coordinate, and implement wetland habitat restoration projects for BUI removal at the following locations (refer to Attachment 2 for conceptual plans):

- Pilot construction (completed)
  - Lower Salmon Creek
  - Braddock Bay Emergent Wetland (USACE design)
- Construction (pending full funding)
  - Genesee River Turning Basin
  - Genesee River Turning Point Park
  - Confluence of West and Salmon Creeks
  - Long Pond West
  - Buck Pond East

Other organizations are conducting additional habitat restorations in Buck Pond and Braddock Bay, based on their own assessments, in coordination with the REAOC RAC and environmental agencies.

Pilot Structural Habitat Restoration Project

Construction of potholes, habitat mounds, and connecting channels is complete at the Lower Salmon Creek site. Plantings of native herbaceous and woody plants, including mast-producing shrubs, on the habitat mounds is complete. The NYFO also assisted USACE with implementing the habitat enhancement component of the USACE's proposed construction plan for Braddock Bay. In coordination with the USACE, NYFO has constructed some of the proposed channels at the Braddock Bay Emergent Wetland site (the large cattail emergent wetland on the western margin of the Bay's open water). Historical aerial photographs that predate Lake Ontario water level regulation and the Lake Ontario Parkway show some braiding of water flow in a delta within the Braddock Bay system, at the mouths of Salmon and Buttonwood Creeks. The two pilot projects are in adjacent sites connected by a culvert under the Lake Ontario Parkway and together re-establish a historical channel between Salmon Creek and Braddock Bay. Channeling provides about three miles of additional free-flowing water for fish and bird access, and edge habitat for a variety of vertebrate and invertebrate species. Preliminary design plans for habitat construction that NYFO has completed to date are provided in Attachment 5; minor modifications to these plans were implemented on site, to conform to field conditions.

SUNY Brockport has completed preconstruction monitoring at the pilot habitat restoration sites. Final restoration recommendations will be developed upon completion of the post-construction monitoring and data analysis.

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Table 1. Metrics used to rank current wetland quality in the REAOC project area. Results of structural habitat and water quality analyses were used to develop habitat restoration recommendations.

Structural Habitat	**Water Quality**	**Animal Communities**	
		Birds	**Amphibians**
Percent of Assessment Area margin having a Buffer	Total Phosphorus	Species Diversity Index	Species Diversity Index
Buffer Width	Total Suspended Solids	Index of Biological Integrity	Index of Biological Integrity
Stress to the Buffer Zone	Total Dissolved Solids	Species Richness (All)	Species Richness (All)
Topographic Complexity	pH	Focal Species Richness	
Patch Mosaic Complexity	Dissolved Oxygen		
Vertical Complexity	Nitrite		
Plant Community Complexity	Ammonia		
Stress to Water Quality			
Alterations to Hydroperiod			
Habitat/Substrate Alterations			
Percent Cover of Invasive Species			
Vegetation Disturbance			

Table 2. Summary of lowest ranked waterbodies in each wetland habitat assessment category in the immediate vicinity of the REAOC. Colors distinguish between watersheds, inclusive of terminal bays or ponds; waterbodies within those watersheds that ranked low across assessment categories are identified.

	Structural Habitat EPA RAM	Water Quality YSI/grab	Animal Communities MMP	
			Birds	Herps
Lentic	Long Pond	Long Pond		Long Pond
	Buck Pond	Buck Pond	Braddock Bay	Braddock Bay
	Irondequoit Bay	Round Pond	Irondequoit Bay	Irondequoit Bay
Lotic	Genesee River	Genesee River		Genesee River
	Irondequoit Creek	Irondequoit Creek	Irondequoit Creek	Irondequoit Creek
	Braddock Bay Tributaries	West Creek	Buttonwood Creek	

Table 3. USA Rapid Assessment Method (RAM) Metrics; descriptions of the 12 metrics are either direct quotes or paraphrased sections from the RAM manual (USEPA 2011).

Metric	Description
1. Percent of Assessment Area having a Buffer	Percent of the assessment area (AA) perimeter that adjoins a general type of buffer land cover including: open water; wetlands; natural non-vegetated land surfaces; natural, non-impacted vegetated lands; trails. Non-buffer lands include: built structures; artificial, non-vegetated land surfaces; active mining areas; any active agriculture lands; recently burned lands; urban and recreational lawns and playing fields; roadways dangerous to wildlife; railroads; ATV trails. Land cover classes were obtained from the Anderson Land Cover Class system (Anderson et al. 1976). The estimated percent of AA perimeter with a buffer is the basis for scoring this metric.
2. Buffer Width	Mean distance from AA perimeter to the first intersection with non-buffer land, up to 100m maximum distance from AA. Distance is estimated along the four cardinal directions and four ordinal directions (a total of eight measurements), and the average is the basis of scoring this metric.
3. Stress to the Buffer Zone	Field indicators of hydrological, habitat/vegetation, urban/suburban/commercial, and agricultural stress are evaluated and the metric is scored based on presence/absence and relative severity of each indicator.
4. Topographic Complexity	The presence of any of 20 field indicators is positively related to final score. Indicators include berms, swales, natural channels, potholes, and other features that contribute to topographic relief.
5. Patch Mosaic Complexity	This metric is assessed based on visual comparisons between the AA and schematic diagrams of the full range of possible patch mosaic complexity provided on the field data sheets and in the manual.
6. Vertical Complexity	This metric addresses the vertical structure of the plant community in terms of its component number of plant strata. Different strata provide different physical and ecological services. Seven strata are defined: submerged plants, floating aquatic plants, tall emergents, short emergents, short woody, tall woody, and vines. Animal species tend to partition themselves vertically among wetland and riparian plant strata. The basic assumption is that more strata translates into more kinds of habitat and broader ranges in habitat condition.
7. Plant Community Complexity	This metric addresses the diversity of plant species that dominate the plant strata. Within a wetland class, the diversity and levels of ecological function of a wetland are expected to increase with the number and abundance of different plant species. The basic assumption is that greater diversity of co-dominant species translates into more kinds and higher levels of wetland functions.
8. Stress to Water Quality	Field indicators of stress to water quality related to point sources, sedimentation/pollutants, eutrophication, mining, and salinity are evaluated and the metric is scored based on presence/absence and relative severity of each of 13 indicators.
9. Alterations to Hydroperiod	Field indicators of stress to hydroperiod are evaluated within the AA and the metric is scored based on presence/absence and relative severity of each of 11 indicators.

Metric	Description
10. Habitat/Substrate Alterations	Field indicators of stress to substrate are evaluated within the AA and the metric is scored based on presence/absence and relative severity of each of 12 indicators. There is a range of anthropogenic events and activities that alter wetland habitats by disturbing their substrates, including grading, mining, off-road vehicle use, and vegetation control. Some urban wetlands are severely impacted by dumping of yard debris and other trash. Substrate alterations can cause changes in drainage and soil productivity that subsequently alter wetland plant communities.
11. Percent Cover of Invasive Species	This metric is assessed based on field observations of the percent cover of co-dominant invasive species (covering ≥10% of stratum) in each of the plant strata within the AA, for strata covering ≥10% of AA. Plant community composition provides clear and robust signals of human disturbance. Predictable changes in community structure, productivity, and other ecosystem properties are observed as anthropogenic disturbance increases.
12. Vegetation Disturbance	Field indicators of on-going disturbance to vegetation communities are evaluated within the AA with respect to, and the metric is scored based on, presence/absence and relative severity of each of 14 indicators. Indicators include mowing, clear cut, herbicide application, grazing, fire, and other disturbances. As vegetation communities shift in response to stress, important wetland services, such as biodiversity support and water quality improvement, may be affected.

Table 4. Threshold screening values used to rank relative water quality across waterbodies in the REAOC project area.

WQ Parameter	Upper Threshold, Criterion, or Normal Range			Reference	Notes
	Lotic (Trout Stream/River)	Lotic (non-Trout Stream/River)	Lentic (Ponds, Bays)		
Total Phosphorus	15 ug/L	15 ug/L	15 ug/L	USEPA 2014	REAOC BUI Delisting Criteria – Eutrophication or Undesirable Algae
Total Phosphorus			30 ug/L	Wetzel 2001	Lentic systems only – mesotrophic/eutrophic threshold
Total Phosphorus			100 ug/L	Wetzel 2001	Lentic systems only – eutrophic/hypereutrophic threshold
Total Phosphorus			11.25 ug/L	USEPA 2000	Lentic systems – "reference value"
Total Phosphorus	24.1 ug/L	24.1 ug/L		USEPA 2000	Lotic systems – "reference value"
Total Phosphorus			20 ug/L	NYSDEC 1998	Lentic systems and Class B waters, only – NYS Guidance Value for Recreation/Aesthetics – applies only to ponds, lakes, and reservoirs
Total Suspended Solids	200 mg/L	200 mg/L	200 mg/L	USEPA 2014	REAOC BUI Delisting Criteria – Loss of Fish and Wildlife Habitat. [TSS should not exceed 200 mg/L more than 5 times per year]
Total Suspended Solids	30 mg/L	30 mg/L	30 mg/L	USEPA 2014	REAOC BUI Delisting Criteria – Loss of Fish and Wildlife Habitat. [TSS should not exceed 30 mg/L during 80% of the year]
Total Dissolved Solids	500 mg/L	500 mg/L	500 mg/L	NYSDEDC 1999	http://www.dec.ny.gov/regs/4590.html
pH	6.5-8.5	6.5-8.5	6.5-8.5	NYSDEDC 1999	http://www.dec.ny.gov/regs/4590.html
Dissolved Oxygen	(TS) ≥7.0 mg/L (T) ≥5.0 mg/L	≥4.0 mg/L	≥4.0 mg/L	NYSDEDC 1999	http://www.dec.ny.gov/regs/4590.html
Nitrite	20 ug/L	100 ug/L	100 ug/L	NYSDEC 1998	For lotic systems used "cold-water" values; for lentic systems used "warm-water" values
Ammonia	Site-specific	Site-specific	Site-specific	NYSDEC 1998	Temperature and pH specific. For lotic systems, used trout water values; for lentic systems used non-trout water values.

Table 5. Metric values were summed across sample sites within each of four observation sets. Lowest scoring metrics in each observation set are identified with red highlighting. Five metrics, identified in bold italics, were consistently low-ranking across observation sets.

FALL 2012

LENTIC SYSTEMS		
Metric	Sum of Scores (N=42)	Fall 2012 Metric Rank
Patch Mosaic	195	1
Stress in the Buffer Zone	252	2
Topographic Complexity	270	3.5
Plant Community Complexity	270	3.5
Vertical Complexity	306	5
Invasive Species Cover	429	6
Altered Substrate	444	7
Water Quality Stress	453	8
Buffer Width	456	9
Altered Hydroperiod	459	10
Vegetation Disturbance	480	11
Percent of AA Having Buffer	489	12

LOTIC SYSTEMS		
Metric	Sum of Scores (N=11)	Fall 2012 Metric Rank
Stress in the Buffer Zone	42	1
Patch Mosaic	51	2
Plant Community Complexity	75	3
Topographic Complexity	84	4.5
Vertical Complexity	84	4.5
Altered Substrate	87	6
Water Quality Stress	102	7
Altered Hydroperiod	105	8
Species Cover	105	9
Vegetation Disturbance	108	10
Buffer Width	120	11
Percent of AA Having Buffer	132	12

SPRING 2013

Metric	Sum of Scores (N=40)	Spring 2013 Metric Rank
Patch Mosaic	186	1
Topographic Complexity	195	2
Stress in the Buffer Zone	243	3
Invasive Species Cover	300	4.5
Vertical Complexity	300	4.5
Plant Community Complexity	303	6
Water Quality Stress	378	7
Altered Hydroperiod	396	8
Altered Substrate	441	9
Buffer Width	447	10
Percent of AA Having Buffer	462	11
Vegetation Disturbance	465	12

Metric	Sum of Scores (N=12)	Spring 2013 Metric Rank
Stress in the Buffer Zone	57	1
Patch Mosaic	63	2
Topographic Complexity	69	3
Plant Community Complexity	75	4
Invasive Species Cover	84	5
Vertical Complexity	87	6
Water Quality Stress	96	7
Altered Substrate	120	8
Altered Hydroperiod	123	9
Vegetation Disturbance	135	10.5
Buffer Width	135	10.5
Percent of AA Having Buffer	144	12

Table 6. Ranking of water quality parameters based on the number of waterbodies in which excursions of mean measured values from threshold screening levels were observed. Within the data columns, yellow shading indicates an excursion and brown shading identifies values that exceed the higher of two available threshold screening values. Individual waterbodies with high numbers of excursions are also shaded. Values shown are mean values within waterbodies; number of sampling stations is in parentheses.

Waterbody	Waterbody Class	Total Excursions	Water Grab Parameters (Fall 2012)				YSI Parameters				
							Fall 2012			Spring 2013	
			Ammonia (mg/L)	Nitrite (mg/L)	TP (mg/L)	TSS[1] (mg/L)	TDS (ug/L)	DO (mg/L)	pH	TDS (ug/L)	DO (mg/L)
Lake Ontario nearshore	A	3	0.04 (10)	0.01 (10)	0.046 (10)	33.32 (10)	221 (10)	13.7 (10)	7.88 (10)	na	na
LENTIC											
Braddock Bay	B	2	0.13 (6)	0.01 (6)	0.127 (6)	32.2 (6)	279 (6)	8.77 (6)	na	301 (5)	8.91 (5)
Bogus Pond	B	4	2.46 (1)	0.01 (1)	0.734 (1)	89 (1)	340 (1)	4.4 (1)	6.8 (1)	322 (2)	1.71 (2)
Rose Marsh	B	2	na	na	na	na	na	na	na	566 (2)	0.027 (2)
Cranberry Pond	B	2	0.04 (4)	0.01 (4)	0.083 (4)	22.78 (4)	406 (5)	5.22 (5)	8.11 (5)	389 (5)	2.23 (5)
Long Pond	B	5	0.17 (5)	0.01 (5)	0.169 (5)	153.7 (5)	321 (4)	4.73 (4)	8.43 (4)	559 (4)	3.88 (4)
Buck Pond	B	4	0.02 (5)	0.01 (5)	0.081 (5)	40.88 (5)	427 (5)	2.98 (5)	8.27 (5)	428 (10)	3.33 (10)
Round Pond	C	4	0.08 (2)	0.01 (2)	0.032 (2)	7.65 (2)	449 (3)	1.73 (3)	7.81 (3)	403 (1)	0.22 (1)
Irondequoit Bay	B	3	0.07 (10)	0.01 (10)	0.051 (10)	9.76 (10)	625 (9)	6.64 (9)	8.26 (4)	581 (3)	4.07 (3)
Total Lentic Excursions		26	3	0	7	4	1	2	0	3	6
LOTIC											
Genesee River	B	4	0.07 (8)	0.04 (8)	0.05 (8)	13.31 (8)	422 (8)	4.45 (8)	8.12 (8)	390 (2)	6.92 (2)
Salmon Creek	B	1	0.02 (4)	0.01 (4)	0.101 (4)	18.7 (4)	379 (4)	7.16 (4)	7.98 (2)	321 (4)	6.17 (4)
West Creek	B	4	0.11 (2)	0.01 (2)	1.18 (2)	631 (2)	288 (2)	4.85 (2)	7.9 (1)	302.3 (2)	6.66 (2)
Buttonwood Creek	B	3	0.04 (1)	0.01 (1)	0.341 (1)	179 (1)	416 (1)	8.02 (1)	na	897 (1)	8.79 (1)
Northrup Creek	B	3	0.1 (2)	0.01 (2)	0.068 (2)	7.05 (2)	345 (1)	3.86 (1)	7.51 (1)	na	na
Round Pond trib	C	2	na	na	na	na	845 (1)	4.85 (1)	7.93 (1)	na	na
Irondequoit Creek	B	5	0.04 (3)	0.01 (3)	0.04 (3)	12.7 (3)	841 (3)	2.43 (2)	8.15 (3)	533 (1)	5.31 (1)
Total Lotic Excursions		22	5	1	7	2	3	5	0	3	0
Range of Values[2] in Individual Samples			0.01 - 2.46	0.01 - 0.11	0.02 - 1.96	1 - 1200	201 - 852	1.51 - 15	6.8 - 9.14	86 - 1021	0.1 - 12
Lentic Screening Value			variable; based on pH and Temp.	>0.1	>0.03; 0.1	>30; 200	>500	<4	6.5-8.5	>500	<4
Lotic Screening Value			variable; based on pH and Temp.	>0.02	>0.024	>30; 200	>500	<5	6.5-8.5	>500	<5
Screening Value Source			NYSDEC 1998	NYSDEC 1998	Lentic: trophic state thresholds - Wetzel 2001; Lotic: EPA 2000	USEPA 2014	NYSDEC 1999	NYSDEC 1999	NYSDEC 1999	NYSDEC 1999	NYSDEC 1999

Footnotes:

1 - The "thresholds" used for TSS were not issued by a regulatory agency; they are reported as "of interest" to the RAC because they are values that appear in other BUI criteria

2 - For non-detects, the detection limit value was used.

Table 7. Deconstruction of the USEPA RAM Stress to the Buffer Zone metric identified the driving field indicators that exceeded ~20% occurrence among sampling stations. Indicators identified as drivers based on occurrence in 4, 3, or 2 of the four observation sets are highlighted, respectively, with red, yellow, and green, indicating relative importance throughout the project area.

Fall 2012 - Lentic

Buffer Zone Indicator Sum of Scores	Occurrence (N=42)	Percent Occurrence	Indicators
61	33	0.79	Cover of non-native or invasive species
24	20	0.48	Mowing/shrub cutting (brush hogging)
23	18	0.43	Trash/ dumping
17	16	0.38	Ditches/ drains/ channelization
21	14	0.33	Dikes/dams/levees/ railroad or road beds
15	13	0.31	Trails
13	13	0.31	Inlets and outlets
16	12	0.29	Road – 1 or 2 lane paved
13	12	0.29	Culverts, pipes (point source discharge except stormwater) in buffer zone
12	12	0.29	Moderate to heavy formation of filamentous algae
13	11	0.26	Wall/riprap
12	9	0.21	Fill / spoil banks
11	8	0.19	Suburban residential land use

Fall 2012 - Lotic

Buffer Zone Indicator Sum of Scores	Occurrence (N=11)	Percent occurrence	Indicators
17	9	0.82	Cover of non-native or invasive species
10	9	0.82	Mowing/shrub cutting (brush hogging)
8	7	0.64	Trash/ dumping
7	6	0.55	Dikes/dams/levees/ railroad or road beds
7	5	0.45	Road – 1 or 2 lane paved
7	5	0.45	Trails
6	5	0.45	Lawn/ park
4	4	0.36	Inlets and outlets
4	3	0.27	Suburban residential land use
4	3	0.27	Obvious spills, discharges or odors; unusual water color or foam
3	3	0.27	Ditches/ drains/ channelization

Spring 2013 - Lentic

Buffer Zone Indicator Sum of Scores	Occurrence (N=39)	Percent Occurrence	Indicator
61	35	0.90	Cover of non-native or invasive species
51	18	0.46	Dikes/dams/levees/ railroad or road beds
18	18	0.46	Mowing/shrub cutting (brush hogging)
34	12	0.31	Road – 1 or 2 lane paved
18	8	0.21	Suburban residential land use
10	8	0.21	Trails

Spring 2013 - Lotic

Buffer zone Indicator Sum of Scores	Occurrence (N=12)	Percent Occurrence	Indicator
24	12	1.00	Cover of non-native or invasive species
9	5	0.42	Trails
4	4	0.33	Mowing/shrub cutting (brush hogging)
8	3	0.25	Road – 1 or 2 lane paved
7	3	0.25	Suburban residential land use
6	3	0.25	Obvious spills, discharges or odors; unusual water color or foam
6	3	0.25	Sediment input (construction, erosion, agricultural runoff)
5	3	0.25	Excavation, dredging
5	3	0.25	Fallow field – recent
4	3	0.25	Other mechanical plant removal
3	3	0.25	Moderate to heavy formation of filamentous algae

Table 8. Deconstruction of the USEPA RAM Topographic Complexity metric identified the driving field indicators that did ***not*** exceed ~20% occurrence among sampling stations. Indicators identified as drivers based on occurrence in 4, 3, or 2 of the four observation sets were highlighted, respectively, with red, yellow, and green, indicating relative importance throughout the project area.

Fall 2012 - Lentic

Topographic Complexity Sum of Scores	Occurrence (N=42)	Percent occurrence	Indicators
0	0	0.00	Natural or artificial levee or berm
0	0	0.00	Soil cracks or fissures
0	0	0.00	Cobbles or boulders
1	1	0.02	Wallows, pig damage, or similar scale excavations by animals
1	1	0.02	Inorganic sediment mounds not from animals
2	2	0.05	Animal tracks large enough to hold water
3	3	0.07	Animal burrows or spoil piles
3	3	0.07	Natural/artificial swales
3	3	0.07	Potholes/sinkholes
8	8	0.19	Multiple high water marks etched in substrate
9	9	0.21	Bank slumps or undercut banks

Fall 2012 - Lotic

Topographic Complexity Sum of Scores	Occurrence (N=11)	Percent occurrence	Indicators
0	0	0.00	Multiple high water marks etched in substrate
0	0	0.00	Inorganic sediment mounds not from animals
0	0	0.00	Natural or artificial levee or berm
0	0	0.00	Soil cracks or fissures
0	0	0.00	Cobbles or boulders
1	1	0.09	Wallows, pig damage, or similar scale excavations by animals
2	2	0.18	Undercut banks
2	2	0.18	Animal burrows or spoil piles
2	2	0.18	Bank slumps or undercut banks
2	2	0.18	Natural/artificial swales
2	2	0.18	Animal tracks large enough to hold water

Spring 2013 - Lentic

Topographic Complexity Sum of Scores	Occurrence (N=39)	Percent Occurrence	Indicators
0	0	0	Bank slumps or undercut banks
0	0	0	Undercut banks
0	0	0	Animal tracks deep enough to hold water (e.g., cattle or elk tracks)
0	0	0	Wallows, pig damage, or similar scale excavations by animals
0	0	0	Soil cracks or fissures
0	0	0	Cobbles or boulders
0	0	0	Bare ground
1	1	0.03	Animal burrows or spoil piles from burrows (including ant or termite mounds
1	1	0.03	Inorganic sediment not from animals
1	1	0.03	High water marks etched in substrate
2	2	0.05	Multiple slopes of varying steepness
3	3	0.08	Potholes, sink holes or similar depressions not caused by animals
5	5	0.13	Natural/Artificals wales

Spring 2013 - Lotic

Topographic Complexity Sum of Scores	Occurrence (N=12)	Percent occurrence	Indicators
0	0	0.00	Animal burrows or spoil piles from burrows (including ant or termite mounds
0	0	0.00	Natural or artificial levee or berm
0	0	0	Bank slumps or undercut banks
0	0	0	Undercut banks
0	0	0	Animal tracks deep enough to hold water (e.g., cattle or elk tracks)
0	0	0	Wallows, pig damage, or similar scale excavations by animals
0	0	0	Soil cracks or fissures
0	0	0	Cobbles or boulders
0	0	0	Bare ground
1	1	0.08	Natural/Artifical swales
1	1	0.08	Natural or artificial debris in topographic low areas
1	1	0.08	Inorganic sediment not from animals
1	1	0.08	Multiple slopes of varying steepness
1	1	0.08	Potholes, sink holes or similar depressions not caused by animals
2	2	0.17	High water marks etched in substrate

Figure 1. Summary of the parallel process used to rank waterbodies in terms of current wetland habitat quality using three categories of wetland quality metrics, culminating in a weight-of-evidence analysis to identify candidate waterbodies for restoration.

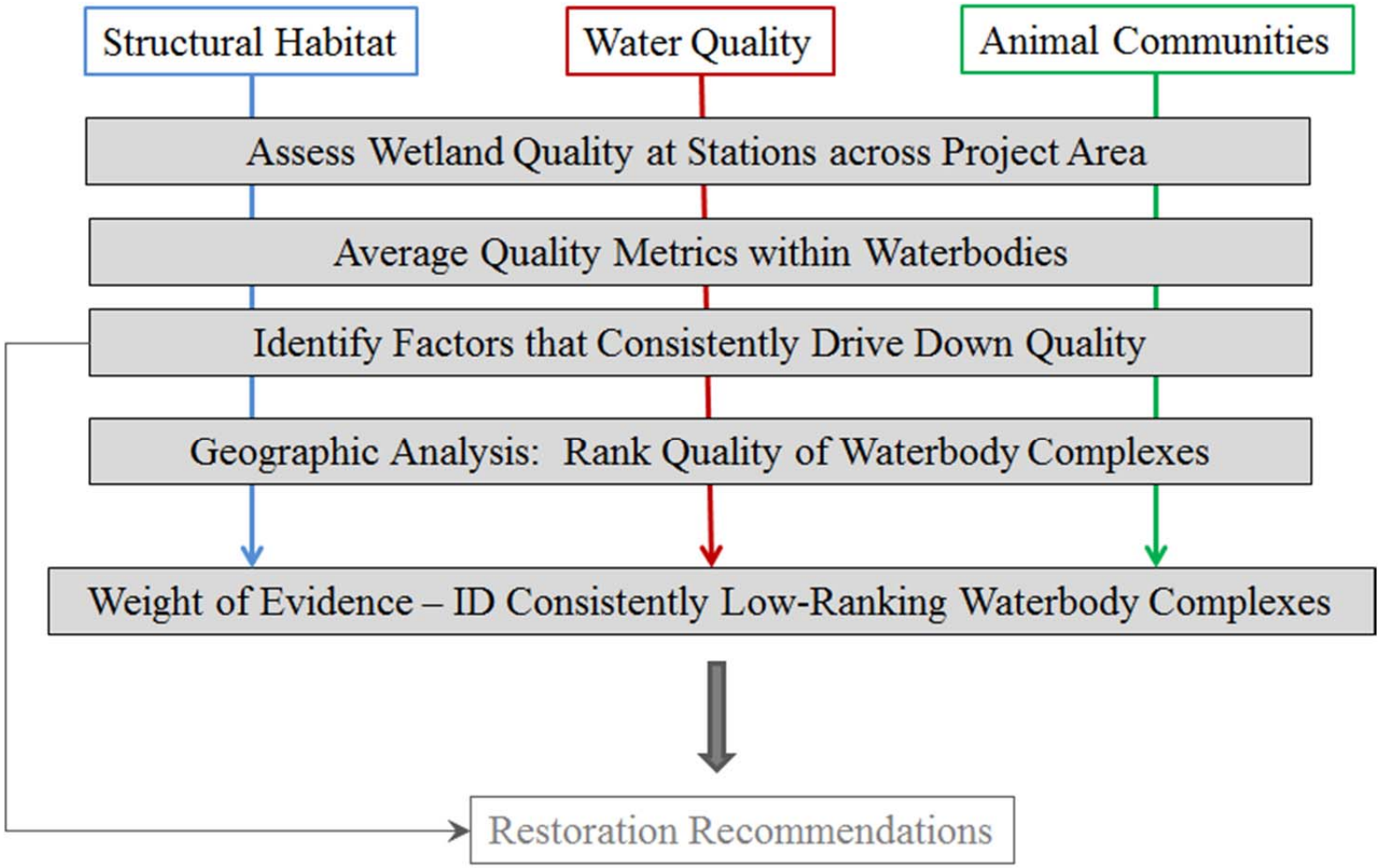


Figure 2. Distribution of 112 stations sampled in the Fall of 2012 or the Spring of 2013 for structural and vegetative habitat, water quality, and/or animal communities, in order to rank wetland quality among waterbodies in the immediate vicinity of the REAOC. Points are differentiated by sampling season.

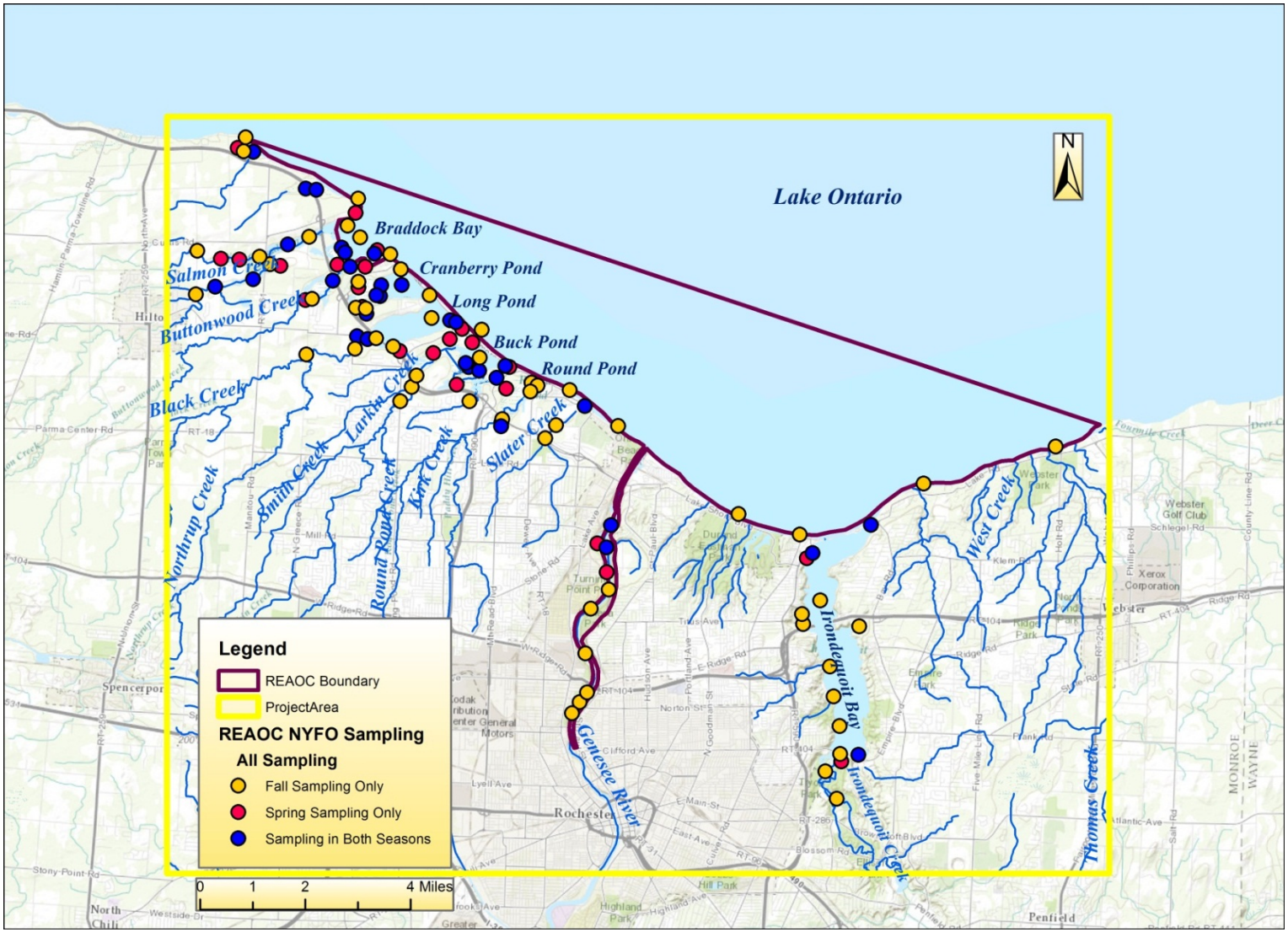


Figure 3. Schematic illustration of constructing individual metric scores, and the overall RAM score (USEPA 2011), from visual observations of a large number of field indicators.

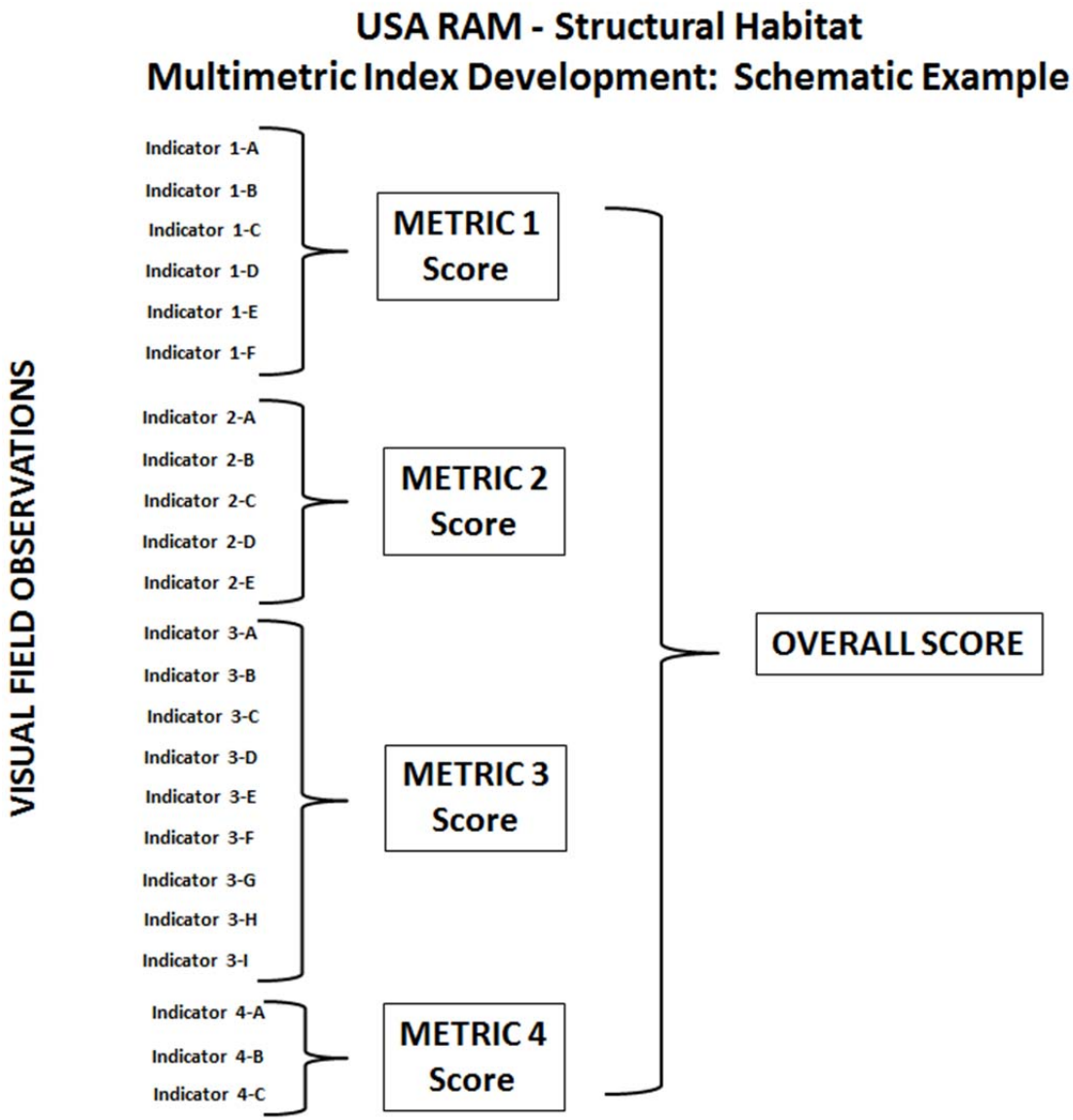
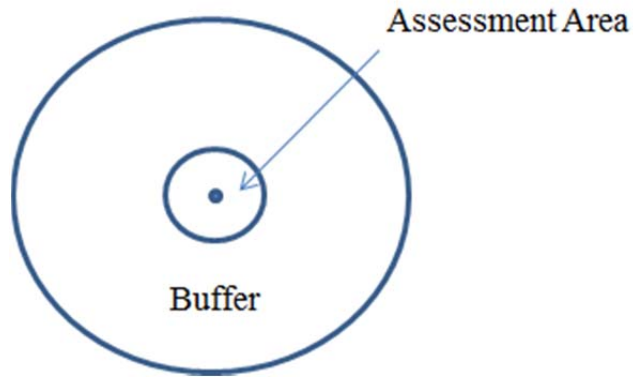


Figure 4. Schematic illustration of RAM sampling site (not to scale) and corresponding condition and stressor metrics. Numbers of visual indicators associated with each metric are provided in parentheses, as applicable.



	Assessment Area (40m radius)	Buffer Area (100m radius)
Condition	• Topographic Complexity (20) • Patch Mosaic Complexity • Vertical Complexity • Plant Community Complexity	• % AA having a Buffer • Mean Buffer Width
Stressors	• Stress to Water Quality (13) • Alterations to Hydroperiod (11) • Habitat/Substrate Alterations (12) • % Cover Invasive Plant Species • Vegetation Disturbance (13)	• Stress to the Buffer Zone (57)

Attachment 1 – USEPA's USA RAM 2012 Field Data Sheets

FORM USA-RAM 1: USA-RAM Metrics 1 and 2 –Buffer Perimeter and Buffer Mean Width

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 1. Percent of AA having buffer: use the site imagery plus field reconnaissance to examine the entire perimeter of the AA and estimate the percent of the perimeter that adjoins any type of Buffer Land Cover, based on Tables 1 and 2 in USA-RAM Manual. Fill in the bubble that corresponds to the best choice.

Choose 1	Percent of AA Perimeter adjoining buffer	Metric Score
O	< 25 %	3
O	26 – 50%	6
O	51 – 75%	9
O	> 75%	12

Metric 2. Buffer Width. Average width of buffer to a maximum extent of 100m. Four lines, each 100m long, are drawn on the site imagery in the cardinal directions (N, S, E, W); these will be walked during field sampling. Another four lines are drawn in the ordinal directions (NE, SE, SW, NW), outward from the AA perimeter. Lines are numbered clockwise with North as "1". Starting at the AA perimeter, estimate the distance in meters along each line between the perimeter and where the line first intercepts any type of non-buffer land cover. This distance equals the buffer width.

Line	Buffer Width (m)
1	
2	
3	
4	
5	
6	
7	
8	
Average Buffer Width (mean of 1 – 8):	

Metric 2 Provisional Scores:

Average Buffer Width (m)	Score
0-25	3
26-50	6
51-74	9
75-100	12

FORM USA-RAM 2: USA-RAM Metric 3 - Stressors in Buffer Area (Front)

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Tally stressors based on observations of the 100 m area surrounding the AA. Data should be collected in all land uses whether or not they count as buffer in Metric 1. Use these guidelines to indicate stressor severity.

Portion of 100m Area Surrounding AA Influenced by Stressor	Severity Code
< one-third	1
between one-third and two-thirds	2
at least two-thirds	3

If stressor is present indicate severity with 1, 2, 3			Stressor (by stressor category)
1	*2*	*3*	**Hydrological Stressors**
O	O	O	Ditches/drains/channelization
O	O	O	Dikes/dams/levees/railroad or road beds
O	O	O	Culverts, pipes (point source discharge) in the buffer zone
O	O	O	Water level control structure
O	O	O	Obvious spills, discharges or odors; unusual water color or foam
O	O	O	Moderate to heavy formation of filamentous algae
O	O	O	Excavation, dredging
O	O	O	Fill/spoil banks
O	O	O	Wall/riprap
O	O	O	Inlets and Outlets
O	O	O	Impervious surface input
1	*2*	*3*	**Habitat/Vegetation Stressors**
O	O	O	Soil subsidence, scour or surface erosion (root exposure)
O	O	O	Substrate disturbance (off-road vehicles, mountain biking, logging roads)
O	O	O	Sediment input (construction, erosion, agricultural runoff)
O	O	O	Forest - selective cut
O	O	O	Forest - clear cut
O	O	O	Removal of large woody debris
O	O	O	Tree plantation present
O	O	O	Heavily grazed grasses, excessive grazing
O	O	O	Tree canopy herbivory
O	O	O	Shrub layer browsed
O	O	O	Fire lines (fire breaks)
O	O	O	Recently burned forest canopy
O	O	O	Recently burned grassland
O	O	O	Mowing/shrub cutting (brush hogging)
O	O	O	Other mechanical plant removal

FORM USA-RAM 3: USA-RAM Metric 3 - Stressors in Buffer Area (Back) Site ID: _____ Date: ___ ___ / ___ ___ / 2012			
O	**O**	**O**	Chemical vegetation control (herbicide application)
O	**O**	**O**	Cover of non-native or invasive species
O	**O**	**O**	Oil/gas wells
O	**O**	**O**	Offroad vehicle damage
O	**O**	**O**	Trails
1	***2***	***3***	**Residential/Urban/Commercial Stressors**
O	**O**	**O**	Suburban residential land use
O	**O**	**O**	Urban multifamily
O	**O**	**O**	Urban/commercial buildings
O	**O**	**O**	Road – gravel
O	**O**	**O**	Road – 1 or 2 lane paved
O	**O**	**O**	Road- 4 lane
O	**O**	**O**	Parking lot/pavement
O	**O**	**O**	Lawn/park
O	**O**	**O**	Golf course
O	**O**	**O**	Landfill
O	**O**	**O**	Gravel pit/mining
O	**O**	**O**	Surface mine
O	**O**	**O**	Military land
O	**O**	**O**	Trash/dumping
1	***2***	***3***	**Agricultural Stressors**
O	**O**	**O**	Pasture /rangeland
O	**O**	**O**	Row crops
O	**O**	**O**	Small grains
O	**O**	**O**	Nursery
O	**O**	**O**	Orchard
O	**O**	**O**	Dairy
O	**O**	**O**	Confined animal feeding operations
O	**O**	**O**	Irrigation (irrigated land)
O	**O**	**O**	Fallow field – recent
O	**O**	**O**	Fallow field – old
O	**O**	**O**	Rural residential
Scoring			
			A. Indicate total number of bubbles filled in each column
1 x ____	***2 x*** ____	***3 x*** ____	**B. Score each column (multiply number of bubbles filled in each column by its corresponding severity score)**
			C. Total Score (sum of all 1s, 2s and 3s)
Provisional Score:			**D. If C is < 3 = 12 points, if C is 3 - 4 = 9 points, If C is 5 - 7 = 6 points, if C is >7 = 3 points**

FORM USA-RAM 3: USA-RAM Metric 4 – Topographic Complexity

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

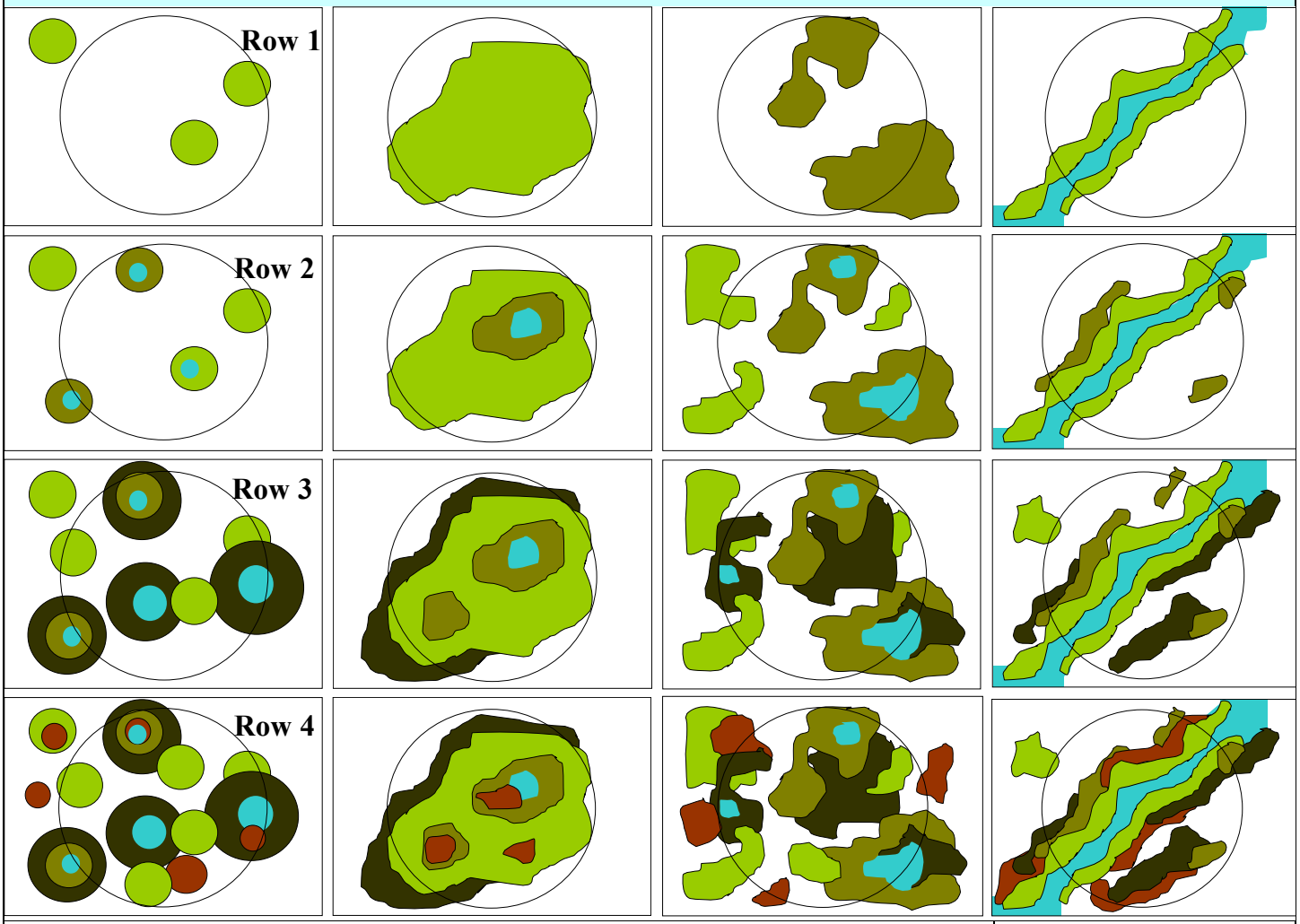
Metric 4: Checklist of field indicators of topographic complexity observed in the AA. Bold terms are in the glossary. An indicator should not be checked unless it covers at least $2m^2$ of the AA. For example, animal burrows should not be checked unless, *in aggregate*, they cover at least $2m^2$ of the AA.

Indicators	Fill bubble if indicator is observed
Multiple horizontal plains, **benches**, **terraces**, or **flats** at different elevations	O
Multiple slopes of varying steepness	O
Natural or artificial **levee** or **berm**	O
Bank slumps or undercut banks	O
Undercut banks	O
Multiple high water marks etched in substrate	O
Potholes, sink holes or similar depressions not caused by animals	O
Natural or artificial **channels**	O
Natural or artificial **swales**	O
Animal burrows or spoil piles from burrows (including ant or termite mounds)	O
Animal tracks deep enough to hold water (e.g., cattle or elk tracks)	O
Wallows, pig damage, or similar scale excavations by animals	O
Inorganic **sediment mounds** not made by animals	O
Natural or artificial debris or **wrack** along high water lines	O
Natural or artificial debris in topographic low areas	O
Natural or artificial debris dispersed across AA (**tree** limbs, lumber, etc)	O
Plant hummocks or **tussocks**	O
Soil cracks or fissures	O
Cobbles or boulders	O
Bare ground	O
Total Number of Indicators Observed	

FORM USA-RAM 4: USA-RAM Metric 5 – Patch Mossaic Complexity

Site ID: _____ **Date: ___ ___ / ___ ___ / 2012**

Metric 5: Select the diagram that most closely resembles the actual AA and fill-in the associate bubble in the scoring table. The mosaic within the AA might appear to consist of replications of one of these diagrams. Any AA with a simpler mosaic than indicated in Row 1 should be assumed to belong to Row 1. Any AA with a more complex mosaic than indicated in Row 4 should be assumed to belong to Row 4.



Select the Row that contains the mosaic pattern that most closely resembles the AA	Fill the bubble associated with the selected row
1	**O**
2	**O**
3	**O**
4	**O**

Provisional Score

Row 1 = 3 points	***Score:***
Row 2 = 6 points	
Row 3 = 9 points	
Row 4 = 12 points	

FORM USA-RAM 5: USA-RAM Metric 6 – Vertical Complexity

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 6: Mark the category of percent absolute cover of the AA that best fits each plant stratum. Since strata can overlap, their combined absolute coverage estimates can exceed 100%. See Glossary for definitions.

Plant Strata (see glossary)	**Percent Coverage**				
	< 10%	10-15%	16-25%	26-50%	>50%
Submerged Plants (any depth)	**O**	**O**	**O**	**O**	**O**
Floating or Floating-leaved Plants	**O**	**O**	**O**	**O**	**O**
Short Emergent Plants (< 0.5 m)	**O**	**O**	**O**	**O**	**O**
Tall Emergent Plants (≥ 0.5 m)	**O**	**O**	**O**	**O**	**O**
Short Woody Plants (shrubs and trees <5.0m)	**O**	**O**	**O**	**O**	**O**
Vines (any present)	**O**	**O**	**O**	**O**	**O**
Tall Woody Plants (shrubs and trees ≥ 5.0m)	**O**	**O**	**O**	**O**	**O**
Total number of strata having at least 10% percent cover					

Provisional Scores:

No. of Plant Strata Covering at Least 10% of the AA	**Score**
1	3
2 or 3	6
4 or 5	9
> 5	12

FORM USA-RAM 6: USA-RAM Metric 7 – Plant Community Complexity (Front)

Site ID: _____ **Date: ___ ___ / ___ ___ / 2012**

Metric 7: The invasive status and relative percent cover of co-dominant plant species of dominant plant strata. Disregard strata with less than 10% absolute cover of AA (see Metric 6). Information about invasive status is used in Metric 11.

Plant Strata fill bubble if cover ≥ 10% (see Metric 6)	**For each Plant Stratum** **List All Plant Species Comprising at least 10% Relative Cover**					
	Species Name	**fill bubble if Invasive**	**% Cover**	**Species Name**	**fill bubble if Invasive**	**% Cover**
O Submerged (any depth)		**O**			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
O Floating or Floating-leaved		**O**			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
O Short Emergent (herbaceous, < 0.5m)		**O**			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
O Tall Emergent (herbaceous, ≥ 0.5 m)		**O**			**O**	
		O			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
O Short Woody (shrubs, trees <5.0m)		**O**			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
O Vines (any present)		**O**			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
O Tall Woody (shrubs, trees ≥ 5.0m)		**O**			**O**	
		O			**O**	
		O			**O**	
	Total Percent Coverage for All Invasive Species in Stratum					
Total number of listed species for all plant strata combined (Do not count any species more than once).						

FORM USA-RAM 6: USA-RAM Metric 7 – Plant Community Complexity (Front)

Site ID: _____ **Date: ___ ___ / ___ ___ / 2012**

Provisional Scores:

No. of Co-dominant Plant Species (count no species more than once)	Score
< 3	3
3-6	6
7-10	9
> 10	12

FORM USA-RAM 7: USA-RAM Stressor Metric 8 –Stressors to Water Quality in the AA

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 8: Indicate water quality stressors observed in the AA. Each observed indicator is ranked as: **1) not severe** (stressor is present, but does not appear to negatively affect any condition attribute in the AA); **2) moderately severe** (stressor is present and appears to have moderately negative impacts on one or more condition attributes); or **3) severe** (stressor is present and appears to have major negative impacts on one or more condition attribute). Each indicator can have only one severity rank. Fill in the bubble corresponding to the choice for each stressor indicator that is observed, then provide an overall rank for each Stressor Category. Tally all the marked ranks for the final score (excluding scores for Stressor Categories).

If stressor present, mark severity			Field Indicators by Stressor Category
1	*2*	*3*	
O	O	O	**Point Sources**
O	O	O	Point source inputs (discharge from wastewater plants, factories, etc.)
O	O	O	Stormwater inputs (discharge pipes, culverts, sewer outfalls)
O	O	O	**Sedimentation/Pollutants**
O	O	O	Debris lines on plants, trees, or silt-laden vegetation
O	O	O	Sedimentation (e.g., the presence of sediment fans, deposits, or plumes)
O	O	O	Industrial or domestic spills or discharges (odors; color, oil sheen*, foam)
O	O	O	Turbidity in the water column
O	O	O	**Eutrophication**
O	O	O	Direct discharges from feedlot manure pits, etc.
O	O	O	Direct discharges from septic or sewage systems
O	O	O	Direct application of fertilizer
O	O	O	Agricultural runoff (drain tiles, etc. discharging to site)
O	O	O	Formation of heavy algal or *Lemna* sp. surface mats or heavy benthic algal growth
			Mining Impacts
O	O	O	Acid mine drainage discharge (excessively clear water (low pH) or presence/accumulation of "yellow-boy" orange precipitate)
			Salinity
O	O	O	Obvious increases in the concentration of dissolved salts (dead or stressed plants; salt encrustations, etc.)
			Scoring
			A. Indicate total number of bubbles filled in each column (not including those for Stressor Categories).
1 x ____	*2 x* ____	*3 x* ____	**B. Multiply "A" above by its corresponding severity score.**
			C. Add together the numbers from "B" above.
Provisional Score:			**D. If C is 0-1= 12 points; if C is 2-4 = 9 points; if C is 5-6 = 6 points; if C is ≥ 7 = 3 points.**

FORM USA-RAM 8: USA-RAM Stressor Metric 9 –Alterations to Hydroperiod in the AA

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 9: Indicators of altered hydroperiod observed in AA. Each observed indicator is ranked as: **1) not severe** (stressor is present, but does not appear to negatively affect any condition attribute in the AA); **2) moderately severe** (stressor is present and appears to have moderately negative impacts on one or more condition attributes in the AA); or **3) severe** (stressor is present and appears to have major negative impacts on one or more condition attribute in the AA). Each indicator can have only one severity rank. Fill in the bubble corresponding to the choice for each stressor indicator that is observed. Tally all the marked ranks for the final score.

If stressor is present, mark its severity			**Field Stressor Indicators**
1	***2***	***3***	
O	**O**	**O**	Ditches/channelization within AA
O	**O**	**O**	Dikes/dams/levees/berms at AA margin or within AA or roadbed or railroad (acting as block to water flows into or through AA)
O	**O**	**O**	Channels have deeply undercut banks and/or bank slumps or slides
O	**O**	**O**	Culverts, pipes (point sources) into AA *(change in water quantity)*
O	**O**	**O**	Water level control structure that impound water in all or part of the AA
O	**O**	**O**	Upland plant species encroaching into AA (due to drying of wetland)
O	**O**	**O**	Die-off of trees within AA due to increased ponding (exempting beaver impounded sites)
O	**O**	**O**	Tidal restriction in tidal wetlands (restricts flows to and from AA)
O	**O**	**O**	Presence of agricultural tiles or culverts at AA margin or within AA
O	**O**	**O**	Siphons, pumps moving water in or out of AA
O	**O**	**O**	Stormwater inputs from impervious surfaces/flashy flows into AA
Scoring			
			A. Indicate total number of bubbles filled in each column.
1 x ____	***2 x*** ____	***3 x*** ____	**B. Multiply "A" above by its corresponding severity score.**
			C. Add together the numbers from "B" above.
Provisional Score:			**D. If C is 0-1 = 12 points; if C is 2-3 = 9 points; if C is 4-5 = 6 points; if C is ≥ 6 = 3 points.**

FORM USA-RAM 9: USA-RAM Stressor Metric 10 –Stress to substrate in the AA

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 10. Indicators of altered substrate observed in AA. Each observed indicator is ranked as: **1) not severe** (stressor is present, but does not appear to negatively affect any condition attribute in the AA); **2) moderately severe (**stressor is present and appears to have moderately negative impacts on one or more condition attributes); or **3) severe** (stressor is present and appears to have major negative impacts on one or more condition attribute). Each indicator can have only one severity rank. Fill in the bubble corresponding to the choice for each stressor indicator that is observed. Tally all the marked ranks for the final score.

If stressor is present, mark its severity			**Field Stressor Indicators**
1	***2***	***3***	
O	**O**	**O**	Soil subsidence, scour, or surface erosion (root exposure, etc.)
O	**O**	**O**	Off-road vehicles, mountain biking, trails cut, etc.
O	**O**	**O**	Inorganic sedimentation inflow (sediment accumulation around vegetation, deep sediment splays, recent vegetation burial, etc.)
O	**O**	**O**	Dredging or other prominent excavation at AA margin or in AA
O	**O**	**O**	Grazing by domesticated or feral animals in AA (includes trampling, digging, wallowing, etc.)
O	**O**	**O**	Grazing by native ungulates.
O	**O**	**O**	Recent farming activity (plowing, disking, etc.)
O	**O**	**O**	Soil compaction by human activity (parking by cars, heavy machinery, etc)
O	**O**	**O**	Filling, grading, or other prominent deposition of sediment
O	**O**	**O**	Dumping of garbage or other debris
O	**O**	**O**	Mechanical plant removal that disturbs substrate (rutting, grubbing by heavy machinery, etc.)
			Fire lines (fire breaks) dug in AA or at AA margin
Scoring			
			A. Indicate total number of bubbles filled in each column
1 x ____	***2 x*** ____	***3 x*** ____	**B. Multiply "A" above by its corresponding severity score.**
			C. Add together the numbers from "B" above.
Provisional Score:			**D. If C is 0-1 = 12 points; if C is 2-3 = 9 points; if C is 4-5 = 6 points; if C is ≥ 6 = 3 points.**

FORM USA-RAM 10: USA-RAM Stressor Metric 11 –Cover of Invasive Plants Species in the AA

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 11: Data table to indicate cover of invasive plant species in each plant layer. Numbers indicate the score given for each cover class in each layer. Fill in the bubble corresponding to the choice for each plant layer and tally all ranks for the final score.

Plant Strata	**Total Percent Cover of Invasive Species**				
Percent Cover:	**None**	**< 5%**	**5-25%**	**26-75%**	**>75%**
Cover Score:	**0**	**1**	**2**	**3**	**4**
Submerged (any depth)	**O**	**O**	**O**	**O**	**O**
Floating or Floating-leaved	**O**	**O**	**O**	**O**	**O**
Short Emergent (herbaceous < 0.5m)	**O**	**O**	**O**	**O**	**O**
Tall Emergent (herbaceous ≥ 0.5 m)	**O**	**O**	**O**	**O**	**O**
Short Woody (shrubs and trees <5m)	**O**	**O**	**O**	**O**	**O**
Vines (any present)	**O**	**O**	**O**	**O**	**O**
Tall Woody (shrubs and trees ≥ 5.0m)	**O**	**O**	**O**	**O**	**O**
Scoring					
A. Indicate total number of bubbles filled in each column.					
B. Multiply "A" above by its corresponding cover score.	***0***	***1 x ____***	***2 x ____***	***3 x ____***	***4 x ____***
C. Add together the numbers from "B" above.					
D. If C is < 2 = 12 points; if C is 2-4 = 9 points; if C is 5-7 = 6 points, if C >7 = 3 points.	***Provisional Score:***				

FORM USA-RAM 11: USA-RAM Stressor Metric 12 –Stress to vegetation in the AA

Site ID: _____ Date: ___ ___ / ___ ___ / 2012

Metric 12. Indicators of vegetation disturbance observed in AA. Each observed indicator is ranked as: **1) not severe** (stressor is present, but does not appear to negatively affect any condition attribute in the AA); **2) moderately severe** (stressor is present and appears to have moderately negative impacts on one or more condition attributes in the AA); or **3) severe** (stressor is present and appears to have major negative impacts on one or more condition attributes in the AA). Each indicator can have only one severity rank. Fill in the bubble corresponding to the choice for each stressor indicator that is observed, then provide an overall rank for each Stressor Category. Tally all the marked ranks for the final score (excluding scores for Stressor Categories).

If stressor is present mark its severity			**Field Indicators by Stressor Category**
1	***2***	***3***	**Human Use and/or Management**
O	**O**	**O**	
O	**O**	**O**	Mowing within AA (or at AA margin)
O	**O**	**O**	Forest - selective cut
O	**O**	**O**	Forest - clear cut
O	**O**	**O**	Prominent removal of large woody debris
O	**O**	**O**	Mechanical plant removal besides tree cutting or woody debris removal
O	**O**	**O**	Evidence of planting of non-native vegetation
O	**O**	**O**	Chemical vegetation control (herbicide application, defoliant use)
O	**O**	**O**	Farming (recent plowing, disking, etc.)
O	**O**	**O**	**Excessive Grazing or Herbivory**
O	**O**	**O**	Grazing by domestic or feral animals (cows, sheep, pigs, etc.)
O	**O**	**O**	Excessive wildlife herbivory (deer, muskrat, geese, carp, beaver, etc.)
O	**O**	**O**	Excessive insect herbivory of tree canopy, shrub layer
O	**O**	**O**	**Fire**
O	**O**	**O**	Evidence of intentional burning at AA margin or in AA (blackened tree canopy, ground cover, etc.)
O	**O**	**O**	Fire lines (fire breaks)
Scoring			
			A. Indicate total number of bubbles filled in each column (not including those for Stressor Categories).
1 x ____	***2 x*** ____	***3 x*** ____	**B. Multiply "A" above by its corresponding severity score.**
			C. Add together the numbers from "B" above.
Provisional Score:			**D. If C is 0-1 = 12 points; if C is 2-3 = 9 points; if C is 4-5 = 6 points; if C ≥ 6 = 3 points.**

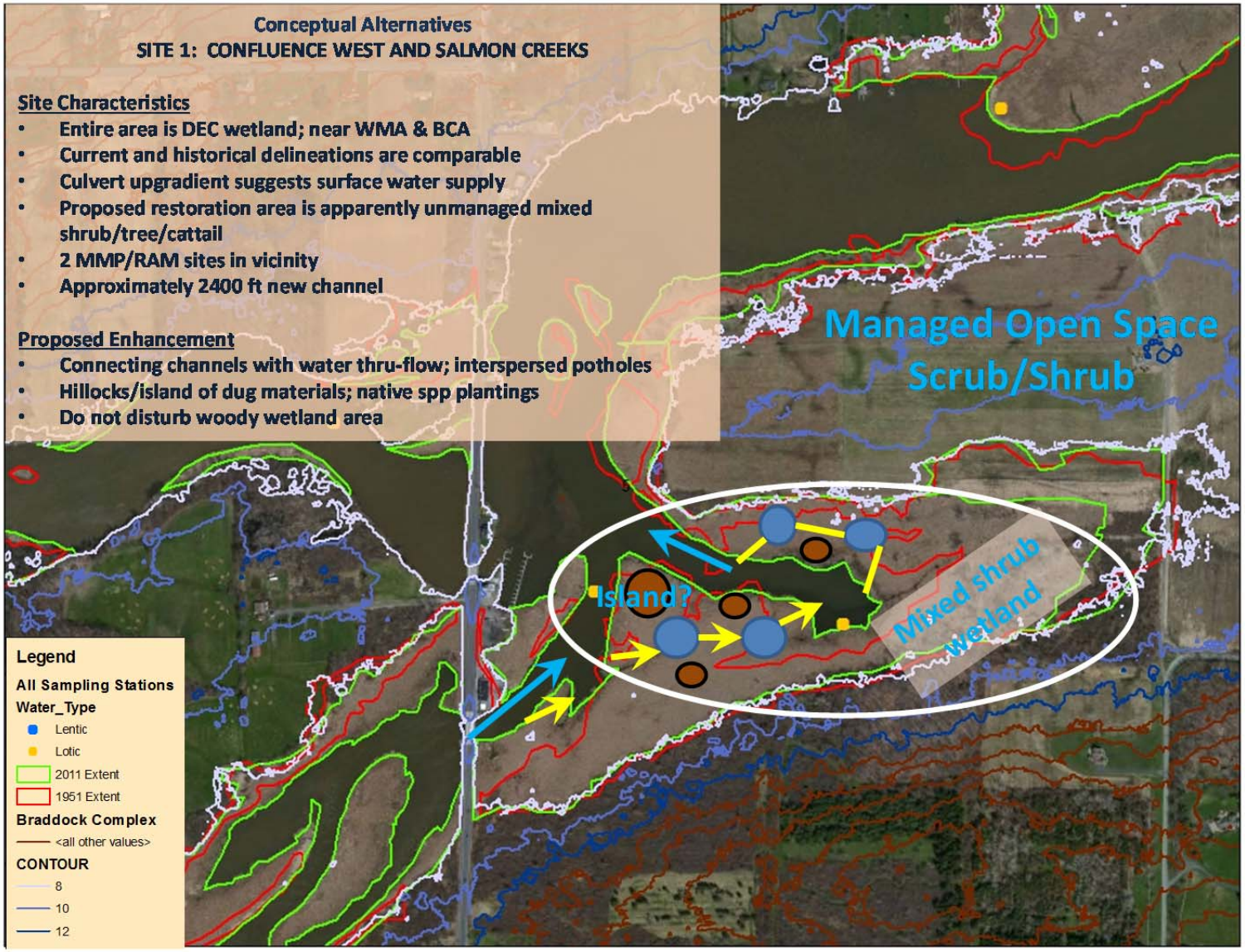
Attachment 2 – Portfolio of Conceptual Plans for NYFO's Ten Candidate Pilot Projects

Pilot Projects Proposed for Five of the Lowest Ranked Waterbodies
Based on Preliminary Habitat Restoration Recommendations

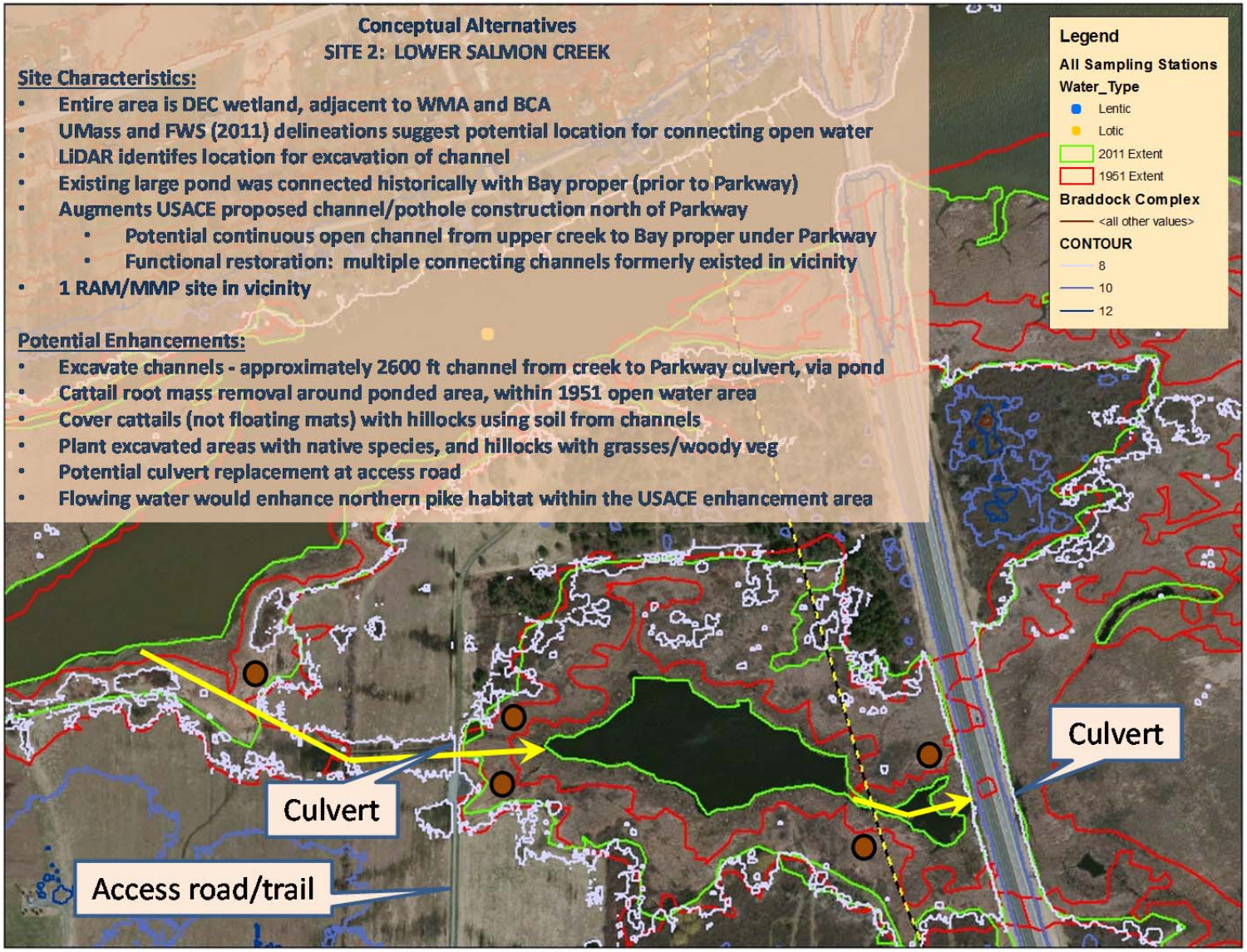
As presented to the REAOC RAC, technical advisors, regulatory agencies, NGOs, and other stakeholders
on September 16, 2013

SITE 1: CONFLUENCE WEST AND SALMON CREEKS

SITE 2: LOWER SALMON CREEK



Symbol Explanation: blue arrows indicate presumed current flows; yellow arrows are proposed new surface water connectors and flow direction; blue ovals are proposed new potholes; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

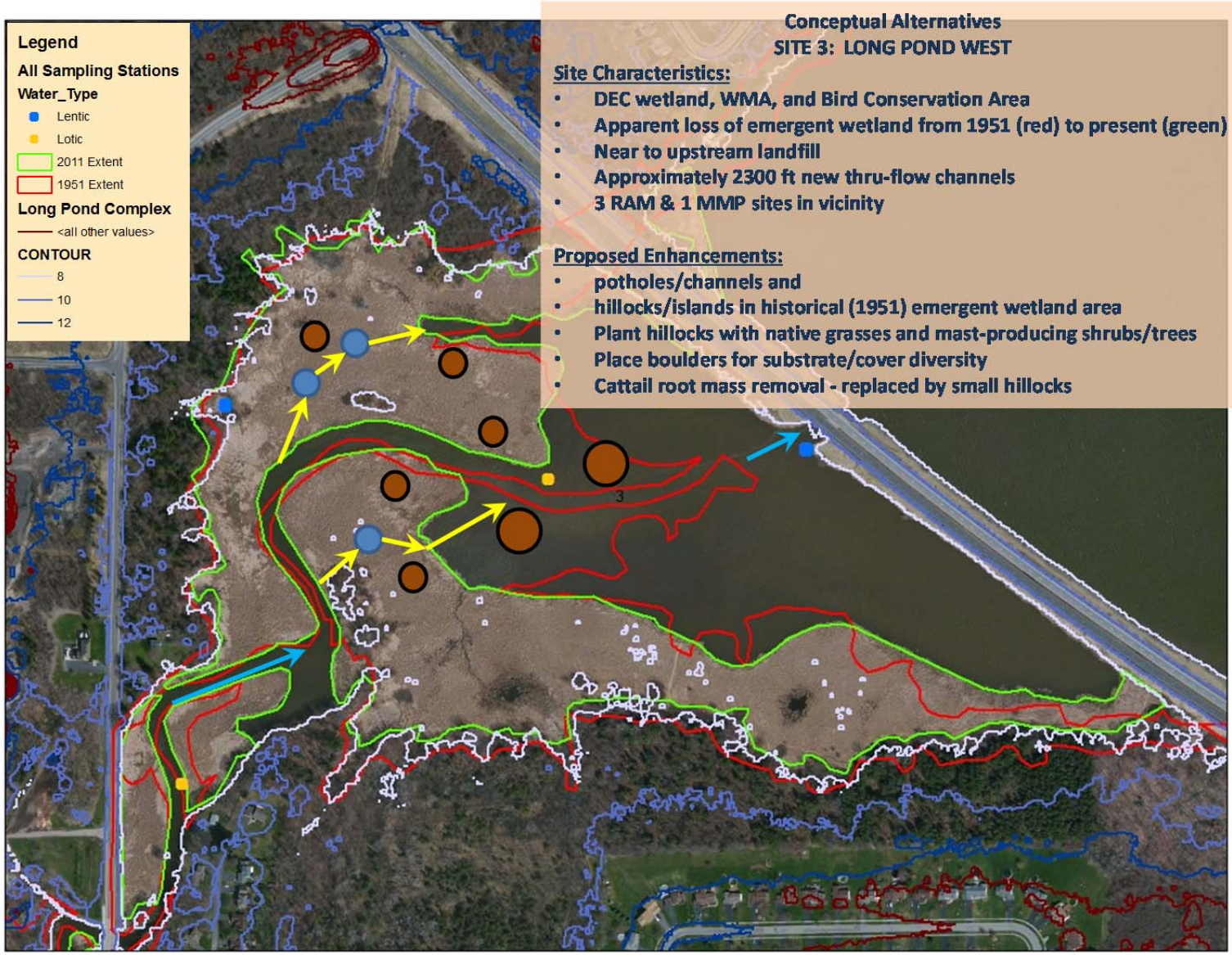


Symbol Explanation: yellow arrows are proposed new surface water connectors and flow direction; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project
Narrative Explanation: In 1951, prior to the Lake Ontario State Parkway (major road in aerial image), several natural, connected open water areas existed, interspersed within the wetland. This project is intended to restore some of that former surface water connectivity and channeling, and increase topographic and vegetative complexity.

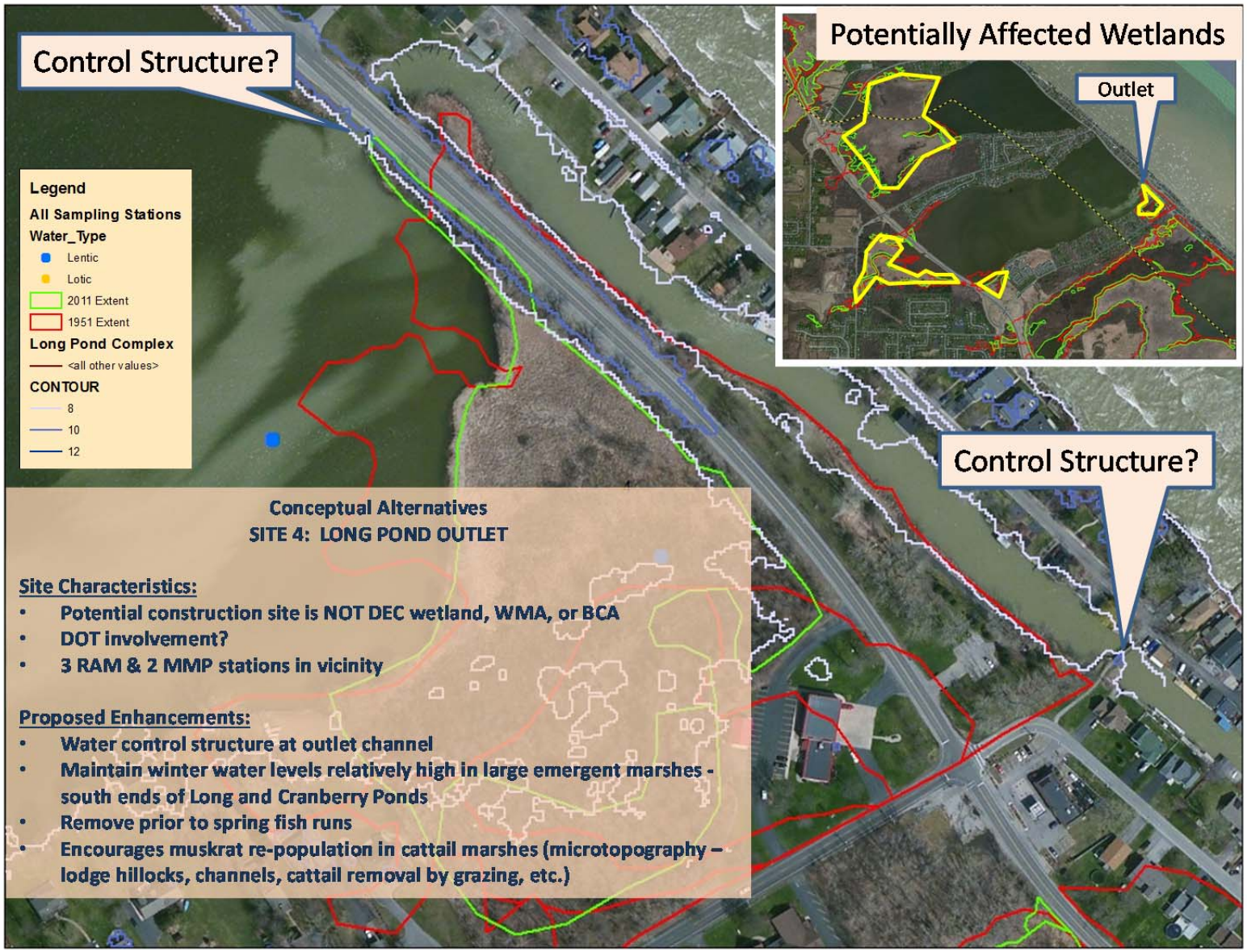
SITE 3: LONG POND WEST

SITE 4: LONG POND OUTLET

Bing.com - 09-12-13

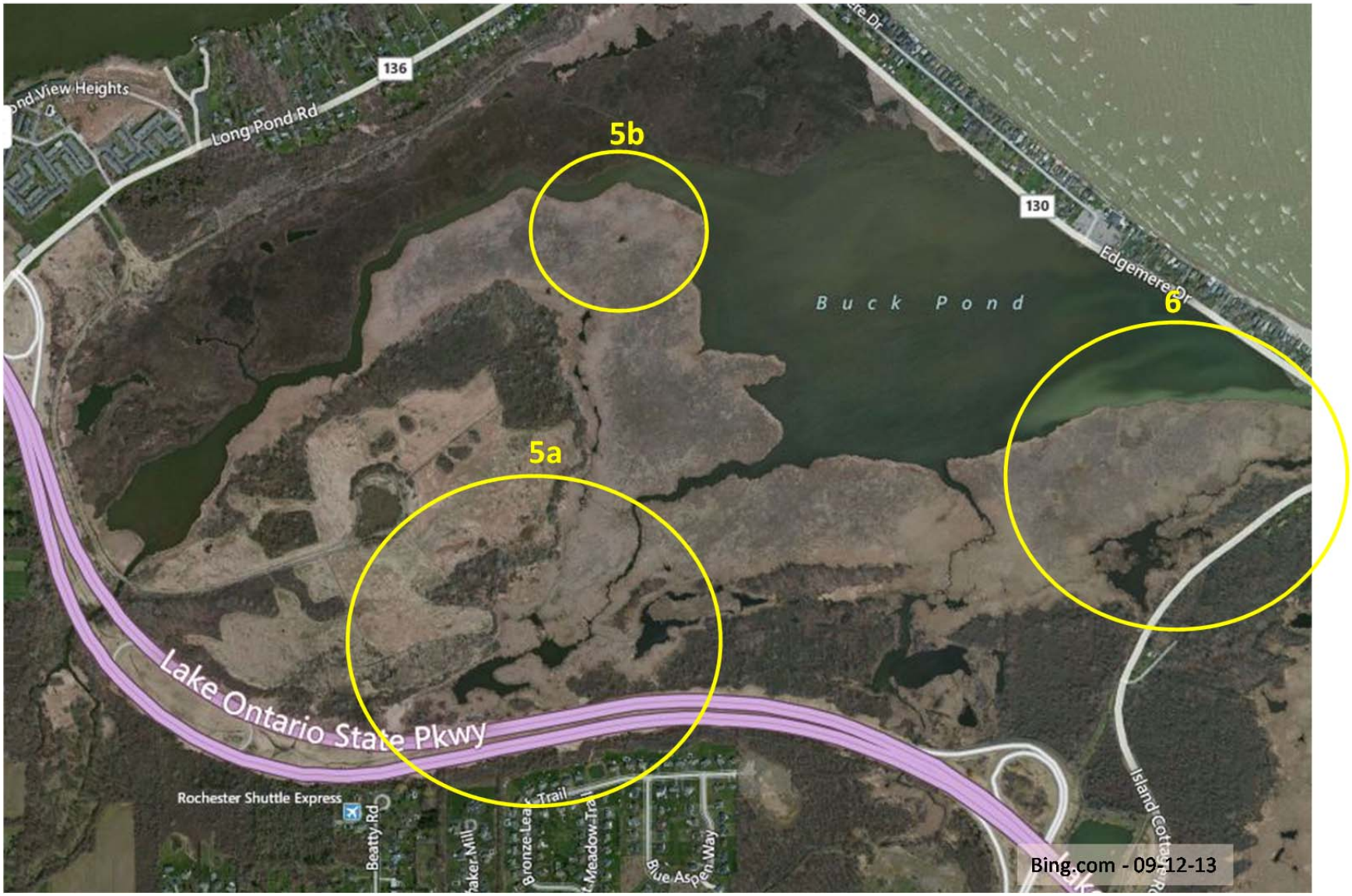


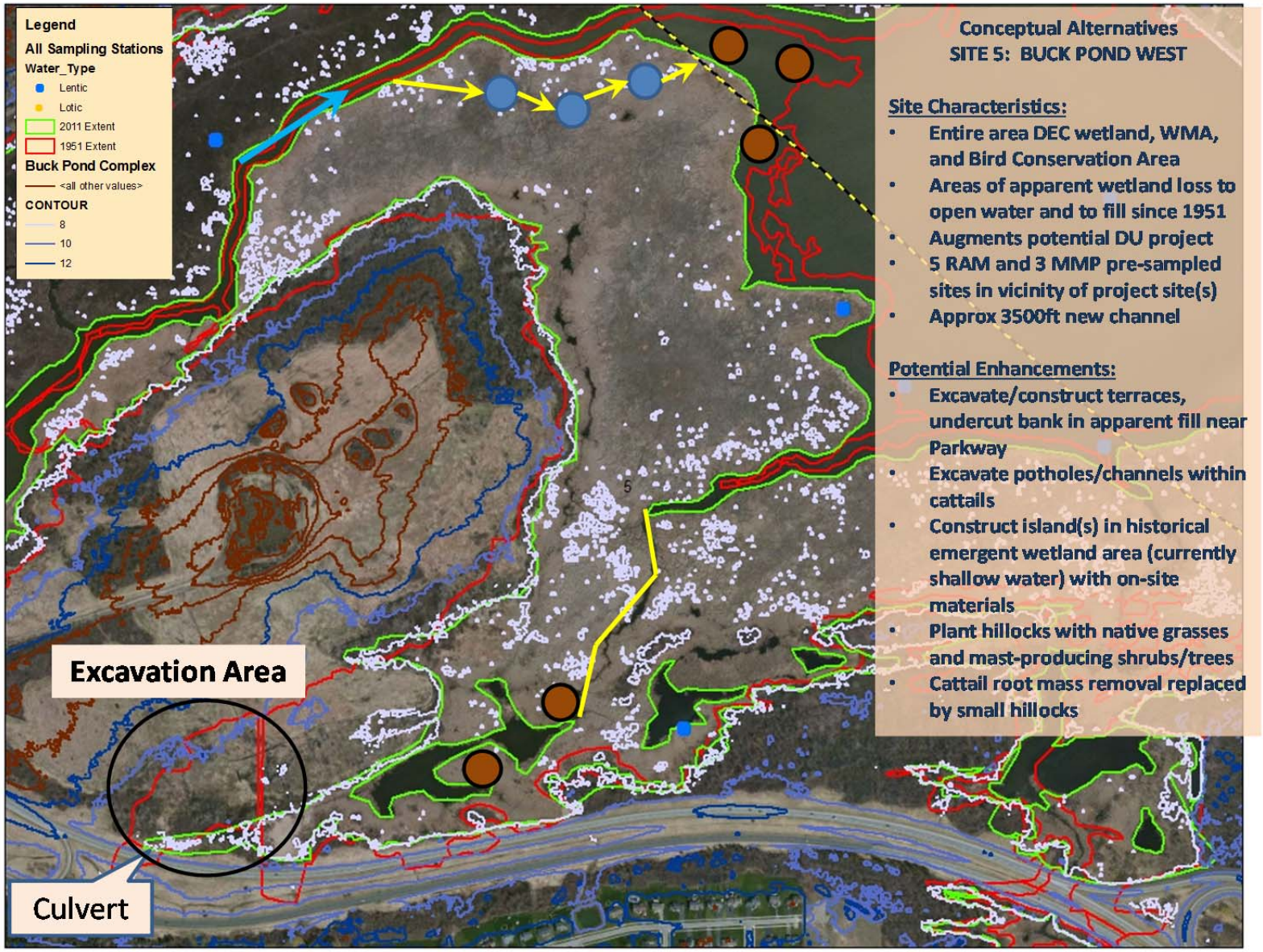
Symbol Explanation: blue arrows indicate presumed current flows; yellow arrows are proposed new surface water connectors and flow direction; blue ovals are proposed new potholes where cattails and their root masses would be removed; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project



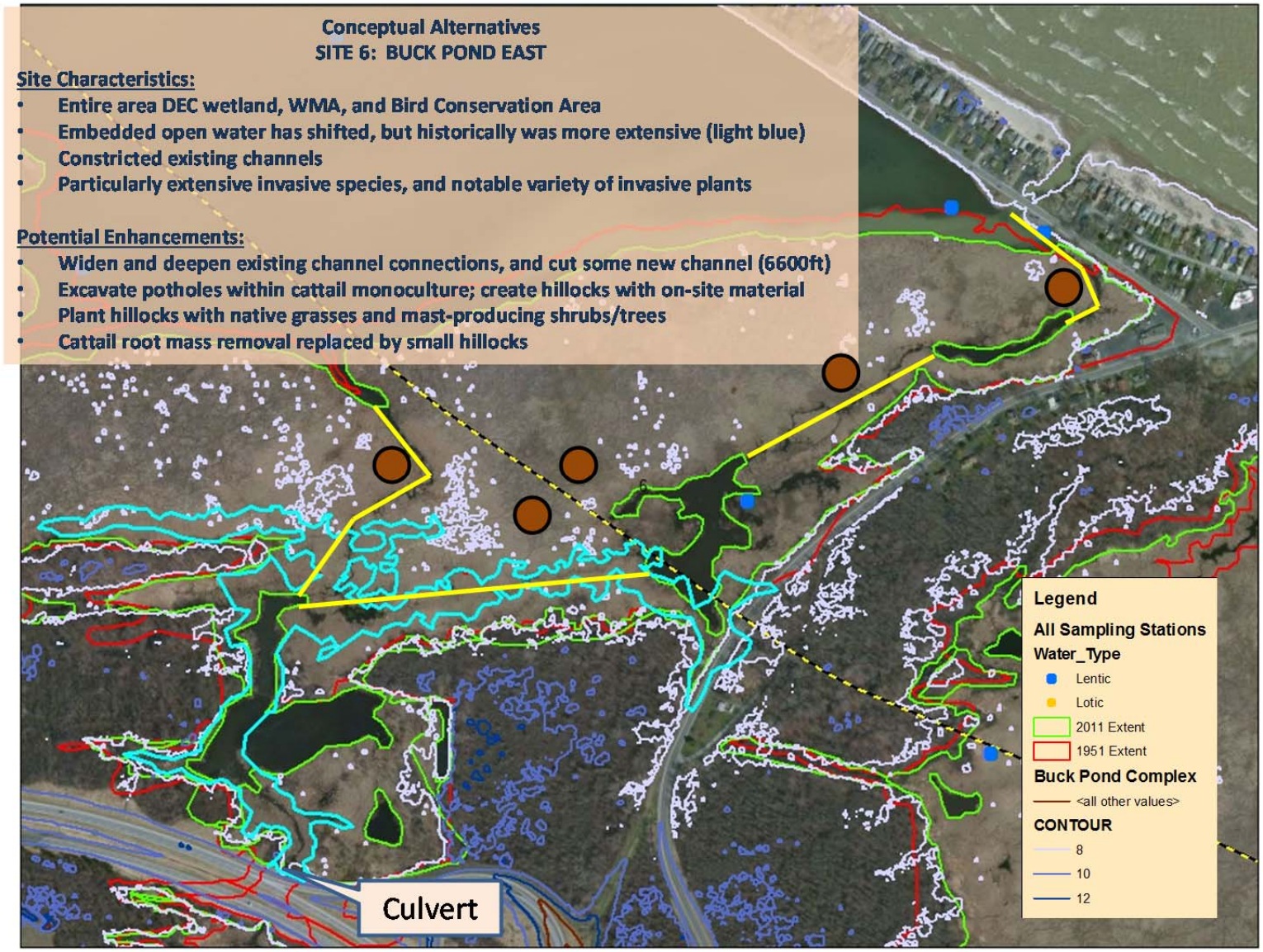
Symbol Explanation: yellow highlighted areas in inset are large emergent wetlands that would be flooded during winter to mimic natural water level fluctuations, which would encourage muskrat re-colonization
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

SITE 5: BUCK POND WEST
SITE 6: BUCK POND EAST





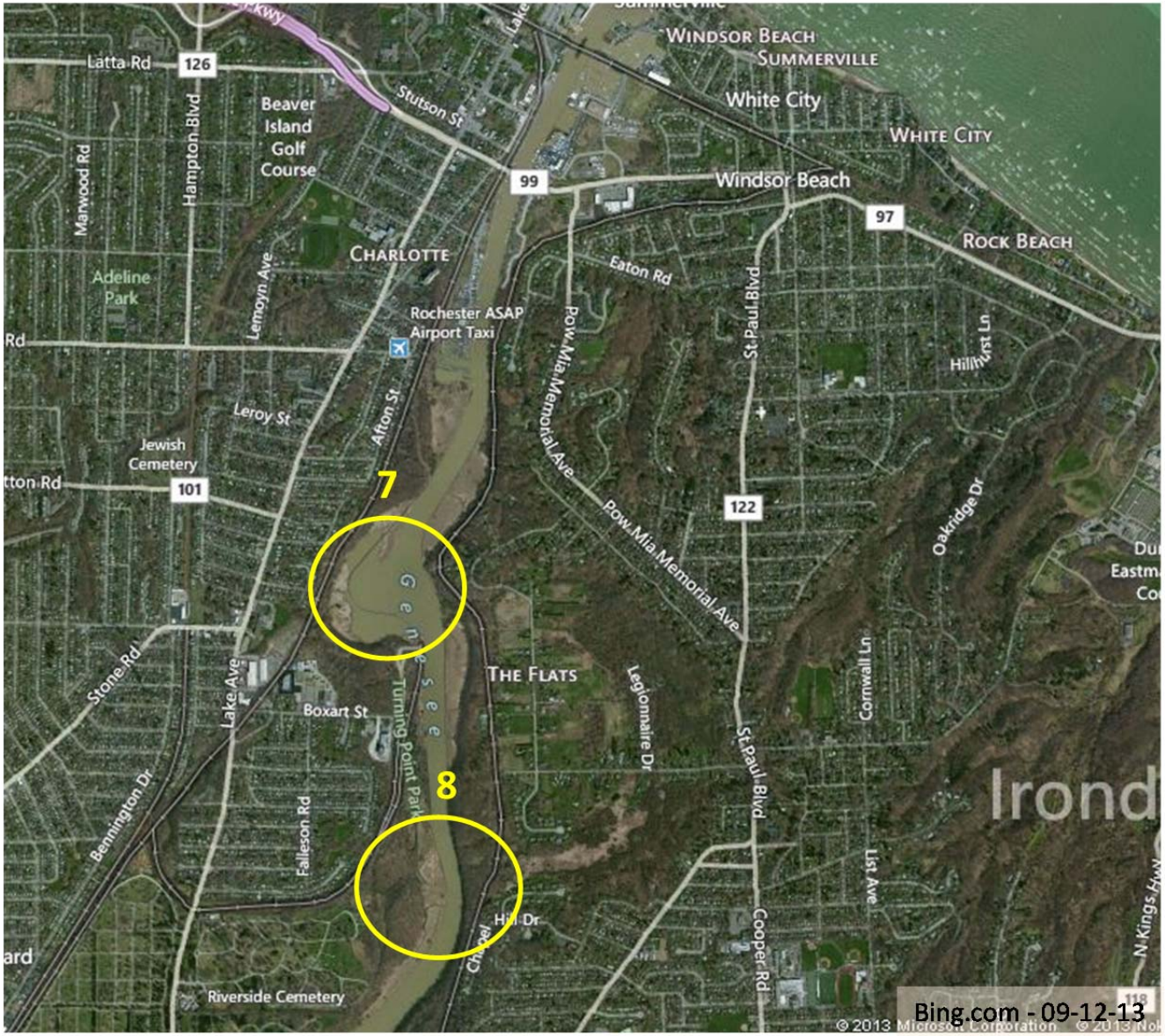
Symbol Explanation: blue arrows indicate presumed current flows; yellow arrows are proposed new surface water connectors and flow direction; blue ovals are proposed new potholes; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

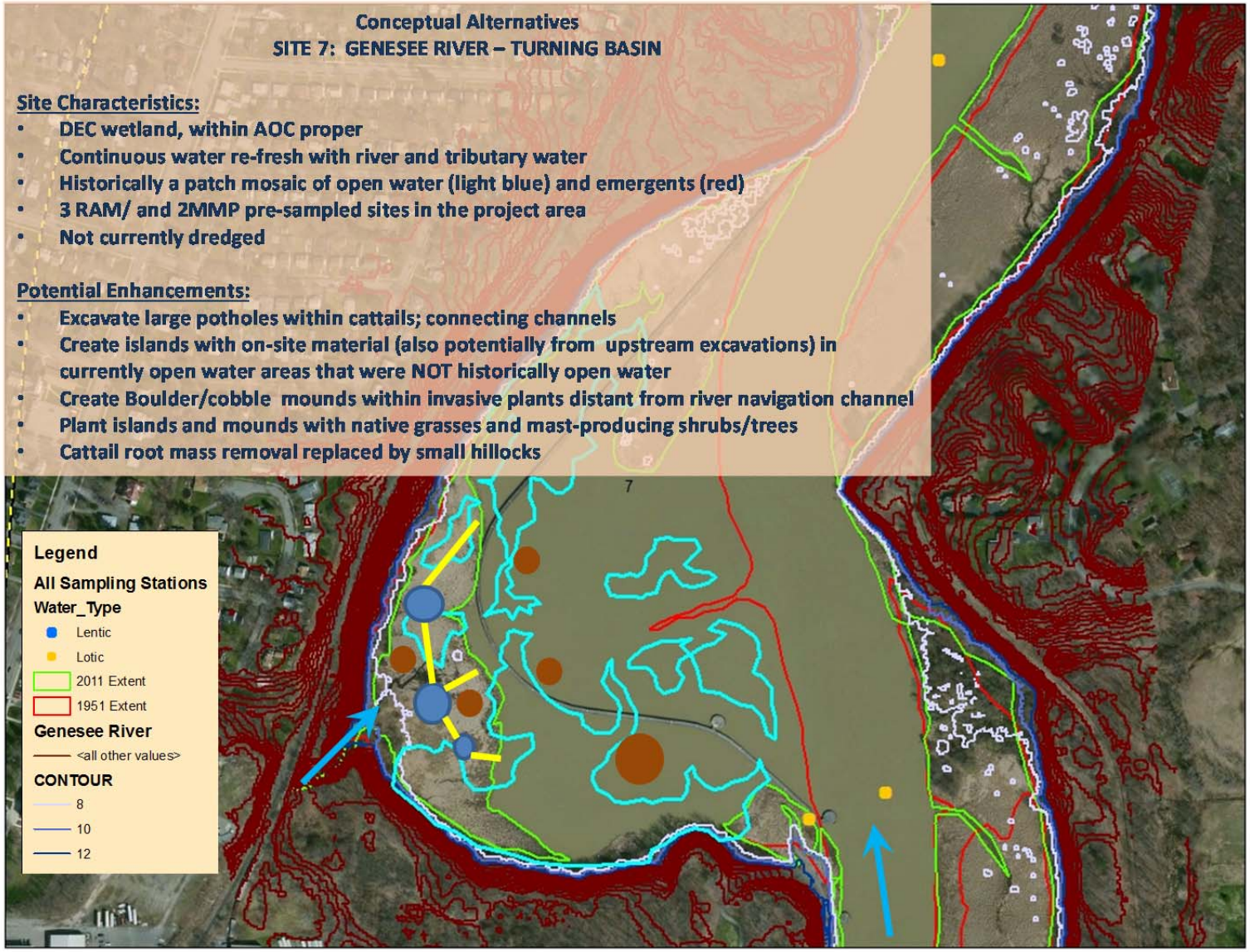


Symbol Explanation: yellow lines are proposed new surface water connectors, roughly following existing narrow channels; brown ovals are proposed new habitat mounds; light blue highlighted area was open water in 1951 – proposed new channels would reopen some of the former surface water
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

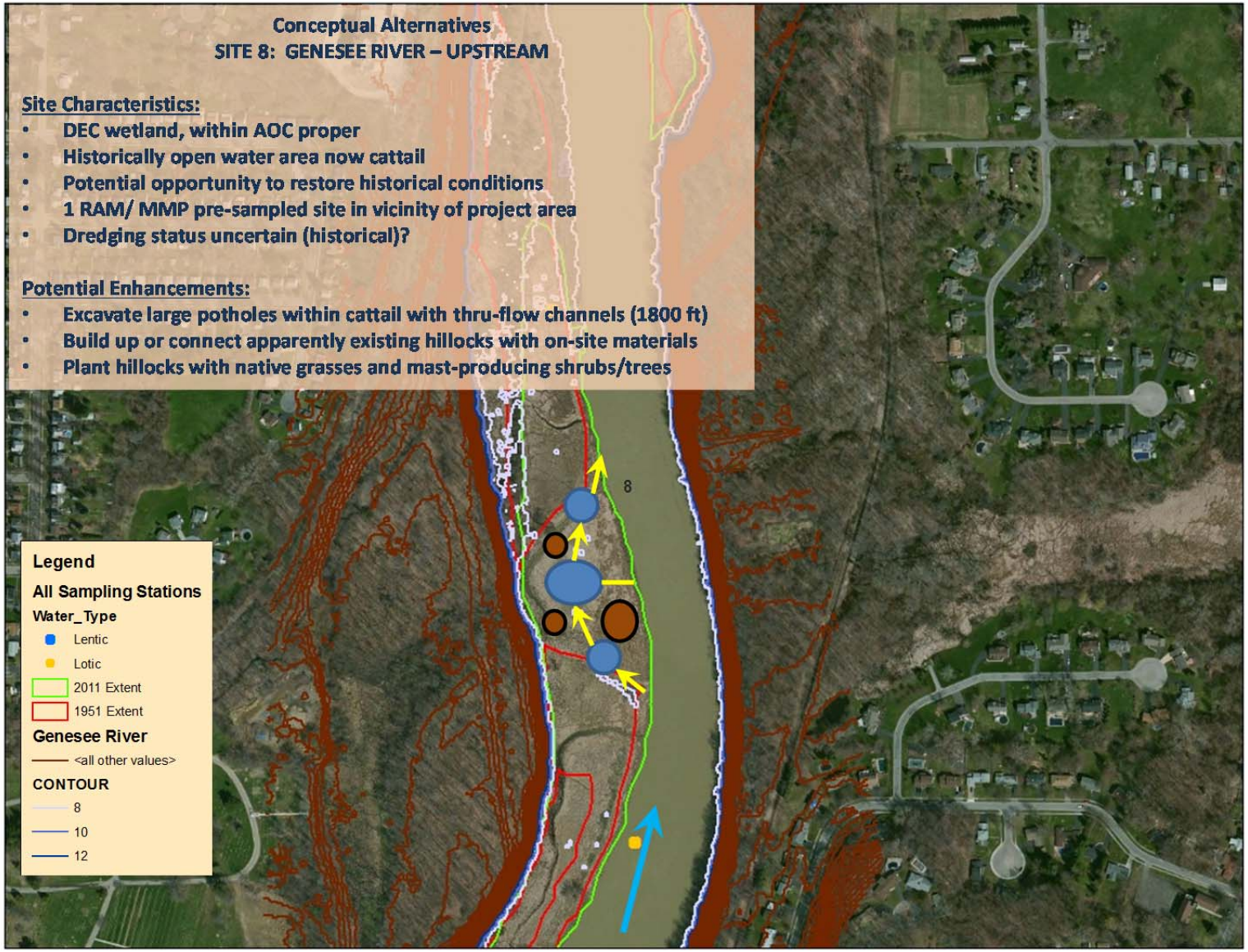
SITE 7: GENESEE RIVER – TURNING BASIN

SITE 8: GENESEE RIVER – UPSTREAM





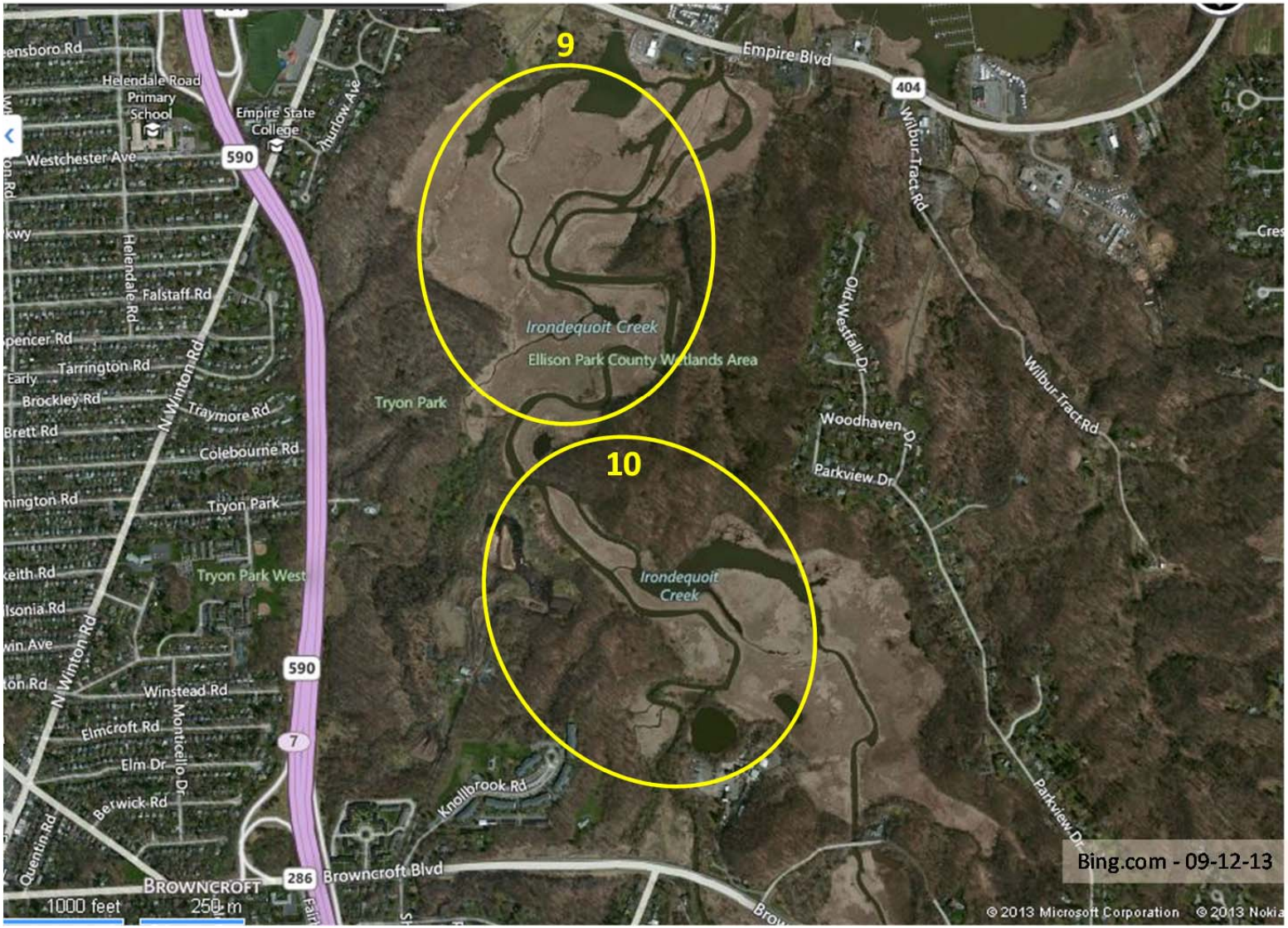
Symbol Explanation: blue arrows indicate current flows; yellow lines are proposed new surface water connectors; blue ovals are proposed new potholes; brown ovals are proposed new islands or boulder/cobble mounds; light blue polygons were areas of open water in 1951 interspersed within historically more extensive emergent wetland (historical outer boundary of marsh is red line at edge of navigation channel)
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

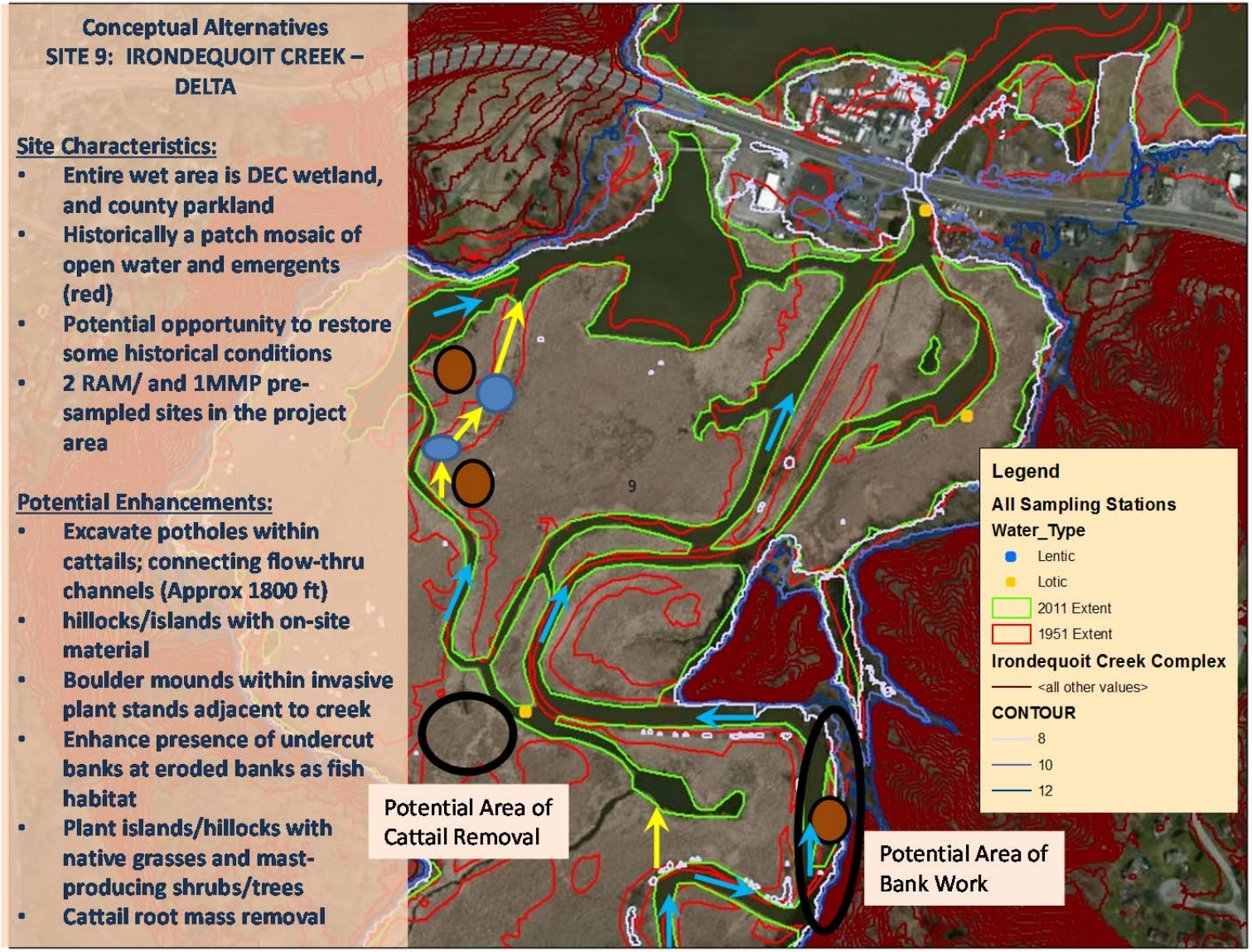


Symbol Explanation: blue arrows indicate current flows; yellow lines are proposed new surface water connectors and flow direction; blue ovals are proposed new potholes; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

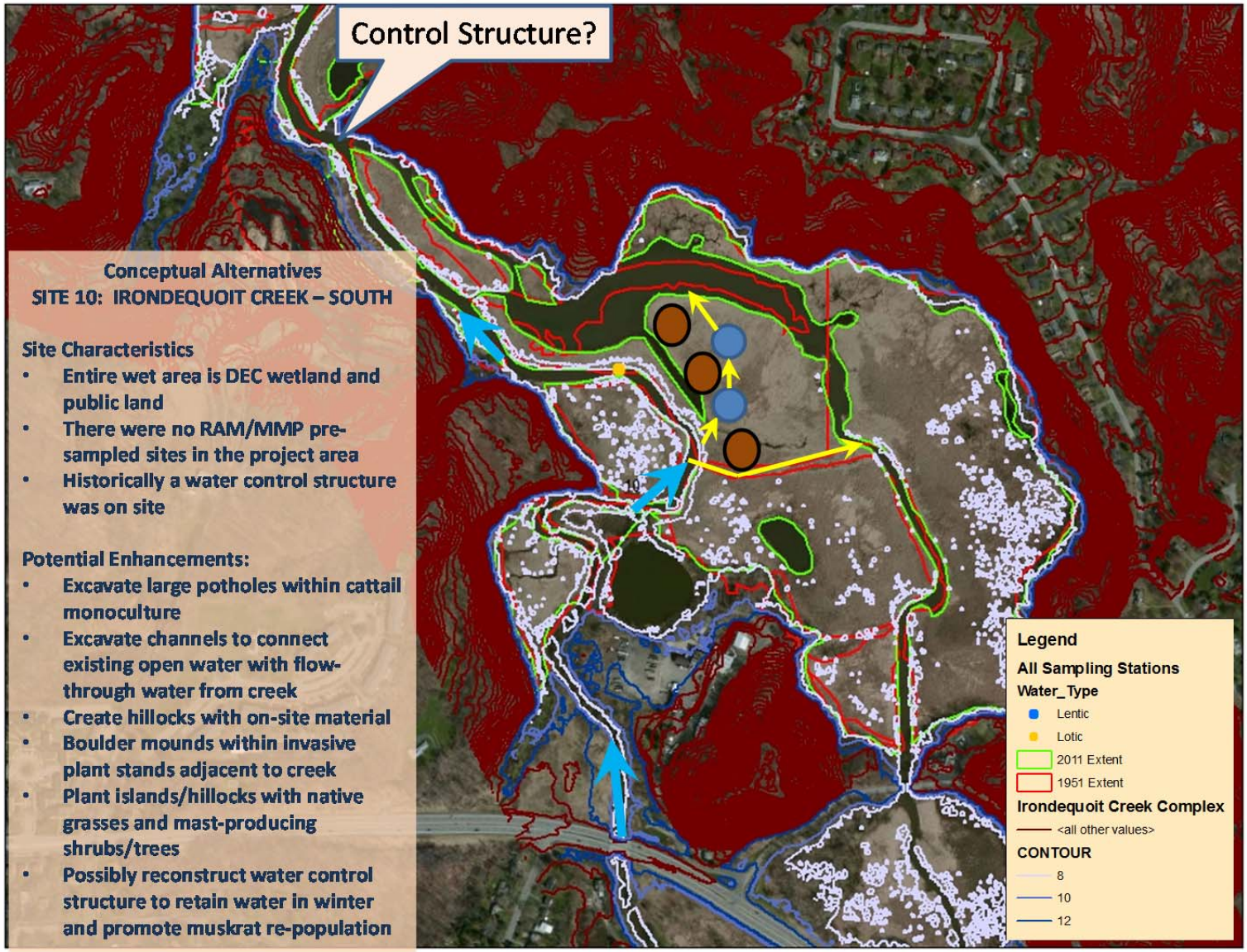
SITE 9: IRONDEQUOIT CREEK DELTA

SITE 10: IRONDEQUOIT CREEK SOUTH





Symbol Explanation: blue arrows indicate current flows; yellow arrows are proposed new surface water connectors and flow direction; blue ovals are proposed new potholes; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project



Symbol Explanation: blue arrows indicate presumed current flows; yellow arrows are proposed new surface water connectors and flow direction; blue ovals are proposed new potholes; brown ovals are proposed new habitat mounds
Legend Explanation: contours are from LiDAR data (presumably feet above mean lake level); 2011 and 1951 Extent are emergent wetland boundaries developed in the wetland assessment project; Sampling Stations are also from the wetland assessment project

Attachment 3 – Ranking of Field Indicators in the Stress to Buffer Zone Metric based on Percent Occurrence (High Occurrence = Low Score)

Fall 2012 - Lentic			
Buffer Zone Indicator Sum of Scores	Occurrence (N=42)	Percent Occurrence	Indicators
61	33	79%	Cover of non-native or invasive species
24	20	48%	Mowing/shrub cutting (brush hogging)
23	18	43%	Trash/ dumping
17	16	38%	Ditches/ drains/ channelization
21	14	33%	Dikes/dams/levees/ railroad or road beds
15	13	31%	Trails
13	13	31%	Inlets and outlets
16	12	29%	Road – 1 or 2 lane paved
13	12	29%	Culverts, pipes (point source discharge except stormwater) in buffer zone
12	12	29%	Moderate to heavy formation of filamentous algae
13	11	26%	Wall/riprap
12	9	21%	Fill / spoil banks
11	8	19%	Suburban residential land use
8	7	17%	Water level control structure
8	7	17%	Obvious spills, discharges or odors; unusual water color or foam
7	5	12%	Lawn/ park
7	5	12%	Chemical vegetation control (herbicide application)
7	5	12%	Road-4 lane
6	5	12%	Input from impervious surfaces (stormwater culvert)
4	4	10%	Substrate disturbance (ATVs off-road vehicles, mountain biking)
4	4	10%	Parking lot/ pavement
3	3	7%	Tree plantation present
3	3	7%	Sediment input
3	2	5%	Presence of power lines or utility corridors (continual maintenance)
2	2	5%	Soil subsidence, scour or surface erosion (root exposure)
2	2	5%	Other mechanical plant removal
2	1	2%	Road – gravel
1	1	2%	Excavation, dredging
1	1	2%	Fallow field - RECENT
1	1	2%	Fallow field - old
1	1	2%	Pasture/rangeland
0	0	0	Landfill
0	0	0	Row crops
0	0	0	Forest -selective cut
0	0	0	Forest -clear cut
0	0	0	Removal of large woody debris
0	0	0	Heavily grazed grasses, excessive grazing
0	0	0	Tree canopy herbivory
0	0	0	Shrub layer browsed
0	0	0	Fire lines (fire breaks)
0	0	0	Recently burned forest canopy
0	0	0	Recently burned grassland
0	0	0	Oil/gas wells
0	0	0	Logging roads
0	0	0	Urban multifamily land use
0	0	0	Golf course
0	0	0	Gravel pit/mining
0	0	0	Surface mine
0	0	0	Military land
0	0	0	Small grains
0	0	0	Nursery
0	0	0	Orchard
0	0	0	Dairy
0	0	0	Confined animal feeding operations
0	0	0	Irrigation (irrigated land)
0	0	0	Rural residential

Fall 2012 - Lotic			
Buffer Zone Indicator Sum of Scores	Occurrence (N=11)	Percent occurrence	Indicators
17	9	82%	Cover of non-native or invasive species
10	9	82%	Mowing/shrub cutting (brush hogging)
8	7	64%	Trash/ dumping
7	6	55%	Dikes/dams/levees/ railroad or road beds
7	5	45%	Road – 1 or 2 lane paved
7	5	45%	Trails
6	5	45%	Lawn/ park
4	4	36%	Inlets and outlets
4	3	27%	Suburban residential land use
4	3	27%	Obvious spills, discharges or odors; unusual water color or foam
3	3	27%	Ditches/ drains/ channelization
4	2	18%	Excavation, dredging
2	2	18%	Moderate to heavy formation of filamentous algae
2	2	18%	Chemical vegetation control (herbicide application)
2	2	18%	Water level control structure
2	2	18%	Wall/riprap
3	1	9%	Input from impervious surfaces (stormwater culvert)
2	1	9%	Sediment input
2	1	9%	Row crops
1	1	9%	Presence of power lines or utility corridors (continual maintenance)
1	1	9%	Culverts, pipes (point source discharge except stormwater) in buffer zone
1	1	9%	Road – gravel
1	1	9%	Landfill
0	0	0	Fill / spoil banks
0	0	0	Substrate disturbance (ATVs off-road vehicles, mountain biking)
0	0	0	Parking lot/ pavement
0	0	0	Tree plantation present
0	0	0	Road-4 lane
0	0	0	Soil subsidence, scour or surface erosion (root exposure)
0	0	0	Other mechanical plant removal
0	0	0	Fallow field - RECENT
0	0	0	Fallow field - old
0	0	0	Pasture/rangeland
0	0	0	Forest -selective cut
0	0	0	Forest -clear cut
0	0	0	Removal of large woody debris
0	0	0	Heavily grazed grasses, excessive grazing
0	0	0	Tree canopy herbivory
0	0	0	Shrub layer browsed
0	0	0	Fire lines (fire breaks)
0	0	0	Recently burned forest canopy
0	0	0	Recently burned grassland
0	0	0	Oil/gas wells
0	0	0	Logging roads
0	0	0	Urban multifamily land use
0	0	0	Golf course
0	0	0	Gravel pit/mining
0	0	0	Surface mine
0	0	0	Military land
0	0	0	Small grains
0	0	0	Nursery
0	0	0	Orchard
0	0	0	Dairy
0	0	0	Confined animal feeding operations
0	0	0	Irrigation (irrigated land)
0	0	0	Rural residential

Spring 2013 - Lentic			
Buffer Zone Indicator Sum of Scores	Occurrence (N=39)	Percent Occurrence	Indicator
61	35	90%	Cover of non-native or invasive species
51	18	46%	Dikes/dams/levees/ railroad or road beds
18	18	46%	Mowing/shrub cutting (brush hogging)
34	12	31%	Road – 1 or 2 lane paved
18	8	21%	Suburban residential land use
10	8	21%	Trails
16	6	15%	Road-4 lane
10	6	15%	Presence of power lines or utility corridors (continual maintenance)
10	5	13%	Inlets and outlets
9	5	13%	Lawn/ park
6	5	13%	Input from impervious surfaces (stormwater culvert)
5	4	10%	Trash/ dumping
5	4	10%	Ditches/drans/channelization
4	4	10%	Moderate to heavy formation of filamentous algae
5	3	8%	Parking lot/ pavement
5	3	8%	Wall/Riprap
3	3	8%	Culverts, pipes (point source discharge except stormwater) in buffer zone
4	2	5%	Road – gravel
3	1	3%	Urban/commercial buildings
1	1	3%	Obvious spills, discharges or odors; unusual water color or foam
1	1	3%	Excavation, dredging
1	1	3%	Sediment input (construction, erosion, agricultural runoff)
1	1	3%	Soil subsidence/erosion
0	0	0	Other mechanical plant removal
0	0	0	Row crops
0	0	0	Fallow field – recent
0	0	0	Water level control structure
0	0	0	Fill / spoil banks
0	0	0	Substrate disturbance (ATVs off-road vehicles, mountain biking)
0	0	0	Forest -selective cut
0	0	0	Forest -clear cut
0	0	0	Removal of large woody debris
0	0	0	Tree plantation present
0	0	0	Heavily grazed grasses, excessive grazing
0	0	0	Tree canopy herbivory
0	0	0	Shrub layer browsed
0	0	0	Fire lines (fire breaks)
0	0	0	Recently burned forest canopy
0	0	0	Recently burned grassland
0	0	0	Chemical vegetation control (herbicide application)
0	0	0	Oil/gas wells
0	0	0	Logging roads
0	0	0	Urban multifamily land use
0	0	0	Golf course
0	0	0	Landfill
0	0	0	Gravel pit/mining
0	0	0	Surface mine
0	0	0	Military land
0	0	0	Pasture / rangeland
0	0	0	Small grains
0	0	0	Nursery
0	0	0	Orchard
0	0	0	Dairy
0	0	0	Confined animal feeding operations
0	0	0	Irrigation (irrigated land)
0	0	0	Fallow field – old
0	0	0	Rural residential

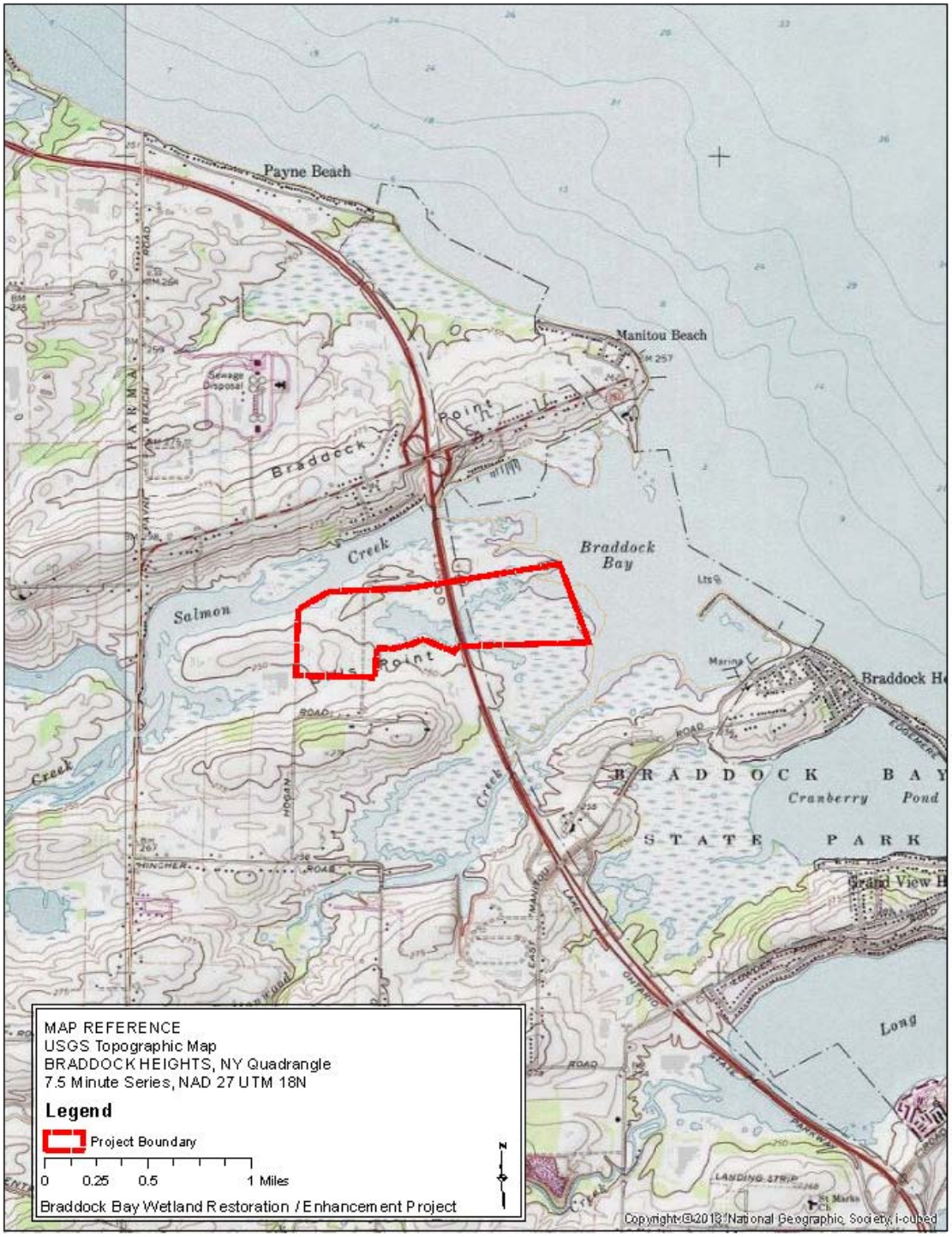
Spring 2013 - Lotic			
Buffer zone Indicator Sum of Scores	Occurrence (N=12)	Percent Occurrence	Indicator
24	12	100%	Cover of non-native or invasive species
9	5	42%	Trails
4	4	33%	Mowing/shrub cutting (brush hogging)
8	3	25%	Road – 1 or 2 lane paved
7	3	25%	Suburban residential land use
6	3	25%	Obvious spills, discharges or odors; unusual water color or foam
6	3	25%	Sediment input (construction, erosion, agricultural runoff)
5	3	25%	Excavation, dredging
5	3	25%	Fallow field – recent
4	3	25%	Other mechanical plant removal
3	3	25%	Moderate to heavy formation of filamentous algae
3	2	17%	Row crops
2	2	17%	Lawn/ park
3	1	8%	Dikes/dams/levees/ railroad or road beds
3	1	8%	Road – gravel
3	1	8%	Wall/Riprap
2	1	8%	Culverts, pipes (point source discharge except stormwater) in buffer zone
1	1	8%	Presence of power lines or utility corridors (continual maintenance)
1	1	8%	Input from impervious surfaces (stormwater culvert)
1	1	8%	Trash/ dumping
0	0	0	Inlets and outlets
0	0	0	Urban/commercial buildings
0	0	0	Road-4 lane
0	0	0	Parking lot/ pavement
0	0	0	Soil subsidence/erosion
0	0	0	Ditches/drans/channelization
0	0	0	Water level control structure
0	0	0	Fill / spoil banks
0	0	0	Substrate disturbance (ATVs off-road vehicles, mountain biking)
0	0	0	Forest -selective cut
0	0	0	Forest -clear cut
0	0	0	Removal of large woody debris
0	0	0	Tree plantation present
0	0	0	Heavily grazed grasses, excessive grazing
0	0	0	Tree canopy herbivory
0	0	0	Shrub layer browsed
0	0	0	Fire lines (fire breaks)
0	0	0	Recently burned forest canopy
0	0	0	Recently burned grassland
0	0	0	Chemical vegetation control (herbicide application)
0	0	0	Oil/gas wells
0	0	0	Logging roads
0	0	0	Urban multifamily land use
0	0	0	Golf course
0	0	0	Landfill
0	0	0	Gravel pit/mining
0	0	0	Surface mine
0	0	0	Military land
0	0	0	Pasture / rangeland
0	0	0	Small grains
0	0	0	Nursery
0	0	0	Orchard
0	0	0	Dairy
0	0	0	Confined animal feeding operations
0	0	0	Irrigation (irrigated land)
0	0	0	Fallow field – old
0	0	0	Rural residential

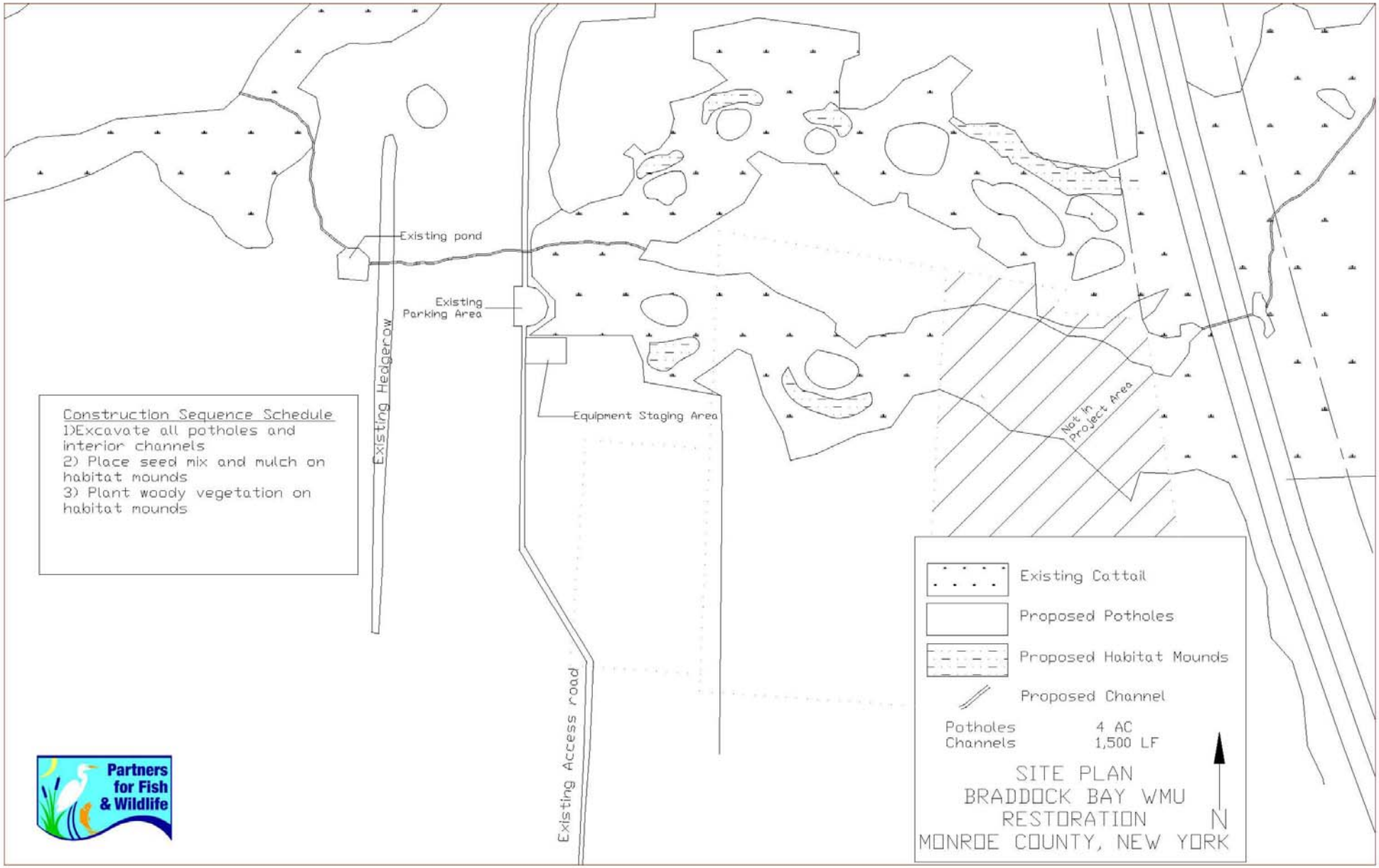
Attachment 4 – Ranking of Field Indicators in the Topographic Complexity Metric based on Percent Occurrence (Low Occurrence = Low Rank)

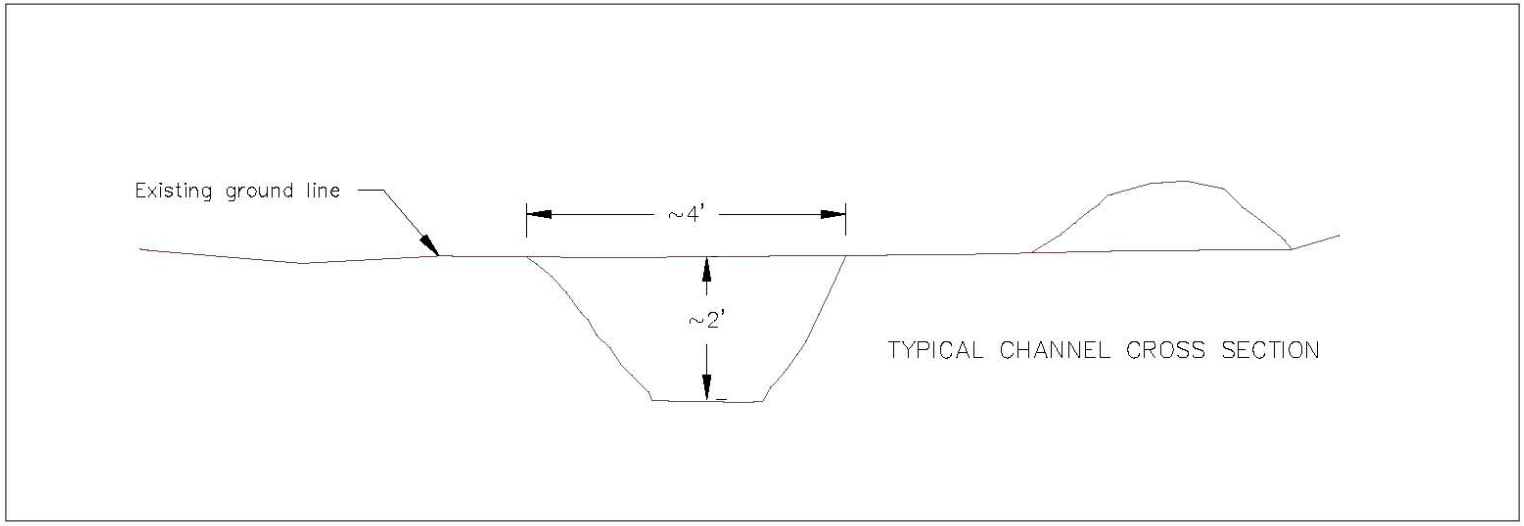
Fall 2012 - Lentic				Fall 2012 - Lotic			
Topographic Complexity Sum of Scores	Occurrence (N=42)	Percent occurrence	Indicators	Topographic Complexity Sum of Scores	Occurrence (N=11)	Percent occurrence	Indicators
0	0	0%	Natural or artificial levee or berm	0	0	0	Multiple high water marks etched in substrate
0	0	0%	Soil cracks or fissures	0	0	0	Inorganic sediment mounds not from animals
0	0	0%	Cobbles or boulders	0	0	0	Natural or artificial levee or berm
1	1	2%	Wallows, pig damage, or similar scale excavations by animals	0	0	0	Soil cracks or fissures
1	1	2%	Inorganic sediment mounds not from animals	0	0	0	Cobbles or boulders
2	2	5%	Animal tracks large enough to hold water	1	1	9%	Wallows, pig damage, or similar scale excavations by animals
3	3	7%	Animal burrows or spoil piles	2	2	18%	Undercut banks
3	3	7%	Natural/artificial swales	2	2	18%	Animal burrows or spoil piles
3	3	7%	Potholes/sinkholes	2	2	18%	Bank slumps or undercut banks
8	8	19%	Multiple high water marks etched in substrate	2	2	18%	Natural/artificial swales
9	9	21%	Bank slumps or undercut banks	2	2	18%	Animal tracks large enough to hold water
10	10	24%	Undercut banks	3	3	27%	Natural or artificial channels
12	12	29%	Natural or artificial debris or wrack along high water lines	3	3	27%	Bare ground
15	15	36%	Natural or artificial channels	3	3	27%	Natural or artificial debris or wrack along high water lines
16	16	38%	Multiple slopes of varying steepness	3	3	27%	Potholes/sinkholes
17	17	40%	Multiple horizontal plains, benches, terraces, or flats at different elevations	4	4	36%	Multiple horizontal plains, benches, terraces, or flats at different elevations
19	19	45%	Natural or artificial debris in topographic low areas	4	4	36%	Multiple slopes of varying steepness
20	20	48%	Bare ground	4	4	36%	Natural or artificial debris in topographic low areas
23	23	55%	Natural or artificial debris dispersed across AA (tree limbs, lumber, etc)	6	6	55%	Natural or artificial debris dispersed across AA (tree limbs, lumber, etc)
28	28	67%	Plant hummocks or tussocks	10	10	91%	Plant hummocks or tussocks

Spring 2013 - Lentic				Spring 2013 - Lotic			
Topographic Complexity Sum of Scores	Occurrence (N=39)	Percent Occurrence	Indicators	Topographic Complexity Sum of Scores	Occurrence (N=12)	Percent occurrence	Indicators
0	0	0%	Bank slumps or undercut banks	0	0	0%	Animal burrows or spoil piles from burrows (including ant or termite mounds)
0	0	0%	Undercut banks	0	0	0%	Natural or artificial levee or berm
0	0	0%	Animal tracks deep enough to hold water (e.g., cattle or elk tracks)	0	0	0%	Bank slumps or undercut banks
0	0	0%	Wallows, pig damage, or similar scale excavations by animals	0	0	0%	Undercut banks
0	0	0%	Soil cracks or fissures	0	0	0%	Animal tracks deep enough to hold water (e.g., cattle or elk tracks)
0	0	0%	Cobbles or boulders	0	0	0%	Wallows, pig damage, or similar scale excavations by animals
0	0	0%	Bare ground	0	0	0%	Soil cracks or fissures
1	1	3%	Animal burrows or spoil piles from burrows (including ant or termite mounds)	0	0	0%	Cobbles or boulders
1	1	3%	Inorganic sediment not from animals	0	0	0%	Bare ground
1	1	3%	High water marks etched in substrate	1	1	8%	Natural/Artifical swales
2	2	5%	Multiple slopes of varying steepness	1	1	8%	Natural or artificial debris in topographic low areas
3	3	8%	Potholes, sink holes or similar depressions not caused by animals	1	1	8%	Inorganic sediment not from animals
5	5	13%	Natural/Artifical swales	1	1	8%	Multiple slopes of varying steepness
8	8	21%	Multiple horizontal plains, benches, terraces, or flats at different elevations	1	1	8%	Potholes, sink holes or similar depressions not caused by animals
9	9	23%	Natural or artificial levee or berm	2	2	17%	High water marks etched in substrate
10	10	26%	Natural or artificial debris or wrack along high water lines	3	3	25%	Multiple horizontal plains, benches, terraces, or flats at different elevations
12	12	31%	Natural or artificial channels	3	3	25%	Natural or artificial debris or wrack along high water lines
13	13	33%	Natural or artificial debris in topographic low areas	4	4	33%	Natural or artificial channels
31	31	79%	Natural or artificial debris dispersed across AA (tree limbs, lumber, etc)	6	6	50%	Natural or artificial debris dispersed across AA (tree limbs, lumber, etc)
34	34	87%	Plant hummocks or tussocks	10	10	83%	Plant hummocks or tussocks

Attachment 5 – Initial Construction Sketches for the Lower Salmon Creek and Braddock Bay Emergent Wetland Sites
(modified as required by on-site conditions, in consultation with NYSDEC and collaborators)




Existing pond
Existing Parking Area
Existing Hedgerow
Equipment Staging Area
Not in Project Area
Existing Access road
Construction Sequence Schedule
1)Excavate all potholes and interior channels
2) Place seed mix and mulch on habitat mounds
3) Plant woody vegetation on habitat mounds
Existing Cattail
Proposed Potholes
Proposed Habitat Mounds
Proposed Channel
Potholes 4 AC
Channels 1,500 LF
SITE PLAN
BRADDOCK BAY WMU
RESTORATION
MONROE COUNTY, NEW YORK
N
Partners for Fish & Wildlife



Disposition of spoil

Spoil material from channel excavation shall be disposed of in a manner that will:

1. Not confine or direct flows so as to cause instability
2. Provide for the free flow of water between the channel and flood plain unless the valley routing and water
3. Not hinder the development of travelways for maintenance.

Vegetation of Channel

Vegetation will be established on all channel slopes, berms, spoil and other disturbed areas except where the slopes are permanently covered with water or where bank material, land use, and climatic conditions are such that vegetation is impractical

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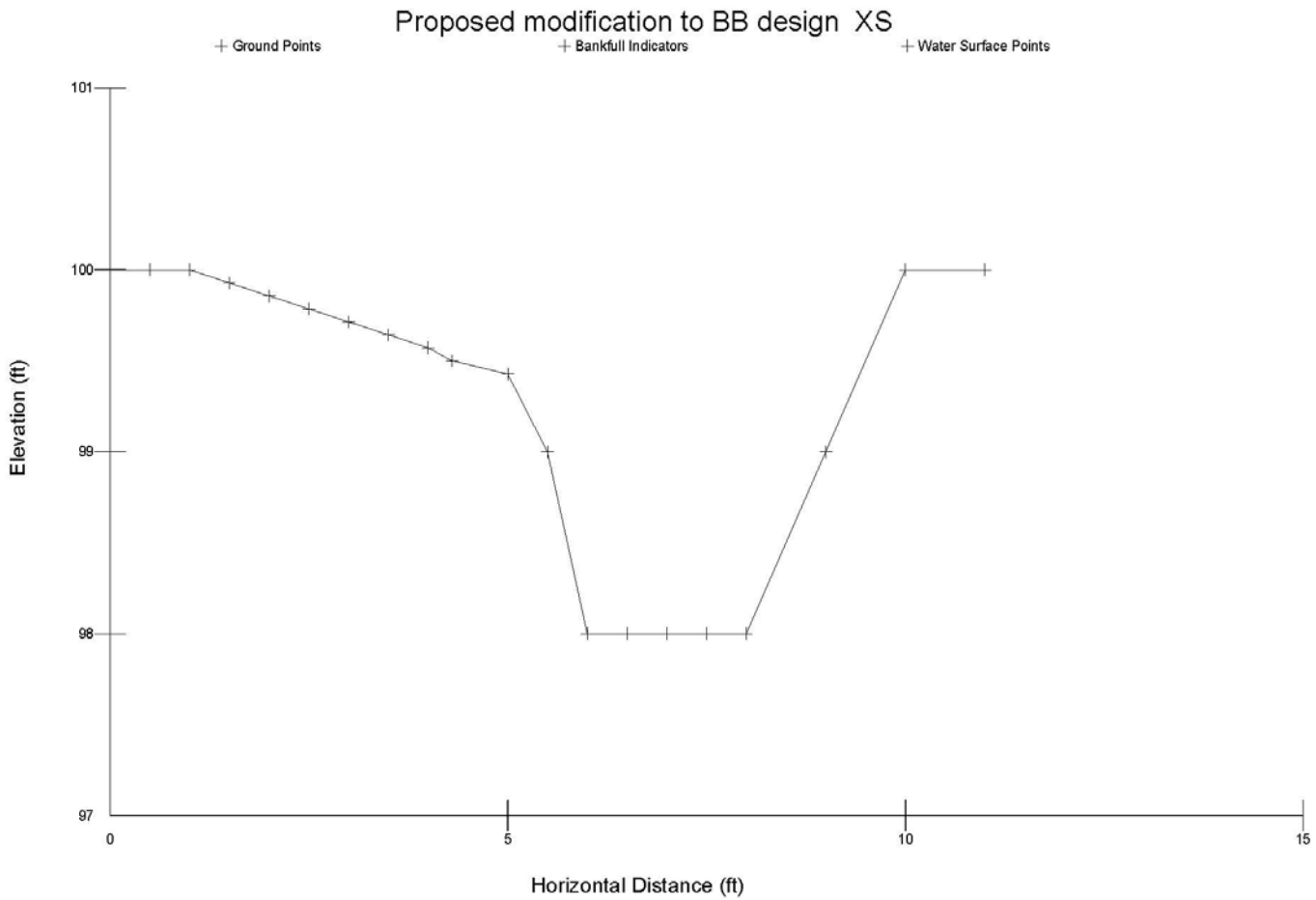
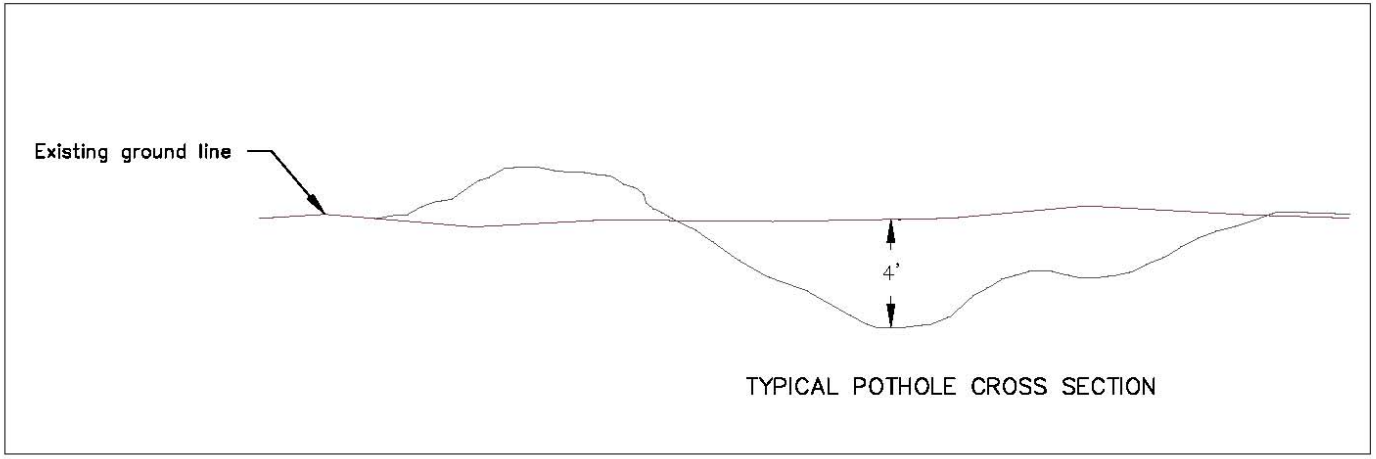
TYPICAL CHANNEL CROSS SECTION



In dense cattail mat the channels will be modified from typical to be widened to approximately 8' by "peeling" back a shallow area on one side of the channel with a ditching bucket The result would be an 8' top width that would be about 2"-6" deep for the first four feet then drop to the design depth of 2' in the main channel.



Construction Specifications:

- Areas to be excavated shall be stripped of all topsoil and sod. Topsoil and sod shall be kept separate from subsoil and shall be stockpiled.
- All wetlands shall be irregular in shape
- Wetland depth shall vary. At least 2/3 of each wetland shall be excavated to depths ranging between 6 inches and 18 inches.
- All disturbed areas surrounding excavations shall be graded to drain towards an adjacent wetland.
- Excess material shall be pushed to an adjacent upland area.
- When excavation is completed, stockpiled topsoil and sod shall be rough spread on spoil material, side slopes, and bottom of wetland where depth is less than 18 inches.

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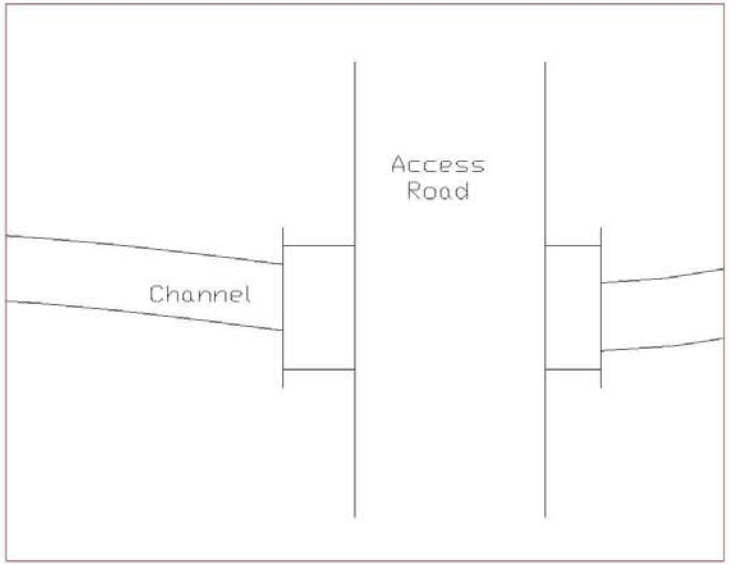
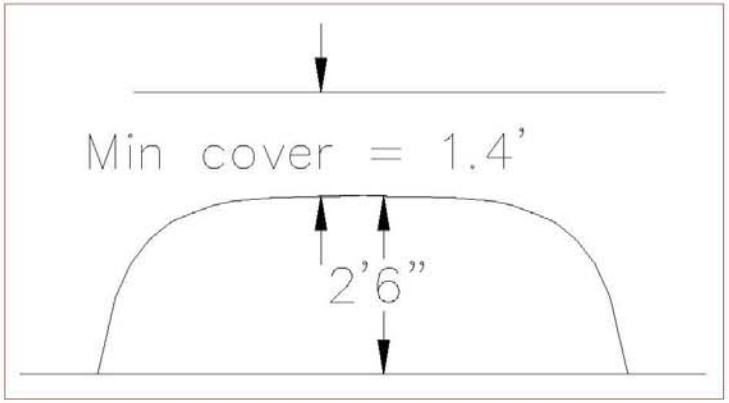
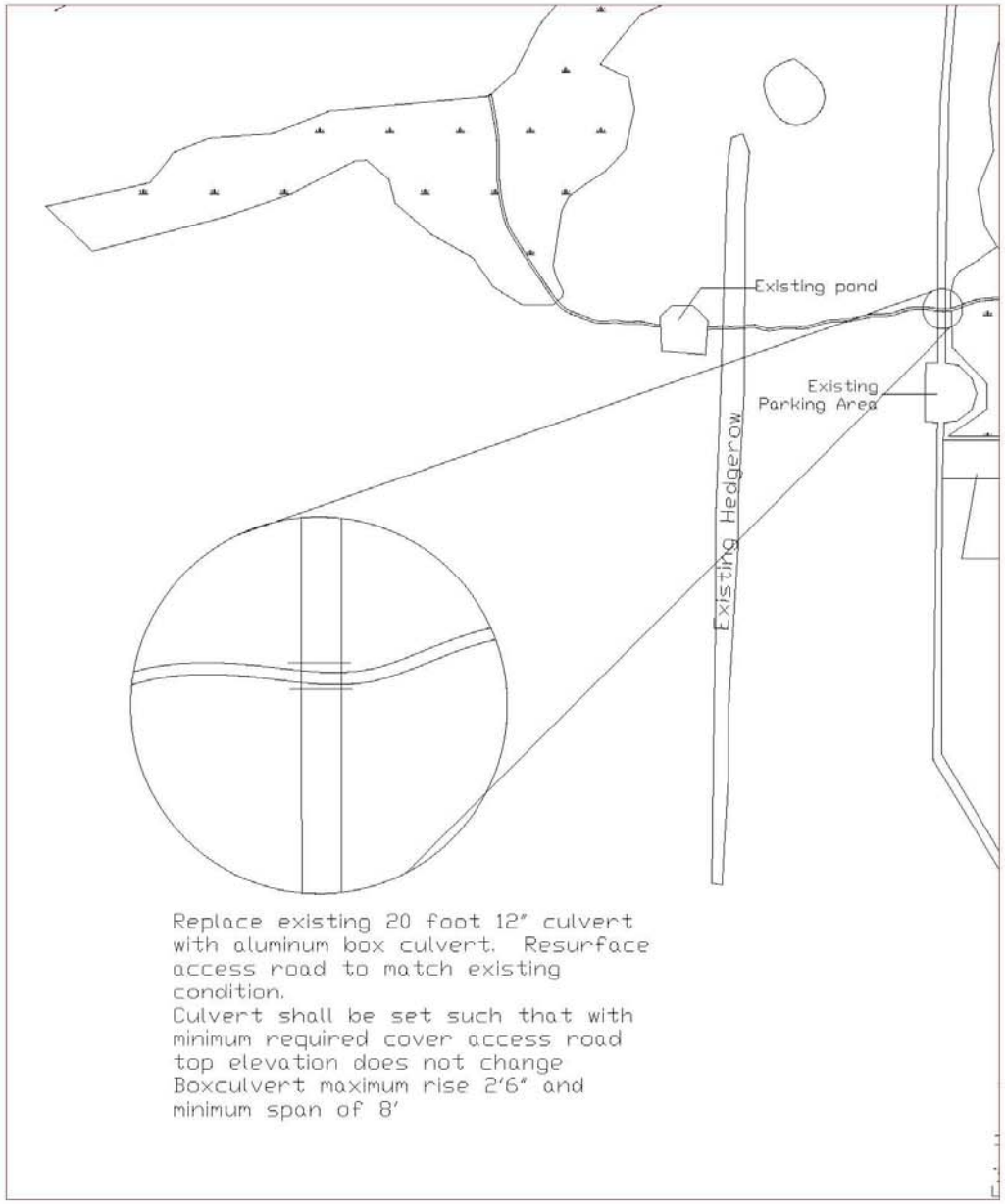
TYPICAL POTHOLE CROSS SECTION


Access
Road
Channel


Min cover = 1.4'
2'6"


Existing pond
Existing
Parking Area
Existing Hedgerow
Replace existing 20 foot 12" culvert
with aluminum box culvert. Resurface
access road to match existing
condition.
Culvert shall be set such that with
minimum required cover access road
top elevation does not change
Boxculvert maximum rise 2'6" and
minimum span of 8'