CONCEPTUAL WETLAND MITIGATION PLAN

for the

CITY OF MARQUETTE
MCCLELLAN AVENUE EXTENSION PROJECT

Marquette
the Superior location

SUPERIOR WATERSHED PARTNERSHIP

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Introduction

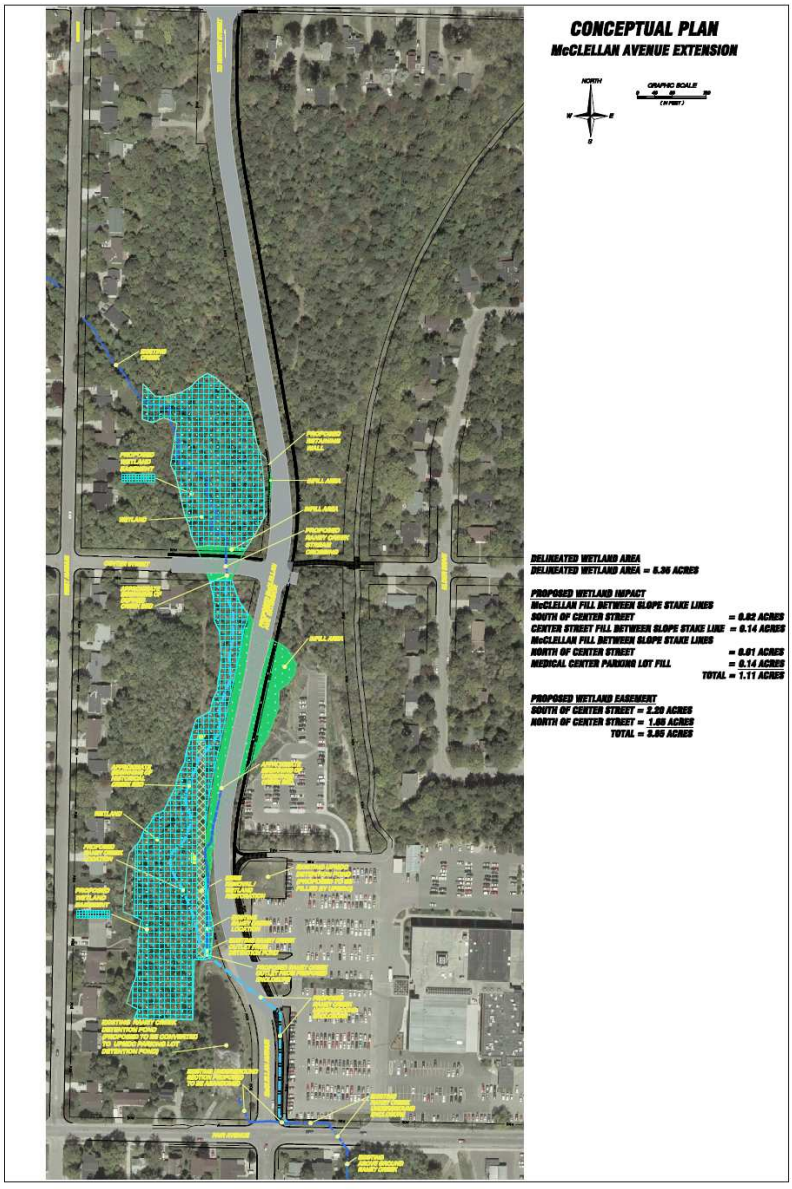
The purpose of this conceptual wetland mitigation plan is to describe the process that will be used by the City of Marquette (applicant) to mitigate unavoidable wetland impacts from a discharge of fill material as a result of the proposed McClellan Avenue Extension Project. The goal is to replace (at a 2:1 ratio) the functions and benefits of the impacted wetlands through on-site restoration and restoration of previously existing Lake Superior coastal wetlands located at Presque Isle Park. The proposed project and mitigation sites are located in the Dead-Kelsey Watershed (HUC: 04020201) in the Lake Superior basin of Michigan's Upper Peninsula (Figure 1).

Figure 1 Project Location Map

Project Site Description

The proposed McClellan Avenue Extension Project is located between West Fair Avenue and Wright Street in the City of Marquette, Marquette County, Michigan (T48N, R25W, Section 15). The project site is primarily forested and includes 5.35 acres of forested wetlands with some portions showing evidence of past filling activity. The preferred alternative was designed to minimize unavoidable impacts to forested wetlands located at the project site by: 1) modifying the road alignment with a curve to greatly lessen wetland impacts; 2) removing an earthen berm to restore hydrology to 0.23 acres of previously impacted portion of the forested wetlands; and 3) restoring an impacted section of Raney Creek located within the project site (Figure 2, Attachment 1).

Figure 2 Preferred Alternative



The proposed project will result in unavoidable impacts to approximately 1.11 acres of inland forested wetlands. The wetlands are dominated by red maple, balsam poplar, tag alder, balsam fir and white cedar with an understory of jewelweed, joe-pye weed, sensitive fern and sedges. The wetlands, while located adjacent to residential and commercial developments, offer food and cover for birds and wildlife due to multiple vegetative strata and the presence of water; reduce flood peaks within the watershed; serve as natural filters for stormwater from adjacent development; and aid in recharge of groundwater. The greatest amount of filling is proposed for an area lying adjacent to a parking area, which limits its value as wildlife habitat in its current state.

Looking north at the south end of the proposed McClellan Ave. Extension

Looking east from Center Street at the forested wetland

The proposed project will result in unavoidable impacts to approximately 1.11 acres of inland forested wetlands. The goal is to replace (at a 2:1 ratio) the functions and benefits of the impacted wetlands through on-site restoration of 0.23 acres of previously impacted wetlands at the project site and off-site restoration of 2.05 acres of previously existing Lake Superior coastal wetlands located at Presque Isle Park (total 2.28 wetland restoration acres). The project will also include preservation of 3.84 acres of forested wetland at the project site. In addition, construction of the proposed project will result in water quality improvements to Raney Creek as described below.

Raney Creek Reconstruction

One waterway is located in the project site. The waterway, Raney Creek, is an intermittent stream that flows south to north. As shown in the attached drawing, the stream is above ground south of Fair Avenue. At Fair Avenue, the stream flows into an underground enclosure, where it remains for approximately 315 feet before discharging to a stormwater detention pond at the northwest corner of Fair and McClellan Avenues. Raney Creek exits the stormwater detention pond into a linear ditch adjacent to a 20 foot wide berm of fill material. After exiting the detention pond, the stream has a defined bed and banks to a point approximately 780 feet north of Fair Avenue at which point it loses its definition and disperses into the existing wetlands. Raney Creek resumes its definition at a point approximately parallel with Center Street. After Center Street, Raney Creek continues north-northwest, eventually draining to the Dead River. When flowing, and where Raney Creek has a defined bed and banks, the stream has an average width of approximately four feet, an average depth of approximately three inches, and an average flow of less than 1 cubic foot per second.

Historical documentation and evidence of a remnant channel suggests Raney Creek originally flowed on the west side of the existing berm. The City of Marquette proposes taking Raney Creek off-line from the stormwater detention pond, removing the berm, abandoning the existing ditch, restoring the stream to a natural meander, and then discharging the stream to its original streambed. In order to take Raney Creek offline from the detention pond, the City proposes abandoning approximately 150 feet of existing stream enclosure and adding approximately 480 feet of enclosure. The purpose of the additional enclosure is twofold; 1) to route the stream around the existing detention pond, thereby avoiding its associate warming impacts and the commingling with other stormwater discharges and 2) to afford additional storage volume for other stormwater runoff, specifically, stormwater from the Upper Peninsula Medical Center parking lot.

Currently stormwater from the adjacent Medical Center parking lot discharges to a small, ineffective on-site detention pond before discharging directly to Raney Creek. The Medical Center is planning to fill the on-site pond for use as a parking lot. Concurrent with the Medical Center's plans to fill the small detention pond, the City and Medical Center plan to divert parking lot stormwater to the large detention pond. This diversion of Raney Creek around this detention pond and diversion to and conversion of the detention pond to a parking lot detention pond is anticipated to provide a significant improvement to water quality.

The City plans to restore Raney Creek to a meandering channel upon discharge from the proposed enclosure. As shown in the attached drawing, the stream would follow a natural

meander for approximately 425 feet before arriving at the location of what is believed to be the original streambed, as evidenced by what appears to be a remnant channel. Upon reaching its original streambed, Raney Creek would be restored to its original channel where it would flow for approximately 500 feet before entering a short enclosure under the proposed Center Street extension and then resume its natural course north.

The proposed stream channel cross section and profile was designed to simulate the existing stream channel cross section and profile and accommodate the 3.5 and 5 cfs flow rates resulting from the 1 and 2 year - 24 hour storms, respectively. The proposed stream channel cross section is proposed to approximate the existing stream channel cross section and be approximately 1 foot deep, 3 feet wide at the bottom, 5 feet wide at the top, with 1:1 sideslopes. Relocated longitudinal channel slopes are planned to be between 0.45% - 1.6%. Depending on longitudinal channel slope, bank-full conditions of the proposed stream cross section will accommodate flows resulting from the 1 to 2 year - 24 hour rainfall event, as shown in the enclosed TR-55 and HEC-RAS calculations. Bank-full conditions from such rainfall events are typical and expected.

Based on HEC-RAS calculations, maximum stream velocities during the 2 year bank full event will be 3 fps. The engineered substrate planned for the stream bottom and sideslopes consist of 50% 6A gravel and 50% 4"-6" rounded cobbles. 4"-6" rounded cobbles chinked with 6A gravel will provide protection against streambank erosion for flows of 4-6 fps (Fischenich, May 2001, "Stability Thresholds for Stream Restoration Materials"). As such, the proposed stream channel is adequately protected for bankfull flow. Flows greater than bankfull overtop the stream channel and disperse within the floodway at greatly reduced velocities, as provided in the HEC-RAS calculations.

Disturbance to the existing ground will be limited to the proposed stream channel construction area with designated access points as noted on plan sheets. The contractor will be required to use the smallest practical equipment to complete work covered in this section and will be required to submit a detailed plan to the Engineer that shows how all the planned work, including all methods and equipment, will be completed. Work will not begin until the Engineer approves the plan. In addition, mature tree removal will be prohibited unless instructed otherwise by the Engineer. These requirements will ensure that the channel reconstruction will utilize existing forest vegetation to the maximum extent practicable to provide an adequate riparian buffer for the stream channel.

Performance Standards for Raney Creek Reconstruction

Performance standards have been established to measure the success of the proposed reconstruction in restoring the natural features and functions of a section of Raney Creek located on the project site. These standards will also be used to monitor progress for a period of five years (see Monitoring Plan below). If the performance standards are not met by the end of the 5-year monitoring period, the site will be monitored for an additional 5 years. The proposed performance standards for Raney Creek reconstruction include:

- Construction will be completed in accordance with the MDEQ-approved plan and specifications referenced in the permit.

- The restored stream channel will have defined bed and banks that will be similar in cross sectional dimensions to the existing stream channel.
- The restored stream channel will contain substrate such that a stable channel is established.
- The restored stream channel will have a sufficient riparian buffer that provides shade to the stream.
- Invasive plants will occupy no more than 10% of the vegetative cover in adjacent riparian areas.

Monitoring Plan for Raney Creek Reconstruction

Monitoring inspections will be conducted annually for a minimum of 5 years and reports will document that the project has met the performance standards for the stream reconstruction. Annual monitoring will be performed in the spring or early summer of the year when the stream is flowing and will include documentation of the following information:

Construction Documentation. During and immediately after construction the stream channel and adjacent riparian areas will be examined and photographed to document adherence to the design plans.

Stream Monitoring. Raney Creek will be monitored annually using a state-approved (MDNR Fisheries Division) protocol to document the success of the stream reconstruction. The protocol consists of data collection at 6 transects within a 300 foot section of stream. Data collection parameters include dominant water type (riffle, pool, run) and physical stream channel characteristics including width, depth and substrate composition. The protocol also includes documentation of adjacent riparian areas, a stream discharge estimate, and other general observations (see data sheet attached).

Photographic Record. At least three photographic points will be established for the monitoring location and a dated photographic documentation produced during each monitoring event.

Invasive Plant Control. The stream reconstruction site will be monitored annually for invasive plant species. Invasive plants discovered on site will be controlled in accordance with species specific best practices (i.e. manual removal, herbicide applications, etc.). Invasive species investigations will utilize transect methods or other acceptable methods and will include documentation of species present, percent cover, and total acreage of infestation. Proposed control methods and timeline for implementation will be communicated to MDEQ via annual monitoring reports.

Reporting. An annual monitoring report, including relevant comparisons from previous years, will be produced and submitted to the MDEQ no later than January 31 of the year following the monitoring for each of the 5 years of monitoring. The report will include the date and time of the monitoring visit(s).

Remedial actions. If the site is found to be not meeting performance standards during annual monitoring events, the Engineer with consult with MDEQ regarding appropriate remedial actions.

On-site Wetland Mitigation

The proposed project site includes an existing 0.23 acre wetland fill consisting of a two-track berm approximately 20 feet wide and 500 feet long. This berm is believed to have been constructed as part of a project to ditch and straighten Raney Creek and provide access through the existing wetland. This berm is planned to be removed as part of the road construction and wetland mitigation plans. Objectives of the restoration are to: 1) excavate and remove artificial fill and restore contours to create diverse microhabitats that mimic heterogeneous forested wetlands, 2) further restore the area with plantings of native herbaceous and woody species that typify the existing wetlands (forested/shrub-carr and emergent/wet meadow types), 3) establish monitoring and adaptive management plan for restored wetland, and 4) establish a permanent conservation easement for protection of the restored wetland and existing wetlands located on City property.

The proposed wetland mitigation design focuses on excavation of an earthen berm and removal of this material to an approved upland site. The mitigation site will be contoured to leave hummocks (about 4-8 feet in diameter and only about 12-24 inches above the visible water table) and short ridges (about 5 feet wide by 10 feet long and similar height) and correspondingly-sized pit areas. This "pit and hummock" micro-topography (with an estimated 50% of the surface being hummocks that favor woody species (forested/shrub/scrub) and 50% emergent/wet meadow with about 5% of that being seasonal standing water in microponds) will facilitate the growth of the greatest variety of wetland plant species and allow the area to follow a successional trajectory that mimics the natural conditions of the existing forested wetlands. Hummocks are particularly valuable as a strategy for fostering growth of woody species (trees and shrubs) by providing aeration for their roots. The varied microsites created all along the miniature slopes accommodate the requirements of plants that grow in conditions ranging from standing water to barely saturated soil. The goal of site construction is to leave a "messy" lumpy surface, not the cleanly sloped and contoured surface of the usual construction site. The placement of pits and hummocks will be irregular. A pit and hummock topography will also better accommodate any future fluctuations in lake levels.

Elevations will vary from the definitively raised hummocks lying above the water table to areas of saturated soil providing habitat for wet meadow species to very small pools of standing water. Such pools of standing water will provide habitat for macro-invertebrates, amphibians, and emergent plant species. The overall goal is a wetland that is roughly 50% forested/shrub/scrub and 50% emergent wet vegetation. Targeting these community types will provide more diversified habitat for birds and other wildlife and a greater potential for successful restoration. The hummocks will also provide sites for volunteer establishment of woody species that will establish themselves from the adjacent sources.

Hydrology and Soil. Fill material will be excavated to about 1 to 2 feet below the water table. Over-excavation will allow for the addition of about 6 inches of clean topsoil amendments that will be used to form the microtopography and to provide nutrients for plant establishment. Care will be taken to procure the soil from a source without invasive species. Over-excavation will also allow for seasonal and yearly fluctuations of the water table. The main water source will be groundwater tied to Raney Creek and existing wetlands at the project site. Seasonal fluctuations in water levels are expected. The goal is not the creation of a permanent water body but, rather,

forested/shrub-carr and wet meadow wetlands that contain a variety of plant species adapted to a varying water regime. Standing water is planned to occur in small pools, mimicking vernal pools and providing habitat for amphibians and invertebrates. Water depths are anticipated to vary from saturated soil within 6-18 inches of the surface to standing water depths of a maximum of 0.5 to 1.5 feet. Some of the hummock surfaces will lie above saturated soil by design to allow for aeration of establishing woody plant roots.

Water Budget. Marquette receives an average of 36.31 inches of precipitation a year. At 144.5 inches of annual snowfall, it is the second snowiest city recorded in the United States. The wettest weather occurs in June with an average of 3.5 inches of rain recorded across 12 days. The annual average temperature is 43 °F with the highest monthly temperature being only 75 °F in July. Average sunlight hours ranges between 2.5 hours per day in December and 10.6 hours per day in July. With this combination of temperature, sunlight, and precipitation, evapotranspiration is not expected to be a significant factor adversely affecting the water budget of the wetland.

Wetland Types and Plantings. A variety of wetland plant species are proposed for planting. Distributions of proposed plants were checked against Voss (1972, 1985, 1996). Plant sources will be as local as is practical relative to species procurement and cost. It is possible that the best sources for northern Great Lakes genotypes could come from sources in Wisconsin or Minnesota. Upper Peninsula sources will be investigated and favored if at all practical. Annual rye and oats will be seeded with native species as a cover crop that will green up quickly and provide a green manure. This seed mix will also help prevent infestation of invasive plant species. The native species are anticipated to take longer to establish, usually requiring a full year or two to establish, flower, and fruit/set seed. The goal is a wetland that is roughly 50% forested/shrub/scrub and 50% emergent. Instead of occurring in discrete patches, these wetland types will occur in a heterogeneous matrix that follows a varied pit and hummock topography. In such a small area, a relatively open wetland of this type, punctuated with small trees and shrubs, will provide more “edge effect” and much more superior cover and food sources for migrants than homogeneous patches of wetland types. It will also more closely mimic the high variation in microsites of the nearby existing wetlands.

In addition to the planted species, colonization by nearby species is anticipated. The adjacent wetlands contain red maple, balsam poplar, tag alder, balsam fir and white cedar with an understory of jewelweed, joe-pye weed, sensitive fern and sedges. This proximity of intact wetlands greatly enhances the likelihood of establishment of volunteers which will add to the successful establishment of wetland vegetation.

Woody species (shrubs and trees) will be chosen for their appropriateness for the restored wetland with the intent to mimic the existing wetlands on the project site. Specific focus will be placed on species that provide food for wildlife in form of fruit and seeds. These will be scattered throughout the mitigation wetland on hummocks and areas of saturated soil. At least 5 species of trees and 5 species of shrubs will be chosen from the attached plant list (Attachment 5) for planting on hummocks. As needed, some protective measures against deer will also be added particularly for the protection of particularly sensitive species such as white cedar.

Herbaceous species will likewise be chosen for their appropriateness for the restored wetland with the intent to mimic the existing wetlands on the project site. Actual species composition will depend on availability. At least 5 emergent species will be included in the planting protocol with species selected to represent a wide amplitude of moisture conditions. A seed mixture will be broadcast at a rate of a about 9 lbs/acre. Potential candidate species are included in the attached plant list although other appropriate available species may also be included or substituted.

Performance Standards for On-site Wetland Mitigation

Performance standards have been established to determine if the restored wetland is progressing toward establishment of successful, diverse and functioning wetland. Wetland species will mean species listed as Facultative and wetter (FAC, FAC+, FACW-, FACW, FACW+, OBL). These standards will also be used to monitor progress for a period of five years (see Monitoring Plan below). If the performance standards are not met by the end of the 5-year monitoring period, the site will be monitored for an additional 5 years. The proposed performance standards for the restored wetland include:

- Construction will be completed in accordance with the MDEQ-approved plan and specifications referenced in the permit
- A minimum of six (6) habitat structures, consisting of at least three (3) types, have been placed per acre of mitigation wetland. At least 50 percent of each structure shall extend above the normal water level. The types of acceptable wildlife habitat structures are:
  - Tree stumps laid horizontally within the wetland area. Acceptable stumps shall be a minimum of 6 feet long (log and root ball combined) and 12 inches in diameter.
  - Logs laid horizontally within the wetland area. Acceptable logs shall be a minimum of 10 feet long and 6 inches in diameter.
  - Whole trees laid horizontally within the wetland area. Acceptable whole trees shall have all of their fine structure left intact (i.e., not trimmed down to major branches for installation), be a minimum of 20 feet long (tree and root ball), and a minimum of 12 inches in diameter at breast height (DBH).
  - Snags which include whole trees left standing that are dead or dying, or live trees that will be flooded and die, or whole trees installed upright into the wetland. A variety of tree species should be used for the creation of snag habitat. Acceptable snags shall be a minimum of 20 feet tall (above the ground surface) and a minimum of 12 inches DBH. Snags should be grouped together so as to provide mutual functional support as nesting, feeding, and perching sites.
  - Sand mounds at least 18 inches in depth and placed so that they are surrounded by a minimum of 30 feet of water measuring at least 18 inches in depth. The sand mound shall have at least a 200 square foot area that is 18 inches above the projected high water level and oriented to receive maximum sunlight.
- The minimum number of native wetland species shall not be less than:
  - 5 species of trees.
  - 5 species of shrubs.
  - 5 species of emergent vegetation.
- The total number of native wetland plant species shall be determined by a sum of all species identified in sample plots of the same wetland type.
- At the end of the monitoring period, the mitigation wetland supports a minimum of:

  - Three hundred (300) individual surviving, established, and free-to-grow trees per acre that are classified as native wetland species and consisting of at least three different plant species.
  - Three hundred (300) individual surviving, established, and free-to-grow shrubs per acre that are classified as native wetland species
- The mitigation area will be free of debris and any contaminants.
- Invasive plants will occupy no more than 10% of the vegetative cover in the restored wetland.

Monitoring Plan for On-site Wetland Mitigation

Monitoring inspections will be conducted annually for a minimum of 5 years and reports will document that the project has met the performance standards for the on-site wetland mitigation. Annual monitoring will be performed between June 15 and September 30, with preference for the peak of the growing/fruiting season, late June through August and will include documentation of the following information:

Construction Documentation. During and immediately after construction the restored wetland will be examined and photographed to document adherence to the design plans.

Vegetation. For assessment of vegetation, a transect will be established and data will be collected from a minimum of two square meter sampling plots. Sample points of transects will be GPS-documented, and mapped on a completed map of the restoration area. If the square meter plots do not sufficiently represent the variability of the restoration wetland, additional plots will be added with GPS locations with the rationale for need and selection documented. In each square meter plot, plants will be identified to species and to the lowest possible taxon when species identification is not possible (example being immature sedges and grasses) and type (woody or herbaceous). Visual percent areal coverage by species (or appropriate taxon) will be recorded by plot. These data can be used to calculate descriptive statistics such as Shannon diversity index ($H' = -\sum p_i \log p_i$), Sorensen similarity index ($CC_J = 2c/s_1+s_2$). Non-parametric statistics can be used to compare ranked and percentage scores. Students t-test can be used to compare Shannon's diversity index among sites and/or years. Species lists (current scientific name, a common name, wetland status, woody or herbaceous, native or alien status) will be generated and percentages of wetland status species, woody/herbaceous, and native species calculated. The entire area will be examined for any significant un-vegetated areas. If such areas persist for more than 2 years, additional seeding/planting will take place.

Hydrology. Depth to groundwater will be recorded during the monitoring visits through soil borings and visible observations. Any visible standing water in the pits will also be noted during these visits.

Photographic Record. At least three photographic points will be established for the monitoring location and a dated photographic documentation produced during each monitoring event.

Invasive Plant Control. The wetland restoration site will be monitored annually for invasive plant species. Invasive plants discovered on site will be controlled in accordance with species specific best practices (i.e. manual removal, herbicide applications, etc.). Invasive species

investigations will include documentation of species present, percent cover, and total acreage of infestation. Proposed control methods and timeline for implementation will be communicated to MDEQ via annual monitoring reports.

Wildlife. Any species of birds, mammals, amphibians, or reptiles present (or having left sign) during the monitoring period shall be reported.

Reporting. An annual monitoring report, including relevant comparisons from previous years, will be produced and submitted to the MDEQ no later than January 31 of the year following the monitoring for each of the 5 years of monitoring. The report will include the date and time of the monitoring visit(s).

Remedial actions. If the site is found to be not meeting performance standards during annual monitoring events, the Engineer with consult with MDEQ regarding appropriate remedial actions.

Long-term Protection for On-site Wetlands

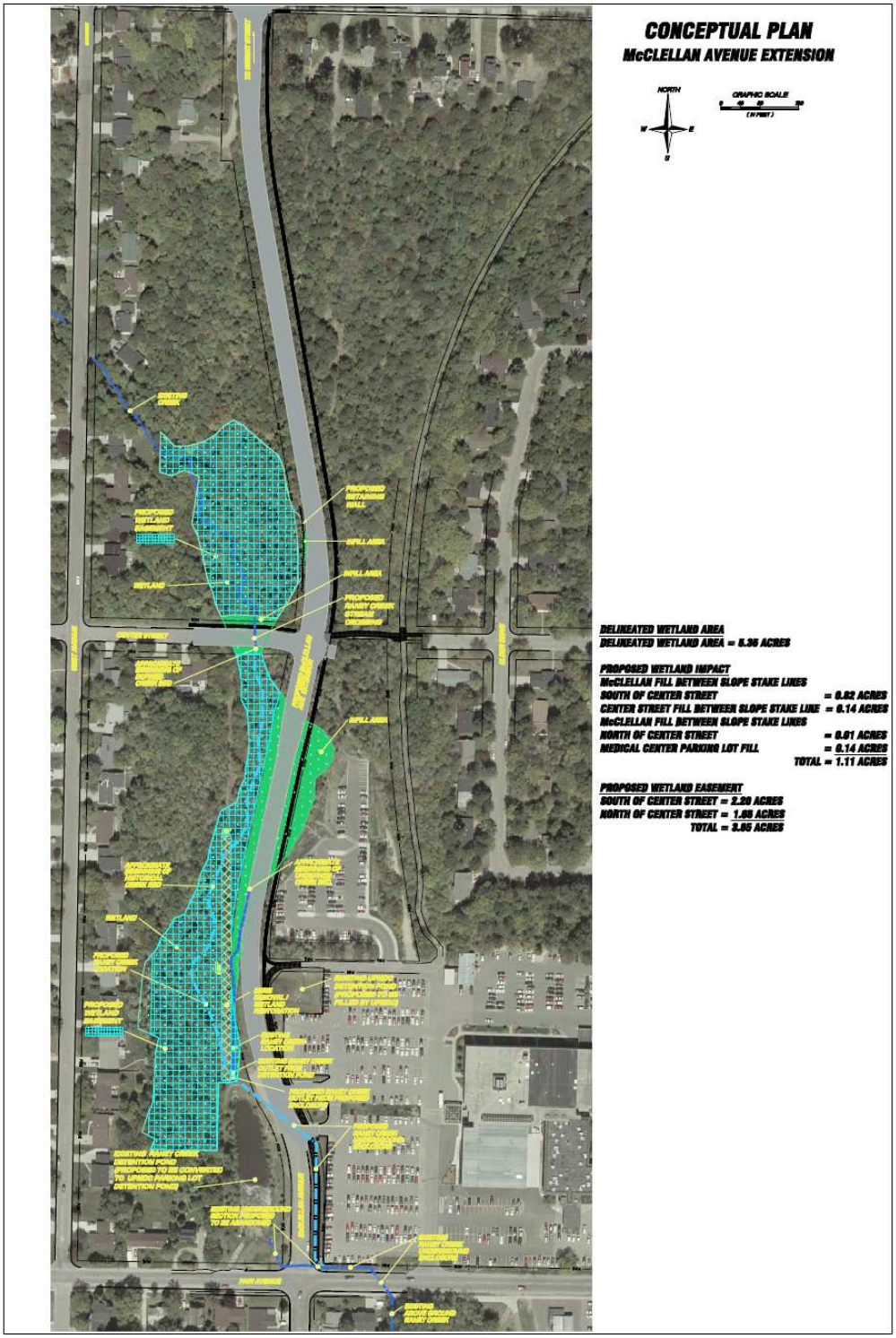
In addition to the 2.28 acres of wetland mitigation for the 1.11 acres of on-site wetland fill, the City of Marquette will also include preservation of the remaining on-site wetlands to serve as protection for Raney Creek and as additional mitigation for unavoidable wetland impacts from the project. These wetland preservation easements are shown on the attached drawing entitled "Conceptual Plan" (Figure 3, Attachment 1) and are included per direction to the City of Marquette from the U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers, and the MDEQ. The preservation of the remaining on-site wetlands will consist of an approximate 2.2 acre wetland preservation easement south of Center Street and an approximate 1.6 acre wetland preservation easement north of Center Street for a total of approximately 3.8 acres. No wetland buffer will be included in these easement areas.

Raney Creek is a tributary to the Dead River and ultimately Lake Superior, the largest freshwater lake in the world. The remaining on-site wetlands surrounding Raney Creek are relatively unique in that they are wooded wetlands. Benefits provided by the wooded wetlands include the reduction and infiltration of urban runoff, reduction of particulate loading to Raney Creek, and shading of Raney Creek.

The area surrounding the remaining on-site wetlands is developed with roads, residential housing, and medical and dental offices. Currently there are no easements or covenants prohibiting specific threats to the remaining on-site wetlands.

Demonstrable threats to the remaining on-site wetlands include; 1) the sale of the undeveloped property for development (as is evidenced by surrounding developed areas and the impending sale of upland property adjacent to the proposed McClellan Avenue extension), and 2) the threat of urban runoff to the wetlands and Raney Creek.

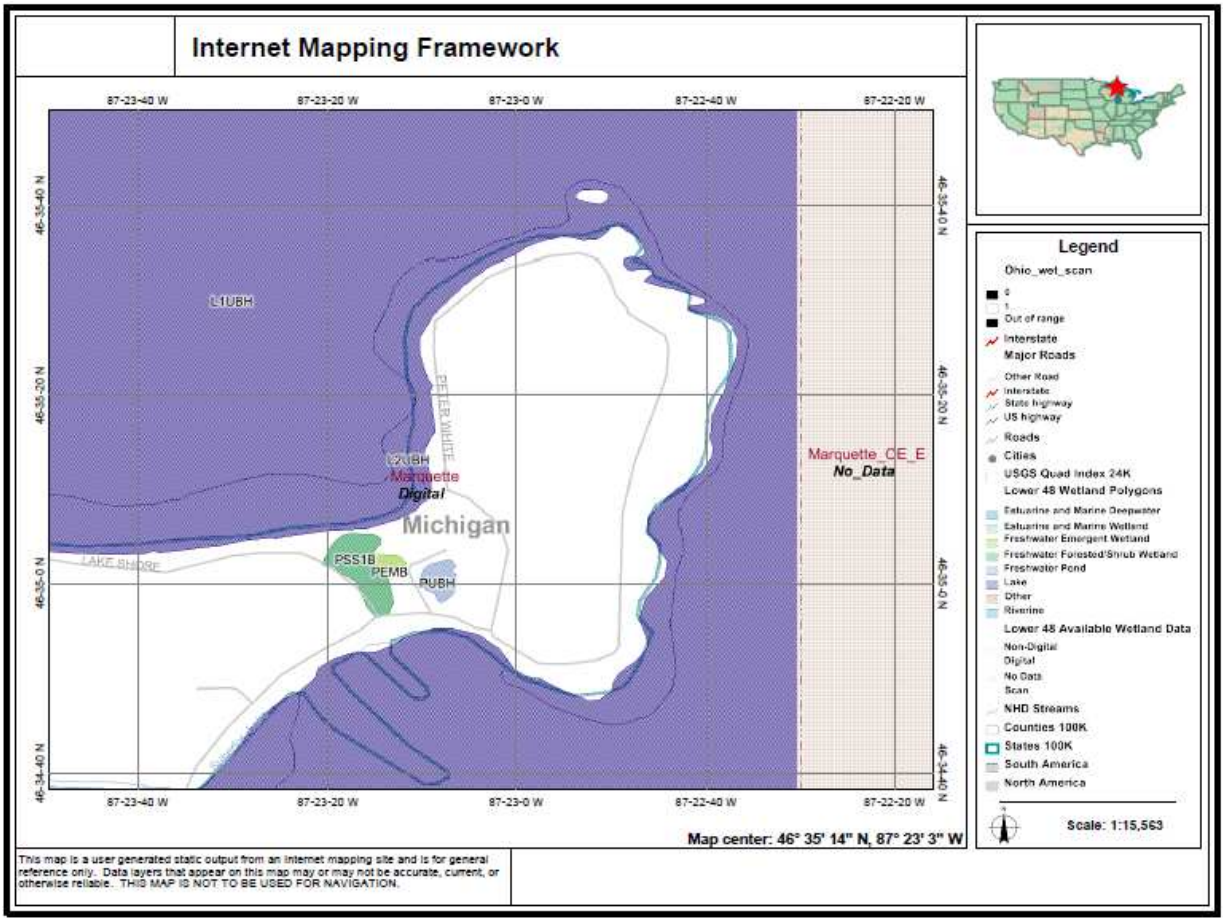
Figure 3 Proposed Conservation Easement Area (shown as green hatched area)



Off-site Wetland Mitigation

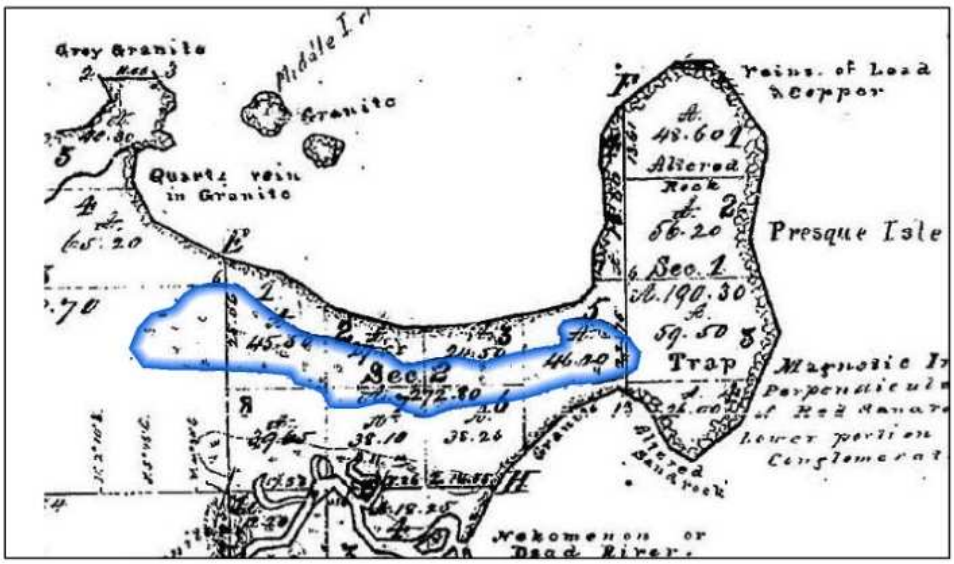
An additional 2.05 acres of previously filled wetland is proposed for off-site mitigation, including a conservation easement. This off-site mitigation is proposed on the land spit connecting the 323-acre Presque Isle Park with the mainland. This area is bounded by roads on the west, south, and east and by Lake Superior on the north. On the north and east, in particular, there is habitat connectivity with Presque Isle Park. The U.S. Fish and Wildlife Service National Wetlands Inventory map (Figure 4) shows the remaining unfilled wetlands (in green) and the general location in reference to the Presque Isle Park (to the east). The open water area (shown in the blue) is a concrete pool (Shiras Pool), which is slated for potential removal and future restoration. Because the area surrounding the proposed mitigation/easement already consists of wetlands or uplands with wetland restoration potential, no buffers will be included with these easement areas.

Figure 4 National Wetlands Inventory Map



Presque Isle Park is a tombolo, a geomorphological feature whereby an island is attached to the mainland by a narrow spit of land. With the probable exception of beach ridges, most of this spit of land was once wetland. In fact, in the original General Land Office (GLO) 1846 survey map (Figure 5), this area was noted as being primarily wetland (blue outline). Based on knowledge of similar coastal wetlands nearby, this area was most likely a wooded dune and swale complex. The area was filled gradually, long ago, with a variety of inert materials such as rock, concrete, metal, and soil.

Figure 5 GLO Map Showing Historic Wetlands



Tombolos are well-known as "traps" for migratory birds, providing valuable stopover habitat. Even in its degraded state, the connecting spit of land attracts birds and other wildlife with its remnant wetlands. There are records of 282 species of birds recorded by the local Audubon club for the Presque Isle tombolo complex. The site is also heavily used by small and large mammals, along with various species of reptiles and amphibians.

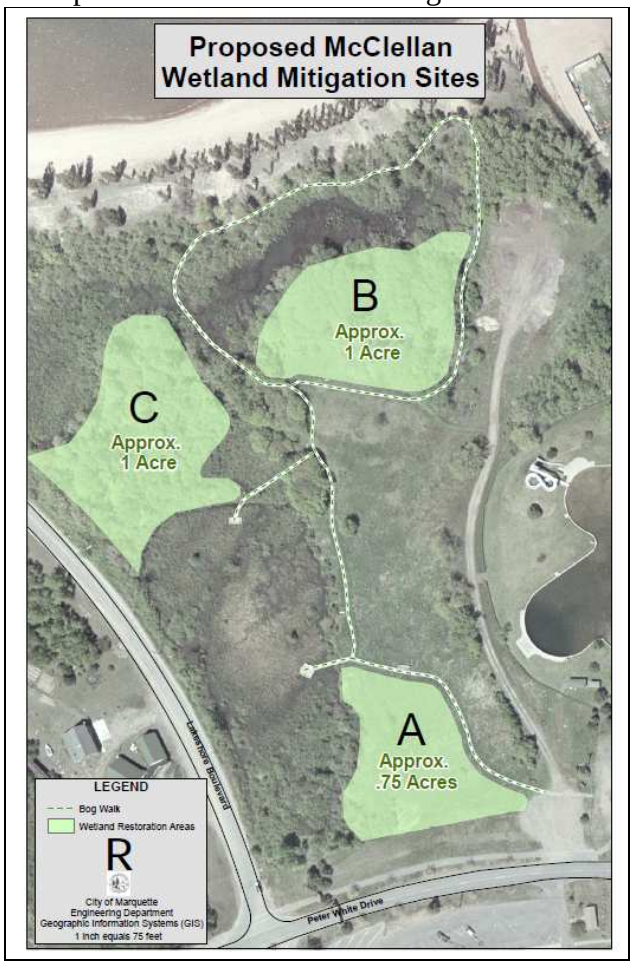
The restored wetlands will provide groundwater recharge and filtration of runoff before it reaches Lake Superior. Given its strategic location contiguous with Presque Isle Park, and as part of a tombolo on Lake Superior's shore, the restored wetlands are expected to offer additional food and cover for wildlife due to multiple vegetative strata and the presence of water, and provide important stopover and breeding habitat for a wide variety of birds.

The location of the restoration site as part of a tombolo and contiguous to a protected natural area to the east (Presque Isle Park) and remaining coastal wetlands to the west, greatly magnifies the value of its acreage as habitat, particularly for migratory birds. The restoration will also provide increased opportunities for public outreach, education and research as it is located adjacent to the Moosewood Nature Center and Superior Watershed Partnership and Land Trust who offer numerous opportunities for public involvement.

The main goal of off-site wetland mitigation is the restoration of 2.05 acres of wetland lying on the tombolo land spit portion of Presque Isle to replace wetland impacted by road construction. Objectives of the restoration are to: 1) excavate and remove artificial fill and restore contours to create diverse microhabitats that mimic heterogeneous wooded dune and swale Lake Superior coastal wetlands, 2) further restore the area with plantings of native herbaceous and woody species that typify the dune and swale wetlands (forested/shrub-carr and emergent/wet meadow

types), 3) establish monitoring and adaptive management plans for restored wetlands, and 4) establish a permanent conservation easement for protection of the restored wetlands. The specific sites chosen for the off-site restoration are shown as Areas B and C in the figure below (Figure 6).

Figure 6 Proposed Off-site Wetland Mitigation – Areas B and C



Baseline Conditions for Off-site Mitigation Areas

This area has long been targeted for restoration due to its potential as high quality wildlife habitat. Originally wetland, most likely a wooded dune/swale complex (comprising forested/shrub-carr wetlands interspersed with wet meadow/shallow water emergent), this area was filled long ago and today is a ecologically degraded upland with very few wetland functions remaining on the filled parcels. Lying so low on the landscape and in such proximity to Lake Superior, the water table is directly influenced by the Lake.

Fluctuating lake levels and storm events result in a disturbance regime in Lake Superior coastal wetlands that creates a heterogeneous community of soil types, varying levels of substrate saturation, and resultant spatially varied plant communities and species diversity. This baseline habitat diversity translates to a variety of wildlife species, both residents and transients.

The overarching goal of this restoration is to mimic the hetergeneous conditions that typify a Lake Superior wooded dune and swale complex. Plant species typical of such a wooded dune and swale complex includes facultative upland species as well as many species with wetland status. This diversity results from the varied ridge elevations recorded as ranging in height from about 18 inches to as much as 12 feet above the water table. In addition, the cool microclimate of Lake Superior fosters some species that are particularly adapted to these conditions.

A wetland determination, performed in April 2010, described three potential restoration areas (see Figure 6 above). These are bordered by the existing paths and wetlands. The present-day wetland/filled wetland border is visually obvious on the ground by the grade difference created by the historic fill (approximately 3 feet).

Hydrology. Currently, most of the proposed restoration area does not function as wetland. Adjacent wetlands lie about 3 feet below the present grade. The depth to the water table of the restored wetland would be expected to fluctuate with the level of Lake Superior as it would have originally.

Soil. The entire area proposed for restoration has been modified with fill (soil, rock, and scrap metal). Although soil maps describe hydric soils for part of the area (19-Deford Muck of the Kalkaska-Carbondale-Deford Association), a hydric soil of depressions and drainageways and lakeplains, this soil is not visible within the first 2 feet of the area. There are a few small patches where the fill has become saturated and begun to exhibit some hydric properties but this fill still lacks a true profile. It is possible that original hydric soils have been buried and will be discovered during excavation. There were no signs of any environmental contaminants observed (stains on the soil, distressed vegetation). At this point it is assumed that the fill, deposited long ago, is of a benign, inert nature. Free-standing water is visible at about 3 feet below the current fill grade. Saturated soils were encountered in only one of the test pits. This was in a depression area on the east edge of Area B, where saturated soil was encountered at 15 inches.

Four additional soil borings were completed in June 6, 2011 in an attempt to document the existence of native wetland soils in the proposed restoration areas. No native wetland soils were encountered in any of the locations. A summary of the results of this investigation are provided below.

- Soil Boring 1 (SB1) was located in the southeast portion of proposed restoration Area B and consisted of primarily sandy soils with no visible profile (total depth dug: 22 inches). Some organics and woody debris were present between 12-22 inches. Standing water was encountered at 15 inches.
- Soil Boring 2 (SB2) was located in the southwest portion of proposed restoration Area B and consisted of sandy soils with no visible profile (total depth dug: 40.5 inches). Standing water was encountered at 25.5 inches.
- Soil Boring 3 (SB3) was located in the east portion of proposed restoration Area A and consisted of sandy soils with no visible profile (total depth dug: 40 inches). Standing water was encountered at 27 inches.
- Soil Boring 4 (SB4) was located in the west portion of proposed restoration Area A and consisted of sandy soils with no visible profile (total depth dug: 24 inches). Standing water was encountered at 24 inches.

Vegetation. Adjacent wetlands are primarily bog vegetation with sweet gale (*Myrica gale*) dominating or shrub/carr with tag alder (*Alnus incana*) dominating. The filled wetlands are upland in nature, although some of the tree species, reaching down into groundwater, have wetland status. The wetland determination, completed in April 2010, described three potential restoration areas. All were assumed to be filled wetlands. Below is a summary of the two areas identified for off-site wetland restoration (Areas B and C).

Area B, with its broken chunks of concrete and metal protruding from the fill matrix, is predominately a wooded area but with stunted ground and shrub layers. The alien species, black willow (*Salix nigra*, OBL) is one of the larger tree species. The specimens present are older and likely don't have that much longer lifespans. Also present are box elder (*Acer negundo*, FACW-), balm-of-gilead (*Populus balsamifera* FACW), and scattered paper birch (*Betula papyrifera* FACU+), and yellow birch (*Betula alleghaniensis* FAC). Depending on the pattern of excavation, especially of some of the larger debris, some of the native tree species may be able to be preserved and incorporated into the restored wetland.

Area B

There is one patch of *Calamagrostis inexpansa* that might be left intact and incorporated into the restoration, or stripped off as a sod and replaced on the restored landscape. Some of the logs and brush from the site preparation should be set aside for scattering throughout the completed restoration as habitat structure. Wetlands border this area on the north and provide complementary cover and structure.

Area C has been severely affected by fill. The eastern half is almost entirely large blocks of concrete with scattered trees and shrubs. The western half was filled with soil and thus has some ground cover including a grass. The same trees were present as in Area B but much smaller in size. In addition, service berry (*Amelanchier laevis*, FACU) and chokecherry (*Prunus virginiana*, FAC-). Also present was mullein (*Verbascum thapsus*, UPL) and dandelion (*Taraxacum officinale*, FACU). There was no detectable wetland in this parcel and very little habitat value even as upland with its stunted ground cover and limited woody structure. Wetlands border this area on the north and south and provide complementary cover and structure.

Area C

The proposed wetland mitigation design focuses on excavation of existing fill and debris, and removal of those materials to an approved upland site. The mitigation site will be contoured to leave hummocks (about 4-8 feet in diameter and only about 12-24 inches above the visible water table) and short ridges (about 5 feet wide by 10 feet long and similar height) and correspondingly-sized pit areas. This "pit and hummock" micro-topography (with an estimated 50% of the surface being hummocks that favor woody species (forested/shrub/scrub) and 50% emergent/wet meadow with about 5% of that being seasonal standing water in microponds) will facilitate the growth of the greatest variety of wetland plant species and allow the area to follow a successional trajectory that mimics the natural disturbance conditions of a Lake Superior wooded dune and swale. Hummocks are particularly valuable as a strategy for fostering growth of woody species (trees and shrubs) by providing aeration for their roots. The varied microsites created all along the miniature slopes accommodate the requirements of plants that grow in conditions ranging from standing water to barely saturated soil. The goal of site construction is to leave a "messy" lumpy surface, not the cleanly sloped and contoured surface of the usual construction site. The placement of pits and hummocks will be irregular. A pit and hummock topography will also better accommodate any future fluctuations in lake levels.

Elevations will vary from the definitively raised hummocks lying above the water table to areas of saturated soil providing habitat for wet meadow species to very small pools of standing water. Such pools of standing water will provide habitat for macro-invertebrates, amphibians, and emergent plant species. The overall goal is a wetland that is roughly 50% forested/shrub/scrub and 50% emergent wet meadow/shallow water vegetation. Targeting these community types will provide more diversified habitat for birds and other wildlife and a greater potential for successful restoration. The hummocks will also provide sites for volunteer establishment of woody species. Alder, sweet gale, aspen, and willow species, for example, will establish themselves from the adjacent sources.

Hydrology and Soil. Fill material will be excavated to about 1 to 2 feet below the water table. Over-excavation will allow for the addition of approximately 6 inches of clean topsoil amendments that will be used to form the microtopography and to provide nutrients for plant establishment. Care will be taken to procure the soil from a source without debris or invasive species. Two potential soil sources are currently being evaluated. They include: 1) the McClellan Avenue construction site and 2) the City compost site located at 2001 Lakeshore Boulevard. Invasive species have been documented at the McClellan Avenue site and are assumed to be present at the compost site; however soil from the compost site will likely present a higher risk due to the fact that city residents bring lawn clippings and weeds (including invasive plants) to this site from all over the City. If soils are used from the McClellan site, invasive species control will likely be more manageable whereas the potential for invasive species infestation from the compost site is unknown and expected to be much higher. The City will continue to work with MDEQ to establish a source for soil amendments prior to construction.

Over-excavation will also allow for seasonal and yearly fluctuations of the water table. The main water source will be groundwater, in this location, tied to lake levels of Lake Superior. Seasonal fluctuations in water levels are expected. The goal is not the creation of a permanent water body but, rather, coastal forested/shrub-carr and wet meadow wetlands that contain a variety of plant species adapted to a varying water regime. Standing water is planned to occur in small pools,

mimicking vernal pools and providing habitat for amphibians and invertebrates. Water depths are anticipated to vary from saturated soil within 6-18 inches of the surface to standing water depths of a maximum of 0.5 to 1.5 feet. Some of the hummock surfaces will lie above saturated soil by design to allow for aeration of establishing woody plant roots.

Water Budget. Marquette receives an average of 36.31 inches of precipitation a year. At 144.5 inches of annual snowfall, it is the second snowiest city recorded in the United States. The wettest weather occurs in June with an average of 3.5 inches of rain recorded across 12 days. The annual average temperature is 43 °F with the highest monthly temperature being only 75 °F in July. Average sunlight hours ranges between 2.5 hours per day in December and 10.6 hours per day in July. With this combination of temperature, sunlight, and precipitation, evapotranspiration is not expected to be a significant factor adversely affecting the water budget of the wetland. Even in droughty years, the cooler, damper microclimate of the Lake Superior will favor wetland plants. Even in today's degraded, filled site, some wetland plants persist, perhaps in part due to the climate-mitigating (cool and moist) effect of the Lake and well as fluctuating lake levels and temporary spring surface ponding.

Wetland Types and Plantings. A variety of wetland plant species are proposed for planting. Distributions of proposed plants were checked against Voss (1972, 1985, 1996). Plant sources will be as local as is practical relative to species procurement and cost. It is possible that the best sources for northern Great Lakes genotypes could come from sources in Wisconsin or Minnesota. Upper Peninsula sources will be investigated and favored if at all practical. Annual rye and oats will be seeded with native species as a cover crop that will green up quickly and provide a green manure. This seed mix will also help prevent infestation of invasive plant species. The native species are anticipated to take longer to establish, usually requiring a full year or two to establish, flower, and fruit/set seed. The goal is a wetland that is roughly 50% forested/shrub/scrub and 50% emergent wet meadow/shallow water. Instead of occurring in discrete patches, these wetland types will occur in a heterogeneous matrix that follows a varied pit and hummock topography. In such a small area, a relatively open wetland of this type, punctuated with small trees and shrubs, will provide more "edge effect" and much more superior cover and food sources for migrants than homogeneous patches of wetland types. It will also more closely mimic the high variation in microsites of the nearby Lake Superior wooded dune and swale wetlands, where upland and wetland intergrade almost imperceptibly and frequently in space.

In addition to the planted species, colonization by nearby species is anticipated. The adjacent wetlands contain willows, dogwoods, alder, sweet gale, balsam polar, quaking aspen as well as herbaceous wetland species. This proximity of intact wetland greatly enhances the likelihood of establishment of volunteers which will add to the successful establishment of wetland vegetation.

Woody species (shrubs and trees) will be chosen for their appropriateness to a Lake Superior coastal wetland, their wetland status, and *particularly* for their value to wildlife. Specific focus will be placed on species that provide food for wildlife in form of fruit and seeds. These will be scattered throughout the mitigation wetland on hummocks and areas of saturated soil. At least 5 species of trees and 5 species of shrubs will be chosen from the attached plant list for planting on hummocks. Any species additional to these lists should be determined to be appropriate

selections for a Lake Superior coastal wooded wetland. As needed, some protective measures against deer will also be added particularly for the protection of particularly sensitive species such as white cedar. This number of seedlings is set deliberately lower than that of an inland wooded forested swamp. This is because of the inherent patchy nature of a wooded coastal wetland and its natural disturbance regime resulting in a mixture of mature trees, young trees, and shrubs interspersed with emergent/wet meadow openings. A greater wildlife value can be achieved with a restored wetland that more closely mimics natural conditions.

Herbaceous species will likewise be chosen for their appropriateness for a wetland along Lake Superior. Already present in some clonal patches in the degraded wetland is *Calamagrostis inexpansa*, a hardy clump-forming wetland grass. One clump located in Area B could be left in place in the restored wetland area or stripped as a sod and replaced in the new landcape. Actual species composition will depend on availability. At least 5 emergent species and 5 wet meadow species will be chosen from the attached plant list. A seed mixture will be broadcast at a rate of a about 9 lbs/acre. Potential candidate species are included in the attached plant list although other appropriate available species may also be included or substituted. Any additional species will be appropriate selections for a Lake Superior coastal wooded wetland.

Habitat Structure. The proximity of Presque Isle Park represents significant forested habitat structure in the immediate area including cavities and snags. In addition, the adjacent bog and shrub-carr wetlands also provide intact habitat that will complement the restoration areas. Unlike a wetland created in isolation, the Presque Isle restoration site has abundant adjacent habitat structure. Additional habitat structural components can be reserved from the onsite clearing. Using the materials that are readily available onsite avoids the danger of introducing additional invasive species in the accompanying seed bank as well as reduces materials to be disposed of offsite. Habitat structural materials will be natural materials only. None of the assorted fill debris will be used. For example, 1) some brush piles can be created (small branches that will readily degrade but will provide cover and herbivore protection for plants in the short term of wetland establishment), 2) larger branches and small logs (less than 12 inch diameter and 6-10 feet long, mimicking small wind throws and providing habitat for reptiles and amphibians and small mammals), and 3) large logs (minimum diameter 12 inches and 10 feet long) from the cleared restoration sites will be reserved to be placed randomly around the new topography to provide additional structure at the ground level. Small root wads and stumps could also be used, but not large or obvious as to create an unsightly landscape in this high public profile location. A minimum of six (6) habitat structure components per acre will be reserved from the clearing efforts.

Performance Standards for Off-site Wetland Mitigation

Performance standards have been established to determine if the restored wetlands are progressing toward establishment of successful, diverse and functioning wetland. Wetland species will mean species listed as Facultative and wetter (FAC, FAC+, FACW-, FACW, FACW+, OBL). These standards will also be used to monitor progress for a period of five years (see Monitoring Plan below). If the performance standards are not met by the end of the 5-year monitoring period, the site will be monitored for an additional 5 years. The proposed performance standards for the restored wetland include:

- Construction will be completed in accordance with the MDEQ-approved plan and specifications referenced in the permit
- A minimum of six (6) habitat structures, consisting of at least three (3) types, have been placed per acre of mitigation wetland. At least 50 percent of each structure shall extend above the normal water level. The types of acceptable wildlife habitat structures are:
  - Tree stumps laid horizontally within the wetland area. Acceptable stumps shall be a minimum of 6 feet long (log and root ball combined) and 12 inches in diameter.
  - Logs laid horizontally within the wetland area. Acceptable logs shall be a minimum of 10 feet long and 6 inches in diameter.
  - Whole trees laid horizontally within the wetland area. Acceptable whole trees shall have all of their fine structure left intact (i.e., not trimmed down to major branches for installation), be a minimum of 20 feet long (tree and root ball), and a minimum of 12 inches in diameter at breast height (DBH).
  - Snags which include whole trees left standing that are dead or dying, or live trees that will be flooded and die, or whole trees installed upright into the wetland. A variety of tree species should be used for the creation of snag habitat. Acceptable snags shall be a minimum of 20 feet tall (above the ground surface) and a minimum of 12 inches DBH. Snags should be grouped together so as to provide mutual functional support as nesting, feeding, and perching sites.
  - Sand mounds at least 18 inches in depth and placed so that they are surrounded by a minimum of 30 feet of water measuring at least 18 inches in depth. The sand mound shall have at least a 200 square foot area that is 18 inches above the projected high water level and oriented to receive maximum sunlight.
- The minimum number of native wetland species shall not be less than:
  - 5 species of trees.
  - 5 species of shrubs.
  - 5 species of emergent vegetation.
  - 5 species of wet meadow vegetation.
- The total number of native wetland plant species shall be determined by a sum of all species identified in sample plots of the same wetland type.
- At the end of the monitoring period, the mitigation wetland supports a minimum of:
  - Three hundred (300) individual surviving, established, and free-to-grow trees per acre that are classified as native wetland species and consisting of at least three different plant species.
  - Three hundred (300) individual surviving, established, and free-to-grow shrubs per acre that are classified as native wetland species
- The mitigation area will be free of debris and any contaminants.
- Invasive plants will occupy no more than 10% of the vegetative cover in the restored wetland.

Monitoring Plan for Off-site Wetland Mitigation

Monitoring inspections will be conducted annually for a minimum of 5 years and reports will document that the project has met the performance standards for the off-site wetland mitigation. Annual monitoring will be performed between June 15 and September 30, with preference for the peak of the growing/fruiting season, late June through August and will include documentation of the following information:

Construction Documentation. During and immediately after construction the restored wetland will be examined and photographed to document adherence to the design plans.

Vegetation. For assessment of vegetation, two sampling transects (each 40 meters in length) will be used, one placed in each of the two restoration areas. These transects will be used to locate paired square meter sampling plots approximately 8 meters apart on the transect. One plot will be used to sample the nearest hummock and one plot the nearest pit to the transect. There will be a minimum of 5 paired plots (10 plots) per transect. If these transect-based plots do not sufficiently represent the variability of the restoration wetland, additional plots will be added with GPS locations with the rationale for need and selection documented. Sample points of transects will be GPS-documented, and mapped on a completed map of the restoration area. During the 5 year monitoring period, woody species will not be of sufficient size to merit the use of 10 square meter plots. The targeted square meter plots on hummocks will be a more effective way of sampling woody species.

In each square meter plot, plants will be identified to species and to the lowest possible taxon when species identification is not possible (example being immature sedges and grasses) and type (woody or herbaceous). Visual percent areal coverage by species (or appropriate taxon) will be recorded by plot. These data can be used to calculate descriptive statistics such as Shannon diversity index ($H' = -\sum p_i \log p_i$), Sorensen similarity index ($CC_J = 2c/s_1+s_2$). Non-parametric statistics can be used to compare ranked and percentage scores. Students t-test can be used to compare Shannon's diversity index among sites and/or years. Species lists (current scientific name, a common name, wetland status, woody or herbaceous, native or alien status) will be generated and percentages of wetland status species, woody/herbaceous, and native species calculated. The entire area will be examined for any significant un-vegetated areas. If such areas persist for more than 2 years, additional seeding/planting will take place.

Hydrology. A minimum of two basic water table wells made of perforated PVC will be installed at each restoration area (4 total), GPS-documented, and examined during the monitoring visit with depth to water table recorded. Any visible standing water in the pits will also be noted during these visits.

Photographic Record. At least three photographic points will be established for each of the two restoration areas (N-S and E-W) and a dated photographic documentation produced during each monitoring event.

Invasive Plant Control. The wetland restoration sites will be monitored annually for invasive plant species. Invasive plants discovered on site will be controlled in accordance with species specific best practices (i.e. manual removal, herbicide applications, etc.). Invasive species investigations will include documentation of species present, percent cover, and total acreage of infestation. Proposed control methods and timeline for implementation will be communicated to MDEQ via annual monitoring reports.

Wildlife. Any species of birds, mammals, amphibians, or reptiles present (or having left sign) during the monitoring period shall be reported. In addition, longer term records of birds from this area will be solicited from Laughing Whitefish Audubon and included in the monitoring report.

Reporting. An annual monitoring report, including relevant comparisons from previous years, will be produced and submitted to the MDEQ by January 31 of the year following the monitoring bout for each of the 5 years of monitoring. The report will include the date and time of the monitoring visit(s).

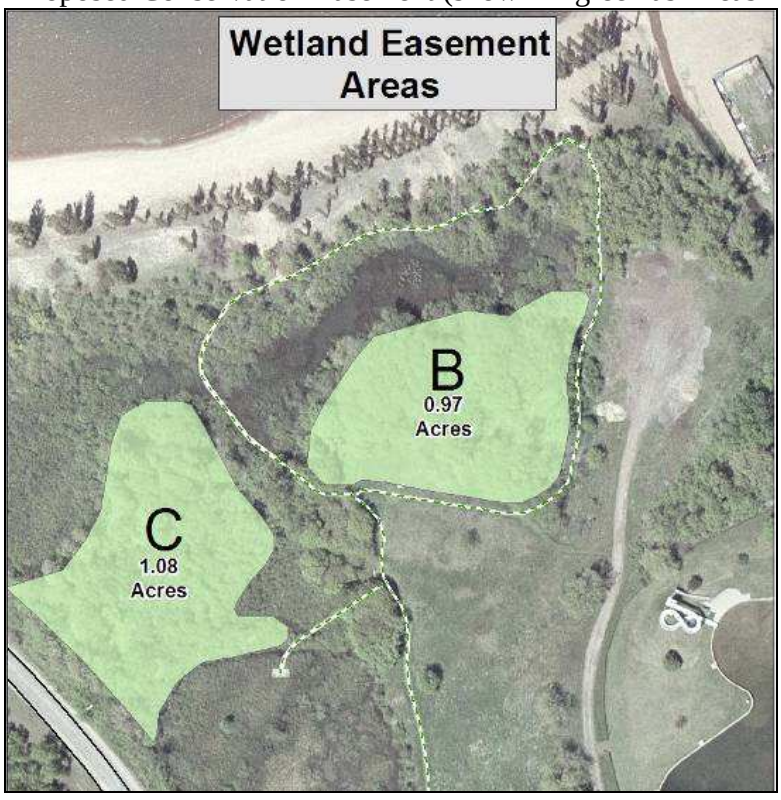
Remedial actions. If the site is found to be not meeting performance standards during annual monitoring events, the Engineer with consult with MDEQ regarding appropriate remedial actions.

Long-term Protection for Off-site Wetlands

The City of Marquette owns the property located at Presque Isle Park. The City will provide a conservation easement to protect the 2.05 acres of restored wetlands in perpetuity (Figure 7).

The presence and status of alien invasive species will be assessed during the yearly monitoring period. If control is indicated, this will be accomplished through mechanical means if possible. If chemical control is indicated, this will happen in a much targeted fashion with herbicides applied by a licensed applicator. If additional herbivore control is indicated, appropriate guards will be applied to woody plantings and any needed re-plantings will also occur**.**

Figure 7 Proposed Conservation Easement (shown in green as Areas B and C)



Schedule for On-site and Off-site Wetland Mitigation

The proposed on-site and off-site wetland mitigation will be constructed concurrently. The construction sequence assumes approval of permit application by end of 2011. Prior to construction/excavation, all necessary soil erosion and sedimentation control structures will be installed at the toe of all fill slopes and locations needed to prevent inadvertent discharge of sediment into adjacent wetlands or storm drain system. The soil erosion and sedimentation control structures/measures will be installed and maintained in accordance with applicable laws and regulations.

The wetland restoration (excavation/construction) is proposed to occur in spring 2012, as on-the-ground conditions allow. Herbaceous seed mixtures may be planted immediately along with an annual green cover crop (annual ryegrass and/or annual oats). Woody plants will be planted in late September-October 2012. In the event that the timing of excavation, local weather conditions, or availability of some native plants do not permit a complete fall planting, planting will be completed in Spring 2013.

Financial Assurances for On-site and Off-site Wetland Mitigation

The following are cost estimates for the on-site and off-site wetland mitigation, mitigation monitoring and development of two conservation easements. These costs will provide a basis for the restoration project on which a bond will be obtained. The City is proposing a bond in the amount of $100,000 to cover the estimated costs of mitigation construction and monitoring.

Budget Line Items	**Description (estimated quantities/costs)**	**Total Cost**
Construction		
Site clearing	~2 acres @ $3,000/acre	$ 6,000
Earth excavation, removal and disposal	7,000 cubic yards @ $7.00/cuyd	$ 49,000
Silt fence	1,500 linear feet @ $1.25/ft	$ 1,875
Final earthwork	~2 acres @ 10,000/acre	$ 20,000
Topsoil hauling	700 cubic yards @ $3.00/cuyd	$ 2,100
Trees	700 @ $2.00/plant	$ 1,400
Shrubs	700 @ $1.70/plant	$ 1,190
Tree protectors	700 @ $1.00/protector	$ 700
Seed	20 lbs. @ 210.00/lb	$ 4,200
Labor for planting		$ 5,000
Total Construction		**$ 91,465**
Mitigation Monitoring		
Post construction inspections and documentation	2 sites @ $300/site	$ 600
Annual field monitoring and report preparation	2 sites for 5 years @ $2,500/year	$ 12,500
Total Mitigation Monitoring		**$ 13,100**
Maintenance		
Invasive plant control	Estimated annual costs for invasive plant control (as needed)	$ 2,500
Maintenance (planting/seeding)	Estimated annual costs for planting/seeding (as needed)	$ 3,000
Total Maintenance		**$ 5,550**
Total Mitigation Costs		**$110,065**

Attachments

1) Conceptual Plan for McClellan Avenue Extension showing preferred alignment, wetland boundaries and proposed on-site restoration and preservation plans.

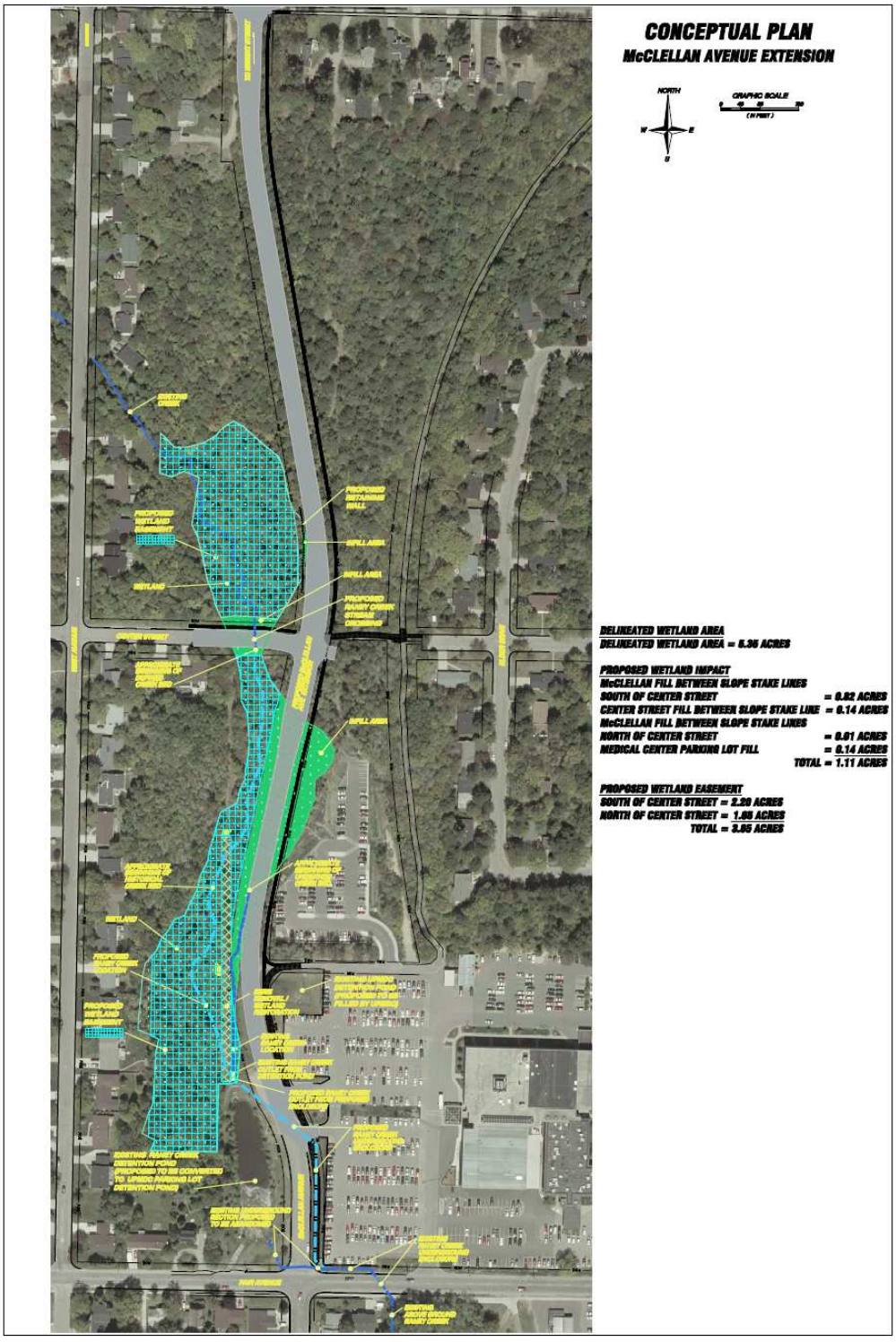
2) Plan views of the off-site mitigation area with contour elevations at one foot intervals and property features.

3) Typical cross sections for On-site and Off-site Wetland Mitigation.

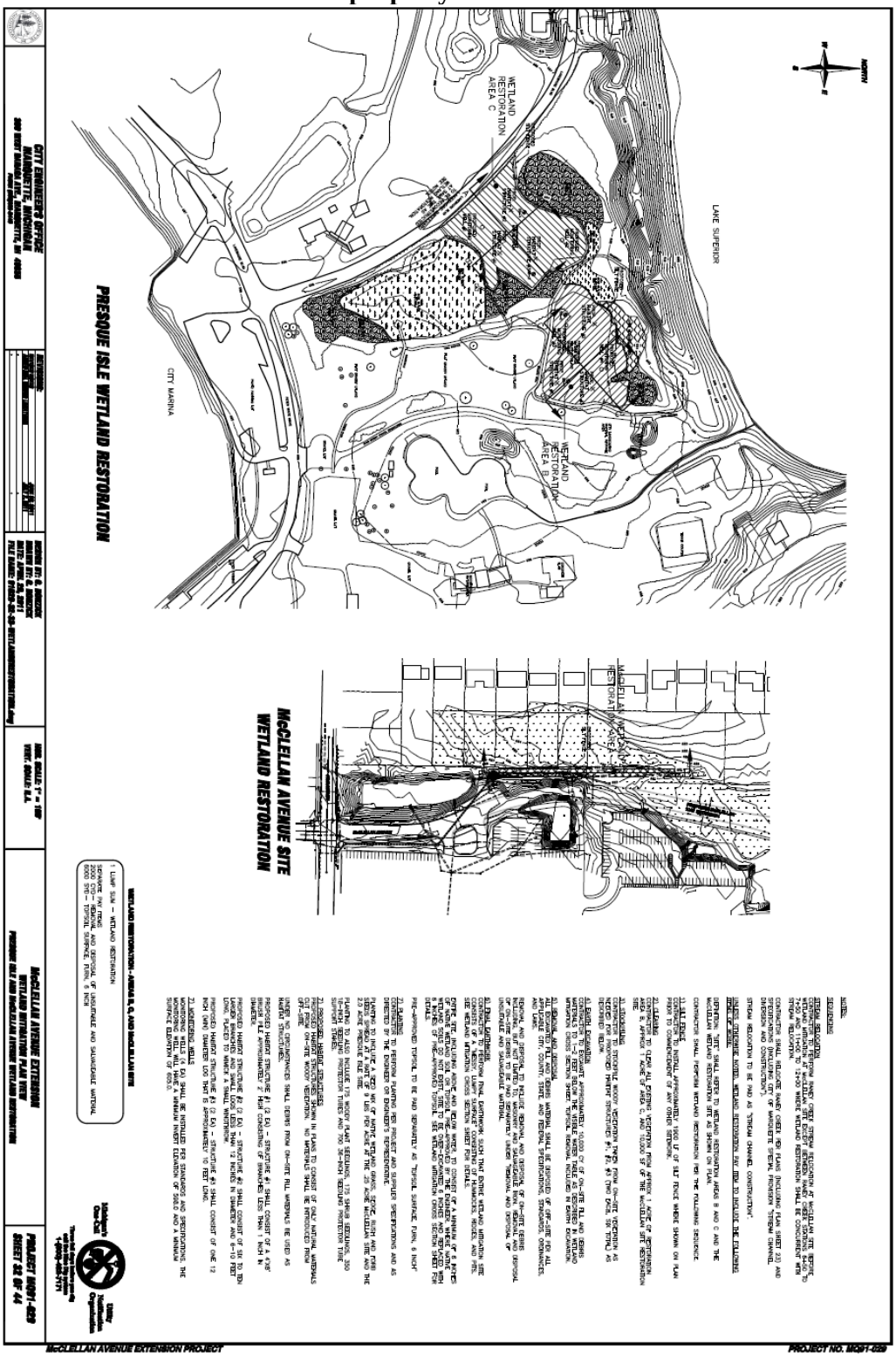
4) Stream monitoring data sheet for Raney Creek reconstruction.

5) Plant List for On-site and Presque Isle Wetland Mitigation

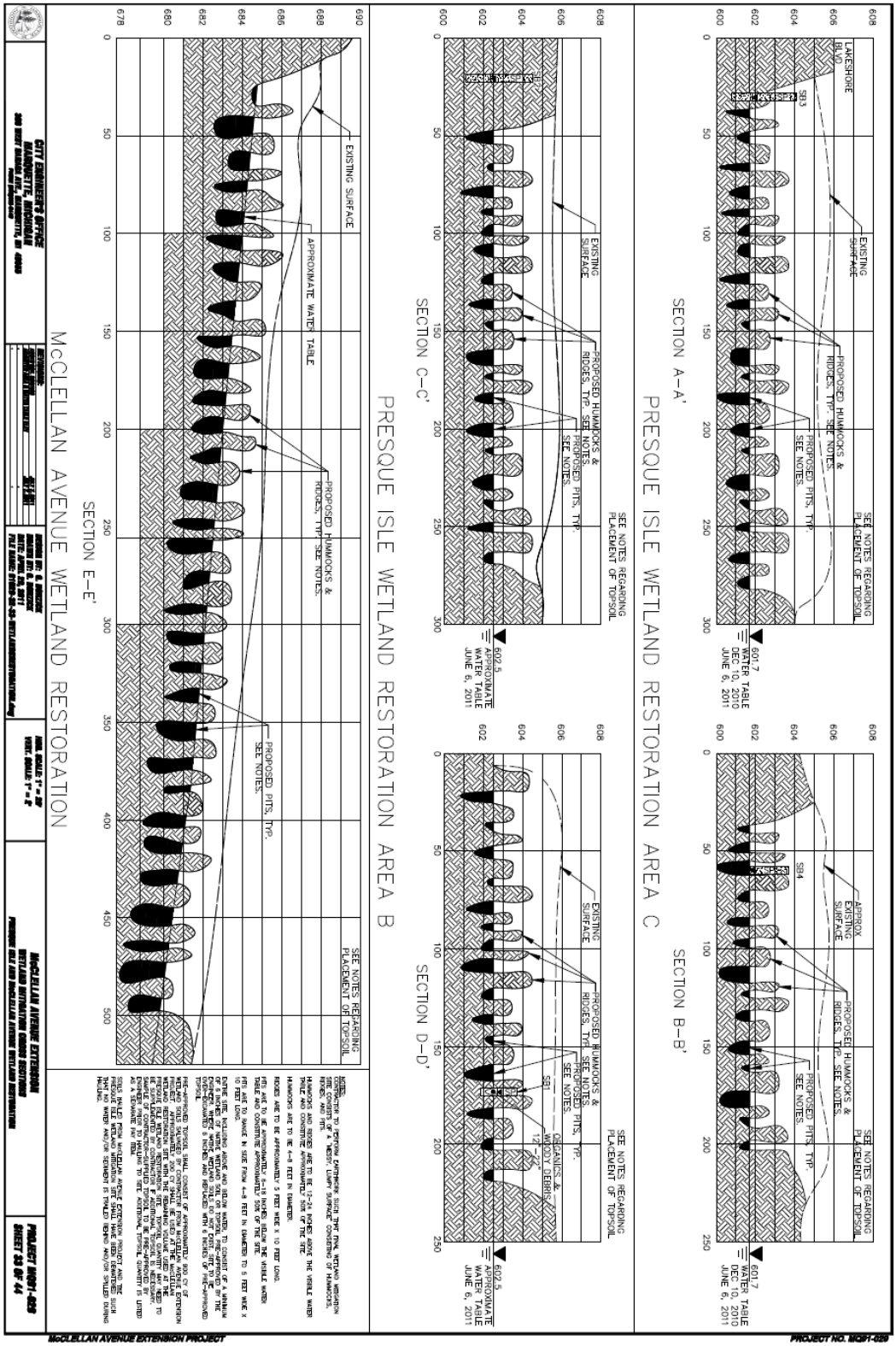
Attachment 1
Conceptual Plan for McClellan Avenue Extension showing preferred alignment, wetland boundaries and proposed on-site restoration and preservation plans



Attachment 2
Plan views of the off-site mitigation area with contour elevations at one foot intervals and property features



Attachment 3
Typical cross sections for On-site and Off-site Wetland Mitigation



Attachment 4
Data Sheet for Annual Monitoring of Raney Creek

Adopt-A-Station

Stream Station Description - Field Form

Station #: _____ Date: _____ Surveyors: _____

Upstream GPS: _____ Downstream GPS: _____

1. Transect Observations: All measurements occur starting at downstream origin, and banks (left, right) are determined while facing UPSTREAM

Transect No.	Distance from Origin (ft.)	Dominant Water Type *	Total Channel Width (ft)	Wetted Channel Width (ft)	Water Depth (ft) ** 1/4	1/2	3/4	Sand Depth (ft) ** 1/4	1/2	3/4	Bottom Type (%) ‡ B	BO	Co	G	S	O	C	I	Emb. (%) ***
1	0																		
2	60																		
3	120																		
4	180																		
5	240																		
6	300																		

*pool (1.5 times deeper than prevailing depth); riffle (distrubed, roiling surface); run (little surface disturbance).

Depths are measured from the **LEFT BANK while FACING UPSTREAM (first depth is taken 2.5 feet from left bank if the wetted width is 10ft)

*** Embeddedness for gravel: Where gravel is present, what percentage of gravel or small cobble particles is embedded (buried) in silt/sand?

‡ B-Bedrock, BO-Boulder (>10"), Co-Cobble (3"-10"), G-Gravel (1/8-3"), **S**-Sand, O-Organic (silt, detritus, muck), C- Clay, I- Island/Dry

2. Water Types*: Estimated % for entire Station % pool_____ %riffle_____ %run_____

3. Stream Observations: (Deep pool is 1.6x the prevailing depth of station)

Undercut Banks	Abundant	Moderate	Sparse	Absent
Overhang. Veg.	Abundant	Moderate	Sparse	Absent
Deep Pools	Abundant	Moderate	Sparse	Absent
Boulders (>10")	Abundant	Moderate	Sparse	Absent

Foam	Abundant	Moderate	Sparse	Absent
Oil Sheen	Abundant	Moderate	Sparse	Absent
Filamentous algae	Abundant	Moderate	Sparse	Absent
Trash	Abundant	Moderate	Sparse	Absent

4. Riparian Vegetation: Record **type** (using codes below) and %. Observe vegetation within 30' of bank for whole Station length (300')

Left Bank:_____

Right Bank:_____

Riparian vegetation classes:

YD - yard/lawn
AP - Agriculture, pasture
AR - Agriculture, row crops
GF - Grassland/Forb
SC - Small coniferous trees (up to 6" diameter)
LC - Large coniferous trees (> 6" diameter)
TA -Tag alder types
SD - Small deciduous trees (up to 6" diameter)
LD - Large deciduous trees (> 6" diameter)

5. Aquatic Vegetation:

Watercress:_____% Lilly pads/duckweed:_____% Cattails:_____%
pondweed:_____% eelgrass/aquatic grass:_____% Other:_____%

6. Fish and Wildlife Observations/Evidence:_____

7. Water Color (green, black, brown, clear):_____ **8. Turbidity** (low, moderate, high):_____ **9. Level** (low, normal, high):_____

10. Water Temperature (degrees C):_____ **11. Air Temperature** (degrees C):_____

12. Time of Day:_____ **13. Preceeding Weather:**_____ **14. Days Since Rain** _____

15. Streamflow:

Transect	Wet. Width	Avg Depth	Area (WxD)
1			
2			

Float distance = _____ ft.
Float time = _____sec. (Ave. of 3 floats)
Current velocity = ft./sec. X 0.9 = _____ ft./sec.

Average Area = _____ sq. ft.

Discharge = Aver. Area x velocity x roughness coefficient (0.9)
Discharge= _____cfs

16. Comments/Observations: Record "unusual" sightings. Examples: Eroded banks, buffer area infringement, ORV crossings, etc.

Attachment 5
Plant List for On-site and Off-site Wetland Mitigation

Forested Wetland Species:

- *Abies balsamea*, balsam fir (FACW)
- *Acer rubrum*, red maple (FAC)
- *Cornus stolonifera*, red osier dogwood (FACW)
- *Fraxinus nigra*, black ash (FACW+)
- *Fraxinus pennsylvanica*, green ash (FACW)
- *Ilex (Nemopanthus) mucronata*, (OBL)
- *Ilex verticillata*, winterberry (FAW+)
- *Larix laricina*, tamarack (FACW)
- *Pinus banksiana*, jack pine (FACU) (not a wetland indicator, but grows on ridges in dune swale wetland)
- *Pinus strobus*, white pine (FACU) (not a wetland indicator, but grows on ridges in dune swale wetland)
- *Populus balsamifera*, balsam poplar (FACW)
- *Populus tremuloides*, quaking aspen (FAC)
- *Salix discolor*, pussy willow (FACW)
- *Sorbus americana*, mountain ash (FAC+)
- *Thuja occidentalis*, northern white cedar (FACW)
- *Viburnum opulus* subsp. *trilobum*, highbush cranberry (FACW)
- *Viburnum lentago*, nannyberry (FAC+)

Scrub-shrub Wetland Species

- *Abies balsamea*, balsam fir (FACW)
- *Acer rubrum*, red maple (FAC)
- *Alnus incana*, tag alder (OBL)
- *Alnus crispa* (*viridis*), mountain alder (FAC)
- *Aronia melanocarpa (prunifolia*), chokeberry (FACW)
- *Ilex (Nemopanthus) mucronata*, (OBL)
- *Ilex verticillata*, winterberry (FAW+)
- *Myrica gale*, sweet gale (OBL)
- *Physocarpus opulifolius*, ninebark (FACW-)
- *Salix bebbiana*, Bebb's willow, FACW+)
- *Salix discolor*, pussy willow (FACW)
- *Salix lucida*, shining willow (FACW+)
- *Sambucus canadensis*, elderberry (FACW-)
- *Spirea alba*, meadowsweet (FACW+)
- *Viburnum opulus* subsp. *trilobum*, highbush cranberry (FACW)

Emergent Wetland Species

- *Alisma subcordatum*, water plantain (OBL)
- *Aster umbellatus*, flat-top aster (FACW)
- *Aster puniceus*, swamp aster (OBL)
- *Carex stricta*, tussock sedge (OBL)
- *Eleocharis acicularis*, spike-rush (OBL)
- *Eleocharis smallii*, spike-rush (OBL)
- *Eupatorium perfoliatum*, boneset (FACW+)
- *Glyceria canadensis*, reed manna grass (OBL)
- *Glyceria striata*, fowl manna grass (OBL)
- *Iris versicolor*, blueflag (OBL)
- *Juncus effusus*, soft stem rush (OBL)
- *Rumex orbiculatus*, great water dock (OBL)
- *Scirpus cyperinus*, woolgrass (OBL)
- *Scirpus atrovirens*, green bulrush (OBL)
- *Thalictrum dasycarpum*, tall meadow rue (FACW-)

Wet Meadow Species

- Anemone canadensis, Canada anemone (FACW)
- *Asclepias incarnata*, swamp milkweed (OBL)
- *Aster puniceus*, swamp aster (OBL)
- *Aster umbellatus*, flat-top aster (FACW)
- *Bidens cernuus*, beggarticks (OBL)
- *Bromus ciliatus*, fringed brome (FACW)
- *Calamagrostis inexpansa*, reed-grass (FACW+) (local source)
- *Carex bebbii*, sedge (OBL)
- *Carex hystericina*, sedge (OBL)
- *Carex scoparia*, pointed broom sedge (FACW)
- *Carex vulpinoidea*, sedge (OBL)
- *Eupatorium maculatum*, spotted Joe-pye weed (OBL)
- *Eupatorium perfoliatum*, boneset (FACW+)
- *Euthamia graminifolia*, grass-leaved goldenrod (FACW-)
- *Lobelia siphlitica*, great blue lobelia (FACW+)
- *Mimulus ringens*, monkeyflower (OBL)
- *Scirpus atrovirens*, green bulrush (OBL)
- *Solidago gigantea*, giant goldenrod (FACW)
- *Thalictrum dasycarpum*, tall meadow rue (FACW-)
- *Verbena hastata*, blue vervain (FACW+)