

Habitat Restoration Plan

Menekaunee Harbor Restoration

Marinette County, Wisconsin

Partners

City of Marinette, Wisconsin Department of Natural Resources & Environmental Protection Agency

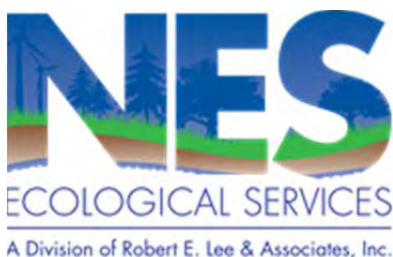


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INTRODUCTION & PROJECT BACKGROUND

Menekaunee Harbor is a 13-acre natural embayment of the Menominee River, and included within the boundaries of the Lower Menominee River Area of Concern (AOC) by the United States Environmental Protection Agency (USEPA). This AOC includes the lower three miles of the River, from the Park Mill Dam to the River's mouth, and approximately 3.1 miles north and south of the mouth along the adjacent shoreline of Green Bay. The Lower Menominee River AOC is one of 43 in the Great Lakes-St. Lawrence River Basin. Beneficial Use Impairments (BUIs) in the Lower Menominee River AOC include: restrictions on fish and wildlife consumption; degradation of fish and wildlife populations; degradation of benthos; restrictions on dredging activities; and loss of fish and wildlife habitat. Pollutants contained within the Harbor, caused by years of upstream heavy industrial manufacturing practices and non-point pollutant storm water run-off, contribute daily to the cause of the BUIs within the AOC.

The Menekaunee Harbor is located within the City of Marinette, Wisconsin, and lies adjacent to the Michigan-Wisconsin border at the mouth of the Menominee River where it enters the bay of Green Bay of Lake Michigan. The harbor is connected to the Menominee River by a 1,000-foot long navigable channel. Historically, the Harbor extended eastward to the shoreline of Green Bay and was an extension of the Lower Menominee River; however, sand dunes formed on the east side of the harbor following the construction of the government pier, establishing a natural barrier that protects the area from lake and storm activity. These geologic and hydrologic conditions support a formerly-diverse wetland complex that extends from the east pocket of Menekaunee Harbor eastward, toward the shoreline of Lake Michigan.

Historically, this wetland and the harbor area, acted as a feeding ground and breeding sanctuary for migratory birds and game fish which attracted anglers and birders alike. The shallow waters, submerged vegetation, and wetlands provided diverse and critical habitat for a variety of game fish, avian species, reptiles, amphibians, mammals, and invertebrates. This area continues to be an important wildlife resource, especially for migratory birds. Menekaunee Harbor along with Red Arrow Park and Seagull Bar State Natural Area can be important stopover or "fallout" locations during spring and fall migration due to their location near the mouth of the junction of Menominee River and Lake Michigan. However, due to reduced water levels of the Great Lakes, Menekaunee Harbor has lost its natural free-flowing river characteristics. Additionally, historical manufacturing practices along the River have resulted in degradation and contamination to this once diverse ecosystem. Hydrologic alteration has caused extensive sediment deposition which has added to the degradation of this wetland by contributing to the rapid spread of invasive plant species, subsequently decreasing plant species diversity and ecosystem functioning.

The City of Marinette (the City), in cooperation with the Wisconsin Department of Natural Resources (WDNR), is undertaking a restoration of the Menekaunee Harbor as part of the Great Lakes Restoration Initiative (GLRI). The WDNR provided the City with a \$1.1 million dollar environmental repair grant that was matched at 35% (\$611,474) by the City. In addition to these funding sources, the WDNR secured a \$6.565 million dollar grant from the USEPA's Great Lakes National Program Office (GLNPO) through the Great Lakes Restoration Initiative (GLRI). Ayres Associates was initially retained by the City to assist with the restoration, including baseline studies, planning, and design. Project components include replacement of a failing seawall, removal of sediment (due to contamination and navigation issues), and restoration of fish and wildlife habitat. The project background and baseline conditions found within the Habitat Restoration Plan were completed by Ayres Associates. The City then contracted with NES Ecological Services – A Division of Robert E. Lee & Associates, Inc. (NES) to complete the site design included within the plan. The Habitat Restoration Plan documents the recommendations by NES, the WDNR, and the Lower Menominee River AOC Fish and Wildlife Technical Advisory Committee for restoring native vegetation and optimal fish and wildlife habitat to the wetland complex at

the east side of the Harbor. The ecological habitat restoration addresses degradation of fish and wildlife populations, and the loss of fish and wildlife habitat.

Site Location

The Menekaunee Harbor is located east of the Ogden Street Bridge within the City of Marinette, Wisconsin, and lies adjacent to the Michigan-Wisconsin border at the mouth of the Menominee River where it enters the bay of Green Bay of Lake Michigan. The project site is located in the SW $\frac{1}{4}$ of the SW $\frac{1}{4}$ and the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 4, and the NW $\frac{1}{4}$ of the NW $\frac{1}{4}$ and the NE $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 9, Township 30 North, Range 24 East (Appendix A). The restoration areas will be accessed via a recreational trail along the south side of the harbor, with staging/parking from the gravel lot at the east end of Russell Street.

Restoration Objectives

The purpose of the Menekaunee Harbor ecological restoration is to restore native vegetation and habitat to a degraded wetland complex. This relates to the goals of the *2013 Fish and Wildlife Population and Habitat Management and Restoration Plan Update for the Lower Menominee River Area Concern*. The achievement of the goals outlined in that plan would mean that conditions have improved such that the BUIs of degradation of fish and wildlife populations and the loss of fish and wildlife habitat will no longer be applicable within the AOC. The goals include:

- Long-term protection is in place for natural areas and wetlands within the AOC, including Seagull Bar and riverine islands.
- Nesting populations of a diverse array of wetland-dependent and riparian-associated birds are consistently present within the AOC.
- The lake sturgeon (*Acipenser fulvescens*) population is enhanced.
- Diverse and functional native fish and mussel assemblages are present in the AOC that sustain natural recruitment.
- A healthy and diverse native vegetation community has been restored.

In support of these goals, the objectives and related target criteria of this restoration are as follows:

1. Restore benthic habitats for use by invertebrates and native fish species which historically utilize the harbor: walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), muskellunge (*Esox masquinongy*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), and bluegill (*Lepomis macrochirus*).
 - a) Eliminate contaminated sediments and establish water depths averaging 6-7 feet.
 - b) Install fish sticks, log structures, woody debris and rock to increase cover and feeding opportunities.
 - c) Establish small populations of submergent native vegetation in the harbor.
 - d) Eliminate and control invasive species within emergent aquatic communities, while establishing native plants to provide spawning habitat.
2. Establish healthy and diverse native vegetation communities
 - a) Restore/create community types found to be high priority communities within the Northern Lake Michigan Coastal Ecological Landscape.
 - b) Install a variety of ferns, grasses, sedges, forbs, shrubs and trees currently and historically found within Marinette County. Wild rice (*Zizania palustris*) was historically found within the Menominee River; therefore, an attempt will be made to re-establish a viable population.

- c) Increase plant diversity by added a few species typically found more often within southern Wisconsin to account for temperature increases due to global climate shifts.
- d) Absolute cover of invasive species will be < 15% within each community type.
3. Restore wetland and upland habitat for use by invertebrates, amphibians, reptiles, mammals and birds.
 - a) Native vegetation capable of providing a variety of food and cover will be established throughout the restored/created communities.
 - b) Existing snags will be left and protected to provide food sources and potential future nesting sites.
 - c) Rock and brush piles will be added to provide cover.
 - d) Downed woody debris will be placed in the emergent aquatic and wet meadow communities to provide sites for loafing and basking.
 - e) Nesting boxes and platforms will be installed to increase suitable nesting sites.
 - f) Bat houses will be erected to provide roosting sites.

In addition to the habitat benefits towards removing BUIs in the AOC, the project presents opportunities for public outreach, education, recreation, beautification, and connectivity with other nearby restoration projects. As a result of achieving the restoration objectives, the project will also increase wetland functional values significantly.

BASELINE CONDITIONS

The existing wetland complex is located in the southeastern portion of the Menekaunee Harbor and consists of open water, shallow marsh, and wet meadow, all degraded due to a dominance of invasive, non-native giant reed grass (*Phragmites australis*). The upland to the east is also dominated by invasive species, some of which are present in the wetland as well. The site is bordered by the Menekaunee Harbor to the west and north, by Lake Michigan shoreline to the east, and by industry and forested wetland to the south. Lands adjacent to the other portions of the harbor are largely developed and in industrial applications. See Appendix B for photographs of the site.

Topography

Topography at the site is nearly level to gently sloping, with the lowest areas along the west end at the inner part of the harbor. Elevations range from approximately 585 mean sea level (msl) at the east end of the site, to approximately 578 msl at the edge of water. Topography developed as sediment was continually deposited into the harbor over the past decades, and has not purposely been altered by human activities.

Geology and Soils

This site is located within the Green Bay Sandy Lake Plain subsection of the Northern Lake Michigan Coastal ecological landscape. The land type association is identified as Marinette Plains, which is nearly level lake plain with many swamps. Soils are predominantly somewhat poorly drained loamy fine sand over sandy lacustrine. Carbonate bedrock is present at a depth between 5-50 feet of the surface.

The Natural Resources Conservation Service (NRCS) does not have any soils mapped at the site, only water (Appendix C). However, adjacent lands have mapped soils of Udorthents, loamy (on the island north of the harbor) and Saprists and Psammaquents, ponded (to the southeast, along the shore of Lake Michigan). The Udorthents, loamy unit consists of loamy and/or sandy human-transported material, and is a somewhat excessively drained non-hydric soil. Both components of the Saprists and Psammaquents, ponded unit are very poorly drained hydric soils, with parent materials of organic material and sandy drift.

Soils further to the south at Red Arrow Park, a reference area for this restoration, are mapped as Saprists and Psammaquents, ponded, Seelyeville and Markey mucks, and Rousseau loamy fine sand. Both components of the Seelyeville and Markey mucks unit are very poorly drained hydric soils, with parent material consisting of herbaceous organic matter, partially over sandy lacustrine deposits and/or outwash. Rousseau loamy fine sand is a moderately well drained non-hydric soil, with parent material of predominantly fine sandy outwash.

Soils at the restoration site developed as sediments were deposited from not only the Menominee River, but also from Lake Michigan wave action. These soils most closely resemble the Saprists and Psammaquents, ponded, unit—within the lower, wet areas—and the Rousseau loamy fine sand unit at the higher and drier upland to the east. The discussed soils are summarized in the table below.

Table 1. Mapped Soils

SOIL SYMBOL	SOIL MAP UNIT	DRAINAGE CLASS	HYDRIC COMPONENT OR INCLUSIONS
RsB	Rousseau loamy fine sand	Moderately well	Non-hydric
Sa	Saprists and Psammaquents, ponded	Very poorly	Hydric
Sd	Seelyeville and Markey mucks	Very poorly	Hydric
Ud	Udorthents, loamy	Somewhat excessively	Non-hydric

Hydrology

The site is located within the lowest reaches of the Menominee River watershed. Hydrology at the site is associated with the water levels in the Menekaunee Harbor and Lake Michigan, which are directly adjacent. In comparison, the input from precipitation and overland runoff is negligible, especially given the small area that drains directly into the wetland. There has been no alteration of hydrology at the site, though there has been natural fluctuation as water levels in Lake Michigan change from year to year. For the last decade and a half water levels have been below average, though 2014 saw significant gains. The restoration does not focus on affecting hydrology, but rather on enabling the site to adapt should water levels rise or fall.

Existing Plant Communities

The Wisconsin Wetland Inventory (WWI) identifies the project site as a combination of scrub/shrub and emergent/wet meadow wetland (S3/E1K) and as flats/unvegetated wet soil (F0K) (Appendix C). However, during the field visit it was observed that the shrubs within the wetlands were entirely dead, and that the area designated as flats/unvegetated wet soil was actually partially wet meadow, and partially upland grassland.

Although the site historically supported wild rice at the wetland, it has most recently been dominated by invasive, non-native giant reed grass. The giant reed grass occurs in not only the shallow marsh parts of the wetland, but also in the slightly less saturated wet meadow areas. However, the fall of 2012 saw the site's first herbicidal treatment for the giant reed grass, with a second application conducted in the fall of 2014. During a site assessment in the fall of 2013 it was noted that the giant reed grass was responding very well to this treatment. However, plant diversity is still limited and has a high occurrence of other invasive species. An inventory of plant species observed at the site in the fall of 2013 by Ayres Associates is contained in Appendix D. Invasive species present included field sow-thistle

(*Sonchus arvensis*), spotted knapweed (*Centaurea biebersteinii*), Canada thistle (*Cirsium arvense*), white clover (*Trifolium repens*), giant reed grass, curly dock (*Rumex crispus*), butter-and-eggs (*Linaria vulgaris*), common mullein (*Verbascum thapsus*), and narrow-leaved cattail (*Typha angustifolia*).

Fish and Wildlife

Current use by wildlife is limited due to the contaminated sediments and impaired plant communities. The fish population is dominated by common carp (*Cyprinus carpio*), although historically the harbor supported diverse native species such as largemouth and smallmouth bass, muskellunge, northern pike, walleye, and yellow perch. There is minimal woody habitat along the shore for loafing or resting by reptiles and amphibians. Very little suitable forage or nesting habitat exists for wetland-dependent and riparian-associated birds. Wildlife observations included whitetail deer and mink. Being contiguous with Red Arrow Park and Seagall Bar on the Lake Michigan shoreline, this site has the potential to be a natural location for terrestrial wildlife to venture into.

The restoration has the potential to benefit a wide variety of invertebrate, bird, fish, mammal, reptile and amphibian species. Birds expected to utilize the restored wetland include but are not limited to: red-winged blackbird (*Agelaius phoeniceus*), wood duck (*Aix sponsa*), tree swallow (*Tachycineta bicolor*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), terns (*Sterna spp.*), gulls (*Larus spp.*), great blue heron (*Ardea herodias*), northern harrier (*Circus cyaneus*), and belted kingfisher (*Megaceryle alcyon*). Species within the following general groups will also benefit: waterfowl, seabirds, wading birds, birds of prey and passerines, many of which are migratory birds that could use the site as a stopover. Fish species which the aquatic habitat will be optimized for include: walleye, yellow perch, muskellunge, smallmouth bass, largemouth bass, bluegill, and northern pike. Mammals expected to frequent the site include the white tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), American mink (*Neovison vison*), raccoon (*Procyon lotor*), Eastern cottontail (*Sylvilagus floridanus*), Eastern gray squirrel (*Sciurus carolinensis*), Little brown bat (*Myotis lucifugus*), muskrat (*Ondatra zibethicus*), woodchuck (*Marmota monax*) and other small mammals such as moles, shrews and mice. Herpetofauna which may utilize the site include the Blanding's turtle (*Emydoidea blandingii*), painted turtle (*Chrysemys picta*), Eastern snapping turtle (*Chelydra serpentina serpentina*), common gartersnake (*Thamnophis sirtalis*), northern leopard frog (*Lithobates pipiens*), American toad (*Anaxyrus americanus americanus*), green frog (*Lithobates clamitans melanota*), gray tree frog (*Hyla versicolor*), and common mudpuppy (*Necturus maculosus*).

Functional Values Assessment

A wetland functional value assessment occurred through use of the Wisconsin Rapid Assessment Methodology. The purpose of this assessment was to be able to document the change in functional values following habitat restoration. Based on the results of this assessment, restoration as described in this document will increase the functional values of floristic integrity, human use values, wildlife habitat, fish and aquatic life habitat, and shoreline protection.

Floristic Integrity – **low**. Invasive species cover over 50% of the site, strata are missing or bare due to invasive species, communities are degraded to the point that they do not fit into the Natural Heritage Inventory classifications, nor are they uncommon.

Human Use Values – **low**. The site has limited use for recreation, but some ice fishing occurs and boating due to the presence of the adjacent private marina. However, the site is not used for educational or scientific purposes, is not aesthetically pleasing (low diversity of habitat types, degraded), does not provide habitat for endangered, threatened, or special concern species, and is not in or adjacent to an archaeological or cultural resource site. The site is, however, visually or physically accessible to the

public, and is in or adjacent to a “RED FLAG” area – Lake Michigan. RED FLAG areas are sensitive or unique water and terrestrial resources.

Wildlife Habitat – *medium*. The site does not have three or more strata present, does not have over 75% natural land cover intact within a 100 meter buffer, does not occur in a Joint Venture priority township, does not support or provide habitat for Species of Greatest Conservation Need or birds listed in the Wisconsin All-Bird Conservation Plan or other plans, is not part of a large habitat block that supports area sensitive species, does not have the presence of an ephemeral pond, and does not have the presence of seasonally exposed mudflats. However, there are over 10 acres of wetland and contiguous habitat, the site is within or adjacent to habitat corridor or an established wildlife habitat area, there is an interspersed of habitat structure, and standing water provides habitat for amphibians and aquatic invertebrates.

Fish and Aquatic Life Habitat – *medium*. The wetland is connected or contiguous with a perennial stream or lake, standing water provides habitat for amphibians and aquatic invertebrates, there are NHI-listed aquatic species within the aquatic system, and vegetation is inundated in the spring. The value is not greater due to the fact that the vegetation which is inundated is largely degraded, there are no tree drops for invertebrate habitat or amphibian loafing, and the sediments within the harbor are currently contaminated.

Shoreline Protection – *medium*. The site is along the shoreline of a stream, lake, pond, or open water area, there is theoretically the potential for erosion (though this has not been an issue), and there is densely rooted emergent vegetation. The value is not greater due to the fact that the densely rooted vegetation is degraded, and because the potential for erosion is currently very low due to limited boat traffic (sediments impede navigation) and there is a limited amount of water entering the harbor directly from the South Channel of the Menominee River to the west.

Flood and Storm water Storage – *low*. Water flow through the site is not channelized and there are a number of storm water outfalls to the harbor from industrial areas. However, the site is not a basin wetland and does not have a constructed outlet or through-flow, vegetation is not consistently dense and persistent, there is no evidence of flashy hydrology, there is no point or non-point source inflow directly onto the land portion of the wetland, impervious surfaces do not cover over 10% of land surface within the watershed, the watershed does not have less than 10% wetland, and the wetland does not have the potential to hold over 10% of the runoff from the contributing area from a 2-year 24 hour storm event.

Water Quality Protection – *medium*. The site does not provide substantial storage of storm and floodwater, is not a basin wetland or constricted outlet, vegetation is not consistently dense and persistent, storm water or surface water from agricultural land is not a major hydrology source, and natural land cover in a 100 meter buffer area is over 50%. However, water flow through the wetland is not channelized, it is a vegetated wetland associated with a lake or stream, there are signs of excess nutrients such as heavy macrophyte growth, and the site discharges to surface water.

Groundwater Protection – *low*. The wetland has organic soils in spots; however, there are no springs, seeps, or indicators of groundwater present, the site is not near a groundwater divide or a headwater wetland, and the wetland is not within a wellhead protection area.

SITE DESIGN

Seven habitat types will be established on the site (Appendix E) and planted with native vegetation. These habitat types are Open Water with Submergent Aquatic, Emergent Aquatic – Wild Rice, Emergent Aquatic, Northern Sedge Meadow, Shrub-Carr, Wet Mesic Forest and Mesic/Wet-Mesic Prairie. Plant communities were chosen based on several factors including: presence within adjacent reference sites such as Red Arrow Park and Seagull Bar found within Marinette County; historical presence based on

John Curtis's vegetation study presented in "The Vegetation of Wisconsin – An Ordination of Plant Communities" (1959); natural communities which are in greatest need of conservation or support wildlife species that are considered to be high priority Species of Greatest Conservation Need (SGCN) within the Northern Lake Michigan Coastal Ecological Landscape (Wisconsin's Wildlife Action Plan, 2005-2015); and existing site conditions including: depth of surface water, depth to groundwater, soil and light conditions, and current vegetative growth. Native vegetation species chosen to be installed within each community type were selected in a similar manner. In addition to using the above reference information, a search of the Robert W. Freckmann Herbarium was conducted to determine historical accounts within Marinette County and the State of Wisconsin. Correspondence with several native plant nurseries was also conducted to ensure species availability.

Many of the selected species are found to occur naturally in multiple community types with varying growing conditions; therefore, certain species are included in several planting zones. Species overlap between communities will ensure success when hydrologic conditions change over time. The majority of species proposed for planting are found commonly throughout Wisconsin; however, a few species typically found within southern Wisconsin were also added to account for potential plant community shifts in the future due to climate change. Chosen species will provide essential wildlife habitat and ground cover, while providing aesthetically pleasing communities in an urban setting.

In addition to establishing native vegetation within the proposed habitats, structural improvements will also be installed to improve feeding, shelter and nesting opportunities within each community type. Structures include submerged log and tree top (fish stick) complexes, exposed woody debris, rock and brush piles, snags and nesting boxes or platforms.

The proposed native planting plan and structural components for each community type are outlined and discussed below.

Design Features and Communities

Open Water with Submergent Aquatic Vegetation

The open water zone was previously dominated by Eurasian water milfoil (*Myriophyllum spicatum*) and common waterweed (*Elodea canadensis*); however, dredging operations completed in the summer and fall of 2014 to remove contaminated sediments as a part of the Menekaunee Harbor restoration have eliminated these and other species. Sunken woody debris was also removed during these operations. Following the removal of the contaminated sediments, the area was backfilled with two feet of native, non-contaminated sand. These activities along with a rise in water levels nearly two feet resulted in the creation of roughly 2.5 acres of open water within the habitat restoration area. Water depths range from 6 inches to 11 feet with an average water depth of less than 4 feet. Disturbance has resulted in a loss of wildlife habitat within the community; however, proposed submergent plantings and installation of woody debris will help restore habitat by providing cover, loafing, basking and feeding opportunities for a variety of invertebrate, fish, amphibian, reptile, mammal and bird species.

Site Preparation - Invasive Species Control

The rise in water levels during 2014 has resulted in some previously exposed areas dominated by emergent vegetation such as giant reed grass and cattails (*Typha spp.*) to be submerged. Herbicide applications completed in the fall of 2012 and 2014 as part of the Menekaunee Harbor restoration have significantly reduced or eliminated emergent vegetation within this portion of the zone. Mowing operations in the winter of 2015 removed most of the dead material. Although the eastern portion of the open water area will eventually revert back into an emergent aquatic zone as the adjacent community develops and expands, the current water depths limit successful planting. Therefore, the area indicated as an enhancement zone within the Open Water Community shall continue to have non-native and invasive

species controlled to ensure overall restoration success.

Invasive species control efforts will likely focus on, but are not limited to the following species: cattails, especially narrow-leaf and hybrid species (*Typha x glauca*), reed canary grass (*Phalaris arundinacea*), giant reed grass and purple loosestrife (*Lythrum salicaria*). Quick, early treatment of these species will save time and money down the road. Addressing invasive species will be an annual endeavor due to their ability to appear suddenly and spread quickly, but aggressive and proactive maintenance early on will limit future activities. Below are some steps that can be taken to address these species.

Prior to conducting any herbicide application over water, a permit for the chemical application needs to be secured from the Wisconsin Department of Natural Resources (WDNR); and, all posting and notification requirements must be followed. The entity or contractor must also have a Wisconsin Pollutant Discharge Elimination System (WPDES) general permit for Pesticide Pollutant Discharge for Control of Aquatic Plants, Algae and Bacteria. Individuals applying the herbicide must be a certified pesticide applicator through the State of Wisconsin in Category 5 – Aquatic & Mosquito. Businesses must also be licensed through the Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP). Records of each application must be kept and provided to the City of Marinette and the WDNR as required by law. All conditions including wearing the appropriate Personal Protective Equipment (PPE) listed on the chemical labels should also be followed.

Reed Canary Grass

Reed canary grass is an aggressive species and can be difficult to control with just one method. Although this grass can be located and identified early in the growing season, it may be more easily identify during the flowering stage. Seed heads on chemically treated plants have been found to produce viable seeds; therefore, the heads should be removed and disposed of properly to prevent further spread. The steps we recommend following include:

Single Plants or Small Clusters

- 1) Seed heads should be cut and placed in thick, plastic bags and removed to a licensed landfill facility for proper disposal.
- 2) A herbicide solution, including the chemical (AquaNeat® or Rodeo®, Habitat®, etc.), a surfactant or MSO, ammonium sulfate, and marking dye, should be applied through one of the below methods:
 - a) Apply solution containing 25-30% glyphosate or imazapyr to the plant using the “Glove of Death” technique. The technique involves spraying the solution onto a cotton glove that is worn by the applicator over chemically resistant gloves; the applicator then takes hold of the plant near the base and runs the cotton glove up the plant stem.
 - b) Broadcast spray solution containing 2% glyphosate or imazapyr on the target plants. Backpack sprayers are typically used. If plant densities are relatively low, this method is not generally used because there is an increased chance of impacting the surrounding, native vegetation through drift since glyphosate and imazapyr are non-selective herbicides.

Large Clusters or Populations

- 1) Grass should be cut prior to seed development and allowed to re-grow.
- 2) Conduct a broadcast spray as discussed above.

If the grass can be accurately identified prior to seed head development, the plant should either be hand wicked or broadcast sprayed in mid to late May to eliminate additional tasks. A follow-up treatment will likely be required in the fall.

A surfactant such as Activator 90 should be added to the herbicide solution because the wetting agent and activator helps break down the waxy leaf cuticle and increases herbicide uptake. Hard water and high pH can reduce the mixing ability and/or solubility of certain pesticides, especially glyphosate based products; therefore, ammonium sulfate (Choice® Weather Master) should be added to improve chemical uptake. A marking dye such as Hi-Light Blue should also be added to ensure appropriate coverage.

Purple Loosestrife

Control of purple loosestrife often requires site visits during the flowering stage to ensure all plants are located and eradicated. Since the quickest and easiest way to identify this invasive species is during the flowering stage, herbicide application alone will not provide total control. Flowers on chemically treated plants have been found to produce viable seeds; therefore, the flower heads should be removed and disposed of properly. Herbicide applications should occur in July and August to achieve best results. The steps we recommend following include:

Single Plants or Small Clusters

- 1) Cut seed heads and place in thick, plastic bags.
- 2) Herbicide remaining vegetation (see below).
- 3) Securely close bagged material and remove to a licensed landfill facility for proper disposal.

Large Clusters or Populations

- 1) Flower heads will be cut and placed in thick, plastic bags. If bags develop tears during the process due to puncturing by the plant's woody stem, the compromised bag and its contents will be placed inside another bag to achieve full containment.
- 2) A herbicide solution, including the chemical (AquaNeat® or Polaris®, etc.), a surfactant or MSO, ammonium sulfate, and marking dye, will be applied through one of the below methods:
 - a) Apply solution containing 25-30% glyphosate or imazapyr directly to cut stem with sponge type applicator so that it can be absorbed into the root system.
 - b) Apply solution containing 5% glyphosate or imazapyr to the plant using the "Glove of Death" technique. The technique involves spraying the solution onto a cotton glove that is worn by the applicator over chemically resistant gloves; the applicator then takes hold of the plant near the base and runs the cotton glove up the plant stem.
 - c) Broadcast spray solution containing 2% glyphosate or imazapyr on the target plants. Backpack sprayers are typically used. If plant densities are relatively low, this method is not generally used because there is an increased chance of impacting the surrounding, native vegetation through drift since glyphosate and imazapyr are non-selective herbicides.
- 3) Securely close bagged material and remove to a licensed landfill facility for proper disposal. Prior to moving the materials, all equipment and clothing will be inspected thoroughly to ensure no plant fragments or seeds are dispersed in the process.

Cattails

Although broad-leaf cattails are native, they can be very aggressive; therefore, they should be selectively controlled so that only a certain percentage occurs within the planting. All non-native cattails should be removed. Initial control can be conducted by manually pulling young plants and composting the material. After that time the following procedures should be implemented:

Plants found in water depths >3”

- 1) Stems are cut under the water surface two or three times during the growing season. When the stems are under water, the rhizomes are unable to receive an air supply, which is detrimental to the plant.
- 2) Material may be removed and composted.
- 3) For additional control, apply an herbicide solution containing 2% glyphosate or imazapyr, a surfactant or MSO, ammonium sulfate, and marking dye on new shoots after the initial cutting. Backpack sprayers are typically used. If plant densities are relatively low, this method is not generally used because there is an increased chance of impacting the surrounding, native vegetation through drift since glyphosate and imazapyr are non-selective herbicides.
- 4) If single plants or small clusters are present, apply solution containing 5% glyphosate or imazapyr to the plant using the “Glove of Death” technique. The technique involves spraying the solution onto a cotton glove that is worn by the applicator over chemically resistant gloves; the applicator then takes hold of the plant near the base and runs the cotton glove up the plant stem.

Plants found along the shoreline and in water depths <3”

- 1) Seed heads, if present, should be cut and properly disposed of at a licensed landfill.
- 2) A herbicide solution, including the chemical (Rodeo®, Habitat®, etc.), a surfactant or MSO, ammonium sulfate, and marking dye, should be applied in a manner similar to the methods discussed above for purple loosestrife control.

Herbicide applications should occur in August or September to achieve best results. Since much of the competing vegetation has been removed, the need for good pro-active cattail control will be important as they grow in the newly opened space. However, as long as they are removed the native vegetation will spread.

Giant Reed Grass

Like reed canary grass, giant reed grass can be very aggressive. The most current research and our fieldwork indicate that the following steps when implemented on mature plants are very effective control methods:

Single Plants or Small Clusters

- 1) Solution containing 25-30% glyphosate or imazapyr is applied to the plant using the “Glove of Death” technique in August or September. The technique involves spraying the solution onto a cotton glove that is worn by the applicator over chemically resistant gloves; the applicator then takes hold of the plant near the base and runs the cotton glove up the plant stem.

Large Clusters or Populations

- 1) Plants are tied together in manageable groups
- 2) Vegetation is cut approximately half way up the stems with loppers
- 3) Solution containing 25-30% glyphosate or imazapyr is sprayed on cut stems with either backpack sprayers or spray bottles in August or September.

Or

- 1) Cut/mow plants in late June or early July
- 2) Broadcast spray re-growth in late August or September with a solution containing 2-5% imazapyr on the target plants. Backpack sprayers are typically used.

Methods for the control of other invasive species that may be identified within the community during maintenance operations shall follow standard control practices within the industry or identified by the WDNR or the University of Wisconsin Extension.

Vegetation Establishment

To assist with re-vegetation of the open water community, six clusters of submergent aquatic plants (Table 2) shall be installed in water depths ranging from 24-36" in depth between mid-June and the end of July. Plant stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250 mile radius of the planting site. The restoration plan indicates the plant's approximate locations as site conditions will dictate their final installation point (Appendix E). Each cluster will contain 175 plants composed of a mixture of the below species. Plants will be installed on 12" centers by making a slit in the existing substrate with either the installer's hand or an instrument such as a tree planting bar. Once the hole is made, the plug or plant's roots will be installed. The entire root mass will be inserted to a depth that ensures the plant is secure and will not dislodge. If the nursery recommends additional means to secure the material to the substrate such as using staples or weights, they shall be utilized to ensure successful establishment. Periodic site visits shall be conducted during the weeks following the planting to re-install vegetation that has become dislodged.

Table 2. Submergent Aquatic Species, Planting Depths and Quantities.

<i>Species</i>		Planting Depth	No. of Plants Required
Common Name	Scientific Name		
Coontail	<i>Ceratophyllum demersum</i>	24-36"	150
Needle Rush	<i>Eleocharis acicularis</i>	24"	150
Water Smartweed	<i>Persicaria amphibia</i>	24"	150
Floating-leaf Pondweed	<i>Potamogeton natans</i>	24"	150
Long-leaved Pondweed	<i>Potamogeton nodosus</i>	24"	150
Sago Pondweed	<i>Stuckenia pectinata</i>	24-36"	150
Water Celery	<i>Vallisneria americana</i>	24-36"	150
		TOTAL	1,050

The submergent plants are to be planted in circular groupings that are approximately 15 feet in diameter. Once installation within a pod is complete, they shall be surrounded by wire to protect them from carp and other herbivores. The protective cages shall be constructed from 14 gauge welded wire with 2" x 4" openings. The wire shall be 48" in height and attached to 5 ½ - 6' metal t-posts placed at roughly five-foot intervals around the outer perimeter of the planting zone. The posts shall be installed within the substrate so they are stable and secure. Wire shall then be fastened to the posts in three (3) locations utilizing 8" UV stabilized zip ties (Appendix F - Carp Fencing Detail). Irregular shaped groupings are acceptable as long as they are adequately protected with the above fencing system. To increase visibility for potential boaters within the area, the upper portion of the metal posts shall be painted in a highly visible color and marked with reflectors in a manner acceptable to the City of Marinette and the WDNR. The fencing system shall be repaired and maintained for a minimum of two years (2015-2016) after installation and then removed in the fall of 2016. If additional protection is warranted, the fencing shall remain through 2017.

Habitat Structure Installation

Due to a lack of structure within the water column for aquatic organisms, woody debris in various forms will be added to the Open Water Community. Sunken log structures are expected to provide cover and habitat for a variety of aquatic insects, amphibians, reptiles and fish. Exposed portions of trees placed within the water along the shoreline will provide feeding and resting opportunities for a diverse group of amphibians, reptiles, mammals and birds.

A Chapter 30 permit was issued by the WDNR to conduct the dredging operations and ecological restoration activities, but these activities were not defined. Because each of the below structures will be placed in a navigable water of the state, additional permits will likely be required. Restoration activities must adhere to Wisconsin Administrative Codes NR 103, NR 323, and NR 353. Prior to work beginning on-site, it will be necessary to obtain permit coverage. General Permits include Wetland Conservation Activities, Habitat Structure – Fish Half Log, Habitat Structure – Fish Sticks, Habitat Structure – Wildlife Nesting Structure and Lakeshore Erosion Control – Biological. Sunken logs are not currently covered under a general permit; therefore, a Chapter 30 Individual Permit will likely be required for placement of these structures.

In addition to the woody debris, nesting platforms for Forster's terns will be placed in the open water community to improve additional habitat opportunities for this species. The tern is considered a SGCN within the Northern Lake Michigan Coastal Ecological Landscape; therefore, efforts to improve their populations are being considered since suitable habitat is expected to be present as part of this restoration.

Sunken Logs

When the harbor was dredged to remove contaminated sediment in 2014, the contractor removed many sunken timbers from within the area. The logs were salvaged and stockpiled. The wood likely provided some limited habitat and cover opportunities; therefore, we are recommending several of the logs be sunk in the deep water portions (7-11') of the open water community to restore and improve the underwater habitat. Rather than just sinking the wooden timbers so they lay on the bottom of the harbor, a series of three logs of varying lengths (10-20') and diameter (8-16") shall be cabled together in a crisscross fashion and dropped through the water column (Appendix F – Sunken Log Detail). The logs were at one time waterlogged, which will reduce their buoyance. Cabled together the logs would likely sink to the bottom and not move with wave action or water current; however, to ensure the materials sink and remain in place, one end of each log shall have concrete cast around it prior to them being cabled together. The concrete cast shall be one-foot thick around the entire timber and a minimum of 2 feet of the log's end shall be covered. The design will ensure space is created above the harbor bottom to provide cover. Six such structures (18 salvaged logs) shall be placed within the open water community. To improve cover within an area, two structures shall be placed in close proximity to one another or so they overlap slightly. The restoration plan indicates the structure's approximate locations (Appendix E). Installation of the log structures can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier, by pulling them off a barge into position or they may be placed on the ice during the winter of 2015-2016, if conditions permit, and allowed to sink in the spring during ice melt.

Half Logs

Four half log structures will be placed within 100 feet of the shoreline at a water depth of approximately 2-4 feet where the substrate is primarily sand. Appendix E indicates the structure's approximate locations; site conditions will dictate their final installation point. Logs salvaged during the dredging operation shall also be utilized to construct these structures. Timbers having a diameter of 16-20 inches shall be cut into 6-8 foot lengths and then then cut in half lengthways, resulting in a finished product with a flat bottom and rounded top. To create space between the structure and harbor bottom, two concrete cinder blocks $\leq 12''$ in height will be used attached as spacers. Two six foot reinforced rods will be used to anchor the blocks to each log and secure the structure into the sediment (Appendix F – Half Log Detail). Installation of the half log structures can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier.

Fish Sticks

Trees to be utilized for these structures shall be hardwood species such as oak that range from 40-70 feet in height with a minimum diameter of 8". Trees shall have intact tops with multiple branches to provide underwater structure and cover. Trees will be freshly harvested no more than four weeks prior to installation from an off-site location and transported to the restoration site for placement. Five groupings

with three to four trees per group will be placed along the shoreline on the south side of the open water community (Appendix E). The groups will be spaced approximately 50 feet apart with final placement based on site conditions. Trees shall be placed near shore with their trunks emerging approximately 10-15' from the water and resting on the shoreline. Tops shall extend into the adjacent shallow water up to depths of roughly three feet. To ensure the trees remain in place and are not moved by fluctuating water levels, they will be anchored to 3" diameter galvanized steel pipes located on shore. Because of safety concerns with recreational users in the areas, the 10-12' steel piping will be driven subsurface so the top of the pipe is approximately one foot below ground and covered. Prior to setting the pipe, each one will be drilled to allow 3/8" galvanized steel cables to be attached with cable clamps. Once the pipes have been set, cables from the pipes will be attached to the trees. Two pipes will be used per grouping of trees; and, each pipe will be attached to two separate tree trunks within the group. Each tree grouping will be secured together around each trunk with a minimum 3/8" galvanized cable and cable clamps (Appendix F – Fish Stick Detail). Installation of the fish sticks can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier, by putting them into position with heavy equipment.

Forster's Tern Nesting Platforms

Since this species is a colonial nester, a group of ten pre-constructed nest platforms will be placed in a portion of the open water community that was recently composed of emergent vegetation (Appendix E). Water depths will range from 1-2' in depth. Although the platforms may not be immediately surrounded and sheltered by stands of emergent vegetation, future expansion of the Emergent Aquatic zone should provide a suitable surrounding to encourage potential tern nesting. Instructions for constructing the platforms can be found in Appendix F. Once constructed, they are to be filled with wet, decomposing marsh vegetation, which can be gathered from the restoration site. The cattail leaves required to create a shaded corner on the platform for tern chicks can also be collected on-site. When the platforms are placed in the water, the 1/4" polypropylene anchor rope installed during construction, which shall be approximately four feet in length, will be attached to a brick to keep the nests from floating away, but allow for a potential rise in water. Platforms may be placed as early as June 1st, but tern nesting will have likely already begun. Their presence in 2015 will expose potential future occupants to their presence.

Emergent Aquatic – Wild Rice

The emergent zone was previously dominated by giant reed grass; however, herbicide applications completed in the fall of 2012 and 2014 as part of the Menominee Harbor restoration have significantly reduced or eliminated emergent vegetation within this zone. Mowing operations in the winter of 2015 removed most of the dead material. The lack of existing vegetation, rise in water levels nearly two feet and location adjacent to a source of flowing water provides an opportunity to potentially re-establish wild rice within the area as it was historically found in the Menominee River.

Based on correspondence with Peter David of the Great Lakes Indian Fish & Wildlife Commission, wild rice grows in 6-36" of standing water with 18-24" being the ideal depth. Although conditions will change in the future as water levels drop or rise, much of the proposed planting zone falls within the optimum water depth; therefore, we believe an effort to establish the species is worthwhile. Mr. David also recommends establishment within a large enough area (> 1 acre) so the stand can withstand wildlife browse as this species is utilized as a food source by a variety of birds and mammals. Rice beds also provide good brood rearing habitat and cover for waterfowl and nesting opportunities for other wetland dependent birds. The emergent plants also provide excellent nursery areas for amphibian and fish species.

In addition to providing excellent opportunities for wildlife, wild rice has significant historical and cultural value. The seed has long been a staple within the diets of Native Americans living within its range including the Menominee. According to Mr. Guy Reiter, Menominee Nation historian and anthropologist, the tribe's creation story indicates they came from the mouth of the Menominee River. Mr. Reiter says, "Menominee translates to the 'people of the wild rice'. Our elders say that the rice

follows us where ever we go. Our elders say that before we plant ‘Maehnomah’ (wild rice), a prayer and offerings are done to have a successful crop”. The Menominee Nation’s deep connection with the area and “Maehnomah” provides this project with an additional opportunity to incorporate traditional ceremonial activities into the project. Mr. Reiter states, “It would be an honor to be able to help restore our rice back on the river plus for our tribe to reconnect with the area”.

The wild rice bed will be the main restoration component within this community; however, the installation of some woody debris (brush pile) and rock will help increase habitat diversity by providing cover, loafing, basking and feeding opportunities both above and below water within the community for a variety of invertebrate, fish, amphibian, reptile, mammal, and bird species.

Site Preparation - Invasive Species Control

The Emergent Aquatic – Wild Rice Planting Zone shall continue to have non-native and invasive species controlled to ensure overall restoration success. Site preparation activities discussed in the Open Water with Submergent Aquatic Vegetation Zone shall be followed.

Vegetation Establishment

To assist with re-vegetation, wild rice shall be seeded at a 100 pounds per acre throughout the Emergent Aquatic – Wild Rice Planting Zone (Appendix E) in water depths ranging from roughly 6-30” in depth during the fall of 2015. The exact seeding location will be established in the field based on current site conditions. Sowing dates will vary depending on the seed source, but should occur between October 15th and November 30th, 2015. The below criteria regarding seed will be followed:

- 1) Native seed stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250 mile radius of the planting site.
- 2) Seed shall come from a source harvested during the fall of 2015. Wild Rice shall be sown within a few days of harvest.
- 3) If seeding must be delayed, rice must be adequately stored in grain sacks within a water source to prevent it from drying out or heating up.
- 4) Seed “finished” for human consumption shall not be utilized.

Seed shall be distributed by hand from a watercraft that allows suitable access to the entire planting zone. Rice shall be scattered as evenly as possible throughout the entire seeding zone. Seeding shall not occur during the following conditions:

- 1) Frozen water conditions
- 2) Wind speeds >10 miles per hour

Habitat Structure Installation

Due to a lack of structure within the water column for aquatic organisms, woody debris and rock will be added to the Emergent Aquatic – Wild Rice Planting Zone. Brush and rock piles with components below water are expected to provide cover and habitat for a variety of aquatic insects, amphibians, reptiles and fish, while the exposed portion of the pile will provide feeding and resting opportunities for a diverse group of amphibians, reptiles, mammals and birds.

A Chapter 30 permit was issued by the WDNR to conduct the dredging operations and ecological restoration activities, but these activities were not defined. Because each of the below structures will be placed in a navigable water of the state, additional permits will likely be required. Restoration activities must adhere to Wisconsin Administrative Codes NR 103, NR 323, and NR 353. Prior to work beginning on-site, it will be necessary to obtain permit coverage. Neither rock nor brush piles appear to be currently

covered under a general permit; therefore, a Chapter 30 Individual Permit will likely be required for placement of these structures.

Brush Pile

Appendix E indicates the structure's location. During the winter of 2014 a tree top was placed at this location and has remained. The existing top shall be used as the base for beginning construction of the brush pile. To help ensure the structure remains in place, three 6-8' long logs with a diameter of 6-8" shall be placed on the top with one end resting on the existing tree top. If available, logs salvaged during the dredging operation shall also be utilized to construct these structures. Similar to the fish stick construction, the 3 logs shall be secured to the tree top with a minimum 3/8" galvanized cable and cable clamps. The opposite ends of the 3 logs shall then be secured with "duckbill" earth anchors, one for each log. Anchors shall be driven a minimum of 3' into the substrate. The opposite end shall then be cabled to the log. The anchoring system shall at a minimum be composed of a 3" anodized aluminum anchor, 1/8" galvanized cable that is 5 feet in length and galvanized cable clamps to secure the system to the logs (Appendix F – Brush Pile Cabling Detail). Once the base is secure, limbs and sticks found throughout the restoration site shall be woven and piled on the logs and top to create the pile (Appendix F – Brush Pile Detail). Tops from trees to be removed from the south shore should provide adequate material; however, if enough debris is not available, the Contractor shall find an off-site location. The City of Marinette's composting site may provide the necessary material. Any imported material must be "disease free". When complete, the pile shall be 12-15' in diameter and roughly five feet in height, resulting in approximately three feet above the existing waterline. Due to site conditions, materials will need to either be brought in and placed by hand or placed by equipment from a boat or barge to ensure minimal damage to the remaining restoration area. Installation of the brush pile can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier.

Rock Pile

A rock pile shall be constructed in the approximate location shown in Appendix E; however, site conditions will dictate its final installation point since water depths shall be no more than 2 feet in depth. Rounded field stone ranging in size from 6-36" shall be placed in a manner that creates an interlocking, stable mound. The base shall be roughly 10 feet wide with the top extending a minimum of three feet above the waterline. One side of the pile shall have a shelf near the water line to improve use by turtles and amphibians (Appendix F – Water Rock Pile Detail). Due to site conditions, rocks will need to either be brought in and placed by hand or placed by equipment from a barge to ensure minimal damage to the remaining restoration area. Installation of the rocks can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier.

Emergent/Floating-Leaved Aquatic

Like the Emergent Aquatic - Wild Rice Planting Zone, this emergent zone was dominated by giant reed grass; and, herbicide applications were completed in the fall of 2012 and 2014 as part of the Menekaunee Harbor restoration. Invasive species have been significantly reduced or eliminated. Mowing operations in the winter of 2015 removed most of the dead material. The lack of existing vegetation and rise in water levels nearly two feet provides an opportunity to establish a diverse stand of emergent species. Emergent Marsh is considered a High Priority Natural Community within the Northern Lake Michigan Coastal Ecological Landscape; therefore, efforts to improve or restore a similar habitat type are expected to greatly benefit many wildlife species. The installation of native aquatic plants along with some woody debris will help restore habitat within this zone by providing cover, loafing, basking and feeding opportunities for a variety of invertebrate, fish, amphibian, reptile, mammal and bird species.

Site Preparation - Invasive Species Control

The Emergent Aquatic Planting Zone shall continue to have non-native and invasive species controlled to ensure overall restoration success. Site preparation activities discussed in the Open Water with Submergent Aquatic Vegetation Zone shall be followed.

Vegetation Establishment

The restoration plan indicates the approximate planting zone location (Appendix E). The exact planting location will be established in the field based on current site conditions. To assist with re-vegetation of the shallow water community, emergent and floating-leaved aquatic plants (Table 3) shall be installed in water depths ranging from 0-12” in depth between mid-June and the end of July. Plant stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250 mile radius of the planting site. Planting these species at shallower water depths ensures an adequate portion of the plant is above water which increases its ability to receive sunlight, take advantage of warmer shallow waters, and minimize the amount of inundation time after storm events. The shallower planting depth will allow the community to fill in more quickly and become well established so the plants can spread into the adjacent Open Water Community and provide additional above water habitat.

Species shall be randomly placed in “clumps” of 5-10 individuals each within their respected planting depth. Aquatic vegetation within a “clump” will be planted on approximate 24” centers throughout the zone. All species within a given “clump” will be the same, and the maximum distance between “clumps” will be five feet. Planting of the live material will be done by making a slit in the substrate with either the installer’s hand or an instrument such as a tree planting bar. Once the hole is made, the container holding the plant shall be gently removed and any encircling roots shall be unwound. Exceptionally long roots shall be shortened. The plug or plant’s roots shall then be inserted into the hole. The entire root mass shall be inserted to a depth that ensures the plant is secure and will not dislodge. Native soil material shall be used to backfill the hole. If the nursery recommends additional means to secure the material to the substrate such as using staples or weights, they shall be utilized to ensure successful establishment. Periodic site visits shall be conducted during the weeks following the planting to re-install vegetation that has become dislodged.

Table 3. Emergent/Floating-Leaved Species, Planting Depths and Quantities.

<i>Species</i>		Planting Depth	No. of Plants Required
Common Name	Scientific Name		
Common Water-plantain	<i>Alisma subcordatum</i>	0-6”	150
Water-shield	<i>Brasenia schreberi</i>	6-12+”	350
River Bulrush	<i>Bolboschoenus fluviatilis</i>	6-12”	550
Water Sedge	<i>Carex aquatilis</i>	0-3”	450
Bristly Sedge	<i>Carex comosa</i>	0-3”	500
Common Lake Sedge	<i>Carex lacustris</i>	0-3”	450
Great Spike Rush	<i>Eleocharis palustris</i>	0-3”	250
Reed Manna Grass	<i>Glyceria grandis</i>	0-3”	300
Northern Blue Flag	<i>Iris versicolor</i>	0-3”	550
Soft Rush	<i>Juncus effusus</i>	0-3”	325
Yellow Water-lily	<i>Nuphar advena</i>	6-12+”	325
White Water-lily	<i>Nymphaea odorata</i>	6-12+”	250
Pickrel Weed	<i>Pontedaria cordata</i>	0-6”	850
Common Arrowhead	<i>Sagittaria latifolia</i>	0-6”	900
Hardstem Bulrush	<i>Schoenoplectus acutus</i>	6-12”	850
Chair-maker’s Rush	<i>Schoenoplectus pungens</i>	0-6”	1,150
Softstem Bulrush	<i>Schoenoplectus tabernaemontani</i>	6-12”	1,400
Common Bur-reed	<i>Sparganium eurycarpum</i>	6-12”	1,400
		TOTAL	11,000

Prior to installing the plants, both carp and goose fencing shall be erected around the planting zone perimeter. The in-water fencing will serve to prevent both carp and geese from accessing the zone via the water. As with the protective cages constructed to protect the submergent aquatic plants, 14 gauge welded wire with 2" x 4" openings will be utilized. The wire shall be 48" in height and attached to 5 ½ - 6' metal t-posts placed at roughly five-foot intervals along the outer perimeter of the planting zone. The posts shall be installed within the substrate so they are stable and secure. Wire shall then be fastened to the posts in three (3) locations utilizing 8" UV stabilized zip ties (Appendix F - Carp Fencing Detail). To increase visibility for potential boaters within the area, the upper portion of the metal posts shall be painted in a highly visible color and marked with reflectors in a manner acceptable to the City of Marinette and the WDNR. The fencing system shall be repaired and maintained for a minimum of two years (2015-2016) after installation and then removed in the fall of 2016. If additional protection is warranted, the fencing shall remain through 2017.

In addition to the in-water fencing, another fence shall be erected on the landward side of the planting perimeter to prevent geese and deer from walking into the zone (Appendix F – Goose Fencing Detail). The following steps shall be taken:

- 1) Before live plants are installed, 5 ½ - 6' metal t-posts shall be placed at roughly ten-foot intervals around the outer perimeter of the planting zone. The posts shall be installed within the substrate so they are stable and secure.
- 2) Green safety/snow fence 48" in height shall be attached to each post at a minimum of three (3) locations using utilizing 8" UV stabilized zip ties. Fencing shall be tight once secured.
- 3) Nylon rope or baling twine shall be attached between the inner and outer posts in a cross-hatch pattern over the planting area once planting in a section is completed. Additional metal t-posts will also need to be installed between the carp and goose fencing at roughly 20' intervals to prevent too much slack in the rope (Appendix F – Goose Fencing Detail). The additional twine will deter geese from flying into the planting.
- 4) Goose fencing shall be maintained throughout two full growing seasons. Provided the plantings are successfully established, the fencing can be removed after October 1st and before November 15th, 2016; however, if plants need to be replaced and protected through another growing season, the fence shall remain for a third growing season.

Habitat Structure Installation

Due to a lack of structure within and adjacent to the water for aquatic organisms, woody debris will be added to the Emergent/Floating-Leaved Aquatic Planting Zone. Sections of logs below the water are expected to provide cover and habitat for a variety of aquatic insects, amphibians, reptiles and fish, while the exposed portion of the logs will provide basking and loafing opportunities for a diverse group of amphibians, reptiles and birds.

A Chapter 30 permit was issued by the WDNR to conduct the dredging operations and ecological restoration activities, but these activities were not defined. Because the log structures will be placed in either a navigable water of the state or a wetland, additional permits will likely be required. Restoration activities must adhere to Wisconsin Administrative Codes NR 103, NR 323, and NR 353. Prior to work beginning on-site, it will be necessary to obtain permit coverage. General Permits include Wetland Conservation Activities. Log structures do not appear to be currently covered under a general permit; therefore, either a Chapter 30 or Wetland Individual Permit will likely be required for placement of these structures.

Logs

The logs shall be placed in the approximate locations shown in Appendix E; however, site conditions will dictate their final installation points since water depths shall be shallow enough to allow portions of the

logs to remain above the existing water level. Logs salvaged during the dredging operations shall be utilized. The number of logs to be installed at each location will depend on availability once the log structures are constructed for the Open Water Community. One or two wooden timbers of varying lengths (10-20') and diameter (8-16") shall be installed so that approximately one half of the log is above water. To help ensure the structures remain in place, they shall be anchored similar to the logs used to construct the in-water brush pile. Each end of the logs shall be secured with "duckbill" earth anchors, two per log. Anchors shall be driven a minimum of 3' into the substrate. The opposite end shall then be cabled to the log. The anchoring system shall at a minimum be composed of a 3" anodized aluminum anchor, 1/8" galvanized cable that is 5 feet in length and galvanized cable clamps to secure the system to the logs (Appendix F – Log Securing Detail). Due to site conditions, materials will need to either be brought in and placed by hand or placed by equipment from a boat or barge to ensure minimal damage to the remaining restoration area. Installation of the logs can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier.

Northern Sedge Meadow

Much of the northern and southern portions of the Northern Sedge Meadow Planting Zone were dominated by giant reed grass; however, herbicide applications completed in the fall of 2012 and 2014 as part of the Menekaunee Harbor restoration have significantly reduced or eliminated the species. Mowing operations in the winter of 2015 removed the dead material. Based on site visits conducted by NES ecologists outside the growing season, the middle portion of this planting zone appears to be dominated by Blue-joint grass (*Calamagrostis canadensis*) and sedges (*Carex spp.*); species that historically dominated this community type. Shrubs were encroaching within the area, but most have perished possibly due to rising water levels. The presence of an apparently intact native community type provides the opportunity to enhance and expand the existing community within this planting zone. Northern Sedge Meadow is considered a High Priority Natural Community within the Northern Lake Michigan Coastal Ecological Landscape; therefore, efforts to improve or restore a similar habitat type are expected to greatly benefit many wildlife species.

Native vegetation establishment will be the main restoration component within this community; however, the installation of some woody debris (brush pile) and nesting structures (bird houses) will help increase habitat diversity by providing cover, loafing, basking, feeding and nesting opportunities for a variety of invertebrate, fish, amphibian, reptile, mammal and bird species.

Site Preparation – Litter/Duff Removal

As mentioned above, dead material throughout the zone was mowed during the early portion of 2015. The operations effectively removed the standing material and chopped much of it into small pieces, but the quantity of material will prove problematic, especially in the northern portion of the zone. In some areas, our ecologists observed more than 3" of litter/duff that had been deposited by the mower. To ensure good seed to soil contact and sunlight availability to germinating seeds, the litter/duff layer must either be spread out or removed from the planting area and properly composted. Due to the wet soil conditions, care will need to be taken to avoid rutting if heavy equipment is utilized. Soil must be visible in 50% of the area with the other 50% containing less than 1/2" of debris layer.

Other than the litter/duff removal, no other soil disturbing activities are suggested or required as many of the species to be seeded should be surface sown to increase germination rates.

The Enhancement Zone will be over seeded to increase species diversity. Although seeding will occur via hand sowing, the existing vegetation may not allow even seed distribution. Vegetation shall be mowed or trimmed to a height of 2-3" prior to seeding to allow good seed dispersal.

Site Preparation - Invasive Species Control

The northern and southern segments of the Northern Sedge Meadow Planting Zone shall continue to have non-native and invasive species controlled to ensure overall restoration success. These portions of the planting zone are referred to as the re-work areas (Appendix E). Site preparation activities discussed in the Open Water with Submergent Aquatic Vegetation Zone shall be followed. In addition to controlling the aquatic invasive species discussed above, some terrestrial species may invade the site and require attention. Below are some steps that can be taken to address these species. In order to eliminate these unwanted species, a minimum of two (2) or three (3) herbicide applications in combination with mowing activities will be conducted throughout the 2015 growing season to ensure adequate weed control for site preparation. It is possible a native seed bank is present and will respond with the removal of the competing Phragmites; therefore, care shall be taken to salvage populations where feasible rather than conducting broadcast herbicide applications throughout the area.

Although the middle portion of zone contains native species, there are some undesirable species present such as, but not limited to thistles (*Cirsium spp.*), field sow-thistle (*Sonchus arvensis*), curly dock (*Rumex crispus*) and quack grass (*Elytrigia repens*) that shall be controlled through cutting and spot herbicide treats. This area is referred to as the enhancement zone within the community (Appendix E).

Biennial & Annual Broadleaf Weeds

Sweet clovers (*Melilotus spp.*), wild carrot (*Daucus carota*) and burdock (*Arctium minus*), along with other less aggressive yet undesirable annual and biennial species can be controlled and populations reduced through repetitive cutting. Mowing or hand cutting shall be done when the plants are mature and in the beginning stages of flowering to ensure the best control. Do not mow too often as the plants will begin growing lower to the ground and be more difficult to control through mowing efforts. In the event that individuals are found with mature seed heads, those plants shall be manually cut with machetes or loppers prior to them setting seed, bagged, and removed from the site. All noxious/invasive weeds shall be properly disposed of in a landfill. In rare cases, herbicide could be applied through spot applications, but there is an increased risk of damaging native species within the planting, which can be avoided through the mechanical removal process.

Perennial Broadleaf Weeds

Canada and bull thistles (*Cirsium arvense* and *C.vulgare*), red, white and alsike clovers (*Trifolium pratense*, *T. repens*, and *T. hybridum*), crown vetch (*Coronilla varia*), and bird's-foot trefoil (*Lotus corniculatus*) along with other aggressive perennial weeds can be controlled to some degree through mowing activities prior to seed set, but full control will require herbicide applications. The steps we recommend following include:

- 1) A herbicide solution, including the chemical (AquaNeat®, Habitat®, Transline®, etc.), a surfactant or MSO, ammonium sulfate, and marking dye, shall be applied through one of the below methods:
 - a) Broadcast spray solution containing a combination of 1% glyphosate or imazapyr and 2/3 to 1 1/3 pint/acre of Transline on the target plants. Backpack sprayers are typically used. If plant densities are relatively low, this method or combination should not be used because there is an increased chance of impacting the surrounding, native vegetation through drift since glyphosate and imazapyr are non-selective herbicides. To reduce impacts with this solution, a spray bottle or hand wicking could be substituted.
 - b) Broadcast spray solution containing 2/3 to 1 1/3 pint/acre of Transline on the target plants. The chemical is more selective and targets broadleaf plants so grasses won't be impacted; however, caution must be used around native forbs. The choice of application will depend on the population size of the targeted species.

Note: If standing water or saturated soil conditions are present, Transline may not be utilized as it is not an aquatic approved herbicide.

Ideally these species shall be identified and sprayed either early or late in the growing season prior to or after native plant growth. If species are located during the growing season they shall either be sprayed or cut to prevent seeding. Mature seed heads shall be removed and properly disposed of to prevent further spread.

Perennial Grasses

Reed canary grass, fescues (*Festuca spp.*), smooth brome and cheat grass (*Bromus inermis* and *B. tectorum*), Kentucky bluegrass (*Poa pratensis*), and quack grass along with other aggressive perennial grasses can be controlled to some degree, like the perennial broadleaf weeds, through mowing activities prior to seed set, but full control will require herbicide applications. Although these grasses can be located and identified early in the growing season, they may be more easily identified during the flowering stage; therefore, additional steps may be necessary to prevent their spread. The steps we recommend following include:

Single Plants or Small Clusters

- 1) Seed heads shall be cut and placed in thick, plastic bags and removed to a licensed landfill facility for proper disposal.
- 2) A herbicide solution, including the chemical (AquaNeat® or Rodeo®, Habitat®, Intensity® One, etc.), a surfactant or MSO, ammonium sulfate, and marking dye, shall be applied through one of the below methods:
 - a) Apply solution containing 5% glyphosate or imazapyr or 2% clethodim to the plant using the “Glove of Death” technique. The technique involves spraying the solution onto a cotton glove that is worn by the applicator over chemically resistant gloves; the applicator then takes hold of the plant near the base and runs the cotton glove up the plant stem.
 - b) Broadcast spray solution containing 2% glyphosate or imazapyr or 1% clethodim on the target plants. Backpack sprayers are typically used. If plant densities are relatively low, this method is not generally used because there is an increased chance of impacting the surrounding, native vegetation through drift since glyphosate and imazapyr are non-selective herbicides. The exception would be with the use of clethodim as this chemical is grass selective; however, caution would still need to be taken when spraying around native grass species.

Large Clusters or Populations

- 1) Grass shall be cut prior to seed development and allowed to re-grow.
- 2) Conduct a broadcast spray as discussed above.

Note: If standing water or saturated soil conditions are present, Intensity One may not be utilized as it is not an aquatic approved herbicide.

If the grass species can be accurately identified prior to seed head development, the plants shall either be hand wicked or broadcast sprayed in mid to late May to eliminate additional tasks. A follow-up treatment may be required in the fall.

Vegetation Establishment

To assist with re-vegetation, a combination of seeding and planting activities shall occur throughout the Northern Sedge Meadow Planting Zone (Appendix E). The selected grasses, sedges, rushes, ferns and wildflowers for the community can be found in Tables 4 and 5. Species were chosen to provide an aesthetically pleasing community in an urban setting, while providing wildlife habitat and ground cover.

Native seed application rates are based on applying 180-210 seeds per square foot. The quantity of seed required per acre (Table 4) is based on purchasing “Pure Live Seed (PLS)”. These rates shall be utilized in the Re-work Zones while ½ those rates shall be utilized in the Enhancement Zone due to the presence of a well-established native community. The below criteria regarding seed shall be followed:

- 1) All native seed stock shall be wild ecotype indigenous to Wisconsin or the first tier counties in those states bordering Wisconsin or have natural origins within a 250 mile radius of the intended planting site.
- 2) Grasses classified as “Agricultural Grasses” shall be PLS as specified. Other seed shall be “clean” according to high quality industry standards.
- 3) Seed shall not be more than one year old at time of seeding.

The native seed along with a cover crop shall be dormant sown between October 15th and November 30th, 2015. Due to wet soil conditions, seed shall be hand sown. The seed shall be mixed with a carrier (e.g., sawdust, vermiculite, moist sand, etc.) to ensure even seed distribution; however, if a hand operated Truax seed slinger is utilized then a carrier is not required.

Table 4. Northern Sedge Meadow Herbaceous Species and Seeding Rate.

Species		Ounces Required Per Acre
Common Name	Scientific Name	
<i>Forbs</i>		
Canada Anemone	<i>Anemone canadensis</i>	0.9
Angelica	<i>Angelica atropurpurea</i>	4.7
Marsh Milkweed	<i>Asclepias incarnata</i>	2.7
Shining Aster	<i>Aster firmus</i>	0.4
Panicled Aster	<i>Aster lanceolatus</i>	0.7
Swamp Aster	<i>Aster puniceus</i>	0.9
Flat-top Aster	<i>Aster umbellatus</i>	1.4
Nodding Bur Marigold	<i>Bidens cernua</i>	2.6
Common Beggar's Ticks	<i>Bidens frondosa</i>	2.2
Turtlehead	<i>Chelone glabra</i>	0.6
Water Hemlock	<i>Cicuta maculata</i>	0.9
Cinnamon Willow Herb	<i>Epilobium coloratum</i>	0.4
Joe Pye Weed	<i>Eupatorium maculatum</i>	2.1
Boneset	<i>Eupatorium perfoliatum</i>	1.0
Grass-leaved Goldenrod	<i>Euthamia graminifolia</i>	0.5
Sneezeweed	<i>Helenium autumnale</i>	1.5
Saw-tooth Sunflower	<i>Helianthus grosseserratus</i>	1.0
Spotted Touch-me-not	<i>Impatiens capensis</i>	1.4
Great Blue Lobelia	<i>Lobelia siphilitica</i>	0.5
Water Horehound	<i>Lycopus americanus</i>	0.8
Wild Mint	<i>Mentha arvensis</i>	0.4
Monkey Flower	<i>Mimulus ringens</i>	0.2
Pinkweed	<i>Persicaria pensylvanica</i>	1.1
Obedient Plant	<i>Physotegia virginiana</i>	0.7
Marsh Cinquefoil	<i>Potentilla palustris</i>	0.3
Common Mountain Mint	<i>Pycnanthemum virginianum</i>	0.7
Annual Buttercup	<i>Ranunculus sceleratus</i>	1.5
Wild Golden Glow	<i>Rudbeckia laciniata</i>	3.9
Tall Water Parsnip	<i>Sium suave</i>	0.6
Late Goldenrod	<i>Solidago gigantea</i>	0.3
Swamp Goldenrod	<i>Solidago patula</i>	0.6
Woundwort	<i>Stachys palustris</i>	0.8

Table 4. Continued.

Purple Meadow Rue	<i>Thalictrum dasycarpum</i>	2.0
Blue Vervain	<i>Verbena hastata</i>	3.1
Culver's Root	<i>Veronicastrum virginicum</i>	0.3
Golden Alexanders	<i>Zizia aurea</i>	6.6
<i>Grasses/Sedges/Rushes</i>		
Fringed Brome	<i>Bromus ciliatus</i>	3.6
Blue-joint Grass	<i>Calamagrostis canadensis</i>	1.3
Water Sedge	<i>Carex aquatilis</i>	0.6
Crested Oval Sedge	<i>Carex cristatella</i>	1.2
Porcupine Sedge	<i>Carex hystericina</i>	5.2
Common Lake Sedge	<i>Carex lacustris</i>	0.8
Broad-leaved Woolly Sedge	<i>Carex pellita</i>	0.5
Deflexed Bottle-brush Sedge	<i>Carex retrorsa</i>	2.0
Awl-fruited Sedge	<i>Carex stipata</i>	4.6
Tussock sedge	<i>Carex stricta</i>	3.4
Common Yellow Lake Sedge	<i>Carex utriculata</i>	2.7
Walter's Barnyard Grass	<i>Echinochloa walteri</i>	4.6
Great Spike Rush	<i>Eleocharis palustris</i>	0.9
Virginia Wild Rye	<i>Elymus virginicus</i>	21.2
Rattlesnake Grass	<i>Glyceria canadensis</i>	3.3
Fowl Manna Grass	<i>Glyceria striata</i>	2.8
Dudley's Rush	<i>Juncus dudleyi</i>	0.1
Common Rush	<i>Juncus effusus</i>	0.3
Rice Cut Grass	<i>Leersia oryzoides</i>	1.1
Fowl Bluegrass	<i>Poa palustris</i>	1.4
Dark Green Bulrush	<i>Scirpus atrovirens</i>	1.5
Wool Grass	<i>Scirpus cyperinus</i>	0.5
Prairie Cord Grass	<i>Spartina pectinata</i>	2.7
TOTAL		116.6

In addition to seeding, live plants (Table 5) shall be installed either between October 15 and November 30, 2015 when they are dormant or in late May to early June 2016 to increase diversity and provide quicker establishment as some species are slow to germination and establish. Plant stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250 mile radius of the planting site. The exact planting locations will be established in the field based on current site conditions. Species shall be randomly placed in “clumps” of 5-10 individuals and planted on approximate 18” centers throughout the zone. Plant pits shall be prepared by excavating a hole with either the installer’s hand, tree spade, shovel or power auger to a minimum diameter of 3-5”, where feasible, and sufficiently deep to allow the root collar to be at the original grade after the potted plant is positioned in the hole. Once the hole is made, the container holding the plant shall be gently removed and any encircling roots shall be unwound. Exceptionally long roots shall be shortened. The hole shall then be backfilled with native soil material.

Table 5. Northern Sedge Meadow Live Plant Species, Quantities and Sizes.

<i>Species</i>			
Common Name	Scientific Name	Quantity	Minimum Pot Size
<i>Sedges/Grasses</i>			
Porcupine Sedge	<i>Carex hystericina</i>	300	2.5"
Common Lake Sedge	<i>Carex lacustris</i>	400	2.5"
Tussock Sedge	<i>Carex stricta</i>	250	2.5"
Prairie Cord Grass	<i>Spartina pectinata</i>	150	2.5"
<i>Ferns</i>			
Ostrich Fern	<i>Matteuccia struthiopteris</i>	100	4.5"
Sensitive Fern	<i>Onoclea sensibilis</i>	200	4.5"
<i>Forbs</i>			
Northern Blue Flag	<i>Iris versicolor</i>	250	2.5"
Marsh Marigold	<i>Caltha palustris</i>	50	4.5"
TOTAL		1,700	

Habitat Structure Installation

Due to a lack of structure and nesting opportunities within the community, woody debris (brush pile) and bird houses will be added to the Northern Sedge Meadow Planting Zone. The brush pile is expected to provide cover, habitat and feeding opportunities for a variety of aquatic insects, amphibians, reptiles, mammals and birds. The addition of bird houses will benefit cavity nesting species, in particular tree swallows and wood ducks.

A Chapter 30 permit was issued by the WDNR to conduct the dredging operations and ecological restoration activities, but these activities were not defined. Because each of the below structures will be placed in a navigable water of the state, additional permits will likely be required. Restoration activities must adhere to Wisconsin Administrative Codes NR 103, NR 323, and NR 353. Prior to work beginning on-site, it will be necessary to obtain permit coverage. General Permits include Wetland Conservation Activities and Habitat Structure – Wildlife Nesting Structure. Brush piles are not currently covered under a general permit; therefore, a Chapter 30 or Wetland Individual Permit will likely be required for placement of these structures.

Brush Pile

The brush pile shall be placed in the approximate location shown in Appendix E. The base of the pile shall be constructed by placing three 6-8' long logs with a diameter of 6-8" on the substrate and then placing three similarly sized timbers on those in a perpendicular fashion. Once the base is complete, limbs and sticks found throughout the restoration site shall be woven and piled on the logs to create the pile (Appendix F – Brush Pile Detail). Tops from trees to be removed from the south shore should provide adequate material; however, if enough debris is not available, the Contractor shall find an off-site location. The City of Marinette's composting site may provide the necessary material. When complete, the pile shall be 12-15' in diameter and roughly five feet in height. Due to site conditions, materials will likely need to be brought in and placed by hand or placed by equipment that will ensure minimal damage to the remaining restoration area. Installation of the brush pile can be done during the summer of 2015 after July 1st, unless cleared by the WDNR to do so earlier.

Bird Houses

Although tree swallows and wood ducks are relatively common throughout the area, the existing site lacks suitable nesting habitat for either species. Both species are well adapted to utilizing nest boxes; therefore, installation of these structures is a simple, cost-effective means to increase wildlife use within the restoration site. A total of four tree swallows and one wood duck nesting box shall be placed within the Northern Sedge Meadow Planting Zone (Appendix E). Instructions for constructing the nesting boxes can be found in Appendix F or they may be purchased. Once constructed or purchased, the following instructions shall be followed for placement and installation:

Tree Swallow/Eastern Bluebird

- 1) Entrance hole shall be placed so it is facing East
- 2) Nesting box shall be mounted 5-6 feet above the ground on 3/4" Rigid Metal Conduit (RMC) made of stainless steel.
- 3) Instructions for mounting the box on the RMC are as follows:
 - a) Remove and recycle 2 feet of a standard 10 foot section of 3/4" RMC
 - b) Using a post pounder, drive 2 feet of the RMC into the ground so 6 feet is left above ground
 - c) Loosely attach stainless steel 3/4" conduit 2-hole straps to the back of the nesting box with 3/4" stainless steel deck screws. The top strap shall be attached just below the roof while the bottom strap shall be attached even with the floor.
 - d) Slip straps on the nesting box onto the RMC, adjust to the recommended height listed above and tighten the screws to secure the box to the RMC.

Wood Duck

- 1) 4" of wood shavings or a mix of shavings and wood chips shall be placed in the nest box
- 2) Entrance hole shall be placed so it is facing the water.
- 3) Nesting box shall be mounted 6 feet above the ground on a Schedule 40 Galvanized Steel Pole with an inside diameter of $\geq 2"$. The pole shall be 8' in length.
- 4) Using a post pounder, drive 2 feet of the steel post into the ground so 6 feet is left above ground.
- 5) A standard mounting bracket such as the one sold by Lone Star Woodcraft or equal may be utilized; however, the bracket shall be made flush with the box edges when complete. Otherwise, the contractor shall follow instructions at the following website: <http://www.batcon.org/pdfs/bathouses/InstallingYourBatHouseWoodenPostSteel%20Pole.pdf> Although the instructions are for the installation of a bat house, the procedure for installing a house on a steel pole can be applied.
- 6) Mounting shall allow a slight (1/8") forward lean to allow easier duckling exist

Nest boxes may be mounted to a cedar post rather than a stainless steel pole; however, a predator guard (Appendix F) must be installed to prevent feral cat and raccoon predation.

Although nesting season will have begun, the nesting boxes shall be installed in early June as they may be utilized by a pair of birds raising a second brood during 2015. Otherwise, they will be in place for use during the 2016 breeding season.

Shrub-Carr

Much of the northern and southern portions of the Shrub-Carr Planting Zone were also dominated by giant reed grass; however, herbicide applications completed in the fall of 2012 and 2014 as part of the Menekaunee Harbor restoration have significantly reduced or eliminated the species. Mowing operations in the winter of 2015 removed the dead material. Based on site visits conducted by NES ecologists outside the growing season, the middle portion of this planting zone appears to be dominated by Blue-joint grass (*Calamagrostis canadensis*) and sedges (*Carex spp.*); species that historically dominated this community type. Shrubs, primarily willows (*Salix spp.*) and a few cottonwood (*Populus deltoides*) trees are also found within this area. The presence of an apparently intact native community type provides the opportunity to enhance and expand the existing community within this planting zone. Efforts to improve or restore a similar habitat type are expected to greatly benefit many wildlife species.

Native vegetation establishment will be the main restoration component within this community; however, a few dead trees exist along the eastern edge of the community. The snags shall be left to increase habitat diversity by providing feeding and possible nesting/den opportunities for a variety of invertebrate, mammal and bird species.

An existing trail utilized by City residents passes through a portion of community. In an effort to educate individuals regarding the project, restoration signs shall be posted. Although the trail will be left open, fencing similar to the goose exclusion fence (Appendix F) shall be erected on both sides of the trail marked on the restoration map (Appendix E).

Site Preparation – Litter/Duff Removal

Activities within this community shall mirror those conducted in the Northern Sedge Meadow.

As with the Northern Sedge Meadow, the Enhancement Zone within this community will be over seeded to increase species diversity. Although seeding will occur via hand sowing, the existing vegetation may not allow even seed distribution. Vegetation shall be mowed or trimmed to a height of 2-3” prior to seeding to allow good seed dispersal. Existing shrubs shall not be cut down in the process.

Site Preparation - Invasive Species Control

Activities within this community shall be similar to those conducted in the Northern Sedge Meadow as there are both Re-work and Enhancement Zones within the community (Appendix E).

Vegetation Establishment

To assist with re-vegetation, a combination of seeding and planting activities shall occur throughout the Shrub-Carr Planting Zone (Appendix E). The selected grasses, sedges, rushes, ferns and wildflowers for the community can be found in Tables 6 and 7. Species were chosen to provide an aesthetically pleasing community in an urban setting, while providing wildlife habitat and ground cover.

Native seed application rates are based on applying 180-210 seeds per square foot. The quantity of seed required per acre (Table 6) is based on purchasing “Pure Live Seed (PLS)”. These rates shall be utilized in the Re-work Zones while ½ those rates shall be utilized in the Enhancement Zone due to the presence of a well-established native community. Seed requirements shall be the same as those provided in the Northern Sedge Meadow discussion above. The native seed along with a cover crop shall be dormant sown between October 15th and November 30th, 2015. Due to wet soil conditions, seed shall be hand

sown. The seed shall be mixed with a carrier (e.g., sawdust, vermiculite, moist sand, etc.) to ensure even seed distribution; however, if a hand operated Truax seed slinger is utilized then a carrier is not required.

In addition to seeding, live plants (Table 7) shall be installed either between October 15 and November 30, 2015 when they are dormant or in late May or early June 2016 in a manner similar to those installed in the Northern Sedge Meadow community. Plant stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250 mile radius of the planting site.

Table 6. Shrub-Carr Herbaceous Species and Seeding Rate.

Species		
Common Name	Scientific Name	Ounces Required Per Acre
<i>Forbs</i>		
Canada Anemone	<i>Anemone canadensis</i>	0.9
Angelica	<i>Angelica atropurpurea</i>	4.7
Marsh Milkweed	<i>Asclepias incarnata</i>	2.7
Shining Aster	<i>Aster firmus</i>	1.0
New England Aster	<i>Aster novae-angliae</i>	1.1
Swamp Aster	<i>Aster puniceus</i>	0.9
Flat-top Aster	<i>Aster umbellatus</i>	1.4
Nodding Bur Marigold	<i>Bidens cernua</i>	2.6
Common Beggar's Ticks	<i>Bidens frondosa</i>	2.2
Turtlehead	<i>Chelone glabra</i>	0.6
Water Hemlock	<i>Cicuta maculata</i>	0.9
Marsh Cinquefoil	<i>Comarum palustre</i>	0.3
Cinnamon Willow Herb	<i>Epilobium coloratum</i>	0.7
Joe Pye Weed	<i>Eupatorium maculatum</i>	2.3
Boneset	<i>Eupatorium perfoliatum</i>	1.1
Grass-leaved Goldenrod	<i>Euthamia graminifolia</i>	0.5
Sneezeweed	<i>Helenium autumnale</i>	1.5
Saw-tooth Sunflower	<i>Helianthus grosseserratus</i>	3.4
Spotted Touch-me-not	<i>Impatiens capensis</i>	1.4
Cardinal Flower	<i>Lobelia cardinalis</i>	0.9
Water Horehound	<i>Lycopus americanus</i>	0.8
Wild Mint	<i>Mentha arvensis</i>	0.5
Obedient Plant	<i>Physotegia virginiana</i>	0.7
Common Mountain Mint	<i>Pycnanthemum virginianum</i>	0.7
Wild Golden Glow	<i>Rudbeckia laciniata</i>	3.9
Great Water Dock	<i>Rumex orbiculatus</i>	6.1
Tall Water Parsnip	<i>Sium suave</i>	0.6
Late Goldenrod	<i>Solidago gigantea</i>	0.5
Swamp Goldenrod	<i>Solidago patula</i>	0.6
Woundwort	<i>Stachys palustris</i>	0.8
Purple Meadow Rue	<i>Thalictrum dasycarpum</i>	6.6
Blue Vervain	<i>Verbena hastata</i>	3.9
Culver's Root	<i>Veronicastrum virginicum</i>	0.4
Golden Alexanders	<i>Zizia aurea</i>	6.6
<i>Grasses/Sedges/Rushes</i>		
Fringed Brome	<i>Bromus ciliatus</i>	3.6
Blue-joint Grass	<i>Calamagrostis canadensis</i>	1.3
Water Sedge	<i>Carex aquatilis</i>	0.6

Table 6. Continued

Crested Oval Sedge	<i>Carex cristatella</i>	1.2
Porcupine Sedge	<i>Carex hystericina</i>	5.2
Common Lake Sedge	<i>Carex lacustris</i>	0.8
Narrow-leaved Woolly Sedge	<i>Carex lasiocarpa</i>	1.3
Broad-leaved Woolly Sedge	<i>Carex pellita</i>	0.5
Deflexed Bottle-brush Sedge	<i>Carex retrorsa</i>	2.0
Awl-fruited Sedge	<i>Carex stipata</i>	4.6
Tussock sedge	<i>Carex stricta</i>	2.9
Common Yellow Lake Sedge	<i>Carex utriculata</i>	2.7
Great Spike Rush	<i>Eleocharis palustris</i>	0.9
Virginia Wild Rye	<i>Elymus virginicus</i>	21.2
Reed Manna Grass	<i>Glyceria grandis</i>	3.5
Fowl Manna Grass	<i>Glyceria striata</i>	2.6
Dudley's Rush	<i>Juncus dudleyi</i>	0.1
Rice Cut Grass	<i>Leersia oryzoides</i>	1.1
Fowl Bluegrass	<i>Poa palustris</i>	1.4
Dark Green Bulrush	<i>Scirpus atrovirens</i>	1.5
Wool Grass	<i>Scirpus cyperinus</i>	0.5
Rufous Bulrush	<i>Scirpus pendulus</i>	1.4
Prairie Cord Grass	<i>Spartina pectinata</i>	2.7
TOTAL		127.4

Table 7. Shrub-Carr Live Plant Species, Quantities and Sizes.

<i>Species</i>			
Common Name	Scientific Name	Quantity	Minimum Pot Size
<i>Sedges/Grasses</i>			
Common Lake Sedge	<i>Carex lacustris</i>	50	2.5"
Tussock Sedge	<i>Carex stricta</i>	125	2.5"
Prairie Cord Grass	<i>Spartina pectinata</i>	75	2.5"
<i>Ferns</i>			
Ostrich Fern	<i>Matteuccia struthiopteris</i>	50	4.5"
Sensitive Fern	<i>Onoclea sensibilis</i>	50	4.5"
<i>Forbs</i>			
Northern Blue Flag	<i>Iris versicolor</i>	75	2.5"
Marsh Marigold	<i>Caltha palustris</i>	25	4.5"
TOTAL		450	

The installation of shrubs in the form of potted, bare-root and live stake materials (Tables 8 & 9) will provide the foundation for establishing the overall community. The larger potted material will help establish the community more quickly while the bare-root and live stakes provide additional species diversity and cost savings. The selected shrub species will eventually provide additional cover, nesting and foraging opportunities for the surrounding wildlife.

Shrub stock shall be wild ecotype indigenous to the Upper Midwest and shall have been grown within the same hardiness zone as the Project Site or acclimated to conditions of same hardiness zone for a minimum of two growing seasons. Material shall conform to the species and sizes contained within Table 8 and shall be dormant planted between October 15 and November 30, 2015 throughout the Shrub-Carr Planting Zone (Appendix E). Suitable locations within the community shall be chosen based up current

site conditions. The shrubs shall be randomly scattered planted in clumps of 3-5 individuals on no less than 5' centers.

The shrubs shall be planted by excavating an adequately sized hole for the potted or bare-root material, which in most cases will be created using an auger or shovel. Once the hole is made, potted plants shall be removed from the container and any encircled roots cut with a sharp tool and the sides of the root ball scored in several locations around their perimeter. Exceptionally long roots will be shortened on both potted and bare-root material. Plants shall be placed in the center of the pit and at a depth to ensure the root collar is flush with the existing soil surface. Potted material shall be set on undisturbed soil, while bare-root material shall be set on a mound created at the pit's bottom. Appendix F contains typical planting details for these materials. Roots shall be guided gently downward and outward to prevent root girdling. Salvaged ground placed in the hole shall not be compacted; rather, water shall be poured over the soil to promote natural settling around the root ball. Once settled, fill the remaining hole making sure to use salvaged topsoil to bring up to grade. Water the additional backfill to promote final settling, lightly tamp and add topsoil, if necessary. No soil shall be placed over the root collar and any excess soil shall be removed from the site. Shrubs shall be protected with shelters; however, due to their shape and size, multi-stemmed shrubs may not be tubed.

Live stakes shall conform to the following requirements:

- 1) Stakes shall be wild ecotype indigenous to the Upper Midwest and shall have been harvested within same hardiness zone as the Project Site. Hardiness zones shall conform to "Zones of Plant Hardiness" as provided by U.S. Department of Agriculture.
- 2) Stake dimensions must meet the following:
 - a) Diameter - ½" – 2"
 - b) Length – 18" – 24"
- 3) The top of the stake must be cut flush and the butt end cut at a 45 degree angle.
- 4) All branches on the stake must be removed. They shall be trimmed close to the stem without damaging the stake.
- 5) Stakes shall be constructed from native species that are healthy, vigorous stock that is straight wood at least one (1) year old.

Stakes shall be installed on 3' centers between October 15 and November 30, 2015, shortly after they are harvested, by creating a pilot hole with a suitable tool that will allow roughly ¾ of the stake (75%) to be inserted into the soil. If the soils allow, a planting hole may not be necessary and the stake can either be pushed or tapped (using a rubber mallet) into the ground to the required depth. Installing stakes via the latter method will require care so the stakes are not damaged including split tops. Damaged material shall be replaced. Live stakes shall be installed as vertically as possible with two to five (2-5) bud scars present above ground. Additional length shall be removed. Stakes installed in a pilot hole shall have the soil around the stake tamped and watered to eliminate air pockets.

Installation of shrub material shall not be permitted during the following conditions:

- 1) Saturated soil conditions
- 2) Frozen soil conditions
- 3) Temperatures less than 32 degrees Fahrenheit
- 4) Temperatures greater than 90 degrees Fahrenheit

Table 8. Shrub-Carr Woody Species, Quantities and Sizes.

<i>Species</i>			
Common Name	Scientific Name	Quantity	Size - Height
<i>Shrubs</i>			
Speckled Alder	<i>Alnus rugosa</i>	15	#5 gallon
Silky Dogwood	<i>Cornus amomum</i>	10	2-4' bare-root
Red-osier Dogwood	<i>Cornus stolonifera</i>	25	2-4' bare-root
Winterberry (Male & Female)	<i>Ilex verticillata</i>	25	2-4' bare-root
Black Currant	<i>Ribes americanum</i>	20	#1-2 gallon
Meadow-sweet	<i>Spiraea alba</i>	40	#2-5 gallon
Bebb's Willow	<i>Salix bebbiana</i>	50	#1-2 gallon
Pussy Willow	<i>Salix discolor</i>	50	#2-5 gallon
American Highbush Cranberry	<i>Viburnum opulus L. subsp. trilobum</i>	15	2-4' bare-root
TOTAL		250	

Table 9. Shrub-Carr Live Stake Species.

<i>Species</i>		
Common Name	Scientific Name	No. of Stakes Required
Silky Dogwood	<i>Cornus amomum</i>	100
Red-osier Dogwood	<i>Cornus stolonifera</i>	100
Bebb's Willow	<i>Salix bebbiana</i>	100
Pussy Willow	<i>Salix discolor</i>	100
TOTAL		400

Wet-Mesic Forest

As indicated in Appendix E, there are small groves of trees and many scattered individuals present, most of which are cottonwood. Although difficult to determine because the area was mowed, it appears there are scattered shrubs such as red-osier dogwood (*Cornus stolonifera*) also present. Like the Shrub-Carr Planting Zone, the proposed Wet-Mesic Forest community has areas that will need more attention during the restoration process. A small segment found in the middle portion of this planting zone appears to be a continuation of the native community dominated by Blue-joint grass and sedges; while, the remainder has a mix of native and non-native species present. The presence of an apparently intact native community and existing tree cover provides the opportunity to enhance and expand the existing community within this planting zone. Vegetative components of both northern and southern wet-mesic forests will be utilized for this project. Northern Wet-Mesic Forest is considered a High Priority Natural Community within the Northern Lake Michigan Coastal Ecological Landscape; therefore, efforts to improve or restore a similar habitat type are expected to greatly benefit many wildlife species.

Native vegetation establishment will be the main restoration component within this community; however, the installation of some rock and nesting/roosting structures (bird and bat houses) will help increase habitat diversity by providing cover, feeding, roosting and nesting opportunities for a variety of invertebrate, amphibian, reptile, mammal and bird species. As with the Shrub-Carr Planting Zone, a few dead trees exist within the community. The snags shall be left to increase habitat diversity by providing feeding and possible nesting/den opportunities for wildlife.

The existing trail discussed above in the Shrub-Carr section passes through a portion of this community also. As with the Shrub-Carr community, signs and fencing shall be erected in an effort to educate and protect the project.

Site Preparation – Litter/Duff Removal

Dense patches of Phragmites were not present within this area; therefore, a thick layer of litter/duff is not present. However, when the site was mowed, several shrubs and small trees were shredded in the process and strewn throughout the area. To prepare the site for seed installation, the soil shall be lightly worked to a depth of ¼” – ½” in depth with a disc and/or harrow. Using these implements may be difficult with too much woody debris. Therefore, larger woody pieces shall be removed and ideally used to construct brush piles found throughout the restoration site. Some woody debris may remain as its presence will help enrich the soils within the community. An NR 216 Construction Site Storm Water Discharge Permit shall be secured from the WDNR prior to earth disturbing activities.

As with the Shrub-Carr, the Enhancement Zone within this community will be over seeded to increase species diversity. Although seeding will occur via hand sowing, the existing vegetation may not allow even seed distribution. Vegetation shall be mowed or trimmed to a height of 2-3” prior to seeding to allow good seed dispersal. Existing shrubs or trees shall not be cut down in the process.

Site Preparation - Invasive Species Control

Patches of giant reed grass were treated with herbicide in the fall of 2012 and 2014 as part of the Menekaunee Harbor restoration; however, the invasive grass was not the dominant species found within the area. Activities within this community shall be similar to those conducted in the Northern Sedge Meadow as there are both Re-work and Enhancement Zones within the community (Appendix E). Species of particular concern within the re-work zone include quack grass and spotted knapweed.

Vegetation Establishment

To assist with re-vegetation, a combination of seeding and planting activities shall occur throughout the Wet-Mesic Forest Planting Zone (Appendix E). The selected grasses, sedges, rushes, ferns and wildflowers for the community can be found in Tables 10 and 11. Species were chosen to provide improved wildlife habitat and ground cover.

Native seed application rates are based on applying 180-210 seeds per square foot. The quantity of seed required per acre (Table 10) is based on purchasing “Pure Live Seed (PLS)”. These rates shall be utilized in the Re-work Zones while ½ those rates shall be utilized in the Enhancement Zone due to the presence of a well-established native community. Seed requirements shall be the same as those provided in the Northern Sedge Meadow and Shrub-Carr discussions above. The native seed along with a cover crop shall be dormant sown between October 15th and November 30th, 2015. If the community is hand sown, the seed shall be mixed with a carrier (e.g., sawdust, vermiculite, moist sand, etc.) to ensure even seed distribution. If a hand operated Truax seed slinger is utilized then a carrier is not required. The seeded areas shall then be rolled with a cultipacker to ensure good seed to soil contact if the soils are not saturated. Otherwise, the seed shall be installed with a broadcast type seeder (Brillion) capable of properly handling and distributing the small and fluffy native seeds. As mentioned above, the soil shall be lightly worked to a depth of ¼” – ½” in depth with a disc and/or harrow prior to seeding. If the soil is too light and fluffy, the area shall be cultipacked to provide a firmer seedbed prior to seeding.

In addition to seeding, live plants (Table 11) shall be installed either between October 15 and November 30, 2015 when they are dormant or in late May or early June 2016 in a manner similar to those installed in the Northern Sedge Meadow and Shrub-Carr communities. The exact planting locations will be established in the field based on current site conditions; and, most plants will be concentrated within the existing

groves of trees. Plant stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250 mile radius of the planting site.

Table 10. Wet-Mesic Forest Herbaceous Species and Seeding Rate.

Species		Ounces Required
Common Name	Scientific Name	Per Acre
<i>Forbs</i>		
Canada Anemone	<i>Anemone canadensis</i>	1.8
Tall Thimbleweed	<i>Anemone virginiana</i>	1.0
Columbine	<i>Aquilegia canadensis</i>	2.9
Calico Aster	<i>Aster lateriflorus</i>	1.0
Large-leaved Aster	<i>Aster macrophyllus</i>	0.7
Common Beggar's Ticks	<i>Bidens frondosa</i>	2.9
Smallspike False Nettle	<i>Boehmeria cylindrica</i>	0.4
Wild Cucumber	<i>Echinocystis lobata</i>	3.6
White Snakeroot	<i>Eupatorium rugosum</i>	0.7
Northern Bedstraw	<i>Galium boreale</i>	1.0
Bottle Gentain	<i>Gentiana andrewsii</i>	0.5
Wild Geranium	<i>Geranium maculatum</i>	1.5
Yellow Avens	<i>Geum aleppicum</i>	7.3
Grass-leaved Goldenrod	<i>Euthamia graminifolia</i>	0.5
Saw-tooth Sunflower	<i>Helianthus grosseserratus</i>	1.9
Pale-leaved Sunflower	<i>Helianthus strumosus</i>	3.5
Spotted Touch-me-not	<i>Impatiens capensis</i>	0.9
Cardinal Flower	<i>Lobelia cardinalis</i>	0.9
Water Horehound	<i>Lycopus americanus</i>	1.7
Solomon's Plume	<i>Maianthemum racemosum</i>	4.6
Wild Mint	<i>Mentha arvensis</i>	0.5
Bishop's Cap	<i>Mitella diphylla</i>	0.4
Sweet Cicely	<i>Osmorhiza claytonii</i>	2.9
Wood Betony	<i>Pedicularis canadensis</i>	0.8
Jacob's Ladder	<i>Polemonium reptans</i>	1.0
Common Mountain Mint	<i>Pycnanthemum virginianum</i>	1.0
Wild Golden Glow	<i>Rudbeckia laciniata</i>	3.9
Mad-dog Skullcap	<i>Scutellaria lateriflora</i>	2.2
Late Goldenrod	<i>Solidago gigantea</i>	0.7
Purple Meadow Rue	<i>Thalictrum dasycarpum</i>	6.6
Culver's Root	<i>Veronicastrum virginicum</i>	0.9
Golden Alexanders	<i>Zizia aurea</i>	11.6
<i>Grasses/Sedges/Rushes</i>		
Fringed Brome	<i>Bromus ciliatus</i>	21.8
Canada Bluejoint	<i>Calamagrostis canadensis</i>	1.3
Bebb's Oval Sedge	<i>Carex bebbi</i>	4.3
Common Wood Sedge	<i>Carex blanda</i>	1.5
Plains Oval Sedge	<i>Carex brevior</i>	6.3
Fringed Sedge	<i>Carex crinita</i>	4.7
Crested Oval Sedge	<i>Carex cristatella</i>	2.7
Wood Gray Sedge	<i>Carex grisea</i>	3.0
Slender Sedge	<i>Carex leptalea</i>	1.1
Field Oval Sedge	<i>Carex molesta</i>	7.1
Long-beaked Sedge	<i>Carex sprengei</i>	2.2

Table 10. Continued.

Awl-fruited Sedge	<i>Carex stipata</i>	4.6
Narrow-leaved Oval Sedge	<i>Carex tenera</i>	1.0
Brown Fox Sedge	<i>Carex vulpinoidea</i>	4.5
Canada Wild Rye	<i>Elymus canadensis</i>	51.4
Virginia Wild Rye	<i>Elymus virginicus</i>	53.0
Fowl Manna Grass	<i>Glyceria striata</i>	3.0
Dudley's Rush	<i>Juncus dudleyi</i>	0.1
Path Rush	<i>Juncus tenuis</i>	0.3
Leafy Satin Grass	<i>Muhlenbergia mexicana</i>	2.1
Upland Wild Timothy	<i>Muhlenbergia racemosa</i>	2.3
Fowl Bluegrass	<i>Poa palustris</i>	1.4
TOTAL		251.5

Table 11. Wet-Mesic Forest Live Plant Species, Quantities and Sizes.

<i>Species</i>			
Common Name	Scientific Name	Quantity	Minimum Pot Size
<i>Ferns</i>			
Lady Fern	<i>Athyrium felix-femina</i>	50	4.5"
Cinnamon Fern	<i>Osmunda cinnamomea</i>	100	4.5"
Interrupted Fern	<i>Osumuda claytoniana</i>	100	4.5"
Royal Fern	<i>Osnumda regalis</i>	50	4.5"
<i>Forbs</i>			
Wild Sarsaparilla	<i>Aralia nudicaulis</i>	50	4.5"
Wild Strawberry	<i>Fragaria virginiana</i>	150	2.5"
Starry False Solomon's Seal	<i>Maianthemum stellatum</i>	150	2.5"
Woodland Phlox	<i>Phlox divaricata</i>	150	2.5"
Barren Strawberry	<i>Waldsteinia fragarioides</i>	50	2.5"
TOTAL		850	

The installation of trees and shrubs in the form of potted and bare-root materials (Table 12) will provide the foundation for establishing the overall community. The larger potted material will help establish the community more quickly while the bare-root plants provide additional species diversity and cost savings. The selected tree and shrub species will eventually provide additional cover, nesting and foraging opportunities for the surrounding wildlife.

Tree and shrub stock shall be wild ecotype indigenous to the Upper Midwest and shall have been grown within the same hardiness zone as the Project Site or acclimated to conditions of same hardiness zone for a minimum of two growing seasons. Material shall conform to the species and sizes contained within Table 12 and shall be dormant planted between October 15 and November 30, 2015 throughout the Wet-Mesic Forest Planting Zone (Appendix E). Suitable locations within the community shall be chosen based up current site conditions. The trees shall be randomly scattered planted on $\geq 10'$ centers while shrubs shall be randomly scattered planted in clumps of 3-5 individuals on no less than 5' centers. Trees and shrubs shall be protected with shelters; however, due to their shape and size, multi-stemmed shrubs may not be tubed. The trees and shrubs shall be installed as discussed in the Shrub-Carr section above.

Table 12. Wet Mesic Forest Woody Species, Quantities and Sizes.

<i>Species</i>			
Common Name	Scientific Name	Quantity	Size - Height
<i>Trees</i>			
Balsam Fir	<i>Abies balsamea</i>	25	#5-7 gallon
Red Maple	<i>Acer rubrum</i>	25	2-4' bare-root
Silver Maple	<i>Acer saccharinum</i>	75	2-4' bare-root
Yellow Birch	<i>Betula alleghaniensis</i>	50	2-4' bare-root
Musclewood	<i>Carpinus caroliniana</i>	25	2-4' bare-root
Northern Hackberry	<i>Celtis occidentalis</i>	15	2-4' bare-root
Black Ash	<i>Fraxinus nigra</i>	5	#5-7 gallon
Tamarack	<i>Larix laricina</i>	25	#5-7 gallon
Black Spruce	<i>Picea mariana</i>	25	#5-7 gallon
Swamp White Oak	<i>Quercus bicolor</i>	100	2-4' bare-root
Bur Oak	<i>Quercus macrocarpa</i>	50	2-4' bare-root
Peach-leaf Willow	<i>Salix amygdaloides</i>	50	#2-5 gallon
Black Willow	<i>Salix nigra</i>	75	2-4' bare-root
White-cedar	<i>Thuja occidentalis</i>	25	#5-7 gallon
Canadian Hemlock	<i>Tsuga canadensis</i>	10	#5-7 gallon
Slippery Elm	<i>Ulmus rubra</i>	20	#2-5 gallon
<i>Shrubs</i>			
Black Chokeberry	<i>Aronia melanocarpa</i>	25	#2-5 gallon
Swamp Birch	<i>Betula pumila</i>	15	#2-5 gallon
Buttonbush	<i>Cephalanthus occidentalis</i>	10	2-4' bare-root
Alternate-leaved Dogwood	<i>Cornus alternifolia</i>	15	#5 gallon
Silky Dogwood	<i>Cornus amomum</i>	50	2-4' bare-root
Red-osier Dogwood	<i>Cornus stolonifera</i>	25	2-4' bare-root
Bush Honeysuckle	<i>Diervilla lonicera</i>	25	#1-2 gallon
Winterberry (Male & Female)	<i>Ilex verticillata</i>	10	2-4' bare-root
Fly Honeysuckle	<i>Lonicera canadensis</i>	15	#1-2 gallon
Common Ninebark	<i>Physocarpus opulifolius</i>	35	2-4' bare-root
Black Currant	<i>Ribes americanum</i>	25	#1-2 gallon
Wild Rose	<i>Rosa blanda</i>	20	#1-2 gallon
American Elder	<i>Sambucus canadensis</i>	35	2-4' bare-root
Meadow-sweet	<i>Spiraea alba</i>	10	#2-5 gallon
Lowbush Blueberry	<i>Vaccinium angustifolium</i>	15	#1-2 gallon
Nannyberry	<i>Viburnum lentago</i>	35	2-4' bare-root
American Highbush Cranberry	<i>Viburnum opulus L. subsp. trilobum</i>	35	2-4' bare-root
TOTAL		1,000	

Habitat Structure Installation

Due to a lack of nesting and roosting opportunities within the community, bird and bat houses will be added to the Wet-Mesic Forest Planting Zone. A rock pile will also be added to provide additional cover, habitat and feeding opportunities for a variety of aquatic insects, amphibians, reptiles, mammals and birds. The addition of bird houses will benefit cavity nesting and dwelling species, in particular eastern screech-owl (*Otus asio*) and gray squirrel (*Sciurus carolinensis*). The bat house may provide roosting for several species, but little and big brown bats are expected to be the most common.

A formal wetland delineation was not conducted and our ecologists reviewed the site outside the growing season; therefore, the need for permits is unknown. The structures will not be placed in navigable water

of the state, but wetland could be impacted. Restoration activities must adhere to Wisconsin Administrative Codes NR 103, NR 323, and NR 353. Prior to work beginning on-site, it will be necessary to obtain permit coverage. General Permits include Wetland Conservation Activities and Habitat Structure – Wildlife Nesting Structure. Rock piles are not currently covered under a general permit; therefore, a Wetland Individual Permit may be required for placement of this structure.

Rock Pile

A rock pile shall be constructed in the approximate location shown in Appendix E. Rounded field stone ranging in size from 6-36" shall be placed in a manner that creates an interlocking, stable mound. The dimensions of the piles shall be roughly five feet wide by 2 ½ feet high (Appendix F –Rock Pile Detail). Provided site conditions are suitable, rocks can be brought in and placed by equipment. Installation can be done during the summer of 2015.

Bird and Bat Houses

Although gray squirrels and eastern screech owls are relatively common throughout the area, the existing site lacks suitable nesting or denning habitat for either species. Both species are well adapted to utilizing nest boxes; therefore, installation of these structures is a simple, cost-effective means to increase wildlife use within the restoration site. A total of two nesting box, which could be utilized by either species shall be placed within the Wet-Mesic Forest Planting Zone (Appendix E). Little and big brown bats are also relatively common, but the recent discovery of White-nose Syndrome in the state has resulted in a need to assist bat species in any manner possible. Four bat houses will provide accessible daytime roosting, which may reduce stress and increase their health. Instructions for constructing the nesting and roosting boxes can be found in Appendix F or they may be purchased. Once constructed or purchased, the following instructions shall be followed for placement and installation:

Bats

Houses shall be placed so they are:

- 1) 12-20 feet above the ground on a pole with predator guard
- 2) facing East or South
- 3) receiving a minimum of 6-8 hours of sun exposure per day
- 4) protected from the wind
- 5) >25 feet from a potential predator perch such as tree limbs
- 6) not near bright lights such as street, security or porch lighting

Houses shall be painted black.

Purchased houses shall be installed per manufacturer's instructions or those found at <http://www.batcon.org/pdfs/bathouses/InstallingYourBatHousebuilding.pdf>.

Constructed and purchased houses not placed on buildings shall be secured to a Schedule 40 Galvanized Steel Pole with an inside diameter of $\geq 2"$. The pole shall be $\geq 16'$ in length. Pole installation can also be found at the above web address. Two houses shall be placed back-to-back on each pole (4 total); therefore, a double mounting bracket shall be utilized. Brackets can be purchased from Lone Star Woodcraft.

Eastern Screech Owl & Gray Squirrel

- 1) To prevent squirrel occupation, one of the two houses shall be placed $\geq 15'$ from any jumping point including tree trunks and overhanging branches.
- 2) 2-3" of wood chips shall be placed in the box
- 3) Nesting box shall be placed at least 10 feet above the ground on a Schedule 40 Galvanized Steel Pole with an inside diameter of $> 2"$. The pole shall be $\geq 13'$ in length.

A standard mounting bracket such as the one sold by Lone Star Woodcraft or equal may be utilized; however, the bracket shall be made flush with the box edges when complete. Otherwise, instructions found at the following website shall be followed: <http://www.batcon.org/pdfs/bathouses/InstallingYourBatHouseWoodenPostSteel%20Pole.pdf> Although the instructions are for the installation of a bat house, the procedure for installing a house on a steel pole can be applied. The steps for installing the steel pole can also be found here.

Although nesting season will have begun and bats will be utilizing familiar roosting sites, the nesting and roosting boxes shall be installed in early June. Their presence in 2015 will expose potential future occupants to their presence.

Mesic to Wet-Mesic Prairie

The proposed community (Appendix E) exists in an opening among the surrounding trees that appears to receive adequate sunlight to support prairie species. Based on our site review, the area appears to contain a mix of native and non-native species. Although prairie doesn't appear to be a historic community found within the project area, the sunny and sandy location should support many plant species associated with prairies. The added plant diversity will provide additional cover and feeding opportunities. Native vegetation establishment will be the main restoration component within this community; however, the installation of rock and brush piles along with nesting structures (bird houses) will help increase habitat diversity by providing cover, feeding, and nesting opportunities for a variety of invertebrate, amphibian, reptile, mammal and bird species.

The existing trail discussed above in the Shrub-Carr and Wet-Mesic Forest sections passes through a portion of this community also. As with the other two communities, signs and fencing shall be erected in an effort to educate and protect

Site Preparation

Although some native species may be present, the Mesic to Wet-Mesic Prairie is being considered a Re-work Zone; therefore, the site shall be treated with herbicide 2-3 times during the 2015 growing season. A combination of chemicals discussed above shall be utilized per the labels to adequately control existing vegetation.

Following the last herbicide application and prior to sowing the native seed, the soil shall be lightly worked to a depth of ¼" – ½" in depth with a disc and/or harrow. An NR 216 Construction Site Storm Water Discharge Permit shall be secured from the WDNR prior to earth disturbing activities.

Vegetation Establishment

To assist with re-vegetation, seeding activities shall occur throughout the Mesic to Wet-Mesic Prairie Planting Zone (Appendix E). The selected grasses, sedges and wildflowers for the community can be found in Table 13. Species were chosen to provide an aesthetically pleasing community in an urban setting, while providing wildlife habitat and ground cover.

Native seed application rates are based on applying 60-100 seed per square foot. The quantity of seed required per acre (Table 13) is based on purchasing "Pure Live Seed (PLS)". Seed requirements shall be the same as those provided in the community discussions above. The native seed along with a cover crop shall be dormant sown between October 15th and November 30th, 2015. If the community is hand sown, the seed shall be mixed with a carrier (e.g., sawdust, vermiculite, moist sand, etc.) to ensure even seed

distribution. If a hand operated Truax seed slinger is utilized then a carrier is not required. The seeded areas shall then be rolled with a cultipacker to ensure good seed to soil contact if the soils are not saturated. Otherwise, the seed shall be installed with a broadcast type seeder (Brillion) capable of properly handling and distributing the small and fluffy native seeds. As mentioned above, the soil shall be lightly worked to a depth of ¼” – ½” in depth with a disc and/or harrow prior to seeding. If the soil is too light and fluffy, the area shall be cultipacked to provide a firmer seedbed prior to seeding.

Table 13. Mesic to Wet-Mesic Prairie Species and Seeding Rate.

Species		Ounces Required
Common Name	Scientific Name	Per Acre
<i>Forbs</i>		
Nodding Onion	<i>Allium cernuum</i>	4.1
Columbine	<i>Aquilegia canadensis</i>	0.8
Common Milkweed	<i>Asclepias syriaca</i>	1.2
Butterfly Weed	<i>Asclepias tuberosa</i>	0.9
Smooth Blue Aster	<i>Aster laevis</i>	1.0
Calico Aster	<i>Aster lateriflorus</i>	0.3
New England Aster	<i>Aster novae-angliae</i>	1.0
Purple Prairie Clover	<i>Dalea purpurea</i>	8.4
Showy Tick Trefoil	<i>Desmodium canadense</i>	0.9
Shooting Star	<i>Dodecatheon meadia</i>	0.8
Pale Purple Coneflower	<i>Echinacea pallida</i>	9.0
Ox-eye	<i>Heliopsis helianthoides</i>	6.2
Round-headed Bushclover	<i>Lespedeza capitata</i>	6.9
Rough Blazingstar	<i>Liatris aspera</i>	4.9
Pale Spiked Lobelia	<i>Lobelia spicata</i>	0.2
Wild Bergamot	<i>Monarda fistulosa</i>	1.8
Common Mountain Mint	<i>Pycnanthemum virginianum</i>	0.4
Yellow Coneflower	<i>Ratibida pinnata</i>	2.6
Black-eyed Susan	<i>Rudbeckia hirta</i>	0.9
Brown -eyed Susan	<i>Rudbeckia triloba</i>	2.8
Compass Plant	<i>Silphium laciniatum</i>	1.2
Prairie Dock	<i>Silphium terebinthinaceum</i>	1.6
Showy Goldenrod	<i>Solidago speciosa</i>	0.6
Common Spiderwort	<i>Tradescantia ohimensis</i>	7.8
Culver's Root	<i>Veronicastrum virginicum</i>	0.1
Golden Alexander	<i>Zizia aurea</i>	7.1
<i>Grasses/Sedges</i>		
Big Bluestem	<i>Andropogon gerardii</i>	7.8
Side Oats Grama	<i>Bouteloua curtipendula</i>	65.3
Sand Bracted Sedge	<i>Carex muehlenbergii</i>	6.5
Canada Wild Rye	<i>Elymus canadensis</i>	60.3
Switch Grass	<i>Panicum virgatum</i>	5.6
Little Bluestem	<i>Schizachyrium scoparium</i>	26.1
Indian Grass	<i>Sorghastrum nutans</i>	19.6
TOTAL		264.7

Habitat Structure Installation

Due to a lack of nesting opportunities within the community, bird houses will be added to the Mesic to Wet-Mesic Prairie Planting Zone. Rock and brush piles will also be added to provide additional cover, habitat and feeding opportunities for a variety of aquatic insects, amphibians, reptiles, mammals and birds. The addition of bird houses will benefit cavity nesting.

A formal wetland delineation was not conducted and our ecologists reviewed the site outside the growing season; however, the area does not appear to be wetland. Therefore, the structures will not be placed in a navigable water of the state or a wetland. Restoration activities must still adhere to Wisconsin Administrative Codes NR 103, NR 323, and NR 353 so the WDNR shall be consulted prior to work beginning on-site.

Rock Pile

A rock pile shall be constructed in the approximate location shown in Appendix E. Construction shall be similar to the pile installed in the Wet-Mesic Forest Planting Zone.

Brush Pile

A brush pile shall be constructed in the approximate location shown in Appendix E. Construction shall be similar to the pile installed in the Northern Sedge Meadow Planting Zone.

Bird Houses

Two nesting structures, one tree swallow and one wood duck box shall be erected in the approximate locations shown in Appendix E. Construction and installation shall be similar to those specified in the Northern Sedge Meadow Planting Zone.

Prairie

The proposed community exists along the south slope of the restoration site (Appendix E). Much of the area has been disturbed during the dredging operation. In the spring of 2015, slopes within the area will be re-graded, topsoil applied and the area seeded with a cover crop of oats. Part of the site preparation by the dredging contractor will also include the removal of the existing trees, which include cottonwood and box elder. The tree tops will be available for use to construct brush piles throughout the site (Appendix E). Removal of the large trees will allow more light to the slope. Although prairie doesn't appear to be a historic community found within the project area, the sunny and sandy location should support many plant species associated with prairies. The added plant diversity will provide additional cover and feeding opportunities. Native vegetation establishment will be the main restoration component within this community; however, the installation of nesting structures (bird houses) will help increase habitat diversity by providing nesting opportunities for bird species.

Site Preparation

The Prairie is being considered a Re-work Zone since it will be re-graded and planted with a cover crop in 2015; therefore, the site shall be treated with herbicide 2-3 times during the 2015 growing season. A combination of chemicals discussed in the above sections shall be utilized per the labels to adequately control existing vegetation.

Following the last herbicide application and prior to sowing the native seed, the soil shall be lightly worked to a depth of ¼" – ½" in depth with a disc and/or harrow.

An NR 216 Construction Site Storm Water Discharge Permit shall be secured from the WDNR prior to earth disturbing activities.

Vegetation Establishment

To assist with re-vegetation, seeding activities shall occur throughout the Prairie Planting Zone (Appendix E). The selected grasses, sedges and wildflowers for the community can be found in Table 14. Species were chosen to provide an aesthetically pleasing community in an urban setting, while providing wildlife habitat and ground cover. The majority of the species chosen are also less than four feet in height to reduce visual obstructions of the harbor from the adjacent walking trail.

Native seed application rates are based on applying 60-100 seed per square foot. The quantity of seed required per acre (Table 14) is based on purchasing “Pure Live Seed (PLS)”. Seed requirements shall be the same as those provided in the community discussions above. The native seed along with a cover crop shall be dormant sown between October 15th and November 30th, 2015. If the community is hand sown, the seed shall be mixed with a carrier (e.g., sawdust, vermiculite, moist sand, etc.) to ensure even seed distribution. If a hand operated Truax seed slinger is utilized then a carrier is not required. The seeded areas shall then be rolled with a cultipacker to ensure good seed to soil contact if the soils are not saturated. Otherwise, the seed shall be installed with a broadcast type seeder (Brillion) capable of properly handling and distributing the small and fluffy native seeds. As mentioned above, the soil shall be lightly worked to a depth of ¼” – ½” in depth with a disc and/or harrow prior to seeding. If the soil is too light and fluffy, the area shall be cultipacked to provide a firmer seedbed prior to seeding. Upon completing the seeding, Class I, Urban, Type A erosion blanket shall be installed.

Table 14. Prairie Species and Seeding Rate.

Species		Ounces Required
Common Name	Scientific Name	Per Acre
<i>Forbs</i>		
Nodding Onion	<i>Allium cernuum</i>	2.1
Prairie Onion	<i>Allium stellatum</i>	2.1
Leadplant	<i>Amorpha canescens</i>	2.0
Thimbleweed	<i>Anemone cylindrica</i>	0.6
Northern Thimbleweed	<i>Anemone virginiana</i>	0.6
Columbine	<i>Aquilegia canadensis</i>	0.8
Butterfly Weed	<i>Asclepias tuberosa</i>	0.9
Whorled Milkweed	<i>Asclepias verticillata</i>	1.4
Heath Aster	<i>Aster ericoides</i>	0.2
Smooth Blue Aster	<i>Aster laevis</i>	1.1
Sky Blue Aster	<i>Aster oolentangiense</i>	0.6
Lance-leaf Coreopsis	<i>Coreopsis lanceolata</i>	1.2
Purple Prairie Clover	<i>Dalea purpurea</i>	3.1
Shooting Star	<i>Dodecatheon meadia</i>	0.5
Pale Purple Coneflower	<i>Echinacea pallida</i>	4.5
Flowering Spurge	<i>Euphorbia corollata</i>	0.8
Sweet Everlasting	<i>Gnaphalium obtusifolium</i>	0.1
Prairie Alumroot	<i>Heuchera richardsonii</i>	0.1
Round-headed Bushclover	<i>Lespedeza capitata</i>	2.9
Rough Blazingstar	<i>Liatris aspera</i>	2.5
Dwarf Blazing Star	<i>Liatris cylindracea</i>	1.7

Table 14. Continued.

Wild Lupine	<i>Lupinus perennis</i>	3.6
Wild Bergamot	<i>Monarda fistulosa</i>	1.3
Spotted Bee Balm	<i>Monarda punctata</i>	0.9
Wild Quinine	<i>Parthenium integrifolium</i>	4.5
Foxglove Beardtongue	<i>Penstemon digitalis</i>	0.6
Hairy Beardtongue	<i>Penstemon hirsutus</i>	0.3
Prairie Cinquefoil	<i>Potentilla arguta</i>	0.4
Yellow Coneflower	<i>Ratibida pinnata</i>	2.6
Black-eyed Susan	<i>Rudbeckia hirta</i>	0.9
Brown-eyed Susan	<i>Rudbeckia triloba</i>	2.3
Prairie Blue-eyed Grass	<i>Sisyrinchium campestre</i>	1.4
Stiff Goldenrod	<i>Solidago rigida</i>	1.5
Showy Goldenrod	<i>Solidago speciosa</i>	0.8
Common Spiderwort	<i>Tradescantia ohiensis</i>	3.9
Hoary Vervain	<i>Verbena stricta</i>	3.4
Golden Alexander	<i>Zizia aurea</i>	7.1
<i>Grasses/Sedges</i>		
Side Oats Grama	<i>Bouteloua curtipendula</i>	65.3
Sand Bracted Sedge	<i>Carex muehlenbergii</i>	6.5
Purple Love Grass	<i>Eragrostis spectabilis</i>	1.4
June Grass	<i>Koeleria macrantha</i>	0.8
Little Bluestem	<i>Schizachyrium scoparium</i>	31.4
Indian Grass	<i>Sorghastrum nutans</i>	19.6
TOTAL		190.3

Habitat Structure Installation

Due to a lack of nesting opportunities within the community, bird houses will be added to the Prairie Planting Zone. The addition of bird houses will benefit cavity nesting.

Bird Houses

Two tree swallow nesting structures shall be erected in the approximate locations shown in Appendix E. Construction and installation shall be similar to those specified in the Northern Sedge Meadow Planting Zone.

CONSTRUCTION SEQUENCING

Once permits have been issued, on-site work can begin in the late spring/early summer of 2015. Work cannot occur in the water March 1st through June 15th in order to minimize adverse impacts on fish movement, fish spawning, and egg incubation periods. Tables 14 & 15 provide an approximate timeline for completion of tasks associated with the native plantings and structure installations. The schedule needs to be flexible to accommodate for weather, scheduling conflicts, etc., but it provides a general indication of the dates for completing the proposed components.

Table 15. Implementation Schedule - 2015.

Task	Year 2015											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Install & Maintain Restoration Signs & Barrier Fencing						■	■	■	■	■		
Site Preparation – Invasive Species Control in all Communities						■	■	■	■	■		
Site Preparation – Herbicide Applications in Re-work Zones						■		■		■		
Debris/Litter Removal						■	■	■	■	■		
Install Carp & Goose Fencing						■	■					
Aquatic Submergent & Emergent Live Plant Installation						■	■					
Install Tern Nesting Platforms						■	■					
Erect Bird & Bat Houses						■	■					
Install Half-Log & Log Structures							■	■	■	■		
Construct Rock & Brush Piles							■	■	■	■		
Install Fish Sticks							■	■	■	■		
Disc & Harrow										■	■	
Mow Enhancement Zone Vegetation										■	■	
Native Seed Installation										■	■	
Live Plant Installation										■	■	
Install Potted & Bare-root Trees/Shrubs										■	■	
Install Live Stakes										■	■	

Table 16. Implementation Schedule - 2016.

Task	Year 2016											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Install Log Structures	■	■										
Install Fish Sticks*	■	■		■	■							
Maintenance/Repair of Restoration Signs & Barrier Fencing				■	■	■						
Maintenance/Repair Carp & Goose Fencing				■	■							
Live Plant Installation					■	■						

Activities in red may be completed over the ice if not completed in 2015.

*Final measures to secure the structures shall be conducted when the soil is no longer frozen

POST-CONSTRUCTION

Following completion of the ecological restoration, four years of monitoring and maintenance (2015-2018) will occur, with 2015 considered to be year zero. Monitoring will be conducted by Dr. Keith West of the University of Wisconsin-Marquette and his students with training and guidance provided by WDNR biologists. Maintenance activities, per the Chapter 30 Permit, will be conducted by either the installation contractor under a separate contract or by another restoration firm hired by the City of Marinette.

Monitoring

Goals

Many of the functional values discussed in the Baseline Conditions section will improve with the proper installation and maintenance of the communities; however, in order to quantify their success, in-depth

studies, requiring money and time for the community to become established, would have to be conducted. Therefore, objectives for this project's goals will revolve around vegetation establishment, invasive species control and the presence of wildlife.

There are three goals related to this project. Goal one is to enhance the plant communities that have been degraded through the invasion of species such as cattail, giant reed grass, purple loosestrife, reed canary grass, spotted knapweed and quack grass. Suppression of these invasive species along with the re-establishment of native vegetation through seeding and planting activities will improve the overall quality of the wetland complex and its buffer. A diverse native vegetation community will provide quality habitat for local wildlife populations. The second goal is to provide additional habitat structure to increase use of the site by a variety of wildlife species. Native vegetation will provide necessary cover, food and nesting; however, additional structures such as rock and brush piles, nesting boxes and woody debris will further benefit and increase wildlife species found utilizing the site. The third goal will include the preservation of the restoration site. To meet this goal, the City of Marinette intends to zone the site as P1-Park District "Conservancy District" which preserves natural areas and restricts development to only low-impact features such as nature trails and wildlife observation structures.

Performance Standards

The below performance standards will be used to verify the success of the restored wetland and upland communities. Some of the standards will also help determine if the wetland is providing increased functional values.

- 1) Aerial coverage of invasive, non-native species such as giant reed grass, reed canary grass, cattail spp., purple loosestrife and spotted knapweed will not be >5% absolute cover after three years.
- 2) After three years, $\geq 85\%$ of the vegetative cover within the restoration site will be native species, <15% of the cover will be invasive, non-native species.
- 3) Ninety percent of the site will be vegetated within three years.
- 4) 600 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy three years after installation.
- 5) 750 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy three years after installation.
- 6) The Open Water with Submergent Vegetation Community shall have a minimum of 5 native, non-invasive species present.
- 7) The Emergent Aquatic Community shall have a minimum of 15 native, non-invasive species present.
- 8) The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 20 native species present.
- 9) To ensure the restored communities have natural significance, the floristic quality index (FQI) and Coefficient of Conservatism (Mean C) for each shall be ≥ 25 and ≥ 4.0 , respectively, after three years. FQI values will be calculated utilizing all species present: non-native species will be assigned a value of zero.
- 10) Six of the twelve nesting and roosting boxes shall be utilized or occupied annually by year three.
- 11) Twenty avian species, five species of reptiles and amphibians, and five mammal species will be recorded, either through direct observation, calls or sign left by the species, utilizing the site after three years.

Year zero (2015) will include conducting a meander survey in June to compile a comprehensive species list of the vegetation currently found within the different communities. The previous vegetation survey conducted by Ayres was completed in the fall of 2013. An updated survey will help establish conditions after the last herbicide application and prior to substantial work being completed on-site. In addition to the qualitative data conducted in June, quantitative data shall be collected in August by establishing

permanent sample plots. Repeated sampling within these locations will provide valuable information regarding site progression.

The seven restored communities will be monitored annually over a four year period. Quantitative data will be collected in mid-August the first and third years after activities are completed. The site will be monitored by collecting data at 15 1-m² (herbaceous layer), 5-m² (shrub layer) and 10-m² (tree layer) sample plots (1-3 per community type) established randomly throughout the seven communities (Appendix E). Each plot will be marked with a wooden stake and located with a Trimble GPS (sub-meter accuracy) unit to allow for the analysis of temporal trends within the communities. Qualitative data will be collected in late May or early June each of the three years and in mid-August on the second year after restoration activity completion. These data will be collected by conducting a meander survey through each community. Both quantitative and qualitative data collected during these periods and utilized within the monitoring report will be specific and dated. Appendix G contains a Habitat Description and Botanical Survey Form that can be utilized to record data.

A photographic record of each community will also be maintained by taking pictures from the same vantage point each monitoring year. Photos shall be dated and captioned, including those used in the monitoring report.

In addition to the site visits indicated above, qualitative (e.g., invasive species and wildlife observations) data shall be collected during site visits conducted throughout the growing season (May through October) to implement maintenance activities.

Annual monitoring reports containing the below elements shall be submitted to the City of Marinette and the Wisconsin Department of Natural Resources by the end of December each year.

- 1) Identify site
- 2) Dates of site inspections
- 3) A restatement of the plan goals, objectives, and performance standards.
- 4) A description of management activities and corrective actions implemented during the past year including the identification of any structural failures or external disturbance on the site.
- 5) A site map showing the locations of data collection and fixed photo points
- 6) Site photos
- 7) A summary of and full presentation of the data collected during the past year. A narrative summary of the results and conclusions of the monitoring including an assessment of the presence and level of occurrence of invasive species. An assessment of the degree to which performance standards are being met. Proposed corrective actions to improve attainment of performance standards.

Vegetation

At each sample plot, the plant species and percent coverage will be recorded within a 1 m² (herbaceous), 5 m² (shrubs) and 10 m² (trees) area during August in the first and third years of monitoring. Coverage will be determined using the perpendicular projection to the ground from the outline of the aerial parts of the plant species and reported as the percent of the total area (e.g., substrate or water surface) covered (Brower et al. 1990). The percent foliage coverage will help determine the success of the overall vegetation establishment on the site and it will be analyzed for each species using the Daubenmire Classification Scheme ((Mueller-Dombois and Ellenberg 1974). The Daubenmire methodology will rank each species observed according to estimated foliage cover (Table 9). By providing a range of percent foliage cover for each rank, the Daubenmire Classification Scheme will help minimize errors due to observer bias, visual estimation, etc. Frequency of occurrence and relative frequency of occurrence will also be estimated. The frequency of occurrence is defined as the number of times that a given species occurred in each community type. The relative frequency of occurrence is the frequency of that species divided by the sum of the frequencies of all species in the community (Bower et al. 1990). The rankings

developed using the Daubenmire Classification Scheme and the frequency of occurrence data will be utilized to help determine whether the objectives relating to dominance by native taxa and the percent coverage of exotic species is satisfactorily achieved.

Table 17. Daubenmire Classification Scheme Cover Ranking System.

Percent Foliage Cover	Rank
0-5	1
5-25	2
25-50	3
50-75	4
75-95	5
95-100	6

During the June meander survey, conducted each monitoring year, the number of living planted trees and shrubs and a comprehensive list of plant species found within each community will be determined. Since there must be 75% survival rate at the end of the third year, an accurate count of the trees and shrubs will be required each year to determine if corrective actions are required. Each living woody species location will be located with a GPS and placed on a community map. Data sets within GIS will then be used to compare subsequent years to determine shrub age, which will be color coded on the aforementioned map. The plant species list accumulated during this survey will be added to an August list compiled at either the established sample points or through another meander survey conducted in the second year of monitoring. Plant species not found in the sample plots, but identified while walking between points will be added to the comprehensive list.

Once a comprehensive plant list has been accrued, the average coefficient of conservatism or Mean C and floristic quality index (FQI) (Herman et al. 1996) will be calculated for each community type within the restoration site. Each plant's coefficient of conservatism will be taken from the document "Development of A Floristic Quality Assessment Methodology for Wisconsin." The coefficient of conservatism (C) is based on a scale of 1 to 10 and is a measure of a plant's affinity or its estimated probability of occurring in a landscape relatively unaltered from what is believed to be a pre-settlement condition. A C of 0; therefore, is assigned to plants like box elder (*Acer negundo*) that have demonstrated little fidelity to any remnant natural community (i.e., it may be found anywhere), while a C of 10 is assigned to plants like shrubby cinquefoil (*Potentilla fruticosa*) that are almost always restricted to high quality natural areas. According to the "Development of A Floristic Quality Assessment Methodology for Wisconsin," a Mean C that ranges between 0 and 3 contains many species that are very tolerant of disturbance. An average between 4 and 6 indicates a moderately tolerant community, while anything above 7 contains many species that are not tolerant of disturbance. The FQI is calculated by averaging the sum of the coefficients of conservatism for all identified species and then by dividing the average by the square root of the total number of plants. Based upon Michigan studies (Herman et al. 1996), a FQI of less than 20 has minimal significance from a natural quality standpoint. A FQI higher than 35 suggests that an area has relatively high conservatism and richness and that they are floristically important. Habitats with a FQI higher than 50 are extremely rare and represent a significant component to native biodiversity and natural landscapes. The Mean C and floristic quality index will be used to assess the floristic quality (i.e., natural condition) of the restored communities.

All raw vegetation data collected during our surveys shall be included within the attachments of each monitoring report.

Wildlife

Evidence of wildlife on the site will be documented when conducting data collection at the sample plots, during the meander surveys, and during maintenance activities to determine the functional value of the restored habitat. A table containing the species or sign observed along with their recorded date will be included within the annual monitoring reports.

We are hopeful that many more wildlife species will be present than the number indicated in the performance standard, but the goal needs to be realistic. The successful restoration of the wetland and upland communities will draw many wildlife species seeking food, water, and shelter. If species observations are low, specific activities such as conducting avian surveys in the early morning or setting up live animal and pit fall traps to capture mammals, reptiles and amphibians shall be undertaken. These activities will provide opportunities to observe the wildlife using the site.

Maintenance

The City of Marinette or their representative shall inspect and monitor the plantings so that the suggested maintenance activities can be conducted to ensure optimum success of the site.

Open Water, Emergent and Wet Meadow Communities

The aquatic and wet meadow zones will need maintenance as they develop and even after they are established due to the threat of invasion by exotic weeds. As discussed in the Site Preparation Sections for these communities, species such as narrow-leaf cattail, reed canary grass, giant reed grass, and purple loosestrife shall be removed or treated with herbicide to prevent them from becoming established or spreading. Vegetation patches greater than 10'X10' that are treated and eliminated through herbicide applications will be replanted or reseeded with native plants or seed. Quick, early treatment of these species will save time and money down the road. Addressing invasive species will be an annual endeavor between 2016-2018 due to their ability to appear suddenly and spread quickly, but aggressive and proactive maintenance early on will limit future activities. Activities discussed above shall be utilized to treat and remove these and other invasive species.

Invasive species control within the Wild Rice planting zone will be particularly important since success of the seeding is unknown. If conditions allow, a healthy stand of rice will become well established and provide the intended community. Emergent aquatic vegetation planted in the adjacent zones will spread over time if the wild rice does not successfully grow; however, invasive species populations must be kept under control to eliminate competition.

To ensure adequate plant establishment, goose and carp fencing shall be repaired and maintained annually so it is in place and functional through the 2018 growing season. If plant establishment allows ($\geq 90\%$ coverage) the fence may be removed early. All fencing material will be removed by November 30, 2018.

If the communities lack the number of species required in the performance standards, additional seeding or planting shall be conducted to increase diversity and plant coverage. Live plants shall be installed in June or early July while any seeding shall be conducted in mid-October to late November. These activities shall follow those guidelines provided above.

A muskrat control plan will also need to be implemented. Populations of these herbivores can grow rather quickly; and although, the emergent vegetation is there to provide food and habitat for wildlife, the overall population of these animals must be controlled. Trapping and removal activities will be a long-term maintenance activity that will not only benefit the health of the emergent vegetation, but the integrity of the community and its associated structures.

Although not necessary, nesting platforms and houses can be repaired and cleaned out in early spring prior to the arrival of migratory birds.

Shrub-Carr and Wet-Mesic Forest Communities

The woody planting zones will need maintenance as they develop and even after they are established due to the threat of invasion by exotic weeds. As discussed in the Site Preparation Sections for these communities, both aquatic and terrestrial species shall be removed or treated with herbicide to prevent them from becoming established or spreading. Vegetation patches greater than 10'X10' that are treated and eliminated through herbicide applications will be reseeded with native seed. Quick, early treatment of these species will save time and money down the road. Addressing invasive species will be an annual endeavor between 2016-2018 due to their ability to appear suddenly and spread quickly, but aggressive and proactive maintenance early on will limit future activities. Activities discussed above shall be utilized to treat and remove invasive species.

Trees and shrubs within the Shrub-Carr and Wet-Mesic Forest Planting Zones should not require much, if any, maintenance as long as the tree shelters remain in place and plants are not damaged by rabbits or deer. The site shall be regularly evaluated to determine the condition of the shelters and whether or not herbivory is affecting the development of the plantings. Corrective/protective measures including shelter replacement and repair will be taken if they are required. If monitoring indicates that certain areas do not have satisfactory tree and shrub numbers due to mortality, they will be replanted. Potted and bare-root trees and shrubs shall be installed between mid-April and mid-May or mid-October and late November. If the communities lack the number species required in the performance standards, additional seeding and planting shall be conducted to increase diversity and plant coverage. Live plants shall be installed in June or early July while any seeding shall be conducted in mid-October to late November. These activities shall follow those guidelines provided above.

To ensure adequate plant establishment and protection, restoration signs and barrier fencing shall be repaired and maintained annually so it is in place and functional through the 2018 growing season. If plant establishment allows ($\geq 90\%$ coverage) the fence may be removed early. All fencing material will be removed by November 30, 2018. Informational signs, however, may remain to remind recreational users of the restoration project and to prohibit unauthorized use by such things as motorized vehicles.

Although not necessary, bird houses can be repaired and cleaned out in early spring prior to the arrival of migratory birds.

Mesic to Wet-Mesic Prairie Community

The communities planted with the prairie species mixture will likely need the most maintenance. An abundance of annual and perennial weeds invade newly planted sites no matter how much preparation work is completed prior to seeding. A combination of mowing and spot herbicide treatment will be critical in the first 3-4 years of establishment. Vegetation patches greater than 10'X10' that are treated and eliminated through herbicide applications will be reseeded with native seed. Dormant seeding shall be conducted in mid-October to late November. Once the warm and cool season grasses have become dense enough to provide a suitable litter layer, the community can be managed with prescribed burns. Fire will assist with controlling many undesirable species; however, pressure from invasive species will still warrant occasional hand removal or spot herbicide applications for optimum control. If burning is not an option, mowing may be substituted to maintain the health and vigor of the native planting. Long-term management of the prairie will include mowing or burning activities completed every 3-5 years to eliminate woody species invasion, control undesirable cool season species and rejuvenate the plant community. As discussed above in the Site Preparation Section for this community, terrestrial species shall be removed or treated with herbicide or through mowing to prevent them from becoming established or spreading.

The City of Marinette or their representative will conduct the above-mentioned maintenance as outlined in Tables 17-20. Every maintenance activity conducted during a specific year will be documented and included within the annual monitoring reports.

Table 18. Proposed Maintenance Schedule For Year One.

Task	Year 1											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Herbicide/Remove Invasive Species in Wetland & Upland Communities												
Mow Prairie Community												
Site Inspections												
Conduct supplemental seeding/planting, if needed												

Activity in red may not be required.

Table 19. Proposed Maintenance Schedule For Year Two.

Task	Year 2											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mow Prairie Community												
Herbicide/Remove Invasive Species from Wetland & Upland Communities												
Site Inspections												

Activity in red may not be required.

Table 20. Proposed Maintenance Schedule For Year Three.

Task	Year 3											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Herbicide/Remove Invasive Species from Wetland & Upland Communities												
Mow Upland Buffer												
Site Inspections												

Activity in red may not be required.

Table 21. Proposed Maintenance Schedule For Years Four and Beyond.

Task	Years 4+											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Herbicide/Remove Invasive Species from Wetland & Upland Communities												
Mow or Burn Upland Buffer*												
Site Inspections												

*Task to be completed when appropriate during the above timeframe.

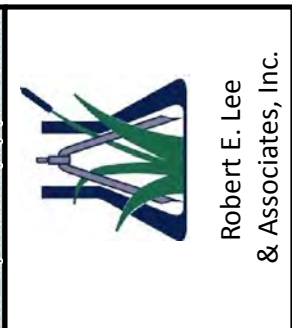
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- Wisconsin Department of Natural Resources. 2003. *Development of a Floristic Quality Assessment Methodology for Wisconsin*.
- WDNR, Michigan Department of Environmental Quality (MDEQ). (2014, February). *2013 Fish and Wildlife Population and Habitat Management and Restoration Plan Update for the Lower Menominee River Area of Concern*.

A

APPENDIX A

Site Location Map



Site Location

4/20/2015

**Lower Menominee River Area of Concern
Menominee Harbor Restoration Project
City of Marinette-Grant/Proj. No. GL-00E01312-0
REL Project No. 13775005
Marinette, Marinette County, WI**

Located in parts of:
Section 11 & 12
T31N, R27W
City of Marinette
Marinette County
Wisconsin

Legend

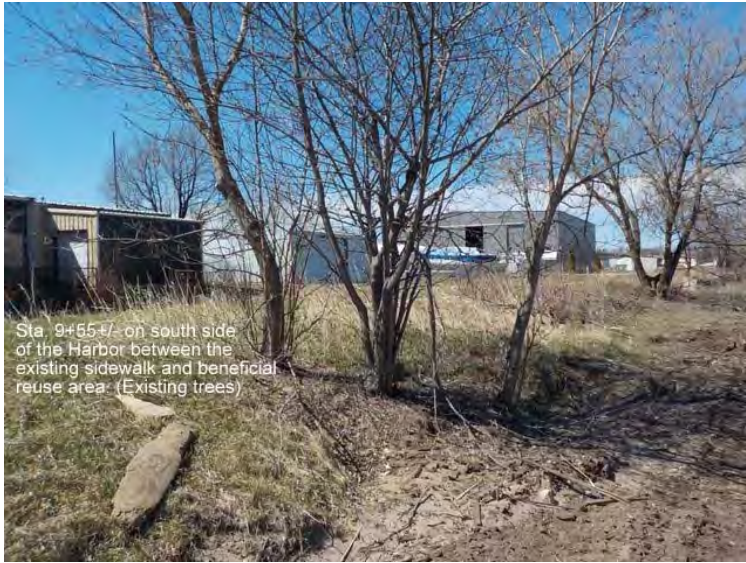
Project Area (+/- 9.09 Acres)

Document Path: H:\NES GIS\Jobs\13775005 - City of Marinette\Map\SiteLocation.mxd

B

APPENDIX B

Site Photographs



Sta. 9+65+/- on south side of the Harbor between the existing sidewalk and beneficial reuse area. (Existing trees)



Sta. 8+91 south side of the Harbor existing clump of trees (24' +/-)



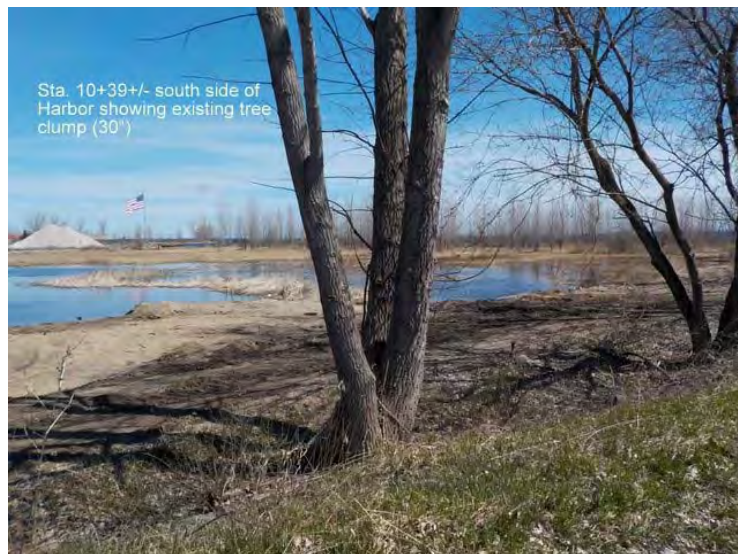
Sta. 8+22+/- south side of Harbor existing 8'+/- tree.



Sta. 7+95+/- south side of the Harbor showing the existing tree clump (6' & 10')



Sta. 7+64+/- existing bush that is the approx. start location of the proposed riprap heading easterly



Sta. 10+39+/- south side of Harbor showing existing tree clump (30')



Sta. 10+63+/- south side of the Harbor showing 20'+/- existing tree clump.



Sta. 10+95+/- south side of Harbor showing the existing tree clump (48'+/-)



Sta. 11+10+/- south side of Harbor looking westerly along tree line.



C

APPENDIX C

WDNR Surface Water Data Viewer Map

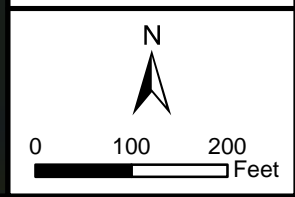


- Legend**
- Project Area (+/- 9.09 Acres)
 - Dammed pond
 - Excavated pond
 - Filled excavated pond
 - Filled/draind wetland
 - Wetland too small to delineate
 - Wetland
 - Upland
 - USDA Wetspots
 - Wetland Indicators
 - Soil Mapping Unit
 - Water
 - Intermittent Streams

**Lower Menominee River Area of Concern
Menekaunee Harbor Restoration Project
City of Marinette-Grant/Proj. No. GL-00E01312-0
REL Project No. 13775005
Marinette, Marinette County, WI**

Sources: Robert E. Lee
& Associates, Inc.,
WDNR, ESRI

Disclaimer: Robert E. Lee & Associates, Inc. makes every effort to ensure this map is free of errors but does not warrant the map or its features are either spatially or temporally accurate or fit for a particular use. Robert E. Lee & Associates, Inc. provides this map without any warranty of any kind whatsoever, either expressed or implied.



D

APPENDIX D

Ayres Associates 2013 Plant Survey

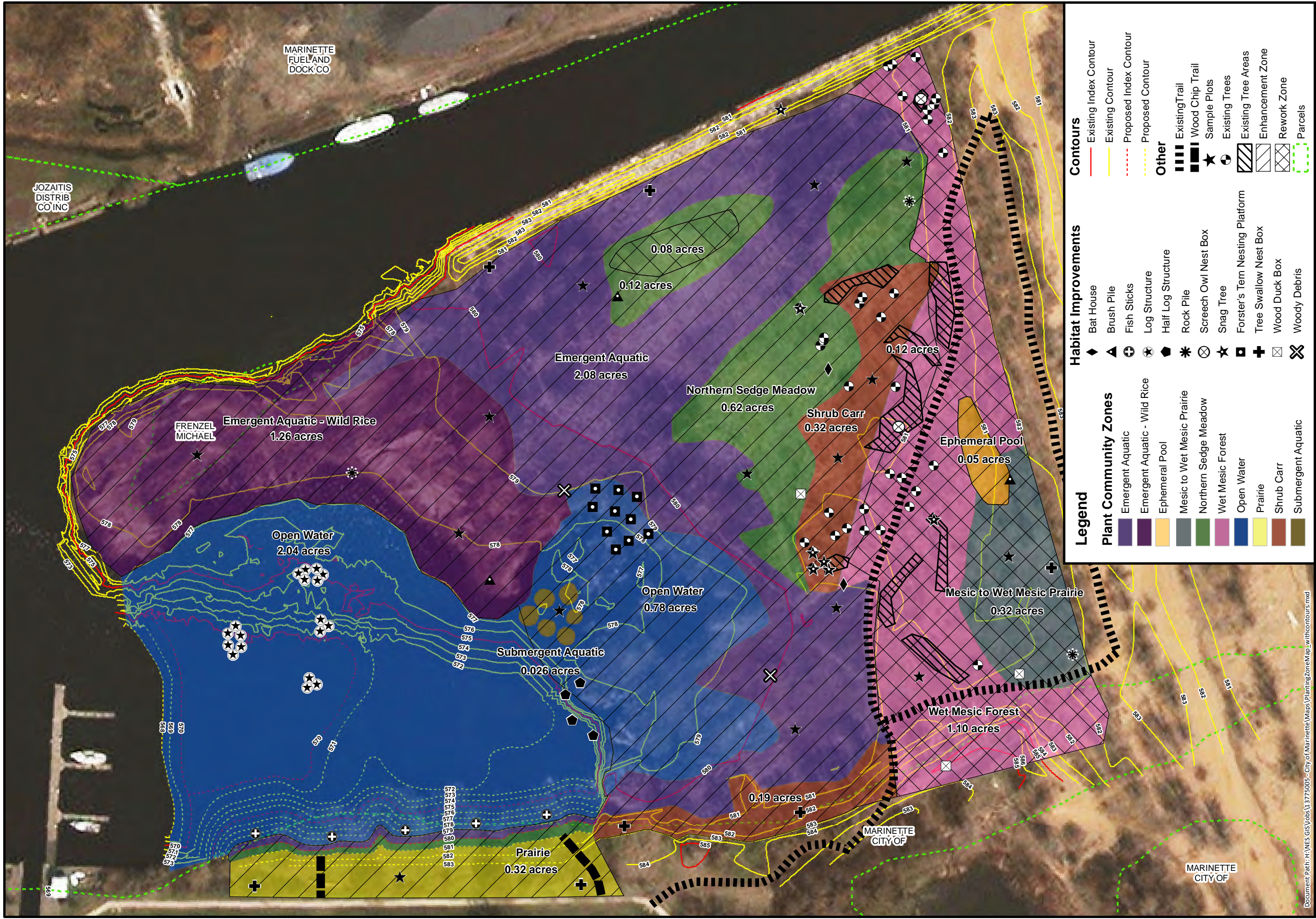
Table 1. Fall 2013 Plant Inventory

Family	Taxon	Common Name	Non-native or Invasive	Notes
Alismataceae	<i>Sagittaria latifolia</i>	Common Arrow-head	N	
Alismataceae	<i>Alisma triviale</i>	Northern Water-plantain	N	
Amaranthaceae	<i>Amaranthus tuberculatus</i>	Rough-fruited Amaranth	N	
Apiaceae	<i>Cicuta bulbifera</i>	Bulblet Water-hemlock	N	
Asteraceae	<i>Ambrosia trifida</i>	Giant Ragweed	Y	Native, but potentially invasive
Asteraceae	<i>Sonchus arvensis</i>	Field Sow-thistle	Y	Introduced - naturalized
Asteraceae	<i>Eupatorium perfoliatum</i>	Boneset	N	
Asteraceae	<i>Achillea millefolium</i>	Common Yarrow	N	
Asteraceae	<i>Bidens frondosa</i>	Common Beggar-ticks	N	
Asteraceae	<i>Centaurea biebersteinii</i>	Spotted Knapweed	Y	Introduced - naturalized; ecologically invasive
Asteraceae	<i>Lactuca biennis</i>	Tall Blue Lettuce	N	
Asteraceae	<i>Solidago canadensis</i>	Canada Goldenrod	N	
Asteraceae	<i>Solidago gigantea</i>	Giant Goldenrod	N	
Asteraceae	<i>Cirsium arvense</i>	Canada Thistle	Y	Introduced - naturalized; ecologically invasive
Asteraceae	<i>Conyza canadensis</i>	Canadian Horseweed	N	
Balsaminaceae	<i>Impatiens capensis</i>	Orange Jewelweed	N	
Campanulaceae	<i>Campanula aparinoides</i>	Marsh Bellflower	N	
Cornaceae	<i>Cornus alba</i>	Res-osier Dogwood	N	Shrubs were all dead; ID based on 2011 vegetation survey
Cyperaceae	<i>Eleocharis acicularis</i>	Needle Spike-rush	N	
Cyperaceae	<i>Carex spp.</i>	Sedge	N	
Cyperaceae	<i>Juncus effusus</i>	Soft Rush	N	
Cyperaceae	<i>Scirpus cyperinus</i>	Woolgrass	N	
Fabaceae	<i>Trifolium repens</i>	White Clover	Y	Introduced - naturalized; potentially invasive
Lamiaceae	<i>Lycopus americanus</i>	Common Water-horehound	N	
Lamiaceae	<i>Scutellaria galericulata</i>	Common Skullcap	N	
Nymphaeaceae	<i>Nymphaea odorata</i>	White Water-lily	N	
Poaceae	<i>Phragmites australis</i>	Common Reed Grass	Y	Native, but potentially invasive
Poaceae	<i>Panicum virgatum</i>	Switch Grass	N	
Poaceae	<i>Agrostis hyemalis</i>	Tickle Grass	N	
Poaceae	<i>Leersia oryzoides</i>	Rice Cut Grass	N	
Polygonaceae	<i>Rumex crispus</i>	Curly Dock	Y	Introduced - naturalized; potentially invasive
Ranunculaceae	<i>Anemone canadensis</i>	Canada Anemone	N	
Scrophulariaceae	<i>Linaria vulgaris</i>	Butter-and-eggs	Y	Introduced - naturalized; potentially invasive
Scrophulariaceae	<i>Verbascrum thapsus</i>	Common Mullein	Y	Introduced - naturalized; potentially invasive
Scrophulariaceae	<i>Mimulus ringens</i>	Monkey-flower	N	
Sparganiaceae	<i>Sparganium eurycarpum</i>	Giant Bur-reed	N	
Typhaceae	<i>Typha angustifolia</i>	Narrow-leaved Cattail	Y	Introduced - naturalized; ecologically invasive
Typhaceae	<i>Typha latifolia</i>	Broad-leaved Cattail	Y	Native, but potentially invasive
Urticaceae	<i>Pilea pumila</i>	Canada Clearweed	N	

E

APPENDIX E

Restored Plant Community Zones & Habitat Improvements



MARINETTE
FUEL AND
DOCK CO

JOZAITIS
DISTRIB
CO INC

FRENZEL
MICHAEL

MARINETTE
CITY OF

MARINETTE
CITY OF

Legend	
	Emergent Aquatic
	Emergent Aquatic - Wild Rice
	Ephemeral Pool
	Mesic to Wet Mesic Prairie
	Northern Sedge Meadow
	Wet Mesic Forest
	Open Water
	Prairie
	Shrub Carr
	Submergent Aquatic
	Bat House
	Brush Pile
	Fish Sticks
	Log Structure
	Half Log Structure
	Rock Pile
	Screech Owl Nest Box
	Snag Tree
	Forster's Tern Nesting Platform
	Tree Swallow Nest Box
	Wood Duck Box
	Woody Debris
	Existing Index Contour
	Proposed Index Contour
	Existing Trail
	Wood Chip Trail
	Sample Plots
	Existing Trees
	Existing Tree Areas
	Enhancement Zone
	Rework Zone
	Parcels

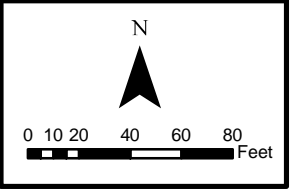


**Plant
Community
Zones**

8/4/2015

**Lower Menominee River Area of Concern
Menekaune Harbor Restoration Project
City of Marinette-Grant/Proj. No. GL-00E01312-0
REL Project No. 13775005
Marinette, Marinette County, WI**

Sources: Robert E. Lee & Associates, Inc., 2010 WROC, ESRI
Disclaimer: Robert E. Lee & Associates, Inc. makes every effort to ensure this map is free of errors but does not warrant the map or its features are either spatially or temporally accurate or fit for a particular use. Robert E. Lee & Associates, Inc., provides this map without any warranty of any kind whatsoever, either expressed or implied.

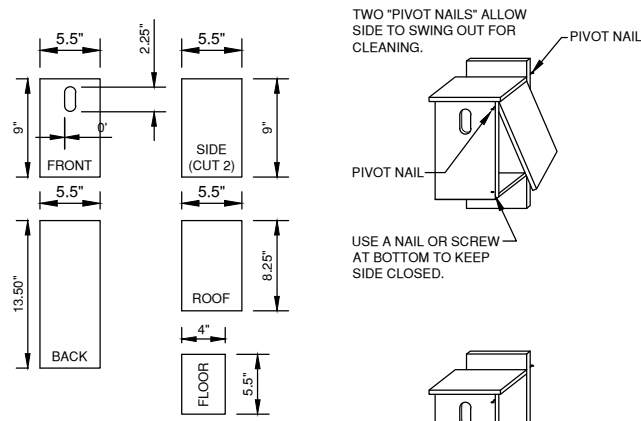


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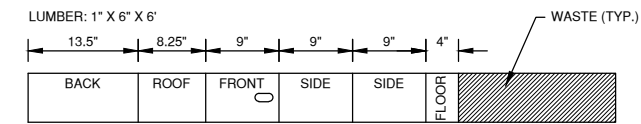
F

APPENDIX F

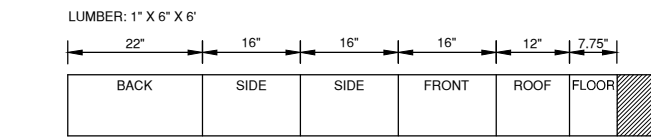
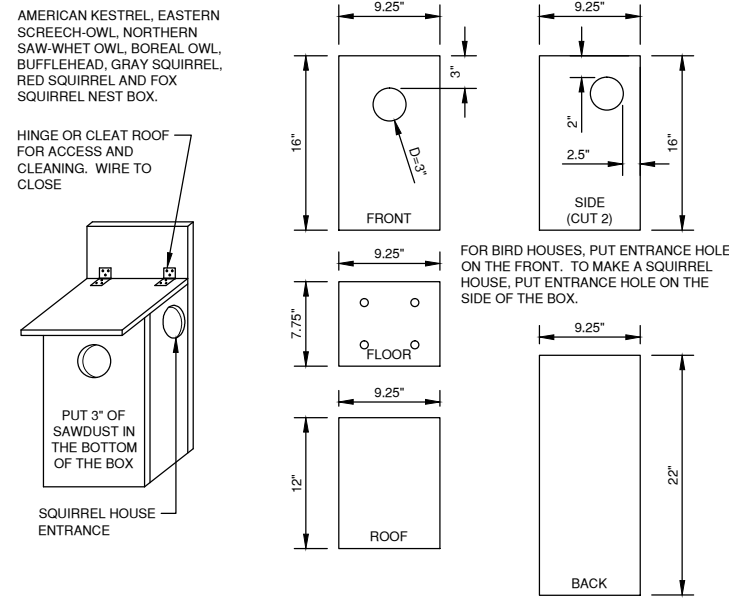
Habitat Structure Details



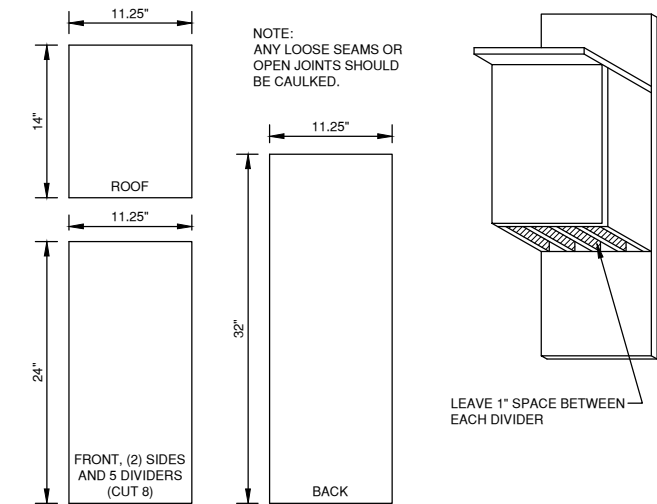
NOTE: THESE DIMENSIONS ARE FOR 3/4" THICK BOARD. SOME CEDAR BOARDS ARE 7/8" THICK. IF SO, THE FLOOR MUST BE 3 3/4" WIDE, NOT 4".



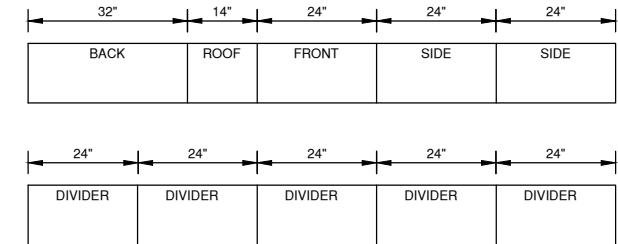
TREE SWALLOW AND EASTERN BLUEBIRD NEST BOX



OWL AND SQUIRREL NEST BOX



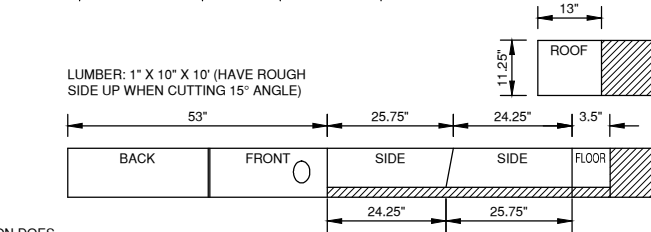
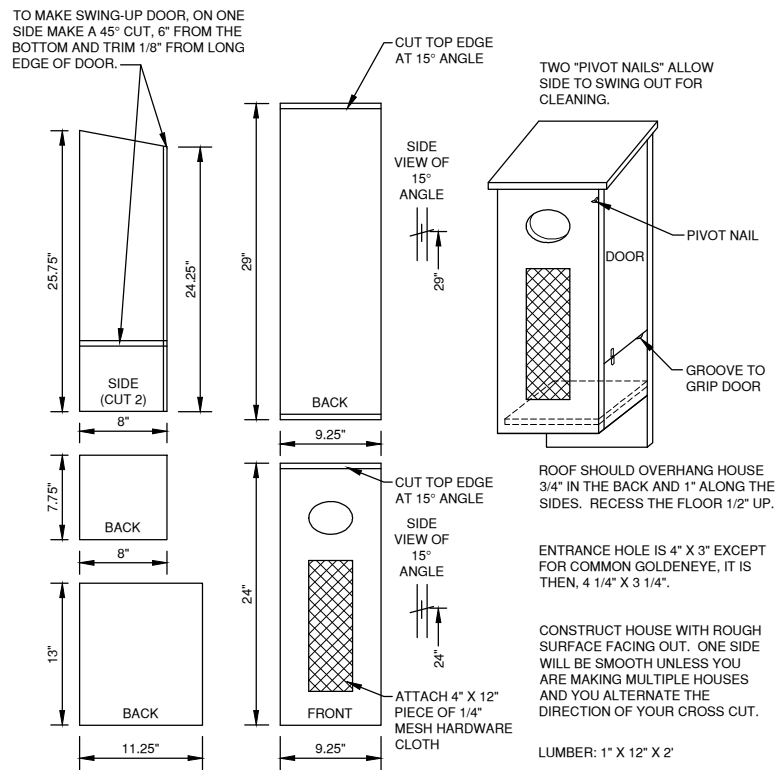
LUMBER: (2) 1" X 12" X 10" ROUGH SAWN LUMBER OR ROUGHEN ALL INTERIOR SURFACES WITH A CHISEL.



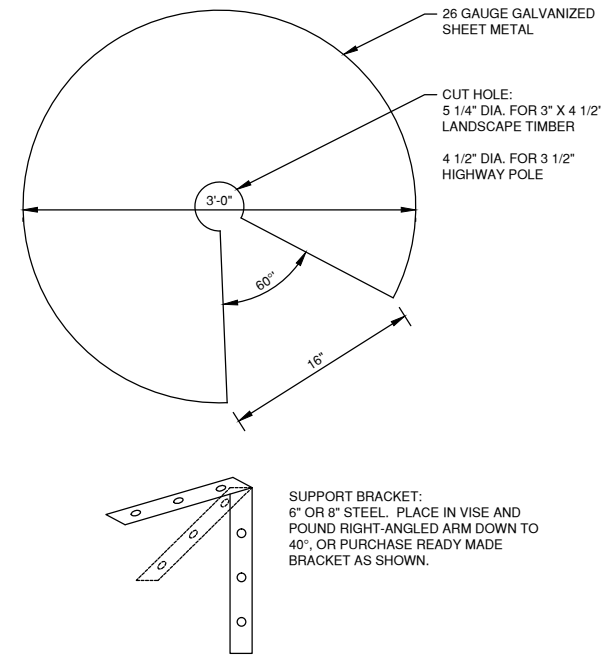
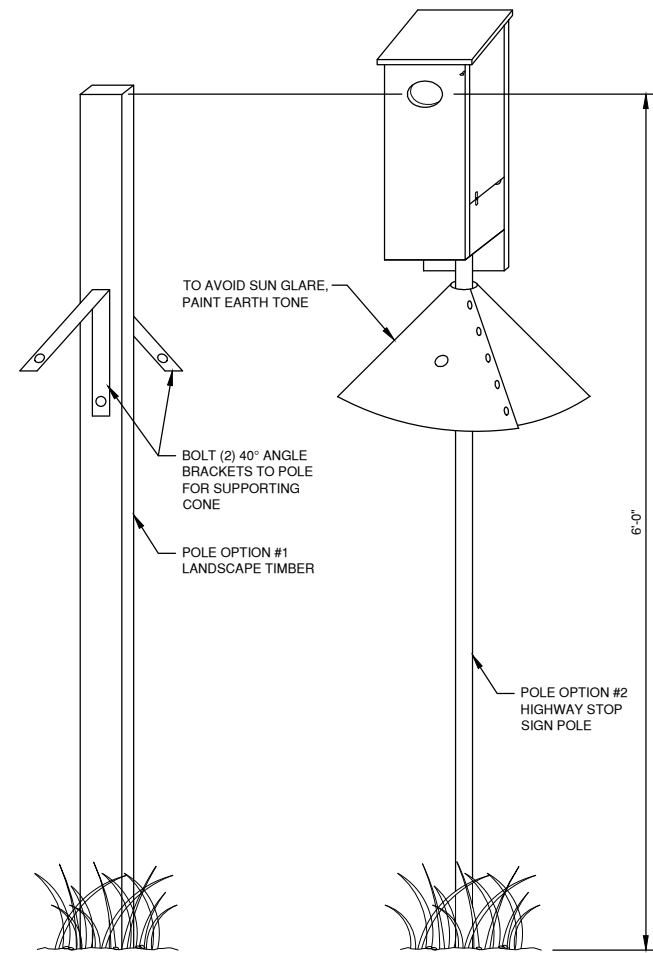
BAT HOUSE

NOTE: ALL NESTING/ROOSTING STRUCTURES SHALL BE CONSTRUCTED WITH CEDAR WOOD.

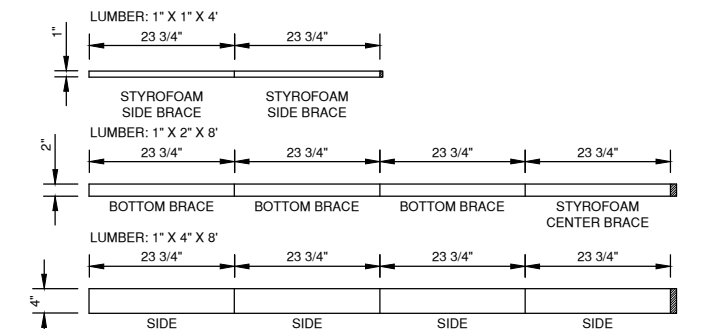
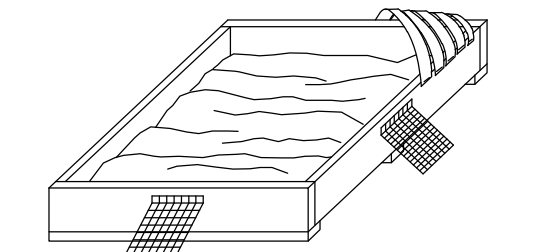
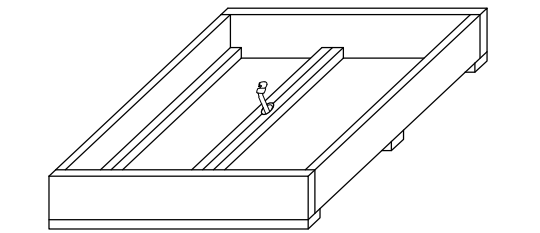
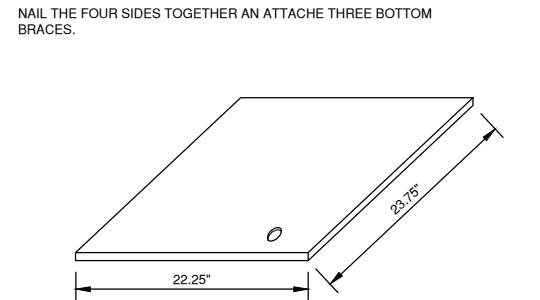
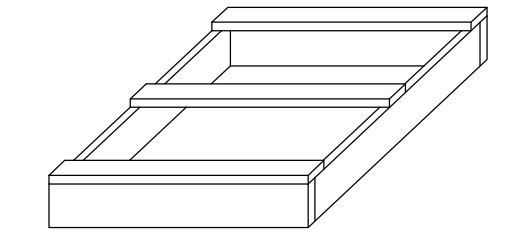
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WOOD DUCK, HOODED MERGANSER AND COMMON GOLDENEYE NEST BOX



CONE GUARD DETAIL



FORSTER'S TERN NEST PLATFORM

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION

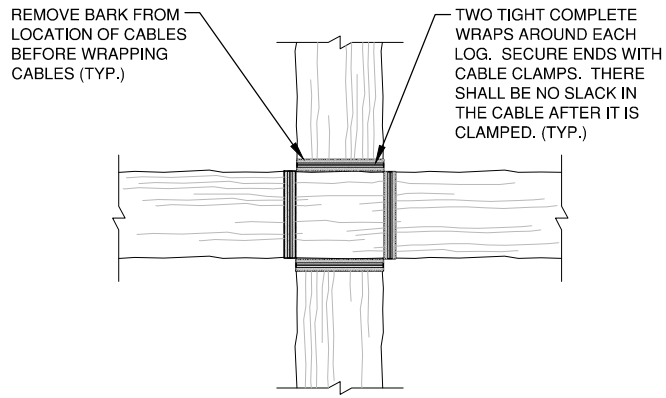
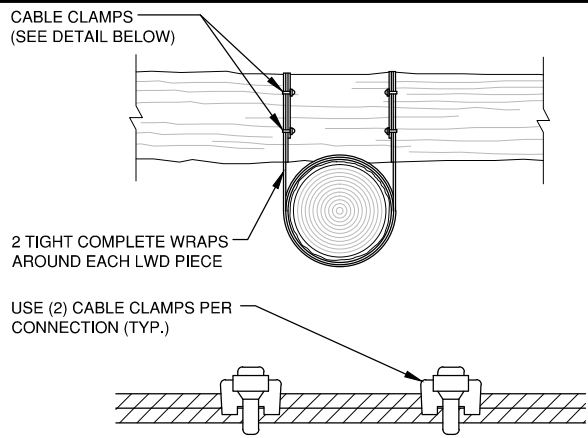
CONTRACT NO. 3775-15-01
MENEKAUNEE HARBOR RESTORATION PROJECT
CITY OF MARINETTE
MARINETTE COUNTY, WISCONSIN

MISCELLANEOUS DETAILS

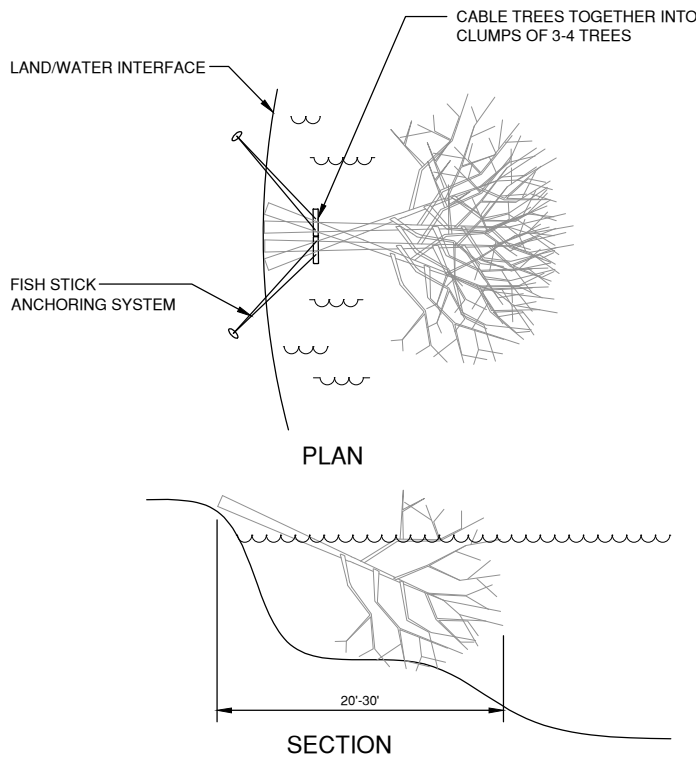
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FILE: DETAILS
JOB NO. 3775005

Robert E. Lee & Associates, Inc.
ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES
1250 CENTENNIAL CENTRE BOULEVARD
HOBART, WI 54155
PHONE: (920) 662-9641
INTERNET: www.releeinc.com
FAX: (920) 662-9141

SHEET NO. 4

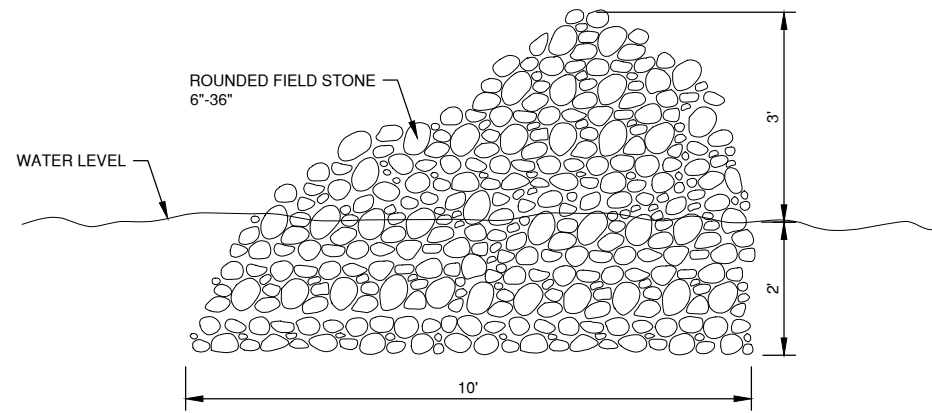


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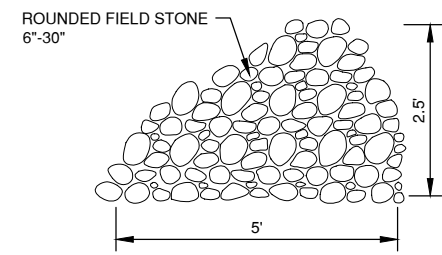


FISH STICK DETAIL

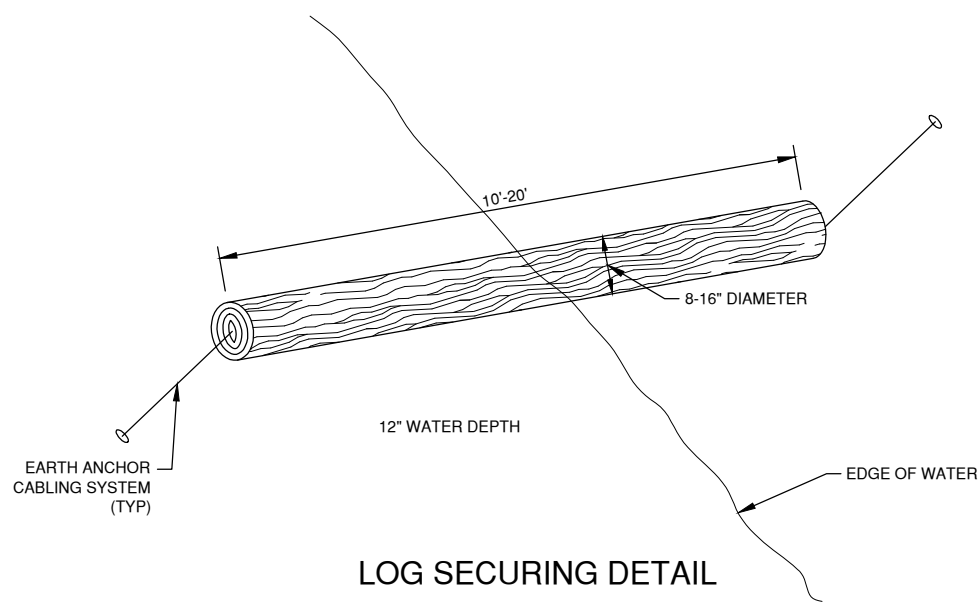
NOTE: TWO PIPES WILL BE USED PER GROUPING OF TREES; AND, EACH PIPE WILL BE ATTACHED TO TWO SEPARATE TREE TRUNKS WITHIN THE GROUP. EACH GROUPING SHALL BE SECURED TOGETHER AROUND EACH TRUNK WITH A MIN. 3/8" GALVANIZED CABLE AND CABLE CLAMPS.



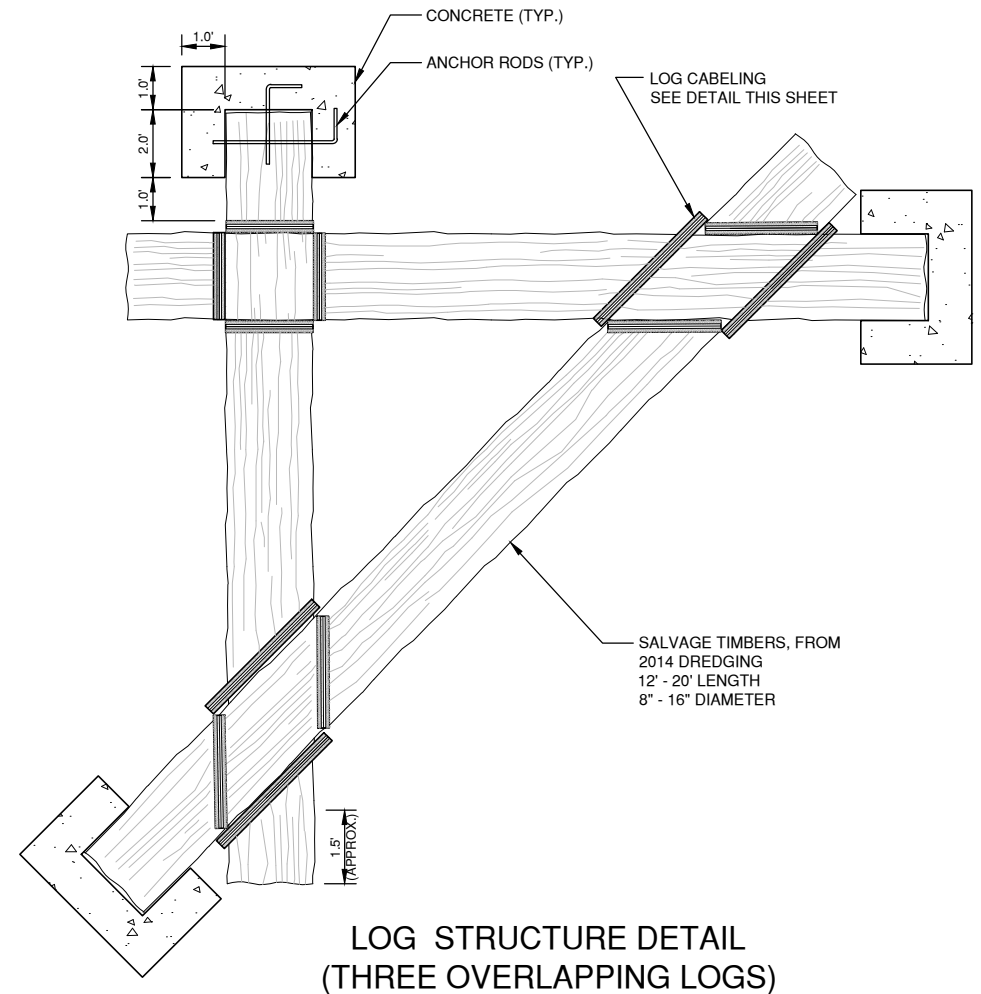
ROCK PILE IN WATER DETAIL



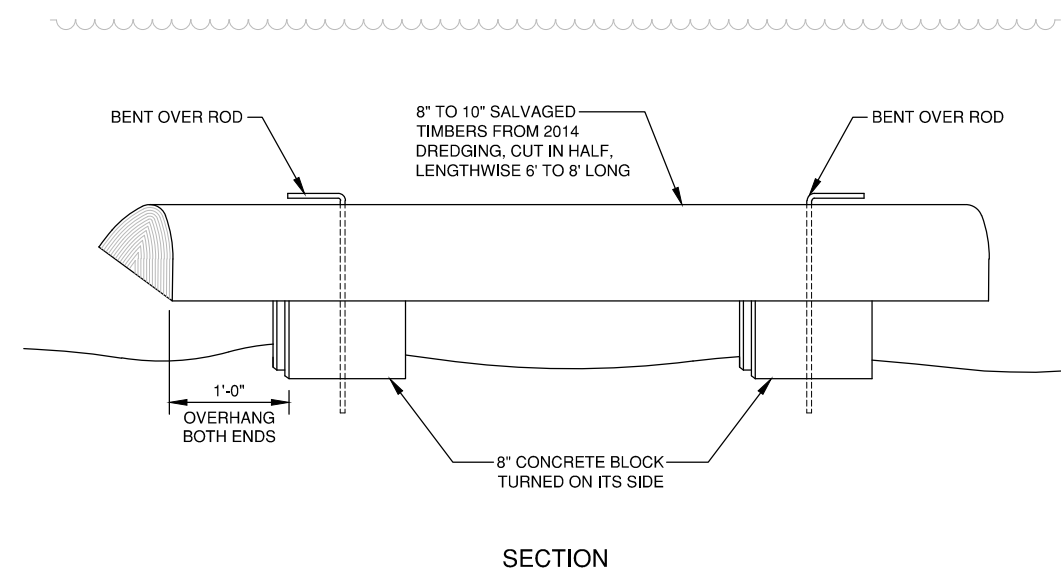
ROCK PILE OUT OF WATER DETAIL



LOG SECURING DETAIL



LOG STRUCTURE DETAIL (THREE OVERLAPPING LOGS)



SECTION HALF LOG STRUCTURE DETAIL

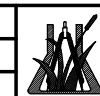
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NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION

CONTRACT NO. 3775-15-01
 MENEKAUNEE HARBOR RESTORATION PROJECT
 CITY OF MARINETTE
 MARINETTE COUNTY, WISCONSIN

MISCELLANEOUS DETAILS

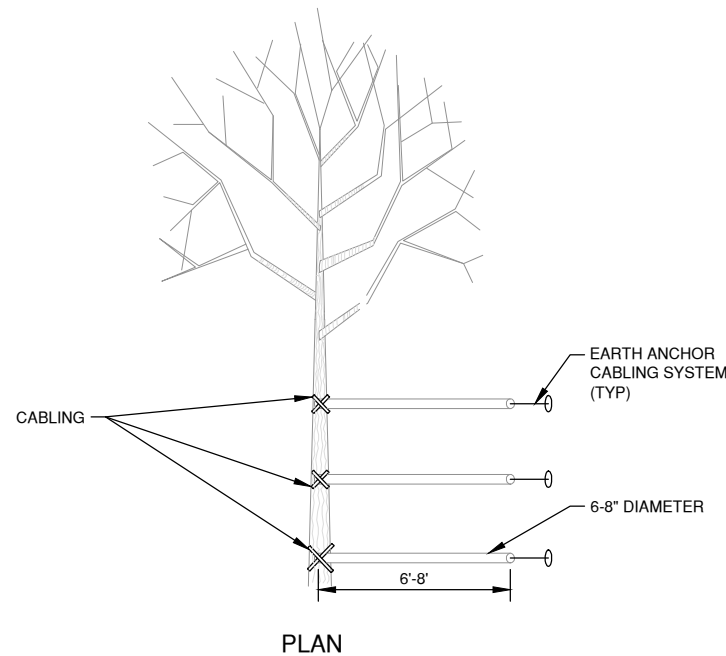
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FILE	DETAILS
JOB NO.	3775005



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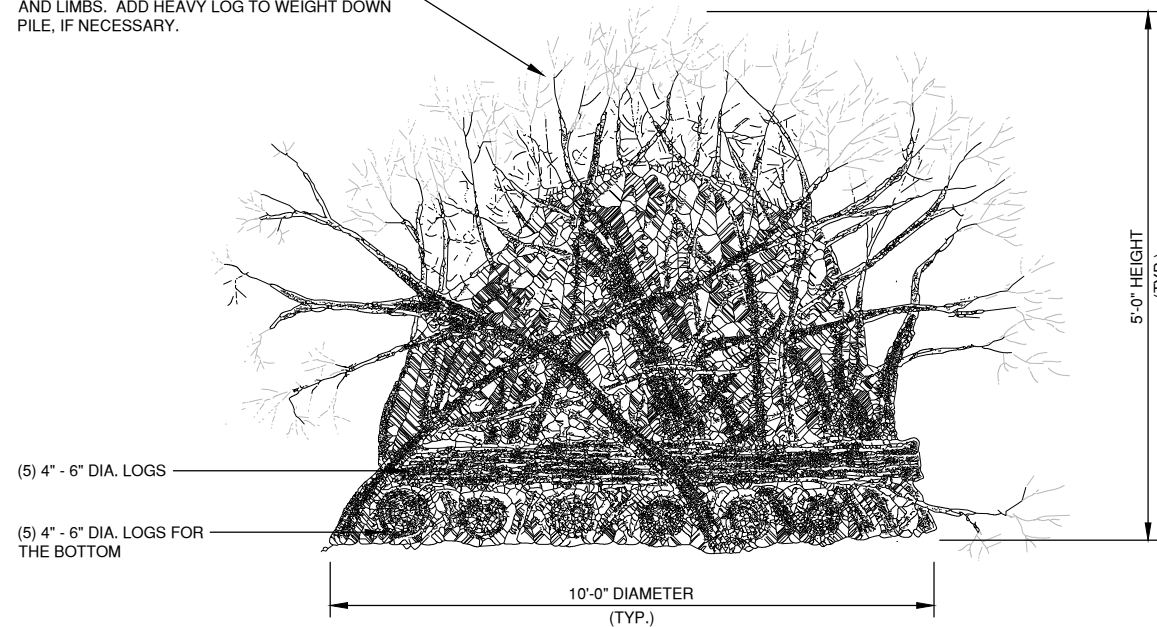
PHONE: (920) 662-9641
 FAX: (920) 662-9141

SHEET NO.
5

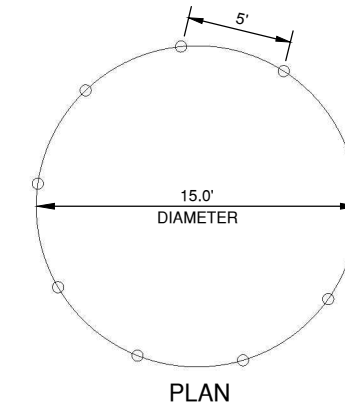


EXISTING TREE TOP ANCHORING

CONSTRUCT WITH ODD LENGTH BRANCHES AND LIMBS. ADD HEAVY LOG TO WEIGHT DOWN PILE, IF NECESSARY.



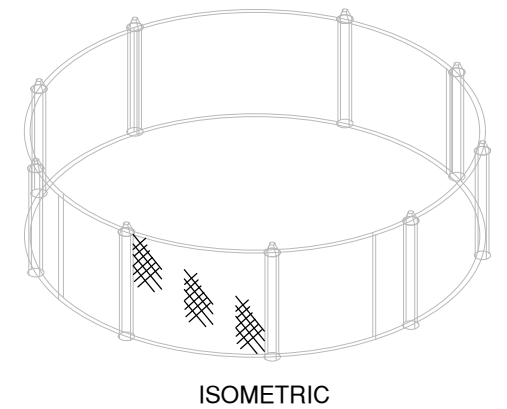
BRUSH PILE DETAIL



PLAN

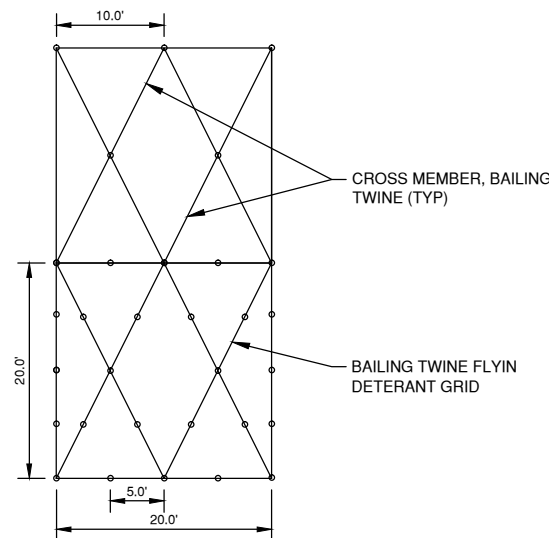
SUBMERGENT AQUATIC PLANT PROTECTION

SAME MATERIAL AS CARP EXCLUSION FENCING



ISOMETRIC

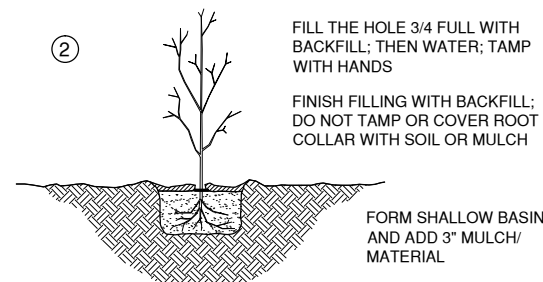
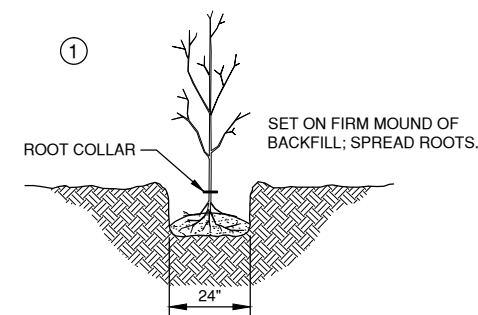
GOOSE EXCLUSION FENCING PLAN VIEW



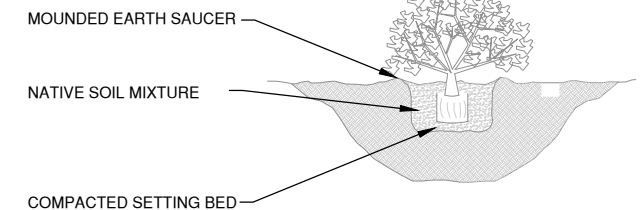
CARP EXCLUSION FENCING PLAN VIEW

- NOTE:
- GOOSE FENCING MATERIAL SHALL BE 48" GREEN SNOW FENCE
 - GOOSE FENCING POST SHOULD BE 10' APART, CARP FENCING POST SHOULD BE 5' APART

NOTE:
PRUNE DAMAGED OR WEAK ROOTS AND BRANCHES.

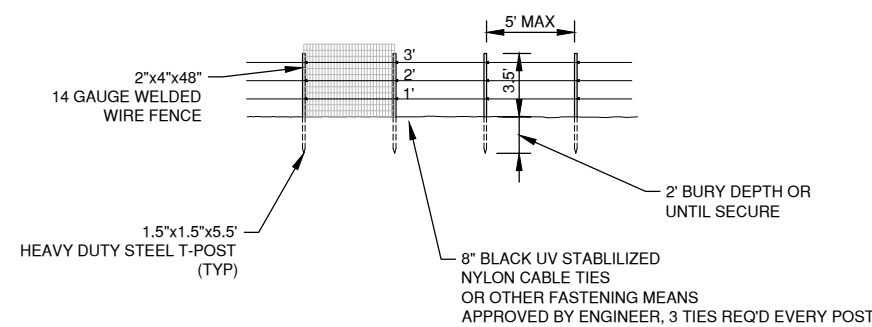
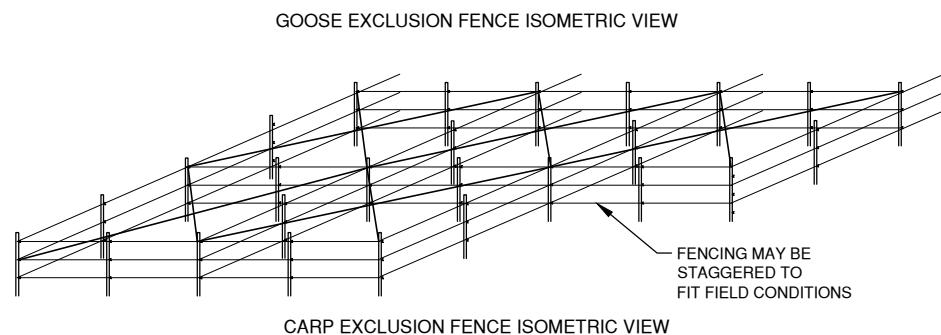


TYPICAL BARE-ROOT PLANTING DETAIL



NOTE: SHRUB SHALL BEAR SAME RELATION TO FINISH GRADE AS IN NURSERY.

TYPICAL POTTED TREE AND SHRUB PLANTING DETAIL



CARP EXCLUSION FENCING ELEVATION VIEW

CARP AND GOOSE EXCLUSION FENCING DETAIL

File: R:\3701\3775\3775000\Drawings\DETAILS.dwg
 Plot Date: May 13, 2015 - 2:58pm
 Layer: DETAILS 3

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION	DRAWN	CONTRACT NO.	DATE	SHEET NO.	
								LLP	3775-15-01	04/2015	Robert E. Lee & Associates, Inc. ENGINEERING, SURVEYING, ENVIRONMENTAL SERVICES 1250 CENTENNIAL CENTRE BOULEVARD HOBART, WI 54155 PHONE:(920) 662-9641 INTERNET: www.releeinc.com FAX:(920) 662-9141	
								RHT	MENKAUNEE HARBOR RESTORATION PROJECT	FILE		6
								JRH	CITY OF MARINETTE	DETAILS		
									MARINETTE COUNTY, WISCONSIN	JOB NO.		
									MISCELLANEOUS DETAILS	3775005		

G

APPENDIX G

Habitat Description and Botanical Survey Form

