Lower Menominee River Area of Concern
Menekaunee Harbor Restoration Project
Great Lakes Restoration Initiative Grant
Grant/Project No. GL-00E01312-0

Quality Assurance Project Plan

REL Project No. 3775-005

Prepared for:

Wisconsin Department of Natural Resources (WDNR)
2984 Shawano Avenue
Green Bay, WI 54313-6727

City of Marinette
1905 Hall Avenue
Marinette, WI 54143-1716

Prepared by:
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A1. Title of Plan and Approval

Quality Assurance Project Plan

Lower Menominee River Area of Concern

Menekaunee Harbor Restoration Project

Approvals:

Brian M Miller — 10.27.15

Brian Miller, PE — Date
City of Marinette Project Manager

Donalea Dinsmore — 11-9-2015*

Donalea Dinsmore — Date
WDNR Office of Great Lakes Funding and Quality Assurance Coordinator

Cheryl A Bougie — 10-22-2015

Cheryl Bougie — Date
WDNR Sediment and Monitoring Coordinator – Lake Michigan

Jennifer Con — 11/10/15

Jennifer Connor — Date
EPA-GLNPO Grant Manager

JSCHMT — 10-22-2015

Jared Schmidt, PE, Robert E. Lee & Associates, Inc. — Date
Oversight Consultant Quality Assurance Project Manager

Alyx Solut — 11-3-15

Construction PM, Applied Ecological Services, Inc. — Date
Joshua Kraemer, Construction Project Manager / Ecologist

* Review on 10/22 indicated that the document is acceptable. Signatures completed afterward.

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10-22-2015

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Jennifer Connor Date
EPA-GLNPO Grant Manager

Jared Schmidt, PE, Robert E. Lee & Associates, Inc. Date
Oversight Consultant Quality Assurance Project Manager

Construction PM, Applied Ecological Services, Inc. Date
Joshua Kraemer, Construction Project Manager / Ecologist

A2. Table of Contents

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A3. Distribution List

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A4. Project/Task Organization

Figure 1 presents the organizational structure for the Menekaunee Harbor Restoration Project. All lines of communication, management activities, and technical direction within this project team will follow this organizational arrangement. Any directions or communications from the U.S. EPA will be given to the City of Marinette Project Manager and to the Wisconsin Department of Natural Resources Project Manager. The City of Marinette Project Manager will subsequently communicate directions to Robert E. Lee and Contractor. The Wisconsin Department of Natural Resources and U.S. EPA project manager will be notified of all proposed changes in personnel.

Responsibilities of key project personnel are outlined in Table 1 and as follows:

U.S. EPA Grant Manager

The USEPA Grant Manager (GM) for this project will be Jennifer Connor. The GM has the overall responsibility for general grant oversight to include:

1. Grant administration.
2. Final approval of project quality documentation.

Wisconsin Department of Natural Resources (WDNR) Great Lakes Funding and Quality Assurance Coordinator

The WDNR Quality Assurance Reviewer for this project will be Donalea Dinsmore.

1. Review and approve the QAPP.
2. Technical consultation on data quality issues.
3. Communication with USEPA Grant Manager.
4. Prepare grant progress reports for USEPA.

Wisconsin Department of Natural Resources Project Manager

The project manager for the WDNR will be Cheryl Bougie. The WDNR project manager has overall responsibility for project oversight.

1. Provide technical consultation services to the City of Marinette Project Manager.
3. Oversee and address project progress.
4. Communicate with the City, WDNR, and USEPA project managers.
5. Review progress reports detailing work accomplished.
6. Approve project invoices charged to the grant (per aid agreement).
7. Review all final reports.

City of Marinette Project Manager

The project manager for the City of Marinette will be Brian Miller. The city project manager has overall responsibility for implementing the project. The City project manager will:

1. Direct project activities.
2. Prepare and submit progress reports detailing work accomplished, funds spent, and the project status.
3. Be responsible for review of project deliverables, development of project planning, and the overview of project strategies.
4. Review site reports for consistency with objectives stated in work plans.
5. Provide final signature on all assessments.
6. Assure timely invoicing to WDNR for eligible project expenses.

Construction Project Manager (Contractor) – Applied Ecological Services, Inc.

The construction manager for this project will be a Contractor Representative, led by Project Manager,

Joshua Kraemer, Ecologist. The project manager is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The project manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved. The project manager will:

1. Be responsible for planning, coordinating, monitoring, and evaluating of project field activities.
2. Define project objectives and develop a detailed work plan schedule.
3. Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
4. Develop project plans and strategies and review all project deliverables.
5. Review the work performed on each task to ensure its quality, responsiveness, and timeliness.
6. Resolve technical problems.
7. Be responsible for environmental reports and documents.

Robert E. Lee Quality Assurance Manager

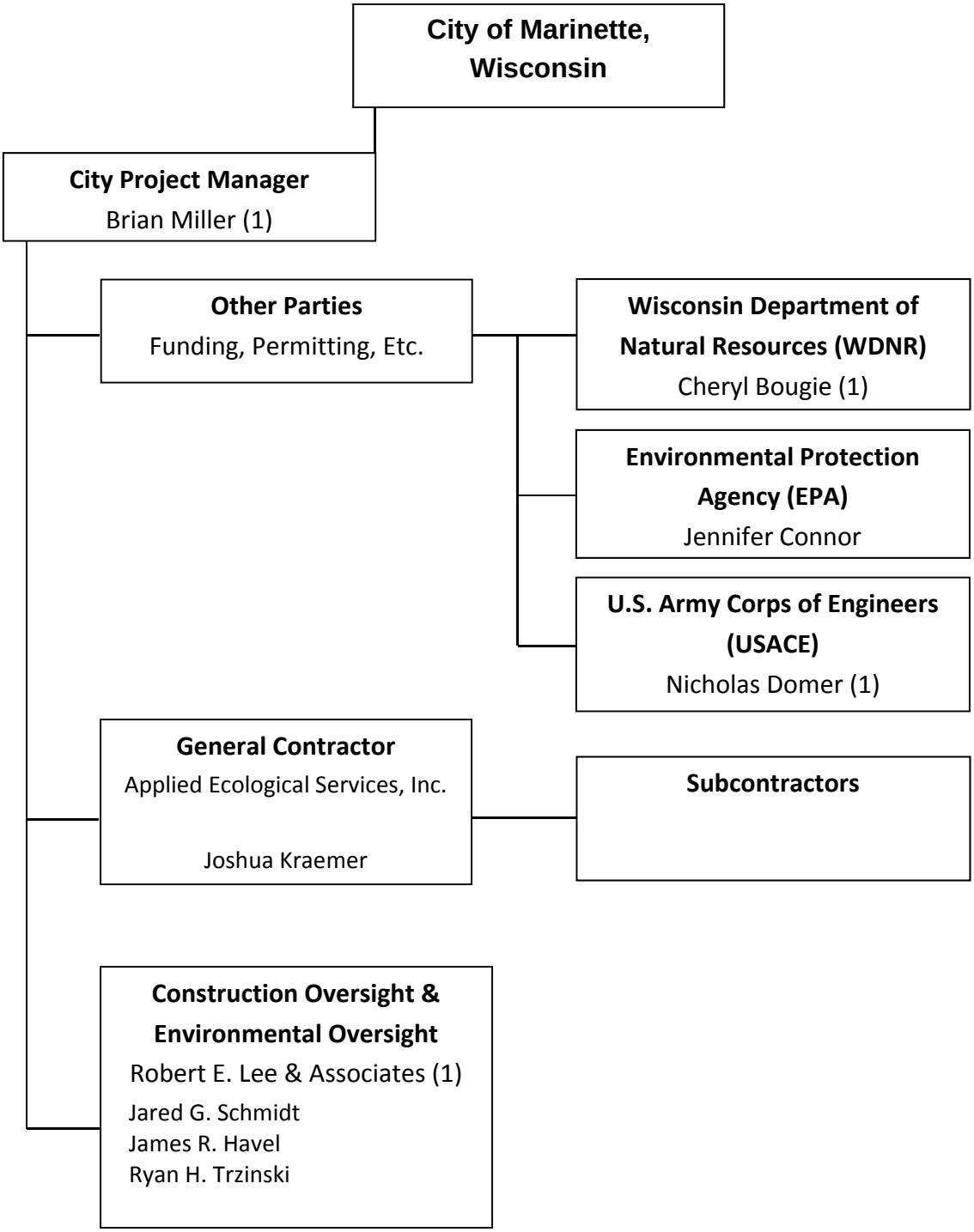
The REL quality assurance (QA) manager for this project will be Jared Schmidt. The QA manager will:

1. Oversee assessment activities to ensure that restoration methodology and construction method procedures are being followed.
2. Assist in any QA issues with field questions, as needed.
3. Conduct Field Audits.
4. Communicate with the City project manager, contractor, and WDNR with regard to project progress.

Table 1. Roles & Responsibilities

Individual(s) Assigned	Responsible for:	Authorized to:
Brian Miller City of Marinette	Project management on behalf of City of Marinette	Stop work Approve contracts Approve change orders
Cheryl Bougie Wisconsin DNR	Project oversight Technical assistance Reporting internally to DNR	Stop work
Donalea Dinsmore Wisconsin DNR	Quality Assurance	Approve QAPP
Jennifer Connor US EPA	Grant coordination	Approve funding
Contractor Applied Ecological Services, Inc. Joshua Kraemer	Construction activities: Site restoration and enhancement installation Installation and maintenance of storm water BMPs Installation and maintenance of in-water TSS controls Implementing corrective actions with appropriate documentation	Select subcontractors Stop work due to weather Address spills
Construction & Environmental Oversight Robert E. Lee & Associates	Performing daily oversight Preparing weekly construction oversight reports Serving as the main point of contact at the site for WDNR/City/engineer	Stop work
	Performing weekly inspections of storm water BMPs Performing weekly inspections of in-water TSS controls Preparing weekly reports, uploading to FTP site Prescribe corrective actions for BMPs and process Identifying necessary corrective actions and follow-up on implementation	Stop work Prescribe corrective actions for storm water BMPs

Figure 1. Organization Chart



(1) Authority to stop work.

A5. Problem Definition/Background

The Menekaunee Harbor is located within the City of Marinette, Wisconsin, at the mouth of the Menominee River where it enters Lake Michigan's Green Bay (Appendix A. *Site Location Map*). The harbor lies adjacent to the Michigan-Wisconsin border, and is connected to the Menominee River by a 1,000-foot long navigable channel. The harbor is part of the Lower Menominee River Area of Concern (AOC), which includes the lower three miles of the river from the Park Mill Dam to the river's mouth. Beneficial use impairments (BUIs) within the Menominee River AOC include:

1. Degradation of fish and wildlife populations;
2. Loss of fish and wildlife habitat;
3. Restrictions on fish and wildlife consumption;
4. Degradation of benthos; and
5. Restrictions on dredging activities.

Historically, the Menekaunee Harbor extended directly 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 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 the Menekaunee Harbor eastward toward the bay of Green Bay. The shallow waters, submerged vegetation, and wetlands provided diverse and critical habitat for a variety of fish, birds, and other wildlife.

However, hydrologic alteration has caused extensive sediment deposition, which not only negatively impacted the diversity and function of the wetland complex, but also severely restricted navigation within the harbor. Additionally, pollutants associated with historical industrial manufacturing practices along the river have resulted in degradation and contamination of the harbor, and contributed daily to the cause of the BUIs within the Menominee River AOC. In addition to contaminants within the sediment of the harbor and shallow depths caused by sediment, the existing timber pile shoreline (wooden seawall) treatment is in poor condition and is in need of replacement. These sediments and wooden seawalls have been removed or covered within a separate construction contract.

The City of Marinette, working in tandem with the Wisconsin Department of Natural Resources and the U.S. Environmental Protection Agency (U.S. EPA) has received funding support to address the dredging, seawall, and habitat restoration activities associated with the Harbor and Menominee River Area of Concern.

The purpose of the project is to address BUIs within the harbor by removing contaminants, which was completed under a separate construction contract, restoring the fish and wildlife habitat and at the same time improving navigation and shoreline treatments. This QAPP addresses restoration activities to restore the fish and wildlife habitat within the south easterly cove of the harbor.

A6. Project/Task Description

As discussed within Appendices A, B, and C, (Menekaunee Harbor Restoration Plan and Specifications) the project tasks are described and laid out in detail. As with many habitat restoration plans, it is important to note that this plan is intended to be presented as the best available at the time the document is published, but nature is continually changing. Therefore, the guidance within this document should be used with consideration as an adaptive management and maintenance plan, where decisions are made relative to the changing environment, with the intent of meeting the desired performance standards.

B1. Primary Goals and 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.
- 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 structures 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 adding 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.

This project is being conducted as one of the multiple projects concurrently happening within this Area of Concern. The overall goal is to delist the AOC.

C1. Quality Control

a) Quality Control Procedures

To understand the role of Quality Control in the overall Quality Assurance/Quality Control (QA/QC) process, it is important to distinguish the terms Quality Control and Quality Assurance.

Establishing Quality Assurance for this project is the overall purpose of this QAPP. Quality Assurance defines the successful project outcome based on the project's objectives, data inputs, available resources, and required technical skills. In contrast, Quality Control is the set of procedures used to check that the QA process is being followed and that the end product meets the standards established by the Quality Assurance Project Plan.

As is appropriate for most construction projects, Quality Control will be accomplished primarily through site reviews by NES/REL personnel, bi-weekly project management team meetings, submittal reviews, plant inspections, and site surveys. NES/REL personnel will be in contact with AES on daily basis to address questions or concerns. NES/REL personnel will document work on a weekly basis and will create weekly reports that will summarize the weekly activities completed. In addition to reviews and report generating, deliverables will be presented to the project management team (City of Marinette, WDNR, Robert E. Lee & Associates, and NES Ecological Services) for review and comment, providing another layer of QC for the project.

During site reviews, NES/REL personnel will inspect the site to verify compliance with all permits associated with this project. Then will meet with AES personnel to discuss current activities and potential future activities. NES/REL will document what work has been completed within logbooks and will photograph the site to document the site review. The site information obtained will be compiled and included in the weekly reporting.

At the Bi-weekly project management team meetings, work items that have been completed since the last meeting, and will discuss potential work items that will be completed before the next meeting. During this meeting the City of Marinette, NES/REL, AES, and WDNR will discuss concerns any party has in regards to the work that is currently taking place, or for future work items.

Submittal reviews will be completed in accordance with Specification section 01 32 19, Submittals. Submittals will be sent to REL/NES for review on all items specified within the project Specifications.

Underwater fish habitat structure placements within the harbor will be verified by REL utilizing bathymetry surveys, pole sounding, or underwater optics, as applicable, to verify the structures are placed in accordance with the plans and specifications. Robert E. Lee will conduct the bathymetric survey using a SonarMite echo sounder, and will conduct spot checks with traditional methods to verify the accuracy of the equipment and placement of underwater structures. A control point of known coordinates shall be surveyed as a ground control check of the accuracy of the GPS receiver. A USACE control point is located on the Ogden Bridge at the west side of the project area and is a good option. This control point is located at 812178.28 feet East, 145998.65 feet North, 589.06 feet Z (Wisconsin County Coordinate System, Marinette Zone, North American Datum of 1983, adjustment 1991). The GPS receiver shall also use a cellular modem capable of receiving real-time corrections from the Wisconsin Continuously Operating Reference Stations (WISCORS). The accuracy of the hand-held GPS system will be submeter in the X, Y axis. Subsurface bathymetric survey has a vertical calibration of less than 0.10 feet vertical and horizontal. The desired location and depth of water will be coordinated with the contractor prior to placement to ensure proper placement. Exact horizontal location to the foot is not critical for placing the habitat but general location and target water depth is critical. If placement is not properly conducted, the subsurface structures may require relocation as deemed appropriate by the project team.

Fish stick habitat structure placements within the harbor will be laid out by REL and installed by AES personnel. Placement will be verified by visual inspection of the tree structure and on-site observance of anchor placement and cabling to ensure installation per plans and specifications.

b) Special Training/Certification

Construction oversight personnel must be licensed in Wisconsin as a Professional Engineer (PE), have designation as an Engineer in Training (EIT), Restoration Ecologist, or by a Senior Engineering Technician with direct oversight by a PE, and have experience or training in construction observation, and ecological planting installation.

Environmental compliance personnel shall have had training in the principles and practices of erosion and sediment control measures, and possess the skill to assess conditions that could impact storm water quality, and to assess the effectiveness of any sediment and erosion control measures that are in use. Licensure as a Professional Engineer or registration as a Certified Professional in Erosion and Sediment Control (CPESC) or similar is preferred.

Robert E. Lee & Associates, Inc. (REL) personnel conducting bathymetric and topographic surveys have

the required knowledge of SOPs and site-specific HASP requirements.

c) Documents and Records

A private FTP site maintained by Robert E. Lee & Associates, Inc., will be made accessible to all parties involved in the project and be updated, as necessary, with the most current approved versions of the project plan drawings, QAPP, and Erosion Control & Storm Water Management Plan, as deemed necessary by the project team. This site could also be utilized for dissemination of progress reports, audit reports, construction observation logs, and inspection records. An email notification shall be sent to personnel identified in A3. Distribution List upon upload of any updated plans. This FTP site will also provide templates for forms used by field personnel. In addition to the documents outlined below, additional submittals and documentations, as required by the technical specifications, shall also be prepared and distributed.

Documentation will be prepared throughout the project for the following:

1. Schedule, budget, and personnel details
2. Conformance to project specifications
3. Construction quantities management
4. Materials and equipment taken off-site and brought on-site
5. Photographs and written records management
6. Construction materials utilized, including those plantings, and seed mixes placed
7. Site challenges and actions taken to address.

The documentation gathered during site construction, operations, and closure, including as-constructed drawings, will be assembled into a project documentation report that will be provided to the WDNR following cessation of harbor site and containment site activities and closure. Three hard copies and one electronic CD copy will be provided to both the WDNR and the City of Marinette.

Construction observation logs shall include details and photographs for weekly construction activities. These logs shall be retained for the duration of the project plus at least three years post-construction. Construction observation shall be used to produce reports that include documentation of all of the following:

1. Plant inspection reviews
2. Site preparation
3. Construction as-built drawings
4. Material quantities
5. Data will be recorded on the appropriate field forms or in field logbooks.

d) Procedures for Corrective Actions

During the construction and implementation portion of this project, the project management team will work closely with the Contractor to ensure implementation follows the intent of the bidding documents. The project management team will work within the parameters of sound engineering/ecological procedures to adapt to changes in climate, water levels, plant availability, and other natural effects throughout the construction and ongoing monitoring and maintenance component of the project. The following are general parameters of the approval and implementation practices.

Contractor will submit a draft version of shop drawings and any other request for interpretations to the NES/ REL personnel for review and comment. The reviewer will provide comments and edits to AES for incorporation into the construction project and will discuss the comments as necessary to ensure clarity.

The review process will be documented by maintaining edited copies and comments in the project file. Once formal approval is given for shop drawings, the contractor can move into implementation phase.

If changes in conditions require corrective action after the work has been finalized, the Project Manager will convene a meeting of the project management team and notify them there is a need for corrective action. This team will identify the necessary actions to address the issue and prepare a formal response and it will be sent to AES for implementation. Corrective actions will be made relative to attaining the same overall project goal as identified within this document and supporting habitat plan, design plans, and construction specifications.

As potential changes are encountered during the construction process, AES will notify REL/NES of the item and REL/NES will determine if the proposed alteration still falls within the proposed plans and specifications. REL/NES will provide recommendations to the City and WDNR either through e-mail, telephone conversations, or at bi-weekly meetings. The City and WDNR will have time to review the proposed alteration recommendation or discommendation and will provide comments to REL/NES. Then REL/NES will work with AES to address the change within a contract modification, amending the contract documents or will work to implement the specified items as specified.

If plant availability issues arise, REL/NES and AES will work together to determine which species, sizes, or types are not available at the time of ordering. If a species specified is available next year, REL/NES will document the species and will direct AES to install these plants in the spring of 2016 once available again. If a species is not available, and is potentially not available in the spring of 2016, REL/NES will notify WDNR of the species and will include additional seeds, plants, tress, or shrubs that are currently available to maintain the proper vegetative growth planned for each corresponding zone.

e) Performance Standards

Performance standards are stated within the Construction Specifications, specifically section 1.04 and as detailed in 4.12, 4.13, 4.14, and 4.15 of Specification Section 32 90 10, Native Landscaping, Appendix B. Performance standards are further supplemented with-in the Menekaunee Restoration Plan within Appendix C. Appendix D is the draft maintenance plan provided by the Contractor, and reinforces the procedures and responsibilities of the contractor to ensure successful plan implementation, including ongoing maintenance and monitoring, including replacements as deemed appropriate by the guidelines, as dictated by the oversight consultant.

The Contractor is under contract to perform year zero, 1, 2, and 3 of the longer-term maintenance plan. Maintenance, currently contracted to Applied Ecological Services, will be performed through November 2018. Detailed maintenance activities currently proposed are identified starting on page 48 of the Restoration Plan, Appendix C.

It should be noted that there are two levels of performance standards identified within this document. The performance standards identified within the project specifications correlate to the standards that are expected to be reached by the installation contractor. These levels would be reviewed in association with a 1-year warranty period. Additional standards apply to the ongoing monitoring and maintenance component of the project. Due to available funding the installation contractor has also been contracted

to perform additional ongoing monitoring and maintenance. These guidelines and specifications are identified within the project plan, and identify proposed actions to be provided, and performance goals to be reached including plant retention, invasive species removal, and physical structure upkeep. The performance goals are also identified within Section E1 of this plan.

In addition to maintenance completed by the contractor, Keith West, PhD, University of Wisconsin-Marinette (UW-M) has offered participation by his students, to aid in the ongoing maintenance program. Exact tasks and responsibilities have yet to be determined, but UW-M staff and students will participate within the ongoing maintenance, to further help the project area thrive and succeed. During the continued efforts of the monitoring and maintenance components of this project, UW-M staff and students will work with the City, NES, AES, and WDNR staff to become accustomed to the tasks they are likely to take on going forward. Since AES is performing 3-years of monitoring and maintenance as part of their contract duties, specific roles and responsibilities for UW-M could vary significantly based on the ecological condition of the habitat area. However UW-M will play a significant role in the success of long term maintenance of the habitat area, supplemented with professional assistance as deemed necessary by the City and appointed project team.

f) Data Review, Verification, and Validation

Upon receipt of observation and inspection reports, the QA/QC manager shall conduct a 100% completeness check to ensure all necessary information has been provided. Instances where information is missing shall be raised to the report preparer for resolution. In the event that items are outside the specified restrictions for the material, results will be flagged, and the project team will investigate provide alternate resolutions. All resolutions will be documented.

g) Verification and Validation Methods

Throughout the project, REL will perform site reviews to document incremental progress on the project that can be compared with Applied Ecological Services reported progress. In isolated areas, discrepancies in documentation will be reconciled on a case-by-case basis.

h) Inspection/Acceptance of Supplies & Materials

REL/NES will have qualified personnel on-site to view supplies and materials delivered to the site. REL/NES will validate that supplies and materials brought to the site meet the requirements of the specifications. During live plant stock delivery, REL/NES will be on-site to view the plants delivered to the site to verify plant materials conform to contract documents with respect to quantity, quality, size, species, upright, green, healthy condition, and disease free. Once materials are installed on-site, REL/NES will verify proper installation and location.

D1. Project Schedule

a) Project Schedule

Tables 2 and 3 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 4 identifies the contractor's preliminary schedule.

Table 2. 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												

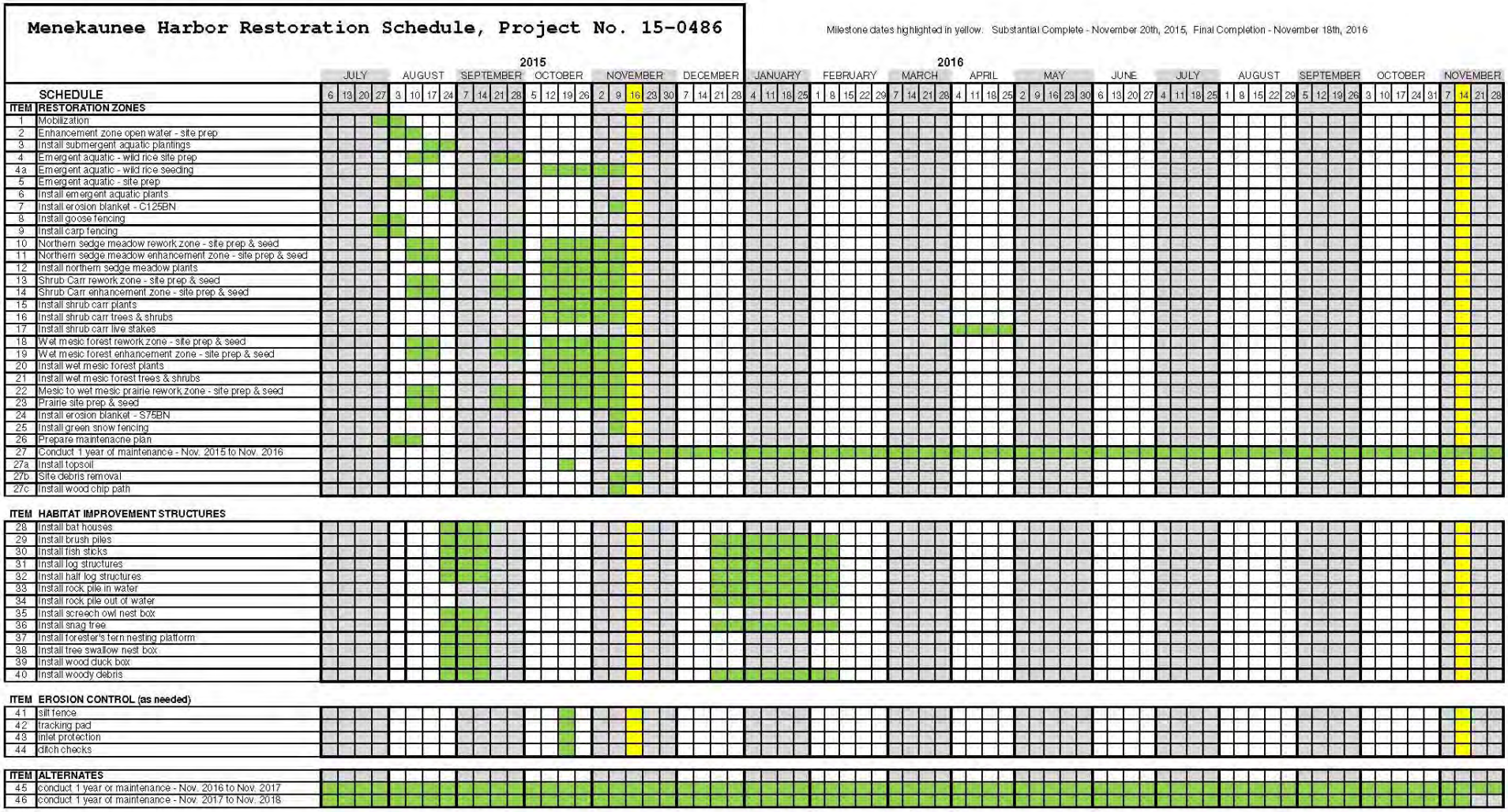
Table 3. Implementation Schedule - 2016.

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.

Table 4. Applied Ecological Services, Inc., Preliminary Project Schedule.



E1. Site Maintenance and Vegetative Growth Goals

a) Maintenance Plan

1) The maintenance plan developed by the contractor shall strive to obtain the performance standards that are identified in *Section b) Performance Standards*. The maintenance plan shall be a fluid document that will need to address unpredictable weather patterns such as drought, high waters, excessive prolonged heat, extreme weather, but not limited to these items, and potential remedies that will address each potential scenario to ensure the performance standards are reached. If extreme conditions persist beyond the reasonable expectation of a warranty, or extend beyond the warranty period, alternate funding sources may need to be identified to supplement planting deficiencies that may be a result of significant naturally occurring conditions.

Wisconsin DNR, City of Marinette, and REL will review and comment on the maintenance plan provided from the Contractor, to ensure that all possibilities are addressed within this document.

Specifications attached within Appendix B discuss the maintenance plan requirements in further detail and clarification. Reference section 1.04 and as detailed in 4.12, 4.13, 4.14, and 4.15 of Specification Section 32 90 10, Native Landscaping.

b) 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.

Year 1

a. 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 one year.
b. After one year, ≥75% of the vegetative cover within the restoration site will be native species, <25% of the cover will be invasive, non-native species.
c. Eighty percent of the site will be vegetated within one year.
d. 720 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy one year after installation.
e. 900 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy one year after installation.
f. The Open Water with Submergent Vegetation Community shall have a minimum of 5 native, non-invasive species present.
g. The Emergent Aquatic Community shall have a minimum of 15 native, non-invasive species present.
h. The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 15 native, non-invasive species present.
i. To ensure the restored communities have natural significance, the floristic quality index (FQI) and Coefficient of Conservatism (Mean C) for each shall be ≥ 20 and ≥ 3.5, respectively, after one year. FQI values will be calculated utilizing all species present: non-native species will be assigned a value of zero.

1) During the 1-year warranty period, AES shall re-seed areas with poor germination and replace diseased, unhealthy, and dying plants. Prior to expiration of the 1-year warranty period, follow-up inspection will be made to determine replacements required to be made by AES in accordance with provisions of the Plan Specifications. REL/NES will document findings in field report, and forward copies to AES. Items identified for

replacement will be tagged during inspection with plastic flagging. Decision of REL/NES for required replacements is final and binding upon AES. AES is responsible for repairing damage to property caused by defective workmanship and materials.

AES is not liable for replacement cost of seeds and plants damaged by extreme weather conditions and for plants not installed by AES under AES's supervision, by relocation or removal by others, by acts of God, or by vandalism, and losses because of curtailment of water by local authorities. If any of the above mentioned items occur and the ecological plantings or seeding needs to be installed, AES will work with REL/NES to determine costs associated with the item. It will be at the discretion of WDNR and City of Marinette to determine if any remediation work will occur at additional costs.

Year 2

a. 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 two years.
b. After two years, ≥80% of the vegetative cover within the restoration site will be native species, <25% of the cover will be invasive, non-native species.
c. Eighty five percent of the site will be vegetated within two years.
d. 640 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy two years after installation.
e. 800 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy two years after installation.
f. The Open Water with Submergent Vegetation Community shall have a minimum of 5 native species present.
g. The Emergent Aquatic Community shall have a minimum of 15 native species present.
h. The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 15 native species present.
i. To ensure the restored communities have natural significance, the floristic quality index (FQI) and Coefficient of Conservatism (Mean C) for each shall be ≥ 22 and ≥ 3.8, respectively, after two years. FQI values will be calculated utilizing all species present: non-native species will be assigned a value of zero.

Year 3

a. 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.
b. After three years, ≥85% of the vegetative cover within the restoration site will be native, non-invasive species, <15% of the cover will be invasive, non-native species.
c. Ninety percent of the site will be vegetated within three years.
d. 600 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy three years after installation.
e. 750 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy three years after installation.
f. The Open Water with Submergent Vegetation Community shall have a minimum of 5 native, non-invasive species present.
g. The Emergent Aquatic Community shall have a minimum of 15 native, non-invasive species present.
h. The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 20 native, non-invasive species present.
i. 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.
j. Six of the twelve nesting and roosting boxes shall be utilized or occupied annually by

year three.

k. 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.

After Year 3

a. City of Marinette will be responsible for maintaining the habitat restoration area. The City will work with UW-Marinette and WDNR to continue with long-term maintenance activities to help limit invasive species from reestablishing, ensure habitat structures are viable for fowl, and to help protect the revitalization of the Menekaunee Harbor habitat.

A

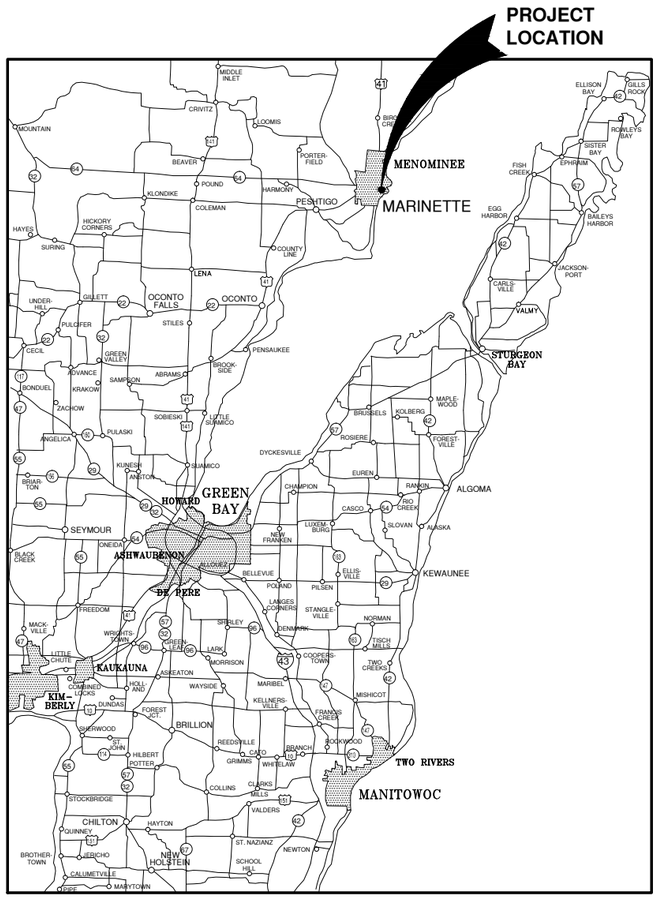
APPENDIX A

Construction Plans

MENEKAUNEE HARBOR RESTORATION PROJECT
CITY OF MARINETTE
MARINETTE COUNTY, WISCONSIN

CONTRACT NO. 3775-15-01

ATTENTION!
DOWNLOADED PLANS ARE NOT SCALEABLE, NEITHER THE OWNER OR THE ENGINEER SHALL BE HELD RESPONSIBLE FOR THE SCALE OR PRINT QUALITY OF DOWNLOADED PLANS. ONLY PRINTED PLANS FROM BLUE PRINT SERVICE CO., INC. SHALL BE CONSIDERED TO BE SCALEABLE PLANS.

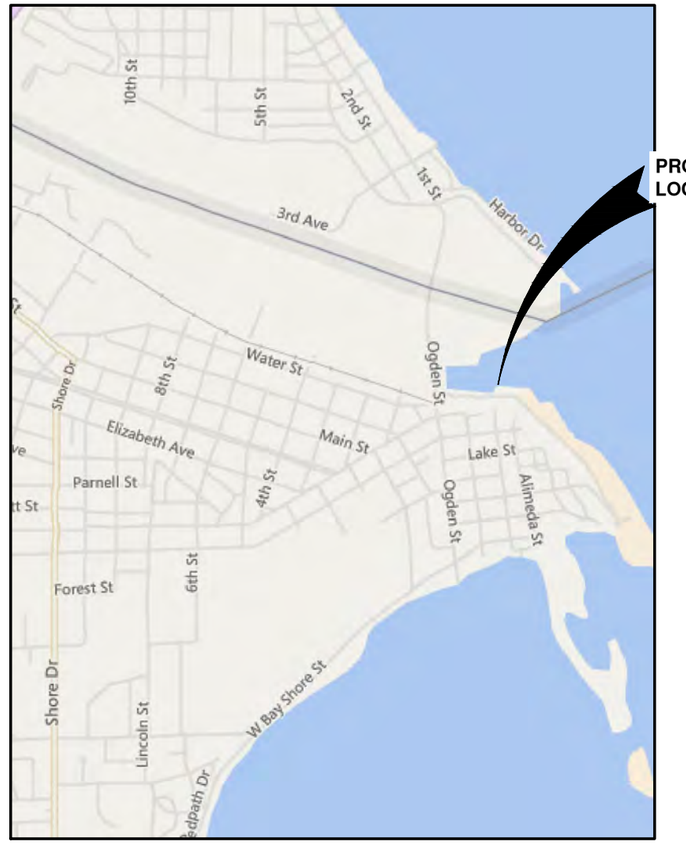


VICINITY MAP

NOTE:
EXISTING UTILITIES SHOWN ON PLANS ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING EXACT LOCATIONS AND ELEVATIONS OF ALL UTILITIES, WHETHER SHOWN OR NOT, FROM THE OWNERS OF THE RESPECTIVE UTILITIES. ALL UTILITY OWNERS SHALL BE NOTIFIED FOR LOCATES BY THE CONTRACTOR 72 HOURS PRIOR TO EXCAVATION.

NOTE:
ALL EROSION CONTROL MEASURES SHALL BE IN PLACE PRIOR TO CONSTRUCTION AND SHALL CONFORM TO THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES CONSTRUCTION SITE EROSION CONTROL AND TECHNICAL STANDARDS.

INDEX TO DRAWINGS



LOCATION MAP

CONFORMED PLAN

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

DRAWN RLB
CHECKED JGS
DESIGNED RHT

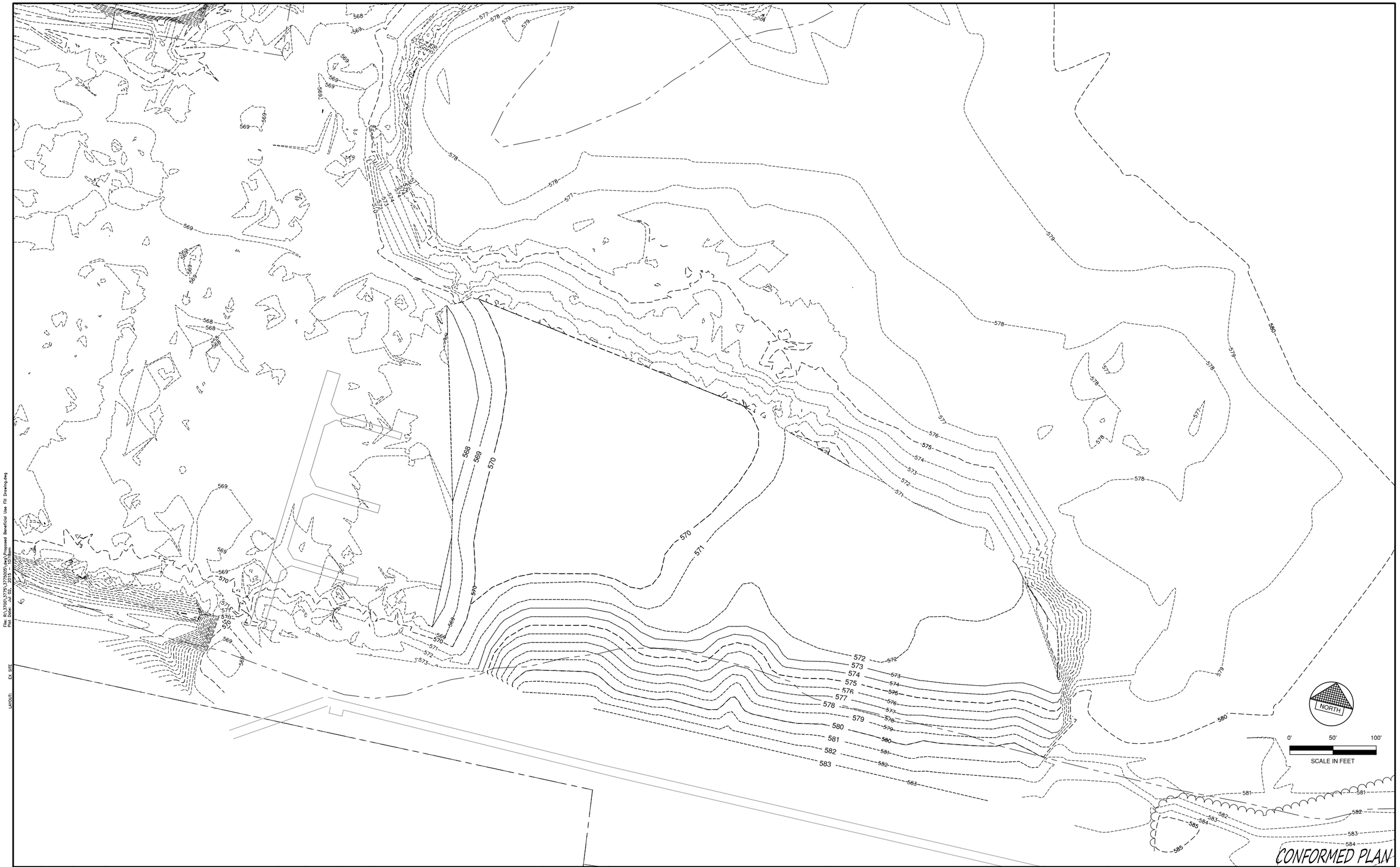
CONTRACT NO. 3775-15-01
MENEKAUNEE HARBOR RESTORATION PROJECT
CITY OF MARINETTE
MARINETTE COUNTY, WISCONSIN

LOCATION MAPS AND INDEX TO DRAWINGS

DATE 04/2014
FILE 3775005C
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. 1



CONFORMED PLAN

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

DRAWN LLP
CHECKED JGS
DESIGNED JGS

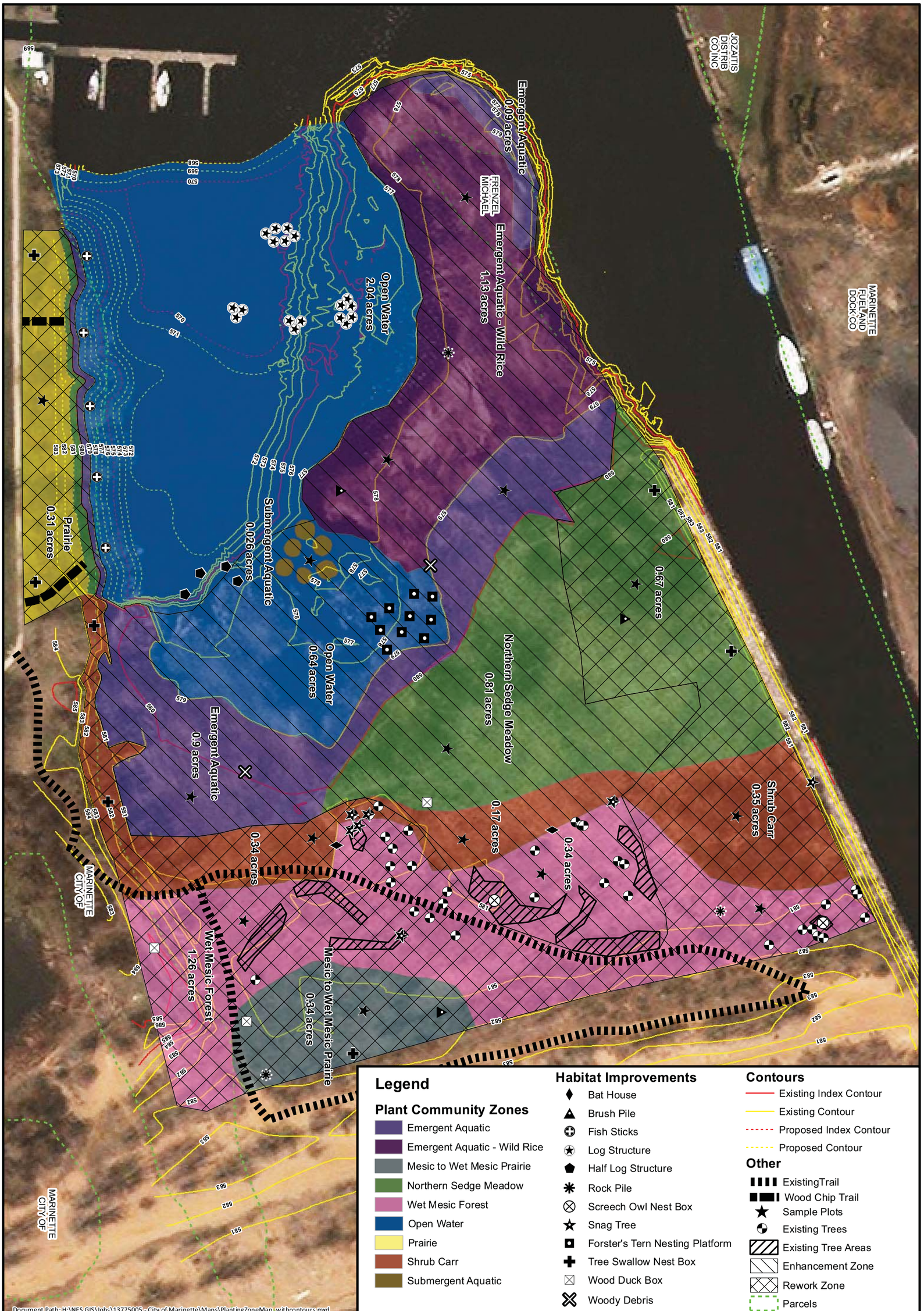
CONTRACT NO. 3775-15-01
MENEKAUNEE HARBOR RESTORATION PROJECT
CITY OF MARINETTE
MARINETTE COUNTY, WISCONSIN

EXISTING SITE CONDITIONS

DATE 2/2015
FILE PROPOSED BENEFICIAL USE FILL DRAWING
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. 2



Legend

Plant Community Zones
- Emergent Aquatic
- Emergent Aquatic - Wild Rice
- Mesic to Wet Mesic Prairie
- Northern Sedge Meadow
- Wet Mesic Forest
- Open Water
- Prairie
- Shrub Carr
- Submergent Aquatic

Habitat Improvements
- 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

Contours
- Existing Index Contour
- Existing Contour
- Proposed Index Contour
- Proposed Contour

Other
- ExistingTrail
- Wood Chip Trail
- Sample Plots
- Existing Trees
- Existing Tree Areas
- Enhancement Zone
- Rework Zone
- Parcels

0 10 20 40 60 80 Feet

N CONFORMED

SHEET 3

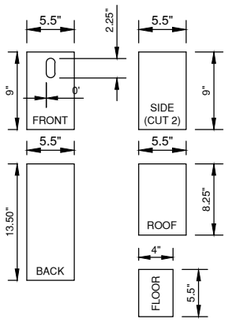
Sources: Robert E. Lee & Associates, Inc., 2010 WROC, ESRI

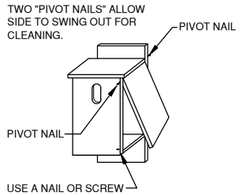
Lower Menominee River Area of Concern
Menekaunee Harbor Restoration Project
City of Marinette-Grant/Proj. No. GL-00E01312-0
REL Project No. 13775005
Marinette, Marinette County, WI

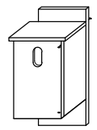
5/22/2015

Plant Community Zones

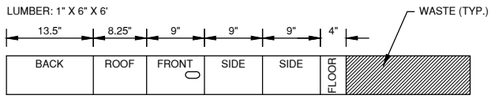
Robert E. Lee & Associates, Inc.





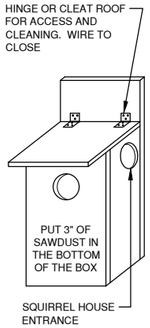


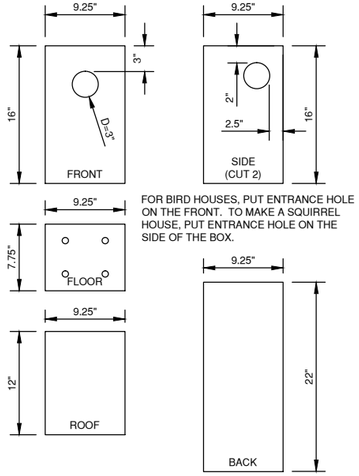
NOTE:
THESE DIMENSIONS ARE FOR 3/4" THICK BOARD. SOME CEDAR BOARDS ARE 7/8" THICK. IF SO, THE FLOOR MUST BE 3 3/4" WIDE, NOT 4".



TREE SWALLOW AND EASTERN BLUEBIRD NEST BOX

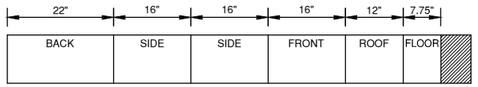
AMERICAN KESTREL, EASTERN SCREECH-OWL, NORTHERN SAW-WHET OWL, BOREAL OWL, BUFFLEHEAD, GRAY SQUIRREL, RED SQUIRREL AND FOX SQUIRREL NEST BOX.



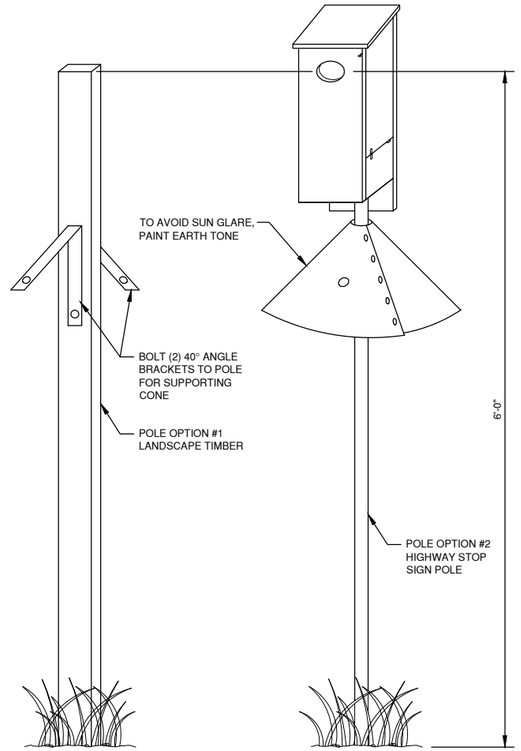


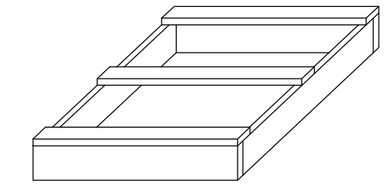
FOR BIRD HOUSES, PUT ENTRANCE HOLE ON THE FRONT. TO MAKE A SQUIRREL HOUSE, PUT ENTRANCE HOLE ON THE SIDE OF THE BOX.

LUMBER: 1" X 6" X 6'

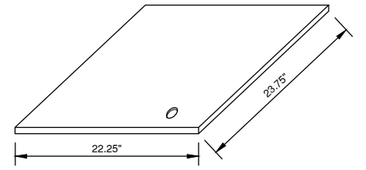


OWL AND SQUIRREL NEST BOX

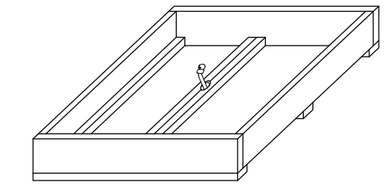




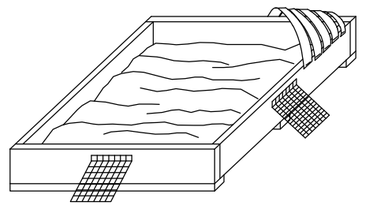
NAIL THE FOUR SIDES TOGETHER AN ATTACHE THREE BOTTOM BRACES.



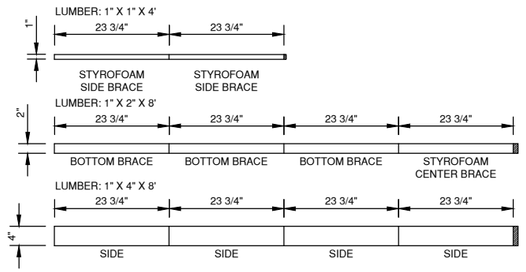
CUT A 2' SQUARE PIECE OF 3/4" STYROFOAM AS SHOWN TO FIT INSIDE THE PLATFORM. MAKE A HOLE IN THE CENTER FOR AN ANCHOR ROPE.



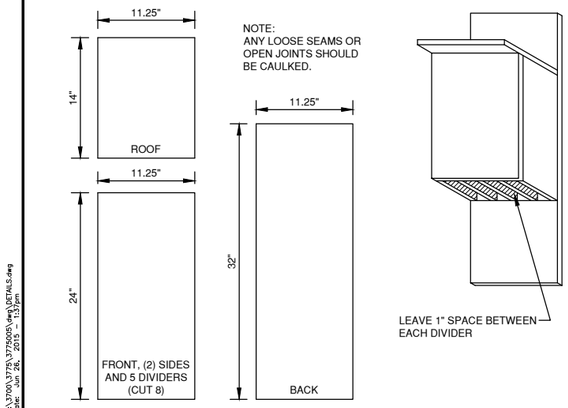
NAIL THE 1" X 1" BRACES AND ONE OF THE 1" X 2" TO HOLD THE STYROFOAM IN PLACE. DRILL A HOLE IN THE CENTER BRACE. PULL ANCHOR ROPE THROUGH AND TIE A KNOT.



FILL PLATFORM WITH WET MARSH VEGETATION. STAPLE CATTAIL LEAVES IN AN ARCH IN THE CORNER TO MAKE A CHICK SHELTER. MAKE AND ATTACH SCREEN CHICK RAMPS.

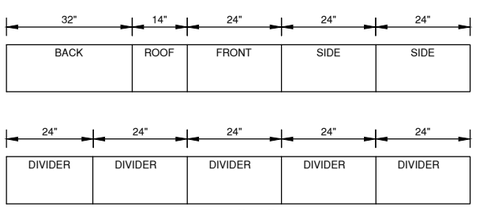


FORSTER'S TERN NEST PLATFORM



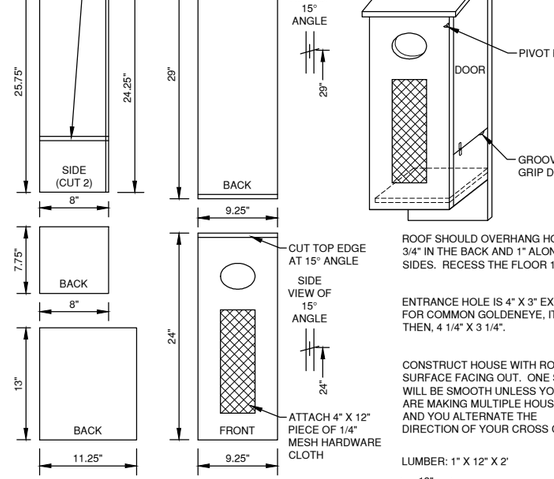
NOTE:
ANY LOOSE SEAMS OR OPEN JOINTS SHOULD BE CAULKED.

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



BAT HOUSE

TO MAKE SWING-UP DOOR, ON ONE SIDE MAKE A 45° CUT, 6" FROM THE BOTTOM AND TRIM 1/8" FROM LONG EDGE OF DOOR.

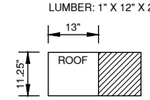


ROOF SHOULD OVERHANG HOUSE 3/4" IN THE BACK AND 1" ALONG THE SIDES. RECESS THE FLOOR 1/2" UP.

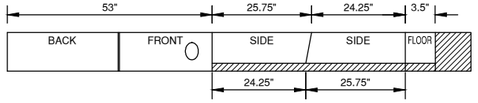
ENTRANCE HOLE IS 4" X 3" EXCEPT FOR COMMON GOLDENEYE, IT IS THEN, 4 1/4" X 3 1/4".

CONSTRUCT HOUSE WITH ROUGH SURFACE FACING OUT. ONE SIDE WILL BE SMOOTH UNLESS YOU ARE MAKING MULTIPLE HOUSES AND YOU ALTERNATE THE DIRECTION OF YOUR CROSS CUT.

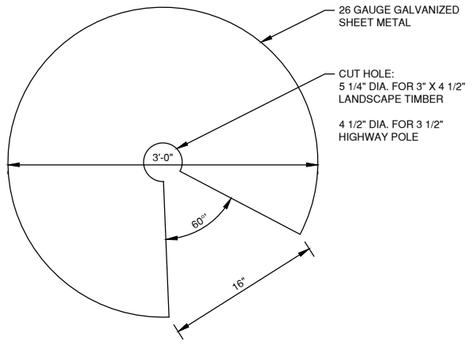
LUMBER: 1" X 12" X 2'

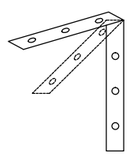


LUMBER: 1" X 10" X 10' (HAVE ROUGH SIDE UP WHEN CUTTING 15° ANGLE)



WOOD DUCK, HOODED MERGANSER AND COMMON GOLDENEYE NEST BOX





SUPPORT BRACKET:
6" OR 8" STEEL. PLACE IN VISE AND POUND RIGHT-ANGLED ARM DOWN TO 40°, OR PURCHASE READY MADE BRACKET AS SHOWN.

CONE GUARD DETAIL

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

CONFORMED PLAN

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

DRAWN LLP
CHECKED RHT
DESIGNED JRH

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

MISCELLANEOUS DETAILS

DATE 04/2015
FILE DETAILS
JOB NO. 3775005

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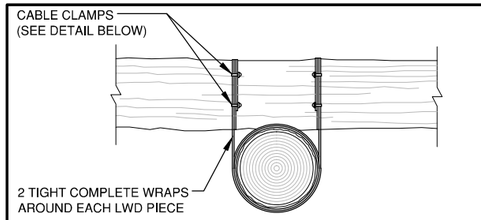
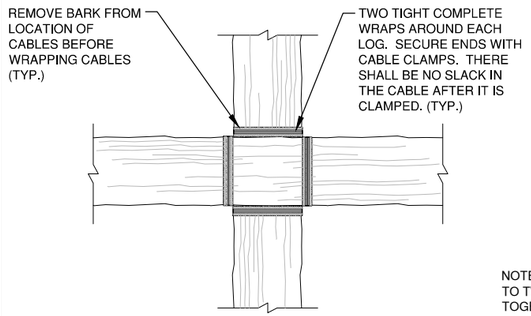
INTERNET: www.releeinc.com FAX:(920) 662-9141

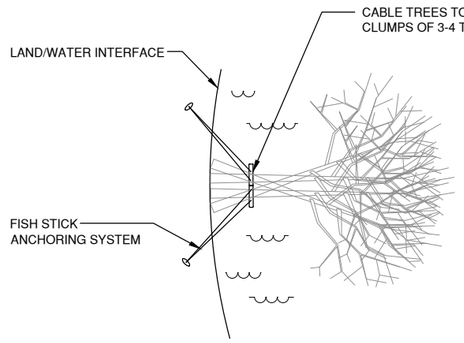
SHEET NO. 4

File: (L):\3700\3775\3775005\dwg\DETAILS.dwg
Plot Date: Jun 26, 2015 - 1:37pm
LAYOUT: DETAILS 1

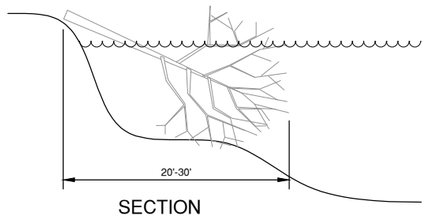




LOG CABLING DETAIL



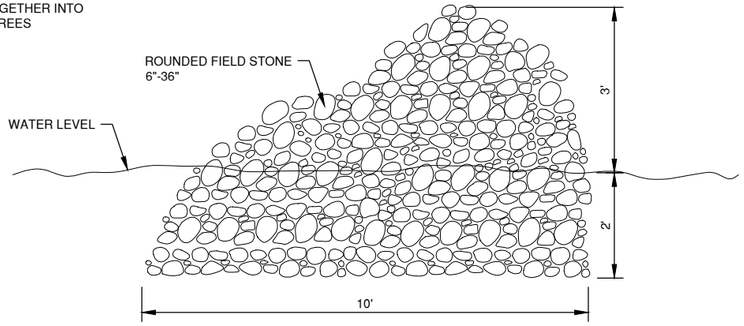
PLAN



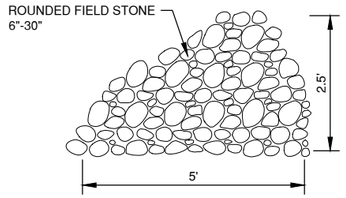
SECTION

FISH STICK DETAIL

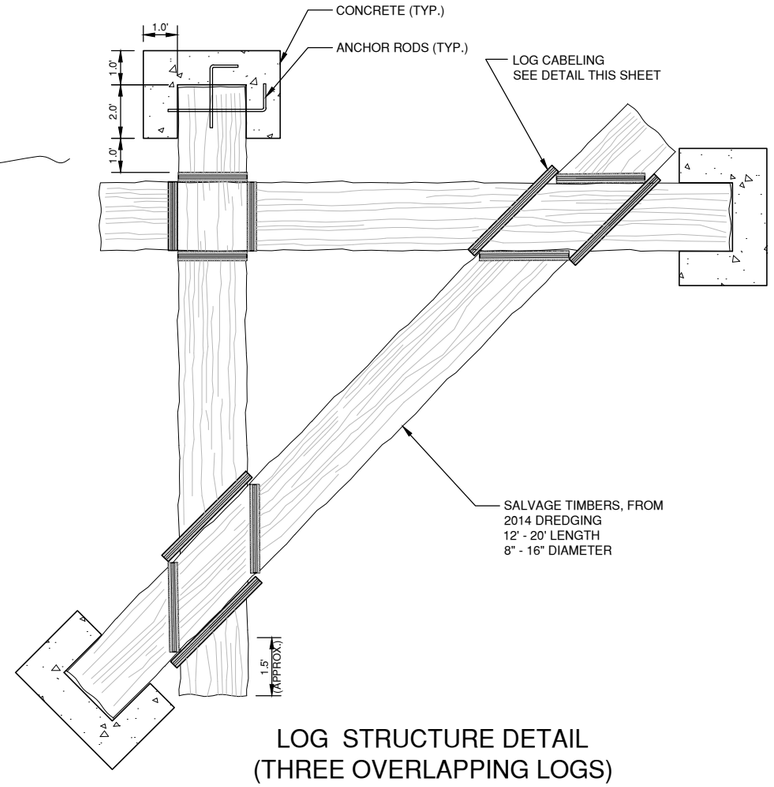
NOTE: TWO PIPES WILL BE USED PER GROUPING OF TREES; AND, EACH PIPE WILL BE ATTACHED TO TWO SEPARATE TREE TRUNKS WITHIN THE GROUP. EACH GROUPING SHALL BE SECURED TOGETHER AROUND EACH TRUNK WITH A MIN. 3/8" GALVANIZED CABLE AND CABLE CLAMPS.



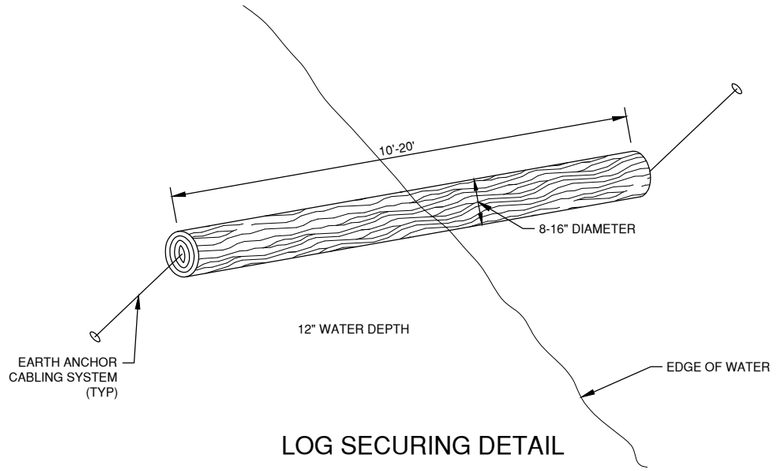
ROCK PILE IN WATER DETAIL



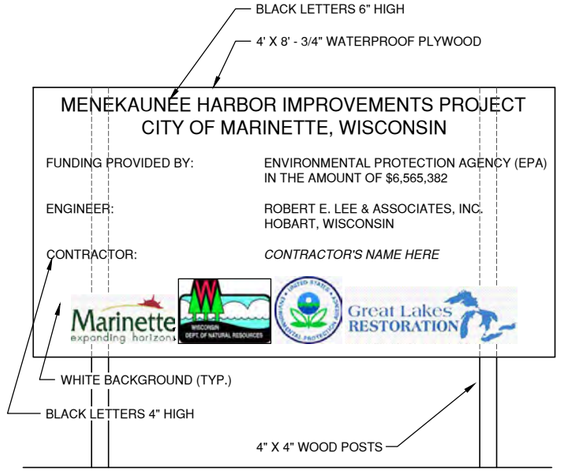
ROCK PILE OUT OF WATER DETAIL



LOG STRUCTURE DETAIL
(THREE OVERLAPPING LOGS)

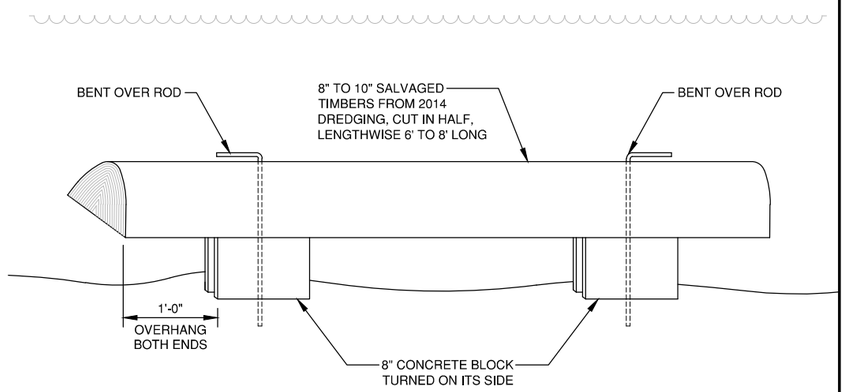


LOG SECURING DETAIL



NOTES:
1. ALL PAINT SHALL BE EXTERIOR GRADE ENAMEL IN COLOR INDICATED.
2. SIGN SHOULD INCLUDE GREAT LAKES RESTORATION INITIATIVE LOGO (GLRI) IN LOWER RIGHT HAND CORNER OF SIGN. GLRI LOGO TO BE PROVIDED TO CONTRACTOR BY EPA.
3. FINAL SIGN DETAILS AND INFORMATION TO BE COORDINATED WITH OWNER. SUBMIT SHOP DRAWING FOR REVIEW.

SIGN PLATE DETAIL



SECTION

HALF LOG STRUCTURE DETAIL

CONFORMED PLAN

NO.	DATE	APPROV.	REVISION
1	5/22/15	RHT	ADDENDUM NO. 2

NO.	DATE	APPROV.	REVISION

DRAWN LLP
CHECKED RHT
DESIGNED JRH

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

MISCELLANEOUS DETAILS

DATE 04/2015
FILE DETAILS
JOB NO. 3775005

Robert E. Lee & Associates, Inc.
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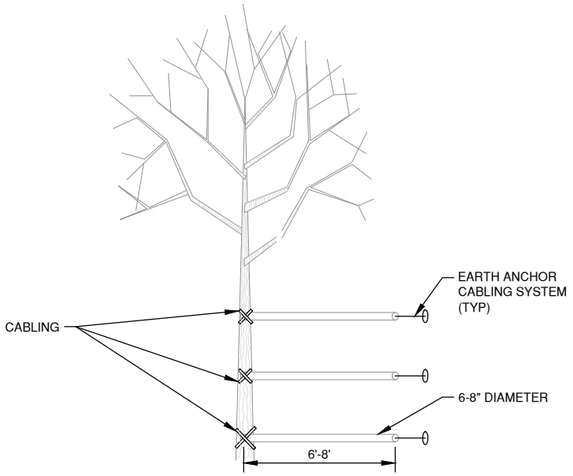
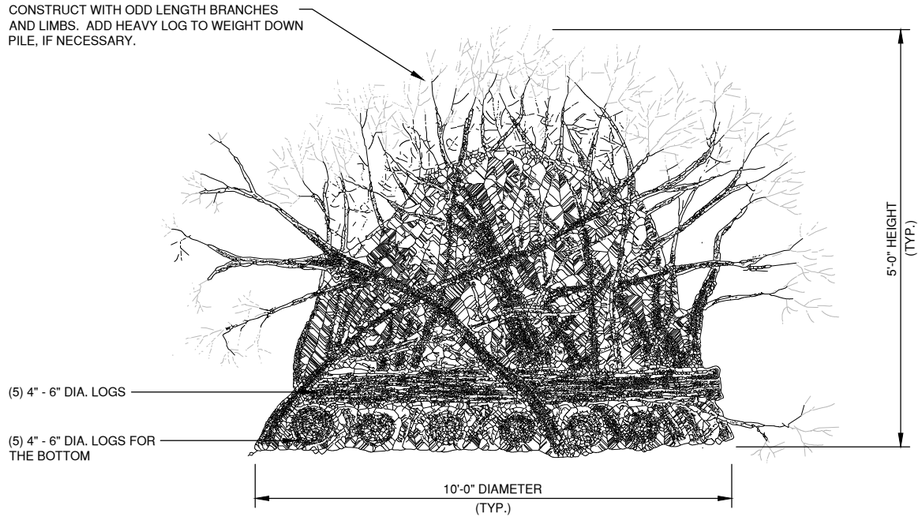
SHEET NO. 5

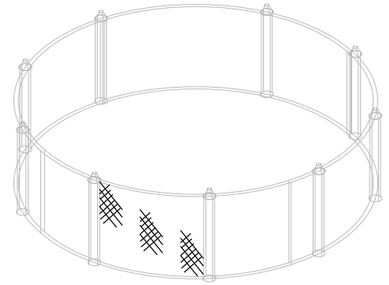


PLAN

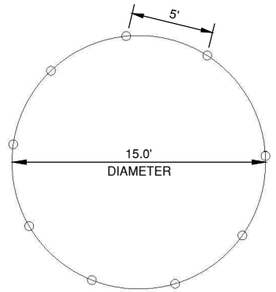
EXISTING TREE TOP ANCHORING



BRUSH PILE DETAIL



ISOMETRIC

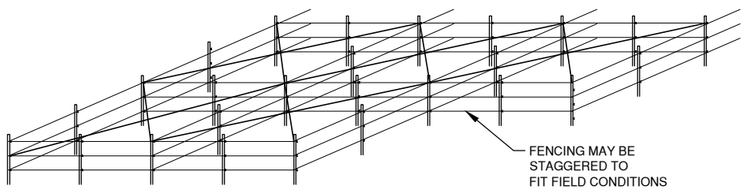


PLAN

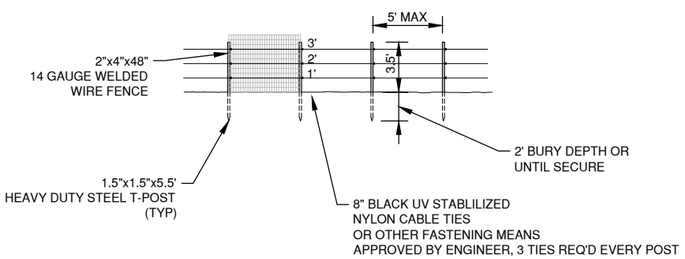
SUBMERGENT AQUATIC PLANT PROTECTION

SAME MATERIAL AS CARP EXCLUSION FENCING

GOOSE EXCLUSION FENCE ISOMETRIC VIEW

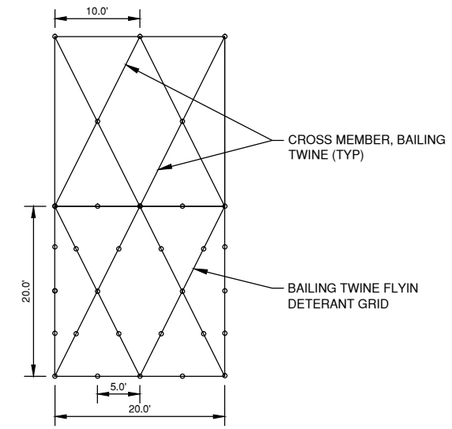


CARP EXCLUSION FENCE ISOMETRIC VIEW



CARP EXCLUSION FENCING ELEVATION VIEW

GOOSE EXCLUSION FENCING PLAN VIEW

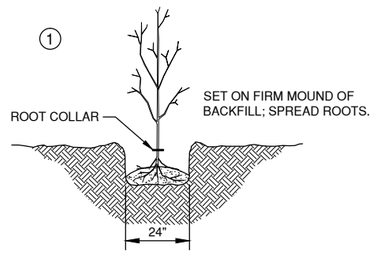


CARP EXCLUSION FENCING PLAN VIEW

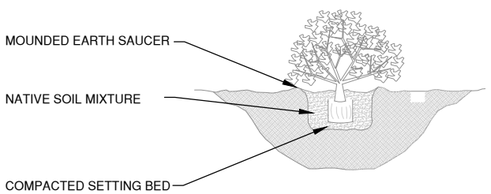
NOTE:
1. GOOSE FENCING MATERIAL SHALL BE 48" GREEN SNOW FENCE
2. GOOSE FENCING POST SHOULD BE 10' APART, CARP FENCING POST SHOULD BE 5' APART

CARP AND GOOSE EXCLUSION FENCING DETAIL

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

CONFORMED PLAN

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

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CHECKED RHT
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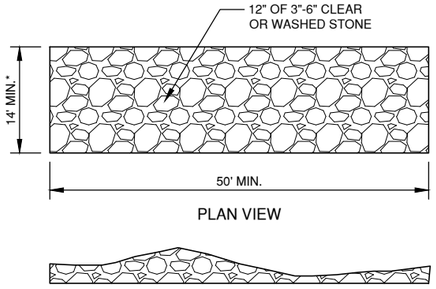
SHEET NO. 6



*14' MIN. OR FULL WIDTH OF THE EGRESS POINT.
REFERENCE WDNR TECHNICAL STANDARD 1057.

TRACKING PAD DETAIL

(IF APPLICABLE)

INLET PROTECTION NOTES:

MANUFACTURED ALTERNATIVES APPROVED AND LISTED ON THE WDOT PRODUCT ACCEPTABILITY LIST MAY BE SUBSTITUTED.

WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED ON THE GEOTEXTILE FABRIC DOES NOT FALL INTO THE INLET. ANY MATERIAL FALLING INTO THE INLET SHALL BE REMOVED IMMEDIATELY.

① FINISHED SIZE, INCLUDING FLAP POCKETS WHERE REQUIRED, SHALL EXTEND A MINIMUM OF 10" AROUND THE PERIMETER TO FACILITATE MAINTENANCE OR REMOVAL.

② FOR INLET PROTECTION, TYPE C (WITH CURB BOX), AN ADDITIONAL 18" OF FABRIC IS WRAPPED AROUND THE WOOD AND SECURED WITH STAPLES. THE WOOD SHALL NOT BLOCK THE ENTIRE HEIGHT OF THE CURB BOX OPENING.

③ FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2"X4".

INSTALLATION NOTES:
TYPE "B" & "C"

TRIM EXCESS FABRIC IN THE FLOW LINE TO WITHIN 3" OF THE GRATE.

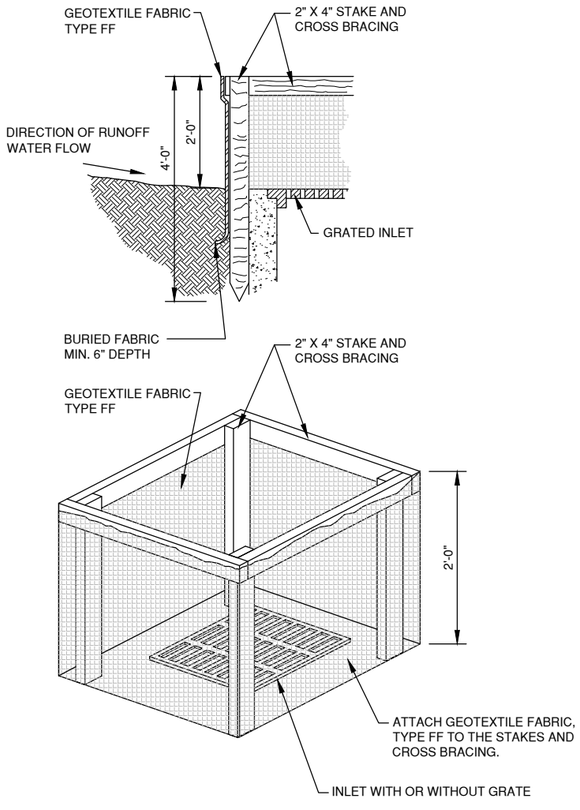
DEMONSTRATE A METHOD OF MAINTENANCE, USING A SEWN FLAP, HAND HOLDS OR OTHER METHOD TO PREVENT ACCUMULATED SEDIMENT FROM ENTERING THE INLET.

TYPE "D"

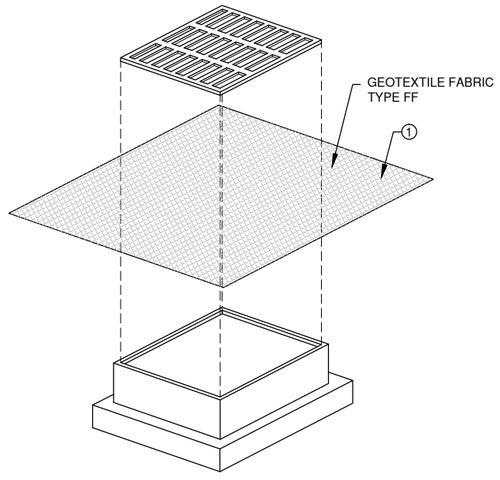
DO NOT INSTALL INLET PROTECTION TYPE D IN INLETS SHALLOWER THAN 30" MEASURED FROM THE BOTTOM OF THE INLET TO THE TOP OF THE GRATE.

TRIM EXCESS FABRIC IN THE FLOW LINE TO WITHIN 3" OF THE GRATE.

THE INSTALLED BAG SHALL HAVE A MINIMUM SIDE CLEARANCE, BETWEEN THE INLET WALLS AND THE BAG, MEASURED AT THE BOTTOM OF THE OVERFLOW HOLES, OF 3". WHERE NECESSARY, CINCH THE BAG, USING PLASTIC ZIP TIES, TO ACHIEVE THE 3" CLEARANCE, THE TIES SHALL BE PLACED AT THE MAXIMUM OF 4" FROM THE BOTTOM OF THE BAG.

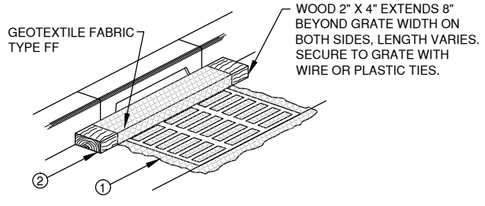


INLET PROTECTION, TYPE A

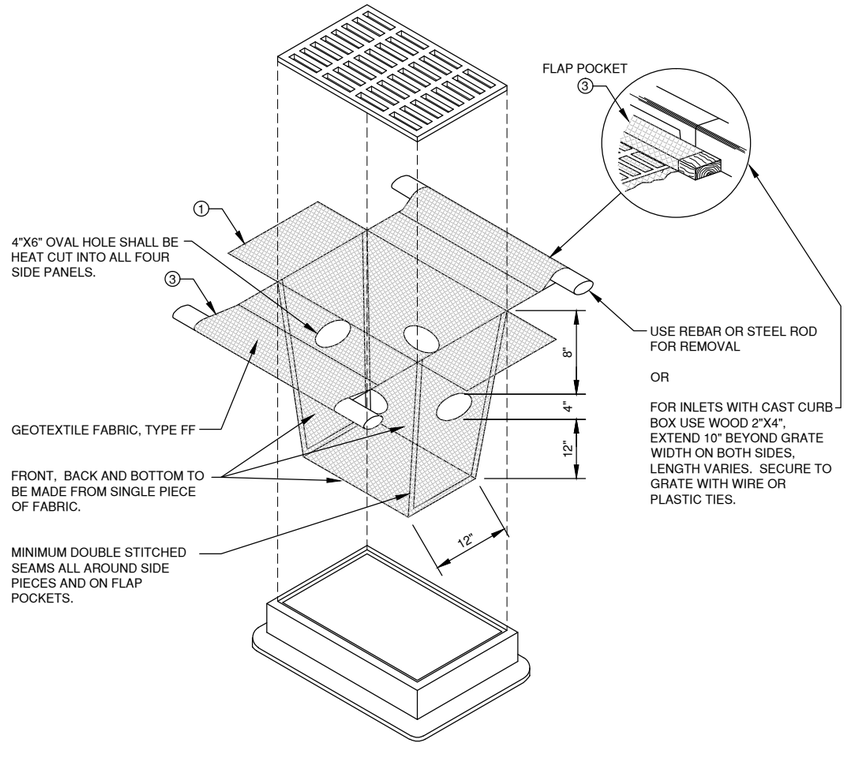


INLET PROTECTION, TYPE B
(WITHOUT CURB BOX)

(CAN BE INSTALLED IN ANY INLET WITHOUT A CURB BOX)



INLET PROTECTION, TYPE C
(WITH CURB BOX)



INLET PROTECTION, TYPE D

(CAN BE INSTALLED IN ANY INLET TYPE WITH OR WITHOUT CURB BOX AS PER NOTE "2")

CONFORMED PLAN

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DRAWN: RLB
CHECKED: JGS
DESIGNED: RHT

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

EROSION CONTROL
INLET PROTECTION AND
MISCELLANEOUS DETAILS

DATE: 05/2015
FILE: EROSION CONTROL
JOB NO. 3775005

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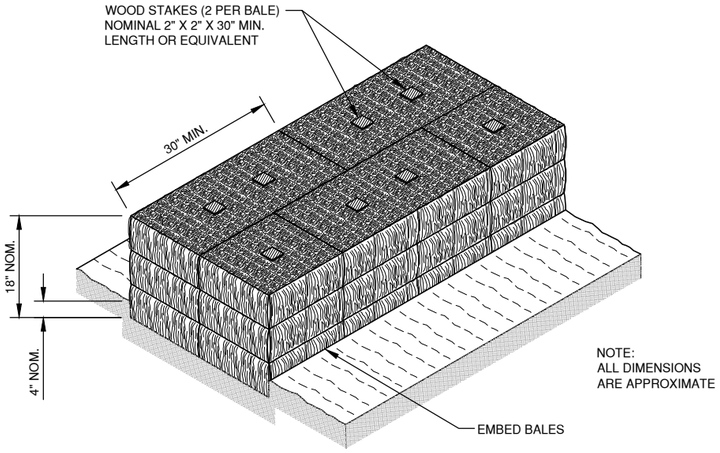
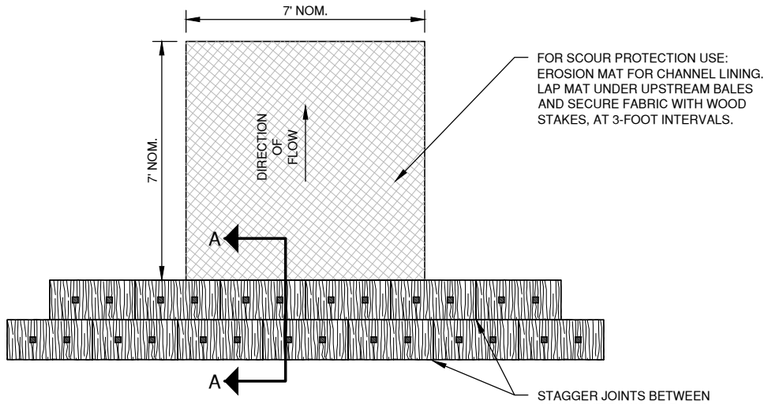
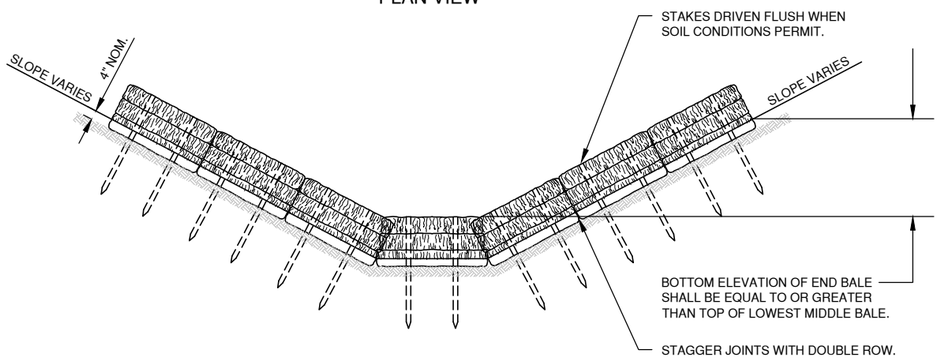
SHEET NO. 7



SECTION A-A

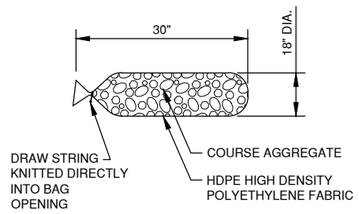


PLAN VIEW



FRONT ELEVATION

TEMPORARY DITCH CHECK USING EROSION BALES TYPE A



FILTER BAG DETAIL

COURSE AGGREGATE INFORMATION

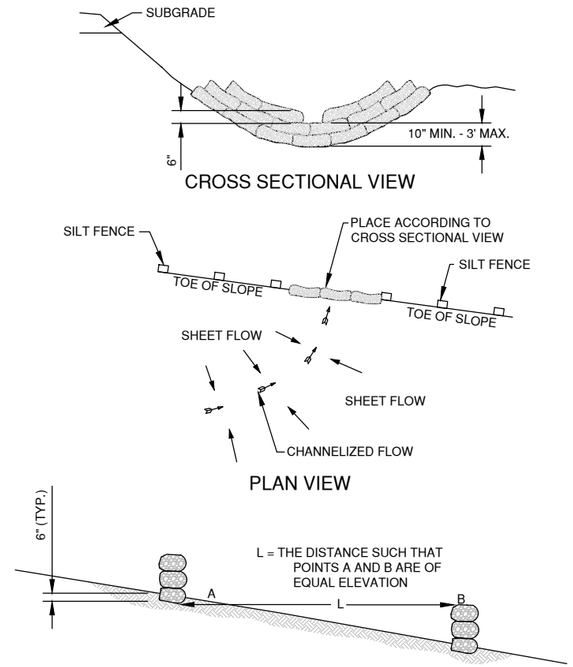
SIEVE SIZE	SIZE NO. AASHTO No. 67 (1)
2 INCH (50 mm)	-
1 1/2 INCH (37.5mm)	-
1 INCH (25.0 mm)	100
3/4 INCH (19.0mm)	90-100
3/8 INCH (9.5mm)	20-55
No. 4 (4.75mm)	0-10
No. 8 (2.36mm)	0-5

(1) SIZE No. ACCORDING TO AASHTO M 43

NOTES:

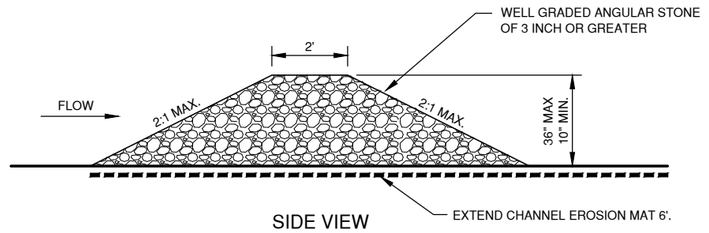
18" X 30" ROCK FILLED FILTER BAG SHALL BE COMPRISED OF THE FOLLOWING:
HDPE HIGH DENSITY POLYETHYLENE
HDPE HIGH DENSITY POLYETHYLENE DRAW STRING KNITTED DIRECTLY INTO BAG OPENING.
80% FABRIC CLOSURE WITH APPARENT OPENING SIZE NO LARGER THAN 1/8 " X 1/8 "
ROLLED SEAM USING A MINIMUM OF 480 DENIER POLYESTER SEWING YARN FOR STRENGTH AND DURABILITY.

USE WELL GRADED COURSE AGGREGATE CONFORMING TO THE FOLLOWING GRADATION REQUIREMENTS

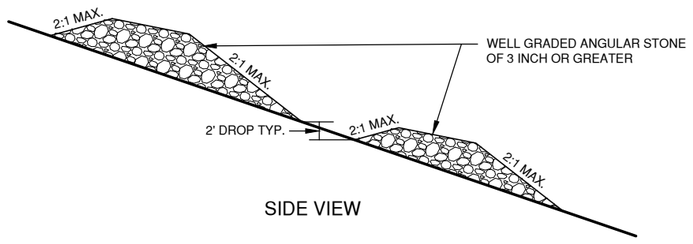


DITCH CHECK DETAIL

ROCK FILLED EROSION CONTROL BAGS TYPE B



SIDE VIEW



SIDE VIEW

TEMPORARY DITCH CHECK USING STONE TYPE C

CONFORMED PLAN

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DRAWN RLB
CHECKED JGS
DESIGNED RHT

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MENEKAUNEE HARBOR RESTORATION PROJECT
CITY OF MARINETTE
MARINETTE COUNTY, WISCONSIN

EROSION CONTROL
DITCH CHECK DETAILS

DATE 05/2015
FILE EROSION CONTROL
JOB NO. 3775005

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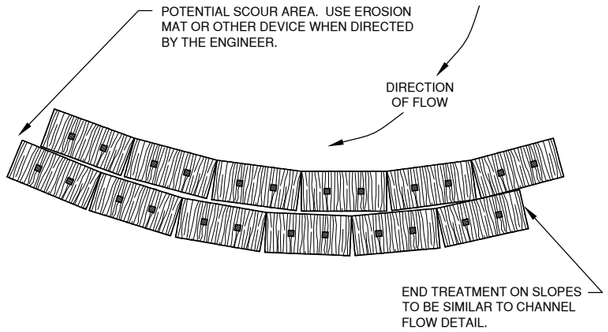
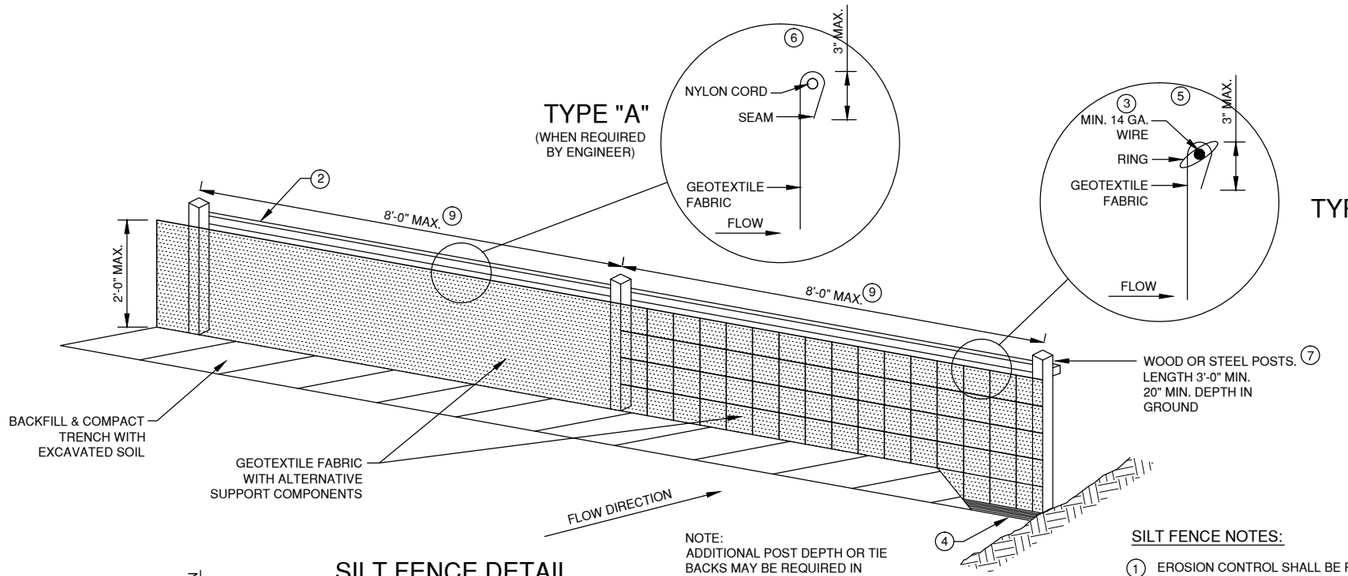
SHEET NO. 8

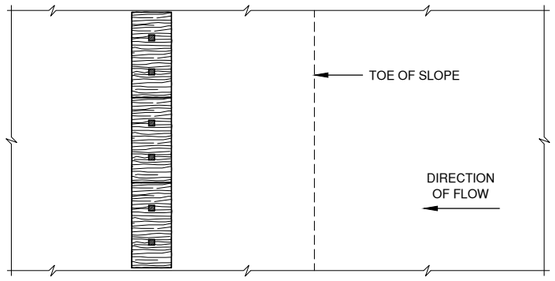


PLAN VIEW
(WHEN ALTERING THE DIRECTION OF FLOW)

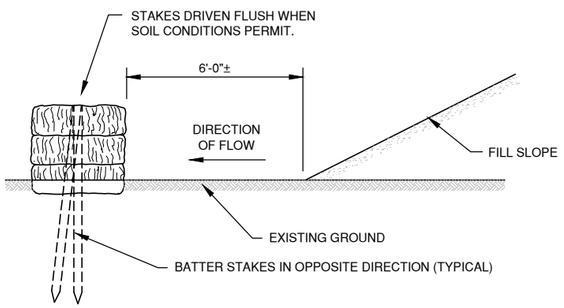


NOTE:
ADDITIONAL POST DEPTH OR TIE BACKS MAY BE REQUIRED IN UNSTABLE SOILS.

SILT FENCE DETAIL

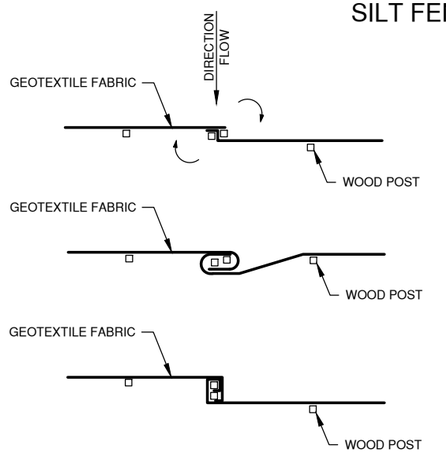


PLAN VIEW

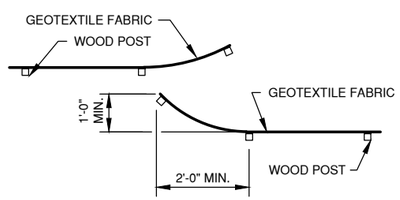


FRONT ELEVATION
WHEN EXISTING GROUND SLOPES AWAY FROM FILL SLOPE

EROSION BALES FOR SHEET FLOW

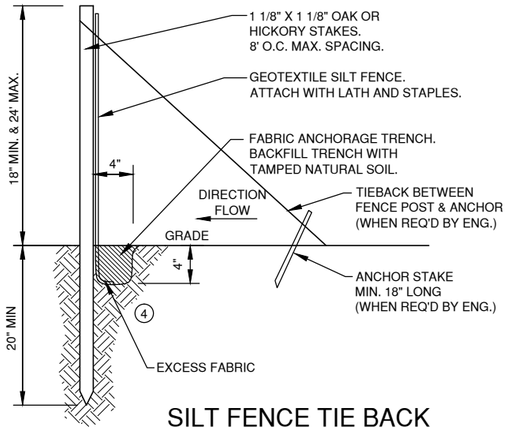


TWIST METHOD 8



HOOK METHOD 8

JOINING TWO LENGTHS OF SILT FENCE



SILT FENCE TIE BACK

SILT FENCE NOTES:

1. EROSION CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH WDNR TECHNICAL STANDARD.
2. CROSS BRACE WITH 2" X 4" WOODEN FRAME OR EQUIVALENT AT TOP OF POSTS AS DIRECTED BY THE ENGINEER.
3. MINIMUM 14 GAUGE WIRE REQUIRED, FOLD FABRIC 3" OVER THE WIRE AND STAPLE OR PLACE WIRE RINGS ON 12" C.C.
4. EXCAVATE A TRENCH A MINIMUM OF 4" WIDE & 6" DEEP TO BURY AND ANCHOR THE GEOTEXTILE FABRIC. FOLD MATERIAL TO FIT TRENCH AND BACKFILL & COMPACT TRENCH WITH EXCAVATED SOIL.
5. WIRE SUPPORT FENCE SHALL BE 14 GAUGE MINIMUM WOVEN WIRE WITH A MAXIMUM MESH SPACING OF 6". SECURE TOP OF GEOTEXTILE FABRIC TO TOP OF FENCE WITH STAPLES OR WIRE RINGS AT 12" C.C. (TYPE B)
6. GEOTEXTILE FABRIC SHALL BE REINFORCED WITH AN INDUSTRIAL POLYPROPYLENE NETTING WITH A MAXIMUM MESH SPACING OF 3/4" OR EQUAL. A HEAVY DUTY NYLON TOP SUPPORT CORD OR EQUIVALENT IS REQUIRED. (TYPE A)
7. STEEL POSTS SHALL BE STUDDED "TEE" OR "U" TYPE WITH A MINIMUM WEIGHT OF 1.28 LBS./LIN. FT. (WITHOUT ANCHOR) FIN ANCHORS SUFFICIENT TO RESIST POST MOVEMENT ARE REQUIRED. WOOD POSTS SHALL BE A MINIMUM SIZE OF 1 1/8" X 1 1/8" OF OAK OR HICKORY.
8. CONSTRUCT SILT FENCE FROM A CONTINUOUS ROLL, IF POSSIBLE, BY CUTTING LENGTHS TO AVOID JOINTS. IF A JOINT IS NECESSARY, USE ONE OF THE FOLLOWING TWO METHODS: A.) TWIST METHOD -- OVERLAP THE END POSTS AND TWIST, OR ROTATE, AT LEAST 180 DEGREES, B:) HOOK METHOD -- HOOK THE END OF EACH SILT FENCE LENGTH.
9. THE MAXIMUM SPACING OF POSTS FOR WOVEN FABRIC SILT FENCE SHALL BE 8 FEET AND FOR NON-WOVEN FABRIC, 3 FEET.

EROSION CONTROL SHEET FLOW NOTES:

1. ANY SOIL STOCKPILED THAT REMAINS FOR MORE THAN 7 DAYS SHALL BE COVERED OR TREATED WITH STABILIZATION PRACTICES SUCH AS TEMPORARY OR PERMANENT SEEDING AND MULCHING.
2. A MINIMUM OF 4 INCHES OF TOPSOIL MUST BE APPLIED TO ALL AREAS TO BE SEEDED OR SODDED.
3. ALL WASTE AND UNUSED BUILDING MATERIALS (INCLUDING GARBAGE, DEBRIS, CLEANING WASTES, WASTEWATER, TOXIC MATERIALS, OR HAZARDOUS MATERIALS) SHALL BE PROPERLY DISPOSED OF AND NOT ALLOWED TO BE CARRIED OFF-SITE BY RUNOFF OR WIND.
4. ALL OFF-SITE SEDIMENT DEPOSITS OCCURRING AS A RESULT OF CONSTRUCTION WORK OR A STORM EVENT SHALL BE CLEANED UP BY THE END OF EACH DAY. **FLUSHING SHALL NOT BE ALLOWED.**
5. ANY SOIL EROSION THAT OCCURS AFTER FINAL GRADING AND/OR THE APPLICATION OF STABILIZATION MEASURES MUST BE REPAIRED AND THE STABILIZATION WORK REDONE.
6. FOR ANY DISTURBED AREA THAT REMAINS INACTIVE FOR GREATER THAN 7 WORKING DAYS, OR WHERE GRADING WORK EXTENDS BEYOND THE PERMANENT SEEDING DEADLINES, THE SITE MUST BE TREATED WITH TEMPORARY STABILIZATION MEASURES SUCH AS SOIL TREATMENT, TEMPORARY SEEDING AND/OR MULCHING.
7. ALL TEMPORARY EROSION CONTROL PRACTICES SHALL BE MAINTAINED UNTIL THE SITE IS STABILIZED WITH 70% VEGETATION AND A NOTICE OF TERMINATION HAS BEEN APPROVED BY THE DNR.
8. WIND EROSION SHALL BE KEPT TO A MINIMUM DURING CONSTRUCTION. WATERING, MULCH OR A TACKING AGENT MAY NEED TO BE UTILIZED TO PROTECT NEARBY RESIDENCES/WATER RESOURCES.
9. CONTRACTOR RESPONSIBLE FOR MAINTAINING ALL THE EROSION CONTROL MEASURES IN CONFORMANCE WITH THE WDNR CONSERVATION PRACTICE STANDARDS, LATEST EDITION.
10. UPON COMPLETION OF STORM INLET CONSTRUCTION, INSTALL STORM DRAIN INLET PROTECTION FOR CONSTRUCTION SITE AS SPECIFIED.
11. FINE SEDIMENT ACCUMULATIONS SHALL BE CLEANED FROM STREETS, PRIVATE DRIVES, OR PARKING AREAS BY MANUAL OR MECHANICAL SWEEPING A MINIMUM OF ONCE PER WEEK AND BEFORE ALL IMMINENT RAINS.
12. EROSION AND SEDIMENT CONTROL STRUCTURES SHALL BE INSPECTED WEEKLY AND WITHIN 24 HOURS OF RAINFALL OF 0.5 INCH OR MORE.

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EROSION CONTROL
SHEET FLOW DETAILS

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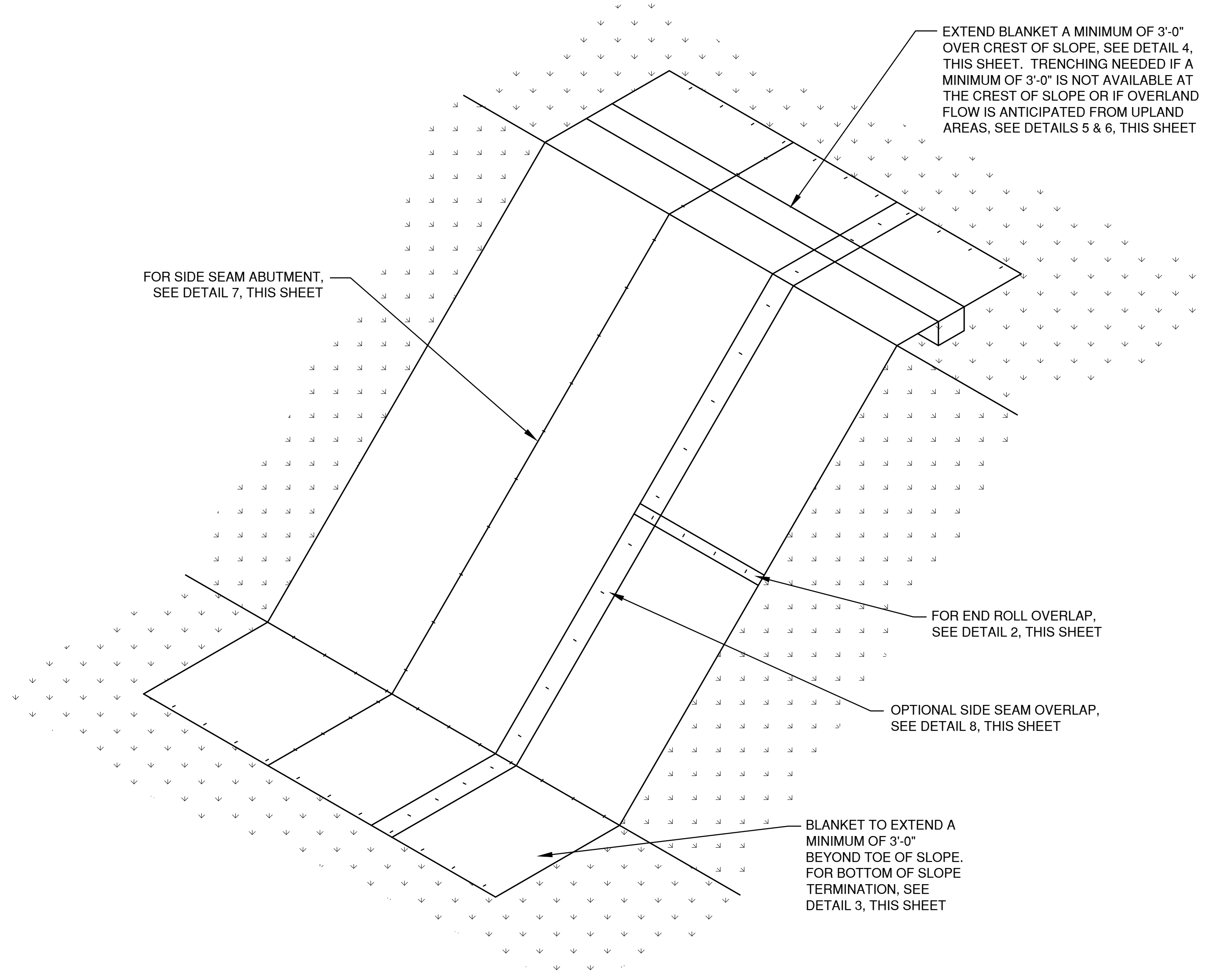
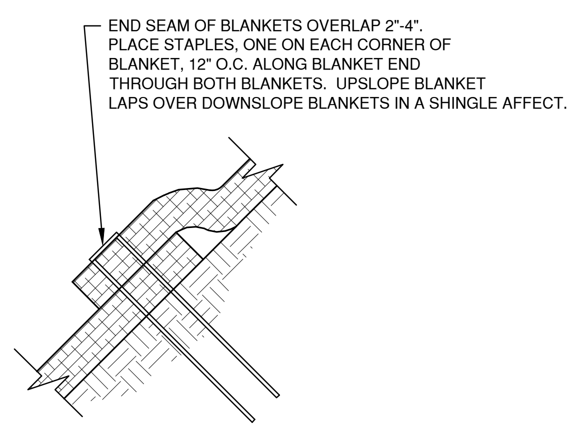
INTERNET: www.releeinc.com FAX:(920) 662-9141

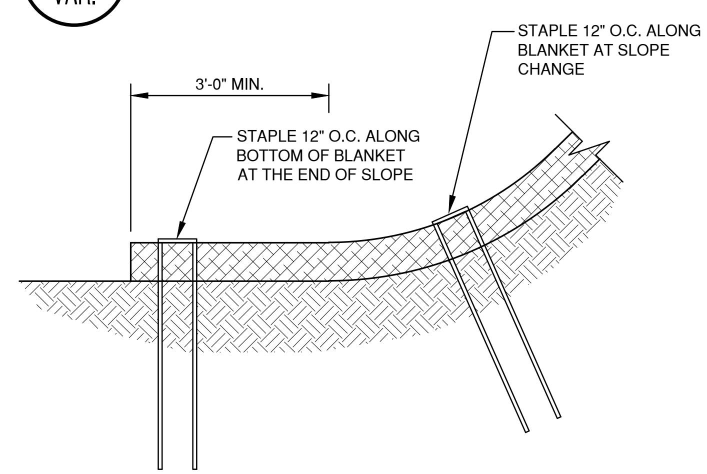
SHEET NO. 9



SLOPE DETAIL 1 VAR.



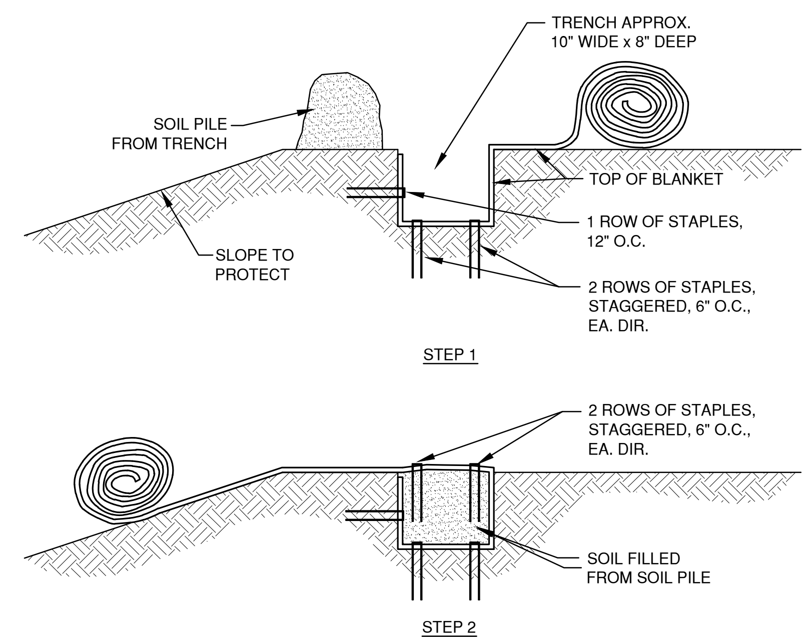
END ROLL OVERLAP 2 VAR.



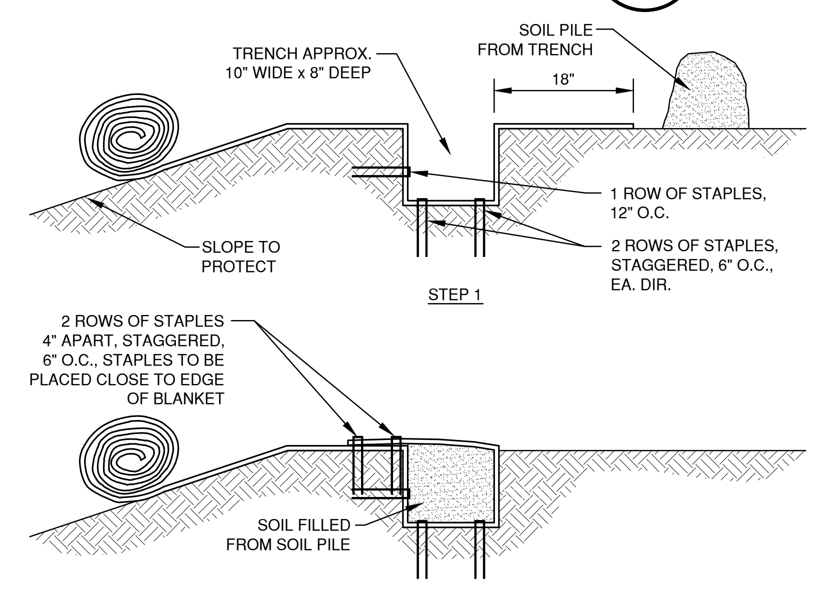
BOTTOM OF SLOPE TERMINATION 3 VAR.

SLOPE CREST ANCHOR METHOD "A" (NO TRENCH) 4 VAR.

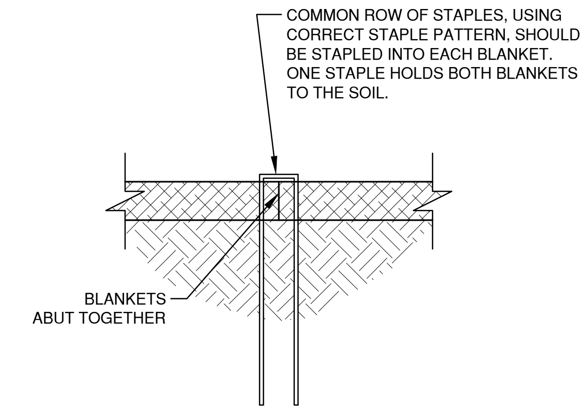
DO NOT NEED TO TRENCH BLANKET IN IF IT CAN BE EXTENDED A MINIMUM OF 3'-0" OVER THE CREST OF THE SLOPE.



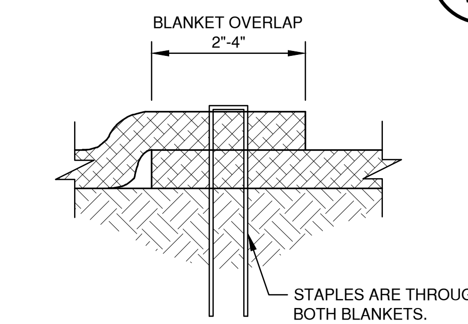
SLOPE TRENCHING METHOD "B" 5 VAR.



SLOPE TRENCHING METHOD "C" 6 VAR.



SIDE SEAM ABUT STAPLE DETAIL 7 VAR.



SIDE SEAM OVERLAP STAPLE DETAIL 8 VAR.

NOTES:
1. STAPLE PATTERNS ARE DEPENDENT ON SITE CONDITIONS. SEE MANUFACTURER STAPLE PATTERN GUIDE FOR DETAILS.

CONFORMED PLAN

File: R:\3700\3775\3775005\dwg\EROSION MAT.dwg Plot Date: Jun 26, 2015 - 2:01pm

NO.	DATE	APPROV.	REVISION	NO.	DATE	APPROV.	REVISION						
								DRAWN RLB	CONTRACT NO. 3775-15-01 MENEKAUNEE HARBOR RESTORATION PROJECT CITY OF MARINETTE MARINETT COUNTY, WISCONSIN	EROSION MAT SLOPE APPLICATION DETAILS	DATE 05/2015	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	SHEET NO. 10
								CHECKED JGS			FILE EROSION MAT		
								DESIGNED RHT			JOB NO. 3775005		

B

APPENDIX B

Construction Specifications

SECTION 32 90 10
NATIVE LANDSCAPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes requirements for the following:
   1. Site Preparation.
   2. Seeding.
   3. Planting.
   4. Maintenance.
   5. Warranty.

1.02 REFERENCES

A. Native material references:
   1. Black, M.R. and E.J. Judziewicz. 2009. Wildflowers of Wisconsin and the Great Lakes Region. University of Wisconsin Press, Madison, WI.
   2. Curtis, J. 1959. Vegetation of Wisconsin. University of Wisconsin Press, Madison, WI.
   3. Fassett, N.C. 1975. A Manual of Aquatic Plants. University of Wisconsin Press, Madison, WI.
   4. Fassett, N.C. 1976. Spring Flora of Wisconsin. University of Wisconsin Press, Madison, WI.
   5. Hip, A.L. 2008. Field Guide to Wisconsin Sedges – An Introduction to the Genus *Carex* (*Cyperaceae*). University of Wisconsin Press, Madison, WI.
   6. Kelsey, H.P, and W.A. Dayton. Standardized Plant Names. American Joint Committee on Horticulture Nomenclature (current edition).

B. "State Specifications:" State of Wisconsin Department of Transportation, "Standard Specifications for Highway and Structure Construction – Sections 627,630 & 632," current edition, including any subsequent Supplemental Specifications.

C. Wisconsin Statutes and Wisconsin Administrative Code - Chapters ATCP 20 and 29.

D. American Association of Nurserymen, Inc. (AAN) Standard: American Standard for Nursery Stock (ANSI Z60.1).

E. Standard Methods of the Association of Official Agricultural Chemists.

1.03 SUBMITTALS

A. Submit the following to the OWNER and ENGINEER prior to installation in accordance with Section 01 32 19, Submittals:
   1. Information indicating vendor, species botanical and common names, gross weight, seed purity (% PLS), harvest date, and origin. Original nursery packaging for each species must be provided 14 days after seeding activities are completed.
   2. Information indicating vendor, species botanical and common names, and pot size. Plant material shall comply with State of Wisconsin and federal laws with respect to inspection for plant diseases and insect infestation.
   3. Inspection certificates and paperwork indicating the licensed nursery, species botanical and common names, and material size within 14 days of shipment.
   4. Sample of erosion blanket and staples along with paperwork regarding their certification properties.
   5. Sample or photo of tree/shrub protector
   6. Chemical Labels and Herbicide Application Record(s) within 30 days after application.
   7. Photograph or detailed design of carp and goose fencing system.

B. Maintenance Plan:

1. CONTRACTOR shall prepare a plan outlining native vegetation maintenance activities to be conducted by the CONTRACTOR during the warranty period. The plan shall include general procedures (i.e., fertilizing, watering, pruning); noxious and invasive species control (i.e. reed canary grass, purple loosestrife, phragmites, spotted knapweed, etc.); as well as native vegetation enhancement procedures. The plan shall be in accordance with industry standards.
2. The Maintenance Plan shall be submitted and approved by the ENGINEER prior to conducting landscape installation.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. **CONTRACTOR or Subcontractor shall be a company specializing in native landscaping installation.**
2. **Perform planting by personnel familiar with accepted native landscape planting procedures. Qualified foreman, representing CONTRACTOR or Subcontractor, shall be on-site during planting procedures. The individual shall be an ecologist with at least 5 years of native plant installation experience.**
3. **Submit qualifications requested on the *qualification form* with the bid. OWNER has sole authority to approve or disapprove native landscape contractor and/or subcontractor at OWNER's sole discretion.**

B. Ability to Deliver:
1. Investigate sources of supply and confirm they can supply plants specified on plant list in sizes, variety, and quantity noted and specified before submitting bid. Failure to take this precaution will not relieve responsibility for furnishing and installing plant material in accordance with Contract requirements.
2. Substitutions may be permitted only upon submission of written proof that specified plant is not obtainable locally. Such substitution may be made upon written authorization by qualified botanist. Adjustments will be made at no additional cost to OWNER.
3. Provide seed and plant materials discussed below in quantity and size designated.

C. Inspection:
1. OWNER and ENGINEER may inspect plant material at nursery. Such inspection shall be in addition to inspection at job site.
2. Upon delivery and before seeding and/or planting, OWNER and ENGINEER may inspect seed packages and plants.
3. Inspection and approval is for quality, size, and variety only, and in no way impairs right of rejection for failure to meet other requirements during progress of Work.
4. CONTRACTOR shall be present during required inspections.

D. Source Quality Control.
1. Certification: Landscape materials shall be from stock inspected and certified by authorized governmental agencies. Material shall comply with governmental regulations prevailing at supply source and project.
2. Plant material shall comply with State of Wisconsin and federal laws with respect to inspection for plant diseases and insect infestation.
3. Size and grading standards of plant materials shall be in accordance with American Association of Nurserymen, Inc. (AAN) Standard: American Standard for Nursery Stock (ANSI Z60.1).

E. VHS and INVASIVE SPECIES
1. To the extent practicable, equipment and gear used on infested waters should not be used on other non-infested waters.
2. All equipment utilized for the project including but not limited to tracked equipment, barges, boats, silt/turbidity curtains, hoses and pumps shall be decontaminated for invasive and exotic viruses and species prior to and after use. The following steps shall be taken every time equipment is moved to avoid transporting invasive and exotic viruses and species:
    a. Inspect and remove terrestrial and aquatic plants, seeds, animals and mud from equipment.
    b. Drain all water from equipment that comes in contact with infested waters.
    c. Dispose of aquatic plants and animals in the trash. Never release or transfer aquatic plants, animals or water from one water body to another.

d. Wash equipment with hot (>104 degrees F) and/or high pressure water **OR** allow your equipment to dry thoroughly for 5 days.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Delivery:
1. Seed:
a. Pack seeds for delivery in suitable bags in accordance with standard commercial practice.
b. Tag or label each bag as required by laws of State of Wisconsin and Federal Seed Act. Vendor's name shall show on or be attached to each bag together with statement signed by vendor indicating following:
1) Kind of seed contained.
2) Percentage of purity and germination for native grass/sedge mix.
3) Percentage of hard seed, if any.
4) Statement conforming to laws of State of Wisconsin herein before mentioned showing percentage of weed seeds, if any.
2. Potted or Container Plants:
a. Provide container to hold rootstock protecting root mass and structure during delivery and handling.
b. Roots shall be developed and free from root rot.
c. Roots shall be kept cool and moist and out of sun and wind.
d. Trees and shrubs shall not be pruned prior to shipping.
e. Follow nursery guidelines.
f. Bare root plants are unacceptable unless plants are being installed during normal dormant periods (i.e., spring and fall). Where bare root stock is used, it must be delivered and handled in such a way that roots are never allowed to dry out.
3. Bare-root Plants:
a. Dig and prepare for shipment in manner that will not damage roots, branches, shape, and future development of plant.
b. Ensure roots are moistened and adequately covered to prevent drying. Cover root with thick coating of mud by puddling or wrap in wet straw, moss or other suitable packing material immediately after they are dug for protection until delivery and installation.
c. Pruning shall not occur prior to shipping.
4. Live Stakes:
a. All live stakes shall be handled in a manner that will prevent injuries to the bark and exposed ends.
b. Stakes shall be harvested during the dormant season prior to installation, which is defined as, "The period when woody vegetation has set buds and photosynthesis in the leaves has ceased."
c. Live Stakes shall be refrigerated at a temperature between 31 – 40 degrees Fahrenheit with 60-70% humidity prior to being delivered to the site unless they are harvested from a nearby site and installed within 2-3 days. Stakes shall be inspected regularly for issues such as rotting and drying.

B. Delivery:
1. Schedule shipping to minimize on-site storage of materials.
2. Notify ENGINEER 48 hours before delivery of seed and/or plant material.
3. Each shipment shall be accompanied by paperwork showing sizes and varieties included.
4. Failure to notify ENGINEER in advance, in order to arrange proper scheduling, may result in loss of time or removal of plant material not installed as specified.
5. Seed: Each species shall be delivered to the project site in the nursery's original, sealed packaging and labeled in accordance with Wisconsin State Law and the Federal Seed Act.
6. Protect seed against weather-related damage or other damages occurring during transit. Remove from site, seed that has become wet, moldy, or otherwise damaged and replace without extra cost to OWNER.
7. Plant Material: Take precautions in accordance with best trade practices and nursery recommendations to ensure arrival of material at Project Site in good condition and without injury. Cover plants to prevent freezing, drying, transit injury, or other exposure. During shipment, plants shall not be bent, stacked, or bound in manner that damages or destroys natural shape. Soil moisture shall be checked and material watered, if necessary.

8. Trees with damaged, crooked leader or multiple leaders, unless specifically specified, will be rejected. Trees and shrubs with abrasion of bark, sun scalds, disfiguring knots or fresh cuts of limbs over 1-1/4 in. which have not completely calloused, will be rejected.
9. Live Stakes that are crooked or have damaged bark will be rejected.

C. Temporary Storage:

1. Storage of Plant Material:
   a. Set plants that are not to be planted within 4 hours, on ground and heal in with peat, soil, mulch or other approved media.
   b. Protect roots of plant material from drying or other possible injury.
   c. Water plants as necessary until planted.
   d. Plants shall not remain unplanted for longer than 3 days.
   e. Maintain bare-root plants in cold storage at approximately 31 – 40 degrees Fahrenheit prior to being delivered to Site.
   f. Live Stakes purchased from a nursery or constructed by the CONTRACTOR shall be installed within 2 days of delivery or cutting. During this time, stakes shall be kept out of direct sunlight and protected from the wind. The stakes can be stored in water to prevent them from drying out; in fact, soaking the stakes in cool/cold water for 24-48 hours prior to installation with a small amount of rooting hormone will improve survivability. Stakes shall be inspected regularly for issues such as rotting and drying.
   g. Live Stakes that are to be shipped and/or harvested by the CONTRACTOR and stored for a longer period of time must discuss storage conditions with the ENGINEER.
2. Keep seed cool, dry, and protected against weather-related damage or other damages occurring during storage so their effectiveness will not be impaired. Do not store in direct contact with ground. Replace seed that has become wet, moldy, or otherwise damaged at CONTRACTOR'S expense.
3. Store fertilizer, humus, and spray materials in weatherproof storage areas and in such manner, their effectiveness will not be impaired.

PART 2 PRODUCTS

2.01 PLANT SPECIMENS

A. General:
1. Plant material shall be nursery grown or harvested unless otherwise specified or approved in writing by ENGINEER.
2. Unless specifically noted otherwise, plant material shall be of selected specimen quality, have normal habit of growth, and be sound, healthy, vigorous plants with well-developed root systems. Plants shall be free of disease, insect pests, their eggs or larvae, and injuries.
3. Plant/Seed information:
   a. See Paragraphs 2.01 G. & H. for seed mix and plant quantity requirements.
   b. It is the CONTRACTOR'S responsibility to ensure plants and/or seed are true to species and variety and conform to measurement specified in Paragraphs 2.01 G. & H., except plants larger than specified may be used if approved by ENGINEER. Use of such plants shall not result in increased Contract Price.
   c. Where plants larger than specified have been submitted in writing for approval and approved in writing by ENGINEER, CONTRACTOR shall assume responsibility of guarantee for plant in size as planted.
   d. OWNER & ENGINEER must approve any substitutions.
4. Tree/Shrub/Live Stake information:
   a. See Paragraph 2.01 I. for tree, shrub, live stakes size and quantity requirements. Provide source of plant material at least 4 weeks prior to digging or harvesting.
   b. Plants shall be freshly dug or container grown material. Plants placed in cold storage for an extended period (>1 month) of time are not acceptable unless the CONTRACTOR makes such a request in writing and the materials are inspected and approved.
   c. Measure plants when branches are in normal position. Height and spread refer to plant's main body and not from branch tip to branch tip.
   d. If range of size is given, no plant or stake shall be less than minimum size and not less than 50% of plants shall be as large as upper half of range specified.

e. Measurements specified are minimum size acceptable and are measurements after pruning, where pruning is required. Plants meeting measurements specified, but not producing normal balance between height and spread, will be rejected.

B. Cover Crop

1. Cover Crop Seed mix for all restored areas shall be as follows:

Species	% Minimum Purity	% Minimum Germination
Annual Oats	98	90
Winter Wheat	95	90
Barnyard Grass (*Echinochloa crus-galli*)	95	90

2. Seeding a cover crop by itself between April 15th & August 15th shall be conducted using Annual Oats at a rate of 120 lbs/acre.
3. Seeding a cover crop by itself between August 15th & November 30th shall be conducted using Winter Wheat at a rate of 90 lbs/acre.
4. Native seeding conducted between April 15th & June 15th shall include a cover crop of Annual Oats at a rate of 20 lbs/acre.
5. Native seeding conducted between October 15th & November 30th shall include a cover crop of Winter Wheat at a rate of 10 lbs/acre and Annual Oats at a rate of 20 lbs/acre.
6. Native wetland seeding shall also include a cover crop of Barnyard Grass at a rate of 1 lb/acre.

C. Native Seed

1. 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.
4. Legumes shall be inoculated with proper rhizobia immediately prior to planting (six hours or less).

D. Pot/Container Grown Plants

1. Wetland live plant seed stock shall be wild ecotype indigenous to Wisconsin or have natural origins within a 250-mile radius of the intended planting site. Plugs shall not be less than 2.5 x 2.5 square in. size with a depth of 3.5 in., unless bare root or smaller material is the only stock available,
2. Tree and shrub seed stock shall be wild ecotype indigenous to the Upper Midwest and shall have been grown within same hardiness zone as the Project Site or acclimated to conditions of same hardiness zone for a minimum of two growing seasons. Hardiness zones shall conform to "Zones of Plant Hardiness" as provided by U.S. Department of Agriculture.
3. Pot grown plants and select bare-root species shall have heavy fibrous root system, or well-developed tap root, developed by proper horticultural practice including transplanting and root pruning, and shall have grown in container for at least one growing season.
4. Root system shall have developed sufficiently long for new fibrous roots to develop so root mass will retain its shape and hold together when removed from container.
5. Container shall not strangle or girdle natural growth of plant. Plants, other than groundcovers, over-established in container as evidenced by pot-bound root ends will be rejected.
6. Bare root plants are generally unacceptable; however, exceptions may be made for species difficult to secure as potted material such as some submergent aquatic plants and floating-leaved species including water lilies. If bare root material is not specified in Paragraph 2.01 H., the CONTRACTOR must request permission, in writing, to use bare root stock.

E. Bare Root Trees & Shrubs:

1. Tree and shrub seed stock shall be wild ecotype indigenous to the Upper Midwest and shall have been grown within same hardiness zone as the Project Site or acclimated to conditions of same hardiness zone for a minimum of two growing seasons. Hardiness zones shall conform to "Zones of Plant Hardiness" as provided by U.S. Department of Agriculture.

2. Root Spread shall be:

Height of Plant	Minimum Spread of Root (in.)
18 - 24 in.	10
2 - 3 ft	11
3 - 4 ft	14
4 - 5 ft	16
5 - 6 ft	18
6 - 8 ft	20

F. Live Stakes

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-inch – 2-inch
   (b) Length – 18-inch – 24-inch
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.

G. Wetland and Upland Seed Mix Species and Quantities:

Prairie Planting Zone

Common Name	***Scientific Name***	Ounces Required Per Acre
Forbs		
Nodding Onion	*Allium cernuum*	2.1
Prairie Onion	*Allium stellatum*	2.1
Leadplant	*Amorpha canescens*	2.0
Thimbleweed	*Anemone cylindrica*	0.6
Northern Thimbleweed	*Anemone virginiana*	0.6
Columbine	*Aquilegia canadensis*	0.8
Butterfly Weed	*Asclepias tuberosa*	0.9
Whorled Milkweed	*Asclepias verticillata*	1.4
Heath Aster	*Aster ericoides*	0.2
Smooth Blue Aster	*Aster laevis*	1.1
Sky Blue Aster	*Aster oolentangiense*	0.6
Lance-leaf Coreopsis	*Coreopsis lanceolata*	1.2
Purple Prairie Clover	*Dalea purpurea*	3.1
Shooting Star	*Dodecatheon meadia*	0.5
Pale Purple Coneflower	*Echinacea pallida*	4.5
Flowering Spurge	*Euphorbia corollata*	0.8
Sweet Everlasting	*Gnaphalium obtusifolium*	0.1
Prairie Alumroot	*Heuchera richardsonii*	0.1
Round-headed Bushclover	*Lespedeza capitata*	2.9
Rough Blazingstar	*Liatris aspera*	2.5
Dwarf Blazing Star	*Liatris cylindracea*	1.7
Wild Lupine	*Lupinus perennis*	3.6
Wild Bergamot	*Monarda fistulosa*	1.3
Spotted Bee Balm	*Monarda punctata*	0.9
Wild Quinine	*Parthenium integrifolium*	4.5
Foxglove Beardtongue	*Penstemon digitalis*	0.6
Hairy Beardtongue	*Penstemon hirsutus*	0.3
Prairie Cinquefoil	*Potentilla arguta*	0.4
Yellow Coneflower	*Ratibida pinnata*	2.6
Black-eyed Susan	*Rudbeckia hirta*	0.9
Brown -eyed Susan	*Rudbeckia triloba*	2.3
Prairie Blue-eyed Grass	*Sisyrinchium campestre*	1.4
Stiff Goldenrod	*Solidago rigida*	1.5
Showy Goldenrod	*Solidago speciosa*	0.8
Common Spiderwort	*Tradescantia ohiensis*	3.9
Hoary Vervain	*Verbena stricta*	3.4
Golden Alexander	*Zizia aurea*	7.1
Grasses/Sedges		
Side Oats Grama	*Bouteloua curtipendula*	65.3
Sand Bracted Sedge	*Carex muehlenbergii*	6.5
Purple Love Grass	*Eragrostis spectabilis*	1.4
June Grass	*Koeleria macrantha*	0.8
Little Bluestem	*Schizachyrium scoparium*	31.4
Indian Grass	*Sorghastrum nutans*	19.6
	TOTAL	190.3

Wet-Mesic/Mesic Prairie Planting Zone

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

Wet-Mesic Forest Planting Zone

Species		
Common Name	***Scientific Name***	**Ounces Required Per Acre**
Forbs		
Canada Anemone	*Anemone canadensis*	1.8
Tall Thimbleweed	*Anemone virginiana*	1.0
Columbine	*Aquilegia canadensis*	2.9
Calico Aster	*Aster lateriflorus*	1.0
Large-leaved Aster	*Aster macrophyllus*	0.7
Common Beggar's Ticks	*Bidens frondosa*	2.9
Smallspike False Nettle	*Boehmeria cylindrica*	0.4
Wild Cucumber	*Echinocystis lobata*	3.6
White Snakeroot	*Eupatorium rugosum*	0.7
Northern Bedstraw	*Galium boreale*	1.0
Bottle Gentain	*Gentiana andrewsii*	0.5
Wild Geranium	*Geranium maculatum*	1.5
Yellow Avens	*Geum aleppicum*	7.3
Grass-leaved Goldenrod	*Euthamia graminifolia*	0.5
Saw-tooth Sunflower	*Helianthus grosseserratus*	1.9
Pale-leaved Sunflower	*Helianthus strumosus*	3.5
Spotted Touch-me-not	*Impatiens capensis*	0.9
Cardinal Flower	*Lobelia cardinalis*	0.9
Water Horehound	*Lycopus americanus*	1.7
Solomon's Plume	*Maianthemum racemosum*	4.6
Wild Mint	*Mentha arvensis*	0.5
Bishop's Cap	*Mitella diphylla*	0.4
Sweet Cicely	*Osmorhiza claytonii*	2.9
Wood Betony	*Pedicularis canadensis*	0.8
Jacob's Ladder	*Polemonium reptans*	1.0
Common Mountain Mint	*Pycnanthemum virginianum*	1.0
Wild Golden Glow	*Rudbeckia laciniata*	3.9
Mad-dog Skullcap	*Scutellaria lateriflora*	2.2
Late Goldenrod	*Solidago gigantea*	0.7
Purple Meadow Rue	*Thalictrum dasycarpum*	6.6
Culver's Root	*Veronicastrum virginicum*	0.9
Golden Alexanders	*Zizia aurea*	11.6
Grasses/Sedges/Rushes		
Fringed Brome	*Bromus ciliatus*	21.8
Canada Bluejoint	*Calamagrostis canadensis*	1.3
Bebb's Oval Sedge	*Carex bebbi*	4.3
Common Wood Sedge	*Carex blanda*	1.5
Plains Oval Sedge	*Carex brevior*	6.3
Fringed Sedge	*Carex crinita*	4.7
Crested Oval Sedge	*Carex cristatella*	2.7
Wood Gray Sedge	*Carex grisea*	3.0
Slender Sedge	*Carex leptalea*	1.1
Field Oval Sedge	*Carex molesta*	7.1
Long-beaked Sedge	*Carex sprengelii*	2.2
Awl-fruited Sedge	*Carex stipata*	4.6
Narrow-leaved Oval Sedge	*Carex tenera*	1.0
Brown Fox Sedge	*Carex vulpinoidea*	4.5
Canada Wild Rye	*Elymus canadensis*	51.4
Virginia Wild Rye	*Elymus virginicus*	53.0
Fowl Manna Grass	*Glyceria striata*	3.0
Dudley's Rush	*Juncus dudleyi*	0.1
Path Rush	*Juncus tenuis*	0.3
Leafy Satin Grass	*Muhlenbergia mexicana*	2.1
Upland Wild Timothy	*Muhlenbergia racemosa*	2.3
Fowl Bluegrass	*Poa palustris*	1.4
	TOTAL	**251.5**

Shrub-Carr Planting Zone

Species		
Common Name	***Scientific Name***	**Ounces Required Per Acre**
Forbs		
Canada Anemone	*Anemone canadensis*	0.9
Angelica	*Angelica atropurpurea*	4.7
Marsh Milkweed	*Asclepias incarnata*	2.7
Shining Aster*	*Aster firmus*	1.0
New England Aster	*Aster novae-angliae*	1.1
Swamp Aster	*Aster puniceus*	0.9
Flat-top Aster	*Aster umbellatus*	1.4
Nodding Bur Marigold	*Bidens cernua*	2.6
Common Beggar's Ticks	*Bidens frondosa*	2.2
Turtlehead	*Chelone glabra*	0.6
Water Hemlock	*Cicuta maculata*	0.9
Marsh Cinquefoil	*Comarum palustre*	0.3
Cinnamon Willow Herb	*Epilobium coloratum*	0.7
Joe Pye Weed	*Eupatorium maculatum*	2.3
Boneset	*Eupatorium perfoliatum*	1.1
Grass-leaved Goldenrod	*Euthamia graminifolia*	0.5
Sneezeweed	*Helenium autumnale*	1.5
Saw-tooth Sunflower	*Helianthus grosseserratus*	3.4
Spotted Touch-me-not	*Impatiens capensis*	1.4
Cardinal Flower	*Lobelia cardinalis*	0.9
Water Horehound	*Lycopus americanus*	0.8
Wild Mint	*Mentha arvensis*	0.5
Obedient Plant	*Physotegia virginiana*	0.7
Common Mountain Mint	*Pycnanthemum virginianum*	0.7
Wild Golden Glow	*Rudbeckia laciniata*	3.9
Great Water Dock	*Rumex orbiculatus*	6.1
Tall Water Parsnip	*Sium suave*	0.6
Late Goldenrod	*Solidago gigantea*	0.5
Swamp Goldenrod	*Solidago patula*	0.6
Woundwort	*Stachys palustris*	0.8
Purple Meadow Rue	*Thalictrum dasycarpum*	6.6
Blue Vervain	*Verbena hastata*	3.9
Culver's Root	*Veronicastrum virginicum*	0.4
Golden Alexanders	*Zizia aurea*	6.6
Grasses/Sedges/Rushes		
Fringed Brome	*Bromus ciliatus*	3.6
Canada Bluejoint	*Calamagrostis canadensis*	1.3
Water Sedge	*Carex aquatilis*	0.6
Crested Oval Sedge	*Carex cristatella*	1.2
Porcupine Sedge	*Carex hystericina*	5.2
Common Lake Sedge	*Carex lacustris*	0.8
Narrow-leaved Woolly Sedge	*Carex lasiocarpa*	1.3
Broad-leaved Woolly Sedge	*Carex pellita*	0.5
Deflexed Bottle-brush Sedge	*Carex retrorsa*	2.0
Awl-fruited Sedge	*Carex stipata*	4.6
Tussock sedge	*Carex stricta*	2.9
Common Yellow Lake Sedge	*Carex utriculata*	2.7
Great Spike Rush	*Eleocharis palustris*	0.9
Virginia Wild Rye	*Elymus virginicus*	21.2
Reed Manna Grass	*Glyceria grandis*	3.5
Fowl Manna Grass	*Glyceria striata*	2.6
Dudley's Rush	*Juncus dudleyi*	0.1
Rice Cut Grass	*Leersia oryzoides*	1.1
Fowl Bluegrass	*Poa palustris*	1.4
Dark Green Bulrush	*Scirpus atrovirens*	1.5
Wool Grass	*Scirpus cyperinus*	0.5
Rufous Bulrush	*Scirpus pendulus*	1.4
Prairie Cord Grass	*Spartina pectinata*	2.7
	TOTAL	**127.4**

Northern Sedge Meadow Planting Zone

Species Common Name	*Scientific Name*	Ounces Required Per Acre
Forbs		
Canada Anemone	*Anemone canadensis*	0.9
Angelica	*Angelica atropurpurea*	4.7
Marsh Milkweed	*Asclepias incarnata*	2.7
Shining Aster*	*Aster firmus*	0.4
Panicled Aster	*Aster lanceolatus*	0.7
Swamp Aster	*Aster puniceus*	0.9
Flat-top Aster	*Aster umbellatus*	1.4
Nodding Bur Marigold	*Bidens cernua*	2.6
Common Beggar's Ticks	*Bidens frondosa*	2.2
Turtlehead	*Chelone glabra*	0.6
Water Hemlock	*Cicuta maculata*	0.9
Cinnamon Willow Herb	*Epilobium coloratum*	0.4
Joe Pye Weed	*Eupatorium maculatum*	2.1
Boneset	*Eupatorium perfoliatum*	1.0
Grass-leaved Goldenrod	*Euthamia graminifolia*	0.5
Sneezeweed	*Helenium autumnale*	1.5
Saw-tooth Sunflower	*Helianthus grosseserratus*	1.0
Spotted Touch-me-not	*Impatiens capensis*	1.4
Great Blue Lobelia	*Lobelia siphilitica*	0.5
Water Horehound	*Lycopus americanus*	0.8
Wild Mint	*Mentha arvensis*	0.4
Monkey Flower	*Mimulus ringens*	0.2
Pinkweed	*Persicaria pensylvanica*	1.1
Obedient Plant	*Physotegia virginiana*	0.7
Marsh Cinquefoil	*Potentilla palustris*	0.3
Common Mountain Mint	*Pycnanthemum virginianum*	0.7
Annual Buttercup	*Ranunculus sceleratus*	1.5
Wild Golden Glow	*Rudbeckia laciniata*	3.9
Tall Water Parsnip	*Sium suave*	0.6
Late Goldenrod	*Solidago gigantea*	0.3
Swamp Goldenrod	*Solidago patula*	0.6
Woundwort	*Stachys palustris*	0.8
Purple Meadow Rue	*Thalictrum dasycarpum*	2.0
Blue Vervain	*Verbena hastata*	3.1
Culver's Root	*Veronicastrum virginicum*	0.3
Golden Alexanders	*Zizia aurea*	6.6
Grasses/Sedges/Rushes		
Fringed Brome	*Bromus ciliatus*	3.6
Canada Bluejoint	*Calamagrostis canadensis*	1.3
Water Sedge	*Carex aquatilis*	0.6
Crested Oval Sedge	*Carex cristatella*	1.2
Porcupine Sedge	*Carex hystericina*	5.2
Common Lake Sedge	*Carex lacustris*	0.8
Broad-leaved Woolly Sedge	*Carex pellita*	0.5
Deflexed Bottle-brush Sedge	*Carex retrorsa*	2.0
Awl-fruited Sedge	*Carex stipata*	4.6
Tussock sedge	*Carex stricta*	3.4
Common Yellow Lake Sedge	*Carex utriculata*	2.7
Walter's Barnyard Grass	*Echinochloa walteri*	4.6
Great Spike Rush	*Eleocharis palustris*	0.9
Virginia Wild Rye	*Elymus virginicus*	21.2
Rattlesnake Grass	*Glyceria canadensis*	3.3
Fowl Manna Grass	*Glyceria striata*	2.8
Dudley's Rush	*Juncus dudleyi*	0.1
Common Rush	*Juncus effusus*	0.3
Rice Cut Grass	*Leersia oryzoides*	1.1
Fowl Bluegrass	*Poa palustris*	1.4
Dark Green Bulrush	*Scirpus atrovirens*	1.5
Wool Grass	*Scirpus cyperinus*	0.5
Prairie Cord Grass	*Spartina pectinata*	2.7
	TOTAL	**116.6**

Emergent Aquatic - Wild Rice Planting Zone

Species		
Common Name	**Scientific Name**	
Wild Rice	*Zizania aquatic*	**Pounds Required Per Acre**
		100

H. Live Plant Species and Quantities:

Wet-Mesic Forest Planting Zone

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

Shrub-Carr Planting Zone

Species			
Common Name	**Scientific Name**	**Quantity**	**Minimum Pot Size**
Sedges/Grasses			
Common Lake Sedge	*Carex lacustris*	100	2.5”
Tussock Sedge	*Carex stricta*	250	2.5”
Prairie Cord Grass	*Spartina pectinata*	150	2.5”
Ferns			
Ostrich Fern	*Matteuccia struthiopteris*	100	4.5”
Sensitive Fern	*Onoclea sensibilis*	100	4.5”
Forbs			
Northern Blue Flag	*Iris versicolor*	150	2.5”
Marsh Marigold	*Caltha palustris*	50	4.5”
	TOTAL	**900**	

Northern Sedge Meadow Planting Zone

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

Emergent/Floating-Leaved Aquatic Planting Zone

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

Submergent Aquatic Planting Zone

Species			
Common Name	**Scientific Name**	**Planting Depth**	**No. of Plants Required**
Coontail	*Ceratophyllum demersum*	12-24”	150
Needle Rush	*Eleocharis acicularis*	12”	150
Water Smartweed	*Persicaria amphibia*	12”	150
Floating-leaf Pondweed	*Potamogeton natans*	12”	150
Long-leaved Pondweed	*Potamogeton nodosus*	12”	150
Sago Pondweed	*Stuckenia pectinata*	12-24”	150
Water Celery	*Vallisneria americana*	12-24”	150
		TOTAL	**1,050**

I. Tree, Shrub and Live Stake Species and Quantities:

Wet Mesic Forest Planting Zone

Species

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

Shrub-Carr Planting Zone

Species

Common Name	Scientific Name	Quantity	Size - Height
Shrubs			
Speckled Alder	*Alnus rugosa*	15	#5 gallon
Silky Dogwood	*Cornus amomum*	20	2-4' bare-root
Red-osier Dogwood	*Cornus stolonifera*	50	2-4' bare-root
Winterberry (Male & Female)	*Ilex verticillata*	50	2-4' bare-root
Black Currant	*Ribes americanum*	25	#1-2 gallon
Meadow-sweet	*Spiraea alba*	50	#2-5 gallon
Bebb's Willow	*Salix bebbiana*	100	#1-2 gallon
Pussy Willow	*Salix discolor*	75	#2-5 gallon
American Highbush Cranberry	*Viburnum opulus L. subsp. trilobum*	15	2-4' bare-root
	TOTAL	**400**	

Live Stakes – Shrub-Carr Planting Zone

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

2.02 PLANTING & PROTECTION MATERIALS

A. Topsoil:
1. Obtained from natural well drained areas, and be fertile, friable soil, clean of undesirable materials such as plants, weeds, roots, stalks, stones, and other debris.
2. Existing topsoil shall be salvaged as it will be placed during restoration activities.
3. Acidity range of pH 5.0 and pH 7.0 and shall contain no less than 4% organic matter as determined by loss on ignition of moisture free samples dried at 100^{o}C.

B. Soil Amendments:
1. Planting to be installed in native soils.

C. Mulching Materials:
1. Processed Hardwood Bark:
   a. From mixed hardwood species and free of sticks and leaves, 60% shall range between 1 and 3 in. in length; remaining 40% shall not exceed 1-1/2 in.
   b. Maximum of 5% content by weight of shredded wood particles.
2. Mushroom Manure:
   a. Well-rotted cattle or stable manure with admixture of 15% to 30% topsoil.
   b. Used for commercial growing of at least one crop of mushrooms.

D. Water: CONTRACTOR shall make arrangements for water used for planting with appropriate water utilities. Cost of water usage is responsibility of CONTRACTOR and is incidental to contract.
1. Obtain from fresh water sources and free from injurious chemical or other toxic substances harmful to plant life. No water, which is brackish, may be used.
2. Provide hose and equipment necessary for proper watering of plant material.

E. Tree Wrap:
1. Trees shall not be wrapped.

F. Tree Protectors & Stakes:
1. Bare-root & Container Grown Plants. Products designed to eliminate herbivore damage from small rodents and protect the seedlings from wind and herbicide damage
   a. Protectors
      1) Minimum 48” height
      2) Minimum 3” diameter
   b. Stakes
      1) Minimum 30” height
      2) Wooden stakes shall be minimum 1”x1”
      3) PVC stakes shall be minimum 1/2”’ diameter

2.03 EROSION CONTROL MATERIALS

A. Erosion Blanket & Stakes:
1. Materials shall be completely biodegradable (Class I Urban Type A – S 75 BN & C 125 BN) and included on WisDOT PAL
2. Anchoring devices shall be a minimum of 6” in length, be completely biodegradable (Urban) and included on WisDOT PAL

2.04 HERBICIDE, ADJUVANT & DYES

A. General:
   1. Use only chemicals approved by and registered with the Environmental Protection Agency (EPA).
   2. Chemicals used around water shall be aquatic approved.
   3. The chemical or combination of chemicals shall be chosen based on the target species present and the desired treatment outcome.

2.05 GOOSE FENCING

A. General:
   1. 1.5" x 1.5" X 5.5' heavy-duty steel t-posts or equivalent.
   2. 48" green snow/safety fence.
   3. 8" Black UV stabilized cable ties to secure fencing to posts.
   4. Nylon rope, bailing twine or equivalent.

2.06 CARP FENCING

A. General:
   1. 1.5" x 1.5" X 5.5' heavy-duty steel t-posts or equivalent.
   2. 2" X 4" X 48" 14 gauge welded wire fence.
   3. 8" Black UV Stabilized Cable Ties to secure fencing to posts.

PART 3 SUPPLIERS

3.01 PLANT SUPPLIERS

A. At CONTRACTOR'S option, CONTRACTOR may contact the following companies for seed, plant, tree, and shrub supplies:

JFNew
708 Roosevelt Road
Walkerton, IN 46574
(574) 586-2412

Taylor Creek Restoration Nursery
17921 Smith Road
P.O. Box 256
Brodhead, WI 53520
(608) 897-8641

Marshland Transplant Aquatic Nursery
116 East Huron Street
Berlin, WI 54923-2050
1-800-AQUATIC

J&J Transplant Aquatic Nursery, LLC
P.O. Box 227
Wild Rose, WI 54984-0227
1-800-622-5055

Prairie Nursery, Inc.
P.O. Box 306
Westfield, WI 53964
1-800-476-9453

Prairie Moon Nursery
32115 Prairie Lane
Winona, MN 55987
1-866-417-8156

Dragonfly Gardens
491 State Highway 46
Amery, WI
(715) 268-7660

Hickory Road Gardens
2041 Hickory Road
Mosinee, WI 54455
(715) 693-6446

Stone Silo Prairie Garden
2325 Oak Ridge Circle
De Pere, WI 54115
(920) 336-1662

Agrecol, LLC
10101 North Casey Road
Evansville, WI 53536
(608) 223-3571

Alpha Nurseries, Inc.
3737 65th Street
Holland, MI 49423
(269) 857-7804

Outback Nursery, Inc.
15280 110th Street South
Hastings, MN 55033
651) 438-2771

Reeseville Ridge Nursery
512 South Main Street
Reeseville, WI 53579
(920) 927-3291

3.02 EROSION CONTROL SUPPLIERS

A. At CONTRACTOR'S option, CONTRACTOR may contact following companies for erosion blanket and staple supplies:

ERO-TEX
N94W143330 Garwin Mace Drive
Menomonee Falls, WI 53051
(866) 437-6839

CFM – Construction Fabrics & Materials Corp.
2525 Peiper Road
Cottage Grove, WI 53527
(608) 839-8031

Brock White
1425 South Ashland Avenue
Green Bay, WI 54304
(920) 432-6438

Earth & Road
101 Skyline Drive
Arlington, WI 53911
(608) 635-7755

3.03 HERBICIDE SUPPLIERS

A. At CONTRACTOR'S option, CONTRACTOR may contact following companies for chemical supplies:

Crop Production Services
N125 County Highway C
DeForest, WI 53532
(608) 846-1100

Red River Specialties, Inc.
7545 Haygood Road
Shreveport, LA 71107
(317) 440-7103

PART 4 EXECUTION

4.01 PROJECT/SITE CONDITIONS

A. Inspection:
1. Prior to beginning Work, CONTRACTOR shall examine and verify acceptability of Project site for conditions under which seeding and planting are to be performed. Do not proceed with Work until satisfactory conditions are present.
2. Starting Work constitutes acceptance of conditions under which Work is to be performed. After such acceptances, CONTRACTOR shall be responsible for correcting unsatisfactory and defective Work resulting from such unsatisfactory conditions.
3. When landscape work is executed in conjunction with construction of other work, coordinate schedule to permit execution of landscape work.

4.02 SEEDING

A. Seedbed Preparation
1. Prior to seeding a cover crop or native species, the planting areas shall be prepared through the following sequence:
a. Enhancement Zones (Plant Community Map): A combination of selective cutting and two (2) or three (3) spot herbicide applications to address invasive species will be conducted throughout the growing season. A herbicide solution including aquatic approved chemical (glyphosate or imazapyr), surfactant or MSO, ammonium sulfate and marking dye are to be utilized for each application and shall be applied at the rates recommended on the label for the vegetation species present. The first application is expected to be completed in early July. The second and third applications are expected to be undertaken in mid to late August and late September – prior to the first hard freeze. The schedule for herbicide applications will be flexible to accommodate the weather and existing growing conditions; however, the Contractor must communicate with the City and the Engineer prior to conducting any application. Care must be taken to ensure

populations of existing or installed native plants are not killed during the process. Contractor must select appropriate means in which to apply the herbicide to ensure protection of native plant populations. Incomplete, untimely or unsuccessful herbicide treatments may result in additional treatment requirements to be conducted at the Contractor's expense. Damage or loss of native plant populations shall also be replaced at Contractor's expense.

b. Re-Work Zones (Plant Community Map): A combination of mowing and two (2) or three (3) broadcast herbicide applications to eliminate existing vegetation will be conducted throughout the growing season. A herbicide solution including the chemical (glyphosate, imazapyr, clopyralid or clethodim – later 2 may only be utilized in non-aquatic settings), a surfactant or MSO, ammonium sulfate and marking dye are to be utilized for each application and shall be applied at the rates recommended on the label for the vegetation species present. The first application is expected to be completed in early July. The second and third applications are expected to be undertaken in mid to late August and late September – prior to the first hard freeze. The schedule for herbicide applications will be flexible to accommodate the weather and existing growing conditions; however, the Contractor must communicate with the City and the Engineer prior to conducting any application. Contractor must select appropriate means in which to apply the herbicide. Incomplete, untimely or unsuccessful herbicide treatments may result in additional treatment requirements to be conducted at the Contractor's expense.

c. Northern Sedge Meadow, Shrub-Carr and Wet-Mesic Forest Planting Zones: Remove or spread out litter/duff build-up remaining from Phragmites and woody vegetation mowing operations. Soil must be visible in 50% of the area with the other 50% containing less than ½" debris layer. Due to wet soil conditions, care will need to be exercised by the Contractor to avoid rutting if heavy equipment is utilized. Any damages must be repaired at Contractor's expense.

d. Wet-Mesic Forest, Mesic to Wet-Mesic Prairie and Prairie Planting Zones: following the last herbicide application and prior to sowing the native seed and cover crop, the soil shall be lightly worked to a depth of ¼" – ½" in depth with a disc and/or harrow. The topsoil shall be free of heavy clay, refuse, stumps, large roots, rocks over 2 inches in diameter, weeds, or other extraneous material which would be detrimental to good seed-to-soil contact, and therefore seed establishment. If the soil is too light and fluffy, the area shall be cultipacked to provide a firmer seedbed prior to seeding.

e. Northern Sedge Meadow, Shrub-Carr and Wet-Mesic Prairie Enhancement Zones: Existing vegetation shall be mowed to a height of 2-3" prior to sowing the native seed and cover crop to allow good seed dispersal and soil contact.

B. Installation:

1. Seeding shall occur immediately after seedbed preparation. Re-work Zones shall be seeded with the native seed mixes at the PLS ounces per acre rate indicated in Paragraph 2.01 G. Enhancement Zones shall be seeded with the native seed mixes at one half the PLS ounces per acre rate indicated in Paragraph 2.01 G. Seeding shall be conducted within the designated communities (Drawings) between October 15th and November 30th.
2. All native seed species shall be mixed on-site prior to installation.
3. If the communities are hand sown, the seed shall be mixed with a carrier (e.g., sawdust, vermiculite, moist sand, etc.) to ensure even seed distribution. The one exception will be the Emergent Aquatic – Wild Rice which shall be hand sown from a watercraft suitable to adequately access the planting area. If a broadcast seeder is utilized, it shall be properly calibrated to ensure an even seed distribution is achieved within the planting area.
4. After the seed has been installed, the area shall be rolled to ensure good seed to soil contact.
5. Once seed installation is complete in the Prairie Planting Zone, erosion blanket shall be placed in those areas designated on the Drawings. Erosion blanket installation shall follow those requirements outlined in 4.08 below.

C. Seeding shall not be permitted during the following conditions unless otherwise approved:

1. Frozen soil or water conditions.

2. Wind speeds >10 miles per hour.
3. Temperatures less than 32 degrees Fahrenheit.
4. Temperatures greater than 90 degrees Fahrenheit.

4.03 LIVE PLANTING WITH PLUGS OR BARE-ROOT MATERIAL

A. Preparation:
1. Prior to installing the live plants, the planting area shall be prepared through the following sequence:
   a. Enhancement Zones (Plant Community Map): A combination of selective cutting and two (2) or three (3) spot herbicide applications to address invasive species will be conducted throughout the growing season. A herbicide solution including aquatic approved chemical (glyphosate or imazapyr), surfactant or MSO, ammonium sulfate and marking dye are to be utilized for each application and shall be applied at the rates recommended on the label for the vegetation species present. The first application is expected to be completed in early July. The second and third applications are expected to be undertaken in mid to late August and late September – prior to the first hard freeze. The schedule for herbicide applications will be flexible to accommodate the weather and existing growing conditions; however, the Contractor must communicate with the City and the Engineer prior to conducting any application. Care must be taken to ensure populations of existing or installed native plants are not killed during the process. Contractor must select appropriate means in which to apply the herbicide to ensure protection of native plant populations. Incomplete, untimely, or unsuccessful herbicide treatments may result in additional treatment requirements to be conducted at the Contractor's expense. Damage or loss of native plant populations shall also be replaced at Contractor's expense.
   b. Re-Work Zones (Plant Community Map): A combination of mowing and two (2) or three (3) broadcast herbicide applications to eliminate existing vegetation will be conducted throughout the growing season. A herbicide solution including the chemical (glyphosate, imazapyr, clopyralid or clethodim – later 2 may only be utilized in non-aquatic settings), a surfactant or MSO, ammonium sulfate and marking dye are to be utilized for each application and shall be applied at the rates recommended on the label for the vegetation species present. The first application is expected to be completed in early July. The second and third applications are expected to be undertaken in mid to late August and late September – prior to the first hard freeze. The schedule for herbicide applications will be flexible to accommodate the weather and existing growing conditions; however, the Contractor must communicate with the City and the Engineer prior to conducting any application. Contractor must select appropriate means in which to apply the herbicide. Incomplete, untimely, or unsuccessful herbicide treatments may result in additional treatment requirements to be conducted at the Contractor's expense.
   c. OWNER, ENGINEER and CONTRACTOR will meet on site to identify plant species locations throughout the restoration area.
   d. Paragraph 2.01 H. indicates the native species and quantities to be planted.

B. Excavation for Planting:
1. Erosion blanket in the narrow Emergent Aquatic Planting Zone on the south side of the restoration site shall be cut in a manner that will allow the fabric to be folded out of the way during pit excavation and plant installation.
2. 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" for 2.5" potted material and 6" for 4.5" potted material and sufficiently deep for both potted and bare root material to allow the root collar to be at the original grade after the plant is positioned in the hole.
3. Additional directions regarding bare root plant installation from the nursery shall be followed.

C. Installation and Procedures:

1. Submergent and Emergent Aquatic plants shall be installed between June 15th and July 30th.
2. Plants to be installed in the Northern Sedge Meadow, Shrub-Carr and Wet-Mesic Forest communities shall be installed between October 15th and November 30th.
3. Submergent Aquatic plants shall be installed in water depths ranging from 24”-36” in depth.
4. Emergent Aquatic plants shall be installed in water depths ranging from 0”-12” in depth.
5. Submergent Aquatic plants will be planted in clusters of 175 plants per pod, which will be roughly 15’ in diameter (Planting Detail). Clusters shall contain a mix of species found in Paragraph 2.01 H. and be randomly planted in “clumps” of 10 to 25 individuals on approximate one-foot centers throughout the pod.
6. Emergent Aquatic plants shall be installed at indicated planting depths and cannot be submerged when planted. A minimum of 3” of plant material must be above the waterline, to ensure good growth and to handle flood inundations from storm events. Wetland plants will be randomly planted in “clumps” of 5 to 10 individuals on approximate two-foot centers throughout the planting zone. All species within a given “clump” shall be the same and the maximum distance between “clumps” shall be five feet.
7. Live plants to be installed in the Northern Sedge Meadow, Shrub-Carr and Wet-Mesic Forest communities will be randomly planted in “clumps” of 5 to 10 individuals on approximate 18” centers that will be randomly scattered throughout the planting zone.
8. Container-Grown Plants:
    a. Carefully open and remove potted plants from containers.
    b. Unwind and/or cut encircling roots with a sharp tool. Exceptionally long roots shall be shortened and all roots shall be guided gently downward and outward to prevent root girdling.
    c. Place plant in center of pit making sure the root collar is flush with the existing soil surface prior to backfilling with native soil. Backfill and hand tamp until soil is at final grade. No soil shall be placed over the root collar.
    d. If planted through erosion blanket, replace blanket to its original position making sure to secure the material with additional staples. The fabric shall not be in direct contact with the plant. Excess material shall either be removed or folded upon itself to eliminate contact.
9. Bare-root Plants:
    a. If nursery recommends additional means to secure the bare root material to the substrate such as using staples or weights, they shall be utilized to ensure successful establishment.

D. Planting shall not be permitted during the following conditions unless otherwise approved:
1. Frozen soil conditions.
2. Temperatures less than 32 degrees Fahrenheit.
3. Temperatures greater than 90 degrees Fahrenheit.

4.04 TREE & SHRUB PLANTING

A. Preparation:
1. OWNER, ENGINEER and CONTRACTOR will meet on site to identify plant species locations throughout the restoration area.
2. Paragraph 2.01 I. indicates the native species and quantities to be planted.

B. Excavation for Planting:
1. Plant Pits:
    a. Planting pits shall be prepared through the following sequence:
        1) Center the planting pits at the stake location.
        2) Excavate pits to a minimum diameter of 24”, where feasible, and sufficiently deep to allow the root collar to be at the original grade after the bare-root and/or potted tree or shrub is positioned in the hole. Pits shall be saucer-shaped with no vertical sides.
        3) The pit sides shall be roughened to allow future root penetration.
        4) Do not install plantings where depth of soil over underground construction, obstructions or rock is insufficient to accommodate roots or where pockets in rock or impervious soil require drainage. Remove rock

or other underground construction and drain planting areas only when approved by ENGINEER. Payment for extra work shall be based on in-place volume required to provide normal requirements for plantings.

a) Where such conditions are encountered in excavation planting areas and where stone, boulders or other obstruction cannot be broken or removed by hand methods and where trees to be planted are under overhead wires, alternate locations for planting may be designated by ENGINEER.

b) Where locations cannot be changed as determined by ENGINEER, submit cost required to remove obstructions to depth of not less than 6 in. below required pit depth.

c) Dispose of excavated material not suitable for backfilling off-site.

d) If drainage problems are encountered detrimental to growth of specified plant material, notify ENGINEER of conditions before proceeding with Work.

5) Container grown plants shall be placed on undisturbed soil. See typical planting detail – Sheet 6

6) Bare-root plants shall be set on a mound of backfill material. See typical planting detail – Sheet 6.

7) If holes are excavated on a slope, proper depth shall be obtained by adding or removing soil on uphill or downhill side such that root collar ends up slightly above grade 1" – 2".

8) Subsoil materials shall be kept separate from the above topsoil layer.

C. Installation Procedures:

1. Trees and shrubs will be randomly scatter planted throughout the Shrub-Carr and Wet-Mesic Forest Communities. Shrubs shall be placed in "clumps" of 3 to 5 individuals on approximate five-foot centers. Trees shall be planted no closer than ten feet apart throughout the restoration area.
2. Bare root and container-grown trees and shrubs shall be dormant planted between October 15th to November 30th.
3. Planting materials outside the above dates shall be considered unseasonable and requires approval by the ENGINEER.
4. If special conditions exist which warrant installation outside normal planting seasons, CONTRACTOR shall submit a written request to the OWNER and ENGINEER describing conditions and stating proposed variance. Approval to plant under such conditions shall in no way relieve CONTRACTOR from warranty.
5. Container-Grown Plants:
   a. Carefully open and remove potted plants from containers.
   b. Unwind and/or cut encircling roots with a sharp tool and then score the sides of the root ball in several locations around the perimeter. Exceptionally long roots shall be shortened and all roots shall be guided gently downward and outward to prevent root girdling.
   c. Place plant in center of pit making sure the root collar is flush with the existing soil surface prior to backfilling with native soil. While backfill approximately 3/4 of the hole, large rocks and debris shall be removed. Large clumps of ground and sod shall be broken apart while filling the pit; and if used, shall not interfere with root growth. 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 that meets CITY specifications, if necessary. No soil shall be placed over the root collar. Approximately 10-20 gallons of water shall be used to settle the soil and irrigate the root ball and surrounding soil during installation.
6. Bare Root Plants:
   a. Prior to installing the trees and shrubs, their roots shall be soaked in water for several minutes, but no longer than 3 hours. Care should be taken to keep the roots from drying out during the planting process.
   b. Place plants firmly on the mound of backfill material in the center of pit and spread the roots in a natural position within the pit while keeping the root collar flush with the existing soil surface.

c. Cut off broken or frayed roots. Roots too long for the planting hole shall be trimmed to prevent root girdling.

d. Place plant in center of pit making sure the root collar is flush with the existing soil surface prior to backfilling with native soil. While backfill approximately 3/4 of the hole, large rocks and debris shall be removed. Large clumps of ground and sod shall be broken apart while filling the pit; and if used, shall not interfere with root growth. 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 that meets CITY specifications, if necessary. No soil shall be placed over the root collar. Approximately 5-10 gallons of water shall be used to settle the soil and irrigate the root ball and surrounding soil during installation.

e. CONTRACTOR shall inspect all trees and shrubs two to five days after installation is completed and make any required adjustments or material additions.

D. Tree Protectors & Stakes:

1. Bare-root & Container Grown Plants.
   a. Assemble and install loose plastic tubing around tree or shrub
   b. Tube shall be placed flush or below the soil surface to prevent rodent access.
   c. Protector shall be securely fastened in place with a wooden or PVC stake
   d. Stakes shall be installed 12” into the ground to ensure stability.
   e. Tubes shall be attached the stake with cable or wire ties at two

E. Planting shall not be permitted during the following conditions unless otherwise approved:

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

4.05 LIVE STAKE INSTALLATION

A. Preparation:

1. OWNER, ENGINEER and CONTRACTOR will meet on site to determine live stake locations.
2. Paragraph 2.01 I. indicates the native species and quantities to be planted.

B. Installation:

1. Stakes shall be installed in a dormant state between October 15th and May 15th.
2. Stakes shall be randomly scattered throughout the Shrub-Carr Planting Community and installed on approximate three-foot centers.
3. A pilot hole shall be created 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 the CONTRACTOR to take care so the stakes are not damaged including split tops. Damaged material will be replaced at the CONTRACTOR’S expense.
4. 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.
5. Stakes installed in a pilot hole shall have the soil around the stake tamped and watered to eliminate air pockets.

C. Installation shall not be permitted during the following conditions unless otherwise approved:

1. Frozen soil conditions.
2. Temperatures less than 32 degrees Fahrenheit.
3. Temperatures greater than 90 degrees Fahrenheit.

4.06 GOOSE FENCE

A. Installation

1. Before live plants are installed, metal t-posts shall be placed at roughly ten-foot intervals around the outer perimeter (East and South sides) of the Emergent Aquatic planting zone.
2. The isolated Emergent Aquatic planting zone located in the Northwest portion of the restoration site will not require goose fencing, but it will likely require the roped, cross-hatch pattern, discussed below, to prevent geese from flying into the area.
3. Green safety/snow fence shall be attached to each post at three locations using cable ties along the length of the plantings. Fencing shall be taut to keep geese from walking into the area from land. The fence shall be four feet in height and must be installed so it is flush with the ground to prevent geese from going under.
4. Except for the narrow Emergent Aquatic Zone found along the south side of the restoration site, nylon rope or bailing twine shall be attached between the inner and outer posts in a cross-hatch pattern over the planting area. Additional posts shall be added to ensure supports are no more than 20 feet apart. The rope shall be taut and located a minimum of 36" above the water. Flagging shall be tied intermittently along the rope to provide motion and alert waterfowl to the fencing. Fencing shall be installed as the plants are installed to ensure protection of the plants throughout the entire planting process. See fencing detail – Sheet 6.

B. Maintenance
   1. Goose fencing shall be maintained throughout the first full growing season.

C. Removal
   1. CONTRACTOR shall not be responsible for removal of the fencing system. Fencing will be removed by the CITY or their representative.

4.07 CARP BARRIER

A. Installation
   1. Before live plants are installed, metal t-posts shall be placed at roughly five-foot intervals around the inner perimeter (North and West sides) of the Emergent Aquatic planting zone.
   2. The isolated Emergent Aquatic planting zone located in the Northwest portion of the restoration site shall have the perimeter of the zone protected.
   3. 14 gauge welded wire fence shall be attached to each post at three locations using cable ties along the length of the plantings. Fencing shall be four feet in height, taut and must be installed so it is flush with the ground to prevent carp from going under. See fencing detail per Sheet 6.
   4. Fencing shall be installed as the plants are installed to ensure protection of the plants throughout the entire planting process.

B. Maintenance
   1. Carp fencing shall be maintained throughout the first full growing season.

C. Removal
   2. CONTRACTOR shall not be responsible for removal of the fencing system. Fencing will be removed by the CITY or their representative.

4.08 EROSION CONTROL MATERIALS

A. Installation
   1. The CONTRACTOR shall install the erosion blanket and stakes per manufacturer's recommendations.
   2. Install Class I, Urban, Type A (S 75 BN) erosion blanket and biodegradable stakes on the prairie seeding per Sheet 10 within 72 hours after seeding.
   3. Install Class I, Urban, Type A (C 125 BN) erosion blanket and biodegradable stakes in the emergent aquatic planting zone per Sheet 10 prior to installing emergent live plants.
   3. Do not apply during high winds.

4.09 WATERING

A. General:
   1. Apply a minimum of five gallons of water to each tree, shrub, and live stake immediately after installation.
   2. Apply a minimum of five gallons of water to each tree, shrub, and live stake weekly for the first four (4) weeks of the growing season after installation unless ≥ 1" of rainfall is received during that week.

4.10 CLEAN UP AND REPAIR

A. Remove excess and waste material daily.

B. Upon completion of planting, remove excess soil, stones, and debris and dispose of off-site.

C. CONTRACTOR shall be liable for any damage caused to surrounding properties as a result of negligence when conducting landscape installation. Damage to existing landscape, pavements, or other site features as result of Work shall be repaired to its original condition.

4.11 PRELIMINARY ACCEPTANCE

A. Notify ENGINEER at conclusion of planting and seeding operations so OWNER and ENGINEER can determine completion by field inspection.

B. Completion requires:
   1. Seed and plant material conforms to Contract Documents with respect to quantity, quality, size, species, and location, except those items accepted or revised in the field by OWNER and ENGINEER.
   2. Plant material shall be established, upright, green (i.e., healthy condition), and exist in the locations as determined by the OWNER and ENGINEER.

4.12 MAINTENANCE DURING WARRANTY PERIOD

A. General:
   1. CONTRACTOR shall provide maintenance during the warranty period in accordance with the submitted and approved Maintenance Plan.
   2. Repair work necessitated by CONTRACTOR'S operations, land disturbance outside designated work areas, CONTRACTOR'S failure to perform adequate maintenance or due to CONTRACTOR'S negligence shall be performed without cost to OWNER.
   3. Any soil erosion resulting from inadequate cover crop or permanent seed establishment shall be corrected at the CONTRACTOR'S expense.

B. Protection:
   1. CONTRACTOR is liable for damage to planted areas caused by deicing compounds, toxic substances, fertilizers, pesticides, and other materials applied by CONTRACTOR. CONTRACTOR is not liable for materials applied by others or damage caused by vandalism or acts of God.
   2. Protect landscape Work and materials from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection until completion and acceptance.
   3. Protect existing property and improvements within these sites and those adjacent to OWNER'S property.

C. 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. Year 1
      a. 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 one year.
      b. After one year, ≥75% of the vegetative cover within the restoration site will be native species, <25% of the cover will be invasive, non-native species.
      c. Eighty percent of the site will be vegetated within one year.

d. 720 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy one year after installation.

e. 900 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy one year after installation.

f. The Open Water with Submergent Vegetation Community shall have a minimum of 5 native, non-invasive species present.

g. The Emergent Aquatic Community shall have a minimum of 15 native, non-invasive species present.

h. The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 15 native, non-invasive species present.

i. To ensure the restored communities have natural significance, the floristic quality index (FQI) and Coefficient of Conservatism (Mean C) for each shall be $\geq$ 20 and $\geq$ 3.5, respectively, after one year. FQI values will be calculated utilizing all species present: non-native species will be assigned a value of zero.

2. Year 2

a. 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 two years.

b. After two years, $\geq$80% of the vegetative cover within the restoration site will be native species, <25% of the cover will be invasive, non-native species.

c. Eighty five percent of the site will be vegetated within two years.

d. 640 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy two years after installation.

e. 800 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy two years after installation.

f. The Open Water with Submergent Vegetation Community shall have a minimum of 5 native species present.

g. The Emergent Aquatic Community shall have a minimum of 15 native species present.

h. The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 15 native species present.

i. To ensure the restored communities have natural significance, the floristic quality index (FQI) and Coefficient of Conservatism (Mean C) for each shall be $\geq$ 22 and $\geq$ 3.8, respectively, after two years. FQI values will be calculated utilizing all species present: non-native species will be assigned a value of zero.

3. Year 3.

a. 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.

b. After three years, $\geq$85% of the vegetative cover within the restoration site will be native, non-invasive species, <15% of the cover will be invasive, non-native species.

c. Ninety percent of the site will be vegetated within three years.

d. 600 of the 800 planted shrubs and live stakes within the Shrub-Carr community will be present and healthy three years after installation.

e. 750 of the 1,000 planted trees and shrubs within the Wet-Mesic Forest community will be present and healthy three years after installation.

f. The Open Water with Submergent Vegetation Community shall have a minimum of 5 native, non-invasive species present.

g. The Emergent Aquatic Community shall have a minimum of 15 native, non-invasive species present.

h. The Northern Sedge Meadow, Shrub-Carr, Wet-Mesic Forest and Mesic to Wet-Mesic Prairie Communities shall each have a minimum of 20 native, non-invasive species present.

i. To ensure the restored communities have natural significance, the floristic quality index (FQI) and Coefficient of Conservatism (Mean C) for each shall be $\geq$ 25 and $\geq$ 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.

j. Six of the twelve nesting and roosting boxes shall be utilized or occupied annually by year three.

k. 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.

4.13 WARRANTY

A. During the 1-year warranty period, CONTRACTOR shall re-seed areas with poor germination and replace diseased, unhealthy, and dying plants to meet the following criteria:
   1. Seeding success criteria – An area will be considered satisfactory if it meet the following:
      a. A minimum of 75% total native vegetative coverage.
      b. No bare areas larger than 10 square feet.
      c. Vegetation is in healthy condition.
   2. 90% of the installed plants, shrubs, trees, and live stakes are living and healthy.

B Replacement and Damages:
   1. Prior to expiration of the 1-year warranty period, follow-up inspection will be made to determine replacements required to be made by CONTRACTOR in accordance with provisions of these Specifications. ENGINEER will document findings in field report, and forward copies to CONTRACTOR. Items identified for replacement will be tagged during inspection with plastic flagging. Decision of OWNER and ENGINEER for required replacements is final and binding upon CONTRACTOR.
   2. CONTRACTOR is responsible for repairing damage to property caused by defective workmanship and materials.

C. Exclusions:
   1. CONTRACTOR is not liable for replacement cost of seeds and plants damaged by extreme weather conditions. CONTRACTOR is not liable for plants not installed by CONTRACTOR under CONTRACTOR'S supervision, by relocation or removal by others, by acts of God, or by vandalism, and losses because of curtailment of water by local authorities.

4.14 REPLACEMENTS

A. General Procedure
   1. Reseeding and replanting shall be performed at the CONTRACTOR'S expense and in conformance with the original seeding and planting specifications unless they are modified by the ENGINEER.
   2. Seed and plant replacements shall be of the same species, quality, and size as originally installed, or with substitutes pre-approved in writing by the ENGINEER.
   3. Replanting and reseeding activities shall be conducted during the first available period, as determined by the OWNER and ENGINEER.
   4. Dispose of dead plants off-site.
   5. Restore areas damaged by replacement operations to original condition.
   6. Notify OWNER and ENGINEER at conclusion of replacement program
   7. OWNER and ENGINEER will conduct inspection of replacements for determining final acceptance.

B. Plant Material
   1. Replace plants that have failed to flourish so their usefulness or appearance has been impaired. Missing or displaced plants along with those that have died, are in dying condition, or are stressed (e.g., yellowed, wilted, etc.) shall be replaced per OWNER recommendations.
   2. Replace trees and shrubs with dead main leader or crown which is 25% or more dead.
   3. Replace live stakes with no vegetative growth.

4.15 FINAL ACCEPTANCE

A. Procedure
   1. Upon completion of replacement program, CONTRACTOR shall notify OWNER and ENGINEER.
   2. OWNER and ENGINEER will inspect the site to determine acceptability of required replacements.
   3. If acceptable and the warranty criteria outlined in 4.13.A.1.&2. are met, OWNER and ENGINEER shall notify CONTRACTOR, in writing, of final acceptance of Work.
   4. After acceptance, OWNER will be responsible for all future replacements and maintenance.

4.15 MEASUREMENT AND PAYMENT

A. Include cost of:
   1. Site preparation activities including spot & broadcast herbicide applications, mowing, debris removal, and soil preparation.
   2. Providing and installing seed mixtures.
   3. Providing and installing plants, shrubs, trees, and live stakes.
   4. Storage of plant material.
   5. Replacement of plants under warranty period.
   6. All labor, materials and equipment necessary for planting and maintenance during establishment of native vegetation.
   7. Cleanup.
   8. Maintenance Plan.
   9. Other appurtenant and incidental Work.

B. Do not include cost of:
   1. Work included in other Bid items.

C. Measurement for Payment:
   1. Work under this section shall be paid for at the contract unit price.

- END OF SECTION -

C

APPENDIX C

NES Habitat Restoration Plan Document

Habitat Restoration Plan

Menekaunee Harbor Restoration

Marinette County, Wisconsin

Partners

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

Marinette
expanding horizons

WISCONSIN DEPT. OF NATURAL RESOURCES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Great Lakes RESTORATION

Prepared By:

James Havel
Senior Ecologist

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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 ¼ of the SW ¼ and the SE ¼ of the SW ¼ of Section 4, and the NW ¼ of the NW ¼ and the NE ¼ of the NW ¼ 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 serpentine*), 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 interspersion 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 Stormwater 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 form 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, stormwater 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.

Species			
Common Name	**Scientific Name**	**Planting Depth**	**No. of Plants Required**
Coontail	*Ceratophyllum demersum*	24-36"	150
Needle Rush	*Eleocharis acicularis*	24"	150
Water Smartweed	*Persicaria amphibia*	24"	150
Floating-leaf Pondweed	*Potamogeton natans*	24"	150
Long-leaved Pondweed	*Potamogeton nodosus*	24"	150
Sago Pondweed	*Stuckenia pectinata*	24-36"	150
Water Celery	*Vallisneria americana*	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 habor 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 ¼" 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 Menekaunee 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 'Maehnomaeh' (wild rice), a prayer and offerings are done to have a successful crop". The Menominee Nation's deep connection with the area and "Maehnomaeh" 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.

	Species		
Common Name	**Scientific Name**	**Planting Depth**	**No. of Plants Required**
Common Water-plantain	*Alisma subcordatum*	0-6"	150
Water-shield	*Brasenia schreberi*	6-12+"	350
River Bulrush	*Bolboschoenus fluviatilis*	6-12"	550
Water Sedge	*Carex aquatilis*	0-3"	450
Bristly Sedge	*Carex comosa*	0-3"	500
Common Lake Sedge	*Carex lacustris*	0-3"	450
Great Spike Rush	*Eleocharis palustris*	0-3"	250
Reed Manna Grass	*Glyceria grandis*	0-3"	300
Northern Blue Flag	*Iris versicolor*	0-3"	550
Soft Rush	*Juncus effusus*	0-3"	325
Yellow Water-lily	*Nuphar advena*	6-12+"	325
White Water-lily	*Nymphaea odorata*	6-12+"	250
Pickerel Weed	*Pontedaria cordata*	0-6"	850
Common Arrowhead	*Sagitaria latifolia*	0-6"	900
Hardstem Bulrush	*Schoenoplectus acutus*	6-12"	850
Chair-maker's Rush	*Schoenoplectus pungens*	0-6"	1,150
Softstem Bulrush	*Schoenoplectus tabernaemontani*	6-12"	1,400
Common Bur-reed	*Sparganium eurycarpum*	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 ½" 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		
Common Name	***Scientific Name***	**Ounces Required Per Acre**
Forbs		
Canada Anemone	*Anemone canadensis*	0.9
Angelica	*Angelica atropurpurea*	4.7
Marsh Milkweed	*Asclepias incarnata*	2.7
Shining Aster	*Aster firmus*	0.4
Panicled Aster	*Aster lanceolatus*	0.7
Swamp Aster	*Aster puniceus*	0.9
Flat-top Aster	*Aster umbellatus*	1.4
Nodding Bur Marigold	*Bidens cernua*	2.6
Common Beggar's Ticks	*Bidens frondosa*	2.2
Turtlehead	*Chelone glabra*	0.6
Water Hemlock	*Cicuta maculata*	0.9
Cinnamon Willow Herb	*Epilobium coloratum*	0.4
Joe Pye Weed	*Eupatorium maculatum*	2.1
Boneset	*Eupatorium perfoliatum*	1.0
Grass-leaved Goldenrod	*Euthamia graminifolia*	0.5
Sneezeweed	*Helenium autumnale*	1.5
Saw-tooth Sunflower	*Helianthus grosseserratus*	1.0
Spotted Touch-me-not	*Impatiens capensis*	1.4
Great Blue Lobelia	*Lobelia siphilitica*	0.5
Water Horehound	*Lycopus americanus*	0.8
Wild Mint	*Mentha arvensis*	0.4
Monkey Flower	*Mimulus ringens*	0.2
Pinkweed	*Persicaria pensylvanica*	1.1
Obedient Plant	*Physotegia virginiana*	0.7
Marsh Cinquefoil	*Potentilla palustris*	0.3
Common Mountain Mint	*Pycnanthemum virginianum*	0.7
Annual Buttercup	*Ranunculus sceleratus*	1.5
Wild Golden Glow	*Rudbeckia laciniata*	3.9
Tall Water Parsnip	*Sium suave*	0.6
Late Goldenrod	*Solidago gigantea*	0.3
Swamp Goldenrod	*Solidago patula*	0.6
Woundwort	*Stachys palustris*	0.8

Table 4. Continued.

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

Species Common Name	Scientific Name	Quantity	Minimum Pot Size
Sedges/Grasses			
Porcupine Sedge	*Carex hystericina*	300	2.5"
Common Lake Sedge	*Carex lacustris*	400	2.5"
Tussock Sedge	*Carex stricta*	250	2.5"
Prairie Cord Grass	*Spartina pectinata*	150	2.5"
Ferns			
Ostrich Fern	*Matteuccia struthiopteris*	100	4.5"
Sensitive Fern	*Onoclea sensibilis*	200	4.5"
Forbs			
Northern Blue Flag	*Iris versicolor*	250	2.5"
Marsh Marigold	*Caltha palustris*	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 swallow 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**
Forbs		
Canada Anemone	*Anemone canadensis*	0.9
Angelica	*Angelica atropurpurea*	4.7
Marsh Milkweed	*Asclepias incarnata*	2.7
Shining Aster	*Aster firmus*	1.0
New England Aster	*Aster novae-angliae*	1.1
Swamp Aster	*Aster puniceus*	0.9
Flat-top Aster	*Aster umbellatus*	1.4
Nodding Bur Marigold	*Bidens cernua*	2.6
Common Beggar's Ticks	*Bidens frondosa*	2.2
Turtlehead	*Chelone glabra*	0.6
Water Hemlock	*Cicuta maculata*	0.9
Marsh Cinquefoil	*Comarum palustre*	0.3
Cinnamon Willow Herb	*Epilobium coloratum*	0.7
Joe Pye Weed	*Eupatorium maculatum*	2.3
Boneset	*Eupatorium perfoliatum*	1.1
Grass-leaved Goldenrod	*Euthamia graminifolia*	0.5
Sneezeweed	*Helenium autumnale*	1.5
Saw-tooth Sunflower	*Helianthus grosseserratus*	3.4
Spotted Touch-me-not	*Impatiens capensis*	1.4
Cardinal Flower	*Lobelia cardinalis*	0.9
Water Horehound	*Lycopus americanus*	0.8
Wild Mint	*Mentha arvensis*	0.5
Obedient Plant	*Physotegia virginiana*	0.7
Common Mountain Mint	*Pycnanthemum virginianum*	0.7
Wild Golden Glow	*Rudbeckia laciniata*	3.9
Great Water Dock	*Rumex orbiculatus*	6.1
Tall Water Parsnip	*Sium suave*	0.6
Late Goldenrod	*Solidago gigantea*	0.5
Swamp Goldenrod	*Solidago patula*	0.6
Woundwort	*Stachys palustris*	0.8
Purple Meadow Rue	*Thalictrum dasycarpum*	6.6
Blue Vervain	*Verbena hastata*	3.9
Culver's Root	*Veronicastrum virginicum*	0.4
Golden Alexanders	*Zizia aurea*	6.6
Grasses/Sedges/Rushes		
Fringed Brome	*Bromus ciliatus*	3.6
Blue-joint Grass	*Calamagrostis canadensis*	1.3
Water Sedge	*Carex aquatilis*	0.6

Table 6. Continued

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

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

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

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

Table 9. Shrub-Carr Live Stake Species.

	Species	
Common Name	***Scientific Name***	**No. of Stakes Required**
Silky Dogwood	*Cornus amomum*	100
Red-osier Dogwood	*Cornus stolonifera*	100
Bebb's Willow	*Salix bebbiana*	100
Pussy Willow	*Salix discolor*	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		
Common Name	***Scientific Name***	**Ounces Required Per Acre**
Forbs		
Canada Anemone	*Anemone canadensis*	1.8
Tall Thimbleweed	*Anemone virginiana*	1.0
Columbine	*Aquilegia canadensis*	2.9
Calico Aster	*Aster lateriflorus*	1.0
Large-leaved Aster	*Aster macrophyllus*	0.7
Common Beggar's Ticks	*Bidens frondosa*	2.9
Smallspike False Nettle	*Boehmeria cylindrica*	0.4
Wild Cucumber	*Echinocystis lobata*	3.6
White Snakeroot	*Eupatorium rugosum*	0.7
Northern Bedstraw	*Galium boreale*	1.0
Bottle Gentain	*Gentiana andrewsii*	0.5
Wild Geranium	*Geranium maculatum*	1.5
Yellow Avens	*Geum aleppicum*	7.3
Grass-leaved Goldenrod	*Euthamia graminifolia*	0.5
Saw-tooth Sunflower	*Helianthus grosseserratus*	1.9
Pale-leaved Sunflower	*Helianthus strumosus*	3.5
Spotted Touch-me-not	*Impatiens capensis*	0.9
Cardinal Flower	*Lobelia cardinalis*	0.9
Water Horehound	*Lycopus americanus*	1.7
Solomon's Plume	*Maianthemum racemosum*	4.6
Wild Mint	*Mentha arvensis*	0.5
Bishop's Cap	*Mitella diphylla*	0.4
Sweet Cicely	*Osmorhiza claytonii*	2.9
Wood Betony	*Pedicularis canadensis*	0.8
Jacob's Ladder	*Polemonium reptans*	1.0
Common Mountain Mint	*Pycnanthemum virginianum*	1.0
Wild Golden Glow	*Rudbeckia laciniata*	3.9
Mad-dog Skullcap	*Scutellaria lateriflora*	2.2
Late Goldenrod	*Solidago gigantea*	0.7
Purple Meadow Rue	*Thalictrum dasycarpum*	6.6
Culver's Root	*Veronicastrum virginicum*	0.9
Golden Alexanders	*Zizia aurea*	11.6
Grasses/Sedges/Rushes		
Fringed Brome	*Bromus ciliatus*	21.8
Canada Bluejoint	*Calamagrostis canadensis*	1.3
Bebb's Oval Sedge	*Carex bebbi*	4.3
Common Wood Sedge	*Carex blanda*	1.5
Plains Oval Sedge	*Carex brevior*	6.3
Fringed Sedge	*Carex crinita*	4.7
Crested Oval Sedge	*Carex cristatella*	2.7
Wood Gray Sedge	*Carex grisea*	3.0
Slender Sedge	*Carex leptalea*	1.1
Field Oval Sedge	*Carex molesta*	7.1
Long-beaked Sedge	*Carex sprengelii*	2.2

Table 10. Continued.

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

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

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

	Species		
Common Name	**Scientific Name**	**Quantity**	**Size - Height**
Trees			
Balsam Fir	*Abies balsamea*	25	#5-7 gallon
Red Maple	*Acer rubrum*	25	2-4' bare-root
Silver Maple	*Acer saccharinum*	75	2-4' bare-root
Yellow Birch	*Betula alleghaniensis*	50	2-4' bare-root
Musclewood	*Carpinus caroliniana*	25	2-4' bare-root
Northern Hackberry	*Celtis occidentalis*	15	2-4' bare-root
Black Ash	*Fraxinus nigra*	5	#5-7 gallon
Tamarack	*Larix laricina*	25	#5-7 gallon
Black Spruce	*Picea mariana*	25	#5-7 gallon
Swamp White Oak	*Quercus bicolor*	100	2-4' bare-root
Bur Oak	*Quercus macrocarpa*	50	2-4' bare-root
Peach-leaf Willow	*Salix amygdaloides*	50	#2-5 gallon
Black Willow	*Salix nigra*	75	2-4' bare-root
White-cedar	*Thuja occidentalis*	25	#5-7 gallon
Canadian Hemlock	*Tsuga canadensis*	10	#5-7 gallon
Slippery Elm	*Ulmus rubra*	20	#2-5 gallon
Shrubs			
Black Chokeberry	*Aronia melanocarpa*	25	#2-5 gallon
Swamp Birch	*Betula pumila*	15	#2-5 gallon
Buttonbush	*Cephalanthus occidentalis*	10	2-4' bare-root
Alternate-leaved Dogwood	*Cornus alternifolia*	15	#5 gallon
Silky Dogwood	*Cornus amomum*	50	2-4' bare-root
Red-osier Dogwood	*Cornus stolonifera*	25	2-4' bare-root
Bush Honeysuckle	*Diervilla lonicera*	25	#1-2 gallon
Winterberry (Male & Female)	*Ilex verticillata*	10	2-4' bare-root
Fly Honeysuckle	*Lonicera canadensis*	15	#1-2 gallon
Common Ninebark	*Physocarpus opulifolius*	35	2-4' bare-root
Black Currant	*Ribes americanum*	25	#1-2 gallon
Wild Rose	*Rosa blanda*	20	#1-2 gallon
American Elder	*Sambucus canadensis*	35	2-4' bare-root
Meadow-sweet	*Spiraea alba*	10	#2-5 gallon
Lowbush Blueberry	*Vaccinium angustifolium*	15	#1-2 gallon
Nannyberry	*Viburnum lentago*	35	2-4' bare-root
American Highbush Cranberry	*Viburnum opulus L. subsp. trilobum*	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 a 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 ≥ 2". The pole shall be ≥ 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 ≥ 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 ≥ 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		
Common Name	***Scientific Name***	Ounces Required Per Acre
Forbs		
Nodding Onion	*Allium cernuum*	4.1
Columbine	*Aquilegia canadensis*	0.8
Common Milkweed	*Asclepias syriaca*	1.2
Butterfly Weed	*Asclepias tuberosa*	0.9
Smooth Blue Aster	*Aster laevis*	1.0
Calico Aster	*Aster lateriflorus*	0.3
New England Aster	*Aster novae-angliae*	1.0
Purple Prairie Clover	*Dalea purpurea*	8.4
Showy Tick Trefoil	*Desmodium canadense*	0.9
Shooting Star	*Dodecatheon meadia*	0.8
Pale Purple Coneflower	*Echinacea pallida*	9.0
Ox-eye	*Heliopsis helianthoides*	6.2
Round-headed Bushclover	*Lespedeza capitata*	6.9
Rough Blazingstar	*Liatris aspera*	4.9
Pale Spiked Lobelia	*Lobelia spicata*	0.2
Wild Bergamot	*Monarda fistulosa*	1.8
Common Mountain Mint	*Pycnanthemum virginianum*	0.4
Yellow Coneflower	*Ratibida pinnata*	2.6
Black-eyed Susan	*Rudbeckia hirta*	0.9
Brown -eyed Susan	*Rudbeckia triloba*	2.8
Compass Plant	*Silphium laciniatum*	1.2
Prairie Dock	*Silphium terebinthinaceum*	1.6
Showy Goldenrod	*Solidago speciosa*	0.6
Common Spiderwort	*Tradescantia ohiensis*	7.8
Culver's Root	*Veronicastrum virginicum*	0.1
Golden Alexander	*Zizia aurea*	7.1
Grasses/Sedges		
Big Bluestem	*Andropogon gerardii*	7.8
Side Oats Grama	*Bouteloua curtipendula*	65.3
Sand Bracted Sedge	*Carex muehlenbergii*	6.5
Canada Wild Rye	*Elymus canadensis*	60.3
Switch Grass	*Panicum virgatum*	5.6
Little Bluestem	*Schizachyrium scoparium*	26.1
Indian Grass	*Sorghastrum nutans*	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		
Common Name	***Scientific Name***	Ounces Required Per Acre
Forbs		
Nodding Onion	*Allium cernuum*	2.1
Prairie Onion	*Allium stellatum*	2.1
Leadplant	*Amorpha canescens*	2.0
Thimbleweed	*Anemone cylindrica*	0.6
Northern Thimbleweed	*Anemone virginiana*	0.6
Columbine	*Aquilegia canadensis*	0.8
Butterfly Weed	*Asclepias tuberosa*	0.9
Whorled Milkweed	*Asclepias verticillata*	1.4
Heath Aster	*Aster ericoides*	0.2
Smooth Blue Aster	*Aster laevis*	1.1
Sky Blue Aster	*Aster oolentangiense*	0.6
Lance-leaf Coreopsis	*Coreopsis lanceolata*	1.2
Purple Prairie Clover	*Dalea purpurea*	3.1
Shooting Star	*Dodecatheon meadia*	0.5
Pale Purple Coneflower	*Echinacea pallida*	4.5
Flowering Spurge	*Euphorbia corollata*	0.8
Sweet Everlasting	*Gnaphalium obtusifolium*	0.1
Prairie Alumroot	*Heuchera richardsonii*	0.1
Round-headed Bushclover	*Lespedeza capitata*	2.9
Rough Blazingstar	*Liatris aspera*	2.5
Dwarf Blazing Star	*Liatris cylindracea*	1.7

Table 14. Continued.		
Wild Lupine	*Lupinus perennis*	3.6
Wild Bergamot	*Monarda fistulosa*	1.3
Spotted Bee Balm	*Monarda punctata*	0.9
Wild Quinine	*Parthenium integrifolium*	4.5
Foxglove Beardtongue	*Penstemon digitalis*	0.6
Hairy Beardtongue	*Penstemon hirsutus*	0.3
Prairie Cinquefoil	*Potentilla arguta*	0.4
Yellow Coneflower	*Ratibida pinnata*	2.6
Black-eyed Susan	*Rudbeckia hirta*	0.9
Brown -eyed Susan	*Rudbeckia triloba*	2.3
Prairie Blue-eyed Grass	*Sisyrinchium campestre*	1.4
Stiff Goldenrod	*Solidago rigida*	1.5
Showy Goldenrod	*Solidago speciosa*	0.8
Common Spiderwort	*Tradescantia ohiensis*	3.9
Hoary Vervain	*Verbena stricta*	3.4
Golden Alexander	*Zizia aurea*	7.1
Grasses/Sedges		
Side Oats Grama	*Bouteloua curtipendula*	65.3
Sand Bracted Sedge	*Carex muehlenbergii*	6.5
Purple Love Grass	*Eragrostis spectabilis*	1.4
June Grass	*Koeleria macrantha*	0.8
Little Bluestem	*Schizachyrium scoparium*	31.4
Indian Grass	*Sorghastrum nutans*	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-Marinette 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, ≥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-m^2 (herbaceous layer), 5-m^2 (shrub layer) and 10-m^2 (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 m^2 (herbaceous), 5 m^2 (shrubs) and 10 m^2 (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 (≥ 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 (≥ 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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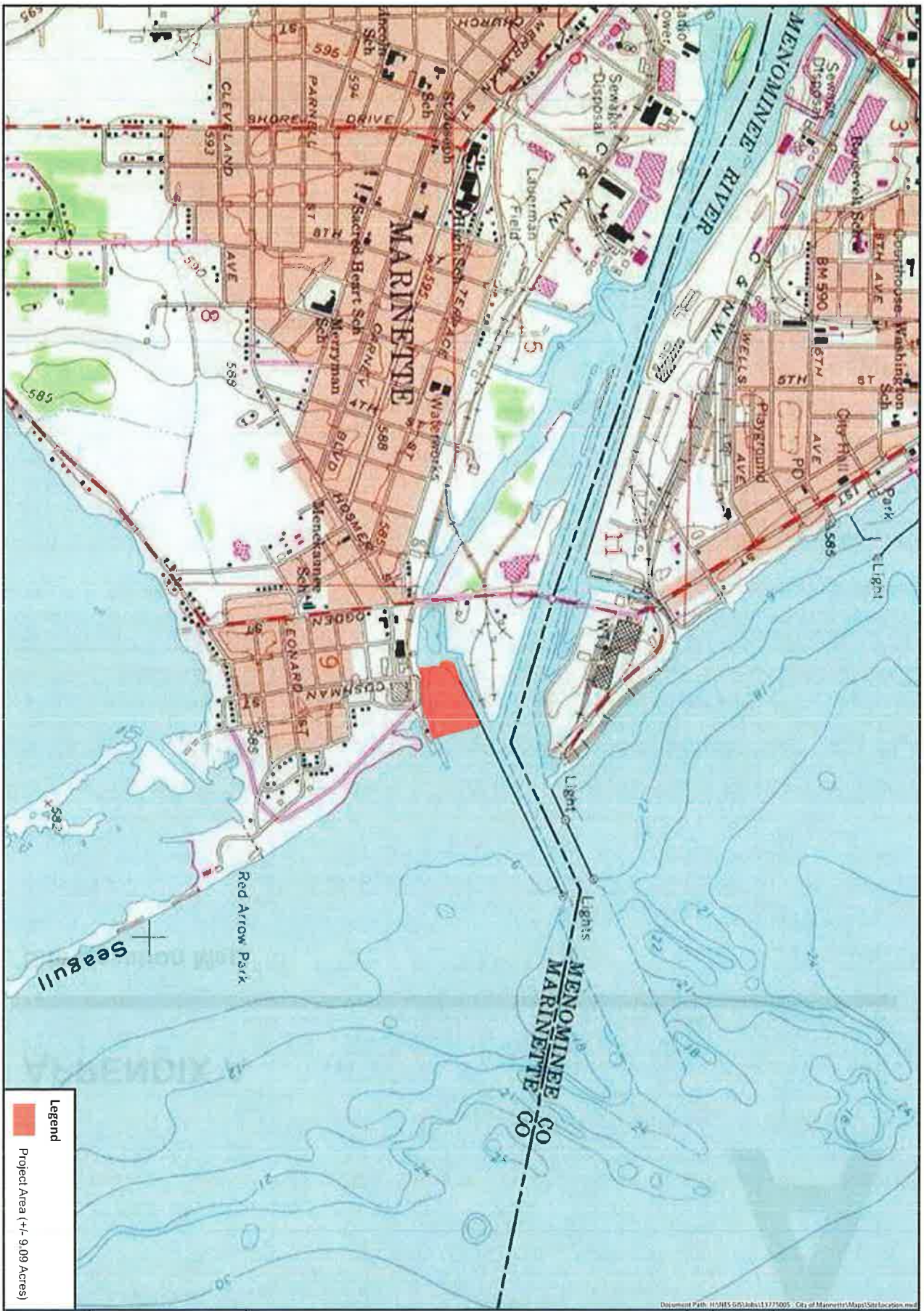
A

APPENDIX A

Site Location Map



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

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

4/20/2015

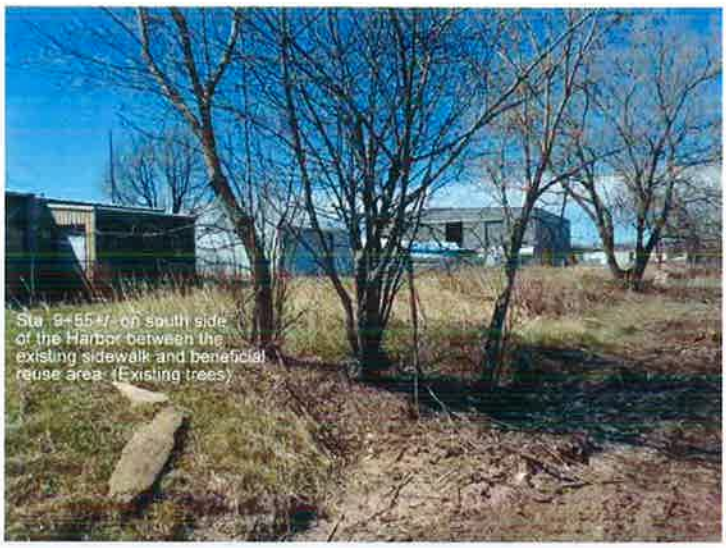
Site Location

Robert E. Lee
& Associates, Inc.

B

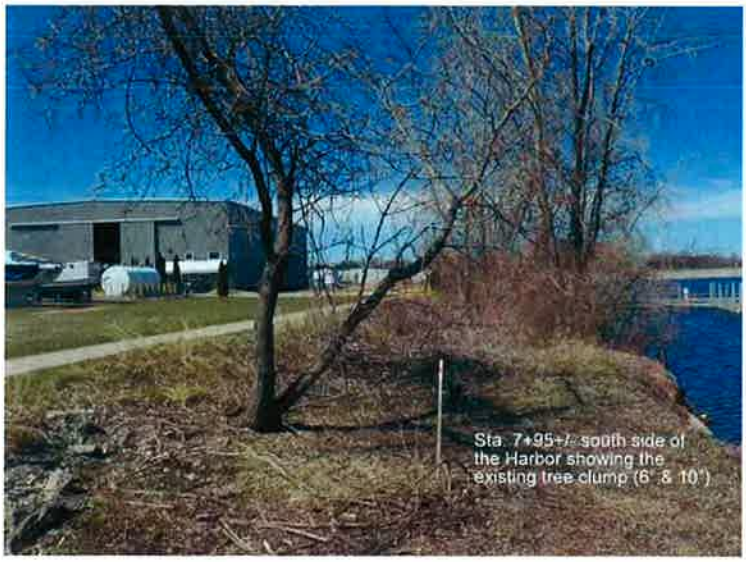
APPENDIX B

Site Photographs


Sta. 9+55+/- 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 +/-)

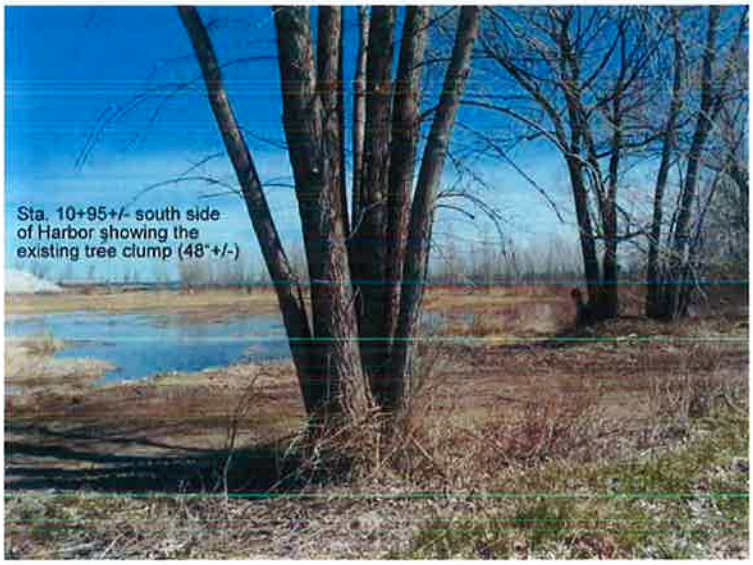

Sta. 8+22+/- south side of Harbor
existing 8"+/- tree.


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

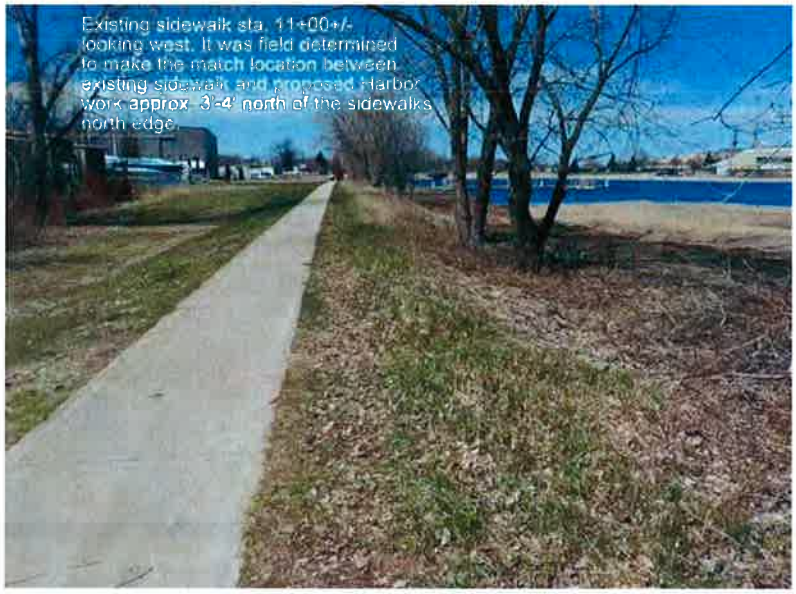

Sta. 7+54 +/- existing bush
that is the approx. start location
of the proposed riprap heading
easterly


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.


Existing sidewalk sta. 11+00+/-
looking west. It was field determined
to make the match location between
existing sidewalk and proposed Harbor
work approx. 3'-4' north of the sidewalks
north edge.

C

APPENDIX C

WDNR Surface Water Data Viewer Map

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.

0 100 200 Feet

N

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

4/20/2015

WDNR Surface Water Data Viewer

Robert E. Lee & Associates, Inc.

D

APPENDIX D

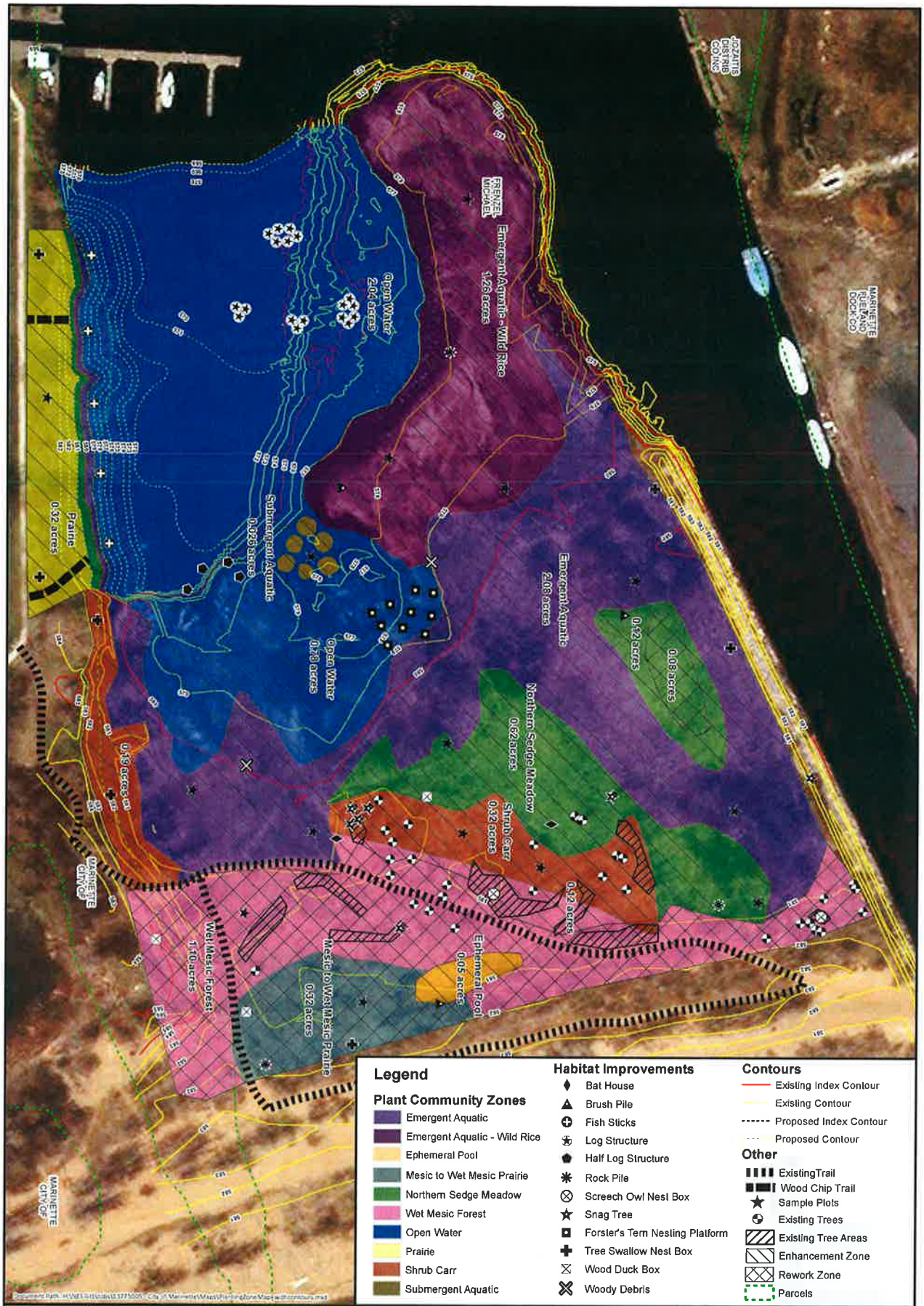
Ayres Associates 2013 Plant Survey

Table 1. Fall 2013 Plant Inventory

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

APPENDIX E

Restored Plant Community Zones & Habitat Improvements



0 10 20 40 60 80 Feet

N

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.

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

8/4/2015

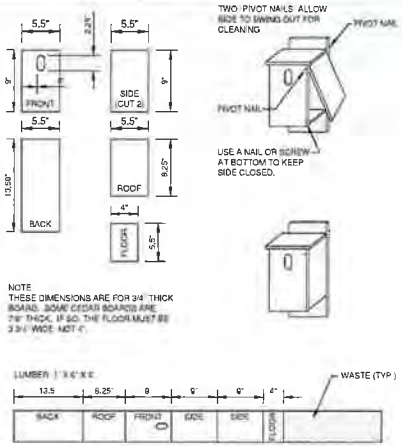
Plant Community Zones

Robert E. Lee & Associates, Inc.

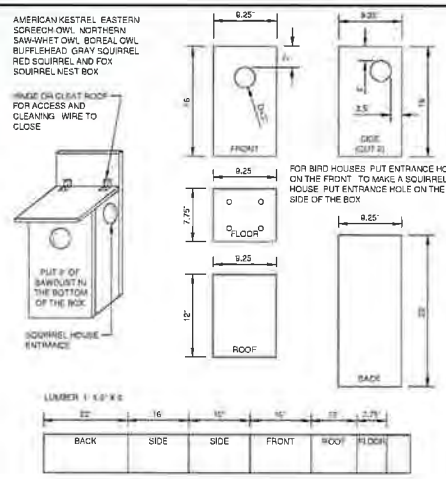
F

APPENDIX F

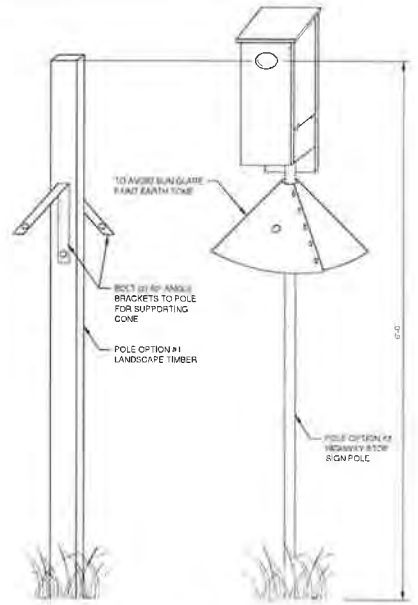
Habitat Structure Details

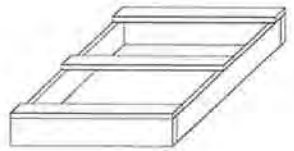


TREE SWALLOW AND EASTERN BLUEBIRD NEST BOX

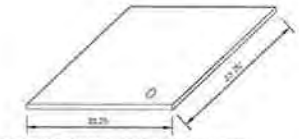


OWL AND SQUIRREL NEST BOX

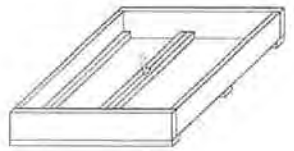




NAIL THE FOUR SIDES TOGETHER AN ATTACHE THREE BOTTOM BRACES

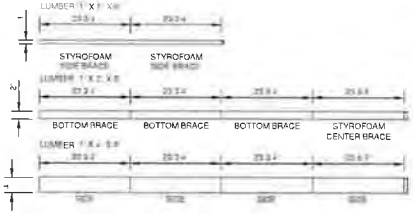


CUT A 2' SQUARE PIECE OF 3/4" STYROFOAM AS SHOWN TO FIT INSIDE THE PLATFORM. MAKE A HOLE IN THE CENTER FOR AN ANCHOR ROPE.

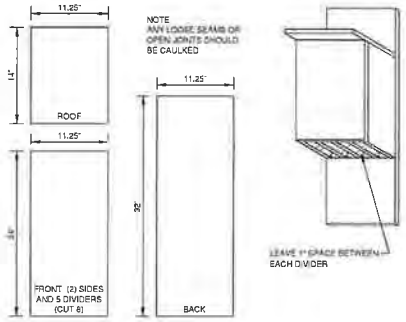


NAIL THE 1" X 1" BRACES AND ONE OF THE 1" X 2" TO HOLD THE STYROFOAM IN PLACE. DRILL A HOLE IN THE CENTER BRACE. PULL ANCHOR ROPE THROUGH AND TIE A KNOT.

FILL PLATFORM WITH WET MARSH VEGETATION. STAPLE CATTAIL LEAVES IN AN ARCH IN THE CORNER TO MAKE A CHICK SHELTER. MAKE AND ATTACH SCREEN CHICK RAMPS.

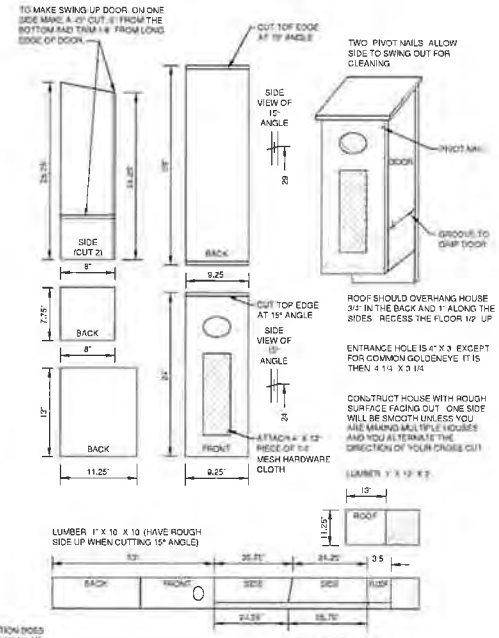


FORSTER'S TERN NEST PLATFORM

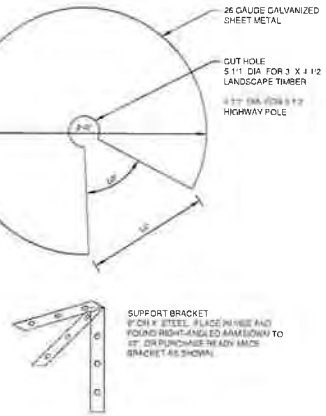


BAT HOUSE

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



WOOD DUCK, HOODED MERGANSER AND COMMON GOLDENEYE NEST BOX



CONE GUARD DETAIL

NO.	DATE	APPROV.	REVISION	NO	DATE	APPROV.	REVISION

DRAWN
CHECKED
DESIGNED

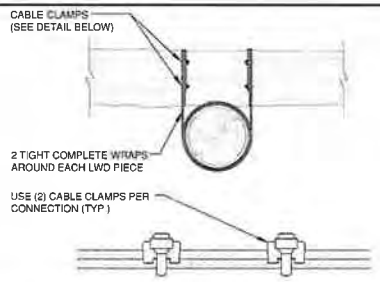
CONTRACT NO. 3775-15-01
MENEKAUNEE HARBOR RESTORATION PROJECT
CITY OF MARINETTE
MARINETTE COUNTY, WISCONSIN

MISCELLANEOUS DETAILS

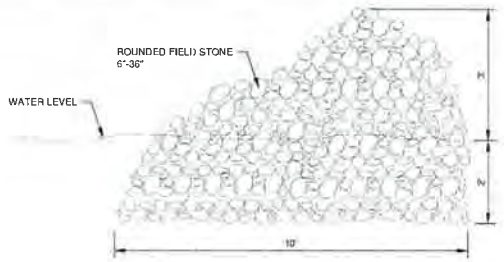
DATE
FILE
JOB NO.

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

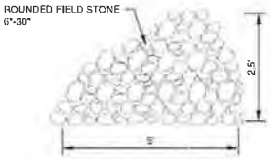
SHEET NO. 4



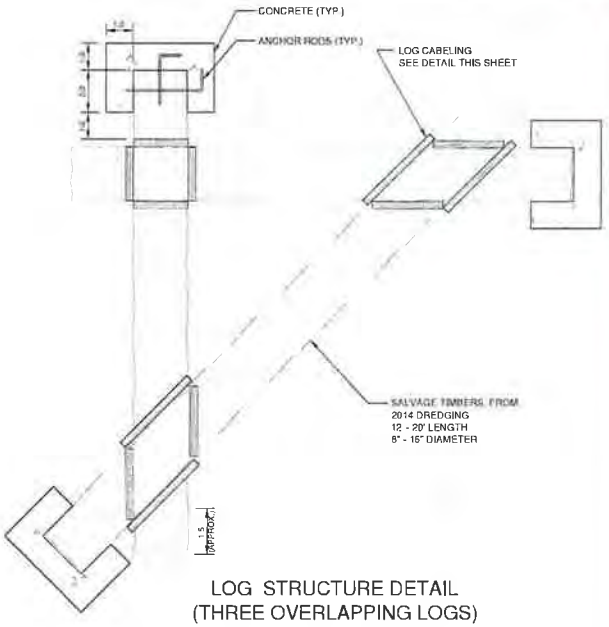
LOG CABLING DETAIL



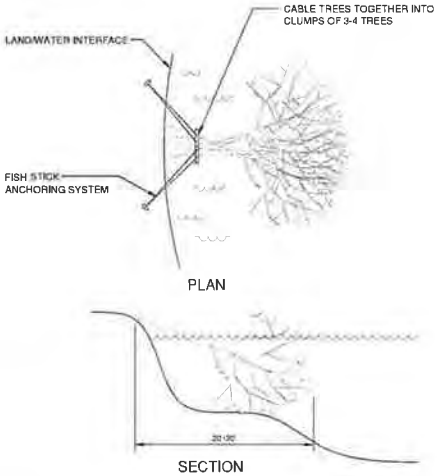
ROCK PILE IN WATER DETAIL



ROCK PILE OUT OF WATER DETAIL



LOG STRUCTURE DETAIL
(THREE OVERLAPPING LOGS)

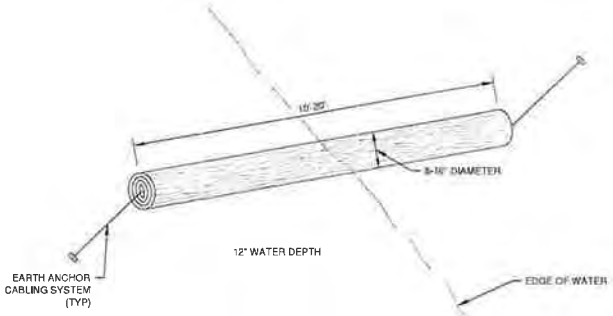


PLAN

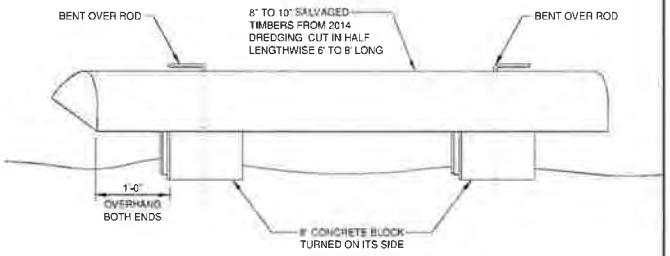
SECTION

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.

FISH STICK DETAIL



LOG SECURING DETAIL



SECTION

HALF LOG STRUCTURE DETAIL

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

DRAWN
CHECKED
DESIGNED

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

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SCALE
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JOB NO.

Robert E. Lee & Associates, Inc.
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HOBART, WI 54155
INTERNET: www.rebeinc.com
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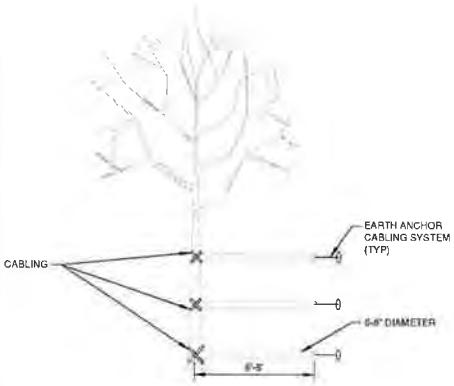
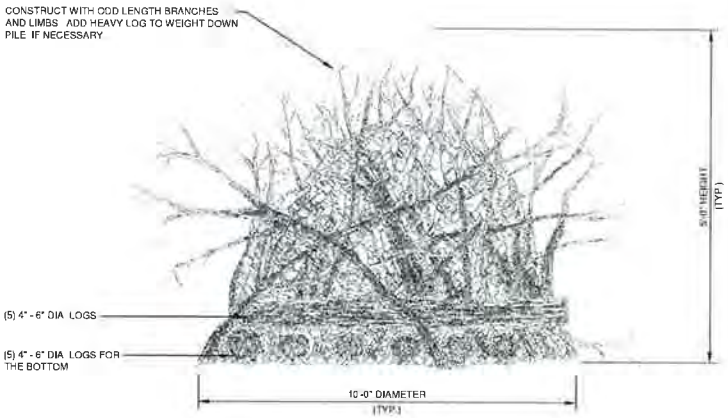
SHEET NO.
5

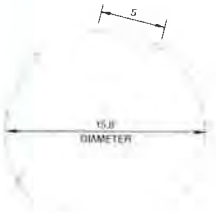


PLAN

EXISTING TREE TOP ANCHORING



BRUSH PILE DETAIL



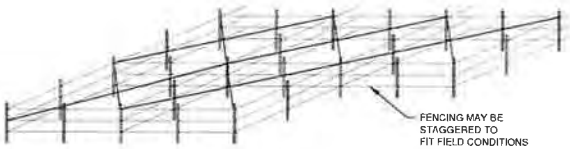
PLAN

ISOMETRIC

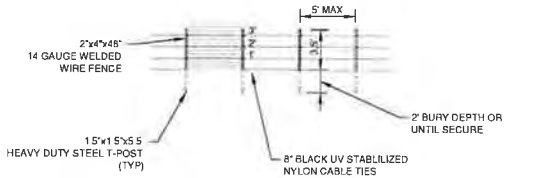
SUBMERGENT AQUATIC PLANT PROTECTION

"SAME MATERIAL AS CARP EXCLUSION FENCING"

GOOSE EXCLUSION FENCE ISOMETRIC VIEW

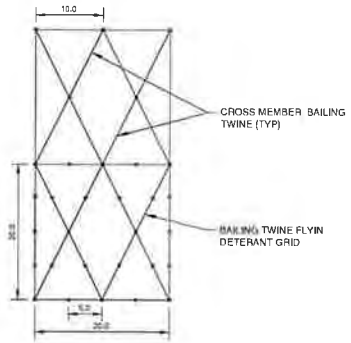


CARP EXCLUSION FENCE ISOMETRIC VIEW



CARP EXCLUSION FENCING ELEVATION VIEW

GOOSE EXCLUSION FENCING PLAN VIEW

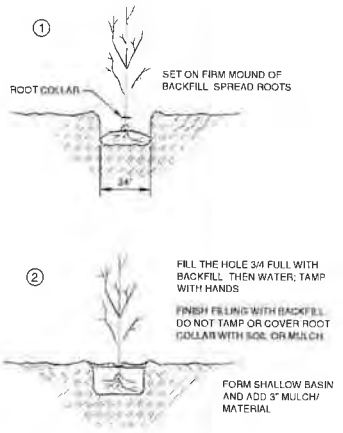


CARP EXCLUSION FENCING PLAN VIEW

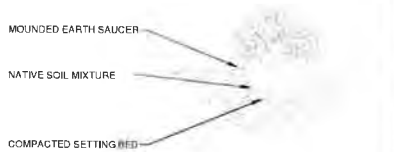
NOTE
1. GOOSE FENCING MATERIAL SHALL BE 48" GREEN SNOW FENCE
2. GOOSE FENCING POST SHOULD BE 10' APART CARP FENCING POST SHOULD BE 5' APART

CARP AND GOOSE EXCLUSION FENCING DETAIL

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

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

DRAWN
CHECKED
DESIGNED

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

MISCELLANEOUS DETAILS

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FILE
JOB NO.

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

SHEET NO. 6

G

APPENDIX G

Habitat Description and Botanical Survey Form

Habitat Description and Botanical Survey Form

Surveyor:_____ Date:_____ Sheet ___ of

Client:

A. SITE LOCATION

Site ID	T	R	S	1/4 Section
Location Description:				

B. HABITAT TYPE AND DESCRIPTION (DOMINANT SPECIES, PERCENT COVER, SOILS, ETC.):

C. PLANT LIST (* = Dominant):

Client:_____ Sheet ___ of
Site ID:

PLANT LIST CONTINUED:

D

APPENDIX D

AES – Maintenance Plan

Menekaunee Harbor Restoration Project – Marinette, WI

MAINTENANCE PLAN

Prepared by:
Applied Ecological Services

August 11, 2015

TABLE OF CONTENTS

METHODS

1. Undesirable species control

Control of undesirable plant species will be performed throughout all plant community zones within the site boundaries as shown in the plans and site map provided *(Please see Appendix C for the Site Map.)* The focus of vegetation management shall be ensuring success of the planted and seeded vegetation in all plant community zones. This will be accomplished by using an adaptive management plan. Plans often change in response to new data and derived insights. For these reasons, this plan should be viewed as being neither conclusive nor absolute. This program is a starting point in an ongoing process of restoring the site's natural processes.

When regular monitoring and maintenance begins, it will provide feedback on the plans effectiveness, and generate information to evaluate and justify the need for changes. This process of evaluation, adjustment, refinement, and change is called "Adaptive Management." Adaptive management is a tool that is fundamental to the restoration, management, and maintenance work in the management plan described below.

A minimum number of five site visits per year will be scheduled during the growing season. A minimum of two treatments (herbicide and/or mowing as required) per growing season will be scheduled. Each trip will include monitoring of all planted locations. Applied Ecological Services (AES) will supply a maintenance log (*Please see Appendix A for a copy of this log)* for each visit with a description of treatments and findings. For each trip, the Engineer will be notified a day in advance.

Main Tools for Control

Herbicide Management:

The main tool for invasive species control needed at the site will be chemical control using a backpack sprayer and/or ATV sprayer depending on site conditions. By using these setups, we will selectively spray any undesirable vegetation throughout all of the plant community zones. Undesirable vegetation to be controlled, but not limited to, is reed canary grass, purple loosestrife, giant reed grass, spotted knapweed, etc. Care will be taken in the application and selection of chemicals to avoid damage to the trees and shrubs.

At all times, AES will follow the application guidelines listed in the herbicide labels for percent solution and rates per acre, disposal, etc. Also dictated on the label are the site conditions that particular herbicide may be applied. For example, by law, RoundUp cannot be applied over water, but Rodeo can. Chemicals that will be used onsite in aquatic areas will be approved for that use. All other herbicides to be used for the control of undesirable species onsite will be approved for that use. All chemicals will be applied by Wisconsin State-licensed commercial applicators *(Please see Appendix D for the Business & Applicator Licenses)* that are certified for specific categories (i.e. 5.0 - Aquatic & Mosquito, 1.1 - Field Crops & Vegetables/6.0 – Right-of-Way & Natural Areas).

Herbicides will be mixed with water, surfactants, oils, fuels, anti-foaming agents, tackifiers, dyes, and/or drift control agents to achieve desired results as specified by the manufacturer and in accordance with all applicable regulations.

Herbicide Application Data Forms will be filled out daily as chemical control methods are utilized. The site will be posted prior/after each chemical application with WDNR treatment signs for the wet areas and AES company treatment signs for the dry areas. Two types of forms will be needed depending on site conditions. For wet areas, a WDNR Aquatic Treatment Record will be filled out. For all other areas, an AES treatment record will be filled out. *(Please see Appendix B for the Herbicide Application Data Forms.)*

The types of equipment that may be used for herbicide management are backpack sprayers, ATV sprayers, spray bottles, Tyvek chemical suits, Nitrile chemical gloves, rubber steel-toed boots, and safety glasses.

Mowing:

The need for mechanical control may be utilized to keep undesirable species at bay throughout all plant community zones to promote growth of desirable vegetation and reduce competition for the trees and shrubs.

Mowing is a physical, non-selective activity that can be effectively implemented in the early stages of the restoration activities and is most often used during the construction and restoration phases of a project. It will be an effective tool for managing undesirable weed competition around the trees and shrubs.

If mowing is necessary, it will be performed as the undesirable vegetation starts to crowd and compete with the desirable vegetation, trees and shrubs. It will them be mowed to a height of 2-10 inches using a hand weed whip, ATV mower, DR mower or an amphibious machine with mower, depending on site conditions.

The type of equipment needed will be dependent on the size of the treatment area, the water level and its location and if the owner's representative will allow a motorized piece of equipment based on conditions at the time of mowing.

Manual Controls:

Multiple hand tools may be used in place of chemical treatment or mowing depending on site conditions and treatment size of areas.

Additional Notes:

- The controlled pesticide applications at the Menekaunee Harbor Restoration Project will need an aquatic herbicide permit from the WDNR issued by an Aquatic Plant Management Coordinator. This permit will be obtained by AES yearly and a copy will be forwarded on to the owner's representative when it comes in each year. All general and specific conditions within this permit will be followed.
- AES will follow all applicable safety regulations and guidelines of federal, state, and local jurisdictions, all applicable OSHA safety regulations and guidelines, and Federal Construction Safety and Health Standards while carrying out activities related to the project.
- The following safety equipment will be available at all times onsite for personnel: first aid kit, portable emergency eyewash, chemical spill kit, fire extinguisher, Material Safety Data Sheets, and appropriate PPE.
- All handling of materials and non-native species management will comply with the guidance provided in the Wisconsin Natural Resources Code 40 (Chapter NR 40).

2. Watering

Watering to maintain the plant community zones is not expected to be necessary due to the hydric soils found on site. In drought situations, we may need to water some of the plant community zones to

maintain survivability necessary to meet the project goals. During our visits to maintain these zones, we will monitor the condition of the trees and shrubs and will schedule watering as necessary. In this instance, we will water the trees and shrubs using drip irrigation tree rings or bags and entire zone watering would be done with watering cannons. Water will be pulled from the harbor/lake or brought in via ATV's depending on site conditions.

3. Replacements

The contractor will work with the owner's representative to meet the performance standards outlined in the specifications. Replacements necessary to meet the performance standards will be determined by a joint yearly inspection conducted with the owner's representative and the contractor or otherwise as identified by the Owner. Replacements will be installed once during the 1- year warranty period within the planting periods as identified in the specifications within 30 days after written notification from the Owner's representative. Consideration for these replanting periods will be given for site conditions and weather. The contractor has the right to agree or disagree with replacements and offer alternative resolutions. Any agreed upon replacements will be installed during the next appropriate planting date as outlined in the specifications. Replacement trees and shrubs will be negotiated to determine what species are best suited for the site conditions. Some species may find the soil conditions on site to be more suitable than others and AES would like to plant more of the successful replacement species and have the option to remove replacement species that have shown poor survivability due to site conditions.

Replacements will occur:

- If less than 90% of the installed trees, shrubs, plants, and live stakes are living and healthy.
- If there is less than 75% total native vegetation coverage.
- If bare areas lager than 10 square feet exist.
- If vegetation is not in healthy condition.

Exclusions:

The contractor is not liable for replacement costs to seeds and plants damaged by extreme weather conditions (severe droughts/floods), plants not installed by the contractor, plants relocated or removed by others, acts of God, losses because of curtailment of water by local authorities, or damage by vandalism. Vegetation management is for the contracted bid items only. The contract does not include any management or guarantee for the past, current, or future addition of plantings by others throughout the

site. All care will be given in trying to avoid damage to plantings done by others. To minimize damage and increase visibility, the contractor requests flagging be installed and maintained on all plantings done by others that will be visible as the tall vegetation grows in. A location map is also requested for such plantings to be provided as a reference for the contractor. The contractor will only be liable for any contractor damage to plantings installed by others provided those plantings were flagged by the owner's representative.

4. Herbivory Fencing

Fencing of appropriate height and type to exclude herbivory grazing will be maintained in each zone that it applies to for the first full growing season. This includes the goose fencing, tree protectors, and carp fencing installed by the contractor and as directed by the owner throughout the warranty period.

REPORTING

1. Maintenance Logs

Maintenance logs will be filled out by the maintenance crews for every trip that occurs to the site, detailing specific areas and what activity occurred (herbicide treatment, mowing, watering, reseeding, replanting, herbivory fence repair, tree and shrub condition, etc.) The maintenance logs will be sent to the owner's representative/engineer within a week of the site visit.

Please see Appendix A for a copy of this log.

2. Pesticide Application Forms

All pesticide treatments will be recorded on a form, detailing the target area, type and amount of chemical used, and the target species. Maintenance crews will be recording this information. A copy of the pesticide application forms will be sent to the owner's representative/engineer within 30 days of application.

Please see Appendix B for a copy of these forms.

APPENDICES

Appendix A. Maintenance Log

MAINTENANCE LOG

Project: _____ Client: _____

By: _____ Date: _____ Time: _____

AES Project Number: _____

Undesirable Species Control:

Irrigation:

Tree/Shrub Condition:

Replacements:

Herbivory Fence:

Other:

Owner Signature: Date:

Copies: ☐ Owner ☐ A/E ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ File

Appendix B. Herbicide Application Data Forms

APPLIED ECOLOGICAL SERVICES, INC.

17921 Smith Road, P.O. Box 256 Brodhead, WI 53520
Phone: (608) 897-8641 • Fax: (608) 897-2044
Email: info@appliedeco.com

SPECIALISTS IN ENVIRONMENTAL MANAGEMENT AND RESEARCH

HERBICIDE APPLICATION DATA FORM

DATE: _____ PROJECT MANAGER: _____

PROJECT NAME: _____ PROJECT #: _____

PROJECT LOCATION: (City, State) _____

APPLICATOR(S) NAME: _____ LICENSE #'S ON BACK OF PAGE

START TIME: ____:____ END TIME: ____:____ LABOR HOURS: _____

DESCRIPTION/LOCATION OF AREA TREATED (or as indicated on map):

_____

_____

VEGETATION TREATED:

_____

_____

CAUTION SIGNAGE PLACED: ____ REENTRY PERIOD: _____ MIXED LOAD SITE MAPPED: _____

✓	Equipment Used	✓	Method Used
	Backpack Sprayer		Spot Spray
	Glove Applicator		Broadcast Spray
	Hand Sprayer		Wick Application
	Wick Applicator		Stump Treat
	Tractor Sprayer		Other:
	ATV Sprayer		Other:

PRODUCT INFORMATION

Product Name	Spray Volume	Manufacturer	% a.i.	EPA#	Amount Used	Application Rate

WEATHER CONDITIONS: DIRECTION & WIND SPEED: _____ TEMPERATURE: _____ HUMIDITY: _____

(Please check one)

CLEAR: _____ PARTLY CLOUDY: _____ CLOUDY: _____

DID IT RAIN WITHIN 12 HOURS AFTER APPLICATION? _____ YES, If so, when: _____

_____ NO

*Product Labels and MSDS sheets are available by request free of charge
Revised 2-15-07

State of Wisconsin
Department of Natural Resources
dnr.wi.gov

Aquatic Plant Management Herbicide Treatment Record

Form 3200-111 (R 11/21)

Notice: Completion of this form is a condition of the permit and provides records required by WDNR (NR 107) and DATCP (ATCP 29.21 and 29.22). The Department may not issue you future permits unless you complete and submit this form. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records Law [ss. 19.31-19.39, Wis. Stats.].

Submit this form: **(1) immediately if any unusual circumstances occurred during treatment**
(2) as soon after treatment as possible, no later than 30 days
(3) by October 1 if no treatment occurred

Completion of this form along with the permit satisfies the requirements of WDNR (NR 107) and DATCP (ATCP 29.21 and 29.22).

General Permit Information

Permit Number	Waterbody Name (including condo, e.g. Smith Pond)			
County	Permit Holder Name (Customer Name)			
Permit Holder Address		City	State	ZIP Code

Treatment Information

Treatment Date (mm/dd/yyyy)	Starting Time (24 hr)	Ending Time (24 hr)	Water Temp (°C)	Ambient Air Temp (°C)
Wind Speed (mph)	Wind Direction	Expected Duration of Chemical Residuals		

Adverse Conditions Noted (i.e., dead fish, spawning fish, algae bloom, etc.)

If adverse conditions noted, indicate corrective actions taken

Onsite Supervision Present? ◯ Yes ◯ No — If Yes, Supervisor Name

Mixing and Loading Site Location (if other than business site or from prepackaged retail container or applied with equipment with a total capacity of not more than 5 gallons liquid or 50 pounds dry)

Herbicide Treatment and Water Use Restrictions Signs Posted In Accordance With NR 107? ◯ Yes ◯ No

Applicator shall provide each customer with a free copy of each pesticide label used (if requested)

Applicator Information

Individual or Business Name			Telephone Number
Street Address			
City	State	ZIP Code	

Individuals Making Pesticide Application	Last Name	First	Certification #
	Last Name	First	Certification #
	Last Name	First	Certification #

Name of Person Completing Form	Signature	Date Signed	DNR Use Only Date Received

Sheet ____ of ____ Date ________

Aquatic Plant Management Herbicide Treatment Record

Form 3200-111 (R 11/11)

Page 2 of 2

Treatment Site and Chemical Information (attach additional sheets if necessary)

Site No, Property Name Address / Fire No	Treated Acreage	Permitted Acreage	Sensitive Area?	Latitude	Longitude	Herbicide Name: EPA Reg No.: Amount Applied	Concentration (mg/l = ppm)	Herbicide Name: EPA Reg No.: Amount Applied	Concentration (mg/l = ppm)	Herbicide Name: EPA Reg No.: Amount Applied	Concentration (mg/l = ppm)
			☐ Y								
			☐ Y								
			☐ Y								
			☐ Y								
			☐ Y								
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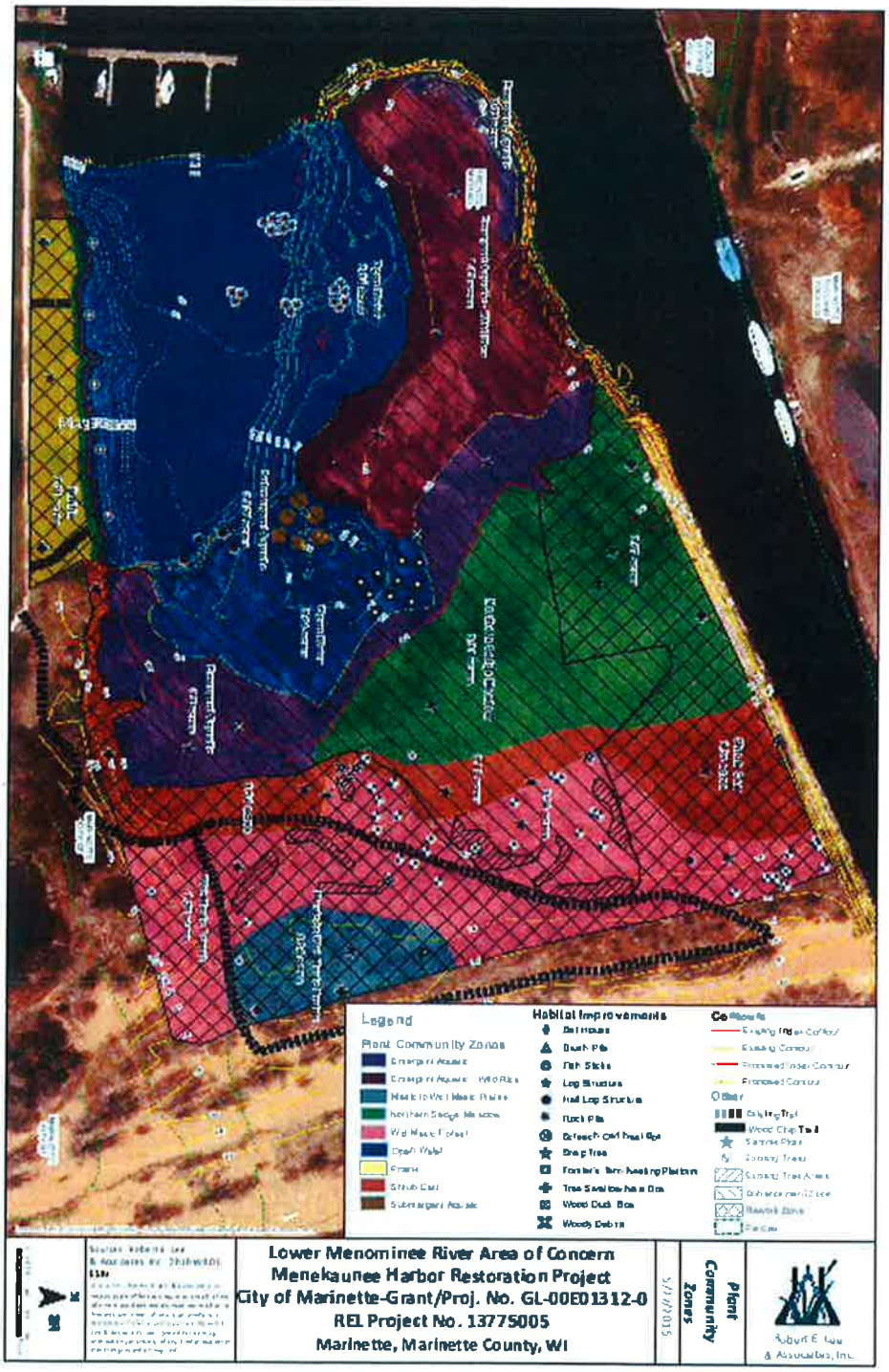
			☐ Y								
			☐ Y								
			☐ Y								
			☐ Y								
			☐ Y								
			☐ Y								
					Totals						

Aquatics at Treatment Site: TS = Target Species SP = Species Present

TS	SP		Site(s)	TS	SP		Site(s)	TS	SP		Site(s)	TS	SP	Other Aquatics	Site(s)
☐	☐	Cattail		☐	☐	Filamentous Algae		☐	☐	Planktonic Algae		☐	☐	White Stem Pondweed	
☐	☐	Chara		☐	☐	Flat-Stem Pondweed		☐	☐	Purple Loosestrife		☐	☐	Wild Celery	
☐	☐	Coontail		☐	☐	Floating-Leaf Pondweed		☐	☐	Richardson Pondweed		☐	☐		
☐	☐	Curly-Leaf Pondweed		☐	☐	Illinois Pondweed		☐	☐	Robbins Pondweed		☐	☐		
☐	☐	Duckweed		☐	☐	Large-Leaf Pondweed		☐	☐	Sago Pondweed		☐	☐		
☐	☐	Elodea		☐	☐	Northern Milfoil		☐	☐	Watershield		☐	☐		
☐	☐	Eurasian/hybrid Milfoil		☐	☐	Phragmites		☐	☐	White Water Lily		☐	☐		

Appendix C. Site Map



Appendix D. Business & Applicator Licenses

Wisconsin Department of Agriculture,
Trade and Consumer Protection
PO BOX 8911, MADISON, WI 53708-8911

NUMBER:
03-002104-019082

COMMERCIAL PESTICIDE APPLICATION BUSINESS LIC
s. 94.703, Wis. Statutes

EXPIRES:
12/31/2018

LICENSED BUSINESS LOCATION
APPLIED ECOLOGICAL SERVICES INC
W2835 DUNDAS RD
BRILLION WI

SUBJECT TO REVOCATION
AS PROVIDED BY LAW

DOING BUSINESS AS:

MAIL ADDRESS
APPLIED ECOLOGICAL SERVICES INC
PO BOX 256
BRODHEAD WI 53520

THIS LICENSE IS NOT TRANSFERABLE

POST OR CARRY AS REQUIRED BY LAW

2015 WI PESTICIDE APPLICATOR LICENSES

Last	First	License #	Exp Date	Cert. #	Category	Exp Date
Banach	Evan	298226-CA	12/31/2015	90130	1.1	3/31/2019
Campbell	Charles	149492-CA	12/31/2015	67694	1.1, 5.0	5/31/2015
deChrams	Cory	301287-CA	12/31/2015	95530	1.1	8/31/2019
Gerbyshak	Thomas	292791-CA	12/31/2015	90718	1.1, 2.0, 5.0	12/31/2017
Germano	Jeffrey	302242-CA	12/31/2015	95568	3.0	8/31/2019
Gingerich	Nathan	185254-CA	12/31/2015	70714	1.1, 5.0	5/31/2015
Kraemer	Joshua	185255-CA	12/31/2015	70715	1.1, 5.0	6/30/2016
Krogstad	Tad	287691-CA	12/31/2015	91793	1.1, 3.0, 5.0	3/31/2018
Kubichka	Aaron	146291-CA	12/31/2015	54107	1.1, 5.0	4/30/2017
LaPointe	Joshua	150789-CA	12/31/2015	69736	1.1, 5.0	6/30/2019
Solawetz	Alex	268275-CA	12/31/2015	87664	1.1, 5.0	5/31/2016
Walker	Robert	199025-CA	12/31/2015	72124	1.1, 5.0	4/30/2017

Location	WDATCP Business Lic.			Exp Date
AES - Brodhead, WI	93-002104-002104			12/31/2015
AES - Prior Lake, MN	93-017946-014832			12/31/2015
AES - Appleton, WI	93-002104-019082			12/31/2015
AES - West Allis, WI	93-002104-009727			12/31/2015