Lakeshore Invasive Species Management Area, Wisconsin Phragmites and Japanese Knotweed Management Plan

Prepared for:

Lakeshore Natural Resource Partnership, Inc.
P.O. Box 358
Cleveland, Wisconsin, 53015

Prepared by:

Stantec Consulting Services Inc.
1165 Scheuring Road
De Pere, Wisconsin 54115
Phone: (920) 592-8400

December 1, 2019

TABLE OF CONTENTS

INTRODUCTION 2

PROJECT AREA 3

THREATS TO AQUATIC ECOSYSTEMS 5

BIOLOGY AND ECOLOGICAL THREAT 5
SOCIAL, RECREATIONS AND FISCAL 6

HISTORICAL AND CURRENT CONDITION 7

MANITOWOC COUNTY 7
KEWAUNEE COUNTY 8
FOND DU LAC COUNTY 9
CALUMET COUNTY 10

HISTORICAL CONTROL ACTIONS 10

MANITOWOC COUNTY 11
KEWAUNEE COUNTY 12
FOND DU LAC COUNTY 12
CALUMET COUNTY 12

FISHERY, WILDLIFE, AND AQUATIC PLANT COMMUNITY 13

MANITOWOC COUNTY 13
KEWAUNEE COUNTY 14
FOND DU LAC COUNTY 14
CALUMET COUNTY 15

PROJECT PURPOSE AND NEED 15

MANAGEMENT OBJECTIVES 16

ALTERNATIVE AND PROPOSED MANAGEMENT ACTIONS 17

PHRAGMITES CONTROL 17
JAPANESE KNOTWEED CONTROL 18

NO MANAGMENT 19

MINIMIZATION OF ADVERSE IMPACTS 19

RESTORATION & RECOVERY 20

MONITORING AND PREVENTION STRATEGY 21

CONTINGENCY STRATEGY 22

PROJECT FEASIBILITY 22

Attachment A:

Figure 1 - Manitowoc County Treatment Areas

Figure 2 - Kewaunee County Treatment Areas

Figure 3 - Fond du Lac County Treatment Area

Figure 4 - Calumet County Treatment Areas

INTRODUCTION

On behalf of Lakeshore Natural Resource Partnership, Inc. (LNRP), Stantec Consulting Services Inc. (Stantec) has drafted this Management Plan detailing proposed treatment strategies to control target non-native invasive species along the Lake Michigan shoreline and many significant, protected natural areas within the four-county region encompassed by Lakeshore Invasive Species Management Area (LISMA). Many Wisconsin Department of Natural Resource (DNR)-owned and protected state parks, state natural areas, wildlife areas and easements fall under this plan.

Under the umbrella organization of LNRP, LISMA is a broad-based coalition that promotes efficient and effective management of invasive plant and animal species throughout a four-county region including Manitowoc, Kewaunee, Fond du Lac, and Calumet counties (the "Project Area"). Through LISMA, LNRP provides the opportunity for partners to share and leverage limited resources, raise awareness about invasive species problems, and collaboratively reduce the impact of invasive species on both public and private lands. The mission of LISMA is to educate the public and protect biodiversity and ecological function throughout the region.

LNRP and other project partners have identified goals for LISMA, which include: raising public awareness about invasive species in the Project Area; preventing their introduction and spread through early detection and rapid response; addressing known populations of invasive species utilizing Integrated Invasive Species Management methods where appropriate; considering invasive species during restoration projects; and continually working to enhance collaboration among all stakeholders. Possible partners and affiliates that will advance the proposed activities set forth in this Management Plan, include, but are not limited to:

Kewaunee County
Manitowoc County
Calumet County
Fond du Lac County
Stantec Consulting Services, Inc.
Wisconsin DNR
University/Research Partners
U.S. Department of Agriculture - Natural Resources Conservation Service (NRCS)
U.S. Fish and Wildlife Service
Partner non-profits

As part of this project, LNRP intends to target the invasive common reed grass (*Phragmites australis* subsp*. australis*), commonly referred to as *Phragmites*, and Japanese knotweed *(Fallopia japonica;* synonyms: *Reynoutria japonica, Polygonum cuspidatum)*. While *Phragmites* and Japanese knotweed are the target invasive species, this Plan applies to other invasive

species designated as Prohibited or Restricted under Wisconsin NR 40 that are currently known or have potential to occur in this region, provided they occur in areas under NR 107 jurisdiction.

Although there is a native subspecies of *Phragmites* that occurs naturally within Wisconsin wetlands, that is abundant within the Project Area, this management plan focuses on the extremely aggressive, non-native subspecies that has invaded roadsides, wetlands, and shorelines across the Great Lakes region. The spread and colonization of this species has severe consequences to native ecosystems, reduces access to recreational opportunities, degrades viewsheds and aesthetic appeal of beaches and shorelines, and has negative economic impacts including reduced property values, with an associated reduction in property tax revenues. Japanese knotweed is also a highly aggressive, invasive species that typically colonizes roadsides, railroad and other embankments, riverbanks, woodland edges, and wetlands throughout the region. Japanese knotweed forms extensive colonies of shrub-like stems up to 10 ft. tall and can aggressively outcompete native vegetation.

The objectives of this Management Plan are to: 1) update and improve the monitoring and mapping of established *Phragmites* and Japanese knotweed (and other invasive species) populations within the LISMA region; 2) establish a rapid response reporting and treatment protocol to address emergent infestations, reduce the established populations of *Phragmites* and Japanese knotweed (and other invasive species) along the Lake Michigan shoreline and inland populations within these counties (where treatment practices are not currently in place); 3) minimize the spread to un-infested areas; 4) educate and provide private landowners with the ability to control the target invasive species on their respective properties; 5) collaborate with local nonprofits, municipalities, federal and state agencies, research institutions and private individuals actively controlling *Phragmites* and/or Japanese knotweed populations to maximize efficiency; and 6) develop and expand the highly successful, sustainable, long-term control strategy initiated in Manitowoc County and replicate across the Project Area.

PROJECT AREA

The Project Area is located in the Central Lake Michigan Coastal and Southeast Glacial Plains Ecological Landscapes of Wisconsin. The four counties cover a combined area of 3,741 square miles (2,394,240 acres). At the time of the first European settlement, the area was predominately a mesic forested landscape dominated by sugar maple (*Acer saccharum*), American basswood (*Tilia americana*) and American Beech (*Fagus grandifolia*). Western portions of the Project Area are located in the Southeast Glacial Plains and were characterized by a rolling landscape with a mix of oak savanna, oak forest, prairie, and wetland. Euro-American settlers cut down forests for lumber, cleared uplands and drained wetlands to create farmland. The Central Lake Michigan Coast has suffered an overwhelming loss of mesic forest cover with only a small percentage (14% versus 96% historically) remaining. Almost all the

savanna and prairie in the Southeast Glacial Plains have been converted to agricultural use, and with scattered woodlots and wetland areas separated by cropland and pasture.

Along with loss of native forest cover, other significant vegetation changes have occurred because of hydrological disruption, fragmentation and isolation of remnant forests and open wetlands, grazing, and an increase in invasive plants and plant pathogens affecting remaining native vegetation communities. Anthropogenic activities associated with agriculture, transportation, industrial activity and commercial and residential development are the primary disturbances in the Project Area. Changes in land use have indirectly and negatively affected water quality, disturbed or eliminated habitats, altered natural disturbance regimes, and increased flood frequency due to loss of wetlands.

Agriculture is the dominant land use by area with several small and medium-sized cities and some large, forested wetlands. Current forest vegetation includes a mix of species including sugar maple, American basswood, white ash (*Fraxinus americana),* red maple (*Acer rubrum*), northern white-cedar (*Thuja occidentalis*), lowland hardwood species including green ash (*Fraxinus pennsylvanica),* black ash (*Fraxinus nigra*), swamp white oak (*Quercus bicolor*), and eastern cottonwood (*Populus deltoides*). Significant wetland ecosystems, such as marshes, wet meadows, sedge meadows, hardwood swamps, and conifer swamps, contain plants of both northern and southern distribution.

The four-county Project Area is primarily located within the Lake Michigan basin. It includes five DNR Water Management Units (WMUs): Manitowoc-Sheboygan, reaching up into southern Manitowoc County; Upper Fox in eastern Calumet and Fond du Lac counties; Lower Fox in northern Calumet County, and Twin-Door-Kewaunee in Manitowoc and Kewaunee counties. Runoff from point and non-point sources, sedimentation and nutrient-enriched runoff from agricultural and stormwater sources, contaminated lake and river sediments from industry, habitat degradation (e.g., channelization, dams, ditching, tiling and draining of wetlands for cultivation) have degraded water quality throughout much of these watersheds.

The Project Area lies along the Niagara Escarpment stretching from eastern Wisconsin through Michigan's Upper Peninsula, across Ontario, Canada, and on through the Niagara Falls in New York. The escarpment was originally deposited as lime mud on an ancient sea floor about 430 million years ago and has since undergone uplift, weathering, and erosion. It is home to over 240 different rare, threatened, or endangered plant and animal species, including northern white-cedar trees that are more than 1,000 years old, and is an important source for groundwater recharge.

Brillion, Collins Marsh, Killsnake, and Eldorado Wildlife Areas are all significant conservation areas in the inland portion of the Project Area and contain emergent marsh and wet meadow wetland communities that support many migratory birds and wildlife habitats. Killsnake and Collins Marsh support extensive areas of shrub-carr wetlands, and along with Brillion Wildlife

Area, support areas of high-quality southern hardwood swamp. Additionally, the 31,000-acre Horicon marsh is located just south of the Project Area and is a major breeding and migration stopover habitat for waterfowl. Other notable, significant State Natural Areas include Oakfield Ledge and Spruce Lake Bog in Fond du Lac County, Calumet County Park and High Cliff Escarpment State Natural Area along the Lake Winnebago shoreline, and Woodland Dunes Nature Center and Preserve, a 1,500-acre property containing hardwood and conifer forests, wetlands and prairies in Manitowoc County, are all benefited from invasive species control projects.

The WDNR owned Point Beach State Forest in Manitowoc County lies along six miles of the Lake Michigan coast. This 2,900-acre Significant Natural Area includes forest and beach wildlife habitats, campsites, picnic areas, and eleven miles of hiking/skiing trails. The Lake Michigan Shoreline has been particularly affected by aggressive, invasive species such as *Phragmites.* Approximately 35 miles of shoreline in Manitowoc County and 28 miles in Kewaunee County are addressed and protected as part of this Management Plan. Undeveloped shoreline habitats of Lake Michigan are highly significant to migratory birds and shorebirds including many endangered, threatened, and special concern species that benefit from invasive species control efforts.

THREATS TO AQUATIC ECOSYSTEMS

Biological and Ecological Threat

Invasive *Phragmites* is a perennial wetland grass introduced from Europe that grows 12—15 feet, occasionally to 20 feet tall. It is distinct from the American subspecies, and can be identified by its dulled, slightly ridged, stiff, and hollow stems and distinct purple-brown seed head with feathery plumes. *Phragmites* colonies expand via underground rhizomes and above ground runners or stolons, and can spread quickly to new areas by plant fragments that disperse by natural and human transport: in contaminated soil on construction and agricultural equipment; stem fragments (from mowing, often along highway ditches); seeds, transported by wind or in contaminated soil, that germinate readily in disturbed ground or exposed lakebeds; and via stolon or rhizome fragments, transported on water by wave action, currents, or boats. *Phragmites* has spread rapidly through coastal and interior wetlands, riparian corridors, roadside ditches and other disturbed areas within the Great Lakes basin.

Japanese knotweed has hollow, smooth, purple to green colored stems up to 1 inch in diameter. The hollow jointed stems have reddish-brown solid nodes surrounded by a papery sheath (stipule). The herbaceous stems die back to the ground each fall and the dead stalks remain standing over the winter. Numerous new stems emerge in the spring from the over-wintering root system. Japanese knotweed grows rapidly; stems can grow up to 3 inches per day. The plant can grow more than 3 ft. in height in three weeks, with the mature plant reaching full height

by the end of July. Japanese Knotweed quickly spreads and forms dense colonies by extensive underground stem (rhizome) systems which account for two thirds of its total mass. The rhizomes can extend more than 6 ft. deep and 60 ft. in length and can spread outwards at a rate of about 20 inches a year in optimal conditions. Due to this extensive underground biomass, Japanese knotweed is a very persistent plant. Stem/rhizome fragments can produce new plants within six days if they are submerged in water.

Japanese knotweed forms dense thickets of bamboo-like vegetation that aggressively outcompete native plants, and negatively impacts wetland and riparian areas. It grows in a wide range of habitats including riparian areas, wetlands, roadsides, ditches, utility right of ways and fence lines. This invasive species is often found around old homesteads where it may have been originally planted as an ornamental. It spreads along riparian areas or ditches where plant and rhizome fragments can be dispersed in moving water (i.e. along ditches, beaches, streams and rivers). Japanese knotweed can also be spread along roadsides by moving machinery or equipment with soil containing plant parts. Seeds (if produced) are spread mainly by wind.

Phragmites and Japanese knotweed form tall, dense stands that choke out native vegetation, forming monocultures that result in reduced plant species diversity and wildlife habitat quality. Dense stands are inhospitable to native birds, have lowered invertebrate densities and reduce the ecological value of shorelines. Infested stands have reduced populations of native amphibians, reptile, bird and animal species. Dense stands can also impact the hydrologic regime of wetlands by increasing evaporation and trapping sediment. Following treatment, areas occupied by invasive species can return to an increased level of ecological function and will typically be rapidly recolonized by native plants when the target species has been reduced.

Social, Recreational and Economic Impacts

The spread of *Phragmites* and Japanese knotweed in the Project Area, and throughout the region, has reduced access to beaches and riverfronts for recreational activities such as swimming and fishing, restricted lakefront views, and caused damage to walkways and structures along the beach front. The density of the infestations, which extend to the waterline, have made public beaches inaccessible. Likewise, riparian access along streams and tributaries is precluded by infestations, rendering these public waters unusable for recreational fishing and use by the general public.

Lake access is a prime contributor to the value of shoreline properties, and when blocked by invasive species, reduces property values substantially. While such losses are obviously difficult for the individual homeowner, they impact the public through loss of tax revenue, because lakefront property contributes an outsize share to local taxes.

Currently, scattered to large populations of *Phragmites* and Japanese knotweed occur on roadsides, shorelines and wetlands across the four-county region. If left untreated, scattered

small populations can develop into dense stands that are considerably more difficult to control. Control actions are needed to address large stands where native habitats have been significantly impacted by invasion. Early detection and control of small populations is critical to preventing further spread and avoid significantly greater treatment expense once large populations become established. Lake Michigan water levels have rebounded from a 14-year low period, exceeding long term average levels since 2014. Storm events can break apart rhizome masses and redistribute them along the shoreline. While historic control efforts have proven successful, new colonies are likely to propagate at increasing distances from existing infestations, and over time, untreated populations may expand and increase in density if left unchecked. Continued and diligent control efforts are needed to ensure long-term control.

HISTORICAL AND CURRENT CONDITION

Manitowoc County

Manitowoc County is located on the western shore of Lake Michigan. The County contains 589 square miles. Original vegetation maps prepared from US land survey notes indicate that Manitowoc County was primarily forested with beech, sugar maple and basswood. Parts of the County (especially near Point Beach State Forest) had a higher percentage of conifers including hemlock (*Tsuga canadensis*) and pine (*Pinus* spp.). The ridge-and-swale complex at Point Beach contains the largest area of Great Lakes coastal forest remaining within the county (with associated wetlands, dunes, and beaches) and constitutes a regionally significant repository of biodiversity.

Today's landscape, by contrast, is largely agricultural. As is common throughout southern Wisconsin, the remaining forested acres are highly fragmented, with most woods in parcels of 40 acres or less. Because *Phragmites* prefers open wetlands without canopy cover, the existing modified landscape offers ample opportunities for *Phragmites* to invade agricultural ditches, waterways and connected wetlands.

There are approximately 35 miles of Lake Michigan shoreline in the county and almost all of it is susceptible to erosion. Nearly half the lakeshore is sand and cohesive bluffs (45%), with the remainder comprised of low banks (28%) and sand beaches (23%). Approximately 4% is artificial waterfront, mostly in the City of Manitowoc. Wave action prevents the bluff and low banks from ever reaching a state of equilibrium. Wave action cuts through the slumped material at the base of the bluff, causing undercutting and eventual slumping or slope failure.

Bluff height varies from 60 feet in the southern extent at the Manitowoc-Sheboygan county line to 40 feet in north-central Manitowoc County. The steep bluffs are continuous except where interrupted by valleys containing perennial to intermittent waterways. Manitowoc County’s bluffs erode more rapidly in response to lake level, wave action and precipitation patterns than the higher bluffs found to the south. Generally, low bluffs that experience erosion at the base have

no trees and very little vegetation due to the short "cycle" time of the slope failures. The predominant slope processes of low bluffs are shallow slumps, translational slides, and face degradation.

Bluff recession rates are moderately high for much of the Manitowoc County shoreline and are between 0.7 and 1.6 feet per year. At the most northern part of the county recession rates are significant at 2.4 to 3.3 feet per year. Most of the Manitowoc County shoreline has little or no shore protection, which has resulted in a lack of vegetation due to bank slumping along a significant portion of the shoreline.

Targeted control efforts since 2013 have addressed many of the *Phragmites* populations within the county (Figure 1). Prior to 2013, *Phragmites* occurred as scattered to dense colonies along the shoreline and adjacent tributaries, as isolated pockets along inland waterways and/or wetlands and along local, county or Interstate roadways. The Interstate 43 corridor was perhaps the most infested road corridor in the county. Significant progress has been made in the county using funds from state, federal and local sources, but continued control is needed to treat new infestations where permission was not secured, early stage infestations, or support on-going control efforts for challenging or large treatment sites. Eradication is possible for many of the treatment sites, but diligent and repeated efforts to locate and treat resprouts is needed to sustain control efforts long term. Japanese knotweed is located in scattered locations throughout the county.

Kewaunee County

Kewaunee County is located on the western shore of Lake Michigan, just north of Manitowoc County, and has a small extent of frontage along the eastern shore of Green Bay. The County contains 343 square miles and 28 miles of Lake Michigan shoreline. Historic vegetation included maple-basswood-beech forest, hemlock-hardwood forest, northern white-cedar swamp, hardwood-conifer swamp, wet meadows, and coastal marshes. Conifer dominated upland forests that resemble the boreal forest were present along Lake Michigan and contained a significant component of white spruce (*Picea glauca*) and balsam fir (*Abies balsamea*). Emergent marshes and wet meadows were common in and adjacent to Green Bay, while Lake Michigan shoreline areas featured beaches, dunes, interdunal wetlands, marshes, and highly diverse ridge and swale vegetation. Small patches of prairie and oak savanna were present in the southwestern portion of this landscape.

Existing vegetation in this area consists of predominately agricultural crops, with smaller amounts of grassland, wetland, shrubland, and urbanized areas. Forested lands are dominated by maple-basswood, with smaller amounts of lowland hardwoods, aspen-birch, and lowland conifers. Because of the frequent wetlands lacking canopy cover in the county, the existing modified landscape offers ample opportunities for *Phragmites* to invade agricultural ditches, waterways and connected wetlands.

Currently, the target invasive species occur as scattered to dense colonies along the shoreline and adjacent tributaries, as isolated pockets along inland waterways and/or wetlands and along local, county or Interstate roadways. Major road corridors, particularly WI-42, WI-29, WI-54, and WI-57, are where most populations of *Phragmites* have been identified in Kewaunee County. Many *Phragmites* populations have also been recognized near waterways, especially along the Kewaunee River and other streams including Rio Creek, Black Creek, Silver Creek and Tisch Mills Creek. A few scattered Japanese knotweed populations have been identified in this county with most of the populations in the northeast part of the county. The current, manageable amount of these aggressive, invasive species makes it an ideal time for effective control in Kewaunee County.

Fond du Lac County

Fond du Lac County is located on the southern shore of Lake Winnebago with an area of 719 square miles. The County lies within two Water Management Units (WMU), the Upper Fox Basin and Manitowoc Basin, and within the Southeast Glacial Plains Ecological Landscape. This Ecological Landscape covers a large portion of southeastern and south-central Wisconsin. It is also home to some of the world's most unique glacial landscapes such as drumlins, eskers, kettle lakes, kames, ground and end moraines.

Historically, Fond du Lac County was a mix of prairie, oak forest, and oak savanna, and maple-basswood forests. Wetlands, including wet-mesic prairies, southern sedge meadows, emergent marshes, calcareous fens, and tamarack swamps were also common. Expansion of agriculture and urban environments drastically changed the ecology of the landscape. Current vegetation consists primarily of agricultural cropland, willow, soft maple, box-elder, ash, and elm, large acreages of marsh and wet meadow. Emergent marsh dominated by cattails and mixed broad-leaved sedges, degraded wet meadows dominated by reed canary grass, forested wetlands, and shrub swamps are the most common wetland communities.

Phragmites populations are most dense along the I-41, US-151, and WI-23 corridors surrounding the City of Fond du Lac. The Eldorado Marsh Wildlife Area, a WDNR owned property in central Fond du Lac County, is a significant wetland community severely disturbed by invasive species such as *Phragmites*. Infested waterways include Sevenmile Creek in the western part of the County and the Lake Winnebago shoreline in the north-central part of the County.

Currently, few Japanese knotweed populations have been identified in Fond du Lac County and are confined to the City of Fond du Lac. Like Kewaunee County, the amount of Japanese knotweed at present makes it the ideal time for control.

Calumet County

Calumet County is located on the eastern shore of Lake Winnebago atop the Niagara Escarpment, and has total area of 318 square miles. Prior to settlement, Calumet County was primarily forested. Upland mesic forests including sugar maple, basswood, and white ash dominated the vegetation. Uplands included oaks, hickory, ash, and other hardwoods. In lowland swamps, black and green ash, elm, soft maple, swamp white oak, white cedar, and tamarack were common. Remaining woodland areas include DNR owned public lands, including the Brillion, Killsnake, and Kiel Marsh Wildlife Areas, Stockbridge Ledge Natural Area, and High Cliff State Park. Due to draining or filling, the total area of wetlands in the county is less than half of what it was in the mid-1800's. The historical loss of wetlands has resulted in negative impacts to other natural resources such as loss of habitat, flooding, stream bank erosion, and degraded surface water and groundwater quality.

Current vegetation in Calumet County is predominately agricultural with about 13% of the land in woodland and another 13% wetland. The County is home to four state owned park and recreation sites including High Cliff State Park, Brillion State Wildlife Area, Killsnake Marsh State Wildlife Area, and Kiel Marsh State Wildlife Area.

Phragmites populations in Calumet County have been mainly identified along road corridors such as US-10, County Rd E, WI-57 and WI-55. Spring Creek running through the City of Brillion and the Lake Winnebago shoreline in the western part of the County have several known *Phragmites* populations as well. Areas in and surrounding the Brillion and Killsnake Wildlife Areas on the border of Calumet and Manitowoc Counties are *Phragmites* hotspots and likely significant vectors for spreading invasive species between the two counties.

Identified Japanese knotweed populations in Calumet County are found in the City of Chilton and scattered populations between the Lake Winnebago shoreline to the west and WI-32 to the east. The densest populations are found in the northwestern portion of the county particularly along the Lake Winnebago shoreline.

HISTORICAL CONTROL ACTIONS

Historical control actions for *Phragmites* and Japanese knotweed within the four-county area are depicted on Figures 1—4 and can be viewed in more detail on the linked web map: http://bit.ly/InvasiveWebMap.

Manitowoc County

Since 2007, LNRP and partner organizations have been pioneers in *Phragmites* and Japanese Knotweed management in the area. The following summarizes control projects in the county, which are also displayed on Figure 1:

- Woodland Dunes Nature Center and Preserve treated *Phragmites* within and adjacent to their property from 2007 to 2018. The East Twin River and West Twin River were a primary focus of their efforts, which were funded by the WDNR.
- LNRP received state funding to treat *Phragmites* within the City of Manitowoc park properties adjacent to the Little Manitowoc River. State funding was used to treat *Phragmites* from 2013-2015.
- UW-Green Bay treated *Phragmites* at their Kingfisher Farm natural area along the Lake Michigan shoreline. Several adjacent individual landowners also manage their infestations. Private property initiatives are important but represent only a small fraction of the Lake Michigan shoreline.
- In 2013, LNRP and partners collaborated on a treatment along one mile of contiguous, private Lake Michigan shoreline properties in Newton. This treatment was intended to establish the effectiveness of treating infestations in differing beach and bluff conditions, as well as to alert landowners to the problems of invasive species and the intended remedial efforts.
- In 2015 LNRP received WDNR funding to treat the six-mile segment of Lake Michigan shoreline within the Point Beach State Forest. Follow-up treatments occurred in 2016 and 2017.
- In 2015 LNRP received WDNR funding to treat a significant portion of the Lake Michigan shoreline where landowner permission was granted. Follow-up treatments in 2016 focused on approximately nine miles of shoreline within the City of Two Rivers and City of Manitowoc. Follow-up treatments occurred in 2016 and 2017.
- In 2017 and 2018, NRCS treated roughly 100 patches of *Phragmites*, totaling about 50 acres, on 8 parcels of land enrolled in NRCS conservation programs across Manitowoc and Calumet counties.
- In 2017, LNRP received WDNR funds to control *Phragmites* in the near lakeshore townships of Centerville, Newton, Manitowoc Rapids, Two Rivers, Two Creeks and Mishicot. Treatments were performed from 2017 to 2019 on all participating parcels.
- In 2017, LNRP was awarded federal funding to control *Phragmites* across all of Manitowoc County. First year or follow-up control was performed in 2018 and 2019 on all participating parcels.
- In 2019, LNRP received WDNR funds to control *Phragmites* in the western townships of Cooperstown, Gibson, Maple Grove, Franklin, Kossuth, Rockland, Cato, Eaton, Liberty,

Schleswig and Meeme. Treatments were performed in 2019 and will continue as funding allows.

- In 2019, LNRP received federal funding to perform follow-up control on all treatment sites in Manitowoc and Sheboygan counties. Treatments will occur during the growing seasons in 2020 and 2021.

In addition to the treatments listed above, LNRP hosts annual educational trainings, workshops, and provides landowners with updates on treatment progress. All treatment areas are monitored each year using GIS mapping data on a web-enabled ArcGIS platform (web-map), which manages treatment information, restoration success and other Project information.

Kewaunee County

In 2018, The U.S. Environmental Protection Agency awarded the Bay-Lake Regional Planning Commission nearly $600,000 in Great Lakes Restoration Initiative (GLRI) funding to manage at least 1,000 acres of invasive *Phragmites*, wild parsnip and Japanese knotweed in Kewaunee County. Beginning in summer 2019, this two-year control program expands upon work initiated by Bay-Lake along the Green Bay shoreline.

Kewaunee County has many treated *Phragmites* populations (Figure 2) along County roads such as WI-42, WI-54, WI-29 and WI-57, the Green Bay shoreline, as well as scattered populations throughout the county. Few dispersed populations of Japanese knotweed have been identified in Kewaunee County with most receiving previous treatments.

Fond du Lac County

Road corridors such as I-41, US-151 and US-45 surrounding the City of Fond du Lac and along the Lake Winnebago shoreline have been previously treated, where heavy concentrations of *Phragmites* have been identified (Figure 3). Scattered *Phragmites* throughout the County have also been targeted for treatment in the past. There are no identified Japanese knotweed populations that have been previously treated in Fond du Lac County.

Calumet County

Some *Phragmites* populations in the Cities of Chilton and Brillion have been previously treated as well as along many road corridors such as US-10, US-151, and WI-55 (Figure 4). Scattered *Phragmites* populations throughout the County have also been targeted for treatment in the past. There are no identified Japanese knotweed populations that have been previously treated in Calumet County. In 2017 and 2018, NRCS treated roughly 100 patches of *Phragmites*, totaling about 50 acres, on 8 parcels of land enrolled in NRCS conservation programs across Manitowoc and Calumet counties.

FISHERY, WILDLIFE, AND AQUATIC PLANT COMMUNITY

Manitowoc County

The Manitowoc-Sheboygan watershed covers all of Manitowoc County, and portions of adjacent Sheboygan, Calumet, Brown, Kewaunee, Milwaukee and Ozaukee counties. Totaling 1,652 square miles, the Manitowoc-Sheboygan Watershed includes the Branch River, the North and South Branches of the Manitowoc River, the Lower Manitowoc River, Sevenmile and Silver Creeks (all in the Manitowoc sub-watershed), Sauk and Sucker Creeks, the Black River, the Sheboygan River, the Onion River, the Mullet River, and the Pigeon River (in the Sheboygan River sub-watershed). Runoff from specific and diffuse sources, contaminated sediments, habitat degradation (e.g., channelization, dams) have degraded water quality throughout the watershed. The 2018 Wisconsin DNR list of impaired waters under 303(d) of the Clean Water Act in Manitowoc County include the Branch River, Manitowoc River, Lake Michigan, Bullhead Lake, Calvin Creek, Carstens Lake, English Lake, Gass Lake, Harpt Lake, Hartlaub Lake, Meeme River, Molash Creek, Mud Creek, Pine Creek, Silver Creek, Silver Lake, Two Rivers Harbor, West Twin River, Weyers Lake, and the Pigeon River.

Some streams throughout the watershed support trout populations and have spring and fall runs of stocked steelhead and salmon. Other fishing opportunities exist in rivers and harbors for northern pike, smallmouth bass, and yellow perch. Portions of the following waterbodies within Manitowoc County are listed as impaired according to an EPA 2006 report: Branch River, Bullhead Lake, East Twin River, West Twin River, Manitowoc River, Pigeon Lake, Warm Water Beach, Two Rivers Harbor and several beaches along Lake Michigan (YMCA Beach, Point Beach State Forest Beach, Red Arrow Park Beach, Memorial Drive Wayside Beach, Neshotah Beach, Fischer Park Beaches and Hika Park Bay).

Characteristic wildlife includes white-tailed deer, ring-necked pheasant, waterfowl, Canada geese, gray and flying squirrels, raccoons, woodcock, a variety of hawks, songbirds, and shorebirds. The National Heritage Inventory has documented 10 endangered, 20 threatened, and 37 special concern plant and animal species, and 24 rare aquatic and terrestrial communities within the Manitowoc-Sheboygan Watershed. Migratory birds utilize Manitowoc County's large wetland areas that provide habitat for numerous amphibians, reptiles, and fish.

The Nature Conservancy has identified critical habitats of Black Ash – Mixed Hardwood Swamp, Great Lakes Dune Pine Forest, Great Lakes Hemlock – Beech – Hardwood Forest, Great Lakes Beachgrass Dunes, and Great Lakes Beach as well as baymouth/barrier beaches with sand near the shore at Point Beach State Forest. In addition, Pitcher's Thistle and the Piping Plover have been identified as critical species at Point Beach State Forest.

Kewaunee County

Kewaunee County is home to the Door-Kewaunee Watershed in the northern two thirds of the County and the Manitowoc Watershed in the southern third of the County. The County is bordered by Green Bay to the west and Lake Michigan to the east with all waterbodies draining into Lake Michigan. Like several counties in the area, urban and agriculture expansion in the past several decades have degraded water quality in many of the County's waterbodies. The 2018 Wisconsin DNR list of impaired waters of Kewaunee County include: Green Bay, Kewaunee River, Neshota River, School Creek, Stony Creek, Casco Creek, East Alaska Lake, East Twin River, Jambo Creek, Krok Creek, Red River, Silver Creek, and Black Creek.

Extensive agricultural lands across the county have created a productive habitat for white-tailed deer and wild turkey. Migratory birds utilize Kewaunee County's large wetland areas which provide habitats for numerous amphibians, reptiles, and fish. Kewaunee County is also home to the federally-threatened northern long-eared bat and the federally-endangered Hine's emerald dragonfly. Thirty-seven rare animal species are known from the Door-Kewaunee watershed including one State Endangered (also Federally Endangered), two State Threatened, and 34 Special Concern species. Twenty-two rare plant species are known including two State Endangered, three State Threatened (one of which is Federally Threatened), and 17 Special Concern species. Rare terrestrial snails, some of which found on the Niagara Escarpment and nowhere else in the world and date back to the last Ice Age, are also found in this County.

Fond du Lac County

Like surrounding counties, agriculture and urban expansion has severely degraded water quality in the waters of Fond du Lac County. The 2018 Wisconsin DNR list of impaired Waters for Fond du Lac County include: Kiefer Creek, West Branch Rock River, West Branch Milwaukee River, Anderson Creek, Campground Creek, De Neveu Creek, East Branch Fond Du Lac River, Fond Du Lac River, Forest Lake, Mauthe Lake, Mosher Creek, Mosher Creek, Parsons Creek, Sevenmile Creek, Silver Creek, South Branch Rock River, West Branch Fond Du Lac River, Willow Creek, South Branch Rock River, and the Grand River.

Southern Fond du Lac County is home to a portion of the US Fish and Wildlife Service's Horicon Marsh National Wildlife Refuge. Horicon Marsh offers habitat for almost three hundred fifty species of birds including herons, egrets, and numerous songbirds. White-tailed deer and other small game animals are abundant, as well as hundreds of thousands of Canada geese for which the marsh is a major staging area for migration. Migratory birds utilize Fond du Lac County's large wetland areas that are homes for numerous amphibians, reptiles, and fish. The Eldorado Marsh Wildlife Area situated west of the City of Fond du Lac is a 6,000-acre, State-owned property containing important wildlife habitats. The wildlife area consists of significant

expanses of wetland, small oak openings, shrub land, grasslands and agricultural land. The West Branch of the Fond du Lac River flows through the wildlife area.

Fond du Lac County is home to the federally-threatened Northern long-eared bat, and the federally-endangered Rusty patched bumble bee. Many rare animal and plant species are known from the county.

Calumet County

Calumet County falls entirely within the Lake Michigan Basin, within four sub-basins (Upper Fox River Basin, Lower Fox River Basin, Sheboygan River Basin, and Lakeshore Basin), and two ecological landscapes (Southeast Glacial Plains and Central Lake Michigan Coastal). Pollutants like fertilizer, animal waste, and other runoff from both agricultural and urban sources have degraded water quality over time. According to the 2018 Wisconsin DNR list of impaired waterbodies, impaired waters in Calumet County include: the East River, Plum Creek, Becker Lake, Jordan Creek, Killsnake River, Mud Creek, North Branch Manitowoc River, Pine Creek, Round Lake, South Branch Manitowoc River, Boot Lake, Garners Creek, Kankapot Creek, and Lake Winnebago.

The various vegetative communities in Calumet County provide habitat for several upland and wetland wildlife species. White-tail deer and wild turkey are common in the areas of cropland. Migratory birds utilize Calumet County's large wetland areas that are habitats for numerous amphibians, reptiles, and fish. Additionally, Lake Winnebago and connected lakes support the largest self-sustaining population of lake sturgeon in the world. Calumet County is home to the federally-threatened Northern long-eared bat, an experimental population of whooping cranes. Many rare animal and plant species are known from the county.

PROJECT PURPOSE AND NEED

The purpose of treating invasive *Phragmites* and Japanese knotweed in the LISMA region is to conserve healthy shorelines and surface waters for the recreational enjoyment of the public; to sustain a thriving regional economy and a quality of life made possible by a clean and healthy environment; and to protect and enhance waterways, shorelines and wetland habitats for vibrant plant and animal communities.

The non-native subspecies of *Phragmites* and Japanese knotweed are recently established species within the past few decades. Efforts to prevent their establishment and spread within the Lake Michigan basin will help prevent many of our inland lakes and wetlands from encountering the problems related to serious infestations of Great Lakes shorelines, such as those occurring along the shore of the Bay of Green Bay in Brown, Oconto and Marinette counties.

The most cost-effective way to address invasive species treatment is to prevent the spread and establishment of large and dense infestations. Because invasive species are already establishing within these counties, management programs to monitor and minimize their spread are necessary. Monitoring and mapping efforts to date by several project partners (Figures 1-4) have increased awareness of the problem and demonstrated the need for coordinated, large scale-treatment initiatives.

The proposed control efforts are consistent with other management plans adopted for the region. The following are management plans and/or reports applicable to the project area which address the need for removal of exotic/problem species:

- Wisconsin's Wildlife Action Plan recommends: management of Great Lakes beach and dune habitat as part of a vegetation mosaic that includes forested ridge and swale, interdunal wetland, shrub-carr, and swamp conifer forest with older age classes. Promote concentrated public access points, limited recreational activities in areas where Species of Greatest Conservation Need (SGCN) are present (particularly during breeding seasons), protecting site hydrology, and **early detection and management of invasive exotic species**.
- WI DNR "State of the Lakeshore Basin" (2001)
- EPA - Great Lakes Restoration Initiative Action Plan III (2020-2024)
- WI DNR – "Wisconsin's Nonpoint Source Program Management Plan" (FFY 2016-2020)
- WI DNR – Wisconsin Aquatic Invasive Species (AIS) Management Plan (2018)
- Fond du Lac Resource management - 2008 Integrated Resource Management Plan
- Fox-Wolf Watershed Alliance - Lake Management Planning Project – August 2018 update
- Calumet County Year 2025 Comprehensive Plan (2006-2025)
- Manitowoc County 20-Year Comprehensive Plan (2010-2030)
- Kewaunee County 20-Year Comprehensive Plan Update (2016-2036)
- Fond du Lac County Land and Water Resource Management Plan (2018-2028)

MANAGEMENT OBJECTIVES

The objective of *Phragmites* and Japanese knotweed management is to reduce populations to manageable levels and minimize spread to previously un-infested areas. Landowners or property managers (e.g., private owners, local municipalities, land trusts, and WDNR) will be

encouraged to fully participate in the treatment on their respective properties so that finite resources can be allocated elsewhere. To achieve this goal, all *Phragmites* and Japanese knotweed identified within areas prioritized for management (i.e., lakeshore and select inland waterways and adjacent wetlands) shall be targeted for consecutive years of treatment, pending landowner approval.

ALTERNATIVE AND PROPOSED MANAGEMENT ACTIONS

Phragmites Control

Chemical Control

There are several methods of chemical (herbicide) control that are label-approved for use in aquatic habitats. Methodologies differ in the mode of application of the chemical agent to the plant and may require mechanical removal of plant material in preparation for application.

Ultra-low volume cut stump application is an effective method that may be appropriate for small, low density stands. Individual stems are cut, and a small amount of herbicide is applied to the cut stems. This chemical method poses one of the lowest levels of risk to non-target plants but has the highest labor costs per unit area. It is appropriate for use in the most sensitive areas where chemical volume must be minimized, such as near known populations of rare or protected plants or animals.

Foliar application is a highly effective method for controlling invasive *Phragmites* and is used in several different treatment methodologies. Recommended foliar application techniques include low volume spraying using backpack sprayers, UTV (Utility Task Vehicle) mounted boom sprayers, or a UTV- or boat-mounted spray gun; and ultra-low volume wick application using backpacks.

Low volume spray application via backpack, boom or spray gun poses an increased risk of non-target plant damage and somewhat higher materials costs relative to other methods; however, it allows for treatment of large and dense infestations with greatest efficiency and lowest cost per unit area. This method is most appropriate for areas with dense infestations that typically have low plant diversity due to competitive exclusion of native vegetation.

Ultra-low volume wick application via backpack or UTV-mounted wick combines a reduced risk of non-target plant damage with a highly targeted and effective delivery of chemical. Wicking applies chemical directly to the leaves of invasive *Phragmites* through direct contact with the wick, using a higher concentration of chemical than used in spray application. Wicking reduces impacts to non-target native plants that may be damaged by foliar spray application. Wicking can be used effectively in stands of low- to moderate-density *Phragmites*, as is the case in many shoreline populations, and is especially well-suited to use in sensitive areas where off-

target damage can be minimized, such as near known populations of rare or protected plants or animals.

Mechanical Control

Mechanical control techniques include mowing and burning. Mowing and/or burning alone will not control invasive *Phragmites* which re-sprouts vigorously after mowing; rather, mechanical control can be an effective preparation for chemical application. Mowing is most effective on large, dense stands in areas that permit access for a UTV- or tractor-mounted deck mower; small areas may be mowed with a handheld brush cutter. Burning may be used to prepare areas of *Phragmites* for chemical application; as well as promote regeneration of native herbaceous vegetation, suppress woody vegetation, and remove thatch and woody debris. Prescribed burning must be carefully planned and conducted by trained professionals. Burning may be advised in certain situations where mowing is impractical, and typically requires higher unit costs. Mechanical control methodologies are an option that may be implemented on a limited basis.

Biological Control

There is currently no biological control available for use on *Phragmites,* which appears to be resistant to damage from native fungal pathogens and insects.

Japanese knotweed Control

Control of Japanese knotweed is difficult and typically requires a combination of mechanical and chemical methods over a period of two or more growing seasons of treatment.

Mechanical Control

To effectively control established populations, mechanical control should be conducted twice during the growing season: in late spring, when the shoots reach 3 feet in height; and again, in late summer, when the plants flower. Mowing of large populations on areas permitting equipment access can be accomplished with a UTV- or tractor-mounted deck mower; small, steep or inaccessible areas may be mowed with a handheld brush cutter. Cut material can be scattered and laid flat onsite. Burning may be utilized in Japanese knotweed control as part of an overall land management approach, but typically requires higher unit costs than mowing.

Chemical Control

Chemical control is applied in the fall, following the second (late summer) mowing. Several methods of chemical application and several herbicide products may be used effectively. Products effective on Japanese knotweed, available in formulations that are approved for wetland use, include aminopyralid, imazapyr, glyphosate, triclopyr and 2, 4-D.

Ultra-low volume cut stump application is an effective method of control that may be appropriate for small, low density stands. A small volume of herbicide with a high concentration of active ingredient is applied to the individual cut stems, directly following mechanical treatment. This chemical method poses one of the lowest levels of risk to non-target plants but has the highest labor costs per unit area. It is appropriate for use in the most sensitive areas where chemical volume must be minimized, such as near known populations of rare or protected plants or animals.

Foliar application is a highly effective method for controlling Japanese knotweed and is applied when the re-sprouts reach 3 feet in height following late summer mechanical treatment. Herbicide is applied to the leaf surfaces until fully wetted. Recommended foliar application techniques include low volume spraying using backpack sprayers, UTV mounted boom sprayers, or a UTV-mounted spray gun.

Low volume spray application via backpack, boom or spray gun poses an increased risk of non-target plant damage and somewhat higher materials costs relative to other methods; however, it allows for treatment of large and dense infestations with greatest efficiency and lowest cost per unit area. This method is most appropriate for areas with dense infestations that typically have low plant diversity due to competitive exclusion of native vegetation. Foliar treatment is likely to be the most efficient treatment for most well-established populations of Japanese knotweed.

Biological Control

There is no available biological control for Japanese knotweed.

NO MANAGMENT

Failing to manage invasive *Phragmites* and Japanese knotweed populations would lead to increased degradation and loss of wetland and shoreline habitat within Manitowoc, Kewaunee, Fond du Lac, and Calumet counties, and would allow continued expansion and spread from existing populations to new areas. Failure to manage invasive species would be inconsistent with the shared interests and values of project partners and the community, to preserve and enhance the aesthetic and functional values of coastal resources, waterways and wetlands of this region.

MINIMIZATION OF ADVERSE IMPACTS

Potential adverse impacts resulting from chemical treatments include herbicide impacts to non-target plant species and creating temporarily unvegetated areas that could provide a niche for invasion by other invasive species. Herbicide drift will be minimized by utilizing best management practices and following the label instructions for the herbicide. Herbicide applications shall be timed to maximize favorable weather conditions. To mitigate drift and potential non-target impacts, herbicide shall not be applied during high winds, or as deemed

unsuitable by a qualified, certified applicator. Other weather conditions that influence herbicide effectiveness include temperature, moisture, and humidity. Warm conditions are usually favorable for chemical application, although hot, dry conditions can slow plant metabolism and can make plants less susceptible to the herbicide. The length of time required between herbicide application and rainfall, referred to as the rainfast period, varies for different herbicides; the qualified applicator will also refer to the product-specific label for guidelines.

Seeding native plants subsequent to treatment will be conducted on an as-needed basis. These invasive species are highly aggressive, clonal species with no natural predators in North America. Removing large monocultures of *Phragmites* and Japanese knotweed in accordance with the proposed control actions listed above could create areas of bare ground that may be prone to erosion. For this reason, the need for native species plantings will be evaluated for larger treatment areas and may depend on factors such as topography, slope, hydrology, susceptibility to erosion, water levels, accessibility, existing plant community, and potential for success. Post treatment management will follow BMPs and adaptive management strategies. Monitoring of the treatment/seeded sites will occur each year to determine progress and make adjustments as needed.

RESTORATION AND RECOVERY

The proposed treatment strategies will result in new areas of exposed substrate that may be recolonized by native vegetation or return to a more dynamic state of exposure to the physical forces of wind and water. The root structure characteristic of long-established *Phragmites* and Japanese knotweed typically will decay three years after treatment.

The general timeline will include:

- Year 1 - monitoring and mapping to assess invasive population site characteristics, site preparations, and subsequent treatments during the appropriate time period;
- Year 2 – monitoring, post-treatment preparations (i.e., mowing, burning) and second year treatments; and
- Year 3 – monitoring, final treatment and restoration when appropriate.

It is anticipated that many areas will have minor regrowth (+/- 10%) following the first treatment period. Therefore, treatments during Years 2 and 3 will include control of modest regrowth, and the level of effort is expected to be less than during the first year.

The need for restoration will depend upon site characteristics, treatment methods and treatment success, and will be evaluated on a case by case basis. Treatment methods utilizing the wicking method are expected to have minimal impact on short-stature vegetation and other non-target plants, so the need for restoration may be minimal. Foliar application of small invasive

species stands using back-pack sprayers or a UTV-mounted spray gun may also not require restoration given the small treatment zone.

Treatment of medium-large invasive species stands with non-target plant damage, where steep or unstable slopes occur, or where large areas of bare soil result, may benefit from restoration and reseeding. Restoration needs will depend upon site characteristics such as hydrology, community types, other invasive species pressure, seedbank response and adjacent vegetation and landowner preferences. An appropriate seed mix designed by plant community will be developed and installed according to site conditions. Native seed mixes generally contain a diverse mixture of sedges, grasses and forbs. Native seed installation shall occur during the fall dormant season or during the spring native seeding window. Seed mixes shall be installed using a no-till native seed drill or by broadcast methods with an appropriate cover crop to reduce erosion and suppress undesirable seed germination. Pending nursery availability and budget, live plugs may be used to supplement the native seed mixes.

If the restoration and recovery phase of the treatment protocol falls beyond the three-year treatment period, these efforts will be assigned to individual landowners and to partner organizations on their respective properties. Landowner education is critical to long-term invasive species control.

MONITORING AND PREVENTION STRATEGY

Control of existing populations of invasive *Phragmites* and Japanese knotweed, and preventing spread to new areas, will depend on coordination, collaboration and communication among project partners, landowners, land managers, and the public. As mentioned previously, landowners will be encouraged to fully participate in the treatment of invasive species on their respective properties so that finite resources can be allocated elsewhere. It is expected that landowners will have varying abilities and interest in participating in this project, but through education, the project partners will work to increase public awareness of the problem and provide the necessary resources for landowners to take responsibility for treating on their property.

LNRP developed a GIS based web-map specifically for this project. The web-map is used for streamlining data management, communication, progress tracking, and planning. Data layers are project-specific and include mapped locations of existing *Phragmites* and Japanese knotweed populations, treatment areas, and landowner parcels. The web-map is a useful tool that enables tracking and administering a complex project and maintaining a dynamic database that is accessible to project partners and will be continuously updated in real time by project staff across mobile and desktop interfaces. The web-map will be used to track on-the-ground efforts, manage progress of field crews, perform quality control of recorded data, update parcel access status when new permissions are received from landowners, assign treatment areas to field crews, record field data and treatment status, and manage herbicide treatment records.

This web-map has proven effective in managing the control efforts to date and will facilitate implementation across the larger LISMA Project Area.

CONTINGENCY STRATEGY

Monitoring of the treatment areas will be an important component of the long-term management strategy. Monitoring pre- and post-treatment will be coordinated and completed by LNRP, with assistance from partner organizations, landowners and volunteers. Monitoring protocols will be established, and efforts reported to the appropriate partner organizations to facilitate treatments. Monitoring and mapping may consist of driving, walking, and/or boating along the treatment areas and visually assessing the location, size, and density of invasive *Phragmites* and/or Japanese knotweed stands. Mapping efforts already underway will be supplemented by mapping of additional areas, utilizing GPS and GIS to identify the extent of infestation within priority areas. Infestations will be revisited after treatment and a visual inspection will be performed to search for surviving stems.

Any new infestations encountered through monitoring efforts will be controlled as soon as possible after discovery. If new infestations are discovered in between treatment periods, treatment will occur during the next treatment window.

In 2019, LNRP partnered with Fox Valley Technical College for a summer internship program anticipating continuation of the program in forthcoming years. Interns were focused on treatment of small, second and third-year re-treatments using backpack sprayers. This program allowed for a more cost-effective monitoring and control strategy by freeing up other project resources and personnel to focus on larger, more challenging treatment areas. In the future, LNRP plans to continue and expand the partnership and internship program for this project.

PROJECT FEASIBILITY

LNRP has demonstrated that large-scale, region-wide control is feasible, but requires collaboration between local nonprofits, municipalities, federal and state agencies, research institutions and private individuals to leverage shared resources for a common goal of sustainable, regional-scale control. Multiple funding sources are required to provide the financial capacity to manage invasive species on a regional scale. Continual monitoring and the establishment of a local-led, rapid response team is required to sustain project benefits long-term. The intent of a rapid-response team is to provide cost-effective control long-term. LNRP has dedicated significant resources to date and intends to expand the treatment model across the LISMA Project Area and work with diverse partners who can build a successful project.

ATTACHMENT A

Figure 1 - Manitowoc County Treatment Areas

Figure 2 - Kewaunee County Treatment Areas

Figure 3 - Fond du Lac County Treatment Areas

Figure 4 – Calumet County Treatment Areas