



Silver Creek Park Restoration Plan

City of Manitowoc, Wisconsin

Prepared for:

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1.0 INTRODUCTION AND PURPOSE

The City of Manitowoc (the “City”), is proposing to initiate ecological restoration and enhancement activities within Silver Creek Park in the City of Manitowoc, Manitowoc County Wisconsin (the “Project” or “Park”). These activities are focused on removing invasive plant species, establishing and maintaining appropriate native plant communities to the unique natural features of the Project area, and stream restoration within Silver Creek, an important tributary to Lake Michigan. Stantec Consulting Services Inc. (Stantec) has prepared this Restoration Plan on behalf of the City, as a resource guide for restoration planning and implementation. This plan includes background information, restoration goals and objectives, and an implementation plan to restore native habitats along the lakeshore at Silver Creek Park.

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2.0 BACKGROUND INFORMATION

General information about the Project site and its historic and existing environmental conditions presented herein is based on preliminary investigations conducted by Stantec staff in May and June 2022. These investigations included two site visits to perform meander surveys throughout the site for reconnaissance of existing conditions, as well as research and analysis of publicly available GIS data, historic information, and natural resources records. As such, these findings are limited to the information available at the time of the investigation and should be considered preliminary.

2.1 SITE CONTEXT AND CURRENT LAND USES

Silver Creek Park includes approximately 72 acres, and is a public multi-use park and natural area owned and operated by the City of Manitowoc. Silver Creek Park is situated along the shore of Lake Michigan, and offers unique features such as 40-foot-high lakeshore bluffs, scenic views of Lake Michigan, mature stands of white cedar, mature hardwood forests, diverse wildflowers, an extensive sand beach, and Silver Creek, a perennial stream. Silver Creek Park features a 36-hole disc golf course, public shoreline access, parking areas, and trail playground area, scenic wooded hiking trails and bridges, fishing, cross country skiing, picnic areas, sledding hills, winter fat tire bike trails, the recently renovated 1939 Fieldhouse, and open-air shelters. Silver Creek provides the largest area of public open space on the south side of Manitowoc. Adjacent to the Park are residential neighborhoods and semi-rural areas to the west. The Park is bordered to the north by UW-Green Bay – Manitowoc Campus, to the south by US Army Reserve, to the east by Lake Michigan, and the west by South 10th Street. The Park is widely used for public recreation such as disc golfing, fishing, birdwatching, running/walking, biking, picnicking, and sunbathing, and hosting community and private events in the historic fieldhouse.

Current land cover within the Project site includes steeply sloped bluffs adjacent to Lake Michigan, northern mesic hardwood and conifer forests, upland meadow, shrub thickets, and maintained lawn (Figure 1, Appendix A). Silver Creek bisects the Park, flowing from west to east into Lake Michigan, and provides important foraging and spawning habitat for a variety of fish species. The Silver Creek lakeshore, including the estuary of Silver Creek at Lake Michigan, has been identified as one of the most significant migratory stopover habitats on Lake Michigan for waterfowl in particular (WDNR 2019). Over 10,000 waterfowl use the site annually, and 130 bird species have been observed to use the site during migration, which provides a diversity of insects and fish for foraging, and meadow, shrub, and deciduous and coniferous forest cover. Significant streambank and bluff erosion is occurring within the Park, resulting in unstable and unsafe banks which release significant sediment loads to Lake Michigan.

2.2 GEOLOGICAL HISTORY AND SOILS

The Project area is situated within a zone of complex surficial geology, owing to its position at the terminus of the most recent advances of the Wisconsin Glaciation. The modern-day shoreline in this area was shaped during the final readvance of the glacier roughly 14,600 years ago, which deposited a generally well-sorted sand and gravel known as Valders and Chilton tills over the previously deposited till and outwash plains. The steep bluffs along the lakeshore resulted from a series of post-glacial fluctuations in the Lake Michigan water level, during which the bluff and beach terraces were eroded by wave action (Mickelson, 2017).

Natural Resources Conservation Service (NRCS) soil mapping for the Project area is provided in Figure 2. Soils are primarily sandy loams to fine sandy loams which represent glacial till layers. Typically, these till layers are well-stratified along the Lake Michigan bluff slopes, and may vary to include clayey silts, gravel, and larger stone depending upon the dynamic series of erosion processes at any given location.

2.3 HYDROLOGY AND DRAINAGE

The northeast portion of Silver Creek Park is located in the Lower Manitowoc River watershed and the south portion is located in the Seven Mile and Silver Creek Basin watershed (Figure 3). Silver Creek bisects the Park, flowing west to east into Lake Michigan. Silver Creek is listed as one of Wisconsin's 2022 impaired waters (303d list). Silver Creek impairments are unknown; however, pollutants include Total Phosphorus, and WDNR assessments have indicated that Silver Creek suffers from degraded water quality impacted by industrial, commercial, and agricultural land uses upstream. The lower portion of Silver Creek has a diverse fishery (WDNR 2001).

Seepage slope wetlands were observed within the Project area during the preliminary assessment. Such features are common along Lake Michigan bluff slopes and ravines. It is typical to see seeps where groundwater runs over clayey substrates which are exposed along the eroded bluff slope. Such seeps often result in localized changes in the plant constituents, and can contribute to soil instability, slumping, and slope failure. The eastern Project boundary is located directly adjacent to Lake Michigan. The Wisconsin Wetland Inventory (WWI) identifies wetlands, classified as too small to delineate, located with the Silver Creek riparian corridor (Figure 3). Wetlands identified onsite include both riparian floodplain wetlands adjacent to Silver Creek, in the vicinity of those mapped by WWI, as well as groundwater seepage wetlands, often forested with white cedar, along the lower slopes. Portions of the tablelands drain directly over the bluff shoulder, and into the Silver Creek riparian zone, with associated gully erosion.

2.4 HISTORIC AND EXISTING VEGETATION PATTERNS

Silver Creek Park is positioned in the Central Lake Michigan Coastal Ecological Landscape, an area characterized by its glacial landscape features and a climate moderated by Lake Michigan (WDNR 2015). Based on public land survey data from the 1800's, the vegetation of the Project area and surrounding landscape was historically comprised primarily of hardwood forest including beech, sugar maple, basswood, red oak, white oak and black oak (Finley 1976), but is now largely agricultural and urban. Stantec performed an analysis of historic aerial imagery to determine general vegetation patterns at the Project site over time. Aerial imagery recorded in 1938 shows that the site had a moderate tree canopy along the Silver Creek riparian area and steep slopes, and an open field landscape on the flat uplands, at that time (Figure 4). Over time, the Silver Creek corridor has become dominated by closed tree canopy, and the park today features a combination of closed canopy forest, shrubby thicket, meadow, mowed turfgrass, and developed areas. Historically, prior to acquisition as a park, the area likely had a history of grazing and/or haying which maintained an open landscape. The presence of mature canopy red oak, sugar maple, American beech, and northern white cedar and a rich native groundlayer including spring ephemeral wildflowers, are elements of the historic Northern Mesic Forest cover. Areas of high-quality natural forest exist onsite, along with degraded or early successional wooded communities. Outside of the wooded groves, the historic landscape of the Project area appears to have had moderate to heavy cover from herbaceous vegetation, with inclusions of bare ground, sand, and scattered shrubs. The coastal bluff

is likely to have historically been a dynamic clay seepage bluff ecosystem characteristic of the coastal landforms of the central Lake Michigan coast of Wisconsin. In these systems, pioneering grasses, sedges, and forbs dominate open (often actively eroding) slopes, which can also have a significant and diverse shrub component.

Plant communities, invasive species, and plant species diversity were evaluated across Silver Creek Park by Stantec in May and June 2022. A preliminary plant species inventory recorded 94 species across the Site of which 75 are native (Appendix B). The current vegetation of Silver Creek Park is a mix of northern mesic forest with a diverse tree canopy with inclusions of white cedar (*Thuja occidentalis*) seepage slopes, conifer plantations, and degraded/early successional woods; cool-season grassy upland meadow containing common milkweed (*Asclepias syriaca*), Canada goldenrod (*Solidago canadensis*), with invasive autumn olive (*Elaeagnus umbellata*); shrub thickets consisting of red-osier dogwood, wild plum (*Prunus americana*), pin cherry (*Prunus pensylvanica*) and scattered invasives; and turf lawn that is frequently mowed.

Wooded areas include a significant component of large sized green ash (*Fraxinus pennsylvanica*). Most of the green ash onsite are either dead or dying as a result of the invasive insect, Emerald Ash Borer (EAB) and present a safety hazard to buildings, roads, and park users. Invasive plant species have become established and widespread within the Project area in multiple habitats, especially in disturbed areas and early successional thicket and forest, and present threats to biodiversity, habitat, and recreational use. Invasive shrubs are widespread within forested areas, and include tartarian honeysuckle (*Lonicera tatarica*), common buckthorn (*Rhamnus cathartica*), autumn olive, multiflora rose (*Rosa multiflora*), and Japanese barberry (*Berberis thunbergia*). Invasive herbaceous species are widespread in forested and open areas, and include reed canary grass (*Phalaris arundinacea*), garlic mustard (*Alliaria petiolate*), Dame's rocket (*Hesperis matronalis*), and Japanese knotweed (*Reynoutria japonica*).

The southern portion of the Site, south of the US Army Reserve center, is comprised of a mix of upland meadow and upland shrub thickets with a mix of non-native cool season grasses, native and invasive shrubs, and forbs. These areas, while not resembling pre-settlement natural communities, provide important habitats for a range of grassland and other native birds.

3.0 PROJECT GOALS AND OBJECTIVES

The primary goal of the Project is to restore ecological function and value by controlling problematic invasive species, conserving unique and high-quality remnant natural communities, and maintaining habitats that are sustainable and enhance bird and wildlife diversity and use. This goal includes the following restoration and management objectives:

- Reduce hazards to safety and structures from dead and dying green ash located in proximity to high-use areas, buildings, and roads.
- Manage and selectively control problematic invasive species.
- Enhance and restore Project area habitats with native plants, including trees, shrubs, and herbaceous species that support pollinator, bird, and wildlife habitat values and are appropriate for the conditions and habitats present onsite.
- Develop and implement short-term and long-term site management programs which provide for ongoing environmental monitoring, invasive species control, site stewardship, and vegetation enhancement.
- Enhance native herbaceous cover on erodible and bare soil areas, and develop additional strategies to reduce erosion of the bluff and streambanks.

A secondary goal of the Project is to provide additional opportunities for public access, recreation, education, outreach, and sustainability. While specific outcomes will be developed in coordination with Project stakeholders, general objectives associated with this goal include:

- Maintain and enhance public access to outdoor recreation, volunteer stewardship and conservation opportunities, and promote awareness of the unique natural features of the Park.
- Improve safety and limit access to portions of the bluff where ongoing erosion has occurred resulting in unstable and dangerous conditions.
- Enhance educational, cultural and sustainability values through the addition of interpretive signage, public art, and recycling bins, showcasing the site's unique coastal habitats, through coordination with local school groups and community organizations, and incorporating multilingual designs.
- Engage diverse park user constituencies, including disc golf, fishing, soccer, trail running, birding, hiking, skiing, biking, sledding, playground, and beach users; schools, University of Wisconsin-Manitowoc, Army Reserve, and youth and community groups in the planning process to ensure broad acceptance and participation.
- Foster community involvement through volunteer program development (site stewardship) and hosting of community events which promote the Project objectives.

4.0 SITE ASSESSMENT AND PLANNING

Recommendations provided within this Restoration Plan are based on preliminary assessment of the general existing conditions at the Project site. While this information is sufficient to guide the overall trajectory of the Project, additional site investigation and planning is needed to address specific ecological impairments and localized conditions. The restoration implementation process should be conducted alongside these assessment and planning efforts and adapted to respond to additional findings, system responses, and local community input. Site assessment and planning tasks are anticipated to include the following:

- **Assessment of Slope Stability** – Portions of the site where severe erosion is ongoing should be assessed by a qualified engineer to determine if slope stability issues exist which may influence the restoration implementation. Areas of concern include streambanks, bluffs, shoreline areas, trails, and steep slopes. Soil erosion, gullying, slumping, and other evidence of slope instability should be noted and mapped for future planning efforts.
- **Hydrologic and Geotechnical Planning** – As needed, develop plans to respond to issues raised during the assessment of site slope stability. Planning requirements and outputs are yet to be determined.
- **Stream Restoration Planning** – Stream restoration planning and design is underway for Silver Creek, and will include detailed evaluations of stream channel conditions, floodplain, and banks.
- **Wetland Delineation** – An investigation of wetlands and surface water features may be required to assess impacts to regulated resources associated with stream restoration and other ground disturbing activities including site improvements planning.
- **Site Improvements Planning** – Project stakeholders should work collaboratively to develop plans for improvement of trails, access routes, interpretive signage, future restrooms, disc/bike storage shed, and other features, and evaluate proposed locations to minimize impacts to high quality habitats and other values.
- **Community Outreach** – Project stakeholders should partner with community leaders, schools, neighborhood associations and local governments to develop plans for public education and outreach. Efforts to promote awareness of ecological issues affecting the site, foster community support, and engage volunteer stewards will work toward the Project goals.

5.0 RESTORATION IMPLEMENTATION PLAN

Restoration implementation planning recommendations are provided for defined restoration units, with more details provided in the following sections. The plan will be implemented in phases, by management zones aligned to existing plant community types, observed conditions, restoration goals and objectives, and anticipated level of effort. Recommended restoration approaches will be developed into detailed work plans in coordination with the City, partner non-profits and professional restoration ecologists, and incorporating volunteer support and anticipated funding availability. Proposed restoration units are depicted on Figure 5.

5.1 MESIC FOREST ENHANCEMENT

The Mesic Forest Enhancement area comprises approximately 7.98 acres of moderate to high quality, mature Northern Mesic Forest. These areas provide excellent migratory songbird stopover habitat, and the mature forest canopy, diverse wildflowers, and sweeping views of Lake Michigan and Silver Creek offer recreational and aesthetic value. The focus of enhancement work proposed in the Mesic Forest Enhancement unit is to manage invasive species infestations, control erosion, and enhance native species coverage to promote resiliency and wildlife habitat. Target invasive herbaceous species include garlic mustard and Dame's rocket. Target invasive woody species include Japanese barberry, common buckthorn, tartarian honeysuckle, and multiflora rose. Herbaceous invasives should be managed through a combination of hand pulling and spot spraying of herbicide. Application of both non-selective and selective herbicides should occur a minimum of two times during the first growing season. This approach protects native plants from damage as herbicide will be applied to only the target species, and hand pulling should be used where invasives are mixed with native species. Non-native shrub removal should be completed by hand (chainsaws and brush saws), with shrubs cut within three inches of the ground surface. Herbicide treatments of stumps should occur within two hours of cutting to prevent re-sprouting, while debris can be disposed of on-site via brush pile burning or chipped and disposed of in an off-site location.

The mesic forest community enhancement should include installation of a native seed mix, shrubs and trees, as needed to enhance native species coverage, diversity, and to stabilize soils. Native tree and shrub planting will enhance habitat structure and promote resilience, using diverse native species selected for adaptability to anticipated site conditions. Woody species can be dispersed through the management unit. Recommended species for tree and shrub planting are provided in Appendix C. Final tree and shrub planting locations will be determined following additional site assessment and can be marked in the field prior to installation. Trees and shrubs should be protected from herbivory with cages or tubes.

5.2 DEGRADED FOREST RESTORATION

The Degraded Forest Restoration area consists of early successional and other degraded areas of upland forest and pine plantation. These areas are affected by a combination of heavy use, compaction, erosion, and high levels of coverage by invasive species. The primary focus of management within the approximately 31.32-acre Degraded Forest accounts for the majority of the forested areas within the Project area. Many of these areas were historically open fields or pasture prior to park purchase, and subsequently succeeded to woody dominated communities. Management in these forested units should focus on control of invasive herbaceous and woody species, and enhancement of tree species diversity to promote resiliency and enhance wildlife habitat. Target herbaceous invasive species include Dame's rocket, garlic mustard, Japanese knotweed, and reed canary grass. Target woody species include tartarian honeysuckle,

common buckthorn, multiflora rose, and Japanese barberry. Some native but low value woody species, such as box elder and green ash, may be removed. Proposed strategies should include forestry mowing and hand removal (chain saws and brush saws) during the dormant season, followed by spot spraying of herbaceous invasives and woody resprouts during the growing season. Stumps should be cut to within three inches of the ground, and sprayed with herbicide. Woody debris from hand cutting can be piled and burned onsite, or shredded by the forestry mower. Spot spraying application of both non-selective and selective herbicides should occur a minimum of two times during the first growing season. This technique limits off-target damage to native plants by relying on trained applicators with backpack sprayers to carefully apply herbicide directly to the target species.

The restoration of degraded early-successional forest areas will include diversification of native herbaceous, shrub and tree species. Installation of a diverse seed mix, shrubs, and trees, to diversify the community, should be completed based on an assessment of habitat conditions and suitable species. Native tree and shrub planting will enhance the canopy structure to promote resilience through increased species diversity and habitat structure. Woody species plantings should be dispersed through the management units. Planting of native trees and shrubs will also support important habitat values including stopover habitat for migratory birds, which utilize the Project area for seasonal foraging, cover, and nesting. Recommended species for tree and shrub planting are provided in Appendix C. Final tree and shrub planting locations can be determined following additional site assessment and can be marked in the field prior to installation. Trees and shrubs should be protected from herbivory with cages or tubes.

Conifer plantations within the Project area provide year-round shade, aesthetics, and habitat, but have limited tree, shrub, and herbaceous species diversity. The primary focus of management within the existing conifer plantations should be control of invasive herbaceous and woody species, and enhancement of tree and shrub species diversity to promote resiliency and wildlife habitat. Forestry practices, including thinning of pines, is recommended to promote tree health and enhance habitat and aesthetic values. Diversification of the stand will be achieved through planting of diverse native forest tree and shrub species.

5.3 POLLINATOR MEADOW ENHANCEMENT

Extensive areas of the Project area consist of actively-maintained, mowed turfgrass and old field meadow, which are lightly maintained. Some of these areas are utilized for gathering, disc golf, and other activities, while other areas are lightly used. Generally, mowed turfgrass requires intensive management and provides limited habitat value. A 15-acre portion of these areas are proposed for habitat enhancement as native meadow (Figure 5). Deep-rooted native meadow species provide superior erosion control and stormwater runoff management and are more drought tolerant compared to the existing non-native, cool season grass meadow. Currently under-utilized areas of mowed turfgrass and lightly maintained old fields are proposed for pollinator meadow enhancement, to provide diverse wildflowers as nectar sources for pollinators, and habitat for nesting grassland bird species. The areas proposed for pollinator meadow enhancement will be refined in consultation with the City and park users to minimize disruption to current uses and to improve user experiences long-term. Proposed locations for pollinator meadow include underused mowed areas adjacent to S. 10th St., along the park entrance drive, and west and southeast of the Army Reserve facility. Additionally, narrow strips of meadow enhancement may be installed on steep slopes, erosion prone areas, and on toeslopes with seepage and wet soils. Pollinator meadows are expected to reduce maintenance costs, add native habitat, and enhance the visual experience for disc golfers and other park users. The approach will include broadcast application of selective and non-selective herbicides to control non-native cool season grasses, followed by seeding of a diverse native prairie seed mix. Management mowing should

be performed 2-3 times per year for the establishment period during the first three growing seasons following seeding. Spot spraying of invasive species and weeds should be conducted as needed during the establishment period. Periodic mowing or prescribed burning of these unit may be required as a management tool for long-term maintenance.

5.4 SHRUB COMMUNITY ENHANCEMENT

Areas of shrubby vegetation, including shrubby meadow and a wild plum thicket, are present within the southern portion of the Project area, and provide unique areas of habitat for birds and wildlife, as well as attractive flower displays in spring that are an important nectar source for pollinators. The Shrub Community Enhancement areas comprise approximately 5.45 acres. The main portion of this community is located in the southeast corner of the Project area and is used extensively for disc golf. This area consists of a mix of native and non-native shrub species, open meadow, and mowed trails and fairways. The wild plum thicket is a smaller area located at the northeast corner of the Army Reserve facility. This area consists of a dense thicket of wild plum.

Management in these units should focus on control of invasive herbaceous and woody species, and enhancement of shrub species diversity. Target herbaceous invasive species include Dame's rocket, garlic mustard, and an extensive population of Japanese knotweed. Target woody species include tartarian honeysuckle, common buckthorn, multiflora rose, and autumn olive. Proposed restoration strategies include forestry mowing and hand removal (chain saws and brush saws) during the dormant season, followed by spot spraying of herbaceous invasives and woody resprouts during the growing season. Stumps should be cut to within three inches of the ground, and sprayed with herbicide. Woody debris from hand cutting can be piled and burned onsite, or shredded by the forestry mower. Spot spraying application of both non-selective and selective herbicides should occur a minimum of two times during the first growing season. Installation of a diverse seed mix and native shrubs should be completed based on an assessment of habitat conditions. Native shrub planting will enhance species diversity and habitat structure. Woody species plantings should be dispersed through the management units to support habitat for migratory birds, pollinators, and to maintain visual screening. Recommended species for shrub planting are provided in Appendix C.

6.0 SITE STEWARDSHIP

Following preliminary restoration activities, the Project site should be maintained to promote the successful establishment of native plant communities. Because weed competition and other disturbance vectors are most impactful during the early stages of native plant development, maintenance needs are typically highest during the establishment period. This initial establishment period typically lasts up to three years but should continue until the desired cover of native vegetation has been achieved. Once target plant communities have been substantially established, a long-term maintenance plan should be adopted to provide for periodic monitoring and management. Cost estimates for this task assume three years of site stewardship (Table 3).

6.1 ADAPTIVE MANAGEMENT

Stewardship of the Project site will follow an adaptive management approach, whereby maintenance, repair, and enhancement activities are responsive to changing site conditions over time. The Project site is a relatively dynamic ecosystem and is likely to respond variably to restoration inputs. Potential corrective measures may include erosion repair and slope stabilization, modification of stormwater infrastructure, overseeding, live plant installation, and/or changes to the monitoring and maintenance requirements.

6.2 INVASIVE SPECIES MANAGEMENT

The primary focus of site stewardship activities will be the ongoing control of invasive species within the Project area. Invasive species control should be performed on an adaptive basis according to the site conditions and system responses encountered at various portions of the Project area over time. As such, target species, treatment timing, and treatment methods will be determined by periodic monitoring. Typically, these methods include hand pulling of shallow-rooted weeds where they occur as scattered individuals; spot herbicide treatment of biennial and perennial weeds via low-pressure spray, wicking, or stump treatment; and herbicide treatment of heavy infestation of persistent weeds via pistol-spraying or broadcast application.

Based on preliminary observations of the site and existing vegetation patterns, Table 1 provides management guidance for invasive species which have high potential to occur within the Project area.

Table 1. Proposed Treatment Methods for Target Invasive Species

Common/Species Name	Treatment Method	Timing
Woody Species		
Various (includes re-sprouts, saplings, and woody vines)	Cut-stump treatment	Any time (dormant season preferred)
	Spot herbicide application (seedlings, small saplings, and resprouts)	Plant actively growing and fully leafed out
Grasses		

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Common/Species Name	Treatment Method	Timing
Non-native cool season grasses including Smooth brome (<i>Bromus inermis</i>), Kentucky Bluegrass (<i>Poa pratensis</i>), etc.	Spot herbicide application	Plant actively growing and fully leafed out
Reed canary grass (<i>Phalaris arundinacea</i>)	Foliar herbicide application (spot or broadcast depending on size of population)	Spring (prior to seed production) or fall (can mow first and allow for appropriate regrowth prior to treating)
Forbs		
Crown vetch (<i>Coronilla varia</i>), lily of the valley (<i>Convallaria majalis</i>)	Foliar herbicide application (spot or broadcast depending on size of population)	Early spring when plant is actively growing
Canada thistle (<i>Cirsium arvense</i>), bull thistle (<i>Cirsium vulgare</i>)	Spot herbicide application	Flower bud to early flowering stage, or to rosettes in the fall as long as leaves are green
Dame's rocket (<i>Hesperis matronalis</i>), Garlic mustard (<i>Alliaria petiolata</i>)	Spot herbicide application	Treat rosettes in spring or fall, or treat flowering plants
	Hand pull	Bolting or flowering plants – flowering plants should be bagged and removed from site (recommended only for small populations)
Japanese knotweed (<i>Reynoutria japonica</i>)	Mow / Spot herbicide application	Mow or cut the plant two times during the growing season (in spring and again when plant flowers); apply herbicide to foliar regrowth in the fall (when plant reaches 3 feet high).
	Alternative method: cut- stump	When plant is actively growing
Sweet clovers (<i>Melilotus</i> spp.), Queen Anne's Lace (<i>Daucus carota</i>)	Mowing, spot herbicide application	Mow during early flowering as soon as basal leaves senesce, or foliar spray basal rosettes in spring/early fall

7.0 MONITORING AND REPORTING

The monitoring period will commence after initial installation of native plant materials is complete. The purpose of monitoring is to evaluate the status of the restoration and native plant establishment, and to determine the need for maintenance or remedial action. The restored plant communities will be monitored throughout the establishment period, until sufficient native cover is achieved. Vegetation will be monitored annually during the growing season using a pedestrian survey to evaluate developing native plant cover and distribution of invasive species. Monitoring will also provide general observations related to slope stability, soil erosion, or changing hydrologic impairments.

The results of site monitoring shall be summarized in an annual report to the Project stakeholders which provides a narrative description of observed site conditions, vegetation monitoring data in tabular form, a record of management actions performed, and recommendations for future site stewardship.

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8.0 IMPLEMENTATION SCHEDULE

The Project will be implemented in phases to accommodate available funding, resource allocations, and other constraints. For planning purposes, the following represents a timeline for implementation once funding is secured.

Table 2. Proposed Implementation Schedule

Restoration Task	Proposed Timeline											
	Year 1				Year 2				Year 3			
Mesic Forest Management Unit												
Invasive Woody Removal	■											
Herbaceous Invasive Control & Woody Resprout		■	■			■	■			■	■	
Native Seeding				■	■							
Native Plant Installation				■	■							
Degraded Forest Restoration Unit												
Invasive Woody Removal	■											
Herbaceous Invasive Control & Woody Resprout		■	■			■	■			■	■	
Native Seeding				■	■							
Native Plant Installation				■	■							
Pollinator Meadow Enhancement Unit												
Site Preparation		■	■									
Native Seeding				■	■							
Management Mowing						■	■			■	■	
Herbaceous Invasive Control						■	■			■	■	
Shrub Community Enhancement Unit												
Invasive Woody Removal	■											
Herbaceous Invasive Control & Woody Resprout		■	■			■	■			■	■	
Native Seeding				■	■							
Native Plant Installation				■	■							

9.0 COST ESTIMATE

A preliminary estimate of probable costs associated with the proposed planning and restoration implementation tasks is included in Table 3. Implementation of the Project will likely require budget flexibility to respond to final funding availability, volunteer contribution, and support from the City or other Project stakeholders. Contributions from the City and volunteer groups have the potential to greatly decrease the overall restoration costs associated with the Project. Depending upon the capabilities and availability of these resources, there are a number of work tasks in each phase which may be suitable for them to assist with or lead. These are indicated in Table 3. Cost estimates provided herein are provided for Project planning purposes only.

Cost estimates do not include costs associated with the implementation of cultural / recreational site improvements or public outreach tasks which may be pursued as part of the Project. The scope of such tasks is yet to be determined. However, cost allowances for professional consultation are included in the Site Assessment and Planning estimate to assist Project stakeholders in coordination and conceptual plan development.

Table 3. Estimated Project Costs

Restoration Task	Potential City / Volunteer Task	Preliminary Cost Estimate
Site Assessment and Planning		\$
Mesic Forest Management Unit – 7.98 acres		
Invasive Woody Removal	x	\$
Herbaceous Invasive Control & Woody Resprout		\$
Native Seeding		\$
Native Plant Installation		\$
Site Stewardship	x	\$
Total		\$
Degraded Forest Restoration Unit – 31.32 acres		
Invasive Woody Removal	x	\$
Herbaceous Invasive Control & Woody Resprout		\$
Native Seeding		\$
Native Plant Installation		\$
Site Stewardship	x	\$
Total		\$
Pollinator Meadow Enhancement Unit – 14.98 acres		
Site Preparation		\$
Native Seeding		\$
Management Mowing		\$
Herbaceous Invasive Control		\$
Site Stewardship	x	\$
Total		\$
Shrub Community Enhancement Unit – 5.45 acres		
Invasive Woody Removal	x	\$

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Restoration Task	Potential City / Volunteer Task	Preliminary Cost Estimate
Herbaceous Invasive Control & Woody Resprout		\$
Native Seeding		\$
Native Plant Installation		\$
Site Stewardship	x	\$
Total		\$
Total Estimated Project Cost		\$

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10.0 REFERENCES

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Appendix A **FIGURES**

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Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources: Stantec, WDNR, WisDOT
3. Background: NAIP 2022

Legend
 Project Area
 Parcel Boundary

0 200 400 Feet
(At original document size of 8.5x11)
1:4,800



Project Location
T18N, R24E, S5, C. and
T. of Manitowoc, Manitowoc Co., WI
Client/Project
Silver Creek Park
Prepared by RA on 2022-12-12
TR by ML on 2022-12-27
IR by XXX on 2022-XX-XX
193709009

Figure No.
1
Title
Project Location

DRAFT

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Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources: Stantec, WDNR, WisDOT, NRCS
3. Background: NAIP 2022

Legend

- Project Area
- Parcel Boundary
- NRCS Soil Survey Data**
- Hydric Soil Rating**
- Hydric (H)
- Predominantly Hydric (PrH)*
- Partially Hydric (PaH)*
- Predominantly Non-Hydric (PNH)
- Non-Hydric

- DNR 24k Hydrography**
- Perennial Stream
 - - - Intermittent Stream
 - Waterbody

0 200 400 Feet
(At original document size of 8.5x11)
1:4,800



Project Location T18N, R24E, S5, C. and T. of Manitowoc, Manitowoc Co., WI
Client/Project Silver Creek Park
Prepared by DJG on 2022-12-27
TR by ML on 2022-12-27
IR by XXX on 2022-XX-XX
193709009

Figure No.
2

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Title
NRCS Soil Survey Data
Hydric Ratings

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Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources: Stantec, WDNR, WisDOT, USGS
3. Background: NAIP 2022

Legend

- Project Area
- Parcel Boundary
- WWI Wetland Features**
 - Wetland Too Small to Delineate
 - Wetland
- Watershed Boundary (HUC-10)
- DNR 24k Hydrography**
 - Perennial Stream
 - Intermittent Stream
 - Waterbody

0 200 400 Feet
(At original document size of 8.5x11)
1:4,800



Project Location
T18N, R24E, S5, C. and
T. of Manitowoc, Manitowoc Co., WI

Client/Project
Silver Creek Park

Prepared by DJG on 2022-12-27
TR by ML on 2022-12-27
IR by XXX on 2022-XX-XX

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Figure No.
3

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WI Wetland Inventory and Watersheds (HUC-10)

Page 1 of 1

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Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources: Stantec, WDNR, WisDOT
3. Background: USDA 1938 Aerial Photography

Legend
Project Area
DNR 24k Hydrography
Perennial Stream
Intermittent Stream

0 200 400 Feet
(At original document size of 8.5x11)
1:4,800



Project Location T18N, R24E, S5, C. and T. of Manitowoc, Manitowoc Co., WI
Prepared by DJG on 2022-12-27
TR by ML on 2022-12-27
IR by XXX on 2022-XX-XX
Client/Project Silver Creek Park 193709009

Figure No.
4

DRAFT

Title
**USDA Aerial Photography
July 4, 1938**

Page 1 of 1

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Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin South FIPS 4803 Feet
2. Data Sources: Stantec, WDNR, WisDOT, USGS
3. Background: NAIP 2022

Legend

- Project Area (76.22 ac)
- Parcel Boundary
- Proposed Restoration Units**
- Degraded Forest Restoration (31.32 ac)
- Mesic Forest Enhancement (7.98 ac)
- Pollinator Meadow Enhancement (14.98 ac)
- Shrub Community Enhancement (5.45 ac)
- Maintained as Turfgrass, Developed Facilities (16.49 ac)

- DNR 24k Hydrography
- ~ Perennial Stream
 - Intermittent Stream
 - ~ Waterbody

0 200 400 Feet
(At original document size of 8.5x11)
1:4,800



Project Location
T18N, R24E, S5, C. and
T. of Manitowoc, Manitowoc Co., WI

Client/Project
Silver Creek Park

Prepared by DJG on 2022-12-27
TR by ML on 2022-12-27
IR by XXX on 2022-XX-XX

193709009

Figure No.
5
Title

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Proposed Restoration Units

Appendix B PRELIMINARY PLANT SPECIES INVENTORY

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**Silver Creek Park
Manitowoc, Wisconsin**

2022 Meander Survey Species List

Scientific Name	Common Name	Native	Physiognomy	C Value
<i>Acer rubrum</i>	red maple	native	tree	3
<i>Acer saccharum</i>	hard maple	native	tree	5
<i>Acer spicatum</i>	mountain maple	native	tree	6
<i>Actaea pachypoda</i>	dolls-eyes	native	forb	6
<i>Agrimonia gryposepala</i>	common agrimony	native	forb	2
<i>Alliaria petiolata</i>	garlic mustard	non-native	forb	0
<i>Allium tricoccum</i>	ramp	native	forb	6
<i>Amelanchier arborea</i>	downy juneberry	native	shrub	6
<i>Anemone quinquefolia</i>	nightcaps	native	forb	6
<i>Antennaria neglecta</i>	cats-foot	native	forb	3
<i>Aralia nudicaulis</i>	wild sarsaparilla	native	forb	6
<i>Arisaema triphyllum</i>	indian turnip	native	forb	5
<i>Asclepias syriaca</i>	common milkweed	native	forb	1
<i>Berberis thunbergii</i>	japanese barberry	non-native	shrub	0
<i>Betula alleghaniensis</i>	yellow birch	native	tree	7
<i>Campanula rapunculoides</i>	creeping bellflower	non-native	forb	0
<i>Cardamine diphylla</i>	broad-leaved toothwort	native	forb	8
<i>Carex peckii</i>	pecks oak sedge	native	sedge	7
<i>Centaurea stoebe</i>	spotted knapweed	non-native	forb	0
<i>Cirsium arvense</i>	canada thistle	non-native	forb	0
<i>Claytonia virginica</i>	spring-beauty	native	forb	6
<i>Convallaria majalis</i>	european lily-of-the-valley	non-native	forb	0
<i>Cornus alternifolia</i>	alternate-leaved dogwood	native	tree	7
<i>Cornus stolonifera</i>	red osier dogwood	native	shrub	3
<i>Cystopteris bulbifera</i>	bladder fern	native	fern	8
<i>Dicentra cucullaria</i>	dutchmans-breeches	native	forb	7
<i>Elaeagnus umbellata</i>	autumn olive	non-native	shrub	0
<i>Equisetum arvense</i>	common horsetail	native	forb	1
<i>Equisetum hyemale</i>	common scouring rush	native	forb	3
<i>Equisetum scirpoides</i>	dwarf scouring rush	native	forb	7
<i>Erythronium americanum</i>	american trout-lily	native	forb	7
<i>Eurybia macrophylla</i>	big-leaved aster	native	forb	4
<i>Fagus grandifolia</i>	american beech	native	tree	8
<i>Fallopia japonica</i>	japanese knotweed	non-native	forb	0
<i>Festuca saximontana</i>	rocky mountain fescue	native	grass	7
<i>Fragaria vesca</i>	thin-leaved wild strawberry	native	forb	3
<i>Fraxinus pennsylvanica</i>	green ash	native	tree	2
<i>Geranium maculatum</i>	cranes-bill	native	forb	4
<i>Glechoma hederacea</i>	creeping-charlie	non-native	forb	0
<i>Glyceria grandis</i>	american manna grass	native	grass	6
<i>Gymnocarpium dryopteris</i>	common oak fern	native	fern	7
<i>Heemerocallis fulva</i>	orange daylily	non-native	forb	0
<i>Heracleum lanatum</i>	american cow-parsnip	native	forb	3
<i>Hesperis matronalis</i>	dames rocket	non-native	forb	0
<i>Hydrophyllum virginianum</i>	johns-cabbage	native	forb	4
<i>Lonicera tatarica</i>	tartarian honeysuckle	non-native	shrub	0
<i>Luzula multiflora</i>	common wood rush	native	forb	5
<i>Lysimachia ciliata</i>	fringed loosestrife	native	forb	5
<i>Maianthemum canadense</i>	canada bead-ruby	native	forb	5
<i>Maianthemum racemosum</i>	false solomons-seal	native	forb	5
<i>Maianthemum stellatum</i>	little false	native	forb	5

**Silver Creek Park
Manitowoc, Wisconsin**

2022 Meander Survey Species List

Scientific Name	Common Name	Native	Physiognomy	C Value
<i>Matteuccia struthiopteris</i>	american ostrich fern	native	fern	5
<i>Menispermum canadense</i>	canadian moonseed	native	vine	5
<i>Mitella diphylla</i>	bishops-cap	native	forb	8
<i>Monarda fistulosa</i>	bee balm	native	forb	3
<i>Ornithogalum umbellatum</i>	star-of-bethlehem	non-native	forb	0
<i>Osmorhiza longistylis</i>	anise-root	native	forb	4
<i>Ostrya virginiana</i>	eastern hop-hornbeam	native	tree	5
<i>Pedicularis canadensis</i>	canadian lousewort	native	forb	8
<i>Phalaris arundinacea</i>	reed canary grass	non-native	grass	0
<i>Poa palustris</i>	fowl meadow grass	native	grass	5
<i>Podophyllum peltatum</i>	may-apple	native	forb	4
<i>Populus balsamifera</i>	balsam poplar	native	tree	4
<i>Populus deltoides</i>	eastern cottonwood	native	tree	2
<i>Potentilla anserina</i>	silver-weed	native	forb	4
<i>Prenanthes alba</i>	lions-foot	native	forb	5
<i>Prunus americana</i>	american plum	native	shrub	3
<i>Prunus pensylvanica</i>	fire cherry	native	tree	4
<i>Prunus serotina</i>	wild black cherry	native	tree	3
<i>Prunus virginiana</i>	chokecherry	native	shrub	3
<i>Ranunculus hispidus</i>	bristly buttercup	native	forb	6
<i>Rhamnus cathartica</i>	common buckthorn	non-native	shrub	0
<i>Ribes americanum</i>	american black currant	native	shrub	4
<i>Rosa multiflora</i>	multiflora rose	non-native	shrub	0
<i>Rubus idaeus</i>	american red raspberry	native	shrub	3
<i>Rudbeckia laciniata</i>	cut-leaved coneflower	native	forb	6
<i>Salix purpurea</i>	basket willow	non-native	shrub	0
<i>Sanguinaria canadensis</i>	bloodroot	native	forb	6
<i>Solidago canadensis</i>	canadian goldenrod	native	forb	1
<i>Solidago flexicaulis</i>	broad-leaved goldenrod	native	forb	6
<i>Solidago gigantea</i>	giant goldenrod	native	forb	3
<i>Solidago juncea</i>	early goldenrod	native	forb	4
<i>Sorbus americana</i>	american mountain-ash	native	tree	7
<i>Symphyotrichum cordifolium</i>	common blue heart-leaved aster	native	forb	6
<i>Symplocarpus foetidus</i>	skunk-cabbage	native	forb	8
<i>Taraxacum officinale</i>	common dandelion	non-native	forb	0
<i>Thalictrum dioicum</i>	early meadow-rue	native	forb	7
<i>Thuja occidentalis</i>	eastern arborvitae	native	tree	9
<i>Trillium cernuum</i>	nodding trillium	native	forb	8
<i>Trillium grandiflorum</i>	big white trillium	native	forb	6
<i>Viburnum lentago</i>	nannyberry	native	shrub	4
<i>Viburnum opulus</i>	cranberry viburnum	non-native	shrub	8
<i>Viola labradorica</i>	alpine violet	native	forb	4
<i>Viola pubescens</i>	yellow forest violet	native	forb	5

FQA Metrics	Species Richness	Mean C Value	FQI
Native	75	5.0	43.3
All Species	94	4.1	39.8

Appendix C PROPOSED TREE AND SHRUB PLANTING LISTS

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Recommended Species for Woody Plantings

Scientific Name	Common Name
Trees	
<i>Acer rubrum</i>	red maple
<i>Acer saccharum</i>	sugar maple
<i>Betula alleghaniensis</i>	yellow birch
<i>Carpinus caroliniana</i>	musclewood
<i>Carya cordiformis</i>	bitternut hickory
<i>Carya ovata</i>	shagbark hickory
<i>Fagus grandifolia</i>	American beech
<i>Pinus strobus</i>	white pine
<i>Prunus serotina</i>	black cherry
<i>Quercus bicolor</i>	swamp white oak
<i>Quercus macrocarpa</i>	bur oak
<i>Quercus rubra</i>	red oak
Shrubs/Small Trees	
<i>Alnus incana</i>	speckled alder
<i>Amelanchier arborea</i>	downy serviceberry
<i>Celtis occidentalis</i>	hackberry
<i>Cornus alternifolia</i>	pagoda dogwood
<i>Cornus amomum</i>	silky dogwood
<i>Cornus stolonifera</i>	red-osier dogwood
<i>Corylus americana</i>	American hazelnut
<i>Diervilla lonicera</i>	bush-honeysuckle
<i>Hamamelis virginiana</i>	common witchhazel
<i>Prunus americana</i>	wild plum
<i>Viburnum lentago</i>	nannyberry