James Rice Park
Natural Resource Management Plan

Prepared for:
The North Loop Neighborhood Association

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Contents

James Rice Park Location and Context

James Rice Park, while not an official park name, describes the Minneapolis Park and Recreation Board (MPRB)-owned parkland east of West River Parkway (also known as James Rice Parkway), south of the Plymouth Avenue bridge and north of the Hennepin Avenue bridge within the North Loop neighborhood of Minneapolis. The park contains a variety of walking and biking paths, picnic areas, parking, a playground, and mostly forested natural areas. There are approximately 6.25 acres of riverside natural areas. It also includes the outlet of the Old Bassett Creek Tunnel, which now serves as a local storm sewer.

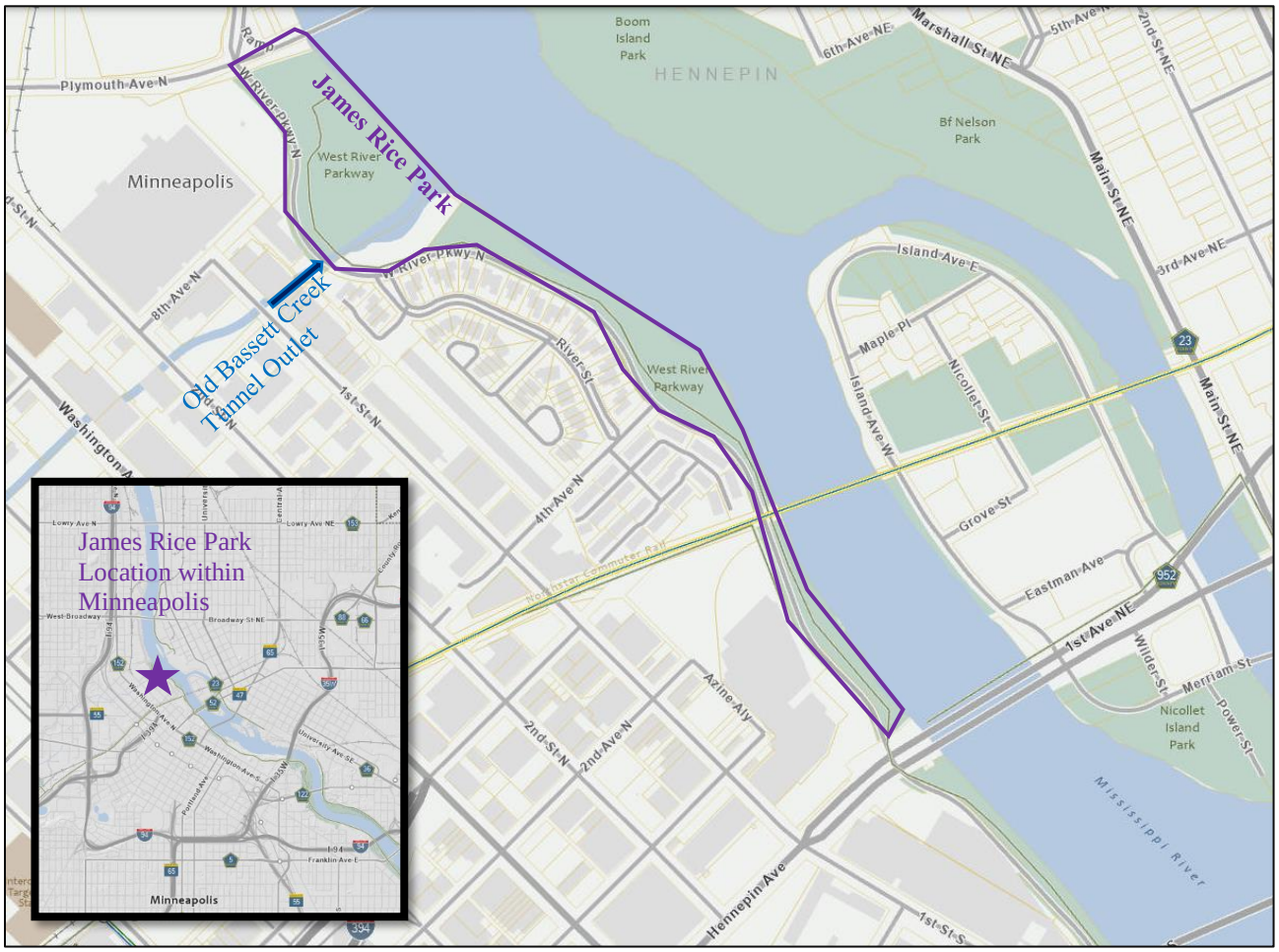

Figure 1: Vicinity of James Rice Park.

James Rice Park is within an identified natural resource corridor due to its protected status as a park, connectivity with natural/semi-natural areas, and proximity to the Mississippi River. While relatively altered due to human disturbances, it is also upstream of MPRB property (south of Interstate 94) classified by the Minnesota Department of Natural Resources (MNDNR) to be sites of biodiversity significance.

This area is identified within the MPRB's Central Mississippi Riverfront Regional Park Master Plan as the Bassett Creek Study Area. Domination of the shoreline by invasive plants is identified as an issue, and the need for restoration is identified as an opportunity. Eroding soils are also noted as a concern.

Project Partners, Funding, and Community Engagement

A variety of organizations have a stake in the management of James Rice Park, either as direct partners or interested parties. The MWMO, through their funding of this management plan, has made possible the future restoration of the natural areas at the site. MWMO will be a valuable partner moving forward and has additional grant programs that could help to fund specific restoration tasks above and beyond the capacity of volunteers. The NLNA has also provided funding and support for development of the Natural Resources Management Plan (NRMP) and will continue to draw on NLNA funding to implement planting and restoration tasks. NLNA will also be important in engaging residents and park users in plan implementation. Ongoing development in the North Loop will also continue to contribute to park dedication fees and will be a key source of funding for future park restoration efforts.

Once an NRMP is in place for James Rice Park, NLNA, and FMR will likely continue to pursue funding from Hennepin County (Healthy Tree Canopy Grants, Good Stewards Grants), state grants, and the MWMO to continue restoration at the site.
The MPRB is the landowner of the areas of interest and will also be a partner in the restoration, providing long term goals and guidance, as well as volunteer event support. The site also falls within the Mississippi National River and Recreation Area (MNRRA), and the National Park Service has an interest in restoration of natural areas within this 72-mile corridor. Other interested parties include the St. Anthony Falls Heritage Board and various environmental organizations who work on environmental issues along the river, including groups like Mississippi Park Connection and the Great River Coalition.

Restoration of natural areas is never done in a vacuum. At FMR, we recognize that humans are an integral part of the ecosystem, and that humans will continue to influence our natural habitat through both direct and indirect means. As such, it is tantamount to the success of restoration to engage and involve the local community. This should happen both before restoration starts, as well as throughout the restoration process. Community support prior for restoration is important for getting the project off the ground and for making sure that the project fulfills the goals and desires that the community has for the space. Providing opportunities for citizens to be involved in the restoration process builds a connection that teaches residents the value of these lands and inspires their interest in their long-term stewardship. Building a community of volunteers from the surrounding area creates a sense of ownership and stewardship and encourages citizens to take a larger role in protecting the resources that benefit their communities. Like restoration, developing an active and involved volunteer base takes time. However, FMR is well positioned in this area and has a robust volunteer program in Minneapolis. For example, in 2021 alone, 473 FMR volunteers contributed 1001 hours at FMR restoration projects on MPRB sites. This momentum has carried through early engagement efforts including

high participation at a fall 2021 planting event, a well-attended community input meeting in March 2022, and strong feedback from a subsequent online survey.

Community feedback also showed strong interest in the development of volunteer crew leaders—community members who would receive special training on restoration techniques that would allow them to lead small groups of volunteers performing suitable restoration tasks. This would provide a greater number of volunteer opportunities beyond what can be organized by FMR or MPRB.

At James Rice Park, we envision a variety of opportunities for community and volunteer engagement. Many opportunities exist to work with MWMO, MPRB, and NLNA, and any suggestions for specific partnerships or projects are encouraged. For example, MPRB or MWMO could install more permanent educational signage about the benefits of prairie plants to water quality, or how native and non-native species differ in their effects on water and other ecological processes. The need for permanent informative and interpretive signage was strongly emphasized in feedback from the community meeting and online survey. Temporary signage placed within the restoration with a QR code was very effective in communicating about the project and ways to be involved. Moreover, FMR and MWMO could host education events around the restoration, including focusing on topics such as prairie plants, invasive species, and water quality.

As restoration progresses, there will also be opportunities for both NLNA and FMR to share articles, blog posts, and photos that tell the story of the project through websites, electronic newsletters, social networks, and the media. NLNA recently created a website for the North Loop Park Stewards group where they plan to post regular project updates and photos. FMR regularly updates members and the community on the progress of restorations through our website, fmr.org, social media posts, and newsletter articles. FMR also plans to work with NLNA to create educational videos and assist with email list creation and dissemination.

As initial steps, FMR and MWMO hosted the aforementioned in-person community outreach event in early March 2022 to gather community input on the content and direction of this plan. This input, as well as responses to an online survey conducted in mid-March 2022, has informed the management plan and steered prioritization of management and potential improvements within James Rice Park. The input is noted throughout the plan where applicable.

Current Plant Communities

The predominant vegetation type at the site is characterized as altered/non-native deciduous woodland by the MNDNR and is divided into five subunits. The three riverbank subunits are situated between the paved walking and biking trails and the Mississippi River, running generally north to south. The north forest subunit runs parallel to the north riverbank unit but is separated from the river by paved walking and biking paths. The final subunit includes the entire outlet bowl around the Old Bassett Creek Tunnel outlet. Successful restoration of these subunits will depend in part on preventing invasive species from spreading from neighboring properties. However, flooding of the

river will also make restoration challenging. Continual soil and vegetative disturbance allow for colonization by non-native species, a cycle that is difficult to break. The five subunits are approximate and serve to better aid the discussion of the vegetation types on the property.

The National Park Service's Vegetation Inventory lists the plant community at the site as "Midwest Box Elder – Ash Ruderal Forest." This provides some additional detail to the "Altered Woodland" distinction but still points to the disturbed nature of the site. Ruderal plant communities dominate on disturbed sites, and ruderal plants are described as the first to colonize an area after a disturbance. While these somewhat weedy species may be less desirable from a habitat quality standpoint, they have provided a valuable ecosystem service in helping to reclaim this site from its history of industry. The current vegetation is likely far different from the historical plant communities that once dominated the area (Figure 2), though it is likely that forested areas persisted at the site, especially on the steeper slopes.

In an initial effort to establish a native plant community within the park, volunteers from the North Loop Neighborhood Association (NLNA) organized buckthorn pulls to decrease the cover of this invasive shrub. Then with guidance from Friends of the Mississippi River (FMR) and funding from the Mississippi Watershed Management Organization (MWMO), 175 native trees were planted in areas where buckthorn had been removed.

Moving forward, removing invasive species and re-vegetating these units will provide important benefits, especially erosion control and water retention and filtration. The remaining woody invasive species should be removed, and native trees and shrubs should be added to open areas. The low light conditions may make establishment of native species difficult, but woodland sedges, grasses, and wildflowers should be added, starting with canopy gaps and open areas created by invasive plant removal. There are additional opportunities to allow more light to the forest floor to encourage grass and wildflower establishment including strategic removal of Siberian elm and box elder. Removing small and medium-size box elder and Siberian elm trees will also pave the way for establishing a more diverse, resilient tree canopy at the site.

Figure 2: Current plant communities within James Rice Park.

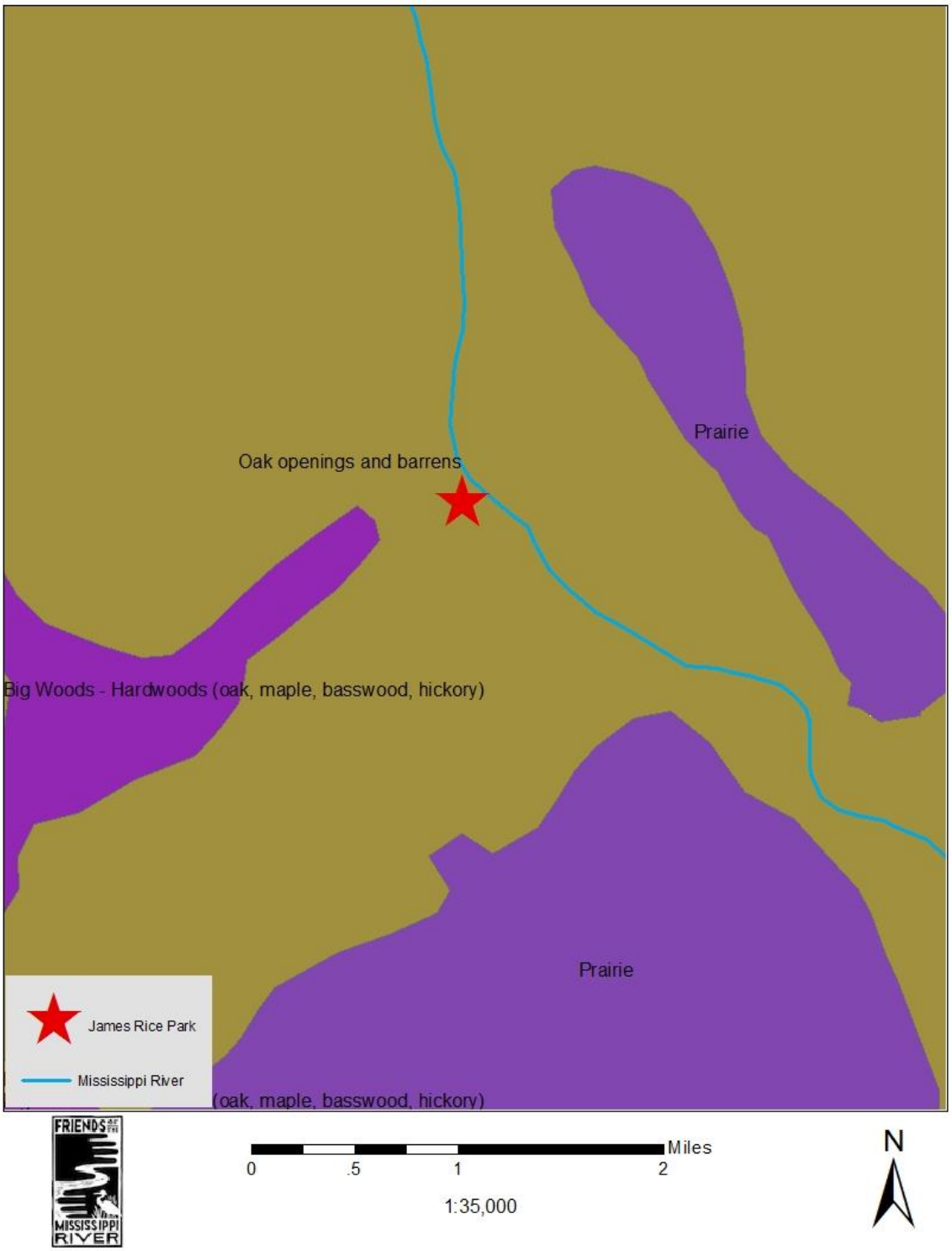

Figure 3: Historic plant communities pre-European colonization.

Figure 4: Historical Aerial Photography – 1940. James Rice Park Area Source: Hennepin County Aerial Imagery.

Figure 5: Hennepin Co. Orthophoto - 2020 Source: Hennepin Co. Aerial Imagery.

Management Units

Five management units were developed within James Rice Park by categorizing the areas by relative geographic location, locally known site characteristics that are familiar to the community, and vegetation types that would benefit from discrete management techniques.

North Forest

The north forest unit is the most disjointed unit in the park, with pockets of trees separated by paths and mowed areas. Unlike the other units, this unit is not continuous,

and is the least “natural” of the five. The lack of natural vegetation cover is also reflected in its diversity, with only 32 plant species recorded during a 2021 vegetation survey. Increasing diversity, especially of ground layer and shrub layer species, will be important to the longevity of the ecosystem services the unit provides. For example, ground layer vegetation will help to retain and filter water that flows from the parking lot and sidewalks, cleaning it before it enters the Mississippi River. The unit also provides little in the way of habitat or aesthetic beauty, though it is one of the first places that people using the parking lot encounter. Adding wildflowers and blooming shrubs to the edges of the unit will not only provide improved wildlife habitat but will help to beautify this part of the park. Due to its proximity to the north parking lot, the unit is also plagued by trash and is a candidate for more frequent clean-ups.

North Riverbank

The north riverbank unit is a long, narrow unit located between the river and the paved bike trail. The unit runs from just south of the Plymouth Ave bridge all the way to the north edge of the Old Bassett Creek Tunnel outlet. The unit had relatively low species diversity with only 38 plant species recorded owing in large part to the dominance of buckthorn and honeysuckle. The unit is a mix of habitats and presents several interesting restoration opportunities. The southern half of the unit is largely forested with trees forming a mostly continuous canopy. This tree cover declines in the north half of the unit to the point that there is only scattered woody shrub material at the north extent. While the species composition may be wholly different, this north half may better reflect the historical plant community structure at the site. This presents an opportunity to restore a grassland or savanna community with groundcover dominated by grasses and wildflowers, and the canopy layer consisting of widely spaced or scattered oak trees. The establishment of an oak savanna in this unit is strongly favored by the community based on feedback given during the community input meeting in March 2022 and the subsequent online survey.

Outlet Bowl

The outlet bowl is the most topographically unique unit with north, south, and east facing slopes forming a “bowl” around the Old Bassett Creek Tunnel outlet. The unit also has some low-lying areas that contain ephemeral riverbank communities which can be inundated for long periods of the year. These areas are dominated by annual and weedy plants, and these species make up 21 of the 60 species recorded in this unit. Early detection of invasive species in shoreline areas will be important for preventing the establishment of new invasive species in other areas of the site.

It should be emphasized that the presence of a non-native species is not necessarily an issue, and non-native does not connote that the species is “bad” or a problem. However, some of the species present have been shown to be “invasive” – which is a behavioral trait, not a trait of origin. These species have the potential to cause ecological harm at the site, whether by increasing erosion, outcompeting other species that are important for

pollinators, birds, and wildlife, or by creating monocultures that affect viewsheds and park aesthetics.
The groundcover on the slopes is dominated by Virginia creeper and wild grape, and shrubs and small saplings struggle to break through the dense vine cover. However, this unit has the most diverse canopy composition at the site with basswood, American elm, maples, hackberry, and green ash all making up components of the canopy or subcanopy in addition to the box elder and cottonwood that are ubiquitous in all units.

Because the unit contains both the Old Bassett Creek Tunnel outlet and is an inlet on the Mississippi River, the shoreline areas contain a sizeable amount of trash throughout the year. While some of the shoreline areas are difficult to access due to the topography and dense vine coverage, trash pickups can be done from other areas of the shore or by wading in the inlet during the low water summer months.

Figure 6: 2 Foot Elevation Contours in vicinity of James Rice Park. Source: Hennepin County GIS - Natural Resources.

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Central Riverbank

This is the most diverse unit within the park, with 64 species recorded during the 2021 field season. However, over one-third (24) of those species are classified as non-native or invasive.

This unit is also the most diverse in terms of topography and influence from neighboring units and features. The unit is crisscrossed by trails, has both steep and flat areas, is bordered by both the river and the upper paved path, and shares its north and south boundaries with two other units. All of this serves to create a large amount of "edge" habitat that is more likely to have conditions that are different from the rest of the unit. The more edge habitat present, the more likely the unit is to suffer from issues like invasive species. True to form, the invasive plants glossy buckthorn, Amur maple, garlic mustard and greater celandine were all more common in this unit than in others.

Portions of this unit are also dominated by vine cover, which prevents most grass and wildflowers from developing past the seedling stage. The unit also has numerous buckthorn resprouts that will require attention in the coming years. Toward the south end of the unit, the canopy is dominated almost entirely by box elder. This and the South Riverbank unit present opportunities for additional subcanopy thinning to allow greater light penetration to the forest floor.

South Riverbank

This unit is the steepest and narrowest at the site, terminating in a concrete retaining wall at the south end. The unit extends both north and south of the 4th St. playground and parking lot known locally as the North Loop Playground – one of the most popular and frequented portions of the park. A small, wooded terrace with a footpath exists below the playground area and could serve as a small nature walk for families and an opportunity for signage promoting the restoration. The community has shown strong interest in formalizing a nature trail in this area with formal interpretive signage.

The canopy cover within the South Riverbank is denser than in other areas of the site, though vines still dominate the understory. There is less opportunity for canopy thinning due to the large size of the existing trees – mostly box elder and cottonwood – though subcanopy green ash are present and appear to be affected by emerald ash borer. These trees may need to be removed by MPRB to prevent them from eventually falling onto the trail. Glossy buckthorn and Amur maple are also present in this unit, and care should be taken to remove these before they spread throughout the unit.

One unique find in the unit was a population of garlic chives present at the southern tip of the unit. Likely spread from garden waste or planted purposefully, garlic chives have shown invasive behavior in Minnesota, and should be monitored or removed though this is a lower priority than removal of other invasive species listed in this plan.

Target Plant Communities

Table 1: Restoration Target Plant Communities for Existing Landcover (Source: MNDNR Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province, 2005).

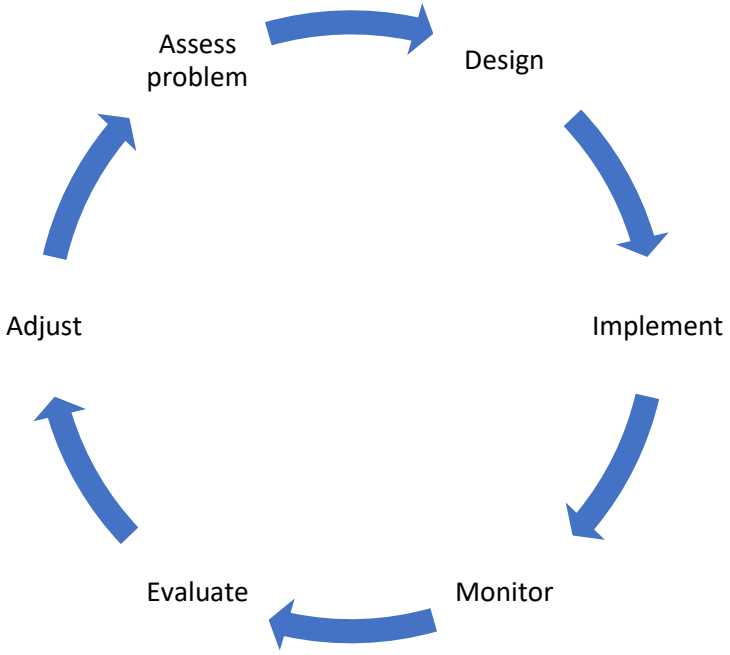
Unit	Approximate acreage	Target Plant Community
North Forest	0.75	Southern Floodplain Forest (FFs88)
North Riverbank	1	Southern Dry Oak Savanna (Ups14)
Outlet Bowl	1.5	Southern Mesic Oak-Basswood Forest (MHs38b)
Central Riverbank	1.5	Southern Terrace Forest (FFs59c)
South Riverbank	1	Southern Terrace Forest (FFs59c)

* All target plant communities will have climate-adapted tree species included to increase resiliency. Selected species come from Mississippi Park Connection and the National Park Service's climate-adapted trees list associated with the Plant for the Future and Adaptive Silviculture for Climate Change projects.

Restoration Process

Restoration is a process. It takes time to restore ecosystems to their former functionality and diversity. Sometimes this can only be approximated. It took many decades to degrade the ecosystem and biological communities on site, so it will not be restored overnight. Many steps are typically involved in a successful restoration; even deciding when a restoration is complete/successful can be very difficult. Restoration should be viewed as a process, not a state of being. The primary goal is to achieve and maintain a diverse natural community at the site, though this does not always proceed in a linear fashion. Using the concept of *adaptive management* will be key to continual progress at the site. Adaptive management is a strategy commonly used by land managers and integrates thought and action into the restoration process. It can be described as a strategy that uses evaluation, reflection, and communication, and incorporates learning into planning and

management. It is set up like a feedback loop and looks like this:



Thus, moving forward with restoration, each round of adaptive management refines and hones the process to better fit the conditions of the site. Emphasis of this strategy will be important to the longevity of this site.

Given the narrow, steep units and overall layout of the property, restoration of the site will be physically challenging. Access to all units will present difficulties, and the varied topography will necessitate care and patience. In some circumstances, steep slopes may require specialized approaches from contractors or trained volunteers to ensure safety. Restoring and maintaining any site takes dedicated time and effort. The location of much of the units above the flood line and away from direct sources of propagules (seeds of invasive species) means that restoration may be less hampered by the cycle of continual reinvasion that may affect the lower bounds of the units. Engaging MPRB and neighboring landowners and businesses in the stewardship of their lands will not only help the restoration of the property be more successful - as it will reduce the potential seed source of non-native or invasive plants - but will also increase the size of natural communities being protected and managed in the area. The creation of a habitat corridor will greatly benefit the wildlife species that use these oases within a very urbanized area.

Within this plan, restoration tasks are prioritized, with the most important resources or vital areas taking precedence. However, restoration will ultimately be conducted based on available funds and resources and may not occur sequentially or as prioritized.

On this site, continued removal of woody invasive plants throughout the property is the highest priority, followed by removal of invasive herbaceous plants. Without these crucial steps, the units will continue to lose diversity and will be consistently plagued by re-invasion. Prioritizing invasive plant removal will lead to better results in subsequent

restoration tasks. The second priority will be to increase native diversity and cover in all units. This will be done through a mix of seeding and planting. Lastly, a final goal will be to thin existing weedy tree species, allowing for more light at the forest floor and better view of the Mississippi River for parkgoers. These priorities will all help to accomplish the main goals of increasing wildlife and pollinator habitat throughout the property.

Restoration Goals

The priority of this restoration is to create diverse, healthy habitats that support wildlife and overall ecosystem health. Healthy ecosystems will support a variety of wildlife, and will provide several ecosystem services, including water retention and filtration. Toward achieving this goal, restoration will aim to improve the diversity, composition, and structure of the plant communities throughout the property, which will also better reflect what would have been present prior to European colonization of the area. This includes the improvement of habitats that have been historically decimated throughout the state but does not mean that the restoration will be solely focused on conversion of current natural communities to what may have been present in the past. However, thoughtful restoration of degraded areas will improve the ecological functions that both historic native plant communities and current healthy communities provide, including:

- habitat for a diversity of wildlife species,
- nutrient and water cycling,
- carbon storage,
- park aesthetics – sightlines, blooms, connection to the river
- erosion control,
- filtration of nutrients, sediment, and pollutants,
- development and enrichment of soils,
- local temperature moderation.

Degraded by past uses, the existing plant cover retains little native diversity, and is mostly dominated by a mix of generalist native species and non-native, invasive plants. A healthy and diverse plant community can provide much greater wildlife value than a degraded one, and tends to be much more stable, and less susceptible to disease, invasive species, and other disturbances. Moreover, the site's location along the Mississippi River – one of the world's most important migration corridors – necessitates that restoration focus on providing plant resources that support migrating birds and other wildlife.

This management direction is strongly supported by the community with the majority of survey respondents highly prioritizing the planting of native plants and especially those plants that will support pollinators.

Management recommendations are developed for each unit with the overall objectives for the property focused on protecting and restoring high quality habitat by removing invasive plant species and providing pollinator, bird, and wildlife habitat that is also

aesthetically pleasing. Specific goals include the following and should be attained by the fifth year of the restoration process:

1) All units: Reduce invasive woody stems to <5% cover.

2) All units: Increase forest plant diversity by establishing at least 10 native grass and forb species, five shrub species, and five tree species adapted for a changing climate.

3) North Riverbank unit: Establish grass-dominated native groundcover with scattered shrubs and trees.

4) Central and South Riverbank units: Thin existing weedy trees (focusing on Siberian elm, box elder, and green ash) and plant climate-adapted canopy species.

Overall management practices to achieve those goals are:

- remove non-native, invasive, woody species;
- control non-native, invasive herbaceous species;
- restore ground layer and shrub layer diversity in forest areas;
- monitor annually for potential erosion, as well as for non-native invasive woody and herbaceous species;
- add climate adapted tree species to improve the overall resiliency of the forested unit;
- institute a monitoring plan to track effectiveness of management and restoration activities;
- explore other opportunities to create wildlife habitat, including but not limited to wildlife piles, turtle nesting habitat, etc.

Management Priorities

Invasive Woody Removal

As of spring 2022, the bulk of the invasive plant removal has already been accomplished. In 2020, NLNA's "North Loop Park Stewards" group began invasive plant removal throughout the park, and with later guidance from FMR staff, the volunteers continued to manage invasive plants. A cursory assessment of the park identified low native tree diversity and abundance of invasive shrubs and trees. Primary non-native species to remove are common buckthorn and Tatarian honeysuckle, and white mulberry, Siberian elm, and black locust constitute secondary species. Because restoration is being completed by volunteers, herbicide will not be used for woody or herbaceous species removal. For all woody removal, stumps should be cut high to allow re-sprouting or cut low and covered with Buckthorn Baggies. (See APPENDIX C. Methods for Controlling

Invasive Plant Species for more information on controlling both native and non-native species.)

Hand cutting (with saws and loppers) will be the most-used method given the varied topography. Hand cutting can be done at various times of the year, though the fall is recommended as native plants will have senesced and buckthorn and other invasive plants that hold their leaves longer will be easier to identify.

Yearly follow-up treatments will be necessary for the first few years as native plant cover re-establishes. If done correctly, stump-sprouting should only occur in small numbers (if at all), though these sprouts will need to be re-cut and covered with Buckthorn Baggies, or continually cut 1-2 times for 2-3 years. The seedbank will be more problematic as buckthorn seeds can remain viable for at least five years. Treating germinating seedlings will be a difficult and repetitive process but can be accomplished through repeated pulling or hand cutting. Seeding and planting native grasses and wildflowers will also help to compete with germinating buckthorn seedlings over time as they establish.

Invasive herbaceous plant removal

Primary non-native species to remove include garlic mustard, greater celandine, burdock, spotted knapweed, Canada thistle, white and yellow sweet clover, and various others (see APPENDIX A. Plant Species Recorded at James Rice Park for species lists by unit). Monitoring for new invasions, like the population of garlic chives present at the south end of the park, will be key to catching and treating any early infestations. Because they are not yet widespread, removal of each of these species through pulling and digging is the best way to limit their spread without requiring the use of any herbicides. For many herbaceous species, the roots and rhizomes can sprout new plants, so every effort should be made to pull or dig the entire plant while limiting soil disturbance and the potential for erosion followed by bagging the removed plants.

Native seeding and planting

In the more open areas of the forests, such as edges, canopy gaps, and much the North Riverbank Unit, seeding will be necessary after woody invasive removal. Cover of native plants will help to fill unoccupied niches and compete with and suppress germinating buckthorn seedlings and herbaceous invaders. Forb, shrub, and tree planting volunteer events will also help restore shrub and sapling-layer diversity. Tree planting should focus on areas where dense buckthorn was removed and where the existing canopy is largely a monoculture. Planting should focus on important habitat trees like cottonwoods and oaks, as well as climate adapted species like sycamore, hickory, Kentucky coffee tree, and others. See

APPENDIX B. Plant Species for Restoration at James Rice Park for a list of native plant species for restoration at the site.

Additional Management Options

Goats

Goats can also be used for buckthorn and native vine control. For woody species, multiple grazing periods will be necessary to get full control. The optimal timing for repeated browsing is late spring and again in late summer. As with critical cutting, grazing can help reduce buckthorn with repeated use over many years and is most successful where there is a dense tree canopy. Grazing is best used in combination with other methods. For example, goat grazing can be combined with native grass and wildflower seeding to improve seed to soil contact, germination, and soil retention.

Goats can also be an effective tool for controlling garlic mustard if the timing is right. Garlic mustard is a biennial plant, so if it is cut or browsed when it is flowering and just starting to form seeds, then the plant will typically die. If cut too soon, the plant will resprout and go another year.

Goats will also graze native species such as riverbank grape and Virginia creeper which can dominate the understory and inhibit growth of other ground layer species.

There are also several downsides to using goats. Goats are not at all selective and will target almost any species of plant within the site. On sites where invasive plant removal is undertaken alongside re-establishment of desirable native species, goat's indiscriminate grazing can set back or entirely remove new native plants. Goat grazing can also lead to erosion on steep slopes with erodible soils.

Goats are a useful "tool in the toolbox" for restoration, and when used correctly can supplement other tools. However, goats are neither a one-off nor inexpensive option. Because of the site logistics and other local regulations, units would have to be fenced with multiple layers of fencing, and the herd would likely need to be always tended, drastically increasing the cost of goat deployment. Coupled with the need for multiple deployments at the site, this could quickly become an expensive proposition.

In consideration of the size, topography, significant public access, and landowner constraints of this site and how these constraints will likely translate into considerable cost, other approaches for managing invasive plants are recommended, though goats can be explored pending MPRB approval and NLNA funding availability.

Subcanopy Thinning

Proactive thinning of the canopy and shrub layers may be necessary to establish native understory vegetation in some areas. Especially in areas where the canopy and subcanopy

are essentially monocultures, this can have the added benefit of making room for additional species that will help diversify the future tree canopy at the site

Native species such as box elder, sumac, and green ash could all be thinned, especially in areas where they have become very dense - such as the North Riverbank, Central Riverbank, and South Riverbank units. Removal should focus on creating canopy gaps through the selective removal of smaller subcanopy or shrub layer individuals. Larger individuals present logistical difficulties for removal, increase cost, and currently play an important role in canopy and slope stabilization.

Any tree removal must be approved by MPRB forestry and be conducted by a professional – whether MPRB staff or a subcontractor. Winter tree removal is recommended to limit soil disturbance and subsequent erosion and may be required to prevent disturbance to bat hibernacula. Large tree removal to open the canopy is highly favored by the community based on input session and online survey feedback.

Monitoring

Monitoring is paramount to restoration success. Restored areas must be regularly monitored to identify ecological issues such as erosion and sedimentation, invasive species, and disease. Vegetation monitoring, evaluation, and assessment should be done yearly by a trained site stewards or restoration professional, and more frequent monitoring will be needed in the initial phases of restoration to evaluate the success of tasks and to inform adaptive management strategies. Adapting to issues or factors observed during monitoring and assessment is vital to the restoration process.

Once the primary restoration tasks are completed, the restoration process will convert to a monitoring and adaptive management phase. Long-term maintenance for the forest areas will consist of managing for invasive species, tending plantings, and monitoring every year for potential new issues. For the savanna areas, prescribed burning, mowing, or grazing should occur every two to five years to prevent woody encroachment and maintain the health of the unit. Monitoring is also important for detecting human-related issues such as waste disposal, misuse of the natural areas, and planting success. Early detection of concerns enables quick responses to address them before they become significant problems.

Monitoring is also a great way to engage volunteer stewards at the site. The James Rice Park Stewards group should engage in monitoring and record-keeping to track the status and outcomes of restoration. Work plans, completed tasks, and site notes can also be kept on-site (in the community toolbox, for example) so that stewards can keep track of changes and issues that need to be addressed. FMR plans to develop a “pocket guide” for use by volunteers that includes the schedule of recommended management tasks, a focused plant identification guide to assist with identification of likely invasive plants and seeded and planted species that can be monitored for establishment.

Finally, monitoring animal as well as plant communities is also helpful for evaluating results of the restoration. A comparison of bird populations before and after restoration, for example, would be a valuable tool for quantifying positive impacts on the land. Trail cameras can also provide information on wildlife using the property. This is another area where citizens should be involved in the process, and tie-ins with programs like Monitoring Avian Productivity and Survivorship (MAPS), the Minnesota Bee Atlas, and eMammal would provide great citizen science opportunities.

Restoration Schedule, Cost Estimates, and MPRB Coordination

A general timeframe is shown in **Error! Reference source not found.**, but note that the year for any given task may shift, depending on when the project starts. Note also that cost estimates are provided for specific tasks that may not be feasible for volunteers. Estimates are based on similar projects but may be higher or lower than actual rates.

The work units are referred to by the unit's name. Undertaking the recommended restoration in this plan will be a significant task. A list of ecological restoration contractors is listed in APPENDIX D. Ecological Contractors, though this process of restoration is designed to be completed with volunteers. Additional fundraising efforts will be needed for contracted services.

The below tables are estimated schedules and approximate costs for restoration and management tasks for the property. Both the project tasks and costs are likely to change as the project progresses; these tables should be used only as general guides.

Work recommended below will require coordination and approval by MPRB. Tree and shrub planting must be completed under an MPRB permit for tree planting. The application for this permit requires submittal of a landscape plan for each planting area showing species, quantities, and intended locations. A permit for each spring and fall planting activities within one calendar year is necessary. The MPRB contact for this permit is:

James Shaffer (or Natural Resources Supervisor)
jshaffer@minneapolisparks.org/ (612) 313-7723

Removal of invasive woody material with the expectation of removal by MPRB Forestry will require similar coordination and approval resulting in a Forestry work permit. MPRB will require submittal of a map with the work area circled and a timeline of work stated. MPRB will accept or amend the proposal and provide direction on how and where to pile debris to be removed by MPRB Forestry. One request per 2-week increments of work is acceptable. The MPRB contact for this permit is:

Craig Pinkalla (or Forestry Supervisor)
cpinkalla@minneapolisparks.org / (612) 499-9233

The NLNA and FMR intend to hold annual coordination meetings with MPRB in January or February of each year. During these meetings, annual restoration progress can be discussed, any necessary changes to future tasks or schedule can be made, and the NLNA and MPRB can coordinate necessary permits and support of volunteer activities.

Table 2: Restoration Schedule and Task List.

Year	Season	Unit	Activity	Acres	Event type	Cost est.
2022	Winter	North Riverbank, Central Riverbank	Seed open areas after woody removal – broadcast seed with native grass-only mix or simple pollinator mix.	2.50	Small groups	$250 (seed)
2022	Spring: May-June	All units	Pull and bag biennial invasive species: burdock, garlic mustard, greater celandine, etc.	6.00	Large event or small groups	$0.50/yard waste bag
2022	Summer	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Tend planted trees and shrubs (check cages, water, weed, place double shredded hardwood mulch)	4.75	Small groups	$200
2022	Fall: September	South Riverbank, North Riverbank	Plant trees and shrubs into removal areas	2.00	Large event	$400
2022	Fall: October	All units	Clip buckthorn re-sprouts, pull seedlings, bundle and stake pulled seedlings on eroded slopes or bag for composting	6.00	Small groups	$0.50/yard waste bag
2022	Fall	All units	Pull and bag first-year rosettes of larger biennial invasive plant species (burdock, celandine, mullein, etc.)	6.00	Small groups	$0.50/yard waste bag
2023	Winter	North Riverbank	Seed open areas after woody removal – broadcast seed with simple pollinator mix	1.00	Small groups	$250
2023	Spring: May-June	All units	Pull and bag biennial invasive species: burdock, garlic mustard, greater celandine, etc.	6.00	Small groups	$0.50/yard waste bag
2023	Spring: June	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Plant wildflowers, grasses, and sedges into open areas	4.75	Large event	$300

2023	Summer	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Tend planted trees and shrubs (check cages, water, weed, mulch with double shredded hardwood mulch)	4.75	Small groups	$200
2023	Fall: September	South Riverbank, North Riverbank	Plant trees and shrubs into removal areas	2.00	Large event	$400
2023	Fall: October	All units	Clip buckthorn re-sprouts, pull seedlings, bundle and stake pulled seedlings on eroded slopes or bag for composting	6.00	Small groups	$0.50/yard waste bag
2023	Late fall	All units	Pull and bag first-year rosettes of larger biennial invasive plant species (burdock, celandine, mullein, etc.)	6.00	Small groups	$0.50/yard waste bag
2024	Spring: May-June	All units	Pull and bag biennial invasive species: burdock, garlic mustard, greater celandine, etc.	6.00	Small groups	$0.50/yard waste bag
2024	Spring	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Plant plugs (~2” root depth) wildflowers, grasses, and sedges into open areas	4.75	Large event	$300
2024	Summer	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Tend planted trees and shrubs (check cages, water, weed, place double shredded hardwood mulch)	4.75	Small groups	$200
2024	Fall: September	South Riverbank, North Riverbank	Plant trees and shrubs into removal areas	2.00	Large event	$300
2024	Fall: October	All units	Clip buckthorn re-sprouts, pull seedlings, bundle and stake pulled seedlings on eroded slopes or bag for composting	6.00	Small groups	$0.50/yard waste bag
2024	Late fall	All units	Pull and bag first-year rosettes of larger biennial invasive plant species (burdock, celandine, mullein, etc.)	6.00	Small groups	$0.50/yard waste bag
2025	Winter	North Riverbank	Seed open areas after woody removal – broadcast seed with simple pollinator mix	1.00	Small groups	$250
2025	Spring: May-June	All units	Pull and bag biennial invasive species: burdock, garlic mustard, greater celandine, etc.	6.00	Small groups	$0.50/yard waste bag

2025	Spring: June	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Plant wildflowers, grasses, and sedges into open areas	4.75	Large event	$300
2025	Summer	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Tend planted trees and shrubs (check cages, water, weed, place double shredded hardwood mulch)	4.75	Small groups	$200
2025	Fall: September	South Riverbank, North Riverbank	Plant trees and shrubs into removal areas	2.00	Large event	$300
2025	Fall: October	All units	Clip buckthorn re-sprouts, pull seedlings, bundle and stake pulled seedlings on eroded slopes or bag for composting	6.00	Small groups	-
2025	Late fall	All units	Pull and bag first-year rosettes of larger biennial invasive plant species (burdock, celandine, mullein, etc.)	6.00	Small groups	$0.50/yard waste bag
2026	Winter	North Riverbank	Seed open areas after woody removal – broadcast seed with simple pollinator mix.	1.00	Small groups	$250
2026	Spring: May-June	All units	Pull and bag biennial invasive species: burdock, garlic mustard, greater celandine, etc.	6.00	Small groups	$0.50/yard waste bag
2026	Spring: June	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Plant wildflowers, grasses, and sedges into open areas	4.75	Large event	$300
2026	Summer	North Forest, North Riverbank, Outlet Bowl, Central Riverbank	Tend planted trees and shrubs (check cages, water, weed, place double shredded hardwood mulch)	4.75	Small groups	$200
2026	Summer	All units	Assessment with MPRB or partner staff	6.00	-	-
2026	Fall: September	South Riverbank, North Riverbank	Plant trees and shrubs into removal areas	2.00	Large event	$300
2026	Fall: October	All units	Clip buckthorn re-sprouts, pull seedlings, bundle and stake pulled seedlings on eroded slopes or bag for composting	6.00	Small groups	$0.50/yard waste bag

2026	Late fall	All units	Pull and bag first-year rosettes of larger biennial invasive plant species (burdock, celandine, mullein, etc.)	6.00	Small groups	$0.50/yard waste bag
			Subtotal (does not include yard waste bag cost or water cost)			$4,900

Long Term Management and Costs

Once initial restoration tasks are completed, then long-term management ensues. Long-term management includes tasks that are required periodically to maintain healthy ecosystems. **Error! Reference source not found.** lists these tasks with associated timing intervals.

Table 3: Long-Term Management Schedule and Cost Estimates.

Season	Units	Activity	Frequency	Cost/ Ac	Cost Est.
Spring/ Summer	All	Monitor spring herbaceous invaders like garlic mustard and narrowleaf bittercress each year.	Yearly	-	-
Spring	All	Add plant diversity in areas where establishment is lacking, or individuals have died off	Every other year	-	$500
Fall	All	Monitor and manage for woody invasive plants like buckthorn. Prevent woody plants from going to seed by yearly pulling or repeatedly cutting	Yearly	-	-
Summer	All	Optional evaluation and assessment by MPRB or partner agency. Assess erosion, tree disease native plant establishment, flood damage, and other issues every 5 years	Every 5 years	-	$500
					$ 1,500-2,000 on 5-year rotation of activities

Park Restoration Beyond Current Management Plan

This NRMP is intended to guide *volunteer-led* restoration activities at James Rice Park. Based on restoration outcomes, undertaking additional activities may be desired to further advance restoration, and these activities may be outside the capabilities of volunteers. Pursuit of more advanced restoration performed by MPRB, or a qualified contractor, would require separate coordination with MPRB beyond the current NLNA-MPRB Stewardship Agreement. If work of this type is pursued, FMR is willing to foster NLNA-MPRB communication to explore activities not within the scope of this NRMP.

The table below contemplates work that might be considered by NLNA and MPRB in future phases of restoration. The inclusion of this information is intended for reference only and does not suggest a granting of permission by MPRB for this work to proceed.

Table 4: Potential Contracted Labor.

Season	Units	Activity	Acres	Cost/Ac
Winter	Central Riverbank, South Riverbank	OPTIONAL: Thin box elder and green ash subcanopy trees to allow light to the forest floor	2.00	MPRB or contracted
Spring: May-June	North Riverbank, Central Riverbank	Identify areas for intensive erosion control. Install biodegradable/natural material EC blanket.	2.50	MPRB or contracted bids
Spring	Central Riverbank, South Riverbank	ALTERNATIVE: Deploy goats to remove herbaceous invasive species and knock-back woody vines and resprouts	2.50	Contracted
Summer	Central Riverbank, South Riverbank	ALTERNATIVE: Deploy goats a second time to remove herbaceous invasive species and knock-back woody vines and resprouts	2.50	Contracted

Other Considerations

Deer and rabbits

High deer and rabbit densities are a problem for native vegetation, especially in forested areas. Both species browse native tree seedlings and saplings, preventing the regeneration of tree species. They also can put serious pressure on rare wildflowers, which they may preferentially seek out and consume. Given the site's highly urban location, use of the site by deer is rare, though possible. Rabbits are much more common, so the protection of trees and shrubs is still necessary. See the links provided in the seed and plant section for the suggested tree tubes and stakes.

Beaver

Evidence of beaver activity is visible throughout the Riverside units. Many smaller trees have been removed and larger trees like cottonwoods have evidence of beaver chewing. In the case of planting shrubs and trees to replace buckthorn and any canopy species that are removed, restoration will need to prioritize initial protection of any plantings in these units.

Tree Disease

Dutch Elm Disease and Emerald Ash Borer

There are American elm and green ash trees growing as a component of the subcanopy and shrub layers at the site. These trees are ecologically valuable but are also at high risk of attack from tree pests. Elms are susceptible to Dutch Elm Disease, and ash are

susceptible to Emerald Ash Borer. These tree pests have caused widespread mortality of elms and ash throughout Minnesota and the eastern United States.

Dutch Elm disease is a fungal infection caused by the fungus *Ceratocystis ulmi*, which is native to Asia and is spread by both native and non-native bark beetles (family: Curculionidae). Once the fungus is introduced to a tree, the tree reacts by sealing its own xylem tissues (conduits of water and nutrients) to prevent further spread. This effectively prevents water and nutrients from reaching the upper branches, causing gradual die-off as more and more of the xylem is sealed. Symptoms include a yellowing and browning of leaves that spreads from the outer crown toward the trunk. Dutch elm disease was first recorded in Minnesota near Monticello in 1961 and has since spread throughout the state. Minnesota relied heavily on American Elms (*Ulmus americana*) as shade trees on streets, with about 140 million in the state at the time of the outbreak. The disease is now present in all Minnesota counties, though elms remain an important component of many Minnesota forests.

Emerald ash borer (EAB) is a non-native wood-boring beetle from Asia that was first identified in the United States in the summer of 2002. Likely transported from Asia to Michigan in ash wood used for pallets and other shipping materials, the beetle has now been confirmed in 15 states, including Minnesota. The beetle works by depositing larvae under the bark of the tree; these larvae then feed on the wood, eventually disrupting enough of the phloem to prevent the transport of nutrients throughout the tree. While Minnesota's cold weather can stymie the spread of the beetle, it continues to spread with new outbreaks confirmed in and around the metro area. Quarantines are already in place around the metro counties, where infestations of the borer have been confirmed (including in Hennepin County and on MPRB lands). It is possible that ash trees at the site are already affected.

Ash should not be included in planting plans for the site, though resistant varieties of elm (Princeton, St. Croix, etc.) are available and can be a component of future plantings.

When large trees die, they open the canopy and create gaps, which in turn releases the understory that was formerly suppressed by the shade from such trees. If desirable species like native forbs, grasses, sedges, and shrubs exist in the understory, then this can be a good thing, since the result will probably be a net increase in bank stability and diversity. In the case of this property, these canopy gaps will likely be filled by buckthorn unless good native cover is established below. To avoid this undesirable scenario, active management is recommended. Removal of undesirable shrub species and replacing them with desirable native shrubs and herbaceous plant species is key to the restoration's longevity.

The creation of preferential canopy gaps through proactive ash removal may also allow new species to establish and planting a diverse mix of tree and shrub species will help improve the property's resilience in the face of climate change and future species invasions. Ultimately, tree removal should occur once invasive species are removed and could occur in specific dense stands or in stages (10-20% per year) to minimize

disturbance to the community. The removal should be timed to minimize impacts on the restoration process and plant communities (winter) and should be timed with understory seeding and planting to achieve the greatest native species success.

Erosion

The soil type at James Rice Park is primarily Udorthents, wet substratum, 0 to 2 percent slopes (U2A), which is considered well drained. This soil type is considered to be highly disturbed, cut and fill, or impervious surfaces, as noted in the MWMO's 2021-2031 Watershed Management Plan, Appendix D. It is likely that much of the soil is deposited fill from building nearby roads and other earthmoving activities. Bricks and other debris are also visible onsite.

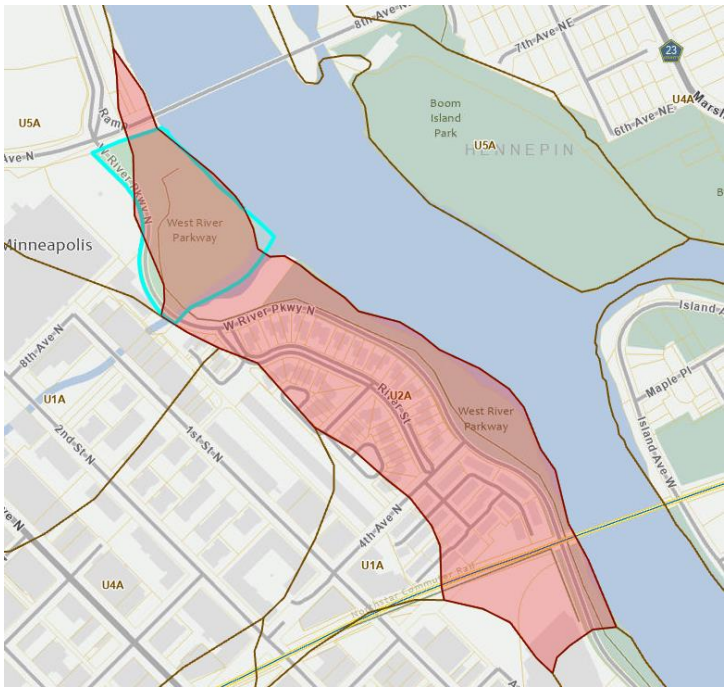


Figure 7: U2A soil type extent (highlighted in red) in vicinity of James Rice Park. Source: Hennepin County GIS - Natural Resources.

Due to the poor soils, steep slopes, and lack of native plant cover at the site, erosion is a persistent problem. Erosion is worst in the Central and South Riverbank units but is present in all units.

Due to the abundance of bare soil resulting from the effects of invasive plants and earthworms, splash erosion is frequent but does not result in much sediment transport in the units. In all units, there is some sheet erosion, evidenced by sediment accumulation behind trees or at the base of portions of the steeper slopes. This is a chronic phenomenon that can also be attributed to the lack of fine-rooted vegetation on these slopes. A denser vegetation layer throughout these units would act to break the impact of raindrops and

dissipate the energy of stormwater running on these slopes, but in some cases larger interventions will be required.

All units will be seeded with native forb and graminoid (grass and sedge) mixes once removal of non-native shrubs is complete. Installing natural wood erosion bars in areas where erosion (sheet and rill) is progressing is recommended. This is a relatively simple volunteer task that can be accomplished by placing stems of cut vegetation perpendicular to the slope, often anchored between two trees. In areas where erosion is present, but tree cover is lacking, bars can be anchored by pounding wood stakes into the slope. These stakes can be purchased at any hardwood store or crafted from additional cut vegetation. In areas where erosion is worsening, erosion blankets, grass strips, seeding and other means may be necessary to further control erosion. These should be purchased and installed with supervision by MPRB staff or subcontractors.

The prevention of further erosion is highly prioritized by the community based on gathered feedback. Simple erosion control methods such as staking small bundles of cut buckthorn on slopes, as well as more intensive approaches including blanketing and seeding are favored.

Bat Hibernacula

To prevent the disturbance of bat roosting sites, large tree removal should be undertaken in the winter months. The MNDNR offers specific guidance and requirements responsive to this concern.

Benches

The community has also expressed great interest in the addition of park benches throughout the park to allow areas for contemplation and rest. This type of improvement would be an excellent target for future fundraising efforts.

APPENDIX A. Plant Species Recorded at James Rice Park

Table 5: Plant Species Recorded at James Rice Park in 2021 Survey.

JAMES RICE PARK

			UNIT:	North Forest	North Riverbank	Outlet Bowl	Central Riverbank	South Riverbank
			DATE:	8/3/21	8/3/21	8/3/21	8/11/21	8/11/21
Non	**Family**	**Scientific Name**	**Common Name**					
Canopy 30 - 100 ft height			**Total cover*:**	**4**	**3**	**4**	**4**	**5**
	Sapindaceae	*Acer negundo*	boxelder	D**	C	A	A	A
	Cannabaceae	*Celtis occidentalis*	hackberry			R		R
x	Moraceae	*Morus alba*	white mulberry		P			
	Pinaceae	*Pinus resinosa*	red pine					R
	Salicaceae	*Populus deltoides*	cottonwood	R	P	A	C	A
	Ulmaceae	*Ulmus americana*	American elm					R
x	Ulmaceae	*Ulmus pumila*	Siberian elm		C		P	
Subcanopy 15-30 ft height			**Total cover:**	**4**	**3**	**3**	**4**	**4**
	Sapindaceae	*Acer negundo*	boxelder	A	A	A	D	D
	Sapindaceae	*Acer rubrum*	red maple			R	R	
	Sapindaceae	*Acer saccharinum*	silver maple		R			
	Betulaceae	*Betula nigra*	river birch	R				
	Bignoniaceae	*Catalpa speciosa*	catalpa				R	
	Cannabaceae	*Celtis occidentalis*	hackberry	P		P	R	P
	Oleaceae	*Fraxinus pennsylvanica*	green ash		P	P	P	P
x	Moraceae	*Morus alba*	white mulberry	P		R	C	
	Salicaceae	*Populus deltoides*	cottonwood		R		R	
	Fagaceae	*Quercus macrocarpa*	bur oak		R			
x	Fabaceae	*Robinia pseudoacacia*	black locust		P			
	Malvaceae	*Tilia americana*	American basswood	R		R		R
	Ulmaceae	*Ulmus americana*	American elm		R	R	P	
x	Ulmaceae	*Ulmus pumila*	Siberian elm		C	R	P	R
Understory/shrub layer 4-15 ft height			**Total cover:**	**2**	**4**	**2**	**3**	**2**
x	Sapindaceae	*Acer ginnala*	amur maple				R	P
	Sapindaceae	*Acer negundo*	boxelder	C		C	P	P

	Fabaceae	*Amorpha fruticosa*	false indigo		R	R	R	
	Juglandaceae	*Carya ovata*	shagbark hickory	R				
	Bignoniaceae	*Catalpa speciosa*	catalpa				R	
	Cannabaceae	*Celtis occidentalis*	hackberry			P	P	R
	Cornaceae	*Cornus racemosa*	gray dogwood			R		R
x	Elaeagnaceae	*Elaeagnus umbellata*	autumn olive				R	
x	Rhamnaceae	*Frangula alnus*	glossy buckthorn			R	R	
	Oleaceae	*Fraxinus pennsylvanica*	green ash	P	P	R	P	P
x	Caprifoliaceae	*Lonicera tartarica*	Tatarian honeysuckle	P	A	R	P	R
	Rosaceae	*Malus sp.*	apple sp.					R
x	Moraceae	*Morus alba*	white mulberry	P		P	P	R
	Rosaceae	*Prunus virginiana*	chokecherry			C	P	P
	Fagaceae	*Quercus macrocarpa*	bur oak					R
x	Rhamnaceae	*Rhamnus cathartica*	common buckthorn	P	A	C	C	P
	Anacardiaceae	*Rhus glabra*	smooth sumac		C		P	C
	Grossulariaceae	*Ribes americanum*	American black currant			P	P	P
	Grossulariaceae	*Ribes missouriense*	Missouri gooseberry			P	C	P
	Rosaceae	*Rubus occidentalis*	black raspberry			R		
	Salicaceae	*Salix nigra*	black willow		R			
	Adoxaceae	*Sambucus racemosa*	red-berried elder	R		P	C	R
	Malvaceae	*Tilia americana*	American basswood			R	R	R
	Ulmaceae	*Ulmus americana*	American elm				R	R
x	Ulmaceae	*Ulmus glabra*	Scotch elm					R
x	Ulmaceae	*Ulmus pumila*	Siberian elm		C	R	P	R
GROUNDCOVER			**Total groundcover:**	**3**	**2**	**3**	**5**	**5**
		Vines and woody species	**Total cover:**					
x	Sapindaceae	*Acer ginnala*	amur maple					C
	Sapindaceae	*Acer negundo*	boxelder			C	P	C
	Sapindaceae	*Acer saccharinum*	silver maple			R	C	
	Cannabaceae	*Celtis occidentalis*	hackberry	P	R	P	R	P

	Cornaceae	*Cornus alternifolia*	pagoda dogwood				R	
	Diervillaceae	*Diervilla lonicera*	bush honeysuckle			R	R	
x	Rhamnaceae	*Frangula alnus*	glossy buckthorn			R	R	R
	Oleaceae	*Fraxinus pennsylvanica*	green ash	R	P	P	P	P
x	Caprifoliaceae	*Lonicera tartarica*	Tatarian honeysuckle	R	P	R	P	P
x	Moraceae	*Morus alba*	white mulberry	R	P	R	P	R
	Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	A	C	A	D	D
	Salicaceae	*Populus deltoides*	cottonwood		R		P	
	Rosaceae	*Prunus virginiana*	chokecherry	R	R	P	P	P
	Fagaceae	*Quercus macrocarpa*	bur oak					R
x	Rhamnaceae	*Rhamnus cathartica*	common buckthorn	P	P	P	C	C
	Anacardiaceae	*Rhus glabra*	smooth sumac		P		P	P
	Grossulariaceae	*Ribes americanum*	American black currant			R	P	
	Grossulariaceae	*Ribes missouriense*	Missouri gooseberry	P	P	P	P	P
	Malvaceae	*Tilia americana*	American basswood		R			P
	Ulmaceae	*Ulmus americana*	American elm			R	R	R
x	Ulmaceae	*Ulmus pumila*	Siberian elm		P			P
	Vitaceae	*Vitis riparia*	wild grape	P	C	A	D	D

		Forbs	**Total cover:**					
x	Malvaceae	*Abutilon theophrasti*	velvet leaf				R	
	Euphorbiaceae	*Acalypha rhomboidea*	three-seeded mercury			R		
	Asteraceae	*Achillea millefolium*	yarrow		R			
	Asteraceae	*Ageratina altissima*	white snakeroot	A	P	C	C	A
x	Brassicaceae	*Alliaria officinalis*	garlic mustard	C	P	P	C	P
x	Alliaceae	*Allium tuberosum*	garlic chives					P
	Asteraceae	*Ambrosia psilostachya*	western ragweed				R	P
x	Asteraceae	*Arctium minus*	common burdock	C		P	P	R
x	Asteraceae	*Artemisia absinthium*	absinthe wormwood	C	P		P	
x	Asteraceae	*Artemisia vulgaris*	common mugwort	P			R	

	Asclepiacea	*Asclepias incarnata*	swamp milkweed				R	
	Asclepiacea	*Asclepias syriaca*	common milkweed		R	R		R
	Asteraceae	*Aster sp.*	aster sp.					R
x	Brassicaceae	*Berteroa incana*	hoary alyssum	P	R	R	P	R
	Asteraceae	*Bidens cernua*	nodding bur-marigold				R	
	Urticaceae	*Boehmeria cylindrica*	false nettle			P	C	R
x	Asteraceae	*Centaurea maculosa*	spotted knapweed		P			
x	Papaveraceae	*Chelidonium majus*	greater celandine				C	
x	Amaranthaceae	*Chenopodium album*	lamb's-quarters			R		R
	Amaranthaceae	*Chenopodium simplex*	maple-leaf goosefoot			R		R
	Onagraceae	*Circaea leutetiana*	enchanter's nightshade			R		
x	Asteraceae	*Cirsium arvense*	Canada thistle	R		R		
x	Convolvulaceae	*Convolvulus arvensis*	field bindweed					R
	Polygonaceae	*Fallopia cilinodis*	fringed black-bindweed			R		
	Rosaceae	*Geum canadense*	white avens			R		
x	Lamiaceae	*Glechoma hederacea*	creeping Charlie			R	R	
	Boraginaceae	*Hackelia virginiana*	Virginia stickseed			R	R	
	Asteraceae	*Helenium autumnale*	sneezeweed				R	
	Asteraceae	*Helianthus sp.*	cultivated sunflower					R
	Balsaminaceae	*Impatiens capensis*	spotted jewelweed			P		
x	Lamiaceae	*Leonurus cardiaca*	motherwort	C	R	P	P	C
x	Scrophulariaceae	*Linaria vulgaris*	butter and eggs				R	
x	Myrsinaceae	*Lysimachia nummularia*	moneywort			R		
x	Fabaceae	*Melilotus alba*	white sweet clover		R	R	P	P
x	Fabaceae	*Melilotus officinalis*	yellow sweet clover					R
	Nyctaginaceae	*Mirabilis nyctaginea*	wild four o'clock		R	R		R
x	Lamiaceae	*Nepeta cataria*	catnip	C	R	R	P	P
	Onagraceae	*cf. Oenothera*	cf. primrose				R	
	Onagraceae	*Oenothera biennis*	common evening primrose				R	

	Oxalidaceae	*Oxalis stricta*	wood sorrel			R	R	
	Polygonaceae	*Persicaria lapathifolia*	pale smartweed	R		R	P	
	Lamiaceae	*Physostegia virginiana*	obedient plant				R	
	Polygonaceae	*Polygonum aviculare*	prostrate knotweed			R		R
	Ranunculaceae	*Ranunculus abortivus*	little leaf buttercup			R		
	Ranunculaceae	*cf. Ranunculus recurvatus*	cf. hooked buttercup				R	
x	Brassicaceae	*Raphanus raphanistrum*	wild radish	R				
x	Polygonaceae	*Rumex crispus*	curly dock	R			R	R
x	Caryophyllaceae	*Saponaria officinalis*	bouncing bet				C	R
	Lamiaceae	*Scutellaria lateriflora*	mad-dog skullcap				R	
x	Fagaceae	*Securigara varia*	crown vetch	P	C			
	Cucurbitaceae	*Sicyos angulatus*	bur cucumber			R		R
x	Caryophyllaceae	*Silene csereii*	Balkan catchfly				R	
x	Caryophyllaceae	*Silene latifolia*	white campion		R			
x	Solanaceae	*Solanum dulcamara*	bittersweet nightshade	P		C	C	P
x	Solanaceae	*Solanum ptychanthum*	black nightshade			R		
	Asteraceae	*Solidago canadensis*	Canada goldenrod	P	R	P	C	C
x	Asteraceae	*Taraxacum officinale*	common dandelion			R		
	Lamiaceae	*Teucrium canadense*	American germander			R		
	Anacardiaceae	*Toxicodendron rydbergii*	poison ivy			R		
	Urticaceae	*Urtica dioica*	stinging nettle	R		R		R
x	Scrophulariaceae	*Verbascum thapsus*	common mullein		R	R		
	Verbenaceae	*Verbena urticifolia*	white vervain				R	
	Asteraceae	*Vernonia fasciculata*	ironweed			R	R	
	Violaceae	*Viola pubescens*	downy yellow violet			R		
	Asteraceae	*Xanthium strumarium*	rough cocklebur				R	

		Graminoids	**Total cover:**					
x	Poaceae	*Bromus inermis*	smooth brome	P		R		P
	Cyperaceae	*cf. Carex bicknellii*	cf. Bicknell's sedge		R			

	Cyperaceae	*Carex blanda*	eastern woodland sedge		R			
	Cyperaceae	*Cyperus esculentus*	yellow nutsedge				P	
	Poaceae	*Elymus virginicus*	Virginia wild rye				R	
	Poaceae	*Leersia virginica*	white cutgrass					R
x	Poaceae	*Phalaris arundinaceae*	reed canary grass				R	
	Poaceae	*Unk. grass*	unknown grass				R	

		*Bare soil**		4	4	4	2	1
		Deadwood		2	2	1	2	2
		Leaf litter		1	2	2	3	5

* Relative Cover Classes for vegetation layers and site characteristic: 0.5 (0-1%), 1 (1-5%), 2 (5-25%), 3 (25-50%), 4 (50-75%), 5 (75-100%).
** D=dominant, A=abundant, C=Common, P=present,
R=rare

APPENDIX B. Plant Species for Restoration at James Rice Park

The following plant species are recommended for use in restoration.

Table 6: Southern Floodplain Forest (FFs68) plant species for restoration.

Forbs, Ferns & Fern Allies		**Grasses & Sedges**	
Three-seeded mercury	*Acalypha rhomboidea*	Ambiguous sedge	*Carex amphibola*
Green dragon	*Arisaema dracontium*	Gray's sedge	*Carex grayi*
Eastern panicled aster	*Aster lanceolatus*	Bladder sedge	*Carex intumescens*
Side-flowering aster	*Aster lateriflorus*	Hop umbrella sedge	*Carex lupulina*
Ontario aster	*Aster ontarionis*	Cattail sedge	*Carex typhina*
Bur marigold and Beggar ticks	*Bidens spp.*	Stout woodreed	*Cinna arundinacea*
False nettle	*Boehmeria cylindrica*	Virginia wild rye	*Elymus virginicus*
Tall bellflower	*Campanula americana*	Rice cut grass	*Leersia oryzoides*
Honewort	*Cryptotaenia canadensis*	White grass	*Leersia virginica*
Dodder	*Cuscuta spp.*		
Wild cucumber	*Echinocystis lobata*	**Climbing Plants**	
White snakeroot	*Eupatorium rugosum*	Canada moonseed	*Menispermum canadense*
Nodding or Virginia stickseed	*Hackelia deflexa or H. virginiana*	Virginia creeper	*Parthenocissus spp.*
Touch-me-not	*Impatiens spp.*	Greenbrier	*Smilax tamnoides*
Southern blue flag	*Iris virginica*	Climbing poison ivy	*Toxicodendron rydbergii*
Wood nettle	*Laportea canadensis*	Wild grape	*Vitis riparia*
Cut-leaved bugleweed	*Lycopus americanus*		
Northern bugleweed	*Lycopus uniflorus*	**Shrubs/Trees**	
Common mint	*Mentha arvensis*	Black willow	*Salix nigra*
Clearweed	*Pilea spp.*	Serviceberry	*Amelanchier spp*
Virginia knotweed	*Polygonum virginianum*	Dogwood	*Cornus spp*
Kidney-leaved buttercup	*Ranunculus abortivus*	Hackberry	*Celtis occidentalis*
Tall coneflower	*Rudbeckia laciniata*	Silver Maple	*Acer saccharinum*
Mad dog skullcap	*Scutellaria lateriflora*	Cottonwood	*Populus deltoides*
Bur cucumber	*Sicyos angulatus*		
Carrion flower	*Smilax spp.*		
Woundwort	*Stachys palustris*		
Narrow-leaved hedge nettle	*Stachys tenuifolia*		
Germander	*Teucrium canadense*		
Stinging nettle	*Urtica dioica*		
Stemless blue violets	*Viola sororia and similar Viola spp.*		

Table 7: Southern Terrace Forest (FFs59) plant species for restoration.

Forbs		**Vines**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Allium tricoccum	Wild leek	*Menispermum canadense*	Canada moonseed
Anemone quinqefolia	Wood anemone	*Parthenocissus quinquefolium*	Virginia creeper
Arisaema triphyllum	Jack in the pulpit	**Shrubs**	
Aster cordifolius	Heart-leaved aster	**Scientific Name**	**Common Name**
Aster ontarionis	Ontario aster	*Cornus amour*	Silky dogwood
Aster pubentior	Flat-topped aster	*Euonymous atropurpureus*	Easten wahoo
Campanula americana	Tall bellflower	*Prunus virginiana*	Chokecherry
Caulophyllum thalictroides	Blue cohosh	*Ribes americanum*	Wild black currant
Circaea alpina	Small enchanter's nightshade	*Ribes cynosbati*	Prickly gooseberry
Circaea lutetiana	pointed-leaved tick-trefoil	*Ribes missouriense*	Missouri gooseberry
Cryptotaenia canadensis	Honewort	*Sambucus canadensis*	Common elder
Dicentra cucullaria	Dutchmen's breeches	*Sambucus racemosa*	Red-berried elder
Enemion biternatum	False rue-anemone	*Viburnum lentago*	Nannyberry
Erythronium albidum	White trout lily	**Canopy Trees**	
Galium aparine	Cleavers	**Scientific Name**	**Common Name**
Galium triflroum	Three-flowered bedstraw	*Acer saccharinum*	Silver maple
Geranium maculatum	Wild geranium	*Celtis occidentalis*	Hackberry
Geum canadense	White avens	*Populus deltoides*	Cottonwood
Hydrophyllum virginianum	Virginia waterleaf	*Salix nigra*	Black willow
Impatiens capensis	Touch-me-not	*Tilia americana*	Basswood
Lilium michiganense	Michigan lily	*Ulmus rubra*	Slippery elm
Maianthemum canadense	Canada mayflower	*Ulmus americana*	American elm
Osmorhiza claytonii	Clayton's sweet cicely	**Ferns & Fern Allies**	
Phlox divaricata	Blue phlox	**Scientific Name**	**Common Name**

Polygonatum biflorum	Giant Solomon's-seal	*Matteucia struthiopteris*	Ostrich fern
Forbs		**Understory Trees**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Ranunculus arbotivus	Kidney-leaf buttercup	*Acer saccharinum*	Silver maple
Rudbeckia lacinata	Goldenglow	*Carya cordiformis*	Bitternut hickory
Sanguinaria canadensis	Bloodroot	*Celtis occidentalis*	Hackberry
Sanicula gregaria	Black snakeroot	*Ostrya virginiana*	Ironwood
Smilacina racemosa	False Solomon's seal	*Tilia americana*	Basswood
Smilacina stellata	Starry false Solomon's seal	*Ulmus americana*	American elm
Smilax lasioneura	Carrion flower	*Ulmus rubra*	Slippery elm
Stachys palustris	Woundwort	**Grasses/Rushes/Sedges**	
Thalictrum dasycarpum	Tall meadow-rue	**Scientific Name**	**Common Name**
Thalictrum dioicum	Early meadow-rue	*Calamagrostis canadensis*	Bluejoint
Trillium cernuum	Nodding trillium	*Carex amphibola*	Ambiguous sedge
Trillium flexipes	Drooping trillium	*Carex pedunculata*	Long-stalked sedge
Uvularia grandiflora	Yellow bellwort	*Carex radiata*	Stellate sedge
Viola pubescens	Yellow violet	*Carex sprengelli*	Sprengel's sedge
		Cinna arundinacea	Stout woodreed
		Elymus hystrix	Bottlebrush grass
		Elymus virginicus	Virginia wild rye
		Elymus wiegandii	Canada wild rye
		Glyceria striata	Fowl manna-grass

Table 8: Southern Mesic Oak-Basswood Forest (MHs38) (Modified from FDs38) plant species for restoration.

Forbs		**Grasses/Rushes/Sedges**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Actaea rubra	Baneberry	*Carex pensylvanica*	Pennsylvania sedge
Amphicarpaea bracteata	Hog-peanut	*Carex blanda*	Woodland sedge
Arisaema triphyllum	Jack in the pulpit	**Shrubs**	
Anemone quinqefolia	Wood anemone	**Scientific Name**	**Common Name**
Aralia nudicaulis	Wild sarsaparilla	*Cornus alternifolia*	Pagoda dogwood
Athyrium filix-femina	Lady fern	*Cornus racemosa*	Gray dogwood
Botrichium virginianum	Rattlesnake fern	*Corylus americana*	American hazelnut
Circaea lutetiana	Enchanter's nightshade	*Prunus virginiana*	Chokecherry
Cryptotaenia canadensis	Honewort	*Viburnum lentago*	Nannyberry
Desmodium glutinosum	pointed-leaved tick-trefoil	*Ribes missouriense*	Missouri gooseberry
Eupatorum rugosum	White snakeroot	**Trees**	
Galium aparine	Cleavers	**Scientific Name**	**Common Name**
Galium triflorum	Three-flowered bedstraw	*Carya cordiformes*	Bitternut hickory
Geranium maculatum	Wild geranium	*Celtis occidentalis*	Hackberry
Geum canadense	White avens	*Fraxinus pensylvanica*	Green ash
Hydrophyllum virginianum	Virginia waterleaf	*Ostrya virginiana*	Ironwood
Helianthus strumosus	Woodland sunflower	*Prunus serotina*	Black cherry
Osmorhiza claytonii	Clayton's sweet cicely	*Quercus alba*	White oak
Phyrma leptostachya	Lopseed	*Quercus ellipsoidalis*	Northern pin oak
Sanicula gregaria	Black snakeroot	*Quercus macrocarpa*	Bur oak
Smilacina racemosa	False Solomon's seal	*Quercus rubra*	Northern red oak
Solidago flexicaulis	Zig zag goldenrod	*Tilia americana*	American basswood
Thalictrum dioicum	Early meadow rue	*Ulmus americana*	American elm
Viola pubescens	Yellow violet	*Ulmus rubra*	Red elm

Table 9: Southern Dry Savanna (Ups14) plant species for restoration.

Forbs		**Trees**	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Ambrosia psilostachya	Western ragweed	*Pinus banksiana*	Jack pine
Anemone cylindrica	Long-headed thimbleweed	*Quercus ellipsoidalis*	Northern pin oak
Artemesia ludoviciana	White sage	*Quercus macrocarpa*	Bur oak
Asclepias syriaca	Common milkweed	*Quercus velutina*	Black oak
Aster ericoides	Heath aster	**Shrubs**	
Aster oolentangiensis	Skyblue aster	**Scientific Name**	**Common Name**
Campanula rotundifolia	Harebell	*Amelanchier alnifolia*	Saskatoon
Chrysopsis villosa	Hairy golden aster	*Corylus americana*	American hazelnut
Comandra umbellata	Bastard toad-flax	*Prunus virginiana*	Chokecherry
Conyza canadensis	Horseweed	*Rhus glabra*	Smooth sumac
Coreopsis palmata	Bird's foot coreopsis	*Viburnum lentago*	Nannyberry
Dalea purpurea	Purple prairie clover	**Grasses/Rushes/Sedges**	
Dalea villosa	Silky prairie clover	**Scientific Name**	**Common Name**
Euphorbia corollate	Flowering spurge	*Andropogon gerardii*	Big bluestem
Hedeoma hispida	Mock pennyroyal	*Bouteloua curtipendula*	Side-oats grama
Helianthemum bicknellii	Hoary frostweed	*Bouteloua hirsuta*	Hairy grama
Helianthus pauciflorus	Stiff sunflower	*Calamovilfa longifolia*	Sand reed-grass
Lechea stricta	Prairie pinweed	*Carex foenea*	Hay sedge
Lespedeza capitata	Round-headed bushclover	*Carex muhlenbergia*	Muhlenberg's sedge
Liatris aspera	Rough blazing star	*Carex pensylvanica*	Pennsylvania sedge
Lithospermum canescens	Hoary puccoon	*Eragrostis spectabilis*	Purple lovegrass
Lithospremum caroliniense	Hairy puccoon	*Koeleria pyramidata*	Junegrass
Monarda punctata	Mountain mint	*Leptoloma cognatum*	Fall witch grass
Penstemon grandiflorus	Large-flowered beardtongue	*Panicum perlongum*	Long-leaved panic grass

Physalis virginiana	Virginia ground cherry	*Panicum oligosanthes*	Scribner's panic grass
Potentilla arguta	Tall cinquefoil	*Panicum virgatum*	Switchgrass
Selaginella rupestris	Rock spikemoss	*Schizachyrium scoparium*	Little bluestem
Smilacina stellata	Starry false Solomon's seal	*Sorghastrum nutans*	Indian grass
Solidago missouriensis	Missouri goldenrod	*Sporobolous heterolepsis*	Prairie dropseed
Solidago nemoralis	Gray goldenrod	*Stipa spartea*	Porcupine grass
Solidago speciosa	Showy goldenrod		

Seed Mixes for Restoration at James Rice Park

The following mixes are recommended for use in restoration at James Rice Park.

Shoreline/Floodplain:
http://bwsr.state.mn.us/sites/default/files/2019-01/riparian_south_and_west_0.pdf
https://mnnativelandscapes.com/product/mnl-lakeshore-waters-edge-mix/

Forest Units:
https://mnnativelandscapes.com/product/mnl-woodland-mix/
https://mnnativelandscapes.com/product/mnl-buckthornreplacement-mix/

North Riverbank Unit:
https://mnlcorp.com/products/seed/savanna-mix/
http://bwsr.state.mn.us/sites/default/files/2019-01/woodland_edge_south_and_west.pdf

Table 10: Shrubs for Replacing Common Buckthorn at James Rice Park.

Dry-Mesic Upland Areas					
Common Name	**Scientific Name**	**Height [feet]**	**Light**	**Wildlife Value**	**Comments**
Allegheny serviceberry	*Amelanchier laevis*	15 to 25	Sun/part shade	high	
Round-leaved dogwood	*Cornus rugosa*	8 to 12	Part sun/shade	Butterflies use flowers; birds eat berries	
Eastern wahoo	*Euonymus atropurpurea*	6 to 20	Sun/shade		Spreads
Common ninebark	*Physocarpus opulifolius*	8 to 10	Full sun	Bird food	Dense growth habit
American plum	*Prunus americana*	20 to 35	Sun	high	
Choke cherry	*Prunus virginiana*	20 to 30	Sun/part shade	Excellent	
Sambucus pubens	*Red-berried elder*	10 to12	Sun/part shade	High value: bird food	Cluster of white flowers; red berries in early summer.
smooth rose	*Rosa blanda*	4 to 6	Sun/part shade		
Red-berried elder	*Sambucus pubens*	6 to 12	Shade	Very high	Excellent massing, fast growing.
Bladdernut	*Staphylea trifolia*	8 to 15	Shade		Tolerates many soil conditions, disease resistant
Arrowwood viburnum	*Viburnum rafinesquianum*	5 to 8	Part shade, shade	high	Pretty foliage
Highbush cranberry	*Viburnum trilobum*	6 to 12	Sun to shade	High -Birds eat fruits.	Foliage open form in shade, dense in sun.
Wafer ash	*Ptelea trifoliata*	10 to15	Sun to shade	Larval host for swallowtail butterfly	Foliage open form in shade, dense in sun.

Flood Tolerant Areas					
Common Name	**Scientific Name**	**Height**	**Light**	**Wildlife Value**	**Comments**
American elder	*Sambucus canadensis*	8 to10	Full sun	High value: bird food	Very tolerant of soil conditions; blue-black fruit in late summer
False Indigo	*Amorpha fruticosa*	8 to10	Sun/part shade	Butterflies	Attractive flower
Black chokeberry	*Aronia melanocarpa*	5 to 8	Sun/shade	Bird food	
Buttonbush	*Cephalanthus occidentalis*	6 to 12	Full sun	Birds, butterflies	Round flower head; fragrant
Pagoda dogwood	*Cornus alternifolia*	15 to 20	Sun/shade		Beautiful growth form.
Silky dogwood	*Cornus amomum*	6 to 12	Full sun	Bird food	Blue fruit; reddish-purple bark
Red twig dogwood	*Cornus sericea*	6 to 12	Sun/part shade	Bird food	Red twigs, greenish-white fruit
Witch hazel	*Hamamelis virginiana*	20 to 30	Sun or shade	Late-season pollinators	Unique, spider-shaped yellow flowers that bloom late in the year.
St. Johns Wort	*Hypericum kalmianum*	2 to 3	Sun/part shade	Pollinators	Masses of yellow flowers in summer
Winterberry	*Ilex verticillata*	6 to 8	Sun/light shade	Bird food	Showy red fruit in fall.
Black Currant	*Ribes americanum*	3 to 6	Sun/light shade	High value: birds and mammals	White flowers and black-purple fruit
Pussy willow	*Salix discolor*	20	Full sun	Soil stabilizer	Showy catkins and ornamental
Red willow	*Salix sericea*	6 to 8	Full sun	Bird food	Upright, rounded form; and reddish-brown twigs
Meadowsweet	*Spirea alba*	3 to 6	Full sun	Bird food	Of wet meadows. Erect branching; white flower spikes in July
Nannyberry	*Viburnum lentago*	16 to 20	Sun/part shade	High	Dense foliage
Highbush cranberry	*Viburnum trilobum*	6 to 12	Sun/part shade	High value: bird food	White flat-topped flower clusters; red fruit persists until spring; red color to foliage in autumn

Climate Adapted Tree Species for Restoration at James Rice Park

Five main tree species not currently present in the restoration units but should be included in plantings. These climate adapted species will improve the resiliency of these communities.

Table 11: Climate Adapted Tree Species Recommended.

Common name	**Scientific name**	**Reasoning**
Yellow Buckeye	*Aesculus flavus*	Climate adaptation, community resilience
Hackberry	*Celtis occidentalis*	Climate adaptation, community resilience

Kentucky Coffee tree	*Gymnocladus dioicus*	Climate adaptation, community resilience
American Sycamore	*Platanus occidentais*	Climate adaptation, community resilience
Swamp White Oak	*Quercus bicolor*	Climate adaptation, community resilience

Tree Tubes and Stakes for Planting

Newly planted trees should be staked while roots are becoming established to ensure the tree does not tip or become uprooted due to wind or foot traffic. Trees should also be protected from damage by animal browse (chewing) and foot traffic. The Plantra grow tube and stake system linked below is a useful tool that accomplishes these goals, is inexpensive, and simple to install and maintain.

Immediately following tree planting, the Plantra system is installed by placing the tree tube over the seedling and attaching the seedling to the integrated stake with the supplied bands. The tube is capped with a piece of flexible mesh. Trees should be watered and mulched as typical.

https://www.plantra.com/SunFlex-Greenhouse-Grow-Tube-Stake-System

APPENDIX C. Methods for Controlling Invasive Plant Species

Trees and Shrubs

Common buckthorn, glossy buckthorn, Tartarian honeysuckle, Siberian elm, and black locust are some of the most common non-native woody species likely to invade native forests, woodlands, and prairies in Minnesota. Buckthorn and honeysuckle are European species that escaped formal landscapes and invaded woodlands in many parts of the country. They are exceedingly aggressive and, lacking natural diseases and predators, can outcompete native species. They remain photosynthetically active longer than most other native shrubs and trees, which gives them a competitive advantage. The seeds are disseminated by birds, which make them especially problematic in open woodlands, savannas, and overgrown prairies. They also benefit from the net actions of invasive earthworms, fire suppression, and high deer populations, forming a synergy that helps set the stage for their establishment and dominance. Invasions eventually result in dense, impenetrable brush thickets that greatly reduce ground-level light availability and can cause declines in native species abundance and diversity.

Biological Control

Currently there are no biological control agents for non-native woody plants in Minnesota. Recently, an 11-year study conducted by the MNDNR and University of Minnesota resulted in the conclusion that there are no viable biological control agents for common or glossy buckthorn based in part on the lack of damage to the host plants and a lack of host specificity. Reference the website below for more information about this study.

http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/buckthorn/biocontrol.html

Mechanical Control

Three mechanical methods for woody plant removal are hand pulling (only useful on small seedlings and only if density is low), weed wrenching (using a weed wrench tool to pull stems of one to two inches diameter), and repeated or “critical” cutting. Pulling and weed wrenching can be done any time when the soil is moist and not frozen. The disadvantage to both methods is that they are somewhat time-consuming, as the soil from each stem should be shaken off. Weed wrenching also creates a great deal of soil disturbance and should not be used on steep slopes or anywhere that desirable native plants are growing. The soil disturbance also creates opportunities for colonization by other non-native plants. This method is the least preferable and is probably best used in areas that have very little desirable native plant cover.

Repeated cutting consists of cutting the plants (by hand or with a brush cutter) at critical stages in its growth cycle, typically twice per growing season. Cutting in the spring (late May) intercepts the flow of nutrients from the roots to the leaves and cutting in fall (about mid-October) intercepts the flow of nutrients from the leaves to the roots. Depending on the size of the stem, the plants typically die within three years, with two cuttings per year.

Cutting can be used in conjunction with Buckthorn Baggies which are black bags secured to the ground over a cut stump of buckthorn, The black bag blocks sunlight from reaching the cut stump and prevents resprouting and photosynthesis effectively killing the buckthorn stem. Buckthorn Baggies need to be maintained regularly to ensure that the cut stem is completely covered preventing resprouting and to ensure that the bags are not dislodged to become litter.

Undesirable trees and shrubs can also be destroyed without cutting them down. Girdling is a method suitable for small numbers of large trees. Bark is removed in a band around the tree, just to the outside of the wood. If girdled too deeply, the tree will respond by resprouting from the roots. Girdled trees die slowly over the course of one to two years. Girdling should be done in late spring to mid-summer when sap is flowing, and the bark easily peels away from the sapwood. Girdling has the added benefit of creating snags for wildlife habitat. While girdling many trees is not feasible, girdling the occasional large tree will provide a matrix of habitat for species that depend on standing dead trees for food or nesting opportunities.

Prescribed Fire

Prescribed burning is the most efficient, cost effective, and least harmful way to control very small stems, seedlings, and resprouts of all woody plants. It also restores an important natural process to fire-dependent natural communities (oak forests, for example). Burning can only be accomplished if adequate fuel (leaf litter) is present and can be done in late fall or early spring, depending on site conditions. An ecological restoration subcontractor would need to be hired to conduct a prescribed burn once the restoration is in a maintenance state.

Disposal

The easiest and most cost-effective method to handle large amounts of woody brush is usually to stack it and burn it. This is most typically done during winter to lessen the impacts to soil (compaction, erosion, rutting, etc.), though often brush will be piled soon after the removal and burned during the winter. In areas where brush is not dense (small resprouts and seedlings), it can be cut up into smaller pieces, scattered, and left on the ground where it will decompose in one to three years (this method is especially useful on slopes to reduce erosion potential). Small brush piles can also be left in the woods as wildlife cover. Where there is an abundance of larger trees, cut trees may be hauled and chipped and used for mulch. Alternatively, some stems can be saved to be used later as erosion bars for slope stabilization.

Forbs

Garlic mustard and Greater celandine

Garlic mustard is an non-native biennial forb of woodlands and woodland edges that is very invasive and aggressive. Following the introduction of just a few plants, populations can rapidly increase and a dramatic “explosion” of garlic mustard plants can occur. In some areas it can form monotypic stands that crowd out other species, while recent studies have shown that in other locations it may simply occupy open ecological niches. Nevertheless, garlic mustard can be very invasive in woodlands, and it is recommended

to monitor and remove it as soon as it is detected (early detection and rapid response). Garlic mustard also produces a flavonoid (root exudate) that suppresses myccorhizal inoculation. Thus, species that are myccorhizae dependent, like oaks, will become stunted and easily outcompeted by garlic mustard. The flavonoid persists in the soil years after garlic mustard plants are removed, which can hamper restoration efforts.

Probably the best way to control garlic mustard is to closely monitor a site, and if garlic mustard is found, hand pull it before it spreads. Hand-pulling should occur before siliques (long, narrow seed pods) form. Once siliques form, removed plants should be bagged and transported from the site, since the plant may have enough energy in the stem and root to make viable seeds, even though it is not growing in the ground. If bagging and transporting are not an option, making weed piles is an option, but prepare to deal with garlic mustard plants in the future at each pile. Garlic mustard plants produce hundreds of seeds per plant—they are very prolific. When pulling garlic mustard plants, take care to remove the entire root, since they may re-sprout if part of the root is left in the ground. This can be difficult since roots are "S-shaped" and tend to break off at ground level. It is also important to remove all soil from pulled plants as an uprooted plant may continue to grow and produce seed if soil remains on the plant's roots.

There are studies underway by the Minnesota DNR and University of Minnesota that show good potential for bio-control of garlic mustard via a weevil (http://www.legacy.leg.mn/projects/biological-control-european-buckthorn-and-garlic-mustard). The testing phase is complete, but the approval process still needs to be performed. If approved, this method could revolutionize garlic mustard control. However, whether it will be effective or not on a landscape scale is yet to be determined.

Sweet clover, Burdock, and Mullein

White and yellow sweet clover are aggressive biennial species that *increase* with fire. Where sweet clover is found, it should be controlled in conjunction with treatment that attempts to eliminate smooth brome. Sweet clovers are common plants in agricultural areas, so if restoration is implemented, the project area should be surveyed for this species on an annual basis. Often times, following initial brush removal and/or burning, a flush of weedy annuals and biennials such as sweet clover can occur. Well-timed mows and burns are usually adequate to control these species. Mowing the site, as is typically prescribed for prairie restoration maintenance, should occur when all plants on the site (including sweet clovers) are approximately 12 inches in height. Sweet clover can bloom even at a height of 6 inches, but if it is burned or mowed in the following year in the late spring, it should be controlled. On steep sites, brush cutting can be substituted for mowing. Individual plants or small populations can be removed by hand-pulling. If seed production occurs, prodigious amounts of seed can be produced and spread, so it is important to pull before seeds appear or to bag seed producing plants. Competition from native species also helps control sweet clovers and other weedy species.

Canada thistle

While native thistles are not generally problematic, some species such as Canada thistle are clone-forming perennials that can greatly reduce species diversity in old fields and

restoration areas (Hoffman and Kearns 1997). Early detection and mechanical control methods will be needed. Mechanical control, involving several cuttings per year for three or four years, can reduce an infestation if timed correctly. The best time to cut is when the plants are just beginning to bud because their food reserves are at their lowest. If plants are cut after flowers have opened, the cut plants should be removed because the seed may be viable. Plants should be cut at least three times throughout the season. Otherwise, pulling the entire plant, including the roots, is the most effective way to deal with an infestation. Late spring burns can also discourage this species, but early spring burns can encourage it. Burning may be more effective in an established prairie, where competition from other species is strong, rather than in an old field, where competition is likely to be weaker.

Spotted knapweed

Knapweed is a perennial species that has become a troublesome prairie invader. Of all the typical prairie weeds, spotted knapweed is probably the most difficult to manage. It cannot be controlled with burning—like sweet clover it actually increases with fire. Hand-pulling individuals or small groups of individuals can be effective for small infestations, and is often a good volunteer group task. However, knapweed has a fairly large tap root and can be difficult to pull. Pulling is typically more difficult when soil is hard (dry), clayey, or compacted, but easier when soil is wet (following a rain), sandy, and friable. Pulling should be done before the target plants form seed, so early to mid-summer is best. If knapweed populations are large, a bio-control approach (knapweed beetles--weevils) is recommended. Knapweed beetles (weevils) are released during the summer. Weevils can be purchased online and sent via mail. Knapweed populations should be monitored each year to keep a record of the effectiveness of the bio-control. Weevils are effective for long-term control but not a good short-term control option.

Grasses

Smooth brome

Smooth brome is a cool season grass —active early in the growing season in southern Minnesota (April-May-June) and then going semi-dormant in July-September. It reproduces by means of underground stems (stolons and rhizomes) called “tillers”. The most effective treatment is timed to occur at the same time as the brome is “tillering”—mid to late May in southern Minnesota. Burning two years in a row (late-season burns in June) followed by seeding has been shown to be effective in controlling smooth brome. Consider that this timing may be a week or two earlier on steep south-facing slopes or in very sandy or sand-gravel soils. Following this method will usually be sufficient to control smooth brome. Seeding following burns, preferably with native seed collected on-site or purchased from a seller that provides local ecotypes, is important for restoring cover at the site. Evaluation can occur each year, and especially after two years. Smothering and repeated tilling are also options, though not on areas with steep slopes or exposed soils. Hand pulling small populations can be effective if kept up.

Kentucky bluegrass and creeping fescue can be treated similarly to smooth brome, since like smooth brome, they are both non-native, stoloniferous, cool-season grasses. Spring burns are the most effective tool against all of these species.

Reed canary grass

This species is extremely difficult to eradicate and requires repeated treatment over a period of up to three years. Pulling and digging out the roots from species clumps will be the only way to keep it from spreading. To slow the spread, seed heads can be cut and bagged and disposed. Monitoring and mapping new individuals or clumps should continue, however, and those individuals should be treated as they appear. If the plants are small they can be removed by digging out the entire root. Native grass and forb seed can be broadcast into bare spots left by reed canary grass removal.

APPENDIX D. Ecological Contractors

The following is a list of contractors to consider for implementing aspects of the management plan. While this is not an exhaustive list, it does include firms with ecologists who are very knowledgeable with natural resource management. Many other brush removal companies are listed in the yellow pages (under tree care), but most do not have knowledge or understanding of native plant communities. We recommend hiring firms that can provide ecological expertise. Additional firm listings can be found on the DNR website: http://www.dnr.state.mn.us/gardens/nativeplants/index.html

The MNDNR also maintains a list of native plant seed producers and native plant growers: https://www.mwmo.org/learn/preventing-water-pollution/native-plants/

Friends of the Mississippi River (FMR) has extensive experience working with landowners to implement natural resource management plans. FMR can assist NLNA with obtaining funding for restoration projects, coordinating restoration and management work, and site monitoring and evaluation.

Conservation Corps Minnesota
2715 Upper Afton Road, Suite 100
Maplewood, MN 55119
(651) 209-9900

Great River Greening
35 West Water St, Suite 201
St. Paul, MN 55107
651-665-9500
www.greatrivergreening.org

Landbridge Ecological
670 Vandalia St.
St. Paul, MN 55114
https://landbridge.eco

MNL
14088 Highway 95 N.E.
Foley, MN 56329
(320) 968-4222
www.mnlcorp.com

Native Resource Preservation
260 Wentworth Ave E
Suite 155
West St. Paul, MN 55118
www.nativeresourcepreservation.com

Prairie Restorations, Inc.
PO Box 305
Cannon Falls, MN 55009
507-663-1091
www.prairieresto.com

Resource Environmental Solutions
21938 Mushtown Rd
Prior Lake, MN 55372
952-447-1919
http://res.us

Stantec
2335 West Highway 36
St. Paul, MN 55113
651-604-4812
www.stantec.com

APPENDIX E. Management Unit Maps with Task Lists

Figure 8: North Riverbank Management Unit Map.

Figure 9: North Forest Management Unit Map.

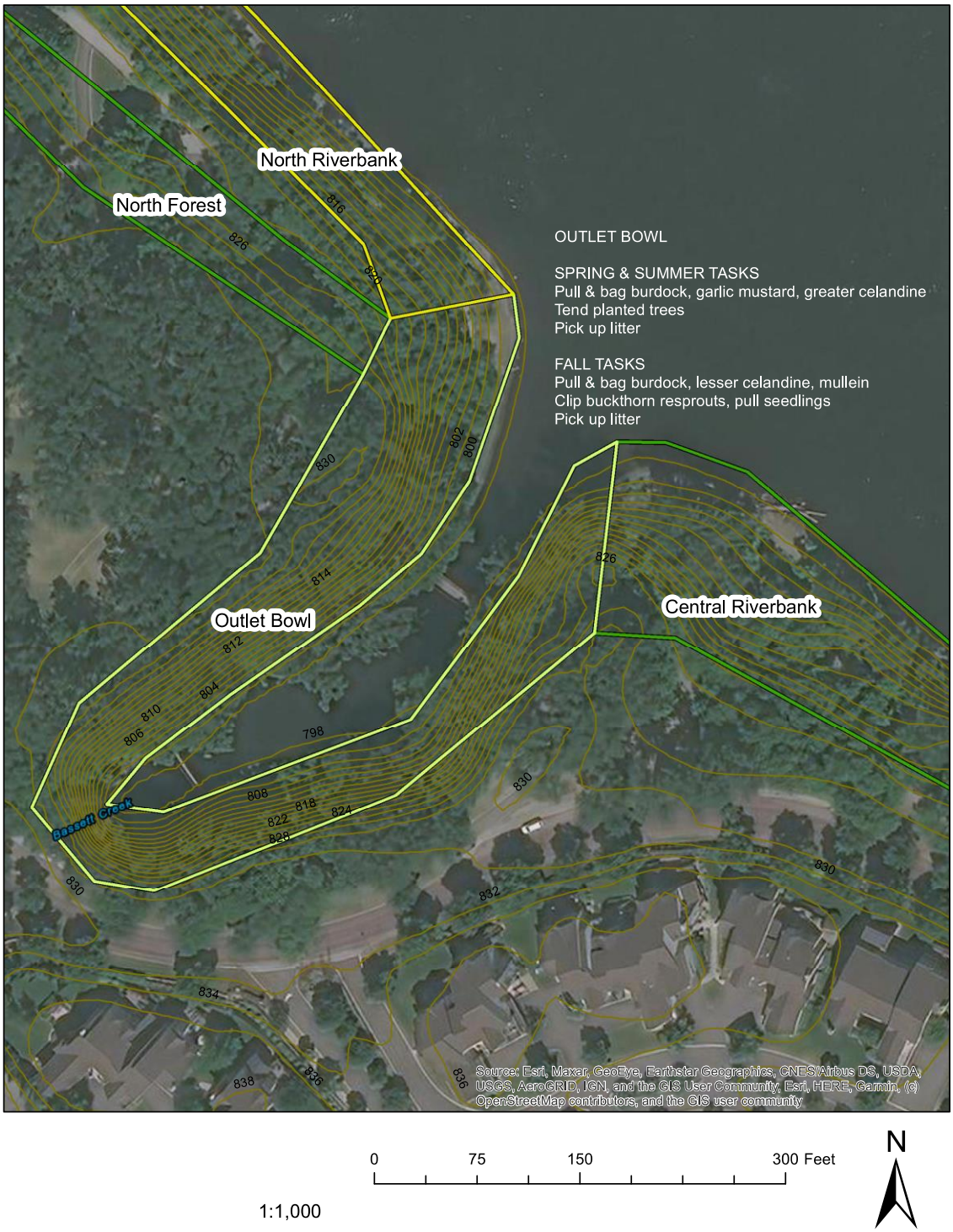


Figure 10: Outlet Bowl Management Unit Map.

Figure 11: Central Riverbank Management Unit Map.

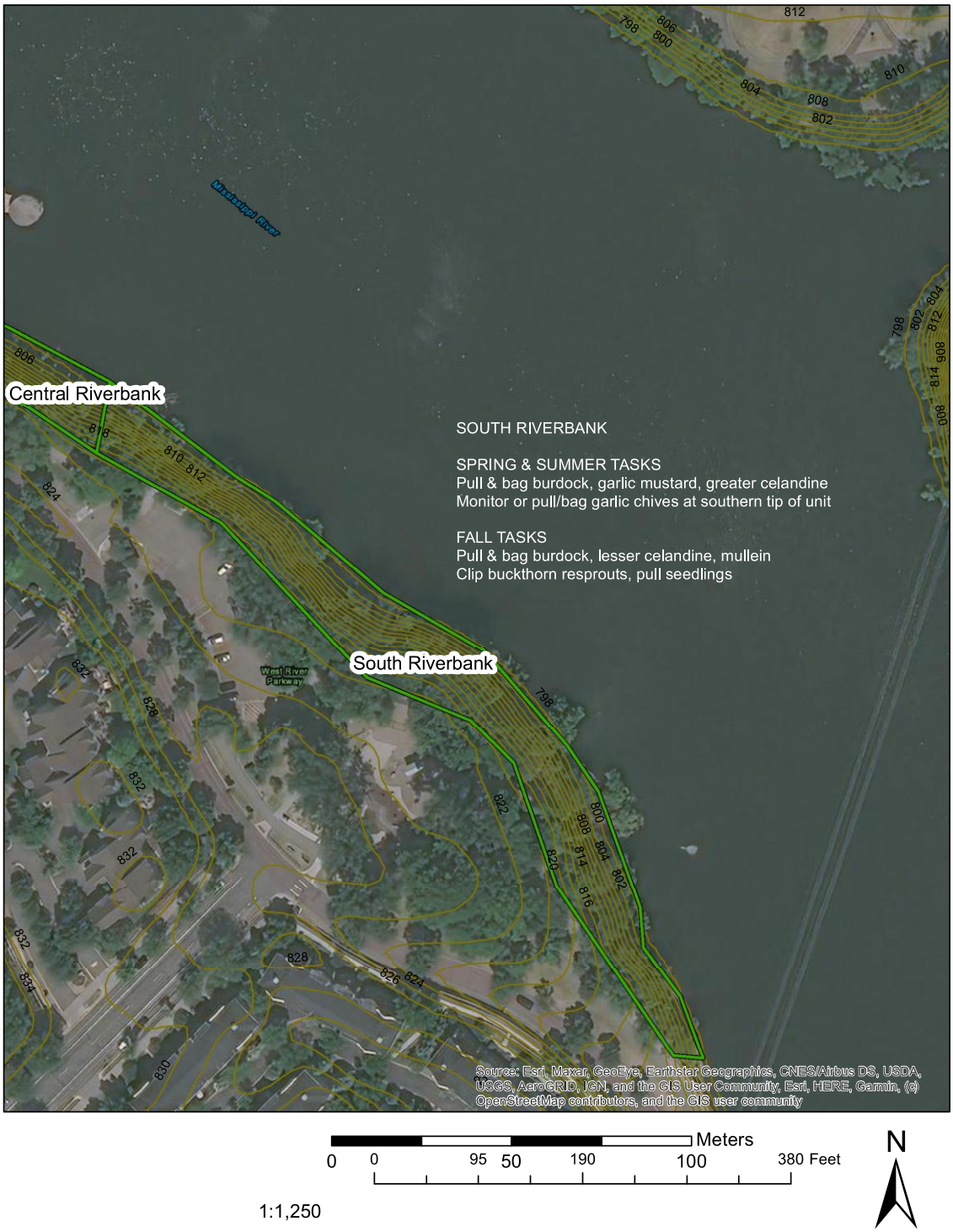


Figure 12: South Riverbank Management Unit Map.