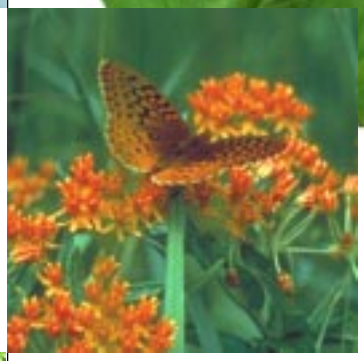
Mississippi River Gorge

Ecological Inventory and Restoration Management Plan



GREAT RIVER GREENING

MISSISSIPPI RIVER GORGE (LOWER GORGE) ECOLOGICAL INVENTORY AND RESTORATION MANAGEMENT PLAN

By Daniel B. Shaw and Carolyn E. Carr
Great River Greening

Executive Summary

At the end of the last Ice Age a torrent of melt-water that became what we now call St. Anthony Falls carved the Mississippi River's only true gorge, a unique geological feature of banks nearly 100 feet high, cloaked in luxuriant trees, shrubs and grasses. Moist forests, sheltered ravines, flowering ground cover and open prairie on the bluff tops were all part of the great diversity found in and around the gorge. Clear springs seeped out of exposed bedrock, and streams percolated down to the river through rock strata laid down over hundreds of millions of years.

The Mississippi River Gorge Ecological Inventory and Restoration Management Plan is the first comprehensive study of this unique feature and makes recommendations for its ecological restoration. In a collaboration of three Twin Cities organizations—Great River Greening, the Longfellow Community Council and the Minneapolis Park and Recreation Board—the plan specifies opportunity areas in the gorge where focused management can begin to reverse cumulative damage to the soil and native plant communities.

Background

Stretching between Minnehaha and St. Anthony Falls, the Lower Gorge was important to Native Americans and later, European settlers. The bluffs were harvested heavily for firewood and blacksmithing. The dams built to improve navigation altered many of the river's islands. Eventually, in the 1880s, landscape architect Horace Cleveland proposed that both sides of the river be reserved for public use as part of a system of "Grand Rounds" in Minneapolis. Acquisition continued well into the 1900s. In the 1930s the Works Progress Administration constructed many of the high-quality rock walls, fences, stairways and picnic grounds still found within the gorge.

Not until the 1970s, however, did conservation efforts focus on restoring degraded plant communities. Decades of erosion, invasion by non-native species such as buckthorn, and storm sewer construction had taken a toll. In its current state, the Mississippi River Gorge primarily comprises three native plant communities: oak savanna, mixed hardwood forest and floodplain forest. The area contains both highly degraded communities and relatively intact remnants of native vegetation.

Plan Summary

In the Mississippi River Gorge Ecological Inventory and Restoration Management Plan, ecologists evaluate several features of the gorge area: land cover and plant species (including exotic species and remnant natural-plant communities), soil types, erosion-prone areas, trail networks and locations of cultural features such as overlooks.

The authors also make detailed recommendations for restoring key opportunity areas. These include planting native plant species, taking steps to reduce erosion, and removing invasive plants that upset the ecological balance of the Gorge. They identify management tasks that can be conducted by volunteers, and those that are more

appropriate for trained professionals. The plan also recommends methods of recruiting and organizing volunteers, and identifies potential funding sources. Appendices provide detailed plant species lists, information on controlling exotic species and resources for trail planning.

This project is one of several funded by the Big Rivers Partnership, an umbrella organization of government and nonprofit groups led by Great River Greening. Funding for the Big Rivers Partnership is provided by the Minnesota Environment and Natural Resources Trust Fund, as recommended by the Legislative Commission on Minnesota Resources.

Table of Contents

	Page
Executive Summary	2
List of Maps	6
List of Figures	6
List of Tables	7
Appendix Table of Contents	7
Acknowledgements	8
Project Description	9
The Mississippi River Gorge project site	9
The purpose of this plan	10
Principles guiding the plan	10
This project and the Big Rivers Partnership	12
Description of the Project Area	13
Ecological Aspects	13
Pre-European settlement vegetation	13
Oak savanna	
Deciduous forest	
Floodplain forest	
Cultural history of the Gorge	17
The concept plan for the Longfellow Gorge	19
Restoration efforts to date	20
Current land cover (specific to the site	21
Bedrock, soils and erosion	22
Bedrock of the site	22
Soil types	23
Erosion, organic matter and soil organisms	24
Social-Cultural Aspects	26
Current site uses	26
Trails	26
Drainage and hydrology	26
Overlooks	27
Education	27
Management Approaches for Restoration Opportunity Areas	
Organization of the site	28
Site inventory information	28
General management recommendations for the River Gorge	30
Selection of restoration opportunity areas	32
Recommendations for restoration opportunity areas	33
River Gorge Savanna Restoration Area	33
Woodland Brushland Savanna and Portions of Lawn	

Section C Prairie
Section B Oak Forest, Mesic Subtype
Section C Oak Forest, Mesic Subtype
Top of Ravine
Southern Park Restoration Opportunity Area 40
Section A Oak Forest, Mesic Subtype
Section A Maple-Baswood Forest
Southern Forest Restoration Opportunity Area 43
Section A Oak Forest, Mesic Subtype
Section A Oak Forest, Tree Planting
Section A Oak Forest, Roadside
Sand Barren Restoration Opportunity Area 47
Section C Sand Flats

Recommendations for Involving Community Volunteers
Volunteer activities and locations at the Mississippi River Gorge 49
Recruiting and engaging volunteers 49
Sources of volunteers from the Longfellow Community 50
The River Gorge Committee - History 50
River Gorge Stewards project -2001 51
Other related community projects 52
General recruiting recommendations 53
Volunteer recruitment resources 53
Organizing volunteer events 54
Planning the volunteer event 54
Organizing the field work 55
Organizing volunteers at the event 55
Field activities at the event 55
Thanking the volunteers 55
Evaluating the event 56
Training volunteer supervisors 56
Potential funding sources 56

Bibliography of References and Resources 58

Great River Greening 62
The Challenge 62
Great River Greening's response 62
Key values 63
We are committed to: 63
Accomplishments-highlights 63
Great River Greening's major partners 63
About the authors 63
To contact us 64

List of Maps

Map 1. Mississippi River Gorge Project Boundary 134
Map 2. Mississippi River Gorge Existing Land Cover 135
Map 3. Mississippi River Gorge Soils and Contours 136
Map 4. Mississippi River Gorge Invasive Species 137
Map 5. Mississippi River Gorge Cultural Features 138
Map 6. Mississippi River Gorge Restoration Opportunities 139

List of Figures

Figure 1. The Mississippi River Gorge project site, looking north from the Ford Parkway Bridge 9
Figure 2. Mesic oak savanna 10
Figure 3. Mesic prairie 13
Figure 4. Example of oak savanna plant community 14
Figure 5. Example of maple-basswood forest plant community 15
Figure 6. Example of floodplain forest plant community 16
Figure 7. 1848 painting of Fort Snelling by Seth Eastman 17
Figure 8. Slopes with little vegetation are common in the project site 24
Figure 9. Maintained trail within the Gorge, looking south 26
Figure 10. Erosion exposed this manhole in the ravine near 36th Street 26
Figure 11. Restoration Opportunity Area within the Mississippi River Gorge project site 28
Figure 12. Common buckthorn seedlings 30
Figure 13. View of Savanna restoration opportunity area from parking lot, looking east 33
Figure 14. View of Woodland Brushland Savanna restoration opportunity area from parking lot, looking east 33
Figure 15. Section C Prairie looking west 33
Figure 16. Southern park restoration opportunity area 40
Figure 17. View of the park, looking east 40
Figure 18. Mesic oak forest, looking east 40
Figure 19. Maple-basswood forest, looking south 40
Figure 20. Southern forest restoration opportunity area 43
Figure 21. Section A Oak Forest, roadside, looking west 43
Figure 22. Bicycle jumps in Section A oak forest, mesic subtype, looking west 43
Figure 23. Section A oak forest, tree planting, looking west 43
Figure 24. Sand Barren restoration opportunity area 47
Figure 25. Sand Barren, restoration opportunity area, looking south 47
Figure 26. Great River Greening planting event 49
Figure 27. Volunteers planting trees and shrubs 54
Figure 28. Great River Greening projects 62

List of Tables

Table 1. Maple-basswood forest 15
Table 2. Mesic oak forest 15
Table 3. Floodplain forest 16
Table 4. Past restoration activities 21
Table 5. River Gorge Savanna Restoration Opportunity Area Recommendations 34
Table 6. Southern Park Restoration Opportunity Area Recommendations 41
Table 7. Southern Forest Restoration Opportunity Area Recommendations 44
Table 7. Sand Barren Restoration Opportunity Area Recommendations 48

Appendix Table of Contents

Appendix A. Minnesota Land-Cover Classification System Land-cover Types 65
Appendix B. Trail Planning Resources 68
Appendix C. Inventory Results 69
Appendix Figure 1. Sections of the Mississippi River Gorge project site 69
Appendix Figure 2. Section A land-cover polygons 70
Appendix Figure 3. Section B land-cover polygons 79
Appendix Figure 4. Section C land-cover polygons 82
Appendix Figure 5. Section D land-cover polygons 92
Appendix Figure 6. Section E land-cover polygons 99
Appendix D. Species Lists for Proposed Restoration Target Communities 103
Appendix Table 1. Oak savanna species list 103
Appendix Table 2. Maple-basswood forest species list 106
Appendix Table 3. Mesic oak forest species list 109
Appendix Table 4. Mesic prairie 113
Appendix E. Fact Sheets on Invasive and Exotic Species 115

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Jeff Lee and Shanna Hendrickson, staff members of the Minneapolis Park and Recreation Board, also played an important role in developing this plan by providing information and guidance. Additional experts provided technical guidance for the ecological management recommendations, and we thank them for their contributions: Cynthia Lane, Karen Schik and David Wiggins. We also thank volunteer Phil Davies for editing this plan.

Several staff from Great River Greening contributed to this project. Veronika Phillips developed GIS maps, plant lists and invasive plant information. Ellen Fuge, David L. Cathcart, Adam Robbins, Cade Hammerschmidt and Shaun Murphy helped develop ecological recommendations. Cade Hammerschmidt and Adam Zielie provided figures. Cassie Neu, an intern at Greening, edited plant lists and references.

Project Description

The Mississippi River Gorge project site

Figure 1. The Mississippi River Gorge project site, looking north from the Ford Parkway Bridge

The Mississippi River Gorge project site extends from the Ford Dam, at the north end of Minnehaha Park near 46th Street, to the railroad bridge at 27th Street in Minneapolis. The site extends up the bluff from the water's edge along the Mississippi River to the bluff top, including the boulevard of West River Parkway. Map 1 (page 134) shows the boundary of the project site.

The Mississippi River Gorge and St. Anthony Falls are unique geological features on the Mississippi River. Bedrock layers of shale, limestone and sandstone exposed today in the Gorge were deposited more than 500 million years ago in seas that once covered the interior of the North American continent. The surface of this bedrock was reshaped by the movement of sheets of glacial ice that originated in Canada 2 million years ago and extended throughout much of North America until approximately 10,000 years ago. Rocks, pebbles and sand collected and carried by these glacial sheets were deposited on the landscape when the ice melted. This deposited rock, known as glacial till, forms much of the upper layer of soil along the Mississippi River Gorge. Boulders deposited as the glacial ice retreated can be found in the project site near the end of 36th Street.

The formation of the Mississippi River Gorge and St. Anthony Falls is summarized well in this description from the Mississippi National River and Recreation Area (National Park Service,1998):

> The glacial River Warren Falls, thought by some geologists to be the largest waterfall ever seen in North America, occurred in what is now downtown St. Paul, 11,700 years ago. At that time the falls is thought to have been 200 feet high and over a half-mile wide. It was fed by a torrent of meltwater from Glacial Lake Agassiz coursing its way down what is now known as the Minnesota River valley. The falls gradually receded upstream as the layer of soft sandstone underlying its limestone caprock was eroded away. By 10,000 years ago the falls had passed the point where the Minnesota and Mississippi rivers now join, and the falls we know as St. Anthony Falls was carving a Gorge on its way to its present location. St. Anthony Falls is the only waterfall on the entire length of the Mississippi, and the Gorge below it that divides Minneapolis and St. Paul is the river's only true Gorge.

Today, the River Gorge is owned by the Minneapolis Park and Recreation Board (MPRB) as public park property and is part of the "Grand Rounds" of Minneapolis. The

Gorge is flanked by a relatively dense residential community of 23,000 people in 7,800 households. Park and Recreation Board property extends from the shore of the Mississippi River to the boulevard between West River Parkway and Edmund Boulevard. This management plan addresses the entire area of Park property. The Gorge also lies within the National Park Service's Mississippi National River and Recreation Area (MNRRA), a corridor of land on either side of the Mississippi River extending from Dayton, Minn. in the north downstream to Hastings, Minn.

The purpose of this plan

Through public processes over several years, Longfellow Community Council and MPRB staff have agreed to manage the Gorge for its value as a natural area and have jointly conducted restoration activities.

The purpose of this plan is to recommend ways this site can be managed to protect and enhance its ecological and social value as an urban natural area. This plan presents the results of an inventory of the natural resources and ecological condition of the site conducted by Great River Greening ecologists. Based on these findings, ecologists analyzed the site, setting restoration goals and specific activities to attain these goals. The plan identifies those activities that can be conducted by professional crews or community volunteers. Stakeholders in the plan include the Minneapolis Park and Recreation Board, which owns the land, and the Longfellow Community Council, which represents the community residents.

Principles guiding the plan

Illustration by Dan Shaw
Figure 2. Mesic Oak Savanna

These principles have guided plan development:

People are part of ecosystems. Humans have significantly altered the landscape in every urban area. Urban natural areas like the Mississippi River Gorge are part of both our cultural and natural heritage. One of the guiding principles in our approach to ecological management is to respect both of these values. The goal is to provide appropriate recreational and viewing opportunities as well as access to cultural and historical resources, while also recognizing and protecting the ecological quality of the site.

People must actively manage a site to protect and restore its ecological quality and value. Ecosystems arise from complex interactions among living organisms and the physical elements (soil, climate and water) in which they exist. The landscape and vegetation of any site are the result of many such interactions and are constantly changing. Managing urban sites for ecological goals requires active engagement, to counteract degradation from ongoing forces such as:

- erosion from stormwater drainage systems and from increased foot traffic
- spread of invasive plant species
- elimination of natural processes such as fire and flooding that established and maintained the plant communities that still remain on the site
- presence of non-native earthworms that change the soil quality in native forests
- environmental pollutants
- fragmentation of plant communities caused by development

Our guiding principle is that people can set a goal of increasing the ecological health of a site and then take action to achieve that goal.

Successful ecological management requires an adaptive approach. Because every site is unique and constantly changing, management must adapt to these changes. Steps in this approach include: conducting an inventory, setting restoration goals, developing management recommendations to meet those goals, and drawing up a monitoring plan, so that management can adapt to local circumstances over time. Monitoring of the results of management, conducted by qualified individuals, is the cornerstone of the adaptive approach to ecological management.

Successful ecological management of urban natural areas requires cooperation among stakeholders. Finally, this plan is based on the principle that ecological management is accomplished best through cooperation. By bringing together the expertise of ecologists, the experience of land managers and the enthusiasm and energy of community members, the shared goal of restoration can be more easily achieved. Protecting and improving the biological diversity of this site involves many tasks, including reducing erosion that threatens existing vegetation, planting native species and removing invasive or non-native plant species. Members of the public can participate in many of these activities, giving them a sense of accomplishment and increasing their knowledge of and appreciation for this urban natural resource. Volunteers can play a vital role in restoring and managing our river valleys, and their involvement is addressed in this management plan.

This Project and the Big Rivers Partnership

Great River Greening leads a team of nonprofit and government agencies, called the Big Rivers Partnership, dedicated to restoring critical river valley habitat while building community investment in the urban natural resources base.

Since 1999, by providing resources and technical assistance to public and private landowners, the Big Rivers Partnership has developed ecological management plans and made on-the-ground improvements at 15 sites in the metropolitan Mississippi and Minnesota river valleys. The Big Rivers Partnership follows a process of nominating, ranking, selecting and implementing projects. This project was selected for implementation after being jointly nominated by Great River Greening, the River Gorge Committee of the Longfellow Community Council and the Minneapolis Park and Recreation Board.

The Big Rivers Partnership receives funding from the Environment and Natural Resources Trust Fund as recommended by the Legislative Commission on Minnesota Resources (ML 1999, Chap. 231, Sec. 16, Subd. 13(c)).

Description of the Project Area

Ecological Aspects

Pre-European settlement vegetation

Historical accounts of vegetation are valuable sources of information for restoration projects. Land survey notes written in the 1850s often describe the vegetation that was present at section corners before significant European settlement. Because the Gorge is an exception-most of its trees were cut for use at Fort Snelling in the early 1800s, before the survey was conducted-earlier descriptions are the most useful for this project.

Illustration. By Dan Shaw
Figure 3. Mesic prairie

Perhaps the most descriptive account was written by Stephen H. Long during a visit to St. Anthony Falls, located just north of the Mississippi River Gorge. This excerpt from his journal written in 1817 describes the majesty of the falls and provides a historical account of the landscape that existed before significant European settlement:

The Place where we encamped last night needed, no embellishments to render it romantic in the highest degree. The banks on both sides of the river are about 100 feet high, decorated with Trees and shrubbery of various kinds. The Post Oak, Hickory, Walnut, Lynden, Sugar tree, White Birch and the American Box, also various evergreans, such as the Pine, Cedar, Juniper &c. added their embellishment to the scene. Amongst the shrubbery were the Prickly ash, Plumb & cherry tree, the goosberry, the Black and red raspberry, the Choak berry. Grape vine &c. There were also various kinds of herbage & Flowers, among which were the wild parsley, rue, spikinard &c., Red & white roses, Morning Glory, and various other handsome flowers. A few yards below us was a beautiful cascade of fine spring water, poring down from a projecting precipice about 100 feet high, on our left was the Mississippi hurrying thro its channel with great velosity, and about 3/4 mile above us in plain view was the majestic cataract of the Falls of St. Anthony. The murmuring of the Cascade, the roaring of the river, and the thundering of the cataract, all contributed to render the scene the most interesting & magnificent of any I ever before witnessed (Kane et al. 1978).

As Long's account describes, the River Gorge contained a great diversity of vegetation. The Gorge was actually part of a 2-million-acre landscape that before European settlement was dominated by a moist forest of sugar maple, basswood, and American elm. This landscape, called the Big Woods, formed a broad band, stretching from roughly Mankato and Faribault north to St. Cloud. However, patches of other natural community types interrupted the uniformity of the Big Woods region. For example, floodplain forests covered the bottomland of the Minnesota and Mississippi rivers. Maple-basswood forests occurred in northern exposures and sheltered ravines. Oak

woodlands and forests were found in the transitional zones between the river's edge and the oak savanna on the bluff tops. Prairies, which are dominated by native grass and wildflower species, occurred wherever fires prevented trees from becoming established.

In its current state, the Mississippi River Gorge primarily comprises three native plant communities: oak savanna, mixed hardwood forest and floodplain forest. The area contains both highly degraded communities and relatively intact remnants of native vegetation. No species listed as endangered, threatened or of special concern in Minnesota were recorded in any plant communities within the project site.

Oak savanna

Figure 4. Example of oak savanna plant community (MN DNR).

The oak savanna community occurs where fire, animal activities and/or soil and moisture conditions have prevented a closed-canopied forest from developing. Savannas are thought to be a transitional community between prairie and woodland that occurred where fires swept across the prairie and burned into forested areas. Only those species that could resprout after fire, such as oak and prairie plants, would survive. The resulting structure of the savanna is a canopy of scattered trees, usually bur and northern pin oak, and a ground cover of prairie grasses and wildflowers.

In the absence of fire or other disturbance, oak savanna undergoes succession to become oak woodland-brushland. In this plant community, oak trees are the dominant vegetation with a dense understory layer of oak brush and shrubs, such as American hazelnut.

Climate, topography and soil type all influence the moisture of a site, and in turn influence the plant species present. Dry and mesic (moist) oak savannas differ mainly in the species of grasses and wildflowers present. A mesic oak savanna is found at the end of 36th Street in the Mississippi River Gorge project site. A small area of prairie is found at this location as well.

Because of fire suppression, agriculture and urban growth, less than 0.1 percent of the original acreage of oak savanna remains today (MN DNR, 1997). The only other mesic oak savanna in the area is found at Fort Snelling State Park. Those interested in learning more about this plant community and its characteristics may enjoy visiting this site.

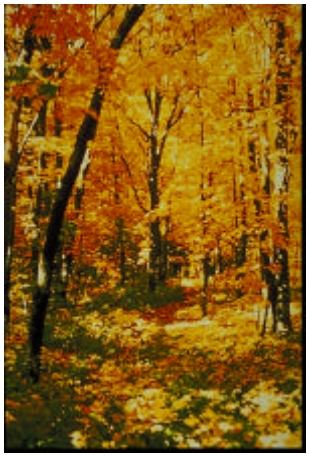

Figure 5. Example of maple-basswood forest plant community (MN DNR).

Deciduous forests (maple-basswood and oak forest)
In the project site, maple-basswood forest is most common in moist, protected areas such as ravines and north-facing slopes. Mesic oak forest and maple-basswood forest are common native plant communities in the Mississippi River Gorge. At many locations in the Gorge, mesic oak forest shows signs of succession to maple-basswood forest.

Because the tree canopy permits so little light from reaching the forest floor during the summer, maple-basswood forest have a suite of early spring wildflower species that bloom, produce seeds and die back before tree leaves are fully developed.

Oak forest occurs in drier sites than maple-basswood forest, but often undergoes succession to maple-basswood forests (Curtis, 1959). Where the frequency of fire is higher, maple-basswood forests may undergo succession to oak forests. Species composition of oak forests changes considerably in response to variation in soil moisture, soil type, fire history and climate. Northern red oaks, white oaks or bur oaks dominate the more mesic oak forest stands, while northern pin oak and white oak dominate the driest stands. Dry oak forests have a relatively open canopy that allows for a dense shrub layer dominated by American hazelnut. In contrast, mesic oak forest stands have sparse shrub layers and denser, diverse forb layers.

The tables below list other remnants of maple-basswood and mesic oak forests near the Twin Cities metropolitan area. These sites are open to the public.

Table 1. Maple-basswood forest
Interstate State Park
Osceola Landing (north of Osceola bridge)
Osceola Landing (south of Osceola bridge)
Wild River State Park: Goose Creek Natural Area
Lyndon Cedarglade Park
Falls Creek Scientific and Natural Area

Table 2. Mesic oak forest
Boot Lake Scientific and Natural Area
Martin-Island-Linwood Lakes Regional Park: Linwood Lake
Osceola Landing (south of Osceola bridge)
Osceola Landing (north of Osceola bridge)
Wild River State Park: Goose Creek Natural Area
Wild River State Park: Sunrise Landing East

(Wovcha et al., 1995)

Floodplain forest

Figure 6. Example of floodplain forest plant community (MN DNR)

Floodplain forests are wet forests that occur on seasonally inundated soils along the floodplains of the major rivers in Minnesota. Dominant canopy trees in these forests vary according to the successional status of the stand and the length and duration of annual flooding. The most common dominant canopy trees are silver maple or cottonwood. Germination and survival of tree and shrub seedlings are severely restricted by flooding. As a result, the understory of most floodplain forests is fairly open. The herb layer has low diversity and contains only short-lived species or species otherwise tolerant of frequent disturbance. Woody climbers such as wild grape, Virginia creeper and poison ivy are often present in light gaps and along open channels.

Floodplain forest occurs in the Mississippi River Gorge project site. Dredge piles and emergent wetlands are also found on the edges of the floodplain forest.

The table below lists other remnants of floodplain forests near the Twin Cities metropolitan area, all open to visitors.

Table 3. Floodplain forest
Chengwatana State Forest: Stevens Creek Landing
Osceola Landing (south of Osceola bridge)
Wild River State Park: Goose Creek Natural Area
Wild River State Park: Sunrise Landing East
Rum River west of Walbo Landing
Fort Snelling State Park: Pike Island
Mississippi River Islands: Scientific and Natural Area
McLeod's Slough
William O'Brien State Park

(*Wovcha et al. 1995)*

Cultural history of the Gorge

The following historical information was obtained from an interview with David Wiggins, Mississippi River National Center Manager with the National Park Service Mississippi National River and Recreation Area, and a Longfellow resident:

Starting around 10,000-12,000 years ago, the River Gorge was used by Native American cultures. It is not fully understood how each of the cultures would have used resources within the Gorge but we do know that hunting, gathering, trapping and farming occurred in the area. Most recently, the Dakota established large settlements and used the river valleys for food and shelter. A large Dakota settlement stood near the present location of Fort Snelling. The several thousand Dakota who used the area would have definitely made an impact on local resources such as plants and animals. The European fur trade put even more pressure on local resources, causing the decline of fur-bearing animals.

Fort Snelling also consumed resources in the project site, harvesting heavily from the bluffs, primarily for heating. An estimated 4,000 to 6,000 cords of wood were burned at the fort in the 1820s and 1830s.

Large amounts of oak were required to fire the blacksmithing forge at Fort Snelling. The bluff-top savanna was a major source of wood for the blacksmithing operation.

Figure 7. Painting of Fort Snelling in 1848 by Seth Eastman from the Minnesota Historical Society. http://www.mnhs.org/

In the 1850s white settlers came to Minneapolis in great numbers, leveling more trees for fuel, including stands in the Gorge. As settlement grew, lumber and flour mills were constructed north of the Longfellow Gorge to harness the river's power. At this time houses were also rising near St. Anthony Falls, and large numbers of cottonwoods were planted around new home sites.

Islands in the Mississippi, rapids near the project site and wetlands in the river valley were significantly altered by the construction of the Meeker Island Lock and Dam in 1909. This dam, built to improve navigation for riverboats, was replaced by the Ford Dam (Lock and Dam No. 1) around 1911. The top of the Meeker Island lock can still be seen on the east side of the river north of the Lake Street Bridge.

Two sandbars lie along the base of the bluffs in the project site. These naturally formed sandbars have been expanded through the piling of dredge spoils. It appears that the sandbar closest to Lake Street once extended well into the river, probably making it a natural crossing point. A terraced road extends down the slope near this location and was likely built as an early route down to the river. A ravine on the opposite side of the river

may have deposited sediment in the same general location, making the river even narrower at this location.

(End of interview with David Wiggins)

In 1872, the Minnesota Geological and Natural History Survey was established under the direction of Newton Horace Winchell. Winchell, the State Geologist of Minnesota from 1872 to 1900, is credited with rapidly advancing the geologic knowledge of Minnesota. One of Winchell's greatest contributions was calculating the rate that St. Anthony Falls retreated to its current location near downtown Minneapolis. Winchell's work at the Gorge is summarized in *Geology of Minnesota*: *A Centennial:*

> The Retreat of St. Anthony Falls was plotted by Winchell in a resourceful and thorough manner, and his estimate of the length of the postglacial time stands today as one of the most accurate exercises in geological chronology. In 1880 Winchell published his work with Upham – in which they plotted positions of the St. Anthony Falls at the time it was discovered by Father Hennepin in 1680, and at seven times during the next 200 years. He calculated the average rate of retreat at about 5.5 feet per year; or a total of 7,800 years for the falls to retreat the 8 miles from Fort Snelling. Since then, the figure has been revised based on further geological analysis, to the now accepted dates of 11,700 to 9,200 years (Sims and Morey 1972; Larson 1998).

Between 1880 and 1885 the population of Minneapolis more than tripled, causing the environment to change rapidly. Fortunately, a group of prominent businessmen that included George A. Pillsbury and Colonel W.S. King urged the state Legislature to authorize a referendum calling for the creation of a board of park commissioners separate from the city government. Despite considerable opposition, park proponents won a majority on April 3, 1883. One of the first actions of the board of park commissioners was to retain the services of landscape architect Horace Shaler Cleveland. "Cleveland proposed the 'Grand Rounds,' an extended system of boulevards, or ornamental avenues throughout Minneapolis that would act as a firebreak, provide sanitary benefits, provide ventilation for the city as well as provide beautiful scenery"(Roise 2000). Cleveland proposed boulevards on each side of the river and in a presentation to the board of park commissioners stated, "Let a broad avenue be laid out on each side of the river near enough to its banks to admit views into the depths below, and reserve for public use every foot of land between the avenue and the water" (Cleveland 1883).

Also in his presentation Cleveland described the river Gorge as follows:

> *The banks of the river on both sides for some miles below the city has a height of 150 or 200 feet and appear almost precipitous, and in fact are actually so in many places, yet on close examination are found to afford easy opportunity for the construction of paths with occasional expansions of area sufficient for lawns of considerable extent. These banks are covered with a magnificent growth of trees and shrubbery, assuming all the picturesque forms which are incident to such growth in such a place, and which no art could imitate. In traversing their face as far as Minnehaha on the west side and nearly*

the same distance on the east, I observed luxuriant growth of elm, oak, linden, ash, butternut, cottonwood, birch, cherry, willow and hornbeam, together with a few groups of grand specimens of white pine and a rich undergrowth of hazel, sumac, alder, serviceberry, dogwood, cornel, red-berried elder and a profusion of wild grape vines. At frequent intervals on both sides, pure and abundant springs burst from the hill sides, affording material at trifling cost for the most charming effects of pools, waterfalls and fountains, and on the eastern side there are two or three natural falls where brooks precipitate themselves over the broken strata of rocks which support the bank (Cleveland 1883).

The plan for the Grand Rounds included Camden Park, Victory Memorial Drive, Glenwood Golf Course, Cedar Lake, Lake of the Isles, Lake Calhoun, Lake Harriet, Minnehaha Parkway, Lake Nokomis, Minnehaha Park and boulevards on each side of the Mississippi River. Acquisition of parklands started in the 1880s and continued well into the 1900s (Roise 2000).

In the 1930s, the Works Progress Administration (WPA) constructed the Winchell Trail, rock walls, fences, stairways and picnic grounds in the Gorge. A quarry near Minnehaha Falls provided the stone for much of the WPA's quality workmanship, a model for future work.

About 30 years ago, restoration of degraded plant communities in the Gorge became a focus of public interest. Since that time neighborhood residents and the Minneapolis Park and Recreation Board have worked together to improve the ecological health of the Gorge.

The concept plan for the Mississippi River Gorge (1996)

In 1996, the Longfellow Community Council (LCC) sponsored a study of the Mississippi River Gorge with funds from the city of Minneapolis Neighborhood Revitalization Program (NRP). Close Landscape Architects was hired to develop a long-term, community vision for the Gorge to guide its development and restoration. This concept plan was designed to help the Longfellow Community Council prioritize spending of NRP development dollars designated for Gorge preservation and recreation, and to provide a framework for securing other funding.

Three major concepts were proposed for the Gorge and presented at open houses. The three concept plans varied in the amount of human use and construction activity proposed in the Gorge. The community chose the concept plan that encouraged passive recreation, with a focus on ecological restoration.

The primary issues addressed in the plan include erosion, long-term viability of the Winchell Trail, access trails from the street, access trails from the Winchell Trail to the river flats, impact on ecosystems from existing and increased use, handicapped accessibility, blight areas and mountain bike usage (Close Landscape Architects 1996).

Restoration efforts to date

Since the development of the Concept Plan, MPRB, LCC and National Park Service-Mississippi National River and Recreation Area (MNRRA) have jointly conducted restoration activities in the Mississippi River Gorge. Because mesic oak savannas are rare in the region, these efforts have focused on the River Gorge savanna near the end of 36th Street.

In 1999 a MNRRA grant allowed MPRB to hire Applied Ecology, Inc. to develop a restoration plan for the savanna. Since that time, MPRB, LCC and Applied Ecology have worked closely to implement restoration activities.

The Park and Recreation Board has been addressing the threat of common buckthorn to this park property by conducting buckthorn removal in areas of the Gorge. MPRB's Common Buckthorn Removal Guidelines (2001) set the following goal:

> Common buckthorn removal is recommended for those areas where the native plant community has been displaced by common buckthorn species and where there is a high likelihood that the native plant community can be enhanced and restored. Restoration of the native plant communities is the overall intent of non-native eradication efforts.

These guidelines also provide for volunteer participation in removal efforts.

Erosion control has also been undertaken in the project area. Near the end of 36th Street, a seep is currently eroding soil along the Winchell Trail. A swale and boardwalk are planned to prevent further erosion. Stairways are planned near the end of 27th and 34th streets to control erosion along steep trails. Controlling erosion was also a focus of restoration efforts in the mesic oak forest savanna; a trail was closed and regraded to reestablish proper hydrology and restore plant cover.

The following is a history of major restoration activities that LCC and MPRB have conducted in the Gorge and in areas adjacent to the project site.

Table 4. Past Restoration Activities

Date	Activity and Location
1975	• Burn of 36th Street Prairie/Savanna
1989	• Burn of 36th Street Prairie/Savanna
1994	• Burn of 36th Street Prairie/Savanna
1996	• Parkway Savanna Planting 33rd to 36th Street (1.4 acres) • Prairie Plantings at Godfrey Parkway and East 46th Street
1999	• Herbicide application, erosion control, seeding at 36th Street Prairie/Savanna • Common buckthorn removal at the 36th Street Prairie/Savanna
2000	• Seeding of 36th Street Prairie/Savanna
2001	• Seeding of 36th Street Prairie/Savanna • Common buckthorn removal at the 36th Street Prairie/Savanna • Sumac removal at the 36th Street Prairie/Savanna • Staircase and overlook installation • Garlic mustard removal • Plug planting at Parkway Savanna Planting 33rd to 36th Street • Burn of 36th Street Prairie/Savanna • Planning for stairs within the Gorge near the end of 34th and 36th Streets

Current land cover

Land cover is defined as the physical cover, including vegetation (natural or planted) and human constructions (buildings, roads, etc.) present on the landscape. Information about existing land cover can help guide decisions about appropriate human uses at a site, areas in which to focus restoration efforts and the plant communities to be restored.

Map 2 (page 136) presents land cover for the Mississippi River Gorge project area. This landcover map is based on work completed under a cooperative agreement among the National Park Service, the Minnesota Department of Natural Resources (DNR) and Great River Greening. The principal objective of this agreement was to complete a landcover inventory using the Minnesota Land Cover Classification System (MLCCS) (Leete et al. 2000, Map 2) for the entire MNRRA corridor and additional areas.

For landcover classification of natural communities, MLCCS relies on the DNR's natural community classification system (MN DNR 1992), and defines and classifies all other forms of land cover. This land-cover data served as a framework for more detailed site surveys also conducted at the Mississippi River Gorge. Additional background information was gleaned from the Minnesota Natural Heritage Database, Minnesota County Biological Survey data and the County Soil Survey.

Land-cover types at the Mississippi River Gorge project area include:

- Buildings and pavement with 76%-90% impervious cover

- Short grasses and mixed trees with 51%-75% impervious cover
- Deciduous trees with 11%-50% impervious cover
- Grassland with sparse deciduous trees—non-native-dominated vegetation
- Deciduous trees on upland soils
- Disturbed deciduous woodland
- Boxelder green ash disturbed native forest
- Maple-basswood forest
- Oak forest mesic subtype
- Mixed hardwood swamp—seasonally flooded
- Floodplain forest
- Riverine sand flats-bars
- Oak woodland-brushland
- Mesic prairie
- Dry prairie barrens subtype

Appendix A provides detailed descriptions and definitions of these land-cover types.

Bedrock, soils and erosion:

Bedrock of the site
The bedrock of the Mississippi River Gorge consists of a combination of sandstone, shale and limestone. The sandstone layer, known as St. Peter sandstone, was formed as large inland seas slowly filled with sand eroding from surrounding uplands. The sand compressed over time, binding the sand grains into stone. St. Peter sandstone is found at the base of the bluff. Above the sandstone is a layer of shale that formed from mud deposited on top of the sandstone. Fossils such as brachiopods, gastropods and trilobites are common in the shale. The chemical precipitation of calcite and the remains of animal life formed a 30-foot layer of limestone known as Platteville limestone. Above the limestone is a layer of Decorah shale, formed from the accumulation of mud as the inland sea receded. The topmost layer of material in the Gorge consists of rock, gravel and sand deposited by glacial action and is known as glacial drift.

Bedrock can influence plant growth in a number of ways. For example, bedrock can hinder root growth, stunting the growth of deep-rooted species. In addition, trees that grow on bedrock may have a higher chance of being blown over during storms, especially if erosion has exposed their roots. Where bedrock is cracked or composed of soft sandstone, water can travel and create seeps where it exits. Seeps will generally support species that require a lot of water. Eroding bedrock also affects vegetation by smothering some plants and creating new areas that favor rapidly establishing species.

Soil types
Soil type is a major factor controlling a site's hydrologic characteristics, the likelihood of erosion, and the vegetation of the site. The project site contains five major soil types. Key features described are water capacity, drainage, depth to bedrock and organic content. The soil types are as follows:

- Elk River Fordom Complex is found within level floodplains. It is a somewhat poorly drained soil with available water capacity to 60 inches and depth to bedrock at over 60 inches. The organic matter content in the top 10 inches is 1.7%. A typical profile is as follows:

  Ap — 0 to 10 inches; fine sandy loam
  A1, A3 — 10 to 26 inches; fine sandy loam
  Bw — 26 to 32 inches; very fine sandy loam
  2C — 32 to 80 inches; sand

- Sandberg Loamy Coarse Sand is found within the savanna areas near the end of 36th Street and sloping areas to the north. Depth to bedrock is generally more than 60 inches and the soil is excessively drained. The soil has an available water capacity to a depth of 60 inches and an organic content in the upper 10 inches of 2%. A typical profile is as follows:

  A — 0 to11 inches; loamy coarse sand
  Bw —11 to 27 inches; coarse sand
  C — 27 to 80 inches; gravelly coarse sand.

- Dorset Bedrock Substratum-Rock Outcrop Complex is found in rocky areas of the project site with steep slopes of 25-65 percent. Depth-to-bedrock is generally 40 to 80 inches and the soil is well drained. Content of organic matter in the upper 10 inches is 3 percent. A typical profile is as follows:

  A — 0-12 inches; sandy loam
  Bt — 12 to 20 inches; coarse sandy loam
  2BC —20 to 27 inches; gravelly coarse sand
  2C — 27 to 60 inches; gravelly coarse sand
  2R — 60 to 80 inches; unweathered bedrock

- Dorset Sandy Loam is found in a level area at the far southern portion of the site. The soil is well drained and it is over 60 inches to bedrock. The organic-matter content in the upper 10 inches is 3%. A typical profile is as follows:

  Ap, A — 0-12 inches; sandy loam
  Bt — 12 to 20 inches; coarse sandy loam
  2BC — 20 to 27 inches; gravelly coarse sand
  2C — 27 to 60 inches; gravelly coarse sand

- Urban land Dorset Complex is found along West River Parkway and extends into the Longfellow neighborhood. This soil type is mainly residential with 35% to 80% of its coverage consisting of impervious surfaces. This soil type is very similar to Dorset Sandy Loam but is generally disturbed by construction activity and often contains fill materials.

Map 3 (page 137) describes the locations of these soil types in the Mississippi River Gorge project area.

Erosion, organic matter and soil organisms

The forces that carved the Gorge left steep slopes that have been prone to erosion since their formation. Some erosion is natural at the Gorge, particularly within ravines and on very steep slopes. However, the rate of erosion occurring presently is much higher than historical rates. Causes include numerous trails on steep slopes, unvegetated hillsides and stormwater outlets.

Figure 8. Slopes with scant vegetation are common in the project site.

Erosion is common on bare slopes that lack vegetation or organic matter. Organic matter plays an important role in controlling erosion by slowing water flow over a slope, absorbing moisture and providing nutrients for groundlayer woodland plant species.

A healthy forest floor is generally composed of accumulated leaves and twigs as well as roots, bulbs, seeds and fungi. Bacteria and fungi slowly decompose accumulated organic material, but new leaves and twigs continually regenerate the forest floor. High productivity and slow decomposition of the forest floor results in the development of a thick organic layer. Accumulated plant material is generally loose and spongy, providing ideal conditions for root growth and germination of woodland plants. The organic layer also provides a good insulating layer during the winter.

Mycorrhizae fungi are particularly important to the health of woodland plants. Mycorrhizae fungi develop a symbiotic relationship with plants by adding an extensive network of root-like strings to the roots of plants. The expanded root system provides more nutrients and water for plants, and in turn, plants supply carbohydrates to the fungi.

Because of the crucial roles of both organic matter and mycorrhizae fungi, increasing organic matter at the project site is important and should be conducted in combination with tree and shrub plantings. Highly degraded areas will benefit from the reintroduction of mycorrhizae fungi in addition to a layer of wood chips. One method of reintroducing

mycorrhizae is to broadcast a site with wood chips collected from trails or plantings within healthy forests (Sauer 1998).

Earthworms are a newly identified threat to the structure of the hardwood forest floor. All earthworms found in the Midwest are non-native and damage forests by quickly consuming the organic layer. Earthworms consume leaves and other organic material on the forest floor, exposing the roots of woodland plants and preventing their growth. Soil exposed after native plants disappear is often colonized by weedy or invasive species that thrive on disturbed sites. Earthworms also consume bacteria and fungi that are essential to the normal functions of the forest floor. The University of Minnesota is conducting research on the impact and control of earthworms.

Social-Cultural Aspects

Current site uses

Figure 9. Maintained trail within the Gorge, looking south.

Trails

In 1917, the Minneapolis Park and Recreation Board authorized the construction of the Winchell Trail along West River Parkway. The majority of the Winchell Trail is now paved and it remains the primary path through the project site. Informal trails are common along the Gorge and vary greatly in the amount of use they receive. Many are exacerbating disturbance by acting as avenues for invasion by exotic species and by increasing erosion, soil compaction and fragmentation of habitat. A high priority for the protection of this site is to develop a detailed trail plan to establish a trail network that serves the needs of visitors yet protects the site's ecological integrity. The Close Master Plan for the Gorge makes general recommendations for locating trails, and can serve as the current guide for trail planning until further trail analysis is conducted. This project mapped primary trails, secondary trails, and locations of trail intersections using a global positioning system (GPS) unit in the field. The results are shown on a GPS (map 5, page 139). Reference information about trail planning has been included in Appendix B.

Drainage and Hydrology

Seeps and ravines were historically wet areas in the project site and would have been vegetated with mosses, ferns and species common to maple-basswood forests. The ravines most likely have received a considerable amount of nutrients from ash washing down from prairies and savannas after fires.

Figure 10. Erosion exposed this manhole in the ravine near 36th Street.

In many areas of the Gorge, storm sewer pipes are buried within ravines or release water in upper portions of the ravines. Buried storm sewer pipes and increased water flows have changed the composition of vegetation in the ravines and in many cases have caused considerable erosion. Figure 10 shows how seven feet of soil placed over a manhole

eventually eroded into the Mississippi River. Although ravines would have been high-erosion areas historically, excessive erosion needs to be controlled in the future. In some cases, specific erosion control plans may be necessary to address areas where erosion is severe. The Minneapolis Public Works Department will need to be involved with projects to address erosion caused by storm sewer pipes.

The velocity and seasonal fluctuation of the Mississippi's flow have changed significantly since European settlement. The greatest changes came from the damming of large lakes that released water to the Mississippi, and the construction of locks and dams. These water-control structures made it possible to hold snowmelt in the spring and slow the velocity and volume of water in the Mississippi. Today, seasonal water fluctuations have decreased from 20 feet to around six feet in some areas.

Overlooks
Along the Gorge, overlooks range from stone or cement structures to benches. Vegetation has been minimally managed for viewing in these areas. The Close Mississippi River Gorge Concept Plan gives specific recommendations for viewing areas along the Gorge and should be the primary guide. The ecological management recommendations in the Mississippi River Gorge Management Plan focus on restoring the ecology of the Gorge, not on the management of vegetation for specific overlooks.

Education
Because of the ecological significance and accessibility of the Gorge, it is an invaluable resource for educators and the general public. Educational activities are described in Chapter 3.

Management Approaches for Restoration Opportunity Areas

Inventories of the project site were conducted during the 2001growing season to gather information used to develop management recommendations for this plan. Four key areas were selected as restoration opportunity areas for this plan. General recommendations are provided for the entire project site and detailed recommendations are provided for the restoration opportunity areas.

Organization of the site

Figure 11. Restoration opportunity areas within the Mississippi River Gorge project site

The Close Mississippi River Gorge Concept Plan for the River Gorge divided the site into sections, A, B, C, D and E from south to north. These same sections are used in the Mississippi River Gorge Management Plan for convenience. The Management Plan is further divided into land-cover polygons and restoration opportunity areas. A map of the land-cover polygons is found in Appendix B (Inventory Results).

Restoration opportunity areas are locations that have been selected for restoration work within the Gorge. Restoration opportunity areas consist of groupings of land-cover polygons.

Site inventory information

Types of inventory data collected for the project site include existing plant communities, plant species in each land-cover type, trails, erosion, soil type, slopes, invasive species present, remnant plant communities, view areas and locations of other cultural features. These results are provided in Appendix C.

- *Existing plant communities:* Plant communities were mapped using MLCCS land-cover data and checked for accuracy in the field.
- *Plant species in each land-cover type:* Plant species in each land-cover polygon were recorded using meander searches.
- *Trails:* Trails were mapped using a handheld Global Positioning System (GPS) unit. Primary trails were mapped as line data, and secondary trails were mapped where they met primary trails as point data. GPS information was then included on Geographic Information System (GIS) maps.
- *Erosion:* Areas of trail or gully erosion were recorded using a handheld GPS unit and ranked as moderate or severe. GPS information was then included on GIS maps

- *Soil type:* Soil types were determined by referring to maps from the U.S. Natural Resource Conservation Service (NRCS), and checking map information in the field. Currently, soil information of the project site is not available in the Hennepin County Soil Survey or as digital information. This information should be available around May of 2002.

- *Slopes:* Topographical maps were used to analyze slopes at the project site

- *Invasives species present:* Invasive species were mapped in the field using meander searches and a handheld GPS unit. Specific methods of removal were recommended for common buckthorn clumps. GPS information was then included on GIS maps

- *Remnant plant communities present:* Remnant plant communities were mapped using MLCCS land-cover maps and meander searches.

- *View areas and locations of other cultural activities:* Overlooks and other cultural features were marked using a handheld GPS unit. GPS information was then included on GIS maps

General management recommendations for the River Gorge

Illustration by Dan Shaw

Figure 12. Common buckthorn seedlings

The River Gorge is a landscape of great variation in topography and plant communities. However, some characteristics are consistent throughout the site and can be addressed with general management recommendations. The following is a list of these general recommendations:

1. **The restoration opportunity areas presented in this management plan are only the starting point for restoration efforts within the project site.** The long-term goal for the site involves expanding restoration efforts by focusing on plant communities between nodes. This will require developing new management plans.

2. **Trails are very common in the Gorge and one of the most significant threats to its ecological health.** An excessive number of trails is exacerbating disturbance of the site by causing soil compaction and erosion, creating avenues of invasion by exotic species, and by fragmenting plant communities. A trail study is needed to determine how informal trails can be eliminated and which trails should be addressed first. Information about trail planning is provided in Appendix B.

3. **Bicyclists are causing erosion on un-paved trails in the project site.** In addition, bicyclists have dug up a large area in the project area and created jumps. A coordinated effort between MPRB, neighborhood residents and bicyclists should be pursued to address these issues.

4. **Common buckthorn is prevalent throughout the site and is degrading plant communities by displacing native species, increasing erosion by eliminating ground-layer species, reducing diversity and changing soil chemistry.** Eradication efforts should be focused in restoration opportunity areas. However, buckthorn is a problem throughout the site and should eventually be removed from the entire area as resources become available.

5. **There is a long, continuous disturbed zone between the plant communities of the River Gorge and West River Parkway. This sunlit, very visible edge is currently colonized with disturbance species such as common buckthorn, Tartarian honeysuckle and thistles. It should be converted to native species.**

- Starting with areas along restoration opportunity areas, edges should be cleared of common buckthorn and planted with native grasses, forbs and shrubs that will create an attractive edge and buffer the woodland plant communities.
- Native species should be planted close together and maintained to inhibit the re-growth of common buckthorn and other invasive species.
- Expansive mowed areas could be reduced to a narrow band along trails. This would reduce mowing requirements, buffer Gorge plant communities and provide

transitions from hard surfaces of roadways and trails to the vegetation of the Gorge.

- Areas of reed canary grass or Kentucky bluegrass will need to be controlled with herbicide before replanting occurs.

6. **West River Parkway marks the transition between the natural communities of the River Gorge and the residences of the Longfellow neighborhood**.

- To function as an effective transitional zone, the boulevard should retain the natural character of the Gorge but also be visually acceptable to local residents and those using the boulevard and its pedestrian trails.
- The top of the bluff was historically covered with prairie and oak savanna. Species from these communities will be best-adapted and most appropriate for boulevard plantings.
- Native plantings and stormwater gardens are encouraged in the Longfellow community to buffer the River Gorge and improve its ecological health.

7. **In areas where invasive species are removed and/or native species are replanted, monitoring is needed to gauge the success of those activities. Determining whether specific management strategies work will help ecologists develop future recommendations.**

- Monitoring is defined as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective (Elzinga 1998).
- Volunteers with good plant identification skills should be recruited to monitor the sites over several years.
- Monitoring methods should be kept as simple and repeatable as possible. Ecologists use many methods to conduct monitoring. One common method involves running equally spaced lines (called transects) through a site and locating equally spaced plots (commonly 3-by-3 foot) along the lines. The evenly spaced plots ensure that the entire project area is being represented in the study. A less time consuming and scientific approach may be appropriate for monitoring invasive species control, the increase of native species and the success of native plantings in the Gorge. In most cases, it will be sufficient for an ecologist to select specific locations within the project site for plots that are 3-by-3 feet or larger. The ecologist will need to determine the number of plots necessary and lay out plots in areas that are representative of the entire project site. Marking plots with flags or other means allows ecologists to collect information from the same location in subsequent years. Data should be collected as close to the same date each year to maintain consistency. An ecologist will also need to help determine the type of information to collect, and create a data form for organizing and analyzing information gathered during monitoring.

Selection of restoration opportunity areas

Restoration opportunity areas are locations within the project site that have been chosen as areas in which to focus ecological restoration. Four areas were chosen by examining each of the plant community polygons (from the MLCCS land-cover classification maps) throughout the site and ranking them on a number of criteria. The criteria included:

- Presence and dominance of invasive species
- Accessibility of crews and volunteers
- Erosion concerns
- Quality of plant communities
- Plant community size
- Proximity to past restoration work at the Gorge

The four restoration opportunity areas in this management plan are:
- The River Gorge Savanna Restoration Opportunity Area
- The Southern Park Restoration Opportunity Area
- The Southern Forest Restoration Opportunity Area
- The Sand Barren Restoration Opportunity Area.

These restoration opportunity areas were named specifically for this management plan. The restoration opportunity areas are listed in order of priority for restoration, with the River Gorge Savanna Restoration Opportunity Area assigned the highest priority and the Sand Barren Restoration Opportunity Area assigned the lowest priority. Map 6 (page 140) shows the location of restoration opportunity areas within the project site.

Recommendations for restoration opportunity areas

River Gorge Savanna Restoration Opportunity Area

This restoration opportunity area is separated into five areas with unique management requirements. The five sections are as follows:

- Woodland Brushland Savanna
- Section C Prairie
- Section B Oak Forest Mesic Subtype
- Section C Oak Forest Mesic Subtype
- Top of Ravine

Management recommendations for the five sections are provided in Table 5.

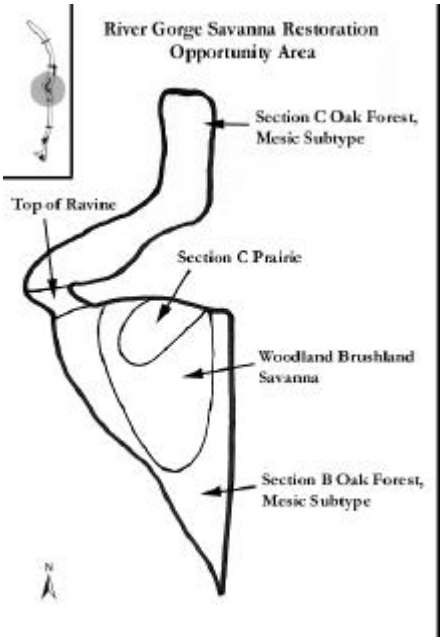

Figure 13.

Figure 14. View of woodland brushland savanna restoration opportunity area from parking lot, looking east.

Figure 15. Section C Prairie, looking west.

Note: In the following tables for each restoration opportunity area, gray boxes indicate tasks that are of the highest priority. Vo indicates areas where volunteers could be involved, and Cr indicates where crew involvement would be necessary.

Table 5. River Gorge Savanna Restoration Opportunity Area Recommendations

Date	Woodland Brushland Savanna	Section C Prairie	Section B Oak Forest, Mesic Subtype	Section C Oak Forest, Mesic Subtype	Top of Ravine
Spring 2002	• Cut trees, shrubs and weeds (using brush blade) to stimulate native grass germination by increasing the amount of sunlight reaching the ground (Cr) • Plant wild rose near overlook to prevent use of unwanted trails (Vol) • Make boundaries of restored area near lawn apparent to crews and public (Cr)		Remove large Norway maple near parking lot (Cr)		
Summer 2002	• Cut trees, shrubs and weeds with brush blade (Cr)	Cut and treat pin oak in prairie (Cr)			
Fall 2002	• Cut trees shrubs and weeds with brush blade (Cr)	Collect seed for use in surrounding areas (Vol)	• Pull, cut and treat common buckthorn, Norway maple and Siberian elm (Cr, Vol)	• Pull, cut and treat common buckthorn, Norway maple and Siberian elm (Vol, Cr).	• Cut boxelder up to 5" dbh. (Cr) • Remove all Norway maple (Cr, Vol)
Winter 2002-03					
Spring 2003	• If sufficient fuel is present, conduct burn. If insufficient fuel, cut existing vegetation (Cr) • If native species are not establishing 1 foot apart, supplement planting with seed from nearby remnants (Vol)	• Burn every 3-4 years. An ecologist needs to be involved to assess development of the plant community and to set future burning schedules. (Cr,) • Monitor and cut, treat northern pin oak as needed (Cr, Vol)	• Replant area where invasives were removed with species found in mesic oak forest (Vol) • Remove extra trails (Cr, Vol) Monitor and cut invasive species every other year (Cr, Vol)	• Replant area where invasives were removed with shrub and ground-layer species, install wattles (Vol) • Spray a strip of lawn along upper edge of forest with herbicide; plant prairie species (Cr, Vol) Volunteers collect seeds from woodland ground-layer species and spread within oak forest planting (Vol)	• Plant ferns, sedges in understory (Vol) • Plant mesic oak forest trees to eventually replace boxelder (Vol, Cr) • Remove extra trails (Cr, Vol) • Monitor and cut invasives every other year (Cr, Vol)

Date	Woodland Brushland Savanna	Section C Prairie	Section B Oak Forest, Mesic Subtype	Section C Oak Forest, Mesic Subtype	Top of Ravine
Summer 2003	Cut existing vegetation if needed. (Cr)				
Fall 2003	• Cut existing vegetation if needed (Cr)			• Collect seed from woodland ground-layer species and spread within oak forest planted in the spring (Vol) • Monitor results of planting and cut invasive species every other year (Cr, Vol)	
Winter 2003-04					
Spring 2004	• Conduct burn unless seeding occurred the previous spring, then wait until the following spring to burn (Cr,)				
Summer 2004	• Once prairie species are established, conduct burns every year, up to 3 to 5 years, until re-growth is controlled, then every 2 or 3 years. Consult an ecologist to assess plant community development and to set future burning schedules (Cr,) • If canopy cover is greater than 50% during fall of 2006, cut larger-diameter trees in the savanna (Cr, Vol)				
Fall 2004				• Repeat volunteer seed collection and replanting. Monitor for invasives and conduct removal in previous plantings. (Vol, Cr)	

Woodland Brushland Savanna

Restoration and management goals:

The Woodland Brushland Savanna Area includes the mesic oak savanna where restoration activities have occurred in the past. Recommendations in this plan focus on transforming the woodland brushland savanna into the mesic oak savanna that once existed at the site. Continuing to restore this area is the highest priority for this site, both to protect this high-quality remnant, and to protect the investment made in past restoration efforts. Mesic Oak Savanna restoration can be judged successful when all of the following conditions are met.

- Tree canopy cover is 50 percent or less; most canopy trees should consist of bur oak as well as some northern pin oak.
- Enough ground-layer species present to conduct prescribed burns; native grasses growing approximately every 1.5 feet.
- Burns control tree and shrub species without the to cut and apply herbicide
- Excess trails are eliminated from the trail network.

When these goals are achieved, even higher objectives (such as increasing ground-layer diversity) can be considered.

Methods of achieving management goals:

- Cutting, herbicide application and burning:

Past cutting of trees and shrubs at the site has resulted in significant re-growth of ground-layer species as well as suckering trees and shrubs. Rapid growth of these species has blocked sunlight and inhibited the germination of prairie grass and forb seed that was spread over the area in past restoration efforts. The first step in controlling growth of unwanted species is repeated cutting with a brush blade and herbicide treatment of basswood, green ash, sumac and selected pin oak. These species must be cut with a brush blade up to three times a year during the growing season. The objective is to cut re-sprouted vegetation to a height of 6 to 8 inches, allowing sunlight to reach the ground layer and promote growth of native prairie species. Unwanted trees and shrubs are treated with herbicide as soon after cutting as possible. If sufficient fuel is present the following spring, the area is burned; if insufficient fuel exists, trees and shrubs are cut again through the growing season as needed, then burned the following spring. An experienced ecologist should be consulted annually to evaluate site conditions before burning.

To qualify as a mesic oak savanna plant community, the tree canopy should cover less than 50% of the restored area. If fire does not sufficiently control tree growth in the future, further cutting of medium-sized trees may be necessary.

- Eliminate trails and reduce erosion:

Measures have been taken within the savanna site to eliminate trails and reduce erosion. A further study should be conducted to determine if even more trails could be eliminated in this part of the project site. Areas where trails are erased should be replanted. Planting

wild rose or other prickly forbs or shrubs can discourage trail widening at trail entry points.

Section C Prairie

Restoration and management goals:

- Cut and treat with herbicide to eliminate all suckering pin oak from the prairie.
- Burn periodically to control tree and shrub species without the need for cutting and treating.

Methods of achieving management goals:

Cutting, herbicide application and burning:

The area of mesic prairie within the larger mesic savanna has been managed with fire for several years and is relatively diverse. However, to attain a more open mesic savanna community, several multiple-stemmed northern pin oaks in the prairie should be eliminated. Northern pin oak should be cut and treated with a 25% glyphosate solution. Prescribed burns cannot be relied on to eliminate northern pin oak, as they are adapted to re-sprout after fire. Future burns should be conducted roughly every three to four years, alternating between spring and fall burns. The season and timing will depend on the status of extant native species and the amount of fuel available. An ecologist should be consulted to set a burning schedule. The presence of poison ivy at the site needs to be taken into consideration before burns are conducted.

Section B Oak Forest Mesic Subtype, North End (within C)

Restoration and management goals:

- More than 80% of shrub and forb cover is native to oak forests.
- After ecological criteria are considered, excess trails are eliminated.
- Soil health is improved.

Methods of achieving management goals:

- Cutting, herbicide application and replanting:

This area of mesic oak forest in section C is an extension of the mesic oak forest that runs through most of Section B. It consists of a relatively thin strip that extends between the restored mesic savanna and West River Parkway. Because of recent losses from oak wilt, the original River Gorge Savanna Restoration Plan (Sudbrock 1999) proposed leaving this strip to be colonized by a diverse array of non-oak species. This plan also recommends that non-oak forest tree species be permitted to grow, but also suggests the planting of young oaks to encourage the regeneration of oak forest to the fullest extent possible. Removing common buckthorn, Norway maple and Siberian elm by pulling or cutting and applying herbicide should be the first step in managing this strip of oak forest. A large seed-producing Norway maple near the parking should be removed to prevent further colonization into the River Gorge. Catalpas near the parking lot and parkway should also be removed and replaced with species native to the River Gorge. Areas where invasive species have been removed should be monitored every two years, and invasive species removed as necessary. In areas where a lot of invasives have been

removed, tree and shrub species found in mesic oak forests should be planted to create competition for non-native species. Planting a variety of grasses, forbs and shrub species commonly found on forest edges along West River Parkway should be considered to improve the appearance and ecological quality of the edge.

- Eliminate trails and reduce erosion:

Further studies should be conducted to determine whether trails through this strip of forest could be eliminated or minimized. Former trails at the project site should be restored with a cover crop as well as seed harvested from the remnant mesic prairie.

- Improve soil health:

In newly planted areas, 4 to 6 inches of wood chips should be laid around shrubs and trees; 2 inches of wood chips should cover areas planted with ground-layer species.

Section C Oak Forest Mesic Subtype

Restoration and management goals:

- More than 80% of shrub and forb cover is native to mesic oak forests.
- Native ground-layer plants grow every 1.5 feet.
- Erosion is controlled.
- Soil health is improved.
- Prairie/savanna species replace non-native grasses in reduced lawn areas.

Methods of achieving management goals:

- Cutting, herbicide application and replanting:

This area of mesic oak forest has little understory vegetation and moderate to severe erosion on upper portions of the slope, where some sedge species are holding the soil. Erosion is most severe farther down, near the ravine that runs to the south and east. Management in this oak forest will start with the cutting and treatment of common buckthorn, Norway maple and Siberian elm, and continue with re-planting. Work will progress from south to north so that the highest quality portions of the management unit are restored first. Species suitable for planting include Sprengel's sedge, woodland sedge, Pennsylvania sedge, hog peanut, false Solomon's seal and shrubs found in mesic oak forests (see species lists in Appendix D). Invasive species removal and replanting could be done in the fall and spring. Volunteers could collect seed in summer and fall from woodland goldenrods and asters, and spread the seed directly over the area.

A large expanse of lawn covers the slope above the oak forest. This lawn could be reduced in size by spraying a strip of grass near the forest edge with herbicide in the spring and planting dormant plugs of prairie species. This planting would decrease water flow down the slope, helping to alleviate erosion. Plantings should be monitored every two years for the return of invasive species and to determine the success of the planting and whether additional plantings are warranted.

- Reduce erosion:

Erosion can be reduced on steep slopes by bundling cut brush of native species such as boxelder into wattles and staking them across the slope to slow water runoff. The bundles should consist of dry twigs to reduce the chance of boxelder re-sprouting. Appropriate plant species will be planted on degraded slopes (mentioned above).

- Improve soil health:

Wood chips (4 to 6 inches around shrubs and trees, 2 inches around ground-layer species) will be spread over planted areas.

Top of Ravine

Restoration and management goals:

- Remove boxelder under 5 inches diameter at breast height.
- Over 80 percent of shrub and forb cover is native.
- Unnecessary trails are eliminated.

Methods of achieving management goals:

- Cutting, herbicide application and replanting:

Most of the ravine near the savanna restoration is severely eroded and devoid of vegetation. The upper portion of the ravine above the Winchell Trail and along West River Parkway is less eroded but is dominated by boxelder and invasive/exotic species. Management within this area will start with the removal of boxelder under 5 inches dbh as well as all Norway maple and common buckthorn. Sedges and ferns such as Sprengel's sedge and Lady fern will be planted in the understory, particularly in severely eroded areas (a seep is located in the northern portion of this area). Planting the following ground-layer species will help control erosion: Jack in the-pulpit (*Arisaema triphyllum*), Lady fern (*Athyrium angustum*), ostrich fern (*Matteucccia struthiopteris*), sensitive fern (*Onoclea sensibilis*), *Carex stipata* and fowl manna-grass (*Glyceria striata*). Canopy trees typical of mesic oak forest (see plant list in Appendix D) will be planted in place of old boxelders as they die or are removed. Invasive species will be removed every two years.

- Eliminate trails and reduce erosion:

Further study should determine whether trails in this area could be eliminated or minimized. Closed trails could be replanted with ground-layer species as well as shrubs to restore vegetation and prevent further use.

- Improve soil health:

Wood chips (4 to 6 inches around shrubs and trees, 2 inches around ground-layer species) will be spread over planted areas.

Southern Park Restoration Opportunity Area

This Restoration Opportunity Area is separated into two areas with unique management requirements. The two sections are as follows:

- Section A Maple-Basswood Forest
- Section A Oak Forest, Mesic Subtype, Southern Park

Management recommendations for the two sections are provided in Table 6.

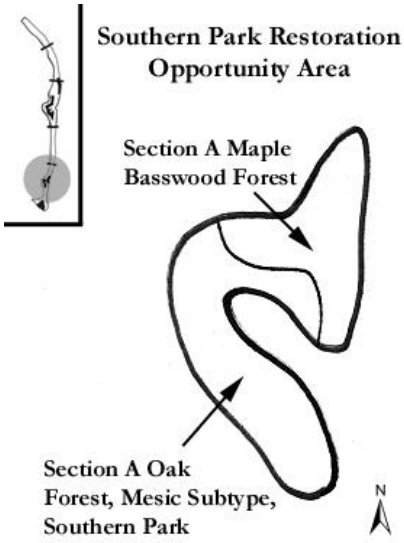

Figure 16. Southern park restoration opportunity area

Figure 18. Mesic oak forest, looking east

Figure 19. Maple-basswood forest, looking south

Figure 17. View of the park, looking east

Table 6. Southern Park Restoration Opportunity Area Recommendations

Date	Section A Oak Forest Mesic Subtype	Section A Maple-basswood Forest
Spring 2002	Collect seed from forests in the river Gorge and spread seed in the oak forest where bicycle jumps were located (Vol)	
Summer 2002		
Fall 2002	Remove common buckthorn and Tartarian honeysuckle (Cr,Vol)	• Remove common buckthorn and Tartarian honeysuckle (Cr, Vol) • Volunteers collect seed from woodland ground-layer species and spread on bare soil in site (Vol)
Winter 2002-03		Monitor for and remove invasive species every other year (Cr, Vol)
Spring 2003	Spray/pull buckthorn re-growth (Cr, Vol)	Replant with species found in maple-basswood forests. Install wattles in eroded areas (Cr, Vol)
Summer 2003	Monitor for invasive species yearly and monitor abundance of ground-layer species (Cr, Vol)	
Fall 2003	• Remove unnecessary trails (Cr, Vol) • If ground-layer species are not thriving, collect seed from the site and spread in areas of bare soil. (Vol)	
Winter 2003-04	Monitor for and remove invasive species every other year (Cr, Vol)	

Section A Oak Forest Mesic Subtype

Restoration and management goals:

- Over 80 percent of shrub and forb cover is native to mesic oak forests or maple-basswood forests
- Increase native ground-layer vegetation so that native species grow about every 1.5 feet.
- Erosion is reduced

Methods of achieving management goals:

- Cutting, herbicide application and replanting:

These areas of mesic oak forest have large oaks in the overstory and a number of native ground-layer species. The first step in managing these oak forests is to remove common buckthorn and Tartarian honeysuckle through a combination of cutting, pulling and herbicide application. Removing invasive species may be enough to stimulate the spread of ground-layer species. It will be important to monitor this area to determine whether ground-layer species are becoming established. If ground-layer species are not increasing after two years, volunteers should collect seed from areas near the site and spread it on bare soil. The area where soil was dug up into mounds for bicycle jumps was re-graded in the fall of 2001. In the spring of 2002 native seed will be spread to prevent

colonization by exotic/invasive species. Invasive species will be monitored and removed as needed every other year.

- Reduce erosion:

Numerous trails are causing significant erosion in both of these oak forest areas. A study needs to be done to develop a trail system consistent with the goals of improving ecological quality and meeting social needs. Erosion can be reduced by bundling brush of native species such as (dried) boxelder into wattles and staking them across the slope to slow water runoff. Plants such as Sprengel's sedge, false Solomon's seal, hog peanut, and Pennsylvania sedge can be established in eroding areas to revegetate and stabilize the soil.

Section A Maple-Basswood Forest

Restoration and management goals:

- Over 80% of shrub and forb cover is native to maple-basswood forests
- Native ground-layer vegetation is found every 1.5 feet
- Erosion is reduced
- Soil health is improved

Methods of achieving management goals:

- Cutting, applying herbicide and replanting:

This area of maple-basswood forest lies on a steep slope leading directly to the river. Maple and basswood trees dominate the overstory, and Pennsylvania sedge and several native forbs can be found in the ground layer. However, most of the ground lacks vegetation. Management of this maple-basswood forest should begin with the cutting and treatment of common buckthorn and Tartarian honeysuckle. Cut and treated areas will be re-planted with species found in maple-basswood forests.

- Monitoring:

Planted plots will be monitored to determine whether planting was successful and further plantings are warranted.

- Reduce erosion:

Wattles can be staked across seriously eroded slopes to slow water flow. Planting species such as Sprengel's sedge, false Solomon's seal, and Pennsylvania sedge will stabilize the soil.

- Improve soil health:

Wood chips (4 to 6 inches around shrubs and trees, two inches around ground-layer species) will be spread over planted areas.

Southern Forest Restoration Opportunity Area

This Restoration Opportunity Area is separated into three areas with unique management requirements. The three sections are as follows:

- Section A Oak Forest, Roadside
- Section A Oak Forest, Mesic Subtype, Southern Forest
- Section A Oak Forest, Tree Planting

Management recommendations for the three sections are provided in Table 7.

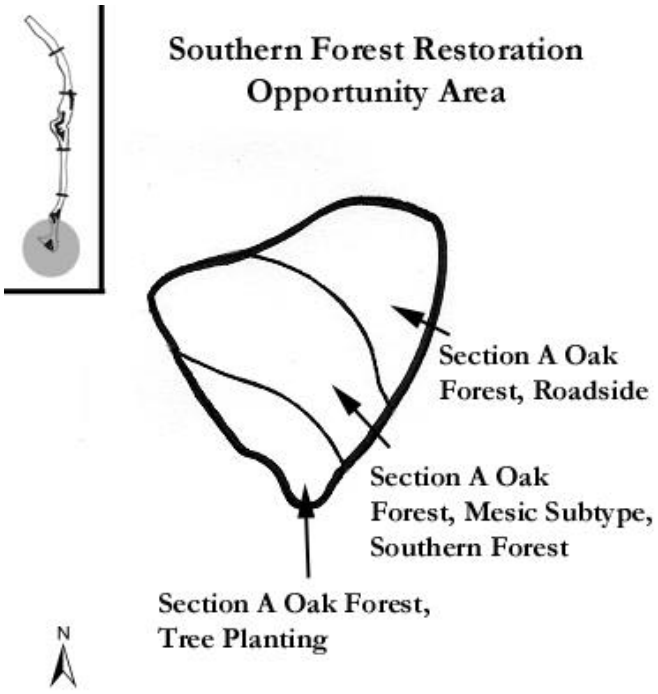

Figure 20. Southern forest restoration opportunity area

Figure 22. Bicycle jumps within Section A oak forest, mesic subtype, looking west.

Figure 21. Section A oak forest, roadside, looking west.

Figure 23. Section A oak forest,tTree planting, looking west

Table 7. Southern Forest Restoration Opportunity Area recommendations

Date	Section A Oak Forest, Mesic Subtype	Section A Oak Forest, Tree Planting	Section A Oak Forest, Roadside
Spring 2002	• Remove refuse piles, ashes, etc. (Cr, Vol) Collect seed from forests within the river Gorge and spread it in the oak forest where bicycle jumps were located (waterleaf, sedges, etc.) (Vol)		• Eliminate mowing except for along roadway (Cr)
Summer 2002	• Install water bars on steep portion of main east-west trail in forest. (Cr, Vol)		• Remove common buckthorn and Tartarian honeysuckle seedlings through selective spraying or pulling (Cr, Vol) • Assess common buckthorn situation; if many seedlings are growing continue spraying/pulling (Vol)
Fall 2002	• Remove common buckthorn and, Tartarian honeysuckle • Monitor for invasives yearly and conduct removal (Cr, Vol)	• Remove common buckthorn and other invasive species (Cr, Vol)	Assess extent of common buckthorn, continue spraying/pulling if many seedlings are present (Vol)
Winter 2002-03			
Spring 2003	• Spread seeds from mesic oak forest. (Vol)	• Plant native shrubs on slope south of tree planting. (Vol)	• Plant native trees and shrubs. Monitor abundance of existing sedges in ground layer. If native sedges are not found every 1.5 feet, supplement with seed of ground-layer species (Vol, Cr)
Summer 2003		Monitor for invasives yearly and conduct removal. If boxelder becomes thick in planting, cut and treat. (Cr, Vol)	• Assess common buckthorn situation, continue spraying/pulling if necessary (Vol, Cr)

<u>Section A Oak Forest, Mesic Subtype</u>

Restoration and management goals:

- Reduce erosion by removing trails.
- Over 80% of shrub and forb cover is native to mesic oak forests.
- Increase native ground-layer vegetation so that native species grow about 1foot apart.

Methods of achieving management goals:

- Reduce erosion:

The forest contains many eroding trails. The main east-west trail has been regraded to level bicycle jumps and is currently unvegetated. Further east on the trail, a steep slope is eroding. Installing water bars at appropriate intervals across the slope will slow runoff. As mentioned in the general recommendations, a study needs to be done to determine which trails should be eliminated in the forest.

- Cutting, herbicide application and replanting:

This area of mesic oak forest has many large red oak in the overstory and a relatively sparse ground layer. The first step in managing this oak forest involves removing common buckthorn and Tartarian honeysuckle through a combination of cutting, pulling and herbicide application. This is quite a large area of forest, so planting with plugs is not practicable. Volunteers could collect seed from within the Gorge throughout the growing season and spread the seed in the woodland. Seed of certain species unavailable on-site should be purchased. Eliminating trails, removing invasive species and seeding may be enough to re-vegetate the understory. A recently re-graded area where mounds were thrown up as bicycle jumps should be seeded in the spring of 2002 to prevent invasive species from becoming established. Invasives should be monitored annually and removed as needed.

Section A Oak Forest, Tree Planting

Restoration and management goals:

- Remove invasive species

Methods of achieving management goals:

The most pressing need in managing this area is removing common buckthorn through cutting and stump treatment. The slope to the south of the planting can be replanted with native shrubs after invasive species are removed.

Section A Oak Forest, Roadside

Restoration and management goals:

- Over 80% of shrub and forb cover is native to mesic oak forests
- Oaks comprise over 50% of trees in overstory
- Forest canopy covers over 50% of the area
- Increase native ground-layer vegetation so that native species grow about 1 foot apart.
- Soil health is improved

Methods of achieving management goals:

- Cutting, herbicide application and replanting:

This area, located between the mesic oak forest and Ford Parkway, contains a variety of mature trees spaced about 25 feet apart on mowed grass. Kentucky bluegrass, many sedges and seedling buckthorn are found in the lawn. Management should begin by ceasing mowing and eliminating common buckthorn and Tartarian honeysuckle. Given the density of buckthorn, spraying or pulling of buckthorn seedlings throughout the growing season will probably be necessary after mowing stops. If a foliar herbicide

application is called for, it's important to choose a herbicide that kills buckthorn but not sedges; there are many sedges in the ground layer. The following spring, volunteers can plant native trees and shrubs found in mesic oak forests. If native plants are not found in the ground layer every 1.5 feet, seed from other ground-layer species can be spread to fill in the gaps. Spraying or pulling buckthorn and other exotic species should continue into the future. The edge along Ford Parkway should be planted with native grasses, forbs and shrubs that will form an attractive border and buffer the woodland plantings. Species should be planted close enough together to inhibit the growth of common buckthorn and other invasive species. A 10- to 15-foot strip of grass can be left along the parkway as a transition between the roadway and plantings.

- Improve soil health:

Wood chips (4 to 6 inches around shrubs and trees, two inches around ground-layer species) will be spread over planted areas.

Sand Barren Restoration Opportunity Area

- Unlike the other Restoration Opportunity Areas, the Sand Barren Restoration Opportunity Area is not divided into subunits. The land-cover polygon for the area used during the site inventory is called Section C Sand Flats.

Management recommendations for the Sand Barren Restoration Opportunity Area are provided in Table 8.

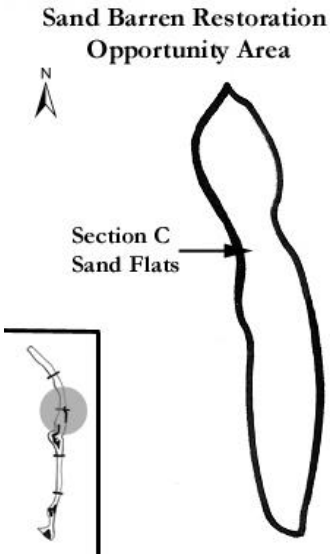

Figure 24. Sand Barren Restoration Opportunity Area.

Figure 25. Sand barren restoration opportunity area, looking south.

Table 8. Sand Barren Restoration Opportunity Area Recommendations

	Section C Sand Flats
Date	
Spring 2002	• Plant prairie forbs (dry prairie mix) throughout prairie to add diversity (Vol)
Summer 2002	
Fall 2002	• Remove Siberian elm and black locust (Cr)
Winter 2002-03	
Spring 2003	• Monitor for re-sprouting Siberian elm and black locust along with other invasives. Cut and treat (Vol, Cr) • Conduct prescribed burn in areas with sufficient fuel (Cr,)
Summer 2003	
Fall 2003	• Monitor and remove invasive species every two years and conduct prescribed burns every three to five years (Cr,Vol)
Winter 2003-04	
Spring 2004	
Summer 2004	
Fall 2004	

Section C Sand Flats

Restoration and management goals:

- Remove Siberian elm and black locust
- Increase prairie forbs to 10% of planting

Methods of achieving management goals:

- Cutting, herbicide application and burning:

The Section C Sand Flats consists of dredge material placed by the U.S. Army Corps of Engineers and planted with prairie species. Management of this area should start by removing Siberian elm in the prairie and on its margins and removing black locust along the west end of the prairie. Native grasses currently dominate the prairie. Interseeding the prairie with forbs (dry prairie species) in the spring should increase species diversity, and burning every three to four years will keep weeds and invasive species out. Invasive species should be monitored and removed as needed every two years.

Recommendations for Involving Community Volunteers

Long-term restoration of the Longfellow River Gorge offers many opportunities for community members to participate. Restoration activities offer rewarding hands-on educational opportunities that contribute directly to improvements in the urban environment. Not only do people enjoy the activities; but by participating, they also develop a stronger sense of stewardship for our urban natural resources. Longfellow community members have already participated in initial restoration projects in the Gorge and in related projects as well.

Figure 26. Great River Greening planting

Volunteer Activities and Locations at the Longfellow River Gorge

The following activities are key to managing the Restoration Opportunity Areas of the Longfellow River Gorge and are appropriate for volunteers:

- Planting native trees and shrubs
- Planting wildflower and grass seedlings
- Collecting and broadcasting prairie seed
- Removing exotic species seedlings with weed wrenches
- Hauling exotic-species brush that has been cut by professional crews
- Burning according to a prescribed plan

Greening has engaged volunteers in all of these activities in the past, except prescribed burning. With proper training, volunteers could participate in this activity as well. Activities that are hazardous (on very steep slopes) or require professional training (such as using power tools or applying herbicide) are inappropriate for volunteers. Tables 5 (p. 33), 6 (p. 41), 7 (p. 44) and 8 (p. 48) indicate the locations of tasks that are appropriate for volunteers.

Recruiting and Engaging Volunteers

Great River Greening has engaged more than 10,700 community volunteers in restoration activities at dozens of sites in the Twin Cities metropolitan river valleys. This approach has succeeded because of the leadership of trained volunteer supervisors who educate and train other volunteers about the purpose of the activities and how to properly carry them out. Greening recruits individuals and families, as well as larger groups, for restoration events.

In Longfellow, many community members already have an interest in restoration projects, as described below. In addition, civic, corporate and school groups often appreciate opportunities to participate in enjoyable hands-on activities that serve the

wider community. Ecological restoration projects are a great match for these groups searching for volunteer opportunities.

Sources of Volunteers from the Longfellow Community

Longfellow community members have already demonstrated impressive leadership and a strong commitment to volunteerism in the Gorge, through the work of the River Gorge Committee, other past community activities, and planned activities for 2002. Many volunteers who have taken part in these projects could be recruited for future restoration activities. A brief summary of community involvement in the restoration of the River Gorge is provided here. Related activities that might serve as a source of volunteers from in the Longfellow community are also outlined briefly.

The River Gorge Committee – History

During the early 1990s, communities in the city of Minneapolis received funding through the Neighborhood Revitalization Program (NRP). The NRP process provided the impetus for initial restoration activities in the River Gorge. In order to obtain NRP funds, community members took part in a lengthy process of identifying and prioritizing shared community goals. After many years of only passive interest in the River Gorge within the Longfellow community, the Environment and Transportation Committee formed as part of the NRP process. This group identified several goals for the River Gorge, including developing an initial Concept Master Plan, improving trails and accessibility, controlling erosion and managing the Gorge according to ecological principles. Numerous Longfellow community members expressed interest in the Gorge, and the Longfellow Community Council (LCC) allocated $310,000 in NRP funds for restoration efforts. In 1994, the River Gorge sub-committee was formed to oversee the community's NRP-funded restoration activities. To date, more than $250,000 in additional funds has been secured for River Gorge projects.

- Concept Master Plan (1995-1996). This document was the first step in identifying the community's goals for the River Gorge. Input from Longfellow residents at a number of community meetings was incorporated into the plan, and its general principles have guided several projects in the Gorge.
- Trail accessibility recommendations. Wilderness Inquiry conducted a brief evaluation of the Gorge's accessibility, focusing on ways the river could be accessed by people with and without disabilities, while preserving the natural quality of the Gorge. Wilderness Inquiry recommended improving access near the Rowing Club (just north of Lake Street), and upgrading the most intact stretches of the Winchell Trail (between 35th and 44th streets).
- Oak savanna restoration project. Restoration of a 10-acre oak savanna area was begun with funding from National Park Service-MNRRA and support from the Minneapolis Park and Recreation Board (MPRB). Activities included development of a restoration plan for the oak savanna area by Andy Sudbrock of Applied Ecology, Inc., and hand-on work to remove exotic species, thin native trees and shrubs, burn grassy areas and spread seed collected from native plants. Volunteers took part in much of this restoration activity.

- Past trail and overlook improvements. With funding from LCC and MPRB, several trails-related projects have been completed.
  - Design and construction of an overlook at 35th Street. This overlook was also funded by a large donation to People for Parks from the Family of Dorothy and Irving Bernstein.
  - Installation of limestone steps near the railroad bridge, to link to a good trail.
  - Construction of a small limestone staircase at 44th Street, and redesign of that location to increase accessibility (A proposed trail in that area is not complete.).
- Trail and overlook improvements currently underway, led by LCC. For current projects, LCC is providing funds along with a matching grant from the MN DNR National Recreation Trail Program.
  - Redesign of eroded portions of trail near the Rowing Club.
  - Improvements to the Winchell Trail, where it circles the ravine at 36th Street and connects the overlook at 36th Street to the woodland brushland savanna area.
  - Restoration of the steps at 34th St. built by the WPA in the 1930s. This will improve access to the flats and trails below the Lake St. Bridge for hikers and volunteers.
- Trail and overlook improvements currently underway, led by MPRB.
  Design and installation of a small overlook by the prairie bowl. A trail will be closed and a wooden staircase installed along another nearby trail.

River Gorge Stewards project – 2001

In 2001, the LCC River Gorge Committee hired Friends of the Mississippi River (FMR) to assist the committee in organizing neighborhood volunteers to restore and enhance the Gorge. The focus of this project is to encourage Longfellow residents to monitor trails as individuals, and to participate in educational and restoration activities in larger groups. (FMR is a member of the Big Rivers Partnership.) Approximately 100 people have taken part in monitoring and restoration, including a core group of 30-40 individuals who have participated in several events. Financial support for the Gorge Stewards project comes from NRP funds of the Longfellow Community Council, and from grants obtained by FMR from the Porter Foundation and from the Gannett Foundation, as recommended by KARE-11 TV.

Volunteers participated in the following River Gorge Stewards activities in 2001:

- A presentation on the history of the Mississippi River, by John Anfinson, historian for the National Park Service.
- Earthday cleanup in collaboration with MPRB.
- Garlic mustard pull volunteer event in the Sand Flats area, with additional volunteers from the National Park Service-MNRRA.
- Buckthorn and sumac removal at the oak savanna site, in collaboration with MPRB and Applied Ecology.
- Stenciling of storm drains to raise public awareness of the importance of not dumping into storm drains.
- Trail-monitoring training of volunteers by MPRB natural resources staff and Parks Police.
- River flats cleanup between Lake Street and the 27th Street railroad bridge.

- Seed collection from the 36th Section C Prairie, and seed broadcasting in the woodland brushland savanna area, in collaboration with MPRB.
- Tour to learn about the geology of the Gorge from a neighborhood resident and geologist, Craig Larson.

Volunteers already engaged in the River Gorge Stewards project are an obvious source of potential neighborhood volunteers for the restoration activities identified in this plan.

The River Gorge Stewards project will continue in the Longfellow Community through 2003 and most likely beyond that, so activities identified in this plan can inform the activities of that project. In addition, the River Gorge Stewards project will expand in 2002 to the Seward neighborhood, located north of Longfellow along the Mississippi between 27th Street and the Interstate 94 bridge. Currently, MPRB is developing a restoration management plan for Seward's stretch of the Gorge, which will also serve as a restoration guide for professional crews and volunteers. This expansion presents a prime opportunity for neighborhood residents throughout this larger stretch of Gorge to coordinate their efforts in restoration projects.

Other related community projects:
Several other community-based environmental projects are taking place involving volunteers who may be interested in helping to restore the Gorge:

- Watershed Workshops. The Friends of the Mississippi River Watershed Workshops program teaches community residents how to improve water quality in their own back yards by creating rain gardens that trap water, decreasing stormwater runoff. For more information about programs in 2002, contact FMR at 651 222-2193.
- Mississippi River Schools project. In 2001, LCC allocated $20,000 in 2001 to introduce material about the Mississippi River into the curriculum of four elementary schools in Longfellow. This project is a collaboration between Hamline University's Center for Global Environmental Education, the Minnesota Historical Society, and the National Park Service-MNRRA. Providing opportunities for students to engage in hands-on restoration of the Gorge would add an exciting experiential component to the Mississippi River Schools project.
- Longfellow Garden Club participants and community gardeners. A garden club has been active in Longfellow for many years. In addition, Longfellow is home to two community gardens. The Dowling Community Garden, on the grounds of Dowling Elementary School, was established during World War II as a victory garden. It features nearly 100 plots and a patch of native prairie grass and wildflowers planted by volunteers in 1995. The smaller Minnehaha Avenue Community Garden, established in 1995, has approximately 15 plots. Garden Club members and plot holders at the two community gardens may be interested in participating in community native plantings in the River Gorge.
- Hiawatha School Playground and Hiawatha Park Green Space. A group of dedicated neighborhood residents has led a community campaign to add fully accessible playgrounds and a sensory garden to this school and park. Plans are also underway to establish a community green space on these grounds. Residents have expressed strong interest in installing native plantings as part of this project. Participants may

be open to combining their efforts with Gorge restoration projects.

- Native Plants Grant project**.** In 2002 LCC is developing a pilot project to provide small matching grants to Longfellow residents who plant native vegetation on their properties. More than 170 residents have registered for this project; they may also have an interest in participating in Gorge restoration.

General recruiting recommendations

In general, volunteers can be recruited from these groups:

- Neighborhood block clubs
- Schools and colleges (many have service learning programs)
- Churches
- Scout troops
- Local businesses
- Civic organizations
- Volunteer recruitment organizations, (eg. Twin Cities Volunteer Resource Center)
- Community volunteer programs for employees of Twin Cities businesses.

Events can be publicized by word-of-mouth, and with fliers, press releases to community newspapers, newsletters, Web sites and e-mail listservs.

Volunteer recruitment resources

The Volunteer Resource Center has a Web-based system for publicizing upcoming volunteer events to interested volunteers throughout the Twin Cities metropolitan area.

Volunteer Resource Center, 2021 Hennepin Ave E, #420
Minneapolis MN 55413 612-379-4900

Figure 27. Volunteers planting trees and shrubs.

Organizing volunteer events

Volunteers enjoy well-organized events. When the basic needs of volunteers are met and their time is used well at an event, they enjoy themselves, experience a sense of satisfaction, and are more likely to volunteer again. Educating volunteers about the purposes and benefits of restoration and training them to properly conduct the activities are essential to holding a well-organized, satisfying volunteer event.

Greening has conducted dozens of restoration events, drawing upon the talents of volunteers of all ages. Greening has staged events with as few as a handful of volunteers, and as many as 1,100 individuals. These events typically last three hours, and are usually held on Saturday mornings. Following are the steps involved in conducting an event.

Planning the volunteer event

- Define the location and field activities of the event, considering event logistics like parking location, registration area and wrap-up/lunch area.
- Estimate the number of volunteers required for the fieldwork and other volunteer event activities. The kinds of volunteers we typically recruit include:
  - Restoration volunteers (for planting, exotic-species removal, etc.). Not all activities are appropriate for volunteers of all ages, and recruitment must reflect this (For example, brush hauling is unsafe for young children.).
  - Trained volunteer supervisors to lead and instruct restoration volunteers.
  - Parking volunteers to direct traffic (especially important for large events).
  - Registration volunteers
  - Food-table volunteers
  - Event cleanup volunteers
- Recruit and register volunteers in advance (especially for large events).
- Confirm registration with volunteers, and provide site maps, directions and event information (by mail or e-mail).

Organizing the fieldwork

- Before the event, organize the restoration work area into "work units." A work unit is a defined area within a project site that can be completed by 20 volunteers and two volunteer supervisors within the time available.
- All work units are clearly marked. All necessary materials (plants, wood chips, water for plantings, for example) and tools are provided at the event site. Occasionally, and particularly for very large events, we ask volunteers to bring their own hand tools to supplement those provided.
- Trained volunteer supervisors arrive at the event shortly before the restoration volunteers to orient themselves to the work units and event activities.

Organizing volunteers at the event

- Posted signs direct volunteers to parking and registration areas.
- Restroom facilities are positioned in convenient locations (We usually rent "biffs.").
- All volunteers sign in at the registration area, and are assigned to work units.
- We provide coffee and snacks, often donated by local businesses.
- Field staff trained in first aid have access to cell phones and first-aid equipment. In case of accident, volunteer supervisors are briefed on emergency plans during their orientation. For very large events, a trained nurse or other medical professional is present at the event site.
- Water is provided at work units and in the event wrap-up area.

Field activities at the event

- Volunteer supervisors direct their volunteers to their work units and conduct a 10-minute training session, talking about the purpose of the project and specific restoration activities, demonstrating correct methods, identifying any safety concerns, and answering questions.
- Volunteer supervisors oversee the activities of the volunteers to ensure proper methods are used.
- Staff oversees volunteer supervisors to ensure work is proceeding appropriately and on schedule. Groups that finish their work early are asked to assist in another work unit so that all the work in the project area can be completed by the end of the event.
- Water is provided at the work units.

Thanking the volunteers

- When fieldwork is completed, volunteers gather at a central location for snacks or lunch and a short presentation.
- Event hosts thank the volunteers for their work and provide additional information about the project. Greening typically invites partner organizations and local public officials to make presentations during the event wrap-up. This is an opportunity for partners and other local groups to increase public awareness at display booths.
- After the event, we mail postcards to volunteers thanking them for their participation.

Evaluating the event

- We request comments about our events from participants, both while they are at the event and after the event. For most events, we typically survey our volunteer supervisors and a subset of the volunteer participants to help identify where we need to improve.
- Staff members "debrief" after each event to further improve our efforts.

Training volunteer supervisors

- Volunteers willing to serve as supervisors participate in Greening's basic training, where they learn to lead groups of volunteers at our events. A supervisor's role is to educate volunteers about the purpose of the project and event activities, to motivate the volunteers by making the activities enjoyable, and to help ensure that they use proper techniques.
- Greening also offers volunteer supervisors advanced training that expands their knowledge of ecological restoration. Advanced training topics include woodland planting design, exotic-species control, identifying and collecting seeds from prairie plants, and an introduction to the natural communities of the Twin Cities area.

Potential Funding Sources

Many opportunities exist for community members to organize restoration events, or participate in these events in any number of ways.

Volunteers are critical for other important tasks as well, such as building community support for the goals of ecological restoration, and pursuing funding for restoration projects.

Ongoing leadership from community members will ensure successful implementation of the recommendations of this management plan. Sources of funds and assistance that could support ecological restoration of the Longfellow River Gorge including the following:

- Big Rivers Partnership. For information about funds for carrying out restoration projects from January 2002 through December 2003, contact Great River Greening.

- Legislative Commission on Minnesota Resources. This commission solicits, evaluates and recommends natural resources projects for legislative funding from the Minnesota Environment and Natural Resources Trust Fund. Application deadlines are biennial. http://www.commissions.leg.state.mn.us/lcmr/lcmr.htm

- Minnesota Department of Natural Resources. Several relevant grant programs exist:
  Conservation Partners Grants
  http://www.dnr.state.mn.us/omb/financial_assistance/cons_part.html

- Metro Greenways Program-Planning and Implementation Grants
  http://www.drn.state.mn.us/greenprint/metro-green.html

- MN Office of Environmental Assistance
  http://www.moea.state.mn.us/

- MN Pollution Control Agency
  http://www.pca.state.mn.us/netscape4.html

- National Park Service-MNRRA
  http://www.nps.gov/miss/

- National Fish and Wildlife Foundation (private foundation)
  http://www.nfwf.org/

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Great River Greening

Helping communities restore, manage and learn about their natural environment through volunteer involvement.

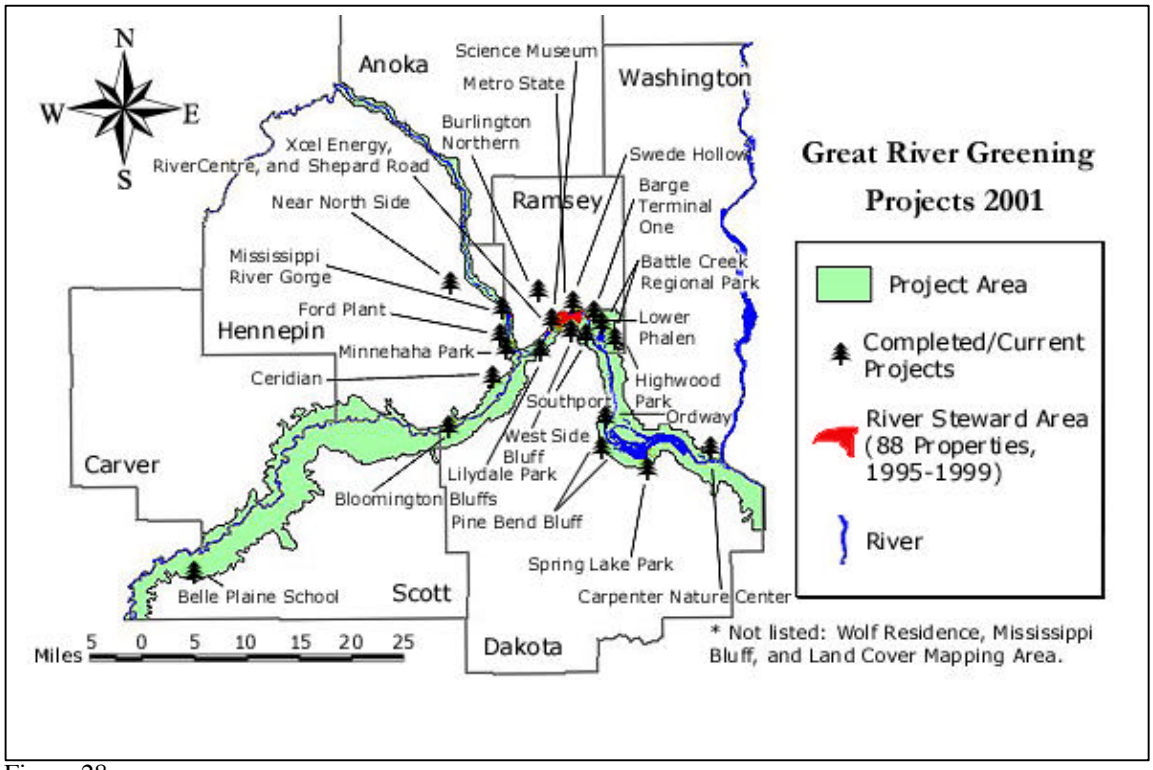


Figure 28.

The Challenge

Erosion, trash, and the invasion of exotic and invasive plant species are degrading our urban river valleys, reducing ecological diversity destroying wildlife habitat. Many public and private organizations are working to protect the river valleys, but these programs often lack long-term community involvement and stewardship.

These problems are especially pressing in the Twin Cities metropolitan region, home to more than 2 million people. The river valleys in this area:

- Hold some of the region's last intact native landscapes
- Serve as vital wildlife corridors for hundreds of migratory bird species
- Provide a water source for millions of the region's residents
- Contain some of the region's most scenic sites and vistas

Great River Greening's response

Great River Greening, a nonprofit organization, helps coordinate a cost-effective and sustained effort to manage ecosystems of the three great river valleys of the metropolitan area: the Mississippi, Minnesota and St. Croix. We are primarily an implementing organization, providing on-the-ground ecological restoration and management of both public and private land. We engage thousands of volunteers in the planting of native vegetation, removal of exotic and invasive weeds, native-seed collection, and stewardship—work that cultivates an informed and involved

citizenry. We also act as a catalyst, creating effective partnerships among agencies, municipalities, and private landowners responsible for managing river valleys and their natural resources. Restoration ecologists and other scientists provide technical expertise.

Key values

Great River Greening bases its work on these values:
1. Native trees and other vegetation have ecological and sociological value: They contribute to the health and biodiversity of ecosystems; they beautify surroundings; and they enhance a community's natural heritage and sense of place.
2. People want opportunities for direct involvement in natural resource protection and management, which help them feel connected and committed to their local natural areas.
3. Volunteer involvement in restoration and planning is one of the most effective methods of environmental education. When people work side by side to improve their environment, their communities become stronger and more vital.
4. Environmental restoration and stewardship require collaboration and inclusiveness.

We are committed to:

Citizen-based restoration, stewardship and education

Ecologically sound implementation and evaluation

Collaboration to help advance ecosystem-based management

Long-term stewardship.

Accomplishments—highlights

Since 1995, Great River Greening has involved more than 10,700 volunteers in the planting of 35,000 trees and shrubs and 16,000 wildflowers and grasses, as well as exotic-species removal, prairie-seed collection and broadcasting, plant inventories, training programs, and ongoing stewardship. In 2000 alone, we organized 30 events attended by nearly 1,500 volunteers!

We've also provided design and ecological consulting for numerous groups, including the city of Saint Paul Parks and Recreation Division, the Saint Paul Port Authority, the Science Museum of Minnesota, RiverCentre, and the Greater Minnesota Housing Fund.

Great River Greening's major partners

City of Saint Paul · Friends of the Minnesota Valley · Friends of the Mississippi River · Metropolitan Council · Minneapolis Park and Recreation Board · Minnesota Department of Natural Resources · National Park Service · Ramsey County Parks and Recreation · Saint Paul Audubon Society · Trust for Public Land · U.S. Fish and Wildlife Service · Private landowners

About the authors

Dan Shaw is involved in restoration work, stormwater design and landscape planning at Great River Greening. He has worked as an ecologist for several years in both the public and private sector, and is author of the publications *Plants for Stormwater Design* and *Native Vegetation in Restored and Created Wetlands*. He also teaches as an adjunct assistant professor in the Landscape Architecture Department at the University of Minnesota.

Carolyn Carr served as Great River Greening's program director and managed the Big Rivers Partnership until December 2001. Funded by the state Legislature, this partnership brings together government and nonprofit organizations to help communities restore habitat in the metropolitan Mississippi and Minnesota river valleys. She also worked as Greening's River Steward, managing technical assistance and outreach. Before joining Greening, Carolyn was program co-manager for the Urban Lands Program of the Sustainable Resources Center, promoting urban agriculture and sustainable landscaping in the Twin Cities.

To Contact Us

Great River Greening, 35 West Water Street, Suite 201, Saint Paul, MN 55107
651-665-9500. http://www.greatrivergreening.org

Appendix

Appendix A: Minnesota Land Cover Classification System Land Cover Types

Land-cover is defined as the physical cover, including vegetation (natural or planted) and human constructions (buildings, roads, etc.) present on the landscape. Information about existing land-cover can help guide decisions about what human uses are appropriate at a site, and where restoration efforts should be focused. Map 2 (page 136) presents the land-cover for the Mississippi River Gorge project area. The following are Minnesota Land-Cover Cover Classification System (MLCCS) land-cover types that are found within the project site. Following the list is descriptions of each land-cover type.

- Buildings and Pavement with 76-90% impervious cover
- Short grasses and mixed trees with 51-75% impervious cover
- Deciduous trees with 11%-50% impervious cover
- Grassland with sparse deciduous trees - non-native dominated vegetation
- Deciduous trees on upland soils
- Disturbed deciduous woodland
- Oak forest mesic subtype
- Mixed hardwood swamp - seasonally flooded
- Floodplain forest
- Riverine sand flats - bars
- Oak woodland - brushland
- Mesic prairie
- Dry prairie barrens subtype

Buildings and pavement with 76%-90% impervious cover: Areas where the sum of buildings, pavement and other impermeable surfaces averages 76% to 90% of the total cover.

Short grasses and mixed trees with 51%-75% impervious cover: Areas of short grasses with a matrix of 51-75% impervious cover.

Deciduous trees with 11% to 50% impervious cover: Areas of deciduous trees with a matrix of 11-50% impervious cover.

Grassland with sparse deciduous trees- non-native dominated vegetation: This upland vegetation has 10-70% cover by trees where >30% of non-native tree cover is herbaceous and dominated by non-native species. The groundlayer is often dominated by brome or Kentucky bluegrass. Common shrubs include sumac and Tartarian honeysuckle. Almost any tree species can be found, but elms, cottonwoods, green ashes, boxelders and bur oaks are common.

Deciduous trees on upland soils: Areas of deciduous trees where regular maintenance occurs over the long term.

Disturbed deciduous woodland: This upland vegetation has 10-70% tree cover and a dense shrub layer. Boxelder, green ash and cottonwood are typical canopy dominants, sometimes together and sometimes singly. Hackberry, oak and basswood may also be present. Both the sub-canopy and shrub layer are dominated by the exotic species common buckthorn and Tartarian honeysuckle. Gooseberry and elderberry are also be common. The groundlayer is dominated by species tolerant of disturbances, including white snakeroot, motherwort and garlic mustard.

Boxelder green ash disturbed native forest: Boxelder, green ash and cottonwood are typical canopy dominants, sometimes together and sometimes singly. Elms are common associates. Hackberries, aspens, oaks and basswoods may also be present. The shrub layer is often dominated by common buckthorn and Tartarian honeysuckle.

Maple-basswood forest: An upland deciduous forest where sugar maple, basswood and (formerly) American elm dominate the canopy or where they dominate along with oaks. Additional canopy species include northern red oak, bur oak and green ash. The canopy is very dense, with tall, straight, relatively narrow-crowned trees. The understory is multi-layered and patchy. It is composed of saplings and seedlings of the canopy species (especially sugar maples), along with ironwood, bitternut hickory, pagoda dogwood and leatherwood. Exotic species, such as Common buckthorn, are also frequently found in the understory and shrub layer. The groundlayer is composed of many spring ephemerals, including Dutchman's breeches, spring beauty, trout-lily, hepatica and wild geranium and many Sedge and grass species.

Oak forest mesic subtype: An upland deciduous forest with greater than 30% oaks. Northern red oak or bur oak dominate. The canopy contains tall, straight, single-stemmed trees that lack spreading lower branches. Additional trees found in the canopy include basswood, hackberry, box elder, American elm and green ash. Gray-bark dogwood, chokecherry, elderberry and raspberries compose a sparse shrub layer. Dense stands of exotic species such as Common buckthorn and Tartarian honeysuckle are also found in the understory and shrub layer. The groundlayer contains a diverse selection of herbs, sedges and grasses.

Mixed hardwood swamp seasonally flooded: A forest with seasonally flooded hydrology, growing on muck or shallow peat. Tree cover is >30%, of which <50% is black ash and <50% is tamaracks, white cedars, and black spruces combined.

Floodplain forest: Floodplain forest is a seasonally wet forest community that occurs throughout Minnesota on the active floodplains of the major rivers and their tributary streams. The canopy of the community is dominated by deciduous tree species tolerant of inundation, abrasion and other disturbances associated with flooding. The canopy is either composed of a mixture of tree species or strongly dominated by a single tree species. The species composition of Floodplain Forest varies both geographically and in relation to such features as substrate type and flood cycles. Common trees include American elms, slippery elms, green ashes, cottonwoods, bur oaks, basswoods, box elders and willows.

Riverine sand flats bars: This community is found from the western Great Plains to the eastern parts of the midwestern United States and Canada, ranging from Indiana northwest to Saskatchewan, and south to Kansas. It is a sparsely vegetated community that occurs along river shorelines, islands, and flats. These sandbars form when receding floodwaters deposit sand and lesser amounts of clay, silt, and cobbles in the stream bed. Soils are often undeveloped due to the ephemeral nature of the stands. Drainage depends on depth above the water level. Herbaceous species include; red-root flatsedge, *Cyperus odoratus, Cyperus squarrosus, Eragrostis hypnoides,* wood lovegrass, *Leptochloa fascicularis, s*martweeds, Western yellow-cress, sand dropseed, and common cocklebur.

Oak woodland brushland: Oak woodland brushland occurs on dry to mesic sites throughout the deciduous forest-woodland zone and locally in the prairie zone near the ecotone between the prairie zone and the deciduous forest-woodland zone. Oak woodland is floristically and structurally intermediate between Oak Savanna and Oak Forest, with a patchy tree canopy and an understory dominated by shrubs and tree saplings. Principal canopy trees include bur oak, northern pin oak, white oak and northern red oak. Aspen may form up to 70% of the tree canopy cover. Most of the floristic diversity in the community

exists in the shrub layer. Shrub layer species include; blackberries, raspberries, gooseberries, dogwoods, cherries, hazelnuts, prickley ashes and sprouts of oak and quaking aspen. Prairie vegetation, if present, occurs in small openings.

Mesic prairie: Mesic prairie is a type of upland prairie, which occurs primarily in the prairie zone, with scattered occurrences in the deciduous forest-woodland zone. The soils of mesic prairies are predominately mollisols with thick, dark mineral surface layers. Mesic prairie is dominated by grasses. Common grass species include big bluestem, Indian grass, prairie dropseed, little bluestem, porcupine grass, switchgrass and prairie cord grass. Some common forb species include; purple prairie clover, white prairie-clover, ground plum, prairie-turnip, rough blazing star, Canada goldenrod, stiff goldenrod, Missouri goldenrod, prairie thistle, smooth aster, stiff sunflower, Maximilian sunflower, smooth rattlesnake-root, white sage and heart-leaved alexanders.

Dry prairie barrens subtype: The barrens subtype of dry prairie occurs on dry to dry-mesic sands on outwash plains, old dune blankets, alluvial deposits along rivers and streams. It is present in the northwest, central and southeastern parts of the prairie zone, and also in the deciduous forest-woodland zone. The low nutrient levels, low organic matter and poor water-retaining capacity of the deep sands presumably are the major determinants of the species composition and structure of the subtype. Major species include; big bluestem Indian grass, porcupine grass, little bluestem, prairie June-grass, sand dropseed, sand reedgrass, hairy grama. Common forbs include; prairie sage, plantain-leaved pussytoes, large-flowered beard tongue and hairy puccoon.

(Source: MN DNR 1992.)

Appendix B: Trail Planning Resources

The following references are recommended to aid future trail planning efforts in the Mississippi River Gorge:

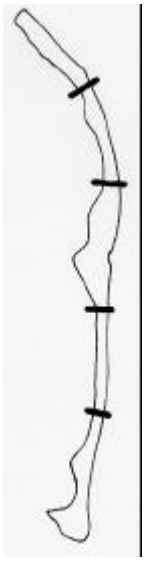
- **Trail Development and Maintenance Manual**, Minnesota Department of Natural Resources, Trails and Waterways Unit, 98p. 1982.

- **Footpaths: A Practical Conservation Handbook**, Wallingford, UK, British Trust for Conservation Volunteers, 192p. 1983.

- ***The Complete Guide to Trail Building and Maintenance,*** Appalachian Mountain Club, Boston, 1998.

- **Trails Bibliography,** University of Minnesota , Dept. of Forestry, http://forestry.lib.umn.edu/bib/trls.html

Appendix C: Inventory Results

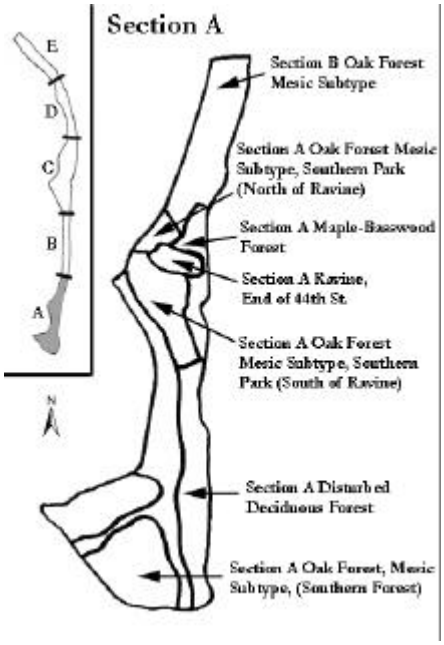


Appendix Figure 1. Sections of the Mississippi River Gorge Project Site.

This section includes information collected during inventories of the Mississippi River Gorge. The information presented includes findings from a May 2001 inventory and an August-September 2001 inventory. The following headings are names given to each land-cover polygon within the site. Some headings are sub-units of the land-cover polygons, these areas are in italics and follow the land-cover polygon that they are found in. An inventory was not conducted for the boulevard of West River Parkway, including an area of "deciduous trees on upland soils" at the far southern end of the site. The areas inventoried totaled 106.45 acres.

A description is provided for each land-cover polygon or sub-unit and a plant list is included with species observed during plant inventories. Plants are listed by vegetation form and are listed alphabetically by scientific name. Abundance is not listed for individual species.

Section A Land-cover Polygons



Appendix Figure2. Section A land-cover polygons

Section A Oak Forest Mesic Subtype, Southern Park (North of Ravine) (5.01 ac.)

This oak forest is generally in good condition. Although there is little organic matter on the ground, large patches of woodland wildflowers such wild ginger, bloodroot and patches of sedge species, are common. Tartarian honeysuckle and Common buckthorn are scattered through the forest but are not dominant. This heavily used forest contains many trails used by both hikers and bicyclists. Cyclists constructed a series of mounds and pits along a central trail, disturbing a large area in the forest. The area has been regraded but the soil is unvegetated.

The section of woods along Ford Parkway is currently maintained as lawn. The groundlayer is dominated by Sprengel's sedge, indicating the area was historically woodland and savanna. This area appears to have little use as lawn and would be an ideal location for plantings by volunteers. Common buckthorn seedlings growing in the lawn would need to be pulled after mowing is stopped. Replanting native trees and shrubs would help control common buckthorn growth.

Canopy Trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Celtis occidentalis	Hackberry
Fraxinus pennsylvanica	Green ash
Populus deltoides	American cottonwood
Quercus rubra	Red oak
Tilia americana	American basswood
Ulmus americana	American elm

Mid-Story trees

Carya cordiformis	Bitternut hickory
Fraxinus nigra	Black ash
Fraxinus pennsylvanica	Green ash
Ostrya virginiana	Ironwood
Picea abies	Norway spruce
Prunus virginiana	Choke cherry
Rhamnus cathartica	Common buckthorn
Tilia americana	American basswood

Shrub Layer

Cornus alternifolia	Pagoda dogwood
Lonicera tatarica	Tartarian honeysuckle
Ribes sativum	Garden currant
xanthoxylem americanum	Prickley ash

Goundlayer Vines

Echinocystis lobata	Wild cucumber
Menispermum canadense	Canada moonseed
Parthenocissus quinquefolia	Virginia creeper

Forbs

Actaea pachypoda	Baneberry
Arisaema triphyllum	Jack in the pulpit
Asarum canadense	Wild ginger
Aster prenanthoides	Crooked-stemmed aster
Circaea quadrisulcata	Enchanter's nightshade
Eupatorium rugosum	White snakeroot
Geranium maculatum	Wild geranium
Hydrophyllum virginianum	Virginia waterleaf
Leonurus cardiaca	Motherwort
Phryma leptostachya	Lopseed
Polygonatum biflorum	Solomon's seal
Rhus toxicodendron	Poison ivy
Rubus sp.	Raspberry
Sanguinaria canadensis	Bloodroot
Smilax herbacea	Carrion flower
Smilacina racemosa	False Solomon's seal
Solidago flexicaulis	Zig-zag goldenrod
Streptopus amplexifolius	Twisted stalk

Grasses and sedges

Carex blanda	Woodland sedge
Carex sprengelii	Sprengel's sedge

Section A Maple-Basswood Forest (3.19 ac.)

This area contains a moderately steep slope with red oak and sugar maple the dominant overstory species. Little organic matter covers the ground but several ground-layer species commonly found in maple-basswood forests are present on the ground layer. Patches of Pennsylvania sedge are preventing erosion in several spots. Several trails are located in this area and are causing significant erosion. Tartarian honeysuckle is present but not prevelent and common buckthorn is scattered.

Canopy Trees

Latin Name	**Common Name**
Acer saccharum	Sugar maple
Quercus rubrum	Red oak
Tilia americana	American basswood
Ulmus americana	American elm

Mid-story trees

Acer negundo	Boxelder
Ostrya virginiana	Ironwood
Prunus serotina	Black cherry
Rhamnus cathartica	Common buckthorn
Salix nigra	Black willow
Ulmus pumila	Siberian elm

Shrub layer

Lonicera tatarica	Tartarian honeysuckle
Xanthoxylem americanum	Prickley ash

Gound-layer vines

Amphicarpa bracteata	Hog peanut
Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper

Forbs or groundlayer trees

Ambrosia artemisifolia	Common ragweed
Aralia nudicaulis	Wild sarsaparilla
Arctium minor	Common burdock
Arisaema triphyllum	Jack in the pulpit
Asarum canadense	Wild ginger
Desmodium glutinosum	Pointed leaf tick trefoil
Eupatorium purpureum	Sweet joe-pye weed
Eupatorium rugosum	White snakeroot
Helianthus divaricatus	Woodland sunflower
Hydrophyllum virginianum	Virginia waterleaf
Polygonatum biflorum	Solomon's seal
Quercus bicolor	Swamp white oak
Sanguinaria canadensis	Bloodroot
Smilax herbacea	Carrion flower
Smilacina racemosa	False Solomon's seal
Solidago flexicaulis	Zig-zag goldenrod
Streptopus amplexifolius	Twisted stalk
Thalictrum dioicum	Meadowrue
Trifolium repens	White clover

Grasses and sedges

Carex blanda	Woodland sedge
Carex pensylvanica	Pennsylvania sedge
Carex sprengelii	Carex sprengelii
Elymus hystrix	Bottlebrush grass
Leersia oryzoides	Rice cut grass

Section A Ravine, End of 44th St.

Steep, bare slopes with several cliffs lead down to a ravine near the end of 44th Street. This ravine is mapped as part of the Section A Oak Forest, Mesic Subtype in Section A

and is a subset of that land cover polygon. Near the road is a wall that drops several feet before reaching a plateau that leads to a ten- foot cliff/waterfall. Ten feet down from the base of the cliff is a six foot diameter concrete pipe that leads underground to the river. There is almost no understory vegetation on the base of the ravine, partially because of shade produced from a dense stand of American elm. Water most likely rushes down adjacent slopes with little organic matter or vegetation to slow its flow. A one foot-deep channel has eroded down the center of the ravine.

Canopy trees

Latin Name	**Common Name**
Acer saccharinum	Silver maple
Fraxinus pennsylvanica	Green ash
Populus deltoides	Eastern cottonwood
Ulmus americana	American elm
Ulmus pumila	Siberian elm
Ulmus rubra	Slippery elm

Mid-story trees

Latin Name	**Common Name**
Morus alba	Mulberry
Rhamnus cathartica	Common buckthorn

Shrub layer

Amorpha fruticosa	Indigo bush
Salix exigua	Sandbar willow
Sambucus racemosa	Elderberry

Groundlayer vines

Amphicarpa bracteata	Hog peanut
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Arctium minor	Common burdock
Ambrosia artemisiifolia	Common ragweed
Asclepias incarnata	Marsh milkweed
Aster prenanthoides	Crooked stem aster
Lythrum salicaria	Purple loosestrife
Eupatorium rugosum	White snakeroot
Lycopus uniflorus	Bugleweed
Ostrya virginiana	Ironweed
Rhus Toxicodendron	Poison ivy

Grasses and sedges

Elymus virginiana	Virginia wild rye
Setaria glauca	Yellow foxtail

Section A Oak Forest Mesic Subtype, Southern Park (South of Ravine) (3.36 ac.)

This area of mesic oak forest consists of large red oaks near the top of the slope and many young sugar maples colonizing the site. The area contains a variety of maple-basswood forest and oak-forest species in the understory. It also contains more organic matter in the groundlayer than surrounding areas. Trails are common and should be limited to reduce erosion. Common buckthorn scattered throughout this oak forest dominates the disturbed woods to the south. Common buckthorn removal should start at the south end of the remnant where it is most common and progress to the north.

A parking area and small park are located near the north end of the mesic oak forest. The forest in this area is south-facing and receives a significant amount of sun. Several large oaks dominate the overstory and are spaced 15 to 20 feet apart. Pennsylvania sedge dominates the groundlayer. Several trails lead down to the nearby ravine and are causing considerable erosion. One trail should be chosen to reach the ravine and river. Because of the steep slope, a stairway would be desirable.

Canopy trees

Latin Name	**Common Name**
Acer saccharum	Sugar maple
Populus deltoides	Cottonwood
Tilia americana	American basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer rubrum	Red maple
Carya cordiformis	Bitternut hickory
Celtis occidentalis	Hackberry
Ostrya virginiana	Ironwood - common
Quercus bicolor	Swamp white oak

Shrub layer

Lonicera tatarica	Tartarian honeysuckle
Prunus virginiana	Chokecherry
Rhamnus cathartica	Common buckthorn
Sambucus racemosa	Elderberry
Staphylea trifolia	Bladdernut
Viburnum rafinesquianum	Downy-arrowwood viburnum
Zanthoxylem americanum	Prickley ash

Groundlayer vines

Amphicapa bracteata	Hog peanut
Celastrus scandens	Bittersweet
Echinocystis lobata	Wild cucumber
Menispermum canadense	Canada moonseed
Parthenocissus quinquefolia	Virginia creeper

Forbs or groundlayer trees

Antennaria plantaginifolia	Plantain-leafed pussytoes
Aralia nudicaulis	Wild sarsaparilla
Arisaema triphyllum	Jack in the pulpit
Asarum canadense	Wild ginger
Aster prenanthoides	Crooked-stem aster
Galium boreale	Northern bedstraw
Caulophyllum thalictroides	Blue cohosh
Desmodium glutinosum	Pointed leaf tick trefoil
Eupatorium rugosum	White snakeroot
Helianthus divaricatus	Woodland sunflower
Hydrophyllum virginianum	Virginia waterleaf
Osmorhiza claytonii	Sweet cicily
Phryma leptostachya	Lopseed
Polygonatum biflorum	Solomon's seal
Sanguinaria canadensis	Bloodroot
Smilax herbacea	Carrion flower
Smilax rotundifolia	Greenbriar
Smilacina racemosa	False Solomon's seal
Solidago flexicaulis	Zig-zag goldenrod
Streptopus roseus	Rose twisted-stalk
Thalictrum dioicum	Meadowrue

Grasses and sedges

Carex blanda	Woodland sedge
Carex pensylvanica	Pennsylvania sedge
Elymus hystrix	Bottlebrush grass
Elymus villosus	Silky wild rye
Leersia oryzoides	Rice cut grass

Section A Disturbed Deciduous Forest (5.16 ac.)

Between the Ford Parkway bridge and a stretch of degraded maple-basswood forest is a consistently steep slope with a grade of about 3:1. The slope shows signs of disturbance and has little understory vegetation. Tartarian honeysuckle is common, and boxelder with some green ash and basswood dominate the understory. One significant trail leads down the steep slope from the south end of the parking area directly down slope to the water. Significant erosion is occurring under the Ford Parkway Bridge caused by past disturbance from construction and recent foot traffic. This area is mostly unvegetated. Erosion is also occurring on the unvegetated slopes and in localized areas near the water. A short rock wall along the base of the slope appears to be slowing erosion.

Common buckthorn is common on the upper half of the slope near the end of 45th Street. The slope is very steep and eroding through this portion of the bluff. Little organic matter and few ground-layer plants are present in this area. Presence of a variety of species commonly found in maple-basswood forests are present indicates that this forest type may be developing. Many eroding trails traverse the slopes in this area.

Canopy trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Acer saccharum	Sugar maple
Fraxinus pensylvanica	Green ash
Ostrya virginiana	Ironwood
Populus deltoides	Cottonwood
Quercus ellipsoidalis	Pin oak
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-Story trees

Ostrya virginiana	Ironwood
Ulmus pumila	Siberian elm

Shrub layer

Amorpha fruticosa	Indigo bush
Cornus sericia	Red-osier dogwood
Lonicera tatarica	Tartarian honeysuckle
Rhamnus cathartica	Common buckthorn
Zanthoxylem americanum	Prickley ash

Groundlayer vines

Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Anemone canadensis	Canada anemone
Asarum canadense	Wild ginger
Aster macrophyllus	Large leaf aster
Aster prenanthoides	Crooked-stemmed aster
Eupatorium rugosa	White snakeroot
Galium sp.	Cleavers
Geranium maculatum	Wild geranium
Helianthus divaricatus	Woodland sunflower
Hydrophyllum virginianum	Virginia waterleaf
Leonurus cardiaca	Motherwort
Rhus Toxicodendron	Poison ivy
Ribes sativum	Garden currant
Rubus sp.	Raspberry
Smilax herbacea	Carrion flower
Smilacina racemosa	False Solomon's seal
Solidago flexicaulis	Zig-zag goldenrod

Grasses and sedges

Bromus inermus	Smooth brome
Carex blanda	Woodland sedge
Carex pensylvanica	Pennsylvania sedge
Carex sprengelii	Sprengel's sedge

Section A Oak Forest, Tree Planting

This area is a is a subset and located just west of the relatively large area of oak forest at the southern end of the project site (Section A Oak Forest, Mesic Subtype, (Southern Forest)). Neighborhood residents planted a variety of tree species at this location. The understory is dominated by Kentucky bluegrass and many weeds, indicating that the area may have been maintained as lawn. Plants usually found in moist areas such as sedges, rushes, green ash, boxelder and silver maple are present and show that the soil has a high moisture content. A stormsewer is located near the western portion of the area and further west an even older outlet pipe is found. Some desirable woodland species are found growing on the edges of the grassed area such as zig-zag goldenrod and woodland sedge. This site is visible along the road and as a result it is important to think about aesthetic as well as ecological aspects of future plantings. Common buckthorn is prevalent and should be removed before it becomes dominant. Boxelder is also very common and may need to be thinned before it starts to shade out desirable understory species. The addition of native shrubs may help control unwanted species.

Canopy trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Acer saccharinum	Sugar maple
Juglans nigra	Walnut
Ulmus americana	American elm
Ulmus pumila	Siberian elm

Shrub layer

Rhus typhina	Staghorn sumac

Groundlayer Vines

Parthenocissus quinquefolia	Virginia creeper
Vitis riparia	Riverbank grape

Forbs

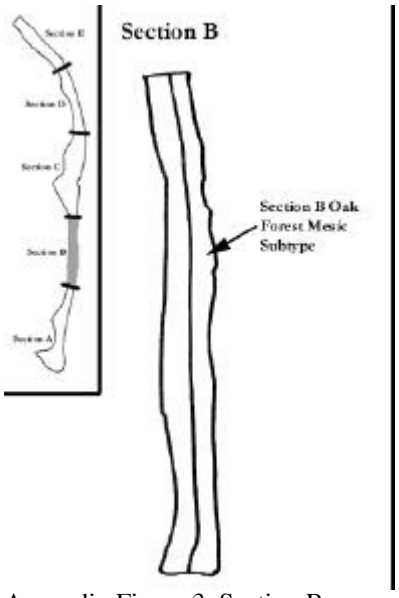
Ambrosia artemisiifolia	Common ragweed
Ambrosia trifida	Giant ragweed
Arctium minor	Burdock
Aster	Aster sp.
Aster plantaginifolia	Crooked-stemmed aster
Cirsium canadensis	Canada thistle
Cirsium vulgare	Bull thistle
Geum aleppicum	Yellow avens
Glechoma hederacea	Creeping Charlie
Laportea canadensis	Wood nettle
Leonurus cardiaca	Motherwort
Nepeta cataria	Catnip
Oxalis montana	Wood sorrel
Polygonum sp.	Smartweed
Rhus Toxicodendron	Poison ivy
Rubus sp.	Raspberry

Solidago canadensis	Canada goldenrod
Solidago flexicaulis	Zig-zag goldenrod
Sonchus asper	Perennial sow thistle
Taraxacum officinale	Common dandelion
Uvularia grandiflora	Bellwort

Grasses and sedges

Agropyron repens	Quackgrass
Carex blanda	Woodland sedge
Carex sprengelii	Sprengel's sedge
Juncus tenuis	Slender rush
Leersia oryzoides	Rice cut grass
Phalaris arundinacea	Reed canary grass
Poa pratensis	Kentucky bluegrass
Setaria glauca	Yellow foxtail

Section B Land-cover Polygons



Appendix Figure 3. Section B land-cover polygons

Section B Oak Forest Mesic Subtype (19.72 ac.)

The steep slopes of the river Gorge are very noticeable along this section of river. The organic layer is generally thin or non-existent and groundlayer species are scattered or occur in patches. Along the entire stretch large red oaks dominate the overstory, but smaller sugar maple and basswood are becoming more common. Mature ironwood is also common. The paved Winchell Trail traverses the upper portion of the slope and because it is so steep, few side trails lead down to the water. However, several trails lead up to the walking and bicycle trails above. One trail runs along the base of the bluff through much of the area.

Erosion is common on bare, steep slopes, particularly where common buckthorn is dense. Erosion is also a problem where stormwater outlets release water on upper portions of the slope. Perhaps the most problematic area of erosion is located near the southern campus of Minnehaha Academy. Both Tartarian honeysuckle and Common buckthorn are scattered throughout this area and are found in several large clumps.

Some areas along the bicycle trail such as at the end of Folwell Street. are currently mowed to the edge of the slope and could be replanted as. Generally, mowing should be pulled back from the edge of the bluff wherever possible and the bluff edge should be replanted with native prairie or shrub species. Patches of common buckthorn are present at the base of the bluff where flooding, waves and floating debris have disturbed the area. As the oak forest approaches the area of savanna restoration at the end of 36th Street, groundlayer species are less common, perhaps because of greater foot traffic. It would be desirable to connect more intact sections of the oak forest to the savanna restoration.

Trees

Latin Name	**Common Name**
Acer saccharum	Sugar maple
Fraxinus pensylvanica	Green ash
Juglans nigra	Walnut
Populus deltoides	Cottonwood
Quercus alba	White oak
Quercus ellipsoidalis	Pin oak
Quercus macrocarpa	Bur oak
Quercus rubrum	Red oak
Tilia americana	American basswood

Ulmus americana	American elm

Mid-story trees

Acer saccharum	Sugar maple
Fraxinus nigra	Black ash
Fraxinus pensylvanica	Green ash
Ostrya virginiana	Ironwood
Rhamnus cathartica	Common buckthorn
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Shrub layer

Amelanchier sp.	Serviceberry
Cornus racemosa	Grey dogwood
Lonicera tatarica	Tartarian honeysuckle
Prunus virginiana	Choke cherry
Rhus typhina	Staghorn sumac
Symphoricarpos orbiculatus	Wolfberry
Viburnum rafinesquianum	Downy arrowwood viburnum
Viburnum trilobum	High bush cranberry
Wild rose	Rose sp.
Zanthoxylum americanum	Prickley ash

Groundlayer vines

Amphicarpa bracteata	Hog peanut
Celastrus scandens	Bittersweet
Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper
Vicia americana	Purple vetch
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Anemone canadensis	Canada anemone
Antennaria plantaginifolia	Plantain-leafed pussytoes
Asarum canadense	Wild ginger
Campanula americana	Tall bell flower
Caulophyllum thalictroides	Blue cohosh
Clematis virginiana	Clematis
Desmodium canadense	Showy tick trefoil
Desmodium glutinosum	Pointed leaf tick trefoil
Equisetum	Equisetum sp.
Eupatorium rugosum	White snakeroot
Galium boreale	Northern bedstraw
Geranium maculatum	Wild geranium
Geum apleppicum	Yellow avens
Helianthus divaricatus	Woodland sunflower
Hydrophyllum virginianum	Virginia waterleaf
Melilotus alba	White sweet clover
Rhus Toxicodendron	Poison ivy
Smilax herbacea	Carrion flower
Smilacina racemosa	False Solomon's seal
Solidago canadensis	Canada goldenrod

Solidago flexicaulis	Zig-zag goldenrod
Thalictrum dasycarpum	Meadowrue
Veronicastrum virginicum	Culver's root

Grasses and sedges

Andropogon gerardii	Big bluestem
Bromus inermus	Smooth brome
Carex blanda	Woodland sedge
Carex pennsylvanica	Pennsylvania sedge
Hystrix patula	Bottle brush grass

Section A Floodplain Forest

Near the end of 44th Street, a small areas of floodplain forest is found below the maple-basswood forest. The floodplain forest is at the base of a steep slope and is about 20 feet at its widest point. Silver maple, black willow and green ash dominate the overstory. Common buckthorn is found on the edges of this area.

Canopy trees

Latin Name	**Common Name**
Fraxinus nigra	Black ash
Fraxinus pennsylvanica	Green ash
Salix nigra	Black willow

Mid-story trees

Fraxinus pennsylvanica	Green ash
Rhamnus cathartica	Common buckthorn
Ulmus americana	American elm

Shrub layer

Salix exigua	Sandbar willow

Groundlayer vines

Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper
Vitis riparia	Riverbank grape

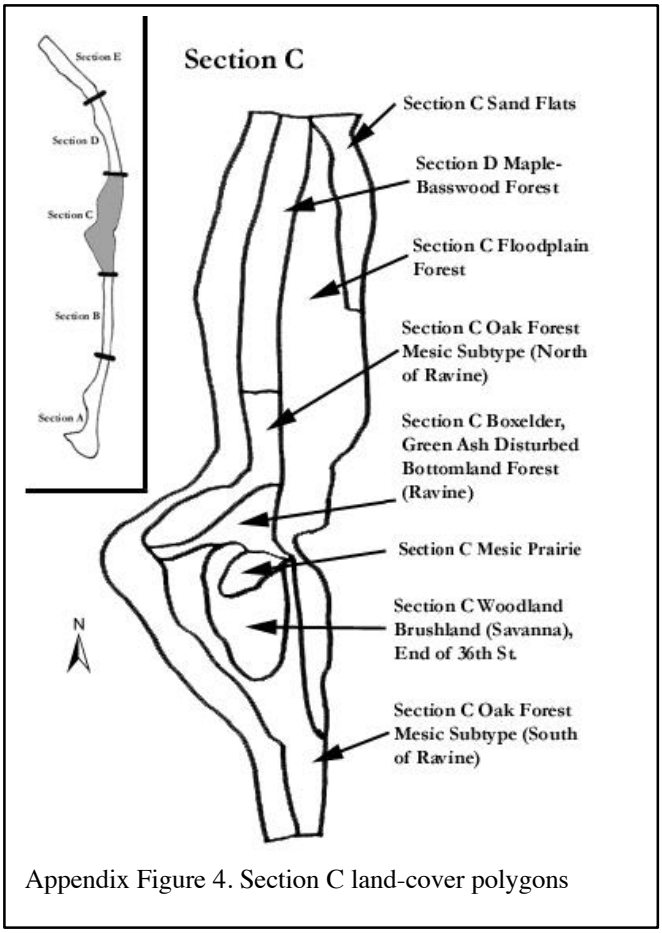
Forbs or groundlayer trees

Aster prenanthoides	Twisted-stalk aster
Lythrum salicaria	Purple loosestrife
Phryma leptostachya	Lopseed
Smilax tamnoides	Greenbriar

Grasses and sedges

Leersia oryzoides	Rice cut grass

Section C Landcover Polygons



Appendix Figure 4. Section C land-cover polygons

Section C Sand Flats (3.56 ac.)

This area of dredge spoil was most likely a sandbar or floodplain forest historically. The sandbar has been planted with a variety of prairie grasses, including little bluestem, sideoats grama and hairy grama. Switchgrass and prairie cord grass are also common, but it is unclear whether these species were planted because they occur naturally in several other areas of the project site. The prairie grasses were not actively growing during an early-season inventory conducted soon after the 2001 flood, but the species developed quickly between June and mid-August. Few weedy species are competing with the prairie grasses, However, Siberian elm is common in the sand flats and black locust is common on the edge between the sand flats and the floodplain forest. The sandbar is currently hard to reach on foot but will be more accessible when a stairway is installed at the end of 34th Street.

Canopy trees

Latin Name	**Common Name**
Populus deltoides	Cottonwood
Robinia pseudoacacia	Black locust

Mid-story trees

Acer negundo	Boxelder
Ulmus pumila	Siberian elm

Shrub layer

Amorpha fruticosa	Indigo bush
Rhus glabra	Smooth sumac
Rhus typhina	Staghorn sumac
Salix exigua	Sandbar willow
Viburnum trilobum	Highbush cranberry

Groundlayer vines

Vitis riparia	River bank grape

Forbs or groundlayer trees

Ambrosia artemisiifolia	Common ragweed
Asclepias syriaca	Common milkweed
Decodon verticillatus	Swamp loosestrife
Erigeron canadensis	Horseweed
Helianthus mollis	sunflower
Ipomoea purpurea	Morning glory
Lythrum salicaria	Purple loosestrife
Quercus alba	White oak
Solidago canadensis	Canada goldenrod
Typha angustifolia	Narrow-leaf arrowhead

Grasses and sedges

Agropyron repens	Quack grass
Andropogon gerardii	Big bluestem
Andropogon scoparium	Little bluestem
Bouteloua curtipendula	Side oats gram
Bouteloua hirsuta	Hairy gram
Bromus inermus	Smooth brome
Panicum virgatum	Switchers
Scirpus pungens	Three-square bulrush
Scirpus validus	Soft-stem bulrush
Spartina pectinata	Prairie cord grass
Typha angustifolia	Narrow-leaf cattail

Section C Floodplain Forest (14.17 ac.)

This floodplain forest has an overstory dominated by eastern cottonwood and scattered with boxelder, green ash and silver maple. The diversity is relatively good in all levels of the forest partly because of the rolling topography and variable moisture levels throughout the area. Although both Siberian elm and Common buckthorn are scattered throughout the floodplain, neither is common. Garlic mustard is common throughout the groundlayer of nearly the entire floodplain. Few stalks are present from last year's growth of this perennial herb, indicating high spring waters of 2001 aided dispersal, germination or both. The high plant density over such a large area would make mechanical control difficult to achieve at this time.

Canopy trees

Latin Name	**Common Name**
Acer saccharinum	Silver maple
Fraxinus pensylvanica	Green ash
Populus deltoides	Eastern cottonwood
Quercus rubrum	Red oak
Tilia americana	American basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer negundo	Boxelder
Fraxinus pensylvanica	Green ash
Morus alba	Mulberry
Ostrya virginiana	Ironwood
Prunus serotina	Black cherry
Rhamnus cathartica	Common buckthorn
Salix nigra	Black willow
Tilia americana	Basswood
Ulmus pumila	Siberian elm

Shrub layer

Cornus alternifolia	Pagoda dogwood
Cornus amomum	Silky dogwood
Cornus sericea	Red-osier dogwood
Ribes sativum	Garden currant
Salix exigua	Sandbar willow
Sambucus racemosa	Elderberry

Groundlayer vines

Amphicarpa bracteata	Hog peanut
Parthenocissus quinquefolia	Virginia creeper
Solanum nigrum	Black nightshade
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Alliaria officinalis	Garlic mustard
Anemone canadensis	Canada anemone
Apocynum cannabinum	Indian hemp
Arctium minor	Common burdock
Asclepias incarnata	Marsh milkweed
Aster prenanthoides	Crooked-stem aster
Decodon verticillatus	Swamp loosestrife
Eupatorium rugosum	White snakeroot
Geranium maculatum	Wild geranium
Geum apleppicum	Yellow avens
Impatiens capensis	Jewelweed
Iris versicolor	Wild iris
Laportea canadensis	Wood nettle
Leonurus cardiaca	Motherwort
Lysimachia ciliata	Fringed loosestrife
Lythrum salicaria	Purple loosestrife
Melilotus alba	White sweet clover
Osmorhiza claytonii	Sweet cicily
Ostrya virginiana	Ironweed
Phryma leptostachya	Lopseed
Quercus alba	Swamp white oak
Rhus toxicodendron	Poison ivy
Smilax herbacea	Greenbriar
Smilacina racemosa	False Solomon's seal
Solidago canadensis	Canada goldenrod

Stachys palustris	Hedge nettle
Thalictrum dioicum	Meadowrue
Verbena urticifolia	White vervain
Veronica americana	American brookline
Violet	Violet sp.

Grasses and sedges

Bromus inermus	Smooth brome
Elymus canadensis	Canada wild rye
Elymus virginiana	Virginia wild rye
Leersia oryzoides	Rice cut grass
Panicum virgatum	Switchgrass
Phalaris arundinacea	Reed canary grass

Section C Oak Forest Mesic Subtype (North and South of Ravine)(2.95 ac.)

This section of mesic oak forest has many large red oaks dominating the overstory. Many medium-sized common buckthorn are also present. Tartarian honeysuckle is also scattered over the groundlayer. Yard waste is commonly dumped in this area and is a possible source of invasive plant seeds. An overlook at the end of 34th Street and a stairway are located near the top of the oak forest. The overlook offers views of the floodplain forest and Mississippi River. Directly below the wall of the overlook is a small prairie planting dominated by weeds such as white sweet clover, giant foxtail and common ragweed.

Canopy trees

Latin Name	**Common Name**
Quercus rubrum	Red oak
Tilia americana	Basswood

Mid-Story trees

Acer saccharum	Sugar maple
Celtis occidentalis	Hackberry
Fraxinus pennsylvanica	Green ash
Ostrya virginiana	Ironwood
Rhamnus cathartica	Common buckthorn
Ulmus pennsylvanica	American elm
Ulmus pumila	Siberian elm

Shrub layer

Amorpha canescens	Leadplant (in prairie planting)
Cornus alternifolia	Pagoda dogwood
Lonicera tatarica	Tartarian honeysuckle
Prunus virginiana	Chokecherry
Rhus typhina	Staghorn sumac
Symphoricarpos occidentalis	Wolfberry
Viburnum rafinesquianum	Downy arrowwood viburnum
Zanthoxylem americanum	Prickley ash

Groundlayer vines

Amphicarpa bracteata	Hog peanut
Celastrus scandens	Bittersweet
Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper
Vitis riparia	River bank grape

Forbs or groundlayer trees

Arctium minor	Burdock
Arctium minor	Burdock
Campanula rotundifolia	Harebells
Eupatorium rugosum	White snakeroot
Potentilla simplex	Common cinquefoil (in prairie planting)
Rudbeckia hirta	Black eyed Susan (in prairie planting)
Solidago canadensis	Canada goldenrod
Solidago flexicaulis	Zig-zag goldenrod
Solidago rigida	Stiff goldenrod (in prairie planting)
Taraxacum officinale	Dandelion
Verbena urticifolia	White vervain

Grasses and sedges

Andropogon scoparium	Little bluestem (in prairie planting)
Bouteloua curtipendula	Side oats grama (in prairie planting)
Bouteloua hirsuta	Hairy grama (in prairie planting)
Bromus inermus	Smooth brome (in prairie planting)
Carex pensylvanica	Pennsylvania sedge
Carex sprengelii	Sprengel's sedge
Panicum virgatum	Switchgrass (in prairie planting)
Setaria faberi	Giant foxtail (in prairie planting)

Sinkhole between 34th and 35th Streets

The sinkhole between 34th and 35th streets and east of 47th Street is a unique geological feature that is located just outside of the project boundary boundary. It is nearly 30 feet deep and contains many plant species that require moist soils. The sinkhole receives large amounts of foot traffic and, as a result, it contains a limited number of species that can tolerate a large amount of disturbance.

Canopy trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Celtis occidentalis	Hackberry
Fraxinus nigra	Black ash
Quercus rubrum	Red oak
Tilia americana	American basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer negundo	Boxelder

Fraxinus pensylvanica	Green ash
Rhamnus cathartica	Common buckthorn

Shrub layer

Cornus alternifolia	Pagoda dogwood
Ribes sp.	Gooseberry
Sambucus racemosa	Elderberry

Groundlayer forbs and trees

Alliaria officinalis	Garlic mustard
Arisaema triphyllum	Jack in the pulpit
Hydrophyllum virginianum	Virginia waterleaf
Impatiens capensis	Jewelweed
Laportea canadensis	Wood nettle
Phryma leptostachya	Lopseed
Smilax tamnoides	Green briar
Smilacina racemosa	False Solomon's seal

Section C Boxelder, Green Ash Disturbed Bottomland Forest (Ravine) (1.75 ac.)

Management recommendations are given for upper portion of the ravine in the management portion of the plan. An old concrete stormwater pipe runs down the center of the ravine north of the Section C Woodland Brushland Savanna. Limestone boulders line the ravine's entire base. The slopes of the ravine are steep and largely unvegetated with little organic matter and few fallen trees to slow the movement of water. Stormwater is currently directed down the ravine from the end of 36th Street. The water traverses two falls, one cement and one stone before entering the base of the ravine. A seep is eroding the main walking trail that traverses the upper portions of the ravine. Plans call for elevating the trail to allow water to flow under the walkway. The majority of the ravine contains areas of severe erosion. A management plan needs to be written to specifically address water flow and erosion issues in this area.

Canopy trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Celtis occidentalis	Hackberry
Fraxinus pensylvanica	Green ash
Populus deltoides	Cottonwood
Tilia americana	Basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer negundo	Boxelder
Acer saccharum	Sugar maple
Betula papyrifera	Paper birch
Morus alba	Mulberry
Prunus virginiana	Chokecherry

Ulmus pumila	Siberian elm

Shrub layer

Cornus alternifolia	Pagoda dogwood
Lonicera tatarica	Tartarian honeysuckle
Prunus virginiana	Chokecherry
Ribes sativum	Garden currant
Sambucus racemosa	Elderberry

Groundlayer vines

Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper

Forbs or groundlayer trees

Acer platanoides	Norway maple
Arctium minor	Common burdock
Arisaema triphyllum	Jack in the pulpit
Geum apleppicum	Yellow avens
Impatiens capensis	Jewelweed
Laportea canadensis	Wood nettle
Rhus Toxicodendron	Poison ivy
Smilacina racemosa	False Solomon's seal
Solanum nigrum	Black night shade
Solidago flexicaulis	Zig-zag goldenrod

Grasses and sedges

Carex pensylvanica	Pennsylvania sedge
Carex sprengelii	Sprengel's sedge
Elymus virginiana	Virginia wild rye

Section C Mesic Prairie (.8 ac.)

The Section C Mesic Prairie is a remnant that has been managed through prescribed burns by the Minneapolis Park and Recreation Board and community volunteers. The small prairie is surrounded by the Section C Woodland Brushland Savanna at the end of 36th Street. The prairie has been used as a seed source for the surrounding savanna and as the savanna restoration develops, the prairie will become part of the larger savanna landscape. An overlook has been installed uphill (north) of the prairie and was developed as an ending point for a trail that continued towards the river. The trail has been closed and seeded but people are still using the trail. Hindrances to trail use such as thorny shrubs may prevent further use.

(note: the inventory for the Section C Mesic Prairie was conducted in November, about two months after inventories were completed for other areas of the site.)

Trees

Latin Name	**Common Name**
Quercus ellipsoidalis	Northern pin oak
Quercus macrocarpa	Bur oak

Tilia americana	American basswood

Mid-story trees

Rhamnus cathartica	Common buckthorn

Shrub layer

Rhus glabra	Smooth sumac
Rosa c.f. arkansana	Prairie rose
Rubus occidentalis	Black raspberry

Groundlayer vines

None	

Forbs or groundlayer trees

Anemone virginiana	Thimbleweed
Antennaria plantaginifolia	Plantain-leafed pussytoes
Arctium minus	Burdock
Asparagus officinalis	Asparagus
Aster prenanthoides	Crooked-stemmed aster
Cirsium vulgare	Bull thistle
Desmodium canadense	Canada tick trefoil
Eupatorium rugosum	White snakeroot
Fragaria virginiana	Wild strawberry
Galium boreale	Northern bedstraw
Helianthus divaricatus	Woodland sunflower
Hydrophyllum virginianum	Virginia waterleaf
Lespedeza capitata	Round-headed bush clover
Melilotus alba	White sweet clover
Monarda fistulosa	Wild bergamot
Phryma leptostachya	Lopseed
Solidago canadensis	Canada goldenrod
Solidago speciosa	Showy goldenrod
Veronicastrum virginicum	Culver's root

Grasses and sedges

Andropogon gerardii	Big bluestem
Carex sprengelii	Sprengel's sedge
Carex pensylvanica	Pennsylvania sedge
Poa pratensis	Kentucky bluegrass
Sorghastrum nutans	Indian grass

Section C Woodland Brushland Savanna, End of 36th St. (3.05 ac.)

The savanna at the end of 36th Street is a culturally and ecologically significant landscape. It is a popular destination for many Twin Cities residents and the mesic savanna now being restored is one of the rarest plant communities in the region. Restoration efforts involving many community volunteers have been conducted for about the last 10 years. Consequently, this plan emphasizes this area as a focus for future work.

Some of the most important work to be done in the savanna includes trail removal and control of both native and non-native aggressive species. An area of remnant prairie occurs at the north end of the savanna. Species found in the Section C Mesic Prairie are included in the following plant list and specific recommendations are given for the prairie in the management portion of the plan.

Trees

Latin Name	**Common Name**
Celtis occidentalis	Hackberry
Quercus alba	White oak
Quercus ellipsoidalis	Northern pin oak
Quercus macrocarpa	Bur oak
Quercus rubra	Red oak
Tilia americana	American basswood
Ulmus americana	American elm
Ulmus pumila	Siberian elm

Mid-story trees

Crataegus sp.	Hawthorne
Rhamnus cathartica	Common buckthorn

Shrub layer

Lonicera tatarica	Tartarian honeysuckle
Rhus glabra	Smooth sumac
Rhus typhina	Staghorn sumac
Rosa c.f. arkansana	Prairie rose
Rubus allegheniensis	Blackberry
Rubus idaeus	Red raspberry
Rubus occidentalis	Black raspberry

Groundlayer vines

Amphicarpaea	Hog peanut
Parthenocissus quinquefolia	Virginia creeper
Smilax herbacea	Carrion flower
Toxicodendron rydbergii	Poison ivy
Vicia americana	Purple vetch
Vitis riparia	Wild grape

Forbs or groundlayer trees

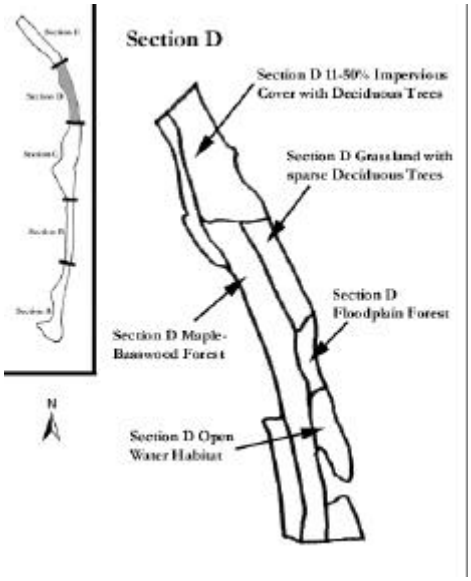
Agrimonia sp.	Cocklebur
Ambrosia artemisiifolia	Common ragweed
Ambrosia trifida	Greater ragweed
Amorpha canescens	Leadplant
Anemone virginiana	Thimbleweed
Antennaria plantaginifolia	Plantain-leafed pussytoes
Arctium minus	Burdock
Arisaema triphyllum	Jack in the pulpit
Asclepias syriaca	Common milkweed
Asparagus officinalis	Asparagus
Aster oolentangiensis	Sky blue aster

Aster prenanthoides	Crooked-stemmed aster
Berteroa incana	Hoary alyssum
Campanula rotundifolia	Harebells
Cirsium discolor	Field thistle
Cirsium vulgare	Bull thistle
Desmodium canadense	Canada tick trefoil
Eupatorium rugosum	White snakeroot
Galium boreale	Northern bedstraw
Grindelia squarrosa	Gumweed
Helianthus divaricatus	Woodland sunflower
Houstonia c.f. longifolia	Bluets
Hydrophyllum virginianum	Virginia waterleaf
Lespedeza capitata	Round-headed bush clover
Melilotus alba	White sweet clover
Monarda fistulosa	Wild bergamot
Oenothera sp.	Evening primrose
Plantago major	Common plantain
Potentilla arguta	Prairie cinquefoil
Rudbeckia hirta	Black-eyed Susan
Smilacina racemosa	False Solomon's seal
Smilacina stellata	Star-flowered false Solomon's seal
Solanum dulcamara	Common night shade
Solidago canadensis	Canada goldenrod
Solidago flexicaulis	Zig-zag goldenrod
Solidago rigida	Stiff goldenrod
Solidago speciosa	Showy goldenrod
Sonchus arvensis	Sow thistle
Trifolium pratense	Red clover
Uvularia grandiflora	Large-flowered bellwort
Verbena stricta	Hoary vervain
Veronicastrum virginicum	Culver's root

Grasses and sedges

Agropyron repens	Quack grass
Agrostis stolonifera	Red top
Andropogon gerardii	Big bluestem
Carex c.v. tenera	A species of sedge
Carex cristatella	Crusted sedge
Carex muhlenbergii	Muhlenberg's sedge
Carex pensylvanica	Pennsylvania sedge
Elymus canadensis	Canada wild rye
Juncus tenuis	Path rush
Panicum virgatum	Switch grass
Phalaris arundinacea	Reed canary grass
Poa pratensis	Kentucky bluegrass
Setaria italica	Foxtail millet
Sorghastrum nutans	Indian grass

Section D Landcover Polygons



Appendix Figure 5. Section D land-cover polygons

Section D 11-50% Impervious Cover with Deciduous Trees (7.90 ac.)

The woodland north of the Lake Street Bridge and near the University Rowing Club is generally dominated by boxelder as an overstory species and has little organic matter and few understory trees. The slope is very steep in some places and significantly eroded.

Canopy trees

Latin Name	Common Name
Acer negundo	Boxelder
Acer nigrum	Black maple
Acer saccharum	Sugar maple
Celtis occidentalis	Hackberry
Tilia americana	American basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer negundo	Boxelder
Acer saccharum	Sugar maple
Rhamnus cathartica	Common buckthorn

Shrub layer

Cornus sericea	Red-osier dogwood
Rhus typhina	Staghorn sumac
Ribes cynosbati	Prickly gooseberry

Goundlayer vines

Echinocystis lobata	Wild cucumber
Menispermum canadense	Canada moonseed
Vitis riparia	River bank grape

Forbs or groundlayer trees

Ambrosia artemisiifolia	Common ragweed
Arctium minor	Common burdock
Artemisia sp.	Wormwood
Aster	Aster sp.
Cirsium vulgare	Bull thistle
Eupatorium rugosum	White snakeroot
Impatiens capensis	Jewelweed
Leonurus cardiaca	Motherwort
Nepeta cataria	Catnip
Smilacina racemosa	False Solomon's seal
Smilax tamnoides	Greenbriar

Grasses and sedges

Bromus inermus	Smooth brome
Echinochloa crusgalli	Barnyard grass
Setaria glauca	Yellow foxtail

Section D Grassland with Sparse Deciduous Trees (2.14 ac.)

Just south of the Lake Street Bridge is an area slightly higher in elevation than the floodplain directly to the south. This area contains a large planting of switchgrass as well as many Siberian elm and a large area of purple loosestrife near the bridge A seep in the upper portion of the top of the bluff releases a steady stream of water along the entire length of the slope. Spotted-touch-me-not is the most common species along the slope. The stormsewer collecting water from the upstream watershed may be the primary source of purple loosestrife seed. Biological control methods could be considered or herbicide applied to eliminate the plant. Species such as prairie cord grass or switchgrass should be planted to prevent re-establishment. A small area of purple loosestrife is present farther up the slope, directly under the bridge and along the lawn. Meeker Dam was installed south of Lake Street in 1906 and was an early source of disturbance in this area. Concrete from the Meeker Dam can still be found near the water's edge.

Canopy trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Populus deltoides	American cottonwood
Ulmus americana	American elm

Mid-story trees

Morus alba	Mulberry
Rhamnus cathartica	Common buckthorn
Ulmus americana	American elm
Ulmus pumila	Siberian elm

Shrub layer

Amorpha fruticosa	Indigo bush
Lonicera tatarica	Tartarian honeysuckle

Groundlayer vines

Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Ambrosia artemisiifolia	Common ragweed
Arctium minor	Common burdock
Centaurea maculosa	Spotted knapweed
Cirsium canadensis	Canada thistle
Erigeron annuus	Daisy fleabane
Lysimachia ciliata	Fringed loosestrife
Lythrum salicaria	Purple loosestrife
Melilotus alba	White sweet clover
Physostegia virginiana	Obedient plant
Potentilla simplex	Weedy cinquefoil
Solidago canadensis	Canada goldenrod
Taraxacum officinale	Common dandelion
Verbena hastata	Blue vervain

Grasses and sedges

Agropyron repens	Quack grass
Bromus inermus	Smooth brome
Hordeum jubatum	Wild barley
Phalaris arundinacea	Reed canary grass
Phleum pratense	Timothy
Poa pratensis	Kentucky bluegrass

Section D Floodplain Forest (30.47 ac.)

The floodplain forest south of the Lake Street Bridge is dominated by cottonwood and silver maples in the overstory, with green ash, boxelder and black willow also present. The groundlayer is not as diverse as that of the floodplain to the south, perhaps because the topography changes less and the lower elevation likely undergoes more disturbance during floods. No garlic mustard was found in this area, unlike the floodplain to the south. The floodplain decreases in elevation from north to south and becomes an emergent wetland. Purple loosestrife is common along the shores of both the floodplain and emergent wetland. Prairie cord grass and sedges are also common along the shoreline.

Canopy trees

Latin Name	**Common Name**
Acer negundo	Boxelder
Acer saccharinum	Silver maple
Fraxinus pennsylvanica	Green ash
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer negundo	Boxelder

Celtis occidentalis	Hackberry
Rhamnus cathartica	Common buckthorn
Tilia americana	Basswood
Ulmus americana	American elm
Ulmus pumila	Siberian elm

Shrub layer

Amorpha fruticosa	Indigo bush
Lonicera tatarica	Tartarian honeysuckle
Rhus glabra	Smooth sumac
Ribes lacustre	Prickley gooseberry
Salix exigua	Sandbar willow

Groundlayer vines

Parthenocissus quinquefolia	Virginia creeper
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Alliaria officinalis	Garlic mustard
Aruncus dioicum	Goats beard
Eupatorium rugosum	White snakeroot
Impatiens capensis	Jewelweed
Laportea canadensis	Wood nettle
Lythrum salicaria	Purple loosestrife
Melilotus alba	White sweet clover
Phryma leptostachya	Lopseed
Quercus alba	Swamp white oak
Rhus toxicodendron	Poison ivy
Solidago canadensis	Canada goldenrod
Violet	Violet sp.

Grasses and sedges

Elymus canadensis	Canada wild rye
Panicum virgatum	Switchgrass
Spartina pectinata	Prairie cord grass

Section D Maple-Basswood Forest
(10.70 ac.)

This disturbed maple-basswood forest runs from near 36th Street, nearly to Lake Street. The forest runs from the road to the bottom of the slope. This steep slope has many cliffs. Rock and soil have collected below the slope, which has generally bare slopes with little organic matter or groundlayer plants. Plants growing on the slope include Virginia creeper, false Solomon's seal, young hackberry, sugar maple, basswood, chokecherry and Ribes species. Common overstory species present include American elm, hackberry, basswood, sugar maple and boxelder. Common buckthorn is generally not found on the slopes, but there are patches of medium-sized trees on top of the slope.

Compared with other stretches, this area appears to have experienced more disturbance from human use.

Canopy trees

Latin Name	Common Name
Acer saccharum	Sugar maple
Celtis occidentalis	Hackberry
Fraxinus pennsylvanica	Green ash
Populus deltoides	Cottonwood
Quercus ellipsoidalis	Pin oak
Quercus rubra	White oak
Tilia americana	Basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer saccharum	Sugar maple
Aesculus glabra	Ohio buckeye
Amelanchier sp.	Serviceberry
Fraxinus pennsylvanica	Green ash
Ostrya virginiana	Ironwood
Quercus macrocarpa	Bur oak
Rhamnus cathartica	Common buckthorn
Tilia americana	Basswood
Ulmus americana	American elm
Ulmus pumila	Siberian elm

Shrub layer

Cornus alternifolia	Pagoda dogwood
Cornus racemosa	Grey dogwood
Lonicera tatarica	Tartarian honeysuckle
Rhus typhina	Staghorn sumac
Ribes lacustre	Prickley gooseberry
Ribes sativum	Garden currant
Zanthoxylum americanum	Prickley ash

Groundlayer vines

Parthenocissus quinquefolia	Virginia creeper
Sambucus racemosa	Elderberry
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Ambrosia artemisiifolia	Common ragweed
Apocynum cannabinum	Indian hemp
Arctium minor	Burdock
Arisaema triphyllum	Jack in the pulpit
Asclepias incarnata	Common milkweed
Eupatorium rugosum	White snakeroot
Euphorbia esula	Leafy spurge
Geum apleppicum	Yellow avens
Hemerocallis sp.	Daylily

Hydrophyllum virginiana	Virginia waterleaf
Nepeta cataria	Catnip
Rhus toxicodendron	Poison ivy
Rumex crispus	Curly dock
Scrophularia lanceolata	Figwort
Smilax tamnoides	Green briar
Smilacina racemosa	False Solomon's seal
Solidago canadensis	Canada goldenrod
Veronicastrum virginicum	Culver's root

Grasses and sedges

Setaria glauca	Yellow foxtail

Section D Open-Water Habitat (1.31 ac.)

This emergent wetland is south of the floodplain forest (described on page 92) and surrounds a lagoon. A large stormsewer pipe empties directly into the lagoon. Above the pipe is a gully with significant erosion. A stormsewer pipe is near the top of the ravine (end of 33rd Street), but moisture coming down the ravine appears to be from a seep rather than the pipe. The wetland has a gradual slope and transitions slowly from floodplain forest to emergent and submergent wetland. The wetland has relatively high diversity but purple loosestrife is common.

Canopy trees

Latin Name	**Common Name**
None	

Mid-story trees

Fraxinus pennsylvanica	Green ash

Shrub layer

Amorpha fruticosa	Indigo bush
Cornus sericea	Red-osier dogwood
Salix exigua	Sandbar willow

Groundlayer vines

Vitis riparia	River bank grape

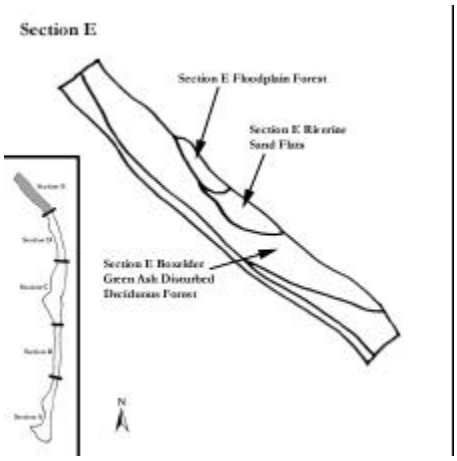
Forbs or groundlayer trees

Asclepias incarnata	Marsh milkweed
Chenopodium capitatum	Pigweed
Cicuta maculata	Water hemlock
Lycopus americanus	Bugleweed
Lythrum salicaria	Purple loosestrife
Ostrya virginiana	Ironweed
Polygonatum sp.	Smartweed
Typha angustifolia	Narrow-leaf arrowhead

Grasses and sedges

Carex stricta	Hummock sedge
Phalaris arundinacea	Reed canary grass
Typha angustifolia	Narrow-leaf cattail

Section E Landcover Polygons



Appendix Figure 6. Section E land-cover polygons

Section E Floodplain Forest (1.68 ac.)

The floodplain forest south of the railroad trestle has rolling topography, probably because of the accumulation of dredge spoil. The line between upland and wetland is not clear because of the upland species found in areas closer to the river and wetland species slightly up the slope. Large cottonwood trees dominate the overstory but upland species such as sugar maple and basswood are also relatively common. Virginia creeper and poison ivy dominate the understory, and unlike the floodplain forest to the south (Section D Floodplain), garlic mustard was not found.

Canopy trees

Latin Name	Common Name
Acer saccharum	Sugar maple
Populus deltoides	American cottonwood
Salix nigra	Black willow
Tilia americana	American Basswood
Ulmus americana	American elm

Mid-story trees

Fraxinus pennsylvanica	Green ash
Morus alba	Mulberry
Populus deltoides	Cottonwood
Rhamnus cathartica	Common buckthorn
Salix nigra	Black willow
Ulmus americana	American elm
Ulmus pumila	Siberian elm

Shrub layer

Cornus sericea	Red-osier dogwood
Lonicera tatarica	Tartarian honeysuckle
Prunus virginiana	Chokecherry
Rhus typhina	Staghorn sumac

Groundlayer vines

Echinocystis lobata	Wild cucumber
Parthenocissus quinquefolia	Virginia creeper

Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Arctium minor	Common burdock
Aster prenanthoides	Crooked-stem aster
Eupatorium rugosum	White snakeroot
Laportea canadensis	Wood nettle
Leonurus cardiaca	Motherwort
Rhus toxicodendron	Poison ivy
Rubus sp.	Raspberry
Solanum nigrum	Black nightshade

Grasses and sedges

Leersia oryzoides	Rice cut grass

Section E Riverine Sand Flats (1.19 ac.)

The dredge pile south of the railroad trestle generally has steeper banks than the Section C sand Flats south of Lake Street and clearly has not been planted with prairie species. The dredge pile is sparsely vegetated, and Siberian elm is very common as are Canada wild rye, sandbar willow, Virginia creeper and scattered sedges. The normal water level appears to be at least six feet below most of the sandbar.

Canopy trees

Latin Name	**Common Name**
none	

Mid-story trees

Fraxinus pennsylvanica	Green ash
Morus alba	Mulberry
Ulmus americana	American cottonwood
Ulmus pumila	Siberian elm

Shrub layer

Amorpha fruticosa	Indigobush
Lonicera tatarica	Tartarian honeysuckle
Salix exigua	Sandbar willow
Ulmus pumila	Siberian elm

Goundlayer vines

Parthenocissus quinquefolia	Virginia creeper
Solanum nigrum	Black nightshade
Vitis riparia	Riverbank grape

Forbs or groundlayer trees

Ambrosia artemisiifolia	Common ragweed
Asclepias syriaca	Common milkweed
Aster plantaginifolia	Crooked-stem aster

Aster prenanthoides	Oyster plant
Cirsium canadensis	Canada thistle
Eupatorium rugosa	White snakeroot
Melilotus alba	White sweet clover
Oenothera biennis	Evening primrose
Osmorhiza claytonii	Sweet cicely
Quercus bicolor	Swamp white oak
Quercus rubrum	Red oak
Solidago canadensis	Canada goldenrod

Grasses and sedges

Hystrix canadensis	Canada wild rye
Poa palustris	Kentucky bluegrass

Section E Box Elder Green Ash Disturbed Deciduous Forest (30.47 ac.)

This area of disturbed forest is the northernmost forest in the project site. A trail starts near the railroad trestle and gradually extends to the floodplain forest below. The trail is located on a wide terrace that was probably constructed early in the history of Minneapolis. There may have been an ideal crossing point at the base of the bluff because of a narrow stretch of shallow water. The slopes of the forest have little organic matter or groundlayer vegetation and are significantly eroded. The slope generally faces northward and most likely had a maple-basswood forest component historically.

Canopy trees

Latin Name	**Common Name**
Acer saccharum	Sugar maple
Celtis occidentalis	Hackberry
Fraxinus pennsylvanica	Green ash
Populus deltoides	American cottonwood
Tilia americana	American basswood
Ulmus americana	American elm
Ulmus rubra	Slippery elm

Mid-story trees

Acer negundo	Boxelder
Betula papyrifera	Paper Birch
Carya cordiformis	Bitternut hickory
Fraxinus pennsylvanica	Green ash
Morus alba	Mulberry
Populus grandidentata	Big-tooth aspen
Prunus virginiana	Chokecherry
Quercus rubra	Red oak
Rhamnus cathartica	Common buckthorn
Ulmus americana	American elm

Shrub layer

Cornus sericea	Red-osier dogwood
Lonicera tatarica	Tartarian honeysuckle

Rhus typhina	Staghorn sumac
Ribes sativum	Garden currant
Symphoricarpos occidentalis	Wolfberry

Groundlayer vines

Amphicarpa bracteata	Hog peanut
Parthenocissus quinquefolia	Virginia creeper

Forbs or groundlayer trees

Aquilegia canadensis	Columbine
Aralia nudicaulis	Wild sarsaparilla
Arisaema triphyllum	Jack in the pulpit
Asarum canadense	Wild ginger
Aster prenanthoides	Crooked-stem aster
Eupatorium rugosum	White snakeroot
Hydrophyllum virginianum	Virginia waterleaf
Impatiens capensis	Jewelweed
Laportea canadensis	Wood nettle
Phryma leptostachya	Lopseed
Smilax herbacea	Carrion flower
Smilacina racemosa	False Solomon's seal
Solanum nigrum	Black nightshade
Solidago flexicaulis	Zig-zag goldenrod
Violet	Violet sp.

Grasses and sedges

Carex blanda	Woodland sedge

Appendix D: Species Listed for Proposed Restoration Target Communities

The following species lists provide recommendations of native species to use to design plantings to restore plant communities in the restoration opportunity areas at the Mississippi River Gorge. These species lists have been compiled from Curtis (1959), Wovcha et al. (1994) and from plant inventory lists compiled by Cynthia Lane, Ph.D., former staff ecologist with Great River Greening.

- Oak savanna species list (Appendix Table 1)
- Maple-basswood forest species list (Appendix Table 2)
- Mesic oak forest species list (Appendix Table 3)
- Mesic prairie species list (Appendix Table 4)

Appendix Table 1. Oak savanna species list

This species list has been compiled from Curtis (1959), Wovcha et al. (1994) and from plant inventory lists compiled by Cynthia Lane, Ph.D., ecologist with Great River Greening.

Note: ** = species recommended due to availability, ecological or aesthetic reasons*
 # = species recommended for erosion control

Canopy Trees

	Latin Name	Common Name	Notes	Height and Width
*#	*Quercus macrocarpa*	Bur oak	Dominant Species	70-80'H, 70-80'W
*#	*Quercus ellipsoidalis*	Northern pin oak	Dominant Species	50-75'H, 50-75'W
*#	*Quercus alba*	White oak		50-80'H, 50-80'W
	Populus tremuloides	Quaking aspen		20-50'H, 20-35'W
	Prunus serotina	Black cherry		50-60'H, 35-50'W

Shrub Layer

*	*Amorpha canescens*	Leadplant	Dry-Mesic	2-3'H
*	*Ceanothus americanus*	New Jersey tea	Dry-Mesic	2-3'H, 3-5'W
*#	*Cornus racemosa*	Gray dogwood	Mesic	8-10'H, 6-`10'W
*	*Corylus americana*	American hazelnut	Dry-Mesic	6-12'H,6-12'W
*#	*Rhus glabra*	Smooth sumac	Dry-Mesic	6-8'H, Colonial Spreader
*#	*Rosa arkansana*	Prairie rose	Dry-Mesic	3-4'H
*#	*Prunus virginiana*	Chokecherry	Dry-Mesic	20-35'H, 12-15'W
*#	*Amelanchier sanguinea*	Round-leaf serviceberry	Dry-Mesic	3-6'H, 3-6'W
*#	*Symphoricarpos occidentalis*	Wolfberry	Mesic	3-4'H, 4-6'W
	Salix humilis	Prairie willow	Dry-Mesic	4-8'H

Groundlayer

	Graminoids	
	Andropogon gerardii	Big bluestem
	Aristida basiramea	Three-awn grass
*	*Bouteloua curtipendula*	Side-oats grama
*	*Bouteloua hirsuta*	Hairy grama
	Calamovilfa longifolia	Sand reedgrass
*	*Carex muhlenbergii*	Muhlenberg's sedge
*#	*Carex pensylvanica*	Pennsylvania sedge
*	*Elymus canadensis*	Canada wild rye, nodding wild-rye
*	*Koeleria macrantha*	June grass
	Muhlenbergia cuspidata	Plains muhly
*	*Panicum oligosanthes*	Scribner's panic grass
*#	*Panicum virgatum*	Switch grass
*#	*Schizachyrium scoparium*	Little bluestem
*#	*Sorghastrum nutans*	Indian grass
*#	*Sporobolus heterolepis*	Prairie dropseed
	Stipa comata	Needle grass
*	*Stipa spartea*	Porcupine grass
	Forbs	
	Agastache foeniculum	Fragrant giant hyssop
*#	*Anemone cylindrica*	Thimbleweed
*	*Antennaria neglecta*	Pussytoes, white
	Antennaria plantaginifolia	Plantain-leafed pussytoes or large-leafed pussytoes
*	*Aristida tuberculosa*	Butterfly weed
*	*Artemisia ludoviciana*	Prairie sage
	Artemisia frigida	Prairie sagewort
*	*Asclepias tuberosa*	Butterfly milkweed
	Asclepias verticillata	Whorled milkweed
	Asclepias viridiflora	Green milkweed
*	*Aster ericoides*	Heath aster
*	*Aster oolentangiensis*	Azure aster
	Aster sericeus	Silky aster
	Astragalus crassicarpus	Buffalo-bean, ground-plum
	Besseya bullii	Kitten-tails
	Calylophus serrulata	Toothed-leafed evening primrose
*	*Campanula rotundifolia*	Harebell
*	*Coreopsis palmata*	Stiff tickseed or bird-foot coreopsis
*	*Dalea candidum*	White prairie clover
*	*Dalea purpureum*	Purple prairie clover
	Delphinium virescens	Prairie larkspur
*#	*Desmodium illinoense*	Illinois tick-trefoil
	Equisetum laevigatum	Smooth scouring-rush
*	*Euphorbia corollata*	Flowering spurge
*#	*Fragaria virginiana*	Wild strawberry
*#	*Galium boreale*	Northern bedstraw
*	*Geum triflorum*	Prairie smoke
*	*Gnaphalium*	Sweet everlasting

	obtusifolium	
	Helianthemum bicknellii	Hoary frostweed
*#	*Helianthus hirsutus*	Woodland sunflower
	Helianthus occidentalis	Western sunflower
	Hilianthus rigidus	Rigid sunflower
	Heliopsis helianthoides	Early sunflower
	Heterotheca villosa	Hairy golden aster
*	*Heuchera richardsonii*	Alum root
*	*Hieracium longipilum*	Long-bearded hawkweed
	Krigia biflora	Two-flowered Cynthia
*	*Lespedeza capitata*	Round-headed bush-clover
*	*Liatris aspera*	Rough blazing star
*	*Liatris punctata*	Dotted blazing star
*	*Lithospermum canescens*	Hoary puccoon
*	*Lithospermum caroliniense croceum*	Hairy puccoon
	Lobelia spicata	Rough-spiked lobelia
*	*Lupinus perennis*	Wild lupine
*#	*Monarda fistulosa*	Wild bergamot
	Oenothera biennis	Evening primrose
	Oxalis violacea	Violet wood sorrel
*	*Penstemon gracilis*	Slender beard-tongue
*	*Penstemon grandiflorus*	Large-flowered beard-tongue
	Physalis virginiana	Ground cherry
*#	*Pycnanthemum virginianum*	Mountain mint
*	*Rudbeckia hirta pulcherrima*	Black-eyed Susan
*	*Sisyrinchium campestre*	Blue-eyed grass
*#	*Smilacina stellata*	Starry false Solomon's seal
*#	*Solidago nemoralis*	Gray goldenrod
	Solidago ptarmicoides	Upland aster
*	*Solidago rigida*	Stiff goldenrod
*	*Teucrium canadense*	Germander
*	*Tradescantia occidentalis*	Western spiderwort
*	*Verbena stricta*	Hoary vervain
	Viola pedatifida	Prairie violet

Appendix Table 2. Maple-basswood forest species list

This species list has been compiled from Curtis (1959), Wovcha et al. (1994) and from plant inventory lists compiled by Cynthia Lane, Ph.D., ecologist with Great River Greening.

Note: ** = species recommended due to availability, ecological or aesthetic reasons*
 # = species recommended for erosion control

Canopy Trees

	Latin Name	Common Name	Height and Width
*#	*Acer saccharum*	Sugar maple	75-100'H, 50-75'W
*#	*Celtis occidentalis*	Hackberry	75-100'H, 75-100'W
*#	*Juglans cinerea*	Butternut	50-75'H, 50-75'W
*#	*Juglans nigra*	Black walnut	75-100'H, 75-100'W
*#	*Prunus serotina*	Black cherry	50-75'H, 35-50'W
*#	*Quercus alba*	White oak	75-100'H, 75-100'W
*#	*Quercus macrocarpa*	Bur oak	75-100'H, 75-100'W
*#	*Quercus rubra*	Northern red oak	75-100'H, 75-100'W
*#	*Tilia americana*	Basswood	75-100'H, 50-75'W
*#	*Ulmus americana*	American elm	75-100'H, 75-100'W
*#	*Ulmus rubra*	Slippery elm	

Subcanopy Trees

*#	*Betula papyrifera*	Paper-birch	50-75'H, 35-50'W
	Carpinus caroliniana	Blue beech	35-50'H, 35-50'W
*#	*Carya cordiformis*	Bitternut hickory	75-100'H, 75-100'W
	Fraxinus nigra	Black ash	50-75'H, 35-50'W
	Fraxinus pennsylvanica	Green ash	50-75'H, 35-50'W
*#	*Ostrya virginiana*	Ironwood	35-50'H, 20-35'W
*	*Pinus strobus*	White pine	75-100'H, 50-75'W
*#	*Prunus americana*	Wild plum	20-35'H, 20-35'W
*#	*Prunus virginiana*	Chokecherry	35-50'H, 20-35'W

Shrub layer

*#	*Cornus alternifolia*	Pagoda dogwood	20-35'H, 20-35'W
*#	*Cornus foemina*	Gray dogwood	6-12'H, 6-12'W
*#	*Dirca palustris*	Leatherwood	3-6'H, 3-6'W
*#	*Ribes americanum*	Wild black currant	3-6'H, 3-6'W
*#	*Ribes cynosbati*	Prickly gooseberry	3-6'H, 3-6'W
*#	*Ribes missouriense*	Missouri gooseberry	3-6'H, 3-6'W
*#	*Sambucus canadensis*	Common elder	6-12'H,6-12'W
*#	*Sambucus pubens*	Red-berried elder	6-12'H,6-12'W
*#	*Staphylea trifolia*	Bladdernut	6-12'H,6-12'W

Groundlayer Vines

	Celastrus scandens	Climbing bittersweet
	Parthenocissus inserta	Five-leafed Virginia creeper
	Parthenocissus quinquefolia	Virginia creeper

Forbs

*	*Actaea rubra*	Red baneberry
*#	*Adiantum pedatum*	Maidenhair fern
	Allium burdickii	Burdick's leek
*	*Allium tricoccum*	Wild leek
*#	*Amphicarpaea bracteata*	Hog-peanut
*	*Anemone quinquefolia*	Wood-anemone
	Anemone virginiana	Virginia thimbleweed
*	*Anemonella thalictroides*	Rue-anemone
*#	*Aquilegia canadensis*	Columbine
*	*Aralia nudicaulis*	Wild sarsaparilla
*	*Arisaema triphyllum*	Jack in the pulpit
*#	*Asarum canadense*	Wild ginger
*	*Aster cordifolius*	Heart-leafed aster
*#	*Athyrium angustum*	Lady-fern
	Botrychium virginianum	Rattlesnake fern
*#	*Campanula americana*	Tall bellflower
*	*Caulophyllum thalictroides*	Blue cohosh
	Cirsium discolor	Field thistle
	Claytonia caroliniana	Carolina spring-beauty
*	*Claytonia virginica*	Virginia spring-beauty
	Corallorhiza	Coral-root
	Cypripedium calceolus	Yellow lady-slipper
	Cystopteris bulbifera	Bulblet bladder-fern
	Cystopteris fragilis	Fragile bladder-fern
*	*Desmodium glutinosum*	Pointed-leafed tick-trefoil
*#	*Dicentra cucullaria*	Dutchman's breeches
	Dryopteris cristata	Crested fern
*#	*Equisetum pratense*	Meadow horsetail
*	*Erythronium albidum*	White trout-lily
	Eupatorium rugosum	Common snakeroot
	Galearis spectabilis	Showy orchis
	Galium concinnum	Elegant bedstraw
	Galium triflorum	Three-flowered bedstraw
*	*Geranium maculatum*	Wild geranium
*#	*Helianthus hirsutus*	Woodland sunflower
*	*Hepatica acutiloba*	Sharp-lobed hepatica
*#	*Hydrophyllum virginianum*	Virginia waterleaf
	Isopyrum biternatum	False rue-anemone
	Lilium michiganense	Michigan lily
	Lonicera canadensis	Fly honeysuckle

*	*Maianthemum canadense*	Canada mayflower
*#	*Matteuccia struthiopteris*	Ostrich-fern
	Menispermum canadense	Canada moonseed
*	*Onoclea sensibilis*	Sensitive fern
	Osmorhiza claytonii	Clayton's sweet cicely
	Osmorhiza longistylis	Anise-root
*#	*Osmunda claytoniana*	Interrupted fern
*	*Panax quinquefolium*	American ginseng
*	*Phlox divaricata*	Blue phlox
*#	*Polygonatum commutatum*	Giant Solomon's-seal
*#	*Polygonatum pubescens*	Hairy Solomon's seal
	Prenanthes alba	White rattlesnake-root
	Ranunculus abortivus	Kidney-leaf buttercup
	Rubus occidentalis	Black raspberry
	Rubus strigosus	Red raspberry
	Rudbeckia laciniata	Goldenglow
*	*Sanguinaria canadensis*	Bloodroot
*#	*Thalictrum dioicum*	Early meadowrue
	Trillium cernuum	Nodding trillium
*#	*Uvularia grandiflora*	Yellow bellwort
*#	*Uvularia sessilifolia*	Pale bellwort
	Viola pratincola	Meadow violet
*	*Viola pubescens*	Yellow violet
*	*Viola sororia*	Common blue violet

Grasses and Sedges

*#	*Carex blanda*	Charming sedge
*#	*Carex pedunculata*	Long-stalked sedge
*#	*Carex pennsylvanica*	Pennsylvania sedge
*#	*Carex rosea*	Stellate sedge
*#	*Carex sprengelii*	Sprengel's sedge
*	*Elymus hystrix*	Bottlebrush grass
*#	*Elymus villosus*	Downy wild rye
	Festuca obtusa	Nodding fescue
	Milium effusum	Woodland millet grass
*#	*Oryzopsis asperifolia*	Mountain rice-grass
*#	*Oryzopsis asperifolia*	Mountain rice-grass
*#	*Oryzopsis racemosa*	Black-fruited rice-grass
*#	*Schizachne purpurascens*	False melic grass

Appendix Table 3. Mesic oak forest species list

This species list has been compiled from Curtis (1959), Wovcha et al. (1994) and from plant inventory lists compiled by Cynthia Lane, Ph.D., former staff ecologist with Great River Greening.

Note: ** = species recommended due to availability, ecological or aesthetic reasons*
 # = species recommended for erosion control

Canopy Trees

	Latin Name	Common Name	Height and Width
*#	*Prunus serotina*	Black cherry	50-75'H, 35-50'W
*#	*Quercus alba*	White oak	50-80'H, 50-80'W
*#	*Quercus macrocarpa*	Bur oak	75-100'H, 75-100'W
*#	*Quercus rubra*	Red oak	75-100'H, 75-100'W
*#	*Tilia americana*	Basswood	75-100'H, 50-75'W

Subcanopy Trees

*#	*Acer rubrum*	Red maple	75-100'H, 50-75'W
*#	*Acer saccharum*	Sugar maple	75-100'H, 50-75'W
*#	*Betula papyrifera*	Paper birch	50-75'H, 35-50'W
*#	*Carya cordiformis*	Bitternut	75-100'H, 75-100'W
*#	*Celtis occidentalis*	Hackberry	75-100'H, 75-100'W
*#	*Fraxinus americana*	White ash	75-100'H, 50-75'W
*#	*Fraxinus pennsylvanica*	Green ash	50-75'H, 35-50'W
*#	*Juglans cinerea*	Butternut	50-75'H, 50-75'W
*#	*Juglans nigra*	Black walnut	75-100'H, 75-100'W
*#	*Ostrya virginiana*	Ironwood	35-50'H, 20-35'W
*#	*Quercus ellipsoidalis*	Northern pin oak	50-75'H, 50-75'W
*#	*Ulmus americana*	American elm	75-100'H, 75-100'W
*#	*Ulmus rubra*	Slippery elm	

Shrub Layer

*#	*Amelanchier laevis*	Smooth juneberry	20-25'H, 25-35'W
*#	*Cornus alternifolia*	Pagoda dogwood	20-35'H, 20-35'W
*#	*Cornus foemina*	Gray dogwood	6-12'H, 6-12'W
*#	*Cornus rugosa*	Round-leafed dogwood	6-12'H, 6-12'W
*#	*Corylus americana*	American hazelnut	6-12'H, 6-12'W
*#	*Corylus cornuta*	Beaked hazelnut	6-12'H, 6-12'W
*#	*Diervilla lonicera*	Bush honeysuckle	Up to 3'H, 3'W
*#	*Prunus virginiana*	Chokecherry	20-35'H, 12-15'W
*#	*Ribes cynosbati*	Prickly gooseberry	3-6'H, 3-6'W
*#	*Ribes missouriense*	Missouri gooseberry	3-6'H, 3-6'W
*#	*Rosa blanda*	Smooth wild rose	
	Rubus pubescens	Dwarf raspberry	
	Rubus strigosus (idaeus)	Red raspberry	3-6'H, 6-12'W
*#	*Sambucus canadensis*	Common elder	6-12'H, 6-12'W
*#	*Symphoricarpos occidentalis*	Wolfberry	3-6'H, 3-6'W

*#	*Viburnum lentago*	Nannyberry	20-35'H, 10-35'W
*#	*Viburnum rafinesquianum*	Downy arrow-wood	3-6'H, 3-6'W

Groundlayer - Vines

	Celastrus scandens	Climbing bittersweet
	Clematis virginiana	Virgin's bower
	Lonicera prolifera	Yellow vine honeysuckle
	Menispermum canadense	Canada moonseed
	Parthenocissus inserta	Virginia creeper
	Parthenocissus quinquefolia	Virginia creeper
	Parthenocissus vitacea	Virginia creeper
	Vitis riparia	Wild grape

Forbs

*	*Actaea rubra*	Red baneberry
	Agrimonia gryposepala	Agrimony
*	*Allium tricoccum*	Wild leek
*#	*Amphicarpa bracteata*	Hog-peanut
*#	*Andiantum pedatum*	Maidenhair fern
*#	*Anemone cylindrica*	Long-headed thimbleweed
*	*Anemone quinquefolia*	Wood anemone
*#	*Anemone riparia (virginiana)*	Tall thimbleweed
*	*Anemonella thalictroides*	Rue-anemone
	Apocynum androsaemifolium	Spreading dogbane
*#	*Aquilegia canadensis*	Columbine
*	*Aralia nudicaulis*	Wild sarsaparilla
	Aralia racemosa	American spikenard
	Arenaria lateriflora	Sandwort
*	*Arisaema triphyllum*	Jack-in-the-pulpit
*#	*Asarum canadense*	Wild ginger
	Asclepias exaltata	Poke milkweed
*	*Aster cordifolius*	Heart-leafed aster
	Aster lateriflorus	Side-flowering aster
*#	*Aster macrophyllus*	Big-leafed aster
	Aster sagittifolius	Arrow-leafed aster
*#	*Aster shortii*	
	Aster urophyllus	Tall-leafed aster
*#	*Athyrium felix-femina*	Lady fern
	Botrychium virginianum	Rattlesnake fern
*	*Caulophyllum thalictroides*	Blue cohosh
	Chenopodium simplex	Maple-leafed goosefoot
	Circaea lutetiana	Canada enchanter's nightshade
*	*Circaea quadirsulcata*	Flowering spurge
	Cryptotaenia canadensis	Honewort
	Cypripedium pubescens	Yellow lady slipper
	Cystopteris bulbifera	Bulblet bladder-fern
*	*Desmodium glutinosum*	Pointed-leafed tick-trefoil
*	*Desmodium nudiflorum*	Stemless tick-trefoil
	Dioscorea villosa	Wild yam
	Dryopteris goldiana	Goldy's fern
*#	*Equisetum arvense*	Field horsetail
	Erigeron philadelphicus	Philadelphia fleabane

*#	*Fragaria vesca*	Wood strawberry
*#	*Fragaria virginiana*	Common strawberry
	Galearis spectabilis	Showy orchis
	Galium concinnum	Shining bedstraw
	Galium triflorum	Three-flowered bedstraw
*	*Geranium maculatum*	Wild geranium
*#	*Helianthus hirsutus*	Woodland sunflower
	Helianthus rigidus	Stiff sunflower
	Helianthus strumosus	Rough-leafed sunflower
*	*Hepatica acutiloba*	Sharp-lobed hepatica
*	*Hepatica americana*	Round-lobed hepatica
*#	*Hydrophyllum virginianum*	Virginia waterleaf
	Impatiens capensis	Spotted touch-me-not
	Lactuca biennis	Tall blue lettuce
	Lilium michiganense	Michigan lily
*	*Maianthemum canadense*	Canada mayflower
	Mitella diphylla	Two-leafed miterwort
	Monotropa uniflora	Indian pipe
	Osmorhiza claytonii	Clayton's sweet cicely
	Osmorhiza longistylis	Anise-root
*#	*Osmunda claytoniana*	Interrupted fern
*	*Panax quinquefolium*	American ginseng
	Pedicularis canadensis	Wood-betony
*	*Phlox divaricata*	Blue phlox
*	*Podophyllum peltatum*	May apple
*#	*Polygonatum canaliculatum*	Hairy Solomon's seal
*#	*Polygonatum commutatum*	Giant Solomon's seal
	Prenanthes alba	White lettuce
*#	*Pteridium aquilinum*	Bracken fern
*	*Sanguinaria canadensis*	Bloodroot
	Sanicula gregaria	Clustered snakeroot
	Sanicula marilandica	Maryland black snakeroot
*#	*Smilacina racemosa*	False Solomon's seal
*#	*Smilacina stellata*	Starry false Solomon's seal
*#	*Solidago flexicaulis*	Zig-zag goldenrod
*#	*Thalictrum dasycarpum*	Tall meadowrue
*#	*Thalictrum dioicum*	Early meadowrue
	Trillium cernuum	Nodding trillium
	Triosteum perfoliatum	Horse-gentian
*#	*Uvularia grandiflora*	Yellow bellwort
*#	*Uvularia sessilifolia*	Pale bellwort
*	*Veronicastrum virginicum*	Culver's root
	Viola conspersa	Dog violet
	Viola cucullata	Blue marsh violet
	Viola pratincola	Meadow violet
*	*Viola pubescens*	Yellow violet
*#	*Viola sororia*	Common blue violet
*	*Zizia aurea*	Golden alexanders

Grasses and Sedges

	Brachyelytrum erectum	Bearded shorthusk
	Bromus latiglumis	Broad-glumed brome
*#	*Carex blanda*	Charming sedge
*#	*Carex gracillima*	Graceful sedge
*#	*Carex pensylvanica*	Pennsylvania sedge
*#	*Carex rosea*	Stellate sedge
*	*Elymus hystrix (Hystrix patula)*	Bottlebrush grass
*	*Elymus virginicus*	Virginia wild rye
*	*Festuca subverticillata*	Nodding fescue
	Oryzopsis racemosa	Black-fruited rice grass
	Oryzopsis sperifolia	Rough-leafed ricegrass
	Schizachne purpurascens	False melic grass

Appendix Table 4. Mesic prairie species list

Latin Name	Common Name
Shrubs:	
Cornus racemosa	Gray dogwood
Prunus americana	American plum
Prunus virginiana	Choke cherry
Rosa arkansana	Prairie rose
Salix humilis	Prairie willow
Symphoricarpos occidentalis	Wolfberry

Graminoids:	
Andropogon gerardii	Big bluestem
Bromus kalmii	Prairie brome
Calamagrostis canadensis	Blue-joint grass
Carex bicknellii	A species of sedge
Carex tenera	A species of sedge
Elymus canadensis	Canada wild rye
Juncus greenei	A species of rush
Koeleria macrantha	Junegrass
Panicum oligosanthes	Scribner's panic grass
Panicum virgatum	Switchgrass
Schizachyrium scoparium	Little bluestem
Sorghastrum nutans	Indian grass
Sporobolus heterolepis	Prairie dropseed
Stipa spartea	Porcupine grass

Forbs:	
Achillea millefolium ssp. lanulosa	Common yarrow
Amorpha canescens	Leadplant
Anemone canadensis	Canada anemone
Anemone cylindrica	Long-fruited thimbleweed
Apocynum cannabinum	Indian hemp
Apocynum sibiricum	Clasping Indian hemp
Artemisia ludoviciana	White sage
Asclepias speciosa	Showy milkweed
Asclepias syriaca	Common milkweed
Asclepias tuberosa	Butterfly milkweed
Asclepias verticillata	Whorled milkweed
Aster ericoides	Heath aster
Aster laevis	Smooth aster
Aster novae-angliae	New England aster
Aster oolentangiensis	Sky-blue aster
Comandra umbellata	Bastard toadflax
Coreopsis palmata	Stiff tickseed or bird foot coreopsis
Dalea candidum	White prairie clover
Dalea purpureum	Purple prairie clover
Desmodium canadense	Showy tick trefoil
Euphorbia corollata	Flowering spurge
Euthamia graminifolia	Grass-leafed goldenrod
Fragaria virginiana	Thick-leafed wild strawberry
Galium boreale	Northern bedstraw

Gentiana flavida (alba)	Yellowish gentian
Glycyrrhiza lepidota	Wild licorice
Helenium autumnale	Common sneezeweed
Helianthus giganteus	Giant sunflower
Helianthus maximillianii	Maximillian sunflower
Helianthus pauciflorus (rigidus)	Stiff sunflower
Helianthus rigidus	Rigid sunflower
Helianthus tuberosus	Jerusalem artichoke
Heliopsis helianthoides	Ox-eye
Heuchera richardsonii	Alum root
Lactuca ludoviciana	Prairie lettuce
Liatris aspera	Rough blazing star
Liatris ligulistylis	Northern plains blazing star
Liatris pycnostachya	Gayfeather
Lilium michiganense	Turk's cap lily
Lilium philadelphicum	Wood lily
Lithospermum canescens	Hoary puccoon
Lobelia spicata	Pale spiked lobelia
Monarda fistulosa	Wild bergamot
Pedicularis canadensis	Wood-betony
Phlox pilosa	Prairie phlox
Polygala sanguinea	Blood milkwort
Potentilla arguta	Prairie cinquefoil
Prenanthes racemosa	Smooth rattlesnake-root
Pycnanthemum virginianum	Mountain mint
Ratibida pinnata	Gray-headed coneflower
Rosa arkansana	Prairie rose
Rudbeckia hirta	Black-eyed Susan
Silphium laciniatum	Compass plant
Smilacina stellata	Starry false Solomon's seal
Solidago gigantea	Giant goldenrod
Solidago missouriensis	Missouri goldenrod
Solidago rigida	Stiff goldenrod
Solidago speciosa	Showy goldenrod
Spiranthes cernua	Nodding ladies' tresses
Thalictrum dasycarpum	Tall meadow rue
Veronicastrum virginicum	Culver's root
Vicia americana	American vetch
Viola palmata var. *pedatifida*	Prairie Violet
Zizia aptera	Heart-leafed alexanders
Zizia aurea	Golden alexanders

Appendix E: Fact Sheets on Invasive and Exotic Species

Throughout the country, invasive plant species are threatening existing plant communities. Active management to control invasive plant species is essential to restoring the health of plant communities. The following fact sheets describe several invasive species.

Invasive Trees and shrubs

Common buckthorn*	*Rhamnus cathartica*
Tartarian honeysuckle*	*Lonicera tartaric*
Staghorn sumac	*Rhus typhina*
Black Locust	*Robinia pseudoacacia*
Siberian elm*	*Ulmus pumila*

Invasive Forbs

Garlic mustard*	*Alliaria petiolata*
Spotted knapweed*	*Centaurea maculosa*
Purple loosestrife*	*Lythrum salicaria*
Poison ivy	Rhus *Toxicodendron*

*exotic species

Effective management of these species, which are present in the Mississippi River Gorge, is described in the following fact sheets. Concentrations of invasive plants in the Mississippi River Gorge are shown on Map 4 (page 138).

Common Buckthorn *(Rhamnus cathartica)*

Effects of Invasion
Common buckthorn is a problem species in the understory of maple-basswood and oak woodlands, oak savannas, and prairies. Common buckthorn is characterized by long-distance dispersal, prolific reproduction by seed, and wide habitat tolerance. The fruit has a severe laxative effect; birds readily distribute its seeds after eating the fruit. Once established, common buckthorn has the potential to spread very aggressively in large numbers because it thrives in habitats ranging from full sun to shaded understory. Common buckthorn leafs out very early and retains its leaves late in the growing season, thereby shading out herbaceous and low-shrub communities and preventing the establishment of tree seedlings.
Size: 18–25 feet in height with a comparable spread.
Habit: Large shrub or low-branched tree with a rounded, bushy crown of crooked, stoutish stems.
Leaves: Dull green, ovate-elliptic-shaped, smooth on both surfaces with minute teeth on the margins, and pointed tips.
Stem: Slender, somewhat grayish, often having thorn-like spurs.
Bark: Generally gray to brown with prominent, often elongate, light-colored or silvery lenticels.
Fruit: Female plants have ¼-inch-diameter clusters of black, rounded fruit.
Origin: Europe and Asia.
Range: Nova Scotia to Saskatchewan, south to Missouri and east to New England.

Mechanical Control
- Prescribed burns in early spring and fall may kill seedlings, larger stems, and top-killed mature buckthorns. Burning is preferable for fire-adapted communities but should not be used if it adversely affects the community. Burning annually or biannually to control buckthorn may need to be continued for several years depending on the extent of establishment and the seed bank, which generally lasts 3–5 years. It is usually difficult to burn in dense buckthorn stands because the understory is typically well shaded, allowing little fuel build-up.
- Hand pull or weed-wrench seedlings.

- Weed wrench saplings up to 1inch in diameter at breast height.
- Trees of 1–3 inches in diameter at breast height may be weed wrenched if they are growing in sandy soils; otherwise, cut and apply herbicide to the stump.

Chemical Control

- Cut and apply herbicide to tree stumps greater than 3 inches in diameter at breast height.
- Basal bark treatment may be used on trees located near power lines, in difficult terrain, or in areas where it is not important to create openings in the woodland floor for reintroduction of native species.
- In high-quality natural areas and aquatic environments where surface water is present, apply a herbicide formulated for use over water.
- Repeat both mechanical and chemical control methods for at least 3–5 years to stop new plants emerging from the seed bank as well as the continual spread of seed from bird droppings. Underplanting disturbed areas with tolerant native species may hinder reinvasion by common buckthorn.

Cut and spray

- May to October (between first budding in May, through summer, to hard freeze in fall): Spray 25% Triclopyr diluted in water on cut stumps during the growing season. Herbicide should be sprayed immediately after cutting. Avoid spring sap flow. Chemical treatment is generally less effective during the growing season, and there is more risk of affecting non-target plants.
- Winter (from first hard freeze to first budding in May): Spray 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or dilutent oil on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is most effective at this time of year.
- May to October (between first budding in May, through summer, to hard freeze in fall): Apply 25% glyphosate solution formulated for use over water in high-quality natural areas and in aquatic environments where surface water is present. Herbicide should be sprayed immediately after cutting.

Basal bark treatment

- Apply a band of 6% Triclopyr with oil in diesel fuel or dilutent oil on the lower 10 inches of bark, including the root collar.

Source: Wisconsin Department of Natural Resources, 1997.

Honeysuckle *(Lonicera tartarica)*

Effects of Invasion
Tartarian honeysuckle can live in a broad range of plant communities with varying moisture and shade levels. Woodlands are most affected and are particularly vulnerable if the habitat is already disturbed. The vigorous growth of Tartarian honeysuckle inhibits development of native shrub and ground-layer species; eventually, they may entirely replace native species by shading and depleting soil moisture and nutrients. The early leafing of this species is particularly injurious to spring ephemerals, which have evolved to bloom before trees and shrubs have leafed out.

Size: 3–10 feet in height with a 10-foot spread.
Habit: Upright, strongly multi-stemmed. Upper branches are arched, with the overall effect of a dense, twiggy mass.
Leaves: Smooth, hairless, opposite, simple, smooth beneath, ovate, bluish-green leaves. Leaf development begins early in the spring, before native species.
Stem: Green at first, finally brownish.
Bark: Older stems are shaggy.
Fruit: Red, ¼-inch-diameter berry that colors in late June into July and August.
Flower: Fragrant, tubular pink-to-crimson flowers arranged in pairs.
Origin: Central Asia to southern Russia.
Range: New England south to North Carolina and west to Iowa.

Mechanical Control
- Small to medium-sized plants can often be dug, pulled, or weed-wrenched, especially in spring, when the soil is moist. Mechanical removal can result in profuse re-sprouting of the plant if a portion of the root breaks off and remains in the soil.

Chemical Control

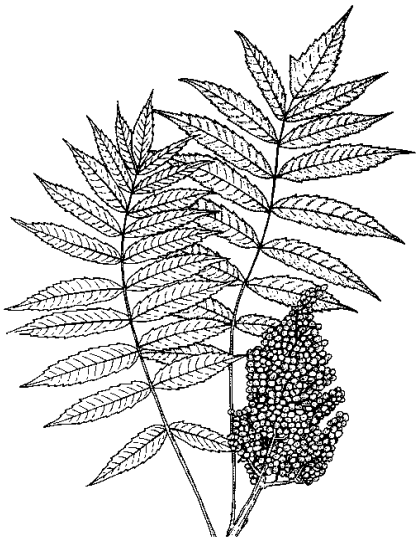
- Cut and apply herbicide to any honeysuckle regardless of size if soil conditions are not appropriate for mechanical control.
- In high-quality natural areas and in aquatic environments where surface water is present, apply a herbicide formulated for use over water.
- Repeat control methods for at least 3–5 years to stop new plants emerging from the seed bank. Underplanting disturbed areas with tolerant native species may hinder reinvasion of Tartarian honeysuckle.

Cut and spray

- May to October (between first budding in May, through summer, to hard freeze in fall): Spray 25% glyphosate solution on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is generally less effective during the growing season and may have to be repeated on re-sprouts.
- Winter (from first hard freeze to first budding in May): Spray 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or dilutent oil on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is most effective at this time of year.
- May to October (between first budding in May, through summer, to hard freeze in fall): In high-quality natural areas and in aquatic environments where surface water is present, apply 25% glyphosate solution formulated for use over water.

Source: Wisconsin Department of Natural Resources, 1997.

Staghorn Sumac *(Rhus typhina)*



Effects of Invasion
Both smooth sumac and staghorn sumac are opportunistic, native prairie shrubs. These aggressive shrubs occur in clones that spread outward by rootstocks or seeds. Sumac sprouts easily and grows rapidly but requires direct sunlight to persist. Re-sprouts grow rapidly and can reach 3 feet in 1 year. Sumac can eliminate or reduce the abundance of many other species that cannot persist in the shade sumac creates. Sumac grows in a variety of habitats, including disturbed sites, such as abandoned fields, roadsides, and fence rows. Sumac also grows in native communities, such as upland prairies, oak savanna, and oak woodlands and forests. Because sumac is a native species, the management objective is usually to keep sumac under control, not to eliminate it.

Size: 10 feet in height with a spreading crown of dense, multi-stemmed clones.
Habit: A large, loose, open, spreading shrub with a flattish crown.
Leaves: Pinnately compound with 7–31 leaflets that are green on the upper surface and nearly white on the lower surface. Leaves turn brilliantly red in fall.
Stem: Twigs are smooth, stout, angular, and hairless on smooth sumac and highly pubescent on the staghorn sumac.
Bark: Light brown and smooth on young plants. Pubescent on older stems of staghorn sumac. Smooth sumac has smooth bark on both young and old stems.
Fruit: Red drupes develop at the end of the stems in late summer and persist into winter. Each drupe is round, has short hairs, and contains a single seed.
Flower: Dioecious, greenish yellow, June to early July. Female borne in dense hairy panicles, 4–8" long; male in a bigger, looser, wider panicle.
Origin: Quebec to Ontario, south to Georgia, Indiana, and Iowa.

Mechanical Control
- Double-cut (once in July and once in August). Cutting may need to repeat for several consecutive years to effectively control in dense populations.
- Mow with a sickle-bar every year in mid to late July.
- Conduct prescribed burns for prairies in spring, then hand cut stems at ground level in July and August. Sumac will re-sprout after each cutting, but dense vegetation may prevent sumac from receiving enough sunlight, causing leaves to turn yellow and eventually die.

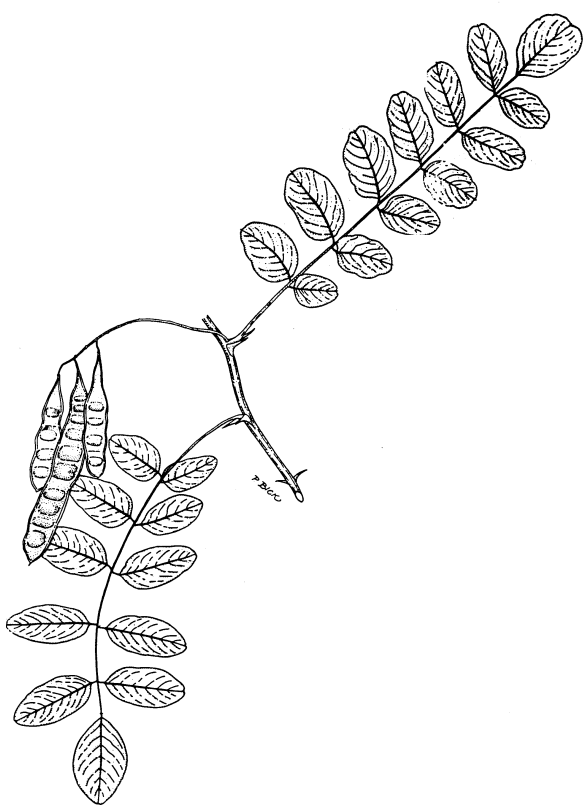
- Mow in mid-summer and conduct spring burns to stimulate herbaceous vegetation.
- Keep small populations under control by conducting prescribed burns every 3–4 years.

Chemical Control
- During July and August apply a 20% concentration of glyphosate to freshly cut stumps.
- Apply oil-based Triclopyr as directed on label to the entire circumference of each stem of the clone; no cutting is done.
- Foliar application of water-based Triclopyr as directed on label or 1%–2% solution of glyphosate in areas with little to no native vegetation.

Caution: The sap of sumac species may cause dermatitis in some people.

Source: Wisconsin Department of Natural Resources, 1997

Black Locust *(Robinia pseudoacacia)*



Effects of Invasion
Black locust is a translocated deciduous tree that is frequently found in upland prairies, savannas, old fields, roadsides, and woodlots. Black locust reproduces vegetatively by root suckering and stump sprouting. Root suckers arise spontaneously from established root systems, sprouting new shoots and interconnecting fibrous roots to form extensive, dense groves of clones. Damage to roots or stems stimulates vigorous sprouting, root suckering, and lateral spread.

Size: 30–80 feet tall with a spread of 20–35 feet.
Habit: An upright tree with a straight trunk and a narrow oblong crown, becoming ragged and straggly with age. Can be spreading in habit with several trunks.
Leaves: Alternate, pinnately compound with 7–21 leaflets. Leaflets are 1–2 inches long, ovate, entire, and dark bluish-green in color.
Stem: Slender, brittle, often zigzag, light reddish to greenish-brown in color, smooth with paired spines at nodes.
Bark: Young trees have smooth, green bark. Mature trees have deep, furrowed, shaggy dark bark with flat-topped ridges.
Fruit: A flat brown-black 2–4-inch smooth long pod.
Flower: Pea-like, fragrant, white or yellow long drooping racemes.
Origin: Southern Appalachia and Ozarks.

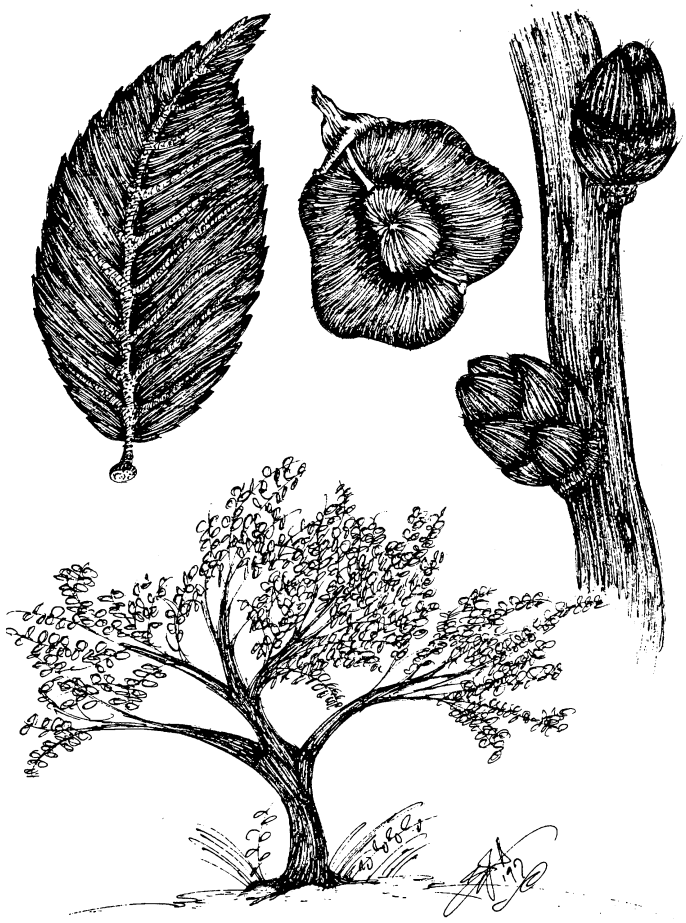
Mechanical Control
- Bulldozing is the only mechanical means of effectively controlling *Robinia*.

Chemical Control

- Basal stem application of Triclopyr formulated for dilution in diesel fuel or mineral oil. Herbicide should be applied in a 6-inch band encircling the trunk approximately 12 inches from the ground.
- For small isolated plants or thick patches under 5 feet in height (resulting from cutting or fire), treat every branch or stem with a foliar application of fisamine ammonium or Triclopyr mixed with water at the end of the growing season.
- A 1–1.55 solution of glyphosate can be applied to foliage of actively growing trees using a hand sprayer. Glyphosate should not be sprayed in high-quality natural areas.
- In late summer, early fall, or during the dormant season, a 20% solution of glyphosate should be applied to stumps immediately after cutting.

Source: Wisconsin Department of Natural Resources, 1997.

Siberian Elm *(Ulmus pumila)*



Effects of Invasion
Siberian elm flowers in spring before leaves begin to unfold. The fruits develop quickly and are disseminated by wind, allowing the species to form thickets of hundreds of seedlings in bare ground. Seeds germinate readily and seedlings grow rapidly.

Size: 50–70 feet in height with a 40–50-foot spread.
Habit: Open, round crown of slender, spreading branches.
Leaves: Small, elliptical, smooth singly toothed leaves that reach lengths of approximately 0.8–2.6 inches, tapering or rounded at their asymmetrical base.
Stem: Slender, brittle, very light gray or gray-green, usually smooth, can be slightly hairy, roughened by lenticellar projections.
Bark: Gray or brown, with shallow furrows at maturity.
Fruit: Single-winged circular or ovate in shape with smooth surface.
Flower: Greenish, lacks petals and occurs in small drooping clusters of 2–5 blossoms.
Origin: Eastern Siberia, northern China, Manchuria, and Korea.
Range: Minnesota south to Arkansas and west to Utah.

Mechanical Control

- Girdle in late spring to mid-summer by removing a band of bark around the tree trunk, just within the bark layer (cambium). Girdling too deeply may lead to re-sprouting. Girdled trees die slowly over 1–2 years.
- Hand pull or weed-wrench seedlings.
- Conduct regular prescribed burns in fire-adapted communities. Saplings older than a few years may not be killed by fire and instead will require another control method.

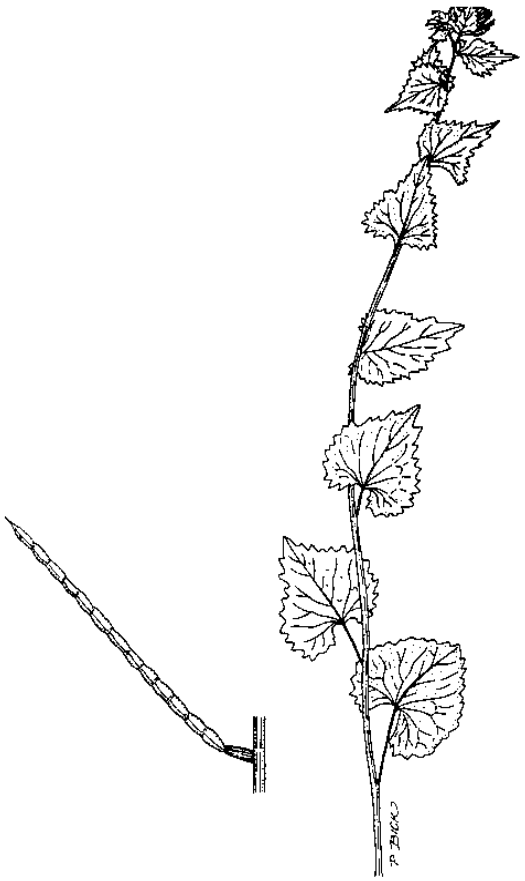
Chemical Control

Cut and spray

- May to October (between first budding in May, through summer, to hard freeze in fall): Spray 25% glyphosate solution on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is generally less effective during the growing season and may have to be repeated on re-sprouts.
- Winter (from first hard freeze to first budding in May): Spray 25% Triclopyr (formulated for oil dilution) diluted in diesel fuel or dilutent oil on cut stumps. Herbicide should be sprayed immediately after cutting. Chemical treatment is most effective at this time of year.
- May to October (between first budding in May, through summer, to hard freeze in fall): In high-quality natural areas and in aquatic environments where surface water is present, apply 25% glyphosate solution formulated for use over water.

Source: Wisconsin Department of Natural Resources, 1997.

Garlic Mustard *(Alliaria pertiolata)*



Effects of Invasion
Garlic mustard is a rapidly spreading woodland weed that displaces native woodland wildflowers. It dominates the forest floor and can displace most native herbaceous species within 10 years. Garlic mustard is a biennial that produces hundreds of seeds per plant. Seeds are dispersed on the fur of mammals, by water, and by humans. The seeds can remain viable for 5 years.

Size: 12–48 inches in height as an adult flowering plant.
Leaves: First-year plants consist of a cluster of 3 or 4 round, scallop-edged, dark-green leaves rising 2–4 inches in a rosette. Second-year plants have alternate, round, scallop-edged, dark-green leaves progressing up the 1 or 2 stems.
Stem: Second-year plants generally produce 1 or 2 flowering stems.
Fruit: Slender capsules 1–2.5 inches long that produce a single row of oblong black seeds with ridged seed coats.
Flower: Second-year plants have numerous small white flowers that have 4 separate petals.
Root: Slender, white taproot with an S-shaped top.
Origin: Europe.

Mechanical Control
- Hand pull at or before the onset of flowering, making sure to remove at least the upper half of the root to eliminate budding at the root crown.
- Cut the flower stalk as close to the soil surface as possible just as flowering begins. Cutting before the plant flowers may promote re-sprouting.

- Burn in fall or early spring (before wild flower growth). Burn annually for 3–5 years until depletion of the seed bank.

Chemical Control

- Apply a 1%–2% glyphosate solution to the foliage during the late fall or early spring before wild flower growth.
- Apply a 1% Tryclopyr solution to the rosettes in early spring before wild flower growth.

Source: Wisconsin Department of Natural Resources, 1997.

Spotted Knapweed *(Centaurea maculosa)*

Effects of Invasion
Spotted knapweed attains high densities on sunny sites, reducing the frequency of native species. Infestation can also contribute to poor water quality and erosion by increasing run-off and sedimentation. Plants average 1,000 seeds per plant. Seeds are viable for 7 years and germinate throughout the growing season.

Habit: Biennial or short-lived upright perennial forb.
Size: 3–4 feet in height.
Leaves: Alternate, pale, rough 1–3 inches in length. Leaf margins on lower leaves are divided about halfway to the midrib. Upper leaves are more linear in shape.
Stem: Slender, hairy, erect, growing in a branched pattern, 2 feet in height on drier sites and up to 4 feet in height on moister sites.
Seeds: ¼ inch and brownish. Notched on one side of the base with a short tuft of bristles at the tip.
Flower: Flower head has stiff bracts marked with fine, vertical streaks and tipped in with dark, comb-like fringes.
Root: Stout, elongated root.
Origin: Eurasia.

Mechanical Control
- Dig or pull the entire root.
- Conduct prescribed burn followed by selective pulling or digging.

Chemical Control

- Use foliar application of a 3% water-soluble solution of Triclopyr with dye. To protect native fauna, avoid getting herbicide on the flowers.
- Apply .2–.5 lbs./acre of Piclorum for 2–3 years in the fall when the plant is in the rosette growth stage or in spring during the bud-to-bloom stage. Do not use Piclorum near water or on sandy soils with ground water 10 feet or less below the surface.
- Apply 1–2 lbs/acre of Dicamba for at least 2 years.
- Apply .25 lbs./acre of Clopyralid or a mixture of .19 lbs./acre of Clopyralid and 1 lb./acre of 2,4-D.
- During the rosette stage, spray a 2,4-D low-volatile ester, oil-soluble amine, or water-soluble amine formulation at 2 lbs./acre.

Biological Control

- Experimental results have yielded a 95% reduction using two seed-head attacking flies *Urophora affinia* and *U. quadrifasciata*. Consult the USDA for more information about biological controls and their availability.

Source: Wisconsin Department of Natural Resources, 1997.
Minnesota Department of Natural Resources, 1995.
United States Department of Agriculture, 1971.

Purple Loosestrife *(Lithrum Salicaria)*

Effects of Invasion
Purple loosestrife spreads mainly by seed, but it can also spread from roots or stems. A single stalk can produce 100,000–300,000 seeds per year. Sunny and partly shaded wetland is susceptible to invasion. Purple loosestrife generally builds up a large seed bank in the soil for several years before becoming dominant. After disturbance, loosestrife can spread rapidly, eventually taking over entire wetlands. Purple loosestrife degrades wetlands by displacing native wetland vegetation and decreasing habitat for wildlife species.

Habit: Purple loosestrife is a perennial herb 3–7 feet tall with a dense bushy growth of 1–50 stems.
Size: 3–7 feet tall.
Leaves: Leaves are opposite, nearly linear, and attached to 4-sided stems without stalks.
Stem: Stems range from green to purple.
Flower: Flowers vary from purple to magenta, have 5–6 petals and are aggregated into numerous long spikes. Flowering occurs from July to September.
Origin: Europe.

Mechanical Control
Small young plants can be hand pulled while older plants can be removed with a shovel. If possible, entire root systems should be removed to prevent re-sprouting. Soil disturbance should be minimized to prevent seedling establishment. Plants should be controlled before the onset of seeds around the first week of August or seeds should be cut and bagged. Plant parts should be dried and disposed of accordingly. Follow-up treatments are recommended for at least 3 years after removal. Mowing and burning have not been effective with purple loosestrife. However, water-level manipulation has been successful. Water levels are reduced until loosestrife has sprouted, then levels are increased until stems are drowned.

Biological Control
Biocontrol is currently considered the most viable option for purple loosestrife control. Several natural insect enemies of purple loosestrife from Europe have been introduced. A species of weevil (*Hylobius transversovittatus*) lays eggs in the stem and upper root system of the plant and its larvae eat root tissue. In addition, two species of leaf-eating beetles (*Galerucella calmariensis* and *G. pusilla*) and a weevil that feeds on flowers (*Nanophyes marmoratus*) are being used. These insects almost exclusively feed on *Lythrum salicaria* and not native plants. The insects generally do not eradicate loosestrife but reduce the population to a state where it does not dominate native habitats.

Chemical Control
Glyphosate is the most common chemical used for killing purple loosestrife. The formula designed for use on wet or standing water sites should be applied in late July or August. A 1% active ingredient (a.i.) solution should be used, and only 25% of the foliage of each plant needs to be covered. Glyphosate mixed to 3%–10% solution can also be used on freshly cut stems (this is effective on larger plants in areas of low loosestrife densities). Cut stems should be removed from the site and disposed of appropriately. Triclopyr formulated for water dilution is an effective herbicide for loosestrife. This broadleaf herbicide does not harm sedges or monocots. Foliar application should cover nearly all of the foliage.

Source: Wisconsin Department of Natural Resources, 1997.

Poison Ivy *(Rhus radicans)*

Effects of Invasion
Although poison ivy is not harmful to other native flora, it can cause severe irritation to humans. It is commonly found in disturbed areas such as trails, parks, yards, and recreation areas where human contact is most likely to occur.

Habit: **Occurs as an upright growing woody shrub or as a vine that climbs the trunks of trees or grows along the ground.**
Size: 24 inches in height in the shrub form.
Leaves: Compound with 3 large shiny leaflets that are variable in outline.
Stem: Erect on the shrub form; supported by aerial roots on the vine form.
Fruit: Yellowish-white berries.
Flower: Clusters of up to 25 yellow-green flowers blooming from leafless lateral branches.
Origin: North America.

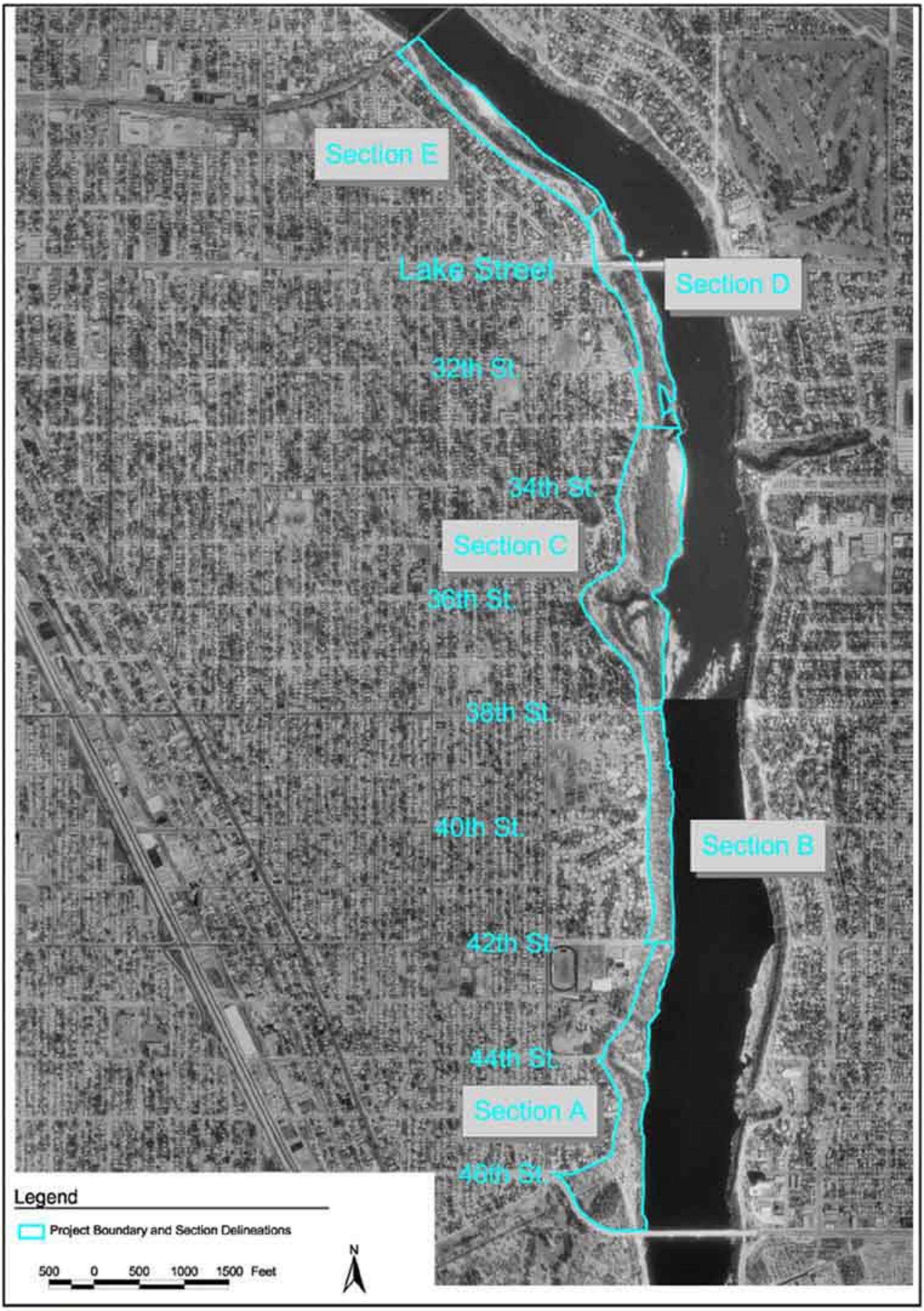
Mechanical Control

- Uproot individual plants in the fall, either before or after the leaves have fallen. Remove entire root to avoid re-sprouting. Repeat for several years to deplete seed bank. Caution: Wear gloves and protective clothing. Do not compost or burn plants.

Chemical Control

- In the late spring or early summer apply glyphosate or 2,4-D to the foliage with a sponge or sprayer as recommended on the label. Repeat for several years to deplete seed bank.

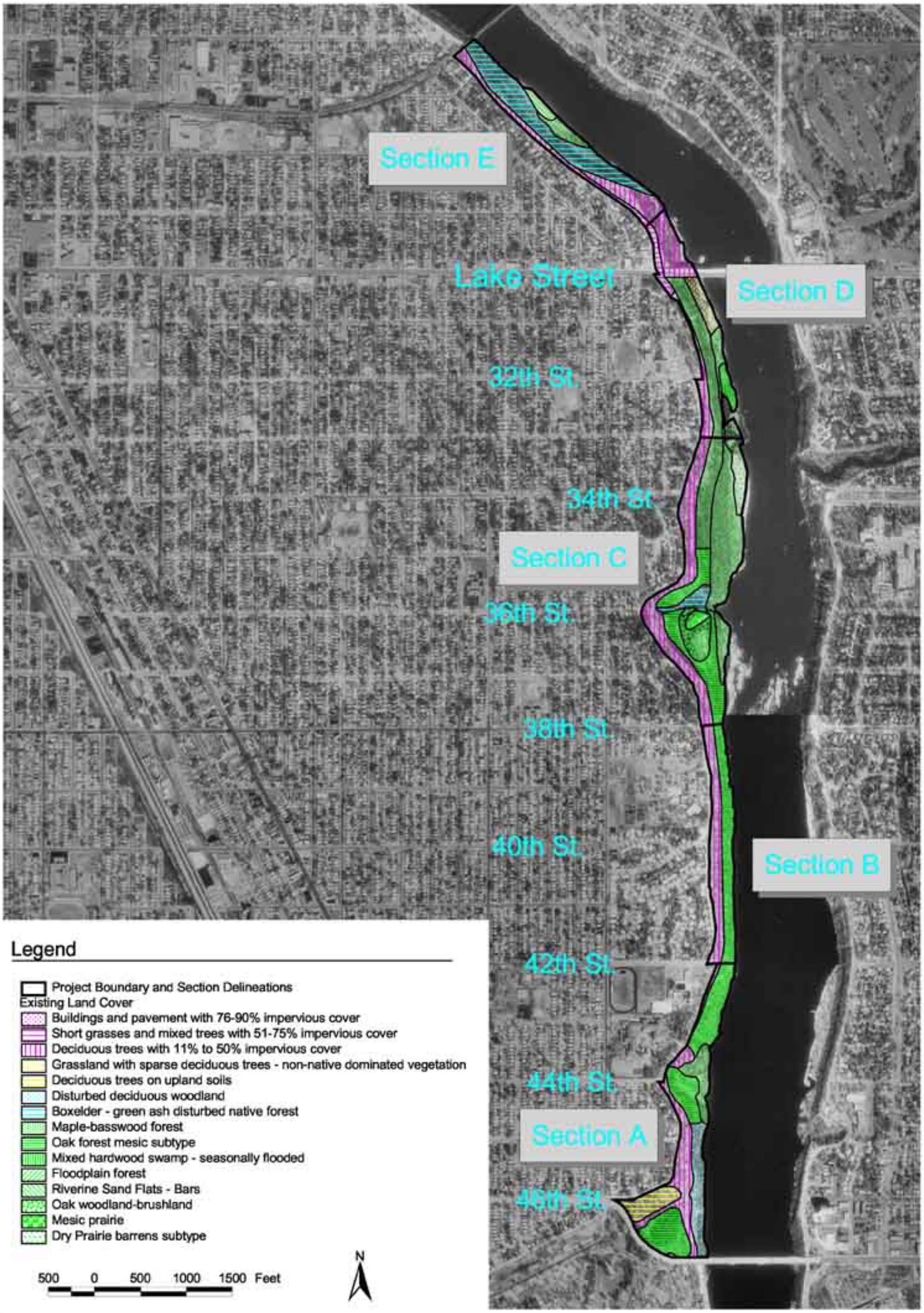
Source: Wisconsin Department of Natural Resources, 1997.



Mississippi River Gorge Project Boundary

A Project of the Longfellow Community Council and the Minneapolis Park and Recreation Board, Map Created Feb, 14, 2002 with funding provided by the Environmental and Natural Resources Fund Project as recommended by the Legislative Commission on Minnesota Resources.

Map 1



Legend

- Project Boundary and Section Delineations

Existing Land Cover

- Buildings and pavement with 76-90% impervious cover
- Short grasses and mixed trees with 51-75% impervious cover
- Deciduous trees with 11% to 50% impervious cover
- Grassland with sparse deciduous trees - non-native dominated vegetation
- Deciduous trees on upland soils
- Disturbed deciduous woodland
- Boxelder - green ash disturbed native forest
- Maple-basswood forest
- Oak forest mesic subtype
- Mixed hardwood swamp - seasonally flooded
- Floodplain forest
- Riverine Sand Flats - Bars
- Oak woodland-brushland
- Mesic prairie
- Dry Prairie barrens subtype

500 0 500 1000 1500 Feet

N

GREAT RIVER GREENING

Mississippi River Gorge Existing Land Cover

Note: Subunits of these MLCCS landcover polygons are presented in the Inventory Results in Appendix figures 2 through 6

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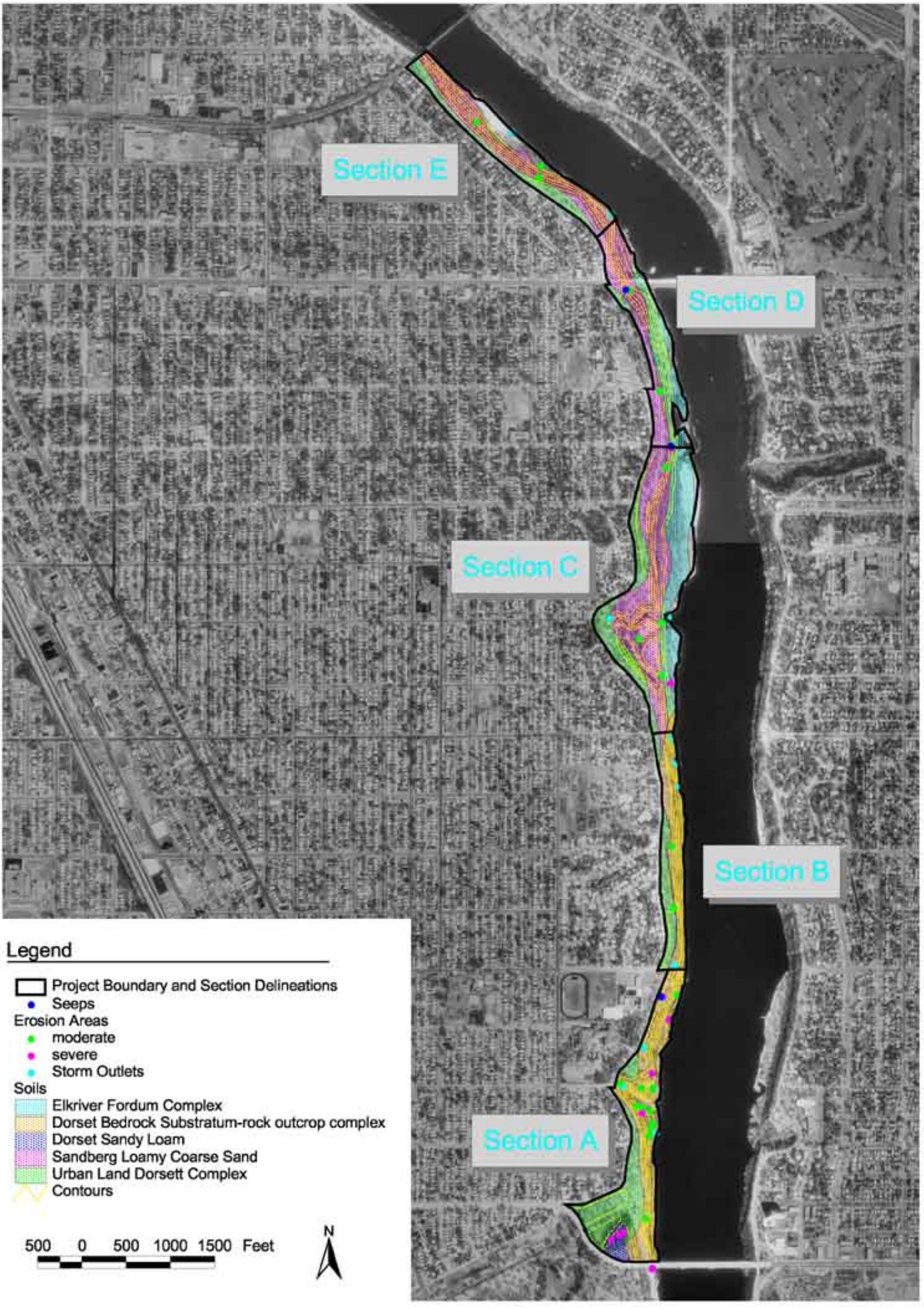
Map 2



GREAT RIVER GREENING

Mississippi River Gorge Soils and Contours

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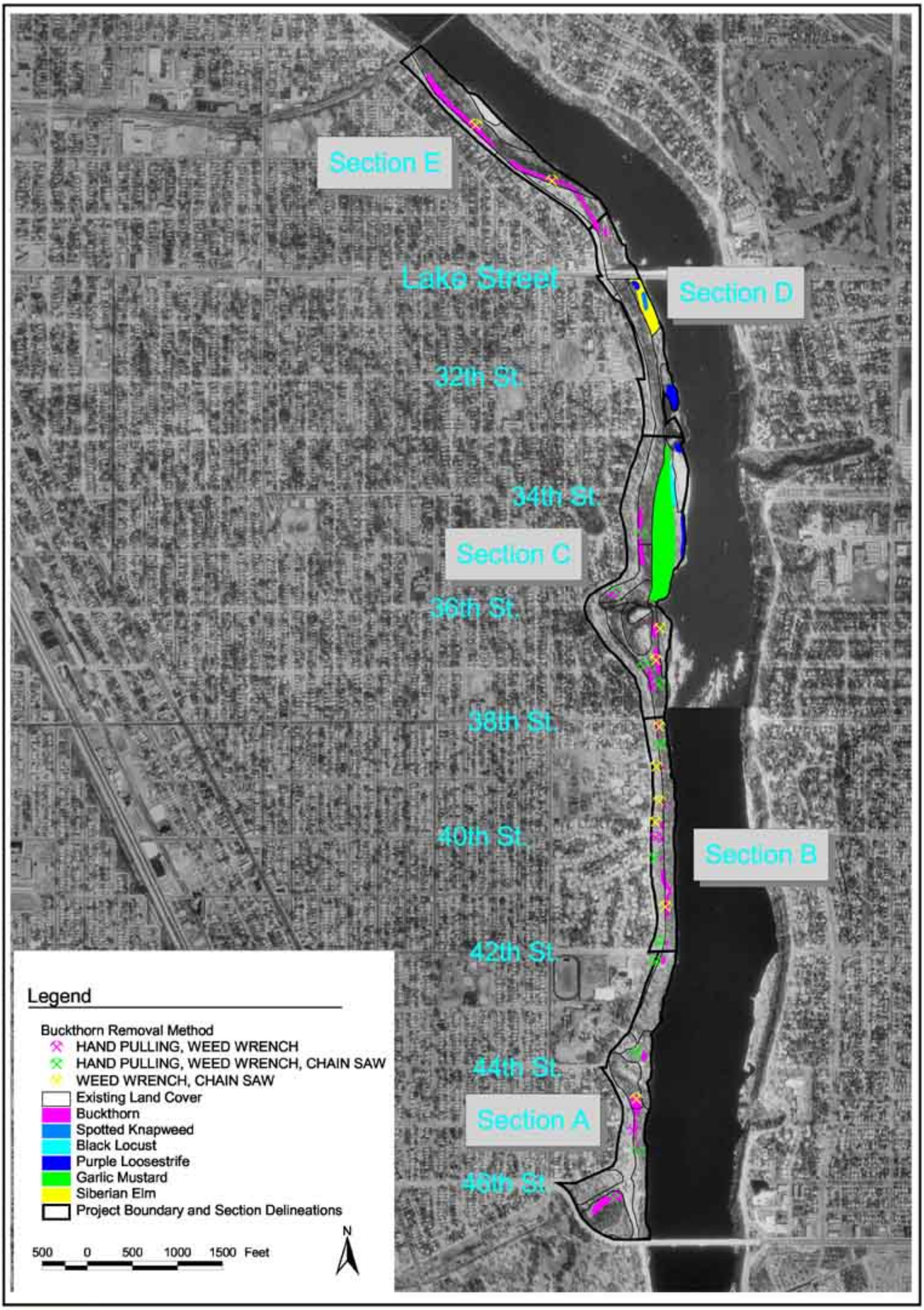
Map 3



GREAT RIVER GREENING

Misssissippi River Gorge Invasive Species

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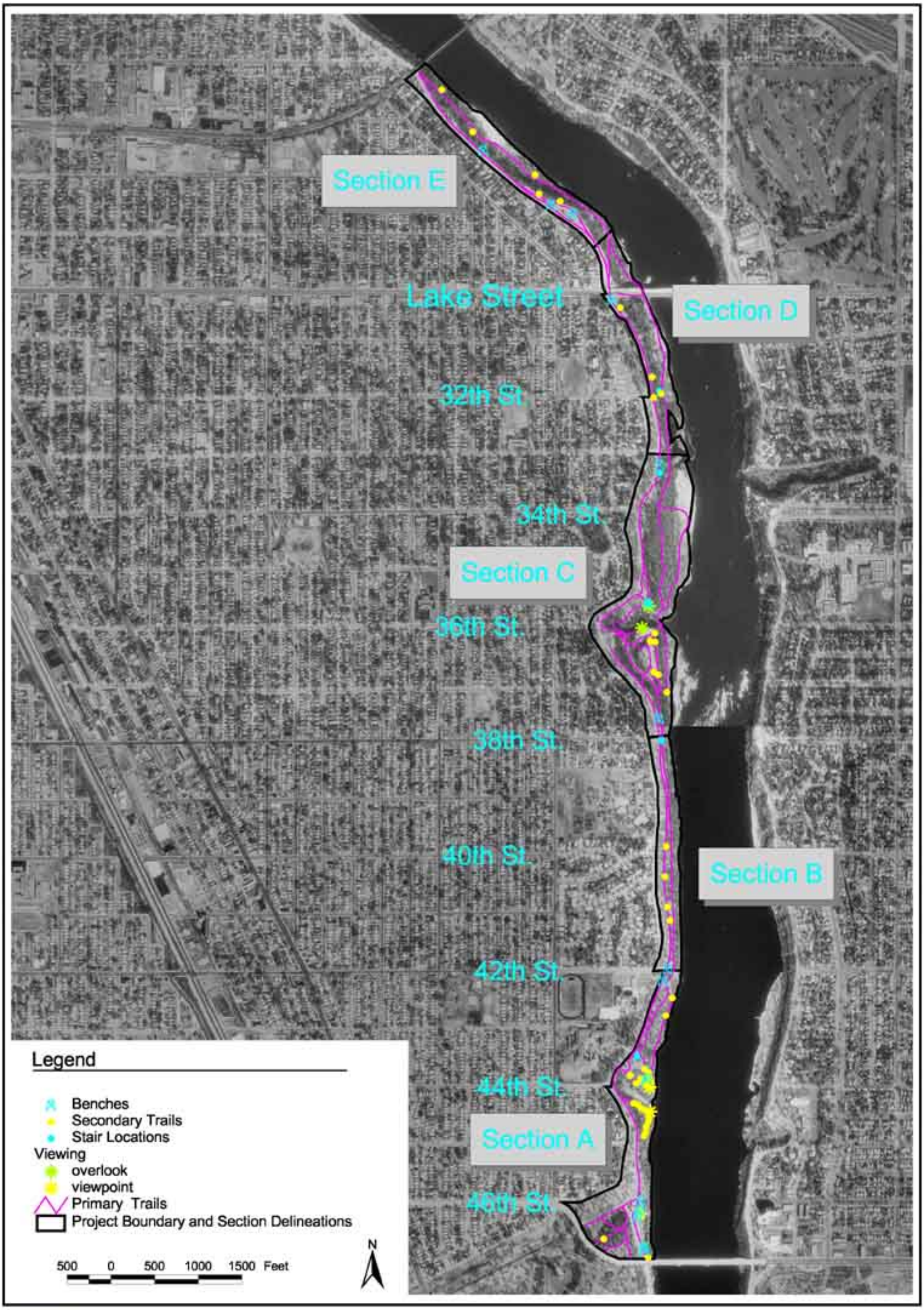
Map 4



Misssissippi River Gorge Cultural Features

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Map 5

Mississippi River Gorge Restoration Opportunities

GREAT RIVER GREENING

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Map 6